

# IOR Gait Full Body Model

This tutorial explains how to implement the IOR Full Body Model in Visual3D.

The IOR Full Body Model is a combination of the IOR Multi-Segment Trunk, and the IOR Lower Extremity Model. The naming convention in this tutorial follows Serge Van Sint Jan's convention.

## Downloads

Sample files may be downloaded [here](#).

The zip file contains:

1. C3D files which you can use to follow along with the tutorial
2. A model template which contains the landmark & segment definitions
3. A script which contains the planar & joint angle definitions
4. A report template which plots the relevant kinematics (joint angles & planar angles)
5. A completed CMO file

## Target Placement

**LCAJ/RCAJ (LA/RA):** Left/Right acromion

**SJN (IJ):** Deepest point of the incisura jugularis

**SXS (PX):** Xiphoid process, i.e. most caudal point of the sternum

**CV7 (C7):** Spinous process of the seventh cervical vertebrae

**TV2 (T2):** Second thoracic vertebrae

**TV7 (MAI):** Midpoint between the inferior angles of the most caudal points of the two scapulae

**LV1, LV3, LV5 (L1, L3, L5):**

First, third and fifth lumbar vertebrae

**LIAS/RIAS (LASIS/RASIS):**

Left/Right anterior superior iliac spine

**LIPS/RIPS (LPSIS/RPSIS):**

Left/Right posterior superior iliac spine

**LFTE/RFTE (LGT/RGT):** Most lateral prominence of the greater trochanter

**LFLE/RFLE (LLE/RLE):** Most medial prominence of the medial femoral epicondyle

**LFME/RFME (LME/RME):** Most medial prominence of the medial femoral epicondyle

**LFAX/RFAX (LHF/RHF):** Proximal tip of the head of the fibula

**LTTC/RTTC (TT/RTT):** Most anterior border of the tibial tuberosity

**LFAL/RFAL (LLM/RLM):** Lateral prominence of the lateral malleolus

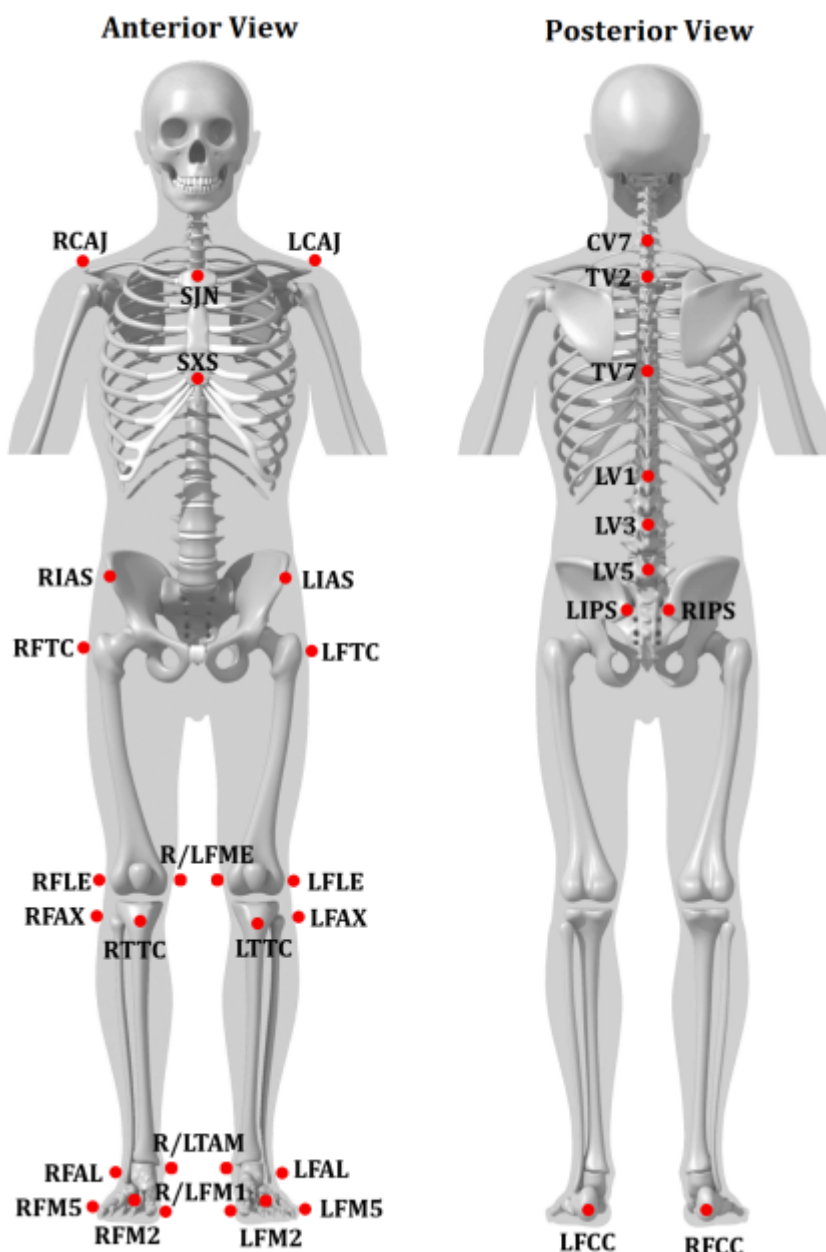
**LTAM/RTAM (LMM/RMM):** Most medial prominence of the medial malleolus

**LFCC/RFCC (LCA/RCA):** Aspect of the achilles tendon insertion on the calcaneus

**LFM1/RFM1 (LFM/RFM):** Dorsal margin of the first metatarsal head

**LFM2/RFM2 (LSM/RSM):** Dorsal aspect of the second metatarsal head

**LFM5/RFM5 (LVM/RVM):** Dorsal margin of the fifth metatarsal head



## Segment Definitions

### Pelvis

The pelvis segment coordinate system is consistent with the [CODA pelvis](#), from which the Left and Right Hip Joint centers are automatically created.

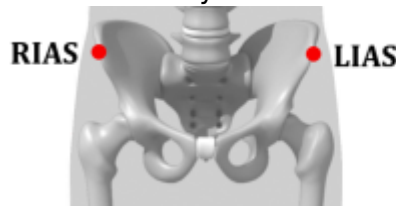
### LIAS/RIAS

#### (LASIS/RASIS):

Left/Right anterior superior iliac spine

### LIPS/RIPS

(LPSIS/RPSIS): Left/Right posterior superior iliac spine



## Pelvis Landmarks

### 1. Create SCRM:

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark:SCRM
  - **Landmark Name:** SCRM
  - **Define Orientation Using:**
  - **Starting Point:** RIPS
  - **Ending Point:** LIPS
4. Offset Using the Following **ML/AP/AXIAL** Offsets:
  - **X:** 0.0 **Y:**0.0 **Z:**0.5
5. **Check:** Offset by Percent (1.0 = 100%)
6. **Check:** Calibration Only Landmark

## Pelvis Definition

### 2. Create Pelvis Segment:

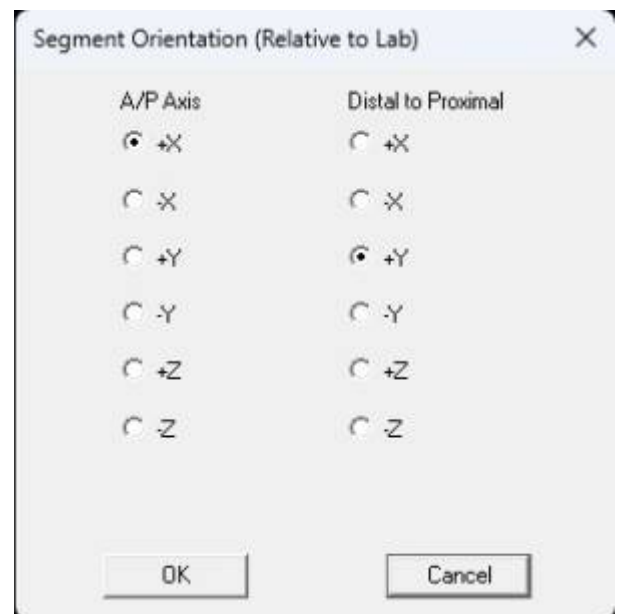
The screenshot shows the 'Pelvis' dialog box in a software application. The dialog has several tabs: 'Segments', 'Landmarks', 'Muscles', 'Subject Data / Metrics', 'Segment Properties', 'IK Constraints', and 'Pelvis'. The 'Pelvis' tab is currently selected. Inside the dialog, there are several sections:

- Define Segment Type:** A dropdown menu showing 'CODA'.
- Subject Name Prefix:** A text input field.
- Define Calibration Signals:** Four rows of dropdown menus for 'R.ASIS', 'L.ASIS', 'R.PSIS', and 'L.PSIS', each showing a selected value (RIAS, LIAS, RIPS, LIPS respectively).
- Define ASIS Target Radius for Hip Joint Center Offset:** A text input field showing '0.000'.
- Select Tracking Signals:** A checkbox labeled 'Use Calibration Signals for Tracking' which is checked.
- 6DOF Cutoff Frequency:** A text input field showing '0.0'.

At the bottom of the dialog, there are four buttons: 'Close Tab', 'Guess Properties', 'Apply', and 'Build Model'.

1. In the **Segments** tab, select *Pelvis* in the Segment Name box
2. In **Segment Type**, select CODA
3. Click on the **Create Segment** button
4. In the **Pelvis** dialog:
  - **Define Calibration Targets**
  - **R.ASIS:** RIAS
  - **L.ASIS:** LIAS
  - **R.PSIS:** RIPS
  - **L.PSIS:** LIPS
  - **Select Tracking Targets:**
  - LIAS, LIPS, RIAS, RIPS
5. Close **CODA Segment Markers** dialog box
6. Click on **Build Model**
7. Click on **Close Tab** before proceeding

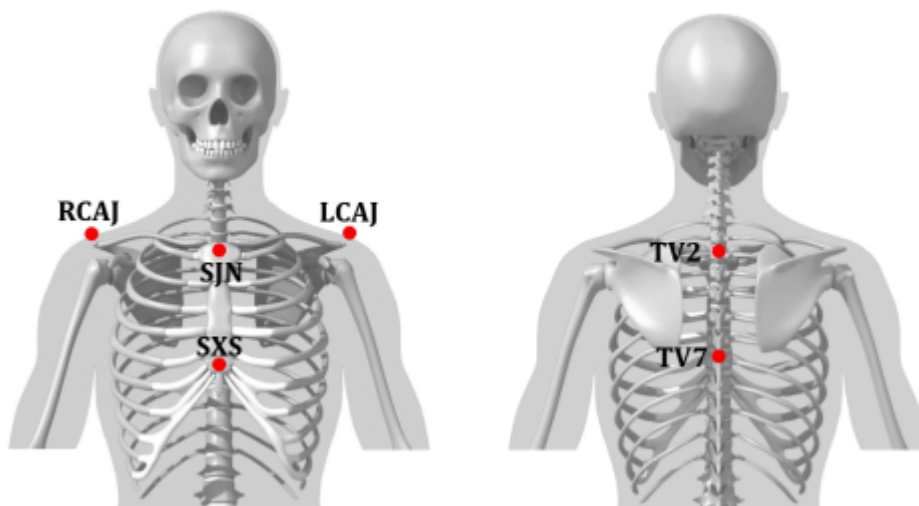
### 3. Modify the Segment Coordinate System



- Define the Segment Orientation as:
  - A/P Axis:** +X
  - Distal to Proximal:** +Y

## Thorax Segment

This marker set is consistent with the Rizzoli Gait model and the ISB recommendations.



**LCAJ/RCAJ (LAR/RA):** Left/Right acromion

**SJN (IJ):** Deepest point of the incisura jugularis

**SXS (PX):** Xiphoid process, i.e. most caudal point of the sternum

**C7V (C7):** Spinous process of the seventh cervical vertebrae

**TV2 (T2):** Second thoracic vertebrae

**TV7 (MAI):** Midpoint between the inferior angles of the most caudal points of the two scapulae

## Thorax Definition

### 4. Create Thorax/Ab:

The screenshot shows the 'Thorax' configuration window. It includes the following settings:

- Define Proximal Joint and Radius:** Lateral: None, Joint Center: TV2, Medial: None, Radius (Meters):  $0.5 \cdot \text{DISTANCE}(\text{RCAJ}, \text{LCAJ})$
- Define Distal Joint and Radius:** Lateral: None, Joint Center: TV7, Medial: None, Radius (Meters):  $0.5 \cdot \text{DISTANCE}(\text{RCAJ}, \text{LCAJ})$
- Extra Signal to Define Orientation (if needed):** Location: Anterior, Signal: SXS
- Select Tracking Signals:**
  - ☐ Use Calibration Signals for Tracking
  - ☐ RFM1, ☐ RIAS, ☒ SXS
  - ☐ RFM2, ☐ RIPS, ☒ TV2
  - ☐ RFM5, ☐ RTAM, ☒ TV7
  - ☐ RFME, ☐ RTTC
  - ☐ RFTC, ☒ SJN
- Depth (Meters):** (empty field)
- 6DOF Cutoff Frequency:** 0.0
- Buttons: Close Tab, Guess Properties, Apply, Build Model

1. In the **Segments** tab, select *Thorax/Ab* in the Segment Name box.

2. Click **Kinematic Only**

3. Click on the **Create Segment** button

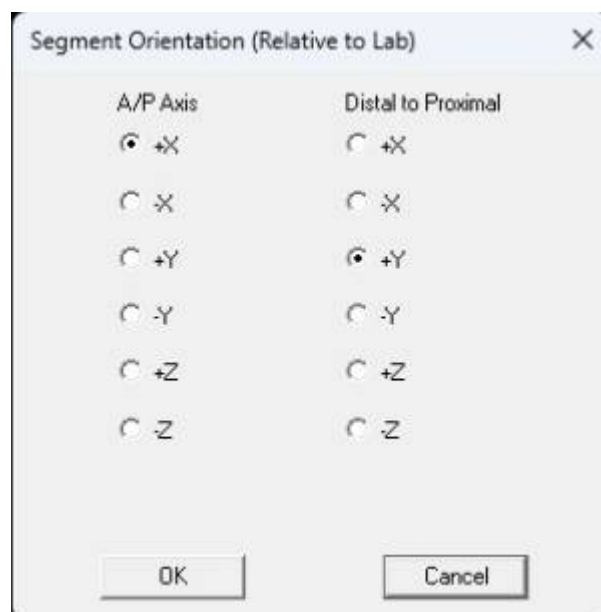
4. In the **Thorax/Ab** tab, enter these values:

- **Define Proximal Joint and Radius**
- **Lateral:** None **Joint:** TV2 **Medial:** None
- **Radius**  $0.5 \cdot \text{DISTANCE}(\text{RCAJ}, \text{LCAJ})$
- **Define Distal Joint and Radius**
- **Lateral:** None **Joint:** TV7 **Medial:** None
- **Radius:**  $0.5 \cdot \text{DISTANCE}(\text{RCAJ}, \text{LCAJ})$
- **Extra Target to Define Orientation**
- **Location:** Anterior **SXS**
- **Select Tracking Targets:**
- SJN, SXS, TV2, TV7

5. Click on **Build Model**

6. Click on **Close Tab** before proceeding.

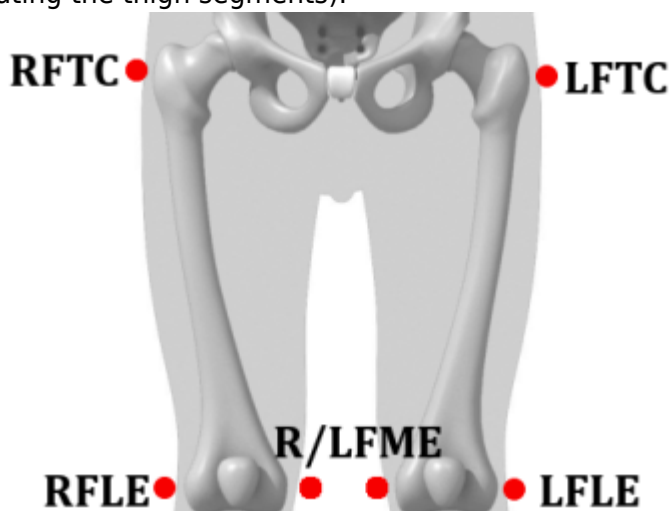
**5. Modify the Segment Coordinate System \* \* \***  
**Define the Segment Orientation as: \* \*\*A/P Axis:**  
 +X



- **Distal to Proximal: +Y**

## Thigh Segment

The RIGHT\_HIP/LEFT\_HIP landmarks are used to define the thigh segments. These landmarks are created automatically when the Pelvis segment is defined (so the Pelvis must be defined prior to creating the thigh segments).



**LFTC/RFTC (LGT/RGT):** Most Lateral prominence of the greater trochanter

**LFKE/RFLE (LLE/RLE):** Most lateral prominence of the lateral femoral epicondyle

**LFME/RFME (LME/RME):** Most medial prominence of the medial femoral epicondyle

## Thigh Definition

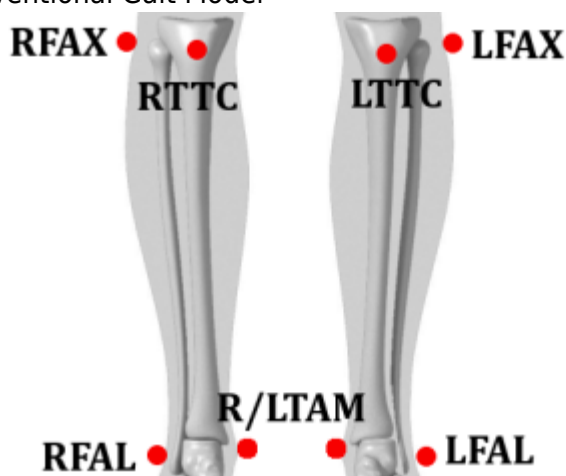
### 6. Create Right Thigh:

1. In the **Segments** tab, select Right Thigh in the Segment Name box
2. Click on the **Create Segment** button
3. In the **Right Thigh** tab, enter these values:
  - **Define Proximal Joint and Radius**
  - **Lateral:** None **Joint** RIGHT\_HIP **Medial:** None
  - **Radius:**  $0.5 * \text{DISTANCE}(\text{RIGHT\_HIP}, \text{LEFT\_HIP})$
  - **Define Distal Joint and Radius**
  - **Lateral:** RFLE **Joint:** None **Medial:** RFME
  - **Select Tracking Targets:**
  - RIGHT\_HIP, RFLE, RFME, RFTC
4. Click on **Build Model**
5. Click on **Close Tab** before proceeding

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## Shank Segment

The segment coordinate system is different from the [conventional gait model](#) because the shank segment is designed according to markers located on the tibia and fibula, not the femur as with the Conventional Gait Model



**LFAX/RFAX (LHF/RHF):** Proximal tip of the head of the fibula

**LTTC/RTTC (TT/RTT):** Most anterior border of the tibial tuberosity

**LFAL/RFAL (LLM/RLM):** Lateral prominence of the lateral malleolus

**LTAM/RTAM (LMM/RMM):** Most medial prominence of the medial malleolus

## Shank Landmarks

### 7. Create RKNE Joint Center:

Segments | Landmarks | Muscles | Subject Data / Metrics

Landmarks | Functional | Digitizing | RKNE

Landmark Name: RKNE

Define Orientation Using:

Starting Point: RFLE (Reference)

Ending Point: RFME (On a line)

\*Lateral object: (On a plane)

\*Project From: (Projection onto a line or plane)

\* = Optional

Existing Segment:

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: 0.5

☒ 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

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: RKNE
  - **Landmark Name:** RKNE
  - **Define Orientation Using:**
  - **Starting Point:** RFLE
  - **Ending Point:** RFME
4. Offset Using the Following **AXIAL** Offset: 0.5
5. **Check:** Offset by Percent (1.0 = 100%)
6. **Check:** Calibration Only Landmark

## 8. Create RANK Joint Center:

The screenshot shows the 'RANK' landmark configuration dialog. The 'Landmarks' tab is active. The 'Landmark Name' is 'RANK'. Under 'Define Orientation Using:', 'Starting Point' is 'RFAL' (Reference). 'Targets and/or Landmark:' is selected, with 'Ending Point' set to 'RTAM' (On a line). 'Lateral object' is empty (On a plane). 'Project From' is empty (Projection onto a line or plane). 'Existing Segment' is empty. Under 'Landmark Offset from Start Point (Reference) or Segment Origin', 'Offset to Existing Calibration Target or Landmark' is empty. 'Offset Using the Following ML/AP/AXIAL Offsets' is selected, with 'ML' empty, 'AP' empty, and 'AXIAL' set to '0.5'. The checkbox 'Offset by Percent (1.0 = 100%) (Meters when not checked)' is checked. At the bottom, 'Calibration Only Landmark (Not generated for assigned motion file(s))' is checked. Buttons include 'Undo Changes', 'Apply', 'Build Model', and 'Close Tab'.

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: RANK
  - **LANDMARK Name:** RANK
  - **Define Orientation Using:**
  - **Starting Point:** RFAL
  - **Ending Point:** RTAM
4. Offset Using the Following **AXIAL** Offset: 0.5
5. **Check:** Offset by Percent (1.0 = 100%)
6. **Check:** Calibration Only Landmark

## 9. Create RTTC\_PORJ:

The screenshot shows the 'RTTC\_PROJ' dialog box within the 'Landmarks' tab. The 'Landmark Name' is set to 'RTTC\_PROJ'. Under 'Define Orientation Using:', 'Starting Point' is 'RFAX' (Reference), 'Ending Point' is 'RFAL' (On a line), '\*Lateral object' is 'RTAM' (On a plane), and '\*Project From' is 'RTTC' (Projection onto a line or plane). The 'Existing Segment' option is selected. Under 'Landmark Offset from Start Point (Reference) or Segment Origin', 'Offset to Existing Calibration Target or Landmark' is selected. The 'Offset Using the Following ML/AP/AXIAL Offsets' section has empty input fields for ML, AP, and AXIAL. The 'Offset by Percent (1.0 = 100%) (Meters when not checked)' checkbox is unchecked. The 'Calibration Only Landmark (Not generated for assigned motion file(s))' checkbox is checked. At the bottom are buttons for 'Undo Changes', 'Apply', 'Build Model', and 'Close Tab'.

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: RTTC\_PROJ
  - **Landmark Name:** RTTC\_PROJ
  - **Define Orientation Using:**
  - **Starting Point:** RFAX
  - **Ending Point:** RTAM
  - **Lateral Object:** RTAM
  - **Project From:** RTTC
4. **Do Not Chck:** Offset by Percent (1.0 = 100%)
5. **Check:** Calibration Only Landmark

## 10. Create RSK\_PROX:

The screenshot shows the 'RSK\_PROX' dialog box in the software. The 'Landmarks' tab is active. The 'Landmark Name' is 'RSK\_PROX'. Under 'Define Orientation Using:', 'Starting Point' is 'RANK' (Reference). 'Targets and/or Landmark:' is selected, with 'Ending Point' as 'RTTC\_PROJ' (On a line), '\*Lateral object' as '(On a plane)', and '\*Project From' as 'RKNE' (Projection onto a line or plane). '\* = Optional'. 'Existing Segment' is empty. Under 'Landmark Offset from Start Point (Reference) or Segment Origin', 'Offset to Existing Calibration Target or Landmark' is empty. 'Offset Using the Following ML/AP/AXIAL Offsets' has empty fields for ML, AP, and AXIAL. 'Offset by Percent (1.0 = 100%) (Meters when not checked)' is unchecked. 'Calibration Only Landmark (Not generated for assigned motion file(s))' is checked. Buttons at the bottom are 'Undo Changes', 'Apply', 'Build Model', and 'Close Tab'.

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: RSK\_PROX
  - **Landmark Name:** RSK\_PROX
  - **Define Orientation Using:**
  - **Starting Point:** RANK
  - **Ending Point:** RTTC\_PROJ
  - **Lateral Object:** Leave Blank
  - **Project From:** RKNE
4. **Do NOT Check:** Offset by Percent (1.0 = 100%)
5. **Check:** Calibration Only Landmark

## Shank Definition

### 11. Create Right Shank:

1. In the **Segments** tab, select Right Shank in the Segment Name box
2. Click on the **Create Segment** button
3. In the **Right Shank** tab, enter these values:
  - **Define Proximal Joint and Radius**
  - **Lateral:** None **Joint:** RSK\_PROX **Medial:** None
  - **Radius:**  $0.5 * \text{DISTANCE}(\text{RFLE}, \text{RFME})$
  - **Define Distal Joint and Radius**
  - **Lateral:** RFAL **Joint:** None **Medial:** RTAM
  - **Select Tracking Targets:**
  - RFAL, RFAX, RTAM, RTTC

### 12. Modify the Segment Coordinate System:

- Define the Segment Orientation as:
- **A/P Axis:** +X
- **Distal to Proximal:** +Y

## Foot Segment

The foot segment coordinate system is consistent with some version of the [Conventional Gait Model](#). The foot segment is created using the RANK/LANK landmarks which are described in the Shank Landmarks section



**LFAL/RFAL (LLM/RLM):** Lateral prominence of the lateral malleolus

**LTAM/RTAM (LMM/RMM):** Most medial prominence of the medial malleolus

**LFCC/RFCC (LCA/RCA):** Aspect of the achilles tendon insertion on the calcaneus

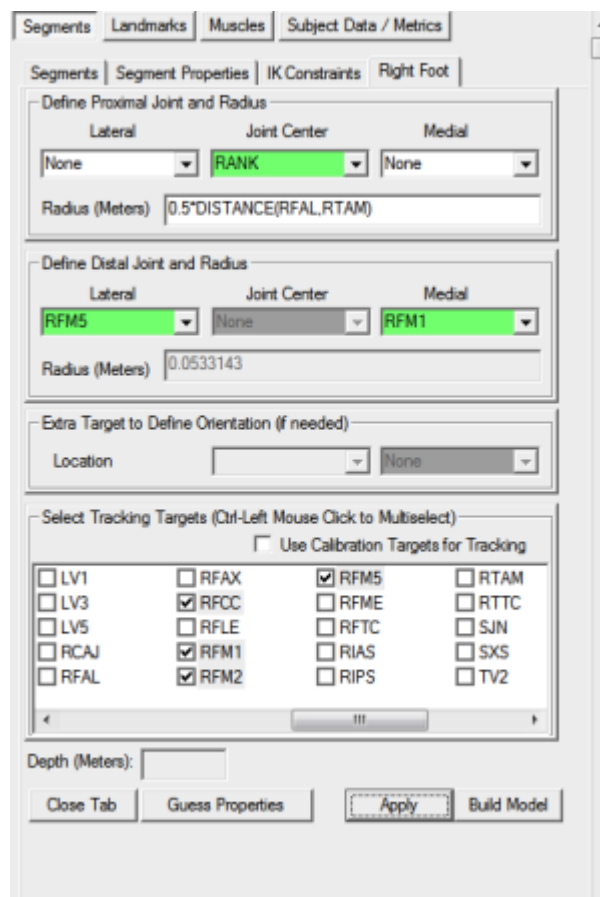
**LFM1/RFM1 (LFM/RFM):** Dorsal margin of the first metatarsal head

**LFM2/RFM2 (LSM/RSM):** Dorsal aspect of the second metatarsal head

**LEFM5/RFM5 (LVM/RVM):** Dorsal margin of the fifth metatarsal head

## Kinetic Foot

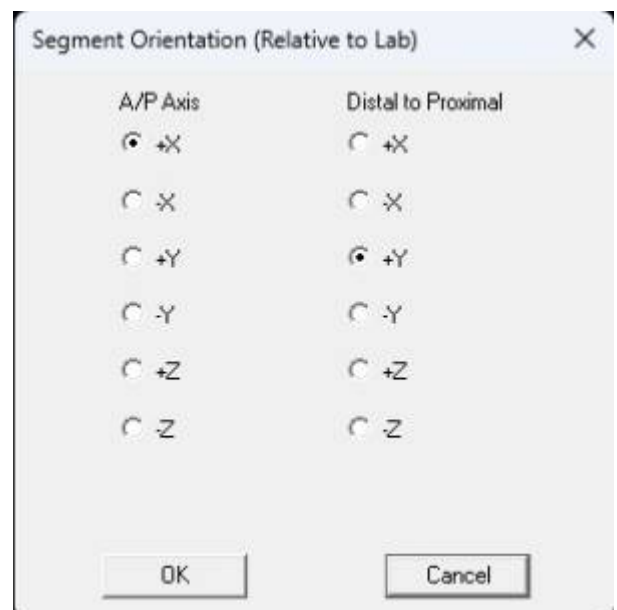
### 13. Create Right Foot:



1. In the **Segments** tab, select the Right Foot in the Segment Name box

2. Click on the **Create Segment** button
3. In the **Right Foot** tab, enter these values:
  - **Define Proximal Joint and Radius**
  - **Lateral:** None **Joint:** RANK **Medial:** None
  - **Radius:**  $0.5 * \text{DISTANCE}(\text{RFAL}, \text{RTAM})$
  - **Define Distal Joint and Radius**
  - **Lateral:** RFM5 **Joint:** None **Medial:** RFM1
  - **Select Tracking Targets:**
  - RFCC, RFM1, RFM2, RFM5
4. Click on the **Build Model**
5. Click on **Close Tab** before proceeding

#### 14. Modify the **Segment Coordinate System**:



- Define the Segment Orientation as:
  - **A/P Axis:** +X
  - **Distal to Proximal:** +Y

## Kinematic Foot Landmarks

### 15. Create RFT\_DIST:

The screenshot shows the 'Landmarks' tab in the Visual3D software. The 'RFT\_DIST' landmark is being configured. The 'Landmark Name' is 'RFT\_DIST'. The 'Define Orientation Using' section is set to 'Starting Point' (RFCC) and 'Ending Point' (RFM5). The 'Targets and/or Landmarks' section is set to 'Lateral object' (RFM1) and 'Project From' (RFM2). The 'Landmark Offset from Start Point (Reference) or Segment Origin' section is set to 'Offset Using the Following ML/AP/AXIAL Offsets'. The 'Offset by Percent (1.0 = 100%) (Meters when not checked)' checkbox is unchecked. The 'Calibration Only Landmark (Not generated for assigned motion file(s))' checkbox is checked. The 'Apply' button is highlighted.

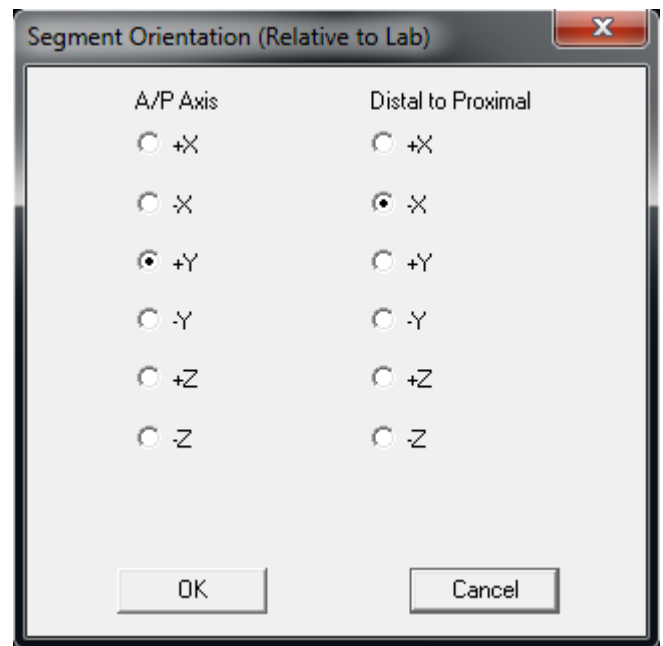
1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: RFT\_DIST
  - **Landmark Name:** RFT\_DIST
  - **Define Orientation Using:**
  - **Starting Point:** RFCC
  - **Ending Point:** RFM5
  - **Lateral Object:** RFM1
  - **Project From:** RFM2
4. **Do NOT Check:** Offset by Percent (1.0 = 100%)
5. **Check:** Calibration Only Landmark

## Kinematic Foot Definition

## 16. Create Right Virtual Foot:

1. In the **Segments** tab, type *Right Virtual Foot* into the Segment Name box
2. Check the **Kinematic Only** Check Box
3. Click on the **Create Segment** button
4. In the **Right Virtual Foot** tab, enter these values:
  - **Define Proximal Joint and Radius**
  - **Lateral:** None **Joint:** RFCC **Medial:** None
  - **Radius:** 0.1
  - **Define Distal Joint Radius**
  - **Lateral:** RFM5 **Joint:** RFT\_DIST **Medial:** None
  - **Select Tracking Targets:**
  - RFCC, RFM1, RFM2, RFM5

## 17. Modify the Segment Coordinate System:



- Define the Segment Orientation as:
  - **A/P Axis:** +Y
  - **Distal to Proximal:** -X

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## Virtual Lab

### Virtual Lab Landmarks

## 18. Create Lab\_Origin:

Segments | Landmarks | Muscles | Subject Data / Metrics

Landmarks | Functional | Digitizing | Lab\_Origin

Landmark Name: Lab\_Origin

Define Orientation Using:

Starting Point: (Reference)

Targets and/or Landmark:

Ending Point: (On a line)

\*Lateral object: (On a plane)

\*Project From: (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

X: 0.0

Y: 0.0

Z: 0.0

☐ 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

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: Lab\_Origin
  - **Landmark Name:** Lab\_Origin
4. Offset Using the Following **ML/AP/AXIAL** Offsets:
  - **X:** 0.0 **Y:** 0.0 **Z:** 0.0
5. **Do NOT Check:** Offset by Percent (1.0 = 100%)
6. **Do NOT Check:** Calibration Only Landmark

## 19. Create Lab\_AX:

The screenshot shows the 'Lab\_AX' dialog box within the 'Landmarks' tab. The 'Landmark Name' is set to 'Lab\_AX'. Under 'Define Orientation Using:', 'Starting Point' is set to '(Reference)'. The 'Existing Segment' is set to 'LAB'. Under 'Landmark Offset from Start Point (Reference) or Segment Origin', 'Offset Using the Following ML/AP/AXIAL Offsets' is selected, with X: 0.0, Y: 0.0, and Z: 0.1. The 'Offset by Percent' checkbox is unchecked. The 'Calibration Only Landmark' checkbox is also unchecked. At the bottom, there are buttons for 'Undo Changes', 'Apply', 'Build Model', and 'Close Tab'.

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: Lab-Origin
  - **Landmark Name:** Lab\_AX
4. Offset Using the Following **ML/AP/AXIAL** Offsets:
  - **X:** 0.0 **Y:** 0.0 **Z:** 0.1
5. **Do NOT Check:** Offset by Percent (1.0 = 100%)
6. **Do NOT Check:** Calibration Only Landmark

## 20. Create Lab\_ML:

Segments | Landmarks | Muscles | Subject Data / Metrics

Landmarks | Functional | Digitizing | Lab\_ML

Landmark Name: Lab\_ML

Define Orientation Using:

Starting Point (Reference)

Targets and/or Landmark:

Ending Point (On a line)

\*Lateral object (On a plane)

\*Project From (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

X 0.1

Y 0.0

Z 0.0

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

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: Lab\_ML
  - **Landmark Name:** Lab\_ML
4. Offset Using the Following **ML/AP/AXIAL** Offsets:
  - **X:** 0.1 **Y:** 0.0 **Z:** 0.0
5. **Do NOT Check:** Offset by Percent (1.0 = 100%)
6. **Do NOT Check:** Calibration Only Landmark

## 21. Create Lab\_ML:

Segments | Landmarks | Muscles | Subject Data / Metrics

Landmarks | Functional | Digitizing | Pel\_ML

Landmark Name: Pel\_ML

Define Orientation Using:

Starting Point: Lab\_Origin (Reference)

Targets and/or Landmark:

Ending Point: (On a line)

\*Lateral object: (On a plane)

\*Project From: (Projection onto a line or plane)

\* = Optional

Existing Segment: Pelvis

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: 0.1

AP: 0.0

AXIAL: 0.0

☐ 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

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: Lab\_ML
  - **Landmark Name:** Lab\_ML
4. Offset Using the Following **ML/AP/AXIAL** Offsets:
  - **X:** 0.1 **Y:** 0.0 **Z:** 0.0
5. **Do Not Check:** Offset by Percent (1.0 = 100%)
6. **Do NOT Check:** Calibration Only Landmark

## 22. Create Pel\_ML:

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: Pel\_ML
  - **Landmark Name** Pel\_ML
  - **Define Orientation Using:**
  - **Starting Point:** Lab\_Origin
  - **Existing Segment:** Pelvis
4. Offset Using the Following **ML/AP/AXIAL** Offsets:
  - **X:** 0.1 **Y:** 0.0 **Z:** 0.0
5. **Do NOT Check:** Offset by Percent (1.0 = 100%)
6. **Do NOT Check:** Calibration Only Landmark

## 23. Create Pel\_ML\_Proj:

The screenshot shows the 'Landmarks' tab in the Visual3D software. The 'Pel\_ML\_Proj' landmark is being configured. The 'Landmark Name' is 'Pel\_ML\_Proj'. Under 'Define Orientation Using:', 'Starting Point' is 'Lab\_Origin' (Reference), 'Ending Point' is 'Lab\_ML' (On a line), '\*Lateral object' is empty (On a plane), and '\*Project From' is 'Pel\_ML' (Projection onto a line or plane). '\* = Optional'. The 'Existing Segment' is empty. Under 'Landmark Offset from Start Point (Reference) or Segment Origin', 'Offset to Existing Calibration Target or Landmark' is empty, and 'Offset Using the Following ML/AP/AXIAL Offsets' has empty fields for ML, AP, and AXIAL. The 'Offset by Percent (1.0 = 100%) (Meters when not checked)' checkbox is unchecked. The 'Calibration Only Landmark (Not generated for assigned motion file(s))' checkbox is also unchecked. At the bottom are buttons for 'Undo Changes', 'Apply', 'Build Model', and 'Close Tab'.

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: Pel\_ML\_Proj
  - **Landmark Name:** Pel\_ML\_Proj
  - **Define Orientation Using:**
  - **Starting Point:** Lab\_Origin
  - **Ending Point:** Lab\_ML
  - **Project Point:** Pel\_ML
4. **Do NOT Check:** Offset by Percent (1.0 = 100%)
5. **Do NOT Check:** Calibration Only Landmark

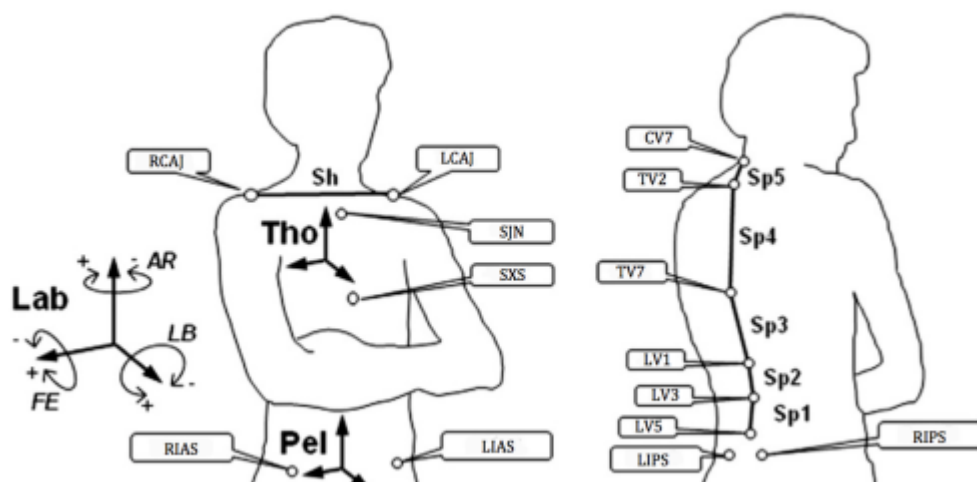
## 24. Create VLab\_ML:

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: VLab\_ML
  - **Landmark Name:** VLab\_ML
  - **Define Orientation Using:**
  - **Starting Point:** Lab\_Origin
  - **Ending Point:** Lab\_ML
  - **Project Point:** Pel\_ML\_Proj
4. Offset Using the Following **ML/AP/AXIAL** Offsets:
  - **AXIAL:** 0.1
5. **Do NOT Check:** Offset by Percent (1.0 = 100%)
6. **Do NOT Check:** Calibration Only Landmark

## Planar Angles

To calculate the orientation of the trunk segments, planar angles are calculated to determine the orientation of the various segments relative to one another. To calculate a planar angle, you need to

either reference the ORIGINAL or PROCESSED folder when defining a target. If your targets have not been filtered or interpolated, you will not have a processed folder and will need to use the ORIGINAL. However, if you plan to process your target data in any way, you should do this now, prior to creating you planar angles.



The following abbreviations are used in naming the planar angles

- **FE** Flexion/Extension
- **LB** Lateral Bending
- **AR** Axial Rotation

## Spine FE & LB Landmarks

### 25. Create RPV\_AX:

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: RPV\_AX

- **Landmark Name:** RPV\_AX
  - **Define Orientation Using:**
  - **Starting Point:** LV5
4. Offset Using the Following **ML\AP\AXIAL** Offsets:
    - **X:** 0.0 **Y:** 0.0 **Z:** -0.05
  5. **Do NOT Check:** Offset by Percent (1.0 = 100%) (Meters when not checked)
  6. **Do NOT Check:** Calibration Only Landmark (Not generated for assigned motion file(s))

## FE Planar Angles

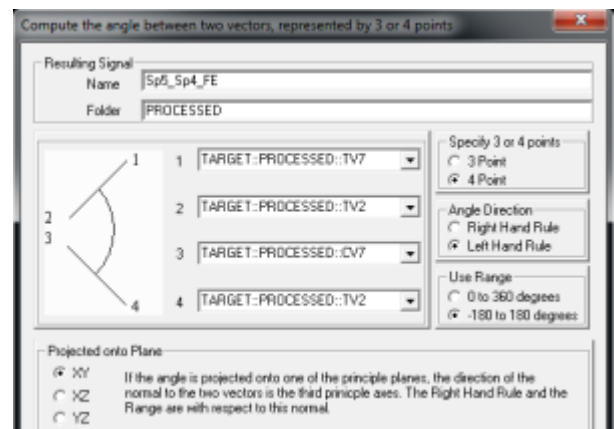
Below defines the orientation (flexion/extension) of the adjoining spine segments resolved in the pelvis coordinate system

**NOTE:** For the FE Planar Angles, the same definitions for the angles are used for both the left & right side. This means the different sets of signals do not need to be created for the left and right sides (as with the LB and AR planar angles).

**NOTE-2:** To access these dialogs, you need to edit a command pipeline, the "[Compute\\_Planar\\_Angle](#)" pipeline command.

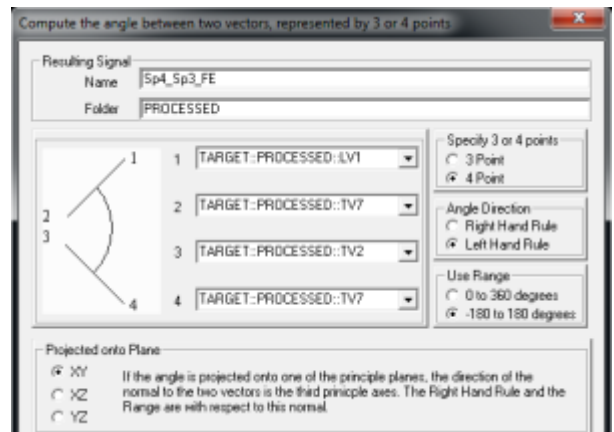
## Spine FE Definitions

### 26. Create Sp5\_sp4\_FE Planar angle:



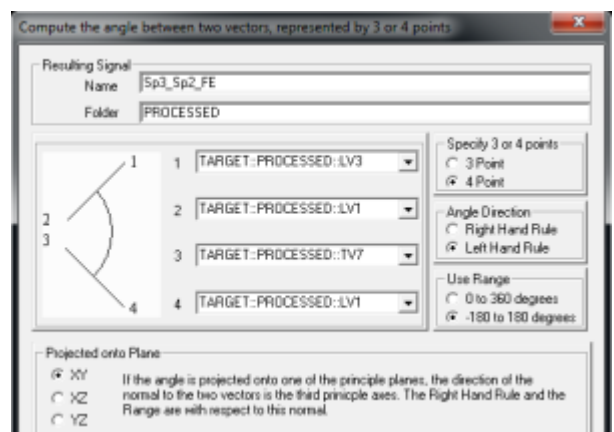
1. Define **Resulting Signal** Name: Sp5\_Sp4\_FE
2. Calculate a **4 point angle** between the following targets:
  1. TARGET::PROCESSED::TV7
  2. TARGET::PROCESSED::TV2
  3. TARGET::PROCESSED::CV7
  4. TARGET::PROCESSED::TV2
    - **Angle Direction:** Left Hand Rule
    - **3D Space:** Always 0 to 180 degrees
    - **Projected onto Plane:** XY
    - **Note:** The Reference segment will need to be changed to RPV within the text option.

## 27. Create Sp4\_Sp3\_FE planar angle:



1. Define **Resulting Signal** Name: Sp4\_Sp3\_FE
2. Calculate a **4 point angle** between the following
  1. TARGET::PROCESSED::LV1
  2. TARGET::PROCESSED::TV7
  3. TARGET::PROCESSED::TV2
  4. TARGET::PROCESSED::TV7
  - **Angle Direction:** Left Hand Rule
  - **3D Space:** Always 0 to 180 degrees
  - **Projected onto Plane:** XY
  - **Note:** The reference segment will need to be changed to RPV within the text option

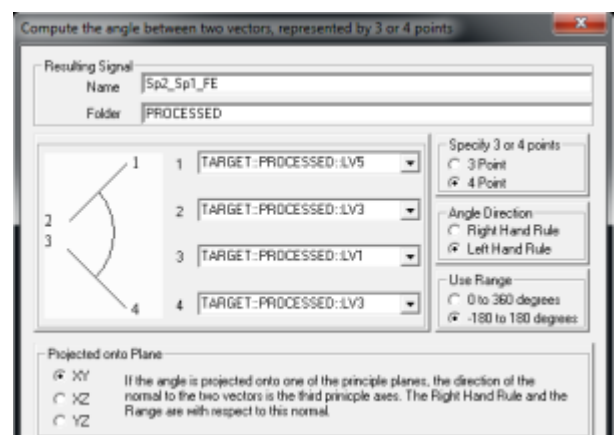
## 28. Create Sp3\_Sp2\_FE planar angle:



1. Define **Resulting Signal** Name: Sp3\_Sp2\_FE
2. Calculate a **4 point angle** between the following targets:
  1. TARGET::PROCESSED::LV3

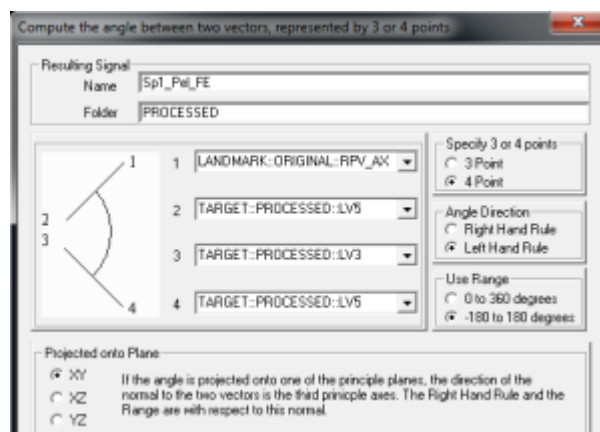
2. TARGET::PROCESSED::LV1
3. TARGET::PROCESSED::TV7
4. TARGET::PROCESSED::LV1
  - **Angle Direction:** Left Hand Rule
  - **3D Space:** Always 0 to 180 degrees
  - **Projected onto Plane:** XY
  - **Note:** The reference segment will need to be changed to RPV within the text option

## 29. Create Sp2\_Sp1\_FE planar angle:



1. Define **Resulting Signal** Name: Sp2\_Sp1\_FE
2. Calculate a **4 point angle** between the following targets:
  1. TARGET::PROCESSED::LV5
  2. TARGET::PROCESSED::LV3
  3. TARGET::PROCESSED::LV1
  4. TARGET::PROCESSED::LV3
    - **Angle Direction:** Left Hand Rule
    - **3D Space:** Always 0 to 180 degrees
    - **Projected onto Plane:** XY
    - **Note:** The reference segment will need to be changed to RPV within the text option.

### 30. Create Sp1\_Pel\_FE planar angle:



1. Define **Resulting Signal** Name: Sp2\_Sp1\_FE
2. Calculate a **4 point angle** between the following targets:
  1. LANDMARK::ORIGINAL::RPV\_AX
  2. TARGET::PROCESSED::LV5
  3. TARGET::PROCESSED::LV3
  4. TARGET::PROCESSED::LV5
    - **Angle Direction:** Left Hand Rule
    - **3D Space:** Always 0 to 180 degrees
    - **Projected onto Plane:** XY
    - **Note:** The reference segment will need to be changed to RPV within the text option.

## Shoulder LB

Below defines the orientation of the line between the shoulder targets (LCAJ/RCAJ) relative to the trunk segment

### Shoulder LB & AR Landmarks

### 31. Create RTA\_OR:

The screenshot shows the 'RTA\_OR' dialog box within the 'Landmarks' tab. The 'Landmark Name' is set to 'RTA\_OR'. Under 'Define Orientation Using:', 'Starting Point' is set to '(Reference)'. The 'Existing Segment' is set to 'Thorax/Ab'. Under 'Landmark Offset from Start Point (Reference) or Segment Origin', 'Offset Using the Following ML/AP/AXIAL Offsets' is selected, with ML, AP, and AXIAL all set to 0.0. The checkbox 'Offset by Percent (1.0 = 100%) (Meters when not checked)' is checked. The checkbox 'Calibration Only Landmark (Not generated for assigned motion file(s))' is unchecked. Buttons at the bottom include 'Undo Changes', 'Apply', 'Build Model', and 'Close Tab'.

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: RTA\_OR
  - **Landmark Name:** RTA\_OR
  - **Existing Segment:** Thorax/Ab
4. Offset Using the Following **ML/AP/AXIAL** Offsets:
  - **X:** 0.0 **Y:** 0.0 **Z:** 0.0
5. **Check:** Offset by Percent (1.0 = 100%) (Meters when not checked)
6. **Do NOT Check:** Calibration Only Landmark (Not generated for assigned motion file(s))

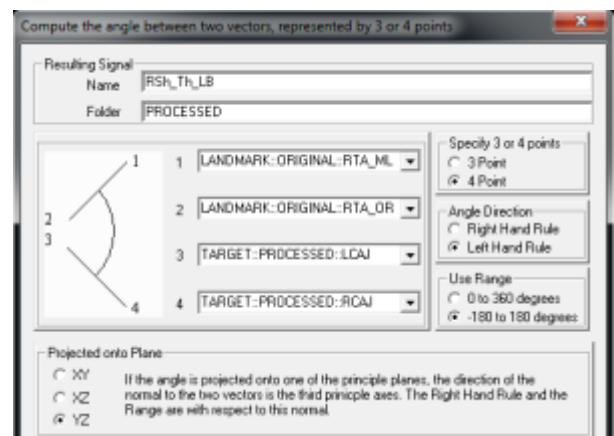
## 32. Create RTA\_ML:

The screenshot shows the 'RTA\_ML' dialog box within a software application. The 'Landmarks' tab is selected. The 'Landmark Name' is 'RTA\_ML'. Under 'Define Orientation Using:', 'Starting Point' is set to '(Reference)'. Under 'Targets and/or Landmark:', 'Ending Point' is '(On a line)', '\*Lateral object' is '(On a plane)', and '\*Project From' is '(Projection onto a line or plane)'. The 'Existing Segment' is 'Thorax/Ab'. Under 'Landmark Offset from Start Point (Reference) or Segment Origin', 'Offset to Existing Calibration Target or Landmark' is selected. The 'Offset Using the Following ML/AP/AXIAL Offsets' section shows 'ML' as 0.5, 'AP' as 0.0, and 'AXIAL' as 0.0. The 'Offset by Percent (1.0 = 100%) (Meters when not checked)' checkbox is checked. The 'Calibration Only Landmark (Not generated for assigned motion file(s))' checkbox is unchecked. At the bottom are buttons for 'Undo Changes', 'Apply', 'Build Model', and 'Close Tab'.

1. Click **Landmarks** button
2. Click **Add New Landmark** button
3. Create Landmark: RTA\_ML
  - **Landmark Name:** RTA\_ML
  - **Existing Segment:** THORAX/Ab
4. Offset Using the Following **ML/AP/AXIAL** Offsets:
  - **X:** 0.5 **Y:** 0.0 **Z:** 0.0
5. **Check:** Offset by Percent (1.0 = 100%) (Meters when not checked)
6. **Do NOT Check:** Calibration Only Landmark (Not generated for assigned motion file(s))

## Shoulder LB & AR Definitions

### 33. Create RSh\_Th\_LB planar angle:

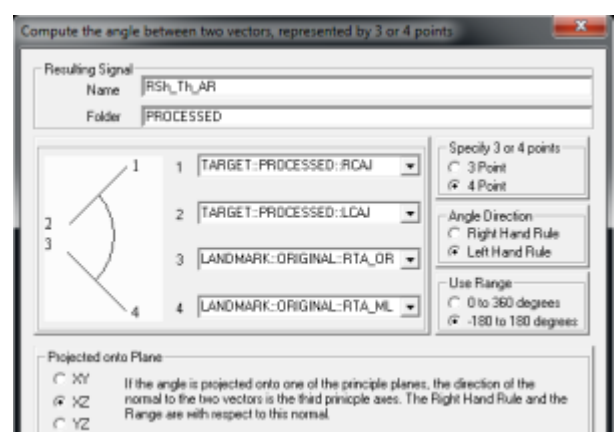


1. Define **Resulting Signal** Name: RSh\_Th\_LB
2. Calculate a **4 point angle** between the following targets:
  1. LANDMARK::ORIGINAL::RTA\_ML
  2. LANDMARK::ORIGINAL::RTA\_OR
  3. TARGET::PROCESSED::LCAJ
  4. TARGET::PROCESSED::RCAJ
    - **Angle Direction:** Left Hand Rule
    - **3D Space:** Always 0 to 180 degrees
    - **Projected onto Plan:** YZ
    - **NOTE:** The reference segment will need to be changed to RTA within the text options.

### 34. Create LSh\_Th\_LB planar angle:

- When defining the left signal, use same definitions **except** set:
  - **Angle Direction:** Right Hand Rule

### 35. Create RSh\_Th\_AR planar angle:



1. Define **Resulting Signal** Name: RSh\_Th\_AR
2. Calculate a **4 point angle** between the following targets:
  1. TARGET::PROCESSED::RCAJ
  2. TARGET::PROCESSED::LCAJ
  3. LANDMARK::ORIGINAL::RTA\_OR
  4. LANDMARK::ORIGINAL::RTA\_ML
    - **Angle Direction:** Left Hand Rule
    - **3D Space:** Always 0 to 180 degrees
    - **Projected onto Plane:** XZ
    - **Note:** The reference segment will need to be changed to RTA within the text option

### 36. Create LSh\_Th\_AR planar angle:

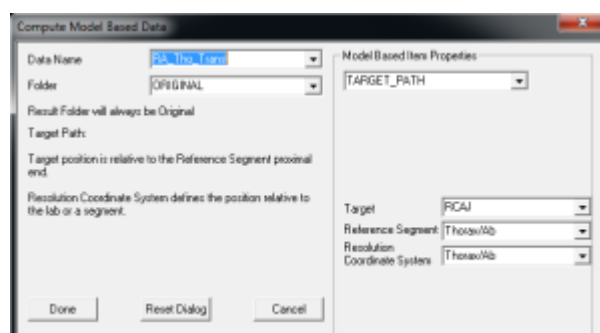
- When defining the left signal, use same definitions **except** set:
  - **Angle Direction:** Right Hand Rule

## Translation

Below defines the translation of the shoulder targets (LCAJ/RCAJ) in the trunk coordinate system

### Shoulder Translation Definitions

#### 37. Define RA\_Tho\_Transl:



1. Open the **Compute Model Based** dialog
2. Select **TARGET\_PATH** from drop down list
  - **Date Name:** RA\_Tho\_Transl
  - **Target:** RCAJ
  - **Reference Segment:** Thorax/Ab
  - **Resolution Coordinate System:** Thorax/Ab

#### 38. Define LA\_Tho\_Transl:

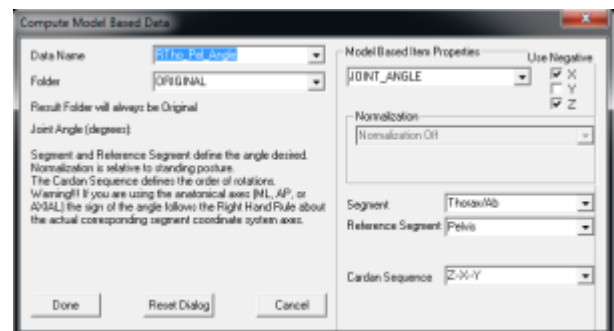
- When defining the left signal, use the same definitions **except** set:
  - **Target:** LCAJ

## Joint Angles

The Tho\_Pel and Tho\_Lab angles are described here, while the lower extremity joint angles were created based on the segment coordinate systems described here

## Joint Angle Definitions

### 39. Define the RTho\_Pel\_Angle:



1. Open the **Compute Model Based** dialog
2. Select **JOINT\_ANGLE** from drop down list
  - **Data Name:** RTho\_Pel\_Angle
  - **Segment:** Thorax/Ab
  - **Reference Segment:** Pelvis
  - **Cardan Sequence:** Z-X-Y
3. **Use Negative:**
  - **X:** TRUE **Y:** FALSE **Z:** TRUE

### 40. Define LTho\_Pel\_Angle:

- When defining the left signal, use same definitions **except** set:
  - **Use Negative**
    - **X:** FALSE **Y:** TRUE **Z:** TRUE

## 41. Define the RTho\_Lab\_Angle:

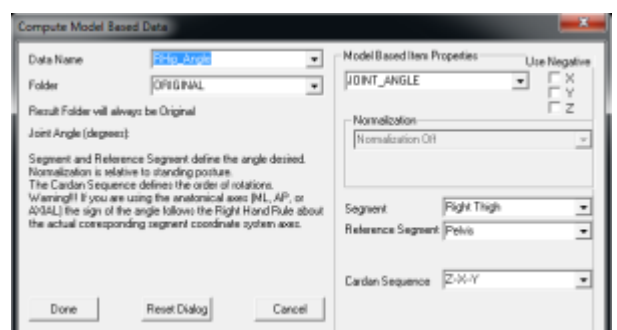


1. Open the **Compute Model Based** dialog
2. Select **JOINT\_ANGLE** from the drop down list
  - **Data Name:** RTho\_Lab\_Angle
  - **Segment:** RThorax/Ab
  - **Reference Segment:** VLab
  - **Cardan Sequence:** Z-X-Y
3. **Use Negative:**
  - **X:** TRUE **Y:** FALSE **Z:** TRUE

## 42. Define LTho\_Lab\_Angle:

- When defining the left signal, use same definitions **except** set:
  - **Use Negative:**
    - **X:** FALSE **Y:** TRUE **Z:** TRUE

## 43. Define the RHip\_Angle:



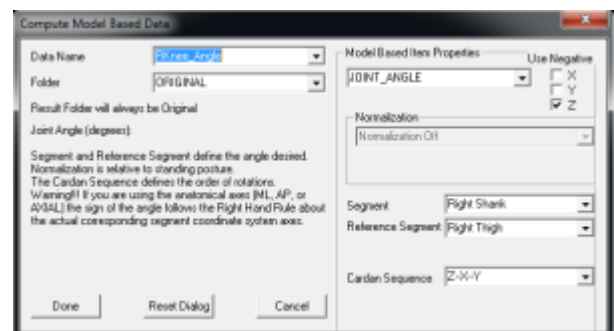
1. Open the **Compute Model Based** dialog

2. Select **JOINT\_ANGLE** from drop down list
  - **Date Name:** RHip\_Angle
  - **Segment:** Right Thigh
  - **Reference Segment:** Pelvis
  - **Carden Sequence:** Z-X-Y
3. **Use Negative:**
  1. **X:** FALSE **Y:** FALSE **Z:** FALSE

#### 44. Define LHip\_Angle:

- When defining the left signal, use same definitions **except** set:
  - **Segment:** Left Thigh
  - **Use Negative:**
    - **X:** TRUE **Y:** TRUE **Z:** FALSE

#### 45. Define the RKnee\_Angle:



1. Open the **Compute Model Based** dialog
2. Select **JOINT\_ANGLE** from drop down list
  - **Data Name:** RKnee\_Angle
  - **Segment:** Right Shank
  - **Reference Segment:** Right Thigh
  - **Carden Sequence:** Z-X-Y
3. **Use Negative:**
  - **X:** FALSE **Y:** FALSE **Z:** TRUE

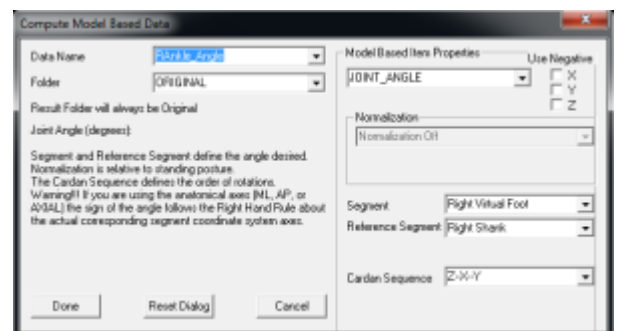
#### 46. Define LKnee\_Angle:

- When defining the left signal, use same definitions **except** set:

- **Segment:** Left Shank
- **Reference Segment:** Left Thigh
  - **Use Negative:**
    - **X: TRUE Y: TRUE Z: TRUE**

---

#### 47. Define the RKnee\_Angle:



1. Open the **Compute Model Based** dialog
2. Select **JOINT\_ANGLE** from drop down list
  - **Data Name:** RAnkle\_Angle
  - **Segment:** Right Virtual Foot
  - **Reference Segment:** Right Shank
  - **Cardan Sequence:** Z-X-Y
3. **Use Negative:**
  - **X: FALSE Y: FALSE Z: FALSE**

---

#### 48. Define LAnkle\_Angle:

- When defining the left signal, use the same definitions **except** set:
  - **Segment:** Left Virtual Foot
  - **Reference Segment:** Left Shank
  - **Use Negative:**
    - **X: TRUE Y: TRUE Z: FALSE**

# IOR Multi-Segment Foot Model

detailed tutorial focusing on the [IOR Multi-Segment Foot Model](#).

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Last update: **2024/11/25 21:14**

