

Example - Functional Knee

When defining the functional knee joint, the calculation defines the axis of rotation, but not the location on the axis.

Two additional landmarks (RKneMed & LKneMed) must be created off the position of the mediolateral knee targets.

[Sample files](#) for this tutorial may be downloaded.

- 1) This tutorial will use the **Static.c3d** and **Functional Knee.c3d** files.
- 2) The Functional Hip.c3d file is used for the [Functional Hip Tutorial](#).
- 3) FunctionalJoints_Hip_Knee.cmo contains a static trial with both the functional hip and knee defined.

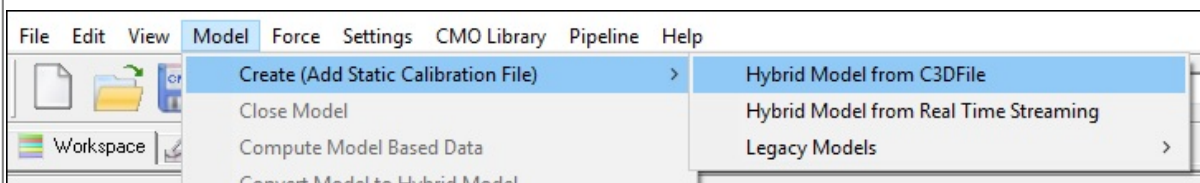
The calculation of functional joints is described [here](#).

Load Static Trial

1. From the **Model** menu, select **Create → Hybrid Model from C3D file**.

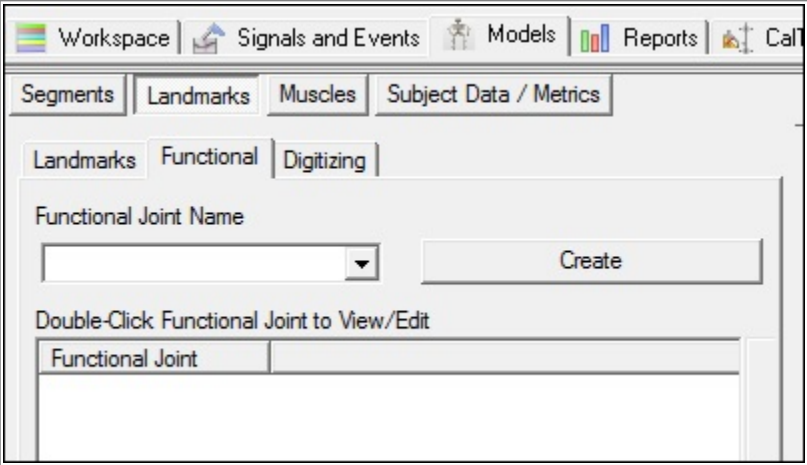
2. A dialog titled **Select the calibration file for the new model** will appear;

Select *Static.c3d*
Click **Open**.



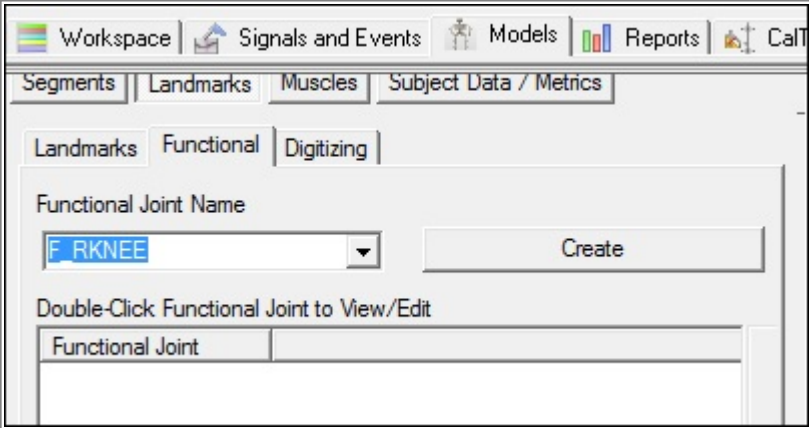
Create Functional Joint

1. On the **Landmarks** tab:
1. Select the **Functional** tab



Create Right Functional Joint

1. On the **Landmarks** tab:
1. Select the **Functional** tab
2. From the **Functional Joint Name** box, select *F_RKNEE*.
3. Click **Create**.

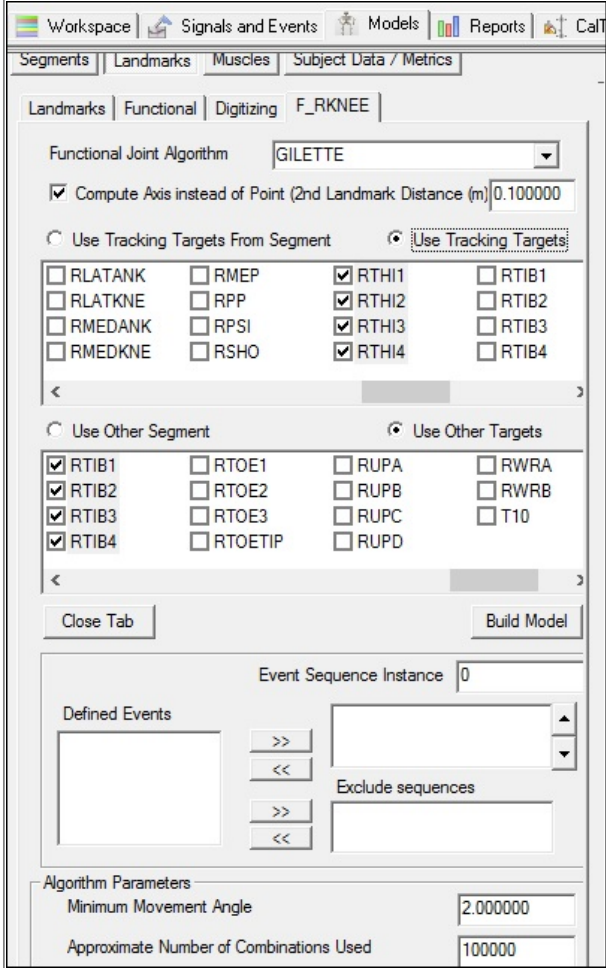


2. Select tracking targets for the **F_RKNEE**:

Tracking Segment/Targets
Select **Use Tracking Targets**
(ctrl-click to multi select)
RTH1, RTH2, RTH3, RTH4

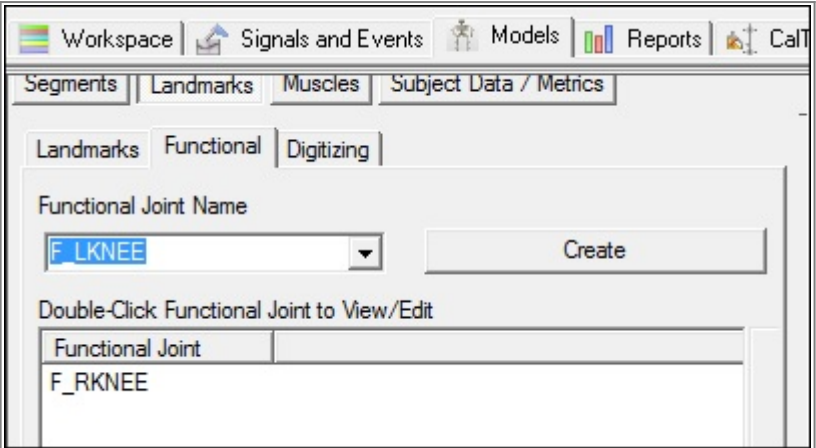
Other Segment/Targets:
Select **Use Other Targets**
(ctrl-click to multi select)
RTIB1, RTIB2, RTIB3, RTIB4

Click on **Close Tab** before proceeding.



Create Left Functional Joint

1. On the **Landmarks** tab:
1. Select the **Functional** tab
2. From the **Functional Joint Name** box, select *F_LKNEE*.
3. Click **Create**.

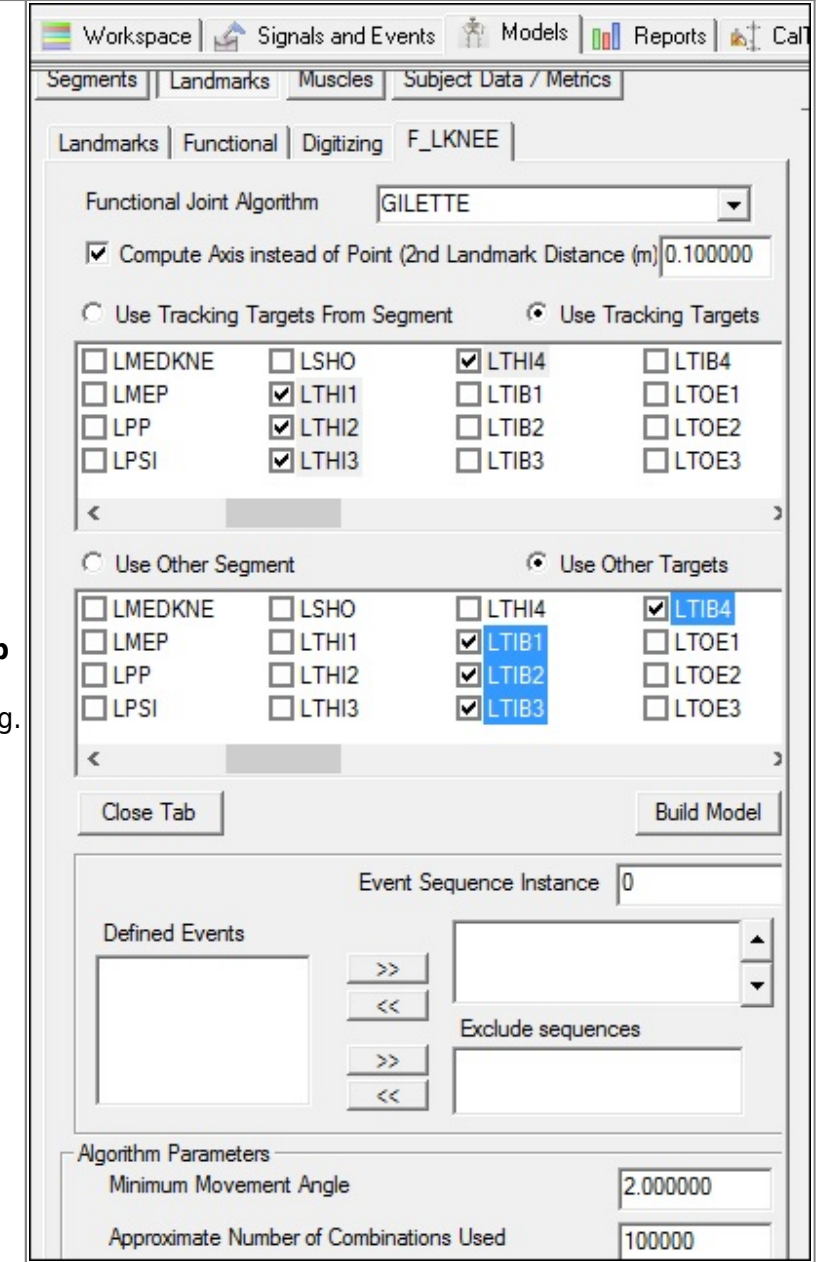


2. Select tracking targets for the **F_LKNEE**:

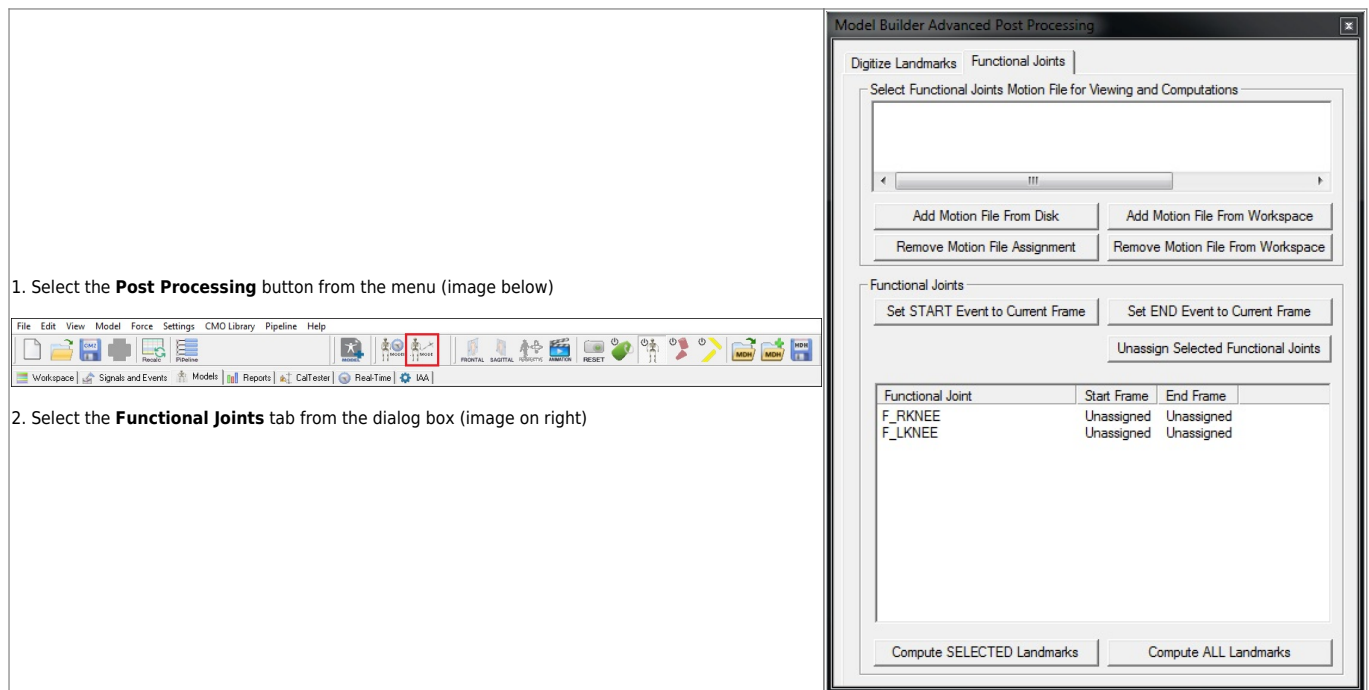
Tracking Segment/Targets
Select **Use Tracking Targets** (ctrl-click to multi select)
LTHI1, LTHI2, LTHI3, LTHI4

Other Segment/Targets:
Select **Use Other Targets** (ctrl-click to multi select)
LTIB1, LTIB2, LTIB3, LTIB4

Click on **Close Tab** before proceeding.



Model Builder Advanced Post Processing



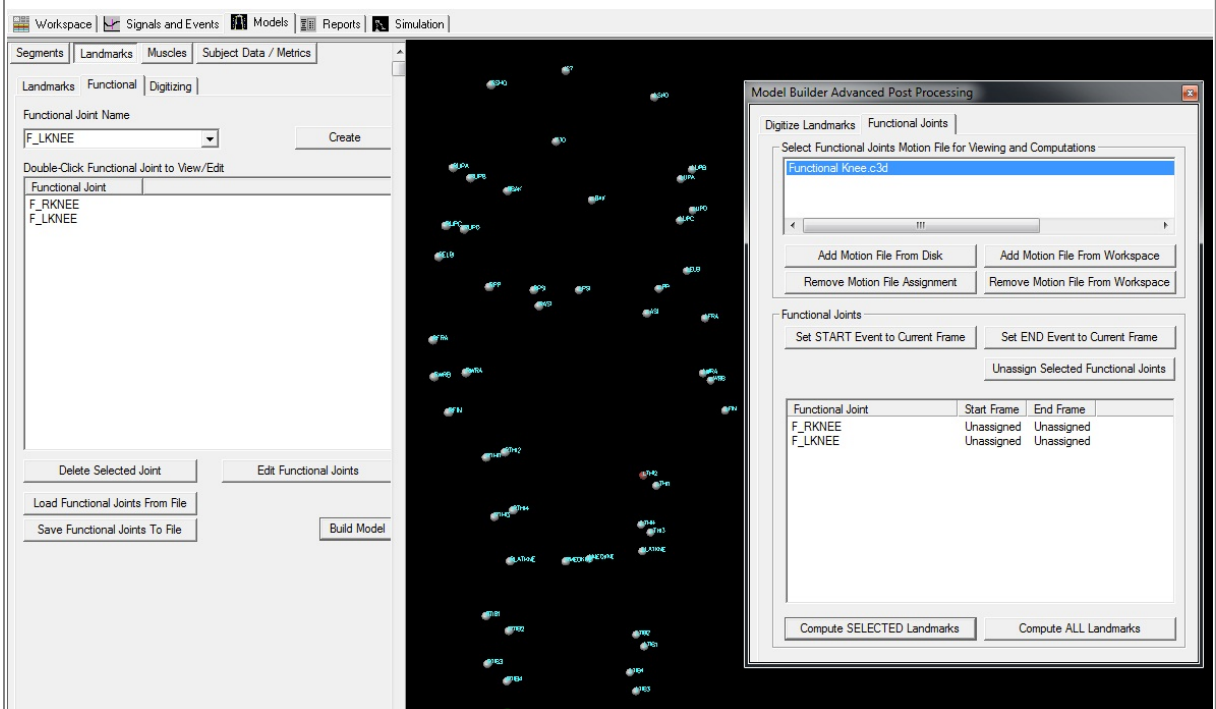
3. Open functional movement file:

1. Select the **Add Motion File From Disk**

2. **Browse** to functional movement file, select *Functional Knee.c3d*

3. Click **Open**

4. **Select** the motion file by clicking on the trial, this will highlight the trial in **blue**.



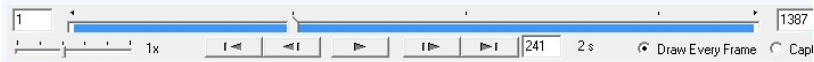
NOTE: Once the trial has been selected, the name of the trial will be highlighted and the movement file will appear in 3D viewer.

Define F_RKNEE Start and End of motion

1. Select the **START** frame of the right functional movement

1. **Select F_RKNEE**, this will highlight the joint in **blue**

2. Using the **slider** (seen below), select the START frame of the right functional movement. *Set the Start Frame to 241*



The screenshot shows a timeline slider with a blue bar representing a motion segment. The current frame is 241, and the duration is 2 seconds. The slider has various playback controls and a 'Draw Every Frame' checkbox.

3. Click **Set START Event to Current Frame**

Model Builder Advanced Post Processing

Digitize Landmarks | Functional Joints |

Select Functional Joints Motion File for Viewing and Computations

Functional Knee.c3d

Add Motion File From Disk

Add Motion File From Workspace

Remove Motion File Assignment

Remove Motion File From Workspace

Functional Joints

Set START Event to Current Frame

Set END Event to Current Frame

Unassign Selected Functional Joints

Functional Joint	Start Frame	End Frame
F_RKNEE	Unassigned	Unassigned
F_LKNEE	Unassigned	Unassigned

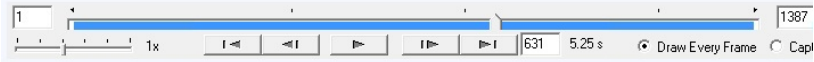
Compute SELECTED Landmarks

Compute ALL Landmarks

2. Select the **END** frame of the right functional movement

1. **Select F_RKNEE**, this will highlight the joint in **blue**

2. Using the **slider** (seen below), select the END frame of the right functional movement. *Set the End Frame to 631*



The screenshot shows the same timeline slider as before, but now the end frame is set to 631, and the duration is 5.25 seconds.

3. Click **Set END Event to Current Frame**

Model Builder Advanced Post Processing

Digitize Landmarks | Functional Joints |

Select Functional Joints Motion File for Viewing and Computations

Functional Knee.c3d

Add Motion File From Disk

Add Motion File From Workspace

Remove Motion File Assignment

Remove Motion File From Workspace

Functional Joints

Set START Event to Current Frame

Set END Event to Current Frame

Unassign Selected Functional Joints

Functional Joint	Start Frame	End Frame
F_RKNEE	241	Unassigned
F_LKNEE	Unassigned	Unassigned

Compute SELECTED Landmarks

Compute ALL Landmarks

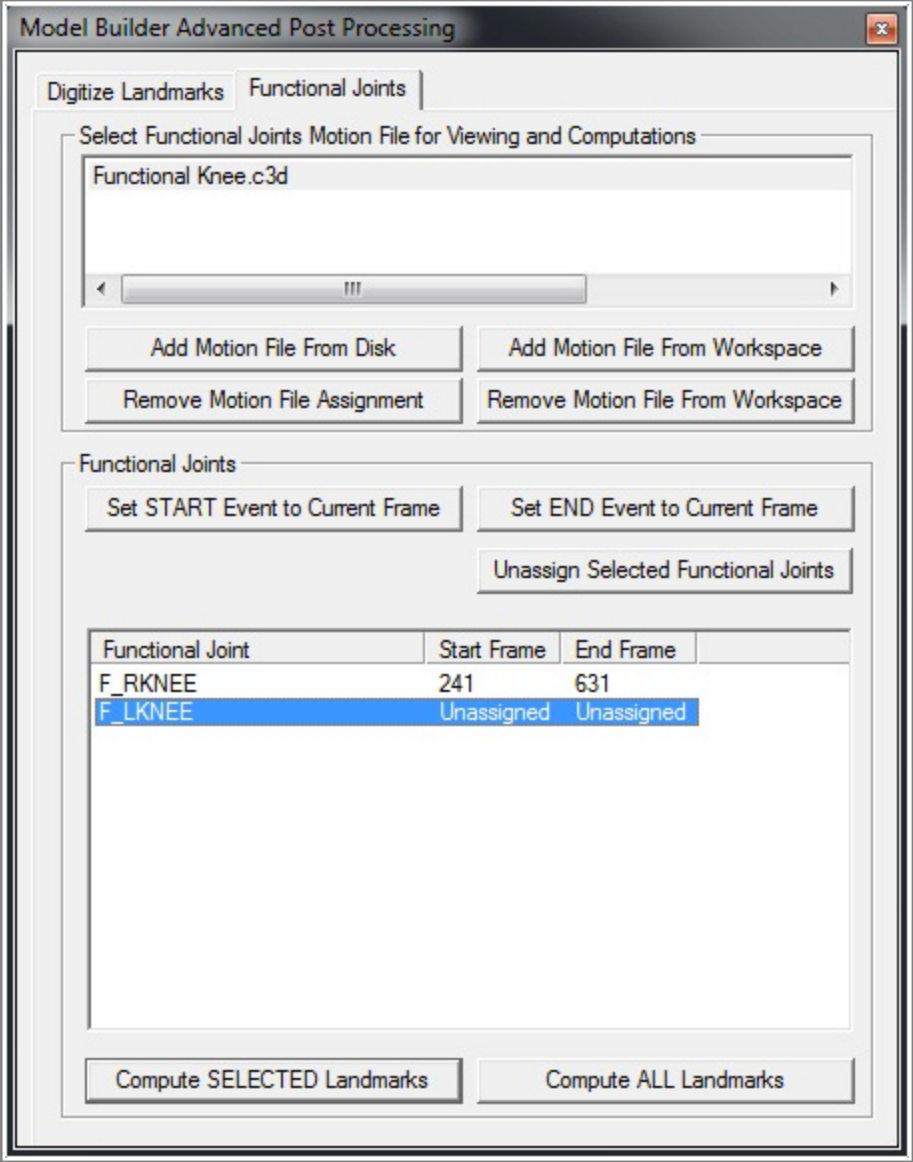
Define F_LKNEE Start and End of motion

1. Select the **START** frame of the left functional movement

1. **Select F_LKNEE**, this will highlight the joint in **blue**

2. Using the **slider**, select the START frame of the left functional movement. *Set the Start Frame to 733*

3. Click **Set START Event to Current Frame**

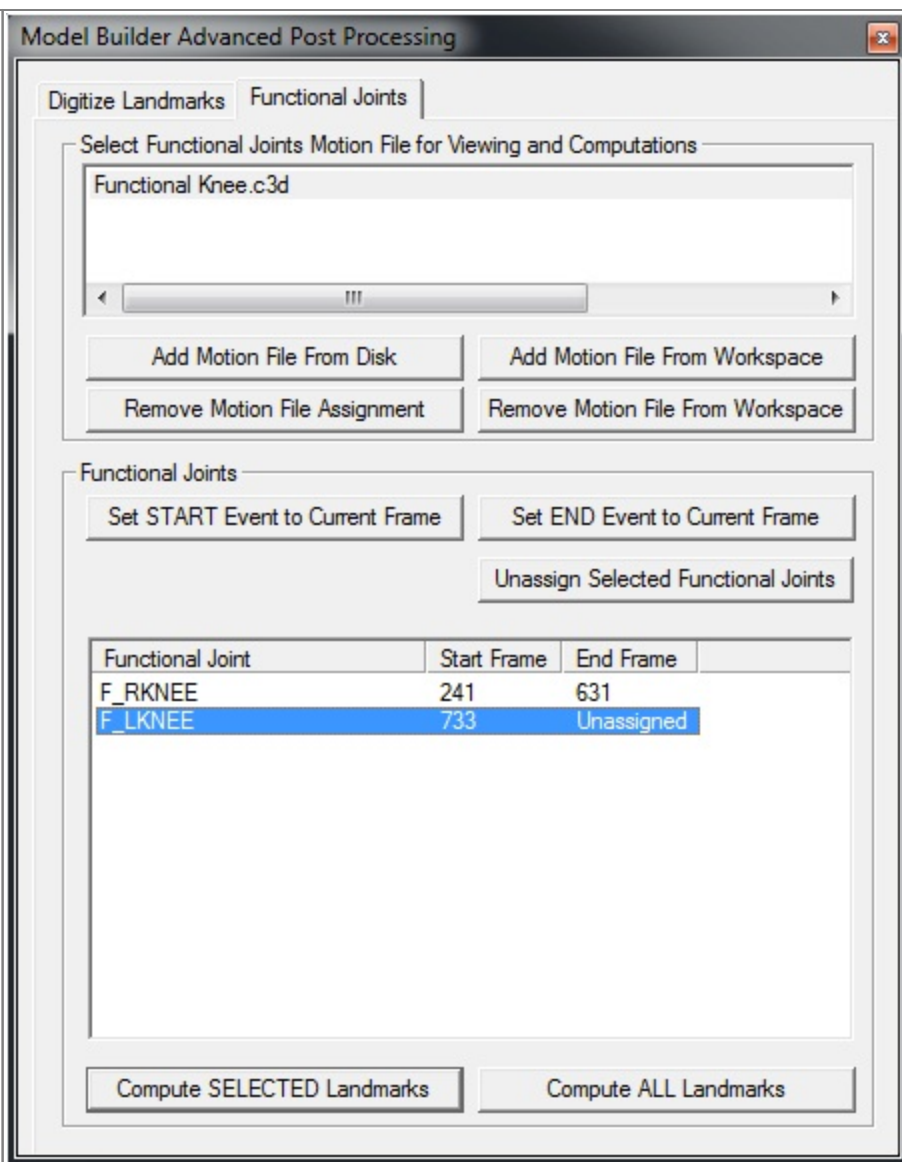


2. Select the **END** frame of the left functional movement

1. **Select F_LKNEE**, this will highlight the joint in **blue**

2. Using the **slider**, select the END frame of the left functional movement. *Set the End Frame to 1149*

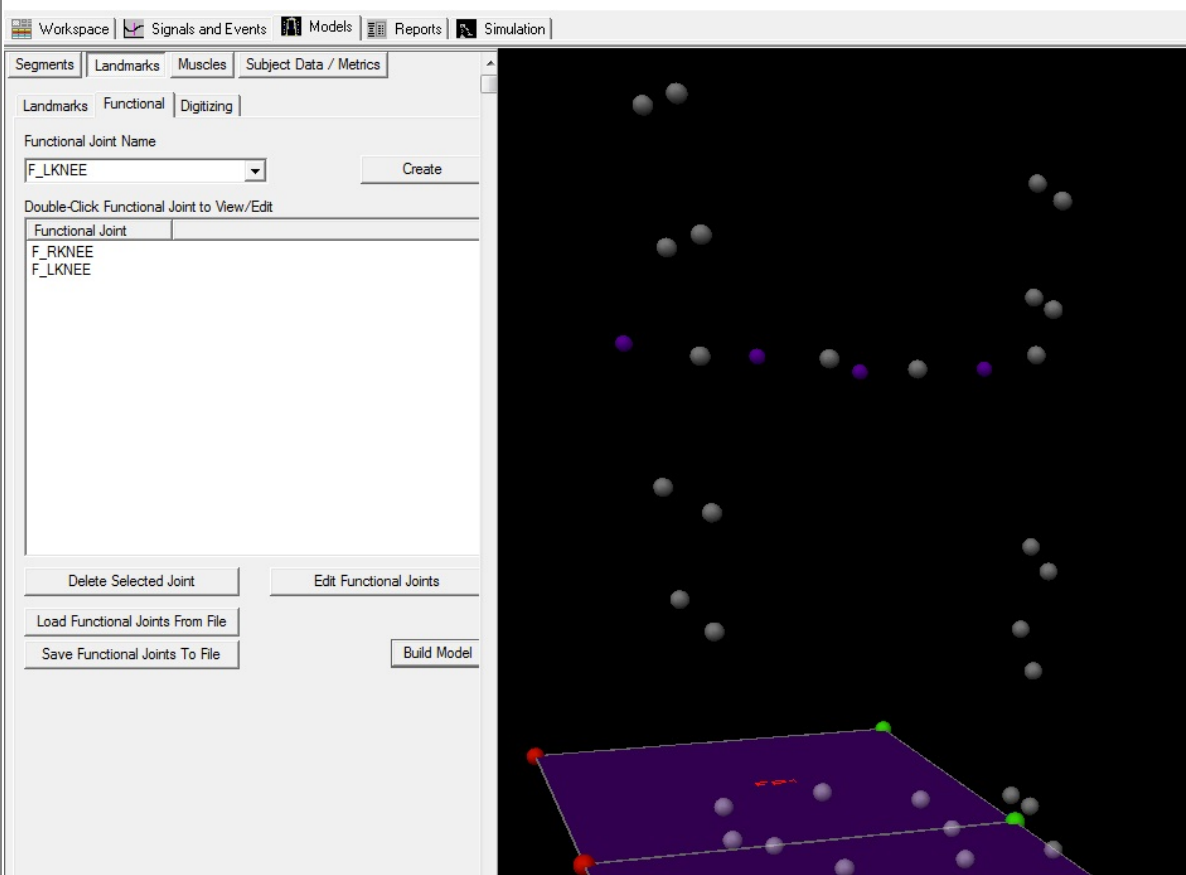
3. Click **Set END Event to Current Frame**



Compute Landmarks

1. Select **Compute ALL Landmarks**
2. **Close** the Model Builder Advanced Post Processing dialog box
3. Four landmarks (**F_RKNEE**, **F_RKNEE_X**, **F_LKNEE** and **F_LKNEE_X**) should appear in purple in the 3D viewer

If the landmarks do NOT appear in the 3D viewer, check:
- That the landmarks are turned on (3D View Options)
- Check that all steps in this tutorial were completed



Compute Right Mediolateral Borders of the Knee Joint Center

The RKneLat and RKneMed landmarks created below will be used to define the mediolateral borders of the knee joint.

These landmarks will project the mediolateral targets (RLATKNE, RMEDKNE) onto the axis of rotation created by the functional joint (F_RKNEE, F_RKNEE_X).

1. Create Lateral Border of the Right Knee Joint Center (RKneLat): - Click Landmarks button - Click Add New Landmark button - Create Landmark: <i>RKneLat</i>	Landmark Name: <i>RKneLat</i> Define Orientation Using: Starting Point: <i>F_RKNEE</i> Ending Point: <i>F_RKNEE_X</i> Project From: <i>RLATKNE</i>	Do NOT Check: <i>Offset by Percent (1.0 = 100%)</i> Do NOT Check: <i>Calibration Only Landmark</i>	
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2. Create Medial Border of the Right Knee Joint Center (RKneMed): - Click Landmarks button - Click Add New Landmark button - Create Landmark: <i>RKneMed</i>	Landmark Name: <i>RKneMed</i> Define Orientation Using: Starting Point: <i>F_RKNEE</i> Ending Point: <i>F_RKNEE_X</i> Project From: <i>RMEDKNE</i>	Do NOT Check: <i>Offset by Percent (1.0 = 100%)</i> Do NOT Check: <i>Calibration Only Landmark</i>	
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Compute Left Mediolateral Borders of the Knee Joint Center

The LKneLat and LKneMed landmarks created below will be used to define the mediolateral borders of the knee joint.

These landmarks will project the mediolateral targets (LLATKNE,LMEDKNE) onto the axis of rotation created by the functional joint (F_LKNEE,F_LKNEE_X).

1. Create Lateral Border of the Left Knee Joint Center (LKneLat): • Click Landmarks button • Click Add New Landmark button • Create Landmark: LKneLat	Landmark Name: LKneLat Define Orientation Using: Starting Point: F_LKNEE (Reference) Targets and/or Landmarks: Ending Point: F_LKNEE_X (On a line) *Lateral object (On a plane) *Project From: LLATKNE (Projection onto a line or plane) * = Optional Existing Segment: LAB Landmark Offset from Start Point (Reference) or Segment Origin Offset to Existing Calibration Target or Landmark Offset Using the Following ML/AP/AXIAL Offsets ML AP AXIAL Offset by Percent (1.0 = 100%) (Meters when not checked) Calibration Only Landmark (Not generated for assigned motion file(s)) Undo Changes Apply Build Model Close Tab	• Do NOT Check: Offset by Percent (1.0 = 100%) • Do NOT Check: Calibration Only Landmark	Workspace Signals and Events Models Reports Si Segments Landmarks Muscles Subject Data / Metrics Landmarks Functional Digitizing Landmark Name: LKneLat Define Orientation Using: Starting Point: F_LKNEE (Reference) Targets and/or Landmarks: Ending Point: F_LKNEE_X (On a line) *Lateral object (On a plane) *Project From: LLATKNE (Projection onto a line or plane) * = Optional Existing Segment: LAB Landmark Offset from Start Point (Reference) or Segment Origin Offset to Existing Calibration Target or Landmark Offset Using the Following ML/AP/AXIAL Offsets ML AP AXIAL Offset by Percent (1.0 = 100%) (Meters when not checked) Calibration Only Landmark (Not generated for assigned motion file(s)) Undo Changes Apply Build Model Close Tab
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2. Create Medial Border of the Left Knee Joint Center (LKneMed): • Click Landmarks button • Click Add New Landmark button • Create Landmark: LKneMed	Landmark Name: LKneMed Define Orientation Using: Starting Point: F_LKNEE Ending Point: F_LKNEE_X Project From: LMEDKNE	• Do NOT Check: Offset by Percent (1.0 = 100%) • Do NOT Check: Calibration Only Landmark	Workspace Signals and Events Models Reports Cal Segments Landmarks Muscles Subject Data / Metrics Landmarks Functional Digitizing Landmark Name: LKneMed Define Orientation Using: Starting Point F_LKNEE (Reference) Targets and/or Landmarks Ending Point F_LKNEE_X Landmark Is: (On a line) *Lateral object (On a plane) *Project From RMEDKNE (Projection onto a line or plane) * = Optional Existing Segment LAB Landmark Offset from Start Point (Reference) or Segment Origin Offset to Existing Calibration Target or Landmark Offset Using the Following ML/AP/AXIAL Offsets ML AP AXIAL Offset by Percent (1.0 = 100%) (Meters when not checked) Calibration Only Landmark (Not generated for assigned motion file(s)) Undo Changes Apply Build Model Close Tab
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