VICON

Vicon Nexus Product Guide

Contents

Vicon Nexus Product Guide. For use with Vicon Nexus 1.8.5 and later.

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EASY. FLEXIBLE. EFFICIENT. SEAMLESS. COMPATIBLE. STATE OF THE ART

Vicon Nexus is a motion capture platform designed expressly for Life Sciences applications. Clinical and research laboratories, sports performance centers, universities and other institutions can take advantage of the user-friendly interface to track and measure motion in real time. Optical, digital, and analog capture are all contained in a single, easy-to-use platform that gives Life Sciences professionals an advantage in their applications for gait analysis and rehabilitation; biomechanical research; posture, balance and motor control; sports performance; and animal science.

EASY TO LEARN, EASY TO USE

Nexus offers unprecedented levels of usability. The interface guides you through the full motion-capture and analysis workflow from preparation, through acquisition, to review. The buttons, menus, and controls for the functionality you need are just where you expect to find them. The clearly laid out workflow tools panes enable you to access tools quickly and easily.

NATIVE REAL TIME

Nexus is real-time to its core. You can view all data—analog, markers, and video—in real time, all the time. Hardware appears automatically in the software as soon as you plug it in, so you don't need to tell the system when you've added a camera—it tells you. The unique Status Communications summaries inform you in real time if something unexpected occurs. You can check the quality of your data as soon as it is measured, so there won't be any unexpected surprises at the end of your capture.

SEAMLESS VIDEO

Nexus fully integrates and synchronizes reference video capture with the optical capture. Video camera calibration and force vector overlays are automatic and integrated. You can choose Bonita Video cameras and/or a variety of other digital video options.

PAST PRESENT, FUTURE PERFECT

Nexus offers both backward compatibility and a platform built for the future. You can access data captured with previous generation Vicon hardware and software and process data through existing plug-ins such as Plug-in Gait and Plug-in Modeler. You can transfer data seamlessly to Vicon Polygon for reporting.

About this guide

This document originally accompanied Vicon Nexus 1.8.5. If you are using it as a reference for later versions of Nexus, be aware that some functionality that is described in this document has been superseded. For up-to-date information on the latest features, see *What's New in Vicon Nexus 2.2*.

Upgrading Vicon Nexus

Important:

- When upgrading from Nexus 1.8.0, 1.8.1, 1.8.2, or 1.8.3, do not delete or move the installer before using Nexus 1.8.5 for the first time.
- This is to enable your Nexus installation to be fully updated.
- Before you upgrade from an earlier version of Nexus (even from Nexus 1.8.3), transcode all captured video and delete the remote files, as Nexus 1.8.5 is not backward-compatible with video captured in earlier versions.
- If Basler digital cameras will be connected to Nexus 1.8.5, update the Basler Pylon drivers to version 2.3.5 (available from the Vicon Support website).
- See Using the Correct Basler Drivers below.

Using the Correct Basler Drivers

If you are using Basler video cameras with Vicon Nexus 1.8.5, install version 2.3.5 of the Basler drivers.

Depending on your system setup, note the following additional points. If you are using:

- An Intel I340 network card: When you install the drivers, select the option for Filter drivers, not Performance drivers.
- Multiple versions of Nexus: Ensure you use the appropriate version of the Basler drivers for the version of Nexus with which you intend to use your Basler video cameras:

Nexus version number	Basler drivers version number
Nexus 1.7	Basler drivers 2.2
Nexus 1.8	Basler drivers 2.3.5

Caution Although you can keep Nexus 1.7 on a machine on which you install Nexus 1.8.5, after you install the 2.3.5 Basler drivers, the video cameras that use the drivers are not available for use with Nexus 1.7.

About Nexus

Preparing the Capture Environment

Before you begin connecting up and using your Vicon system, to ensure its precision and accuracy:

- Choose an optimal measurement volume for a given experiment
- Place cameras to achieve uniform precision in all directions
- Consider the mechanical stability of the cameras and their mountings.

As the resolution of Vicon cameras has increased, mechanical stability has become increasingly important, because a very small shift in position can have an impact on system measurements, as shown in the following example.

Example of the effect of camera position on system accuracy

A Vicon T160 camera with a standard 18mm lens has a horizontal field-of-view of 54°. Each pixel subtends an angle of 0.0115° or 200 micro-radians.

In other words, a change of 200 micro-radians in the angular position of the camera and its sensor represents a one pixel shift in the system's measurements. This shift is equivalent to 3mm at a range of 16m.

Note This is a 2D shift. All 3D measurements are estimated from the intersection of several 2D rays, so the resulting 3D shift may be smaller.

Minimizing System Inaccuracy

The most common causes of inaccuracy are:

- Mounting_Creep
- Vibration
- Temperature

Mounting Creep

Scenario: Cameras are often clamped onto a framework that allows their position and orientation to be easily adjusted. The framework is commonly cylindrical tube and the clamps depend on friction.

Problem: If a camera is cantilevered so that its weight may rotate the clamp, the amount of slippage or creep at the clamp/frame junction needed to introduce 200 micro-radians of angular change is tiny: about 5 microns or about 1/50th of the diameter of a human hair. This slippage is far too small to be seen.

Solution: To minimize the risk of movement, mount cameras so that their weight does not rotate their mounting point either by bending the mounting frame or by causing a clamp to slip or creep.

Vibration

Scenario: Many buildings are of steel-frame construction. A steel framework can transmit vibrations caused passing footsteps, elevators, and passing vehicles. Most building vibrations are locally translational and, while undesirable, have little direct effect on camera rotation.

Problem: If a camera is mounted on a bracket or cantilever, building vibration combined with the cantilevered mass of the camera can cause a rotational oscillation of the camera mount.

Solution: Ensure that camera mounting brackets, and the structure to which they are attached, are extremely stiff and cannot wobble if there is any vibration in the building frame. This applies whether the camera mounting is vertical or horizontal.

Temperature

Scenario: Thermal expansion and contraction in large structures such as a building can be very large but the temperature changes that drive them tend to be relatively slow compared with the duration of a Vicon calibration/trial cycle.

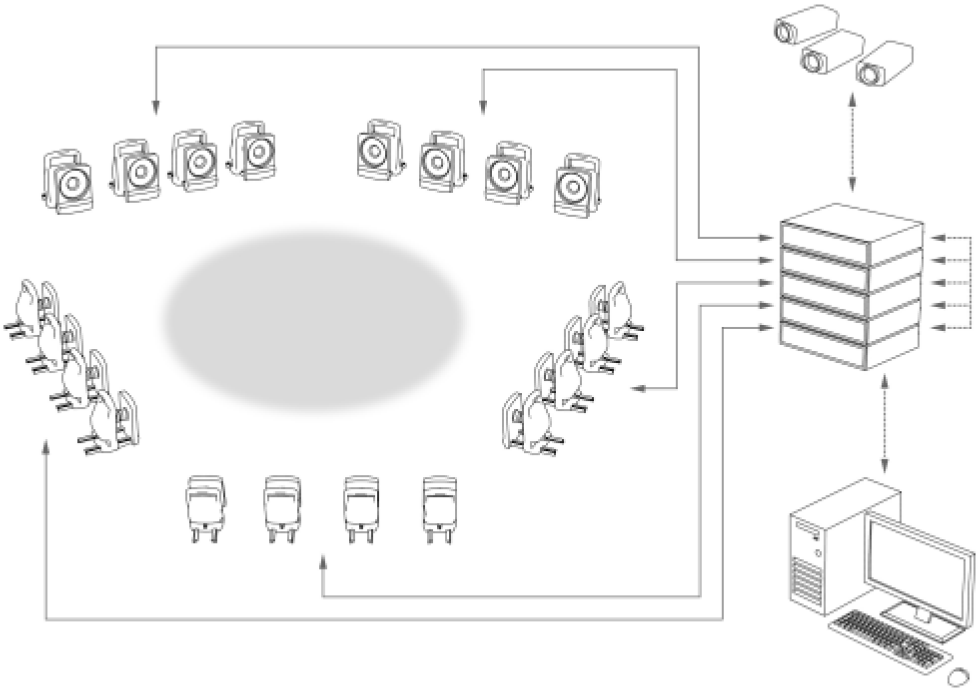
Problem: One part of the system that changes temperature much more quickly is the camera itself. The inside of a Vicon camera reaches a steady temperature of around 50° Celsius. While the camera is warming up from the ambient temperature of its surroundings, its internal components inevitably change dimension. However, when the components reach operating temperature, their dimensions remain stable.

Vicon measures the effects of warm-up and ambient temperature changes on all its cameras. All current camera models reach their steady operating temperature in approximately 30 minutes. This time is relatively independent of ambient temperature over the normal operating range of 0°–30°C. During warm-up, the equivalent positional change varies between 0.25 pixel for lower resolution cameras to approximately 1 pixel for the T160.

Solution: Allow Vicon cameras to warm up for at least 30 minutes before calibration and measurement.

Nexus Components

Nexus is part of the fully integrated and expandable Vicon system that lets you build an architecture best suited to your motion capture application

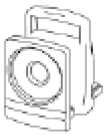


In this architecture diagram, Nexus is installed on the MX host PC. For more architecture diagrams, see the *Go Further with Vicon MX T-Series* reference book..

Important Vicon Nexus 1.8 supports the Vicon MX T-Series cameras and hardware units, and Bonita (Optical and Video) cameras. For details of earlier Vicon MX systems and how to integrate them into the Vicon MX T-Series system, see the *Go Further with Vicon MX T-Series* reference book, or contact Vicon Support.

You can include the following components in a Vicon system architecture:

MX Cameras



The ranges of Vicon motion capture cameras for Vicon systems feature multiple high-speed processors that perform real-time proprietary image processing. The following ranges of MX cameras can be included in your Vicon system architecture:

- **MX T-Series Cameras:** T160, T40-S, T20-S,T10-S, and T10
- **MX F-Series Cameras:** MX-F40 (F40) and MX-F20 (F20)
- **MX+ Cameras:** MX40+, MX20+, MX13+, and MX3+
- **MX Cameras:** MX40, MX13, and MX3
- T-Series, F-Series, and MX+ cameras are RoHS-compliant

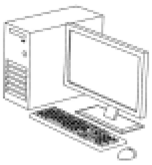
Important: For brevity, the Nexus documentation generally refers to "MX cameras". Unless otherwise noted, references to MX cameras apply equally to T-Series, F-Series, and MX+ cameras. Although Bonita cameras are not technically part of the MX family of cameras, references to “MX cameras” also apply to the use of Bonita cameras with Nexus.

MX Connectivity Units

Smart boxes that can be combined to create a distributed architecture, enabling you to customize the number of MX cameras and supported third-party devices in your Nexus system:

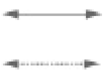
- MX Giganet: Link between T-Series cameras and the host PC, with a 5-port Ethernet switch for connection to the host PC, other client PCs and up to 4 other devices including Basler GigE cameras, with Timecode and genlock to sync reference video with mocap data, and a 64-channel analog card to connect and sync Force plates and EMG devices.
- MX Ultranet HD: Link between MX Cameras and the host PC in earlier Vicon MX F-Series systems.
- MX Ultranet: Link between MX Cameras and the host PC in earlier Vicon MX+ systems.
- The T-Series, F-Series, and MX+ hardware units are RoHS-compliant.

MX Host PC



The main PC in the Vicon system architecture, with a dedicated Ethernet port to enable Vicon system communications (this is in addition to any other network ports on the PC). Vicon Nexus application software is installed on this host PC. Some supported third-party capture devices (such as digital video cameras) and analog devices are connected to this host PC. Remote PCs may be used for other Vicon application software or third-party applications.

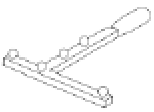
MX Cables



The proprietary MX Gigacable plus a commercially available Ethernet cable connect the Vicon MX T-Series system components, providing a combination of power, Ethernet communication, synchronization signals, video signals, and data.

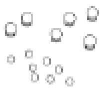
Other cables are required for earlier MX F-Series, MX+ and MX systems. For details on these cables, see the *MX Hardware System Reference* book that came with your original MX system.

Vicon Calibration Device



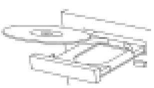
Specialized devices used to accurately calibrate the Vicon system.

Vicon Accessories



Supplies for the Vicon system.

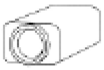
Vicon Life Sciences Software



You can use existing Vicon plug-in software (e.g., Plug-in Gait and Plug-in Modeler) in Vicon Nexus and transfer data seamlessly to Vicon Polygon for reporting.

Third-party Digital Video

DV (Camcorder), DCAM, and Gigabit Ethernet (GigE) type

Cameras 	digital video cameras can be integrated in your Vicon system architecture. Nexus supports only the following third-party digital video cameras: Basler Monochrome and Color area-scan DCAM: – A601 – A602 Basler GigE cameras: – piA640-210gc – piA1000-48gc – piA1000-60gc For details on installing and configuring GigE cameras, see the *Go Further with Vicon MX T-Series* reference.
Third-party Devices (optional)	A range of supported devices that can be integrated in your Vicon system architecture: – Analog devices (such as force plates and EMG equipment) – Audio devices (such as microphones) – External video sources (such as PAL or NTSC video tape recorders)

Related Documentation

The following resources provide additional information on Vicon Nexus.

Document	Description
Go Further with Vicon MX T-Series	The technical reference document for Vicon MX T-Series hardware installed with your system software that contains reference data, technical specs, and regulatory information..
Vicon Nexus Product Guides	These release documents provide information for the current release of Vicon Nexus. The *Foundation Notes* provide essential product information which you need to get started using the current release of Vicon Nexus. They describe the main features and functionality; list prerequisites and any limitations; and provide instructions on installing, licensing, starting up, and using the product. Any *Advanced Notes* provide more detailed technical information for specific advanced features and functionality in Vicon Nexus.
	These product documents are installed in PDF format (requires Adobe Acrobat version 5.0 or later) as part of your Nexus software installation. To access them, from the **Windows Start** menu point to **Programs > Vicon > Documentation**. From **Books** or **Release Documents**, click the desired book title.
Vicon Online Support	Vicon Online Support is a knowledge base that enables customers to view previously answered product queries, submit new questions, and download updates to Vicon software and documentation.

Vicon File Types Used in Nexus

During the motion capture workflow, you create and edit a number of configuration files, Vicon Nexus generates a number of data files, and you can import files from and export files to other Vicon applications or supported third-party software. The Data Management tab displays all file types associated with a motion capture trial. For details of a file type, see its glossary definition.

Data Files

Nexus generates these Vicon data file types during motion capture and analysis:

- *.avi*
- *.c3d*
- *.mkr*
- *.mp*
- *.system*
- *.vvid*
- *.x1d*
- *.x2d*

You can import these data file types created with earlier Vicon software into Nexus:

- *.tvd*
- *.vad*

You can load this data file type created with supported third-party devices or software into Nexus:

- *.avi*

Configuration Files

You create and edit these Vicon configuration file types during Nexus motion capture and analysis:

- *.gpo*
- *.monitors*
- *.options*
- *.pipeline*
- *.protocol*
- *.system*
- *.TrialType*
- *.ViewType*
- *.vsk*
- *.vst*
- *.xcp*

You can import these Vicon configuration file types created with earlier Vicon application software into Nexus:

- *.cp*
- *.vtt*

You can export these Vicon configuration files types created in Nexus to other Vicon application software and supported third-party software:

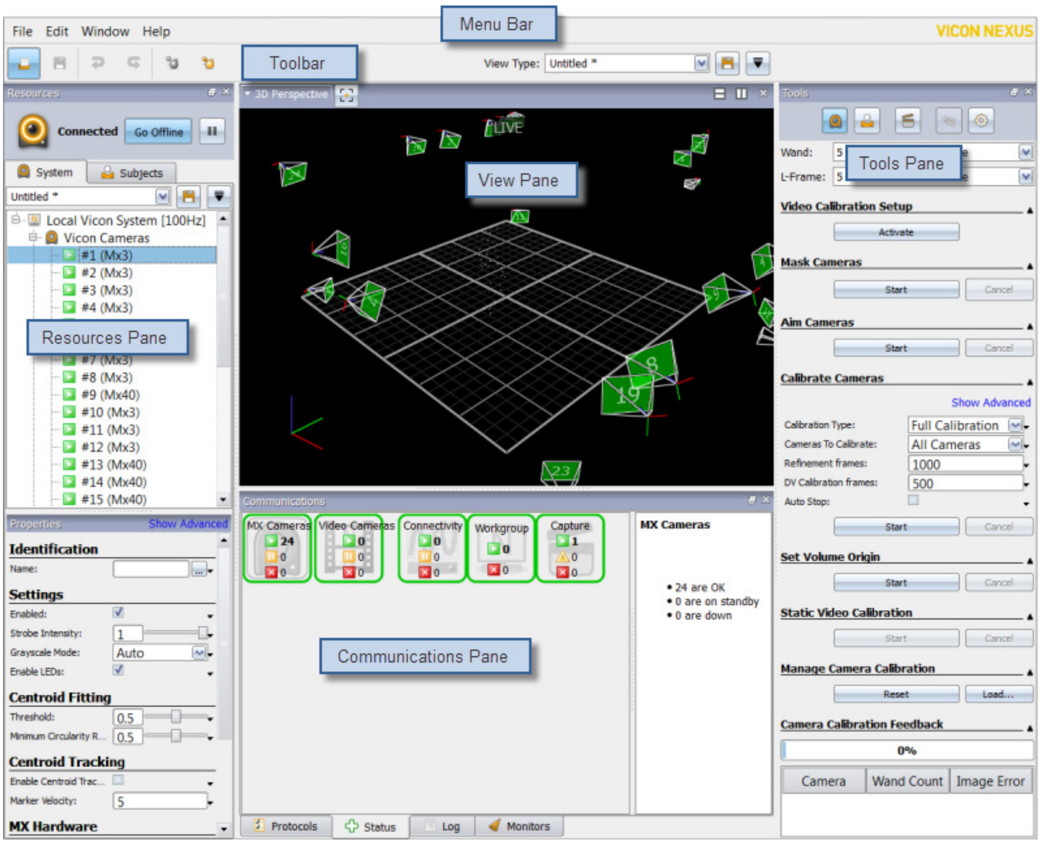
- *.cp*
- *.xcp*

Nexus User Interface

About the Nexus User Interface

The Nexus user interface is designed so that you can access the tools you need quickly and easily. Within the primary panes (**Resources**, **View**, **Tools**, and **Communications**), you use the tabs and buttons to open secondary panes containing tools and options for a specific portion of the motion capture workflow. Tool tips indicate the secondary pane that will be displayed when you click that button on a primary pane.

- **Resources Pane**: Manage the different components of your Vicon system architecture and the subjects whose motion is to be captured.
- **View Pane**: Set up the way you want to visualize the capture data from one or more cameras (or supported third-party devices) either live in real time or from file for post processing.
- **Tools Pane**: Manage each step of the motion capture workflow through preparation, acquisition, and review.
- **Communications Pane**: Run customized workflows, check system status, view log information, and monitor trials.
- **Menu Bar**: Access common commands from whatever stage of the workflow you are in.
- **Toolbar**: Access frequently used commands from whatever stage of the workflow you are in.



Customizing the Nexus User Interface

You can customize the appearance of the Resources, Tools, or Communications panes to suit your preferences. The Nexus window maintains these settings until you adjust them again. This topic includes steps to:

- Dock/undock panes
- Reposition panes
- Resize panes or sections within panes
- Hide/display panes
- Hide/display sections within panes

To dock or undock Resources, Tools, or Communications panes:

- Click the **Dock Pane** button on the right side of the pane title bar. A docked pane becomes a floating pane; a floating pane is docked in its last fixed position.

To reposition of the Resources, Tools, or Communications panes:

1. Click the pane title bar and drag the pane to the desired location in the Nexus window.
2. Drop the pane:
   - anywhere in the window to change it into a floating pane, or
   - on top of another pane to tile them vertically (**Resources** and **Tools** panes only), or
   - when its outline appears in the desired place to dock it into a fixed position on its own.

To resize the Resources, Tools, or Communications panes or sections within the panes:

1. Hover the mouse pointer over the inside edge of the pane or the top edge of a section so that the pointer becomes a double-headed arrow or .
2. Click and drag the arrow to move the split line left or right to resize the pane width, or up and down to resize the section height.

To hide or display the Resources, Tools, or Communications panes:

1. Click the **Close Pane** button on the right side of the pane title bar, or from the window menu, clear the corresponding option to hide the Resources, Tools, or Communications pane.
2. From the **Window** menu, select the corresponding option to display the pane.

To hide or display sections within the Resources, Tools, or Communications panes:

- Click the **Hide Section** arrow ▲ or the **Display Section** arrow ▼ on the right of the section heading.

Tip The **View** pane cannot be undocked, repositioned, or resized in the Nexus window. You can open a separate floating view pane by selecting the **New floating workspace** command from the **Window** menu. This floating workspace can be repositioned and resized. The width of the **View** pane is affected by resizing panes to the left and/or right of it. The height of the **View** pane is affected by resizing panes below it.

Working in the Nexus User Interface

This topic describes how you can work in the Nexus user interface, including:

- Using the mouse in Nexus
- Navigating
- Performing general tasks
- Managing real-time data
- Selecting items
- Visualizing data in View panes
- Visualizing data in Graph view pane
- Visualizing data in the Time Bar

Using the Mouse in Nexus

You can use the mouse to manipulate items and manage the way data is visualized in the Nexus window. Standard mouse actions can also be combined with keyboard keys. These mouse actions and keyboard and mouse combinations are used most frequently in Nexus:

- **Left-click**: Select individual items
- **ALT + left-click and drag**: Select items within a bounding outline
- **CTRL + left-click**: Select multiple non-consecutive items
- **Left-click and drag**: Rotate/orbit
- **Right-click and drag**: Zoom/dolly
- **Click wheel button (or left-and-right-click) and drag**: Translate/Move

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Important The behavior of the ALT GR key depends upon the regional settings specified for your keyboard in the Windows operating system. In some regions, the behavior of this key is identical to that of the ALT key, while in other regions the ALT GR key functions as if the ALT+CTRL keys were pressed together. Vicon Nexus assumes the latter behavior. If you wish to use the ALT GR key as if it was the ALT key, you must change the regional settings for your keyboard to use the US layout, which assumes identical behavior for these two keys. You change your keyboard language settings in the **Text Services and Input Languages** dialog box, accessed from the **Languages** tab in the **Regional and Language Options** dialog box in Windows Control Panel. For details on doing this, see the Microsoft Windows help.

Navigating the Nexus User Interface

Use these keys to navigate to the different areas of the Vicon Nexus user interface.

Task	Function Keys
Display the Vicon Nexus Information System	F1
Display/Close Data Management window	F2
Enter/Exit full screen mode	F5
Display/Close Options dialog box	F7
Go to System Preparation tools pane	F8
Go to Subject Preparation tools pane	F9
Go to Capture tools pane	F10
Go to Label/Edit tools pane	F11
Go to Pipeline tools pane	F12

Tip The behavior of function keys is dependent upon the area of the Nexus window that has focus when the key is pressed. Click anywhere in the window to set the focus before using the function keys to navigate to a different part of the user interface.

Performing General Tasks

Use these mouse actions to perform general tasks in Vicon Nexus.

Task	Mouse
Manipulate a selected item with object manipulators (if available for selected item)	Drag
Display shortcut menu (if available for selected item)	Right-click
Scroll forward or backward through a list	Rotate mouse wheel

Managing Real-time Data

Use these keys to manage real-time data streaming and offline data processing in Vicon Nexus.

Task	Keys
Switch between Live and Offline mode	CTRL+TAB
Pause/Restart real-time data streaming (Live mode)	SPACE
Play/Stop offline data (Offline mode)	SPACE

Selecting Items in the Vicon Nexus Window

Use these keys and mouse actions to select items in the Vicon Nexus window. To cancel a selection, left-click again in the workspace.

Task	Keys and Mouse
Select single item	Left-click
Select multiple non-consecutive items	CTRL and left-click
Select multiple non-consecutive items maintaining the order of selection	SHIFT+CTRL and left-click
Select multiple consecutive items	SHIFT and left-click, SHIFT and drag, or drag

Visualizing Data in View Panes

Use these keys and mouse actions to visualize data in a 3D Perspective, 3D Orthogonal, and Camera view panes.

Camera Viewpoint Displayed in Workspace	Mouse
Dolly/Zoom: Move the camera viewpoint closer to or further away from the focal point	Right-click + drag forward or backward
Orbit: Move the camera viewpoint around the focal point	Left-click + drag left, right, forward, or backward
Truck/Translate: Move the camera viewpoint along a horizontal or vertical axis	Click wheel button + drag left, right, forward, or backward

Visualizing Data in Graph View Pane

Use these keys and mouse actions to visualize data in a Graph view pane. See also the notes on visualizing graph data below.

Graph Data Displayed in Workspace	Keys and Mouse
Select range of frames to zoom	ALT and right-click + drag across frames
Slide x-axis left	Click wheel button + drag left
Slide x-axis right	Click wheel button + drag right
Slide y-axis up	Click wheel button + drag forward
Slide y-axis down	Click wheel button + drag backward
Zoom x-axis in	Right-click + drag left
Zoom x-axis out	Right-click + drag right
Zoom y-axis in	Right-click + drag backward
Zoom y-axis out	Right-click + drag forward

Notes on Visualizing Graph Data

The way the graph that is displayed in a **Graph** view pane depends on whether the system connection is live or offline and whether an individual point or a range has been selected for plotting:

Zoom an axis (x or y)

All component graphs in a single workspace maintain the same scale for both the x- and y-axes. The x-axis is shared across all components, but each component has its own y-axis. The y-axes may show different ranges, but represent the same number of values.

- **Offline:** The portion of the specific component trace displayed in the workspace is centered around the point where the mouse was clicked. All other component views are scaled by the same amount, with the vertical range centered on the median value of the visible portion of all the selected traces.
- **Live:** The x-axis, the workspace is centered around zero, keeping the zero on the right edge of the workspace and changing the values displayed on the left.

Zoom selected range of frames

- **Offline:** The y-axis displays only the selected area of the specific trace and the x-axis displays only the selected frames.
- **Live:** This type of zooming in the x-axis is disabled to ensure that the live frame is always on the right of the graph.

Pan across an axis (x or y)

- **Offline:** Each component in the y-axis can be panned independently.
- **Live:** Panning in the x-axis is disabled to ensure that the live frame is always on the right of the graph.

Tip When zooming into or out of graph data, the display of grid lines in the workspace can be set to guide the eye toward the selected area of focus. Major grid lines remain at their normal weight, while any minor grid lines gradually fade. To obtain this behavior, select Show Minor Grid Lines in the Graph section of the Nexus Options dialog box.

Visualizing Data in the Time Bar

Use these keys and mouse actions to visualize data in the Time Bar at the bottom of a view pane.

Timescale Displayed in Timeline	Keys and Mouse
Slide timeline left	Middle-click + drag left
Slide timeline right	Middle-click + drag right
Select range of frames to zoom	ALT and right-click + drag across frames
Zoom scale in	Right-click and drag right or up
Zoom scale out	Right-click and drag left or down

Time Bar Data Displayed in Workspace	Mouse
Start/Stop data playback	Middle-click
Jog forward/backward through data playback	Rotate mouse wheel forward/backward
Move Current Time Cursor to specific frame	Left-click frame in the timeline
Move Start Range Frame Cursor back to zero frame of trial	Left-click cursor
Move End Range Frame Cursor back to last frame of trial	Left-click cursor
Go to the previous frame	LEFT ARROW
Go to the next frame	RIGHT ARROW
Go to the first frame	HOME
Go to the last frame	END
Go forward 10 frames	PAGE UP
Go backward 10 frames	PAGE DOWN

Event Identification Mode in Timeline	Keys and Mouse
Enter/exit event identification mode (time cursor follows the mouse)	CTRL+E
Go to the previous event	CTRL+LEFT ARROW
Go to the next event	CTRL+RIGHT ARROW
Lock/unlock event context (In event identification mode, select desired Left, Right, or General event context on timeline; subsequently moving the mouse forward or backward does not change context.)	UP ARROW or DOWN ARROW
Display context menu (after event context locked)	ENTER
Highlight command from context menu	UP ARROW or DOWN ARROW
Select highlighted command from context menu	ENTER

Tip The behavior of shortcut keys is dependent upon the area of the Nexus window that has focus when the key is pressed. Click anywhere in the workspace to set the focus before using the function keys to navigate to a different part of the user interface.

You can also manage offline data using the data playback controls.

Setting Properties in Nexus

You can configure the way certain areas of Nexus look and behave by configuring settings in the corresponding **Properties** section Properties Show Advanced.

The specific properties you can configure depend on the particular **Properties** section. If a property does not have an entry field, you can view but not specify a value for it. Read-only properties are indicated in *italics*. Required properties that must have a value specified are indicated in the Nexus user interface with a shaded background.

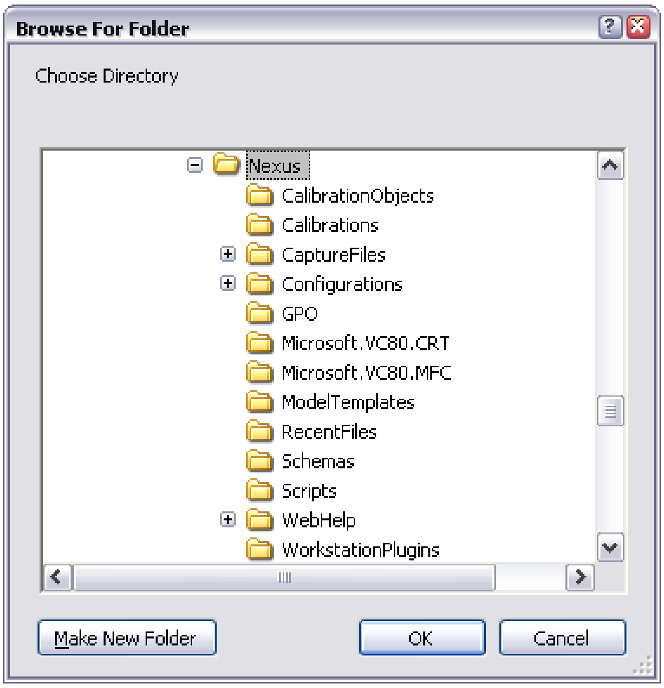
Some properties settings automatically persist, so Nexus remembers them in subsequent sessions. You must explicitly save other settings using the relevant Configuration Management section for that area of the Nexus window.

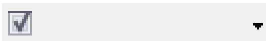
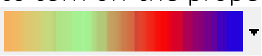
To set properties in Nexus:

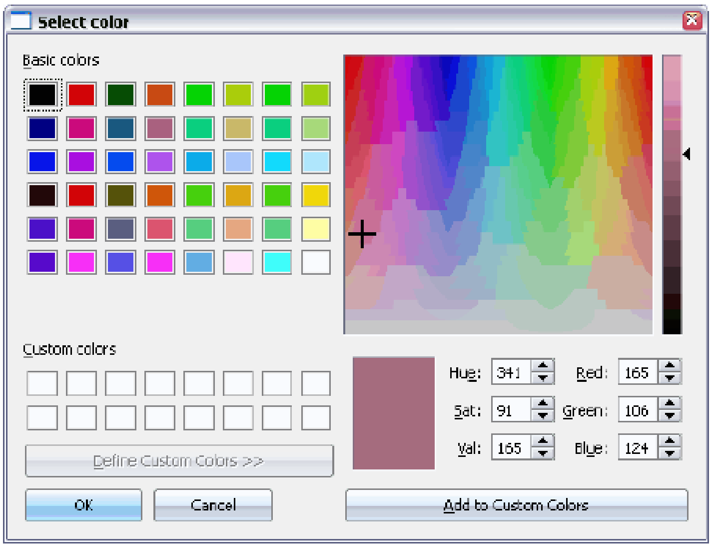
1. In the **Nexus** window, open the pane or dialog box containing the **Properties** section whose settings you wish to configure:
   - System components - System resources pane
   - Motion-capture subjects - Subjects resources pane
   - Camera calibration process - System Preparation tools pane
   - Subject calibration process - Subject Preparation tools pane
   - Data processing operations - Pipeline tools pane
   - Customized workflow protocols - Protocol Builder
   - Monitor and event actions - Monitors communications pane
   - Data visualization - Options dialog box
2. In the **Properties** section, click the **Show Advanced** link to view all of the available properties. Click the **Hide Advanced** link to show just the basic properties.

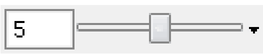
3. In the **Properties** section, view or change the setting for the desired properties using its entry field or control.

- Browse for folder  Click the Browse for Folder button  to display a dialog box in which you can navigate to the appropriate folder.

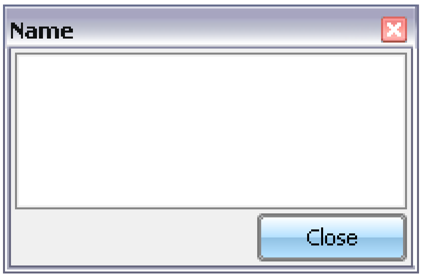


- Check box  Select the check box to turn on the property. Clear the check box to turn off the property.
- Color map  Click the current color in the entry field to display the Select color dialog box. In the Basic colors area, click the square for the desired color, or in the Custom colors areas define a new color.



- Drop-down menu  Click the drop-down arrow and select the desired entry from the list.
- Numerical range slider  Move the slider to the left to decrease the value or to the right to increase the value displayed in the entry field. Alternatively, overtype the current entry with a specific value.

- Numerical value box  Overtype the existing value, or right-click the existing value and draw circles around it clockwise to increase the value or counterclockwise to decrease the value.
- 
- You can adjust the speed at which to move through the possible values while spinning the mouse, by holding SHIFT to increase the speed or CTRL to decrease the speed.
- Text box  Overtype the existing value, or click the Edit Text button  to display a dialog box in which you can enter a longer text string or edit other default values. Alternatively, you can change the value of a particular property by clicking the context menu button  on its right and selecting the desired command from those available:



- Set to DefaultAbandon any changes and return the property to its default setting (blank if it did not have a specific value).
- ClearAbandon any changes and return the property to a blank setting.
- MacroSelect the macro button (if it is enabled) to fill in a drop-down list with special, predefined entries.

4. If you are working in the following areas of the Nexus window, save your settings to the appropriate configuration file using the [Configuration Management section](#).

   - System resources pane
   - Pipeline tools pane
   - Monitors communications pane
   - Options dialog box

Managing Configurations in Nexus

You can determine how Nexus looks and behaves by creating and editing configurations in the **Configuration Management** section in the Nexus window .

You can create different configurations to suit different types of motion capture applications and then select the appropriate configuration when required. You can also save configurations for use by multiple users (shared) or for a specific user (private), to suit the way your organization works.

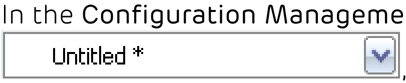
- **Shared**These configurations can be viewed by all users; they can be changed only by the user who was logged on when the file was first created and saved. Shared configuration files are stored in the appropriate folder under the Nexus configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations*).
- **Private**These configurations can be viewed and changed only by the user who was logged on when the file was first created and saved. Private files are stored in the appropriate folder under the Nexus system configuration folder under the logged-in user's Application Data files folder (by default, *C:\Documents and Settings\<user_name>\Application Data\Vicon\Nexus\Configurations*).

Important	The default Nexus toolbar is stored in the Standard.toolbar configuration file in the Shared Nexus configuration folder Toolbars. If you add, delete, or reposition buttons on the Nexus toolbar using the Customize Toolbar dialog box, these customizations are stored in the user's Private configuration folder.

To manage configurations in Nexus:

1. In the Nexus window, open the pane or dialog box containing the type of Nexus configuration file you wish to manage:

Nexus UI Area	Configuration Type	Configurations Folder\File
Capture tools pane	Motion capture settings	*TrialTypes*.TrialTypes*
Monitors Communications pane	Event monitors and actions	*Monitors*.Monitors*
Options dialog box	Data view options	*Options*.Options*
Pipeline tools pane	Automated processing operations	*Pipelines*.Pipeline*
System resources pane	System settings	*Systems*.System*
View pane	View options and layouts	*ViewTypes*.ViewType*

2. In the **Configuration Management** section, from the **Current Configuration File** drop-down , either:

   - Leave the currently loaded configuration file. If no configuration file has yet been created, `Untitled*` is displayed.

     or

   - Click the button to select another existing system configuration file from the drop-down list. If you have made changes to the current configuration files, Nexus prompts you to save these before changing configuration files.

3. In other areas of the Nexus pane or dialog box, make any desired changes to settings, such as those in a Properties section.

4. Click the **Configuration menu** and select any of the desired commands from the displayed list:

   - **New**: Create a new configuration in which to save the current settings. The name `Untitled*` is displayed in the **Current Configuration** list.
   - **Save As**: In the **Save As** dialog box, enter a name to overwrite the default new configuration file name `Untitled*` or to create a new system configuration file in which to save a copy of the current configuration file and click **OK**.

   Additional options include:

   - Rename: In the Rename dialog box, enter a new name for the currently loaded configuration file and click OK.
   - Delete: At the Delete prompt, click Yes to delete the current file displayed in the Current Configuration list.
   - Reload: Reload or delete an automatically saved configuration file. You can select from the list of timestamped files or, if required, delete all the saved configurations.
   - Refresh List: Re-display the contents of the Current Configuration list.

5. In the **Configuration type** dialog box, select the user permissions for the configuration: **Shared** or **Private**.
6. The new file name is displayed in the **Current Configuration** list.
7. Click **Save** to store the settings in the configuration displayed in the **Current Configuration** list.

About the Nexus Menu Bar

Access common commands from any stage of the Nexus motion capture workflow in the Nexus **Menu** bar. This topic describes the following menus:

- File
- Edit
- Window
- Help

File Menu

The **File** menu contains the following commands:

- Data Management

  Displays the Data Management window in which you can store and manage all data associated with your motion capture trials.

  Tip You can leave the window open on your desktop by clicking the check box next to the command on the **File** menu. If this check box is cleared, the window closes automatically when you click anywhere outside of the window.

- Save

  Saves the current data for subjects enabled in the Subjects resources pane to the *.c3d* file for the current trial.

- Copy As

  Makes a copy of the current trial *.c3d*, *.vsk*, and *.mp* files. Using this feature, you can archive copies of a *.c3d* file to document its processing progression.

  Tip You are prompted to save the copy in the Data Management Hierarchy Node where the original file resides, and after saving it will be available in the Data Management pane.

- Import XCP

  Displays the **Choose an XCP File** dialog box in which you can select the desired MX camera Calibration Parameters (*.xcp*) file to load in Nexus. Use this command to import *.xcp* files created in Vicon Nexus.

- Export XCP

  Displays the **Choose an XCP File** dialog box in which you can specify a Calibration Parameters (*.xcp*) file into which to export the current MX camera settings.   Use this command to export *.xcp* files created in Vicon Nexus.

- Import CP

  Displays the **Choose a CP file** dialog box in which you can select the desired MX camera calibration parameters (*.cp*) file to load in Nexus. Use this command to import *.cp* files created in Vicon motion capture application software prior to Vicon Nexus.

- Export CP

  Displays the **Choose a CP file** dialog box in which you can specify a calibration parameters (*.cp*) file into which to export the current MX camera settings. Use this command to export *.cp* files in a format compatible with Vicon motion capture application software prior to Vicon Nexus.

- Exit

  Closes the Vicon Nexus application window.

  If you have not saved any changes made to trial data, Nexus displays a prompt to enable you to save changes to trial data, to subjects, or to both subjects and trial data before it closes.

Edit Menu

The **Edit** menu contains the following commands, which take effect only when the system is in Pause or Offline mode:

- Undo

  Undoes the last action. This command is available only after a relevant action has been performed. The name of the **Undo** command changes to reflect the latest action, for example, **Undo Import XCP**. You also can hover the mouse pointer over the **Undo** button to display a ToolTip identifying the action to be undone. Some actions, such as reconstructing data, cannot be undone.

- Redo

  Reinstates the previously undone action. This command is available only after an **Undo** command has been performed. The name of the **Redo** command changes to reflect the latest action, for example, **Redo Import XCP**. Hover the mouse pointer over the **Redo** button to display a ToolTip identifying the action to be redone. Any action that was undone can be redone.

Window Menu

The **Window** menu contains the following commands:

- New floating workspace

  Opens a separate floating view pane.

- Resources

  Displays or hides the Resources pane in which you manage the components of your Vicon system architecture and the subjects whose motion is to be captured. To display the pane, click the check box next to the command on the **Window** menu.

- Tools

  Displays or hides the Tools pane in which you manipulate the system components or trial subjects selected in the **Resources** pane. To display the pane, click the check box next to the command on the **Window** menu.

- Communications

  Displays or hides the Communications pane in which you view and manage the state of your Vicon system and to streamline your motion capture workflow in Nexus. To display the pane, click the check box next to the command on the **Window** menu.

- Toolbar

  Displays the Customize Toolbar dialog box in which you add, remove, and customize buttons on the Nexus toolbar.

- Options

  Displays the Options dialog box in which you control the way data is displayed in view panes.

- Plugins

  Displays the **Plugins** dialog box in which you can view and manage plug-in modules that have been loaded in Vicon Nexus.

Help Menu

The **Help** menu contains the following commands:

- Contents

  Opens the Vicon Nexus help system at the home page.

- Workflow

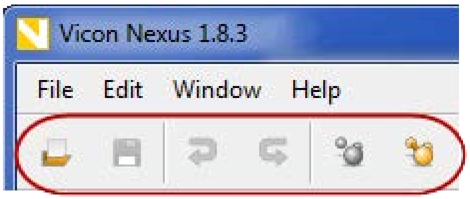
  Opens the Vicon Nexus help system at the Nexus Motion Capture Workflow topic.

- About Vicon Nexus

  Displays the Vicon Nexus startup screen, in which you can view version information about the installed release of Nexus.

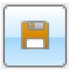
About the Nexus Toolbar

Access frequently used commands from any stage of the Nexus motion capture workflow in the Nexus **Toolbar** .



The Nexus toolbar contains the following buttons:

 **Show/Hide Data Management** Displays or closes the Data Management window in which you can store and manage all data associated with your motion capture trials.

 **Save** Saves the current data for subjects enabled in the Subjects resources pane to the *.c3d* file for the current trial.

 **Undo** Undoes the last action. This command is available only after a relevant action has been performed. Hover the mouse pointer over the **Undo** button to display a ToolTip identifying the action to be undone. Some actions, such as reconstructing data, cannot be undone.

 **Redo** Reinstates the previously undone action. This command is available only after an **Undo** command has been performed. Hover the mouse pointer over the **Redo** button to display a ToolTip identifying the action to be redone. Any action that was undone can be redone.

 **Reconstruct** Runs the **Reconstruct** operation defined in the Pipeline tools pane.

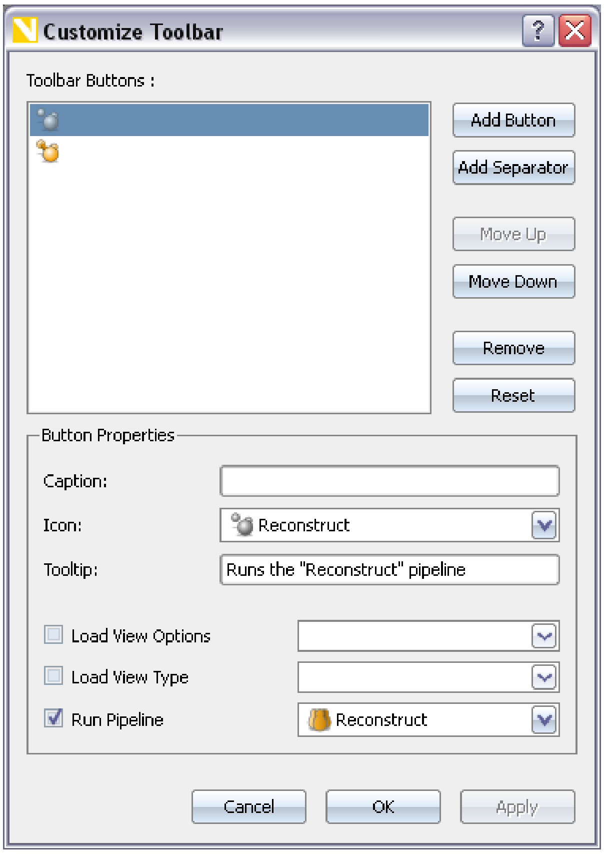
 **Reconstruct and Label** Runs the **Reconstruct and Label** operation defined in the Pipeline tools pane.

 **Any user-customized buttons** Runs a specified pipeline or loads a previously created View Option configuration or View Type configuration. You can create or change Toolbar buttons in the Customize Toolbar dialog box.

Clicking a button on the Toolbar executes the defined action for the button. A button is dimmed if it is not available, for example, if it cannot be run at that stage of the workflow or if customized button has been deleted or renamed. Hover the mouse pointer over an unavailable button to display a ToolTip indicating its status, such as "Nexus must be in Offline mode to execute this command."

Customize Toolbar Dialog Box

You can add, remove, and customize buttons on the Nexus toolbar in the **Customize Toolbar** dialog box .



Access this dialog box by selecting **Toolbar** from the **Window** menu. The toolbar settings are saved in the appropriate configuration file: the default Nexus **Toolbar** is stored in the Shared configuration folder; if customized, the toolbar is saved in a Private configuration folder and loaded the next time you start Vicon Nexus.

The **Show/Hide Data Management**, **Save**, **Undo**, and **Redo** buttons always appear on the Nexus toolbar in their default positions on the left of the toolbar; you cannot customize these buttons.

You can add new buttons to run a specified pipeline, load a previously created View Option configuration, or display a View Type configuration. For each button, you can define a ToolTip, associate an icon, and associate a text string. You can group related buttons together on the toolbar with separators or reposition buttons along the toolbar.

You can customize your toolbar in the following ways:

- Add or change toolbar buttons
- Change a button's position on the toolbar
- Group related buttons together with separators
- Remove a button or separator from the toolbar

To add or change a toolbar button in the Customize Toolbar dialog box:

1. Click **Add Button**. A new button entry is added to the bottom of the **Toolbar Buttons** list and is highlighted and selected. Alternatively, select an existing toolbar button.
2. In the **Button Properties** area, configure the following information for the selected button:
   - **Caption:** The label to be displayed on the button.
   - **Icon:** The icon to be displayed for the button. Select an available icon from the drop-down list.
   - **Tooltip:** The text to be displayed to indicate the operation to be executed when the button is pressed.
3. Select the check box for one of the following actions to be taken when the button is pressed:
   - **Load View Options:** Apply the specified view options settings. Select a previously created View Option configuration from the drop-down list. If you have not created any configurations, this check box is not selectable and this list is empty.
   - **Load View Type:** Apply the specified view type layout. Select a previously created View Type configuration from the drop-down list. If you have not created any configurations, this check box is not selectable and this list is empty.
   - **Run Pipeline:** Run the specified pipeline. Select a pipeline file supplied with Nexus or a previously created custom pipeline from the drop-down list.
4. Click **Apply** to preview the button on the Nexus toolbar. If you are not happy with the result, change the button details in the **Customize Toolbar** dialog box and preview the changes again.
5. Repeat steps 1-4 for each button you want to add to the Nexus toolbar.
6. Click **OK** to save the customized toolbar and close the dialog box.

To change the position of a toolbar button in the Customize Toolbar dialog box:

1. In the **Toolbar Buttons** list, select the entry for the button whose position you want to change.

   Button entries in this list from top to bottom correspond to the button positions on the toolbar from left to right.

   Important Nexus executes any customized buttons in the following order:

   1) View Option

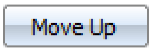
   2) View Type

   3) Pipeline

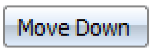
   Vicon recommends that you lay out your custom toolbar buttons in this order to avoid the potential for losing unsaved changes if you press multiple buttons before saving a configuration.

   ---

2. Change the button's position on the toolbar using the buttons:

Move the selected button up one position in the list, that is, left one position on the toolbar.

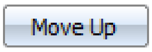
   

Move the selected button down one position in the list, that is, right one position on the toolbar.

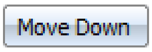
3. Click **Apply** to preview the changed button location on the Nexus toolbar. If you are not happy with the result, change the position again in the **Customize Toolbar** dialog box and preview the position again.
4. Click **OK** to save the customized toolbar and close the dialog box.

To group related buttons together on the toolbar in the Customize Toolbar dialog box:

1. Click **Add Separator**. A new separator entry is added to the bottom of the **Toolbar Buttons** list and is highlighted and selected.
2. Change the separator's position on the toolbar using the buttons:

   Move the selected separator up one position in the list, that is, left one position on the toolbar.

   Move the selected separator down one position in the list, that is, right one position on the toolbar.

3. Repeat steps 1-2 for each separator you want to add between buttons on the Nexus toolbar.
4. Click **OK** to save the customized toolbar and close the dialog box.

To remove a toolbar button or separator in the Customize Toolbar dialog box:

1. In the **Toolbar Buttons** list, select the entry for the button or separator you want to remove from the toolbar.
2. Click **Remove** 

   .
3. In the displayed confirmation dialog box, click **Remove Item**. The entry is removed from the list and button or separator is removed from the **Toolbar**.
4. Click **OK** to save the customized toolbar and close the dialog box.

If you wish to discard any changes you have made in the **Customize Toolbar** dialog box, click **Cancel**. Nexus displays a warning message for you to confirm that you wish to lose any changes you have made. If you wish to reload the default Nexus **Toolbar**, click **Reset**. Nexus displays a warning message asking you to confirm that you want to discard any customizations you have previously saved.

Motion Capture with Nexus

About Motion Capture with Nexus

Vicon Nexus is a Life Science-specific motion capture software application. It has been designed for Life Science requirements, and its workflows are based on an analysis of the needs of typical Life Science users. Nexus makes it easy to perform daily routine tasks at the same time as it offers the customization and flexibility necessary to fit the situation of particular users.

Vicon Nexus is easy to learn and easy to use. To get started with Vicon Nexus, follow these steps:

1. Set up your Vicon system.
2. Prepare subjects for motion capture in Nexus.
3. Perform the basic motion capture workflow.

The user interface guides you through the various tasks. For quick tips on how the interface is laid out and how to navigate your way around it, see About the Nexus User Interface. Once you are familiar with the basics, you can customize Nexus to look and behave the way you want it to.

Setting Up a Vicon System Using Nexus

The first time you use Nexus, you must prepare your Vicon system for motion capture. Thereafter, you only need to make changes to the system setup if your hardware configuration changes or if you require different system settings, for example, a different camera frequency.

Once you have completed this initial system setup, you will have a calibrated Vicon system that is ready to capture motion data from the connected devices: optical data from MX / Bonita Optical cameras, reference video from Bonita Video and/or other supported digital video cameras, and analog data from force plates or EMG devices. For details on capturing motion data with Nexus, see Performing the Nexus Motion Capture Workflow.

You can save system setup settings in a configuration file and subsequently modify them. You can create any number of additional system configuration files to meet your particular requirements for unique motion capture situations. You can then just load the appropriate file for a particular type of motion capture application.

The stages involved in setting up your Vicon system for motion capture using Nexus are outlined below. Steps within each stage are described in the following sections.

Vicon System Setup Stages:

I. Configure Vicon system hardware

II. Calibrate the Vicon system

III. Prepare a database

Important

- These stages assume that your Vicon system hardware (including the MX / Bonita cameras, MX units, and any supported third-party devices) have already been set up and that the Nexus application software has already been installed and licensed.
- Your Vicon system may have been professionally installed by a Vicon Support Engineer. If you are installing the system yourself, for full details on installing system hardware, see the *Get Going* and *Go Further with Vicon MX T-Series* books and for installing and licensing the software, see the *Vicon Product Guide - Foundation Notes*.
- Vicon Nexus software is licensed using a HASP dongle. The licensing drivers must have been installed on the host PC, and the dongle must be plugged into an appropriate port (parallel or USB) on the computer while you are running the application software.
- The IP address for the Vicon MX Ethernet card on the host PC must be set to 192.168.10.1 using the default IP address range (for details, see the *Get Going* and *Go Further with Vicon MX T-Series* books).

Note: Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to “MX camera” also apply to the use of Bonita cameras within Nexus.

I. Configure Vicon System Hardware

The first stage of setting up your Vicon system for motion capture using Nexus is to configure the Vicon MX / Bonita cameras, MX units, and any supported third-party devices such as digital video cameras, force plates, or EMG devices. When you start Nexus, it automatically detects all the hardware currently connected to your Vicon system and groups them into several different categories. You also configure any preferred system-wide parameter and data processing settings. You configure the hardware integrated in your Vicon system and the system settings in the System resources pane.

To configure Vicon system hardware:

1. Configure Vicon system parameters.
2. Position the MX / Bonita cameras to acquire data from the capture volume.
3. Mask out any unwanted reflections visible to the cameras automatically or manually.
4. Configure the MX cameras for optical data capture.
5. Configure MX Giganet, MX Ultranet HD or MX Ultranet units for system communications and any GPO or remote triggering.
6. Configure any MX Control units for analog data acquisition (for pre-MX T-Series systems).
7. Configure any force plates for analog data capture.
8. Configure any supported devices for analog data capture.

9. Configure any digital video cameras for digital video capture.
10. Configure real-time processing.

II. Calibrate the Vicon System

The second stage of setting up your Vicon system for motion capture using Nexus is to calibrate the MX cameras and define the origin of the capture volume to produce accurate 3D data. Camera calibration enables Nexus to work out the positions, orientations, and lens properties of all the MX cameras. You calibrate the MX cameras and set the origin of the capture volume in the System Preparation tools pane.

To calibrate the Vicon system:

1. Calibrate the MX / Bonita cameras.
2. Set the volume origin to ensure subjects are displayed the right way up.
3. If not using an Active Wand, use Static Video Calibration to calibrate any digital video cameras.

III. Prepare a Database

The third stage of setting up your Vicon system for motion capture using Nexus is to prepare a database in which to store and manage all the data associated with your motion capture trial. You do this in the Data Management window.

To prepare a database:

- Create a new database or edit an existing one.

Preparing Subjects for Motion Capture in Nexus

Vicon Nexus requires certain information to identify subjects and process their motion data. Nexus requires a description of the generic relationship between segments and joints and the Vicon markers for a certain type of subject, such as a human being. This information identifying what markers Nexus is to track and how these markers are connected to the underlying segments is stored in either of the following types of file:

- Vicon Skeleton Template (*.vst* file):Describes the generic relationship between physical markers attached to a subject and the skeletal structure to which the markers are attached for a certain type of subject. The .vst file defines the marker set and specifies which markers are attached to which segment, and which markers are shared between two segments, as well as which segments are connected to other segments.   For example, a .vst file may be used to represent a human being.
- Vicon Skeleton (*.vsk* file):Describes the relationship between physical markers and the skeletal structure to which the markers are attached for a specific subject of the type described in the associated .vst file. For example, if the .vst file represents a human being, the .vsk file contains the marker arrangement and skeletal structure scaled for an individual person.

The generic information in a *.vst* file must be scaled to create a *.vsk* file for a specific subject of that type, such as an individual patient, whose motion you intend to capture with your Vicon system. The generic *.vst* file needs to be scaled to fit a specific subject because the template contains only the general topology of the markers and segments, not the specifics of the subject being captured. For example, the *.vst* file for a human being may say that the femur is 450mm long, but the length of the specific patient's femur is only 320mm. The Static Subject Calibration pipeline operation scales a generic *.vst* file to create a *.vsk* file for a specific subject.

This operation uses a single, fully labeled frame of reconstructed and labeled markers captured from the subject wearing the marker set described in the *.vst* file to calculate all the distances between the markers to calibrate the template to fit the subject. Once the *.vst* file has been calibrated, the resulting *.vsk* file can be used to reliably label that subject either in real time or offline for as long as the markers are attached in the same configuration.

The primary use of the *.vsk* file in Nexus is automatic labeling, so *.vst* and *vsk* files created in Nexus contain only the following information (those created in other Vicon applications and imported into Nexus may contain additional subject data):

- The names of the different markers in the marker set (e.g., LASI, RASI).
- The skeletal structure of what you are tracking (e.g., the Femur connected to the Pelvis, the Tibia connected to the Femur).
- The relationship between the marker set and the skeletal structure (e.g., the LASI marker is attached to the Pelvis segment).
- The type of joints that connect the segments (e.g., ball-and-socket, hinge or completely unrestricted 6 degree-of-freedom joints).
- Other properties of segments, markers, and joints such as colors.

You can use a *.vst* file supplied with Nexus or create one of your own to suit your application requirements. If you are planning on processing your collected data with Vicon's prevalidated full-body model, Plug-in Gait, then you will use one of the supplied Plug-in Gait .vst files. Otherwise, if you are planning on using your own model to process your data, you must create your own .vst file.

Important	*A .vst* file you create in Nexus is used only to define the marker set and to enable Nexus to perform automatic labeling. It is not a biomechanical model that will output valid joint angles or other kinematic/kinetic variables. To derive valid kinematics or kinetics, use either a predefined model (such as Vicon Plug-in Gait) or create your own model using Vicon BodyBuilder.

Creating a Vicon Skeleton Template (*.vst* file) is a one-time task; using an existing *.vst* file to calibrate a Vicon Skeleton (*.vsk* file) is a frequent—if not daily—task, so subject calibration is covered as part of the daily Nexus workflow. Use the stages in this topic on preparing a subject for motion capture whenever you have a new type of subject whose motion you intend to capture or a new marker arrangement. You create and select *.vst* files in the Subject resources pane and the Subject Preparation tools pane.

Important	These stages assume that your Vicon system has already been set up appropriately for your motion capture application. For details on doing this, see Setting Up a Vicon System using Nexus.

Using a Plug-in Gait VST in Nexus

Plug-in Gait is the Vicon implementation of the Conventional Gait Model (CGM) that is widely used in the gait analysis community and has been validated through its frequent citation in peer-reviewed publications. Plug-in Gait enables users to produce gait analysis reports that conform to established clinical practices. Plug-in Gait directly calculates kinematics (angles) and kinetics (forces, moments, and powers) from the measured XYZ marker positions for the model's joint centers on a frame-by-frame basis. You can import the kinematic and kinetic data calculated by the model for your subject (patient) in Nexus into another software application, such as Vicon Polygon, for subsequent gait analysis.

There is a single stage involved in preparing to use Plug-in Gait in Nexus.

Plug-in Gait Preparation Stage:

I. Create a new subject node from one of the supplied Plug-in Gait templates.

You can then calibrate a VSK based on the specified Plug-in Gait template.

Building a Vicon Skeleton Template in Nexus

The Nexus **Labeling Template Builder** enables you to build your own Vicon Skeleton Template (*.vst* file), suitable for labeling.

The stages involved in preparing a Vicon Skeleton Template in Nexus are outlined in the following table.

Vicon Skeleton Template Preparation Stages:

I. Create a blank subject node.

II. Build a Vicon Skeleton Template for labeling a generic subject type.

III. Customize Vicon Skeleton Template properties.

IV. Optionally add subject measurements to the Vicon Skeleton Template.

V. Save the Vicon Skeleton Template as a .vst file.

You can then calibrate a VSK based on the Nexus template.

Performing the Motion Capture Workflow in Nexus

In Vicon Nexus, you can capture and analyze the movement of live subjects (such as human beings or animals) and of inanimate objects (such as sports equipment or other rigid objects) for a variety of motion capture applications. You can either stream motion data in real time or capture it for offline processing depending on your requirements.

Important

- These stages assume that your Vicon system has already been set up appropriately for your motion capture application. For details on doing this, see Setting Up a Vicon System using Nexus.
- For brevity, the Nexus Help System topics refer to "subjects" rather than "subjects and/or objects." Unless otherwise noted, references to motion capture subjects apply equally to objects.
- Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to "MX camera" also apply to the use of Bonita cameras within Nexus.

The stages involved in the typical workflow for the day-to-day operation of Nexus for motion capture production and control are outlined in the following table. Steps within each stage are described in the following sections.

Nexus Motion Capture Workflow Stages:

I. Prepare system.

II. Prepare subject.

III. Capture and process a trial.

IV. Review trial and fill gaps.

V. Post process trial.

Stages I and II are typically performed when you set up your system or prepare a new subject for capture the first time. Stages III through V are iterative; repeat them as many times as necessary to finalize your motion capture data.

Throughout the workflow, you will visualize data in the View pane and view and manage the state of your Vicon system in the Communications pane.

I. Preparing the Vicon System for Motion Capture

The first stage of the motion capture workflow is to prepare the Vicon system, including the MX cameras and any digital video cameras, for motion capture. You check the aim and calibration of MX and digital video cameras in the System Preparation tools pane.

To prepare the Vicon system for motion capture:

1. Check MX /Bonita camera positions.
2. Check MX / Bonita camera calibrations.
3. Check any static video camera calibrations.
4. Manage camera calibration files.

II. Preparing a Subject for Motion Capture

The second stage of the motion capture workflow is to prepare the subject whose motion is to be captured. You prepare subjects in the Subjects resources pane and the Subject Preparation tools pane.

To prepare a subject for motion capture:

1. Create a subject node based on a Vicon Skeleton Template (.vst file).
2. Capture a static trial and reconstruct markers.
3. Manually label reconstructed markers.
4. Calibrate a Vicon Skeleton for a specific subject based on a Nexus or a Plug-in Gait Vicon Skeleton Template.
5. Save the Vicon Skeleton in a (.vsk file).

III. Capturing and Processing Motion Capture Data

The third stage of the motion capture workflow is to capture a trial for the specified subject and process the trial data. You capture motion data in the Capture tools pane. You process trial data from the Nexus Menu Bar.

To capture and process motion capture data:

1. Capture a trial manually or automatically trigger motion capture remotely.
2. Reconstruct and automatically label the trial data.

IV. Reviewing and Gap Filling Motion Capture Data

The fourth stage of the motion capture workflow is to review the reconstructed and labeled motion capture data and fill any gaps in the trial data. You review and fill gaps in motion data in the Label/Edit tools pane.

To review and gap fill motion capture data:

- Manually review and fill individual gaps or automatically fill all gaps in the reconstructed and labeled trial data.

V. Post-Processing Motion Capture Data

The fifth stage of the motion capture workflow is to perform any post-processing of the trial data. You post-process trial data in the Pipeline tools pane and the Data Management window.

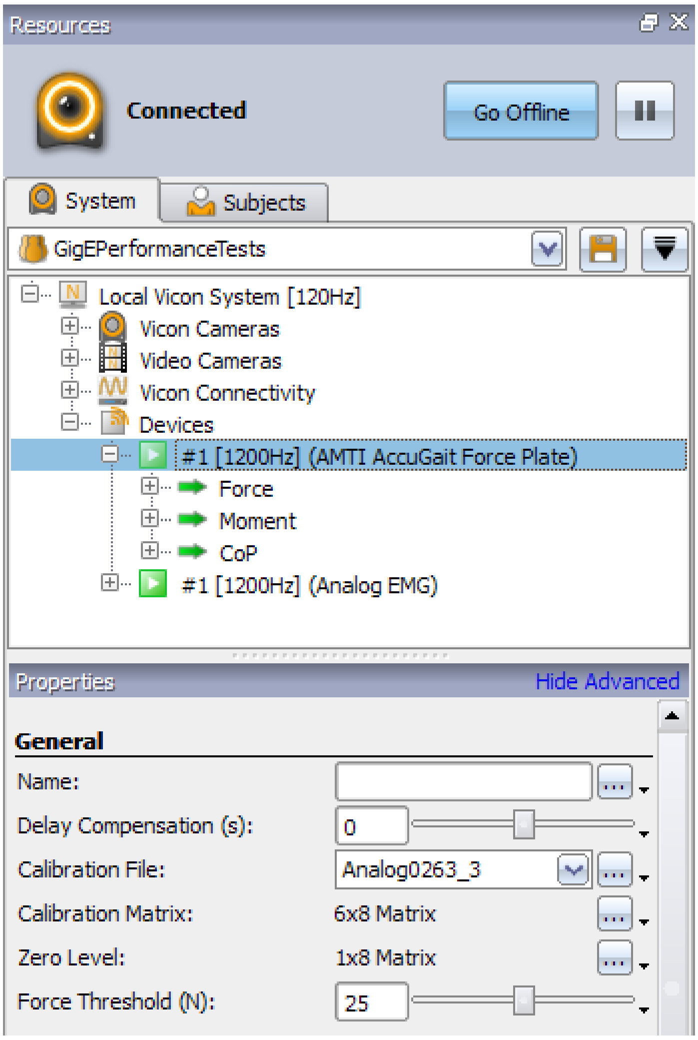
To post-process motion capture data:

1. Set up and run pipelines for any operations you want to automate.
2. Transfer any digital video files to the Nexus host PC.
3. Optionally batch process multiple trials in a database using a previously defined pipeline.

Resources Pane

About Nexus Resources Pane

Manage the components of your Vicon system architecture and the subjects whose motion is to be captured in the **Resources** pane .



Nexus Motion Capture Workflow:

I. Prepare system.

II. Prepare subject.

After you have prepared your Vicon system and selected the subjects for motion capture in this **Resources** pane, you use the **Tools** pane to manage the motion capture and analysis process, and the View pane to visualize the data.

Tip	By default, the **Resources** pane is on the left side of the Nexus window. You can detach or change the position of this pane. For details, see Customizing the Nexus User Interface.

The **Resources** pane contains the following sections:

- System Connection Buttons

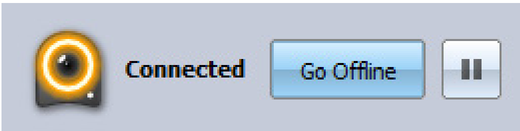
  Nexus has two operating modes: Live Mode and Offline Mode. The system status indicators at the top of the Resources pane make it easy for you to immediately identify (1) the current operating mode and (2) the hardware connection status.

  Live Mode connects the system and starts real-time streaming.

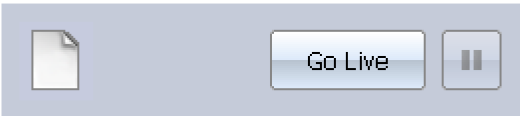
  Offline Mode disconnects the system and stops real-time data streaming. Previously captured and saved data can be played back offline.

  System in Live Mode - No connection established with Vicon hardware

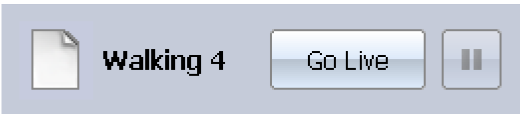
  System in Live Mode - Connection established with Vicon hardware



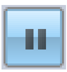
  System in Offline Mode - No trial loaded in memory



  System in Offline Mode - Trial is loaded in memory



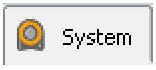
  The trial name is displayed to the left and the tool tip shows the file location.


Pause

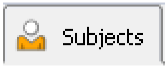
  Pauses real-time data streaming. This button is available and is a bright blue color when the system is in its **Live** mode. When the system is in its **Offline** mode, this button is a light-gray color.

Resources Tabs

You select the type of **Resources** pane to be displayed from the Resources tabs:

System 

Configure the components of your Vicon system.

Subjects 

Load and manage files for the subjects whose motion data you want to capture and analyze in Vicon Nexus.

Resources Tree

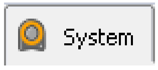
You select the items and any sub items to be configured with the resources tree in the middle of the **Resources** pane. The nodes displayed in this section depend on whether you are in **System** resources pane or the **Subjects** resources pane.

Properties

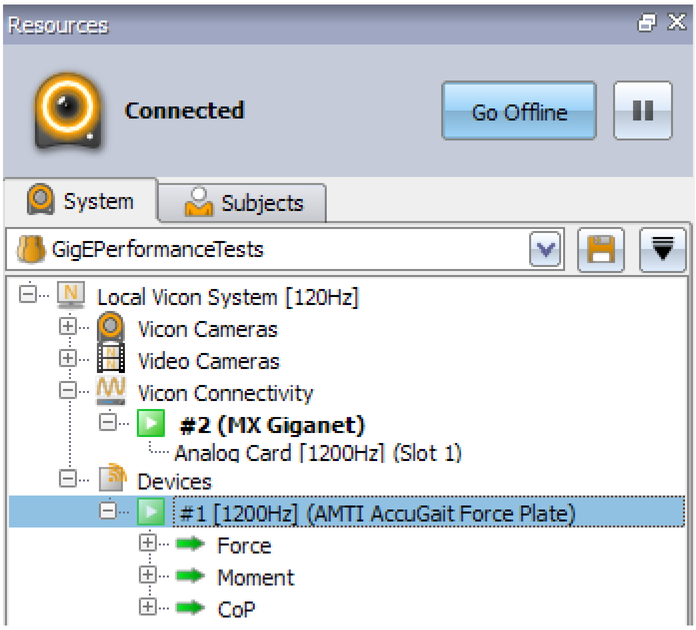
You view and change settings for the item selected in the resources tree with the **Properties** section at the bottom of the **Resources** pane. The contents of this section depend on the node selected in the resources tree. For details on how to specify settings for properties, see Setting Properties in Nexus. For details on the available properties, see the topic for that component in this **Resources** section of the Vicon Nexus Help System.

System Resources Pane

About System Resources Pane

Manage the components of your Vicon system in the **System** resources pane 

.

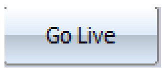


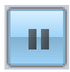
Vicon System Setup:

1. Configure Vicon system hardware.

The **System** resources pane contains the following sections:

- **System Configuration Management**

  Create or manage configurations for the settings in the **System** resources pane using the **Configuration Management** section at the top of the pane. This section is displayed when Nexus is in **Live** or **Pause** mode (click the **Go Live** button 

 or the **Pause**  button).

- **System Resources Tree**

  Select the node for the system component you want to configure in the **Resources Tree** section of the **System** resources pane (the nodes displayed depend on the current system connection mode and connected system components):

Local Vicon System

The Vicon system capture rate and the Nexus memory buffer size; real-time processing settings; and the identification and connection settings for the Nexus host PC.

Vicon Data

The details for cameras and capture devices in your MX system that were used for a previously saved motion capture trial.

Vicon Cameras

The identification and configuration settings for each MX / Bonita camera connected to your Vicon system.

Video Cameras

The identification and configuration settings for each digital video camera connected to your Vicon system.

MX Controls

For MX systems earlier than T-Series. The identification and configuration settings for each MX Control unit included in your Vicon system architecture.

Vicon Connectivity

The identification and configuration settings for each MX Giganet, MX Ultranet HD or MX Ultranet unit included in your Vicon system architecture.

Devices

The connection and configuration settings for Vicon and supported third-party devices included in your Vicon system architecture.

Tip	You can perform commands specific to a type of system component node or sub node by right-clicking on a node in the **System** resources tree and selecting the desired command from the displayed context menu.

Synchronization Master

The node for the device designated as the Vicon system synchronization master is highlighted in bold in the **System** resources tree. If an MX Giganet is included in the system, it is automatically designated as the synchronization master, responsible for providing the master synchronization signal to the system.

For MX systems earlier than the T-Series, if an MX Ultranet HD is included in the system, it is automatically designated as the synchronization master.

If the system does not contain an MX Giganet or MX Ultranet HD, then a suitable MX Control, MX Ultranet, or MX Camera is designated as the synchronization master. If there are multiple MX Ultranet HD devices, the one with Genlock enabled is designated as the synchronization master.

If the automatically selected synchronization master is not the required choice, you can change it.

To do this:

1. At the top of the **System** tab, click **Local Vicon System** to select it.
2. At the top of the **Properties** list, click **Show Advanced**.
3. In the **MX System** area of the **Properties** list, click the **Master Select** list and then choose the required synchronization master from the list.

MX Device Status

Some **System** resources tree nodes have sub nodes for individual components of that type:

Green play button: Component OK (active or connected); if an analog device is connected to the MX component, the analog source is selected and all channels are configured.

Yellow pause button: Component not fully set up

Gray play button: Component connected but not contributing any data.

Red stop button: Component down (unavailable or disconnected)

Green arrow: Analog channel connected to source device.

Yellow arrow: Analog channel not connected to source device, or device is disabled (**Enabled** properties check box in the Status section is not ticked).

For more information on the status of system components, see About Status Communications Pane.

System Properties

View or modify system components in the **System Properties** section at the bottom of the **System** resources pane. The properties displayed depend upon the component node selected in the system resources tree. Properties can be presented in categories such as General, Settings, Commands, etc. For details on how to specify settings for properties, see Setting Properties in Nexus.

Note	Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to "MX camera" also apply to the use of Bonita cameras within Nexus.

Managing Local Vicon System

Managing your local Vicon system includes the following:

- Configure the Vicon system capture rate and the amount of memory allocated to Nexus for motion capture.
- Manage the way Nexus is to produce real-time 3D representations of the subjects whose motion is being captured.
- Specify the identification and connection settings for the Nexus host PC with the **Local Vicon System** node.

Vicon System Setup:

I. Configure Vicon system hardware.

11. Configure the local Vicon system.

This is the top-level node that is displayed for the Nexus host PC when Nexus is in **Live** mode. The **Local Vicon System** node contains sub nodes for each device connected to your MX system under the following nodes:

- Vicon Cameras
- MX Controls
- Vicon Connectivity
- Video Cameras
- Devices (including force plates, accelerometers, EMG, Dikablis eye tracker, etc)

The node for the device designated as the MX system synchronization master is highlighted in bold in the **System** resources tree. For details on the components that may be included in a Vicon system architecture, see Nexus Components.

Important	Nexus must be in **Live** mode for this node to be displayed (click the **Go Live** button Go Live). Before managing the local Vicon system, ensure that the desired system configuration has been selected in the **System** resources pane.

To configure the Local Vicon System:

1. In the **System** resources pane System, click the **Go Live** button.
2. In the **System** resources tree, click the **Local Vicon System** node.
3. In the **Properties** section at the bottom of the **System** resources pane, view or change settings for the desired properties to suit the needs of your motion capture application.

Important	When you first set up your MX system, you must configure at least the **Requested Frame Rate (Hz)** property under the **MX System** section. In subsequent sessions, you may wish to configure additional properties to suit the needs of your motion capture application.

4. At the top of the **System** resources pane, click the **Save** button to save your system configuration settings to a *.system* file in the **Systems** configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Systems*).

Context Menu

You can select from the following commands on the context menu displayed when you right-click on the **Local Vicon System** node:

- **Reboot Vicon Hardware**Reset all of the MX hardware devices in the Vicon system. Use this command if a camera has failed to boot, or if you need to reset the whole system for other reasons. Alternatively, use the **Reboot All** button in the **MX System Properties** section.
- **Reboot Core Processor**Restarts the **Core Processor** and resets the labeler. Alternatively, press CTRL + R.
- **Resynchronize**Forces the MX system synchronization master to resynchronize the frame rate for all connected cameras and third-party devices.
- **Reprogram Vicon Firmware**Display the Reprogram MX Firmware dialog box in which you can view and update firmware for certain MX devices present in your Vicon MX architecture.

Setting Properties for Local Vicon System

When configuring the local Vicon system, you can configure the following settings in the **Properties** section for the **Local Vicon System** node:

- **MX System**

  System-wide parameters that affect all the connected cameras and devices:

  Genlock Standard

  The type of video standard supported by the connected video source: **None**, **PAL**, **NTSC**, **Film (24 fps)**, or **Film (24/1.001 fps)**.

  Default: None

  Requested Frame Rate (Hz)

  The rate (in Hertz) at which to synchronize the MX cameras. If using external video signal, select from displayed values (multiples of the base frame rate of the PAL, NTSC, or Film video standard specified in **Standard**) up to a maximum of 2,000. You can choose any number you want if you do not have any Genlock Standard set.

  The configured Vicon system capture rate is displayed in square brackets beside the node. For example, if the Vicon system frame rate is set to 100 Hz, the node title is displayed as **Local Vicon System [100Hz]**. If the **Requested Frame Rate** cannot be met due to the camera frame rate, Vicon Nexus displays the nearest adjusted frame rate in square brackets. To meet the **Requested Frame Rate**, you can change the **Sub Sample Ratio** of the relevant camera(s).

  Default: 100

  Actual Frame Rate (Hz)

  The frame rate used by the Vicon system, which is constrained by the camera frame rate limits.

  Master Select

  A list from which you can choose the synchronization master. If you are using multiple devices (such as Giganets) to connect and control your cameras, a synchronization master is automatically chosen by Vicon Nexus. If the automatically selected synchronization master is not the required choice, you can select the appropriate device from the **Master Select** list.

Default: Automatic

Buffer Size (MB)

The size (in MB) of the memory buffer on the host PC when Nexus is receiving data from Vicon hardware. Specify a value between 0-1024 MB. This buffer is used if data comes in faster than Nexus can process it; therefore, the larger the buffer, the longer it takes before capture fails. Increasing this value enables a greater **Capture Before Start** duration to be set. The optimum size of the **Buffer Size** parameter depends on the amount of memory on your PC. The proportion of the total memory buffer that is reserved for Vicon devices is determined by the **MX Buffer Reserve** (see below).

Tip	If you experience failure of a combined video and optical camera calibration under Windows XP, particularly if you are capturing a long wand wave, close and restart Nexus. Reduce the **Buffer Size** to 0 MB before calibrating. Do not increase the buffer size to its usual level until you have completed a successful calibration.

Default: 250

MX Buffer Reserve

The proportion of the total buffer size (see **Buffer Size** above) that is reserved for Vicon video devices. The default of 0.5 results in half of the total buffer size being reserved for Vicon video devices (MX and Bonita cameras). The remaining buffer space is used by third-party video cameras. If you want to maximize the buffer space reserved for Vicon MX or Bonita video cameras, set this value to 1.0. If you are using only Basler cameras or third-party DV cameras, set this value to 0.

Default: 0.5

Reboot All

Resets all of the Vicon hardware devices in the MX system. Use this button if a camera has failed to boot, or if you need to reset the whole system for other reasons.

Alternatively, use the **Reboot Vicon Hardware** command from the context menu.

Minimize Latency

Minimizes the level of latency, or lag time, the RealTime Engine introduces during data streaming when data rates approach or exceed system processing capacity.

If selected, the RealTime Engine introduces no lag time when processing data frames. This decreases data throughput, but increases the possibility of frames being dropped.

If cleared, the RealTime Engine introduces 20 frames of lag time when processing data frames. As this increases data throughput, it can produce better labeling results.

Default: Cleared

Core Processor

Settings for the **Core Processor** component, which receives data from the MX / Bonita cameras and transforms the data to the trajectories or segments your MX system is tracking:

Processing Level

The amount of real-time processing the **Core Processor** is to perform on source data:

- **Circle Fit:** Have the Nexus Core Processor attempt to circle fit grayscale blobs that the MX / Bonita cameras could not resolve. Data will not be reconstructed to 3D trajectories, so you will only see data in the **2D Camera** view pane.
- **Reconstruct:** Create 3D reconstructions of marker images. 3D trajectories are created, but they are not labeled.
- **Label:** Assign labels to markers, based on the Vicon Skeleton (*.vsk* file). Labels are applied to the reconstructed trajectories if a *.vsk* file is present.
- **Kinematic Fit:** Fit joint angles defining the relationship between segments. The segments defined in the *.vsk* file are fitted and displayed.

Default: Label

Important	
	- These settings are applied cumulatively. For example, selecting **Label** applies that setting as well as the **Reconstruct** and **Circle Fit** settings. - When setting the volume origin in the **System Preparation** tool pane, the **Core Processor** setting automatically changes to **Kinematic Fit**, then returns to its previous setting when the process is complete.

Marker Movement Speed

The speed of marker movement specified as a value in the range 0-10, where 0 is almost stationary (such as turtle movements), and 10 is very fast (such as a golf swing).

This setting affects the Core Processor's ability to create continuous trajectories. If you use the fastest setting, you can expect continuous trajectories even for very fast moving markers, but if two markers are close to each other there is an increased chance of a crossover (where the 3D trajectory changes from one marker to the other). The default value should be sufficient for typical captures where markers move at around 1-3 m/s. Increase the value for high speed movements such as a golf swing; decrease it for situations where the markers are in close proximity but do not move very much.

Default: 5

Label Model Rigidity

The rigidity of the relationship between the segment and the markers on the object being labeled specified as a value in the range 0-10, where 0 is completely rigid (that is markers are not expected to move in respect to the underlying segment), and 10 is loose (that is the markers are expected to move significantly in respect to the segment).

Default: 2

Quality / Speed

The relative importance of the quality over the speed of processing specified as a value in the range 0-10, where 0 places a higher priority on processing quality (the system tries very hard to get the labels right at the expense of processing speed), and 10 places a higher priority on processing speed (the system processes at high speed at the expense of labeling accuracy).

This property primarily affects the labeling function of the Core Processing.

Default: 2

Ray Intersection Factor

The factor, specified as a value in the range 0-10, by which the reconstruction algorithm will be able to form a single reconstruction from rays from different cameras. The higher the value, the more distance is allowed between two rays that contribute to the reconstruction.

Default: 4

Minimum Recon Separation

The minimum distance, specified as a value in the range 0-100 millimeters, allowed between 3D marker positions in order for them to be considered for reconstruction. If two candidate reconstructions are closer than this minimum separation, only the most likely reconstruction (in terms of the number of cameras contributing) will be reported. The other will be discarded. A higher value decreases the likelihood of creating spurious reconstructions, but increases the possibility that some genuine markers will not be reconstructed.

Default: 14

- Grayscale Circle Fitting
  - **Enable:** Select this check box to enable grayscale circle fitting.
  - Grayscale Fit Method
    - **Fit Fast:** This method uses the same circle fitting parameters that are used by default onboard the Vicon cameras.
    - **Fit Robust:** This method uses circle fitting parameters that are designed to separate "merged" markers.
    - **Fit As Appropriate:** This method attempts to fit the grayscale data using the fast fitting method first and then uses the robust method if the fast fitter fails.
    - **Fast Fit Circularity Threshold:** Identical to that used on cameras and represents how the circular blob needs to be accepted.
    - **Robust Fitter Quality Threshold:** Represents what proportion of an occluded marker is required to be visible for the circle to be accepted.
    - **Robust Fitter Intensity Threshold:** Represents how (relatively) bright a marker needs to be in order to be accepted.

- Reconstruction

Controlling the number of cameras that are required to start or continue a trajectory can be beneficial in producing higher quality data. The ability to define how trajectories are created can help you to produce higher quality data that requires less manual editing.

Ray Noise Factor

This parameter is used to model the noise levels on individual rays.

Default: 1

Camera Noise Factor

This parameter is used to model the calibration inaccuracy of all cameras. Increase this value to compensate for inaccurate calibrations.

Default value: 2

Environmental Drift Tolerance

Increase this parameter to reduce the sensitivity (in mm) of the calibration to environmental factors, particularly temperature change.

Use this setting to compensate for environmental changes when you do not have time or other resources to recalibrate the whole system. For the most accurate results, recalibration remains the preferred solution.

For advice about reducing the effect of environmental factors, see Minimizing system inaccuracy.

Default: 0

Minimum Cameras to Start Trajectory

This parameter controls how many cameras (rays) must see the same marker (centroid) in order to create a new reconstruction and potentially form a new trajectory. The minimum value that can possibly create a reconstruction is two cameras. The maximum value of this parameter is 30 cameras or the total number of cameras in your system. This value can be increased if there are a large number of unlikely reconstructions being created.

Default: 3 cameras

Minimum Cameras to Continue Trajectory

This parameter controls how many cameras (rays) must see the same marker (centroid) in order to create a reconstruction to continue a recognized trajectory. The minimum value that can possibly create reconstructions is two cameras. The maximum value of this parameter is 30 cameras or the total number of cameras in your system. The value can be decreased if there are gaps in trajectories where reconstruction should be possible when viewed by fewer cameras.

Default: 2 cameras

Min 3D Radius

This parameter specifies the minimum 3D radius (in mm) that is allowed for a reconstruction. Any reconstruction with a radius less than this value is removed.

Default: 0

Max 3D Radius

This parameter specifies the maximum 3D radius (in mm) that is allowed for a reconstruction. Any reconstruction with a radius greater than this value is removed.

Default: 10000

Trajectory Tracking

Prediction Error

The deviation allowed (in mm/sec) in a marker's position on a trajectory. This value is related to the radius within which the current trajectory is matched to a reconstruction in the following frame.

Default: 150

Startup Error

The deviation allowed (in mm/sec) in a marker's position at the start of a trajectory. This value is related to the radius within which the current trajectory is matched to a reconstruction in the following frame.

Default: 150

Labeling

Fixed labeling tolerance

Allows slight extra uncertainty (mm) in marker placement, in addition to that in the subject calibration.

Default: 3

Proportional labeling tolerance

Allows slight extra uncertainty in marker placement, as a proportion of the wobble observed in the subject calibration.

Default: 0.2

Fixed Marker Recalibration tolerance

Allows slight deviation in marker placement on their segments from that in the subject calibration (in mm). If you are labeling a subject using a slightly inaccurate subject calibration, you may need to increase this value.

Default: 10

Proportional joint range tolerance

Extends the range of motion (ROM) from that allowed in the subject calibration. If you are labeling a subject whose joints' movement range was insufficient during the ROM trial, you may need to increase this value.

Default: 0.2

Fixed joint position tolerance

Allows slight inaccuracy in the joint positions (in mm). If you are labeling a subject using a slightly inaccurate subject calibration, you may need to increase this value.

Default: 2

Entrance Threshold

Specifies the proportion of markers that have to be present when a subject enters the capture volume or when the trial starts. If it is less than this value, the subject is not labeled.

Default: 0.92

Exit Threshold

Specifies the proportion of a subject's markers below which the subject is considered by Nexus to have left the capture volume. Labeling will not recommence unless the proportion reaches the **Entrance Threshold**.

Default: 0.5

Minimum trajectory length (in frames)

Trajectories below this length are not labeled. If they are already labeled, they are unaffected, even if **Clear existing trajectory labels** is selected in the **Autolabel Trial** pipeline in **Processing** operations in the **Tools** pane.

Default: 5

Kinematic Fitting

Factor for adjusting the weighting given to the rest pose in the fit. Range 0 (none) to 10 (maximum). If you are working with data that has occluded markers, increasing this value may improve your results.

Default: 1

Identification

Identification details for the Nexus host PC.

Unique Name

The Windows computer name of the Nexus host PC.

Default: The value specified in the Microsoft Windows **System Properties** dialog box.

Name

The name of the Nexus host PC in the workgroup (local network) of computers included in a distributed Vicon system.

This name is displayed in parenthesis beside the node in the format `(hostPC@group)`, where `hostPC` is the name specified in this **Name** property and `group` is the name specified in the **Workgroup** property.

Default: Blank

Workgroup

The name of the workgroup (local network) of computers included in a distributed Vicon system.

Default: Blank

IP Address

The Internet Protocol (IP) address for the local Ethernet network card in the Nexus host PC that connects the PC to the LAN. This is a separate, local Ethernet network card in addition to that dedicated to the Vicon system (the Vicon Ethernet network card has a default IP address of 192.168.10.1).

Default: Blank

Managing Vicon Data

View details of the cameras and capture devices in your MX system that were used for a previously saved motion capture trial with the **Vicon Data** node in the **System resources** pane.

Vicon System Setup:

I. Configure Vicon system hardware.

11. Configure the local Vicon system.

This is the top-level node that is displayed for the Nexus host PC when Nexus is in **Offline** mode. The **Vicon Data** node contains sub nodes for each capture device that was connected to your MX system during the trail capture under the following nodes:

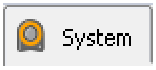
- Vicon Cameras
- Video Cameras
- Devices (including force plates, accelerometers, etc)

For details on the components that may be included in a Vicon system architecture, see Nexus Components.

Note	Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to “MX camera” also apply to the use of Bonita cameras within Nexus.

Important	Nexus must be in **Offline** mode for this node to be displayed (click the **Go Offline** button). In this mode, you can view but not manage the device details displayed in the **System** resources pane.

To view device details in Vicon data:

1. In the **System** resources pane 

, click the **Offline** button.
2. In the **System** resources tree, expand the **Vicon Data** node .
3. Expand the **Devices** node and click the required device node.
4. In the **Properties** section at the bottom of the **System** resources pane, view settings for properties that were set for the selected device when the trial was captured.

Tip	The top-level **Vicon Data** node does not have any displayed properties. Not all properties that are configurable for a device in **Live** mode are visible in **Offline** mode. For further details, also see Managing Local Vicon System.

Managing MX / Bonita Optical Cameras

Manage the identification and configuration settings for each MX camera connected to your Vicon system with the **Vicon Cameras** node in the **System resources** pane.

Note	Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to “MX camera” also apply to the use of Bonita cameras within Nexus. The following instructions refer to MX cameras and Bonita Optical cameras. For information on Bonita Video cameras, see Managing Video Cameras.

Vicon System Setup:

I. Configure Vicon system hardware.

4. Configure the MX cameras for optical data capture.

Configuring MX camera ensures that all the camera settings are correct and appropriate for your motion capture application. You can configure the settings for an individual camera, several cameras, or all cameras at once.

This node is displayed under the Local Vicon System node when Vicon Nexus is connected to the MX system and is in **Live** mode. It is displayed under the Vicon Data node when Nexus is in **Offline** mode. The **Vicon Cameras** node lists each MX camera connected to your MX system. For each camera, the node name includes the device position number, any display name specified in the Identification property, and the camera type listed in parentheses, for example, **#1 Over Door (MX T160)**. For details on the types of cameras and other components that may be included in a Vicon system architecture, see Nexus Components.

Important	Nexus must be in **Live** mode (click the **Go Live** button ) or a previously saved trial must be loaded for this node to be displayed. Before managing your MX cameras, ensure that the desired system configuration has been selected in the **System** resources pane.

To configure MX cameras for optical data capture:

1. In the **System resources** pane **System**, click the **Go Live** button.
2. From the **View** pane toolbar, select **Camera**. The 2D data being captured by each MX camera selected in the **System** resources tree is shown in a separate **Camera** view pane.
3. Visualize your capture volume:
   - In the **Options** dialog box, under the **General View Options** section, select the **Target Volume** option. On the right side of the **Options** dialog box, update the properties of the target volume to reflect the dimensions of your capture volume inside your laboratory. In the **Camera** view pane toolbar, from the **View** drop-down list, select **3D Overlay**.
   - Place the calibration object in the geometric center of your capture volume's width and length, on the floor.
   - Select the **System Preparation** button on the **Tools** pane.
   - Select the **Start** button for the operation titled **Aim Cameras**. A virtual representation of your target volume is overlaid on the 2D data from selected the camera image.
   - In the capture volume, place a selection of static markers on the floor to roughly outline your target capture volume.
4. In the **System** resources tree, select the node whose properties you wish to configure:
   - **Vicon Cameras** node for all MX cameras
   - a sub node for a specific **MX Camera**– For Vicon MX systems, the camera sub nodes in the **System** resources tree correspond to the User IDs you set in the **Properties** section (described below). If there is no MX Giganet present in the MX system, the sub node for the MX camera acting as the synchronization master is in bold.

   When a camera is selected, a blue status light on the front of its strobe unit lights up (unless you have cleared the **Enable LEDs** option in the **Properties** section for that MX Camera).

Tip	In many cases, it is best to start by selecting all of the cameras in order to find a common baseline. You can then adjust individual cameras as required.

   The commands available on the context menu depend on the node you have selected.
5. In the **Properties** section at the bottom of the **System** resources pane, view or change settings for the desired properties.

When you first set up your MX system, you may configure the following properties in the order shown:

Identification area:	**Name** (If you wish to distinguish it from the others)
Settings area:	**Strobe Intensity** **Gain** **Grayscale mode** (leave at default **Auto** setting)
Centroid Fitting area	**Threshold** **Minimum Circularity Ratio**

> Tip: If adjusting these settings does not easily enable you to eliminate reflections, create camera masks to eliminate reflections and other unwanted light sources that occur in parts of the capture volume.

Centroid tracking area:	**Enable Centroid Tracking** **Marker Velocity**

> Note: Centroid Tracking is only available for T-Series cameras.

> Important: These properties affect the quality of the motion capture data. Therefore, it is important to optimize these before you collect data intended for later analysis. In subsequent sessions, you may wish to configure additional properties to suit the needs of your motion capture application.

6. When you have finished adjusting the Vicon Camera settings, in the **Settings** area, ensure that **Grayscale Mode** is set to **Auto**.
7. At the top of the **System** resources pane, press the **Save** button to save your system configuration settings to a *.system* file in the **Systems** configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Systems*).

Vicon Cameras Context Menu

You can select the following commands from the context menu displayed when you right-click on the **Vicon Cameras** node:

- **Reorder** Display the Reorder Devices dialog box in which you can change the order in which MX cameras are displayed in the **System** resources tree.
- **Reboot Vicon Cameras** Stop and restart all of the MX cameras in the Vicon system.
- **Remove Vicon Cameras** Displays a choice of Disconnected or Missing:
  - Disconnected - removes from the Resources tree cameras that are currently unplugged.
  - Missing - removes from the Resources tree cameras that are unplugged, but were previously used in a calibration.

- **Enable Preview Mode**Enables Preview mode for MX T-Series cameras. In this mode Vicon Nexus displays a 'video' image from the optical sensor of an MX T-Series camera, which enables you to aim cameras more quickly and easily during setup.
- Note that this preview feature is for system setup purposes only. You cannot capture camera data in Preview mode.

You can select the following command from the context menu displayed when you right-click on a node for a specific MX camera:

- **Reset Calibration**Remove the selected camera from the current calibration.
- **Reboot**Start and restart the selected MX camera.

Setting Properties for MX / Bonita Cameras

When you first set up your Vicon system, you may configure the following properties in the order shown:

Identification area:	**Name** (If you wish to distinguish it from the others)
Settings area:	**Strobe Intensity**
	Tip: If adjusting these two settings does not easily enable you to eliminate reflections, create camera masks to eliminate reflections and other unwanted light sources that occur in parts of the capture volume.
	Gain
	Grayscale mode (Leave at default **Auto** setting)
Centroid Fitting area:	**Threshold**
Centroid Tracking area:	**Enable Centroid Tracking**
	Note: Centroid Tracking is only available for T-Series cameras.

Important: These properties affect the quality of the motion capture data. Therefore, it is important to optimize these before you collect data intended for later analysis. In subsequent sessions, you may wish to configure additional properties to suit the needs of your motion capture application.

Note: Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to "MX camera" also apply to the use of Bonita cameras within Nexus.

You can configure the following settings in the **Properties** section for MX cameras:

- Identification

Name

A user-defined display name for the entire set of MX cameras or for each individual MX camera. For example, if a camera is placed over a door, you could name it "Over Door."

Default: Blank

Device ID

The unique identification number Vicon assigns to each MX camera during manufacture. The top-level entry for all MX cameras takes no value.

Default: Identified on connection

- Settings

Enabled

Whether or not the MX camera is currently enabled for use.

Default: Selected

Strobe Intensity

The amount of light emitted by MX camera strobe units. This value can be set between 0-1 to minimize reflections and obtain clear marker images. The higher the setting, the larger the markers appear, but this may cause blobs to be produced from unwanted reflection sources. Lower settings reduce unwanted reflection sources but make the markers themselves less visible to the MX cameras.

In almost all circumstances, you will want to keep the intensity at its maximum level because the system works by recording light from the strobes that is reflected from the markers, thus the more light the strobes send out the more light the markers reflect. However, there are two significant cases where you may want to lower the intensities:

- If you see a lot of reflections in the volume, either from other cameras or from other objects in the room, such as shiny equipment, floors, or from the subject.
- If you are capturing a very fast moving subject. The strobe intensity affects the time the strobe is on for each camera frame. The full strobe intensity corresponds to 1ms for normal frame rates. Lower strobe intensities mean that the markers are captured with the strobes on for less time and, therefore, have less time to move during the frame.

Tip	In normal circumstances, it is advisable to use full strobe intensity and deal with reflection problems by closing the camera lens aperture. However, especially when the capture volume is very small, this may be uncomfortable to the patient, so less than the full intensity may be the best setting.

Adjust this setting in conjunction with the **Threshold** setting until reflections are minimized or gone.

Default: 1

Gain

The digital amplification of the pixel value. Select a displayed value to determine the intensity of the grayscale from the MX cameras: **x1**, **x2**, **x4**, or **x8**.

This setting is applied to the camera to change the dynamic range of the recorded image. Increasing the gain means that markers have less variation in grayscale intensity between the center and edge, but in certain circumstances, using a higher gain yields markers that are easier for the camera to distinguish. Vicon does not recommend using a gain setting higher than **x2**.

Adjust this setting if the markers appear too faint or if the cameras have trouble distinguishing them; otherwise, leave the this property at the default **x1** setting.

Default: x1

Grayscale mode

The type of data for processed grayscale blobs that the MX cameras send to Vicon Nexus. The MX cameras perform data processing to create 2D data for Vicon markers. They generate grayscale blobs for reflections from objects in the capture volume and then use centroid-fitting algorithms to determine which of these are likely to be markers by comparing the shape of the grayscale blobs to the **Minimum Circularity Ratio** and **Max blob height** settings. During this processing, MX cameras can produce the following types of data for grayscale blobs: centroids data (x, y coordinates and the radius of the centroid calculated), grayscale data (pixel and line information), or coordinates data (line information, i.e. grayscale data without pixel values).

You can specify which type of processed data MX cameras send to Nexus:

- **Auto:** Send grayscale data only of the grayscale blobs for which centroids were not generated, that is, those below the threshold specified for **Minimum Circularity Ratio**.

  Send coordinates data of grayscale blobs for which one or more line segments, or the total number of lines in the blob, exceeds the value set for **Max blob height**.

  If a marker can be centroid fitted by the MX camera, the centroid is passed to the capture PC. If it cannot, the full grayscale of the image is sent, allowing the data to be post-processed on the PC. This is the default and recommended mode.

- **None:** Send no grayscale or coordinates data; send only centroid data.

  Any grayscale image that cannot be centroid fitted by the camera will be discarded. Select this mode if you are capturing a large number of markers and have redundancy in your capture setup (i.e. the same marker is seen by more than the number of cameras specified in **Minimum Cameras per Marker** under the **Core Processor** section of the properties for Local Vicon System.

- **All:** Send grayscale data both of grayscale blobs for which centroids were generated and of those for which centroids were not generated, that is those below the threshold specified for **Minimum Circularity Ratio**.

  Send coordinates data of grayscale blobs for which one or more line segments, or the total number of lines in the blob, exceeds the value set for **Max blob height**.

  Select this setting if you need to see exactly where the camera calculates the centroid with respect to the grayscale marker image, for example when adjusting parameters. This setting results in much larger data rates and files; it may be useful for diagnostic purposes, but do not use it in normal capture situations.

- **Only:** Send all grayscale and coordinates data; send no centroid data.

  This setting is useful when focusing or making other adjustments to the cameras themselves as you see exactly the image recorded on the sensor.

- Edges: Send only edge coordinates data; send no centroid or grayscale data.

  If data rates are very high, for example when there are too many reflections, the camera automatically enters this mode. Use this setting to manually force the camera into this mode.

- No Edges: Send grayscale data both of grayscale blobs for which centroids were generated and of those for which centroids were not generated; send no coordinates data.

  Use this setting to prevent the MX camera from sending edge coordinates.

Default: Auto

Caution	Even if you have not specified a Grayscale mode setting that would have coordinates data sent to Nexus, an MX camera automatically sends coordinates data– either temporarily or permanently– if it is overloaded with data (e.g., too many markers, too many reflections, hand or reflective objects immediately in front of the camera, too low a threshold or too high a gain). If a camera automatically starts to present coordinates data, you should identify the source of the overload and attempt to remedy it.

Allow Windowing

Windowing enables Vicon MX T-Series cameras to run at a faster frame rate by using letterboxing to reduce the dimensions of the camera sensor area. Cannot be used in calibration mode.

Default: Selected

Enable LEDs

Whether or not to use the status lights on the lower right of the MX camera strobe unit that provide feedback on the status of the camera (such as its enabled, connection, or selection state and any processing feedback). This is useful for motion capture applications in very dark environments (such as Virtual Reality) where the brightness of these LED status lights can cause problems.

Default: Selected

Centroid Fitting

Threshold

The threshold for the minimum brightness (intensity) for marker pixels (the setting does nothing to an overall marker, just the individual pixels); pixels of an intensity lower than this threshold are ignored. This value can be set between 0-1 to determine the pixels to be considered for centroid fitting onboard the MX cameras. Lower settings enable the camera to detect lower light levels, thus making the markers appear larger, but introduce more noise from unwanted reflections and other light sources. Higher settings reduce the noise, but make the markers themselves less visible.

This setting differentiates between markers and ambient light. An MX camera records 10-bit grayscale data, which for each sensor pixel is a measure of how much light fell on that pixel during a given amount of time. However, the cameras will almost always pick up some ambient light in the volume. To enable the cameras to distinguish between light that comes from markers and light that does not, a threshold is applied. Anything above this threshold is deemed to be a marker, anything below is deemed to be ambient light. A value in the region of 0.2 to 0.5 is usually appropriate, but Vicon strongly recommends that you use static markers in the volume in order to establish an appropriate setting. If cameras are evenly spaced around the volume, the same threshold value is usually sufficient for all cameras.

Adjust this setting, the **Strobe Intensity**, and the camera's aperture until reflections are minimized or gone.

Default: 0.5

Minimum Circularity Ratio

The circularity threshold used by the centroid-fitting algorithms in an MX camera. This value can be set between 0-1 to determine how similar a grayscale blob must be to the internal model of a marker– that is a radially symmetric object that has smooth, sharp edges and whose pixel intensity is brightest at the center and gradually fades towards the edges. The MX cameras consider grayscale blobs with circularity equal to or greater than this threshold to be well-formed, circular marker images. The higher the value, the more stringent the centroid fitter is; the lower the value, the less stringent the centroid fitter is. You may wish to apply higher settings for camera calibration to ensure that Vicon MX selects the best markers and thus provides the best possible calibration. A lower value may be appropriate for data capture.

Default: 0.5

Maximum Blob Height

The maximum number of pixels per line that a grayscale blob can contain in a horizontal line. If the number of pixels exceeds this value, the MX camera determines that the grayscale blob is not a marker, stops processing it, and discards the pixel values (it preserves just the coordinates data, which can be sent to Vicon Nexus, depending on the **Grayscale mode** setting).

Set this value between 0-500 to determine how large a grayscale blob can be for an MX camera to consider it a candidate marker. The MX cameras consider grayscale blobs with horizontal lines containing this number or fewer pixels to be good-sized, circular marker images. The higher the value, the larger a grayscale blob can be; the lower the value, the smaller a grayscale blob must be.

Default: 50

Centroid Tracking

Enable Centroid Tracking

When Nexus recognizes the presence of T-Series cameras, the **Enable Centroid Tracking** parameter becomes available. Tracking and identifying 2D centroids on an individual camera allows the production of 2D tracks. Tracking and identifying 2D camera centroids provides extra information that maintains marker labels in real time when only one camera can see a marker. When enabled, the 2D track calculations are performed by the cameras' onboard sensors. When disabled, the 2D track calculation is performed by the PC (in Nexus).

Click on a Vicon camera to turn on 2D switchable tracks. Disable this option to turn off.

> Note: Only Vicon's T-Series cameras have the ability to process this information onboard the camera.

Default: Off

Marker Velocity

Maximum velocity at which a marker will be tracked, expressed as the percentage of image width per second.

Default: 5

Status

Connected

Whether or not the MX camera is currently connected to the Vicon system.

Default: Identified on connection

Sync Master

Whether or not the MX camera is designated as the synchronization master for the MX system. (Not relevant to MX T-Series cameras or MX devices with an Ultranet HD.)

Default: Identified on connection

Contributing Centroids

Whether or not the MX camera is contributing centroid data during the current motion capture.

Default: Identified during capture

Contributing Grayscale

Whether or not there is a socket open to the MX camera capable of receiving grayscale. This socket may be dropped when the system is under heavy load, therefore this property is useful as a system status monitor. It is not related to **Grayscale** property under **Settings**.

Default: True

Contributing Tracks

Whether or not the camera is contributing tracks.

MX Hardware

Type

The type of MX camera (T160, T40-S or T20-S). The top-level entry for all MX cameras takes no value.

Default: Identified on connection

Strobe Type

The type of strobe unit attached to the front of the MX camera: Visible Red (VR), Near Infrared (NIR), or Infrared (IR). MX T-Series T160, T40-S, and T20-S cameras support only VR and NIR strobe units. The top-level entry for all MX cameras takes no value.

Default: Identified on connection

Strobe Temperature

Current strobe operating temperature given in degrees Centigrade.

Default: Identified during connection

Sensor Width

The width (in pixels) of the MX camera sensor.

Default: Identified on connection

Sensor Height

The height (in pixels) of the MX camera sensor.

Default: Identified on connection

Revision

Camera revision number.

MAC Address

The Media Access Control (MAC) address assigned to the MX camera during manufacture. This is a hexadecimal value in the format ##.##.##.##.##.##. The top-level entry for all MX cameras takes no value.

Default: Identified on connection

IP Address

The Internet Protocol (IP) address assigned to the MX camera on the Vicon MX Ethernet network. The top-level entry for all MX cameras takes no value.

Default: Identified on connection

Destination IP Address

The IP address of the network adapter to which data from this camera will be sent.

Default: Default

MX Firmware

Firmware Version

The version number of the MX firmware currently installed on the MX camera.

Default: Identified on connection

Firmware Complete

Whether or not the currently installed MX firmware is complete. If not, you can reprogram the MX firmware.

Default: Identified on connection

- Calibration

  Reset Calibration

  Removes the selected camera from the current calibration.

  Focal Length (mm)

  The focal length (in millimeters) of the MX camera lens. The focal length of the lens is automatically calculated by the calibration algorithm. You only need to enter this value manually if you use the Aim MX Cameras function. Can be set to a value between 2-100.

Default: 20

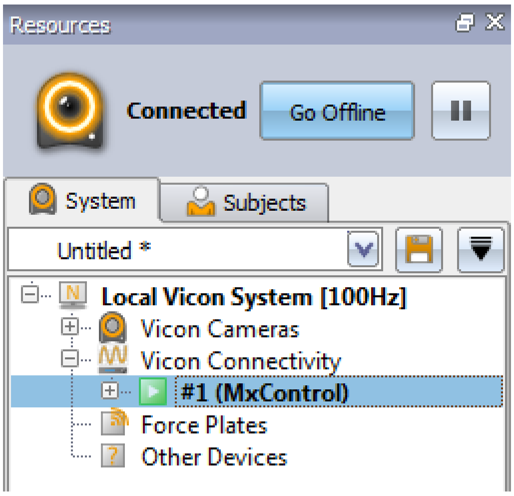
- Commands

  Reboot

  Stop and restart the selected Vicon camera.

Managing MX Control Units

Manage the identification and configuration settings for each MX Control unit included in your Vicon system architecture with the **MX Control** node in the **System** resources pane .



Vicon System Setup:

1. Configure Vicon system hardware.

   6. Configure any MX Control units for analog data acquisition.

Important	This topic applies only to MX systems containing an MX Control (generally those supplied before November 2007). Vicon MX T-Series systems use the MX Giganet as the single-unit controller for the MX system. The MX Control is not compatible with the MX Giganet. If you are using an MX Control, see the *Go Further with Vicon MX T-Series* reference or contact Vicon Support for configuring your system.

This node is displayed under the Local Vicon System node when Vicon Nexus is connected to an MX system with at least one MX Control unit and is in **Live** mode. The **MX Control** node lists each MX Control unit connected to your MX system. For each MX Control, the node name includes the device position number, any display name specified in the **Identification** property, and the device type listed in parentheses, for example **#1 Name (MX Control)**. If either or both analog option cards are installed in the MX Control, the sample rates are displayed in brackets, for example, **#1 Name [1000Hz/1000Hz] (MX Control)**, and the **Analog Card (Slot 1)** and **Analog Card (Slot 2)** sub nodes are displayed as appropriate. If no analog source is selected, **[No Source]** is displayed after the MX Control device name. For details on the components that may be included in a Vicon system architecture, see Nexus Components.

Important	Nexus must be in **Live** mode (click the **Go Live** button Go Live) for this node to be displayed. Before managing MX Control units in your Vicon system, ensure that the desired system configuration has been selected in the **System** resources pane.

To configure MX Control units for analog data acquisition:

1. In the **System** resources pane System, click the **Go Live** button.
2. In the **System** resources tree, select the node whose properties you wish to configure:
   - **MX Control** node for all MX Control units
   - a sub node for a specific **MX Control unit**– For Vicon MX systems, the MXControl sub nodes in the **System** resources tree correspond to the IDs assigned by Nexus. If an MX Control unit has automatically been designated as the synchronization master for the MX system, its node name is displayed in bold.

   The colored icon beside an **MX Control** node identifies the status of the device and of any connected analog source:

   Green play button: Component OK (active); if an analog device is connected, the analog source is selected and all channels are configured.

   Yellow pause button: Component not fully set up

   Gray play button: Component connected but not contributing any data.

   Red stop button: Component down (unavailable, disconnected or disabled)

   These colored icons correspond to those used for the device summary in the **Status** communications pane.

   The commands available on the context menu depend on the node you have selected.
3. In the **Properties** section at the bottom of the **System** resources pane, view or change settings for the desired properties.
4. When you first set up your MX system, you configure at least the **Name** property and, if you are using synchronization functionality, the **Sync Out** properties. In subsequent sessions, you may wish to configure additional properties to suit the needs of your motion capture application.
5. If an analog option card is installed in the unit, expand the MX Control node and select the sub node for an analog card.
6. In the **Properties** section, set the **Sampling Frequency (Hz)** option.
7. At the top of the **System** resources pane, press the **Save** button to save your system configuration settings to a *.system* file in the **Systems** configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Systems*).

MX Control Context Menu

You can select the following commands from the context menu displayed when you right-click on the **MX Controls** node:

- **Reorder**Display the [Reorder Devices] dialog box in which you can change the order in which MX Control units are displayed in the **System** resources tree.
- **Reboot All MX Controls**Stop and restart all of the MX Control units in the MX system.

You can select the following commands from the context menu displayed when you right-click on a node for a specific MX Control:

- **Reboot**Start and restart the selected MX Control unit.
- **Reset Timecode**Reset the timecode to 00:00:00:00.

Setting Properties for MX Control Units

Properties

You can configure the following settings in the **Properties** section for [MX Control units] (**Vicon Connectivity** node):

- **Identification**

  Name

  A user-defined display name for the entire set of MX Control units or for each individual MX Control unit.

Default: Blank

  Type

  The MX device type.

Default: MX Control

  Device ID

  The unique identification number Vicon assigns to each MX Control unit during manufacture. The top-level entry for all MX Control units takes no value.

Default: Identified on connection

- **Status**

  Enabled

  Whether or not the MX Control unit is currently enabled for use.

Default: Selected

Sync Master

Whether or not the MX Control unit is designated as the synchronization master for the MX system.

Default: Identified on connection

Sync Locked

Whether or not the MX Control unit is receiving and locked to the master synchronization signal for the Vicon system.

Default: Identified on connection

Sync Out

The characteristics of a synchronization pulse that the MX Control is to generate to synchronize third-party hardware with the Vicon system (for technical details, see the *MX Hardware System Reference* book). The general purpose output driver (**.gpo* file) you specify here determines the output frequency of the synchronization pulse. You can select a driver for each of the four independent sockets.

For each socket, use the **Browse for a folder** button to navigate to the folder containing the *.gpo* files (by default, *C:\Program Files\Vicon\Nexus\GPO*) and then used the drop-down list button to select the desired file (None, Duration, DV_Double, DV_Half, DV_Normal, or DV_Quarter):

Socket 1

The *.gpo* configuration file to use to specify the synchronization signal for Pin 1 of the **GPIO** socket on the rear panel of the MX Control.

Default: Blank

Socket 2

The *.gpo* configuration file to use to specify the synchronization signal for Pin 2 of the **GPIO** socket on the rear panel of the MX Control.

Default: Blank

Socket 3

The *.gpo* configuration file to use to specify the synchronization signal for Pin 3 of the **GPIO** socket on the rear panel of the MX Control.

Default: Blank

Socket 4

The *.gpo* configuration file to use to specify the synchronization signal for Pin 4 of the **GPIO** socket on the rear panel of the MX Control.

Default: Blank

MX Hardware

MAC Address

The Media Access Control (MAC) address assigned to the MX Control during manufacture. This is a hexadecimal value in the format ##.##.##.##.##.##. The top-level entry for all MX Control units takes no value.

Default: Identified on connection

IP Address

The Internet Protocol (IP) address assigned to the MX Control on the Vicon MX Ethernet network. The top-level entry for all MX Control units takes no value.

Default: Identified on connection

MX Firmware

Firmware Version

The version number of the MX firmware currently installed on the MX Control.

Default: Identified on connection

Firmware Complete

Whether or not the currently installed MX firmware is complete. If not, you can reprogram the MX firmware.

Default: Identified on connection

Commands

Reboot

Stop and restart the MX Control.

You can configure the following settings in the **Properties** section for an analog card connected to an MX Control:

Configuration

Requested Sample Rate (Hz)

The required sample rate for the analog card.

The default analog sampling frequency is 1000 Hz and the corresponding default MX system frame rate is 100 Hz. The analog frequency must be an integer multiple of the frame rate and both must divide evenly into 135 MHz (the master clock frequency). If you change the **Requested Frame Rate**, the analog frequency may change automatically to meet these criteria. Similarly, if you enter an invalid analog sampling rate, its value will be adjusted to meet the criteria automatically.

Default: Identified on connection

Actual Sample Rate (Hz)

The actual sample rate for the analog card. As explained above, it is dependent on the system frame rate and therefore may not be the same as the Requested Frame Rate.

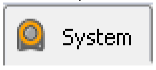
Channel Count

The number of channels provided by the analog card.

Default: 64

Managing Vicon Connectivity Units

About Vicon Connectivity Units

Configure Vicon Connectivity units – smart boxes that can be combined to create a distributed architecture, enabling you to customize the number of MX / Bonita cameras and supported third-party devices in your Vicon system – with the **Vicon Connectivity** node in the **System** resources pane 

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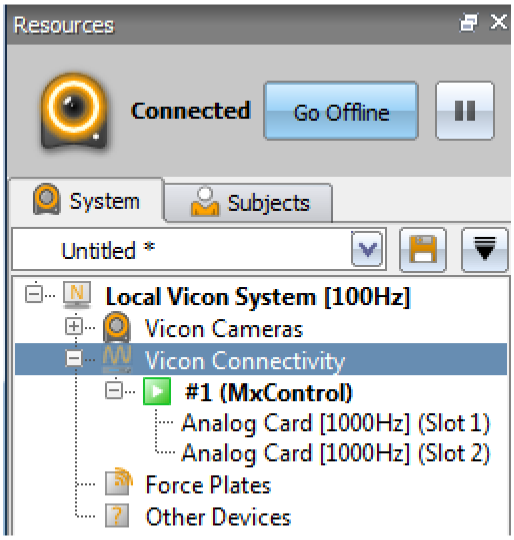


Vicon System Setup:

I. Configure Vicon system hardware.

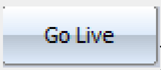
5. Configure MX Giganet, MX Ultranet HD, or MX Ultranet units for system communications and any GPO or remote triggering.

This **Vicon Connectivity** node is displayed under the *Local Vicon System* node when Vicon Nexus is connected to the Vicon system and is in **Live** mode. It is displayed under the *Vicon Data* node when Nexus is in **Offline** mode. The **Vicon Connectivity** node lists each connectivity unit connected to your Vicon system.

Depending on the type of Vicon system you are running, your Vicon system architecture will contain one or more of the following Vicon Connectivity units:

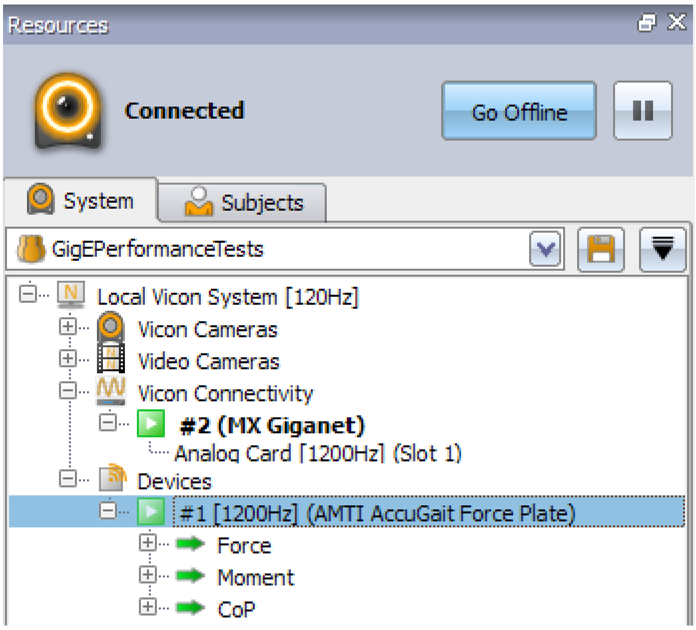
- MX Giganet: The primary connectivity unit in an MX T-Series system
- MX Ultranet HD: The primary connectivity unit in an MX F-Series system
- MX Ultranet: The primary connectivity unit in an MX+ system

You can incorporate units and components from earlier MX Series systems into your MX T-Series system. See the *Go Further with Vicon MX T-Series* reference or contact Vicon Support for details on configuring a combined architecture. For details on these components that may be included in a Vicon system architecture, see Nexus Components.

Important	Nexus must be in **Live** mode (click the **Go Live** button ) or a previously saved trial must be loaded for this node to be displayed. Before managing Vicon connectivity units, ensure that the desired system configuration has been selected in the **System** resources pane.

Managing MX Giganet Units

Manage the identification and configuration settings for each MX Giganet unit included in your Vicon system architecture in an **MX Giganet** node under the Vicon Connectivity node in the **System** resources pane .



Vicon System Setup:

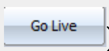
l. Configure Vicon system hardware.

8. Configure MX Giganet, MX Ultranet HD, or MX Ultranet units for system communications and any GPO or remote triggering.

Important	This topic applies to MX T-Series systems containing an MX Giganet unit. The MX Giganet is the single box replacement for the MX Ultranet HD and MX Control units present in earlier Vicon MX systems. You can incorporate components from earlier MX systems into an MX T-Series system (for details, see Nexus Components).

Setting Up MX Giganet Units

This node is displayed under the Local Vicon System node when Vicon Nexus is connected to an MX system with at least one MX Giganet unit and is in **Live** mode. The **Vicon Connectivity** node lists each MX Giganet unit connected to your Vicon system. For each MX Giganet, the node name includes the device position number, any display name specified in the **Identification** property, and the device type listed in parentheses, for example **#1 Name (MX Giganet)**. If either or both analog option cards are installed in the MX Giganet, the sample rates are displayed in brackets, for example, **#1 Name [1000Hz/1000Hz] (MX Giganet)**, and an **Analog Card (Slot 1)** sub node is displayed as appropriate. If no analog source is selected, **[No Source]** is displayed after the MX Giganet device name. For details on the components that may be included in a Vicon system architecture, see Nexus Components.

Important	Nexus must be in **Live** mode (click the **Go Live** button ) for this node to be displayed. Before managing MX Giganet units in your MX system, ensure that the desired system configuration has been selected in the **System** resources pane.

To configure MX Giganet units for analog data acquisition:

1. In the **System resources** pane System, click the **Go Live** button.
2. In the **System** resources tree, select the node whose properties you wish to configure:
   - **Vicon Connectivity** node for all MX Giganet units
   - A sub node for a specific **MX Giganet unit**– For Vicon systems, the MX Giganet sub nodes in the **System** resources tree correspond to the IDs assigned by Nexus. If an MX Giganet unit has automatically been designated as the synchronization master for the Vicon system, its node name is displayed in bold.

     The colored icon beside an **MX Giganet** node identifies the status of the device:

     Green play button: Component OK (active). If an analog device is connected, this status does not reflect the analog device's status.

     Yellow pause button: Component is not fully set up or device has been disabled in Status section of **Properties.**

     Gray play button: Component connected but not contributing any data.

     Red stop button: Component down (unavailable or disconnected).
   - An analog card node for a specific MX Giganet unit

     MX Giganets can be configured with a 64-channel analog card in order to connect and sync Force plates and EMG devices.

   The commands available on the context menu depend on the node you have selected.
3. In the **Properties** section at the bottom of the **System** resources pane, view or change settings for the desired properties.

   When you first set up your MX system, you configure at least the **Name** property and, if you are using synchronization functionality, the **Sync Out** properties. In subsequent sessions, you may wish to configure additional properties to suit the needs of your motion capture application.
4. At the top of the **System** resources pane, click the **Save** button to save your system configuration settings to a *.system* file in the **Systems** configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Systems*).

MX Giganet Context Menu

You can select the following commands from the context menu displayed when you right-click on the **MX Giganets** node:

- ReorderDisplay the Reorder Devices dialog box in which you can change the order in which MX Giganets are displayed in the **System** resources tree.
- **Reboot All MX Giganets**Stop and restart all of the MX Giganets in the MX system.

You can select the following commands from the context menu displayed when you right-click on a node for a specific MX Giganet:

- RebootStop and restart the selected MX Giganet.
- **Reset Timecode**Reset the Timecode to 00:00:00:00.

Setting Properties for MX Giganet Units

You can configure the following settings in the **Properties** section for the **Vicon Connectivity** node and nodes for any MX Giganet units:

Identification

Name

A user-defined display name for the entire set of MX Giganets or for each individual MX Giganet.

Default: Blank

Type

The MX device type. The Vicon Connectivity node takes no value.

Default: MX Giganet

Device ID

The unique identification number Vicon assigns to each MX Giganet during manufacture. The Vicon Connectivity node takes no value.

Default: Identified on connection

Status

Connected

Whether or not the MX Giganet is currently connected to the Vicon system.

Default: Identified on connection

Enabled

Whether or not the MX Giganet unit is currently enabled for use.

Default: Selected

Sync Locked

Whether or not the MX Giganet is receiving and locked to the master synchronization signal for the Vicon system.

Default: Identified on connection

Sync Master

Whether or not the MX Giganet is designated as the synchronization master for the Vicon system.

Default: Identified on connection

Genlock

Enabled

Whether or not Genlock functionality supported by the MX Giganet is currently enabled. If so, the scan rate of the incoming video signal from a PAL or NTSC video source is synchronized with MX cameras.

Default: Identified on connection

Source

The genlock device source.

Default: Internal

Standard

The video standard of the external video source with whose incoming video signal scan rate the MX Giganet is to synchronize the MX cameras. If one is not identified, None is displayed.

Default: Identified on connection

Status

The status of the Genlock functionality: None, In Use, Ready To Use, Requires Other Frame Rate, Requires Device To Be Master, or Requires Genlock.

Default: Identified on connection

Timecode

Enabled

Whether or not Timecode functionality supported by an MX Giganet is currently enabled. If so, the MX Giganet can be configured to trigger from or be time-stamped from a connected VITC (video) or LTC (audio) Timecode source.

Default: Identified on connection

Source

The source designated as the master Timecode signal generator: VITC (external video device), LTC (external audio device), or Internal (MX Giganet).

Default: Internal

Dropped Frames

Whether or not the MX Giganet is to adjust its internal counter to drop frames for the NTSC video standard. This option is available only if Internal is specified in Source. If selected, the separator character in the Timecode display in the Capture tools pane changes between a colon (:) for non-drop frames and semicolon (;) for drop frames.

Default: Cleared

Standard

The video standard of the Timecode source from which the MX Giganet will trigger data capture or be time-stamped. If one is not identified, None is displayed.

Default: Identified on connection

Status

The status of the Timecode functionality: None, In Use, Ready To Use, Requires Other Frame Rate, Requires Device To Be Master, or Requires Genlock.

Default: Identified on connection

Sync Out

The characteristics of a synchronization pulse that the MX Giganet is to generate to synchronize third-party hardware with the MX system (for technical details, see the *Go Further with Vicon T-Series* book). The general purpose output driver (**.gpo* file) you specify here determines the output frequency of the synchronization pulse. You can select a driver for each of the sync outputs.

For each sync output, use the **Browse for a folder** button to navigate to the folder containing the *.gpo* files (by default, *C:\Program Files\Vicon\Nexus\GPO*) and then used the drop-down list button to select the desired file (None, Duration, DV_Double, DV_Half, DV_Normal, or DV_Quarter):

Socket 1

The *.gpo* configuration file to use to specify the synchronization signal for **Powered Sync Output 1** in the rear panel of the MX Giganet.

Default: Blank

Socket 2

The *.gpo* configuration file to use to specify the synchronization signal for **Powered Sync Output 2** in the rear panel of the MX Giganet.

Default: Blank

Socket 3

The *.gpo* configuration file to use to specify the synchronization signal for **Powered Sync Output 3** in the rear panel of the MX Giganet.

Default: Blank

Socket 4

The *.gpo* configuration file to use to specify the synchronization signal for **Powered Sync Output 4** in the rear panel of the MX Giganet.

Default: Blank

Socket 5

The *.gpo* configuration file to use to specify the synchronization signal for Sync Output 5 in the rear panel of the MX Giganet.

Default: Blank

Socket 6

The *.gpo* configuration file to use to specify the synchronization signal for Sync Output 6 in the rear panel of the MX Giganet.

Default: Blank

Socket 7

The *.gpo* configuration file to use to specify the synchronization signal for Sync Output 7 in the rear panel of the MX Giganet.

Default: Blank

Socket 8

The *.gpo* configuration file to use to specify the synchronization signal for Sync Output 8 in the rear panel of the MX Giganet.

Default: Blank

MX Hardware

MAC Address

The Media Access Control (MAC) address assigned to the MX Giganet during manufacture. This is a hexadecimal value in the format ##.##.##.##.##.##. The top-level entry for all MX Giganet units takes no value.

Default: Identified on connection

IP Address

The Internet Protocol (IP) address assigned to the MX Giganet on the Vicon MX Ethernet network. The top-level entry for all MX Giganet units takes no value.

Default: Identified on connection

MX Firmware

Firmware Version

The version number of the MX firmware currently installed on the MX Giganet.

Default: Identified on connection

Firmware Complete

Whether or not the currently installed MX firmware is complete. If not, you can reprogram the MX firmware.

Default: Identified on connection

- Commands

  Reboot

  Stop and restart the MX Giganet.

You can configure the following settings in the **Properties** section for an analog card connected to an MX Giganet:

- Configuration

  Sampling Frequency (HZ)

  The sample rate for the analog card. The default analog sampling frequency is 1000 Hz and the corresponding default MX system frame rate is 100 Hz. The analog frequency must be an integer multiple of the frame rate and both must divide evenly into 135 MHz (the master clock frequency). If you change the frame rate, the analog frequency may change automatically to meet these criteria. Similarly, if you enter an invalid analog sampling rate, it's value will be adjusted to meet the criteria automatically.

  Default: Identified on connection

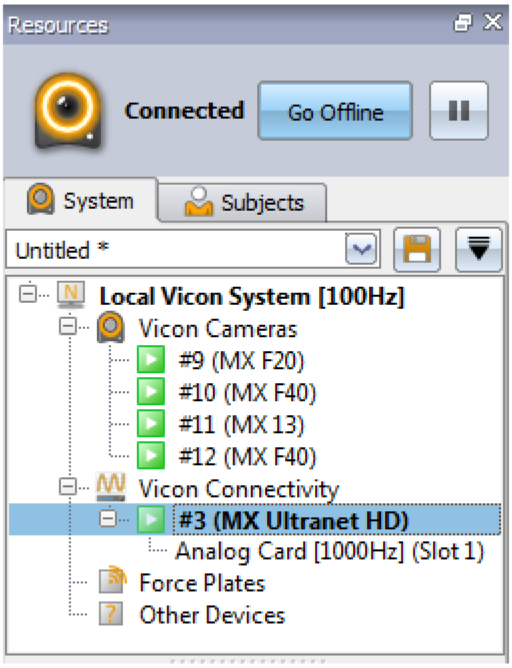
  Channel Count

  The number of channels provided by the analog card

  Default: 64

Managing MX Ultranet Units

Manage the identification and configuration settings for each MX Ultranet HD and MX Ultranet unit included in your Vicon system architecture in an **MX Ultranet HD** or **MX Ultranet** node under the **Vicon Connectivity** node in the **System** resources pane .



For brevity, references in this topic to MX Ultranet units apply equally to MX Ultranet HD units unless otherwise specified.

Vicon System Setup:

I. Configure Vicon system hardware.

5. Configure MX Giganet, MX Ultranet HD or MX Ultranet units for system communications and any GPO or remote triggering.

Important	This topic applies only to Vicon systems containing an MX Ultranet HD (generally those supplied before August 2008) or an MX Ultranet (generally those supplied before November 2007), or an MX T-Series system incorporating one of these units. Vicon MX T-Series systems use the MX Giganet as the single-unit controller for the MX system. You can incorporate components from earlier MX systems into an MX T-Series system by connecting the MX Ultranet HD to the MX Giganet. For details on cameras and units that can be incorporated in your MX system, see Nexus Components.

This node is displayed under the *Local Vicon System* node when Vicon Nexus is connected to a Vicon system with at least one MX Ultranet HD or MX Ultranet unit and is in **Live** mode. The **Vicon Connectivity** node lists each MX Ultranet unit (as well as each MX Giganet unit) connected to your MX system. For each device, the node name includes the device position number, any display name specified in the **Identification** property, and the device type listed in parentheses, for example **#1 Name (MX Ultranet HD)**. If an analog option card is installed in the MX Ultranet, its sample rate is displayed in brackets, for example, **#1 Name [2000Hz] (MX Ultranet HD)**, and the **Analog Card #1** sub node is displayed. If no analog source is selected, [No Source] is displayed after the MX Ultranet device name. For details on the components that may be included in a Vicon system architecture, see Nexus Components.

If you select an MX Ultranet HD unit in the **System** resources tree, the red **Selected Unit** LED on the rear panel of the MX Ultranet HD unit is lit. This is useful when you are connecting MX cables or analog devices to the unit.

Important	Nexus must be in **Live** mode (click the **Go Live** button Go Live) for this node to be displayed. Before managing MX Ultranet units in your MX system, ensure that the desired system configuration has been selected in the **System** resources pane.

To configure MX Ultranet units for analog data acquisition:

1. In the **System resources** pane System, click the **Go Live** button.
2. In the **System** resources tree, select the node whose settings you wish to configure:
   - **Vicon Connectivity** node for all MX Ultranet HD, MX Ultranet, and MX Giganet units
   - a sub node for a specific **MX Ultranet HD or MX Ultranet unit**– For Vicon MX systems, the MX Ultranet HD and MX Ultranet sub nodes under the **Vicon Connectivity** node in the **System** resources tree correspond to the IDs assigned by the Nexus system.

   The commands available on the context menu depend on the node you have selected.
3. In the **Properties** section at the bottom of the **System** resources pane, view or change settings for the desired properties.
4. When you first set up your MX system, you may configure at least the **Name** and **Sync Out** properties. In subsequent sessions, you may wish to configure additional properties to suit the needs of your motion capture application.
5. At the top of the **System** resources pane, click the **Save** button to save your system configuration settings to a *.system* file in the **Systems** configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Systems*).
6. If an analog option card is installed in the unit, expand the **MXControl** node and select the sub node for an analog card.
7. In the **Properties** section, set the **Sampling Frequency (Hz)** option.

Vicon Connectivity Context Menu

You can select the following commands from the context menu displayed when you right-click on the **Vicon Connectivity** node:

- **Reorder**Display the *Reorder Devices* dialog box in which you can change the order in which MX Ultranet units are displayed in the **System** resources tree.
- **Reboot All Vicon Connectivity Units**Stop and restart all of the MX Ultranet units in the MX system.

You can select the following commands from the context menu displayed when you right-click on a node for a specific MX Ultranet unit:

- **Reboot**Start and restart the selected MX Ultranet unit.
- **Reset Timecode**Reset the Timecode to 00:00:00:00.

Setting Properties for MX Ultranet Units

MX Ultranet Properties

You can configure the following settings in the **Properties** section for the **Vicon Connectivity** node and nodes for any MX Ultranet HD and MX Ultranet units it contains:

- **Identification**

  Name

  A user-defined display name for the entire set of units under the Vicon Connectivity node, or for each individual MX Ultranet unit.

Default: Blank

  Type

  The MX device type. The Vicon Connectivity node takes no value.

Default: Identified on connection

  Device ID

  The unique identification number Vicon assigns to each MX Ultranet unit during manufacture. The Vicon Connectivity node takes no value.

Default: Identified on connection

- **Status**

  Connected

  Whether or not the MX Ultranet unit is currently connected to the Vicon system.

Default: Identified on connection

  Enabled

  Whether or not the MX Ultranet unit is currently enabled for use.

Default: Selected

  Sync Locked

  Whether or not the MX Ultranet unit is receiving and locked to the master synchronization signal for the Vicon system.

Default: Identified on connection

  Sync Master

  Whether or not the MX Ultranet unit is designated as the synchronization master for the MX system.

Default: Identified on connection

Sync Out

The characteristics of a synchronization pulse that the MX Ultranet is to generate to synchronize third-party hardware with the Vicon system (for technical details, see the *Go Further with Vicon MX T-Series* reference book). The general purpose output driver (**.gpo* file) you specify here determines the output frequency of the synchronization pulse. You can select a driver for each of the four independent pins.

For each pin, use the **Browse for a folder** button to navigate to the folder containing the *.gpo* files (by default, *C:\Program Files\Vicon\Nexus\GPO*) and then use the drop-down list button to select the desired file (None, Duration, DV_Double, DV_Half, DV_Normal, or DV_Quarter):

Socket 1

The .gpo configuration file to use to specify the synchronization signal for socket 1 of the **Powered Sync Out** socket in the rear panel of the MX Ultranet HD or for GPO Pin 1 of the **GPIO & Remote** socket in the rear panel of the MX Ultranet.

Default: Blank

Socket 2

The *.gpo* configuration file to use to specify the synchronization signal for socket 2 of the **Powered Sync Out** socket in the rear panel of the MX Ultranet HD or for GPO Pin 2 of the **GPIO & Remote** socket in the rear panel of the MX Ultranet.

Default: Blank

Socket 3

The *.gpo* configuration file to use to specify the synchronization signal for socket 3 of the **Powered Sync Out** socket in the rear panel of the MX Ultranet HD or GPO Pin 3 of the **GPIO & Remote** socket in the rear panel of the MX Ultranet.

Default: Blank

Socket 4

The *.gpo* configuration file to use to specify the synchronization signal for socket 4 of the **Powered Sync Out** socket in the rear panel of the MX Ultranet HD or GPO Pin 4 of the **GPIO & Remote** socket in the rear panel of the MX Ultranet.

Default: Blank

Socket 5

The *.gpo* configuration file to use to specify the synchronization signal for GPO Pin 5 of the **Sync Out** socket in the rear panel of the MX Ultranet.

Default: Blank

Socket 6

The *.gpo* configuration file to use to specify the synchronization signal for GPO Pin 6 of the **Sync Out** socket in the rear panel of the MX Ultranet.

Default: Blank

Socket 7

The *.gpo* configuration file to use to specify the synchronization signal for GPO Pin 7 of the **Sync Out** socket in the rear panel of the MX Ultranet.

Default: Blank

Socket 8

The *.gpo* configuration file to use to specify the synchronization signal for GPO Pin 8 of the **Sync Out** socket in the rear panel of the MX Ultranet.

Default: Blank

MX Hardware

MAC Address

The Media Access Control (MAC) address assigned to the MX Ultranet during manufacture. This is a hexadecimal value in the format *##.##.##.##.##.##*. The Vicon Connectivity node takes no value.

Default: Identified on connection

IP Address

The Internet Protocol (IP) address assigned to the MX Ultranet on the Vicon MX Ethernet network. The Vicon Connectivity node takes no value.

Default: Identified on connection

MX Firmware

Firmware Version

The version number of the MX firmware currently installed on the MX Ultranet.

Default: Identified on connection

Firmware Complete

Whether or not the currently installed MX firmware is complete. If not, you can Reprogram the MX firmware. If firmware is complete, **True** is displayed.

Default: Identified on connection

Commands

Reboot

Stop and restart the MX Ultranet.

Tip	Click **Show Advanced** at the top right of the **Properties** pane to see additional settings available for the selected device. To show basic settings only, click **Hide Advanced**.

Managing Video Cameras

Manage the identification and configuration settings for each digital video camera connected to your Vicon system with the **Video Cameras** node in the **System** resources pane. You can also remove or reorder video cameras.

Note	References in this help system to "video camera" also apply to the use of Bonita Video cameras, except where stated. The following instructions refer to Basler cameras (DCAM-type cameras), Bonita Video cameras, and other camcorder-type cameras (DV-type cameras) supported by Vicon Nexus.

Vicon System Setup:

I. Configure Vicon system hardware.

10. Configure any digital video cameras for digital video capture.

This node is displayed under the *Local Vicon System* node when the video camera is connected to the Nexus host PC and Vicon Nexus is in **Live** mode. The **Video Cameras** node lists each video camera connected to your Vicon system. For each camera, the node name includes the camera number, the camera type in parentheses and the frame rate in brackets, for example, **#DV2 Over Door (Bonita 720c) [50Hz]**. For details on the types of digital video cameras that are supported in Nexus, see Nexus Components.

Important

- Nexus must be in **Live** mode (click the **Go Live** button Go Live) or a previously saved trial must be loaded for this node to be displayed. Before managing video cameras in your Vicon system, ensure that the desired system configuration has been selected in the **System** resources pane.
- This topic assumes that the digital video camera is connected and feeding data through the FireWire or GigE port. For information on setting up this port, see the documentation provided with your FireWire card or GigE port. For details on installing and configuring Basler cameras in your Vicon system, see the *Nexus Product Guide–Advanced Notes*.
- If your camera is a DV type camera (Camcorder), you cannot change the camera image or frame rate settings from within the Nexus user interface. For information on adjusting these settings on your DV camera, see the documentation supplied with the camera.

You can connect a digital video camera to the Nexus host PC. You can connect supported video cameras to the FireWire or GigE port on the PC and then capture reference video for use with your optical motion capture data. You can overlay the Vicon optical motion data onto the digital video images from the video cameras in the **Camera** view pane using a **Combined** view. If required, you can burn this information into the digital video image and export the *.avi* file for viewing in another application using the *Export 3D Video Overlay* pipeline operation.

To configure video cameras for digital video capture:

1. Stream live or load a previously captured trial containing digital video data created by the digital video camera to be configured in either of the following ways:

   - In the **System resources** pane System, click the **Go Live** button.
   - From the **Data Management** window, open the desired trial.

2. In the **System** resources tree, select the node whose properties you wish to configure:
   - **Video Cameras** node for all digital video cameras
   - A sub node for a specific video camera

   Note that if you are configuring a Bonita video camera, the node will not become green until you specify the **Destination IP Address**.

   Also note that cameras with gray icons are connected to the network but are not contributing data. For example, if you have connected Vicon Bonita video cameras, but your Giganet does not support jumbo packets, the icons for the Vicon Bonita video cameras will remain gray. For more information and help with upgrading your system, contact Vicon Support.

3. In the **Properties** section at the bottom of the **System** resources pane, view or change settings for the required properties.

   When you first set up your Vicon system, you must configure at least the following properties in the order shown:

   In subsequent sessions, you may wish to configure additional properties to suit the needs of your motion capture application.

Identification area:	Name
MX Hardware area	**Destination IP Address (Bonita Video only)**
Settings area:	**Capture Path** (enter a separate HDD or an SSD drive for each camera)
	Video Gain and **Brightness Offset** (Bonita Video) **Camera Gain** and **Camera Brightness** (Basler)
Frame Rate area:	**Requested Frame Rate**
Settings area:	**Shutter Duration** and **Camera AOI** (Basler),
Frame Rate area:	**Packet Size** (Baslers using Firewire)
MX Hardware area	**Trigger Source** (Basler)
Calibration area:	**Focal Length (millimeters)** (if you will be using **Aim Cameras** or **Static Video Calibration**)

4. If you are using Basler cameras, to align the shutters with the rest of the Vicon system, in the **System** resources tree, right-click the **Video Cameras** node and then click **Align Shutters (Basler)**.

5. At the top of the **System** resources pane, click the **Save** button to save your system configuration settings to a *.system* file in the **Systems** configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Systems*).

Context Menu

You can select the following commands from the context menu displayed when you right-click on the **Video Cameras** node:

- **Reorder**Display the Reorder Devices dialog box in which you can change the order in which digital video cameras are displayed in the **System** resources tree.
- **Reboot Vicon Cameras**Stop and restart all of the MX cameras in the Vicon system.
- Remove Video Cameras (Disconnected or Missing)
- **Align Shutters (Basler)**Aligns the shutters with the rest of the Vicon system. Use after any change to the camera settings that affects shutter alignment.

Setting Properties for Video Cameras

You can configure the following settings in the **Properties** section for video cameras. The available properties depend on the type of digital video camera included in your Vicon system, so you may not see all of the properties described.

Note	The settings for some properties may differ depending on whether you are using video calibration setup mode or live capture mode. For these properties, changes you make in video calibration setup mode do not affect the settings in live capture mode and *vice versa*. In the following lists, these properties are indicated by an asterisk (*).

- **Identification**

  Name

  A name that you supply, which enables you to identify the camera in Vicon Nexus.

  Default: Blank

  Device ID

  The unique identification number Vicon assigns to the digital video camera. The top-level entry for all cameras takes no value.

  Default: Identified on connection

- **Settings**

  Enabled

  Whether or not the digital video camera is currently enabled for use.

  Default: Selected

  Color*

  Whether the video camera captures in color.

  Default: Selected

  Shutter Duration*

  The length of time that the camera shutter is open during an image capture. The maximum shutter speed cannot exceed the value specified in **Requested Frame Rate**. For example, if the frame rate is set to 50 fps, an image is taken every 20 milliseconds, the shutter speed cannot exceed 19 ms.

Default: 9

Video Saturation

This value controls the amount of color in the image. Decreasing the value towards 0 results in a grayscale image with no color; increasing the value over 1 results in supersaturated colors.

Default: 1

Video Gain*(all)

The digital amplification of the pixel value. Select a displayed value to determine the intensity of the grayscale from the video cameras: **x1**, **x2**, **x4** or **x8**.

This setting is applied to the camera to change the dynamic range of the recorded image. Increasing the gain means that the marker has less variation in grayscale intensity between its center and its edge, but in certain circumstances, using a higher gain yields markers that are easier for the camera to distinguish. Vicon does not recommend using a gain setting higher than **x2**.

Adjust this setting if the markers appear too faint or if the cameras have trouble distinguishing them; otherwise, leave the this property at the default setting.

Default: x1

Camera Gain*

The digital amplification of the pixel value. The value can be set between 0-100. Gain on a video camera is similar to the contrast control on a television. Higher values mean a greater camera response to a change in light level and, therefore, a greater visible difference between pixels of different intensity. Adjust this setting until you are satisfied with the image quality– the optimum settings depends on factors such as the ambient light conditions and the **Camera Brightness** setting.

Default: 10

Camera Brightness*

The brightness of pixels. The value can be set between 0-100. Brightness on a video camera is similar to the brightness control on a television; it represents an offset of the entire image signal. Higher values mean a greater apparent brightness of the image. Adjust this setting until you are satisfied with the image quality– the optimum settings depends on factors such as the ambient light conditions and the **Camera Gain** setting.

Default: 50

Camera Gamma*

The gamma setting of the camera. The value can be set between 0.1-10. A setting of 1 is linear.

Default: 1

Brightness Offset*(all)

A linear intensity offset that is applied to each component of the video image. Where **Video Gain** is a multiplication, **Brightness Offset** adds a value to the component.

Default: 0

Capture Path

The drive letter (e.g., `C:\` or `H:\`) of the computer from which video data from the digital video camera is to be captured. Because the data rates can be very high, you are advised to capture digital video data to a different drive than the MX optical data. For optimum performance, specify a different capture drive for each camera. Do not use a mapped drive.

Default: Blank

Pixel Aspect Ratio

The height vs. width ratio of pixels. The default varies according to camera type: Vicon Nexus detects whether the camera is likely to produce non-square pixels and adjusts the ratio accordingly.

Default: Depends on camera type

Frame Rate

Trigger Source

The source of the synchronization signal. Select the MX Giganet, MX Ultranet HD, MX Ultranet, or MX Control to which the video camera is connected from this drop-down list. If "none" is selected, no synchronization occurs.

When specifying a requested frame rate for Basler cameras, set the **Requested Frame Rate** and ensure the **Incoming Frame Rate** and the rate reported in the **System** tree are as required, before selecting the trigger source.

Default: Blank

Trigger Offset (ms)*

The sync pulse delay, in millisecond (ms).

Default: 0

Requested Frame Rate*

The rate, in frames per second (fps), for the video camera to control the camera shutter speed, data rate, and area of interest to achieve the desired frequency.

Default: Depends on the connected camera

Incoming Frame Rate

The actual system frame rate at which the camera is sending video frames to Nexus. The **Incoming Frame Rate** may differ from the **Requested Frame Rate** and the rate reported next to the camera node in the System tree due to system limits and fluctuations.

Centroid Fitting

Threshold

This setting differentiates between markers and ambient light. To enable the cameras to distinguish between light that comes from markers and light that does not, a threshold is applied. Anything above this threshold is deemed to be a marker, anything below is deemed to be ambient light. A value in the region of 0.2 to 0.5 is usually appropriate.

Default: 0.5

MX Hardware

Destination IP Address

The IP address of the network adapter to which data is to be sent. For video cameras, the Destination IP address must not be shared with another camera.

Always choose the shortest possible path between the camera and the computer and ensure that the network adapter with the destination IP address is plugged into the same Vicon connectivity device or switch as the camera.

Default: Default

For more information, see the *Bonita Quick Start Guide*.

Sub Sample Ratio*

Ratio of sub-sampled frames to requested frame rate, for example, for a Requested Frame Rate of 240Hz, a sub sample ratio of 2:1 gives a sub-sampled frame rate of 120Hz.

Default: 1:1

Calibration

Reset Calibration

Removes the selected camera from the current calibration.

Focal Length (mm)

The focal length (in millimeters) of the camera lens. Set this to a value between 2-100.

Set this value if you use the Aim MX Cameras function or Static Video Calibration. On some cameras with variable zoom, the focal length may be difficult to determine; to obtain the lens properties, see the documentation supplied with the camera.

Default: Basler 20, Bonita: 8

Commands

Reboot

Button that, when clicked, reboots the selected camera.

Tip	You can also remove or reorder video cameras.

Managing Force Plates

Manage the connection and configuration settings for supported force plates included in your Vicon system architecture with the appropriate force plate node. Select the required force plate node under the **Devices** node in the **System** resources pane.

Vicon System Setup:

I. Configure Vicon system hardware.

7. Configure any force plates for analog data capture.

The appropriate force plate node is displayed under the Devices node of the Local Vicon System node when Vicon Nexus is connected to an MX system with at least one Force Plate unit and is in **Live** mode. It is displayed under the Devices node of the Vicon Data node when Nexus is in **Offline** mode. The **Devices** node lists each force plate connected to your MX system. For each device, the node name includes any display name specified in the Name property, its sample rate in brackets, and the force plate type in parenthesis, for example, **Name [1000Hz] (AMTI AccuGait Force Plate)**. If no analog source is selected, **[No Source]** is displayed after the device type. **Channel - #** sub nodes are displayed for each channel. Predefined configurations for some supported force plates are supplied with Vicon Nexus. For details on the components that may be included in a Vicon system architecture, see Nexus Components.

Important	Nexus must be in **Live** mode (click the **Go Live** button) to add new force plate entries to the **Devices** node. You can manage force plates from a previously saved trial in **Offline** mode. Before managing force plates, ensure that the desired system configuration has been selected in the **System** resources pane. Force plates data can be acquired through the analog capture functionality of an MX Giganet with an analog card (or an MX Ultranet HD in earlier MX systems). This topic describes the analog connection only. If your force plate has a digital output, it is possible that this data stream can also be captured, but this depends on the data stream's format and the equipment's manufacturer. Please contact Vicon Support or your local distributor for more information on the digital data streams that can be used with Vicon MX.

To configure force plates for analog data capture:

1. In the **System resources** pane System, click the **Go Live** button.
2. The first time you use Nexus, the **Devices** node is empty. You must add and configure a new force plate device before it will be displayed in the **System** resources tree.
3. In the **System** resources tree, right-click the **Devices** node, point to **Add Analog Device** and from the displayed context menu select the type of force plate that is integrated in your MX system.
4. The selected force plate node automatically expands to display the newly created device. If the appropriate type is not displayed, contact Vicon Support.
5. The colored icon beside a force plate node identifies the status of the device and of any connected analog source:

   Green play button: Component OK (active or connected); if an analog device is connected, the analog source is selected and all channels are configured.

   Yellow pause button: Component is not fully set up (e.g., not all channels have been assigned a pin or the calibration matrix has not been configured).

   Gray play button: Component connected but not contributing any data.

   Red stop button: Component down (unavailable or disconnected).

These colored icons correspond to those used for the device summary in the **Status** communications pane.

6. In the **Properties** section at the bottom of the **System** resources pane, view or change settings for the following properties:
   a. In the **General** section, enter a **Name**.
   b. In the **General** section, load the manufacturer's calibration file:
      - If the calibration file is not listed in the drop-down list, click the Browse for a folder button ..., browse to the location of the calibration file and select it. The file becomes available in the drop-down list.
      - Select the calibration file.
      - If not supplied by the manufacturer's calibration file, you can set the device **Dimensions**, **Position**, **Orientation**, and **Origin** in those **Properties** sections.
   c. If there is no calibration file, click **Show Advanced** at the top right of the **Properties** section and enter the **Calibration Matrix 6x6 Matrix** values manually.

Important	The **Matrix** values must be entered, either via a calibration file or by manual entry, in order for the force plate to become active.

   d. In the **Source** section, select a Source (the MX Giganet to which the device is attached) from the drop-down list.

      For force plates attached to an MX Giganet with an analog card, the Source drop-down list contains all connected MX Giganets; a USB force plate will have its Source drop-down list populated with connected USB devices of the required type.
   e. In the **Source** section, use the **Fill** button to populate the input connections sequentially (if these are consecutive on the MX Giganet).
   f. In the **Source** section, select the **Gain** for the **Source** from the choice of gains available for the MX Giganet.

Tip	Click **Show Advanced** at the top right of the **Properties** pane to see additional settings that may be available for the selected device. To show basic settings only, click **Hide Advanced**.

7. In the **System** resources tree, if necessary, expand the force plate node to expose the **Force**, **Moment** and **CoP** (Center of Pressure) channels.

   The colored icon beside the device output node identifies the analog channel status:

   Green arrow: Analog channel connected to source device.

   Yellow arrow: Analog channel has not been assigned a pin.

8. To tare the force plate at zero load:
   - In the **General** section, click the **Zero Level browse** button ... and enter the matrix properties.
   - You can also tare the force plate by right-clicking on the force plate name in the System resources tree and selecting Zero Level
9. In a 3D Perspective view pane, ensure that a gray or colored rectangle with the number 1 on it, representing the force plate, is displayed in the capture volume where you have positioned it.
10. If you have multiple force plates configured, they will be numbered in the order they appear in the **System** resources tree.

11. In the capture volume, have someone step onto the force plate. You should see the force vector being displayed in real time.
12. At the top of the **System** resources pane, press the **Save** button to save your system configuration settings to a *.system* file in the **Systems** configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Systems*).
13. From the **System** resources tree, expand the force plate node and select the **Force** output.
14. Switch to a **Graph View** pane.

    If necessary, select **Components** from the **Graph Type** drop-down list. A real-time graph of the **Force** output is displayed.
15. Verify that the vertical (**Fz**) force component is equal to [known mass * 9.81].

Force Plate Minimum Setup Requirements

For a force plate to appear in the **3D Perspective** view pane, you must configure at least the following properties:

- **Source**
- **Calibration Matrix**
- **Position** (X, Y, Z)
- **Name:** Assigning a force plate name is recommended, especially if you are setting up more than one force plate.

For a force plate to appear in **Live** mode in the **3D Perspective** view pane, you must fully configure:

- **Source**
- **Calibration Matrix**
- **Dimensions** (X, Y)
- **Origin**

The **Position** and **Orientation** are necessary for the **CoP** (Center of Pressure) and **Force** vector to be represented correctly, but they can be changed according to the setup. In subsequent sessions, you may wish to configure additional properties to suit the needs of your motion capture application.

Devices Node Context Menu

You can select the following commands from the context menu displayed when you right-click on the **Devices** node:

- **Reorder**
- Selecting this command displays the Reorder Devices dialog box. Reordering the force plates changes their position in the **Devices** tree.

You can select from the following options for force plates when you then click **Add Analog Device**:

- Add AMTI AccuGait Force Plate
- Add AMTI OR6 Series Force Plate
- Add Bertec Force Plate
- Add Kistler Force Plate (External Amplifier)
- Add Kistler Force Plate (Internal Amplifier)

You can select the following commands from the context menu displayed when you right-click on a specific force plate node:

- **Foot Contact**

  Attributes the force plate to:

  Auto-detect, in which Nexus attributes the force plate contact based upon foot segment kinematics

  Left foot contact

  Right foot contact

  Invalid if no valid left or right foot contact can be associated with the force plate.

  You can also adjust these settings by right-clicking a displayed force plate in the 3D Perspective view pane.

- **Show Raw**

  Adds each raw voltage signal for the device.

  For example, Kistler force plates contain 8 input channels that are processed to yield a resultant force and moment (3 components each, 6 total).

  Using the **Show Raw** command, you can select one or more inputs and graph their raw data in a **Graph** view pane, allowing you to view, troubleshoot, or configure a monitor for the raw signals.

  If you **Show Raw** and collect a trial, the raw voltages will be stored in the *.x1d* file, so you can view them in the offline trial as well as the force channels. If you save the trial, or export a *.c3d* file, when you load the trial the raw channels will be grouped together and designated within an **Imported Analog Device**.

  To remove the raw inputs from the **System Resources** tree, click **Hide Raw**.

- **Zero Level**

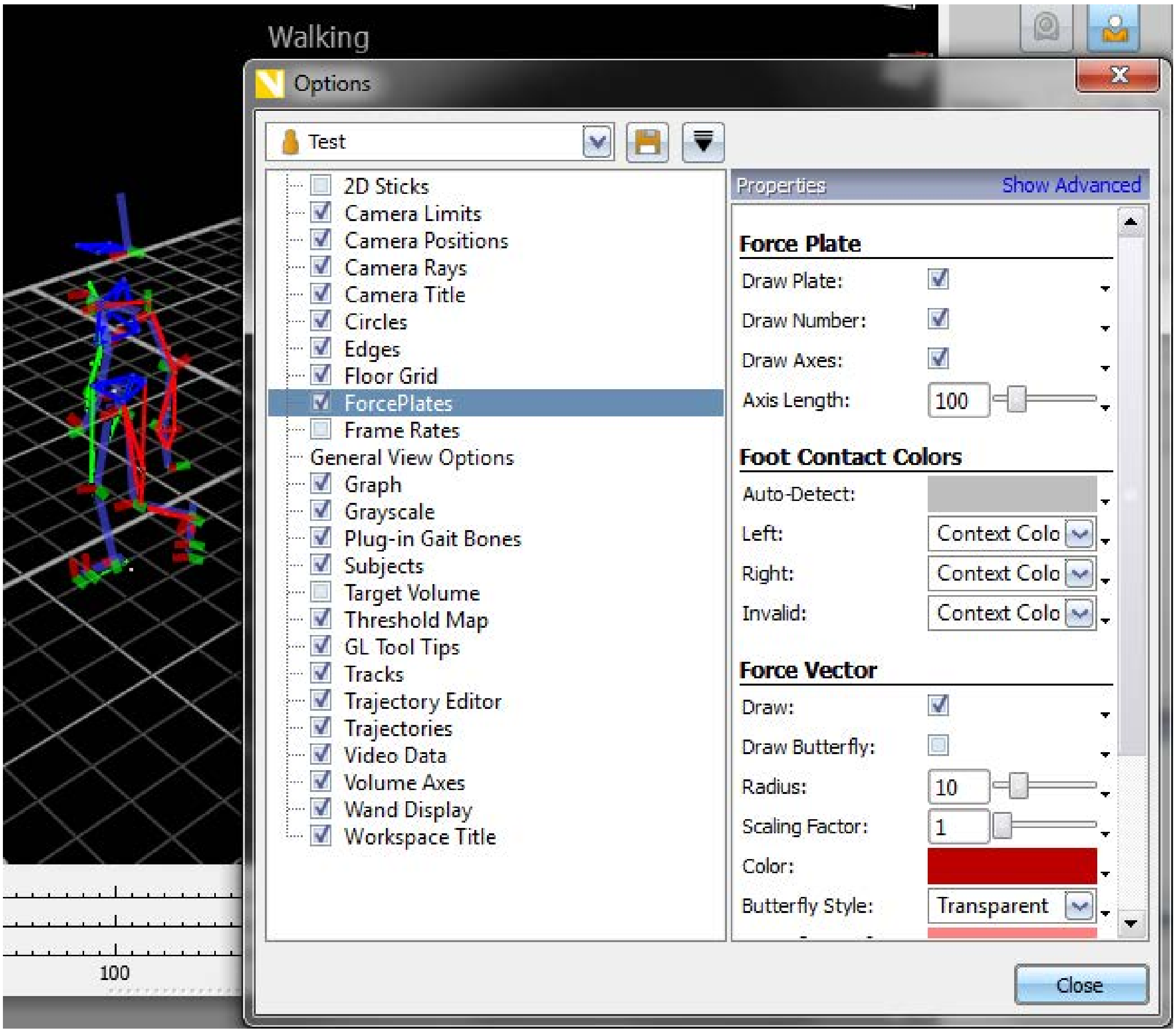
  Calibrates the force plate. This process eliminates any significant offset between the force plate's nominal output levels at rest and its theoretical zero level. Select this option if, after setting the force plates to the electrical zero level, small differences remain between the theoretical zero level and the observed output level. This option is also available in the **General Properties** section.

- **Remove Device**

  Removes the force plate entry from the **System** resource tree.

Force Plate Display Options

You can configure colors and other force plate display options in the **Options** dialog box .



You turn a display option on or off by selecting or deselecting the corresponding check box. To view all display options, click the **Show Advanced** button at the top of the **Properties** window.

Tip	You can set colors for some of the display options. If a default color is listed as **Context Color** (this indicates the color is set to the system default) and you want to change it, click the down arrow to the right of the drop-down list, and de-select the **Macro** tick box. Then you can activate the color picker.

To view force plates in a **3D Perspective** view pane, select the **Force Plates** check box on the left side of the **Options** dialog box. The following options can be configured:

- Force Plate
- Draw Plate

  Select the check box to have the force plate appear in the **View** pane. Clear the check box and the force plate will not appear.

- Draw Number

  By default, each force plate displays a number (e.g., 1, 2, 3). The number corresponds to the order in which the force plates appear in the **System** resources tree. You can turn off the number display by deselecting the check box.

- Draw Axes

  You can configure how the force plate axes appear in the 3D Perspective view pane by selecting the Draw Axes tick box. The axes appear below the floor plane of the volume. Set the axis width and length by typing in a number value or by moving the slider.

  - Axis Width
  - Axis Length

- Foot Contact Colors

  If you have designated a force plate to be a left or right foot contact, by default Nexus displays a left-foot contact force plate in red in the **3D Perspective** view pane, a right-foot contact force plate in green. An auto-detect force plate is displayed in light gray, and an invalid force plate (neither left, right nor auto-detect) is displayed in dark gray.

  To change the default colors for the force plate display, in the **Options** dialog box, select the **Force Plates** entry from the list, and in the **Properties** section on the right, click on a displayed color in the **Foot Contact Colors** section to activate the color picker.

- Force Vector

  You can visualize the force vector by selecting the **Draw** and **Draw Butterfly** check boxes. Then you can set the quality of the vector display, as well as the radius and scaling factor (length), the butterfly style (whether the butterfly is represented as transparent, as a wireframe or both), and color. Setting a **Scaling Factor** value causes the vector to be displayed as an arrow originating from the force plate in the direction of the force.

- Moment Vector

  You can select whether the moment vector is visually represented in the **3D Perspective** view pane, as well as the quality, radius and color of the moment vector display.

Tip	You can see the results of your settings in the **3D Perspective** view pane as you configure an option. As needed, drag the **Options** dialog box to the side of the **3D Perspective** view pane as you configure the force plate options.

Setting Properties for Force Plates

You can configure the following settings in the **Properties** section for force plates:

- General

For all force plates:

Name

A user-defined display name for the force plate.

Default: Blank

Delay Compensation

The delay compensation value (in frames). All devices have a delay compensation value which adjusts the synchronization offset between the device and the MX data. Analog data collected with the MX Control or MX Ultranet HD should already be synchronized, so this value should be set at 0. Values can be set between -10 and 10.

Default: 0

For all but Kistler force plates:

Calibration File

The force plate calibration file Nexus is to use. This file describes the forces plate's properties, such as its physical dimensions, output voltages, and crosstalk coefficients between each analog output. Nexus automatically displays some of these values as the default settings in the relevant properties for the force plates (for example, **X Length**, **Y Length** and **Calibration Matrix**). Use the **Browse for a folder** button ... to navigate to the folder containing the calibration file supplied by the force plates manufacturer. Then use the drop-down list button to select the desired file.

Default: Blank

Calibration Matrix

Displays the size of the calibration matrix (e.g., 6x6 Matrix). Click the **Edit Text** button ... to display the **Calibration Matrix** dialog box, which shows the values supplied by the force plate manufacturer. If you do not have a calibration file for your force plate, contact the manufacturer for a replacement file or refer to the calibration information supplied in your force plate documentation. You can manually edit the values for each channel scale. If you manually enter the values, ensure that you use the correct input values to transform the voltages captured by the MX Giganet or MX Ultranet analog card to forces and moments.

The sensitivity values you must specify depend upon the type of force plate as shown in the following table.

Supported Force Plate	Manufacturer Supplied Units	Nexus Required Units	
		Force Channels	Moment Channels
AMTI Hall Effect Plate (AccuGait Series)	United States Customary (USC) units Supplied in manufacturer's .acl file.	lb/V	lb/V
AMTI Strain Gage Plate (BP Series and OR6 Series) (See Caution below)	United States Customary (USC) unit matrix Supplied in manufacturer's .plt file and Sensitivity Matrix.	uV/Vex/lb	uV/Vex/in.lb
Bertec	International System (SI) units Supplied in manufacturer's documentation.	N/V	Nm/V
Kistler (External Amplifier)	International System (SI) units Supplied in manufacturer's documentation.	pC/N	pC/N
Kistler (Internal Amplifier)	International System (SI) units Supplied in manufacturer's documentation.	mV/N	mV/N

Caution

If you are connecting to AMTI OR6 Series force plates, Nexus expects the force plate calibration values from the USC matrix in pounds (lb) and Inch-Pounds (in-lb) as supplied by AMTI with recent plates.

Some older AMTI OR6 Series plates, however, have their USC calibration matrix presented in units of Pounds and Foot-Pounds (ft-lb). If the calibration matrix for your force plate is presented with units of ft-lb, you must convert the values to the required in-lb units. To do this, create a copy of the calibration *.plt* file and in this copy divide the values of the last three columns of the matrix by 12. Save this modified calibration file and apply it to your force plate by specifying it in the **Calibration File** field. If you enter the matrix values manually, first divide the terms in the Sensitivity Matrix by 12. The force plate moments will then scale correctly.

Default: Identified from calibration file specified in the **Calibration File** property

Zero Level

Resets the force plate voltage zero level. This process eliminates any significant offset between the force plate's nominal output levels at rest and its theoretical zero level. Use this function if after setting the force plates to the electrical zero level, small differences remain between the theoretical zero level and the observed output level. Click the **Edit Text** button ... to display the **Zero Level** matrix in which you can enter the required value to calibrate the force plate. Then click **Apply**, then click **Close**.

Correction Factor

The factor by which Nexus is to convert the values supplied from a force plate into the values it requires. Correction factor corresponds to a force plate's amplifier setting and is used along with the calibration matrix to convert raw Volts to Newtons.

For an AMTI OR6 Series force plate:

- Forces: from Newtons per microvolt (N/μV) to Newtons (N).
- Moments: from Newton meters per microvolt (Nm/μV) to Newton millimeters (Nmm).

The formula for calculating the coefficient (K) is:

`K = 1000000/(Gain x Excitation Voltage)`

where both `Gain` and `Excitation Voltage` are established in the AMTI amplifier. Check the settings for your AMTI amplifier.

Default: 25 (for an AMTI amplifier with a default setting of 4,000 Gain and 10V Excitation Voltage)

Force Threshold (N)

The threshold (in Newtons) identifying the noise floor value for calculated forces. Forces that do not exceed this magnitude are assumed to be too noisy and are clamped to zero. Values can be set between 0 - 50.

Default: 25

For Kistler (Internal amplifier) force plates only:

Sensitivities (mV/N)

Force plate sensitivity vector. Click the Edit Text button ... to display the Sensitivities (mV/N) matrix in which you can enter the required values in millivolts per Newton.

Default: Identified on connection

- Source

Source

The MX Giganet to which the physical force plates device is connected. From the drop-down list, select the correct one from the available analog option cards detected in your Vicon system architecture.

Default: None

Fill

Fills all input connections in the expected sequence, starting with the lowest unassigned pin, for the device selected in **Source**.

Clear

Clears the input connection setting from all pins.

Channel

The input connections from the device. After selecting the **Source**, select the source input from the drop-down list, or use the **Fill** button to automatically fill all the positions.

AMTI AccuGait: FzA, FzB, FzC, FzD, FyAC, FxDC, FxAB, FyBD

AMTI OR6 and Bertec: Fx, Fy, Fz, Mx, My, Mz

Kistler: Fx (1+2), Fx (3+4), Fy (1+4), Fy (2+3), Fz1, Fz2, Fz3, Fz4

Default: None

Gain (V)

The programmable gain (+/- volts) for the channel: 1.25 Volts, 2.5 Volts, 5 Volts, or 10 Volts. The gain voltages correspond to 8, 4, 2 and 1 gain values, respectively (e.g., a gain of 2.5 Volts means that the input signal will be multiplied by 4.

Default: 10.00

Dimensions

X Length (mm)

The length (in millimeters) of the x axis of the force plate.

Default: Identified from calibration file specified in the **Calibration** property, if one.

Y Length (mm)

The length (in millimeters) of the y axis of the force plate.

Default: Identified from calibration file specified in the **Calibration** property, if one.

Position

X Position (mm)

The origin coordinate (in millimeters) for the X axis of the force plate in relation to the origin of the capture volume, as specified by the L-Frame when you perform the System calibration..

Default: 0

Y Position (mm)

The origin coordinate (in millimeters) for the Y axis of the force plate in relation to the origin of the capture volume, as specified by the L-Frame when you perform the System calibration.

Default: 0

Z Position (mm)

The origin coordinate (in millimeters) for the Z axis of the force plate in relation to the origin of the capture volume, as specified by the L-Frame when you perform the System calibration.

Default: 0

Tip: Normally, the force plate origin is chosen by placing the static calibration object on the desired corner of the force plate. In this case, the position offset is half the width and half the length of the plate. However, for other plates that did not have the static object placed on them during calibration, you must fully specify the coordinates of the center of the plate in relation to the capture volume origin.

Orientation

X Angle Axis (deg)

Maps the x axis (in degrees) of the local force plate coordinate system to the global coordinate system specified for Nexus in the **System Preparation** tools pane.

Default: 0

Y Angle Axis (deg)

Maps the y axis (in degrees) of the local force plate coordinate system to the global coordinate system specified for Nexus in the **System Preparation** tools pane.

Default: 0

Z Angle Axis (deg)

Maps the z axis (in degrees) of the local force plate coordinate system to the global coordinate system specified for Nexus in the **System Preparation** tools pane.

Default: 0

Origin

For all but Kistler force plates:

X Origin (mm)

The displacement (in millimeters) from the sensor X origin to the force plate X origin.

Default: 0

Y Origin (mm)

The displacement (in millimeters) from the sensor Y origin to the force plate Y origin.

Default: 0

Z Origin (mm)

The displacement (in millimeters) from the sensor Z origin to the force plate Z origin.

Default: 0

For Kistler force plates:

a (mm)

The displacement (in millimeters) from the sensor X origin to the force plate X origin.

Default: 120

b (mm)

The displacement (in millimeters) from the sensor Y origin to the force plate Y origin.

Default: 200

az0 (mm)

The negative displacement (in millimeters) from the sensor Z origin to the force plate surface.

Default: 48

Managing Devices

Manage the connection and configuration settings for Vicon and supported third-party analog and digital EMG devices included in your Vicon system architecture with the **Devices** node in the **System** resources pane.

Although this topic describes using **Devices** to connect only an EMG device, it can be used to connect many other analog and digital device types. To view additional analog devices, in step 2. below, instead of selecting a type of EMG device from the context menu, select **Add Generic Analog** and then right-click the **Generic Analog** node.

To view or add a digital device, for example a ZeroWire EMG, right-click the **Devices** node, point to **Add Digital Device** and click the required device.

Vicon System Setup:

I. Configure Vicon system hardware.

8. Configure any supported devices for analog data capture.

This node is displayed under the Local Vicon System node when Vicon Nexus is connected to an MX system with at least one Vicon or supported third-party analog or EMG device and is in **Live** mode. It is displayed under the Vicon Data node when Nexus is in **Offline** mode. The **Devices** node lists each supported device connected to your MX system.

For each device, the node name includes any display name specified in the Name property, its approximate sample rate in brackets, and the device type in parentheses, for example, **Name [2000Hz] (Analog EMG)**. The default name property displayed is **Name [1000Hz] (Analog EMG)**.

If no analog source is selected, **[No Source]** is displayed after the device type. **Channel** sub nodes are displayed for any analog channels. Predefined configurations for some devices are supplied with Vicon Nexus. For details on the components that may be included in a Vicon system architecture, see Nexus Components.

Important	Vicon Nexus must be in **Live** mode (click the **Go Live** button ) to add new device entries to this node. You can manage other devices from a previously saved trial in **Offline** mode. Before managing other devices, ensure that the desired system configuration has been selected in the **System** resources pane. EMG data can be acquired through the analog capture functionality of an MX Giganet (or an MX Ultranet HD or MX Control in earlier MX systems). This topic describes analog connection only. If your EMG device has a digital output, it is possible that this data stream can also be captured, but this depends on the data stream's format and the equipment's manufacturer. Contact Vicon Support or your local distributor for more information on the digital data streams that can be used with MX.

To configure EMG devices for data capture:

1. In the **System resources** pane , click the **Go Live** button.

   The first time you use Nexus, the **Devices** node is empty. You must add and configure a new EMG device before it will be displayed in the **System** resources pane.

2. In the **System** resources tree, right-click **Devices**, point to **Add Analog Device** or **Add Digital Device** and from the context menu select the type of EMG device that is integrated in your MX system.

   The **Devices** node automatically expands to display the newly created EMG device with its attendant output:

   - An Analog Accelerometer will have an Acceleration output
   - An Analog EMG will have a Voltage output
   - A ZeroWire EMG will have a Voltage and a Foot Switch output

3. In the **System** resources tree, select the node whose properties you wish to edit:

   - **Generic Analog Device** sub node for all other devices
   - A sub node for a specific device

   The colored icon beside a force plate node identifies the status of the device and of any connected analog source:

   Green play button: Component OK (active or connected); if an analog device is connected, the analog source is selected and all channels are configured.

   Yellow pause button: Component not fully set up, e.g., not all channels have been assigned a pin or the calibration matrix has not been configured.

   Gray play button: Component connected but not contributing any data.

   Red stop button: Component down (unavailable or disconnected).

   The commands available on the context menu depend on the node you have selected.

4. In the **Properties** section at the bottom of the **System** resources pane, view or change settings for the following properties:

   a. In the General section:

      – Enter a **Name**.

      – Set the **Delay Compensation**.

      – Set the **Amplifier Gain**.

   b. In the Source section, select a Source (the MX Giganet to which the device is attached) from the drop-down list.

   When you first set up your MX system, you must configure at least the **Name** and **Source** properties, add channels and designate the **Source** for each channel. In subsequent sessions, you may wish to configure additional properties to suit the needs of your motion capture application.

5. In the **System** resources tree, expand the device node you added and select a device output sub node which corresponds to an output from the device (such as Acceleration for an accelerometer, or Voltage for an EMG device).

   - Right-click the device output and add an output component or components:
   - For an accelerometer or analog EMG, choices will be:

     – **Add Component** (or 2,4,or 8 Components)

- For a ZeroWire EMG, choices will be:
  - Under **Voltage**:
    - o **Add EMG** (numbered 1 - 16)
    - o **Remove Channels** (if you have added channels)
    - o **Enable Auto Populate** (or **Disable Auto Populate** if the **AutoPopulate** Properties box is checked)
  - Under **Foot Switch**:
    - o **Add FSW** (designated A1-A4 and B1-B4)

A new component node (or nodes) is added to the tree.

The colored icon beside the device output node identifies the analog channel status:

Green arrow: Analog channel connected to source device.

Yellow arrow: Analog channel not fully set up (e.g., not all channels have been assigned a pin or the calibration matrix has not be configured).

6. In the **Properties** section, under the **General** section, specify a **Name** for the node or nodes you have added.

   For the ZeroWire EMG, **Name** is the only property setting necessary.

7. In the **Properties Source** section:

   a. Assign the Pin to one of the available pins on Source device. Once you have assigned a pin, the status icons will turn green.

   b. Specify the **Gain (V)**.

   c. Set the **Zero Level**.

8. At the top of the **System** resources pane, press the **Save** button to save your system configuration settings to a *.system* file in the **Systems** configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Systems*).

9. To view a graph or one or more device output or component signals:

   a. In the **System** resources tree, expand the **Devices** node to show the devices connected to your Nexus system.

   b. Select one or more devices, outputs or components.

   c. From the **View** pane toolbar, select **Graph**.

   d. If necessary, in the **Graph** view pane toolbar, from the **Graph Type** drop-down list, select **Components**.

   The **Graph** view pane displays a graph of the selected components.

Context Menu

You can select the following options from the context menu displayed when you right-click on the **Devices** node:

- Reorder: Displays the Reorder Devices dialog box. Reordering a device changes its position in the **Devices** tree.
- **Add Analog Device** and **Add Digital Device**. See below.
- **Disconnected Devices**: Shows and hides digital devices that are not currently connected to the system.

You can select the following EMG options from the context menu displayed when you right-click on the **Devices** node and point to **Add Analog Device**:

- Add Analog Accelerometer
- Add Analog EMG
- Add Generic Analog

You can select the following EMG options from the context menu displayed when you right-click on the **Devices** node and point to **Add Digital Device**:

- Add Dikablis Eye Tracker
- Add Noraxon TeleMyo
- Add ZeroWire EMG

You can select the following options from the context menu displayed when you right-click on a node for a specific device:

- **Zero Level** Calibrates the force plate. This process eliminates any significant offset between the force plate's nominal output levels at rest and its theoretical zero level. Select this option if, after setting the force plates to the electrical zero level, small differences remain between the theoretical zero level and the observed output level. This option is also available in the **General Properties** section.
- **Remove Device** Remove the device entry from the **System** resource tree.

You can select the following commands from the context menu when you right-click on a sub node for a specific device:

- **Add Component** Add a single component to the device. In the **System** resources tree, expand the device entry to view the new channel.

  For a ZeroWire EMG, the selection is **Add EMG #**.

- **Add # Components** Add the specified number of channels to the device. In the **System** resources tree, expand the device entry to view the new channels. The number of channels that can be added depends upon the device type.
- **Remove Component** Remove the component from the **System** resources tree.

  For a ZeroWire EMG, the selection is **Remove Channel**.

Setting Properties for Devices

You can configure the following settings in the **Properties** section for devices:

- General

Name

A user-defined display name for the device.

Default: Blank

Delay Compensation (s)

The delay compensation value (in frames). Many EMG systems, particularly new wireless systems, may introduce a small delay in transmission of data. This delay may cause a misalignment between Vicon frames of data and EMG frames of data. The Delayed Compensation slider bar allows the user to correct this difference and properly align Vicon optical data with EMG data. The amount of delay for an EMG system should be available within the operating manual of the EMG system. If this value cannot be found in the EMG manual, please contact the EMG manufacturer.

All devices have a delay compensation value which adjusts the synchronization offset between the device and the MX data. Analog data collected with the MX Giganet should already be synchronized, so this value should be set at 0. Values can be set between -10 and 10.

Default: 0

Amplifier Gain (V)

The voltage gain scale factor. Can be set between 1 - 1000.

Default: Depends on device

ZeroWire EMGs

Auto Populate

Enables or disables automatic detection of ZeroWire EMG modules that are in use. Enabling this feature causes Nexus to automatically add and remove EMG components when they are connected. When Auto Populate mode is enabled, the add and remove EMG menu items are unavailable.

Default: Selected

Errors

An advanced parameter which stores any diagnostic errors received from the ZeroWire device. Use this parameter for troubleshooting. For further information, see the documentation supplied by the manufacturer.

Default: Determined by device state

- Source

Source Device

The MX Giganet to which the physical force plates device is connected. From the drop-down list, select the correct one from the available analog option cards detected in your Vicon MX system architecture.

Default: None

- Sync

For ZeroWire EMG only:

Sync Rate

Sets the device frame rate, and affects the number of samples per frame. In free-running mode this parameter may be left at its default. In hardware sync mode this parameter should be set to the appropriate sync frame rate, which would usually be the same as the MX frame rate. Values which do not divide into 2000 can not be used. See the Sync Pulse parameter.

Default: 50

Sync Pulse

Enables or disables the use of a TTL compatible hardware sync pulse to control drift between the ZeroWire device and a Vicon system. If you wish to use this feature, connect the ZeroWire unit to a GPO pin via the included ZeroWire sync cable.

Advanced users wishing to synchronize ZeroWire to a Vicon system running at a frame rate which does not divide into 2000Hz (for example, 120Hz) should construct a GPO program which provides a sync pulse at a rate which does divide. The GPO program entitled *ZeroWire 100Hz Sync.gpo* is provided as an example.

The *ZeroWire 100Hz Sync.gpo* file is defined as follows:

```
<?xml version="1.0" standalone="yes"?>
<AllPrograms>
<Program Name="ZeroWire 100Hz Sync">
<Type>Repeating</Type>
<Polarity>High</Polarity>
<StartEvent>MXDVStart</StartEvent>
<StopEvent>MXDVStop</StopEvent>
<StartOffset MicroSeconds="0"/>
<StopOffset MicroSeconds="0"/>
<PulseWidth MicroSeconds="5000"/>
<PulsePeriod MicroSeconds="10000"/>
</Program>
</AllPrograms>
```

Default: Unchecked

Trigger Pulse

Enables or disables the use of a TTL compatible hardware trigger pulse to synchronize the start and stop of ZeroWire data acquisition with a Vicon system. Users wishing to synchronize ZeroWire to a Vicon system should connect the ZeroWire unit to a GPO pin via the included ZeroWire sync cable, and run the included GPO program entitled *ZeroWire Trigger.gpo* (see below).

For best results use this feature with the Sync Pulse feature. Consult the ZeroWire technical manual for a description of the ZeroWire sync cable.

The *ZeroWire Trigger.gpo* file is defined as follows:

```
<?xml version="1.0" standalone="yes"?>
<AllPrograms>
<Program Name="Duration">
<Type>Duration</Type>
<Polarity>High</Polarity>
<StartEvent>MXDVStart</StartEvent>
<StopEvent>MXDVStop</StopEvent>
<StartOffset Frames="0"/>
<StopOffset Frames="0"/>
<PulseWidth Frames="0"/>
<PulsePeriod Frames="0"/>
</Program>
</AllPrograms>
```

Default: Unchecked

About the Dikablis Eye Tracking System

The Dikablis Eye Tracking system provides automated processing of gaze data for ergonomics, sports, defense, automotive, product, and research applications.

The Dikablis head unit, with its lightweight and comfortable setup, can be adjusted to fit any subject. This head unit can even be adjusted to fit over glasses. The Dikablis Eye Tracking unit is available in either wired or wireless options. The wireless unit provides unlimited mobility and allows the test subject to move within a perimeter of up to 800 meters.

When the Dikablis Eye Tracking system is combined with the Vicon Motion Capture system, the head position and 3D gaze vector of the test subject is calculated in all possible environments and scenarios.

The Dikablis Eye Tracking system is compatible with both T-Series and Bonita cameras. A minimum of two cameras are required for use with the system.

Tracking Eye Movement

Combined with the Vicon Motion Capture system, the Dikablis Eye Tracking system calculates the head position and 3D gaze vector of test subjects in all possible environments and scenarios.

What's Included

The following is included with your Dikablis eye tracking system:

- Head unit
- Dikablis laptop
- Ethernet cable or crossover cable
- Battery pack and wireless transmitter (for wireless option)
- Dikablis wireless receiver (for wireless option)

Setting up the Hardware

Although it is possible to capture both Vicon data and Dikablis gaze data on a single PC, a dual-computer setup is recommended. The Dikablis laptop connects to the head unit and runs the Dikablis data collection software. The desktop computer is connected to the Vicon system and runs the Vicon Nexus software. The two computers are directly connected via a cable that runs between two Ethernet ports.

Basic Setup

- The Dikablis laptop connects to the eye tracking software. This laptop runs the Dikablis data collection software.
- The Nexus PC connects to the Local Vicon System. This PC runs Vicon Nexus.
- The Dikablis laptop connects to the Nexus PC.

Important	For instructions on setting up the hardware, see the *Dikablis Eye Tracker User Manual*.

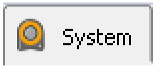
Setting up the Software Device

First set up the Dikablis laptop and ensure that it is working properly.

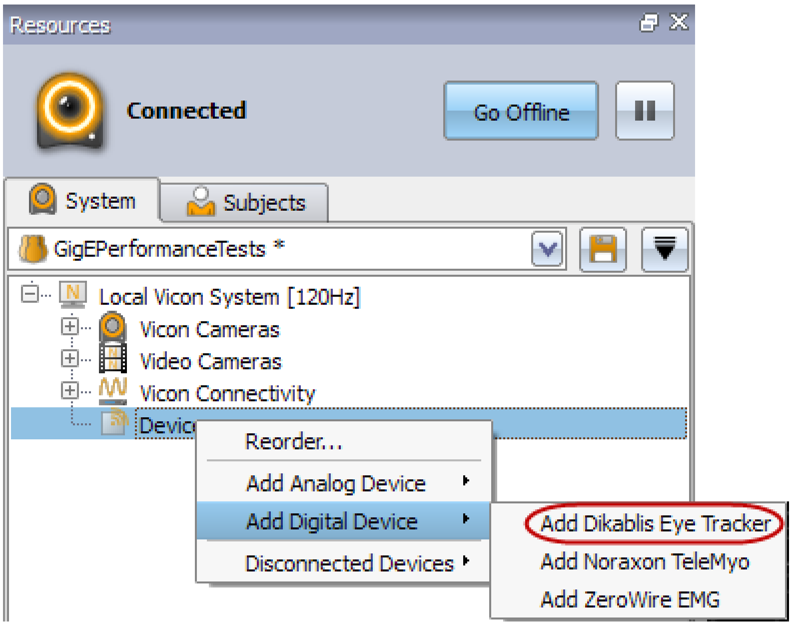
To do this:

1. Turn on the Dikablis laptop.
2. Double-click the **Recorder Streaming** icon on the desktop.
3. Attach the head unit to the subject's head (for instructions, see the *Dikablis Eye Tracker User Manual*).
4. In the Recorder Streaming software, ensure that a cross hair appears on subject's pupil.

   Next, add the Dikablis Eye Tracker to Nexus as a device.

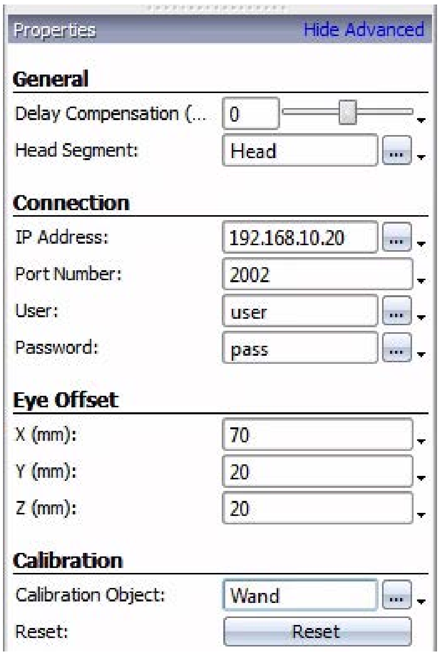
5. In the **System resources** pane 

, click the **Go Live** button.
6. Right-click **Devices**, point to **Add Digital Device**, and select **Add Dikablis Eye Tracker**. The device appears under **Devices**.

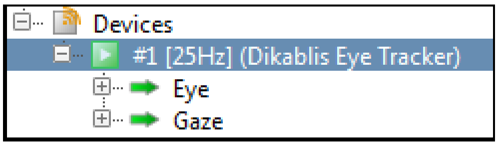


7. Click the **Dikablis Eye Tracker** node that you just added to select it and in the **Properties** pane, set the following communication parameters in the **Connection** section:
   - **IP Address:** Use the same IP address that has been set in the Dikablis eye tracking software.
   - **Port Number:** Leave as default (2002).

The Dikablis Eye Tracker properties can be adjusted to enable proper connection with the Dikablis data stream.



8. If the connection and IP address are correct, the Dikablis Eye Tracker icon will turn green under **Devices**. This indicates that Nexus is able to communicate with and receive the data stream from the Dikablis laptop.



9. With the head unit attached to the subject, look at **Graph** view in Nexus to ensure that a line is displayed charting the pupil coordinates. Resize the **Graph** view as needed.
10. The data will begin streaming from the Dikablis software when the Dikablis software is in **Record** mode.

Calibrating the Dikablis Eye Tracking System

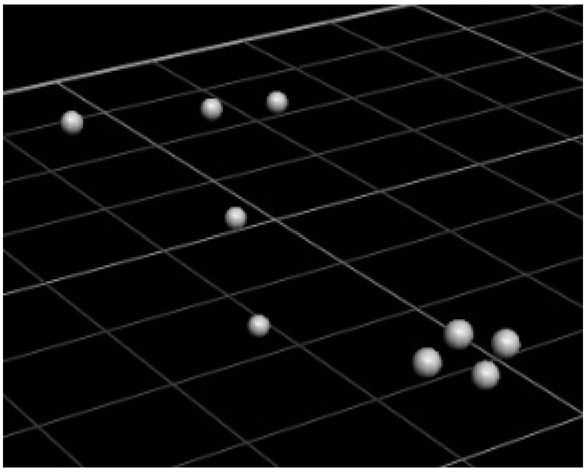
Follow these instructions for calibrating the Dikablis Eye Tracking system before capturing a trial. For information about setting up the eye tracker, see Tracking Eye Movement.

To calibrate the Dikablis Eye Tracking system, complete the following procedures in the order shown:

- Set up a calibration trial
- Create the relevant objects in Nexus
- Run a static subject calibration
- Add eye tracking to the trial
- Calibrate eye tracking

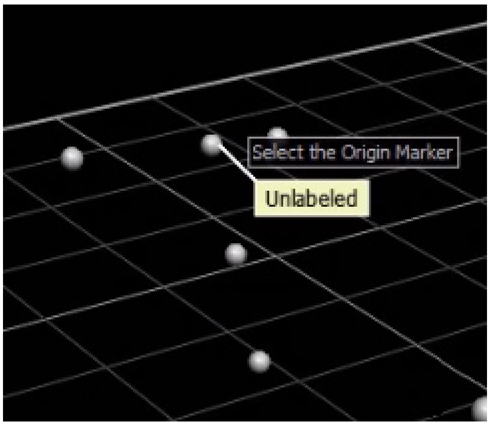
To set up a calibration trial for eye-tracking:

1. Having calibrated your Vicon system, set the volume origin, and set up your Dikablis device, get your subject to enter the volume wearing the head unit with markers, and holding the calibration wand in front of them.
2. In the **Capture Tools** pane, in the **Next Trial Setup** section, enter a **Trial Name** (for example, `Calibration`), and in the **Capture** section, click **Start** to capture a short trial (a couple of seconds).
3. Load the trial you just created (press F2 to open the Data Management window and double-click on the trial) and on the Nexus toolbar, click the **Reconstruct and Label** button .
4. In a **3D Perspective** view, zoom in so you can see the two objects (subject and wand).

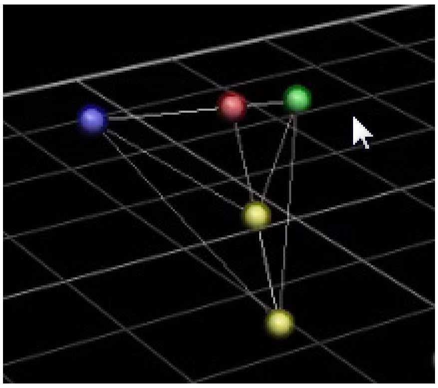


To create the objects in Nexus:

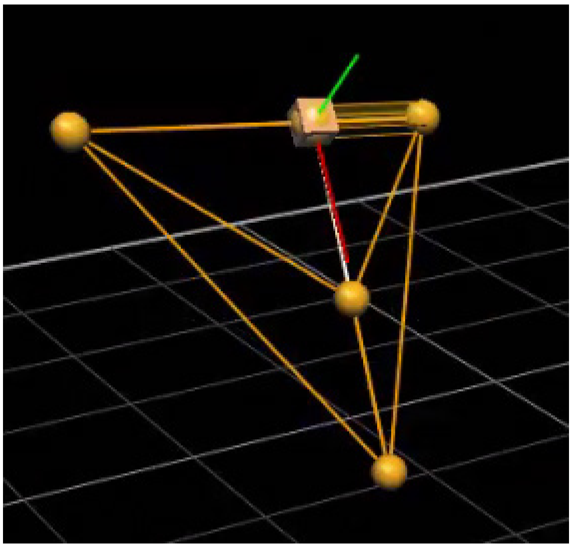
1. On the **Subjects** tab of the **Resources** pane, click the **Create a blank subject** button  and in the **Enter Subject Name** dialog box, enter the subject name: **Wand**.
2. In the **Subject Preparation Tools** pane, in the **Labeling Template Builder** section, enter a segment name (**Wand**) in the **Create Segments** box and click **Create**.
3. In the **3D Perspective** view, select the markers that are going to be the wand object, beginning with the origin (middle) marker.



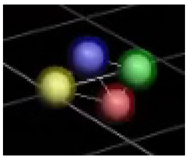
4. Ensure all the wand markers are selected.



5. In the **Labeling Template Builder** section, click **Create** again.
6. In the 3D Perspective view, check the axes and origin are shown for the wand.

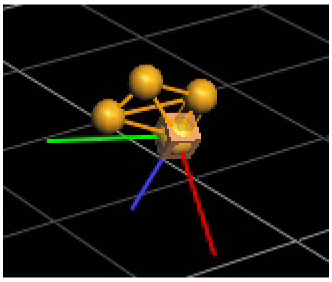


7. To create head object, on the **Subjects** tab of the **Resources** pane, click the **Create a blank subject** button and in the **Enter Subject Name** dialog box, enter **Head**.
8. On the **Subjects** tab, click the **Head** object you just created to select it and at the top of the **Subject Preparation** tab in the **Tools** pane on the right of the screen, in the **Subject** dropdown menu, select **Head**.
9. In the **Labeling Template Builder** section, in the **Create Segments** box, type **Head** and click **Create**.
10. In the **3D Perspective** view, select the markers that are going to be the wand object, beginning with the origin marker. For the head's origin marker, select the marker closest to the eyeball, then select the others.



11. In the **Labeling Template Builder** section, click **Create** again.

12. In the **3D Perspective** view, check the axes and origin are shown for the new object.



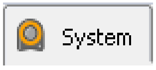
After you have created both objects, you must run a static calibration.

To run a static calibration:

1. In the **Pipeline Tools** pane, expand **Calibration** operations and double-click **Static Subject Calibration** to add it to the list of current pipelines.
2. Ensure both subjects are selected, then in the **Pipeline Tools** pane, right-click on **Static Subject Calibration** and click **Run selected Op**.
3. Before proceeding, it is a good idea to save both models. To do this, on the **Subjects** tab in the **Resources** pane, right-click on the node for each model in turn and then click **Save Model**.

After you have added the head and wand objects to your trial and run a static calibration, you are ready to add eye tracking.

To add eye tracking to the trial:

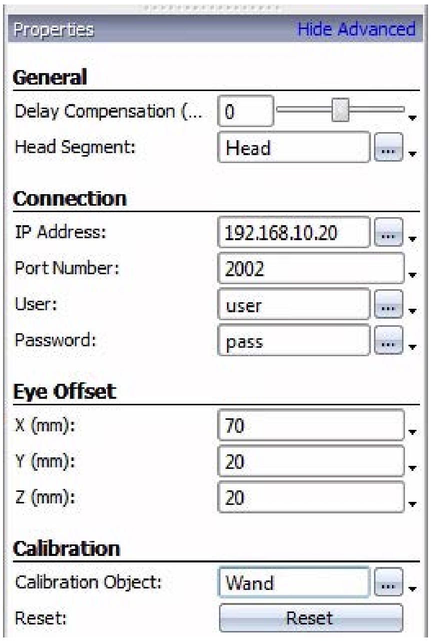
1. In the **Resources** pane, click **Go Live**.
2. To display the axes and origins, on the **System Resources** tab, click **Local Vicon System** and in the **Core Processor** section of **Properties** pane, change **Processing Level** from **Label** to **Kinematic Fit**.
3. To add the Dikablis device, on the **System Resources** tab, click the **Devices** node, point to **Add Digital Device**, then **Add Dikablis Eye Tracker**.
4. On the **System Resources** tab 

, click on the **Dikablis Eye Tracker** node, and in the **General** section of the **Properties** pane, in the **Head Segment** field, enter **Head**.
5. In the **Connection** section, enter the IP address that was set up on the Dikablis laptop. To check the port number, ensure **Show Advanced** properties is selected, then ensure **Port Number** is set to 2002.
6. In the **Eye Offset** section, enter the relevant values (that is, the distance between the origin marker and the eye).

Tip	To find the relevant eye offset values, if your Vicon system includes video cameras, you can use overlay video. If not, you can measure the distance from the origin marker.

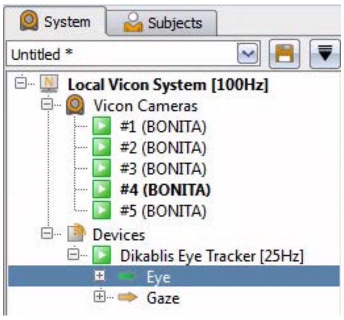
7. In the **Calibration Object** field in the **Calibration** section, enter the name of the calibration object (**Wand**).

You have now set up the eye tracker properties.

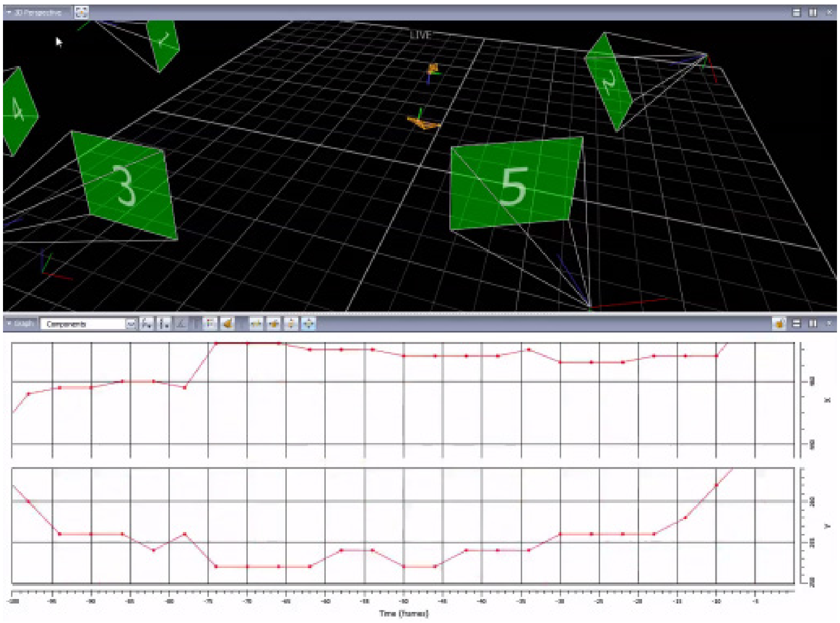


To complete calibration of the eye tracker:

1. On the **System** tab in the **Resources** pane, under the expanded **Dikablis Eye Tracker** node, click the **Eye** node to select it.

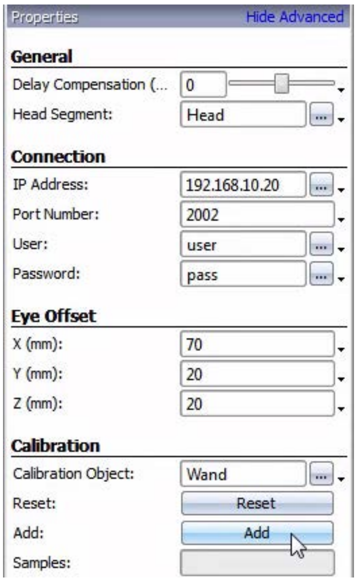


2. Split the view pane so that both **3D Perspective** and **Graph** views are shown. You can see the x and y values for the selected eye.



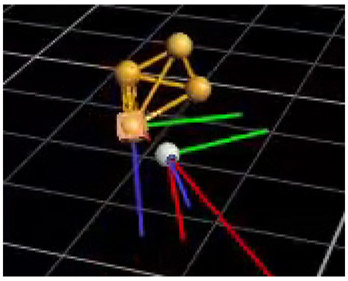
3. In the capture volume, get the subject to hold the wand and look at the origin marker (the middle marker of the T).

4. On the **System** tab, click the **Dikablis Eye Tracker** node and in the **Properties** pane, go to the **Calibration** section and click **Add**.



5. Move the wand and click **Add** again. In the **Samples** box, 2 is displayed.

6. Repeat, and after you have collected three samples, an eye vector and an eyeball are displayed in the **3D Perspective** view.

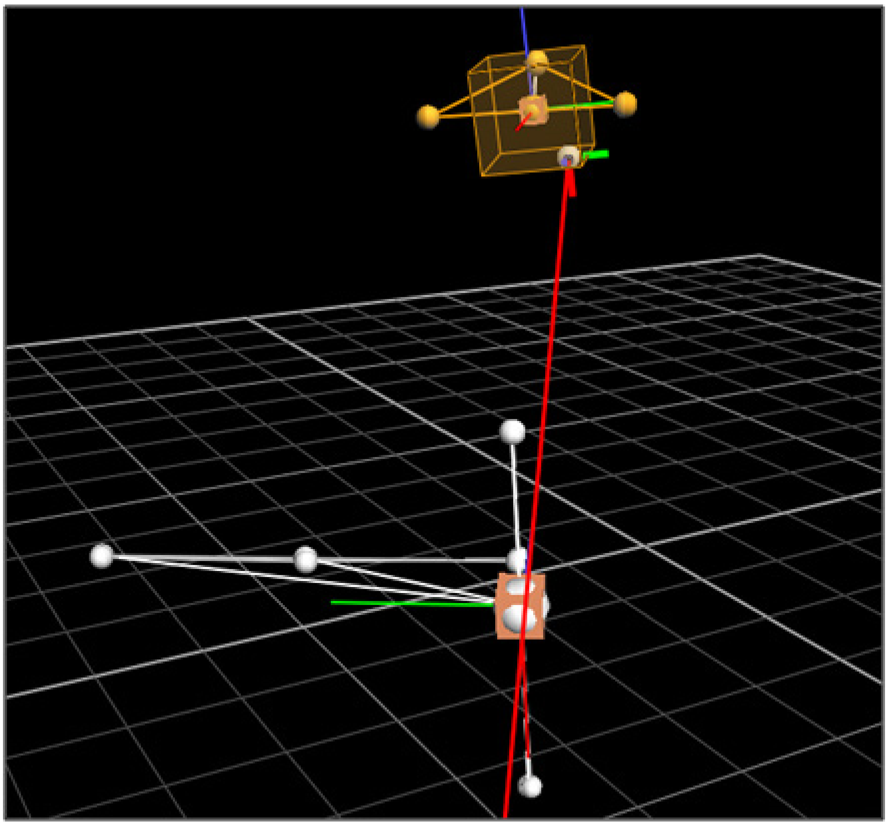


7. Collect further samples to refine your results.

Tip	When collecting samples, ensure you get the best coverage of the volume. To do this, have your subject hold the wand in the bottom left of volume and look at the origin marker. Pause for about a second and then in the **Calibration** section, and click **Add**. Then have the subject go to the top left of the volume, still looking at

the origin marker. Again, pause, and click **Add**. Repeat with the subject at the top right of the volume, and then at the bottom right of the volume. For the final sample, get the subject to stand in the middle of the volume, pause, and click **Add**.

When the eye tracker system has been properly calibrated (and if the subject is looking at the origin marker), in **3D Perspective** view, the eye gaze vector will pass through (or point to) the origin marker of the calibration wand, depending on how far the subject's head is from the wand.



View the results in **3D Perspective** view. You can now record a short trial to check that the eye tracks the wand correctly.

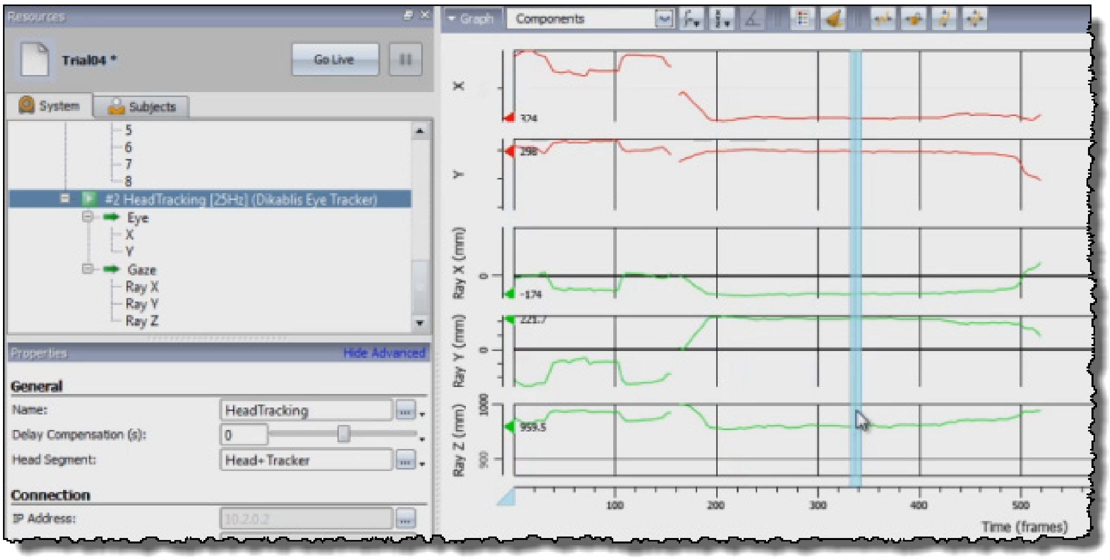
Exporting Eye Vector Data

To use eye vector data, you will normally want to export both the eye vector data itself and the Head and Tracker data (the segment data) that relates the eye vector to its position within the global coordinate system. To export all the information relating to the eye vector, you must reconstruct and label the trial and kinematically fit the data before exporting it.

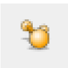
To export eye vector data and segment data:

1. Load into Nexus the trial from which you want to export eye tracking data.
2. On the **System** tab of the **Resources** pane, click the **Dikablis Eye Tracker** node to select it.

3. To check that the eye vector data is included, open a **Graph** view pane and observe the eye vector x and y values.



Note	You can export the eye vector data at this point, but the exported file will not include the segment data, which is necessary to position the eye vector within the global coordinate system.

4. Run **Reconstruct and Label**. To do this, you can either click the **Reconstruct and Label** button  or if you want to customize the options (for example, to change the number of cameras, etc), on the **Tools, Pipeline** pane, expand the **Processing** node and select the **Core Processing** pipeline operation, make any required changes in the **Properties** pane, then right-click and run the operation.

   In the **3D Perspective** view, as processing proceeds, you can see first the addition of the object markers and then the labeling.

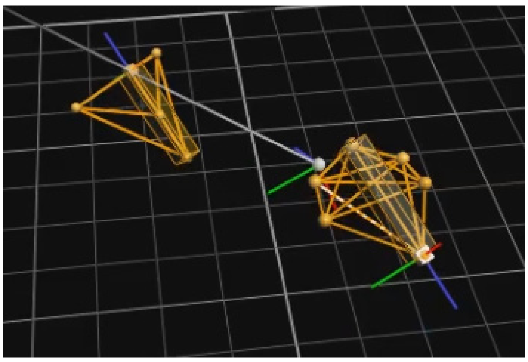
5. After labeling is complete, to see and use the eye vector, you need to kinematically fit the data. To do this, in the **Tools, Pipeline** pane, go to the **Available Operations** section, expand the **Processing** node and then double-click **Fit Subject Motion**.

6. In the **Current Pipeline** section, ensure **Fit Subject Motion** is selected and in the **Properties** pane, make any required changes.

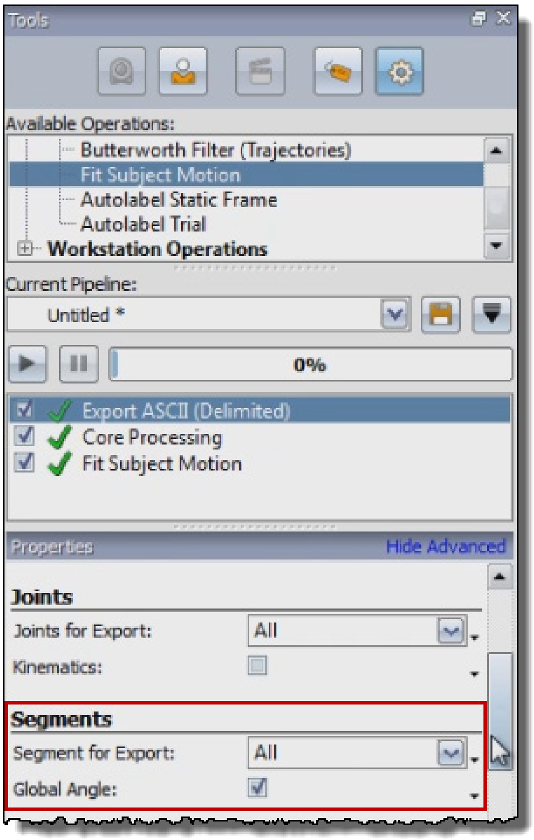
Tip	To produce the required result, you may need to reduce the **Rest Pose Importance** to zero.

7. In the **Current Pipeline** section, right-click **Fit Subject Motion**, and then click **Run Selected Op**.

   The eye vector is displayed in the **3D Perspective** view.



8. In the **Tools**, **Pipeline** pane, expand the **FileIO** node and then double-click **Export ASCII (Delimited)**.
9. In the **Properties** pane, in the **Segments** section, change the **Segment for Export** setting to **All** and select **Global Angle**.



10. In the **Current Pipeline** section, right-click **Export ASCII (Delimited)**, and then click **Run Selected Op**.
11. To see the exported data, in the **Data Management** window, with the relevant trial selected, click on the hyperlink at the bottom left of the window and double-click the relevant *.csv* file to open it.

    The eye vector data is displayed as a unit vector in the columns headed **RayX**, **RayY**, and **RayZ**.

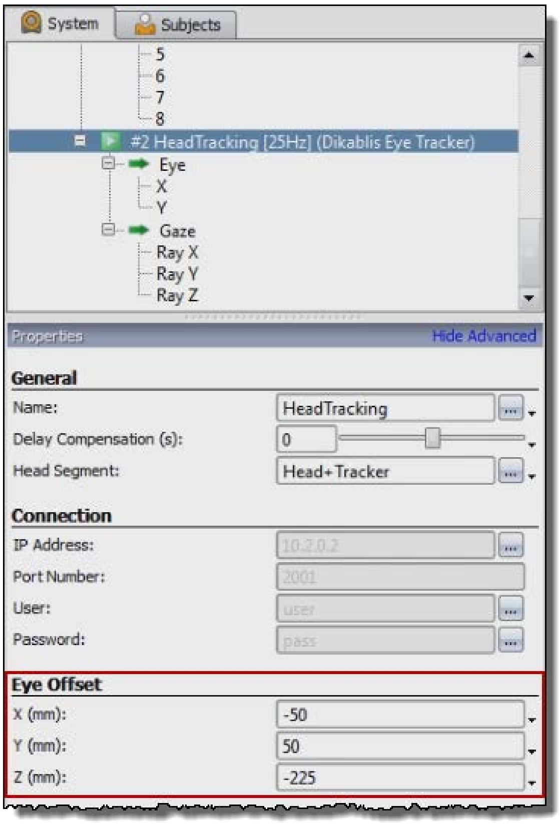
	A	B	C	D	E
1	Devices				
2	25				
3			HeadTracking - Gaze		
4	Frame	Sub Frame	Ray X	Ray Y	Ray Z
5			mm	mm	mm
6	1	0	-43.2913	-204.972	977.81
7	2	0	-28.151	-229.18	972.977
8	3	0	-15.5265	-247.521	968.758
9	4	0	-5.36528	-260.209	965.537
10	5	0	-10.7775	-258.337	965.995
11	6	0	-10.7775	-258.337	965.995
12	7	0	-9.41251	-240.428	970.621
13	8	0	18.4693	-240.82	970.394
14	9	0	26.9812	-239.096	970.621
15	10	0	-43.818	-171.327	984.239
16	11	0	-117.9	-94.7398	988.496
17	12	0	-120.338	-88.8668	988.747
18	13	0	-133.703	-78.817	987.882
19	14	0	-142.171	-80.5209	986.562
20	15	0	-117.9	-94.7398	988.496

The units are between 1000 and -1000mm. Note that the eye vector data is local to the segment to which the eye tracker is connected (ie, the Head). Both the eye vector data and the Head and Tracker (and Wand) data are exported.

	A	B	C	D	E
1	Devices				
2	25				
3			HeadTracking - Gaze		
4	Frame	Sub Frame	Ray X	Ray Y	Ray Z
5			mm	mm	mm
6	1	0	-43.2913	-204.972	977.81
7	2	0	-28.151	-229.18	972.977
8	3	0	-15.5265	-247.521	968.758
9	4	0	-5.36528	-260.209	965.537
10	5	0	-10.7775	-258.337	965.995

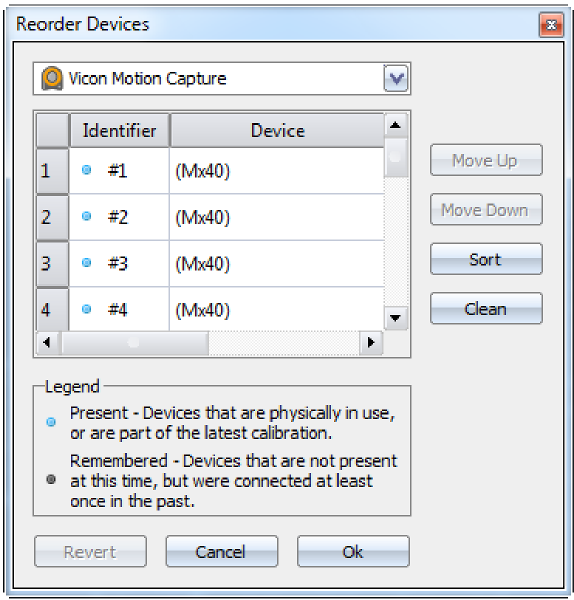
176	Segments									
177	100									
178			dikablis and Noraxon:Head+Tracker						Wand:Wand	
179	Frame	Sub Frame	RX	RY	RZ	TX	TY	TZ	RX	RY
180			deg	deg	deg	mm	mm	mm	deg	deg
181	1	0	134.587	191.974	38.9164	56.5792	271.713	1634.18	28.4567	-113.875
182	2	0	134.305	191.959	39.0978	56.2567	271.888	1634.01	27.8354	-113.664
183	3	0	134.097	191.943	39.3033	56.0005	272.053	1633.93	27.2245	-113.488
184	4	0	133.914	191.957	39.5326	55.7938	272.191	1633.89	26.6595	-113.263
185	5	0	133.829	191.957	39.7651	55.6439	272.303	1633.92	26.1145	-113.085
186	6	0	133.817	191.95	39.9879	55.5337	272.409	1633.98	25.6043	-112.826
187	7	0	133.821	191.942	40.1872	55.483	272.467	1634.03	25.1456	-112.606
188	8	0	133.867	191.924	40.3501	55.4746	272.512	1634.05	24.6909	-112.526
189	9	0	133.938	191.89	40.4957	55.4962	272.552	1634.07	24.3354	-112.152
190	10	0	134.013	191.835	40.6355	55.5498	272.596	1634.06	23.9869	-112.021

12. To position the eye vector in global coordinate space, you need to use the Head and Tracker data. To ensure accuracy, you also need to apply the offset from the Head segment. To see the offset, in the **Resources** pane, **System** tab, click on the **Eye Tracker** node and in the **Properties** pane, go to the **Eye Offset** coordinates.



Reorder Devices Dialog Box

Change the order in which MX devices are displayed in the **System** resources pane from the **Reorder Devices** dialog box .



You access this dialog box by right-clicking **Vicon Cameras**, **Video Cameras**, Vicon connectivity nodes, **or Devices** in the **System** Resources pane and selecting **Reorder** from the displayed context menu. This menu is available only when the system is in **Live** mode (click the **Go Live** button); devices listed in an offline processing file cannot be reordered.

Each MX camera, MX Control, MX Giganet, MX Ultranet HD, and MX Ultranet is assigned a unique device ID at manufacture, which remains the same, regardless of its relative position in the list of other devices of the same type. Once integrated in a Vicon system, each device is assigned a sequential ID, which is used to identify it (for example, in user interface lists and camera calibration parameters (*.xcp*) files). This sequential ID is not dependent on which socket the device is plugged into (for example, an MX Camera plugged into socket 2 in an MX Ultranet is not necessarily assigned a device ID of 2). Reordering the device changes its sequential ID. You may find this useful if you want to order your device numbers to match their physical sequence in your capture volume.

Note	Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to "MX camera" also apply to the use of Bonita cameras within Nexus.

To change the order of devices in the Reorder Devices dialog box:

1. In the **System** resources tree, right-click **Vicon Cameras**, **Video Cameras**, **Vicon Connectivity**, **Force Plates, or Other Devices** and from the displayed context menu select **Reorder**.
2. In the **Reorder Devices** dialog box, click on the device whose position you want to change.

   In the **Indentifier** column, the dot to the left of the ID number indicates the current status of that device:

   Present - Devices that are physically in use, or are part of the latest calibration

   Remembered - Devices that are not present at this time, but were connected at least once in the past

   The **Previous Position** column shows the sequence ID previously assigned to the device.

3. Change the order of the device using the buttons:

   Move Up Move the selected entry up one position in the list.

   Move Down Move the selected entry down one position in the list.

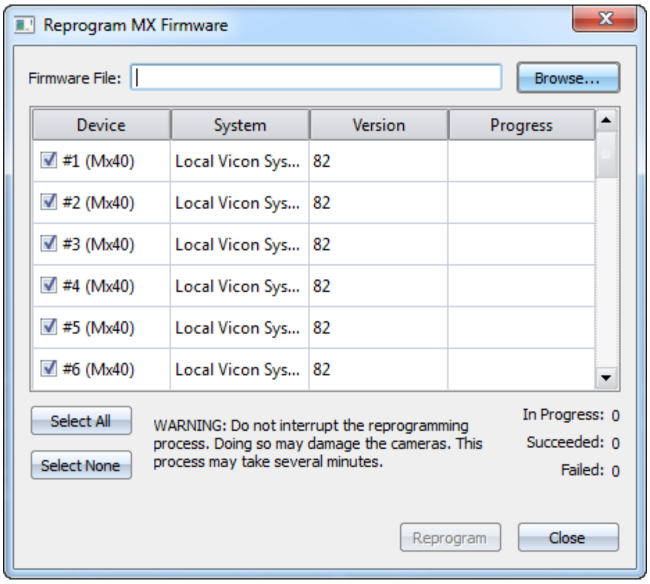
   Sort Sorts the list of devices according to name and type. Remembered devices are at the bottom of the list.

   Clean Removes the entries for the devices that are not present in the current session.

4. Repeat steps 1-2 for each device whose position you wish to change.
5. Click **OK** to save the changes and close the **Reorder Devices** dialog box.

Reprogram MX Firmware Dialog Box

You view and update firmware for certain MX devices present in your Vicon MX architecture in the **Reprogram MX Firmware** dialog box .



You access this dialog box by right-clicking **Local Vicon System** in the **System** resources pane and selecting **Reprogram Vicon Firmware** from the displayed context menu. This menu is available only when the system is in **Live** mode (click the **Go Live** button); firmware for MX devices listed in an offline processing file cannot be reprogrammed.

Each MX / Bonita camera, MX Control, MX Ultranet, and MX Ultranet HD is programmed with firmware to control its operation. Vicon may supply firmware updates to correct or improve MX device functionality. You apply these firmware updates to your MX devices via the Vicon Ethernet network using this **Reprogram MX Firmware** dialog box. You can view version information for the MX firmware currently loaded in your MX devices in the **Version** column of the dialog box. Ensure that all MX devices have the same version of MX firmware.

You can find details on the latest recommended version of MX firmware in the *Vicon Nexus Product Guide– Foundation Notes* supplied with each release of Vicon Nexus.

To update firmware:

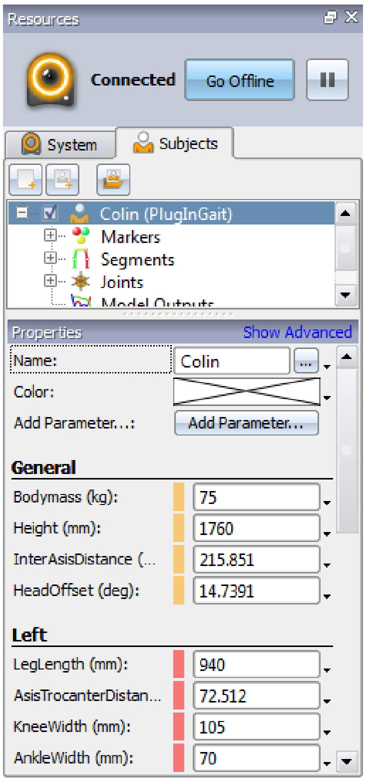
1. In **Firmware File**, enter the full path and file name of the Vicon firmware update, or click **Browse** to display the **Choose a firmware bundle** dialog box in which you can navigate to and select the *MXFirmware_<version no>.mxe* file from the folder into which you copied the supplied update file.
2. In the **Device** column, select the Vicon devices to which to apply firmware updates. Select ☑ or clear ☐ one or more specific devices, or use the **Select All** button to select all devices in the list, or the **Select None** button clear all selected devices in the list.
3. Click **Reprogram** to start the reprogramming function, which sends the firmware updates contained in the specified *.mxe* file to the MX devices selected in the **Device** column.
4. In the **Progress** column indicating the processing progress for each selected device, hover the mouse pointer over the Progress cell for a device to view a ToolTip providing advanced progress information.
5. In the status fields at the bottom right of the dialog box, view a summary of the processing information for all devices:
   - **In Progress**: The number of MX devices to which the firmware updates are being applied.
   - **Succeeded**: The number of MX devices to which firmware updates were successfully applied.
   - **Failed**: The number of MX devices to which firmware updates were not successfully applied.

   If an MX hardware device is not successfully programmed, select that device and hold CTRL while you click the **Reprogram** button to force the device to be reprogrammed.
6. Click **Close** to close the **Reprogram MX Firmware** dialog box.

Subjects Resources Pane

About the Subjects Resources Pane

Prepare and manage the subjects whose motion data you want to capture and analyze in Vicon Nexus in the **Subjects** Resources pane 
.



Plug-in Gait Preparation Stage:

I. Create a new subject node from one of the supplied Plug-in Gait templates.

Vicon Skeleton Template Preparation:

I. Create a blank subject node.

III. Customize Vicon Skeleton Template properties.

IV. Optionally add subject measurements to the Vicon Skeleton Template.

V. Save the additional Vicon Skeleton Template information in the .vst file.

Nexus Motion Capture Workflow:

II. Prepare subject

The **Subjects** resources pane contains the following sections:

- Subjects Resources pane toolbar

  Create or manage subject nodes for Vicon Skeleton Templates (*.vst* files) or Vicon Skeletons (*.vsk* files) using the following buttons in the toolbar at the top of the **Subjects** resources pane:

  Create a blank subject

  Create a new subject node in the resources tree. You can subsequently create, attach, or import *.vst* or *.vsk* files for the blank node. The node automatically includes the minimum sub nodes for the elements required for a *.vst* file.

  Create a new subject from a template

  Create a new subject node in the resources tree based on an existing *.vst* file. The node automatically includes any sub nodes and data for the elements defined in the selected *.vst* file.

  Load a subject

  Load an existing *.vsk* file into a subject node in the resources tree. The node automatically contains sub nodes and data for all elements defined in the selected *.vsk* file.

- Subject Resources tree

  Enable a subject for motion capture and data recording in the **Resources Tree** section of the **Subjects** resources pane. The subject symbol is orange and the subject name is black if a working Vicon Skeleton Template (*.vst* file) or Vicon Skeleton (*.vsk* file) exists for the subject node. If the name is red, the *.vst* or *.vsk* file is not suitable for capture (this may be due to an incomplete definition for the subject). Hover the mouse pointer over the subject node to display a ToolTip identifying the problem.

  Expand (+) or collapse (-) the following sub nodes to display or hide a list of subject elements that you can use for selecting, editing, or showing in graph traces:

  Markers

  Model markers defined in the *.vst* or *.vsk* file as well as trajectories for markers visible in the capture volume or from a loaded *.c3d* file. The marker text is gray if the marker is not physically present in the capture volume.

  Segments

  Segments defined in the *.vst* or *.vsk* file.

  Joints

  Joints defined in the *.vst* or *.vsk* file. The names of the segments that the joint connects are shown in parentheses after the joint name.

  Model Outputs

  Components of variables calculated for a kinematic model (such as Angles, Forces, Moments, Powers, or Bones) created by Vicon Plug-in Gait or Plug-in Modeler and available in Nexus from a loaded *.c3d* file.

Tip

You can perform commands to manage specific nodes by right-clicking on the node in the **Subjects** resources tree and selecting the desired command from the displayed menu.

The color-coded symbols displayed for entries in the **Markers** and **Segments** lists correspond to the colors defined for each model marker and joint in the *.vst* or *.vsk* file. This provides a helpful visual aid when you are manually labeling a subject. The symbols for entries in the **Joints** list and the **Traces** list are not color coded: the same joint symbol is displayed for all joints, and the same model outputs symbol is displayed for all model outputs.

If no markers, segments, or joints have yet been defined for a new subject, the lists may not contain any entries.

- Subject Properties

View or edit subject properties in the **Subjects Properties** section at the bottom of the **Subjects** resources pane. The properties displayed depend upon the subject node, sub node, or element selected in the system resources tree (marker, segment, joint, or trace). For details on how to specify settings for properties, see Setting Properties in Nexus. For details on the available properties, see Editing Vicon Skeleton Template Properties.

Creating a Blank Subject Node

Create a blank subject node in the resources tree in the **Subjects** resources pane 

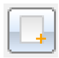
.

Vicon Skeleton Template Preparation:

I. Create a blank subject node.

You can subsequently create, attach, or import Vicon Skeleton Templates (*.vst* files) or Vicon Skeleton (*.vsk* files) for this blank subject node.

To create a blank subject node:

1. In the **Subjects** resources pane toolbar, click the **Create a blank Subject** button .
2. In the displayed **Enter a Subject Name** dialog box, accept the default name (*NewSubject*, *NewSubject2*, *NewSubjectn*, etc.) or overtype it with another name you want to use for your *.vst* or *.vsk* file and then click **OK**.
3. The new subject node is added in alphabetical order to the **Subjects** resources tree. The node automatically includes sub nodes for the minimum elements required for a *.vsk* file: Markers, Segments, Joints, and Model Outputs.

Tip

The subject node name is initially displayed in red to indicate that the node is empty of data. When the node contains a *.vst* or *.vsk* file, the node name is displayed in black.

Creating a New Subject Node from a Template

Create a new subject node in the resources tree based on an existing Vicon Skeleton Template (.vst file) in the **Subjects** resources pane Subjects. For step-by-step instructions on creating a new Vicon Skeleton Template, see the PDF *Creating and Using Labeling Skeleton Templates (VSTs)*.

Plug-in Gait Preparation Stage:

I. Create a new subject node from one of the supplied Plug-in Gait templates.

Nexus Motion Capture Workflow:

II. Prepare subject.

1. Create a subject node based on a Vicon Skeleton Template (*.vst* file).

Sample *.vst* files, including those for Plug-in Gait, are provided under the Nexus model templates folder (by default, *C:\Program Files\Vicon\Nexus\ModelTemplates*). You subsequently scale the template when you calibrate a Vicon Skeleton (.vsk file).

To create a new subject node based on a Vicon Skeleton Template:

1. In the **Subjects** resources pane toolbar, click the **Create a new Subject from a Template** button.

   A list of all Vicon Skeleton Templates (*.vst* files) currently contained in the Nexus model templates folder as well as a **Browse** link are displayed.

2. Specify the desired *.vst* file in either of the following ways:

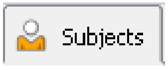
   - Select it from the list contained in the default folder.
   - Click **Browse** if it is not contained in the default folder.

3. In the displayed **Enter Subject Name** dialog box, specify the name for your new subject and click **OK**.
4. If you used the **Browse** link rather than selecting a *.vst* file from the list, the **Choose a Subject file** dialog box is then displayed. Navigate to and select the *.vst* file on which the Vicon Skeleton (*.vsk* file) is to be based.

   The new subject node is added in alphabetical order to the **Subjects** resources tree. The node automatically includes any sub nodes and data for the elements defined in the selected *.vst* file: Markers, Segments, Joints, and Model Outputs.

Tip	The marker names are displayed in gray if they are defined in the *.vst* file but are not physically present in the capture volume.

Loading an Existing Subject

Load a Vicon Skeleton (*.vsk* file) into a subject node in the resources tree in the **Subjects** resources pane .

Nexus automatically loads subject nodes for any *.vsk* files it finds in the currently active database session. If desired, you can explicitly load specific *.vst* file from other motion capture sessions at various stages during the Nexus motion capture workflow.

To load an existing Vicon Skeleton (.vsk file):

1. In the **Subjects** resources pane toolbar, click the **Load a Subject** button .
2. In the displayed **Choose a Subject file** dialog box, navigate to and select an existing *.vsk* file and then click **Open**.

   The subject node is added in alphabetical order to the **Subjects** resources tree. The node automatically contains sub nodes and data for all elements defined in the *.vsk* file.

Caution	If the selected *.vsk* file has the same name as a subject node currently loaded in Nexus, the contents of the selected *.vsk* file replace those in the currently loaded subject node.

Editing Vicon Skeleton Template Properties

Edit the properties of a Vicon Skeleton Template (*.vst* file) or a Vicon Skeleton (*.vsk* file) in the **Subjects** resources pane .

Vicon Skeleton Template Preparation:

III. Customize Vicon Skeleton Template properties.

You can customize Vicon Skeleton Template properties such as names and colors of subject elements (markers, segments, joints, and model outputs). You can edit these properties when you build a Vicon Skeleton Template (*.vst* file) in Nexus or after you calibrate a Vicon Skeleton (*.vsk* file).

For step-by-step instructions on creating a new Vicon Skeleton Template, see the *Product Guide - Advanced Notes Creating and Using a Labeling Model*.

Important	Subject properties are initially taken from the *.vst* or *.vsk* file. You can enter specific measurements for a *.vst* file. These values are read-only for a *.vsk* file. If you need to edit the values for a *.vsk* file, you must use the Revert To Uncalibrated command to display the initial values from the associated *.vst* file, which you can then overtype.

To edit subject properties:

1. Display the subject whose properties are to be edited in either of the following ways:
   - Ensure that the reconstructed and unlabeled markers for a subject in the capture volume are still visible in the **3D Perspective** view pane.
   - From the **Data Management** window, open the desired trial file containing reconstructed and labeled data for that subject.
2. In the **Subjects** resources pane toolbar, load an existing Vicon Skeleton (.vsk file) or create a new subject node from a template.
3. In the **Subjects** resources tree, expand the subject node to display a list of the **Markers**, **Segments**, **Joints**, and **Model Outputs** elements defined in the *.vst* or *.vsk* file (or **Markers** for trajectories visible in the capture volume or from a loaded *.c3d* file).
4. Select the node for the subject or elements whose properties you wish to edit:
   - **Subject** node for properties for the subject.
   - **Markers**, **Segments**, **Joints**, or **Model Outputs** node for all elements of a specific type.
   - **Marker**, **Segment**, **Joint**, **Model Output Type**, or **Model Output** sub node for a specific element of a given type.

Tip	You can select multiple markers, segments, joints, or model outputs in the **Subjects** resources tree by left-clicking and dragging across the desired items. You can then change the properties of all the selected items in a single operation. For more details, see topic Working in the Nexus User Interface. When a marker, segment, or joint is selected in the **Subjects** resources tree, it is also selected in the view pane workspace so that you can readily identify it. If the **Camera centered on selection** button is pressed on the **3D Perspective** view pane toolbar or the **3D Orthogonal** view pane toolbar, the selected marker is automatically positioned in the center of the view pane workspace.

   The commands available on the context menu depend on the node you have selected.
5. In the **Properties** section at the bottom of the **Subjects** resources pane, view or change settings for the desired properties.
6. The contents of the **Properties** section depend on the contents of the loaded *.vst* or *.vsk* file. For example, Plug-in Gait models can contain subject measurements in General, Left and Right contexts.
7. If desired, rename a selected marker, segment, joint or model output in either of the following ways:
   - In the **Properties** section, overtype the current name or click the **Edit Text** button to display the **Name** dialog box in which you can overtype the existing node name with a longer text string.
   - In the **Subjects** resources tree, press ENTER, overtype the current name, and then press ENTER again. You can use the UP ARROW and DOWN ARROW keys to select the previous or next node and rename it if desired. This enables you to specify new marker names for an entire marker set without using the mouse.

Caution	To ensure that your *.vst* file complies with the *.c3d* file format, keep the following in mind if you rename a marker: A marker name can contain up to 30 alphanumeric characters (A-Z and 0-

9). Do not include any punctuation, spaces, or special characters.

The first character of the name must be alphabetical. Subsequent characters can be alphanumeric. For example, "LANK1" is permitted, but "1" or " L Ankle 1" is not.

The marker label includes the subject name automatically prefixed to the segment name. For example, if your model has segment "LASI" for a subject named "Chris", the marker label name is "Chris:LASI".

8. If desired, reorder markers in the **Subjects** resources tree in the **Reorder Markers** dialog box.
9. If desired, delete a segment or a joint by using the **Delete** command from the context menu.
10. Any markers attached only to that segment are also deleted.
11. In the Subjects resources tree, right-click the Subject node and from the displayed context menu select Save Model (for a .vsk file) or Save Model As Template (for a .vst file).

Subject Node Context Menu

You can select the following commands from the context menu displayed when you right-click on the Subject node:

- Attach Model
- Copy Model
- Save Model
- Save Model as Template
- Revert to Uncalibrated
- Remove Subject

You can select the following command from the context menu displayed when you right-click on the **Markers** node:

- Reorder

You can select the following command from the context menu displayed when you right-click on a sub node for a specific **Segment** or **Joint**:

- Delete

Setting Properties for Vicon Skeleton Templates

Edit the properties of a Vicon Skeleton Template (*.vst* file) in the **Subjects** resources pane Subjects. For more information, see Editing Vicon Skeleton Template Properties.

You can configure the following settings in the **Properties** section for a Subject node:

- Name

  The name of the selected subject node. This name is used when the Vicon Skeleton Template is saved in a *.vst* file or the Vicon Skeleton is saved in a .vsk file. You can change this either by overtyping the current name or by clicking the **Edit Text** button ... to display the **Name** dialog box in which you can overtype the existing node name with a longer text string.

- General

  Example properties from a Plug-in Gait model:

  Bodymass

  The subject's body mass (in kg).

Default: As defined in the *.vsk* or *.vst* file or user-specified

  Height

  The subject's height (in mm).

Default: As defined in the *.vsk* or *.vst* file or user-specified

  InterAsisDistance

  The distance (in mm) between the subject's left and right anterior superior iliac spine (ASIS).

Default: As defined in the *.vsk* or *.vst* file or user-specified

Tip	If you load a data file (*.x2d* or *.c3d*) that was processed with Plug-in Gait in earlier Vicon application software, these parameters also will be displayed in Nexus.

- Left

  Example properties from a Plug-in Gait model:

  LegLength

  The length (in mm) of the subject's left leg.

Default: As defined in the *.vsk* or *.vst* file or user-specified

  AsisTrochanterDistance

  The distance (in mm) between the subject's left ASIS and greater trochanter.

Default: As defined in the *.vsk* or *.vst* file or user-specified

KneeWidth

The width (in mm) of the subject's left knee.

Default: As defined in the *.vsk* or *.vst* file or user-specified

AnkleWidth

The width (in mm) of the subject's left ankle.

Default: As defined in the *.vsk* or *.vst* file or user-specified

TibiaTorsion

The torsion (in deg) of the subject's left tibia.

Default: As defined in the *.vsk* or *.vst* file or user-specified

Right

Example properties from a Plug-in Gait model:

LegLength

The length (in mm) of the subject's right leg.

Default: As defined in the *.vsk* or *.vst* file or user-specified

AsisTrochanterDistance

The distance (in mm) between the subject's right ASIS and greater trochanter.

Default: As defined in the *.vsk* or *.vst* file or user-specified

KneeWidth

The width (in mm) of the subject's right knee.

Default: As defined in the *.vsk* or *.vst* file or user-specified

AnkleWidth

The width (in mm) of the subject's right ankle.

Default: As defined in the *.vsk* or *.vst* file or user-specified

TibiaTorsion

The torsion (in deg) of the subject's right tibia.

Default: As defined in the *.vsk* or *.vst* file or user-specified

You can configure the following settings in the **Properties** section for the selected subject element:

- Markers

  Name

  The name of the Vicon marker. You can rename a marker by overtyping it.

Default: As defined in *.vsk* or *.vst* file or as specified in the Labeling Template Builder

  Color

  The color in which to display the Vicon marker in a **3D Perspective** view pane. You can assign either a specific color or the associated context color.

Default: As defined in *.vsk* or *.vst* file or as specified in the Labeling Template Builder

  Radius

  The size of the Vicon marker attached to subject during trial capture. This setting also dictates the size of the marker displayed in the **3D Perspective** view pane. You can change the radius by either overtyping the current value or dragging the slider bar left to decrease the value or right to increase it.

Default: As defined in *.vsk* or *.vst* file or as specified in the Labeling Template Builder

  Status

  The requirement for the marker's inclusion in a *.vst* file for static trials (used for calibration) and/or the *.vsk* file calibrated from the *.vst* file for dynamic trials (used for analysis):

  - – **Required:** Marker must be present for both static and dynamic trials.
  - – **Optional:** Marker can optionally be left off. If the marker is not present for the calibration, the autolabeler will not look for it in the dynamic trials. If the marker is present in the static trial, it will also form part of the dynamic marker set and will be used to aid tracking and to provide redundancy.
  - – **Calibration Only:** Marker must be present for static trials to align coordinate systems, but it must be removed for dynamic trials.

Default: Required

- Segments

  Name

  The name of the skeleton segment.

Default: As defined in *.vsk* or *.vst* file or as specified in the Labeling Template Builder

  Color

  The color in which to display the skeleton segment in a **3D Perspective** view pane. You can assign either a specific color or the associated context color.

Default: As defined in *.vsk* or *.vst* file or as specified in the Labeling Template Builder

- Joints

  Name

  The names of the segments connected by the joint.

Default: As defined in *.vsk* or *.vst* file or as specified in the [Labeling Template Builder](#)

  Output Format

  The joint angle output format (if appropriate):

  – XYZ Euler Angles

  – ZYX Euler Angles

  – XZY Euler Angles

  – YZX Euler Angles

  – YXZ Euler Angles

  – ZXY Euler Angles

  – Helical Axis

Default: Helical Axis

- Model Outputs

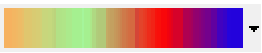
  Name

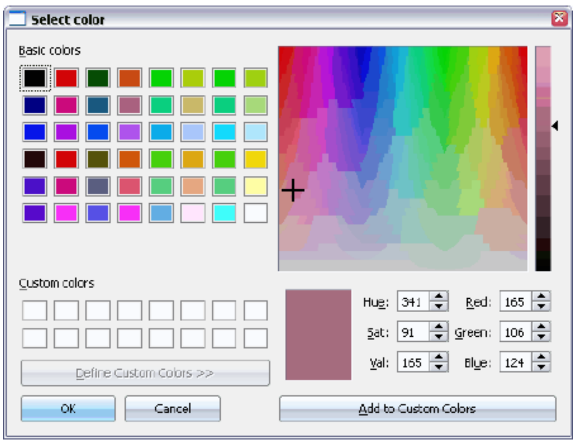
  The names of the model outputs in a loaded *.c3d* file.

Default: As defined in the *.c3d* file

Element Color Properties

In the **Color** property for **Markers** and **Segments**, you can specify the default color for these subject elements using one of the following methods:

- Assign a specific color using the **color map** .
- Click the current color in the entry field to display the **Select Color dialog box**.
- In the **Basic colors** area, click the square for the desired color, or in the **Custom colors** areas define a new color.



- Specify the default color of its associated context (if any) using the **Context Color** macro.
- Click the **Color** property context menu button and select **Macro**. **Context Color** is displayed in the entry field. A marker inherits its context from the segment to which it is attached. A segment's context is derived from its name, for example "LeftFemur" has a left context. To turn off the context color macro, clear **Macro** in the **Color** property context menu.

Context	Default Color
General	Orange
Left	Red
Right	Green

Adding Subject Measurements to a Vicon Skeleton Template

Add subject measurements from a Vicon Skeleton Template (*.vst* file) created in another Vicon application software to a *.vst* file created in Nexus in the **Subjects** resources pane 
.

Vicon Skeleton Template Preparation:

IV. Optionally add subject measurements to the Vicon Skeleton Template.

You can add the physical measurements you have taken of your subject (such as height, weight, and limb lengths) to a Vicon Skeleton Template. If you are not using a biomechanical model that requires subject measurements, you can skip this step when you are preparing subjects for motion capture in Nexus. Subject measurements that are manually taken from the subject are typically used by a biomechanical model to calculate joint center locations or other key concepts in other Vicon application software. While they are not necessary for labeling in Nexus, you can use these subject measurements from a kinematic model if you wish.

Important	Before adding subject measurements, ensure that you have already: – Prepared a Vicon Skeleton Template. – Created a File I/O pipeline that includes an **Import MP** operation for the *.mp* file from which you intend to import subject measurements.

There are two methods for adding subject measurement. The first method (below) is recommended.

To add a subject parameter to a Vicon Skeleton Template:

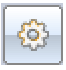
1. In the **Subjects** resources tree, click the subject node.
2. The **Properties** section at the bottom of the pane is populated with the parameters and values for that subject.
3. Click the **Add Parameter** button.
4. In the Add Subject Parameter dialog box, enter the following:
   - **Name**: Enter a name for the parameter.
   - **Required**: Click if this parameter is required for the model.
   - **Unit**: Enter the measurement value (mm, deg, kg, etc.).

- **Value:** Enter the parameter value after the subject has been measured.
- **Default:** If no other measurement is entered, enter the measurement to be used (typically "0").

5. Click **Add**. The parameter is displayed under **General**, **Right**, or **Left**, depending on the name you assigned for it.

Note	The above method is recommended; however, the following method can also be used.

To add subject measurements to a Vicon Skeleton Template using an .mp file:

1. Prepare an *.mp* file containing the subject measurements to correspond to your *.vst* file in either of the following ways:
   a. Either obtain an existing *.mp* file from BodyBuilder or Workstation, or create an *.mp* file yourself (for details, see Model Parameters File Format).
   b. Rename the *.mp* file to correspond to the name of your *.vst* file. For example, if the name of your Vicon Skeleton Template is *LeftUpperArmForReachingExperiments.vst*, rename the model parameters file *LeftUpperArmForReachingExperiments.mp*.
2. In the **Pipeline** tools pane , select and run the pipeline you previously created to import the *.mp* file you prepared in step 1.
3. In the **Subjects** resources tree, click the subject node for the Vicon Skeleton Template.

   The **Properties** section at the bottom of the pane is populated with the parameters and values from the *.mp* file.
4. Save the subject measurements in the .vst file.

   You can then subsequently view and edit these subject properties without having to reimport the *.mp* file again.

Model Parameters File Format

The model parameters (*.mp*) file is used to store subject and model specific parameters in other Vicon application software. You can import parameters from this type of file into a *.vst* file in Nexus, where you can view, edit, and apply them. You can use an *.mp* file created by Vicon BodyBuilder or Vicon Workstation, or you can create your own *.mp* file in a standard text editor.

This format of the *.mp* file is:

```
$<Context><ParameterName1> = <Value1>
…
$<Context>< ParameterNameX> = <ValueX>
```

where:

$	The dollar sign indicates that this is a parameter which the model expects the user to enter manually. Therefore, Nexus only imports parameters prefixed with a "$" sign, for example "$ LKneeWidth."
<Context>	Parameters are automatically sorted into the appropriate context depending on the presence or absence of a context prefix (if present, the prefix must be a capital letter): L Left R Right blank General

	Thus, a parameter named "$ LKneeWidth" will be added to the Left context and one named "$ RKneeWidth" will be added to the Right context.
`<ParameterName>`	The name that uniquely identifies the model parameter.
`<Value>`	The actual measurement that Nexus is to use for the parameter.

Managing Subject Nodes

Manage subject nodes in the resources tree in the **Subjects** resources pane 

.

Vicon Skeleton Template Preparation:

V. Save the Vicon Skeleton Template as a *.vst* file.

Nexus Motion Capture Workflow:

II. Prepare subject.

1. Create a subject node based on a Vicon Skeleton Template (.vst file).
5. Save the Vicon Skeleton in a .vsk file.

A subject node can be blank or can contain a Vicon Skeleton Template (*.vst* file) or Vicon Skeleton (*.vsk* file). You can manage subject nodes using the following commands from the context menu:

- Attach Model
- Copy Model
- Save Model
- Save Model as Template
- Revert to Uncalibrated
- Delete Subject

Important	These procedures assume that you have already loaded an existing *.vsk* file, created a new blank subject node, or created a new subject node from a template.

To attach a Vicon Skeleton Template or Vicon Skeleton to a subject node:

1. In the **Subjects** resources tree, right-click the subject node and select **Attach Model** from the displayed context menu.
2. In the **Choose a Subject file** dialog box, navigate to and select the *.vst* or *.vsk* file to be attached to this subject node and then click **Open**.

   Nexus attaches the specified *.vst* or *.vsk* file, closes the dialog box, and updates the subject node with sub nodes and data contained in the specified file.

To copy a subject node:

1. In the **Subjects** resources tree, right-click the subject node and select **Copy Model** from the displayed context menu.
2. In the **Enter Subject Name** dialog box, leave the default name *NewSubject* or overtype it with another name and click **OK**.

   Nexus creates a copy of the selected node and adds it as a new node in alphabetical order in the **Subjects** resources tree.

To save a subject node as a Vicon Skeleton (*.vsk* file):

- In the **Subjects** resources tree, right-click the subject node and select **Save Model** from the displayed context menu.

Nexus saves the contents of the subject node in a *.vsk* file in the currently active session of the motion capture database.

To save a subject node as a Vicon Skeleton Template (*.vst* file):

1. In the **Subjects** resources tree, right-click the subject node and select **Save Model as Template** from the displayed context menu.
2. In the **Choose a Subject file** dialog box, navigate to the folder in which you want to save the Vicon Skeleton Template, enter the name for the *.vst* file, and then click **Save**.

   Nexus saves the contents of the subject node in the specified *.vst* file. It also generates a corresponding marker file with the same base name and a *.mkr* extension in the same folder. If you subsequently run a BodyBuilder model that requires a marker file, this *.mkr* file is automatically copied to the relevant session folder.

Tip	Use a generic rather than a specific file name for a Vicon Skeleton Template, for example, "LeftUpperArmForReachingExperiments" rather than "JohnSmith." Save your *.vst* file in the default Nexus model templates folder (*C:\Program Files\Vicon\Nexus\ModelTemplates*) to make it available from the list of available *.vst* files displayed when you create a new subject node from a template.

To revert a subject node to an uncalibrated Vicon Skeleton Template (*.vst* file):

- In the **Subjects** resources tree, right-click the subject node and select **Revert to Uncalibrated** from the displayed context menu.
- Nexus discards any calibration data previously *.vsk* file) and reverts to the generic information in the Vicon Skeleton Template *.vsk* file was based.

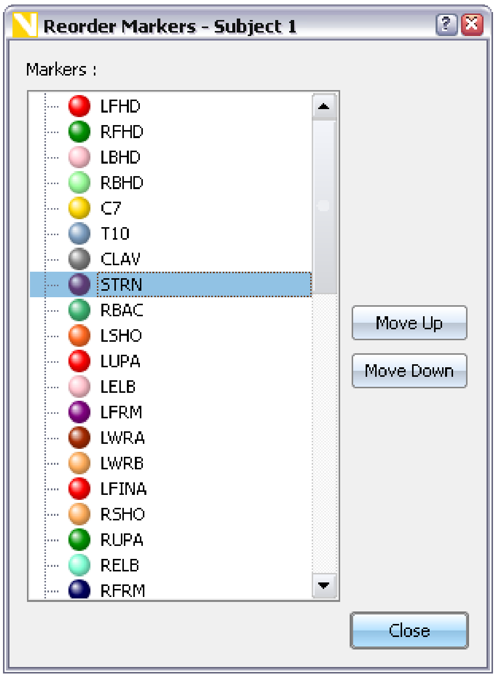
To delete a subject node from the resources tree:

1. In the **Subjects** resources tree, right-click the subject node and select **Delete Subject** from the displayed context menu.
2. In the **Warning** confirmation message, click **Yes** to proceed.

   Nexus deletes the subject node from the **Subjects** resources pane, unloads the *.vsk* file from the current session, and unlabels the trajectories associated with that subject

Reorder Markers Dialog Box

You change the order in which markers are displayed in the **Subjects** resources pane from the **Reorder Markers** dialog box .

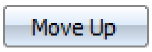


You access this dialog box by right-clicking **Markers** in the **Subjects** resources tree and selecting **Reorder** from the displayed context menu.

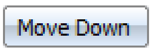
Details for 3D reconstructions of markers are defined in a [Vicon Skeleton Template (.vst file) or Vicon Skeleton (.vsk file)]. The order in which the marker names are listed in the **Subjects** resources tree is based on their position in the *.vst* or *.vsk* file. You can subsequently reorder markers, which you may useful for [manual labeling] purposes.

To change the order of markers in the Reorder Markers dialog box:

1. In the **Subjects** resources tree, right-click **Markers** and from the displayed context menu select **Reorder**.
2. In the **Reorder Markers** dialog box, from the **Markers** list select the entry for a marker whose position you wish to change.
3. Change the order of the marker using the buttons:

   Move the selected entry up one position in the list.

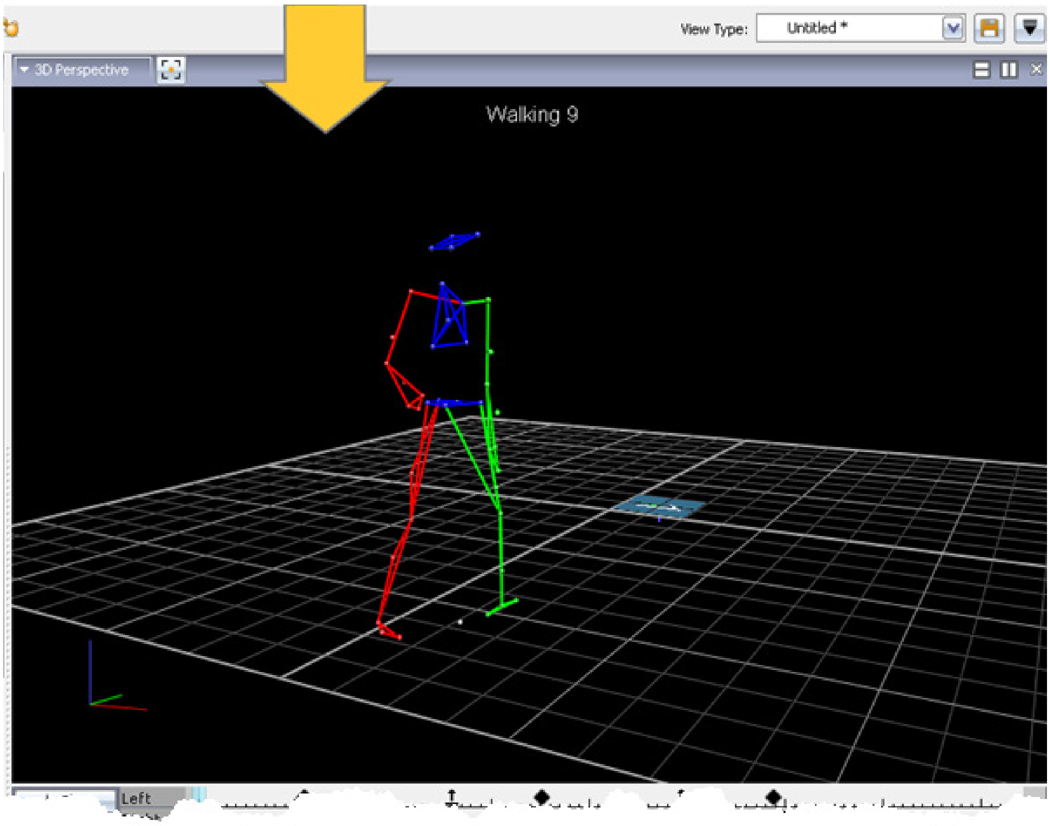
   Move the selected entry down one position in the list.

4. Repeat steps 1-2 for each marker whose position you wish to change.
5. Click **Close** to save the changes to both the **Markers** list and the *.vst* or *.vsk* file and close the **Reorder Markers** dialog box.

View Pane

About Nexus View Pane

Specify how you want to visualize the capture data from one or more cameras in the **View** pane.



View motion capture data live in real time or from a file for post processing. In the **View** pane, you can visualize the system components or subjects selected in the **Resources** pane or the results of processing performed in the **Tools** pane during any stage of the [Nexus motion capture workflow](#).

Tip	By default, the **View** pane is in the center of the Nexus window. You cannot detach or change the position of this pane, but you can open a separate [floating view workspace](#).

The **View Pane** contains the following sections:

- View Pane Configuration Management

  [Create or manage configurations](#) for the layouts specified in the **View** pane using the **Configuration Management** section at the top of the pane.

  The view configuration includes the layout of view panes as well as any cameras, hardware devices, and subject elements that were selected in the **System** resources pane or the **Subjects** resources pane when the configuration was saved. For example, if you save a view pane configuration with all cameras selected and a **Camera** view pane specified for each, the next time you load that configuration, all of the cameras are automatically selected and displayed in separate **Camera** view panes. If you save a configuration with a graph view showing the EMG channels, when you next load this configuration, the correct EMG device is selected. If you save a configuration with a graph view showing the distance between two specific markers, when you next load this file these two markers are selected.

- View Pane Standard Toolbar

Select the type of view pane to use, manage any display options for the selected type of view pane, and specify the number and arrangement of view panes displayed in the workspace in the **View** pane standard toolbar at the top of the view pane. The lists and buttons on the **View** pane standard toolbar are available from all types of view panes.

Select the types of view pane to be displayed from the **View Pane Type** list:

3D Perspective
Reconstructed motion capture data from all active Vicon cameras in 3D (three-dimensional) perspective, that is length, width, and depth.

3D Orthogonal
Motion capture data in 3D perspective viewed from a specified point of sight, or direction, of the capture volume.

Camera
Raw 2D motion capture data from an individual Vicon camera or a supported digital video camera.

Graph
Various values of one or more selected items (such as the x, y, and z components of a marker trajectory) plotted against each other or against time.

Specify the number and arrangement of view panes displayed in the workspace using the following buttons:

Horizontal Split the current view horizontally into two view panes.

Vertical Split the current view vertically into two view panes.

Close Close the current view pane. You cannot close the default View pane in the center of the Nexus window.

Tip	Depending upon the type of view pane selected, there may be additional lists and buttons available to manage the display options for that type of view pane. For details on these, see the appropriate help topic in this **View Pane** section of the Vicon Nexus Help System.

- View Pane Workspace

View and manipulate the type of data you specified for display in the view pane in the workspace below the **View Pane** toolbar. By default, a single view pane is displayed in the workspace. You can display multiple view panes in the workspace, and specify the same or different type of view pane in each. You can manually resize each view pane.

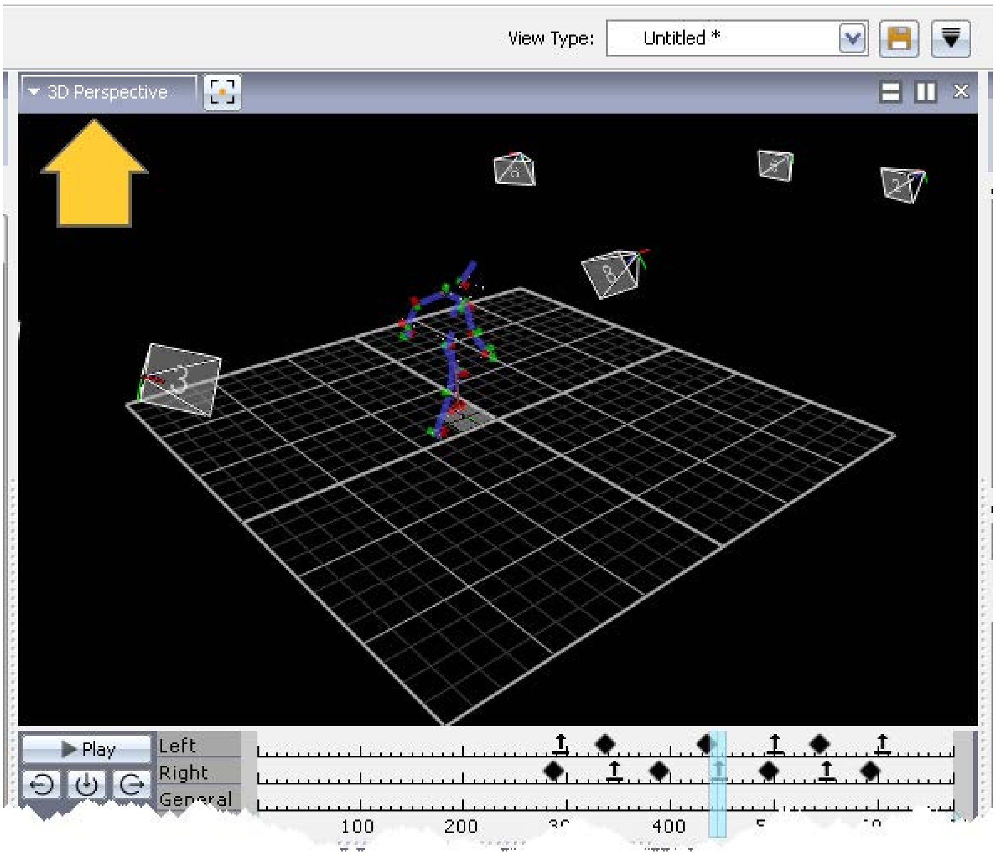
- Time Bar

Manipulate offline trial data with time and synchronization characteristics with the Time Bar. The **Time Bar** is displayed at the bottom of the workspace for all types of view pane when you are analyzing previously captured data saved to file.

3D Perspective View Pane

About 3D Perspective View Pane

Visualize reconstructed motion capture data from all active Vicon cameras in 3D (three dimensional) perspective, that is length, width, and depth, in the **3D Perspective** view pane



The **3D Perspective** view pane contains the following sections:

- 3D Perspective view pane toolbar

  You manage the display of 3D data in the active workspace by selecting the following button in the **3D Perspective** view pane toolbar at the top of the view pane:

  Camera centered on selection .

  Position the currently selected data in the center of the view pane. This option does not automatically zoom in on the selected data.

Tip	This button is specific to the **3D Perspective** view pane. For details on the standard lists and buttons that are available for all types of view pane, see About Nexus View Pane.

- 3D Perspective view pane workspace

  You view and manipulate 3D data in the workspace below the view pane toolbar. You can manage the visualization of 3D perspective data, for example, you can dolly, orbit, pan, tilt, truck, and zoom to control the portion of the capture volume that is displayed in the workspace.

Visualizing Data in 3D Perspective

Visualize reconstructed motion capture data from all active Vicon cameras or Vicon Skeleton Templates (*.vst*) or Vicon Skeleton (*.vsk*) files in 3D perspective in the **3D Perspective** view pane.

Vicon System Setup:

II. Calibrate the Vicon system.

1. Calibrate the MX / Bonita cameras to produce 3D data.
2. Set the volume origin to ensure subjects are displayed the right way up.

Vicon Skeleton Template Preparation:

II. Build a Vicon Skeleton Template for labeling a generic subject type.

Nexus Motion Capture Workflow:

II. Prepare subject.

3. Manually label reconstructed markers.

III. Capture and process a trial.

1. Capture a trial manually or automatically trigger motion capture remotely.
2. Reconstruct and automatically label the trial data.

IV. Review trial and fill gaps.

1. Play back trial data.
2. Fill any gaps in the reconstructed and labeled trial data.

You can view 3D data live in real time or from a previously saved trial.

Tip: Once you have displayed a **3D Perspective** view pane:

– If you have additional **3D Perspective** or other view panes (**3D Orthogonal**, **Camera**, or **Graph** view panes) open, you can arrange the number and arrangement of view panes displayed in the workspace to suit your preferences using the Standard view pane toolbar at the top of the view pane.

– You can manage the visualization of graph data in the workspace below the **3D Perspective** view pane toolbar using the mouse.

– You can highlight the representations of specific cameras in the **3D Perspective** view pane workspace by selecting one or more cameras under the MX Cameras node in the **System** resources pane.

– You can configure display options in the Options Dialog box, such as Force Plate display options.

To visualize data in a 3D Perspective view pane:

1. Stream live camera data or load a processed data file in Nexus in either of the following ways:
   - In the **Resources** pane, click the **Go Live** button.
   - From the **Data Management** window, open the desired trial.
2. From the **View** pane toolbar, select **3D Perspective**. The reconstructed 3D data from all cameras is displayed in a single **3D Perspective** view pane.

3. In the 3D Perspective view pane, select a marker and perform an action on it in either of the following ways:
   - In the Label/Edit tools pane, check the reconstruction and labeling and edit any errors or inconsistencies.
   - Right-click and select a command from the context menu.

Tip — The current trial name appears at the top of the view pane:

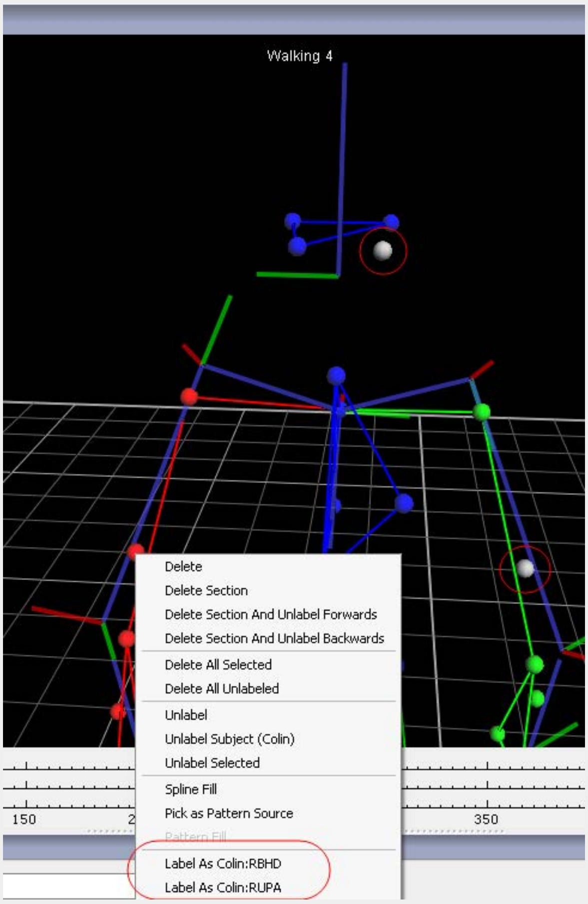
- NO TRIAL if no trial is loaded
- LIVE if Nexus is in Live mode
- The trial file name if you are viewing a trial in Offline mode.

In the Options Dialog Box (F7), this is the Trial Name option in the 2D Tracking Options section.

Important — If any marker labels have not been used, the context menu will show Label As (unused Marker Name) as an additional command at the bottom of the list.

For example, if you have not used the RBHD label, using the context menu on any marker will show "Label As Subject:RBHD" as an option. If multiple labels are unused, there will be a command for each label.

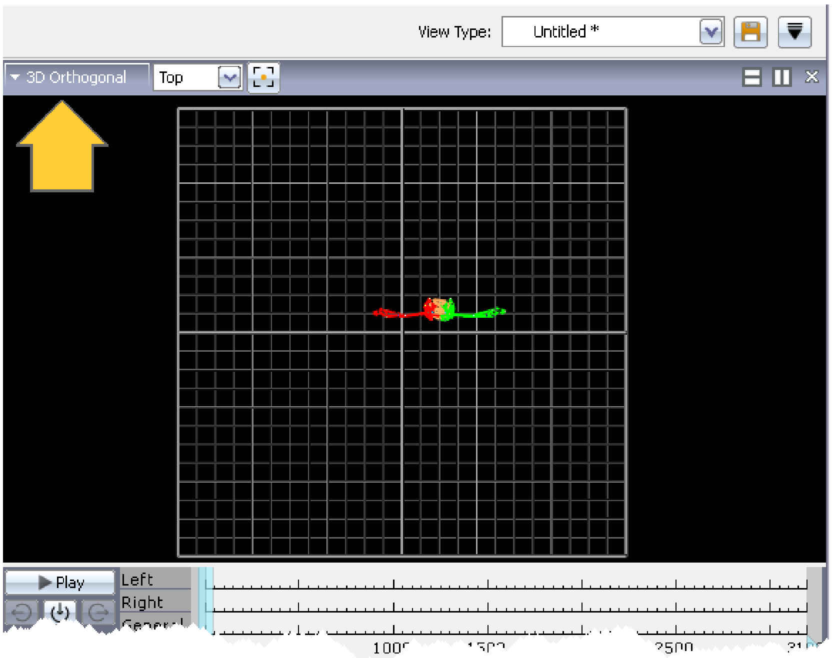
This is a convenience which allows you to identify and label any unidentified markers. Nexus simply lists any unassigned labels; it does not suggest the marker to which the label should be assigned .



3D Orthogonal View Pane

About 3D Orthogonal View Pane

Visualize motion capture data in 3D perspective viewed from a specified point of sight, or direction, of the capture volume in the **3D Orthogonal** view pane .



The **3D Orthogonal** view pane contains the following sections:

- **3D Orthogonal view pane toolbar**

  Manage the display of data in the active workspace with the following list and button in the **3D Orthogonal** view pane toolbar at the top of the view pane:

  Orthogonal View

  Set the point of sight by selecting one of the following orthogonal projections (also called orthographic projections):

  - Top (default)
  - Bottom
  - Left
  - Right
  - Front
  - Back

  Camera centered on selection .

  Position the currently selected data in the center of the view pane. This option does not automatically zoom in on the selected data.

Tip	This list and button are specific to the **3D Orthogonal** view pane. For details on the standard lists and buttons that are available for all types of view pane, see About Nexus View Pane.

- 3D Orthogonal view pane workspace

  View and manipulate 3D data in the workspace below the view pane toolbar. You can manage the visualization of 3D orthogonal data, for example, you can dolly, tilt, truck, and zoom (but not pan or orbit) to control the portion of the capture volume that is displayed in the workspace.

Visualizing Data in 3D Orthogonal Views

Visualize motion capture data in 3D perspective viewed from a specified point of sight, or direction, of the capture volume in the **3D Orthogonal** view pane.

Vicon System Setup:

II. Calibrate the Vicon system.

1. Calibrate the MX / Bonita cameras to produce 3D data.
2. Set the volume origin to ensure subjects are displayed the right way up.

Vicon Skeleton Template Preparation:

II. Build a Vicon Skeleton Template for labeling a generic subject type.

Nexus Motion Capture Workflow:

II. Prepare subject.

3. Manually label reconstructed markers.

III. Capture and process a trial.

1. Capture a trial manually or automatically trigger motion capture remotely.
2. Reconstruct and automatically label the trial data.

IV. Review trial and fill gaps.

1. Play back trial data.
2. Fill any gaps in the reconstructed and labeled trial data.

You can view 3D data from an orthogonal perspective live in real time or from a previously saved trial.

Tip: Once you have displayed a **3D Orthogonal** view pane:

– If you have additional **3D Orthogonal** or other view panes (**3D Perspective**, **Camera**, or **Graph** view panes) open, you can arrange the number and arrangement of view panes displayed in the workspace to suit your preferences using the standard view pane toolbar at the top of the View pane.

– You can manage the visualization of graph data in the workspace below the **3D Orthogonal** view pane toolbar using the mouse.

– You can highlight the representations of specific cameras in **3D Orthogonal** view pane workspace by selecting one or more cameras under the *MX Cameras* node in the **System** resources pane.

To visualize data in a 3D Orthogonal view pane:

1. Stream live camera data or load a processed data file in Nexus in either of the following ways:
   - In the **Resources** pane, click the **Go Live** button.
   - From the **Data Management** window , open the desired trial.
2. From the **View** pane toolbar, select **3D Orthogonal**. The reconstructed 3D data from all cameras is displayed in a single **3D Orthogonal** view pane initially from the Top view.
3. From the **Orthogonal View** list in the **3D Orthogonal** view pane toolbar, either leave the default or select another orthogonal projection to set the view to a different point of sight:
   - Top (default)
   - Bottom
   - Left
   - Right
   - Front
   - Back
4. In the **3D Orthogonal** view pane, select a marker and perform an action on it in either of the following ways:
   - In the **Label/Edit** tools pane, check the reconstruction and labeling and edit any errors or inconsistencies.
   - Right-click and select a command from the context menu.

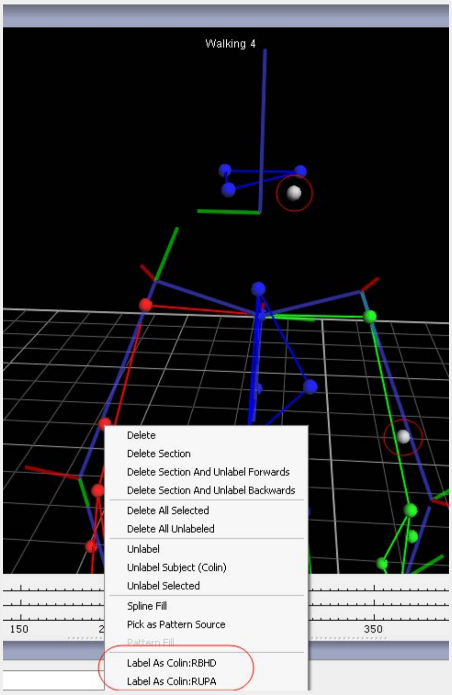
Tip	The current trial name appears at the top of the view pane: – **NO TRIAL** if no trial is loaded – **LIVE** if Nexus is in Live mode – The trial file name if you are viewing a trial in Offline mode. In the **Options Dialog Box** (F7), this is the **Trial Name** option in the **2D Tracking Options** section.

Important

If any marker labels have not been used, the context menu will show **Label As (unused Marker Name)** as an additional command at the bottom of the list.

For example, if you have not used the **RBHD** label, using the context menu on any marker will show "Label As Subject:RBHD" as an option. If multiple labels are unused, there will be a command for each label.

This is a convenience which allows you to identify and label any unidentified markers. Nexus simply lists any unassigned labels; it does not suggest the marker to which the label should be assigned .



Camera View Pane

About Camera View Pane

View raw 2D motion capture data from an individual Vicon camera or a supported digital video camera in the **Camera** view pane.

The **Camera** view pane contains the following sections:

- Camera view pane toolbar

  Manage the display of camera data in the workspace with the following controls and buttons in the **Camera** view pane toolbar at the top of the view pane:

  View

  Manage the way camera data is visualized in the active **Camera** view pane by selecting the following options on the **View** drop-down list:

  3D Overlay

  Overlay multiple **Camera** view panes on top of each other, so all camera views are displayed in a single view pane. Each camera is rendered in a unique color.

Default: Off

  Rotated

  Rotate the camera view, so it is corrected to the vertical axis defined in the system calibration (which corresponds to the earth's vertical axis). It also enables you to manually rotate the view by dragging the view left or right. Information from the camera calibration is required to present the rotated view.

Default: Off

  Combined

  Correctly model lens distortions and display a corrected camera view with the 3D Workspace rendered underneath the camera view. This is particularly useful for viewing Vicon optical data overlaid onto images from DV or DCAM digital cameras. You can burn this overlay information onto the *.avi* file to view in other applications using the Export 3D Overlay Video pipeline operation.

Default: Off

  Zoom to Fit

  Zoom the selected **Camera** view pane to fit the full workspace.

Default: On

Masks

You can create a mask to hide any unwanted reflections and light sources visible to an MX camera (such as stray reflections from other objects or surfaces in the capture volume, opposing strobe units, and direct light sources) with the following buttons in the **Camera** view pane toolbar:

Paint a mask onto the camera

Paint over any cells in the camera grid (displayed when the button is clicked) that contain unwanted reflections. When a cell is painted, its background color changes from black to blue. The camera mask consists of all blue cells obscuring unwanted reflections.

Erase a mask from the camera

Erase a previously painted cell from a mask. When an individual cell is erased, its background color changes from blue to black, and any reflection that had previously been obscured is visible again.

Clear the mask from the camera

Automatically remove a previously painted mask. When the mask is cleared, the background color of any previously painted cells changes from blue to black, and any reflections that had previously been obscured are visible again.

Lock / Unlock Selection Set /

Lock the current **Camera** view pane, so that it is effectively detached from the selection set and is not affected by any subsequent selections in other open view panes. This is useful for displaying views from different cameras in multiple **Camera** view panes.

When the active clip changes, or when you switch from **Live** to **Offline** mode, the selection is automatically unlocked.

Tip: These lists and buttons are specific to the **Camera** view pane. For details on the standard lists and buttons that are available for all types of view pane, see About Nexus View Pane.

Camera workspace

View and manipulate 2D data in the workspace below the view pane toolbar. You can manage the visualization of camera data, for example, you can orbit, truck, dolly, and zoom the displayed data.

Visualizing Optical Data in Camera View Panes

View 2D optical data from MX / Bonita cameras in the **Camera** view pane.

Vicon System Setup:

I. Configure Vicon system hardware.

2. Position the MX cameras to acquire data from the capture volume.

3. Mask out any unwanted reflections visible to the MX cameras automatically or manually.

4. Configure the MX cameras for optical data capture.

10. Configure any digital video cameras for digital video capture.

II. Calibrate the Vicon system.

1. Calibrate the MX cameras to produce 3D data.

2. Set the volume origin to ensure subjects are displayed the right way up.

Nexus Motion Capture Workflow:

I. Prepare system.

1. Check MX camera positions.

2. Check MX camera calibrations.

III. Capture and process a trial.

1. Capture a trial manually or automatically trigger motion capture remotely.

IV. Review trial and fill gaps.

1. Manually review and fill individual gaps or automatically fill all gaps in the reconstructed and labeled trial data.

You can view MX / Bonita camera data live in real time or from a previously saved raw capture (*.x2d*).

Tip

Once you have displayed a **Camera** view pane:

– If you have additional **Camera** or other view panes (**3D Orthogonal**, **3D Perspective**, or **Graph** view panes) open, you can arrange the number and arrangement of view panes displayed in the workspace to suit your preferences using the Standard view pane toolbar at the top of the view pane.

– You can manage the visualization of graph data in the workspace below the **Camera** view pane toolbar using the mouse.

To visualize data in a Camera view pane:

1. Stream live camera data or load a raw data file in Nexus in either of the following ways:
   - In the **Resources** pane, click the **Go Live** button.
   - From the **Data Management** window, open the desired .x2d file.
2. In the **System** resources tree, select one or more cameras whose data you want to visualize:
   - Expand the **Vicon Cameras** node and then click on the sub node for one or more specific MX / Bonita cameras.
   - When a camera is selected, a blue status light on the front of its strobe unit lights up (unless you have cleared the **Enable LEDs** option in the **System** resources properties section for that MX / Bonita camera).
3. From the **View** pane toolbar, select **Camera**. The 2D data from each camera selected in the System resources tree is displayed in a separate Camera view pane.

Visualizing Video Data in Camera View

View video data from supported digital video cameras in the **Camera** view pane.

Vicon System Setup:

I. Configure Vicon system hardware.

   10. Configure any digital video cameras for digital video capture.

II. Calibrate the Vicon system.

   3. Calibrate any digital video cameras so that the 3D overlay can be displayed with the 2D video.

Nexus Motion Capture Workflow:

I. Prepare system.

   3. Check any digital video camera calibrations.

An *.avi* file is denoted as a digital video camera in the **System** pane, in the **Video Cameras** node.

Tip: There will be a video camera listed in the **Video Cameras** node for each *.avi* file you have loaded.

To view a digital video file:

1. View a digital video file in either of the following ways:

   - With the **Camera** view pane selected, click on the desired movie file in the **Data Management** pane.
   - From Windows Explorer, drag an *.avi* file onto a **Camera** view pane in Nexus.

   Tip
   - If you drag an *.avi* file onto a **Camera** view pane from Windows Explorer:
     - The current trial will close
     - There will be no file name displayed in the System Connections Buttons area, because the *.avi* file is not associated with any particular trial.
   - You can import an *.avi* file into a specific trial using the **Import AVI** pipeline operation. This operation is located in the **File I/O Available Operations** list.
   - If you make a change to the video file camera settings, an asterisk (*) will appear next to the **Live** button, reminding you that there are unsaved changes to your system configuration.

2. In the **System Resources** pane, expand the **Video Cameras** node and select one or more digital video cameras.
3. Click **Play** in the **Camera** view pane. The video from each camera selected is displayed in a separate **Camera** view pane.

   Tip
   Once you have displayed a **Camera** view pane:
   – If you have additional **Camera** or other view panes (**3D Orthogonal**, **3D Perspective**, or **Graph** view panes) open, you can arrange the number and arrangement of view panes displayed in the workspace to suit your preferences using the Standard view pane toolbar at the top of the view pane.
   – You can manage the visualization of graph data in the workspace below the **Camera** view pane toolbar using the mouse.

Creating Camera Masks Manually

You can manually create MX / Bonita camera masks with the **Masks** buttons in the **Camera** view pane toolbar.

Vicon System Setup:

I. [Configure Vicon system hardware](#).

3. Mask out any unwanted reflections visible to the MX / Bonita cameras manually.

You can manually create masks to eliminate any reflections in the capture volume that are visible to the cameras. If you have a large number of reflections in your capture volume, it is a good idea to [create camera masks automatically](#) first.

Important	Before manually creating any masks, ensure that you remove from the capture volume any unnecessary objects, such as calibration objects. For best results, the capture volume should be entirely free from objects likely to cause background interference.

To manually create camera masks:

1. From the **System** resources tree, select all MX / Bonita cameras.
2. From the **View** pane toolbar, select **Camera** to display the 2D data being captured by each selected MX / Bonita camera in a separate **Camera** view pane.
3. From the **View** drop-down list at the top of each **Camera** view pane toolbar, ensure that the **3D Overlay** and **Combined** options are cleared.
4. In the **Options** dialog box, under the **General View Options** section ensure that the **Threshold Map** option is selected.

Tip	The **Threshold Map** default color is blue, but the color can be changed in the **Options** dialog box. In the descriptions below, the masking tiles are described as blue, but would be the color you set if you changed this option.

5. From the capture volume, remove any unnecessary objects, such as calibration objects. For best results, the capture volume should be entirely free from objects likely to cause unwanted reflections.
6. Ensure that you have adjusted camera settings as described in [Setting MX Camera Properties](#). If you do have reflections, they should be clearly visible in the **Camera** view pane, typically as non-circular areas of grayscale or edge data. Note that reflections can severely affect the camera data rates, and you may find that the camera overloads. In this case, the camera automatically sends edge data instead of full grayscale.
7. From the **Camera** view pane toolbar, use the following buttons to obscure any unwanted reflections visible to the selected MX / Bonita camera (when you click any of these buttons, a grid of small blue tiles is superimposed over the camera image in each **Camera** view pane):

   - **Paint a mask onto the camera**

     Left-click an individual tile, left-click and drag across multiple consecutive tiles, or hold down ALT and left-click while dragging the mouse across an entire area of unwanted reflections visible in the camera grid. You can drag the mouse horizontally, vertically, or diagonally.

When a cell is painted, its background color changes from black to blue. The camera mask consists of all blue cells obscuring unwanted reflections.

- Erase a mask from the camera

  Left-click an individual tile, drag the mouse across multiple tiles, or hold down ALT and left-click while dragging the mouse across an entire area of blue cells in the camera grid. You can drag the mouse horizontally, vertically, or diagonally.

  When an individual cell is erased, its background color changes from blue to black, and any reflection that had previously been obscured is visible again.

- Clear the mask from the camera

  Click the button to automatically remove the entire mask from the camera.

  When the mask is cleared, the background color of any previously painted cells changes from blue to black, and any reflections that had previously been obscured are visible again.

Tip	You can zoom in on the images, by right-clicking and dragging the mouse forward (to zoom in) or backward (to zoom out). You can pan the image by clicking both mouse buttons and dragging.

The camera masks are applied in real time and are saved along with your camera calibration.

8. In the configuration management section at the top of the System resources pane, press the **Save** button to save your system configuration settings to a .system file in the Systems configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Systems*).

Graph View Pane

About Graph View Pane

You view various values of one or more selected items (such as the x, y, and z components of a marker trajectory) against each other or against time, or analog data from any supported force plates or EMG devices, in the **Graph** view pane.

The **Graph** view pane contains the following sections:

- Graph view pane toolbar

  Manage the display of graph data in the workspace with the following controls and buttons on the **Graph** view pane toolbar at the top of the view pane. The **Graph** view pane toolbar is designed to lead you left to right through the normal flow of operations required to plot a graph for the selected elements:

  Graph Type

  Select the type of graph to be displayed in the workspace from under the categories in this drop-down list (graph types that are not available for the data currently selected on the System resources pane are dimmed):

  - Devices
    - **Components:** Select to view force plate data such as Forces, Moments, and Center of Pressure, or to view Other Devices, such as EMG and Accelerometer data.
  - Trajectories
    - **Components:** Select to view the X, Y, and Z coordinates of a marker selected either in the **Subject** resources pane or from the 3D Perspective view pane.
    - **Distance From Origin:** Select to view the straight-line distance between the chosen point and the global origin.
    - **Distance Between:** Select to see the straight-line distance between two markers selected either in the **Subject** resources pane or from the 3D Perspective view pane.
    - **Distance Between (XYZ):** Select to view the global X, Y, and Z components of the distance between two markers selected either in the **Subject** Resources pane or from the 3D Perspective view pane.
    - **Angle Between:** Select to view the angle between any three markers selected either in the **Subject** resources pane or from the 3D Perspective view pane.
    - **Trajectory Count:** Select to view the number of markers (both labeled and unlabeled) currently reconstructed in the 3D Workspace.

Tip	Press the **CTRL** key as you select multiple markers.

  - Model Outputs
    - **Model Outputs:** Select to view outputs from calculations run in post-capture pipeline.
  - Joints
    - **Kinematics:** Select to view kinematic angles between linked segments of the subject.

Tip	In order to see these angles, you must process your subject with the core processor set to Kinematic Fit level.

Differentiate the graph

Specify, for the currently displayed graph, the current variable, its first derivative (velocity or angular velocity), or its second derivative (acceleration or angular acceleration) by selecting the desired options from this drop-down list:

x (none)

x' (velocity)

x" (acceleration)

A graph of a trajectory will have X, Y, and Z axes, but when differentiated to x' (velocity), the axes will change to X', Y', and Z' axes.

Tip	You can then use the **Add Monitor** button to provide real-time bio-feedback on differentiated as well as positional data.

Graph Components

Specify the components of the selected graph type to be plotted in the active **Graph** view pane by selecting the desired options from this drop-down list (only components that you have selected for graph view are available).

This option enables you to focus on a component of particular interest, which occupies more of the workspace. When multiple components are plotted, each is always shown on a separate axis, and the components shown are applied to all channels visible in the workspace. The number of vertically stacked graphs displayed in the workspace depends on the number of options selected for graph view, and from those, the number selected from this list.

Legend

Display a legend for the current graph listing the color for each trace plotted, the subject (if multiple subjects are loaded), and the name of each element being plotted in that trace:

- – You can display a temporary ToolTip with this information by hovering the mouse over the button.
- – You can open a separate splitter pane to permanently display the legend to the right of the graph workspace by clicking the button.

Add Monitor

Add the selected graph component as a monitor entry in the **Monitors** communications pane.

Managing the scale of the graph

Manage the scale of the graph to ensure that the desired portions of the selected traces are visible using the following buttons:

Fit Horizontally

Zoom out the x-axis to show the complete range of the trace for the selected time period. This is useful if you have zoomed in a long way and now want to quickly see the entire graph again.

Lock the Horizontal Axis button

Lock the horizontal axis to prevent further rescaling of the axis once it is at a desired length of frames. This is useful if you want the horizontal axis range to stay the same.

Fit Vertically

Scale the y-axis so that all the data in selected traces for the currently visible x-axis is visible. If there are multiple components in the selected traces, they are all set to the same range, that is, the range required to show all the data in the component with the largest range.

If Nexus is in **Live** mode, this button acts as a toggle, enabling you to leave this mode switched on or off. If on, when plotting live data, the y-axis is automatically scaled as the data changes so all traces are visible. Manually zooming switches the automatic mode off.

Fit Both Horizontally and Vertically

Scale the x and y axes simultaneously to fit the horizontal and vertical ranges of data.

Lock/Unlock Selection Set /

Lock the current **Graph** view pane, so that it is effectively detached from the selection set and is not affected by any subsequent selections in other open view panes. This is useful for displaying different elements in multiple **Graph** view panes.

When the active clip changes, or when you switch from **Live** to **Offline** mode, the selection is automatically unlocked.

> Tip: These lists and buttons are specific to the **Graph** view pane. For details on the standard lists and buttons that are available for all types of view pane, see About Nexus View Pane.

Graph view pane workspace

View and manipulate graph data in the workspace below the view pane toolbar. You can manage the visualization of graph data, for example, you can slide the displayed data along the axes or zoom in and out.

> Tip: When zooming into or out of graph data, the display of grid lines in the workspace can be set to guide the eye toward the selected area of focus. Major grid lines remain at their normal weight, while any minor grid lines gradually fade. To obtain this behavior, select the **Show Minor Grid Lines** property for the **Graph** option in the Nexus **Options** dialog box.

The workspace contains rulers and axes along the left and bottom edges and graph traces for the item being plotted. The contents of the axes of the **Graph** view pane depend on whether the system is in **Live** or **Offline** mode:

Live

The y-axis vertical ruler is on the right side of the graph and the x-axis horizontal ruler is below the graph. The y-axis represents the live frame, so is constantly updated in real time. The x-axis represents the time (in frames). It starts on the right side, which is labeled 0 (zero) and is labeled from right to left with decreasing negative values to reflect the number of frames away from the live frame. Because the current time is always zero, the **Time Bar** is not displayed at the bottom of the workspace.

Offline

The y-axis vertical ruler is on the left side of the graph and the x-axis horizontal ruler is below the graph. The rulers indicate the scale and the variable names that are being plotted and the horizontal and vertical axes are labeled to indicate the units of measurement used. The graph traces represent the actual data and are scaled to the current rulers. You can select elements to graph from the Resources pane or from the 3D Workspace.

If the elements selected have more than one component, these components are shown on separate, vertically stacked axes sharing a common x-axis. You can select the components to be displayed from the **Component Options** list in the **Graph** view pane toolbar.

Visualizing Data in Graphs

Display graphs of motion capture data in the **Graph** view pane.

Nexus Motion Capture Workflow:

III. Capture and process a trial.

1. Capture a trial manually or automatically trigger motion capture remotely.

IV. Review trial and fill gaps.

1. Play back trial data.
2. Fill any gaps in the reconstructed and labeled trial data.

You can view graphs of motion data live in real time or from a previously saved reconstructed and labeled trial.

The **Graph** view pane can display graphs for the following types of data that can be produced in a motion capture trial:

- **Trajectories:** Displays graphs for one or more marker trajectories selected, such as the global XYZ components of a marker, a marker's distance from the global origin, distance between two markers, angle between three markers, or a count of how many reconstructed markers are in any current frame of data.
- **Model Outputs:** Displays three graphs of the components of any output variables (such as Angles, Forces, Moments, Powers, or Bones) that have been calculated by Vicon Plug-in Gait or Plug-in Modeler for your model. This is useful for visually validating data produced by post-capture processing models without having to load the data into Polygon for full biomechanical analysis or reporting.
- **Devices:** Displays graphs for the components of the analog signals from force plates or EMG devices. This is useful for examining analog device activity such as force plate strikes or EMG voltage output. You can also display graphs displaying units of mm/s^2 of analog signals from an accelerometer device, which allows you to examine voltage output from an accelerometer device.
- **Joints:** Displays graphs of the components of selected joint kinematics, either three graphs for Euler angles or six graphs for a helical vector (as appropriate for the joint type). This is useful for displaying approximate joint angles between linked segments of the labeling template worn by your subject in real time. This type of graph can only be plotted for a subject that has been kinematically fitted (for example, one that has had the **Fit Subject Motion** operation under the *Processing* pipeline run).

Tip — When you have displayed a **Graph** view pane:
– If you want to have additional **Graph** or other view panes open (**3D Perspective**, **3D Orthogonal**, or **Camera** view panes), you can arrange the number and arrangement

of view panes displayed in the workspace to suit your preferences using the Standard view pane toolbar at the top of the view pane.

– You can manage the visualization of graph data in the workspace below the **Graph** view pane toolbar using the mouse. For example, to pan and zoom, click and hold the right mouse button and then drag the mouse up/down to zoom along the Y axis or drag left/right to zoom along the X axis. To pan the graph in any direction, hold the left and right mouse buttons down at the same time as you drag the mouse.

– You can add a monitor to provide real-time biofeedback on the graphed data. On the **Graph** view pane toolbar, click the **Add Monitor** button .

– When you select a data type in the **System** resources pane (Trajectories, Model Outputs, Devices, or Joints), Nexus will attempt to intelligently update the **Graph** view type to match the data type you've selected.

To visualize 3D trajectories in a graph:

1. Stream live camera data or load a processed data file in Nexus in either of the following ways:
   - In the **Resources** pane, click the **Go Live** button Go Live.
   - From the **Data Management** window , open the desired *.c3d* file.
2. Select the markers to be graphed in any of the following ways:
   - In the **Subjects** resources pane Subjects, expand the desired **Subject** node , expand the **Markers** node , and then select one or more markers .
   - In a **3D Perspective** view pane, select one or more markers displayed in the workspace.

   The number of markers you must select depends on the type of graph you wish to view, as described in step 4 below.

Tip	Press the **CTRL** key as you select multiple markers.

3. From the **View** pane toolbar, select **Graph**.

Tip	Once you have displayed a **Graph** view pane, you can select additional markers to add to the **Graph** view pane. Each trajectory is displayed in a different color trace. You can use the **Legend** button in the **Graph** view pane toolbar to identify the color trace used for each trajectory. If the trace for any additional markers is not visible, use the **Fit Horizontally** , **Fit Vertically** , or **Fit Both Horizontally and Vertically** buttons.

4. From the Graph Type list in the Graph view pane toolbar, select another option under the Trajectories section to plot the selected marker trajectories in a different type of graph:
   - **Distance From Origin:** Plots the distance from the capture volume origin to each selected marker. This is useful for later plotting velocity or acceleration of markers.
   - **Distance Between (XYZ):** Plots the absolute distance (as a vector) between two selected markers. This is useful, for example, to see how the distance between two markers that are assumed to have a rigid relationship changes over time. This graph

type calculates a separate component (X,Y,Z) distance between the two markers. This graph type is only available when two markers have been selected in the 3D Workspace.

- **Angle Between:** Plots the angle between the two vectors formed by three selected markers. This is useful for seeing how the group of markers move over time.
- **Trajectory Count:** Plots the total number of trajectories over time visible to the MX / Bonita cameras (if streaming Live data in real time) or processed in trial (if viewing previously captured data in a file).

5. If you want to save a particular graph view (for example, specific trajectories that you have selected), save your configuration using View pane Configuration Management.

To visualize kinematic model outputs in a graph:

1. From the **Data Management** window, open the desired *.c3d* file.
2. In the **Subjects** resources tree Subjects, expand the desired **Subject** node, expand the **Model Outputs** node, expand the desired model outputs type node, and then select one or more model outputs.
3. From the **View** pane toolbar, select **Graph**.
4. From the **Graph Type** list in the **Graph** view pane toolbar, select the **Model Outputs** option under the **Model Outputs** section to plot the components of the selected model outputs.
5. If you want to save a particular graph view (for example, specific outputs that you have selected), save your configuration using View pane Configuration Management.

To visualize force plates or other device data in a graph:

1. Stream live camera data or load a processed data file in Nexus in either of the following ways:
   - In the **Resources** pane, click the **Go Live** button Go Live.
   - From the **Data Management** window, open the desired .c3d file.
2. In the **System** resources pane System, select the desired device:
   - Expand the **Force Plates** node, and then select one or more force plates. Expand the force plate node and select one or more components:
     - **Force:** Plots the X, Y, and Z components of the ground reaction force vector for the selected force plate.
     - **Moment:** Plots the X, Y, and Z components of the ground reaction moment for the selected force plate.
     - **Center Of Pressure (CoP):** Plots the center of pressure for the selected force plate. This is useful if you need to know the value of the X and Y coordinates of the force plates.

     From the **System** resources tree, you can also select individual components for a device and they will be displayed in Graph view.
   - Expand the **Other Devices** node, and then select one or more EMG or accelerometer devices. Expand the individual device node and select:
     - **Voltage:** Plots the voltage for all the components for the device
     - One or more sensors from the **Voltage** node

3. From the **View** pane toolbar, select **Graph**. From the **Graph Type** drop-down list, select the type of graph desired.
4. After you have displayed a **Graph** view, you can select other sensors or devices, and they will be plotted in the **Graph** view.
5. If you want to save a particular graph view (for example, specific components that you have selected), save your configuration using **View** pane **Configuration Management**.

> Tip
>
> For force plates and analog EMG devices, you can also select the analog device from the **System** resources pane, and then in the Graph Components drop-down list , select the individual components you want displayed in the **Graph** view pane.
>
> You can visualize raw analog signals in a Graph view by selecting Show Raw from the device node context menu in the **System resources** pane.
>
> After configuring the device to show raw signals, select one or more signals and they will be displayed in **Graph** view.

To visualize joint kinematics in a graph:

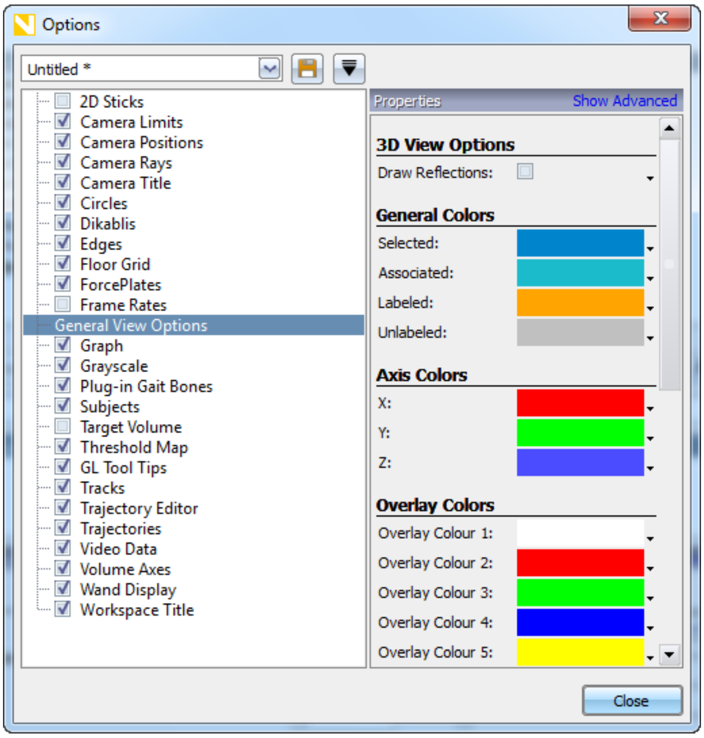
1. Stream live camera data or load a processed data file in Nexus in either of the following ways:
   - In the **Resources** pane, click the **Go Live** button Go Live.
   - From the **Data Management** window , open the desired .c3d file.
2. In the **Subjects** resources pane Subjects, expand the desired **Subject** node , expand the **Joints** node , and then select one or more joints .
3. From the **View** pane toolbar, select **Graph**. A single **Graph** view pane is displayed. The workspace may be initially blank until you proceed to the next step.
4. From the **Graph Type** list in the **Graph** view pane toolbar, select the **Kinematics** option under the **Joints** section to plot the joint angles for the selected joints.
5. Kinematic components for root segments include Tx, Ty, and Tz, accompanied by Rx, Ry, and Rz. These components can be further differentiated to also include Rx', Ry', Rz', Rx'', Ry'', Rz'', Tx', Ty', Tz', Tx'', Ty'', and Tz''. Designate the T's as translations and the R's and rotations between the two segments the joint is across.
6. If you want to save a particular graph view (for example, specific components that you have selected), save your configuration using View pane Configuration Management.

> Tip
>
> You can plot the Mean and Standard Deviation values for a component in a **Graph** view pane:
>
> - Select **Graph** under **General View Options** in the Options Dialog Box.
> - Click **Show Advanced**.
> - Click the **Show SD and Mean** check box.

Note The ' and " designations are used to indicate velocity and acceleration,respectively.

Options Dialog Box

Control the way data is visualized in view panes in the **Options** dialog box . Access this dialog box from the **Window** menu or by pressing **F7**. When you save option settings in configuration files, you can customize sets of options to use for different types of motion capture applications.



To configure settings in the Options dialog box:

1. In the **Configuration** area at the top of the dialog box, create or manage configurations for the settings specified in the **Options** dialog box.
2. In the **Options** list on the left side of the dialog box, click an option whose properties you wish to view or change.
3. In the **Properties** section on the right side of the dialog box, view or change settings as desired for any available properties.

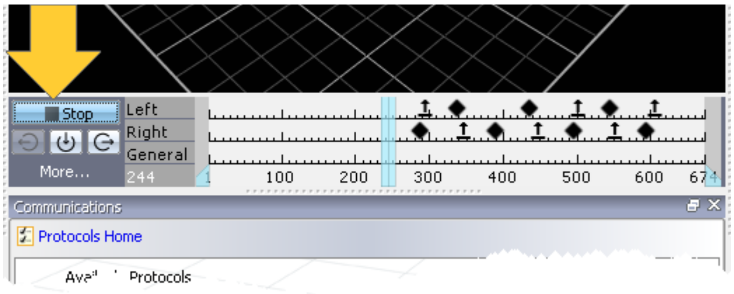
Tip	Click **Show Advanced** to see additional settings that may be available for an option. To show basic settings only, click **Hide Advanced**.

4. In the **Options** list, select the check box ☑ to switch on the functionality or clear the check box ☐ to switch off the functionality for the option.
5. Repeat steps 2-4 for each property whose settings you wish to configure.
6. Click **Close** to save your settings and close the **Options** dialog box.

Time Bar

About the Time Bar

You manipulate offline trial data with time and synchronization characteristics in the **Time Bar** .



The **Time Bar** is available from all types of view pane when you are playing back data from a previously saved trial.

Tip	The **Time Bar** is located at the bottom of the View pane workspace. It is displayed only when the system is in **Offline** mode (click the **Go Offline** button).

The **Time Bar** view pane contains the following sections:

- Data Playback Controls

  You manage the playback of offline trial data with the following controls and buttons on the **Time Bar Data Playback Controls**:

  Play 

 / Stop 

  Play forward continuously through trial. When pressed, the button switches to its **Stop** setting.

  Jump to Previous Event 

  Play backward one event (when in Event Identification Mode).

  Enter Event Identification Mode 

  Switch between modes in which you can manipulate data based on Time (button off) or Events (button on). For details on manipulating data, see **Ruler** below.

  Jump to Next Event 

  Play forward one event (when in Event Identification Mode).

  More 

  Display a context menu from which you can select the following options to manipulate trial data (you also can display the context menu by right-clicking anywhere on the Time Bar):

Zoom to Trial

Reset the ruler to the full trial timescale after zooming in or out (for details on zooming the timescale, see **Ruler** properties below).

Zoom to Region-of-Interest

Reset the ruler to the range of frames identified by the **Start Range Frame Cursor** and the **End Range Frame Cursor** (for details on these cursors, see **Ruler** below).

Replay Speed

Specify the playback speed relative to real time by selecting one of the following sub options: $\frac{1}{10}$, $\frac{1}{4}$, $\frac{1}{2}$, 1, 2, or Other. The **Other** option displays a dialog box in which you can set a specific value.

Default: 1

Trajectory Tails

Specify the length of tails for selected trajectories, as a value in frames before and after every gap by selecting one of the following from the displayed context menu: 0 frames, 25 frames, 50 frames, 100 frames, 200 frames, or Other. The **Other** option displays the **Trajectory Tails** dialog box in which you can set a specific value.

Default: 100 frames

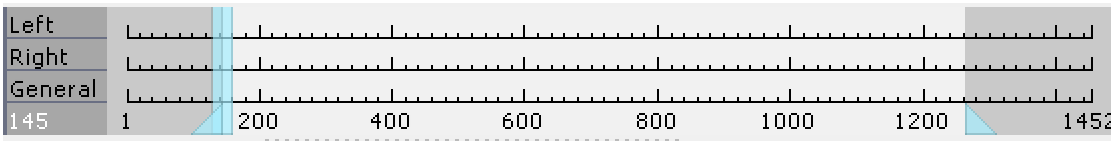
Clear All Events

Clear all marked events from the ruler.

Tip	You can also manage [data playback using the keyboard](). For example, you can use keys and mouse actions to manage the timescale displayed in the timeline, the Time Bar data displayed in the workspace, and event identification mode.

Ruler

You identify or manipulate trial data based either on time or event, depending on the whether the **Enter Event Identification Mode** button is on or off (for details, see **Data Playback Controls** above) with the following areas of the **Time Bar** ruler:



Timeline

Display the overall time span and the range of frames currently viewable in the workspace. The timeline is split into three default contexts, which are labeled on the left side:

Left

The top rule on the timeline contains markers for any events specified for the left context.

Right

The middle rule on the timeline contains markers for any events specified for the right context.

General

The bottom rule on the timeline contains markers for any events specified for the general context.

Timescale

Displays the overall span of time for the range of frames that can currently be selected. The current frame of trial data is displayed in the label on the left side of the scale at the bottom of the timeline. You can move the visible portion of the timescale or zoom in or out of it (for details, see Working in the Nexus User Interface).

Cursors

Indicate a selected characteristic of the trial data for playback. You can move the cursors along the timeline to manually move the data playback forward or backward and display the desired frame in the workspace. Cursors are displayed when appropriate for the playback operation:

Current Time Cursor

Locate the current time of the data playback along the timeline displayed in the ruler. This vertical bar cursor spans the entire height of the timeline. In **Event Identification Mode**, the current time cursor follows the mouse cursor. You can left-click and drag the mouse for slow-motion playback. When you release the left-mouse button, the event context menu is displayed.

Start Range Frame Cursor

Locate the frame specified as the start of the range of trial data to play back or process. This triangular cursor is initially positioned on the first frame of the timescale at the bottom of the timeline.

End Range Frame Cursor

Locate the frame specified as the end of the range of trial data to play back. This triangular cursor is initially positioned on the last frame of the timescale at the bottom of the timeline.

Event Markers

Indicate a specific event to be applied or displayed in the currently selected frame of the trial data:

Foot Strike ◆

The point at which the trial subject's foot contacts the ground.

Foot Off

The point at which the trial subject's foot leaves the ground.

General

A point at which the trial subject performs a user-defined event.

Delete Event <Type>

Delete the selected event.

Delete All Events at Frame x

Delete all events previously set for the current frame.

Clear All Events

Delete all events previously set for the entire trial.

You must be in **Event Identification Mode** in order to work with an event. For details on the **Enter Event Identification Mode** button, see **Data Playback Controls** above. For details on the default contexts, see **Timeline** above.

Playing Back Trial Data

You can view and manipulate offline trial data in the *Time Bar*.

Tip	When any trial file is playing within Nexus, the data will now automatically be streamed out through the Nexus Data server. This means that offline data files will be streamed out of Nexus in the exact same way that live data is streamed out. This is beneficial to users who are connecting to third-party applications or building their own external programs that received data from Nexus. If a file is paused or stopped within Nexus and time bar is used to “scrub” through the data (manually moving the Timebar to different frame numbers or across a series of frames), the data available in those frame will also be streamed out of Nexus. This is referred to as “offline data scrubbing."

Nexus Motion Capture Workflow:

II. Prepare subject.

2. Capture a static trial and reconstruct markers.
3. Manually label reconstructed markers.

IV. Review trial and fill gaps.

1. Play back trial data.
2. Fill any gaps in the reconstructed and labeled trial data.

You can play back data from a previously saved trial. You can also mark and locate events in specific frames of trial data.

To play back motion capture trial data in the Time Bar:

1. From the **Data Management** window, open the desired trial.
2. From the **View** pane toolbar, select the desired type of view pane (**3D Perspective**, **3D Orthogonal**, **Camera**, or **Graph**).
3. Play back the desired portion of the trial:
   - **Full trial:**

     On the Data Playback Controls, click **Play** Play to start playing back the trial data. The data plays through to the end and restarts at the beginning if you do not click **Stop** button Stop.

- Range of frames:

  Move the **Start Range Frame Cursor** and **End Range Frame Cursor** along the timeline to manually adjust the range of frames.

- Individual frame:

  Move the **Current Time Cursor** along the timeline to manually locate the desired frame.

Tip

> You can use the **More** button More... on the **Data Playback Controls** to display a context menu in which you can reset the timescale on the timeline, set the playback speed, or specify the length of trajectory tails.

To work with events in motion capture trial data in the Time Bar:

1. From the **Data Management** window, open the desired trial.
2. From the **View** pane toolbar, select the desired type of view pane (**3D Perspective**, **3D Orthogonal**, **Camera**, or **Graph**).
3. Enter event identification mode in either of the following ways:
   - On the **Data Playback Controls**, click **Enter Event Identification Mode**.
   - Press CTRL+E.
4. On the **Time Bar Ruler**, zoom in or out on the Timescale to manually adjust the time span of data displayed in the workspace and then move the **Current Time Cursor** along the timeline to manually locate the desired frame.
5. Lock the event context by positioning the mouse pointer over the desired Left, Right, or General context on the selected frame (the timeline for a context is highlighted when the mouse points to it) and pressing the UP ARROW or DOWN ARROW key. When the event context is locked, moving the mouse forward or backward does not change the context.
6. Set a new event in the current context on the selected frame by either left-clicking or pressing **ENTER** and selecting the desired command from the displayed context menu:

   Create Event "<Subject>/Foot Strike"

   Create Event "<Subject>/ Foot Off"

   Create Event "<Subject>/General"
7. Navigate existing events in either of the following ways:
   - On the **Data Playback Controls**, click **Jump to Previous Event** or **Jump to next Event**.
   - Press CTRL+LEFT ARROW or CTRL+RIGHT ARROW to go the previous or next event.
8. If desired, move an existing event to another frame by clicking in it with the left mouse button, holding the button down, dragging it left or right along the timeline.

9. If desired, delete existing events:

   - **Single event:**On the **Time Bar Ruler** left-click the desired event or press ENTER, and from the displayed context menu select **Delete Event <Type>**.
   - **All events on current frame:**On the **Time Bar Ruler**, left-click the desired event or press ENTER, and from the displayed context menu select **Delete All Events at Frame x**.
   - **All events in trial:**On the **Time Bar Ruler**, right-click anywhere on the timeline, and from the displayed context menu select **Clear All Events**.

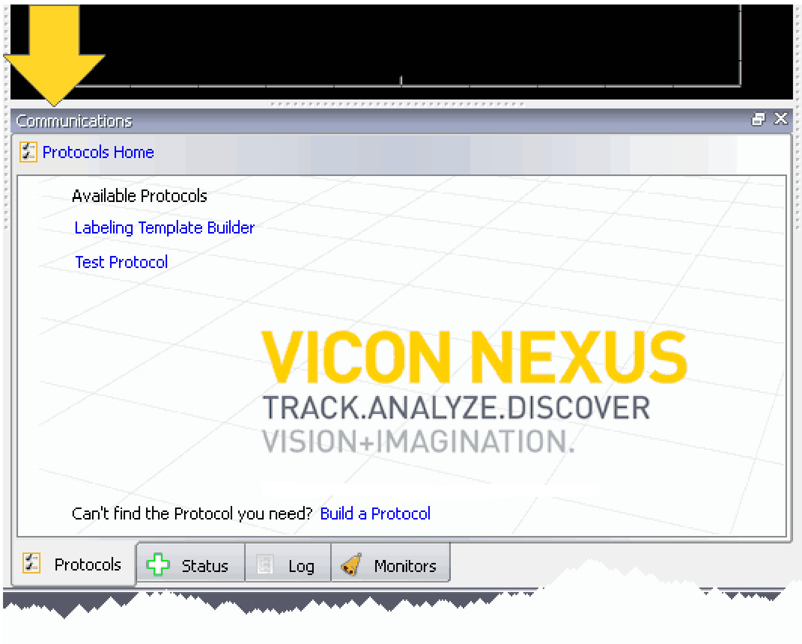
10. When you have finishing editing the current event context, unlock the event context by either moving the mouse over a different context or using the Up/Down arrow keys on the keyboard.
11. Repeat steps 5-10 for each event context you wish to edit.
12. When you have finished editing all events, exit event identification mode in either of the following ways:

   - On the **Data Playback Controls**, click **Enter Event Identification Mode** 
   - Press CTRL+E.

Communications Pane

About Nexus Communications Pane

View and manage the state of your Vicon system and streamline your motion capture workflow in Nexus in the **Communications** pane .



You can use the tools in this **Communications** pane during any stage of the [Nexus motion capture workflow](#).

Tip	By default, the **Communications** pane is in the bottom center of the Nexus window. You can [resize this pane](#), but you cannot detach it or change its position.

The **Communications** pane contains the following sections:

- **Communications Tabs**

  You switch between the available monitoring tools by selecting the following tabs at the bottom of the **Communications** pane:

  [Protocols](#) 

  Customize and streamline the Nexus motion capture workflow to suit your particular requirements.

  [Status](#) 

  Monitor the state of your Vicon system.

  [Log](#) 

  Monitor Nexus system activity.

[Monitors](#) 

Configure monitors for motion capture events.

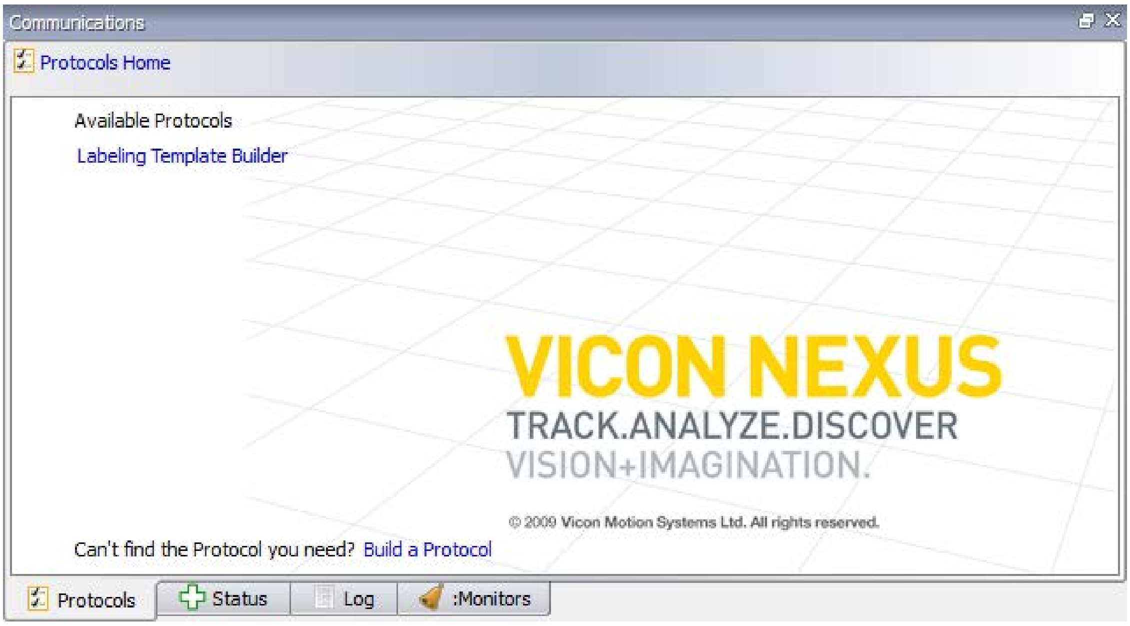
- Communications Detail

  View and manage communications information in the **Communications Details** section above the **Communications** tabs. The contents of this section depend on the Communications tab you selected.

Protocols Communications Pane

About Protocols Communications Pane

Create and run protocols to customize and streamline your [motion capture workflow](#) in Nexus in the **Protocols** Communications pane .



Protocols are a series of sequential pages, each of which is designed to guide the user through a single step of the workflow or to provide information required to complete a step. Protocols customize the settings for specific sections of the **Resources** pane and **Tools** pane and specify the sequence in which processing should be done.

The **Protocols** pane contains the following key sections:

- Protocols Home

  View your location in the **Protocols** communications pane on this line at the top of the **Protocols Home** page. It lists the full path to your current location. For example, if you are using the Labeling Template Builder protocol, this link shows the following path: *Protocols Home/Labeling Template Builder*. Click this **Protocols Home** link to return to the Protocols home page.

- Available Protocols

  Open existing protocols by clicking on the desired link under **Available Protocols** in the **Protocols Home** page.

- Build a Protocol

  Open the [Protocol Builder]() in which you can create or edit protocols by clicking on the **Build a Protocol** link at the bottom of the Protocols Home page.

About Protocol Builder

Create or edit protocols to customize and streamline your [motion capture workflow]() in Nexus using the **Protocol Builder** window accessed from the **Protocols** Communications pane 

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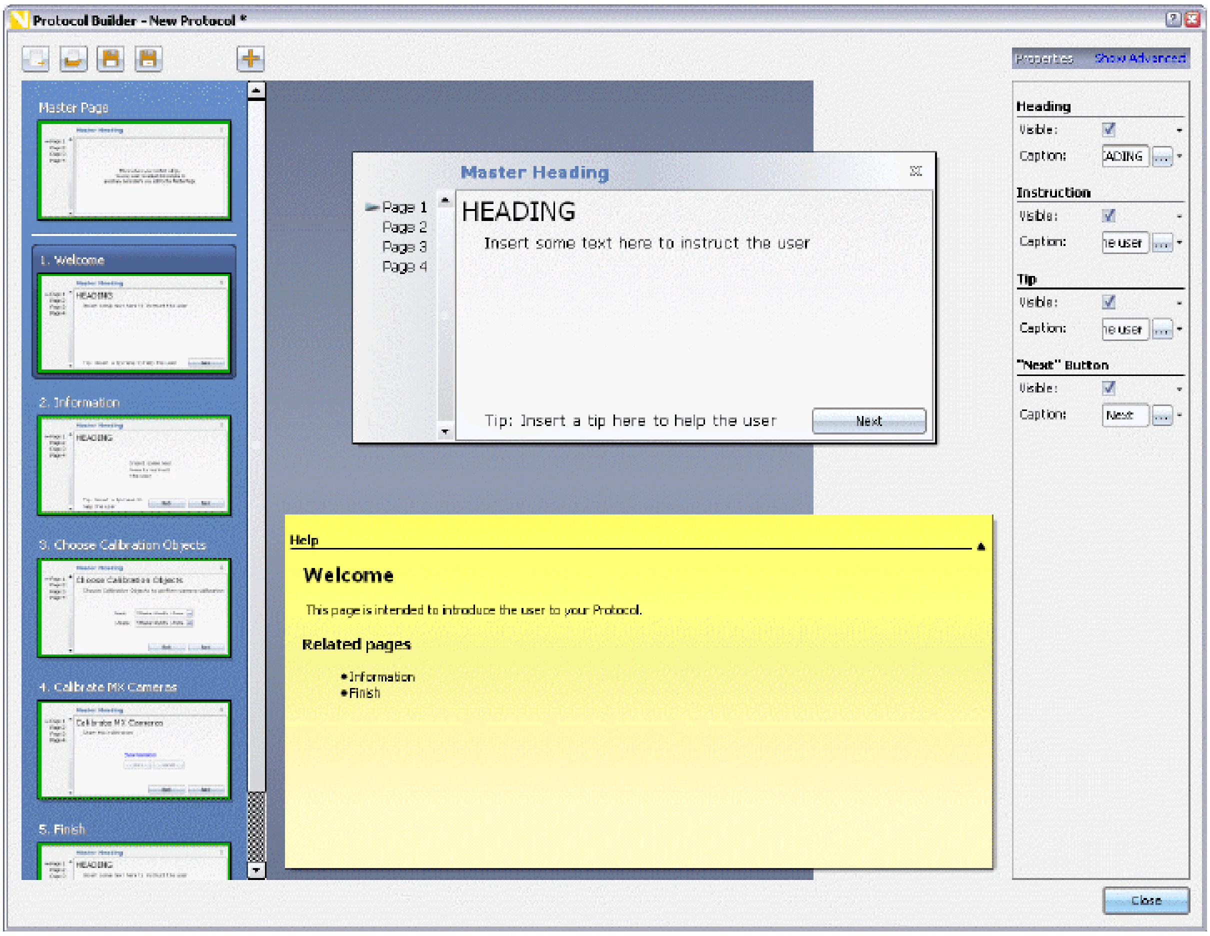

The **Protocol Builder** window contains the following sections:

- Protocol Builder Toolbar

  Create or manage the contents of a protocol using the following buttons in the toolbar at the top of the **Protocol Builder** window:

  Create a new protocol 

Creates a blank protocol containing the Master Page template by default. If another protocol is currently loaded, a confirmation message is displayed enabling you to save or discard changes before creating the new protocol.

Load an existing protocol

Displays the **Load a Protocol** dialog box, in which you can select an existing protocol to open for editing.

Save the current protocol

Displays the **Protocol Type** dialog box, in which you can specify whether to save the current protocol as a Shared or Private file:

- **Shared:** These protocols can be viewed by all users; they can be changed only by the user who was logged on when the protocol was first created and saved. Shared protocols are saved to *.protocol* files under the Nexus protocols configurations folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Protocols*.
- **Private:** These protocols can be viewed and changed only by the user who was logged on when the file was first created and saved. Private protocols are saved to *.protocol* files in the appropriate folder under the Nexus protocols configurations folder under the logged-in users Application Data files folder (by default, *C:\Documents and Settings\<user_name>\Application Data\Vicon\Nexus\Configurations\Protocols*).

Tip	If you subsequently wish to delete a protocol, you must manually delete the file from the Protocols folder in which it was saved.

Save the current protocol with a new name

Displays the **Protocol Type** dialog box, in which you can specify whether to save a copy of the current protocol as a Shared or Private file.

Add a page to this protocol

Displays the **Protocol Builder – Add Page** dialog box in which you can select a template on which to base a new protocol page:

– Titles

– System

– Subjects

– Capture

– Post-Processing

– Review

– Import

– Export

– Other

- Protocol Pages Pane

  View the structure of the current protocol in the **Protocol Pages Pane** section of the **Protocol Builder** window. The Master Page at the top of the pane defines the format and layout of the protocol pages. The body pages beneath the separator line contain the content of the protocol. You can drag body pages into the desired order. Click a body page to select it for editing. Double-click a body page to display the **Rename Page** dialog box in which you can change the name of the page.

- Protocol Page Contents Pane

  Customize the Master Page and body pages for your protocol in the **Protocol Pages Pane** section of the **Protocol Builder** window. When you create a new protocol the Master Page is displayed by default.

- Protocol Page Properties Pane

  View or edit properties for the Master Page or for a selected body page in the **Protocol Page Properties Pane** on the right of the **Protocol Builder** window.

Building Protocols

You can build your own protocol or edit an existing one to customize and streamline your motion capture workflow in Nexus using the *Protocol Builder* window.

Building protocols is an optional step, which you can do during any stage of the motion capture workflow.

The Protocol Builder contains the following types of template page:

- **Master Page**Defines the title of the Protocol and the standard format and layout for body pages. The storyboard on the left indicates where a list of body page titles will be displayed when a user runs the protocol.
- **Body Pages**Provide information or actions for users to perform within the specified workflow.

Note	Also see information about special protocols.

Building protocols involves editing the Master Page to customize the look and feel of your protocol pages and then selecting available template pages and combining them into a sequence reflecting the desired workflow for the protocol. Once saved, the protocol is available for end users to select and run.

The **Protocol Builder** has three areas:

- On the left, the **Protocols Pages Pane**, where the page types are organized.
- In the middle, the **Protocol Page Content Pane**, where you view the design of an individual page.
- On the right, the **Protocol Page Properties Pane**, where you set the properties for each page.

To build a protocol from template pages:

1. At the bottom of the **Protocols Home** page, click the **Build a Protocol** link to display the **Protocol Builder** window.
2. On the **Protocol Builder** toolbar, click either the **Create a new protocol** or the **Load an existing protocol** button.
3. On the **Protocol Builder** toolbar, click the **Add a page to this protocol** button.
4. In the **Protocol Builder – Add Page** dialog box, from the **Categories** pane select the desired category, then in the **Choose a template for your new page** pane double-click one or more templates to be included in the protocol, and then click **Close**.
5. As each template is selected, it is added as a body page to the **Protocol Pages Pane** section of the **Protocol Builder** window. You can hover the pointer over a page to display ToolTips on available actions you can perform for that page.
6. In the **Protocol Pages Pane**, click the Master Page to select it for editing.
7. In the **Protocol Page Properties Pane**, view or edit Master Page properties to specify the title of the protocol, as well as the page format and layout.
8. In the **Protocol Pages Pane**, click a body page to select it for editing.
9. In the **Protocol Page Properties Pane**, view or edit Body Page properties to specify the content of the page, including instructional and tip text, functionality and settings, and page controls.
10. You can view your changes in the **Protocol Page Contents Pane**. Expand the **Help** pane at the bottom of the contents pane to view guidance on editing the active template to create your protocol page.
11. Repeat steps 7-8 for each body page to be included in your protocol.
12. On the **Protocol Builder** toolbar, click the **Save the current protocol** button or the **Save the current protocol with a new name** button.
13. At the bottom of the **Protocol Builder** window, click **Close** to close the window and return to the main Nexus window.

Tip	To delete a page, select the page in the **Protocol Pages Pane**, and press Delete on your keyboard. The page is removed, and any subsequent pages shift up in the layout sequence. To view tips about a specific page, rest the mouse on a page in the **Protocol Pages Pane**.

Setting Properties for Protocol Pages

When building protocols, you can configure the following settings for the Master Page, Body Pages, and colors.

Master Page

- Storyboard

  Visible

  Whether or not the list of body page titles is displayed on the left side of the protocol when a user runs the protocol

  Default: Selected

- Heading (master page)

  Visible

  Whether or not the protocol title is to be displayed at the top of each protocol page.

  Default: Selected

  Caption

  The text for the protocol title. You can change this either by overtyping the current name or by clicking the **Browse for Folder** button to display the **Caption** dialog box in which you can overtype the existing title with a longer text string.

  Default: Master Heading

  Color

  The color in which to display the protocol title. You assign a color using the color map.

  Default: Custom blue

  Close Button

  Whether or not to include a page close button at the top right of each protocol page.

  Default: Selected

- Background Gradient

  Start Color

  The deepest color of the background, which runs in a gradient from the top to the bottom of the protocol page You assign a color using the color map.

  Default: Custom medium gray

Stop Color

The lightest color of the background, which runs in a gradient from the top to the bottom of the protocol page You assign a color using the color map.

Default: Custom light gray

Background Image

Visible

Whether or not an image is displayed in the protocol page background.

Default: Cleared

File location

The full path and file name of a PNG file to be used as the background image. Click the **Browse for Folder** button ... . The **Choose File** dialog displays, in which you can browse to the image folder and select the image file.

Default: Blank

Content Margins

Top

The amount (in pixels) of blank space between the top edge of the page and the content of a body page.

Default: 5

Left

The amount (in pixels) of blank space between the left edge of the page and the content of a body page.

Default: 5

Bottom

The amount (in pixels) of blank space between the bottom edge of the page and the content of a body page.

Default: 5

Right

The amount (in pixels) of blank space between the right edge of the page and the content of a body page.

Default: 5

Body Pages

Heading (body pages)

Visible

Whether or not the heading is displayed at the top of the body page.

Default: Selected

Caption

The text of the body page heading. You can change this either by overtyping the current name or by clicking the **Edit Text** button to display the **Caption** dialog box in which you can overtype the existing title with a longer text string.

Default: HEADING

Font Name

The font for the body page heading. You can change this either by overtyping the current text or by clicking the **Edit Text** button to display the **Font Name** dialog box in which you can enter a longer text string.

Default: Verdana

Font Size

The size (in points) for the body page heading. Overtype the default value to change it.

Default: 16

Instruction

Visible

Whether or not the instruction text is to be displayed in the body page.

Default: Selected

Caption

The instruction text. You can change this either by overtyping the current text or by clicking the **Edit Text** button to display the **Caption** dialog box in which you can overtype the existing content with a longer text string.

Default: Insert some text here to instruct the user

Font Name

The font for the instruction text. You can change this either by overtyping the current text or by clicking the **Edit Text** button to display the **Font Name** dialog box in which you can enter a longer text string.

Default: Verdana

Font Size

The size (in points) for the instruction text. Overtype the default value to change it.

Default: 10

- Image

Visible

Whether or not an image is displayed in the body page. The image can only be selected in the Master Page, and if made visible, will appear on each page of the Protocol Builder.

Default: Cleared

File location

The full path and file name of a PNG file to be used as the background image. Click the **Browse for Folder** button ... . The **Choose File** dialog displays, in which you can browse to the image folder and select the image file.

Default: Blank

- Tip

Visible

Whether or not the tip text is to be displayed in the body page.

Default: Selected

Caption

The tip text. You can change this either by overtyping the current text or by clicking the **Edit Text** button ... to display the **Caption** dialog box in which you can overtype the existing content with a longer text string.

Default: Tip: Insert a tip here to help the user

Font Name

The font for the tip text. You can change this either by overtyping the current text or by clicking the **Edit Text** button ... to display the **Font Name** dialog box in which you can enter a longer text string.

Default: Verdana

Font Size

The size (in points) for the tip text. Overtype the default value to change it.

Default: 10

"Back" Button

Visible

Whether or not the Back button is to be displayed at the bottom right of the body page.

Default: Selected

Caption

The label for the Back button. You can change this either by overtyping the current text or by clicking the **Edit Text** button ... to display the **Caption** dialog box in which you can overtype the existing content with a longer text string.

Default: Back

"Next" Button

Visible

Whether or not the Next button is to be displayed at the bottom right of the body page.

Default: Selected

Caption

The label for the Next button. You can change this either by overtyping the current text or by clicking the **Edit Text** button ... to display the **Caption** dialog box in which you can overtype the existing content with a longer text string.

Default: Next

"Restart" Button

Finish Page Only

Visible

Whether or not the Restart button is to be displayed at the bottom right of the last body page.

Default: Selected

Caption

The label for the Restart button. You can change this either by overtyping the current text or by clicking the **Edit Text** button ... to display the **Caption** dialog box in which you can overtype the existing content with a longer text string.

Default: Next

"Close" Button

Finish Page Only

Visible

Whether or not the Close button is to be displayed at the bottom right of the last body page.

Default: Selected

Caption

The label for the Close button. You can change this either by overtyping the current text or by clicking the **Edit Text** button to display the **Caption** dialog box in which you can overtype the existing content with a longer text string.

Default: Next

Important	Additional settings may be included in the **Properties** pane for body pages, including controls and parameters from other areas of the Nexus user interface. For details on such settings, see the relevant topic for the area of the user interface.

Color Properties

In the **Color** properties for protocol pages, you can specify the default color for these subject elements using the **color map**

Click the current color in the entry field to display the **Select color dialog box**. In the **Basic colors** area, click the square for the desired color, or in the **Custom colors** areas define a new color.

Running Protocols

You can run an existing protocol, either a default supplied with Nexus or a user-defined protocol, for a particular stage of the Nexus motion capture workflow in the **Protocols** communications pane Protocols.

To run a protocol:

1. At the top of the **Protocols Home** page, under the **Available Protocols** section, click the desired protocol.
2. In the **Communications Details** section, follow the instructions on each protocol page:
    a. Specify any required information in the protocols page itself.
    b. Perform any specified actions in the appropriate part of the Nexus window. Some pages may contain tips providing guidance on performing the specified action.
    c. Click **Next** to move to the next protocol page.

Tip	- If all of the text is not visible on a protocol page, you can resize the **Protocols** communications pane. - If available, you can use the **Back** buttons to view or edit a previous page. The current page within the overall sequence of pages is indicated by an arrow in the list on the left of the protocol page. - If you want to exit a protocol without completing it, click the **Protocols Home** link at the top of the **Protocols** communications pane.

3. On the final protocol page, click **Close**.

Special Protocols

The following three protocols allow you to control and modify the global coordinate system.

- Offset to Location of the Global Origin

  Allows you to move the global origin to a new position by applying an X, Y, and Z offset value in millimeters. This option may be useful if you want a global origin location that is in an area where it is not possible to place the calibration object (for example, inside of an MRI machine).

- Single Marker Set Origin

  Allows you to move the global origin to a new position by selecting a reconstructed marker in the volume.

- Three Marker Set Origin

  Allows you to define the global axes (X, Y, Z) by placing three markers in the volume rather than using a calibration object. This option may be useful if you want a global origin location that is in an area where it is not possible to place the calibration object (for example, the inside of an engine block).

  Select the markers in the following order: (1) origin marker, (2) a point along the X axis, and (3) a marker in the X-Y plane.

Status Communications Pane

About Status Communications Pane

View the state of components in your Vicon system in the **Status** communications pane


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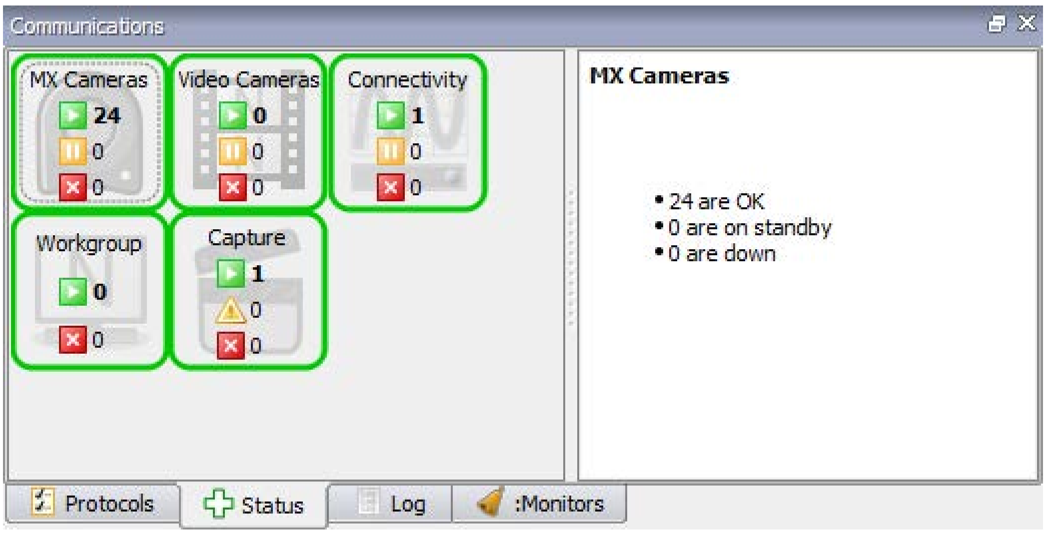

You can view the state of your system in this **Status** communications pane during any stage of the Nexus motion capture workflow. This is useful for identifying problems and determining the Nexus system component that needs to be examined.

The **Status** communications pane contains the following sections:

- Status Summary

  View a visual summary of the status of system components in the **Status Summary** section of the **Status** communications pane:

  MX Cameras 

  View the status of MX /Bonita cameras.

  Video Cameras 

  View the status of digital video cameras.

  Connectivity 

  View the status of MX Control units.

  Workgroup 

  View the status of PCs in the Nexus workgroup in a distributed MX architecture.

  Capture 

  View the status of capture sessions in Nexus.

Tip	The background in each summary corresponds to the icon displayed for the devices in the **System** resources pane. The color of a summary border reflects the status for the set of components: – Green: All components OK – Yellow: One or more components are on standby – Red: One or more components are down

- Status Details

  View details of the status of a system component in the **Status Details** section of the **Status** communications pane. The contents of this section depend on the component you click on in the **Status Summary** section.

For details on managing the components of your Vicon system, see About System Resources Pane.

Monitoring Device Status

View the status of system devices (Vicon cameras, video cameras, and connectivity units) in your Nexus system in the **Status** communications pane 

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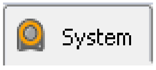
Note: Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to “MX camera” also apply to the use of Bonita cameras within Nexus.

You can manage any problems identified with system devices in the Vicon Cameras, Video Cameras, or Connectivity node under the **Local Vicon System** node in the **System** resources pane 

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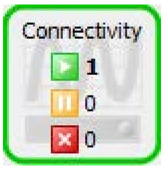
To view the status of Nexus system devices:

1. In the **Status** communications pane, view the summary for the desired device type:

MX Cameras

Video Cameras



Vicon Connectivity Devices

- The color of the summary border reflects the status for the current capture sessions:

  Green: All components OK (active or connected).

  Yellow: One or more components are on standby (idle).

  Red: One or more components are down (unavailable or disconnected).

- The colored icons inside the summary identify the status and the number of devices at that status:

  Green: The number of devices that are OK.

  Yellow: The number of devices that are on standby.

  Red: The number of devices that are down.

  These colored icons correspond to those used for the components in the **System** resources tree.

2. Click the desired summary and then in the status description section, view the status details:

- **Device type:** Vicon Cameras, Video Cameras, Connectivity. This section is always displayed. It lists the number of devices of that type at each status:

  # are OK

  # are on standby

  # are down

- **Status details:** Device type and position number (as listed in the **System** resources tree). This section is displayed for devices with a problem status. This section heading is color coded to match the component status (red or yellow).

- **System**: The computer in the Nexus system to which the device is connected. This is typically the **Local Vicon System** node in the **System** resources tree for the Nexus host PC when Nexus is in **Live** mode.
- **Device ID**: The User ID for this device in Vicon MX systems (for details on these identification numbers, see the *Go Further with Vicon MX T-Series* books).
- **Status**: A brief description of the status. For example, device is disconnected.

Monitoring Workgroup Status

View the status of the host PC and any remote computers included in your Nexus system in the **Status** communications pane 

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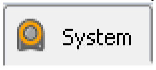
You can manage any problems identified with system computers in the **Local Vicon System** node in the **System** resources pane 

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To view the status of computers in the Nexus system:

1. In the **Status Summary** section of the **Status** communications pane, view the **Workgroup** summary:

   Workgroup

   The color of the summary border reflects the status for the set of computers in the workgroup:

   Green: All computers are OK (active or connected).

   Red: One or more computers are down (unavailable or disconnected).

   The colored icons inside the summary identify the status and the number of computers in the workgroup at that status:

   Green: The number of computers that are OK.

   Red: The number of computers that are down.

2. Click the **Workgroup** summary and then in the **Status Description** section, view the status details:

   - **Workgroup:** This section is always displayed. It lists the number of computers at each status:

     # are OK

     # are down

   - **PC Name:** The remote computer in the workgroup. This section is displayed for computers with a problem status. This section heading is color coded to match the status (red or yellow).
   - **Description:** A brief description of the status. For example, This node does not have a connection to the workgroup.

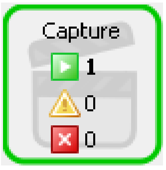
Monitoring Capture Status

View the status of the motion capture sessions in Nexus in the **Status** communications pane Status.

You can manage any problems identified with motion capture sessions in the [Local Vicon System]() node in the **System** resources pane System and in the **Capture** tools pane.

To view the status of motion capture sessions in Nexus:

1. In the **Status Summary** section of the **Status** communications pane, view the **Capture** summary:

   Capture

   The color of the summary border reflects the status for the current capture sessions:

   Green: All capture sessions are OK (active).

   Yellow: Low Buffer Space Remaining.

   Red: One or more capture sessions are down (unavailable).

   The colored icons inside the summary identify the status and the number of devices at that status:

   Green: The number of capture sessions that are OK.

   Yellow: Low Buffer Space Remaining.

   Red: The number of capture sessions that are down.

2. Click the **Capture** summary and then in the **Status Description** section, view the status details:

   - **Capture:** This section is always displayed. It lists the number of computers at each status:

     # are OK

     # have low buffer space remaining

     # are down

   - **System:** The computer in the Nexus system managing the capture session. This is typically the Local Vicon System node in the System resources tree for the Nexus host PC. This section heading is color coded to match the component status.

     Frames Captured: A running total of the number of frames being captured in the current session.

     Frames Dropped: A running total of the number of frames dropped in the current session.

Frame Rate: The maximum frame rate that capture can currently achieve. This may be lower than the frame rate at which the system is currently running, due to bandwidth limitations in synchronization and shipping of data.

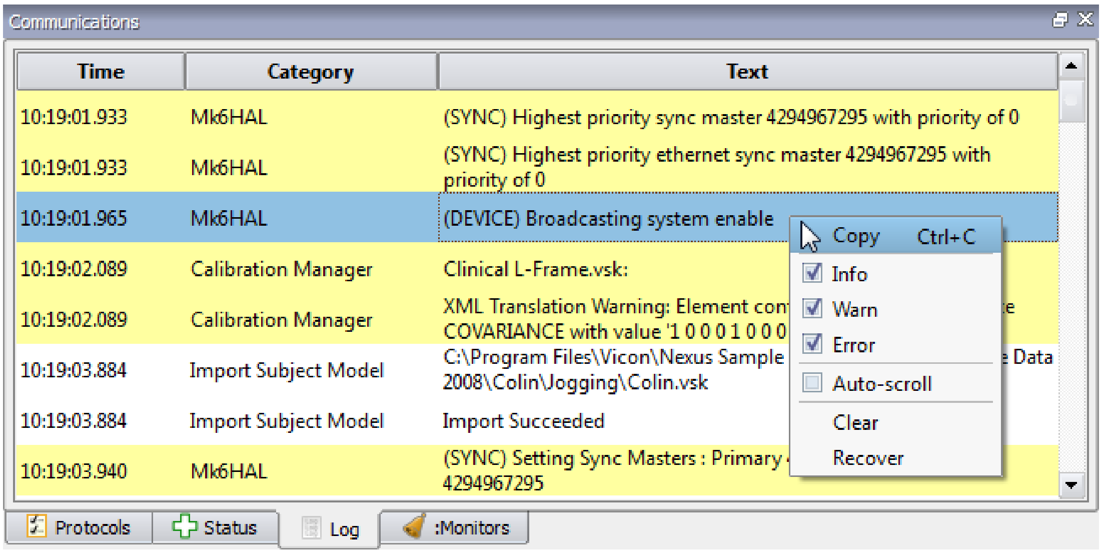
Buffer Range: The maximum duration of data that the buffer can hold (in seconds). When you select **Capture Before Start** in the **Auto Capture Setup** section of the **Capture** tools pane, this is roughly the maximum time that the system is able to capture data before the **Start** button is clicked.

Buffer Latency: Always starts at zero, but rises if data (.x1d, x2d, and videos) is written to disk more slowly than it arrives in the system. If the **Frame Rate** reported in this pane is less than the frame rate at which the system is running, the **Buffer Latency** rises during capture, and capture eventually fails. If the **Buffer Latency** is greater than zero, then the data seen on the screen is behind real time by this number of seconds.

Log Communications Pane

About Log Communications Pane

Monitor the activity of your Vicon system in the **Log** communications pane .



You can view the updates in this **Log** communications pane during any stage of the [Nexus motion capture workflow](). The **Log** communications pane contains a single window, which displays a continual update of Nexus system activity since start up as well as feedback on some motion capture and processing operations.

The log entries list the timestamp for the operation being executed in the hh:mm:ss format, followed by the general Nexus function being performed (e.g., VST Importer or Calibration Manager), then the specific action and its success or failure.

Example:

09:02:33 : XCPExporter : C:\Program Files\Vicon\Nexus\Calibrations\LatestCalibration.xcp

09:02:33 : XCPExporter : Export Succeeded

Vicon Support may ask you for log information if you contact us to report a system problem.

Context Menu

You can select the following commands from the context menu displayed when you right-click on the **Log** communications pane:

- **Copy**Enables you to copy and paste the selected log entry or entries to an external file.
- **Info**Displays information messages (white background)
- **Warn**Displays warning messages (yellow background)
- **Error**Displays error messages (red background)
- **Autoscroll**Scrolls to the bottom of the Log pane
- **Clear**Deletes all entries from the Log pane.
- **Recover**Restores previously deleted entries to the Log pane.

Monitoring System Activity

Monitor the activity of your Vicon system in the **Log** communications pane 

.

A new log is written each time you start Nexus. New entries recorded during the current session are appended at the bottom of the log. You can copy all or part of the information in the log and save it to an external file, such as a Rich Text Format (*.rtf*) or plain text (*.txt*) file.

To monitor system activity in the Log:

1. In the **Log** communications pane, view the entries for system activity and processing operations.
2. Use the scroll bar to move down or back up the displayed entries.

To copy Log entries to external files:

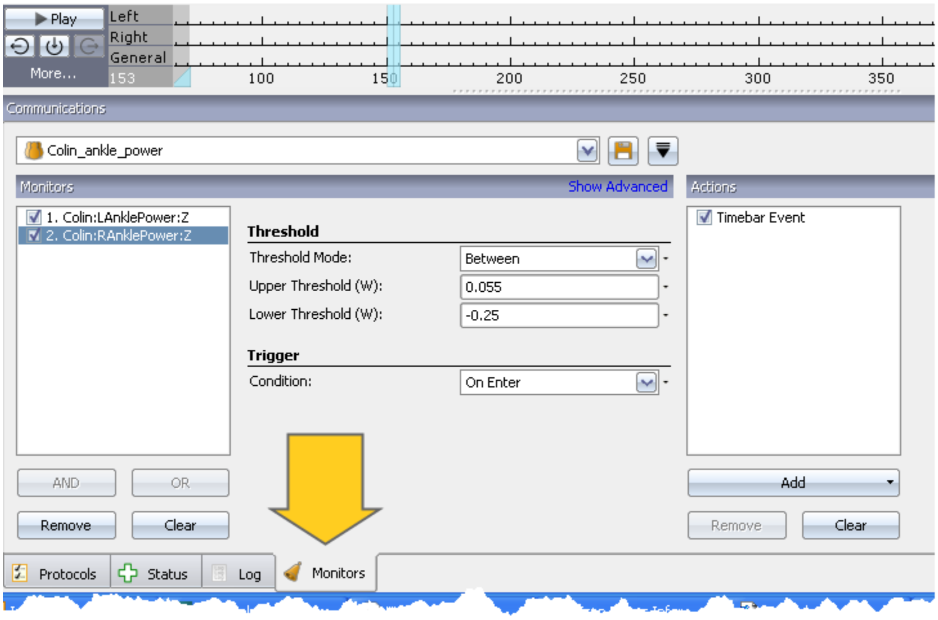
1. Drag the cursor across the desired text, or right-click and on the displayed context menu click **Select All**.
2. Right-click and on the displayed context menu click **Copy**. Nexus copies the text to the clipboard.
3. Open the desired text editor, such as Microsoft Notepad, and paste the copied text.

Monitors Communications Pane

About Monitors Communications Pane

Create monitors in the **Graph** view pane and configure them in the **Monitors** communications pane 

.



Nexus Motion Capture Workflow:

III. [Capture and process a trial](#).

V. [Post process trial](#).

Using monitors is optional, but they are useful for specifying conditions or events that you want to identify during motion capture sessions. For example, you may want to set an event on the Time Bar when the subject raises an arm to a certain height, or have Nexus sound a tone when the subject's left knee angle exceeds 180 degrees.

Monitors can evaluate subject as well as device outputs based on the parameters you specify. The **Monitors** communications pane contains the following sections:

- Monitors Configuration Management

  You [manage monitor configurations](#) in the **Monitors** communications pane using the **Configuration Management** section at the top of the pane.

- Monitor Properties

  You define the monitor behavior in the **Monitors Properties** section of the **Monitors** communications pane: 

Monitors

Lists the currently defined monitors. Select the check box next to a monitor name to enable the monitor, or clear the check box to disable the monitor. Select a monitor in the list to view or configure its properties.

AND

When multiple monitors are selected from the list, this button adds a **Boolean AND** monitor that triggers an action when all of the monitor trigger conditions are present. To create an **AND** monitor, see Configuring an AND/OR Monitor.

OR

When multiple monitors are selected from the list, this button adds a **Boolean OR** monitor that triggers an action when at least one of the monitor conditions is present. To create an **OR** monitor, see Configuring an AND/OR Monitor.

Remove

Removes the selected monitor from the list.

Clear

Removes all monitors from the list.

- Monitor Actions

  You view or modify monitor action settings in the **Actions** section of the **Monitors** communications pane. 

  For details on how to specify settings for monitor properties, see Configuring Monitors.

Configuring Monitors

About Configuring Monitors

Create monitors for motion capture events in the **Graph** view pane and configure them in the **Monitors** communications pane 

.

For example, you can create a monitor for a graphed model output, and then configure it in the **Monitors** communications pane to trigger one or more actions when the model output matches a condition you specify. You can also configure multiple actions and multiple monitors.

Monitors can be used in both **Live** and **Offline** modes. In Live mode, you can compare the current value against the thresholds. In **Offline** mode, you can tune a series of monitors against captured data before applying them to live data. For more information, see topics to:

- Configure a Monitor
- Configure an AND or OR Monitor
- Activate a Monitor
- Reload a Monitor
- Monitor Configuration Examples
- Use a Monitor for Real-time Event Detection

Configuring a Monitor

Create monitors for motion capture events in the **Graph** view pane and configure them in the **Monitors** communications pane 
.

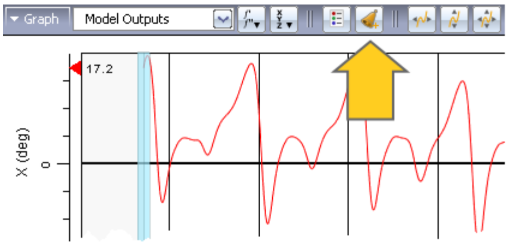
To configure a monitor:

1. To create a monitor, in the **Graph** view pane, select a graph plotting the elements you wish to monitor (trajectories, model outputs, devices, or joints):

   a. Differentiate the graph view  to select either the current variable or the derivative that you want to include.

   b. Specify the graph components  that you want plotted in the active **Graph** view pane.

2. On the **Graph** view pane toolbar and click the **Add Monitor** button .

   The monitor is added to the list in the **Monitors** properties section of the **Monitors** communications pane.

   The monitor takes the name of the component you selected. For example, if the Graph view you've selected shows X, Y, and Z for the LeftAnkleForce, three monitors are created: LAnkleForce:X, LAnkleForce:Y, and LAnkleForce:Z.

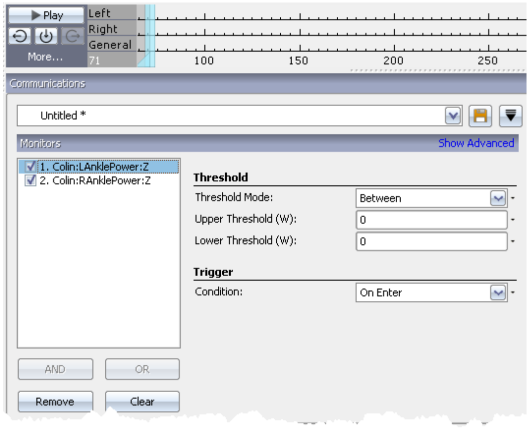
Tip	If you select multiple components for your Graph view, a monitor is created for each component (e.g., x, y, z). You can remove monitors you don't need, or deactivate them.

3. In the **Monitors** properties section of the **Monitors** communications pane, name the monitor.

   Select the monitor from the list, then:

   - Leave the displayed monitor name as is, or
   - Double-click it and over type with a new name.

4. Select the monitor in the list and the **Properties** settings appear.



5. In the **Threshold** section, specify the value and condition that will trigger the action:

   - **Threshold Mode:** Select the **type** of threshold.

     – **Above Upper:** Tracks a graph value above a specified range.
     Upper Threshold: When you select this option, set the upper threshold value.

     – **Below Lower:** Tracks a graph value below a specified range.
     Lower Threshold: When you select this option, set the lower threshold value.

     – **Between:** Tracks a graph value within a specified range.
     Upper Threshold: When you select **Between**, you are specifying a range. Enter the **Upper Threshold** and **Lower Threshold** values.
     Lower Threshold: When you select **Between**, you are specifying a range. Enter the **Upper Threshold** and **Lower Threshold** values.

     – **Outside:** Tracks a graph value outside a specified range.
     Upper Threshold: When you select **Outside**, you are specifying a range. Enter the **Upper Threshold** and **Lower Threshold** values.
     Lower Threshold: When you select **Outside**, you are specifying a range. Enter the **Upper Threshold** and **Lower Threshold** values.

Tip	The threshold range you specify is displayed as a shaded area with a dashed line in the **Graph** view pane.

6. In the Trigger section, specify the condition under which the threshold should activate.

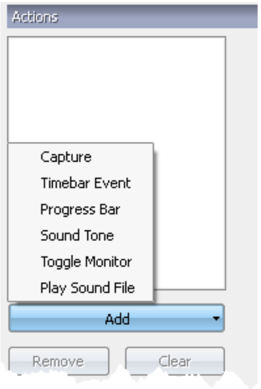
   Condition: Select the **condition**.

   - **On Enter:** Monitor triggers upon entering the threshold range.
   - **On Exit:** Monitor triggers upon exiting the threshold range.
   - **Within:** Monitor triggers on every frame within the threshold range.
   - **Max Value on Exit:** Monitor triggers upon exiting the threshold range, but the event is registered at the point of maximum value within the range.

     For example, if you set a Timebar Event with Max Value on Exit, the Time Bar event registers at the point of maximum value within the specified threshold range.

   - **Min Value on Exit:** Monitor triggers upon exiting the threshold range, but the event is registered at the point of minimum value within the specified range.

7. To add the action that will execute when the monitor threshold and trigger conditions are met to the monitor, select a monitor in the **Monitors** properties section. In the **Actions** section on the right side of the **Monitors** communication pane, click **Add** and make a selection:



- Capture
- **Start**: Starts a capture.
- **Stop**: Stops a capture.
- **Toggle**: Switches to the opposite capture state, e.g., stops a capture that is in progress, or starts a capture if the previous state was stopped.

Important	Capture actions can only be performed in **Live** mode. If you want to create and test a capture action based on a representative trial, you can add a complementary Time Bar event to indicate that the condition was met. Then for the live test or real trial capture, turn off the monitor **Time Bar** action.

Tip	**In the** Auto Capture settings **of the Capture Tools pane, ensure the Arm button is enabled (pressed down) before triggering capture.** You can also use other Auto Capture settings in conjunction with monitor events. For example, in addition to setting up a monitor event to trigger a capture, you can also set a pre-trigger capture time. To do this, set up the monitor to trigger the capture and also set a pre-trigger capture time so that the first frame captured is prior to the condition which triggers the capture.

- Time Bar Event

Places an event on the Time Bar, which can be configured to include:

– **Subject Name**: Enter the subject name.

– **Context**: Select where to place a time bar event:
o **General**: Places a marker on the General rule of the Time Bar ruler.
o **Left**: Places a marker on the **Left** (e.g., left side of the body) rule of the Time Bar ruler.
o **Right**: Places a marker on the **Right** (e.g., right side of the body) rule of the Time Bar ruler.

– **Event Type**: Select the type of user-defined event that will be specified on the **Time Bar**:
o **General**: Indicates the point on the time bar at which the trial subject performs a user-defined event.
o **Foot Strike**: Indicates the point on the time bar at which the trial subject's foot contacts the ground.
o **Foot Off**: Indicates the point on the time bar at which the trial subject's foot leaves the ground.

- **Clip**: Select the clip:
  - o **Active**: Sets the action to whichever state Nexus is in.

Tip	Active has the same functionality as Offline if you are analyzing or processing an offline trial, and Live if you are currently in Live mode. This eliminates having to change this property when you switch between Live and Offline.

  - o **Live**: Sets the action to occur on a live clip.
  - o **Offline**: Sets the action to occur on a captured trial that has been loaded or a trial that is currently being captured.
- **Frame**: **Select the** frame:
  - o **Current**: Sets the action for the currently selected frame in the clip.
  - o **First**: Sets the action to the first frame in the time interval. For an offline clip, this would be frame 1. For a live clip, this would be the first frame of a 100-frame moving time window.
  - o **Last**: Sets the action to the last frame in the current interval. For an offline clip, this would be the very last frame.

Tip	The **Frame** settings detect real time events that are written to the offline clip. During capture, the current **Live** frame is equivalent to the last **Offline** frame. If you set **Clip** to **Offline** and **Frame** to **Last**, you will have real time event detection during capture. If you configure this option, you will need to run a post-capture pipeline. See Using Monitors for Real-time Event Detection.

- **Frame Offset**: Type a number in the field to indicate the number of frames of offset before adding the event.
- **Progress Bar**

  Select to display a progress bar. The progress bar reflects a normalized value within the boundaries of the threshold; that is, Nexus computes the upper and lower threshold values so that a given value within the range is represented as a progress bar percentage.

Important	This action works best when the **Monitor Threshold** is set to **Between**, and is intended for a **Trigger** condition of **Within**. The Progress Bar will function when used **On Enter**, **On Exit**, etc., but will not provide meaningful results. For example, if you set the trigger condition to **On Enter** and the parameter enters the threshold region from below, then the progress bar value will remain near 0%. If the parameter enters the threshold region from above, the progress bar value will remain around 100%.

Tip	The **Progress Bar** is divided into thirds, each designated by a color: Red for the lower third, yellow for the middle third, and green for the upper third.

- **Sound Tone**

  Sounds a system tone based on the threshold range and trigger condition.

Tip

Play Sound File is recommended with the trigger actions of **On Enter** or **On Exit**.

Sound Tone is recommended with the trigger conditions of **Between** and **Within**. The Sound Tone provides an audio alert in a similar fashion to the Progress Bar: If set to Between or Within, the sound pitch varies in proportion to the parameter's value within the threshold range.

– Toggle Monitor

Changes the enabled state of the selected monitor to On, Off, or Toggle.

In the Monitor Index field, type the number corresponding to the monitor in the Monitors List, and then set the toggle state.

Important

Nexus adjusts the **Monitor Index** field if changing the number of Monitors in a configuration affects the **Monitor Index**. That is, if you configure multiple monitors and set **Toggle Monitor** events, deleting a monitor can change the **Monitor Index** field number.

Example:

- You configure Monitor 1, Monitor 2, and Monitor 3.
- You add a **Toggle Monitor** event to Monitor 2, with the **Monitor Index** set to "3" (meaning that Monitor 3 will toggle).
- If you remove Monitor 1, Monitor 2's **Monitor Index** will change from "3" to "2" (Monitor 3 is now Monitor 2).

Example:

- You configure Monitor 1, Monitor 2, and Monitor 3.
- You add a **Toggle Monitor** to Monitor 2, with the **Monitor Index** set to "3."
- If you delete Monitor 3, Monitor 2's **Monitor Index** will be blank (there is no longer any Monitor 3 to toggle).

– Play Sound File

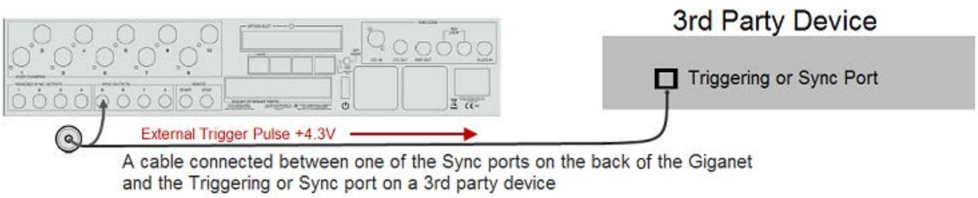
Plays the sound file you specify. Click the Browse button to navigate to and select the .wav file directory on your computer. Then select a .wav file from the drop-down list.

– External Trigger

Sends a trigger pulse to external equipment or software from the Sync Output ports on the back of the connectivity device. For more information on how to connect a third-party device to the Sync Output ports, see *About MX Connectivity Units*.

Sync Port: Select which port you want to use to send the pulse (sends a trigger pulse from a Giganet Sync Output port to an external piece of equipment or software).

Action: Set the pulse to High (+4.3V), Low, (0V), or Toggle (if High then go Low; If Low then go High).



Repeat steps 4 and 5 if you want to configure multiple actions for the monitor.

8. In the Monitors Configuration Management section, click Save to save the configured monitor.
   - Enter a name for the monitor configuration.
   - Select Shared or Private for the configuration.
9. In the View Pane Configuration Management section, save the Graph view that corresponds to the monitor you have configured.
   - Click Save , and type a name for the Graph view configuration.
   - Select Shared or Private for the configuration.
   - Whenever you want to view the graph related to the monitor, you select it from the View pane list.
10. Test the monitor to ensure that the action occurs when the specified condition is met.

Important	Monitor actions function only in a forward time sequence. In other words, monitors will not activate when you manipulate the Time Bar ruler back and forth.

11. To configure multiple monitors, repeat steps 1-10 for each monitor.

Configuring an AND or OR Monitor

You can configure two special monitor types in the **Monitors** communications pane  that execute actions based on the conditions of a group of monitors. They are called **AND** or **OR** monitors, or Boolean monitors.

The monitors comprising an AND or OR monitor are called **Children**. The Boolean monitor bases its action on the status of the children monitors; that is, based on whether the children's thresholds and triggers are present. You can trigger an action based upon a Boolean monitor's condition just like you can for an individual monitor, but Boolean monitors operate in specific ways:

- BooleanAND:

  If all the Children monitors comprising a BooleanAND monitor meet the monitor configuration condition at the same time, then the BooleanAND monitor executes its configured action. In other words, if the condition of all the Children is TRUE then the BooleanAND monitor condition is TRUE and the BooleanAND monitor executes.

  Example: If in Child monitor1 the Left Knee Angle > 180 AND in Child monitor 2 the Right Knee Angle > 180, the BooleanAND monitor is true and the monitor action executes.

  All the BooleanAND monitor Children must meet the specified condition at the same time or the BooleanAND monitor condition is FALSE and the BooleanAND monitor will not execute the action.

- BooleanOR:

  If at least one of the Children monitors comprising a BooleanOR monitor meets the specified monitor configuration (threshold, trigger and condition), then the BooleanOR monitor executes the specified action. In other words, the condition of at least one of Children is TRUE, therefore the BooleanOR monitor condition is TRUE.

  Example: If in Child monitor 1 the Left Knee Angle > 180 OR in Child monitor 2 the Right Knee Angle > 180, the BooleanOR monitor is true and the monitor action executes.

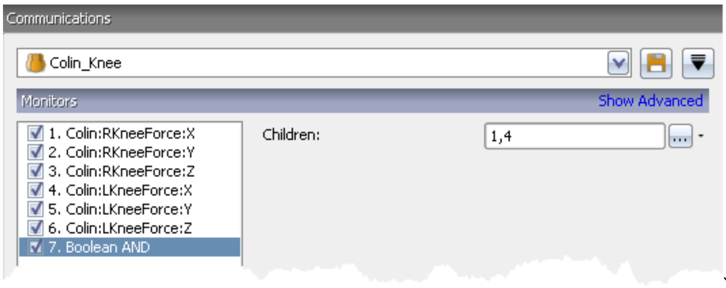
  When none of the Children meets the specified condition, the BooleanOR monitor's condition is FALSE and the BooleanOR monitor does not execute.

To configure an AND or OR Monitor:

Important	This procedure assumes that you have already configured multiple monitors.

1. In the **Monitors** properties section of the **Monitors** communications pane, select two or more monitors that will comprise the AND or OR monitor.
2. Click the **AND** or **OR** button below the **Monitors** list.
3. A new Boolean monitor appears in the list (**Boolean AND** or **Boolean OR**).

4. Highlight the monitor name and a list of the **Children** monitors comprising the monitor appears (This is an example of an **AND** monitor using Monitors 1 and 4.



).

Tip	To change the **Children** monitors included in the Boolean monitor, click in the **Children** field and type the monitor numbers, separated by commas.

5. [Configure the monitor](#).

Activating and Deactivating a Monitor

Create monitors for motion capture events in the **Graph** view pane and configure them in the **Monitors** communications pane 

.

After you [configure a monitor](#), you can activate or deactivate it.

To activate a monitor:

- In the **Monitors** properties section select the check box ☑ for the monitor you wish to activate.

To deactivate a monitor:

- In the **Monitors** properties section, clear its check box ☐ of the monitor you wish to deactivate .

Reloading a Monitor

Create monitors for motion capture events in the **Graph** view pane and configure them in the **Monitors** communications pane 

.

You will need to reload your monitor if you make changes to the monitor configuration, configure or use other monitors, or switch between **Live** and **Offline** mode.

To reload a monitor

1. For a monitor to take effect in **Live** mode, reload the trial file in the **Data Management** window.
2. For a monitor to take effect in **Offline** mode, select **Reload** from the **Configuration menu**  in the **Monitors** properties section.

Tip	Because monitors can be set to toggle on and off, you may need to reload the monitor before processing a new trial.

Monitor Configuration Examples

Configure a monitor to perform multiple actions, or configure multiple monitors, in the **Monitors** communications pane 

.

To configure multiple monitors, follow the steps to configure an individual monitor for each monitor you wish to set up.

Below are usage examples on configuring:

- Multiple actions on a single monitor
- Multiple monitors
- Multiple actions on multiple monitors
- Boolean monitors

Multiple Actions on One Monitor

A single monitor can perform multiple actions, such as to write a Time Bar event, display a progress bar and sound a tone.

To configure a monitor with multiple actions that detects only the first occurrence of an event:

1. Configure a monitor to detect an event.
2. Add a Time Bar Event action.
3. Add a Toggle Monitor action to toggle the monitor **Off** so that the Time Bar event is identified only the first time.

Multiple Monitors

You can use multiple monitors to identify multiple events. Each event type, such as Foot Strike and Foot Off, would have its own monitor.

For example, you may want one monitor to look for the start of a particular body motion, which starts another monitor that evaluates whether the pelvic alignment is within the threshold range. If the pelvic alignment exceeds the threshold range, the second monitor could sound a tone to notify the operator, and activate a third monitor to evaluate the range of yet another element.

To configure multiple monitors:

1. Configure monitor 1 to detect the counter-motion of a jump (e.g., when the angular velocity of the knee exceeds a threshold).
2. Add a Capture action to the monitor to start a capture when this condition is met.
3. Add a **Toggle Monitor** action to toggle the monitor off so that the capture is initiated only once.
4. Configure monitor 2 to detect the maximum height of the sacrum for both the initial jump and the jump after landing on the force plate (**Maximum Value on Exit**).
   - Add a **Time Bar Event** action to the monitor.
5. Configure monitor 3 to detect landing on the force plate.
   - Set the Threshold Mode to monitor the vertical force value (**Fz**) at the appropriate threshold (**On Enter**).

     Tip: Force plate monitor properties will depend on which force plate device is being used. Some force plates used with Nexus register a positive vertical force on contact (such as the AMTI), while others register a negative force on contact (such as Kistler).
6. Add a **Time Bar Event** action.
7. Configure monitor 4 to detect takeoff from the force plate.
   - Set the Threshold Mode to detect when the vertical force value (Fz) drops below a threshold (you can use the same trigger value as for Monitor 3, but you would set the condition to On Exit).

Multiple Actions on Multiple Monitors

To configure multiple monitors, each with multiple actions:

1. Configure a master monitor to trigger the detection of trial events (e.g., subject jumps onto a force plate and then jumps off).
2. Configure a series of monitors with **Time Bar Event** actions (e.g., **Foot Strike** and **Foot Off**).
3. Clear each monitor's check box so that its initial state is **Off**.
4. Add a **Toggle Monitor** action to the master monitor for each event monitor.
5. Set each **Toggle Monitor** to **On**. Once the master monitor is triggered, the event monitors will turn **On**. The events are detected and written to the Time Bar.

   Tip: The trial conditions could be such that a master monitor isn't necessary to control the event detection monitors in Step 2. The value of the master monitor is to make sure that the monitored parameters are in the proper state for appropriate event detections. This is a safeguard against identifying false events.

Boolean Monitors

You should carefully consider how you configure Boolean monitor thresholds and triggers to execute event actions.

If you use an AND monitor, it will mark an event only if the conditions of the children monitors occur at the same frame (an AND monitor event requires all children monitor parameters to be true). This seems obvious, but let’s say you want to mark an event when parameter 1 is above one threshold and parameter 2 falls below another threshold. You’d be inclined to set the threshold to Above for Child monitor 1, the threshold to Below for Child monitor 2, with the trigger condition to On Enter for each. However, configured this way, the AND monitor will mark the event only if the two parameters enter the respective threshold regions on the same frame, which is unlikely.

Unless you want this specific occurrence tracked, instead you would set the parameter for the first monitor to Between a threshold range with a trigger condition of Within. The parameter for the second monitor is set to **Below** a threshold range with a trigger condition of **On Enter**.

Configured in this manner, when the parameter for Child monitor 1 is within its threshold, the action will execute the instant the parameter for Child monitor 2 falls below its threshold:

AND Child Monitor 1	AND Child Monitor 2
Threshold: Between	Threshold: Below
Trigger: Within	Trigger: On Enter

If you use an OR monitor, because the child monitor trigger conditions do not need to coincide (an OR monitor requires only one of the monitor parameters to be true), you can set Child 1 with a threshold of **Above** and a trigger of **On Enter**, and Child 2 with a threshold of **Below** and a trigger condition of **On Enter**:

OR Child Monitor 1	OR Child Monitor 2
Threshold: Above	Threshold: Below
Trigger: On Enter	Trigger: On Enter

Using Monitors for Real-time Event Detection

You create a monitor that captures real-time events in the **Monitors** communications pane 

.

You can configure Nexus to record specified events during a capture, such as foot strike or foot off, which are written to the offline clip and can then be viewed on the Time Bar ruler.

Tip	You can also manually mark the Time Bar ruler.

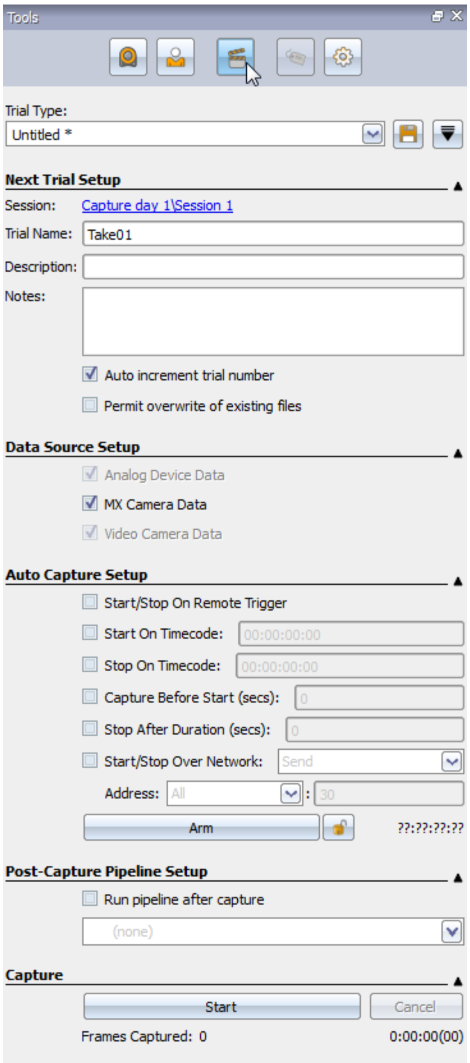
To configure and use a real-time event detection monitor:

1. In the **Monitors** communications pane, configure one or more monitors with the following **Timebar Event** settings:
   - Clip set to **Offline**.
   - Frame set to **Last**.
2. In the **Capture** tools pane , configure your settings to either manually capture a trial or automatically capture a trial.
3. In the **Post-Capture Pipeline Setup** section of the **Capture** tools pane, select a pipeline operation to run.
4. Select the check box to **Run pipeline after capture**.
5. In the **Capture** tools pane , capture a trial.
6. Play back the trial data to view the time bar events in the offline clip.

Tools Pane

About Nexus Tools Pane

Configure settings, run tools, and view data processing results in the sections below the toolbar in the **Tools** pane . The contents of this section depend on the button you selected in the **Tools** pane toolbar.



Vicon System Setup:

I. Configure Vicon system hardware.

II. Calibrate the Vicon system.

Nexus Motion Capture Workflow:

I. Prepare system.

II. Prepare subject.

III. Capture and process a trial.

IV. Review trial and fill gaps.

V. Post process trial.

Select the Vicon system components or motion capture subjects you previously prepared in the **Resources** pane. Use the **View** pane to visualize the data as it is being processed.

Select the type of **Tools** pane to be displayed using the toolbar buttons near the top of the **Tools** pane. These buttons open the following tools panes, which are designed to lead you left to right through the normal motion capture workflow:

System Preparation 

Calibrate the cameras and set the global origin for the capture volume.

Subject Preparation 

Capture a brief subject trials to create a Vicon Skeleton Template (*.vst* file), and calibrate a Vicon Skeleton (*.vsk* file) for an individual subject of that type.

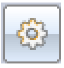
Capture 

Specify where in a motion capture database to store the trial data, select the type of trial data that is to be produced, and manage the capture process.

Label/Edit 

Label the reconstructed trial data for each active subject.

Edit the reconstructed and labeled trial data to fill any gaps.

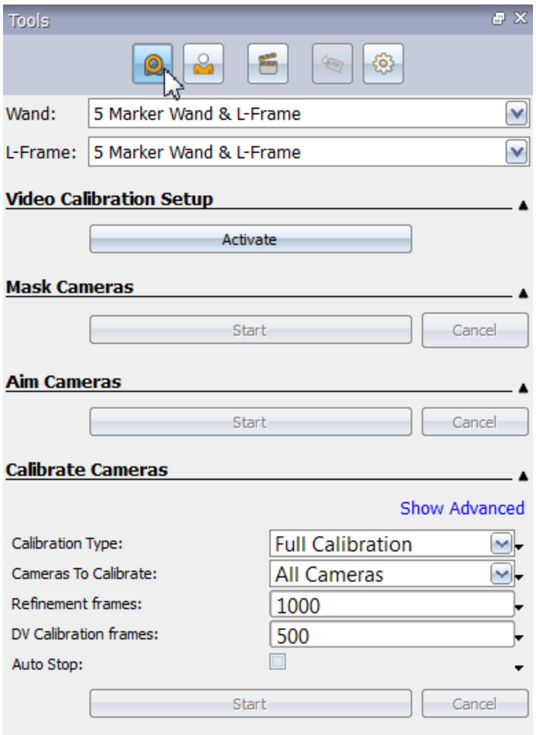
Pipeline 

Create and run any pipelines to automate calibration, processing, file input-output, and Workstation operations.

System Preparation Tools Pane

About System Preparation Tools Pane

Prepare your Vicon system for motion capture in Nexus in the **System Preparation** tools pane  .



Vicon System Setup:

I. Configure Vicon system hardware.

II. Calibrate the Vicon system.

Nexus Motion Capture Workflow:

I. Prepare system.

System calibration is a two-stage process by which Vicon Nexus calibrates the system based on specialized calibration objects (whose dimensions and relative marker positions are known):

1. Dynamic stage (camera calibration)During the first stage, the Nexus camera calibration process calculates the physical position and orientation of each Vicon camera in the capture volume based on the movement of the calibration object. Nexus uses this information to determine each camera's physical position and orientation in the capture volume, to correct for any lens distortion, and to set internal camera parameters.
2. Static stage (global origin)During the second stage, you set the volume origin in Nexus. Nexus measures the position of the calibration object and uses this information to identify the origin of the world (center of the capture volume) and its horizontal and vertical axes. These volume origin and axes are referred to as the global coordinate system. The global origin coordinates are always (0,0,0). The global axes coordinates are given in the form (x, y, z), where x is a horizontal axis, y is the horizontal axis perpendicular to x, and z is the vertical axis.

The **System Preparation** tools pane contains the following sections:

- **Select Calibration Objects**

  You specify the calibration objects that will be used in the two stages of the system calibration process in the fields at the top of the **System Preparation** tools pane:

  Wand

  The calibration object to be used during the dynamic stage of the camera calibration process.

Default: 5 Marker Wand & L-Frame

  L-Frame

  The calibration object to be used during the static stage of the camera calibration process.

Default: 5 Marker Wand & L-Frame

- **Video Calibration Setup**

  You activate calibration mode by clicking the **Activate** button in the **Video Calibration Setup** section. Note that if you haven't saved the current configuration, you will be prompted to do so before you can proceed.

  You automatically activate calibration mode when you click **Start** in the **Mask Cameras** section, the **Aim Cameras** section or the **Calibrate Cameras** section.

  To exit calibration mode, click the **Deactivate** button in the **Video Calibration Setup** section.

- **Mask Cameras**

  You automatically create cameras masks to obscure all reflections visible to the MX / Bonita cameras in the **Mask Cameras** section of the **System Preparation** tools pane.

- **Aim Cameras**

  You check the positioning of MX / Bonita cameras around the capture volume with real-time feedback in the **Aim Cameras** section of the **System Preparation** tools pane.

- **Calibrate Cameras**

  You calibrate the MX / Bonita cameras (both optical cameras and digital video cameras that are calibrated with an Active Wand) to determine their positions, orientations, and lens properties, which enables Nexus to produce accurate 3D and 2D (video) data from motion data captured throughout the capture volume in the **Calibrate Cameras** section of the **System Preparation** tools pane.

- **Set Volume Origin**

  You define the global origin and the axes of the world (in the context of the capture volume) in the Set Volume Origin section of the **System Preparation** tools pane.

- **Static Video Calibration**

  If you are not using an Active Wand, you use the Static Video Calibration section of the **System Preparation** tools pane to calibrate digital video cameras included in your Nexus system. This enables 3D overlay from MX cameras to be displayed with the 2D video from the digital video cameras.

- Manage Camera Calibration

  You can reset or load a camera calibration defining settings for the MX / Bonita cameras and any supported digital video cameras in your Nexus system in the **Manage Camera Calibration** section of the **System Preparation** tools pane.

- Camera Calibration Feedback

  You view system calibration processing progress and status information in the **Camera Calibration Feedback** section of the **System Preparation** tools pane.

Note	Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to "MX camera" also apply to the use of Bonita cameras within Nexus.

Aiming MX / Bonita Cameras

Check the positioning of MX / Bonita cameras around the capture volume with real-time feedback in the **Aim Cameras** section of the **System Preparation** tools pane.

Note	Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to "MX camera" also apply to the use of Bonita cameras within Nexus.

Vicon System Setup:

I. Configure Vicon system hardware.

   2. Position the MX / Bonita cameras to acquire data from the capture volume.

Nexus Motion Capture Workflow:

I. Prepare system.

   1. Check MX /Bonita camera positions.

You can visualize MX camera positioning changes in real time. When you physically move a camera in the capture volume, you see its representation move correspondingly in the **3D Perspective** view pane. After obtaining this approximate camera calibration, perform a full camera calibration.

Important	To aim MX / Bonita cameras, you must use the **Active Wand** or the **5 Marker Wand & L-Frame** calibration object supplied with your Vicon system. If this calibration object was not supplied with your Vicon system, the **Aim Cameras** functionality is not available in Nexus. To aim digital video cameras, you must use the **Active Wand**. Before starting the MX camera aiming process, remove from the capture volume all markers and the sources of any unwanted reflections that have not been accounted for by camera masks previously created in a **Camera** view pane.

To optimize the position of MX / Bonita cameras:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. Visualize the MX camera feedback in either of the following ways:
   - In the **Options** dialog box, under the **General View Options** section, select the **Target Volume** option. In the **Camera** view pane toolbar, from the **View** drop-down list, select **3D Overlay**. A virtual representation of your target volume is overlaid on the 2D data from the camera image.
   - In a **3D Perspective** view pane, view the reconstructed motion capture data from all active Vicon cameras
3. In the **System Preparation** tools pane, from the **L-Frame** drop-down list select the **Active Wand** or **5 Marker Wand & L-Frame** calibration object.
4. In the capture volume, place the calibration object flat on the floor in the center of the capture volume at the desired origin position.
5. In the **Aim Cameras** section, click **Start** to begin the MX camera aiming process. Nexus starts attempting to identify the calibration object in each camera view, and the **Start** button switches to its **Stop** setting.
6. In the **System** resources tree, select the camera you wish to position and ensure that you can see the calibration object in the **Camera** view pane.
7. Physically move an MX camera in the capture volume and check its coverage against the target volume.
8. Repeat steps 6-7 for each MX camera, until they are all correctly aimed at the calibration object.
9. Click **Stop**.

Creating MX / Bonita Camera Masks Automatically

You can automatically create MX / Bonita camera masks in the **Mask Cameras** section of the **System Preparation** tools pane .

Note	Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to "MX camera" also apply to the use of Bonita cameras within Nexus.

Vicon System Setup:

I. Configure Vicon system hardware.

3. Mask out any unwanted reflections visible to the MX cameras automatically.

The automatic camera mask creation tool automatically creates masks to eliminate any reflections in the capture volume that are visible to the cameras. You can subsequently create masks manually to eliminate any remaining or additional reflections.

Important	Before using the automatic mask creation tool, ensure that you remove from the capture volume any unnecessary objects, such as calibration objects. For best results, the capture volume should be entirely free from objects likely to cause background interference.

To automatically create MX camera masks:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. From the **System** resources tree, select all MX cameras.
3. From the **View** pane toolbar, select **Camera** to display the 2D data being captured by each selected MX camera in a separate **Camera** view pane.
4. From the **View** drop-down list at the top of each **Camera** view pane toolbar, ensure that the **3D Overlay** and **Combined** options are cleared.
5. In the **Options** dialog box, under the **General View Options** section ensure that the **Threshold Map** option is selected.
6. From the capture volume, remove any unnecessary objects, such as calibration objects. For best results, the capture volume should be entirely free from objects likely to cause unwanted reflections.
7. Ensure that you have adjusted camera settings as described in Setting MX / Bonita Camera Properties. If you do have reflections, they should be clearly visible in the **Camera** view pane, typically as non-circular areas of gray scale or edge data. Note that reflections can severely affect the camera data rates, and you may find that the camera overloads. In this case, the camera automatically sends edge data instead of full gray scale.
8. In the **System Preparation** tools pane, under the **Mask Cameras** section, click **Start**.
9. The **Start** button switches to its **Stop** setting. Nexus starts recording the data visible to each of the MX cameras connected. Any camera masks created are displayed as blue cells in the **Camera** view panes for affected cameras. If there is no data visible to a particular camera, Nexus does not create any masks for it. About 30 seconds of recording is generally sufficient to enable Nexus to collect the data visible to the cameras.
10. Click **Stop**.

Calibrating MX / Bonita Cameras

Calibrate MX / Bonita cameras in the **Calibrate Cameras** section of the **System Preparation** tools pane .

Note: Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to "MX camera" also apply to the use of Bonita cameras within Nexus. The following instructions apply to both MX cameras and Bonita Optical cameras. If you are using an Active Wand, you can also calibrate Bonita Video cameras as part of the same calibration process.

If you are not using an Active Wand, for instructions on calibrating video cameras, see Calibrating Video Cameras without an Active Wand.

Vicon System Setup:

II. Calibrate the Vicon system.

1. Calibrate the MX / Bonita cameras.

Nexus Motion Capture Workflow:

I. Prepare system.

2. Check MX camera calibrations.

The MX camera calibration process describes the capture volume to the system, enabling Nexus to determine the positions, orientations, and lens properties of all the MX cameras. Nexus uses this information to produce accurate 3D data. During the camera calibration process, Vicon Nexus creates a calibration parameters (*.xcp*) file. This file contains the calibration settings and threshold data specified for the MX cameras (as well as any supported third-party digital video cameras) in your Nexus system and is used when data from these cameras is processed. You can import .cp files created in other Vicon application software (such as Vicon iQ or Workstation) for use in Nexus.

Important: As part of the first stage of the daily Nexus motion capture workflow, Vicon recommends that you calibrate your MX cameras each day before you capture any data. This will ensure that any unexpected changes in your setup that may have occurred when the system was unsupervised (such as someone accidentally knocking a camera slightly out of position) will not influence the quality of your data. You can perform the level of camera calibration that suits your requirements: a full camera calibration or a calibration refinement.

Before starting the calibration process, remove from the capture volume all markers and the sources of any unwanted reflections that have not been accounted for by camera masks previously created in a **Camera** view pane.

To perform a camera calibration, you need a Vicon calibration object, which is supplied with your Vicon system. Note that, to use the following process to calibrate supported digital video cameras, including Bonita Video cameras, you must use an Active Wand, which must be set to Strobe mode.

To calibrate MX cameras in Nexus:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. In the **View** pane, display a **Camera** view pane.
3. In the **System** resources tree, expand the **Vicon Cameras** node and select all MX cameras.
4. In the **System Preparation** tools pane, from the **Wand** and **L-Frame** drop-down lists, select the type of dynamic calibration object you are using.

5. In the **Video Calibration Setup** section, click **Activate** to start calibration mode.

   If you have not already saved the current configuration, you will be prompted to save it. Ensure its name is recognizable as a calibration and then choose whether it will be **Shared** or **Private**.

Tip	The settings for some video camera properties may differ in video calibration setup mode from those in live capture mode. For these properties, any changes made after you click **Activate** only apply during video calibration setup mode. The properties revert to their live capture settings after you click **Deactivate**. For more information, see Setting Properties for Video Cameras.

6. In the **Calibrate Cameras** section, view or change settings for the desired parameters:
   a. Select the appropriate **Calibration Type**: **Full Calibration** or **Calibration Refinement**.

Tip	If you have not already calibrated or aimed all cameras, you cannot perform a calibration with the **Calibration Refinement** option.

   b. To enable Nexus to automatically stop the calibration process when sufficient calibration information has been acquired, ensure **Auto Stop** is selected.
7. In the **Calibrate Cameras** section, click **Start**. The camera calibration process starts, and the **Start** button switches to its **Stop** setting.
8. In the capture volume, wave the calibration wand throughout the area where you intend to capture 3D data, ensuring that the markers on the calibration object are visible to the cameras. Vicon Nexus begins to capture wand wave data.
9. Monitor the calibration progress and status:
   - In each Camera view pane, check the display of colored lines identifying wand frames, ensuring that a good number of wand frames are spread across the intended 3D capture volume. Also check the colored triangle in the lower right of each view pane. The triangles change from red to green as the collection of calibration information progresses, and then vanish when the cameras are calibrated.

Tip	If no cameras are visible in the **Camera** view pane, ensure that the **Show Uncalibrated Cameras** option is selected in the **Camera Positions** section of the **Options** dialog box. You might find it helpful to use a projector to display the Nexus window where the individual in the capture volume can see the feedback in the **Camera** view pane while they are waving the calibration wand throughout the capture volume so they can see the area they have covered.

   - In the **System Preparation** tools pane, under the **Camera Calibration Feedback** section check **Wand Count** values returned for each MX camera.
   - On the strobe unit on the front of each MX camera, the status light flashes orange while the camera registers valid frames where the whole wand is visible (unless you have cleared the **Enable LEDs** option in the **Properties** section for that MX Camera). When the status light turns a solid green, the camera has collected enough data to be calibrated successfully, usually 1,000 frames of valid wand data. For details on these Strobe Unit Status Indicators, see the *Get Going and Go Further with Vicon MX T-Series* books.
10. If **Auto Stop** was not selected, in the **Calibrate Cameras** section, click **Stop**. Vicon Nexus automatically starts processing the calibration information. Note that, for a system that includes video cameras, calibration is done in two passes, so the **Camera Calibration Feedback** bar progresses from 0% to 100% twice.

Tip	If you selected the **Auto Stop** option in the **Parameters** section, Nexus automatically stops collecting calibration information and starts processing it when sufficient calibration information has been acquired.

11. In the **Camera Calibration Feedback** section, monitor the progress bar until the camera calibration process is complete and review the **Wand Count** and **Image Error** data. As a general guideline, Nexus typically takes 15-60 seconds to complete its calculations for a typical Vicon MX system setup, but this can take longer for a very large system or low-specification PC. When the MX camera calibration has successfully completed, it is automatically saved to an .xcp file.

    Note that in the **Camera** view pane, a badly calibrated camera is displayed on a dark red background, enabling you to easily identify a poor calibration.

Tip	Because calibration feedback values are based on factors such as the size of the capture volume and the camera lens type, it is not possible to provide general guidelines on typical or acceptable ranges. Therefore, to determine the optimal values for your Vicon MX system, shortly after the system is installed establish a baseline against which you can compare future daily calibration values.

12. To exit calibration mode and return to your settings for live captures, click **Deactivate** in the **Video Calibration Setup** section.

Camera Calibration Parameters

You can configure settings for the following parameters in the **Calibrate Cameras** section of the **System Preparation** tools pane:

- Show Parameters

  - Calibration Type

    The level of camera calibration to be performed when the camera calibration process is started:

    - **Full Calibration:** A full camera calibration process enables the Vicon system to determine each camera's physical position and orientation in the capture volume and to correct for any lens distortions, and to set internal camera parameters. You must perform a full camera calibration when the system is first installed and set up or if your camera set up has changed.
    - – **Calibration Refinement:** A camera calibration refinement process enables you to correct a simple problem with a camera calibration. The Vicon system recalculates the previous calibration data (e.g., camera positions, orientations, and internal camera parameters) based on the current location of the cameras. You can refine an existing calibration only if the camera positions have not changed significantly.

Default: Full Calibration

  - Cameras To Calibrate

    Can be **All Cameras** or **Selected Cameras** (that is, the cameras selected in the **System** Resources tree). The selection is applied when the **Stop** button in the **Calibrate Cameras** section is clicked.

Default: All Cameras

- Refinement frames

  The minimum coverage (in number of frames) required per camera in the final phase of the refine camera calibration process.

  Default: 1000

- Wand Ratio Tolerance

  (Advanced setting) Tolerance of the distance between the markers on the wand (expressed as a ratio), to enable it to be labeled in 2D.

- Wand Straightness Tolerance

  Tolerance in alignment of wand markers (relating to the maximum angle allowable between the markers), to enable it to be labeled in 2D.

- DV Calibration frames

  The minimum coverage (in number of frames) required per DV camera for the calibration to autostop (if Auto Stop is selected).

  Default: 100

- Auto Stop

  Whether or not Nexus is to automatically stop the camera calibration process when sufficient data has been collected.

  Default: Selected

Camera Calibration Feedback

You can view the camera calibration processing and status information in the **Camera Calibration Feedback** section of the **System Preparation** tools pane:

- **Progress bar** This bar displays a percentage indicating the progress of the overall camera calibration process.
- **Camera** This column contains the device ID for each MX camera being calibrated.
- **Wand Count** For each MX camera, this value identifies the number of frames it has captured containing the calibration object. Initially, the entry for the number of wand frames is displayed in red; the entry turns green when Vicon Nexus has acquired enough wand data to calibrate that camera, typically 1000 frames.

  By default, the calibration process stops when the MX camera with the lowest frame count reaches the number of frames specified in the **Refinement frames** parameter in the **Calibrate Cameras** section.

- **Image Error** This value (in RMS distance in camera pixels) indicates the accuracy of the 3D reconstruction of the markers. This value represents the difference between the 2D image of each marker on the camera sensor and the 3D reconstructions of those markers projected back to the camera's sensor. Acceptable values depend on factors such as the size of the capture volume and the camera lens type.

Calibrating Video Cameras without an Active Wand

If you are not using an Active Wand, calibrate any supported video cameras with your Vicon MX system in the **Static Video Calibration** section of the **System Preparation** tools pane .

Vicon System Setup:

II. Calibrate the Vicon system.

3. If you are not using an Active Wand, use Static Video Calibration to calibrate any digital video cameras.

Nexus Motion Capture Workflow:

I. Prepare system.

3. Check any static video camera calibrations.

Calibrating a digital video camera enables the 3D overlay from MX cameras to be displayed with the 2D video from that digital video camera. During the video camera calibration process, Vicon Nexus creates a calibration parameters (*.xcp*) file. This file contains the calibration settings and threshold data specified for any digital video cameras (as well as the MX cameras) in your Nexus system and is used when data from these cameras is processed. You can import .cp files created in other Vicon application software (such as Vicon iQ or Workstation) for use in Nexus.

Important	As part of the first stage of the daily Nexus motion capture workflow, Vicon recommends that you calibrate your video cameras each day before you capture any data. This will ensure that any unexpected changes in your setup that may have occurred when the system was unsupervised (such as someone accidentally knocking a camera slightly out of position) will not influence the quality of your data. Before calibrating the video cameras, you must first calibrate the MX cameras and set the volume origin. You should already have configured the video camera for digital video capture. To perform a static video camera calibration, you need the 5 Marker Wand & L-frame calibration device supplied with your Vicon system.

To calibrate digital video cameras without an Active Wand:

1. Stream live camera data or load a previously captured trial containing digital video data of the 5 Marker Wand & L-Frame calibration device created by the digital video camera to be calibrated in either of the following ways:
   - In the **Resources** pane, ensure Nexus is in **Live** mode.

     From the **Data Management** window , open the desired trial.
   - From Windows Explorer, drag an *.avi* file onto a **Camera** view pane in Nexus.
2. In the **Resources** pane, click the **Live** button.
3. In the **System** resources tree, expand the **Video Cameras** node and select the digital video camera to be calibrated.
4. In the capture volume, place the 5 Marker Wand & L-frame flat on the floor in the position and orientation that you would like to be the origin of the global coordinate system.

Tip	Ideally, you should perform this step directly after MX calibration as the calibration object is already positioned at the origin and the calibrator assumes that the video calibration is also at the origin.

5. In the **System Preparation** tools pane, from the **Wand** drop-down list select the **5 Marker Wand & L-Frame** calibration object.
6. In the **Video Calibration Setup** section, click **Activate** to start calibration mode.

   If you have not already saved the current configuration, you will be alerted that you cannot proceed without doing so. Save the configuration, ensuring its name is recognizable as a calibration.

Tip	The settings for some video camera properties may differ in video calibration setup mode from those in live capture mode. For these properties, any changes made after you click **Activate** only apply during video calibration setup mode. The properties revert to their live capture settings after you click **Deactivate**. For more information, see Setting Properties for Video Cameras.

7. In the **Calibrate Cameras** section, click **Start**. The video camera calibration process starts, Nexus automatically pauses real-time data streaming, displays the video camera data in a **Camera** view pane and changes the pointer to a **Locate L-Frame Marker** shape.
8. In the **Camera** view pane, click on the center of each of the five markers on the calibration object. A circle is displayed around the area you clicked.

Tip	To adjust the position the circle, drag with the left mouse button. To adjust its radius, rotate the mouse wheel.

9. In the **Static Video Calibration** section, click **Start** to finish the static video camera calibration process. Nexus automatically displays a **3D Perspective** view pane with the digital video camera in its calibrated position in the capture volume.
10. Repeat steps 6-9 for each digital video camera to be calibrated. When the video camera calibration has successfully completed, it is automatically saved to an *.xcp* file.
11. Verify that the calibration was successful. The 3D information, such as the floor grid, markers, and virtual force plates, should overlay the 2D video image.

    If the overlays do not appear to be in the correct position, check the following:

    - Does the digital video camera itself appear in the correct position in the 3D Workspace, relative to the MX Cameras?

      If not, repeat from step 5 above, taking extra care to identify the exact center of each marker on the calibration object. If, after trying again you still have problems, move the position of the digital video camera slightly so that it views the calibration object at a slightly different angle.

    - Does the virtual force plate roughly overlay the force plate in the 2D video image, but the edges line up badly?

      If this is so, the focal length of the lens may be incorrect. Double-check the focal length specified for the camera (see Managing Video Cameras) and repeat this video camera calibration process.

    - Does the virtual force plate appear shifted to one side?

      This could be due to an inaccurate force plate offset from the volume origin. Verify the force plate setup (see Managing Force Plates) and check the overlay again. After correcting this, you do not need to repeat this video camera calibration process.

12. To exit calibration mode and return to your settings for live captures, click **Deactivate** in the **Video Calibration Setup** section.

Note	If video cameras are detached from a system but the system is not recalibrated, you can remove these cameras from the calibration if required, by clicking **Reset Calibration**. For more information, see Managing Camera Calibrations.

Setting the Global Coordinate System

Set the global coordinate system for your motion capture application in the **Set Volume Origin** section of the **System Preparation** tools pane .

Vicon System Setup:

II. Calibrate the Vicon system.

2. Set the volume origin to ensure subjects are displayed the right way up.

Setting the global coordinate system tells the Vicon system where the center of your capture volume is and what its orientation is (x, y, and z axes), so that subjects are displayed the right way up in the Nexus workspace and so that you can change the way data is visualized in the workspace. You set the global coordinate system immediately after Calibrating MX / Bonita Cameras.

Important	These steps assume that your Vicon system has already been set up appropriately for your motion capture application. For details on doing this, see Setting Up a Vicon System using Nexus. Before starting the set volume origin process, remove from the capture volume all markers and the sources of any unwanted reflections that have not been accounted for by camera masks previously created in a **Camera** view pane. To set the volume origin, you need a calibration object, which is supplied with your Vicon system.

To set the global coordinate system:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. Display a **3D Perspective** view pane.
3. In the **System Preparation** tools pane, in the **Wand** drop-down list ensure that the dynamic calibration object you used when you calibrated the MX/Bonita cameras is selected.

   Nexus determines the unit of length for calculating the volume based on the length of the calibration wand. If you specify a wand that is a different length than the one you used during the MX / Bonita camera calibration, the volume will have the wrong unit of length so Nexus will be unable to locate the calibration object.
4. From the **L-Frame** drop-down list, select the type of static calibration object you are using to set the volume origin.
5. In the capture volume, place the calibration object flat on the floor in the position and orientation that you would like to be the origin of the global coordinates system (often a force plate corner or another clearly marked area of the volume).
6. Click **Start**. The calibration object tracking process starts, Nexus identifies the calibration object in the capture volume, displays a 3D representation of it in the **3D Perspective** view pane, and switches the **Start** button to its **Set Origin** setting.
7. Click **Set Origin** to complete the calibration object tracking process. Nexus sets the global origin and axes to correspond to the position and orientation of the calibration object in the capture volume. In the **3D Perspective** view pane, the floor grid is displayed aligned with the capture volume floor and the representations of the cameras are distributed in the position and orientation in which the physical cameras are located around the capture volume. When the global coordinate system has been successfully set, it is automatically saved to an .xcp file.

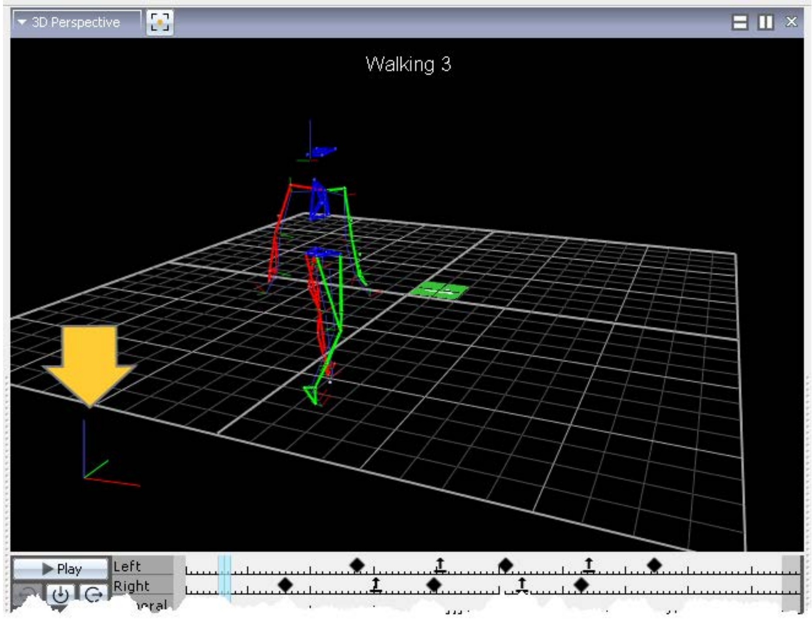
Important	When setting the volume origin, the *Core Processor* setting automatically changes to **Kinematic Fit**, then returns to its previous setting when the process is complete.

8. Verify that the global coordinate system was successfully set by checking that the system tracks the static calibration object.

9. If it does not, check the following:

   - Was the correct dynamic calibration object selected from the **Wand** drop-down list at the top of the tools pane?
   - If not, repeat this procedure from step 3, ensuring that you select the correct entry for the calibration wand you used for calibrating the MX / Bonita cameras.
   - Was the correct static calibration object selected from the **L-Frame** drop-down list at the top of the tools pane?
   - If not, repeat this procedure from step 4, ensuring that you select the correct entry for the L-Frame you are using.

   After you have set the global coordinate system, you can display the volume axes marker in the lower right corner of the **3D Perspective** view pane .



10. Turn the display on or off in the **Options Dialog Box** by selecting or deselecting **Volume Axes** under **General View Options**.

Managing Camera Calibrations

You can reset or load camera calibrations that define settings for the MX / Bonita Optical cameras and supported digital video cameras in the **Manage Camera Calibration** section of the **System Preparation** tools pane .

Nexus Motion Capture Workflow:

I. Prepare system.

4. Manage camera calibration files.

During the MX / Bonita camera calibration process, Vicon Nexus creates a calibration parameters (*.xcp*) file. As you make any changes to the currently loaded *.xcp* file, either by calibrating cameras or by setting the global coordinate system, Vicon Nexus stores the calibration state before the changes. This enables you to revert to the previous calibration or load a different calibration at any time while using Vicon Nexus. This is typically done when you connect your Nexus PC to different systems.

Changing a camera calibration can be useful in the following circumstances:

- to undo a poor calibration change
- to compare calibration changes

To manage camera calibration files in Nexus:

▶ In the **System Preparation** tools pane under the **Manage Camera Calibration** section, click the desired button:

- **Reset**

  Removes all nonexisting cameras, clears the calibrated position for existing cameras, and reverts all calibration parameters to their default settings. This enables you to recalibrate the system from a clean starting point.

- **Load**

  In the **Choose a file** dialog box, navigate to and select the desired camera calibration (*.xcp* or *.cp* file) and click **Open**.

To remove a video camera from an existing system calibration:

Use any of the following methods:

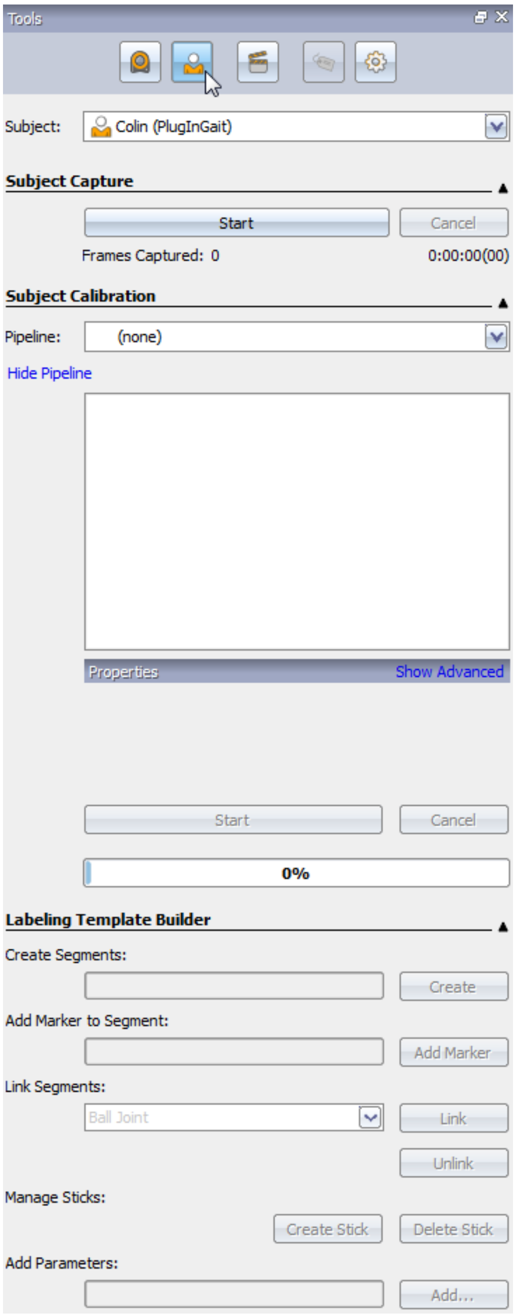
- In the **System** resources pane, right-click on the node for the camera you want to remove and select **Reset Calibration**.
- In the **System** resources pane, select the node for the camera you want to remove and in the **Properties** list, scroll down to the **Calibration** section and click **Reset Calibration**.
- In the **3D Perspective** View pane, right-click the camera that you want to remove and then click **Reset Calibration**.

Note	When you plug a video camera into the Vicon system, the system will automatically assign a number. To reorder video cameras, select the camera in the **Reorder Devices** dialog box and click **Move Up** or **Move Down**. Then click **OK**.

Subject Preparation Tools Pane

About Subject Preparation Tools Pane

Prepare subjects whose motion is to be captured and analyzed in Vicon Nexus in the **Subject Preparation** tools pane .



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Vicon Skeleton Template Preparation:

II. Build a Vicon Skeleton Template for labeling a generic subject type.

Nexus Motion Capture Workflow:

II. Prepare subject.

You must build a Vicon Skeleton Template (.vst file)– or import an existing one– for each type of subject whose motion is to be captured and analyzed in Nexus. You only need to do this once for each type of subject. Sample *.vst* file are provided under the Nexus model templates folder (by default, *C:\Program Files\Vicon\Nexus\ModelTemplates*). You must then calibrate the *.vst* file to create a Vicon Skeleton (*.vsk* file) scaled for each specific subject of that type. You must do this the first time you intend to capture a new subject and then each time you wish to use a different marker arrangement on the same subject.

Tip: As the *.vsk* file contains details on the location of markers on a specific subject, if you wish to use different marker arrangements on the same subject, you must generate a unique *.vsk* file for each marker arrangement to be used on that subject. For each marker arrangement, you need a *.vst* containing definitions of the markers to generate a corresponding *.vsk* file.

The **Subject Preparation** tools pane contains the following sections:

- Select Subject

  You select a specific Vicon Skeleton Template (*.vst* file) or Vicon Skeleton (*.vsk* file) in the **Subject** list at the top of the **Subject Preparation** tools pane. The contents of this list depend on the subject nodes enabled for capture in the **Subjects** resources pane.

- Subject Capture

  You capture a brief trial to obtain subject data in the **Subject Capture** section of the **Subject Preparation** tools pane. The subject data can be used for building or calibrating a Vicon Skeleton Template and manually labeling a subject.

- Subject Calibration

  You manage the subject calibration process to create a Vicon Skeleton (*.vsk* file) for a specific subject in the **Subject Calibration** section.

- Labeling Template Builder

  You build a generic Vicon Skeleton Template (*.vst* file) for a type of subject in the **Labeling Template Builder** section. You subsequently use this *.vst* file to calibrate a Vicon Skeleton (*.vsk* file) for a specific subject of that type.

  Tip: To use the **Labeling Template Builder**, you can follow the step by step process in the *Nexus Product Guide—Advanced Notes Creating and Using a Labeling Model*.

Capturing Subject Data

Capture a brief trial to obtain subject data in the **Subject Preparation** tools pane.

Vicon Skeleton Template Preparation:

II. Build a Vicon Skeleton Template for labeling a generic subject type.

Nexus Motion Capture Workflow:

II. Prepare subject.

3. Manually label reconstructed markers.

4. Calibrate a Vicon Skeleton for a specific subject based on a Nexus or a Plug-in Gait Vicon Skeleton Template.

You can obtain the subject data you need at various stages while working in Nexus in the following ways:

- Capture and reconstruct a static trial.
- Use a range of frames from a previously saved trial containing reconstructed and labeled markers.

You can then follow the procedures for building or calibrating a Vicon Skeleton Template and manually labeling a subject.

Important	Before capturing a static trial, ensure that you have already: – Created or opened a session in the database in which you want to store the static trial data, and ensured that it is the active session. – Created a new subject node from the appropriate Plug-in Gait template in which the subject is to be stored. For Plug-in Gait this node typically uses the patient's name or the hospital number. – Obtained the subject measurements required to run the model (required measurements are highlighted in red in the **Subjects** resources pane): the body weight and height as well as measurements of both left and right leg lengths, knee widths, and ankle widths. These are used to calculate joint center positions, and must be measured and entered into Nexus before any processing can begin. Optionally, you can also measure tibial torsion, the inter-ASIS distance, the ASIS-to-greater trochanter distance, and the sole delta if the subject is wearing shoes.

To capture a static trial and reconstruct markers for a subject in the capture volume:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. In the **System** resources tree, select **Local Vicon System** and then in its **Properties** section under **Core Processor**, set **Processing Level** to **Kinematic Fit**.
3. Display a **3D Perspective** view pane.
4. In the **Subjects** resources tree, ensure that the subject node you created from a *.vst* file is the only entry enabled for capture. When enabled, there is a check mark ☑ in the check box.
5. If required, in the **Properties** section at the bottom of the **Subjects** resources pane, add the required subject measurements you previously obtained.

6. In the **Subject Preparation** tools pane , from the **Subject** list select the subject whose motion is to be captured.
7. In the capture volume, have the subject stand in a stationary neutral pose, to enable the Vicon system to determine the location of key markers.
8. This is typically a T-pose, in which the subject stands in the basic neutral pose and raises the arms out straight to the sides with palms facing down in a position in the shape of a T, ensuring that the markers on the subject are visible to all the cameras. If the subject is not able to attain the T-pose, they can use any neutral pose where all of the markers are visible to the cameras so that the markers will be able to be to be reconstructed.
9. In the **Subject Capture** section, click **Start** to begin capturing subject data. The **Start** button switches to its **Stop** setting.
10. Click **Stop** to end the trial when enough data has been captured. For a static trial, you need to capture only a few frames of data containing all of the markers. Typically 1-2 seconds of data capture is sufficient.
11. Nexus automatically switches to **Offline** mode.
12. Reconstruct the trial.
13. Nexus automatically displays the subject data in the **3D Perspective** view pane. You can then manually label the reconstructed markers in accordance with the associated ***.vst*** file.

To use a range of frames containing reconstructed and labeled data from a previously saved trial:

1. From the **Data Management** window , open the desired trial.
2. On the **Time Bar** ruler, select a range of frames.
3. Place the **Current Time Cursor** on a frame containing the subject standing in a stationary neutral pose to enable the Vicon system to determine the location of key markers.
4. This is typically a T-pose, in which the subject stands in the basic neutral pose and raises the arms out straight to the sides with palms facing down in a position in the shape of a T. If the subject is not able to attain the T-pose, they can use any neutral pose where all of the markers are visible to the cameras so that the markers will be able to be reconstructed.

Vicon Skeleton Templates

Building Vicon Skeleton Templates

Create a Vicon Skeleton Template (*.vst* file) in the **Labeling Template Builder** section of the **Subject Preparation** tools pane .

Vicon Skeleton Template Preparation:

II. Build a Vicon Skeleton Template for labeling a generic subject type.

Building a *.vst* file in Nexus involves defining a marker set and creating and linking segments based on reconstructed markers selected in the **3D Perspective** view pane. You must build a *.vst* file for each generic type of subject whose motion is to be captured. You then use this *.vst* file to calibrate a Vicon Skeleton (*.vsk* file) scaled for each specific subject of that type. Nexus requires a *.vsk* file to reliably and automatically label a specific subject during motion capture.

You can also follow the step-by-step process in the *Nexus Product Guide—Advanced Notes Creating and Using a Labeling Model*, which includes additional hints and tips.

Important	The *.vst* file you create in Nexus is used only to define the marker set and to enable Nexus to perform automatic labeling. It is not a biomechanical model that will output valid joint angles or other kinematic/kinetic variables. To derive valid kinematics or kinetics, use either a predefined model (such as Vicon Plug-in Gait) or create your own model using Vicon BodyBuilder. In a *.vst* file created in the Nexus **Labeling Template Builder**, segments are related to the marker positions, not to the joint centers.

Creating a Vicon Skeleton Template for a generic subject type involves the following stages:

1. Define a marker set.
2. Create segments.
3. Link the segments.
4. Add parameters.

Important	Before beginning to build a Vicon Skeleton Template (*.vst* file), ensure that you have already: – Created or opened a session in the database in which you want to store the trial data, and ensured that it is the active session. – Created a blank subject node in which the *.vst* file defined here is to be stored.

Defining a Marker Set in a Vicon Skeleton Template

The first step in creating a Vicon Skeleton Template (*.vst* file) is to define a marker set for a generic subject type.

To define the marker set, you must attach Vicon markers to a subject in the arrangement you intend to define in the *.vst* file. You then capture a brief trial with the subject standing in a neutral posed where all the markers are visible to the cameras. If you are using a *.vst* file created in another Vicon application, the actual posture for a neutral pose depends upon the definition of the zero position for key joints in the kinematic model described in that *.vst* file. For example, in the supplied *PlugInGait.vst* file, the neutral pose assumes that the subject stands upright with the head level and looking straight ahead, shoulders relaxed (neither hunched forward nor pressed backward), arms hanging loosely by the sides with wrists straight and palms facing inward, pelvis level, and feet flat on the floor and pointing forward. Some third-party applications may require a specific pose of the data they are to process. For details on required poses, see the documentation supplied with the third-party application.

Important	The Plug-in Gait *.vst* files supplied with Nexus cannot be edited safely using the Labeling Template Builder. The Plug-in Gait *.vst* files contain calculations that are lost when one of these file is rewritten by Nexus after editing, which subsequently causes the Vicon Skeleton Template to not calibrate properly. If you need to edit or expand the Plug-in Gait marker set, please create the model from scratch, or edit an existing model that was initially created using the Labeling Template Builder.

Tip	When you plan your Vicon Skeleton Template (*.vst* file), ensure that the marker set you are going to define has sufficient markers to calculate all of the segment positions and orientations for the subject type. When you create your *.vst* file, you can share markers that are close to joint centers between segments. For example, a marker on the lateral epicondyle of the femur can be used to define both the distal end of the femur and the proximal end of the tibia segments. Even if markers are not strictly speaking on joints, this still provides enough information about the skeleton topology for the labeler. Similarly, the anterior superior iliac spine (ASIS) markers, which are often used to define the pelvis, can be used as the origin of the thigh segment, even though the hip joint center is some distance away.

To define a marker set in a Vicon Skeleton Template:

1. Attach Vicon markers to a subject in the arrangement you intend to define in the *.vst* file.
2. In the capture volume, have the subject stand in a stationary neutral pose, to enable the Vicon system to determine the location of key markers.
3. This is typically a T-pose, in which the subject stands in the basic neutral pose and raises the arms out straight to the sides with palms facing down in a position in the shape of a T, ensuring that the markers on the subject are visible to all the cameras. If the subject is not able to attain the T-pose, they can use any neutral pose where all of the markers are visible to the cameras so that they will be able to be reconstructed.
4. In the **Resources** pane, ensure Nexus is in **Live** mode.
5. In the **System** resources tree, select **Local Vicon System** and then in its **Properties** section under **Core Processor**, set **Processing Level** to **Reconstruct**.
6. In the **Subjects** resources tree, ensure that the blank subject node you previously created is the only entry in the resources tree enabled for capture. When enabled, there is a check mark ☑ in the check box.
7. In the **Subject Preparation** tools pane, select the blank subject node from the **Subject** list.
8. In the **Subject Capture** section, capture a brief trial and reconstruct the markers.
9. Display a **3D Perspective** view pane and view the unlabeled markers on the subject in the capture volume.

The second step in creating a *.vst* file is to create segments from the unlabeled markers you reconstructed in this stage.

Creating Segments in Vicon Skeleton Template

The second step in creating a *.vst* file is to create segments from the unlabeled markers you reconstructed in the previous stage (defining a marker set).

Caution: The name you specify in the **Create Segments** field during this step forms part of the marker label.

To ensure that your *.vst* file complies with the *.c3d* file format, keep the following in mind when you create segments from unlabeled markers:

- A marker name can contain up to 30 alphanumeric characters (A-Z and 0-9). Do not include any punctuation, spaces, or special characters.
- The first character of the name must be alphabetical. Subsequent characters can be alphanumeric. For example, "LANK1" is permitted, but "1" or "L Ankle 1" is not.
- The marker label includes the subject name automatically prefixed to the segment name. For example, if you define segment "LASI" for a subject named "Chris," the marker label name is "Chris:LASI."

To create segments in a Vicon Skeleton Template:

1. Ensure that the reconstructed and unlabeled markers created in the procedure for defining a marker set are still visible in the **3D Perspective** view pane.

   Tip: When you start creating a Vicon Skeleton Template, the blank subject node in the **Subjects** resources tree is displayed in red. When the *.vst* file is complete, the subject node turns black. When you are creating a *.vst* file from a live subject in the capture volume, ensure that the *.vst* file is complete before you resume real-time data streaming. If you switch to **Live** mode in the **Resources** pane before the *.vst* file is finished, Nexus may not be able to track or record your subject's movements.

2. In the Labeling Template Builder section, enter a name for the root segment of your subject in the **Create Segments** field and click **Create** to enter the segment creation mode. If the specified name is not unique, the **Create** button is not available.

   Tip: For human subjects, the root segment is typically the Pelvis or the Thorax, but it can be any segment—the key is that all other segments are connected in a chain originating from this segment.

   The shape of the pointer changes to include a ToolTip to guide you in the selection of markers in the **3D Perspective** view pane. Initially, a ToolTip with the text **Select the Origin Marker** hangs from the cursor.

3. In a **3D Perspective** view pane, click on the marker you wish to represent the origin of your root segment. For the Pelvis, this could be the LASI or the RASI marker.

   When the origin marker has been selected, a red sphere surrounds it, indicating that it has been assigned. The pointer ToolTip changes to **Select the Primary Axis Marker**.

4. Select the primary axis of your segment. This typically corresponds to the one representing the length of your segment. For the Pelvis, this could be the previously unused LASI or RASI marker.

   When this marker has been selected, a green sphere surrounds it, and a stick is displayed between the origin marker and this primary axis marker.

   Tip: For two segments that do not share any markers– such as the root segment– you must use at least three markers to fully define the child segment. For other

> segments, you can use only two markers. The segment's rotation around the primary axis will be undefined, but this will not affect the purpose of the *.vst* file in Nexus.

5. If the segment you are creating has more than two markers, select the additional markers according to the pointer ToolTip as follows (if your segment contains only two markers, skip this step):
    a. **Select the Secondary Axis Marker:** Select the marker that will fully define the segment by requiring the primary axis and the secondary axis marker to be in the same plane. For the Pelvis, this could be the SACR marker.
    b. When the marker is selected, a blue sphere surrounds it and further sticks are displayed between the markers.
    c. **Select an Additional Marker:** Since a segment is fully defined using three markers, the additional markers do not affect the segment's coordinate system. However, if you are using extra markers, for example for redundancy, specify them now.
    d. When an additional marker is selected, a yellow sphere surrounds it. The pointer ToolTip remains the same, enabling you to specify any number of additional markers by repeating this step.

    Tip — If you have problems selecting a marker, it may be because the selection operation actually selects something else, like the bounding box of a segment. To turn off the visualization of the segment, clear the **Subjects** option in the **Options** dialog box. The graphics displaying segmental information disappear from the **3D Perspective** view pane. You can turn this option back on when you wish to view the segment information again.

6. When you have specified all the markers attached to the segment, in the Labeling Template Builder section, click **Create** to finish creating the segment and exit the segment creation mode.

    The new segment, the selected markers, and the sticks connecting the markers in the segment as well as a bounding box around the primary axis and a local axis system with red (X), green (Y) and blue (Z) axes are now displayed in the **3D Perspective** view pane, and entries for each of these elements are added under the subject node in the **Subjects** resources tree.

    Tip — If, at any point in the steps above, you make a mistake (for example, you click on the wrong marker), you must finish creating the segment first and then use the Undo operation to remove the segment. You can do this by either using the CTRL+Z shortcut or clicking the **Undo** button on the Nexus toolbar. You can then recreate the segment. You may have to retype the name of the segment at this point.

7. Repeat steps 2-6 to create the second and subsequent segments until you have created all the segments and assigned all the markers to at least one segment in your Vicon Skeleton Template. You can reorder markers so that the manual labeling list suits your preferences.

    Tip — It is important to bear in mind that when creating child segments, the markers you select for the segment will need to be linked using an appropriate joint type in the next stage on linking segments. It is a good idea to look ahead to the next procedure to familiarize yourself with the different joint types now, so that you select the appropriate markers for segments in this step.

    For example, a free joint is typically used to link two segments that do not share any markers, and a ball joint is used to link two segments that do share one marker. So when defining child segments, for example a thigh segment that you intend to link to the pelvis segment using a ball joint, you must use one of the

> pelvis segment's markers as the origin marker of the thigh segment. In the standard gait marker set, this would mean that you would use the LASI marker as the origin, and the LKNE and LTHI markers as your other two markers for the left thigh segment. Do not worry that the LASI marker is not actually positioned on the thigh segment. The *.vst* file is used only for labeling in Nexus, so the object is to define a Vicon Skeleton Template that helps the labeler get it right, not one that is anatomically correct.

The third step in creating a *.vst* file is to link the segments you created in this stage.

Linking Segments in a Vicon Skeleton Template

The third step in creating a *.vst* file is to link the segments you created in the previous stage (creating segments)..

To link segments in Vicon Skeleton Template:

1. In a **3D Perspective** view pane, display the subject you used in the procedure for creating segments.
2. In the **Subject Preparation** tools pane, from the **Subject** list ensure the same subject is selected.
3. In the **Labeling Template Builder** section, from the **Link Segments** list, select the desired joint type (joints can have up to six degrees of freedom (DOF), which indicate how freely the joint is able to move in respect to its parent segment):
   - **Ball Joint**A 3 DOF joint with full rotational (but not translational) freedom. This joint type has the position of the child segment defined from the position of the parent and joint, but its orientation can vary freely. This joint type is typically used to link two segments that share one marker.
   - **Free Joint**A 6 DOF joint with full translational as well as rotational freedom. This joint type is typically used to link two segments that do not share any markers. It is used for the root segment to allow it to move freely with respect to the global origin; you can not change the root's joint type.
   - **Hardy Spicer Joint**A 2 DOF joint with two rotational degrees around two axes. This joint type has two perpendicular vectors defining the directions of the two axes around which the joint can rotate.
   - **Hinge Joint**A 1 DOF joint with rotational freedom around a single axis. This joint has a single vector defining the axis of the hinge.
   - **Slider Joint**A 1 DOF joint with translational freedom along a single axis. The joint has a single vector defining the axis of the slider.

   Tip: When linking segments, Vicon recommends that you use the Free Joint for two segments that do not share any marker and the Ball Joint for segments that do share markers. This will provide good labeling in most cases. The other joint types are for advanced use only.

4. In the **Labeling Template Builder** section, click **Link** to enter the segment linking mode. The shape of the cursor changes to include the pointer ToolTip **Select the Parent Segment** on a red background.
5. In the **3D Perspective** view pane, first select the parent segment of the joint (typically the proximal segment) by clicking on the bounding box surrounding the primary axis of the segment. When the segment is successfully selected, a red box surrounds it, indicating the selected status. The pointer ToolTip changes to **Select the Child Segment** on a green background.

Tip	If you have problems selecting a segment in the **3D Perspective** view pane by clicking on it, you can also select it from the **Subjects** resources tree. Expand the subject node, then its **Segments** sub node, and then select the correct parent or child segment.

6. Click on the child segment of the joint (typically the distal segment). When the segment is successfully selected, a solid cylinder is displayed between the parent and the child in the **3D Perspective** view pane, indicating that the operation was successful and that there now is a link. The pointer ToolTip changes to **Select the Parent Segment** on a red background.

   If more than one marker is shared between the two linked segments, the joint is placed at the average of these positions; otherwise, the joint is created at the origin of the child segment.

   An entry for this kinematic model element is added under the subject node in the **Subjects** resources tree. The default joint name takes the form "Parent_Child" (for example "femur-tibia"); if desired, you can rename the joint in the **Properties** section of the **Subjects** resources pane.

7. Link all the segments of your Vicon Skeleton Template in a chain that originates from the root segment:

   - To use the same joint type to link another pair of segments, repeat steps 5-6 until you have created all of the desired links with this joint type and then click **Link** to exit the segment linking mode.
   - To use a different joint type to link another pair of segments, repeat steps 4-6 and then click **Link** to exit the segment linking mode.

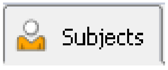
Tip	**To unlink two segments:** – Click the **Unlink** button. The shape of the cursor changes to include the pointer ToolTip **Select a Segment** on a black background – Click on a segment in the **Subject Resources** tree – Click the **Unlink** button again. The segments are now unlinked – Repeat steps 4-6 to link the unlinked segments If the two segments are required for your subject model, the subject name in the **Subjects Resources** pane will change to red font, indicating that required components for a complete Vicon Skeleton are missing.

   Once all segments have been linked, your *.vst* file is fully defined. You can then customize its properties as desired.

8. In the **Subject Preparation** tools pane , save the subject node as a Vicon Skeleton Template (.vst file).

Tip	When you save the model as a template, a *.mkr* file is automatically created along with the *.vst* file.

Adding Subject Measurements to a Vicon Skeleton Template

Add subject measurements from a Vicon Skeleton Template (*.vst* file) created in another Vicon application software to a *.vst* file created in Nexus in the **Subjects** resources pane 
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Vicon Skeleton Template Preparation:

IV. Optionally add subject measurements to the Vicon Skeleton Template.

You can add the physical measurements you have taken of your subject (such as height, weight, and limb lengths) to a Vicon Skeleton Template. If you are not using a biomechanical model that requires subject measurements, you can skip this step when you are preparing subjects for motion capture in Nexus. Subject measurements that are manually taken from the subject are typically used by a biomechanical model to calculate joint center locations or other key concepts in other Vicon application software. While they are not necessary for labeling in Nexus, you can use these subject measurements from a kinematic model if you wish.

Important	Before adding subject measurements, ensure that you have already: – Prepared a Vicon Skeleton Template. – Created a File I/O pipeline that includes an **Import MP** operation for the *.mp* file from which you intend to import subject measurements.

There are two methods for adding subject measurement. The first method (below) is recommended.

To add a subject parameter to a Vicon Skeleton Template:

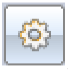
1. In the **Subjects** resources tree, click the subject node.

   The **Properties** section at the bottom of the pane is populated with the parameters and values for that subject.

2. Click the **Add Parameter** button.
3. In the Add Subject Parameter dialog box, enter the following:
   - **Name**: Enter a name for the parameter.
   - **Required**: Click if this parameter is required for the model.
   - **Unit**: Enter the measurement value (mm, deg, kg, etc.).
   - **Value**: Enter the parameter value after the subject has been measured.
   - **Default**: If no other measurement is entered, enter the measurement to be used (typically "0").
4. Click **Add**. The parameter is displayed under **General**, **Right**, or **Left**, depending on the name you assigned for it.

Note	The above method is recommended; however, the following method can also be used.

To add subject measurements to a Vicon Skeleton Template using an .mp file:

1. Prepare an *.mp* file containing the subject measurements to correspond to your *.vst* file in either of the following ways:
   a. Either obtain an existing *.mp* file from BodyBuilder or Workstation, or create an *.mp* file yourself (for details, see Model Parameters File Format).
   b. Rename the *.mp* file to correspond to the name of your *.vst* file. For example, if the name of your Vicon Skeleton Template is *LeftUpperArmForReachingExperiments.vst*, rename the model parameters file *LeftUpperArmForReachingExperiments.mp*.
2. In the **Pipeline** tools pane , select and run the pipeline you previously created to import the *.mp* file you prepared in step 1.
3. In the **Subjects** resources tree, click the subject node for the Vicon Skeleton Template.

   The **Properties** section at the bottom of the pane is populated with the parameters and values from the *.mp* file.
4. Save the subject measurements in the .vst file.

   You can then subsequently view and edit these subject properties without having to reimport the *.mp* file again.

Model Parameters File Format

The model parameters (*.mp*) file is used to store subject and model specific parameters in other Vicon application software. You can import parameters from this type of file into a *.vst* file in Nexus, where you can view, edit, and apply them. You can use an *.mp* file created by Vicon BodyBuilder or Vicon Workstation, or you can create your own *.mp* file in a standard text editor.

This format of the *.mp* file is:

```
$<Context><ParameterName1> = <Value1>
…
$<Context>< ParameterNameX> = <ValueX>
```

where:

$	The dollar sign indicates that this is a parameter which the model expects the user to enter manually. Therefore, Nexus only imports parameters prefixed with a "$" sign, for example "$ LKneeWidth."
<Context>	Parameters are automatically sorted into the appropriate context depending on the presence or absence of a context prefix (if present, the prefix must be a capital letter): L Left R Right blank General Thus, a parameter named "$ LKneeWidth" will be added to the Left context and one named "$ RKneeWidth" will be added to the Right context.
< ParameterName>	The name that uniquely identifies the model parameter.
<Value>	The actual measurement that Nexus is to use for the parameter.

Calibrating a VSK based on a Plug-in Gait VST

Create a Vicon Skeleton (*.vsk* file) for each specific subject whose motion you wish to capture in the **Subject Calibration** section of the **Subject Preparation** tools pane .

Nexus Motion Capture Workflow:

II. Prepare subject.

4. Calibrate a Vicon Skeleton for a specific subject based on a Plug-in Gait Vicon Skeleton Template.

Calibrating a Plug-in Gait Vicon Skeleton Template (*.vst* file) scales the marker and skeletal information defined in the Plug-in Gait model to a specific subject of that type, such as an individual patient. The calibration operation calculates the biomechanical model based on the actual positions of markers for a subject wearing the marker set described in the *.vst* file and creates a specific Vicon Skeleton (*.vsk* file) that is scaled to fit the particular subject. For the calibration process, you can choose to use a Knee Alignment Device (KAD) to specify the knee flexion-extension axis. This is optional, but does change the processing somewhat; any such differences are clearly described. Once the *.vsk* file has been created, it can be used to reliably label that subject during motion capture for as long as the markers are attached in the same configuration.

You must calibrate *.vsk* file the first time you intend to capture a new subject, that is at the beginning of a capture session not before every single trial. Thereafter, you only need to calibrate *.vsk* file for that subject if marker positions change or if you wish to use a different Plug-in Gait model.

You can get a copy of the *Plug-in Gait Product Guide– Foundation Notes* from the Vicon web site > Downloads page.

Important	Before calibrating a Plug-in Gait model in Nexus, ensure that you have already: – Created or opened a session in the database in which you want to store the trial data, and ensured that it is the active session. – Ensured that the appropriate Plug-in Gait *.vst* file is available: * *PlugInGait.vst* for the basic lower-body model with the LPSI/RPSI markers * *PlugInGait (SACR).vst* if using the basic lower-body model with the SACR marker * *KAD PlugInGait.vst* if using Knee Alignment Device (KAD) with the LPSI/RPSI markers * *KAD PlugInGait(SACR).vst* if using KAD with the SACR marker * *PlugInGait FullBody.vst:* for the basic full-body model * *PlugInGait FullBody (SACR).vst*: for the basic full-body model with the SACR marker * *PlugInGait FullBody (UPA and FRM).vst*: with additional UPA and FRM markers Sample *.vst* files are provided under the Nexus model templates folder (by default, *C:\Program Files\Vicon\Nexus\ModelTemplates*) – Created a new subject node from the appropriate Plug-in Gait template in which the subject is to be stored. For Plug-in Gait this node typically uses the patient's name or the hospital number. – Attached the Vicon markers to the subject in accordance with the marker set defined in the associated Plug-in Gait *.vst* file. Attach the Knee Alignment Device (KAD) if you are using one; otherwise, take great care in positioning the knee and thigh markers. – Obtained the subject measurements required to run the model (required

measurements are highlighted in red in the **Subjects** resources pane): the body weight and height as well as measurements of both left and right leg lengths, knee widths, and ankle widths. These are used to calculate joint center positions, and must be measured and entered into Nexus before any processing can begin. Optionally, you can also measure tibial torsion, the inter-ASIS distance, the ASIS-to-greater trochanter distance, and the sole delta if the subject is wearing shoes.

– Captured a brief static trial or obtained a single frame of live data with reconstructed and labeled markers corresponding to the marker set specified in the associated *.vst* file.

To calibrate a Vicon Skeleton based on a Plug-in Gait Vicon Skeleton Template:

1. In the **Resources** pane, ensure Nexus is in **Offline** mode.
2. Display a **3D Perspective** view pane containing the frame of reconstructed and labeled markers for the subject.
3. In the **Subjects** resources tree, ensure that the subject node you created from the Plug-In Gait *.vst* file is the only entry enabled for capture. When enabled, there is a check mark in the check box.
4. In the **Subject Preparation** tools pane, from the **Subject** list select the subject node.
5. In the **Subject Calibration** section, from the **Pipeline** list select the **Static Plug-in Gait** pipeline, ensure that only the **Run static gait model** operation is selected, and click the **Start** button to run the operation.

   Tip: This Nexus supplied pipeline contains the following operations available from the specified categories:

   Calibration section:

   – **Static Subject Calibration**: Calibrates the subject bone lengths, joint locations, and marker locations. This operation is required only if your subject is wearing a Knee Alignment Device (KAD).

   Workstation Operations section:

   – **Run Static gait model**: Runs the static calibration model to calculate offset angles required for running the dynamic model.

   You can view or change settings for the operation in the **Properties** section below the list of pipeline operations.

   The progress bar at the bottom of the **Subject Calibration** section displays a percentage indicating the progress of the operation. The **Start** button switches to its **Stop** setting.

6. Verify that Plug-in Gait has successfully calculated the biomechanical model based on the measured marker positions. In the 3D Perspective view pane, ensure that additional markers corresponding to the joint centers and segment orientations calculated by Plug-in Gait are displayed.

   If they are not, check the following:

   - Have you attached the correct Plug-in Gait *.vst* file to the subject node in the **Subjects** resources pane?
   - Ensure that all the correct subject measurements are displayed in the **Properties** section at the bottom of the **Subjects** resources pane, and all the correct marker names are displayed in the **Manual Labeling** list in the **Label/Edit** tools pane.
   - Have you entered all the required subject measurements?

- If the subject node name in the **Subjects** resources pane is displayed in red, that indicates that the *.vst* file is incomplete. Hover the pointer over the red text to display a ToolTip identifying the nature of the problem
- Have you reconstructed all the markers?
- Check that there is one 3D reconstruction in the **3D Perspective** view pane for each marker the subject is wearing. Reconstructed markers appear as white spheres before they are manually labeled.
- Have you labeled all the markers correctly?
- Check that all markers are connected by sticks in the **3D Perspective** view pane and that the sticks connecting makers on the left side are red and that those on the right side are green.

7. If you initially associated one of the Plug-in Gait .vst files for use with a KAD, you must now associate a different .vst file to account for the KAD not being worn during dynamic trials. In the Subjects resources pane, attach the corresponding basic Plug-in Gait .vst file as indicated in the following table.

Plug-in Gait VST (with KAD)	Plug-in Gait VST (no KAD)
KAD PlugInGait.vst	*PlugInGait.vst*
KAD PlugInGait (SACR).vst	*PlugInGait (SACR).vst*

The sticks connecting the KAD markers (KAX, KD1, KD2) are replaced by a virtual knee marker.

8. In the **Subject Preparation** tools pane, from **Pipeline** list select the **Static Plug-in Gait** pipeline, ensure that only the **Static Subject Calibration** operation is selected, and click the **Start** button to run the operation.

Important	The **Static Subject Calibration** operation relies on a single frame of correctly labeled markers corresponding to the *.vst* file you are using. It is very important to ensure that the labels are present and correct in your *.vst* file and that you have manually labeled your trial before running the **Static Subject Calibration** operation. If your markers are not labeled, the operation will fail. If your markers are erroneously labeled (for example, if left and right markers have been mistakenly swapped) the operation will succeed, but when the Vicon Skeleton (*.vsk* file) is later used for automatic marker labeling, it will continue to produce the erroneous labels.

The progress bar at the bottom of the **Subject Calibration** section displays a percentage indicating the progress of the operation. The **Start** button switches to its **Stop** setting.

9. Verify that Nexus has successfully created a Vicon Skeleton and it is automatically labeling.

In the **3D Perspective** view pane, ensure that bounding boxes for Plug-in Gait model segments are displayed. The bounding boxes Nexus draws around each segment defined in the *.vsk* file are for visualization purposes only.

If you do not see any data in real time, the markers are not being automatically labeled in **Live** mode, or the real-time data seems wrong, check the following:

- Is Nexus in **Live** mode?

  If not, in the **Resources** pane, click the **Live** button.

- Is the **Core Processor** set to at least the **Label** level?

  If not, in the **System** resources pane, select the **Local Vicon System** node. In the **Properties** section under **Core Processor**, ensure that the **Processing Level** parameter is set to **Label** or **Kinematic Fit**.

- Did you change the *.vst* file before performing dynamic captures?

  The KAD *.vst* files include KAD markers in the marker set. Since a KAD device is not used during dynamic trials, you must changed the *.vst* file to one that does not contain the KAD markers, as described in step 7.

- Are the reconstructed markers displayed in **3D Perspective** view pane with labels or sticks?

  Ensure that the *.vsk* file has been correctly created, as described in step 8. In the **Options** dialog box, ensure the **Subjects** option is selected.

- Are your labeling parameters set correctly?

  If not, in the **System** resources pane, select the **Local Vicon System** node. In the **Properties** section under **Core Processor**, try adjusting the settings of the **Label Model Rigidity** parameter.

10. Save the trial.

Calibrating a VSK based on a VST Built in Nexus

Calibrate a Vicon Skeleton (*.vsk* file) for each specific subject whose motion you wish to capture in the **Subject Calibration** section of the **Subject Preparation** tools pane .

Nexus Motion Capture Workflow:

II. Prepare subject.

4. Calibrate a Vicon Skeleton for a specific subject based on a Nexus Vicon Skeleton Template.

Calibrating a Vicon Skeleton Template (*.vst* file) scales the marker and skeletal information defined for a generic type of subject to a specific subject of that type, such as an individual patient. The calibration operation calculates the real length of segments and the actual positions of markers for a subject wearing the marker set described in the *.vst* file and creates a specific Vicon Skeleton (*.vsk* file) for that subject. Once the *.vsk* file has been created, it can be used to reliably label that subject during motion capture for as long as the markers are attached in the same configuration.

You must calibrate *.vsk* file the first time you intend to capture a new subject, that is at the beginning of a capture session not before every single trial. Thereafter, you only need to calibrate *.vsk* file for that subject if marker positions change or if you wish to use a different marker arrangement.

You can also follow the step-by-step process in the *Nexus Product Guide—Advanced Notes Creating and Using a Labeling Model*, which includes additional hints and tips.

Important	Before beginning the subject calibration process, ensure that you have already: – Created or opened a session in the database in which you want to store the trial data, and ensured that it is the active session.

– Built a Vicon Skeleton Template or obtained an existing .vst file corresponding to the type of subject whose motion is to be captured.

– Created a new subject node from the template in which the *.vsk* file created here is to be stored.

– Attached the Vicon markers to the subject in accordance with the marker set defined in the associated *.vst* file.

– Obtained a frame of reconstructed and labeled markers corresponding to the marker set specified in the associated *.vst* file.

To calibrate a VSK based on a VST built in Nexus:

1. In the **Resources** pane, ensure Nexus is in **Offline** mode.
2. Display a **3D Perspective** view pane containing the frame of reconstructed and labeled markers for the subject.
3. In the **Subjects** resources tree, ensure that the subject node you created from the template is the only entry enabled for capture. When enabled, there is a check mark ☑ in the check box.
4. In the **Subject Preparation** tools pane , from the **Subject** list select the subject node.
5. In the **Subject Calibration** section, from the **Pipeline** list select the **Calibrate Labeling Model** pipeline, ensure that the **Static Subject Calibration** operation is selected ☑, and click the **Start** button.

   Important

   > This Nexus supplied pipeline contains the following operation available from the specified category:
   >
   > **Calibration** section:
   >
   > – **Static Subject Calibration**: Calibrates the subject bone lengths, joint locations, and marker locations.
   >
   > You can view or change settings for the operation in the **Properties** section below the list of pipeline operations.
   >
   > The **Static Subject Calibration** operation relies on a single frame of correctly labeled markers corresponding to the *.vst* file you are using. It is very important to ensure that the labels are present and correct in your template and that you have manually labeled your trial before running the **Static Subject Calibration** operation. If your markers are not labeled, the operation will fail. If your markers are erroneously labeled (for example, if left and right markers have been mistakenly swapped) the operation will succeed, but when the *.vsk* file is later used for automatic marker labeling, it will continue to produce the erroneous labels.

   The static subject calibration operation is run on the paused real-time data. The progress bar at the bottom of the **Subject Calibration** section displays a percentage indicating the progress of the overall subject calibration process.

6. Verify that the Vicon Skeleton was successfully created by checking that Nexus correctly labels and tracks the subject's movement.

   In the **Resources** pane, switch Nexus to **Live** mode and then ask your subject to move around in the capture volume. In the **3D Perspective** view pane, you should see the markers being automatically labeled and the subject being tracked.

If the Vicon Skeleton is not being fitted to the labeled markers, check the following:

- Have all the markers in your *.vst* file been identified?

  For the subject calibration to succeed, all the markers specified in the *.vst* file must be identified in the **3D Perspective** view pane. To see if you have successfully done this, in the **Subjects** resources pane, expand the subject node for your *.vsk* file, then expand its **Markers** sub node, and ensure that its list of markers includes all of those defined in the *.vst* file. Markers that have not been identified are shown in gray text; markers that have been identified are shown in black text.

- Is the subject node name in the **Subjects** resources pane displayed in red?

  The red color indicates that something is missing and that the *.vsk* file is incomplete. This could be due either to the *.vst* file on which it was based not being fully developed, for example links might be missing between segments, or to required subject measurements not being defined. Hover the pointer over the red text to display a ToolTip identifying the nature of the problem.

- Is the display of subjects turned on in the view options?

  In the **Options** dialog box, ensure the **Subjects** option is selected.

  If the markers are not being automatically labeled in **Live** mode, check the following:

- Is the **Core Processor** set to at least the **Label** level?

  If not, in the **System** resources tree, select **Local Vicon System** and then in its **Properties** section under **Core Processor**, ensure that the **Processing Level** parameter is set to **Label** or **Kinematic Fit**.

- Is the correct subject selected?

  In the **Subjects** resources pane, ensure that the Vicon Skeleton node is enabled for capture. When enabled, there is a check mark ☑ in the check box.

- Are your labeling parameters set correctly?

  If not, in the **System** resources tree, select the **Local Vicon System** and then in its **Properties** section under **Core Processor**, try adjusting the settings of the **Label Model Rigidity** and **Quality/Speed** parameters.

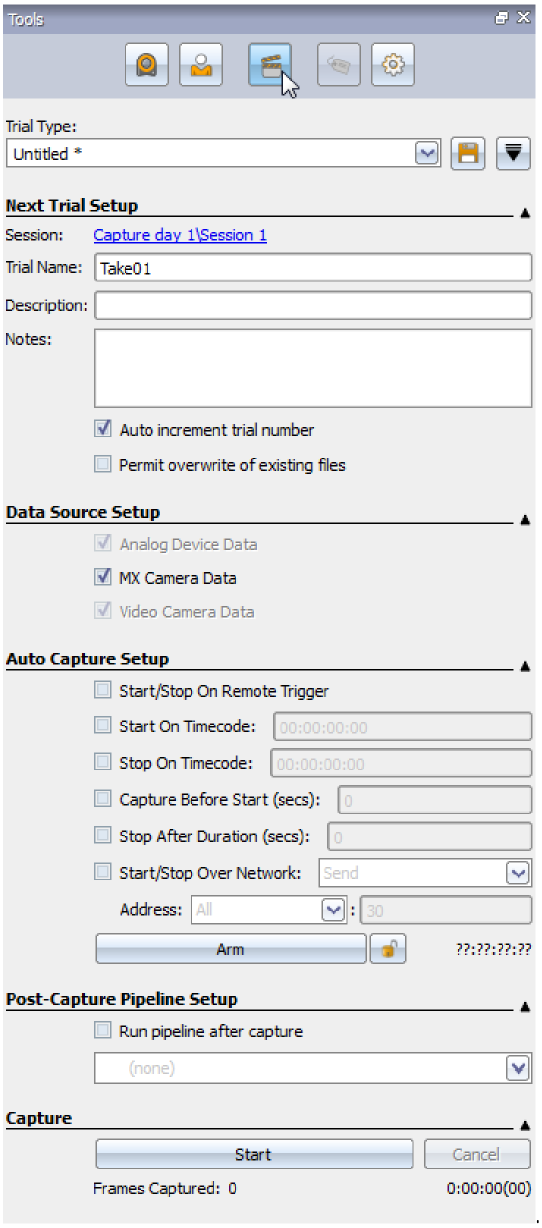
7. Save the Vicon Skeleton in a *.vsk* file.

Tip	If you do not explicitly save your *.vsk* file, Nexus automatically saves a *.vsk* file in the active session in your motion capture database when you capture a trial with this subject.

Capture Tools Pane

About Capture Tools Pane

You can acquire motion data in the **Capture** tools pane 



Nexus Motion Capture Workflow:

III. Capture and process a trial.

Capturing motion data involves identifying where in a motion capture trial database to store the data, specifying the type of source data that is to be captured, optionally configuring any remote triggering, optionally determining any automated processing to be performed, and managing the capture process. You can capture trials manually or configure Nexus to capture trials automatically.

The **Capture** tools pane contains the following sections:

- Capture Configuration Management

  Create or manage configurations for the motion capture **Trial Types** specified in the **Capture** tools pane using the **Configuration Management** section at the top of the pane.

- Next Trial Setup

  Specify identification and information details for the way Nexus is to store data for this trial in a motion capture database in the **Next Trial Setup** section of the **Capture** tools pane:

  Session

  A link for the active subject\session node in the currently loaded trial database. Click the link to open the **Data Management** window, or bring it to the front if already open, with the active node highlighted. If you make a different session the active node, this **Session** link is updated in the **Capture** tools pane.

  Default: Identified by system

  Trial Name

  The name under which to save the trial data in the motion capture database.

  Default: Blank

  Caution

  Do not use the following special characters in a trial name:

\	backslash	.	period
/	slash mark	,	comma
<	left angle bracket	?	question mark
>	right angle bracket	*	asterisk
:	colon	"	double quotation mark
|	vertical bar	%	percent
$	dollar sign		

  Description

  Any description you want to specify for the trial. This value is displayed in the **Data Management** window in the row associated with the captured trial.

  Default: Blank

  Notes:

  Any notes you want to specify for the trial. This value is displayed in the **Data Management** window in the row associated with the captured trial.

  Default: Blank

Auto increment trial number

Whether or not to have Nexus automatically add a numerical suffix to the trial name for each subsequent trial, for example, *Trial001*, *Tria002*, *Trial003*, etc.

Default: Selected

Permit overwrite of existing files

Whether or not to have Nexus overwrite an existing data file without prompting the user with a warning that it has the same name as that specified in the **Trial Name** field with this trial data.

If the **Auto increment trial number** option is selected and the file name which would be created using the next sequential numerical suffix is the same as that for an existing file, that previous file is overwritten.

Default: Cleared

Data Source Setup

Specify the type of motion data to be captured by your Nexus system in the **Data Source Setup** section of the **Capture** tools pane:

Analog Device Data

Analog signals captured by any third-party analog devices such as force plates or EMG devices.

Default: Selected

MX Camera Data

Marker images visible to the MX / Bonita cameras

Default: Selected

Video Camera Data

Digital video captured by any third-party digital video cameras.

Default: Selected

Note	Although Bonita cameras are not technically part of the MX family of cameras, references in this help system to "MX camera" also apply to the use of Bonita cameras within Nexus.

Auto Capture Setup

Configure Nexus to automatically trigger motion capture in the **Auto Capture Setup** section of the **Capture** tools pane:

Start/Stop On Remote Trigger

Whether or not to trigger or stop motion capture using a remote-control device integrated into your Vicon system.

Default: Cleared

Start on Timecode

Whether or not to trigger motion capture based on the timecode specified in standard `hh:mm:ss:ff` format.

Default: Cleared

Stop on Timecode

Whether or not to stop motion capture based on the timecode specified in standard `hh:mm:ss:ff` format.

Default: Cleared

Capture Before Start (secs)

Whether or not to enable the system to record data during the specified number of seconds prior to capture being triggered either manually (with the **Start** button) or automatically (based on timecode or a remote control device). The amount of time available for recording data prior to triggering capture is affected by the **Buffer Size (MB)** and **Frame Rate (Hz)** properties for the **Local Vicon System** node in the **System** resources pane.

Default: 0

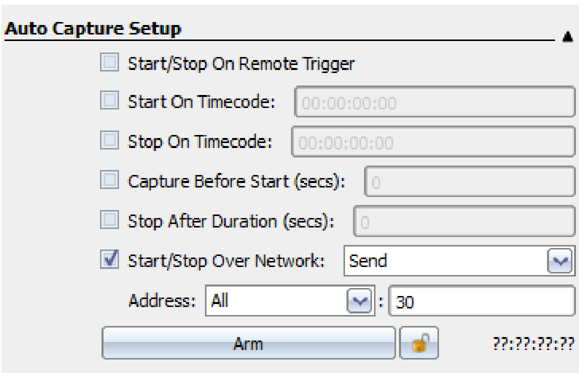
Stop After Duration (secs)

Whether or not to automatically stop motion capture after the specified number of seconds.

Default: Cleared

Start/Stop Over Network

Send or receive a trigger to or from third-party software that broadcasts or receives UDP triggering signals. Select **All** or a specified network adaptor address. Enter the port number in the text box .



Default Network Address: All Default Port Number: 30

Arm

If the system must be set to a state where it is receptive to triggers for automatic capture based on a remote control device or timecode, click the **Arm** button so it appears pressed in and the other **Capture** settings are disabled. At the end of the capture, the **Arm** button automatically pops up again, indicating that the system is no longer receptive to remote triggers.

To cause the system to remain receptive to subsequent remote capture triggers without having to click the **Arm** button again, click the adjacent Lock button.

Default: Unselected

Current Timecode

The current timecode (if present).

Default: Read from system

Post-Capture Pipeline Setup

Specify any automatic post-processing Nexus is to perform on the captured data in the **Post-Capture Pipeline Setup** section of the **Capture** tools pane:

Run pipeline after capture

Whether or not to run a previously defined pipeline immediately after the trial is captured.

Select the desired pipeline from the drop-down list.

Default: Cleared

Capture

Manage the motion capture process and view the number of frames captured and the current duration in seconds during processing in the **Capture** section of the **Capture** tools pane:

Start/Stop

Click this button to start a capture. When clicked, the button switches to the **Stop** setting.

If you have set the **Stop after Duration** or **Stop on Timecode** settings in the **Auto Capture Setup** section, or if there is data in the buffer that has still to be written to disk, the button switches to **Stopping** until the capture has completed. If you click the button while it displays **Stopping**, the capture stops, and you will lose any data that was due to be captured, or that is currently in the buffer but not yet written to disk.

Cancel

Click this button to cancel an active capture.

Frames Captured

The number of frames captured in the current trial. This number increments until the motion capture process is stopped.

Trial Time

The amount of time elapsed during the current capture in `hh:mm: ss(ff)` format, where `hh` is hours, `mm` is minutes, `ss` is seconds and `ff` is frames. For example, a 2.5 second capture at 50 Hz (125 frames) is displayed as 00:00:02(125).

Capturing Trials Manually

Capture a trial manually for motion measurement and analysis in the **Capture** tools pane .

Nexus Motion Capture Workflow:

III. Capture and process a trial.

1. Capture a trial manually.

During a motion capture trial, a subject wearing Vicon markers in the arrangement specified in the Vicon Skeleton (*.vsk* file) moves in the capture volume, and Vicon Nexus automatically reconstructs the markers and fits them to the subject in real time. If you are using force plates, the force vector is also shown in real time as the subject steps on the force plates. You can stream motion data in real time or capture raw camera data for offline processing. You can capture a trial manually as described in this topic, or you can configure Nexus to capture a trial automatically.

Important

Before capturing a dynamic trial, ensure that you have already:

– Created or opened a session in the database in which you want to store the trial data, and ensured that it is the active session.

– Created a new subject node from a template or loaded an existing .vsk file for the subject whose motion is to be captured.

– Attached the Vicon markers to the subject in accordance with the marker arrangement used in the *.vsk* file.

If you are using Plug-in Gait, Vicon recommends that you do not remove the heel markers for the dynamic captures. Their presence does not affect the calculated output from Plug-in Gait, but it does improve the reliability of the automatic labeling in Nexus.

To capture a trial manually:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. Display a **3D Perspective** view pane.
3. In the **Capture** tools pane , under the **Capture Configuration Management** section select an existing capture configuration for the trial from the **Trial Type** list or create a new one.
4. In the **Next Trial Setup** section, fill in the details for storing your trial data in the active session.
5. In the **Data Source Setup** section, select **MX Camera Data** and any of the other options applicable to your capture. If you select **Video Camera Data**, you may need to configure Nexus to transcode and transfer the digital video data.
6. In the **Post-Capture Pipeline Setup** section, specify any pipelines containing operations to be run automatically on the trial data when the capture is complete.

Tip

If you are using Plug-in Gait, select **Run pipeline after capture** and select the **Dynamic Plug-in Gait** pipeline. This Nexus supplied pipeline contains the following operations available from the specified categories:

Processing section:

– **Core Processing**: Reconstruct and label the 3D marker data.

File I/O section:

– **Export C3D**: Save the trial data to a *.c3d* file for import into other software for further processing or report generation. For example, in Vicon Polygon you can visualize the trajectories, kinematic model elements, and kinetics data. If you manually import the corresponding *.vst* file into Polygon, it also visualizes the bones.

Workstation Operations section:

– Apply Woltring filtering routine: Filter the data using the Woltring filter to ensure smooth trajectories for calculating kinetics

– Detect gait cycle events: Automatically detect gait cycle events based on force plate strikes, and add these to the Time Bar.

– Autocorrelate events: Automatically correlate these events to extract other foot contact and foot off events where the subject was not stepping on the force plate.

– Run dynamic gait model: Process Plug-in Gait to generate kinematic and kinetic data.

7. In the System resources tree, select Local Vicon System and then in its Properties section under Core Processor, set Processing Level to Kinematic Fit.
8. In the capture volume, have the subject with the Vicon markers attached perform the desired movements.

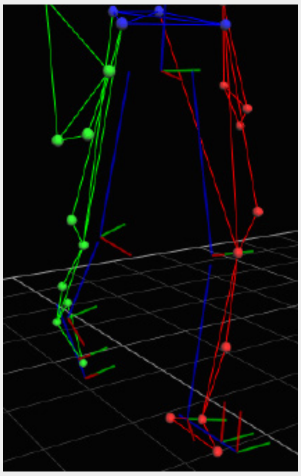
   Nexus reconstructs, labels, and fits the Vicon Skeleton created in the previous stage to the subject in real time.

   Tip — If a labeling error is obvious or persistent, you can manually restart the labeler by rebooting the Core Processor from the Local Vicon System node in the System resources tree.

9. In the Capture tools pane, under the Capture section click Start.

   The MX / Bonita cameras capture the markers on the subject moving in the capture volume and the Start button switches to its Stop setting.

   Tip — If you are using Plug-in Gait, any virtual markers generated by Plug-in Gait, such as an OPLA (Origin Proximal Lateral Anterior) trajectories, are displayed in the 3D Perspective view pane as Vicon X,Y,Z coordinate systems with red, green, and blue axes with the blue axis corresponding to the long axis of the segment .



   If the subject steps on the force plates, the force vector is also shown in real time in the 3D Perspective view pane.

10. After you have acquired the data you need, click Stop. Alternatively, if you had selected the Stop After Duration (secs) option in the Auto Capture Setup section, Nexus automatically stops the capture after the specified number of seconds.

    Nexus automatically switches to **Offline** mode, displays the subject data in the **3D Perspective** view pane, and automatically performs the operations contained in any pipeline selected in the **Post-Capture Pipeline Setup** section.

Tip	If you are using Plug-in Gait, the **Detect gait cycle events** pipeline operation relies on good force plate strikes and clean trajectories in order to automatically detect events. This, unfortunately, is not always the case, and sometimes manual event identification is necessary. To do this, you use the **Enter Event Identification Mode** on the **Time Bar**.

11. Repeat steps 8-10 until you have obtained the required number of trials.

Capturing Trials Automatically

Configure automatic data capture in the **Capture** tools pane .

Nexus Motion Capture Workflow:

III. Capture and process a trial.

1. Automatically trigger motion capture remotely.

This is an optional step, depending on whether you want to trigger data capture using an external device or based on a specified period of time. As with manually capturing a trial, a subject wearing Vicon markers in the arrangement specified in the Vicon Skeleton (*.vsk* file) moves in the capture volume, and Vicon Nexus automatically reconstructs and labels the markers and fits them to the subject in real time.

You can configure Vicon Nexus to automatically capture trials using the following methods:

- **Remote Trigger**Use an external remote control device to trigger data capture in your MX system. The remote control device must be connected to an MX Giganet, MX Ultranet, or MX Control unit in your MX system (for details, see the *Go Further with Vicon MX T-Series* reference), and the sync outputs (GPO pins) for the remote functionality must be configured under the MX Giganet, MX Ultranet, or MX Control node in the **System** resources pane System.
- **Timecode**Use an external timecode source to trigger data capture in your MX system. The timecode source must be connected to an MX Giganet, MX Ultranet, or MX Control unit in your MX system (for details, see the *Go Further with Vicon MX T-Series* reference book), and the corresponding timecode options must be configured under the MX Giganet, MX Ultranet, or MX Control node in the **System** resources pane System.
- **Capture before Start**Specify the number of seconds of data to record prior to capture being triggered either manually (with the **Start** button) or automatically (based on timecode or a remote control device).
- **Elapsed Time**Specify a time period after which Nexus is to automatically stop a capture.
- **Broadcast over a Network**Broadcast a UDP message over an intranet or direct network cable connection to or from another application (or instance of Nexus) to trigger capture

start and stop. Note that Nexus can send or receive the messages, but it cannot send and receive them simultaneously.

Important	Before capturing a static trial, ensure that you have already: – Created or opened a session in the database in which you want to store the trial data, and ensured that it is the active session. – Created a new subject node from a template or loaded an existing .vsk file for the subject whose motion is to be captured. – Attached the Vicon markers to the subject in accordance with the marker arrangement used in the *.vsk* file.

Use one of the following procedures to automatically capture trials with Vicon Nexus:

To trigger data capture using a remote control device:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. Display a **3D Perspective** view pane.
3. In the **Capture** tools pane , under the **Capture Configuration Management** section select an existing capture configuration for the trial from the **Trial Type** list or create a new one.
4. In the **Next Trial Setup** section, fill in the details for storing your trial data in the active session.
5. In the **Data Source Setup** section, select **MX Camera Data** and any of the other options applicable to your capture. If you select **Video Camera Data**, you may need to configure Nexus to transcode and transfer the digital video data.
6. In the **Auto Capture Setup** section select **Start/Stop On Remote Trigger**.
7. To set the system to a state where it is ready to accept a trigger signal for automatic capture based on a remote control device, click the **Arm** button.

   If you want to enable the system to remain ready to receive subsequent remote capture signals after the capture is stopped, click the Lock button to the right of the **Arm** button.
8. Trigger the start of the capture from your remote control device.

   The MX cameras capture the markers on the subject moving in the capture volume and the **Start** button switches to its **Stop** setting.
9. After you have acquired the data you need, trigger the stop of the capture from your remote control device.

   If you clicked the Lock button, the **Arm** button is re-enabled and the **Stop** button switches to its **Start** setting, ready for a subsequent remote capture. When you have finished your capture session, you must manually load the trial to review your subject data.

To trigger data capture using timecode:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. Display a **3D Perspective** view pane.
3. In the **Capture** tools pane , under the **Capture Configuration Management** section select an existing capture configuration for the trial from the **Trial Type** list or create a new one.

4. In the **Next Trial Setup** section, fill in the details for storing your trial data in the active session.
5. In the **Data Source Setup** section, select **MX Camera Data** and any of the other options applicable to your capture. If you select **Video Camera Data**, you may need to configure Nexus to transcode and transfer the digital video data.
6. In the **Auto Capture Setup** section select one or both of the following options:
   - **Start On Timecode:** Select this check box and specify the timecode at which capture should automatically start.
   - **Stop On Timecode:** Select this check box and specify the timecode at which capture should automatically stop.

   Specify these start and stop values in the standard timecode format:

   `hh:mm:ss:ff`

   where:

   `hh` = hours (0-23)

   `mm` = minutes (0-59)

   `ss` = seconds (0-59)

   `ff` = frames (0-24 for PAL/SECAM, 0-29 for NTSC)

   For NTSC, the separator character changes between a colon (:) for non-drop frames and a semicolon (;) for drop frames.

   For further details on the use of timecode functionality in Vicon MX, see the *Get Going and Go Further with Vicon MX T-Series* books.
7. To set the system to a state where it is ready to accept a trigger signal for automatic capture based on a timecode, click the **Arm** button.

   If you want to enable the system to remain ready to receive subsequent timecode signals after the capture is stopped, click the Lock button to the right of the **Arm** button.
8. If you selected the **Start On Timecode** check box, start the timecode source from which the data capture is to be triggered; otherwise, under the **Capture** section click the **Start** button.

   When the specified timecode is reached, the MX cameras capture the subject moving in the capture volume and the **Start** button switches to its **Stop** setting.
9. If you selected the **Stop On Timecode** check box, when the specified timecode is reached capture stops; otherwise, after you have acquired the data you need, click the **Stop** button.

   Nexus automatically switches to **Offline** mode and displays the subject data in the **3D Perspective** view pane.

To stop data capture after elapsed time:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. Display a **3D Perspective** view pane.
3. In the **Capture** tools pane , under the **Capture Configuration Management** section select an existing capture configuration for the trial from the **Trial Type** list or create a new one.
4. In the **Next Trial Setup** section, fill in the details for storing your trial data in the active session.

5. In the **Data Source Setup** section, select **MX Camera Data** and any of the other options applicable to your capture. If you select **Video Camera Data**, you may need to configure Nexus to transcode and transfer the digital video data.
6. In the **Auto Capture Setup** section select **Stop After Duration (secs)** and specify the number of seconds after which to automatically stop motion capture.
7. Capture a trial manually or using one of the remote capture methods described earlier in this topic.

   The MX / Bonita cameras capture the subject moving in the capture volume. Nexus automatically stops the capture after the specified number of seconds, automatically switches to **Offline** mode, and displays the subject data in the **3D Perspective** view pane.

To automatically record data before capture is triggered:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. Display a **3D Perspective** view pane.
3. In the **Capture** tools pane , under the **Capture Configuration Management** section select an existing capture configuration for the trial from the **Trial Type** list or create a new one.
4. In the **Next Trial Setup** section, fill in the details for storing your trial data in the active session.
5. In the **Data Source Setup** section, select **MX Camera Data** and any of the other options applicable to your capture. If you select **Video Camera Data**, you may need to configure Nexus to transcode and transfer the digital video data.
6. In the **Auto Capture Setup** section select **Capture Before Start (secs)** and specify the number of seconds to record data prior to capture being triggered.
7. Trigger the capture manually or using one of the remote capture methods described earlier in this topic.

   The MX / Bonita cameras capture the subject moving in the capture volume.
8. Stop the capture manually or using one of the remote capture methods described earlier in this topic.

   Nexus automatically switches to **Offline** mode and displays the subject data in the **3D Perspective** view pane.

To trigger data capture over a network:

1. In the **Resources** pane, ensure Nexus is in **Live** mode.
2. Display a **3D Perspective** view pane.
3. In the **Capture** tools pane , under the **Capture Configuration Management** section select an existing capture configuration for the trial from the **Trial Type** list or create a new one.
4. In the **Next Trial Setup** section, enter the details for storing your trial data in the active session.
5. In the **Data Source Setup** section, select **MX Camera Data** and any of the other options applicable to your capture.
6. In the **Auto Capture Setup** section select **Start/Stop Over Network** and from the adjacent drop-down list, select **Send** or **Receive**.

7. In the **Address** field, either select the IP address of the network card that will be used to send or receive the start/stop trigger message, or select **All**. In the adjacent field, specify the UDP port which is to send or receive the message.
8. To set the system to a state where it is ready to accept a trigger signal for automatic capture based on a signal broadcast over the network, click the **Arm** button.

   If you want to enable the system to remain ready to receive subsequent network signals after the capture is stopped, click the Lock button to the right of the **Arm** button.
9. Start the capture from the remote software. You can start the capture using a timecode or immediately.

Reconstructing Trial Data

Reconstruct trial data using buttons in the Nexus toolbar.

Nexus Motion Capture Workflow:

II. Prepare subject.

   2. Capture a static trial and reconstruct markers.

III. Capture and process a trial.

   2. Reconstruct and automatically label the trial data.

If you are capturing a subject for the first time and need to label the markers to calibrate a Vicon Skeleton (*.vsk* file), you must first reconstruct the raw camera data to create 3D markers. If you are capturing a subject for whom a *.vsk* file has previously been calibrated, you must first reconstruct and label the raw camera data to create 3D markers.

To reconstruct trial data:

1. Display the subject whose data is to be reconstructed in either of the following ways:
   - Ensure that the raw marker data for a subject in the capture volume is still visible in a **Camera** view pane and in the **Resources** pane, ensure Nexus is in **Offline** or **Pause** mode.
   - From the **Data Management** window , open the desired trial file containing raw trial data for that subject.
2. From the Nexus toolbar, click the **Reconstruct**  button.

   This runs the "Reconstruct" operation defined in the **Pipeline** tools pane. The Running Pipeline progress bar is displayed, indicating when the operation is complete.

To reconstruct and label trial data:

1. Display the subject whose properties are to be edited in either of the following ways:
   - Ensure that reconstructed and unlabeled markers for a subject in the capture volume are visible in the **3D Perspective** view pane and in the **Resources** pane, ensure Nexus is in **Offline** or **Pause** mode.
   - From the **Data Management** window , open the desired trial file containing reconstructed and labeled data for that subject.

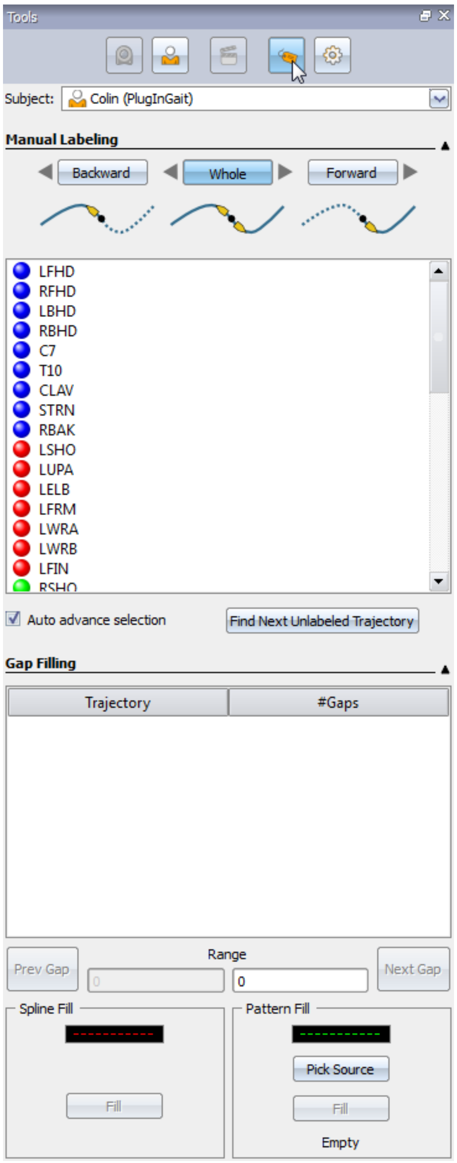
2. From the Nexus toolbar, click the **Reconstruct and Label** button.

   This runs the "Reconstruct and Label" operation defined in the **Pipeline** tools pane. The **Running Pipeline** progress bar is displayed, indicating when the operation is complete.

Label/Edit Tools Pane

About Label/Edit Tools Pane

Manually label trial data and fill any gaps in trial data in the **Label/Edit** tools pane .



Nexus Motion Capture Workflow:

II. Prepare subject.

IV. Review trial and fill gaps.

The **Label/Edit** tools pane contains the following sections:

- Subject

  You select the subject whose motion capture data is to be manually labeled or edited in the **Subject** list at the top of the **Label/Edit** tools pane.

- Manual Labeling

  You manually label reconstructed trial data for the selected subject in the **Manual Labeling** section of the **Label/Edit** tools pane.

Tip	When you are manually labeling the subject, the shape of the pointer changes to include a ToolTip identifying the selected label to assist you in placing it on a 3D reconstruction in the **3D Perspective** view pane.

  Auto advance selection

  Select this check box if you want Nexus to automatically advance to the next marker in the Manual Labeling list.

  Default: Selected

  Find Next Unlabeled Trajectory

  Click this button to have Nexus advance to the next frame in the clip containing an unlabeled marker trajectory.

- Gap Filling

  You identify and fill any gaps in reconstructed marker trajectories in the **Gap Filling** section of the **Label/Edit** tools pane.

Manually Labeling Trial Data

Manually label reconstructed trial data for each active subject in the **Label/Edit** tools pane
.

Nexus Motion Capture Workflow:

II. Prepare subject.

3. Manually label reconstructed markers.

Manual labeling involves associating the markers defined in a Vicon Skeleton Template (*.vst* file) with reconstructed markers displayed in the **3D Perspective** view pane for a subject wearing Vicon markers in the capture volume. The manual labeling is then used when the *.vst* file is scaled to fit the subject wearing the marker set described in the *.vst* file during the subject calibration process. In subsequent trials, Nexus uses the resulting subject-specific Vicon Skeleton (*.vsk* file) to automatically label the subject wearing the same marker set.

Important	Before manually labeling markers, ensure that you have already: – Created or opened a session in the database in which you want to store the trial data, and ensured that it is the active session. – Built a Vicon Skeleton Template or obtained an existing .vst file corresponding to the type of subject whose motion is to be captured. – Created a new subject node from the template in which the manual labeling is to be stored. – Attached the Vicon markers to the subject in accordance with the marker set defined in the associated template. – Captured a brief static trial or obtained a single frame of live data with reconstructed markers corresponding to the marker set specified in the associated *.vst* file.

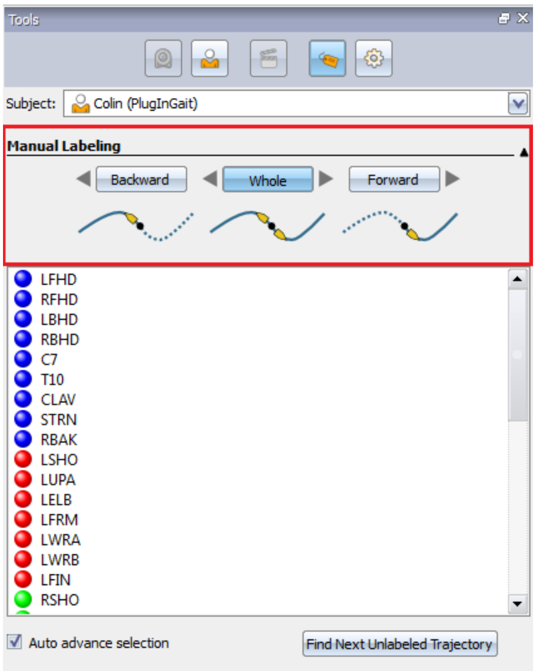
To manually label 3D marker reconstructions:

1. From the **Data Management** window , open the desired trial file containing reconstructed markers.
2. On the **Time Bar** ruler, place the Current Time Cursor on the first frame of the trial in which the subject is standing in a stationary neutral pose to enable the Vicon system to determine the location of key markers.

   This is typically a T-pose, in which the subject stands in the basic neutral pose and raises the arms out straight to the sides with palms facing down in a position in the shape of a T. If the subject is not able to attain the T-pose, they can use any neutral pose where all of the markers are visible to the cameras so that they will be able to be reconstructed.
3. In the **Subjects** resources tree, ensure that the subject node you created from the template is the only entry enabled for capture. When enabled, there is a check mark ☑ in the check box.
4. In the **Label/Edit** tools pane , from the **Subject** list select the subject to be manually labeled.

   Labels for the markers defined in the *.vst* file are displayed in the list in the **Manual Labeling** section.

5. If there is an overlapping trajectory you can label the data backward or forward only .



Overlapping trajectories can cause difficulties during manual labeling. One common difficulty occurs when two markers are correctly labeled at the start of the trial but then become confused or “swapped” later in the trial. Correcting this label swap can cause correct labels early in the trial to be lost. The easiest way to eliminate this issue is by using the Label Backward Only and Label Forward Only buttons.

When these labeling methods are used, Nexus will "snip" the trajectory at the current frame and only label in the direction chosen (forward in time or backward in time from the current frame). The process of snipping a trajectory causes a single continuous trajectory to be split into two separate unique trajectories at the current time frame.

6. From the **Manual Labeling** section, select **Auto advance selection** to have Nexus automatically select the next label in the list after you have assigned a label to a marker.
7. From the list in the **Manual Labeling** section, click on the label you wish to use.

   The shape of the pointer changes to include a ToolTip identifying the selected label to guide you in assigning labels to markers in the **3D Perspective** view pane.

8. In the **3D Perspective** view pane click on the marker you want to assign the label to.

   The next label in the list is selected and the ToolTip changes to indicate that label. As you label more markers, a colored line is drawn between each marker until a stick figure appears.

Important	The cursor will retain the ToolTip if you move the mouse to another area of Nexus workspace while a marker is selected from the Manual Labeling section. If you need to do something else in Nexus before marker labeling is complete, you can turn off the ToolTip by one of the following methods: ▌ Place the cursor in the **Manual Labeling** section and press the ESC key. ▌ Click on the **Label/Edit**  icon. ▌ Click on another icon in the **Tools Pane Toolbar**.

9. Repeat steps 6-7 until you have assigned all of the labels to markers.

   The stick figure in the **3D Perspective** view pane should resemble a skeleton of the subject type defined in the *.vst* file.

10. Verify that the manual labeling was successful by checking that all markers are connected by sticks and that the sticks on the left side of the subject are red and those on the right side are green.

Tip	You can also use the **Find Next Unlabeled Trajectory** button to find the next unlabeled marker in the clip. Nexus searches from the current frame forward until it finds an unlabeled marker. When found, the marker is selected and centered in the view pane.

11. From the Nexus toolbar, click the **Save** button to save the labeling information with the trial.

    You can then calibrate a Vicon Skeleton (*.vsk* file) based on the reconstructed and labeled subject.

Manually Filling Gaps in Trial Data

You can manually fill any gaps in the reconstructed and labeled trial data in the **Label/Edit** tools pane.

Nexus Motion Capture Workflow:

IV. Review trial and fill gaps

- Manually review and fill individual gaps in the reconstructed and labeled trial data.

When Nexus reconstructs subject markers, ideally it produces a smooth trajectory throughout the trial. Realistically, there may be frames with breaks in trajectories due to some markers that could not be reconstructed, spurious data, and odd spikes in data. You can manually fill gaps to correct any errors or inconsistencies in the reconstructed and labeled trial data.

To manually fill gaps in reconstructed and labeled data:

1. Display reconstructed and labeled markers in either of the following ways:
   - Ensure that a trial you have just captured has been reconstructed and labeled.
   - From the **Data Management** window , open a previously captured trial.
2. In the **Resources** pane, ensure Nexus is in **Offline** mode.
3. Display a **3D Perspective** view pane and optionally a **Graph** view pane.

Tip	Using a split layout with both a **3D Perspective** and a **Graph** view pane enables you to view the results of your editing actions and to select specific trajectories, frame ranges, and gaps in trajectories. Since the graphs indicate what changes have been made to the data and by which tool, you can immediately see the results of any edits you have made and determine if you want to change it again or adjust the data using a different tool in the **Gap Filling** section. When editing, in the **3D Perspective** view pane you can right-click a marker and select a command from the displayed context menu.

4. On the Time Bar ruler, select a range of frames to set the region of interest of the trial that you wish to analyze. For example, if the capture includes the subject entering and leaving the capture volume, Vicon highly recommends that you set the range of frames to exclude these portions of the capture. That will simplify the job of cleaning up your data.
5. In the **Subjects** resources tree, ensure that the desired subject is selected. When selected, there is a check mark ☑ in the check box.

   In the **Label/Edit** tools pane, under the **Gap Filling** section, any markers whose trajectories contain gaps within the selected range of frames are listed in the **Trajectory** column, with the number of gaps identified in the **#Gaps** column.
6. In the **Trajectory** column, click on the trajectory whose gaps you want to fill.

   Nexus automatically selects the gap by placing the current time in the middle of the gap and positioning the gap range selectors (blue cones) at the start and end of the gap. A red dotted line is displayed to preview the shape of the trajectory if a spline fill editing operation is run.
7. In the Range section, view the edit range values to identify the size of the gap and use the buttons to navigate between the gaps in the selected trajectory:
   - **Prev Gap**: Navigate to the previous gap in the selected trajectory. This button is available only if there are gaps in the trajectory before this point.
   - **Left edit range**: The frame before the start gap range selector, indicating the start of the gap that will be filled in.
   - **Right edit range**: The frame after the end gap range selector, indicating the end of the gap that will be filled in.
   - **Next Gap**: Navigate to the next gap in the selected trajectory. This button is available only if there are gaps in the trajectory after this point.
8. Use the appropriate fill tool to generate data to fill the selected gap:

   Spline Fill:

Tip	For data with smaller gaps, you could use a Processing pipeline containing the *Fill gaps (Woltring)* operation to automatically fill gaps.

   a. In the workspace, drag the gap range selectors to extend the edit range beyond the actual gap if desired. This is useful if the data leading up to the gap is noisy.

   b. Click **Fill** to have Nexus perform a cubic spline interpolation operation to fill the currently selected gaps.

   Pattern Fill:

Tip	This **Pattern Fill** tool uses the shape of another trajectory without a gap to fill the selected gap. You should use this tool only if there is a suitable marker with a trajectory similar to the one whose gap you wish to fill. This is typically the case when the trajectories originated from markers attached to the same segment, such as those attached to the ankle or heel.

   a. Click **Pick Source**. The shape of the pointer changes to include a ToolTip to guide you in the selection of markers in the **3D Perspective** view pane. Initially, a ToolTip with the text **Pick source marker** hangs from the cursor.

   b. In the **3D Perspective** view pane, click a source marker whose trajectory is to be used to fill the gap of the target marker.

c. A green dotted line is displayed to preview the shape of the trajectory if a pattern fill editing operation is run with the selected source model. In the workspace, drag the gap range selectors to extend the edit range beyond the actual gap if desired. This is useful if the data leading up to the gap is noisy. Nexus displays the name of the source marker at the bottom of the **Pattern Fill** section, so you can confirm that you have selected the desired trajectory.

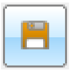
d. In the **Pattern Fill** section, click **Fill** to have Nexus fill the selected gap, with the shape of the filled-in trajectory being similar to the trajectory of the source marker.

When a gap is filled (using either editing tool), Nexus reduces the entry in the **#Gaps** column by one and selects the next gap.

9. Repeat steps 7-8 to fill all the gaps for the selected trajectory.

   When all gaps for the selected trajectory have been successfully filled, the entry for the trajectory is automatically removed from the **Trajectory** list and Nexus selects the next trajectory.

10. Repeat steps 6-9 for each trajectory that needs to have gaps filled.

11. From the Nexus toolbar, click the **Save** button  to save the trial. This will enable you to load the edited trial data. You can then perform any other processing, such as running pipelines.

Context Menu

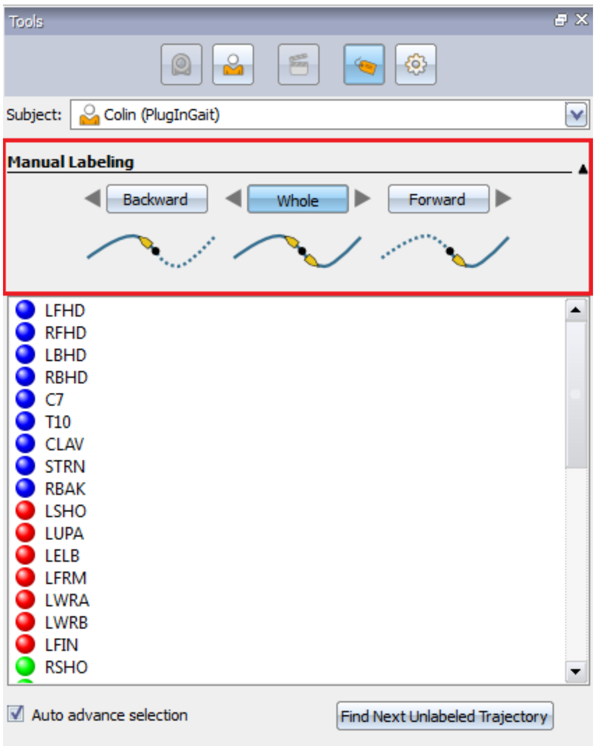
You can select the following command from the context menu displayed when you right-click on the **Markers** node:

- Reorder

Overlapping Trajectories

Labeling Data Forwards or Backwards Only

By default, trajectories are labeled in both directions. If there is an overlapping trajectory, you can resolve it by labeling it forward or backward only (for example, from frame 200 forward or from frame 200 backward). Use the Manual Labeling buttons to resolve trajectory conflict during the manual labeling process .



To label data forward or backward:

1. During the manual labeling process, find the frame in which the trajectory is overlapping.
2. In the **3D Perspective** view pane, label forward or backward from the point of overlapping trajectories by doing one of the following:
   a. In the **Label/Edit** tools pane, click the **Forward** button.
   b. In the **3D Perspective** view pane, select the problematic marker to label the trajectory from that point in time forward.

   OR

   a. In the **Label/Edit** tools pane, click the **Backward** button.
   b. In the **3D Perspective** view pane, select the problematic marker to label the trajectory from that point in time backward.

   The overlapping trajectory is now resolved.

For more information, please see:

- Learning More about Overlapping Trajectories
- Avoiding Overlapping Trajectories in the Future

Learning More about Overlapping Trajectories

Nexus recognizes a marker's trajectory continuously throughout a captured trial. There can be gaps in the data, but Nexus can still recognize the same marker trajectory on either side of a gap, as long as the gap is small enough or the marker's movement doesn't vary significantly within the gap.

Occasionally, however, an anomaly occurs during marker reconstruction. Instead of a gap or a continuous marker trajectory, Nexus creates two separate sub trajectory sections that actually belong to the same marker. This is called an overlapping trajectory, because the two sections overlap; that is, they are both present in the same frame or frames.

Then, during the labeling process, because both trajectories are present in the same frame or frames, Nexus determines that they must belong to separate markers. Therefore, when Nexus auto-labels these trajectory sections, it labels one and leaves the other unlabeled.

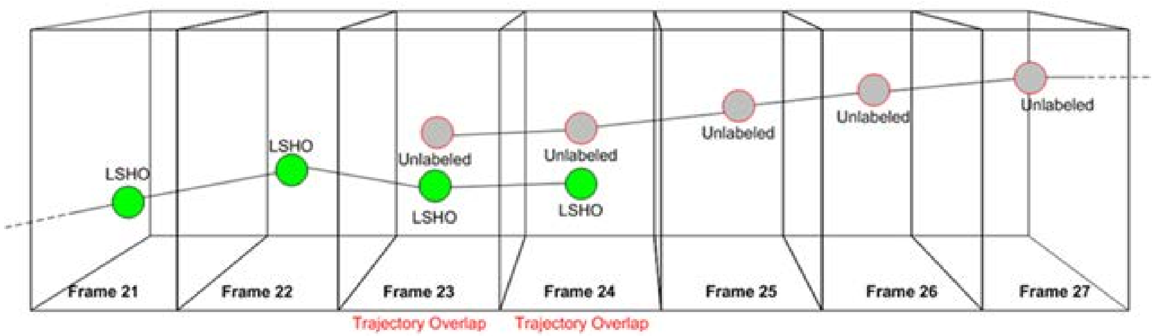
The typical cause of overlapping trajectories is spurious, or ghost, markers that are present during the marker reconstruction process. A ghost marker is a false marker reconstruction that appears as an additional trajectory very close to a legitimate marker trajectory.

To resolve this, you may be able to modify the Core Processor reconstruction parameters and reprocess the trial. For example, a minimum reconstruction separation that is set too low may cause Nexus to reconstruct all detected marker positions rather than selecting only the best candidates. How quickly or slowly the subject markers are moving during the capture, as well as how near the markers move in relation to one another, can also be contributing factors.

If adjusting the reconstruction parameters and reprocessing do not produce a properly labeled trajectory, you must manipulate the trajectory sections manually.

The following diagram shows an overlapping trajectory. Imagine that the markers in Frames 21-24 are part of a continuous trajectory extending from the beginning of the clip and are labeled as LSHO (Left Shoulder). Frames 23-27 are also a continuous trajectory but are unlabeled.

In fact, Frames 1-24 and Frames 23-27 are part of the same LSHO trajectory, but Nexus has recognized them as different sections. That is, both segments should be LSHO, except that in Frame 24 the first segment ends while in Frame 23 a second segment begins. The reason is that the unlabeled markers in Frames 23-24 are ghost markers, but more closely approximate the expected trajectory than the actual markers in Frames 23-24. As a result, Nexus has recognized what appears to be two separate marker trajectories overlapping in the same frames, and it won't assign the same marker to mutually exclusive trajectories. Therefore it has labeled one and left the other unlabeled.



Overlapping Trajectory Diagram

As you begin to manually label the unlabeled marker in Frame 26 as LSHO, Nexus detects that this will create two trajectories labeled LSHO that overlap in Frames 23-24.

Avoiding Overlapping Trajectories

There are various factors that can cause an overlapping trajectory, but the main cause is ghost markers. Ghost markers can be erroneously reconstructed if:

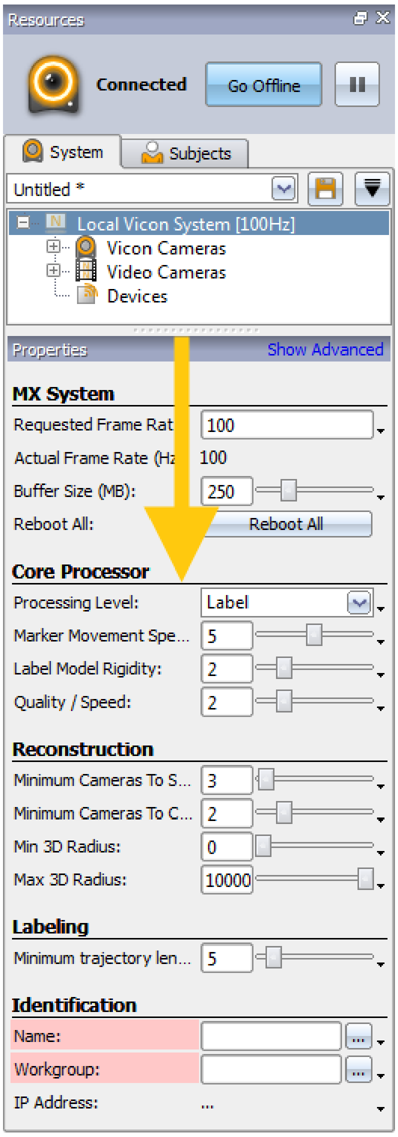
- The Nexus Core Processor settings are not optimized for the type of capture you are performing.
- One or more cameras need to be recalibrated.
- Camera masking is inadequate or has not been performed.

Adjusting Core Processor Settings

Depending on the type of trial you are reconstructing (e.g., slow or simple subject action, or swift, intricate or erratic movements), and the number of cameras you are using, you can adjust the Nexus **Core Processor** settings for your camera configurations and the type of trials you are capturing.

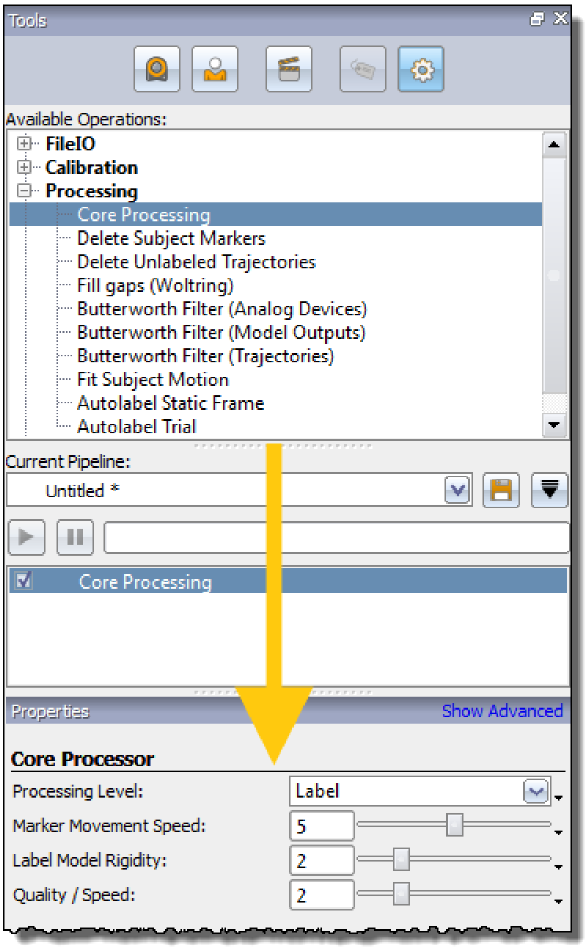
You can adjust Core Processor parameters for both **Live** and **Offline** processing.

- **Live** processing parameters are set for the Local Vicon System in the **System** resources pane .



Adjusting the **Live Core Processor** parameters affects the data displayed in real time.

- **Offline** processing parameters are set in the **Pipeline** tools pane .



  Once data has been captured you can adjust the **Offline Core Processor** parameters to optimize the data quality.

Live settings affect the data being streamed in real-time from the cameras, whereas **Offline** settings affect previously captured and saved data. So settings in the **Local Vicon System** affect how markers are tracked, reconstructed, auto labeled, and kinematically fitted live for a subject moving in the capture volume. **Pipeline** operation settings affect reconstruction and labeling for specified trial files, so you can fix reconstruction and labeling problems in an existing trial file.

Your approach to remedying overlapping trajectories may be twofold: If you do not want to recapture the trial you are processing, you can adjust the **Offline** processing parameters and reprocess the existing trial to see if Nexus can resolve the overlapping trajectory. However, you may also need to evaluate whether future captures will be similar enough to the current trial conditions (such as subject movements, marker placement and movement, number of cameras, etc.), that also adjusting the **Live** Core Processor settings will eliminate this situation in the future.

You can adjust the following Core Processor parameters for both **Live** and **Offline modes**:

- **Marker Movement Speed**

  The size of the search area Nexus uses to reconstruct markers. As Nexus constructs marker movements into trajectories, it predicts where to find the marker in Frame 2 after locating it in a specific XYZ location in Frame 1. Nexus will search in the vicinity of position XYZ in Frame 2 for the candidate marker. The Marker Movement Speed controls the size of the search area, and can be set from 0-10.

A low Marker Movement Speed allows a small search area, which increases the chance of the marker having moved too far out of the search area. This can create gaps in the marker trajectory.

When tracking slow-moving markers that are positioned quite close together, a lower marker movement speed is appropriate.

A high Marker Movement Speed value allows a large search area, which means that the marker can move fairly quickly and still fall within the search area.

When you increase the search area, you also increase the chance of more than one candidate marker falling within the search area, which may result in a broken trajectory, or an overlapping trajectory (see the Overlapping Trajectory Diagram).

When tracking faster moving markers (e.g., a golf swing), the Marker Movement Speed should be 8-10, otherwise the trajectories may not be continuous.

- Set **Live** processing parameters for the **Local Vicon System** in the **System** resources pane.
- Set **Offline** processing parameters in the **Pipeline** tools pane.

- Label Model Rigidity

  The rigidity of the relationship between the segment and the markers on the object being labeled, specified as a value in the range 0-10, where 0 is completely rigid (that is markers are not expected to move in relation to the underlying segment), and 10 is loose (that is, the markers are expected to move significantly in relation to the segment).

  A low value (0-2) tells the core processor that the relationship between the marker and the segment to which it is attached is relatively rigid. The value 0 (zero) is recommended only for rigid object tracking, such as an inanimate object or prop. As the value increases, the more slack is expected, so that the marker can have more movement relative to the underlying segment.

  For human subject tracking, a value in the 2-4 range is recommended. Higher values allow even more slack but can reduce labeling accuracy. If you need to adjust for excessive movement between the marker and its related segment, you can set the Label Model Rigidity between 5-6.

  - Set **Live** processing parameters for the **Local Vicon System** in the **System** resources pane.
  - Set **Offline** processing parameters in the **Pipeline** tools pane.

- Quality / Speed

  The Quality / Speed parameter sets the relative importance between labeling quality and processing speed. It is specified as a value between 0-10, where 0 (zero) places a higher priority on processing quality (the system tries very hard to get the labels right at the expense of processing speed), and 10 places a higher priority on processing speed (the system processes at high speed at the expense of labeling accuracy).

  Always set to 1 or 2, to ensure quality tracking. Setting the Quality / Speed to 0 can slow down processing noticeably.

  - Set **Live** processing parameters for the **Local Vicon System** in the **System** resources pane.
  - Set **Offline** processing parameters in the **Pipeline** tools pane.

- Minimum Cameras per Marker

  The minimum number of Vicon cameras, specified as a value between 2-10, that must contribute to a 3D marker position before it can be reconstructed and its trajectory tracked. The setting depends on how many cameras are likely to detect the same marker at a given time.

  The guideline is:
  – 2 for small systems (4-8 cameras)

  – 3 for medium systems (9-14 cameras)

  – 4 for bigger systems (15+ cameras).

  - Set **Live** processing parameters for the **Local Vicon System** in the **System** resources pane.
  - Set **Offline** processing parameters in the **Pipeline** tools pane.

- Ray Intersection Factor

  This parameter determines the amount of distance allowed between two camera rays that contribute to the reconstruction. Leave at the default unless you determine that the camera calibration is poor and the reconstruction results in multiple unassigned markers, in which case you can set it to a higher value.

  - Set **Live** processing parameters for the **Local Vicon System** in the **System** resources pane.
  - Set **Offline** processing parameters in the **Pipeline** tools pane.

- Minimum Recon Separation

  The Minimum Reconstruction Separation is the minimum distance, specified as a value between 0-100 millimeters, allowed between 3D marker positions in order for them to be considered for reconstruction. If two candidate reconstructions are closer than this minimum separation, only the most likely reconstruction (in terms of the number of cameras contributing) will be used by Nexus. The other will be discarded.

  - A lower value increases the likelihood of creating spurious reconstructions that are likely to be ghost markers. For example, the minimum value of 0 (zero) causes Nexus to attempt to reconstruct any and all 3D marker positions.
  - A higher value decreases the likelihood of creating spurious reconstructions, but increases the possibility that some real markers will not be reconstructed.

  Generally, this parameter should be slightly above the size of the markers you are using. For examples, if you are using 14mm markers, try setting to 16mm. Then, for example, if during reconstruction two markers (one a ghost marker) are found within 17mm, it would be discarded.

  - Set **Live** processing parameters for the **Local Vicon System** in the **System** resources pane.
  - Set **Offline** processing parameters in the **Pipeline** tools pane.

Calibrating Cameras

If your camera setup or capture volume has changed, recalibrate your cameras.

Important	As part of the first stage of the daily Nexus motion capture workflow, Vicon recommends that you calibrate your MX and DV cameras each day before you capture any data.

To calibrate MX and Bonita cameras, see Calibrating MX Cameras.

To calibrate video cameras, see Calibrating Video Cameras.

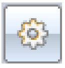
Masking Cameras

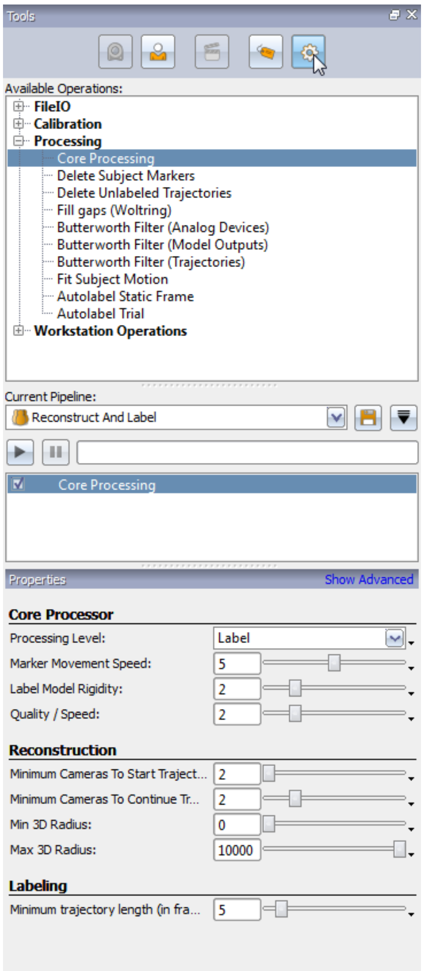
In capture volumes where large amounts of spurious data are present (e.g., reflections from floor or furniture, or opposing camera strobe rings) camera masking will improve calibration robustness and reconstruction quality (both offline and in real time)

You can create camera masks manually or automatically.

Pipeline Tools Pane

About Pipeline Tools Pane

Create and manage a customized sequence of operations to automate processing of a trial in the **Pipeline** tools pane 



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Nexus Motion Capture Workflow:

V. Post process trial.

Pipeline processing is optional, but is useful for automating the data processing operations that you use frequently or on a large number of trials.

The **Pipeline** tools pane contains the following sections:

- Available Operations

  Select the type of pipeline you want to create and the specific operations to be run in the **Available Operations** section. Operations are grouped under the following types:

  - File I/O

    Operations for automating the import and export of trial files between Vicon Nexus and third-party software packages.

  - Calibration

    Operations for automating the processing of system and subject calibration.

  - Processing

    Operations for automating the real-time and offline motion capture data processing.

  - Workstation Operations

    Operations for automating the import and export of trial data (such as Plug-in Gait models), between Vicon Nexus and Workstation.

- Current Pipeline

  Create or manage configurations for the settings specified in the **Pipeline** tools pane using the **Configuration Management** section at the top of the **Current Pipeline** section.

  Manage the pipeline operations and view their status with the playback controls and progress bar in the middle of the **Current Pipeline** section.

  View the operations included in the currently loaded pipeline in the list at the bottom of the **Current Pipeline** section.

Tip	Pipeline operations are run in the order they appear in this list. You can drag operations into the desired position in the list. Alternatively, you can run an individual operation by right-clicking on it and selecting **Run selected Op**.

- Properties

  You can view or change settings for pipeline operations in the **Properties** section at the bottom of the **Pipeline** tools pane. The properties displayed depend upon the operation highlighted in the **Current Pipeline** list.

Automating Processing with Pipelines

Create and run any customized sequences of frequently used processing operations in the **Pipeline** tools pane.

Nexus Motion Capture Workflow:

V. Post process trial

1. Set up and run pipelines for any operations you want to automate.

You can use any of the pipeline files supplied with Nexus or create your own to suit your particular needs. Pipelines can be used to automate operations for calibration, processing, file input-output, and Workstation operations. Pipelines can be run automatically on a trial at different stages of the Nexus workflow. Each operation within a pipeline can have a unique set of options and parameters specified for it. This is useful for automating the data processing operations that you use frequently or on a large number of trials. Some of the pipelines you create here also can be selected and run in the **Subject Preparation** tools pane and the **Capture** tools pane.

To create a pipeline:

1. In the **Pipeline** tools pane, under the **Pipeline Configuration Management** section, select an existing pipeline or create a new one.
2. In the **Available Operations** list, expand (+) or collapse (-) the pipeline type to display or hide the operations you can use for that type of automatic processing of trial data:
   - **File I/O**pipelines automate the import and export of trial files between Vicon Nexus and third-party software packages. See FileIO Pipeline Operations.
   - **Calibration** pipelines automate system and subject calibration processing. See Calibration Pipeline Operations.
   - **Processing** pipelines automate real-time and offline data processing. See Processing Pipeline Operations.
   - **Workstation Operations** pipelines automate the import and export of operations for automating the import and export of trial data (such as Plug-in Gait models), between Vicon Nexus and Workstation. See Workstation Pipeline Operations.
3. Double-click each operation you want to include in your pipeline. The operation is displayed in the list under the Current Pipeline section. Hover the pointer over an entry in the list to view a ToolTip describing the operation's function. The operations are run in the order they appear in the pipeline; you can rearrange the order by dragging operations into the desired position in the list.

   Tip: Add the **Save Trial** operation (located in the **File I/O** list) to automatically save the trial you are processing. As a general rule, you will want to save the trial as a last step after the other pipeline operations have been run, so make sure to position the **Save Trial** operation at the proper point in the **Current Pipeline** operation list.

4. In the **Current Pipeline** section, click on an operation, then in the **Properties** section at the bottom of the **Pipeline** tool pane, view or change settings for the desired properties. The contents of the **Properties** section depend on the selected operation.
5. In the **Pipeline Configuration Management** section, click the **Save** button to save your pipeline settings to a *.pipelines* file in the **Pipelines** folder (by default, *C:\Program Files\Vicon\Nexus\Configurations\Pipelines*). An asterisk (*) is displayed next to the pipeline name if there are unsaved changes.

To run a pipeline:

1. In the Subjects resources pane, ensure that the subjects whose trial data you want the pipeline to operate on are enabled. When enabled, there is a check mark ☑ in the check box.
2. On the Time Bar ruler, move the Start Range Frame Cursor and End Range Frame Cursor along the timeline to set a range of frames if you want the pipeline to operate only on a specific region of interest rather than the whole trial.
3. In the Pipeline tools pane, under the Pipeline Configuration Management section, select an existing pipeline.
4. In the Current Pipeline section, select the operations to be run. When selected, there is a check mark ☑ in the check box.
5. Click the Run Pipeline button to start the pipeline process. Each operation is run in the order it appears in the list from top to bottom.

   The button changes to its Stop Pipeline setting, which you can use to stop the pipeline process before it completes. You can click the Pause button to temporarily suspend the pipeline process at the current operation. The button changes to its Resume setting, which you can use to restart the paused operation.
6. View the progress of the overall process or the status of individual operations:

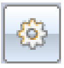
   The Pipeline Processing Progress Bar displays the results of the pipeline processing, and gives an indication of the percentage of processing completed for each operation.

   The Current Pipeline list may contain the following information for each operation (to the right of the check box):

▶	Processing	The operation is being processed
✔	Processed	The operation was completed successfully
✘	Failed	The operation was not completed successfully
⊖	Stopped	The operation processing was stopped

Pipeline Operations

FileIO Pipeline Operations

Use FileIO operations to automate the import and export of trial files between Vicon Nexus and third-party software packages. FileIO Pipeline operations are found in the Pipeline tools pane  under the **Available Operations** section. Select the operation you want to run:

Apply Codec to Video: Applies codec to all AVIs associated with the current trial. You can select which codec to use and whether to keep the original movie file.

Export 3D Overlay Video: Export a copy of the reference video .avi file(s) with the 3D Workspace data overlaid onto the video image. You can choose which 3D view option to display and select the codec used to compress the new .avi file.

Export ASCII (Delimited): Export delimited ASCII format to a .csv or .txt file. You can select commas, tabs, or line feeds as the delimiter.

Export TRC: Export a .trc file.

Export C3D: Export the current state of the processed data to a .c3d file.

Export CP: Export the calibration information of the current trial into a .cp file (calibration file compatible with legacy software).

Export MKR: Export a .mkr file. You can choose whether the exported file name is based on the active subject name(s) or active model name(s). If you choose **Active Model Names**, the name of any model attached to the subject (for example, PlugInGait) is used as the name of the MKR file. If more than one subject is present with the same model attached, a log message indicates that only one MKR file will be exported.

Export MP: Export the current subject parameters to a .mp file (subject parameter file compatible with legacy software).

Export Subject Model: Export a .vsk file

Export VTT: Export the current camera masks into a saved .vtt file.

Export XCP: Export the current calibration file to a .xcp file in a specified location.

Import AVI: Import a video .avi file to be saved and associated with the current trial.

Import CP: Import a .cp (legacy calibration file) to allow Nexus to reconstruct marker data files captured with legacy software.

Import MP: Import subject parameters specified in a .mp file into the active subject.

Import Subject Model: Import a .vsk file.

Import XCP: Import a calibration file .xcp into the current trial to replace the current calibration.

Save Trial: Save all files associated with the currently open trial.

Calibration Pipeline Operations

Use Calibration operations to automate the processing of system and subject calibration.

Calibration Pipeline operations are found in the Pipeline tools pane under the **Available Operations** section. Select the operation you want to run:

Camera Calibration: Run on a captured trial of a calibration wand wave to calibrate a system (instead of calibrating the system live).

Functional Subject Calibration: Calibrate the subject's bone lengths, joint locations, and marker locations from a whole trial.

Static Subject Calibration: Run on a labeled static trial. Fits the model in the .vst file to the specific subject, creating a .vsk file saved in the current session folder.

Calculate Autolabel Trial Parameters: Measure the subject's labeling statistics from a whole trial.

Re-Calculate Autolabel Static Frame Parameters: Used on .vst files created in Nexus 1.0 to enable them to be used with the **Label Static Frame Automatically Using Kinematic Fit** pipeline operation.

Processing Pipeline Operations

Use Processing operations to automate the real-time and offline motion capture data processing. Processing Pipeline operations are found in the Pipeline tools pane under the **Available Operations** section. Select the operation you want to run:

- **Core Processing:** Consisting of the same options as the live Core Processor, this operation controls how the raw marker data is circle fitted, reconstructed, and labeled, and how the model contained in the .vsk is kinematic fitted to the marker data.
- **Trajectory Fitting Method:** Select either 2D tracks or 3D prediction.
- **Suppress Short Trajectories:** Select to prevent the creation of trajectories shorter than a given number of frames (**Minimum Trajectory Length**).
- **Delete Subject Markers:** Run on a any trial to delete subject markers from the marker list that will not be used during the dynamic captures.
- **Delete Unlabeled Trajectories:** Run on a fully labeled trial to delete any remaining unlabeled trajectories. Includes the option to choose maximum length of unlabeled trajectory to delete.
- **Fill Gaps (Woltring):** Run on labeled dynamic trials to fill in gaps using a third order spline interpolation. Includes the option to choose maximum gap frame length to fill.
- **Butterworth Filter (Analog Devices):** Filter analog device data using a low-pass digital Butterworth filter. The filter is by default setup as recommended in Winter, D.A. Biomechanics of Motor Control and Human Movement to filter out signal noise above 300 Hz using a fourth order filter with zero lag (see descriptions below for an explanation of these parameters).

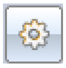
  Note: For force plates, only the calculated Force and Moment signals can be filtered. Raw and Center of Pressure signals cannot be filtered.

- **Cut-Off Frequency:** The filter cut-off frequency, separating the low-frequency signal from high frequency noise. Data at frequencies above the cut-off frequency are attenuated increasingly as the frequency increases. The attenuation exactly at the cut-off frequency is designed to be "half power," or -3 dB.

  Note: Cut-off frequencies greater than half of the analog device sampling frequency (often called the Nyquist frequency) cannot be used and will result in an error message and no filtering of the data.

- **Filter Order:** The **Second Order** filter performs a single pass of the filter in the forwards (increasing time) direction, resulting in a "lag," or "phase shift" in the analog data. The **Fourth Order** filter performs two passes of the filter, in first the forward, then the reverse direction, resulting in any lag being cancelled out (hence "zero lag"). The parameters of the Fourth Order filter are adjusted, such that the attenuation exactly at the cut-off frequency is maintained at "half power," or -3 dB.
- **Devices:** A comma separated list of **Devices**, **Outputs** and **Components** can be typed, or the Macros **All** or **Selected** can be used. **All** will always filter the data from every device currently connected and **Selected** will filter the data from the devices, device outputs, and output components with names matching those currently selected in the **System** resource pane and in the **3D Workspace**.
- **Butterworth Filter (Model Outputs):** Filter Subject Model Outputs using a low-pass digital Butterworth filter. The filter is by default setup as recommended in Winter, D.A. Biomechanics of Motor Control and Human Movement to filter out signal noise above 6 Hz using a Fourth Order filter with zero lag.
- **Cut-Off Frequency:** Same as Analog Devices above.
- **Filter Order:** Same as Analog Devices above.
- **Devices:** A comma separated list of **Model Outputs** can be typed, or the Macros **All** or **Selected** can be used. **All** will always filter all Model Outputs calculated for a subject and **Selected** will filter Model Outputs with names matching those currently selected in the **Subjects** resource pane and in the **3D Workspace**.
- **Butterworth Filter (Trajectories):** Filter trajectories using a low-pass digital Butterworth filter. The filter is by default set up as recommended in Winter, D.A. Biomechanics of Motor Control and Human Movement to filter out signal noise above 6 Hz using a Fourth Order filter with zero lag.
- **Cut-Off Frequency:** Same as Analog Devices above.
- **Filter Order:** Same as Analog Devices above.
- **Devices:** A comma separated list of trajectories can be typed, or the Macros **All**, **All Labelled**, or **Selected** can be used. **All** will always filter every trajectory, including unlabeled ones, **All Selected** will filter every currently labelled trajectory, and **Selected** will filter trajectories with names matching those labelled trajectories currently selected in the **Subjects** resource pane and in the **3D Workspace**.
- **Fit Subject Motion:** Run on fully labeled trials to Kinematic Fit the trial as a whole instead of frame-by-frame as in the Core Processor.
- **Autolabel Static Frame:** Run on a reconstructed static trial to automatically label the subject using information from the .vst file. This operation does not require a .vsk file.
- **Autolabel Trial:** Run on fully reconstructed trials to label the subject as a whole instead of frame-by-frame as in the Core Processor. This operation does require a .vsk file.

Workstation Pipeline Operations

Use Workstations operations to automate the import and export of trial data (such as Plug-in Gait models). Workstation Pipeline operations are found in the Pipeline tools pane  under the **Available Operations** section. Select the operation you want to run:

- **Apply Woltring Filtering Routine:** Runs the Woltring filter (based on a fifth order spline interpolating function) on all reconstructed trajectories. Includes the option to set the parameters of the filtering routine (GCV or MSE).
- **Autocorrelate Events:** Based on user-defined parameters, the operation detects the pattern of the tracked marker at the set events and defines these events for the rest of the trial. The available parameters are: marker being tracked; the X, Y, or Z component of the marker; and the position, velocity, or acceleration of the marker.

- **Detect Gait Cycle Events:** Detects and marks events throughout the trial using vertical GRFs measured by a force platform connected to the Vicon system. Includes the option to set the force threshold and the label of the markers attached to the front and back of the foot for both sides.
- **Export data to ASCII file:** Allows the user to specify which sections of the .c3d file will be exported to a comma-separated ASCII file (.csv).
- **Export data to ASCII file (Advanced):** Exports data to a tab-separated ASCII file (.txt). It allows choosing one or more specific trajectories to export (such as an individual marker or model output) and advanced control over the setup of the file (such as header information). **Note:** A .mkr file (legacy marker file) is needed in order to specify the trajectories to be exported
- **Export data to SIMM motion file:** Exports the trial to a SIMM motion file (.mot). Includes the option to export SIMM joint file (.jnt) and bone files (.asc).
- **Generate Gait Cycle Parameters:** Using gait events, this operation will calculate standard gait cycle spatial and temporal parameters (cadence, speed, etc). Includes the option to set the output units.
- **Perform dynamic BodyLanguage Modeling:** Runs one or more BodyBuilder model script files (.mod). This operation ignores the portion of the script file programmed to run exclusively on a static trial.
- **Perform static BodyLanguage Modeling:** Runs one or more BodyBuilder model script files (.mod). This operation ignores the portion of the script file programmed to run exclusively on a dynamic trial. Includes the option to select the script to run among those saved in the user-specified Models folder.
- **Run Dynamic Gait Model:** Runs the dynamic portion of the Plug-In Gait model on the active subject of the current trial.

Run Static Gait Model: Runs the static portion of the Plug-In Gait model on the active subject of the current trial.

Automatically Labeling Static Trials

You can automatically label static trials or Range of Motion trials with the Automatic Static Labeler operations in the **Pipeline** tools pane.

Nexus Motion Capture Workflow:

II. Prepare subject
   2. Capture a static trial and reconstruct markers
V. Post process trial
   1. Set up and run pipelines for any operations you want to automate

To automatically label a static trial using a Vicon Skeleton Template built in Nexus:

1. Display a **3D Perspective** view pane.
2. In the **Resources** pane, ensure Nexus is in **Live** mode.
3. In the **Subjects** resources tree, ensure that the subject node you created from the template is the only entry enabled for capture. When enabled, there is a check mark ☑ in the check box.
4. In the **Subject Preparation** tools pane, from the **Subject** list select the subject node.
5. In the **Properties** section at the bottom of the **Subjects** resources pane, change settings for any subject measurements you previously obtained.
6. In the capture volume, have the subject in roughly the same pose as that defined in the *.vst* file.
7. In the **Capture** tools pane, capture a brief static trial and reconstruct the markers.
8. Nexus automatically switches to **Offline** mode and displays the subject data in the **3D Perspective** view pane. Ensure that all the markers are clearly visible to the MX / Bonita cameras
9. Create and run a pipeline that includes the **Label Static Frame Automatically Using Kinematic Model** operation.
10. Nexus labels the trajectories based on the marker set defined in the *.vst* file.
11. Verify that the Automatic Static Labeler has successfully labeled the subject based on the marker set defined in the .vst file. In the 3D Perspective view pane, ensure that all markers are connected by sticks and that the sticks on the left side of the subject are red and those on the right side are green.
12. If you see any ghost markers (false reconstructions that appear as additional trajectories very close to an existing one over a short duration), in the **System** resources tree, select **Local Vicon System** and then in its **Properties** section under **Core Processor**, increase the **Minimum Cameras per Marker** to 3 or 4.
13. From the Nexus toolbar, click the **Save** button to save the labeling information with the trial.

To customize an imported .vst file for autolabeling in Nexus:

1. Display a **3D Perspective** view pane.
2. In the **Resources** pane, ensure Nexus is in **Live** mode.
3. In the **Subjects** resources tree, ensure that the subject node you created from the template is the only entry enabled for capture. When enabled, there is a check mark in the check box.
4. In the **Subject Preparation** tools pane, from the **Subject** list select the subject node.
5. In the capture volume, have the subject stand in a stationary neutral pose, to enable the Vicon system to determine the location of key markers.
6. This is typically a T-pose, in which the subject stands in the basic neutral pose and raises the arms out straight to the sides with palms facing down in a position in the shape of a T, ensuring that the markers on the subject are visible to all the cameras. If the subject is not able to attain the T-pose, they can use any neutral pose where all of the markers are visible to the cameras so that the markers will be able to be to be reconstructed.
7. In the **Capture** tools pane, capture a brief static trial and reconstruct and manually label the markers.
8. On the **Time Bar** ruler, position the Current Time Cursor on a frame containing the subject standing in the stationary pose.
9. Create and run a pipeline that includes the **Set VST Static Statistics** operation.
10. Nexus labels all trajectories based on the marker set defined in the *.vst* file.
11. In the **Subjects** resource tree, save the subject as a template with a new file name.
12. This new *.vst* file can be used as a template in future trials to automatically label static poses.

The Automatic Static Labeler applies a Vicon Skeleton Template (*.vst* file) to a subject in a static trial and then attempts to automatically label the subject with the marker set defined in the *.vst* file. This enables you to automatically label static trials or to customize existing *.vst* files for labeling in Nexus.

The Automatic Static Labeler functionality is provided by the following operations in the **Processing** section of the **Pipeline** tools pane:

- **Label Static Frame Automatically Using Kinematic Model**
- This operation uses the labeling information contained in a *.vst* file created in the Nexus Labeling Template Builder to autolabel the current frame of the static trial. Before running this operation, ensure that the current time cursor is positioned at a frame which has all the markers clearly visible.
- **Set VST Static Statistics**
- This operation customizes an existing *.vst* file previously created in another Vicon application software and imported into Nexus to add the labeling information required by Nexus. You can also use this operation to change the definition of the static pose in an existing *.vst* file or to create separate templates with different static poses.

Both operations require that the subject is in roughly the same pose and has the same marker set attached as defined in the *.vst* file. The Automatic Static Labeler is able to perform successfully if the subject's position is a few degrees off on the joint angles but not if the pose is significantly different. For example, if your *.vst* file was generated based on a subject with her arms out straight to the sides with palms facing down, a static trial captured with another subject with his arms raised in front is unlikely to autolabel successfully.

The scale of the generic subject defined in the *.vst* file is not important. It does not matter if the trial subject is 110cm or 190cm tall. Similarly, the subject's orientation and position does not matter. The trial subject can face in any direction in the capture volume. Vicon recommends that you automatically label only one subject at a time, and the subject should not be holding any sports equipment or rigid objects.

You can subsequently manually label any trajectories that were not correctly labeled, for example, because the subject was not able to assume a position sufficiently close to the pose defined in the *.vst* file.

Important	Before beginning the automatic static labeling process, ensure that you have already: – Created or opened a session in the database in which you want to store the trial data, and ensured that it is the active session. – Built a Vicon Skeleton Template or obtained an existing .vst file corresponding to the type of subject whose motion is to be captured. – Created a new subject node from the template in which the *.vsk* file created here is to be stored. – Attached the Vicon markers to the subject in accordance with the marker set defined in the associated template.

Automatically Filling Gaps in Trial Data

You can automatically fill gaps using the **Fill gaps (Woltring)** operation in the **Pipeline** tools pane .

Nexus Motion Capture Workflow:

IV. Review trial and fill gaps.

- Automatically fill all gaps in the reconstructed and labeled trial data.

V. Post process trial.

1. Set up and run pipelines for any operations you want to automate.

When Nexus reconstructs each marker on a subject, ideally it produces a smooth trajectory throughout the trial. Realistically, there may be frames with breaks in trajectories due to some markers that could not be reconstructed, spurious data, or odd spikes in data.

Tip	This **Fill gaps (Woltring)** operation fills all gaps in the trial data. You can set the gap size, but this pipeline operation is recommended for data with smaller gaps. For data containing large gaps, you are advised to review and manually fill gaps in the **Label/Edit** tools pane . Some Nexus supplied pipelines contain the **Fill gaps (Woltring)** operation, so you are advised to review your reconstructed data before running any pipelines containing this operation.

To automatically fill small gaps in reconstructed and labeled data:

1. Display reconstructed and labeled markers in either of the following ways:

- Ensure that a trial you have just captured has been reconstructed and labeled.
- From the **Data Management** window, open a previously captured trial.

2. In the **Resources** pane, ensure Nexus is in **Offline** mode.
3. Display a **3D Perspective** view pane and optionally a **Graph** view pane.

> Tip: Using a split layout with both a **3D Perspective** and a **Graph** view pane enables you to view the results of your editing actions and to select specific trajectories, frame ranges, and gaps in trajectories. Since the graphs indicate what changes have been made to the data and by which tool, you can immediately see the results of any edits you have made and determine if you want to change it again or adjust the data using one of the tools in the **Label/Edit** tools pane.

4. In the **Pipeline** tools pane, create a Processing pipeline that includes the **Fill gaps (Woltring)** operation.
5. In the **Current Pipeline** section, click on the operation, then in the **Properties** section at the bottom of the **Pipeline** tools pane, view or change settings for the desired properties.
6. Run the pipeline either on an individual trial in the **Pipeline** tools pane or on multiple files using the Batch Processing Interface.
7. From the Nexus toolbar, click the **Save** button to save the trial. This will enable you to load the edited trial data. You can then perform any other processing, such as manually filling any remaining gaps.

Properties

You can configure the following settings in the **Properties** section for the **Fill gaps (Woltring)** operation:

- **Max Gap Length**

  The maximum length of any gap in a marker trajectory that will be filled with this operation.

  Default: 4

- **First Frame**

  The first of the range of frames in the region of interest of the trial that you wish to analyze. For example, if the capture includes the subject entering the capture volume, it is highly recommended to set the range of frames to exclude this portion of the capture. That will simplify the job of cleaning up your data. You can specify the following settings:

  - – **First Frame:** The first frame of the trial.
  - – **Selected Start:** The frame indicated by the **Start Range Frame Cursor** on the **Time Bar** ruler.
  - – **Current Frame:** The frame indicated by the **Current Time Cursor** on the **Time Bar** ruler.

  Default: Selected Start

- Last Frame

  The last of the range of frames in the region of interest of the trial that you wish to analyze. For example, if the capture includes the subject leaving the capture volume, it is highly recommended to set the range of frames to exclude this portion of the capture. That will simplify the job of cleaning up your data. You can specify the following settings:

  - – End Frame: The last frame of the trial.
  - – Selected End: The frame indicated by the End Range Frame Cursor on the Time Bar ruler.
  - – Current Frame: The frame indicated by the Current Time Cursor on the Time Bar ruler.

Default: Selected End

Processing Plug-in Gait Models in Nexus

Run the Plug-in Gait Vicon system software option in Nexus by using the Plug-in Gait operations in the **Pipeline** tools pane .

Plug-in Gait is the Vicon implementation of the Conventional Gait Model (CGM), which enables users to produce gait analysis reports that conform to established clinical practices. This topic assumes that you are familiar with Plug-in Gait, including the way the model works, where the markers are placed, and what the subject parameters mean. For example, Plug-in Gait directly calculates the kinematic model's joint centers from the measured XYZ marker positions on a frame-by-frame basis. Therefore, the lengths and orientations of the modeled segments are directly dependent on the marker positions. Accurate marker placement is therefore paramount. The model uses three or more points to define each segment. For all segments distal to the Pelvis, one of the points used is the joint center that defines the proximal joint for the segment, for example, one of the three defining points for the tibia is the knee joint center. You can import the resulting kinematic model of your subject (patient) into another software application, such as Vicon Polygon, for subsequent gait analysis.

Processing Plug-in Gait in Vicon Nexus involves the following stages:

1. Capturing and processing a static trial
2. Capturing and processing a dynamic trial

Important

Before processing a Plug-in Gait model in Nexus, ensure that you have already:

– Created or opened a session in the database in which you want to store the trial data, and ensured that it is the active session.

– Ensured that the appropriate Plug-in Gait *.vst* file is available:

* *PlugInGait.vst* for the basic model with the LPSI/RPSI markers

* *PlugInGait (SACR).vst* if using the basic model with the SACR marker.

* *KAD PlugInGait.vst* if using Knee Alignment Device (KAD) with the LPSI/RPSI markers.

* *KAD PlugInGait(SACR).vst* if using KAD with the SACR marker

Sample *.vst* files are provided under the Nexus model templates folder (by default, *C:\Program Files\Vicon\Nexus\ModelTemplates*)

– Created a new subject node from the appropriate Plug-in Gait *.vst* file in which the subject is to be stored. For Plug-in Gait this node typically uses the patient's name or the hospital number.

– Attached the Vicon markers to the subject in accordance with the marker set defined in the associated Plug-in Gait *.vst* file. Attach the Knee Alignment Device (KAD) if you are using one; otherwise, take great care in positioning the knee and thigh markers.

– Obtained the subject measurements are required to run the model: the body weight and height as well as measurements of both left and right leg lengths, knee widths, and ankle widths. These are used to calculate joint center positions, and must be measured and entered into Nexus before any processing can begin. Optionally, you can also measure tibial torsion, the inter-ASIS distance, the ASIS-to-greater trochanter distance, and the sole delta if the subject is wearing shoes.

– Captured and reconstructed a static trial corresponding to the marker set specified in the associated *.vst* file.

– Created or obtained a VPI Compatibility pipeline for static trial processing that includes the **Run static gait model** operation.

– Created or obtained a Calibration pipeline that includes the **Static Subject Calibration** operation. This pipeline is required only if your subject is wearing a Knee Alignment Device (KAD).

– Created or obtained a pipeline for dynamic trial processing that includes:

* the **Core Processing** operation (under the **Processing** section)

* the **Apply Woltring filtering routine**, **Detect gait cycle events**, **Autocorrelate events**, and **Run dynamic gait model** operations (under the **Workstation Operations** section)

* the **Export C3D** operation (under the **File I/O** section)

Capturing and Processing a Plug-in Gait Static Trial

The first stage of processing with Plug-in Gait in Nexus is capturing and processing a static trial. This involves capturing the subject in a stationary position and labeling the marker images according to the Vicon Skeleton Template (*.vst* file). The static trial enables Plug-in Gait to associate captured markers with known positions or labels and to calculate certain key parameters that are used during the dynamic trial. During this stage, Plug-in Gait calculates the biomechanical model based on the measured marker positions, Nexus creates a Vicon Skeleton (*.vsk* file) that is scaled to fit the particular subject and which will automatically label subsequent trials.

For this stage, you can choose to use a Knee Alignment Device (KAD) to specify the knee flexion-extension axis. This is optional, but does change the processing somewhat; any such differences are clearly described.

To capture a Plug-in Gait static trial:

1. Display a **3D Perspective** view pane.
2. In the **Resources** pane, ensure Nexus is in **Live** mode.
3. In the **Subjects** resources tree, ensure that the subject node you created from the Plug-in Gait *.vst* file is the only entry enabled for capture. When enabled, there is a check mark ☑ in the check box.
4. In the **Properties** section at the bottom of the **Subjects** resources pane, change settings for the subject measurements you previously obtained. The Plug-in Gait model parameters are included with the properties in the **Subject** resources pane.

5. In the capture volume, have the subject stand in a stationary neutral pose, to enable the Vicon system to determine the location of key markers. This is typically a T-pose, in which the subject stands in the basic neutral pose and raises the arms out straight to the sides with palms facing down in a position in the shape of a T, ensuring that the markers on the subject are visible to all the cameras. If the subject is not able to attain the T-pose, they can use any neutral pose where all of the markers are visible to the cameras so that the markers will be able to be reconstructed.
6. In the **Capture** tools pane, capture a brief trial and reconstruct the markers.
7. Nexus automatically switches to **Offline** mode and displays the subject data in the **3D Perspective** view pane.
8. In the **Label/Edit** tools pane, manually label the reconstructed markers in accordance with the associated Plug-in Gait *.vst* file.

To process a Plug-in Gait static trial:

1. In the **Resources** pane, ensure Nexus is in **Offline** or **Pause** mode.
2. Display a **3D Perspective** view pane containing the frame of reconstructed and labeled markers for the subject.
3. In the **Subjects** resources tree, ensure that the subject node you created from the Plug-in Gait *.vst* file is the only entry enabled for capture. When enabled, there is a check mark in the check box.
4. In the **Subject Preparation** tools pane, from the **Subject** list select the subject node.
5. In the **Subject Calibration** section, from the **Pipeline** list select the Workstation Operations pipeline for static trial processing you previously created, ensure the **Run static gait model** operation is selected, and click the **Start** button to run the operation.
6. The operations are run on the paused real-time data. The progress bar at the bottom of the **Subject Calibration** section displays a percentage indicating the progress of the operation. The **Start** button switches to its **Stop** setting.
7. Verify that Plug-in Gait has successfully calculated the biomechanical model based on the measured marker positions. In the **3D Perspective** view pane, ensure that additional markers corresponding to the joint centers and segment orientations calculated by Plug-in Gait are displayed.
8. If they are not, check the following:
   - Have you attached the correct Plug-in Gait *.vst* file to the subject node in the **Subjects** resources pane?
   - Ensure that all the correct subject measurements are displayed in the **Properties** section at the bottom of the **Subjects** resources pane, and all the correct marker names are displayed in the **Manual Labeling** list in the **Label/Edit** tools pane.
   - Have you entered all the required subject measurements?
   - If the subject node name in the **Subjects** resources pane is displayed in red, that indicates that the *.vst* file is incomplete. Hover the pointer over the red text to display a ToolTip identifying the nature of the problem
   - Have you reconstructed all the markers?
   - Check that there is one 3D reconstruction in the **3D Perspective** view pane for each marker the subject is wearing. Reconstructed markers appear as white spheres before they are manually labeled.
   - Have you labeled all the markers correctly?

- Check that all markers are connected by sticks in the **3D Perspective** view pane and that the sticks connecting makers on the left side are red and that those on the right side are green.

9. If you initially associated one of the Plug-in Gait .vst files for use with a KAD, you must subsequently associate a different .vst file to account for the KAD not being worn during dynamic trials.
10. In the **Subjects** resources pane, attach the corresponding basic Plug-in Gait .vst file:

    - If you originally used the *KAD PlugInGait.vst* template, now attach the *PlugInGait.vst* template.
    - If you originally used the *KAD PlugInGait (SACR).vst* file, now attach the *PlugInGait (SACR).vst* file.
    -

    The sticks connecting the KAD markers (KAX, KD1, KD2) are replaced by a virtual knee marker.

11. In the Subject Preparation tools pane, from Pipeline list select the Calibration pipeline you previously created, ensure the Static Subject Calibration operation is selected, and click the Start button to run the operation.

Important	The **Static Subject Calibration** operation relies on a single frame of correctly labeled markers corresponding to the *.vst* file you are using. It is very important to ensure that the labels are present and correct in your *.vst* file and that you have manually labeled your trial before running the **Static Subject Calibration** operation. If your markers are not labeled, the operation will fail. If your markers are erroneously labeled (for example, if left and right markers have been mistakenly swapped) the operation will succeed, but when the Vicon Skeleton (*.vsk* file) is later used for automatic marker labeling, it will continue to produce the erroneous labels.

    The progress bar at the bottom of the **Subject Calibration** section displays a percentage indicating the progress of the operation. The **Start** button switches to its **Stop** setting.

12. Verify that Nexus has successfully created a Vicon Skeleton and it is automatically labeling.
13. In the **3D Perspective** view pane, ensure that bounding boxes for Plug-in Gait model segments are displayed. The bounding boxes Nexus draws around each segment defined in the *.vsk* file are for visualization purposes only.
14. If you do not see any data in real time, the markers are not being automatically labeled in **Live** mode, or the real-time data seems wrong, check the following:

    - Is Nexus in **Live** mode?
    - If not, in the **Resources** pane, click the **Live** button.
    - Is the **Core Processor** set to at least the **Label** level?
    - If not, in the **System** resources pane, select the **Local Vicon System** node. In the **Properties** section, ensure that the **Processing Level** parameter is set to **Label** or **Kinematic Fit**.
    - Did you change the *.vst* file before performing dynamic captures?
    - The KAD *.vst* files include KAD markers in the marker set. Since a KAD device is not used during dynamic trials, you must changed the *.vst* file to one that does not contain the KAD markers, as described in step 7.
    - Are the reconstructed markers displayed in **3D Perspective** view pane with labels or sticks?

- Ensure that the *.vsk* file has been correctly created, as described in step 8. In the **Options** dialog box, ensure the **Subjects** option is selected.
- Are your labeling parameters set correctly?
- If not, in the **System** resources pane, select the **Local Vicon System** node. In the **Properties** section under **Core Processor**, try adjusting the settings of the **Label Model Rigidity** parameter.

15. Save the trial.

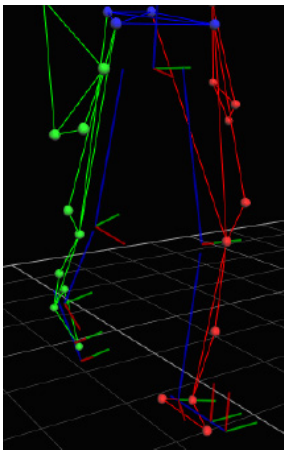
Capturing and Processing a Plug in Gait Dynamic Trial

The second stage of processing with Plug-in Gait in Nexus is capturing and processing dynamic trials on which your clinical analysis will be based.

Tip	Vicon recommends that you do not remove the heel markers for the dynamic captures. Their presence does not affect the calculated output from Plug-in Gait, but it will improve the reliability of the automatic labeling in Nexus.

To capture and process a subject using Plug-in Gait:

1. Display a **3D Perspective** view pane.
2. In the **Capture** tools pane , specify any settings for the dynamic trial in the **Capture Configuration Management**, **Next Trial Setup**, and **Data Source Setup** sections. In the **Post-Capture Pipeline** section, select **Run pipeline after capture** and select the dynamic trial processing pipeline you previously created.
3. In the **Resources** pane, switch Nexus back to **Live** mode.
4. In the capture volume, have the subject start walking across the capture volume.
5. Nexus reconstructs, labels, and fits the Vicon Skeleton created in the previous stage to the subject in real time.
6. In the **Capture** tools pane, under the **Capture** section press **Start**.
7. The MX cameras capture the markers on the subject as they move in the capture volume. Any virtual markers generated by Plug-in Gait, such as an OPLA (Origin Proximal Lateral Anterior) trajectories, are displayed in the **3D Perspective** view pane as Vicon X,Y,Z coordinate systems with red, green, and blue axes with the blue axis corresponding to the long axis of the segment .
8. If the subject steps on the force plates, the force vector is also shown in real time in the **3D Perspective** view pane. The **Start** button switches to its **Stop** setting.



9. After you have acquired the data you need, click **Stop**.

10. Nexus automatically switches to **Offline** mode, displays the subject data in the **3D Perspective** view pane, and automatically performs the operations contained in the dynamic trial processing pipeline:

    - **Core Processing** operation: Reconstruct and label the 3D marker data.
    - **Apply Woltring filtering routine** operation: Filter the data using the Woltring filter to ensure smooth trajectories for calculating kinetics.
    - **Detect gait cycle events** operation: Automatically detect gait cycle events based on force plate strikes, and add these to the Time Bar.
    - **Autocorrelate events** operation: Automatically correlate these events to extract other foot contact and foot off events where the subject was not stepping on the force plate.
    - **Run dynamic gait model** operation: Process Plug-in Gait to generate kinematic and kinetic data.
    - **Export C3D** operation: Save the trial data to a *.c3d* file for import into other software for further processing or report generation. For example, in Vicon Polygon you can visualize the trajectories, kinematic model elements, and kinetics data. If you manually import the corresponding *.vst* file into Polygon, it also visualizes the bones.

    Tip: The **Detect gait cycle events** functionality relies on good force plate strikes and clean trajectories in order to automatically detect events. This, unfortunately, is not always the case, and sometimes manual event identification is necessary. To do this, you use the **Enter Event Identification Mode** on the **Time Bar**.

11. Repeat steps 4-6 until you have obtained the required number of walking trials.

Exporting 3D Overlay to an AVI File

Export the 3D overlay of Vicon optical data over images from a calibrated DV or DCAM digital camera with the *.avi* file for viewing in other applications using the **Export 3D Overlay Video** operation in the **Pipeline** tools pane .

In the **Combined** view from the **Camera** view pane, you can visualize Vicon optical data overlaid onto images from a calibrated DV or DCAM digital camera. For example, you can visualize 3D information, such as the floor grid, markers, and virtual force plates, overlaying the 2D video image. The **Export 3D Overlay Video** operation burns this 3D overlay information into the *.avi* digital video file so that you can view it in other applications, such as Vicon Polygon.

To export 3D Overlay information with .avi files:

1. In the **Camera** view pane toolbar, from the **View** drop-down list select **Combined** to view Vicon optical data overlaid onto images from a DV or DCAM digital camera.
2. In the **Options** dialog box (F7), select the desired options to configure the visualization of data to suit your needs (for example, if you may only want the force vector to appear on the 3D overlay).
3. In the **Options Configuration** section at the top of the **Options** dialog box, save the options configuration. The configuration is saved as an *.Options* file in the Nexus Options folder (by default *C:\Program Files\Vicon\Nexus\Configurations\Options*).
4. In the **Pipeline** tools pane, create a File I/O pipeline that includes the **Export 3D Overlay Video** operation.

    Tip: If you want to de-interlace the *.avi* file, select the **Apply Codec to Video** pipeline operation and position it in the **Current Pipeline** list before the **Export 3D Overlay Video** operation.

5. In the **Current Pipeline** section, click on the operation, then in the **Properties** section at the bottom of the **Pipeline** tools pane, view or change settings for the desired properties. From the **View Options Set** list, which is displayed in alphabetical order, select the name of the *.Options* file you created in step 3.
6. Run the pipeline either on an individual trial in the **Pipeline** tools pane or on multiple files using the Batch Processing Interface.
7. The 3D overlay information from each DV camera is stored in a separate file, in the format:
8. *TrialName.DeviceID.overlay.avi*
9. where:

TrialName	is the base name of the trial file.
DeviceID	is the unique identification number Vicon assigns to a DV camera. You can find the Device ID in the System resources pane, by expanding the **Video Cameras** node, selecting the desired DV camera, and then in the **Properties** section expanding the **Settings** area.
overlay	identifies the file contents as the 3D overlay information associated with the video file.
avi	is the file extension.

For example, take a DV camera with a Device ID of 52883644. If you run the **Export 3D Overlay Video** pipeline operation on a video file named *Walk1.52883644.avi*, the exported 3D overlay file will be called *Walk1.52883644.overlay.avi*.

Important	You can not open an exported 3D overlay (*.overlay.avi*) file in Nexus.

Properties

You can configure the following settings in the **Properties** section for the **Export 3D Overlay Video** operation:

- View Options Set

  The *.Options* configuration files that have been saved using the **Options** dialog box. You can select settings for the 3D data to be exported with the *.avi* file. Select a configuration file from the drop-down list. If you do not specify a file, the current view options are used.

  Default: blank

- Video Codec

  The video compression method to use when exporting the *.avi* file. Select a codec appropriate for the DV or DCAM digital camera used to capture the *.avi* file.

  Default: blank

Important	Due to the rapidly changing nature of available capture hardware, PC processing power and available codecs, please check the FAQ on the Vicon Support web site for the latest information.

De-Interlacing an AVI File

Permanently de-interlace an *.avi* file using a pipeline operation in the **Pipeline** tools pane.

Nexus Motion Capture Workflow:

V. Post process trial

Nexus can permanently de-interlace all interlaced *.avi* files associated with the currently loaded trial. The de-interlaced *.avi* file is placed in the same directory as the source *.avi* file. It retains the original file name, but is appended as follows: *[filename].interlaced.avi.*

If an *.avi* file within the currently open trial has been de-interlaced, Nexus automatically loads the new (de-interlaced) version of the file.

Important	Audio tracks are not transferred to the de-interlaced file.

To de-interlace an .avi file:

1. To load a digital video file, with the **Camera** view pane selected, click on the desired movie file in the **Data Management** pane.
2. In the **Available Operations** section of **Pipeline** tools pane, expand the **File I/O** operations list.
3. Double-click the **Apply Codec to Video** pipeline. The operation is added to the list under the **Current Pipeline** section.
4. In the **Current Pipeline** section, click on the pipeline, and then in the **Properties** section at the bottom of the **Pipeline** tool pane:
   - From the drop-down **Video Codec** list, select the codec you want to use for file compression.

Important	Due to the rapidly changing nature of available capture hardware, PC processing power and available codecs, please check the FAQ on the Vicon Support web site for the latest information.

   - Select the **Keep Backup** to back up the file if you want Nexus to create a backup of the video file.

Important	Reverting to the backup file to re-do the de-interlacing is not supported in Nexus. Therefore, Vicon recommends selecting **Keep Backup** whenever you permanently de-interlace an *.avi* file. To perform de-interlacing again on a video file, you must re-import the file and rerun the pipeline operation.

   - From the **Remove Interlacing** list, select the required option.
5. Select any other pipeline operations you want to include in the pipeline configuration.

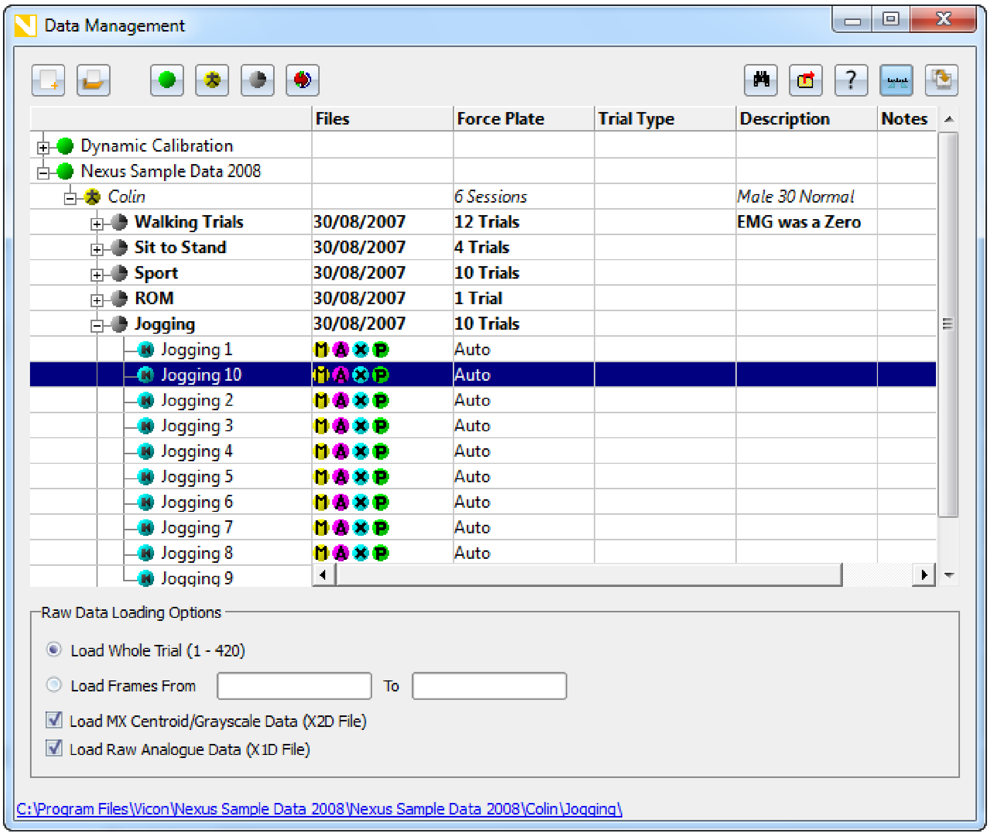
Tip	The pipeline operations are run in the order they appear in the **Current Pipeline** list; you can rearrange the order by dragging operations into the desired position in the list.

6. In the **Current Pipeline** Configuration Management section, click the **Save** button to save your settings. An asterisk (*) is displayed next to the pipeline name if there are unsaved changes.
7. Run the pipeline.

Data Management

About Nexus Data Management

Store and manage all data associated with your motion capture trials in the **Data Management** window  .



Vicon System Setup:

III. [Prepare a database](#).

Nexus Motion Capture Workflow:

III. [Capture and process a trial](#).

IV. [Review trial and fill gaps](#).

V. [Post process trial](#).

You access the **Data Management** window from either the Nexus **File** menu or the Toolbar. By default, the last opened database is loaded when you open the **Data Management** window.

The **Data Management** window provides integrated data management for storing and managing all data associated with your motion capture files (this functionality was available in the Eclipse Data Directory browser in earlier Vicon application software). Data is organized in a hierarchical structure, with specific data and information stored in relevant nodes. Preparing the database in which to store trial data is part of the third step of [Vicon system setup](#).

Opening the database and making the desired session node active for the current trial capture is the third step in the Nexus motion capture workflow.

The **Data Management** window also provides file transfer as well as batch processing functionality. Automatically transcoding reference video files is the third step in the third stage of the Nexus motion capture workflow. Automatically processing multiple trials in a database using a previously defined pipeline is part of the post processing stage in the Nexus motion capture workflow.

Tip — You can leave this **Data Management** window open on your desktop by clicking the check box next to the command on the **File** menu. If this check box is cleared, the **Data Management** window closes automatically when you click anywhere outside of it.

The **Data Management** window contains the following sections:

- Data Management Toolbar

  You create and manage nodes in the database hierarchy using the buttons in the toolbar at the top of the **Data Management** window.

- Database Hierarchy Nodes

  You view a visual representation of the structure and contents of a trial database, and select individual data types for loading in Nexus, in the Database Hierarchy Nodes below the **Data Management** toolbar.

- Data Type Icons

  You can view and select individual motion capture files using the Data Type Icons that represent the data saved for the trial.

- Discrete Data Values

  You can view or specify Discrete Data Values (DDVs) that provide descriptive text or numerical data associated with a specific node in the trial database.

- Database Location

  You can view the full path of the active node in the trial database at the bottom left of the **Data Management** window. To access the files, click the hyperlink.

Data Management Toolbar

About Data Management Toolbar

Create and manage nodes in a trial database hierarchy in the **Data Management** toolbar at the top of the **Data Management** window .

The buttons available on the left side of the **Data Management** toolbar depend upon the Database Template on which the database was based:

- Standard Toolbar

  You create a new database or open an existing one in the **Data Management** standard toolbar. These buttons are always available regardless of the database template used.

  New Database : Displays the **New Database** dialog box in which you can create new trial database using the following options:

  Location: The full path identifying the location on the hard drive in which to store the new trial database to be created. You can either type in the location or click the **Browse** button and navigate to it in the displayed **Browse for Folder** dialog box.

  Name: The unique name by which to identify the trial database to be created.

  Description: Any text you want to use to describe the content of the Eclipse database to be created.

  Based on: The .eni template file on which to base the trial database to be created.

  Create: Create a new database based on the information entered and close the dialog box.

  Cancel: Close the **New Database** dialog box without creating a database.

  Open Database : Displays the **Open Database** dialog box, in which you can open an existing trial database using the following fields and buttons:

  Name | Path: The file name and path of any previously opened trial databases.

  Open: Open the trial database selected in the **Name | Path** list and close any database that is currently open.

  Browse: Open the **Please specify an Eclipse Hierarchy Root File** dialog box in which you can navigate to the folder containing the root .enf template file for the desired Eclipse database. Once selected, this file appears in the **Name | Path** list.

  New: Open the **New Database** dialog box in which you can create a new trial database. For details, see **New Database** above.

  Remove: Remove the selected database entry from the **Name | Path** list.

  Cancel: Close the **Open Database** dialog box without opening a trial database.

  Search : Displays the **Search** dialog box, in which you can specify data to search for in the current database.

Archive : Displays the **Archive** dialog box, in which you can specify where on your computer to create an archive copy of the active session.

About Eclipse : Displays the **About Eclipse Control** dialog box in which you can view version information on the data management module in Vicon Nexus.

Show Trial Loading Options : Displays or hides the **Raw Data Loading Options** area, in which you can specify your requirements for loading large trials.

Show File Transfer/Batch Processing Interface : Displays or hides the **Remote File Transfer/Batch Processing** pane on the right side of the **Data Management** window.

Clinical Toolbar

You manage the nodes in the database hierarchy for a trial based on a Clinical template (such as *Clinical Template.eni*, *Clinical Template for OLGA.eni*, or *Clinical Template 2FP.eni*) with the following buttons:

New Patient Classification : Add a new top-level patient classification node in the database hierarchy.

New Patient : Add a new patient node under the selected project node in the database hierarchy.

New Session : Add a new session node under the selected capture day node in the database hierarchy.

New Report : Add a new report node under the selected session or sub session node in the database hierarchy.

Generic Toolbar

You manage the nodes in the database hierarchy for a trial based on a Generic template (such as *Generic Template.eni*) with the following buttons:

New Top Level : Add a new top-level node in the database hierarchy.

New Subject Day : Add a new subject node under the selected top-level node in the database hierarchy.

New Session : Add a new session node under the selected subject node in the database hierarchy.

New Subsession : Add a new sub session node under the selected session node in the database hierarchy.

New Report : Add a new report node under the selected session or sub session node in the database hierarchy.

Data Management Files

The following types of files are used to manage databases:

- .eni file

  An Eclipse Node Initialization (.eni) file is a template used to define the default hierarchy nodes, data types, and discrete data values available in a new database based on this template. By default, the root *.eni* files are contained in the Vicon Eclipse folder (by default, *C:\Program Files\Vicon\Eclipse*).

  A copy of the template *.eni* file is stored in the new Eclipse database. Any customizations you make to this copy of the template are not reflected in the root template. Any customizations you make to the root template are not reflected in any existing databases; they are applied only to new databases subsequently created based on this root template. If you want to apply the root changes to an existing database, copy the root *.eni* file into your database directory. Note that it completely overwrites the local copy.

- .enf file

  An Eclipse Node File (.enf) file provides the internal details Eclipse needs to manage the current node. There is an *.enf* file associated with each node in the database hierarchy.

Warning	You are advised not to edit these internal database files. Experienced users may customize the files, but they do so at their own risk.

Database Templates

The default icons and names defined for the nodes and data types in a database hierarchy depend on the database template (*.eni* file) you choose when you create the database. A number of *.eni* files are supplied in the Vicon Eclipse directory (by default, *C:\Program Files\Vicon\Eclipse*). The hierarchy structure in an Eclipse database is always strictly maintained, but you can customize the default names and manage the number and types of nodes and data to suit your requirements.

The following default *.eni* files are supplied with Vicon Nexus:

- Clinical

  A clinical templates observe a hierarchy and default naming convention appropriate for Life Sciences applications, such as sports performance, gait analysis, neuroscience, physical therapy, and object tracking in medical environments. In addition to the general clinical template (*Clinical Template.eni*), templates for force plates (*Clinical Template 2FP.eni*) and for OLGA applications (*Clinical Template for OLGA.eni*) are supplied.

- Generic

  The generic template has a hierarchy and default naming convention appropriate for a broad variety of non-specialist applications.

Managing Databases

Create new motion capture databases or open and manage existing ones using the **Data Management** toolbar at the top of the **Data Management** window.

Vicon System Setup:

III. Prepare a database.

– Create a new database or open an existing one.

Nexus Motion Capture Workflow:

III. Capture and process a trial.

1. Capture a trial manually or automatically trigger motion capture remotely.

To create a new database:

1. Open the **New Database** dialog box in either of the following ways:
   - In the **Data Management** toolbar, click the **New Database** button.
   - In **Open Database** dialog box, click **New**.
2. In the **New Database** dialog box, create new trial database using the following options:
   - **Location:** The full path identifying the location on the hard drive in which to store the new trial database to be created. You can either type in the location or click the Browse button ... and navigate to it in the displayed Browse for Folder dialog box.

     Tip: You can save a trial database anywhere on your hard drive, but you may find it useful to store the database in the Vicon User Data folder (by default, *C:\Program Files\Vicon\Userdata*).
   - **Name:** The unique name by which to identify the trial database to be created. Do not include periods (.) in your database name.
   - **Description:** Any text you want to use to describe the content of the Eclipse database to be created.
   - **Based on:** The eni template file on which to base the trial database to be created.
3. Click **Create** to create a new database based on the information entered and close the **New Database** dialog box.
4. The **Open Database** dialog box is displayed, with an entry for the new database in the list. Alternatively, to close the dialog box without creating a database, click **Cancel**.

To open an existing database:

1. Open the **Open Database** dialog box in either of the following ways:
   - In the **Data Management** toolbar, click the **Open Database** button.
   - Right click in the database hierarchy and from the displayed shortcut menu, click **Open Database**.
2. In the **Open Database** dialog box, open an existing trial database using the following fields and buttons:

- **Database list**: View the entries identifying the file **Name** and **Path** of any previously opened trial databases.
- **Browse**: Open the **Please specify an Eclipse Hierarchy Root File** dialog box in which you can navigate to the folder containing the root *.enf* template file for the desired Eclipse database. Click **Open** to select the specified file and close the dialog box. The **Open Database** dialog box is displayed, with an entry for the new database in the **Database list**.

Tip	An error message is displayed if you select an *.enf* file from further down the database hierarchy. Close the error message and navigate back up the hierarchy to the root *.enf* file.

3. Click **Open** to the selected trial database in the Data Management window and close any database that is currently open. Alternatively, to close the dialog box without opening a database, click **Cancel**.

To remove an existing database:

1. In the **Data Management** toolbar, click the **Open Database** button .
2. In the **Open Database** dialog box, click on the entry in the **Database list** for the database you want to remove.
3. Click the **Remove** button. The selected database entry is removed from the **Database list**.

To search for data in the open database:

1. In the **Data Management** window, make the node you wish to search active.
2. In the **Data Management** toolbar, click the **Search** button .
3. In the **Search** dialog box, click the **Search** tab and specify the criteria to search for:
4. **Node Information (use * as wildcard)**
5. Specify text to search for in a node in the database hierarchy (the first column of the **Data Management** window):
   - **Search for**: Enter the text to search for. You can use the asterisk (*) as a wildcard to identify one or more characters that can be substituted in order to search for variations of the specified word.
   - **Node type**: Select the types of node to search.
   - **Match Case**: Select this check box if you want to match only words in the same case (upper or lower) as that entered in **Search for**.
   - **Search**: Select the level of the hierarchy to search:
     - **Whole Hierarchy**: All levels of the current database.
     - **Subtreee of Active Node**: Only the levels beneath the active node.
     - **Current Results Only**: Only those returned in the **Results** tab from a previous search.

   Fields

   Specify any text to search for in a field for the specified node (one of the Discrete Data Value (DDV) columns to the right of a node name):

   - **Do not search Fields**: No field-level search.
   - **Value Between**: A range of values.
   - **Containing Text (* is wildcard)**: The text to search for. You can use the asterisk (*) as a wildcard.

6. Click either of the following buttons to start the search:
   - **New Search**: Search the specified nodes and fields.
   - **Continue Search**: Further refine data returned in the **Results** tab from a previous search.

   The **Results** pane is automatically displayed, with an entry for any nodes matching the specified search criteria.

7. In the **Results** pane, double click on an entry or click **OK** to close the dialog box and make that entry the active node in the database.

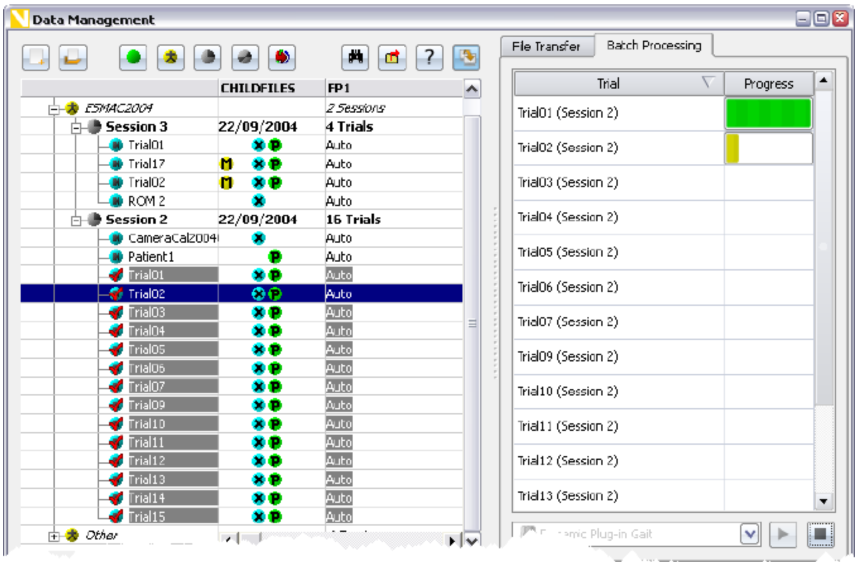
To archive the active session on your computer:

1. In the **Data Management** window, make a session the active node.
2. On the toolbar, click the **Archive** button .
3. In the **Archive** dialog box:
   - **Choose destination path**: Specify where on your computer to create an archive copy of the active session by either typing in the full path, or clicking the **Browse** button ..., navigating to and selecting an existing folder, and clicking **OK**.
   - **Leave sub nodes in tree**: Specify whether or not to leave any sub nodes in the database after archiving the specified node.
   - **Remove all data files**: Specify whether or not to remove all data files from the database after archiving the specified node.
4. Click **Archive** to start the process. When the archive is complete, a red A is stamped on the session icon .

Tip	To quickly access the files for the current session, click the hyperlink at the bottom of the **Data Management** window.

Batch Processing Files

You can automatically process any number of trials from the current motion capture database using the **Show File Transfer/Batch Processing Interface** on the **Data Management** toolbar at the top of the **Data Management** window .



Nexus Motion Capture Workflow:

V. Post process trial.

3. Optionally batch process multiple trials in a database using a previously defined pipeline.

Batch processing is optional. It is useful for processing large numbers of files simultaneously or for automating frequently used processing operations.

Important	Before batch processing trial data, ensure that you have already: – Captured trial data – Created any pipelines you intend to run

To batch process trial data:

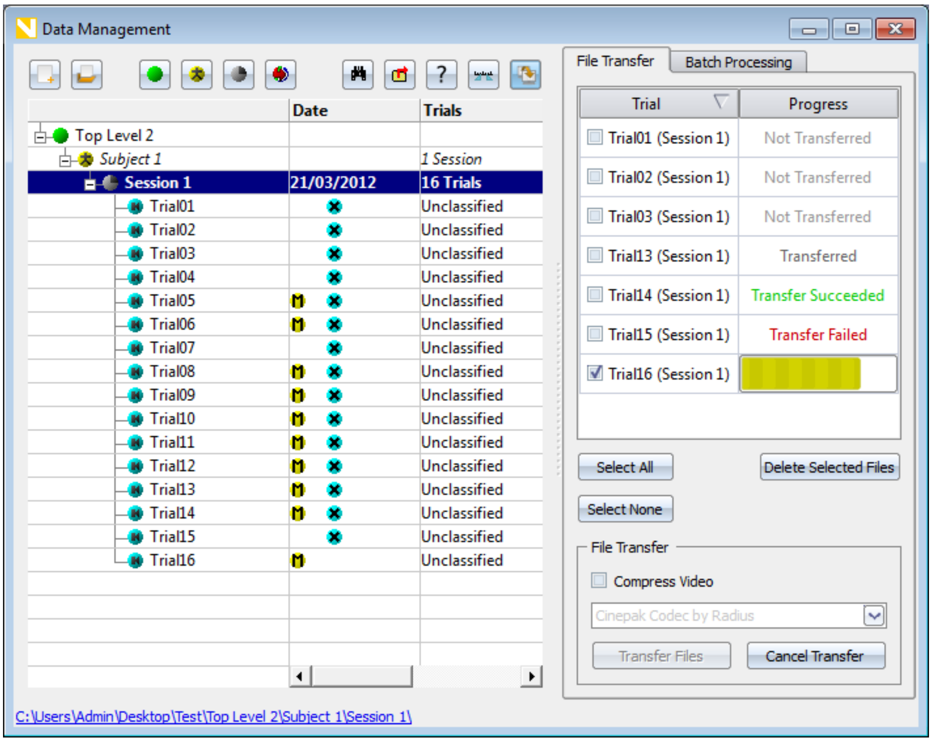
1. In the **Data Management** window, mark the nodes containing the files you wish to batch process.
2. On the **Data Management Toolbar**, click the **Show File Transfer/Batch Processing Interface** , and then click the **Batch Processing** tab. The marked nodes are displayed in the list in the **Batch Processing** tab.
3. From the drop-down menu at the bottom of the **Batch Processing** tab, select the pipeline to be run on the listed trial files and click the **Start** button to start the batch processing.

4. When the batch processing begins, an information window is displayed when a file is being imported for processing. It indicates the import status and contains buttons to Pause, Stop, or Cancel the import operation.
5. During the batch processing, the progress column in the trials list indicates the overall status of the processing:
   - Blank: Batch processing idle.
   - Yellow moving bar: Batch processing in progress.
   - Green static bar: Batch processing successfully completed.
   - Red static bar: Batch processing failed or canceled.

Tip	Hover the mouse pointer over a progress bar to view details of the batch processing operations.

Transferring Reference Video Files

Manage reference video files using the **Show File Transfer/Batch Processing Interface** on the **Data Management** toolbar at the top of the **Data Management** window.



Nexus Motion Capture Workflow:

V. Post process trial.

2. Transfer any digital video files to the Nexus host PC.

Transferring and Transcoding Reference Video Files

Before beginning transfer/transcode reference video files, ensure you have correctly configured Nexus to capture digital video data. You can transcode and transfer reference video files to the Nexus host PC that have been:

- Recorded to separate drives on the host PC
- Recorded directly to the *C:* drive (not recommended), which are stored in the session folder.

Tip	Nexus initially saves video files in *.vvid* format. You cannot view the video until the files are transcoded.

You can transfer and transcode video files produced by one or more Bonita Video cameras, IEEE 1394-based Digital Video (DV) cameras, IIDC 1394-based Digital Cameras (DCAM), or Basler Gigabit Ethernet (GigE) cameras:

- Bonita Video cameras are easiest to configure and offer higher frame rates than other supported video cameras.
- IEEE 1394-based DCAM devices capture raw video (in contrast to DV, which is compressed) and may therefore consume more bandwidth, but should provide a better signal quality.
- Basler DCAM and GigE cameras capture video data in raw format and stream this data directly to a hard drive. This allows Nexus to capture video as quickly as possible while minimizing the chances of dropped video frames during collection; however raw Basler video files are very large, making storage on local hard drives difficult.

Comparison of *vvid* files and transfer rates for supported video cameras

Comparison of vvid files and transfer rates for supported video cameras

All values are approximate and are provided for guidance only.

Camera type	Width	Height	Frame rate	MB\Sec
Bonita 720c\m	1280	720	127	111
Bonita 480m	640	480	360	105
Basler piA640 210 gc	648	488	210	63
Basler piA1000 48gc\m	1004	1004	48	46
Basler A602gc	656	490	100	30
NTSC DV	720	486	29.97	32
PAL DV	720	576	25	31

Video files are large, so as part of the transcode and upload process you normally select a codec (Compressor/ Decompressor) format to reduce the video file size. The selection of an appropriate codec and codec settings ensures the maximum reduction in file size, while minimizing any reduction in video quality.

Important	Due to the rapidly changing nature of available capture hardware, PC processing power and available codecs, please check the FAQ on the Vicon Support web site for the latest information on selecting an appropriate codec.

If a video file within the currently open trial has been transferred and/or transcoded, Nexus automatically loads the new version of the file.

To transcode and upload reference video files:

1. On the **Data Management** window, in the **Show File Transfer/Batch Processing Interface**, click the **File Transfer** tab.
2. The list in the **Trial** column includes all digital video capture trials created during DV capture.
3. From the list, specify the video files to be transferred in any of the following ways:
   - Click the corresponding check box to select a specific trial.
   - Click the **Select All** button [Select All] to select all trials in the list.
   - Click **Select None** button [Select None] to clear all previously selected trials.
4. In the **File Transfer** area, from the **Video Compression** drop-down menu either leave **None** (the default setting) or select one of the supported codecs for compressing the selected video files prior to transfer. Vicon recommends that you use the FFDShow codec, which you can download from the Vicon Support website. For information on installing and setting the correct options for the FFDShow codec, see Installing the FFDShow codec.

Tip	Nexus remembers the last codec selected from the drop-down list.

5. Click the **Transfer Files** button [Transfer Files] to start transferring the video files associated with the selected trials. Any specified transcoding is performed as the first stage of the transfer process.

Caution	Do not attempt to capture data while a file transfer is in process. Interrupting this process may result in problems with the data capture or file transfer. Allow the file transfer process to complete, or click the **Cancel Transfer** button [Cancel Transfer] to manually stop the process before starting a new capture.

   During the transfer, the progress column in the trials list indicates the transfer status:

   - **Blank**: File transfer process idle
   - **Yellow moving bar**: File transfer process in progress
   - **Green static bar**: File transfer process successfully completed
   - **Red static bar**: File transfer process failed or canceled

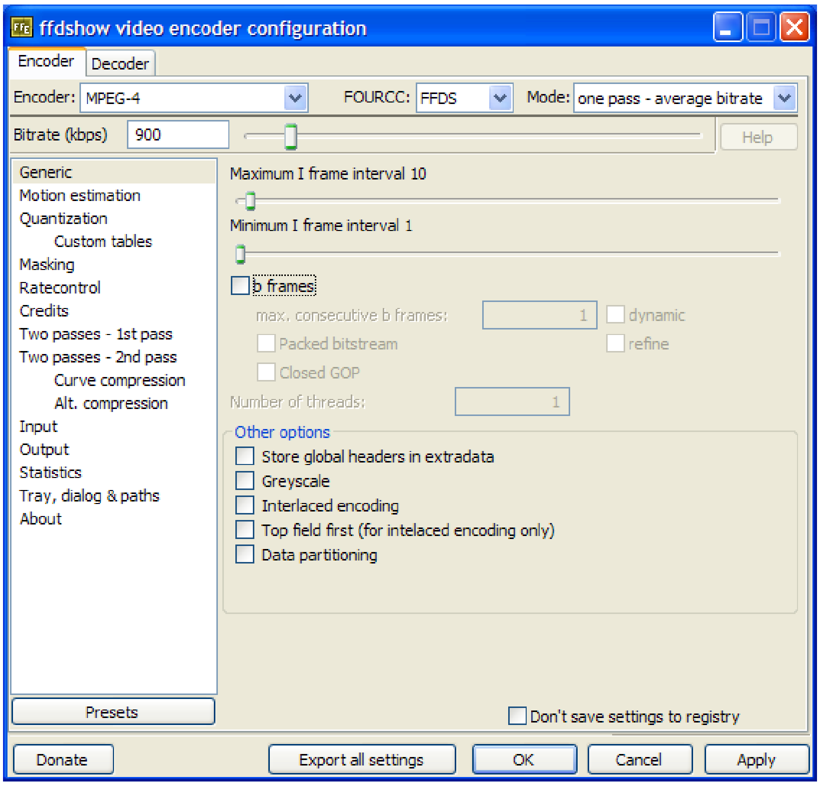
Tips	To view details of the file transfer process during the transfer, hover the mouse pointer over a progress bar. When you restart Nexus, the status of the files (transferred or not transferred) is shown in the **Progress** column, enabling you to select and delete successfully transferred files.

Installing the FFDShow Codec

The FFDShow codec is recommended by Vicon for transcoding your raw video files.

To install this codec:

1. Visit the Vicon Support web page and log in.
2. Go to the **Downloads** page and click **Life Sciences**.
3. In the **Search Downloads** box, type **FFDShow** and click **Find Downloads**.
4. Click on **FFDShow Video Codec** and download the file.
5. Install the downloaded FFDShow *.exe* file.
6. Accept the default options, ensuring that on the **Select Components** screen, the **VFW Interface** option is selected.
7. Click **Start** > **All Programs** > **ffdshow** > **VFW Configuration**.
8. On the **Encoder** tab, ensure **Generic** is selected, then select the following options and click OK:
   - **Encoder**: MPEG-4
   - **FOURCC**: XVID
   - **Mode**: one pass - average bitrate
   - **Bitrate (kbps)**: 900
   - **Maximum I frame interval**: 10
   - **Minimum I frame interval**: 1



9. In Nexus, you can now select the FFDShow codec from the list of available codecs in the **File Transfer** area of the **Data Management** window.

Deleting Reference Video Files

Delete reference video files using the **Delete Selected Files** function on the **File Transfer** tab of the **Show File Transfer/Batch Processing Interface**.

Caution	Do not delete a transcoded *.avi* file that has been saved directly to the host PC *C:* drive. If you do, the trial file itself will be deleted from the session folder in the Nexus motion capture database. Be sure to read this section before deleting any reference video files, as deleted files cannot be restored.

Nexus lists all raw *.vvid* files in the **File Transfer Trial** column list for deletion by default, on the assumption that you have transferred / transcoded raw files to compress their size or to process them for color, and that the raw files are no longer needed.

Designating a Drive for Recording Video Files

Designate the drive to which each camera's video files are written. You must choose an available drive on the computer where the camera is connected, but there is no default drive, so your decision depends upon performance requirements (e.g., number of cameras and frame rates).

Handling Transcoded and Original Files

When you transcode or compress a *.vvid* file, Nexus creates an *.avi* file, which is the transcoded version of the *.vvid* file. You can use the *.avi* file to experiment with different codecs without affecting your original *.vvid* file.

When video data is recorded, Nexus saves a *.vvid* file to the designated recording drive for each video camera. This file will have the filename: *TrialName.DeviceID.vvid.*

The transferred / transcoded *.avi* files will then be written to the session folder with the file name: *TrialName.DeviceID.DateTime.avi.* Every time you transfer / transcode a *.vvid* file to a session *.avi* file, a new file is created with a new date and time stamp, and Nexus will always open the most recent *.avi* file.

Deleting session *.avi* files only affects the video show by Nexus if you delete the *.avi* file with the latest date and time stamp. In this case, Nexus will open the *.avi* file with the next most recent date and time stamp. If you delete all of the *.avi* files, Nexus will not show any video for the camera.

Deciding Which Files to Delete

In the **Show File Transfer/Batch Processing Interface**, all raw *.vvid* files captured that have not been deleted are shown in the **File Transfer Trial** column list by default. Thus, using the **Delete Selected Files** function in the **Trial** column list removes the raw *.vvid* file, which would no longer be needed, helping you to save space and keep organized.

Vicon strongly recommends that, when possible, you do not capture video to the same drive as the session folder.

To delete reference video files:

1. On the **Data Management** window, in the **Show File Transfer/Batch Processing Interface** , click the **File Transfer** tab.
2. From the list of digital video capture trials in the current motion capture database, specify those from which the associated *.vvid* files are to be deleted in either of the following ways:
   - Click the corresponding check box to select a trial.
   - Click the **Select All** button 

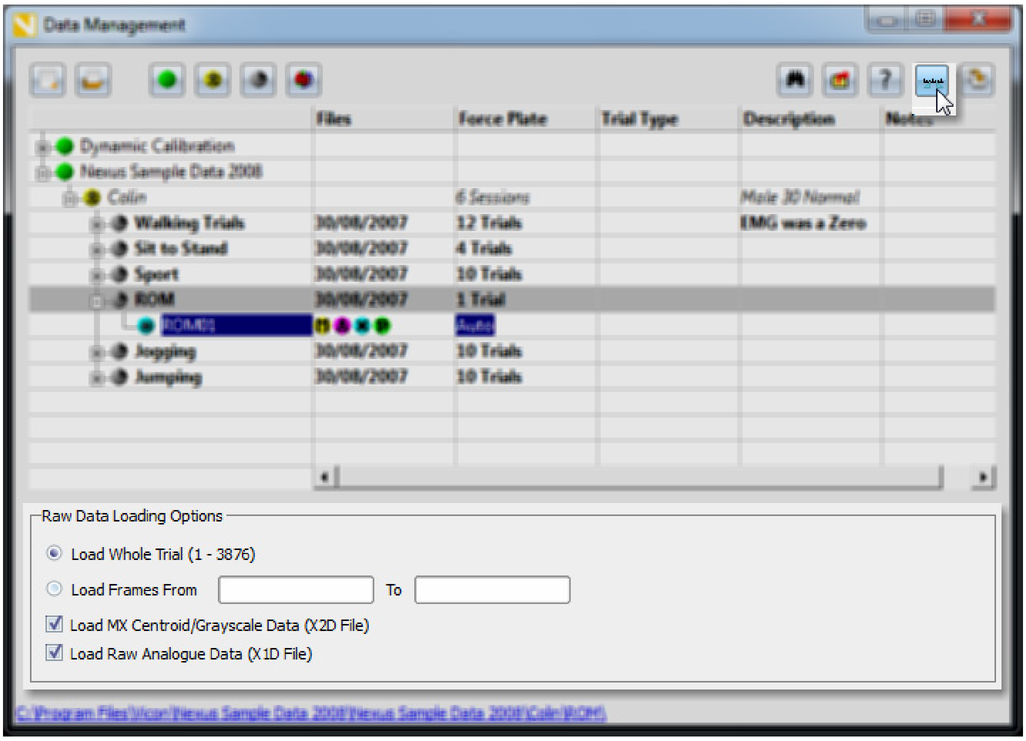
to select all trials in the list.
3. Click the **Delete Selected Files** button 

. The specified trials are removed from the list and all associated raw *.vvid* files are removed.

Loading Large Trials

To facilitate working with very large unprocessed data files, you can choose which files will be loaded (.x2d camera data and/or .x1d analog data), and how many frames of the trial are loaded.

To do this you click **Show Trial Loading Options**  on the **Data Management** toolbar at the top of the **Data Management** window .



To work with large trial data:

1. To select only required frames, in the **Raw Data Loading Options** area, select **Load Range From** and type the frame to start from in the first box and the end frame in the second box.
2. If required, choose whether to load both MX centroid/grayscale data (X2D) and raw analog data (X1D) files, or only one of these options.
3. Process the file(s) as normal.

   Only the selected range and files are processed.

Database Hierarchy Nodes Bar

About Database Hierarchy Nodes

View and manage the nodes created for the database hierarchy in the first column of the **Data Management** window .

The Data Management function keeps all files associated with a Vicon motion capture trial together in a strict hierarchical order. The database hierarchy can contain up to five levels to define the appropriate hierarchical structure for your motion capture trial as defined in the [database template (*.eni*) file] on which the database is based.

Each level (node) in the hierarchy has its own properties and can contain only certain types of data. The top-level node for the hierarchy has the same name as the database, with sub folders for each node. Sub sessions and Trials do not have their own folders but are sets of files within the Session folder.

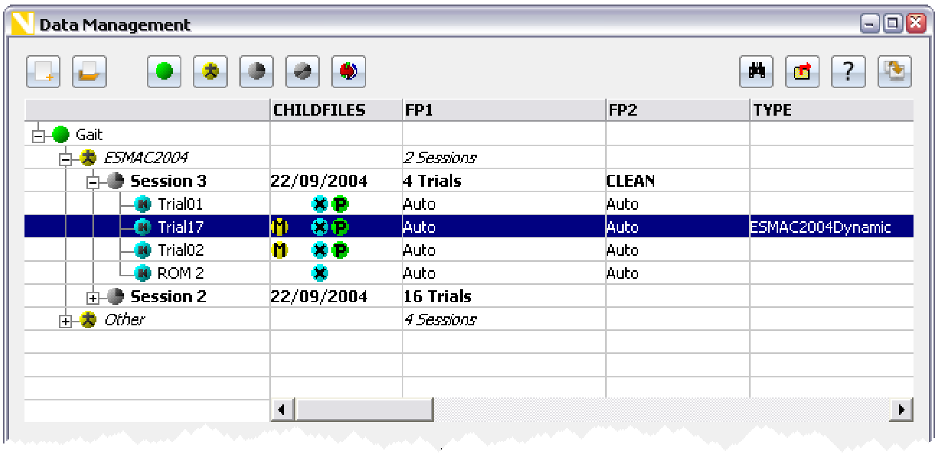
Caution	The hierarchy shown in the **Data Management** window is mirrored in the folder system on your hard drive. Under no circumstances should you manually change these folders on your hard drive as this will prevent your database system from functioning correctly. Make any changes from within the **Data Management** window in Nexus.

You can expand and contract the nodes in an database hierarchy as you would with standard file explorers. Additionally, you can identify a node for which you want to perform an action in the following ways:

- Active node

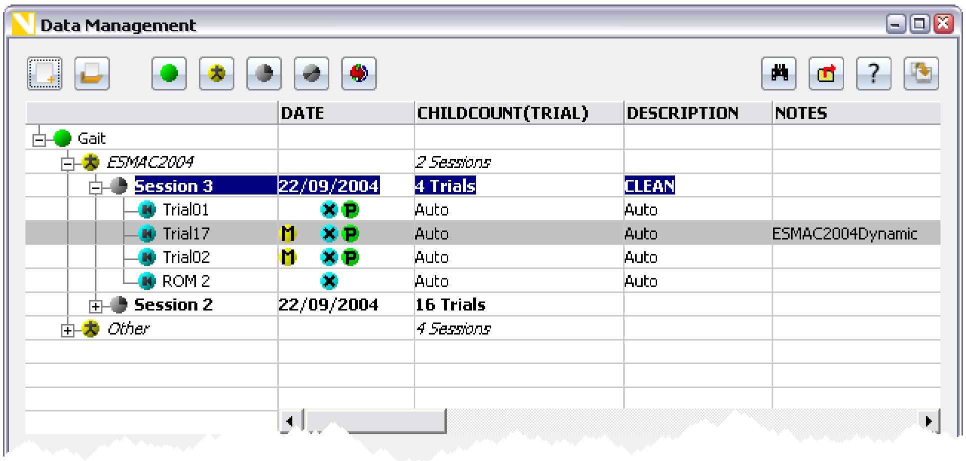
  An active node will be acted on by selections from the **Data Management** toolbar. An active node is highlighted with a solid background across the entire row. You can make a node active by double-clicking anywhere within the highlighted row.

  The background is solid blue if the node is selected and active.



Tip	You can view or change the active session node in the **Capture** tools pane when you are preparing to capture a trial.

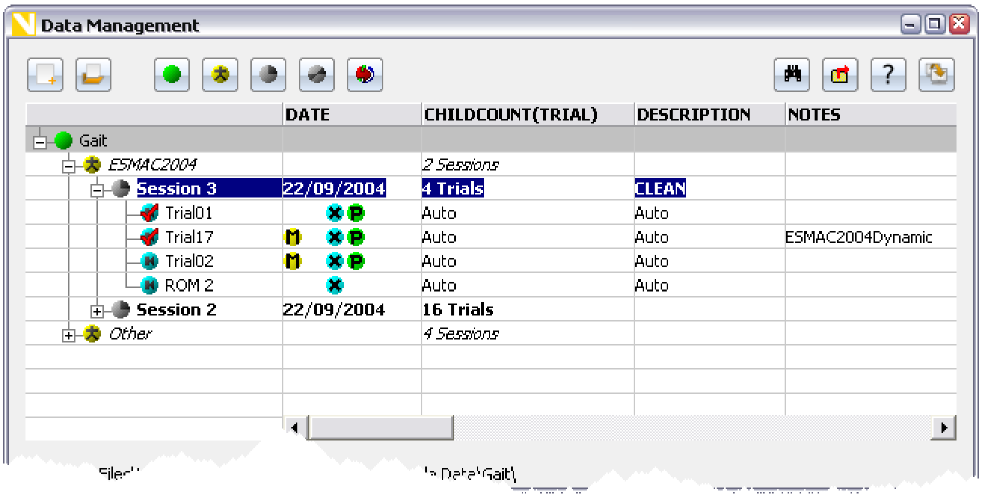
The background is gray if the node is active but another node is selected.



- Marked node

  A marked node will be acted on by buttons selected from the **Nexus Data Management Toolbar**.

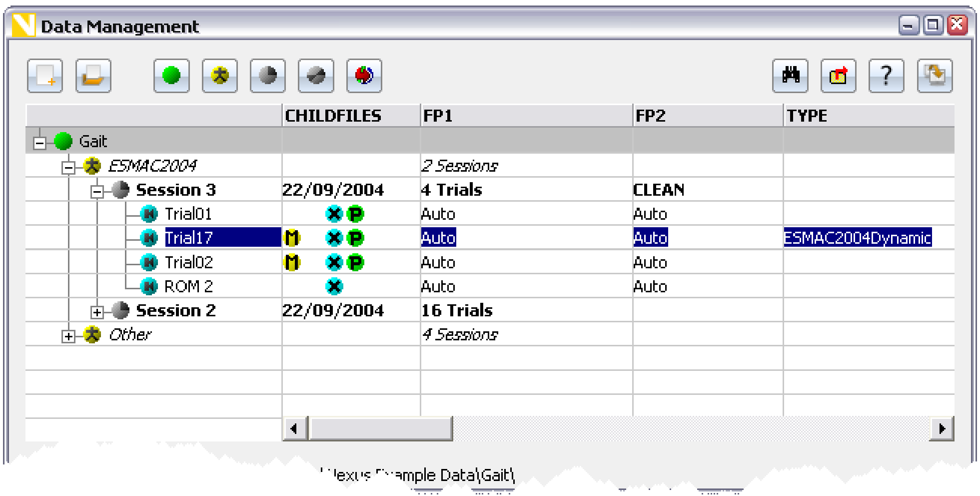
  A marked node is highlighted with a red check mark across the node icon.



- Selected node

  A selected node will be acted on by commands selected from the context menu displayed when you right-click on the node.

  A selected node is highlighted with a blue background behind the text only.



Once you have selected, marked, or made it active, you can carry out the operations described in [Managing Database Nodes](#).

Managing Database Nodes

Manage the nodes for a database hierarchy in the first column of the **Data Management** window .

After you have created one or more nodes in a trial database using the **Data Management** toolbar, you can create, delete, rename, and move folders and files to meet your requirements in the **Data Management** window.

Caution	The hierarchy shown in the **Data Management** window is mirrored in the folder system on your hard drive. Under no circumstances should you manually change these folders on your hard drive as this will prevent your database system from functioning correctly. Make any changes from within the **Data Management** window in Nexus.

You can manage database nodes using the mouse and/or the following commands from the context menu. Click on a command to see instructions for using it.

Move	New
Mark Node(s)	Clear Marks
Refresh	Rename
Import/Auto Import	Export Excel
Cut Selected	Copy Selected
Delete Selected	Paste
Sort Nodes By	Select Font

To move nodes within a database hierarchy:

1. Make the node to be moved the active node.
2. Drag the node to the desired location.
3. The rules of the hierarchy are enforced, so you can only move a node into a valid parent node. You cannot move nodes that do not have their own folder on the hard drive, such as Trials which are sets of individual files within a folder defining a session.

To create a new sub node:

1. Right-click the desired node and on the displayed context menu click the command for the type of sub node to be created.
2. The commands available are those sub nodes that would be valid for the selected node.
3. Accept the default node name or overtype it with a different name and click **ENTER**.

To mark a node/clear a marked node:

1. Right-click the desired node and on the displayed context menu click **Mark Node(s)** to mark it.
2. If you mark a parent node, all sub nodes are also marked.
3. Alternatively, you can select the node and press the SPACE bar to select it.
4. Right-click and on the displayed context menu click **Mark Node(s)** again to clear the marked node and any sub nodes, or **Clear Marks** to clear all marked nodes in the current database.
5. Alternatively, you can press the SPACE bar to deselect a highlighted node.

To refresh the current database hierarchy:

- Right-click the desired node and on the displayed context menu click **Refresh**.

To rename a node:

1. Right-click the desired node and on the displayed context menu click **Rename**.
2. Overtype the existing node name and click **ENTER**.

To import a node into the current database hierarchy:

1. Make the desired node of the current database active.
2. Note the database location of the active node at the bottom of the **Data Management** window.
3. In Windows Explorer, navigate to desired the Eclipse Hierarchy Node File (*.enf) and copy it into the location of the database node into which you want to import it.
4. The active node is automatically updated with the imported nodes in the **Data Management** window.

To export a node to a Microsoft Excel Spreadsheet:

1. Right-click the desired node and on the displayed context menu click **Export Excel**.
2. The node name and DDVs are copied to a Microsoft Excel spreadsheet.
3. Microsoft Excel is automatically started with the new motion capture spreadsheet open.

To cut/copy and paste nodes within a database hierarchy or to another database:

1. Right-click the desired node and on the displayed context menu click **Cut Selected** or **Copy Selected**.
2. Make the node to paste into (either within the current hierarchy or another hierarchy) the active node.
3. The Database Management function temporarily holds the cut or copied data in its own internal clipboard, so if you close the current database and open another, the data is available to paste into the newly opened hierarchy.
4. Right-click the active node and select **Paste Selected** from the displayed context menu.
5. In the displayed confirmation message, click **Yes** to paste the node, including all its associated sub nodes data, into the active node.
6. A cut node is deleted from the source node.
7. A copied node remains in the source node after the copy is pasted into its new destination.

To delete a node:

1. Right-click the desired node and on the displayed context menu click **Delete Selected**.
2. In the displayed confirmation message, click **Yes**.
3. The node is deleted from the current database hierarchy, and the associated folders and files are deleted from your hard disk.

Caution	There is no Undo or Restore function, so if you are not certain that you want the selected node to be permanently deleted, click **No** in the confirmation message.

To sort nodes:

- Right-click anywhere in the database hierarchy and on the displayed context menu point to **Sort Nodes By** and click the desired sort filter:
- **Alphabetically**
- **Time, Oldest First**
- **Time, Newest First**

  All nodes and sub nodes within the current database hierarchy are reordered according to the specified sort filter.

To select the font for node text:

1. Right-click anywhere in the database hierarchy and on the displayed context menu click **Select Font**.
2. In the displayed **Font** dialog box, select the desired font and attributes, then click **OK** to close the dialog box.
3. The specified font is applied to all node text in all databases.

Data Type Icons

About Data Type Icons

View and open the different data types saved for a motion capture trial using the **Data Type icons** in the **Data Management** window .

The icons for the standard data types that can be associated with Vicon motion capture trials are shown here in the default order in which they appear from left to right in the **Childfiles** column:

Icon	Data Type	Description
	Movie File	Multimedia sound and moving picture data in *.mpg* or *.avi* format files
	Raw Analog Data	Unprocessed analog data (e.g., from force plates) in *.x1d* or *.vad* format files
	Raw Capture Data	Unprocessed Vicon video data from Vicon V-series systems in *.tvd* format files
	Model Parameter File	The model's parameters for Plug-in Gait or BodyLanguage models
	MX Centroid/ Grayscale File	Unprocessed Vicon MX video data from MX and Bonita cameras in *.x2d* format files
	Text File	Any text file for the selected trial in *.txt* format files
	Processed Capture Data	Processed Vicon 3D motion data in *.c3d* format files

Tip	There are additional icons for file types of motion data created in earlier Vicon motion capture application software (such as Vicon V files containing subject kinematic data) or exported for use in third-party applications (such as animation software or Excel spreadsheets).

Managing Data Files

View and manage the motion capture data saved to a trial database in the first column of the database hierarchy in the **Data Management** window .

The data files associated with a motion capture trial are indicated by data type icons in the **Childfiles** column to the right of a node name in the database hierarchy.

To open a trial:

- In the database hierarchy, double-click the node name.

  The **Data Management** window closes, Nexus opens the trial, and the reconstructed data (and the associated movie file if present) is displayed in the view pane.

To open a specific data file:

- In the database hierarchy, double-click an icon.

or

- Right-click the desired node and on the displayed context menu point to **Open** and then click on the data file type.

  The **Data Management** window closes, Nexus opens the specified data file, displays system and subject data in the appropriate **Resources** pane and displays the visual data in the appropriate view pane.

To delete a data file:

- In the database hierarchy, right-click the desired node and on the displayed context menu click **Delete File**.

  The specified data file is deleted from the current database hierarchy, and the associated folders and files are deleted from your hard disk.

Discrete Data Values

About Discrete Data Values

View or enter descriptive text or numerical data associated with a node in a trial database in the Discrete Data Value (DDV) columns to the right of a node name in the **Data Management** window .

Vicon Nexus generates information for some DDVs, and you can enter and edit values for other DDVs. The following table identifies the DDVs that you can view and that you can edit for the specified database nodes.

Database Node	DDV	View	Edit
Capture	Description	✓	✓
	Notes	✓	✓
	Subject Measurements (Clinical templates only)	✓	✓
Session	Childcount	✓	·
	Date	✓	·
	Description	✓	✓
	Notes	✓	✓
	Subject Measurements (Clinical templates only)	✓	✓
Subject	Description	✓	✓
	Notes	✓	✓
	Subject Measurements (Clinical templates only)	✓	✓
Trial (Clinical)	Childfiles	✓	·
	FP1 (Force Plates only)	✓	·
	FP2 (Force Plates only)	✓	·
	OLGA_Info (OLGA only)	✓	·
	OLGA_Fit_Residual (OLGA only)	✓	·
	Status	✓	✓
	Type	✓	✓
Trial (Generic)	Childfiles	✓	·
	Stages	✓	

Managing Discrete Data Values

You can view, and in some cases edit, the descriptive text associated with a node in Discrete Data Value (DDV) columns to the right of a node name in the **Data Management** window.

The DDVs displayed and their possible values depend on the database template (.eni) file on which the database is based.

To edit DDV values:

1. Right-click the desired node and on the displayed context menu point to **Edit** and then click the DDV to be edited, or double-click the DDV text.
2. Edit the existing text, depending on the DDV type:
   - **Text:** In the displayed text edit box, type in the desired text and click **OK**.
   - **Restricted range of values:** From the displayed drop-down list, select the desired value.

To resize the width of a DDV column:

- Place the mouse cursor on the right edge of the column until the cursor changes into a double arrow and then drag the arrow left or right to resize the column.

Contacting Vicon

Vicon Contact Information

For further information on Vicon Nexus and other Vicon products, please contact your nearest office or send an email to info@vicon.com.

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PWC Building, Singapore 048424
Tel: +65 6400 3500

Vicon Motion Systems is an OMG plc company.

Vicon Online Support

If you are a licensed user and a current customer, you can access the Vicon Online Support knowledge base. If you do not have a username and password, or need assistance with logging in to Vicon Online Support, please contact Vicon Support.

To log in to Vicon Online Support:

1. Go to www.vicon.com/support. The Vicon Support + Services page is displayed.
2. In the log in area, enter your Vicon Online Support **Username** and **Password**.
3. After reviewing the terms and conditions, select the **Agree to terms and conditions** check box.
4. Click **Enter**. The Online Support page is displayed.

Available Resources

Vicon 3D motion capture and analysis systems have been applied to technologies in the fields of human movement sciences, clinical analysis, computer animation, and engineering around the world. Our web site offers the following resources.

Downloads

Obtain latest firmware and other software patches, models and scripts, and product documentation.

FAQs
Locate topics providing answers to frequently asked questions about Vicon hardware, software, plug-ins, and licensing as well as third-party software.

Cases
If you cannot locate the information you need in the FAQs, submit your own question or report a problem. You can then track responses to your questions and updates to your problems.

Vicon Newsletters
Register online or via email to receive Vicon newsletters for your field of interest:

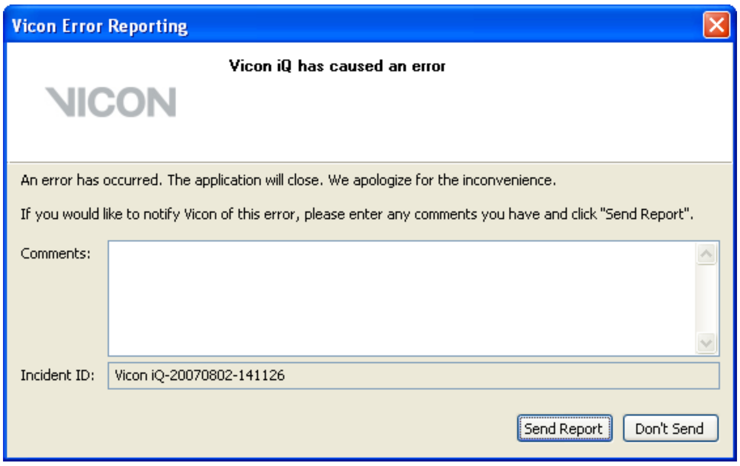
- **Online** - Complete the form at www.vicon.com/contact/.
- **Email** - Send a request to moveme@vicon.com.

The Standard
You can view the latest issue of *The Standard* online or subscribe to receive a printed copy at www.viconstandard.org/. This publication contains articles on motion analysis in science and engineering research and application projects. Articles are contributed by practicing experts and leading authorities in laboratories throughout the world.

Vicon Error Reporting
The Vicon Error Reporting system provides a quick and convenient way for you to contact Vicon in the event that your Vicon application software stops responding. It enables Vicon to investigate particular problems and to take your feedback into consideration in further product updates.

Using the Vicon Error Reporting System
If an error occurs that causes the Vicon application software to stop responding, two events are triggered:

- A Vicon error report file (named *OMG*.tmp*) is automatically created in the Temp directory (by default, *C:\Documents and Settings\< User_Name>\Local Settings\Temp*).
- This file contains information including the operating system version and the state of the application when it stopped responding. It does not contain any personal information.
- The Vicon Error Reporting dialog box is displayed.



You can choose to do one of the following:

- Ignore the error and continue with what you were doing.
- Automatically send an error report to Vicon.
- Email an error report to Vicon. This is useful if you decide to report the problem after closing the **Vicon Error Reporting** dialog box, or if you do not have an active Internet connection on the Vicon host PC.

Ignoring an Error

If the Vicon application software stops responding, you may decide to simply restart the software and continue with what you were doing.

To ignore an error:

1. In case you want to report the incident later, take a note of the number in the **Incident ID** field in the **Vicon Error Reporting** dialog box.
2. Click **Don' t Send** to close the dialog box.
3. After the Vicon software has completely closed, restart the application.

Automatically Sending an Error Report

Unless you do not have Internet access from the Vicon host PC, we recommend that you report errors using the automatically generated report.

To automatically send an error report:

- In the **Comments** field, enter the following details: A brief description of the problem, including steps to reproduce the problem if possible.

  Clear step-by-step details on the actions leading up to the application closing helps Vicon to isolate the probable cause of the problem and identify a solution. Your name and/or organization name to enable Vicon to contact you if additional information is needed to investigate the problem. Make a note of the **Incident ID for future reference. Click Send Report. The automatically generated error report is sent to Vicon, where it is processed and forwarded to the appropriate engineer for investigation.**

Emailing an Error Report

If you do not have Internet access from the Vicon host PC, you can email an error report to Vicon.

To email an error report to Vicon:

1. In the **Subject** line, include "**Vicon Error Report**."
2. In the body of your email, include the following details:
   - **Incident ID** from the **Vicon Error Reporting** dialog box.
   - A brief description of the problem, including steps to reproduce the problem if possible.
   - Clear step-by-step details on the actions leading up to the application closing helps Vicon to isolate the probable cause of the problem and identify a solution.
   - Your name and/or organization name to enable Vicon to contact you if additional information is needed to investigate the problem.
3. Attach the Vicon error report file (OMG*.tmp) to your email.

   This file is automatically stored in the system Temp directory. By default, the Temp directory is *C:\Documents and Settings\<User_Name>\Local Settings\Temp*. If your Temp directory is not in this default location, **determine its location**.
4. In the **Open** field, type the command to open the Command Prompt window for your Windows operating system:
   - Windows XP, Windows 2000, or Windows NT 4.0:
   - `cmd`
   - **Windows ME, Windows 98, or Windows 95:**
   - `command.com`
5. At the command prompt, enter:

   set
6. Make a note of the value for the TEMP entry.
7. From the Windows **Start** menu, click **Run**.
8. Send your email to support@vicon.com.

Vicon Documentation Feedback

At Vicon, we are working to develop comprehensive and easy-to-use documentation to support your use of our products. We welcome your comments or suggestions on how we can continue to improve our product documentation.

To provide documentation feedback:

- Send an email to support@vicon.com with the following information:

  Please include "Documentation Feedback" in the Subject line and provide the following details in the body of your message:

Product details	Product name, version number, and build number. (To find this information, click the **Help** menu and then click **About Vicon Nexus**).
Document details	Type of document and content location: – Book (page number) – Help (topic title) – Release document (document title)
Problem description	Brief description of content, identifying your concerns (eg, specify any factual inaccuracies, errors, or omissions; grammatical errors; navigation or information location problems).
Feedback details	Your suggestions for correcting or improving the documentation.

Vicon Customer Satisfaction Survey

Please help us to improve our services by printing this page and sending your completed survey by fax or mail to your nearest Vicon office.

We value your honest opinion on the service you have received so far. We take your feedback into consideration when providing products and services in the future. If you have any questions or comments about this survey, please contact our Sales and Support Manager in our Oxford office.

Contact Name ________________________ Title ________________________

Organization ________________________ Date ________________________

For each question, check the box that most closely describes your opinion. Leave blank any that are not applicable.

How satisfied are you with the quality of your Vicon system? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you with the purchase experience of your Vicon system? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you with the value of your Vicon system? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you with the installation or your first usage of your Vicon system? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How often do you use your Vicon system? (1=Every day, 2= Every week, 3=Every 2-3 weeks, 4=Every month, 5=Every 2-3 months)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you with your continuing usage of your Vicon system? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you with the after-purchase service (e.g., warranty, repair, customer service) of your Vicon system? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How satisfied are you overall with your Vicon system? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How likely are you to buy another Vicon product in the future? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How likely are you to recommend Vicon to others? (1=Very, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

How completely were any problems you contacted Vicon customer services about resolved? (1=Fully, 5=Not at all)

❍ 1 ❍ 2 ❍ 3 ❍ 4 ❍ 5

Please provide any additional information or comments

Regulatory Information

ISO Certification

ISO 134385: 2003 Certificate of Approval

LRQA
Business Assurance

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

Vicon Motion Systems Ltd
trading as Vicon
14 Minns Business Park, West Way
Oxford
United Kingdom

has been approved by Lloyd's Register Quality Assurance to the following Quality Management System Standards:

ISO 13485:2003

The Quality Management System is applicable to:

Design, manufacture and support of motion capture systems for life science applications, including development of related software.

This certificate forms part of the approval identified by certificate number LRQ 4003146

Approval
Certificate No: LRQ 4003146/C

Original Approval: 17 August 2007

Current Certificate: 17 August 2012

Certificate Expiry: 16 August 2015

J.K. Andrews

Issued by: Lloyd's Register Quality Assurance Limited

UKAS MANAGEMENT SYSTEMS
001

This document is subject to the provision on the reverse
71 Fenchurch Street, London EC3M 4BS United Kingdom. Registration number 1879370
This approval is carried out in accordance with the LRQA assessment and certification procedures and monitored by LRQA.
The use of the UKAS Accreditation Mark indicates Accreditation in respect of those activities covered by the Accreditation Certificate Number 001

ISO 9001: 2008 Certificate of Approval

LRQA
Business Assurance

CERTIFICATE OF APPROVAL

This is to certify that the Quality Management System of:

Vicon Motion Systems Ltd
trading as Vicon
14 Minns Business Park, West Way
Oxford
United Kingdom

has been approved by Lloyd's Register Quality Assurance
to the following Quality Management System Standards:

ISO 9001:2008

The Quality Management System is applicable to:

Design, manufacture and support of motion capture systems.
Development of software for motion capture systems, measurement and analysis of three-dimensional structures.
Manufacture and support of cameras.

This certificate is valid only in association with the certificate schedule bearing the same number on which the locations applicable to this approval are listed.

This certificate forms part of the approval identified by certificate number LRQ 4003146

Approval
Certificate No: LRQ 4003146/A

Original Approval: 17 August 2006

Current Certificate: 17 August 2012

Certificate Expiry: 16 August 2015

Issued by: Lloyd's Register Quality Assurance Limited

UKAS
001

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Medical Devices Directive

CE Declaration of Conformity

CE 0088

Declaration of Conformity

Medical Devices Directive 93/42/EEC as amended by Directive 2007/47/EC.

Electromagnetic Compatability to EMC Directive2004/108/EC.

Electrical Safety to Low Voltage Directive 2006/95/EC.

We, Vicon Motion Systems Limited

Unit 14 Minns Estate

Oxford OX2 0JB

United Kingdom

declare that the VICON MX T-Series motion capture system manufactured by VICON MOTION SYSTEMS LIMITED meets ANNEX V and VII Section 5 of the Medical Devices Directive 93/42/EEC as amended by Directive 2007/47/EC in that the Quality Management System has been approved by Lloyd's Register Quality Assurance, a notified body of the European Union (Reg No. 0088) for the manufacture and support of the aforementioned CLASS 1 Medical device. The topic Product Configurations and Software Options details the product configurations and software options that conform to the metrological requirements of the Directive.

VICON MOTION SYSTEMS LIMITED has tested and demonstrated that all products of its own manufacture meet 2004/108/EC: MX T-Series Systems (MX Giganet based)

Electromagnetic Compatibility to:

EN60601-1-2:2007

Immunity to paragraph 6.2.3.1 to:

Immunity test level of 3V/m over 50 - 60 Hz

Electrical Safety of MxGiganet Power Supply Unit (Low Voltage Directive 2006/95/EC)

IEC 60601-1:1:1988 + A1:1991 + A2:1995 EN 60601-1:1990 A1,A2 and A13,

excluding clause 36 and Korean national differences

T.M.L. Shannon, TD, FIE (Aust), CPEng (Biomedical)

Director of Regulatory Compliance

20th March 2010

Not for use in an operating theater, anesthetic gas environment, or oxygen-rich environments. Not for use where there is a risk of compromising the essential performance of medical electrical equipment. Not suitable for use in high magnetic flux, ionizing radiation, sterile, or life- or safety-critical environments.

Product Configurations and Software Options

This section provides information relating to the CE Declaration of Conformity.

Conformity of the Metrological Performance of CLASS 1 Products in accordance with Annex V and VII Section 5 of the Medical Devices Directive 93/42/EEC as amended by Directive 2007/47/EC

We, Vicon Motion Systems Limited

Unit 14 Minns Estate

Oxford OX2 0JB

United Kingdom

declare that the VICON MX T-Series motion capture system manufactured by VICON MOTION SYSTEMS LIMITED has been tested prior to shipment and meets the following metrological performance:

- Resolution of the distance between the centers of two static 14 mm spherical markers located within a volume no less than 4 m x 4 m x 1.5 m to within 1 mm Mean; 1 mm Standard Deviation; sample size no less than 1,000
- Resolution of a given analog voltage to within +/-20 mV RMS within the following configurations and constraints:
- No fewer than two cameras of any variant fully viewing static markers
- Independent of lens and strobe variants fitted to each camera
- Controlled lighting (no greater than 100 lux) and temperature (17-25° C)
- Single termination to each analog input
- Testing using the following Vicon application software: Nexus Version 1.4 or later

Approval of Conformity Certificate

LRQA
Business Assurance

APPROVAL OF CONFORMITY CERTIFICATE

In accordance with the requirements of the Medical Devices Directive 93/42/EEC and the Medical Devices Regulations 2002, UK Statutory Instrument 2002 No. 618

This is to certify that the Quality Management System of:

Vicon Motion Systems Ltd
trading as Vicon
14 Minns Business Park, West Way
Oxford
United Kingdom

has been assessed against the requirements of Annex V of the Medical Devices Directive 93/42/EEC, and the Medical Devices Regulations 2002 and conforms to the requirements for the products shown on the attached schedule.

Approval is subject to the maintenance of the quality system in accordance with the requirements of the above Directive and Regulations.

Authorisation is hereby given to use the LRQA Notified Body Registration Number in accordance with the requirements of the specified Directives/Regulations in relation to the products as identified above.

Certificate No:	LRQ 4003146/B
Original Approval:	17 August 2006
Current Certificate:	17 August 2012
Certificate Expiry:	16 August 2015

LRQA Notified Body Number 0088

J.K. Anders

Issued by: Lloyd's Register Quality Assurance Limited

This document is subject to the provision on the reverse
71 Fenchurch Street, London EC3M 4BS United Kingdom. Registration number 1879370

LRQA
Business Assurance

APPROVAL OF CONFORMITY CERTIFICATE
CERTIFICATE LRQ 4003146/B SCHEDULE

In accordance with the requirements of the Medical Devices Directive 93/42/EEC and the Medical Devices Regulations 2002, UK Statutory Instrument 2002 No. 618

Vicon Motion Systems Ltd
trading as Vicon
14 Minns Business Park, West Way
Oxford
United Kingdom

Class I Measuring Products
Vicon MX+ System
ViconT-Series System

Schedule Issue: 01

Date of Schedule Issue: 17 August 2012

LRQA Notified Body Number 0088

S.K. Andrews
Issued by: Lloyd's Register Quality Assurance Limited

Page 1 of 1
This document is subject to the provision on the reverse
71 Fenchurch Street, London EC3M 4BS United Kingdom. Registration number 1879370

Regulatory Notices

Regulatory Notices

This section provides required regulatory notices and incident report forms relating to the supply and use of Vicon systems in the United Kingdom and in the United States of America.

Medical Device Adverse Event Reporting

Use the appropriate information and form to report any adverse events involving Vicon systems:

- MHRA Adverse Incident Reporting (UK)
- FDA MedWatch Adverse Event Reporting Program (US)

Should an adverse event occur, the appropriate form is to be completed and forwarded within one working day to Vicon Motion Systems Limited at one of the following addresses:

OXFORD
14 Minns Business Park,
West Way, Oxford, OX2 0JB, UK
Tel: +44.1865.261800
Fax: +44.1865.240527

LOS ANGELES
5419 McConnell Avenue
Los Angeles, CA 90066, USA
Tel: +1 310.306.6131
Fax: +1 310.437.4229

DENVER
7388 S. Revere Parkway, Suite 901
Centennial, CO 80112, USA
Tel: +1 303.799.8686
Fax: +1 303.799.8690

SINGAPORE
8 Cross Street # 11-00
PWC Building, Singapore 048424
Tel: +65 6400 3500

Regulatory Notices

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Tel: +44.1865.261800
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LOS ANGELES
5419 McConnell Avenue
Los Angeles, CA 90066, USA
Tel: +1 310.306.6131
Fax: +1 310.437.4229

DENVER
7388 S. Revere Parkway, Suite 901
Centennial, CO 80112, USA
Tel: +1 303.799.8686
Fax: +1 303.799.8690

SINGAPORE
8 Cross Street # 11-00
PWC Building, Singapore 048424
Tel: +65 6400 3500

MHRA Adverse Incident Reporting (UK)

The information in this section covers the reporting of incidents involving medical devices to the UK Medicines and Healthcare products Regulatory Agency (MHRA).

Notice to Agents	For inclusion in all Vicon systems supplied from the United Kingdom for use outside of the United States of America (for supply and use in the US, see FDA MedWatch Adverse Event Reporting Program). The master Medicines and Healthcare products Regulatory Agency (MHRA) file is located at Vicon Motion Systems Limited. Should an adverse event occur, the MHRA Adverse Incident Report Form is to be completed and forwarded within one working day to Vicon Motion Systems Limited.

The Medicines and Healthcare products Regulatory Agency (MHRA) is a UK government agency which is responsible for ensuring that medicines and medical devices work, and are acceptably safe. Use the form referenced below to report an adverse incident involving a medical device.

Full information and guidance on reporting Adverse Incidents is published in MHRA Device Bulletin DB 2008(01) Reporting Adverse Incidents and Disseminating Medical Advice Alerts. For details on reporting requirements, contact the MHRA:

Medicines and Healthcare products Regulatory Agency
Market Towers 1 Nine Elms Lane
London SW8 5NQ
UK

Tel: +44 20.7084.2000
Fax: +44 20.7084.2353
web: www.mhra.gov.uk

MHRA Adverse Incident Report Form

You can obtain the MHRA Adverse Incident Report Form from the MHRA web site (http://www.mhra.gov.uk/Safetyinformation/Reportingsafetyproblems/Devices/index.htm). Separate online and printed versions of the form are available on that web site.

For your convenience, a copy of this MHRA form is also supplied under *C:\Program Files\Vicon \Documentation\MHRA_Form_AdverseIncident.pdf*).

Important	This PDF version of the MHRA form is current as of publication of this version of the Vicon Nexus Help System. To ensure that you have the latest version of the form, Vicon recommends that you check the MHRA web site for any updates. If you have any difficulty obtaining the MHRA Adverse Incident Report Form, contact Vicon Support immediately to receive the form.

To complete the MHRA Adverse Incident Report Form:

1. Go to www.mhra.gov.uk/Safetyinformation/Reportingsafetyproblems/Devices/index.htm.
2. Print and fill in the PDF form. Then:
   - Mail it to support@vicon.com, including "Adverse Event Report" in your email subject line; or
   - Fax it to the nearest Vicon office.

Tip	In the section **Type of device**, select **Other** and specify your Vicon system.

FDA MedWatch Adverse Event Reporting Program (US)

This section covers the reporting of incidents to the US Department of Health & Human Services.

Notice to Agents	For inclusion in all Vicon systems supplied to the United States of America (for supply and use outside the US, see MHRA Adverse Incident Reporting). The master Medical Device Reporting (MDR) file is located at Vicon Motion Systems Limited. Should an adverse event occur, MEDWATCH Form FDA 3500A (10/05) is to be completed and forwarded within one working day to Vicon Motion Systems Limited.

Department of Health & Human Services,
US Food and Drug Administration
Medical Device Reporting System—Reportable Events
Code of Federal Regulations
Title 21, Volume 8
Revised as of April 1, 2006
Cite: 21CFG803.32

Under 803.1(a) device user facilities and manufacturers must report deaths and serious injuries that a device has or may have caused or contributed to. Should such an event occur, please complete the form specified in this section and forward it in accordance with the applicable regulations and time limits to your nearest Vicon office.

FDA Adverse Event Report Form

You can obtain the FDA Adverse Event Report Form (MEDWATCH form FDA 3500A) from the FDA's MedWatch Adverse Event Reporting program on their web site (http://www.fda.gov/medwatch/safety/FDA-3500A_fillable.pdf). This PDF form can be completed online or printed out.

For your convenience, a copy of this FDA form is also supplied under *C:\Program Files\Vicon\Documentation\USFDA_Form_FDA3500a(10.05)_Fillable.pdf*).

Important	This PDF version of the FDA form is current as of publication of this version of the Vicon Nexus Help System. To ensure that you have the latest version of the form, Vicon recommends that you check the FDA web site for any updates. If you have any difficulty obtaining the FDA Adverse Event Report Form, contact Vicon Support immediately to receive the form.

To complete the Adverse Event Report form (MEDWATCH form FDA 3500A):

1. Go to http://www.fda.gov/medwatch/safety/FDA-3500A_fillable.pdf.
2. Print and fill in the PDF form. Then:
   - Mail it to support@vicon.com, including "Adverse Event Report" in your email subject line; or
   - Fax it to the nearest Vicon office.

Tip	Section C. Suspect Product(s) is not applicable to Vicon systems. For further guidance on completing the form, see the instructions contained in the PDF form.

Glossary

3

3D Workspace: A type of view pane in a Vicon application software window in which reconstructed data from all active cameras is displayed in 3D (three-dimensional) perspective; that is length, width, and depth. Also see View pane.

A

Accessory kit: A collection of specialized Vicon accessories for use with its motion capture systems. The kit typically contains items such as marker fixing tape, licensing dongles, Velcro™, Lycra™ suit, and retroreflective markers.

Activity bar: A tabbed pane on the right side of an operating mode in a Vicon iQ or Tracker application software window. An activity bar provides the tools and functions relating to the current operating mode. Also see Control bar and Operating mode.

ADC option card: An Analog-to-Digital Converter (ADC) device for converting voltage to a digital value that represents the signal at the instant at which it was sampled. Analog or audio ADC option cards are used to integrate a third-party device for capturing analog or audio data into a Vicon system.

Algorithm: A well-defined procedure that transforms one or more given input variables into one or more output variables in a finite number of steps.

Alias: An association between a virtual point and one or more markers whose gaps are to be filled using a virtual points fill operation in some Vicon application software. Also see Marker and Virtual point.

Analog: A voltage that is limited to a maximum range of ±10 v and can optionally be captured by Vicon systems, such as force plates, EMG measurements, or audio data. Also see ADC option card, Datastation, EMG, Force plate, MX Control, Scale factor (analog), and .vad file.

Analog sampling frequency: The rate (in Hertz) at which samples of analog data are taken. The higher the sampling frequency (that is, the more samples taken per second), the more closely the digitized data resembles the original data. Also see Analog.

Analog sensor: An electronic device that produces a voltage proportional to the measured quantity, which must then be converted to a digital format by an ADC device before a computer can process it. Also see ADC option card, Force plate, Reference video, and Sensor.

Angle of view: The total area, expressed as an angle, that the camera lens can reproduce as a sharp, focused image. Also see Field of view.

Aperture: The diameter of the camera lens opening, which determines the amount of light that can pass through the lens in a given time. The size of the lens opening is controlled by an iris and is expressed in f-stop values (f1.4, f2, f2.8, f4, f5.6, f8, f11, f16, f22). Typically, each f-stop value represents a 50 percent change in the amount of light. Smaller f-stop values represent wider apertures that allow more light to pass through. Larger f-stop values represent narrower apertures that allow less light to pass through. Also see Depth of field and Field of view.

Aspect ratio: The proportional width and height of a picture, expressed in the format w:h.

Autolabel: A process by which Vicon application software applies a previously generated autolabel calibration to a saved trial, identifies individual marker trajectories, and labels them automatically. During this offline processing, the Vicon application software compares the reconstructed 3D markers in the 3D Workspace to the marker locations that the autolabel calibration process stored in the .sp or .vsk file for the subject. Also see Autolabel calibration, Marker, .sp file, Subject calibration, and .vsk file.

Autolabel calibration: A process by which some Vicon application software identifies the relationship between the labels defined in the marker (.mkr) or Vicon skeleton template (.vst) file associated with a subject and the reconstructed 3D markers captured in a trial. During this offline processing, the Vicon application software stores the marker locations in the subject parameters (.sp) or Vicon skeleton (.vsk) file. The Vicon application software can then apply this autolabel calibration to that subject in subsequent trials. Some Vicon application software uses the subject calibration process instead. Also see Autolabel, .mkr file, Pipeline, .sp file, Subject calibration, .vsk file, .vst file, and Workstation.

avi file: Audio Video Interleaved file. A Microsoft Windows binary file with extension .avi, which combines multimedia sound and moving picture data in a single stream in the Microsoft RIFF (Resource Interchange File Format) format. Vicon application software can play—and optionally generate—.avi files. Additional compressor/decompressor (codec) software may be required for certain .avi files. Also see Reference video.

B

Ball joint: A 3 DOF joint with full rotational (but not translational) freedom. This joint type has the position of the child segment defined from the position of the parent and joint, but its orientation can vary freely. This joint type is typically used to link two segments that share one marker. Also see Degree of freedom (DOF), Free joint, Hardy Spicer joint, Hinge joint, and Slider joint.

Band-pass filter: A filter that permits only signals within a specified range of frequencies to be passed through. Some Vicon cameras are fitted with band-pass interference optical filters that allow the specific wavelengths of light emitted by the Vicon strobe units to pass. Also see Low-pass filter, MX Camera, and Strobe unit.

Blob: In Vicon V-series systems, a continuous area of above-threshold data from the camera. Blobs are submitted as candidates to Vicon circle-fitting algorithms to determine which are likely to be markers. Also see Grayscale blob.

Blooming: The defocusing of a picture due to excessive brightness. This can occur when a Vicon marker is close to a camera with high sensitivity or whose aperture is too wide. This can be resolved by altering sensitivity and/or the aperture or possibly by moving the camera. Also see Aperture and Marker.

BNC connector: British Naval Connector (BNC). A durable cable connector that transfers signals between devices. It connects with a push and a twist. Also see LEMO® connector.

BOB: Break Out Box. A hardware unit in Vicon V-series systems used to connect one to three cameras to a single port on the Datastation. Also referred to as a Camera Interface Unit. Also see Datastation.

BodyBuilder: Vicon application software for kinematic and kinetic modeling, which reduces complex 3D vector algebra into a simple scripting language, called BodyLanguage. Also see BodyLanguage, Pipeline, Plug-in Modeler, and Workstation.

BodyLanguage: A scripting language used in BodyBuilder to create biomechanical models. Also see BodyBuilder.

Bones: See Segment.

Bounding box: A semitransparent 3D box drawn around each segment defined in the kinematic model for a subject (as specified in the .vsk or .vst file). This display is optional and is used for visualization purposes only. Also see Subject, .vsk file, and .vst file.

Burn-in window: See Video Burn-in window.

C

c3d file: A binary file with extension .c3d, which contains among other details, the 3D reconstructions of video data, unlabeled trajectory data, analog data, and parameters. Vicon application software creates .c3d files when it reconstructs and saves video data captured by the Vicon system. By default, .c3d files are saved to the active Session folder of the open database. This is a public domain file format that also can be read and written by third-party applications (for further details, visit http://www.c3d.org/). Also see Analog, Eclipse database, Label, Reconstruction, and Trajectory.

Cadence: A temporal parameter used in gait analysis for the number of strides the subject takes per minute. Also see Gait analysis.

Calibration: See Autolabel calibration, Camera calibration, Floor plane calibration, and Subject calibration.

Calibration health check: The process by which some Vicon application software determines the state of each camera, provides information about possible reflections in a camera's view, and identifies any cameras whose calibration may need to be repaired. Also see Camera calibration and Camera calibration repair.

Calibration kit: A collection of specialized Vicon calibration objects for use in the Dynamic Calibration (DynaCal) process for calibrating Vicon systems and cameras. Also see Calibration object and Camera calibration.

Calibration object: A specialized piece of equipment used to calibrate the capture volume and Vicon cameras. There are two basic types of calibration object: a frame and a wand. Both types are typically made of metal and have retroreflective markers attached. The Vicon application software uses the known physical dimensions and distance between the markers on a calibration object to calculate calibration parameters. Also see Calibration kit, Calibration wand, Camera calibration, and Static calibration object.

Calibration reference object file: See .cro file.

Calibration volume: The three-dimensional area of the capture space (length, width, and depth) calculated by the camera calibration process. This volume can be visualized in the 3D Workspace in Vicon application software. Also see 3D Workspace, Capture volume, and Reconstruction volume.

Calibration wand: A calibration object used in the camera calibration process. Pieces for constructing different types of calibration wand are supplied in the Vicon calibration kit. Also see Calibration kit, Calibration object, and Camera calibration.

Camera calibration: Also known as system calibration and dynamic calibration (DynaCal). The two- stage process by which Vicon application software calibrates the system. During the dynamic stage, a calibration wand is used to measure the physical position and orientation of each Vicon camera in the system and determine any lens linearization correction required. During the static stage, a static calibration object is used to set the global coordinate system for the capture or tracking volume. The camera calibration is used in reconstructing the 3D motion from all the cameras. Also see Calibration wand, Capture volume, Global coordinate system, Static calibration object, and Tracking volume.

Camera calibration repair: The process by which the Vicon application software repairs the calibration for one or more specified cameras. This might be required if a camera has been moved from its original position or has been identified as requiring repair. Also see Camera calibration and Calibration health check.

Camera interface unit: See BOB.

Camera mask: In Nexus, a grid of small blue tiles superimposed over the camera image in a Camera view pane, each cell of which can be set to obscure raw 2D camera data, such as unwanted reflections, opposing camera strobe units, and direct light sources that are seen by a camera. In Vicon V-series systems, a simple shape that is used to obscure raw 2D camera data, such as unwanted reflections, opposing camera strobe units, and direct light sources that are seen by a camera. You can have Vicon application software automatically create camera masks, or you can create them yourself. The equivalent functionality for Vicon MX systems is generally provided by threshold grids. Also see .msk file, Nexus, Vicon MX, Vicon V-series system, and Threshold grid.

Camera ray: A line displayed in the 3D Workspace identifying the Vicon camera that contributed to the reconstruction of a marker. Also see 3D Workspace, Marker, and Reconstruction.

Camera resection: See Camera calibration repair.

Camera video sensor: A device that measures illumination and converts it to a digital signal. Also see MX Camera, Sensor, and Vicon V-series system.

Camera view pane: A type of view pane in a Vicon application software window in which raw, 2D camera data for an individual camera is displayed. Also see View pane.

Capture: See Motion capture.

Capture data: A single, contiguous period of motion capture data acquired by a Vicon system. This can include video data from Vicon cameras; analog data from third-party analog devices; or movie or reference data from external video or audio recording devices.

Capture space: The full dimensions (length, width, and depth) of the room being used as a Vicon motion capture studio (for entertainment applications) or laboratory (for life sciences applications).

Capture volume: The area of the capture space in which Vicon cameras are able to capture the motion of trial subjects. Also see Capture space, Calibration volume, Reconstruction volume, and Subject.

car file: Capture Analog Reconstruction file. A text file with extension .car, which contains all the parameters required for capture and reconstruction in Workstation application software. This file is created when a system or session configuration is specified in Workstation and initially contains the default parameters for the system. Also see Motion capture and Reconstruction.

CCD: Charge Coupled Device. An image sensor consisting of a grid of pixels made up of capacitors sensitive to light. An image is projected through a lens onto the capacitor array, causing each capacitor to accumulate an electric charge proportional to the light intensity at that location. This charge is subsequently converted into a voltage, and the voltage for each pixel is read out from the sensor. Also see CMOS and Sensor.

CCIR: Consultative Committee for International Radio (the predecessor of the International Telecommunication Union–Telecommunication Standardization Bureau, ITU–T). A format defined for analog black and white television, with a vertical resolution of 625 lines and a base frame rate of 25 Hz. This is the format used in Europe. CCIR uses the EBU timecode standard. Also see EBU timecode, EIA, LTC, PAL, SECAM, Timecode, and VITC.

Center of Mass: The theoretical point of a segment or body at which the whole mass may be considered as concentrated. Also see Segment.

Centroid: In Vicon MX, a 2D circle with cross-hairs for the horizontal and vertical radii fitted around the center of intensity calculated for a grayscale blob viewed by an MX camera. The equivalent for Vicon V-series systems is a circle. Also see Circle, Centroid fitting, and Grayscale blob.

Centroid fitting: In Vicon MX, the process by which algorithms in MX cameras or in Vicon application software calculate the center of intensity for a grayscale blob and fit a centroid around it. The equivalent functionality for Vicon V-series systems is provided by circle fitting. Also see Centroid, Circle fitting, and Grayscale blob.

Centroids data: In Vicon MX, the x,y coordinates and the radius of the centroid calculated for a grayscale blob. Also see Centroid and Grayscale blob.

CG plug-in: Computer Graphics plug-in. A software module that facilitates the import of Vicon data into a third-party animation package. Also see Plug-in.

Child segment: A segment in a kinematic model whose attributes are controlled by a parent segment. A child segment also can be the parent of other child segments. Also see Parent segment.

Circle: In Vicon V-series systems, a 2D circular shape fitted to a series of horizontal video lines for a blob. Also see Blob and Circle fitting. For Vicon MX systems, see Centroid.

Circle fitting: In Vicon V-series systems, the process by which algorithms in Vicon application software calculate a central coordinate for a marker based on three or more horizontal video lines. The equivalent functionality for Vicon MX systems is provided by centroid fitting. Also see Algorithm, Centroid fitting, and Circle.

CMOS: Complementary Metal-Oxide-Semiconductor. An approach to the design and implementation of digital circuits on silicon chips. Image sensors produced by the CMOS process are an alternative to CCD sensors and offer the advantage of requiring less power. CMOS sensors consist of a grid of pixels each made up of a photodetector and several transistors. An image is projected through a lens onto the sensor, and a voltage is read from each pixel proportional to the light intensity at that location. Also see CCD and Sensor.

Composite video signal: A video signal containing all the necessary chrominance (color), luminance (black and white), and synchronization pulses combined using a standard such as PAL or NTSC. Also see NTSC, PAL, Progressive video, S-Video connector, and Synchronization.

conf file: An XML file with extension .conf which contains Vicon Nexus configuration settings. This file is created by Nexus. Also see Nexus.

Constraint: The mathematical relationship between one element in a kinematic model and another element whose behavior it controls. For example, a segment may be constrained by a marker, the path a muscle takes over a segment may be constrained by a wrap object, or the position of a segment or model marker may be constrained in the local coordinate system. Also see Local coordinate system, Marker, and Segment.

Context: The condition or circumstance that relates data in an event (e.g. left and right foot events in gait analysis). Also see Event.

Context bar: The area below the Time Bar ruler in which events contained in context that are currently in use are displayed in some Vicon application software. Also see Context, Event, and Time bar.

Control bar: A tabbed pane on the left side of an operating mode in a Vicon iQ or Tracker application software window. A control bar may contain either options for determining the way data is displayed in the workspace or help on using the application. Also see Activity bar and Operating mode.

Coordinates data: In Vicon MX, the x and y location of the start and end points of a line of illuminated pixels in a grayscale blob; it is the grayscale data without the pixel values. Coordinates data can be displayed as just the start and end edges of each line of grayscale, or with connecting lines between the start and end edges. The latter looks similar to edge data from Vicon V-series cameras. Also see Edges and Grayscale blob.

cp file: Calibration Parameters file. A text file with extension .cp, which contains the calibration parameters specified for a set of Vicon cameras. This file is created during the camera calibration process and used when data from these cameras is processed. A copy of the .cp file is saved to the active Session folder of the open database. Similar functionality is provided by the .xcp file in Vicon Nexus application software. Also see Camera calibration, Nexus and .xcp file.

cro file: Calibration Reference Object file. A text file with extension .cro, which contains for one or more calibration objects the coordinates of its markers in relation to each other. This file also contains configuration entries for each of the calibration objects supplied in the Vicon calibration kit, so they can be selected in Workstation application software. These .cro files are installed in the Vicon Calibration Objects folder (by default, C:\Program Files\Vicon\System \CalibrationObjects). Also see Marker, Calibration kit, and Calibration object.

csm file: Character Studio Motion capture file. A text file with extension .csm, which contains capture data from a Vicon system in a format that can be used by 3D Studio Max. This file is created by a pipeline operation in some Vicon application software and saved in the active Session folder of the open database. Also see Capture data and Pipeline.

D

Data acquisition: The process by which Vicon motion capture and analysis systems convert information from real-world sources to digital form in which it may be stored, manipulated, analyzed, and displayed. Also see Data streaming and Motion capture.

Data capture: See Motion capture and Movie capture.

Data file: Related pieces of data organized in a specific manner. Data files contain information but not instructions or programs.

Data streaming: The passing of real-time motion data from some Vicon application software to Vicon or third-party visualization software. Also see Data acquisition, Motion capture, and Visualization software.

Datastation: In Vicon V-series systems, a Vicon hardware unit that captures and synchronizes all Vicon camera and analog data. This unit provides the link between the Vicon cameras, the host PC running the Vicon application software, and any third-party analog devices. Also see Analog, Host PC, and Vicon V-series system.

DCAM: Instrumentation and Industrial Control Working Group (IIDC) 1394-based Digital Camera Specification. A standard for digital cameras that output uncompressed image data without audio and are to be connected to a computer using an IEEE 1394 connector. The Vicon Reference Video option supports the Basler range of DCAM cameras. Also see IIDC 1394 and Reference video.

Degree of freedom (DOF): An indication of how freely a joint is able to move (translate or rotate) in respect to its parent segment. This is expressed as the minimum number of coordinates required to completely specify the rotational (Rx, Ry, and Rz) and/or translational (Tx, Ty, Tz) movement of the joint. 0 DOF indicates a fixed joint with no rotational or translation freedom. 1 DOF indicates a hinge joint with rotational freedom around a single axis. 2 DOF indicates a universal joint with two rotational degrees of freedom around two orthogonal axes. 3 DOF indicates a ball-and-socket joint with full rotational (but not translational) freedom. 6 DOF indicates a free joint with full translational as well as rotational freedom. Also see Rotation and Translation.

Depth of field: The distance between the nearest object in focus and the furthest object in focus within a scene as viewed by a particular camera lens. Outside this area, moving towards or away from the lens, the focus becomes progressively less sharp and the image appears out of focus. Depth of field varies with subject-to-camera distance, lens focal length, and lens aperture. Also see Aperture and Focal length.

DOF: See Degree of freedom (DOF).

Dolly: The moving of a camera along a horizontal axis closer to (dolly in) or further from (dolly out) the subject. Also see Pan, Tilt, and Truck.

Dongle: A hardware security device connected to an input/output port on a computer to permit the use of licensed software on that computer. Vicon application software is licensed using a HASP dongle, which must be plugged into the appropriate port (parallel or USB) on the computer while the software is in use.

Double support: A temporal parameter used in gait analysis for the period of time, or the percentage of the gait cycle, where both feet are on the ground. Also see Gait analysis and Single support.

Driver: A hardware device or software program that controls a specific hardware device, such as a video driver.

Drop frame: See SMPTE drop-frame timecode.

DV: Digital Video. A video-recording format that stores compressed video image and sound data in digital format based on the IEEE 1394 standard. Also see IEEE 1394 and Reference video.

DV video: See Reference video.

DynaCal: Dynamic Calibration. See Camera calibration.

Dynamic trial: A data capture during which the target of the trial moves. Also see Object, Range of Motion (RoM) trial, Static trial, and Subject.

E

Earth: See Ground.

EBU timecode: The standard of timecode defined by the European Broadcasting Union, which is based on video cameras operating at multiples of 25 Hz. During videotaping, frame numbers corresponding to a particular video frame are encoded in either LTC or VITC. Also see CCIR, LTC, PAL, SECAM, SMPTE timecode, Timecode, and VITC.

Eclipse data directory browser: A window in which new Eclipse databases can be created or the contents of existing databases can be viewed and managed in Vicon application software (similar functionality is provided by the Data Management window in Vicon Nexus). Also see Eclipse database.

Eclipse database: The Vicon integrated data management tool, which Vicon application software uses to store and manage all data associated with Vicon motion capture trials. Data is organized in a hierarchical structure, with specific data and information stored in relevant nodes. Also see Eclipse data directory browser, .enf file, .eni file, Motion capture, and Trial.

Edges: In Vicon V-series systems, the start and end points of horizontal lines of video data for a blob. This looks similar to the display of Vicon MX coordinates data with connecting lines. Also see Blob and Coordinates data.

Edit options: A dialog box in which users can configure parameters to control the behavior of a specific feature or function in Vicon application software.

EIA: Electronic Industries Alliance (formerly Electronic Industry Association). A format defined for analog black and white television, with a vertical resolution of 525 lines and a base frame rate of 29.97 Hz. This format is used in Canada, Japan, Korea, Mexico, USA, and parts of Central and South America. EIA uses the SMPTE timecode standard. Also see CCIR, LTC, NTSC, SMPTE timecode, Timecode, and VITC.

EMG: Electromyography. A test for detecting the electrical activity of muscles and the nerves controlling them to assess their health. Vicon application software can record and analyze the analog signals from third-party EMG devices integrated into a Vicon system. Also see Analog, Datastation, and MX Control.

enf file: Eclipse Node File. A text file with extension .enf, which contains all the information about a specific node level in an Eclipse database. This file contains the default fields defined in the .eni file on which it was based. An .enf file is generated for each node in an Eclipse database. Also see Eclipse database and .eni file.

eni file: Eclipse Node Initialization file. A text file with extension .eni, which contains a definition of the default hierarchy of Eclipse database nodes for a specific application area, such as animation, clinical, and generic. This file is used as a template for creating specific .enf files. The root .eni files are contained in the Vicon Eclipse folder (by default, C:\Program Files\Vicon\Eclipse). Also see Eclipse database and .enf file.

Ergo calibration frame: A type of static calibration object. This object is a triangular metal frame with a rectangular hole, four markers positioned on its upper side, adjuster screws, and two spirit levels. Also see Static calibration object.

Ethernet network: A local area network (LAN) architecture based on the IEEE 802.3 standard for contention networks. Standard Ethernet supports data transfer rates of 10 Mbps. 100Base-T (or Fast Ethernet) supports data transfer rates of 100 Mbps. Gigabit Ethernet supports data transfer rates of 1 Gigabit. A Vicon system runs over its own dedicated Ethernet network; Vicon MX uses Gigabit Ethernet communications. Also see LAN.

Euler angles: The three angles defining the three rotation matrices of an object about an axis. These angles are used to relate two orthogonal coordinate systems in a kinematic model for a motion capture subject. Also see Kinematic model and Rotation.

Event: A single action in the time span of a trial. For example, a foot contacting the floor during a walking trial is an event. Each event must have an associated context. Events are indicated on the context bar in some Vicon application software. Also see Context, Context bar, and Normalization scheme.

F

F-20: See MX-F20.

F-40: See MX-F40.

F-series Camera: A range of high-resolution, digital, motion capture cameras: MX-F40 and MX-F20. This range of Vicon cameras was supplied with Vicon MX systems after April 2007. F-series Cameras provide high-speed, low-latency motion capture. F-series Cameras are made of lead-free components to comply with environmental regulations. Each F-series Camera is fitted with the proprietary Vicon Vegas CMOS sensor and a strobe unit with surface-mount LEDs. Each is programmed with Vicon application firmware to control its operation and enable it to perform its own onboard processing. Also see MX-F20, MX-F40, Firmware, MX Camera, MX+ Camera, RoHS compliant, and Vegas sensor.

F-stop: See Aperture.

Field: An assembly of alternate lines of video information. For interlaced video, an interlaced frame is composed of two fields (odd and even scanning lines of the picture). Also see Frame and Frame rate.

Field of view: The total area that can be seen through the camera lens. Also see Aperture and Depth of field.

FireWire: Proprietary implementation of the IEEE 1394 standard by Apple Computer Inc. Also see IEEE 1394.

Firmware: A set of software routines stored in the read-only memory (ROM) of MX cameras and of some MX hardware units to control their operation and enable them to perform their own processing. Also see MX Bridge, MX Camera, and MX Control.

Floor plane calibration: The process by which Vicon application software refines the initial calibration of the floor plane of the capture volume determined during the system calibration. This is done to account for uneven areas that otherwise would cause the X and Y axes to be on a plane higher or lower than the Z origin. Also see Capture volume and System calibration.

FMV: Full Motion Video. Prerecorded television-quality movie or computer-generated (CG) animation included in a video game. FMV is typically used to provide more complex effects than can be produced in the game engine itself. FMV may be incorporated in entertainment applications.

Focal length: The distance from the center of the camera lens to a focused image with the lens focused on infinity. Short focal lengths offer a broad field of view, while long focal lengths offer a narrow field of view. Zoom lenses have variable focal lengths.

Foot contact: A temporal parameter used in gait analysis for the point in time, or the percentage of the gait cycle, where the foot hits the ground. Also see Foot off and Gait analysis.

Foot off: A temporal parameter used in gait analysis for the point in time, or the percentage of the gait cycle, where the foot leaves the ground. Also see Foot contact and Gait analysis.

Force: A vector quantity that tends to produce an acceleration of a body in the direction of its application. Force is used to describe the action of one body on another, which may be direct, such as the foot pressing on the floor, or indirect, such as the gravitational attraction between the body and the earth. Also see Force plate, Moment, and Vector.

Force plate: Also referred to as a force platform. An electromechanical device for measuring kinetic data as a subject makes contact with or applies force to the platform. The force plate gives electrical signals proportional to the component 3D forces and moments. Vicon application software can record and analyze the analog signals from supported third-party force plates integrated into a Vicon system. Also see Analog, Datastation, Force, Kinetics, and MX Control.

Forward dynamics (kinetics): The process of calculating the position, orientation, velocity, acceleration, angular velocity, and angular acceleration of the elements of an articulated structure, given the force and moment (torque) applied to those elements and their mass and inertia. Also see Forward kinematics, Inverse dynamics (kinetics), Inverse kinematics, and Kinetics.

Forward kinematics: The process of calculating the position and orientation of the elements of an articulated structure, given the angles at all the joints connecting those elements. This is a fully determined problem with a unique solution. Also see Forward dynamics (kinetics), Inverse dynamics (kinetics), Inverse kinematics, and Kinematics.

Frame: A complete video picture composed of two scanned fields at a specific period of time in a continuous video signal. For example PAL video contains 25 frames per second, and each of these frames is made up of two fields that together contain 625 horizontal lines of video information. For non-interlaced data, a frame is synonymous with a field. For interlaced data, a frame is composed of two fields: one even and one odd. Also see Field, Frame number, Frame rate, NTSC, PAL and Progressive video.

Frame number: The sequential number assigned to each frame of a video. Also see Frame and Timecode.

Frame rate: The number of times a second the picture is updated to provide the illusion of continuous movement. Also thought of as the speed at which video cameras capture data, frame rate is measured in either frames per second (fps) or camera frequency in Hertz. The camera frame rate can be configured in Vicon application software. In .avi files, the frame rate refers to the rate at which the video will be played back. Also see .avi file, Frame, and Frame rate view pane.

Frame rate view pane: A type of view pane in a Vicon iQ application software window in which a range of diagnostic real-time graphing views for all active cameras can be displayed: frame rate, mean residual, marker residual, marker separation. Also see Frame rate and View pane.

Free joint: A 6 DOF joint with full translational as well as rotational freedom. In Vicon .vst/.vsk files, this joint type is typically used to link two segments that do not share any markers. It is used for the root segment to allow it to move freely with respect to the global origin; you can not change the root's joint type. Also see Ball joint, Degree of freedom (DOF), Hardy Spicer joint, Hinge joint, Slider joint, .vsk file, and .vst file.

Fullscreen preview: A type of view pane in some Vicon application software in which the unthresholded, full grayscale image from the entire CMOS sensor in an MX camera is displayed. Also see CMOS and Grayscale blob.

G

Gain: A multiplicative increase (or decrease) in a voltage or digital signal by a specified magnitude. Adjusting the gain in a Vicon camera increases or decreases the intensity of a marker displayed in the workspace. Also see Marker and Workspace.

Gait analysis: The study of human movement for medical purposes. Vicon application software can record and analyze such data to generate kinematic and kinetic data. Also see Force plate, Kinematics and Kinetics.

Gap: An absence of one or more reconstructions for a marker trajectory. A gap can occur when a marker is fully occluded (or blocked) from the camera's view during motion capture, thus resulting in missing data for that marker during that period of time. Gaps can be filled using editing tools in Vicon application software. Also see Reconstruction, Tail, and Trajectory.

Genlock: The process of sync generator locking. A genlock device enables a composite video signal from a master source to be introduced to the subject sync generator. The generator to be locked has circuits to isolate vertical drive, horizontal drive, and subcarrier. Vicon systems provide genlock functionality to synchronize Vicon cameras to the scan rate of incoming video signals from an external PAL, SECAM, or NTSC video source integrated in the Vicon system. A Vicon MX system also can act as the synchronization master. Also see Datastation, MX Control, NTSC, PAL, and SECAM.

Ghost marker: Also known as ghost trajectory. A spurious marker trajectory produced by the reconstruction process. A ghost marker is a false reconstruction that appears as an additional trajectory very close to an existing one over a short duration. Also see Reconstruction and Trajectory.

Global coordinate system: The coordinates defining the origin (0,0,0) and the axes (x,y,z) of the world in the context of the Vicon capture volume. Also see Capture volume, Volume origin and Workspace axes.

gpo file: General Purpose Output file. An XML file with extension .gpo, which specifies the characteristics of a synchronization signal through the GPO ports of an MX Control or MX Ultranet unit. For example, .gpo files supplied with the Vicon Reference Video system option specify the relationship of the frame rate of a connected reference video camera with that of the MX cameras. Also see Frame rate, MX Camera, MX Control, MX Ultranet, and Reference video.

Grayscale blob: In Vicon MX systems, the raw, 2D grayscale data MX cameras generate for reflections from objects in the capture volume. Such data is submitted as candidates to MX centroid-fitting algorithms to determine which are likely to be markers. Also see Blob and Centroid fitting.

Grayscale data: In Vicon MX, the complete pixel and line information for a grayscale blob. Also see Grayscale blob.

Ground: Also known as earth. A point that is assumed to be at a zero voltage potential.

H

Hardy Spicer joint: A 2 DOF joint with two rotational degrees around two axes. This joint type has two perpendicular vectors defining the directions of the two axes around which the joint can rotate. Also see Ball joint, Degree of freedom (DOF), Free joint, Hinge joint, and Slider joint.

Hinge joint: A 1 DOF joint with rotational freedom around a single axis. This joint has a single vector defining the axis of the hinge. Also see Ball joint, Degree of freedom (DOF), Free joint, Hardy Spicer joint, and Slider joint.

Host PC: The computer in a Vicon system architecture that contains a dedicated Ethernet port for Vicon system communications and on which the core Vicon application software is installed. The host PC enables communications between the Vicon application software and other Vicon system components. Additional network ports and Vicon application or third-party software may be installed on the host PC, depending upon the computer specification. Also see Vicon application software.

hsf file: Hardware Settings File. An XML file with extension .hsf, which contains hardware, system, and synchronization settings that affect Vicon MX cameras. You can specify settings that are added to the default HardwareSettings.hsf file supplied with Vicon iQ (by default, under C:\Program Files\Vicon\ViconiQ 2.5 \Config) Alternatively, you can save settings to your own .hsf files to suit your particular needs; these are saved to the active Session folder of the open database. Also see MX Camera and Vicon MX.

I

i.LINK: A proprietary implementation of the IEEE 1394 standard by Sony Corporation. Also see IEEE 1394.

IEEE 1394: A standard for connecting digital devices without requiring analog-to-digital conversion. It is typically used for transferring digital video to and from video equipment and computers and for connecting storage devices. Vicon MX supports synchronous movie image capture using an IEEE 1394 digital video capture card installed on the host PC. Also see FireWire, i.LINK, and Reference video.

IIDC 1394: See DCAM.

Image circle: The diameter of the sharp, circular image that the camera lens casts onto the sensor. This indicates the maximum area of usable quality image that the lens can produce.

Impedance: The total opposition to the flow of alternating or direct current specified for signal input/output connections.

Interpolation: The process by which Vicon application software fills a gap in a trajectory by calculating a smooth curve between the broken ends. Also see Trajectory.

Inverse dynamics (kinetics): The process of calculating the force and moment (torque) acting on the elements of an articulated structure, given the mass, inertia, position, orientation, velocity, acceleration, angular velocity, and angular acceleration of those elements. Inverse dynamics approaches are used in Vicon application software for biomechanical modeling applications. Also see Forward dynamics (kinetics), Forward kinematics, Inverse kinematics, and Kinetics.

Inverse kinematics: The process of calculating the angles at all the joints connecting the elements of an articulated structure, given the position and orientation of those elements. Inverse kinematics approaches are used in Vicon application software for biomechanical modeling applications and skeleton editing. In animation applications, inverse kinematics 'solvers' attempt to deduce the motion of segments based on a desired result, commonly the position of the end element (or effector) in an articulated structures. Examples are the positioning of legs by moving the feet, or of arms by moving the hands. This is an inverse problem without a unique solution. Also see Forward dynamics (kinetics), Forward kinematics, Inverse dynamics (kinetics), Kinematics, and Segment.

Iris: The device inside the camera lens that controls the aperture size. Also see Aperture.

K

Kinematic fitting: The process by which Vicon application software positions the segments in the kinematic model so that segments on the model fit to the labeled trajectories. Also see 3D Workspace, Kinematic model, Segment, Trajectory, and .vsk file.

Kinematic model: A mathematical description of a moving object. Kinematic models for subjects or objects whose motion is being captured or analyzed in a Vicon system are contained in Vicon Skeleton Template (.vst) and Vicon Skeleton (.vsk) files. A representation of the kinematic model for a subject can be displayed in the 3D Workspace. Also see Kinematics, Kinematic fitting, .vsk file, and .vst file.

Kinematics: The study of motion without reference to its cause or its mass. Vicon application software is concerned with angular and linear displacements, velocity, and acceleration. Also see Forward kinematics and Inverse kinematics.

Kinetics: The study of the changes in motion as a result of external factors, including internal forces (muscle activity, ligaments or friction in muscles and joints) and external forces (ground or external loads). Vicon application software is concerned with kinetic forces, moments (torque), and power. Also see Force, Forward dynamics (kinetics), Inverse dynamics (kinetics), and Moment.

L

L-frame: A type of static calibration object. Also referred to as an ergo calibration frame. Also see Static calibration object and Ergo calibration frame.

Label: A name by which a point or the trajectory of a marker is identified in Vicon application software. The labels to be used to identify the reconstructed 3D markers are defined in kinematic model (.vst or .vsk file) for the subject or in the associated marker (.mkr) file. Also see Marker, .mkr file, Trajectory, .vsk file, and .vst file.

LAN: Local Area Network. A short-distance data communications network—typically within a single building or group of buildings—used to connect computers in order to share data and peripheral devices (such as printers, CD-ROM drives, and modems). Each device on a LAN is known as a node; nodes are connected by cables through which messages are transmitted. Also see Ethernet network.

LEMO® connector: An electronic connector for attaching electro-optic devices. Connects with a push-pull self-latching mechanism. Also see BNC connector.

Limp index: A temporal parameter used in gait analysis for the total support (single + double) for the current foot divided by the total support for the opposite foot. For a symmetric walk, the limp index is exactly one. Also see Double support, Gait analysis, and Single support.

Live 3D Workspace: See 3D Workspace.

Local coordinate system: A coordinate system whose origin (0,0,0) and axes (x,y,z) are fixed with respect to a particular segment or element in a kinematic model, as opposed to the global origin and axes directions. Also see Capture volume, Global coordinate system, Kinematic model, Volume origin, and Workspace axes.

Low-pass filter: A filter that permits only signal components below a specified frequency to be passed through. Some Vicon cameras are fitted with low-pass absorptive optical filters that allow low-frequency light from Vicon strobe units to pass. Also see Band-pass filter, MX Camera, and Strobe unit.

LTC: Longitudinal Timecode. A form of timecode compatible with standard audio channels so that they can be recorded onto an audio tape track or an audio track on video tape. Also see EBU timecode, SMPTE timecode, Timecode, and VITC.

M

Marker: 1) A sphere, hemisphere, or disk coated with a highly retroreflective material which is attached to a subject or object whose motion is being captured or analyzed in a Vicon system. The Vicon cameras are designed to capture the pattern of light reflected from such a marker and convert it into an image that represents the position and radius of the marker. Also see Subject and Object. 2) The 3D representation of a retroreflective marker generated by Vicon application software (also referred to as a model marker). The expected location of all markers attached to a subject whose motion is being captured or analyzed in a Vicon system is defined in the kinematic model (.vst or .vsk file) for the subject or in the associated marker (.mkr) file. These can be visualized as elements of the 3D representation of the subject. Also see Kinematic model, .mkr file, Subject, .vsk file, and .vst file.

Marker covariance: A 3D representation in Vicon application software of how much a marker is allowed to move in relation to its associated segment or joint, based on the subject's RoM trial. Also see Marker, Range of Motion (RoM) trial, and Segment.

Mask: See Camera mask.

MCam: A high-resolution, high-speed digital CMOS sensor camera used in a Vicon V-series system. There are MCam cameras that lock to PAL or NTSC video systems and run in synchronous multiples of their base frame rate. MCam cameras can be integrated into a Vicon MX system using the MX Bridge unit. Also see CMOS, MX Bridge, NTSC, PAL, Vicon MX, and Vicon V-series system.

MCam2: A high-resolution, high-speed digital CMOS sensor camera used in a Vicon V-series system. MCam2 cameras can be integrated into a Vicon MX system using the MX Bridge unit. Also see CMOS, MX Bridge, and Vicon V-series system.

mkr file: Marker file. A text file with extension .mkr, which specifies the labels to be used on the markers displayed in the 3D Workspace in Vicon application software and indicates the placement of the physical markers on the subject or object whose motion is being captured or analyzed in a Vicon system. The file also can include information about body segments, modeled data, and how the subject will be displayed in the 3D Workspace. You can use any of the default .mkr files supplied with your Vicon application software or create your own to suit your particular needs. Vicon-supplied .mkr files are installed under the Vicon Models directory (by default, C:\Program Files\Vicon\Models). Also see Kinematic model, Label, Marker, Object, Segment, and Subject.

Model marker: See Marker definition 2.

Moment: A vector quantity representing the turning effect produced by a force. This is calculated as the product of the force and the perpendicular distance between the point of application of the force and the axis of rotation. Also see Force and Vector.

Monitors file: An XML file with extension .Monitors, which contains configuration settings for event monitors and action triggers created in the Monitors status pane in Vicon Nexus. Also see Nexus.

Motion capture: The recording of motion data with a Vicon system from retroreflective markers attached to a subject or object. Also Marker, Object, and Subject.

Motorcycle pose: A form of the neutral pose typically used when capturing a RoM trial in Vicon iQ. In this pose, the subject stands in the basic neutral pose with the knees slightly flexed, the arms out straight to the sides, elbows bent forward, and hands in front with palms facing down (in a position similar to holding the handlebars of a motorcycle). Also see Neutral pose, T-pose, and Range of Motion (RoM) trial.

Movie capture: A Vicon system option for Workstation application software that enables movie data from analog video cameras or digital video cameras to be captured simultaneously with optical motion data from Vicon systems. This functionality has been augmented by the reference video functionality available for Vicon MX systems. For analog camera capture, a Broadway option card must be installed in the host PC, and the captured data is stored in .mpeg files. For DV camera capture, an IEEE 1394 option card is required, and the captured data is stored in .avi files. Also see .avi file, DV, IEEE 1394, .mpeg file, Polygon, Reference video, Vicon iQ, Vicon MX, and Workstation.

mpeg file: A binary file with extension .mpeg or .mpg, which contains video and audio information in the MPEG (Moving Picture Experts Group) standard format. Vicon application software can play and generate .mpeg files. Also see Reference video.

msk file: Mask file. A binary file with extension .msk, which contains a set of user-defined camera masks to obscure raw, 2D data viewed by Vicon cameras in a Vicon V-series system. By default, .msk files are saved to the active Session folder of the open database. Also see Camera mask and Vicon V-series system.

MX Bridge: An optional MX hardware unit that provides the interface between Vicon MX and any MCam, MCam2, VCam, and SV Cam cameras supported previously by Vicon V-series systems. The MX Bridge acts like an MX emulator and transforms the images sent by these V-series cameras to the grayscale data format used in Vicon MX. Also see Grayscale data, Vicon MX, and Vicon V-series system.

MX Camera: A range of high-resolution, digital, motion capture cameras: MX40, MX13, and MX3. This range of Vicon cameras was supplied with Vicon MX systems before July 2006; MX Cameras were superseded by MX+ Cameras. MX Cameras provide high-speed and low-latency motion capture. Each MX Camera is fitted with a commercially available CMOS sensor and a strobe unit with through-hole LEDs. Each is programmed with Vicon application firmware to control its operation and enable it to perform its own onboard processing.

MX Control: An optional MX hardware unit that provides the interface between Vicon MX and third-party capture devices, such as force plates, electromyography (EMG), audio, and other digital devices. Also see Vicon MX, Genlock, and Timecode.

MX Link: An optional MX hardware unit that connects multiple MX Net units in a Vicon MX system supplied before July 2006; later systems use the MX Ultranet. Also see MX Ultranet and Vicon MX.

MX Net: An MX hardware unit that supplies power and communications for up to eight connected MX cameras (or certain other MX hardware units) and either the host PC or an MX Link in a Vicon MX system supplied before July 2006; later systems use the MX Ultranet. The MX Net routes all communication to and from the host PC, and timing/synchronization signals to and from the MX cameras. Also see Host PC, MX Bridge, MX Camera, MX Control, MX Link, MX Ultranet, and Vicon MX.

MX Sync: An optional MX hardware unit that provides an extended interface to the MX Control functionality for connecting third-party external devices that Vicon MX can trigger, that can remotely trigger data capture on the Vicon MX system, or that can send synchronization signals. Also see MX Control and Vicon MX.

MX Ultranet: An MX hardware unit that supplies power, synchronization, and communications for up to eight connected MX+ cameras (or alternative devices such as MX Control or MX Bridge units) and the host PC. The MX Ultranet, made of lead-free components to comply with environmental regulations, replaced the MX Net and MX Link units available in Vicon MX systems before July 2006. When integrated with an MX Sync, an MX Ultranet also provides GPIO functionality without the need for an MX Control. Multiple MX Ultranet units can be connected in a single Vicon MX system. Also see MX Bridge, MX Control, MX Link, MX Net, MX Sync, and Vicon MX.

MX Ultranet HD: An MX hardware unit that supplies power, synchronization, and communications for up to 10 connected MX F-series, MX+, and MX Cameras (or optionally subordinate MX Control units) and the host PC. It also supplies direct powered and unpowered synchronization out functionality to connected Gigabit Ethernet cameras. It provides the interface between Vicon MX and third-party capture or remote control devices. The MX Ultranet II replaces the MX Control, MX Ultranet, and

MX Sync units available in Vicon MX systems before November 2007. Also see F-series Camera, MX+ Camera, MX Camera, MX Control, MX Sync, and MX Ultranet.

MX-F20: An F-series camera providing 2 megapixel resolution used in Vicon MX systems from April 2007. Also see F-series Camera and Vicon MX.

MX-F40: An F-series camera providing 4 megapixel resolution used in Vicon MX systems from April 2007. Also see F-series Camera and Vicon MX.

MX+ Camera: A range of high-resolution, digital, motion capture cameras: MX40+, MX20+, MX13+, and MX3+. This range of Vicon cameras was supplied with Vicon MX systems after July 2006; MX+ Cameras were superseded by MX F-series cameras in April 2007. MX+ Cameras provide high-speed, low-latency motion capture. MX+ Cameras are made of lead-free components to comply with environmental regulations. Each MX+ Camera is fitted with a commercially available CMOS sensor and a strobe unit with surface-mount LEDs. Each is programmed with Vicon application firmware to control its operation and enable it to perform its own onboard processing.

MX13: An MX Camera providing 1.3 megapixel resolution used in Vicon MX systems before July 2006. Also see MX Camera and Vicon MX.

MX13+: An MX+ Camera providing 1.3 megapixel resolution used in Vicon MX systems after July 2006. Also see MX+ Camera and Vicon MX.

MX20+: An MX+ Camera providing 2 megapixel resolution used in Vicon MX systems after July 2006. Also see Also see MX+ Camera and Vicon MX.

MX3: An MX Camera providing 0.3 megapixel resolution used in Vicon MX systems before July 2006. Also see MX Camera and Vicon MX.

MX3+: An MX+ Camera providing 0.3 megapixel resolution used in Vicon MX systems after July 2006. Also see MX+ Camera and Vicon MX.

MX40: An MX Camera providing 4 megapixel resolution used in Vicon MX systems before July 2006. Also see MX Camera and Vicon MX.

MX40+: An MX+ Camera providing 4 megapixel resolution used in Vicon MX systems after July 2006. Also see MX+ Camera and Vicon MX.

mxe file: A file with extension .mxe, which contains updates to the Vicon MX firmware in MX cameras and certain MX hardware units. Also see Firmware, MX Bridge, MX Camera, MX Control, MX Sync, and MX Ultranet.

N

Neutral pose: The anatomical position in which a subject maintains a stationary stance. In this type of pose, the subject typically stands upright with the head level and looking straight ahead, shoulders relaxed (neither hunched forward nor pressed backward), arms hanging loosely by the sides with wrists straight and palms facing inward, pelvis level, and feet flat on the floor and pointing forward. The actual posture depends upon the definition of the zero position for key joints in the kinematic model described in the associated .vst file. A neutral pose is using during a static trial or at the beginning of a dynamic trial. Two common forms of the neutral pose are the motorcycle pose and the T-pose. Also see Dynamic trial, Motorcycle pose, Static trial, and T-pose.

Nexus: Vicon application software for optical motion capture, processing, and analysis with Vicon MX systems. It contains functionality to prepare, acquire, and review the movement of live subjects and inanimate objects. Nexus replaced Workstation as the core motion capture and processing software for life sciences applications. Also see Vicon MX and Workstation.

Noise: Random or systematic background interference that is unrelated to the data being collected (such as hum or hiss in audio data, or snow or graininess in video data), or random spikes or jitters in motion data. Some noise is generally present in most data collected. Typical examples are noise caused by human error in digitizing, electrical interference in EMG, mechanical vibrations in force plates, or non-seamless camera tracking of markers during motion capture. Different types of noise require different techniques to eliminate it.

Normalization scheme: A set of events within a context defined for a trial, which is used to normalize graph data in some Vicon application software. Graphs are plotted using a horizontal axis which is determined by two events. This enables graphs from different trials to be compared. Also see Context.

NTSC: National Television System Committee. A format defined for analog color television, with a vertical resolution of 525 lines and a base frame rate of 29.97 Hz. This is the format used in Canada, Japan, Korea, Mexico, USA, and parts of Central and South America. NTSC uses the SMPTE timecode standard. Also see EIA, LTC, PAL, SECAM, SMPTE timecode, Timecode, and VITC.

O

obd file: A text file with extension .obd, which contains information on fixed objects (such as furniture) in the capture volume. This enables such objects to be visualized in Vicon Workstation. You can use the default .obd files supplied in the Workspace directory (by default, C:\Program Files\Vicon\Workstation \Wkspace). A copy is written to the active Session folder of the open database. Also see Capture volume and Workstation.

obj file: Object file. A text file with extension .obj, which contains definitions of mesh segments corresponding to the names of segments in an associated .vst file or modeled data. You can select any of the default .obj files supplied in the Meshes folder of Vicon Polygon (by default, C:\Program Files\Vicon\Polygon \Meshes). Also see Plug-in Gait, Polygon, and .vst file.

Object: The target of a trial, usually a single-segment inanimate article, to which Vicon markers are attached and subsequently tracked by a Vicon system. Also see Trial, Tracking volume, and Subject.

Occlusion: The state of a marker that has been completely obstructed from the view of one or more cameras. This is generally caused by the marker being covered by a body part or by another motion capture subject. Also see Marker.

Offline processing: The process of converting raw motion data previously captured by Vicon cameras and saved in .tvd or .x2d files into 3D data. Also see Real-time processing, .tvd file, and .x2d file.

OLGA: Optimized Lower-limb Gait Analysis. A Vicon system software option for Polygon. OLGA is a plug-in procedure used to increase the accuracy and repeatability of trials that have been captured with the Newington/Helen Hayes marker set and processed with the Conventional Gait Model (CGM), also known as the Davis/Kadaba model (as implemented by Vicon first in Vicon Clinical Manager and later in Plug-in Gait). Also see Gait analysis, Plug-in, and Plug-in Gait.

Operating mode: A window in some Vicon application software that provides access to the activities required during a specific stage of motion capture and processing. Each operating mode has its own control bars, view panes, and activity bars. Also see Control bar, View pane, and Activity bar.

Options file: An XML file with extension .Options, which contains configuration settings for view options created in the Options dialog box in Vicon Nexus. Also see Nexus.

Origin: See Volume origin.

Ortho view pane: A type of view pane in a Vicon iQ or Nexus application software window in which the point of sight, or direction, from which to view the capture volume (or tracking volume) in the workspace can be set. The available views are based on orthographic projection (also called orthogonal projection): top, bottom, front, back, right side, and left side. Also see View pane, Capture volume, Tracking volume, and Workspace.

Orthogonal axes: Three axes which are at right angles to each other. Vectors may be analyzed into components in any orthogonal system of axes, and the components added according to normal vector algebra.

Overlap: The state of two trajectories that are reconstructed in a certain range of consecutive frames and are given the same label. Also see Trajectory.

P

PAL: Phase Alternation by Line. A format defined for analog color television, with a vertical resolution of 625 lines and a base frame rate of 25 Hz. This is the format used in much of Europe (except France), Australia, and parts of Asia and Africa. PAL uses the EBU timecode standard. Also see CCIR, EBU timecode, LTC, NTSC, SECAM, Timecode, and VITC.

Pan: The rotation of a stationary camera in a horizontal plane about a vertical axis (pan left or pan right). Also see Dolly, Tilt, and Truck.

Parameter links: A visual representation in Vicon application software of the parameter associations between specified markers and segments in a subject.

Parent segment: A segment in a kinematic model that controls attributes of one or more child segments. A parent segment also can be the child of other parent segments. Also see Child segment.

PECS: Pipeline External Communication Server. A Vicon system software option for Workstation. PECS enables Workstation to be used as a Windows ActiveX automation server. This gives any application supporting ActiveX technology direct access to Workstation data and the processing API, which enables a variety of client applications, scripts, and processes to be evaluated in the Vicon application software pipeline. It offers the additional capability of providing ActiveX access for processing of 3D marker data and analog data within other applications.

Pipeline: The feature in Vicon application software that specifies one or more operations to be automatically performed on the data for a specific type of trial following motion capture. The pipeline can be run immediately after capture or on demand against one or more previously saved trials. The pipeline includes default operations from the Vicon application software, any Vicon plug-in modules, and any user-created plug-in modules. Also see Trial, Vicon application software, and Plug-in.

Pipeline file: An XML file with extension .Pipeline, which contains configuration settings for automated processing pipelines created in the Pipeline tools pane in Vicon Nexus. Also see Nexus and Pipeline.

Pixel: Picture (pix) element. The smallest unit of the composition of an image capture or display device.

Plug-in: A data-processing module which provides additional functionality directly accessible from the Vicon application software. A number of plug-in modules may be provided as system options with Vicon application software. Some third-party application software (such as computer graphics packages) may provide plug-ins for use with Vicon application software. Workstation plug-ins have the file extension .vpi. Their functionality is accessed through the pipeline. Users also can create their own Workstation plug-ins using the Plug-in Software Development Kit (SDK). Other Vicon application software may provide plug-ins with a different file extension and access method. Also see Pipeline, Vicon application software, and Workstation.

Plug-in Gait: A Vicon system software option for Nexus and Polygon. Plug-in Gait is an enhanced version of the Vicon Clinical Manager model that enables users to produce gait analysis reports that conform to established clinical practices. Also see Gait analysis, Nexus, and Polygon.

Plug-in Modeler: A Vicon system software option that enables BodyLanguage models to be inserted into Workstation as pipeline processing operations. Also see BodyBuilder, BodyLanguage, Pipeline, and Workstation.

Point: A location in space specified by 3D coordinates. A trajectory (or segment of a trajectory) consists of a time-series of points. A point is stored in a .c3d file as three spatial coordinates and a residual, identified by a label. Points may represent the measured positions of real markers. In some Vicon application software, points may be virtual (created by modeling). The terms point and marker are often used interchangeably. Also see .c3d file, Label, Marker, and Virtual point.

Polygon: Vicon application software for biomechanics visualization and reporting, which models bones, muscles, and ligaments. Polygon functionality can be extended with plug-in modules. Also see OLGA and Plug-in Gait.

Post-triggering: A feature in some Vicon application software that enables a Vicon system to capture events that have already happened. This is useful, for example, for subjects whose motion is difficult to predict, such as animals and children.

Primary selection: The first of multiple selected objects (such as markers or graph plots). Some tools or processes in some Vicon application software operate solely on the primary selection. Also see Secondary selection.

Progressive video: Also known as progressive scan. A method for constructing a video image by drawing the lines of each frame in sequence. The entire image is constructed every frame. Also see Composite video signal.

protocol file: An XML file with extension .protocols, which contains configuration settings for customized workflow protocols created in the Protocols status pane in Vicon Nexus. Also see Nexus.

R

Range of Motion (RoM) trial: A short dynamic trial (typically 15-30 seconds) during which the subject moves his or her limbs and joints to enable Vicon application software to determine the location of and measurements between key markers and to assign labels to the reconstructed 3D markers. This type of dynamic trial is required for the subject calibration process. During a RoM trial, the subject moves each limb and joint to be captured through its full range of motion at least once. For entertainment applications, the movements included in a RoM trial should match any moves that will be included in the planned data captures. For life sciences applications, the movements included in a RoM trial depend on factors such as the subject’s physical capabilities; if the subject is not able to perform a RoM trial, use the full subject calibration process in Plug-in Gait instead. Also see Dynamic trial, Plug-in Gait, Subject calibration, Workstation, and Vicon iQ.

Real-time processing: The process of converting raw, 2D motion data being streamed live by Vicon cameras into 3D data. Also see RealTime Engine (RTE) and Offline processing.

RealTime Engine (RTE): Vicon application software that produces 3D data based on the raw motion data acquired by Vicon MX or V-series cameras. The RTE (known as Tarsus in Vicon V-series systems) reconstructs, labels, and optionally kinematically fits this real-time motion data, which can then be viewed and incorporated in Vicon iQ, Polygon, or third-party visualization software. Also see Polygon, Tracker, Vicon iQ, and Workstation.

RealTime subject: A subject or object whose motion is to be acquired and streamed into visualization software in which the data can be visualized and manipulated in real time. Also see RealTime Engine (RTE), Subject, and Object.

Reconstruction: The process by which Vicon application software calculates the position of markers in three-dimensional space and links these points frame-by-frame into a trajectory. Also see Frame, Marker, and Trajectory.

Reconstruction entity: A 3D representation generated by Vicon application software showing the reconstructed markers. Also see Marker and Reconstruction.

Reconstruction volume: The 3D representation of the capture volume displayed in some Vicon application software. This enables the user to visualize the space within which the Vicon system attempts to reconstruct marker data. The dimensions of this volume are user configurable. Also see Calibration volume, Capture volume, Marker, and Trajectory.

Reference video: Digital video data from DCAM- or DV-format video cameras that are captured simultaneously with optical motion data from Vicon MX systems. The captured data is stored in .vvid files. Also see .avi file, DCAM, DV, IEEE 1394, Movie capture, Polygon, Vicon iQ, Vicon MX, and Workstation.

Remote triggering: A feature in Vicon application software that enables a third-party device integrated into a Vicon system to start or stop data capture. Also see Datastation, MX Control, and Trigger.

Resolution: A measure of the fineness of detail with which a camera or monitor can produce an image with good definition. This measurement is based on the total number of pixels displayed horizontally and vertically on the camera video sensor or the video monitor. Also see Camera video sensor and Pixel.

Retroreflective marker: See Marker definition 1.

Rigid body: A virtual object formed from a specified group of markers with a relatively fixed proximity to one another. Some Vicon application software can use rigid bodies to fill gaps in other marker trajectories. Also see Marker and Trajectory.

RoHS compliant: Vicon hardware that complies with Directive 2002/95/EC concerning the Restriction of the Use of certain Hazardous Substances in Electrical and Electronic Equipment (RoHS). This European Commission Directive provides that new electrical and electronic equipment put on the market for the first time from 1 July 2006 should not contain lead, cadmium, mercury, hexavalent chromium, polybrominated biphenyls (PBB) or polybrominated diphenyl ethers (PBDE). Also see WEEE compliant.

RoM trial: See Range of Motion (RoM) trial.

Root: The segment of a subject that the autolabeling process is to identify first. This segment is designated in the file identifying the marker labels to be used. For human subjects, this is typically a 6 DOF joint represented by the pelvis. Also see DOF, .mkr file, .vsk file, and .vst file.

Rotation: A movement about a specified axis. In Vicon application software, the rotation of a kinematic model element can be manipulated to change its displayed orientation in a 3D Workspace. Also see 3D Workspace, Scale, and Translation.

rtp file: RealTime Parameters file. A text file with extension .rtp, which contains a set of parameters that specify the way the RealTime Engine is to stream data through some Vicon application software. You can save settings to .rtp files and load them to suit your particular needs. By default, .rtp files are saved in the active Session folder of the open database. Also see Data streaming and RealTime Engine (RTE).

S

S-Video connector: Superior Video connector. A hardware interface for connecting video equipment that handles chrominance (color) and luminance (black and white) signals separately. An S-video connector provides a higher-quality signal free of the cross luminance/color problems associated with composite video signals. Also see Composite video signal.

Sample skip: A feature in some Vicon application software to reduce the video capture rate. For example, a setting a sample skip video rate of 2 for a camera capturing 120 frames per second reduces the effective sample rate to 60 frames per second. This is useful when capturing slow moving subjects, capturing for long periods, or using large numbers of subjects with many cameras. It can also be used to reduce the amount of data, for example, to free up space on the computer. Also see Frame rate.

Sampling frequency: See Analog sampling frequency.

Scalar: A quantity that has only magnitude. For example, mass, length, or kinetic energy are scalar quantities and can be manipulated with conventional arithmetic. Also see Kinetics and Vector.

Scale: 1) The enlargement or reduction of an image by proportionally adjusting its size. In Vicon application software, the scale of a kinematic model element can be manipulated to change its displayed size in a 3D Workspace. Also see 3D Workspace, Rotation, and Translation. 2) The alteration of values from one unit of measure to another. Vicon application software can scale incoming voltage signals (e.g. from a force plate) from bits to Newtons (N) for forces and Newton millimeters (Nmm) for moments. Also see Force plate and Scale factor (analog).

Scale factor (analog): The factor by which to multiply the incoming voltage unit from a third-party analog device to convert it to another unit of measure that can be used by Vicon application software. Also see Scale definition 2.

Scrub: The movement of the current time cursor left or right along the Time Bar ruler to manage the trial data currently viewable in the 3D Workspace in Vicon application software. Also see 3D Workspace, Trial, and Time bar.

SECAM: Séquential Couleur avec Mémoire. A format defined for analog color television, with a vertical resolution of 625 lines and a base frame rate of 25 Hz. This is the standard used in France, the Middle East, and most of Eastern Europe. SECAM uses the EBU timecode standard. Also see CCIR, EBU timecode, LTC, NTSC, PAL, Timecode, and VITC.

Secondary selection: The second or subsequent of multiple objects (such as markers or graph plots) selected after the primary selection. Also see Primary selection.

Segment: One of the constituent parts into which a body or object is divided. A segment can be represented in a kinematic model of a subject, for example a bone in a human being or an animal. A segment can be visualized as an element of the 3D representation of a subject in Vicon application software. Also see Kinematic model, Segment Axes, and Subject.

Segment axes: The embedded coordinate reference frame for a segment in the kinematic model for a subject whose motion is being captured or analyzed in a Vicon system. This can be visualized as an element of the 3D representation of the subject. Also see Kinematic model, Segment, and Subject.

Sensor: A device that measures or detects a physical quantity such as pressure, motion, sound, or light and converts it into an analog or digital representation. Also see Analog sensor and Camera video sensor.

SIMM export plug-in: A Vicon system option for Workstation. This plug-in exports joint angles, kinetics, trajectories, force plates, and analog data to the files necessary to run a SIMM model. The plug-in is included in Workstation as a pipeline operation that enables the SIMM model automatically to be run immediately following processing. Also see Analog, Force plate, Kinetics, Pipeline, and Plug-in.

Single support: A temporal parameter used in gait analysis for the period of time, or the percentage of the gait cycle, where one foot supports the subject. Also see Double support and Gait analysis.

Slider joint: A 1 DOF joint with translational freedom along a single axis. The joint has a single vector defining the axis of the slider. Also see Ball joint, Degree of freedom (DOF), Free joint, Hardy Spicer joint, and Hinge joint.

SMPTE drop-frame timecode: SMTPE timecode that skips, or drops, two frame numbers per minute, except at the tens of the minute count. This resolves the problem of incorrect synchronization of timecode with clock time caused by SMPTE timecode counting a full

30 frames per second while NTSC video operates at 29.97 Hz. If unresolved, the timecode would count 108 more frames in one hour than actually occur in the NTSC video in one hour. Also see SMPTE timecode and Timecode.

SMPTE timecode: The standard of timecode defined by the Society of Motion Picture and Television Engineers in the USA, which is based on cameras operating at multiples of 29.97 Hz. During videotaping, frame numbers corresponding to a particular video frame are encoded in either LTC or VITC. Also see EBU timecode, EIA, LTC, NTSC, Timecode, and VITC.

sp file: Subject Parameters file. A text file with extension .sp, which contains the names and initial coordinates of markers attached to a subject whose motion is being captured or analyzed by Workstation application software. The .sp file is generated during the autolabel calibration process and subsequently used for labeling reconstructed data. By default, .sp files are saved in the active Session folder of the open database. Also see Autolabel calibration, Subject and Workstation.

Spike: A point that lies to one side of an otherwise smooth trajectory. A spike appears as a sudden, dramatic rise or fall in graph data. Spikes often occur as a result of a poor reconstruction in a particular frame and can be eliminated using editing tools in Vicon application software. Also see Frame, Point, Reconstruction, and Trajectory.

Static calibration object: A calibration object used for setting the global coordinate system in the capture volume. An ergo calibration frame is one type of static calibration object. Also see Calibration kit, Calibration object, Calibration volume, Ergo calibration frame, and Global coordinate system.

Static trial: A short data capture (typically 3-5 seconds) during which the subject stands in a stationary, neutral pose to enable the Vicon system to determine the location of key markers on the subject. This type of trial is required to optimize an autolabel process in Vicon application software. Also see Neutral pose, Motorcycle pose, T-pose and Dynamic trial.

Step length: A temporal parameter used in gait analysis for the distance along the line of progression from foot contact by one foot to foot contact by the other foot. Also see Foot contact and Gait analysis.

Step time: A temporal parameter used in gait analysis for the period of time, or the percentage of the gait cycle, from foot off to foot contact by the same foot. Also see Foot contact, Foot off, and Gait analysis.

Step width: A temporal parameter used in gait analysis for the distance between the specified foot marker and the corresponding marker on the opposite foot when a foot contact event occurs along the line of progression. Also see Foot contact and Gait analysis.

Stick: A visual aid to illustrate the connection between reconstructed marker positions or between virtual points in a kinematic model for a subject whose motion is being captured or analyzed in a Vicon system. This can be visualized as an element of the 3D representation of the subject. Also see Kinematic model, Marker, and Subject.

Stride length: A temporal parameter used in gait analysis for the distance along the line of progression from one foot contact to the next foot contact by the same foot. Also see Foot contact, Gait analysis, and Stride time.

Stride time: A temporal parameter used in gait analysis for the period of time, or the percentage of the gait cycle, from foot off to foot contact by the same foot, that is, the time taken for the foot to do a full gait cycle. Also see Foot contact, Foot off, and Gait analysis.

Strobe unit: A specialized piece of illumination equipment attached to the front of a Vicon camera. The strobe unit generates a bright flash of light, which illuminates the retroreflective markers attached to the subject or object whose motion is being captured or analyzed in a Vicon system. The strobe unit’s flash coincides with the time the camera's shutter (if present) is open. Strobe units can be fitted with Visible Red (VR), Near Infrared (NIR), or Infrared (IR) Light Emitting Diodes (LEDs).

Subject: 1) The target of a trial, usually a multi-segment being such as a person or an animal wearing Vicon markers, whose motion is being captured or analyzed by a Vicon system. Also see Trial, Capture volume, and Object. 2) The 3D representation of the person, animal, or object whose motion is being captured or analyzed in a Vicon system. This is a visualization of the calibrated Vicon Skeleton (.vsk) file for a specific subject. Individual elements of the subject can be visualized in 3D: Bones, Segment Axes, Marker, Stick, Bounding box, and Parameter links. 3) A node in the hierarchy of a database based on the generic Eclipse Node Initialization (.eni) template file. This equates to the Patient node in the Clinical template and the Capture Day node in the Animation template. Also see Eclipse database and .eni file. 4) A collection of files named after the trial subject. Also see .sp file, .mkr file, and .vsk file.

Subject calibration: The process by which the Vicon application software creates or modifies a kinematic model for a specific subject. During this processing, the Vicon application software compares the physical segments, joints, and markers on the trial subject to either a) the definition of segments, joints, and markers in the generic model for the subject type described in the associated Vicon Skeleton Template (.vst) file in Vicon iQ or b) marker locations in a previously manually labeled trial for that subject in Workstation. The results of subject calibration are stored in a subject-specific Vicon Skeleton (.vsk) file, which is used to automatically track and label segments and marker trajectories for the subject in in the 3D Workspace. Also see Autolabel calibration, Kinematic model, Marker, Segment, Trajectory, .vsk file, and .vst file.

SV Cam: A small format, wide-angle lens CMOS digital sensor camera used in a Vicon V-series system. This type of camera is the same specification as a VCam camera, but with a reduced strobe size. Also see CMOS and VCam.

Synchronization: The process by which a signal change common to all camera view and analog signals is used to match them in time. This causes analog and/or video data from different sources to match exactly. Also see Analog, Datastation, and MX Control.

System calibration: See Camera calibration.

System file: An XML file with extension .System, which contains configuration settings for Vicon system hardware managed by Nexus application software. This file is created in the System resources pane in Nexus. Also see Nexus.

T

T-pose: A form of the neutral pose used when capturing a static trial in Workstation or starting a RoM trial in Vicon iQ and Nexus application software. In this pose, the subject stands in the basic neutral pose and raises the arms out straight to the sides with palms facing down (in a position in the shape of a T). This type of static trial may be required for the autolabel or the subject calibration process. Also see Autolabel calibration, Neutral pose, Motorcycle pose, RoM trial, Static trial, and Subject calibration.

Tail: An inaccurate reconstruction for a marker trajectory that occurs immediately before and after gaps. Tails can occur when a marker is partially occluded (or blocked) from the camera's view during motion capture, thus resulting in unreliable data for that marker during that period of time. Tails can be eliminated using editing tools in Vicon application software. Also see Gap.

Tarsus: See RealTime Engine (RTE).

Threshold grid: In Vicon MX, a grid superimposed over the image displayed in a camera view pane in which raw, 2D camera data can be manually marked to be used for processing or to be discarded. This enables grayscale blobs generated from unwanted light sources such as stray reflections from other objects or surfaces in the capture volume and opposing strobe units to be ignored. You can have Vicon application software automatically create threshold grids, or you can create them yourself. The equivalent functionality for Nexus and for Vicon V-series systems is provided by camera masks. Also see Camera mask, Capture volume, Grayscale blob, Vicon MX, Vicon V-series system, and .vtt file.

Tilt: The rotation of a stationary camera in a vertical plane about a horizontal axis (tilt up or tilt down). Also see Dolly, Pan, and Truck.

Time bar: A dialog bar in Vicon application software that enables motion capture data with time and synchronization characteristics to be viewed and manipulated. The time bar contains a ruler, context bars, and data playback controls to move to a specific time range within the visualized data. In some Vicon application software, it also contains normalization ranges. Also see Context bar, Motion capture, and Synchronization.

Timecode: A time signature that can be imprinted in video or audio signals to provide positional information (i.e. time and frame details) on magnetic videotape. Each field of the signal is assigned its own unique eight-digit code number based on a 24-hour clock specifying hours, minutes, and seconds along with a frame number (hh:mm:ss:ff). Vicon MX supports the two forms of timecode: EBU (used for PAL, SECAM, and CCIR systems) and SMTPE (used for NTSC and EIA systems). Vicon MX can synchronize timecode with connected devices and act as a master timecode generator for the system. Vicon V-series systems can synchronize timecode with connected devices. Also see CCIR, EBU timecode, EIA, Field, Frame, LTC, NTSC, PAL, SECAM, SMPTE timecode, and VITC.

Timecode triggering: A feature in Vicon application software that enables a Vicon system to start or stop data capture based on a specified timecode. Also see Datastation, MX Control, Timecode, and Trigger.

tpl file: Template file. A Polygon report file with extension .tpl, from which similar Polygon reports for different data sets can be created. These template files define the hierarchical structure and contents of a specific type of Polygon report. The supplied .tpl files are installed in the Polygon Templates folder (by default, C:\Program Files\Vicon\Polygon\ Templates). Also see Polygon.

Tracker: Vicon application software for 3D optical tracking in virtual environments, simulators, and visualization systems. Tracker is the core motion capture and processing software for engineering applications.

Tracking volume: The area of the capture space in which Vicon cameras are able to capture the motion of specified tracking objects. Also see Reconstruction volume, Calibration volume, and Capture volume.

Trajectory: The path though space that a moving marker follows. This reconstructed data is stored in a file as a time-series of points with the same label. A trajectory can be displayed in the 3D Workspace as a line through the position of a marker in the current field. A trajectory may consist of a single uninterrupted path or of a number of segments. The latter can occur when markers are obscured from view. Also see 3D Workspace, .c3d file, Field, Label, Marker, and .trial file.

Translation: The movement of an object along a specified axis. In Vicon application software, the translation of an object can be manipulated to change its displayed position in a 3D Workspace. Also see 3D Workspace, Rotation and Scale.

trc file: Track Row Column file. A text file with extension .trc, which contains marker and trajectory data in Track Row Column format. A .trc file can be used to import data from third-party applications into some Vicon application software. Also see Marker and Trajectory.

Trial: The result of data capture in a Vicon system. The two basic types of data capture are dynamic trials and static trials. Trial data can be saved to file types appropriate for the stage of processing. Also see .c3d file, Dynamic trial, Static trial, .trial file, .tvd file, and .x2d file.

trial file: A binary file with extension .trial, which contains all data from a motion capture trial (e.g. unprocessed 2D camera, rigid body, virtual point, and kinematic data). This file can be created when the real-time stream is acquired by Vicon motion capture systems and when offline data is processed in some Vicon application software. By default, .trial files are saved to the active Session folder of the open database. Also see Data capture, Kinematic model, Motion capture, Rigid body, Trial, and Virtual point.

TrialTypes file: An XML file with extension .TrialTypes, which contains configuration settings for motion capture trial setups created in the Capture tools pane in Vicon Nexus. Also see Nexus.

Trigger: A specified event that initiates or terminates remote data capture or synchronization in a Vicon system. This can be when a specific level either in increasing or decreasing signal is reached or at a specified point of an incoming analog signal. Also see Post-Triggering, Remote triggering, and Timecode triggering.

Truck: The moving of a camera side to side along a horizontal axis (truck left or truck right). Also see Dolly, Pan, and Tilt.

tvd file: A binary file with extension .tvd, which contains 2D camera data previously captured in a Vicon V-series system. By default, .tvd files are saved to the active Session folder of the open database. Also see Eclipse database and Vicon V-series system.

V

vad file: Vicon Analog Data file. A binary file with extension .vad, which contains unprocessed data from analog data capture. By default, .vad files are saved to the active Session folder of the open database. Similar functionality is provided by the .x1d file in Vicon Nexus. Also see Analog and Nexus.

VCam: A small format, wide-angle lens CMOS digital sensor camera used in a Vicon V-series system. This type of camera is the same specification as an SV Cam camera with a standard body and strobe size. Also see CMOS, SV Cam, and Vicon V-series system.

Vector: A quantity that has both direction and magnitude. For example, velocity is a vector quantity whose magnitude is a body's speed and whose direction is the body's direction of motion. Vicon application software uses vectors to describe and analyze elements of kinematic models of subjects or objects whose motion is being analyzed. Also see Kinematic model.

Vicon application software: Software for motion capture, processing, and analysis by Vicon systems. A range of software is available for use in a variety of engineering, entertainment, and life sciences applications. Also see BodyBuilder, Plug-in, Polygon, Tracker, Vicon iQ, and Workstation.

Vicon iQ: Vicon application software used for tracking and automatically processing complex multiple-character capture scenarios. Vicon iQ is the core integrated motion capture and processing software for entertainment applications.

Vicon MX: Vicon integrated system for digital optical motion measurement and analysis, based on video cameras that perform centroid processing. It consists of specialized cameras, illumination equipment, controlling hardware units, application software, and a host PC. MX network equipment, accessories, calibration apparatus, and cables are supplied with the system. Third-party devices can be integrated with the system. Also see Accessory kit, Host PC, Calibration kit, MX Bridge, MX Control, MX Link, MX Net, MX Sync, MX Camera, and Strobe unit.

Vicon V-series system: Vicon 3D motion capture and analysis system, based on analog cameras and a Datastation that performs the processing. It consists of specialized cameras, illumination equipment, controlling hardware unit, application software, and a host PC. Vicon accessories, calibration apparatus, and cables are supplied with the system. Vicon 460, Vicon 6, Vicon 612, Vicon 624, and Vicon 8i are V-series systems. Also see Accessory kit, Calibration kit, Datastation, Host PC, MCam, MCam2, Strobe unit, SV Cam, and VCam.

Video Burn-in window: A function in some Vicon application software that embeds a small window containing a display of either the current timecode or frame count into the video output signal. Also see Frame, Reference video, and Timecode.

View pane: The area in the middle of a Vicon application software window that enables users to specify the type of data from one or more Vicon cameras to be viewed. Each type of view pane may contain its own menu bar, toolbar, and workspace. Also see View pane menu bar, View pane toolbar, and Workspace.

View pane menu bar: A set of menus from which the type of view pane to display in the workspace is selected. Also see 3D Workspace, Camera view pane, Frame rate view pane, Fullscreen preview, Ortho view pane, View pane, and View pane button bar.

View pane toolbar: A set of buttons with which the number and arrangement of view panes displayed in the workspace is specified. Also see View pane and View pane menu bar.

ViewType file: Vicon Nexus view pane layout configuration file. An XML file with extension .ViewType, which contains configuration settings for view pane layouts in the Nexus window. Also see Nexus.

Virtual point: A virtual marker that is derived through calculations based on a specified group of markers—or other virtual points—whose proximity to one another is relatively fixed. Some Vicon application software can use virtual points as though they were reconstructed markers (e.g. to edit, filter, fill gaps in other marker trajectories, and visualization). Also see Marker, Point, Reconstruction, and Trajectory.

Visualization software: Vicon or third-party application software in which motion data can be visualized and manipulated in real time. Also see Polygon and Vicon iQ.

VITC: Vertical Interval Timecode. A form of timecode that is encoded directly into the video tracks, picked up by the helical scan heads on a Video Cassette Recorder (VCR), and then output on the video signal. This means that even if the VCR is in a pause or slow mode, the VITC can still be read. Also see EBU timecode, LTC, SMPTE timecode, and Timecode.

Volume: See Capture volume, Calibration volume, Reconstruction volume, and Tracking volume.

Volume origin: The coordinates (0,0,0) identifying the origin of the world in the context of the capture volume or tracking volume. The volume origin is specified during the system calibration process. Also see Capture volume, Tracking volume, and System calibration.

vpi file: Vicon Plug-In file. A C++ DLL file with extension .vpi, which is a user-defined plug-in to Workstation application software that has been written using the Vicon Software Development Kit (SDK). A .vpi file is included in Workstation as a pipeline operation in the Vicon Plug-ins directory (by default, C:\Program Files \Vicon\Plugins). These .vpi files can be run in Nexus through the Workstation Operations section of the Pipeline tools pane and are stored in the Workstation Plug-ins directory (by default, C:\Program Files\Vicon\Nexus\WorkstationPlugIns). Also see Nexus, Pipeline, Plug-in, and Workstation.

vsk file: Vicon Skeleton file. An XML file with extension .vsk, which contains a kinematic model that describes the relationships between the segments, joints, and Vicon markers for a specific subject or object of the type described in the associated Vicon Skeleton Template (.vst) file. For example, if the .vst file represents a human being, the .vsk file contains a kinematic model of an individual person. The Vicon application software uses the .vsk file to track and label markers and segments for that subject. By default, .vsk files are saved to the active Session folder of the open database. Also see Eclipse database, Kinematic model, Marker, Object, Segment, Subject, and .vst file.

vst file: Vicon Skeleton Template file. An XML file with extension .vst, which contains a kinematic model that describes the generic relationships between segments, joints, and Vicon markers for a certain type of subject or object. For example, a .vst file may be used to represent a human being, a calibration object, or a prop. You can use any of the default .vst files supplied with your Vicon application software or create your own to suit your particular needs. Also see Kinematic model, Marker, Object, Segment, Subject, .vsk file.

vtt file: Vicon Threshold Table file. An XML file with extension .vtt, which contains the set of threshold grids defined to discard (or in some Vicon application software reduce the data intensity of) defined areas of 2D data visible to MX cameras in a Vicon MX system. By default, .vtt files are saved to the active Session folder of the open database. Similar functionality is provided by the .xcp file in Nexus. Also see MX Camera, Threshold grid, and .xcp file.

vvid file: Vicon Video file. The raw form in which Nexus initially saves video files. After files are transcoded, they are saved in .avi format, enabling you to view the resulting video. See also avi file, and Reference video.

W

Walking speed: A temporal parameter used in gait analysis for the speed of the current foot based on stride time and stride length. Also see Gait analysis, Stride length, and Stride time.

Wand: See Calibration wand.

WEEE compliant: Vicon hardware that complies with Directive 2202/96/EC concerning the disposal of Waste Electrical and Electronic Equipment (WEEE). This European Commission Directive provides for the disposal of certain equipment that may not be treated as household waste. Also see RoHS compliant.

Workspace: The area in the view pane in which data can be viewed and manipulated. The type of workspace displayed depends on the type of view pane selected. Also see View pane and 3D Workspace.

Workspace axes: A visual representation in some Vicon application software of the X, Y, and Z axes in the global coordinate system. These axes are specified as part of the system calibration process. They can be visualized in the 3D Workspace. Also see 3D Workspace, Global coordinate system, and System calibration.

Workstation: Vicon application software for data acquisition and processing of optical motion capture. It contains functionality to set up, calibrate, acquire, verify, edit, and process motion data from Vicon systems as well as analog data from third-party devices such as EMG and force plates. It also controls capture of digital reference video and real-time data streaming. Workstation is the core motion capture and processing software for life sciences applications. A range of plug-in software is available to extend Workstation functionality. Also see Plug-in, PECS, Plug-in Modeler, and SIMM export plug-in.

X

x1d file: A binary file with extension .x1d, which contains unprocessed data from analog data capture in Vicon Nexus. By default, .x1d files are saved to the active Session folder of the open database. Similar functionality is provided by the .vad file in earlier Vicon application software. Also see Nexus and .vad file.

x2d file: An XML file with extension .x2d, which contains 2D camera data previously captured in Vicon MX systems. This can be a mixture of unprocessed grayscale blobs, calculated centroids, and coordinates data. By default, .x2d files are saved to the active Session folder of the open database. Also see Centroid, Coordinates data, Grayscale blob, and Vicon MX.

xcp file: An XML file with extension .xcp, which contains the calibration parameters and threshold data specified for Vicon cameras and supported third-party digital video cameras in Vicon Nexus. This file is created during the MX camera and DV camera calibration processes and used when data from these cameras is processed. A copy of the .xcp file is saved to the active Session folder of the open database. Similar functionality is provided by the .cp and .vtt files in earlier Vicon application software. Also see .cp file, DCAM, DV, Nexus, and .vtt file.

xml file: eXtensible Markup Language file. A condensed form of SGML (Standard Generalized Markup Language) which defines a language standard used to create customized tags for organizing and presenting types of information in documents that can be published on the World Wide Web. A number of Vicon file types are in XML format. Also see .vsk file, .vst file, and .vtt file.

Z

Zoom lens: A camera lens with a variable focal length and whose angle of view can be changed without moving the camera. See MCam2, MX13/MX13+, and MX40/40+.

Zoom ratio: The ratio of the longest and shortest focal length of a zoom lens. Also see Focal length and Zoom lens.

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