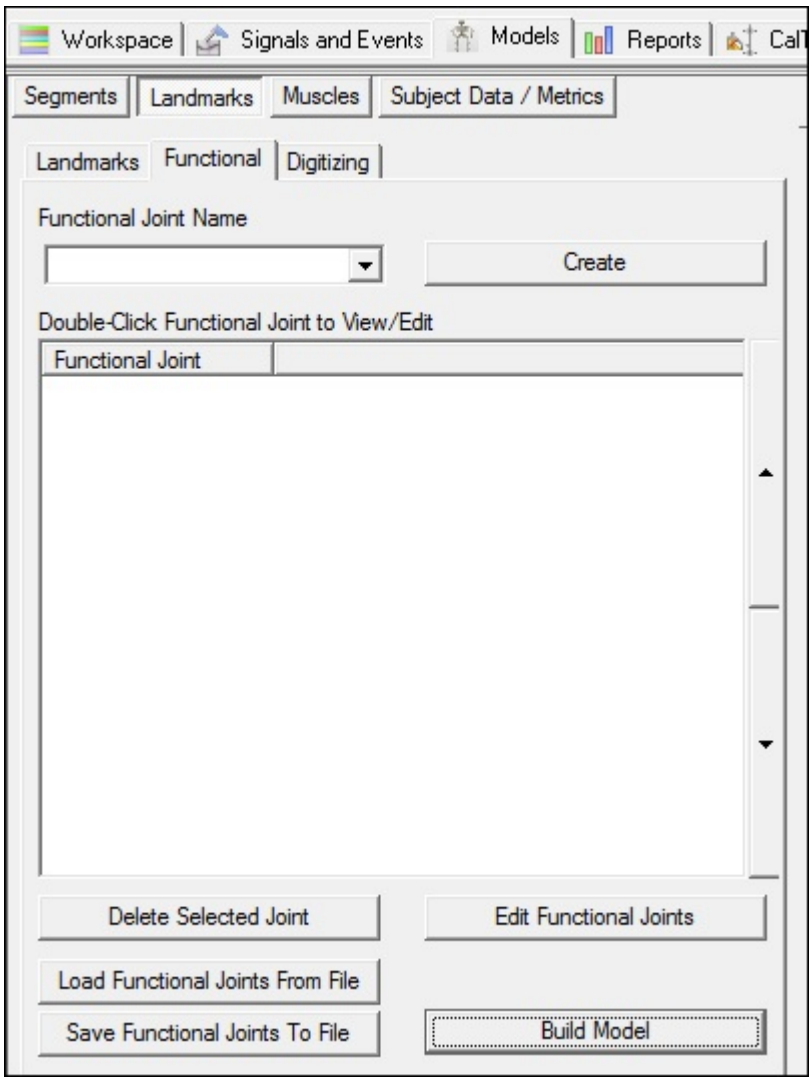
Defining a Functional Joint

This page covers Visual3D's interface for defining functional joint landmarks. See the functional joints overview page for a general overview of the subject and visit the Create a Functional Joint at the Right Hip tutorial for a walkthrough of the process.

The Functional Landmarks Tab in Model Builder Mode

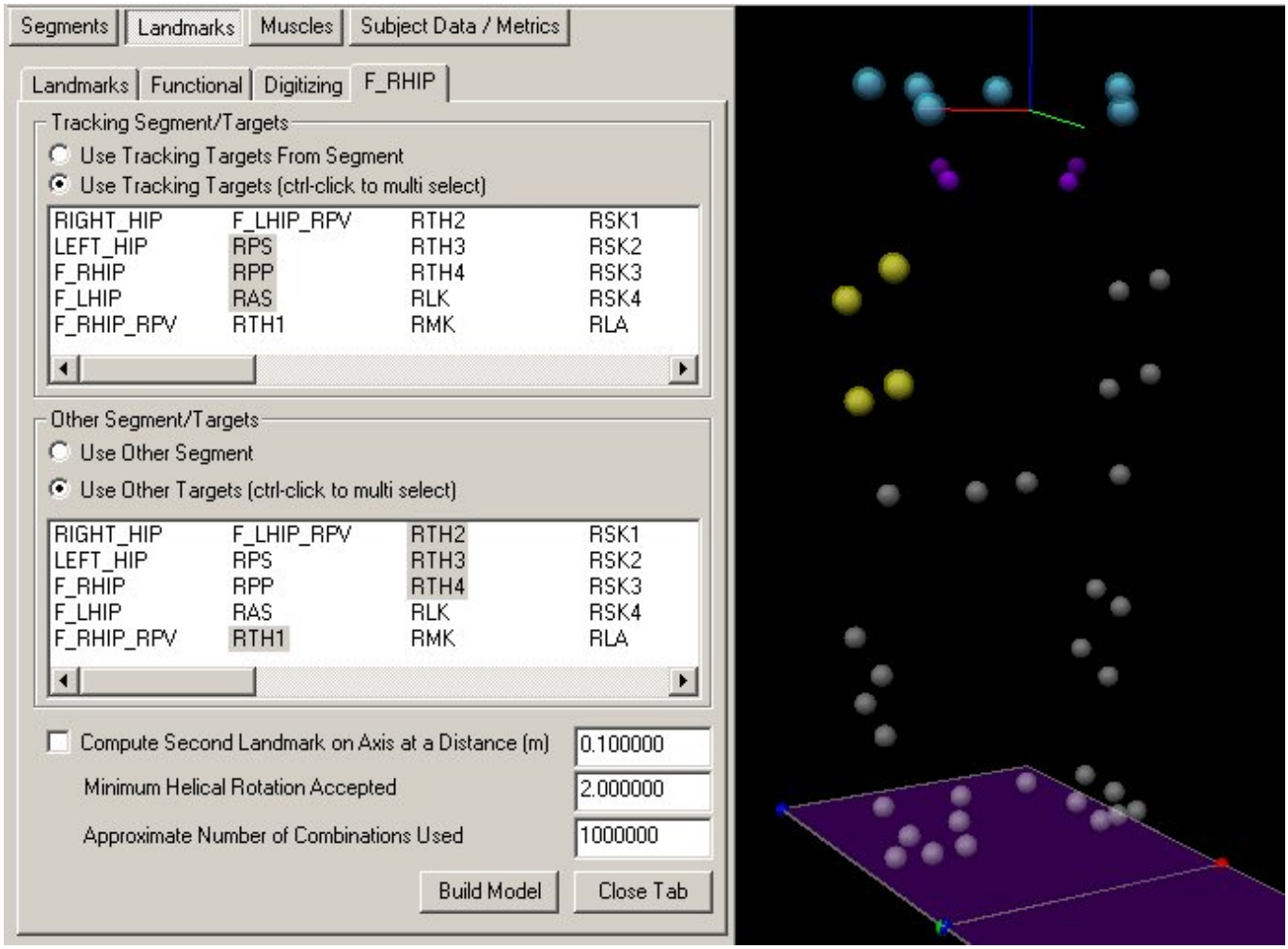
Functional joint properties are defined in the *Landmarks : Functional** tab of the Model Builder.



The definition of the functional joints can be saved in an INI file for future use, but it is more common to simply save the Model Template because the functional joint definitions (and digitized point definitions) will automatically be saved to the template. The Visual3D template will actually contain two versions of the functional joints. The first is the actual definition, and the second is the resulting explicit value that results from the functional joint computation. This second landmark is the one that is displayed in the viewer and can be used to define a segment or other landmarks.

Defining a Functional Joint Landmark

The functional joint landmark will be created relative to the tracking segments/targets. Looking at the definition of the landmark that is created after computing the functional joint will show you these segments/targets.



There are two segments of interest:

- The **tracking** segment (originally the “reference segment”). Tracking targets are coloured blue in the viewer.
- The **other** segment, which is the segment that is moving relative to the tracking segment. Other Targets are coloured yellow.

This dialog presents 3 options:

1. Compute a second landmark that lies on the same axis as the joint computed. This is useful for joints that have only one degree of freedom because the functional joint in these cases can not be computed accurately.
2. The minimum helical rotation is related to the algorithm and causes Visual3D to consider only a collection of postures in which the rotation from one posture to another posture is greater than the specified value.
3. The algorithm uses all combinations of 3 frames of data in the selected range of frames. This can lead to an inordinate number of possible computations, which will slow the computation.

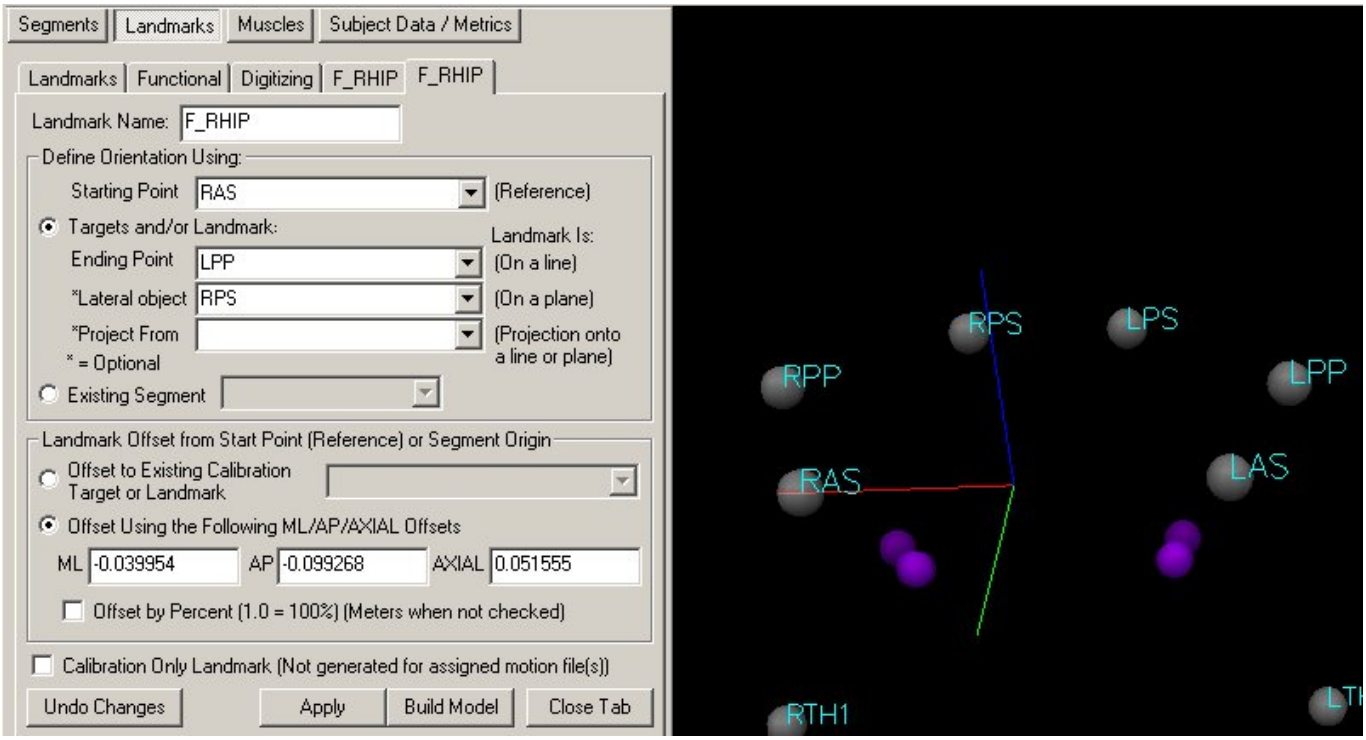
The user can have Visual3D select randomly a restricted number of 3 frames of data

Which targets/segments are actually used in the computation?

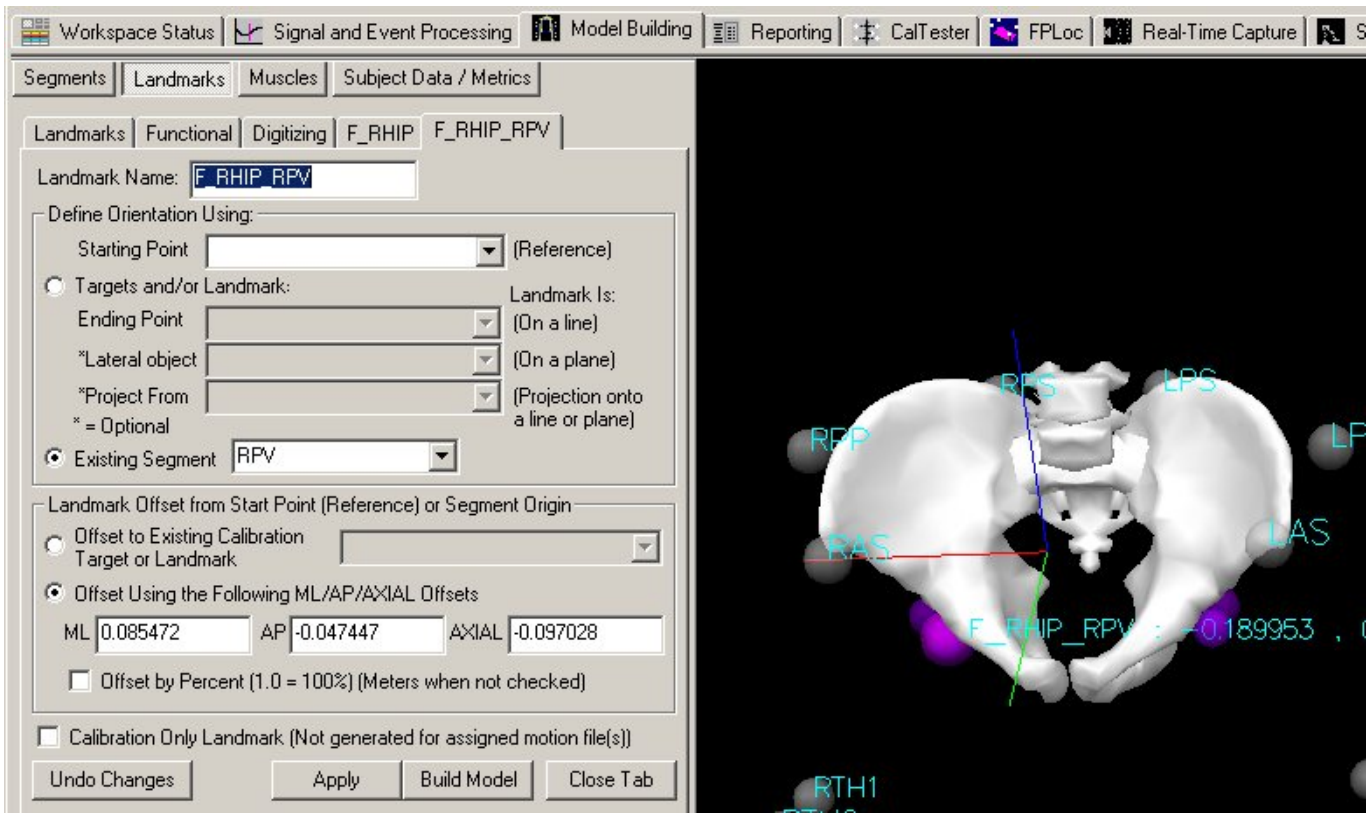
Regardless of whether the user selects Targets or Segments, Visual3D creates a technical coordinate system (TCS) to represent each segment for the computations. This is done to ensure that a segment exists because it is possible that the segment definition depends on the functional joint being computed. Visual3D chooses the three markers (from however many were selected) to be used for the TCS definition. Three markers define the vertices of a triangle. Visual3D searches for the triangle with the largest area, then uses these 3 targets. Visual3D then searches for the two vertices of the three selected that are the farthest apart, and these become the proximal and distal end of virtual segment from which the TCS is defined. The TCS is tracked, however, with all of the Targets that were selected.

If the resulting landmark is defined relative to Targets (e.g. not to a segment), Visual3D uses the three markers that made up the TCS.

If the resulting landmark is defined relative to a segment, Visual3D transforms the landmark from the TCS into the Segment Coordinate System.



In this case, Visual3D elected to define the landmark relative to RAS, LPP, and RPS of the possible 6 Targets used for tracking the segment.



The same landmark can be defined relative to the pelvis segment rather than to markers. If you have created the landmark for use in defining segments (e.g. calibration only), it doesn't really matter whether you define the landmark relative to segments or landmarks. If you have created the landmark and would like to use it for tracking, it is advisable to define the landmark relative to a segment.

See Also

Once you have defined your functional joint landmarks you will need to complete post-processing.

Follow along with the Create a Functional Joint at the Right Hip tutorial for a complete walkthrough of the process.