

1. Create RHal Segment: • In the Segments tab, select RHal in the Segment Name box. • Select Kinematic Only • Click on the Create Segment button. • In the RHal tab, enter these values:	Define Proximal Joint and Radius Lateral: None Joint: RFMH Medial: None Radius: 0.1 Define Distal Joint and Radius Lateral: None Joint: RPM Medial: None Radius: 0.1 Extra Target to Define Orientation Location: Lateral RHal_Vert Select Tracking Targets: RHal_Vert, RFMH, RPM	• Click on Build Model. • Click on Close Tab before proceeding.	2. Modify the Segment Coordinate System: • Define the Segment Orientation as:	A/P Axis: -Z Distal to Proximal: -X	The image to the right (and all other images in this tutorial) show a mediolateral view of the segment coordinate system after it has been modified.
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Metatarsus (Met)

Segment Definition: The FM2 landmark is projected onto the plane defined by the FM1, FM5, and SMB landmarks. The line from the SMB to FM2 projection are used to define the X axis (A/P) axis of the Met segment. The sagittal axis (Z axis) is along the plane defined by the FM1, FM5, and SMB targets. The FMB target is not used to define the segment, but it will be used to track the segment (in addition to the other targets). Joint Angles: * Mid-Met Angle * Cal-Met Angle * F2Pt^[1] / Y component of the Met-Hal Angle^[2] * F2Ps^[1] / Z component of the Met-Hal Angle^[2] Planar Angles: * S2F is projected onto the plane of the Met segment * S2V is projected onto the plane of the Met segment	Metatarsus Landmarks
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1. Create RMET_DIST: - Click Landmarks button - Click Add New Landmark button - Create Landmark: <i>RMET_DIST</i>			Landmark Name: <i>RMET_DIST</i> Define Orientation Using: Starting Point: <i>RFMH</i> Ending Point: <i>RVMH</i> Lateral Object: <i>RSMB</i> Project From: <i>RSMH</i>			Do NOT Check: <i>Offset by Percent (1.0 = 100%)</i> Check: <i>Calibration Only Landmark</i>				
Metatarsus Definition										
1. Create RMet Segment: - In the Segments tab, select <i>RMet</i> in the Segment Name box. - Select Kinematic Only - Click on the Create Segment button. - In the RMet tab, enter these values:	Define Proximal Joint and Radius Lateral: <i>None</i> Joint: <i>RSMB</i> Medial: <i>None</i> Radius: <i>0.1</i> Define Distal Joint and Radius Lateral: <i>None</i> Joint: <i>RMET_DIST</i> Medial: <i>None</i> Radius: <i>0.1</i> Extra Target to Define Orientation Location: <i>Medial RFMH</i> Select Tracking Targets: <i>RFMB, RFMH, RSMB, RSMH, RVMH</i>			- Click on Build Model. - Click on Close Tab before proceeding.		2. Modify the Segment Coordinate System: Define the Segment Orientation as:		A/P Axis: <i>+Y</i> Distal to Proximal: <i>-X</i>		 The image to the right (and all other images in this tutorial) show a mediolateral view of the segment coordinate system after it has been modified.

Mid-foot (Mid)

Segment Definition:

The midpoint between the TN and VMB targets is used to define the origin of the Mid segment. The A/P (X) axis is defined along the line from this midpoint to the SMB target. The sagittal (Z) axis is along the plane defined by the ID, TN and SMB targets.

Joint Angles:

- * Cal-Mid Angle
- * Mid-Met Angle

Planar Angles:

- * Not used for planar angles.



Mid-foot Landmarks									
1. Create RID Joint Center: - Click Landmarks button - Click Add New Landmark button - Create Landmark: <i>RID</i>		Landmark Name: <i>RID</i> Define Orientation Using: Starting Point: <i>RTN</i> Ending Point: <i>RVMB</i>		- Offset Using the Following AXIAL Offset: <i>0.5</i> Check: <i>Offset by Percent (1.0 = 100%)</i> Check: <i>Calibration Only Landmark</i>					
Mid-foot Definition									
1. Create RMid Segment: - In the Segments tab, select <i>RMid</i> in the Segment Name box. - Select Kinematic Only. - Click on the Create Segment button. - In the RMid tab, enter these values:		Define Proximal Joint and Radius Lateral: <i>None</i> Joint: <i>RID</i> Medial: <i>None</i> Radius: <i>0.1</i> Define Distal Joint and Radius Lateral: <i>None</i> Joint: <i>RSMB</i> Medial: <i>None</i> Radius: <i>0.1</i> Extra Target to Define Orientation Location: <i>Medial RTN</i> Select Tracking Targets: <i>RSMB, RTN, RVMB</i>		- Click on Build Model. - Click on Close Tab before proceeding.		2. Modify the Segment Coordinate System: Define the Segment Orientation as:		A/P Axis: +Y Distal to Proximal: -X	

Calcaneus (Cal)

Segment Definition:									
The origin is at the FCP target. The A/P (X) axis is along the line from the FCP to midpoint of the ST and PT targets (IC landmark). The sagittal (Z) axis is along the plane defined by the FCP, ST and TN targets.									
Joint Angles:									
* Sha-Cal Angle									
* Cal-Mid Angle Z rotation & Y Rotation*									
* Cal-Met Angle									
* The 2014 paper ^[2] modified the definition of inversion/eversion for the calcaneus segment relative to the shank segment. This is now calculated as the Sha_Cal_Fro angle which is a four point planar angle.									
Planar Angles:									
* No planar angles									
Calcaneus Landmarks									
1. Create RIC Joint Center:			Landmark Name: <i>RIC</i>			- Offset Using the Following AXIAL Offset: <i>0.5</i> Check: <i>Offset by Percent (1.0 = 100%)</i> Check: <i>Calibration Only Landmark</i>			
- Click Landmarks button - Click Add New Landmark button - Create Landmark: <i>RIC</i>									
Calcaneus Definition									

1. Create RCal Segment: - In the Segments tab, select <i>RCal</i> in the Segment Name box. - Select Kinematic Only - Click on the Create Segment button. - In the RCal tab, enter these values:	Define Proximal Joint and Radius Lateral: <i>None</i> Joint: <i>RFCP</i> Medial: <i>None</i> Radius: <i>0.1</i> Define Distal Joint and Radius Lateral: <i>None</i> Joint: <i>RIC</i> Medial: <i>None</i> Radius: <i>0.1</i> Extra Target to Define Orientation Location: <i>Medial</i> <i>RST</i> Select Tracking Targets: <i>RFCP, RPT, RST</i>	- Click on Build Model. - Click on Close Tab before proceeding.	2. Modify the Segment Coordinate System: Define the Segment Orientation as:	A/P Axis: +Y Distal to Proximal: -X
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Virtual Foot (Foo)

Segment Definition: The origin is at the FCP target. The A/P (X) axis is along the line from the FCP to RFT_DIST landmark. The sagittal (Z) axis is along the plane defined by the FCP, FMH and VMH targets. This foot segment should be set to “kinematic only” since the origin is not at the point of rotation (the mid point of the RIMM & RLM targets. The IORFoot analysis does not calculate kinetics, so no kinetic foot segment is described in this model. To create gait events, you will need a kinetic foot segment. An example of a kinetic foot segment is created in the sample download files for this tutorial.				
Foot Landmarks				
1. Create RFT_DIST: - Click Landmarks button - Click Add New Landmark button - Create Landmark: <i>RFT_DIST</i>	Landmark Name: <i>RFT_DIST</i> Define Orientation Using: Starting Point: <i>RCA</i> Ending Point: <i>RFMH</i> Lateral Object: <i>RVMH</i> Project From: <i>RSMH</i>	Do NOT Check: <i>Offset by Percent (1.0 = 100%)</i> Check: <i>Calibration Only Landmark</i>		
Foot Definition				

1. Create Right Virtual Foot Segment: - In the Segments tab, select <i>Right Virtual Foot</i> in the Segment Name box. - Select Kinematic Only - Click on the Create Segment button. - In the Right Virtual Foot tab, enter these values:	Define Proximal Joint and Radius Lateral: <i>None</i> Joint: <i>RFCP</i> Medial: <i>None</i> Radius: $0.5 * \text{DISTANCE}(RST, RPT)$ Define Distal Joint and Radius Lateral: <i>None</i> Joint: <i>RFT_DIST</i> Medial: <i>None</i> Radius: $0.5 * \text{DISTANCE}(RFMH, RVMH)$ Extra Target to Define Orientation Location: <i>Medial</i> <i>RFMH</i> Select Tracking Targets: <i>RFCP, RFMH, RVMH</i>	- Click on Build Model. - Click on Close Tab before proceeding.	2. Modify the Segment Coordinate System: Define the Segment Orientation as:	A/P Axis: +Y Distal to Proximal: -X	
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Shank (Sha)

Shank Landmarks									
1. Create RIM: • Click Landmarks button • Click Add New Landmark button • Create Landmark: RIM	Landmark Name: RIM Define Orientation Using: Starting Point: RLM Ending Point: RMM	• Offset Using the Following AXIAL Offset: 0.5 • Check: Offset by Percent (1.0 = 100%) • Check: Calibration Only Landmark	2. Create RSK_PROX: • Click Landmarks button • Click Add New Landmark button • Create Landmark: RSK_PROX	Landmark Name: RSK_PROX Define Orientation Using: Starting Point: RIM Ending Point: RLM Lateral Object: RHF Project From: RTT	• Do NOT Check: Offset by Percent (1.0 = 100%) • Check: Calibration Only Landmark				
Shank Definition									

1. Create Right Shank Segment: - In the Segments tab, select <i>Right Shank</i> in the Segment Name box. - Click on the Create Segment button. - In the Right Shank tab, enter these values:	Define Proximal Joint and Radius Lateral: <i>None</i> Joint: <i>RSK_PROX</i> Medial: <i>None</i> Radius: <i>DISTANCE(RSK_PROX,RHF)</i> Define Distal Joint and Radius Lateral: <i>None</i> Joint: <i>RIM</i> Medial: <i>None</i> Radius: <i>0.5*DISTANCE(RLM,RMM)</i> Extra Target to Define Orientation Location: <i>Lateral</i> <i>RLM</i> Select Tracking Targets: <i>RHF, RLM, RMM, RTT</i>	- Click on Build Model. - Click on Close Tab before proceeding.		2. Modify the Segment Coordinate System: Define the Segment Orientation as:	A/P Axis: +X Distal to Proximal: +Y	
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Sagittal Planar Angles

The **F2G**, **S2G**, and **V2G** angles are planar angles relative to the ground.

The **MLA** angle is the angle between the Medial Longitudinal Arch/Navicular drop.

F2G S2G and V2G Landmarks

The F2G, S2G and V2G angles are calculated in the plane orthogonal to the ground. These landmarks will need to be projected onto the ground. To project landmarks onto the ground, the Lab_O, Lab_X and Lab_Y landmarks will need to be created to identify the plane of the ground.																
F2G S2G and V2G Landmarks																
1. Create Lab_O:				2. Create Lab_X:				3. Create Lab_Y:					4. Create RFMH_proj:			
- Click Landmarks button - Click Add New Landmark button - Create Landmark: Lab_O	Landmark Name: Lab_O	- Offset Using the Following ML/AP/AXIAL Offsets: X: 0.0 Y: 0.0 Z: 0.0 - Do NOT Check: Offset by Percent (1.0 = 100%) (Meters when not checked) - Do NOT Check: Calibration Only Landmark (Not generated for assigned motion file(s))		- Click Landmarks button - Click Add New Landmark button - Create Landmark: Lab_X	Landmark Name: Lab_X	- Offset Using the Following ML/AP/AXIAL Offsets: X: 0.05 Y: 0.0 Z: 0.0 - Do NOT Check: Offset by Percent (1.0 = 100%) (Meters when not checked) - Do NOT Check: Calibration Only Landmark (Not generated for assigned motion file(s))		- Click Landmarks button - Click Add New Landmark button - Create Landmark: Lab_Y	Landmark Name: Lab_Y	- Offset Using the Following ML/AP/AXIAL Offsets: X: 0.0 Y: 0.05 Z: 0.0 - Do NOT Check: Offset by Percent (1.0 = 100%) (Meters when not checked) - Do NOT Check: Calibration Only Landmark (Not generated for assigned motion file(s))		- Click Landmarks button - Click Add New Landmark button - Create Landmark: RFMH_proj	Landmark Name: RFMH_proj	- Do NOT Check: Offset by Percent (1.0 = 100%) - Do NOT Check: Calibration Only Landmark	Create landmarks 7-17 by following the same format as the RFMH_proj landmark for: **	5. RFMB 6. RFMB 7. RSMH 8. RSMB 9. RVMH 10. LFMH 11. LFMB 12. LSMH 13. LSMB 14. LVMH 15. LVMB

F2G Angle

F2G Angle - 3D angle of the first metatarsus relative to the ground 				
F2G Definition				
1. Create RF2G planar angle: - Define Resulting Signal Name: <i>RF2G</i> - Calculate a 4 point angle between the following targets:	1 - <i>TARGET::ORIGINAL::RFMB</i> 2 - <i>TARGET::ORIGINAL::RFMH</i> 3 - <i>TARGET::ORIGINAL::RFMH_proj</i> 4 - <i>TARGET::ORIGINAL::RFMB_proj</i> Angle Direction: <i>Right Hand Rule</i> 3D Space: <i>Always 0 to 180 degrees</i> 		2. Create LF2G planar angle: When defining the left signal, use same definitions as for the right angle	

S2G Angle

S2G Angle - 3D angle of the second metatarsus relative to the ground 				
S2G Definition				
1. Create RS2G planar angle: - Define Resulting Signal Name: <i>RS2G</i> - Calculate a 4 point angle between the following targets:	1 - <i>TARGET::ORIGINAL::RSMB</i> 2 - <i>TARGET::ORIGINAL::RSMH</i> 3 - <i>TARGET::ORIGINAL::RSMH_proj</i> 4 - <i>TARGET::ORIGINAL::RSMB_proj</i> Angle Direction: <i>Right Hand Rule</i> 3D Space: <i>Always 0 to 180 degrees</i> 		2. Create LS2G planar angle: When defining the left signal, use same definitions as for the right angle	

V2G Angle

V2G Angle - 3D angle of the fifth metatarsus relative to the ground 

V2G Definition				
1. Create RV2G planar angle: - Define Resulting Signal Name: <i>RV2G</i> - Calculate a 4 point angle between the following targets:	1 - <i>TARGET::ORIGINAL::RVMB</i> 2 - <i>TARGET::ORIGINAL::RVMH</i> 3 - <i>TARGET::ORIGINAL::RVMH_proj</i> 4 - <i>TARGET::ORIGINAL::RVMB_proj</i> Angle Direction: <i>Right Hand Rule</i> 3D Space: <i>Always 0 to 180 degrees</i> 		2. Create LV2G planar angle: When defining the left signal, use same definitions as for the right angle	

1. Create RMLA planar angle: • Define Resulting Signal Name: RMLA • Calculate a 3 point angle between the following targets:	1 - LANDMARK::ORIGINAL::RFCP_track 2 - TARGET::ORIGINAL::RST 3 - TARGET::ORIGINAL::RFMH Angle Direction: <i>Right Hand Rule</i> Use Range: <i>-180 to 180 degrees</i> Projected onto Plane: <i>XY</i> Note: The reference segment will need to be changed to <i>RMF</i> within the text option. Command text should have the internal name (e.g. RMF) and not the display name "Right Virtual Foot". https://www.c-motion.com/v3dwiki/index.php?title=Segment_Default_Names	2. Create LMLA planar angle: • When defining the left signal, use same definitions as for the right angle	Note: The reference segment will need to be changed to <i>Left Virtual Foot</i> within the text option.
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Transverse Planar Angles

S2F Angle

S2F Angle – Angle between the first and second metatarsus projected on to the transverse plane of the Met segment				
S2F Definition				
1. Create RS2F planar angle: • Define Resulting Signal Name: RS2F • Calculate a 4 point angle between the following targets:	1 - TARGET::ORIGINAL::RSMH 2 - TARGET::ORIGINAL::RSMB 3 - TARGET::ORIGINAL::RFMB 4 - TARGET::ORIGINAL::RFMH Angle Direction: <i>Right Hand Rule</i> Use Range: <i>-180 to 180 degrees</i> Projected onto Plane: <i>XZ</i> Note: The reference segment will need to be changed to <i>RMet</i> within the text option.	2. Create LS2F planar angle: • When defining the left signal, use same definitions except set:	Angle Direction: <i>Left Hand Rule</i> Note: The reference segment will need to be changed to <i>LMet</i> within the text option.	

S2V Angle

S2V Angle – Angle between the fifth and second metatarsus projected on to the transverse plane of the Met segment				
S2V Definition				

1. Create RS2V planar angle: - Define Resulting Signal Name: RS2V - Calculate a 4 point angle between the following targets:	1 - TARGET::ORIGINAL::RSMH 2 - TARGET::ORIGINAL::RSMB 3 - TARGET::ORIGINAL::RVMB 4 - TARGET::ORIGINAL::RVMH Angle Direction: <i>Left Hand Rule</i> Use Range: -180 to 180 degrees Projected onto Plane: XZ Note: The reference segment will need to be changed to RMet within the text option.	✖ When defining the left signal, use same definitions except set:	2. Create LS2V planar angle: Angle Direction: <i>Right Hand Rule</i> Note: The reference segment will need to be changed to LMet within the text option.
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Calcaneus Inv/Eve

Sha_Cal_Frontal Angle - Angle of the calcaneus segment relative to the shank segment

This planar angle will be used to replace the inversion/eversion angle of the Sha_Cal joint angle

0 degrees indicates the calcaneus is aligned with the shank.

[illegible]

3. [↑](#) [3.00](#) [3.01](#) [3.02](#) [3.03](#) [3.04](#) [3.05](#) [3.06](#) [3.07](#) [3.08](#) [3.09](#) [3.10](#) [3.11](#) [3.12](#) [3.13](#) [3.14](#) [3.15](#) Serge van Sint Jan “Color Atlas of Skeletal Landmark Definitions: Guidelines for Reproducible Manual and Virtual Palpations” 2007 - Churchill Livingstone

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