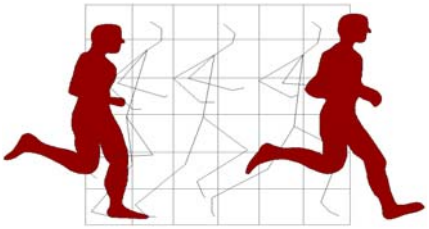

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Visual3D

Quick Reference Guide

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Last revised: 1 November 2006

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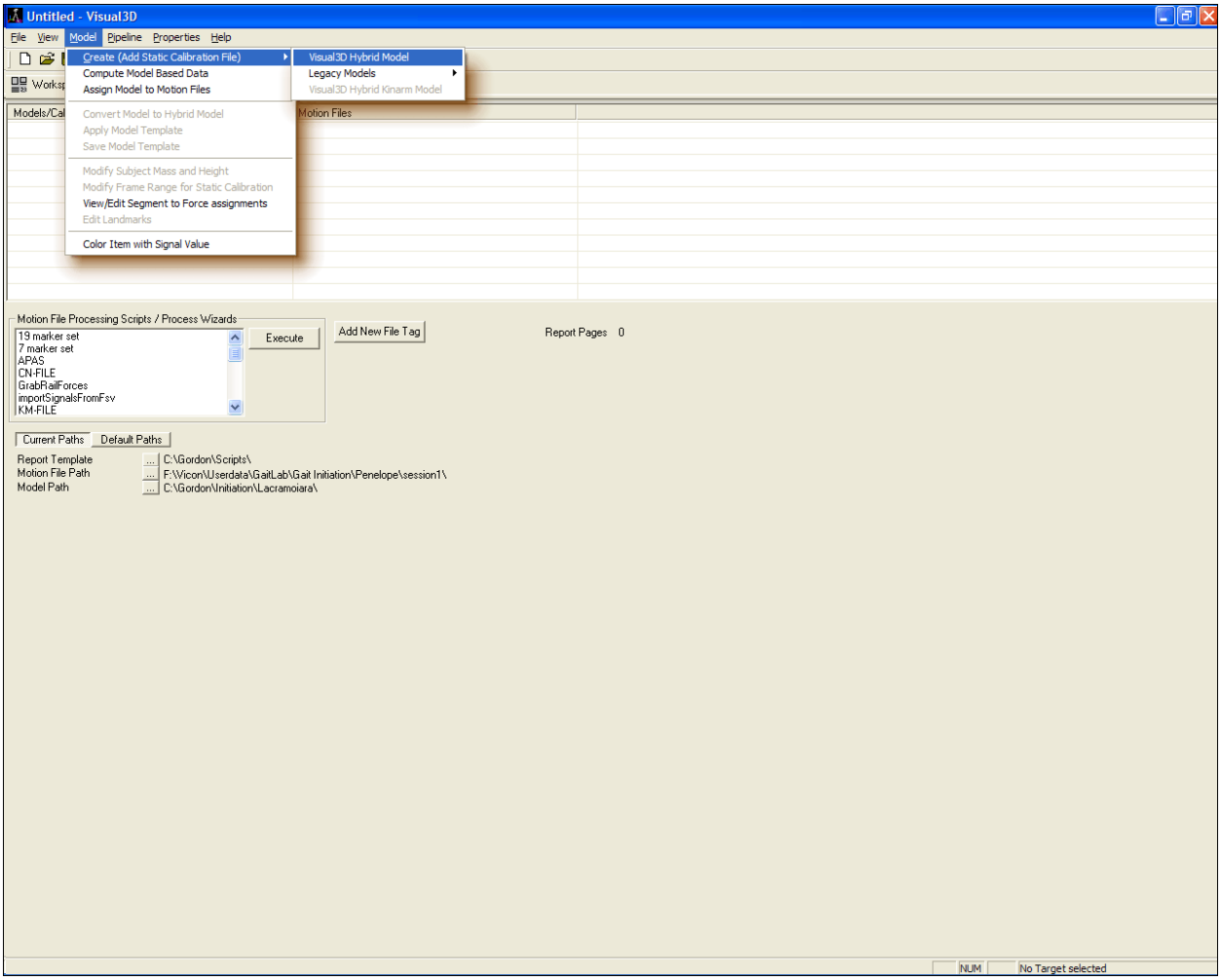
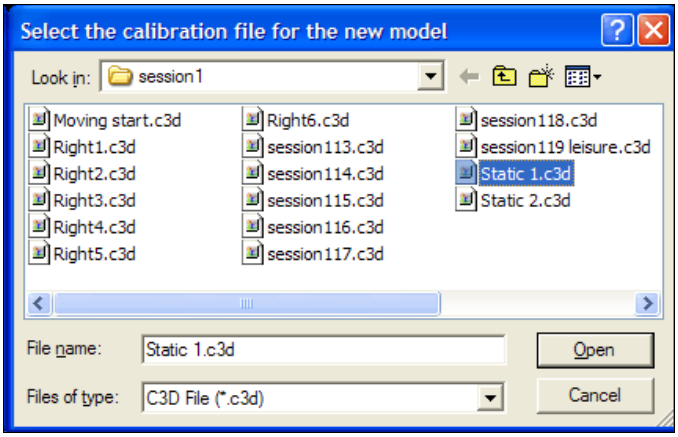
Visual3D Quick Reference Guide

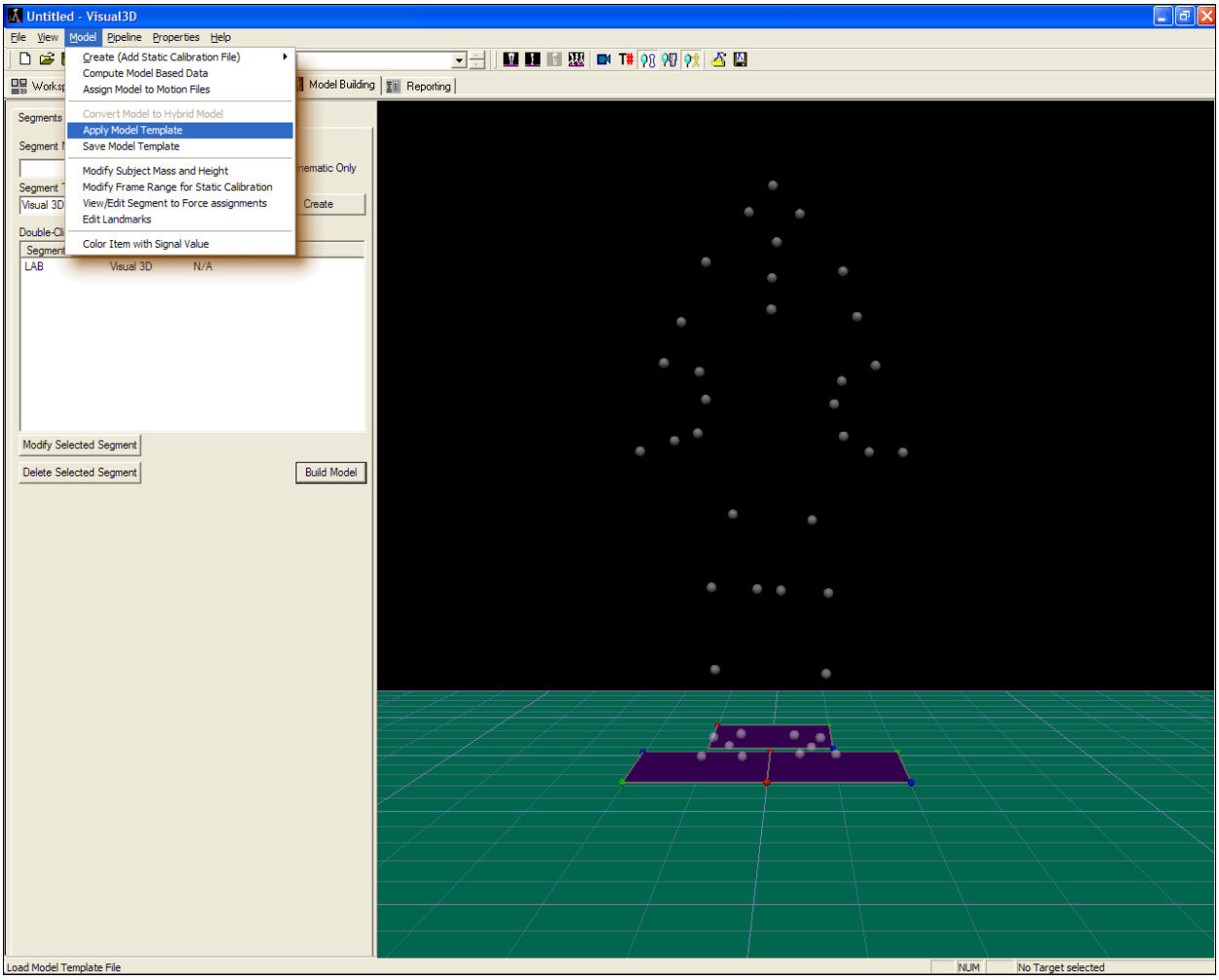
1: Static Trial. Select type of model from **Model** menu. Use *Create (Add Static Calibration File)* and pick *Visual3D Hybrid Model.*



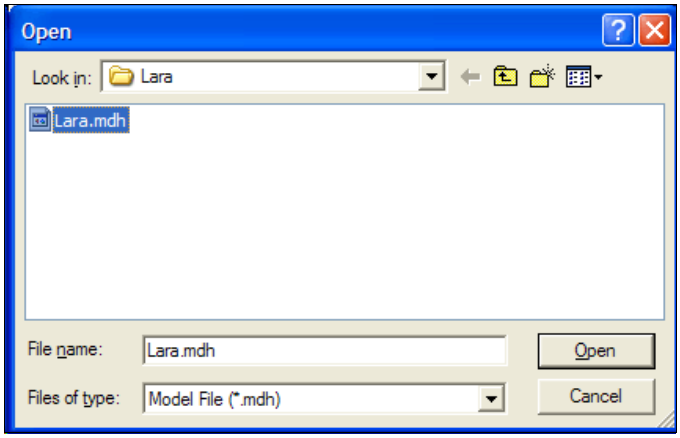
Next, select static trial from Vicon database (e.g., \Vicon\Userdata\Gaitlab\...).



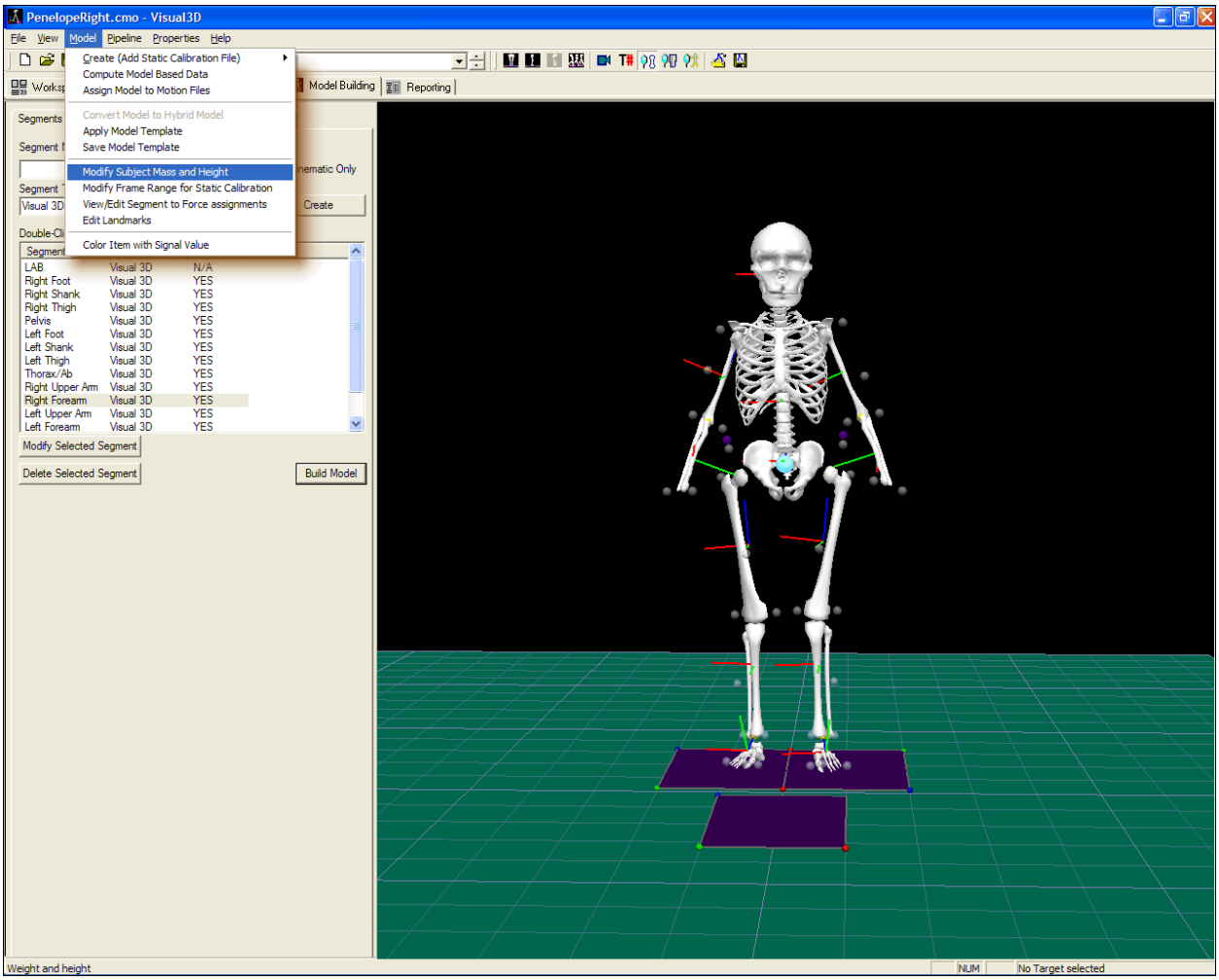
2: Modeling. Apply a template from a previous subject that uses the same marker set. Be sure that the subject's name is not include with the target labels. The Options menu in Vicon Workstation can remove the subject's name.



Select a model template file (.mdh) from a similar project that used the same marker set. Note if your data does not include one or more of the required markers refer to the Appendix for how to create a landmark, e.g., left and right iliac crest.

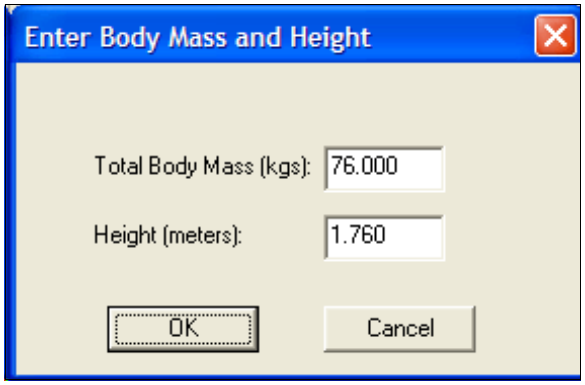


3: Body Parameters. Set subject's mass (in kilogram) and height (in metres).



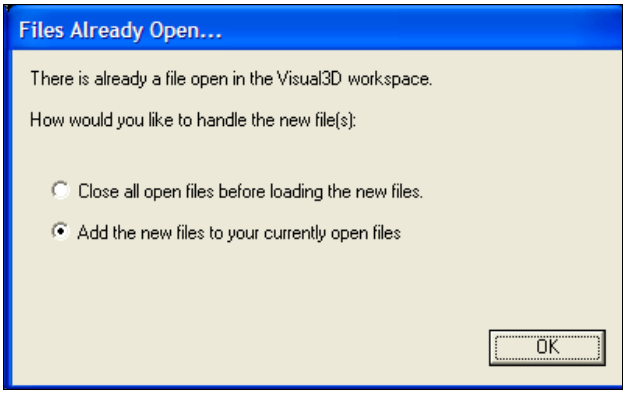
Enter the correct mass and height.

Save the model (.mdh) using the item, *Save Model Template*.

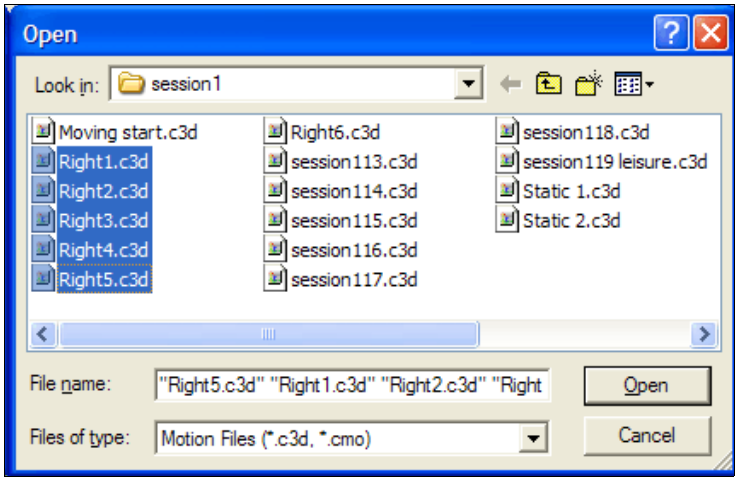


4: Add Motion (Dynamic) Trials. From the **File** menu add one or more dynamic trials of this subject from the Vicon database area.

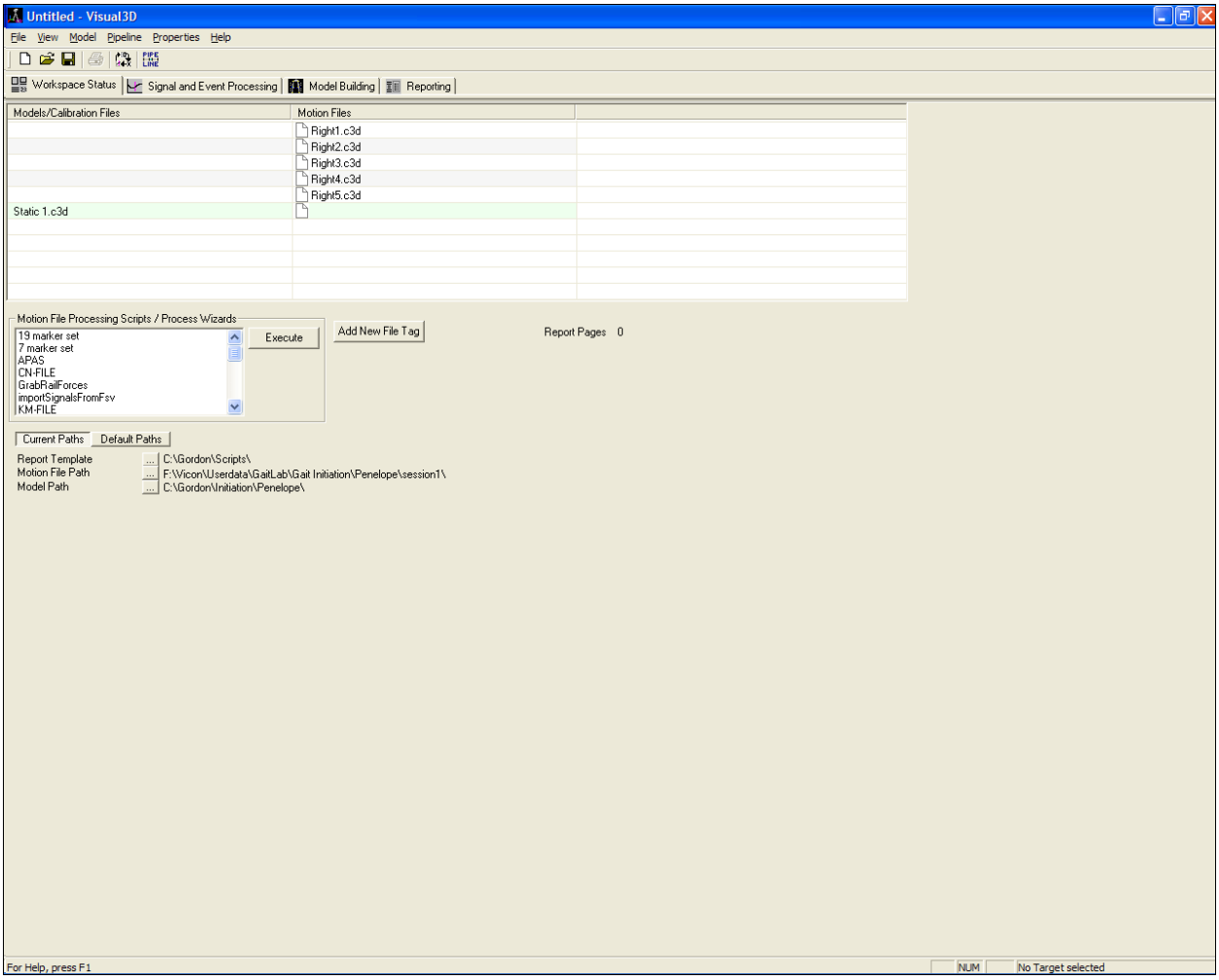
Select, *Add the new files to your currently open files.*



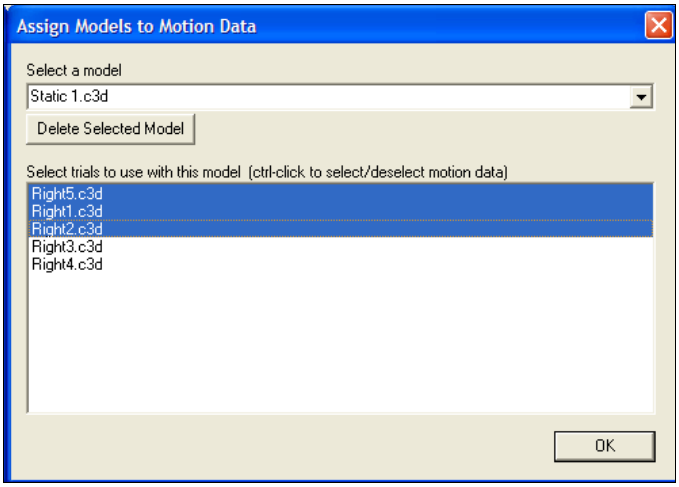
Use the *Ctrl* key to select more than one trial.



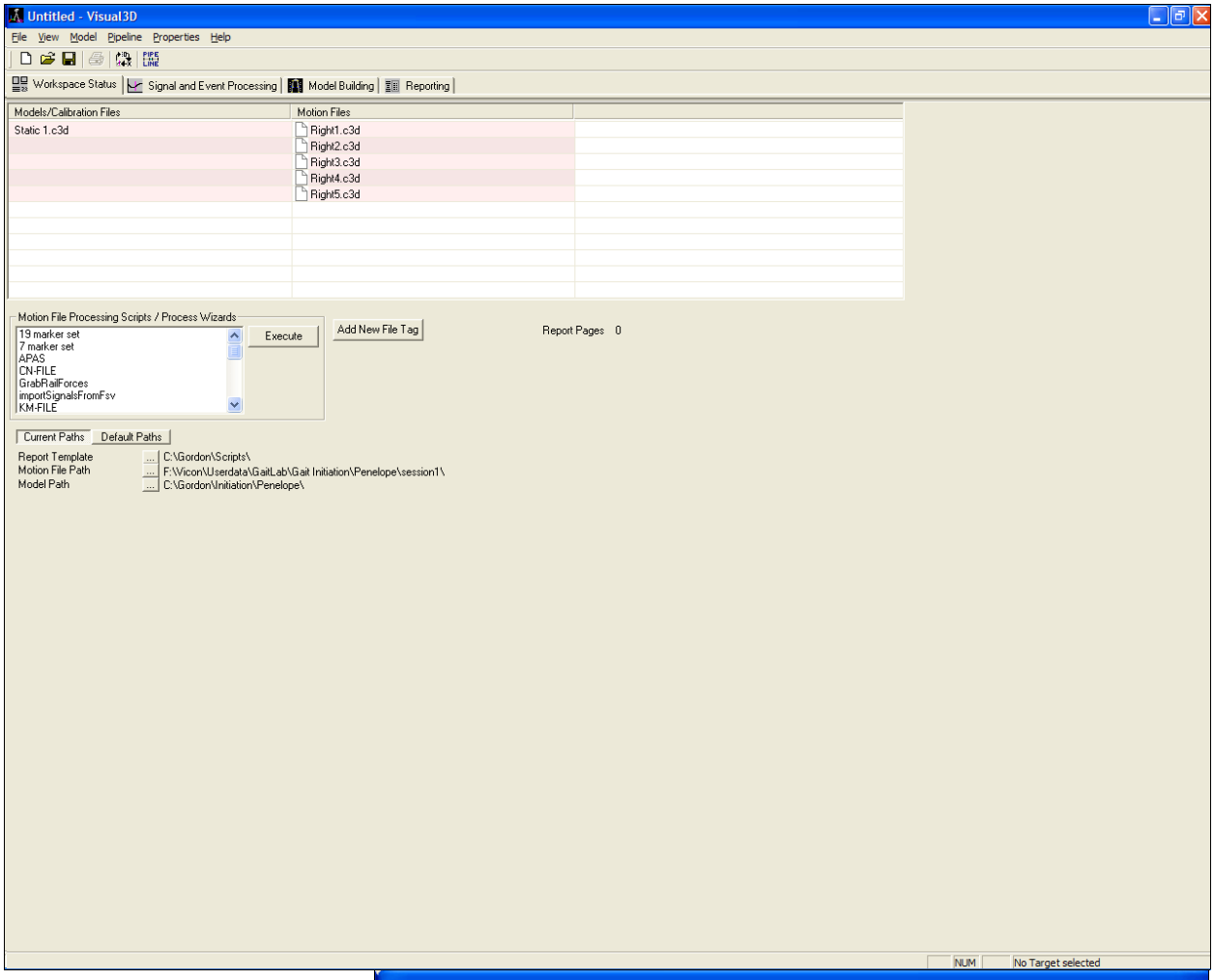
5: Assigning Model. Worksheet will look like this before motion files have been assigned to a model template.



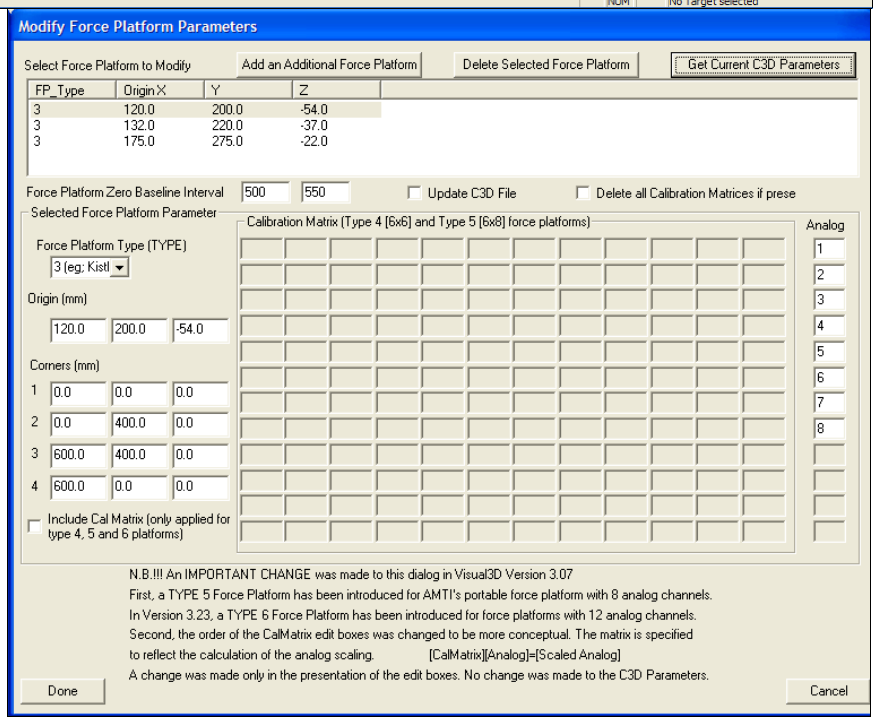
Next from **Model** menu select *Assign Model to Motion Files*. Select each motion trial one at a time. **Be sure to hold the CTRL key** down each time you select a file. There may be a long pause before the model is fully applied to all frames in the trial.



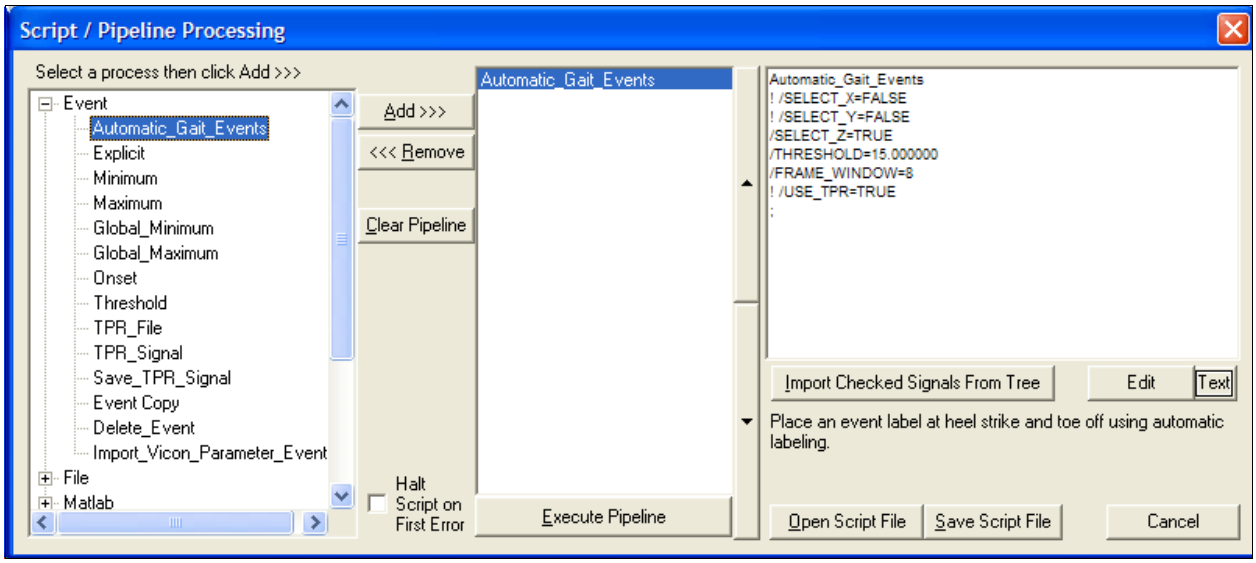
6: Force Plate Offsets. Worksheet will now look like this. Double-clicking a motion file will start animating the data.



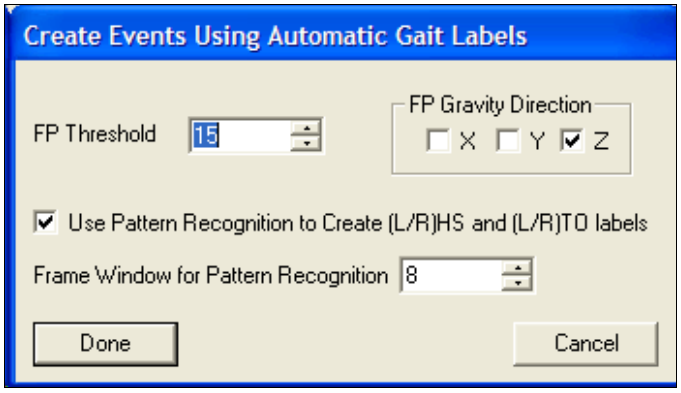
If necessary, set the Zero Baseline Interval for the force platforms. First click on a particular file then select the *Modify Force Platform Parameters* item from the **File** menu. Press the *Get Current C3D Parameters* button and enter the correct region. For gait initiation these numbers should point to the end of the file.



7: Gait Events. Add event codes to each trial. One way is use a Pipeline command. Click the Pipeline icon or press *F11*. Then select *Automatic_Gait_Events* from the *Event* area.



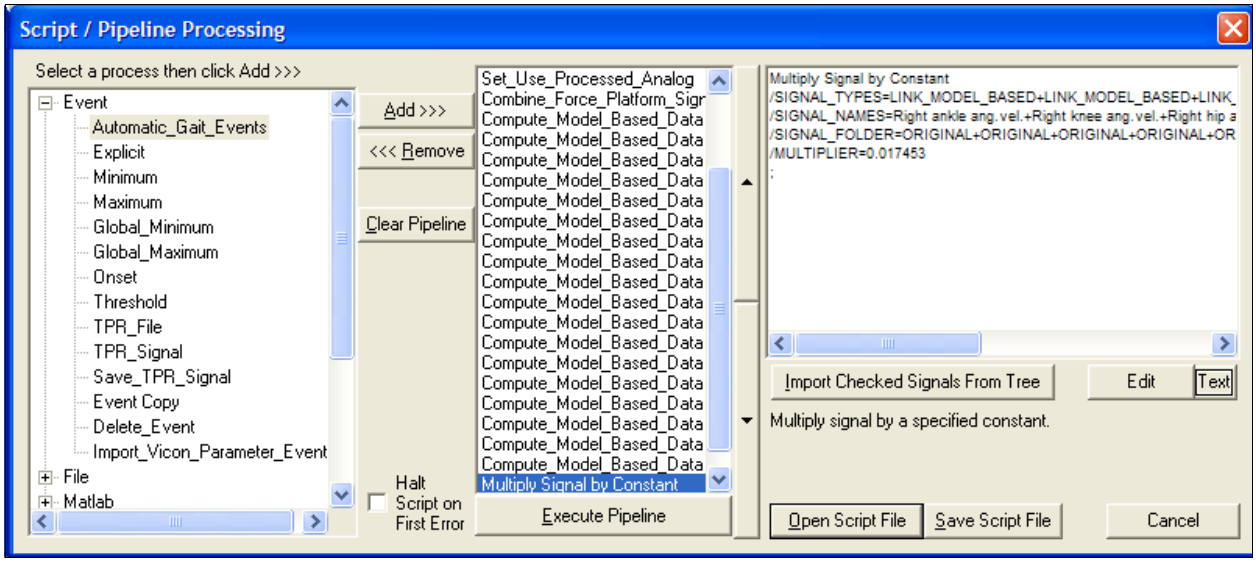
Enter 15 newtons in the *FP threshold* window and check the Z window in the *FP Gravity Direction* frame. The *Use Pattern Recognition to Create (L/R)HS and (L/R)TO labels* must also be checked. A frame window of 8 or larger is sufficient to prevent multiple adjacent events. Press *Done* when complete.



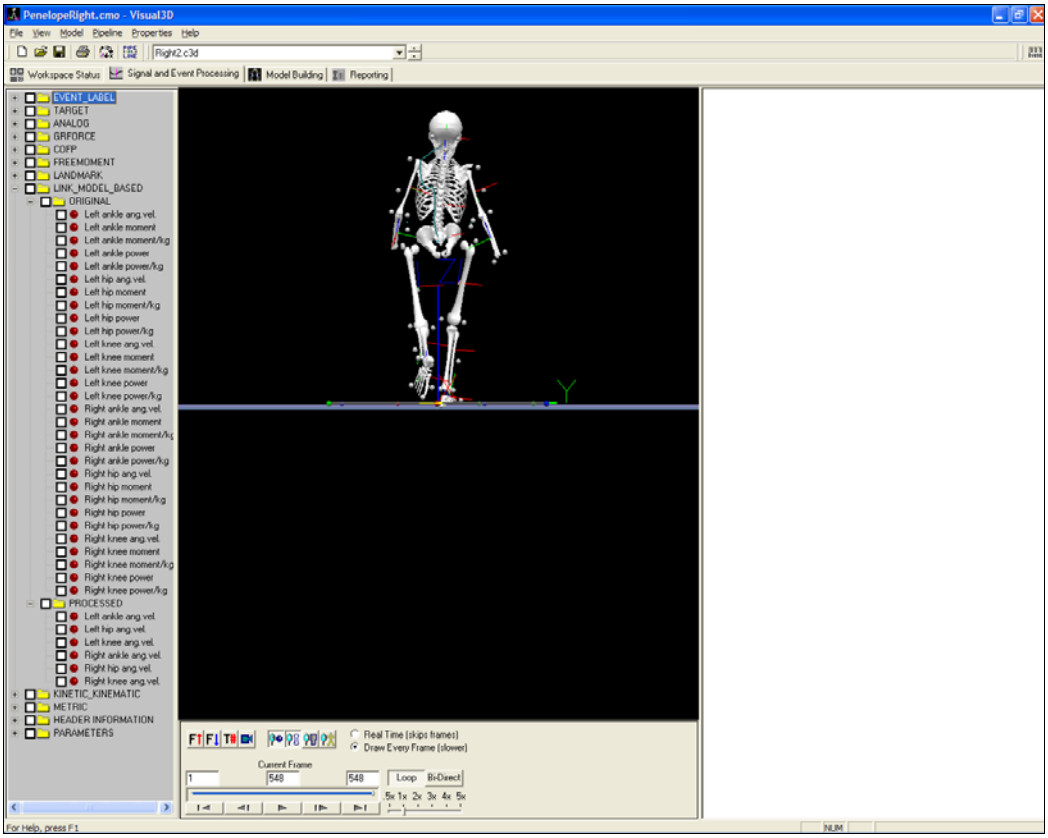
If *ALL_FILES* is selected in the window beside the Pipeline icon event labels will be determined for all loaded trials, otherwise a single trial will be analyzed. Press the *Execute Pipeline* button to start the procedure. Next *Remove* the *Automatic_Gait_Events* from the pipeline.

8: Save the Worksheet .CMO File. Be sure to save your worksheet. The file has a .CMO extension and contains copies of each trial's .C3D file, the model(s) template(s) and the report template. You can also add tags to identify various trial and subject characteristics, such as, gender, dominant foot, gait speed, footwear etc.

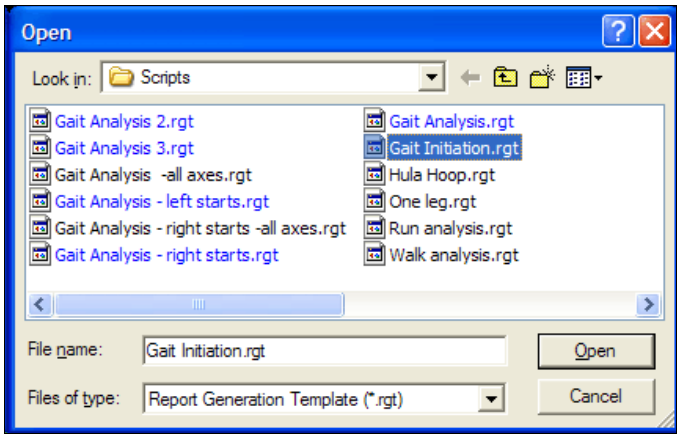
9: Processing. Clear the pipeline then execute the script that will compute the various kinematic and kinetic quantities. The usual script is Process Vicon Data. This Visual3D script (.v3s) file should be in the subdirectory, Scripts, in the Visual3D work directory. From the Pipeline form press the button, *Open Script File* then select file and press the *Execute Pipeline*.



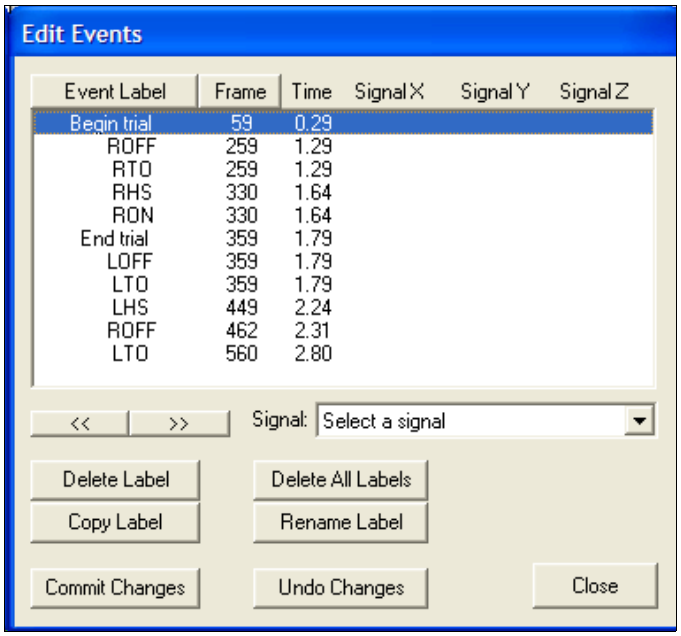
This command may take some time to complete depending on the size of the files and the number of files to be processed. Many more items have now been added to the data tree. Check the *Signal and Event Processing* tab and view the areas *KINETIC_KINEMATIC* and LINK_MODEL_BASED branches.



10: Reporting. Next, select an appropriate report template depending upon the type of motion analyzed. For example, select *Gait Initiation, Gait Termination, Walk Analysis* or *Run Analysis*. From the **File** menu select *Open Report Template* then open the correct file.



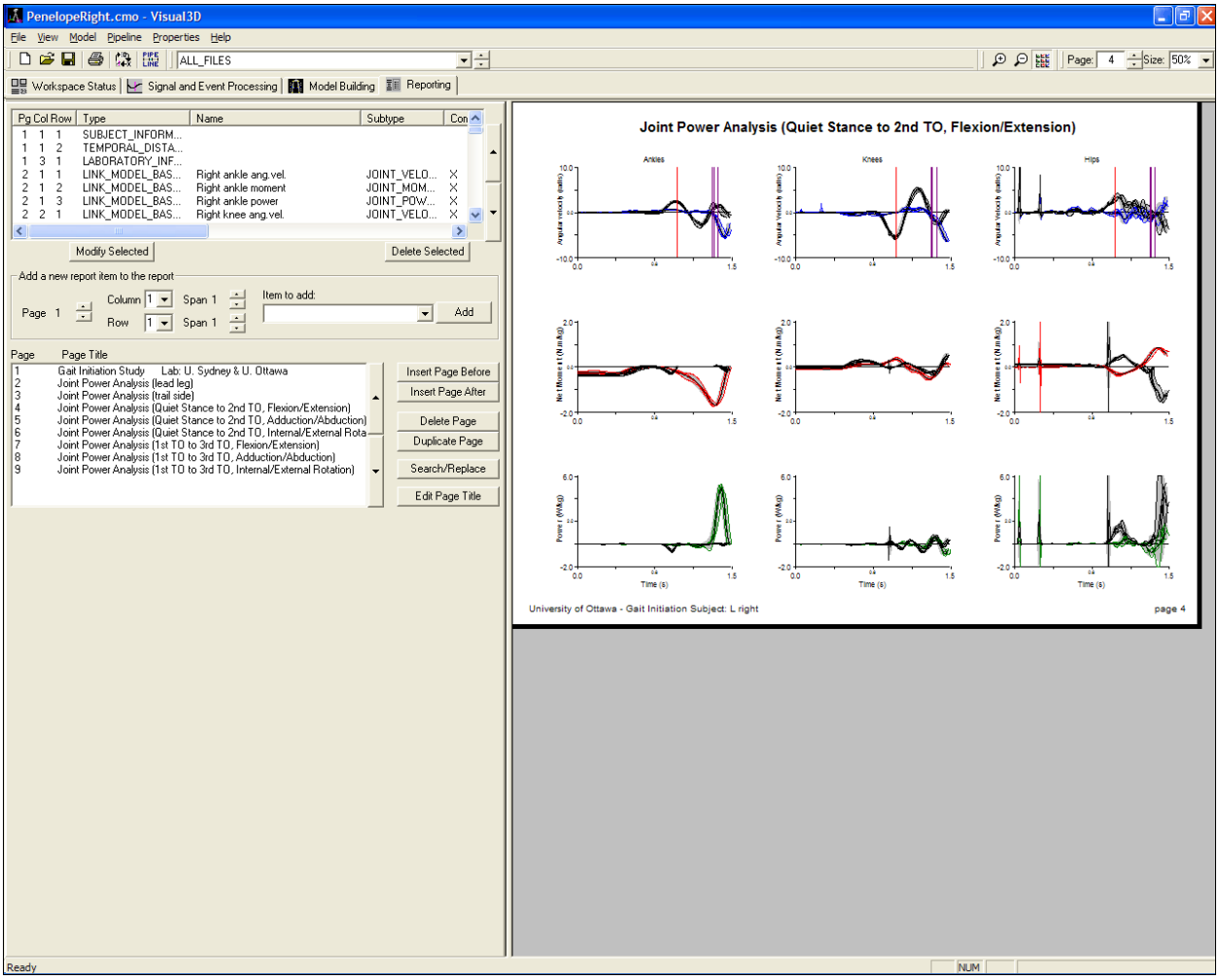
11: Special Events. Before any data are graphed in the Reporting area the correct event codes must be identified in the *Signal and Event Processing* tab. Select this tab and then add the appropriate events such as, *Begin trial* and *End trial* or *Begin stride* and *End stride* or *BeginR, BeginL* and *EndR, EndL*. Press the *Event* button at the top of the form on the right side.



You will need to press the *Recalc* button (beside the Pipeline button) after each trial's event codes have been added. There will be a short delay each time.

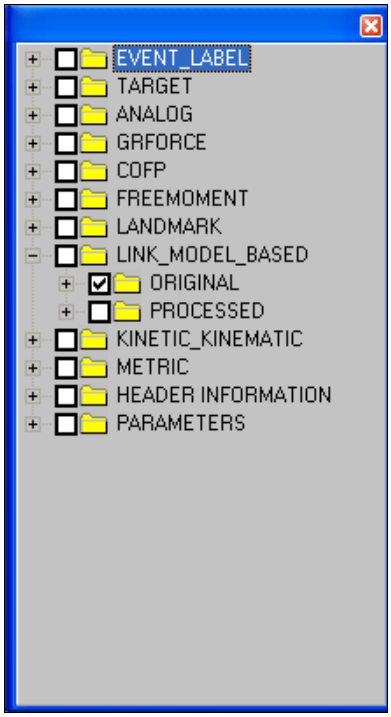
Be sure to save your worksheet. The file has a .CMO extension and contains copies of each trial's .C3D file, the model(s) template(s) and the report template. You can also add tags to identify various trial and subject characteristics, such as, gender, dominant foot, gait speed, footwear etc.

12: Reports. After entering each pair of events click on the *Reporting* tab to see the effects to the various pages in the *Reporting* area.



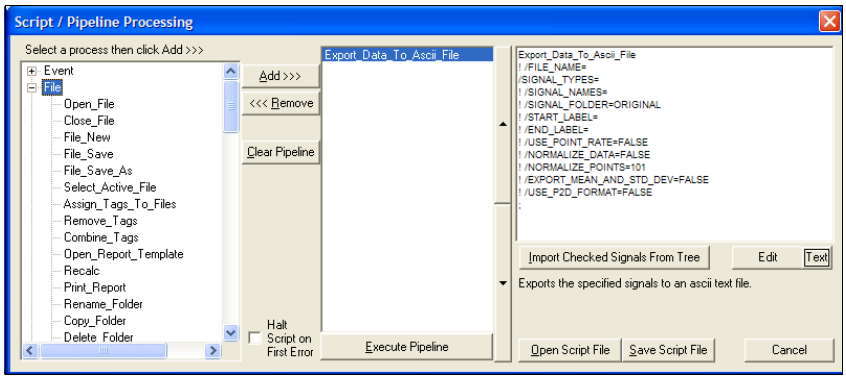
13: Export the Graph to a Document. Be sure to save your worksheet first. Right-click on the graph page that you want to export then select, *Export* <, then either *As Bitmap* or *To Clipboard*.

14: ASCII Export. To export the data in ASCII format to a spreadsheet or graphics program first press the *Signal and Event Processing* tab. Next, check the ORIGINAL folder in the LINK_MODEL_BASED branch.

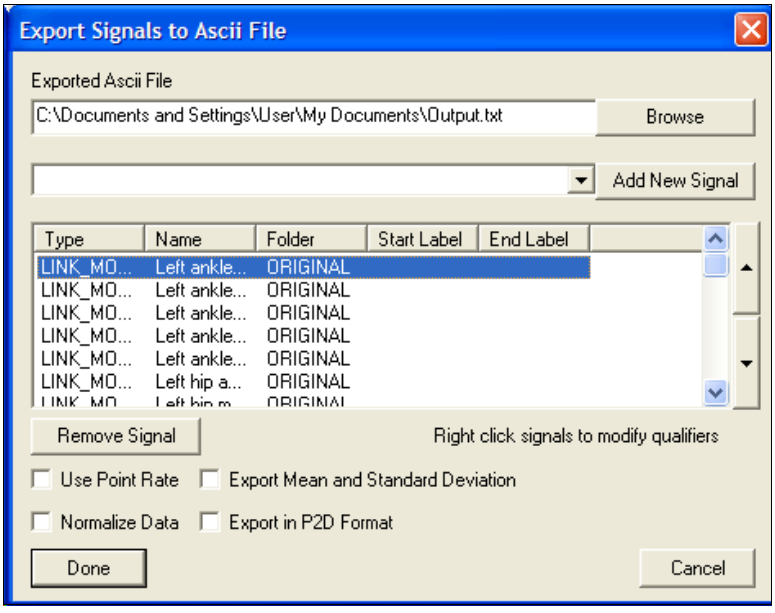


Then open the Pipeline (F11) and remove all entries by pressing the *Clear Pipeline* button.

From the *File* branch, add (*Add* >>>) the command, *Export_to_Ascii_file*, then press the *Insert Checked Signals from Tree* button. Press the *Edit* button.



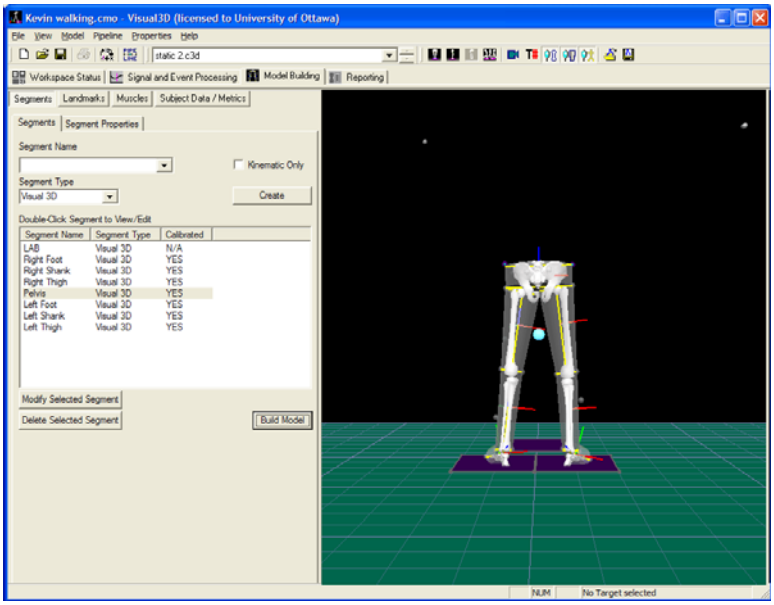
Enter a filename in the first window. Use the *Browse* button so the that the full path is included. Right-click the first item in the signals listbox and click on both *Select Start Event* and *Select End Event* options. You may want to check the *Normalize Data* box and/or the *Export Mean and Standard Deviation* box. Press the *Done* button. To complete the export press the *Execute Pipeline* button and then the *Cancel* button.



Be sure to save your worksheet and exit.

Appendices

Creating Segments. If you want to add or modify a segment, for example, apply the landmarks created in the previous section to the pelvis segment first click on the *Model Building* tab from the main menu then press the *Segments* tab and either double-click on the **Pelvis** item in the list labeled *Double-Click Segments to View/Edit* or select it from the drop-down list labeled *Segment Name* (see figure on right). The form shown below will appear beside the display of the current model.



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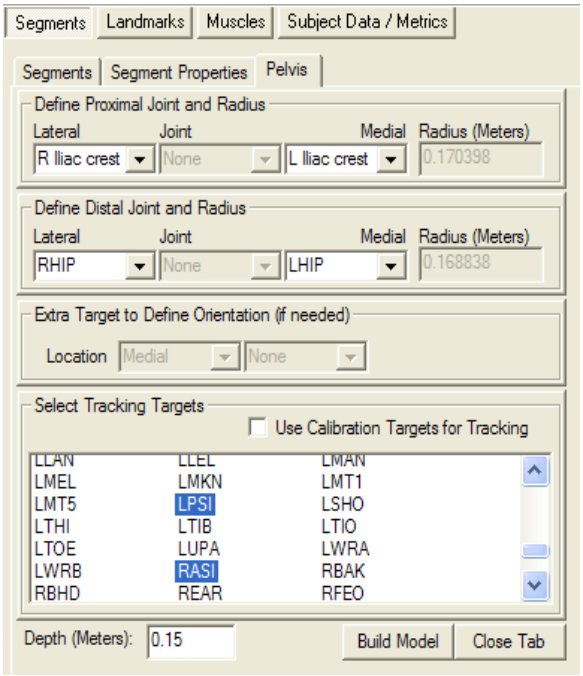


elect the **R Iliac crest** for the *Lateral* proximal end of the pelvis and **L Iliac crest** for the medial proximal end. The *Distal* lateral and medial ends should be the **RHIP** and **LHIP** markers, respectively. Be sure to select the correct tracking markers in the area labeled *Select Tracking Targets*. Click on the first tracking marker, e.g., **LASI** then hold the *Ctrl* key and click on all the other tracking markers for the selected segment. In this case select, **LPSI**, **RASI** and **RPSI**. You could also include the hip markers. Note that when selecting multiple items from a list, each one will become highlighted if the *Ctrl* key is held down, if not only the last item clicked will be selected. You need a minimum of three tracking markers for each segment. These markers should not be on the same straight line. Finish by pressing the *Build Model* button.

Defining Segments Ends and Segment Coordinate Systems. The first step in creating a local segment coordinate system (SCS) is the establishment of the frontal plane. Visual3D allows the user to place either one or two border targets at each end of the segment during subject calibration. Thus, the SCS can be created using two targets (a single border target at each end), three targets (two border targets at one end and a single border target at the other) or four targets (two border targets at each end).

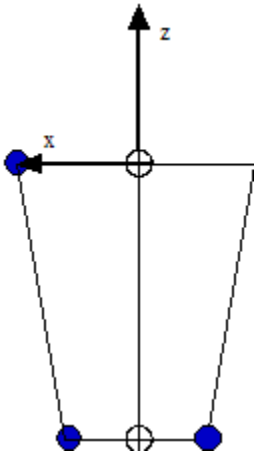


Figure 1. If three border targets are used then the frontal plane is simply the plane define by the three targets.

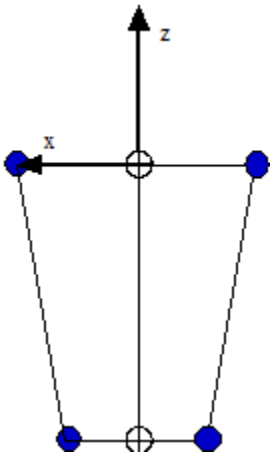


Figure 2. If four border targets are used then a least squares plane is fit to the four targets. The least squares fit is applied such that the sum of squares distance between the targets and the frontal plane is minimized.

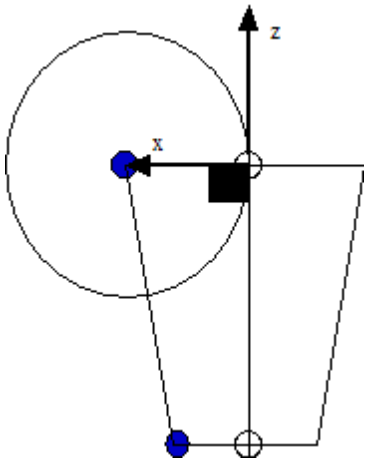


Figure 3. If only two border targets are used then an extra assumption (constraint) must be supplied. In the two-target case, the frontal plane is defined by the plane containing the two targets and the Visual3D coordinate systems (V3CS) X axis. This is equivalent to assuming that there is no internal-external rotation of the segment with respect to the V3CS.

While it is possible to define a segment with only two targets, we strongly encourage that each segment has at least three calibration targets that are used to locate the proximal and distal joint centers and define the frontal plane of the laboratory coordinate system (LCS). The two-target case can be transformed to a three-target case by explicitly creating a virtual target from one of

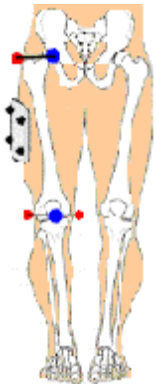
the two targets. In this way, the user has explicitly defined the frontal plane and will not be surprised by the results.

Establishing the Segment Ends. After creating the frontal plane, Visual3D then establishes the distal and proximal segment ends. It should be noted that for kinetic computations, the joint center is assumed to be at the proximal end of the segment distal to the joint. If three border targets are used on a segment, Visual3D creates one segment end at the midpoint between the medial and lateral targets. At the opposite end, where only a single border target is used, Visual3D first defines a circle in the frontal plane (SCS XZ-plane) at a distance of one radius from the border target. Visual3D then establishes the segment end to be the point on the circle such that the vector from that end to the border target will be perpendicular to the vector connecting the two segment ends (Figure 2). If four border targets are used then the midpoints between medial and lateral targets are used to define each end of the segment (Figure 2). If only two border targets are used then, each segment end is established by translating the border one radius along the V3CS X-axis (Figure 2). Note, this translation is along the V3CS X-axis and not along the X-axis of the user's LCS (see Chapter 13 regarding the relationship between the V3CS and the LCS).

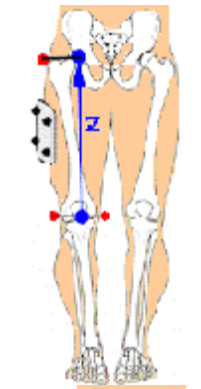
Establishing the SCS X-, Y- and Z-Axes. The SCS Z-axis is determined by the unit vector directed from the distal segment end to the proximal segment end. Next, the SCS Y-axis is determined by the unit vector that is perpendicular to both the frontal plane and the Z-axis. Finally, the SCS X-axis is determined by the application of the right-hand rule. From the above discussion it can be seen that, the SCS Z-axis is directed from distal to proximal, the SCS Y-axis is directed from posterior to anterior, and the SCS X-axis is medial-lateral in orientation.

Establishing the Origin of the SCS. The SCS origin is located along the line connecting the segment ends (the SCS Z-axis) at the segment's proximal joint.

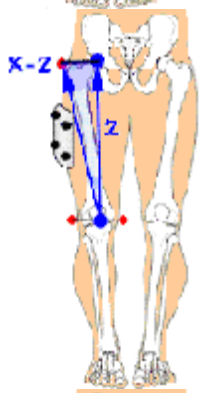
Step-By-Step Procedure.



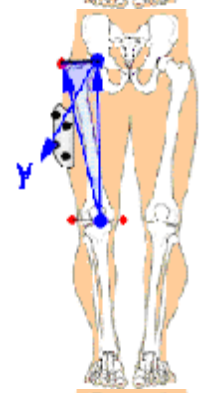
Step 1. The segment endpoints are calculated. As described in the Visual3D documentation elsewhere, there are many ways to calculate the segment endpoint. The relevance to the calculation is that the markers that are used to define the segment endpoints also determine the frontal plane of the segment coordinate system. In this illustration the three red markers are used to calculate the blue segment endpoints



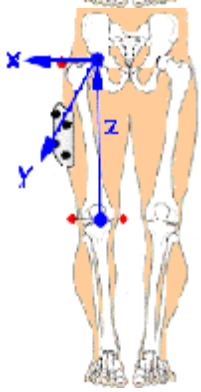
Step 2. The z-axis is defined by the vector from the distal segment endpoint to the proximal segment endpoint.



Step 3. The frontal plane (x-z) plane is defined by the markers.

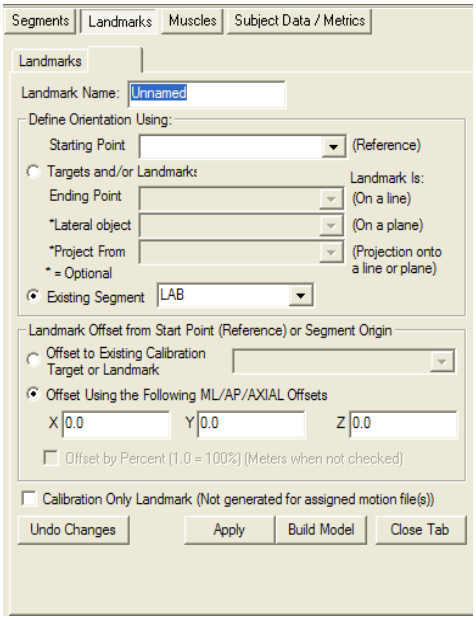


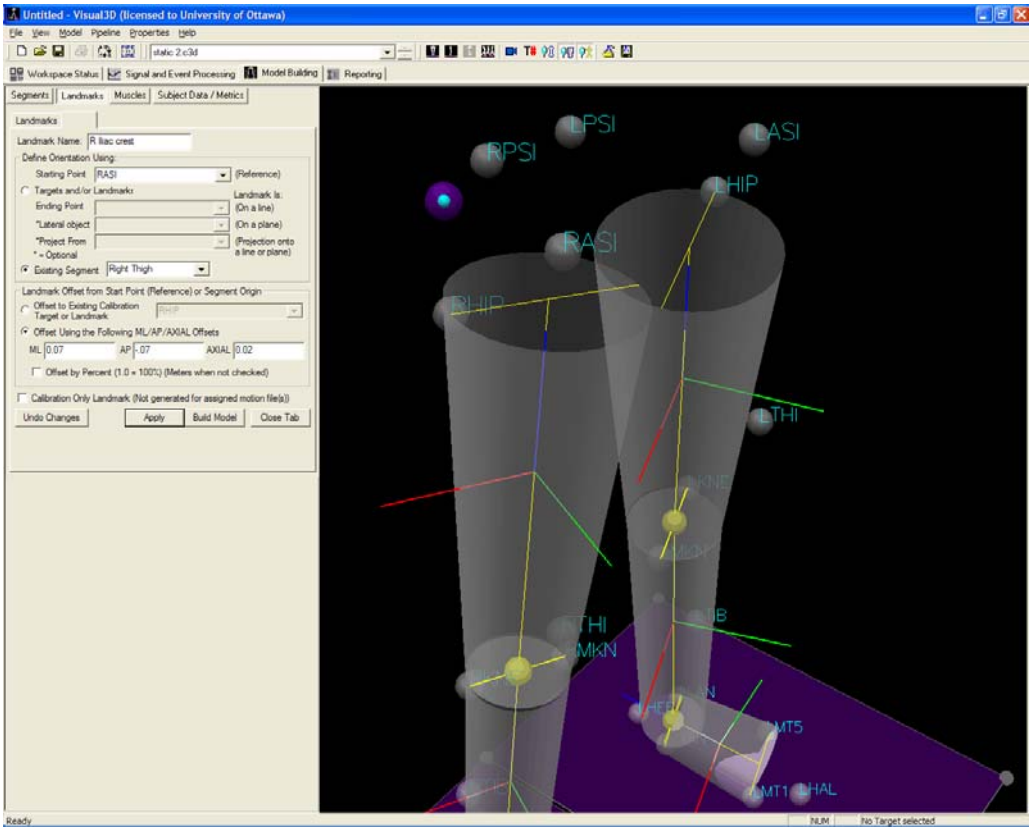
Step 4. The y-axis is projected forward in the anterior posterior direction.



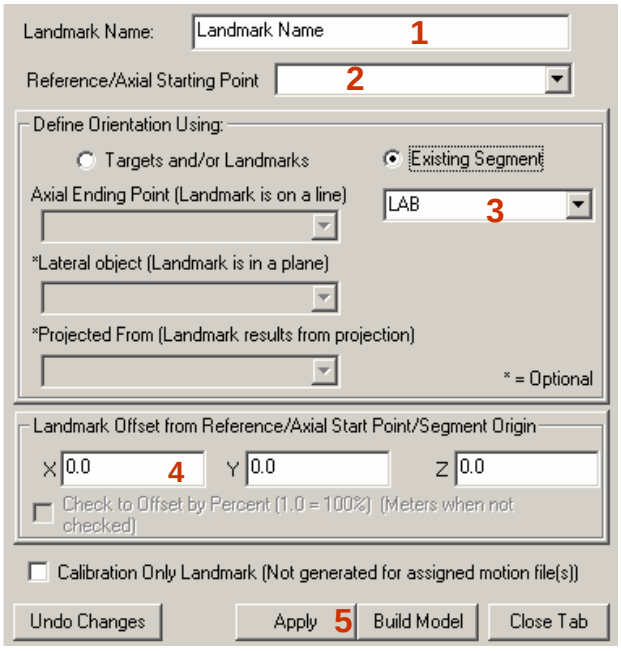
Step 5. The x-axis is then calculated perpendicular to the y-z plane.

Creating Landmarks. If you did not include the left and right iliac crests (for example) as markers but instead applied markers to the left and right anterior and posterior superior iliac spines you can create virtual markers, called landmarks, to identify the lateral and posterior distal ends of the pelvis. The following example shows how this is done. Note, that there are several ways to create landmarks. First press the *Model Building* tab, then the *Landmarks* tab and the *Add New Landmark* button. The landmark creation form (see figure at right) will appear. Enter the landmark's name in the box labeled *Landmark Name:*, e.g., **R Iliac crest**. Select **RASI** as the *Starting Point.* Be sure that the radio button, *Existing Segment:* is selected and click on **Right Thigh**. Select the radio button, *Offset Using the Following ML/AP/AXIAL Offsets*. Enter offsets, in metres, in the next three boxes, for example, 0.07, -0.07, 0.02. Press the *Apply* button and a purple sphere with cyan centre will appear at the location of the newly created landmark (see figure below). You may have to change either of the three offsets to precisely locate the landmark. Press *Close Tab* then repeat for the left iliac crest (L Iliac crest) but change the first offset to –0.07.





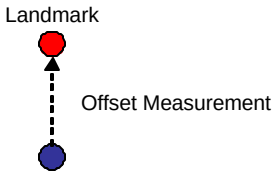
To Create a Landmark of Each Type



- Starting point defined in Field 2

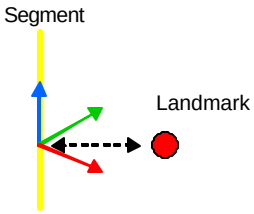
- Offset uses coord system in Field 3

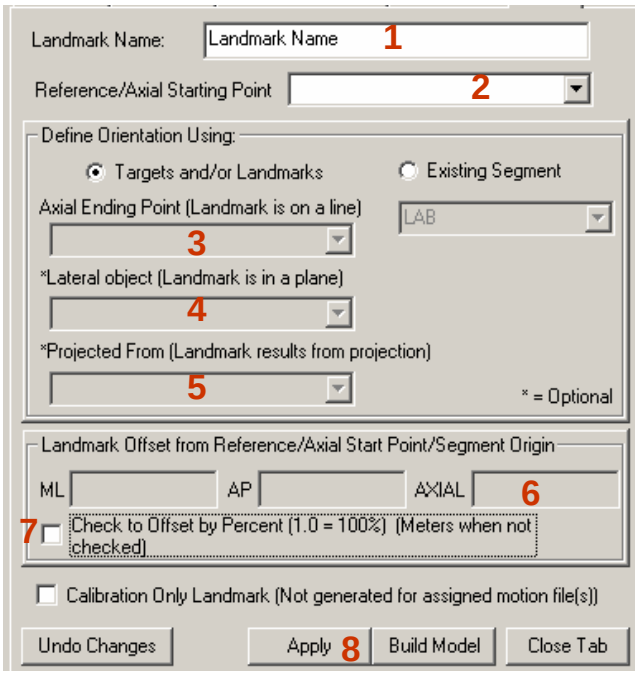
- Actual offset specified in Field 4 (in meters)

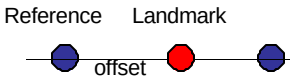


- Field 2 is blank, so starting point is assumed to be (0,0,0) of coordinate system in Field 3

-Actual offset specified in Field 4 (in meters)







- Fields 2 (reference) and 3 define a line

- Offset specified in Field 6
  - In meters from field 2 if field 7 not checked
  - In percentage of line's length from field 2 if field 7 is checked

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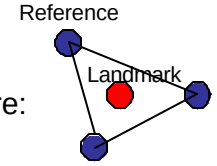
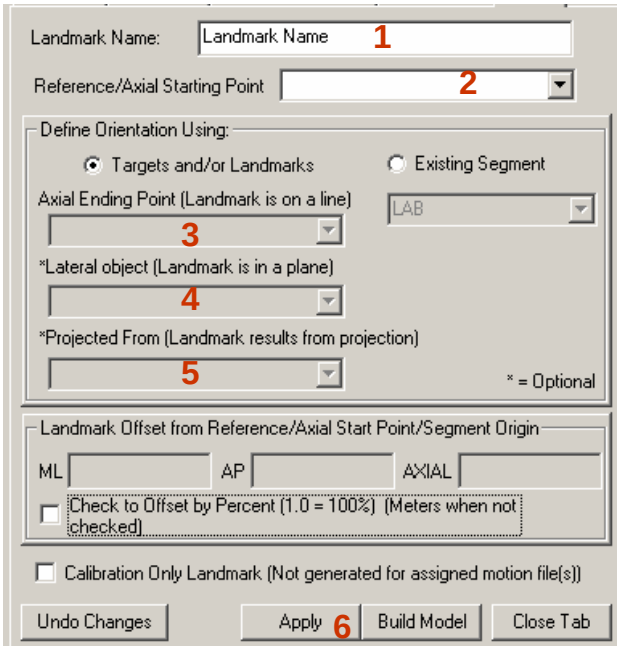
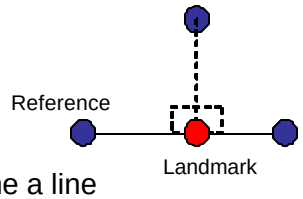
- Fields 2, 3 and 4 define a plane
- Offset from field 2 (reference) (in meters) with respect to the plane where:
  ML is Medial/Lateral (left/right)
  AP is Anterior/Posterior (front/back)
  AXIAL (up/down)





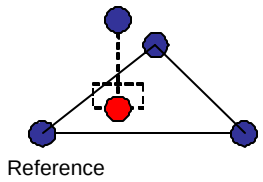


- Fields 2 (reference) and 3 define a line

- The landmark is on the line, as the result of a right angle projection from Field 5

- Fields 2, 3 and 4 define a plane

- The landmark is in the plane, as a result of a right angle projection from field 5



Now, back to the tutorial….