Vicon Nexus Integration

Overview

Vicon Nexus is an all-inclusive modeling and processing tool for movement analysis that was created specifically for the whole life sciences community. Nexus integrates data collection from multiple components, including, but not limited to trajectory data, force plates, EMGs, and IMUs.

This guide outlines the process of transferring both static calibration and dynamic trials from Nexus to Visual3D with correct marker labeling. It can be applied to either a custom marker set (created by the end user) or a commonly used community-defined set (provided by Vicon). Once the fully processed C3D file is exported from Nexus, it can be imported into Visual3D, where a biomechanical model can be built and analyzed.

Purpose: This tutorial provides a step-by-step workflow for collecting marker-based data, labeling, and exporting motion capture data using **Vicon Nexus**, and importing it into **Visual3D** for biomechanical modeling and analysis.

In this example, we are using a custom marker set.

Step 1 - Nexus

Before proceeding, ensure the chosen marker set is placed on the subject and both a static and dynamic trial have been collected.

Step 1a - Static Calibration Trial

1. Marker Placement

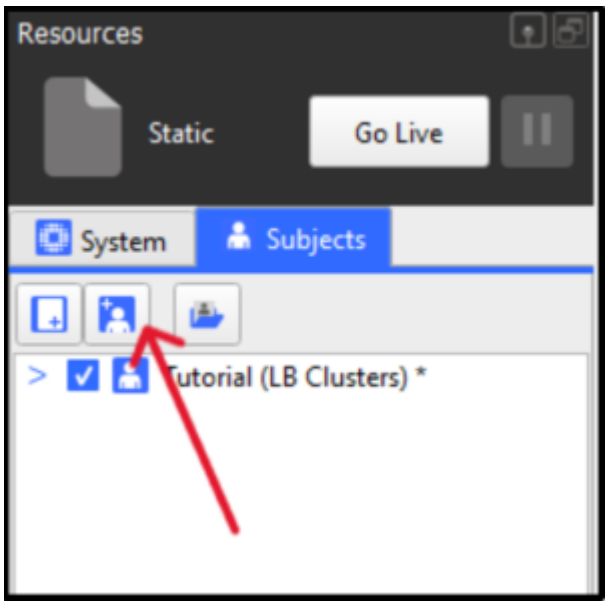
- Place the desired markers on the subject (either a custom marker set or a commonly used community-defined set).

2. Capture Static Calibration Trial

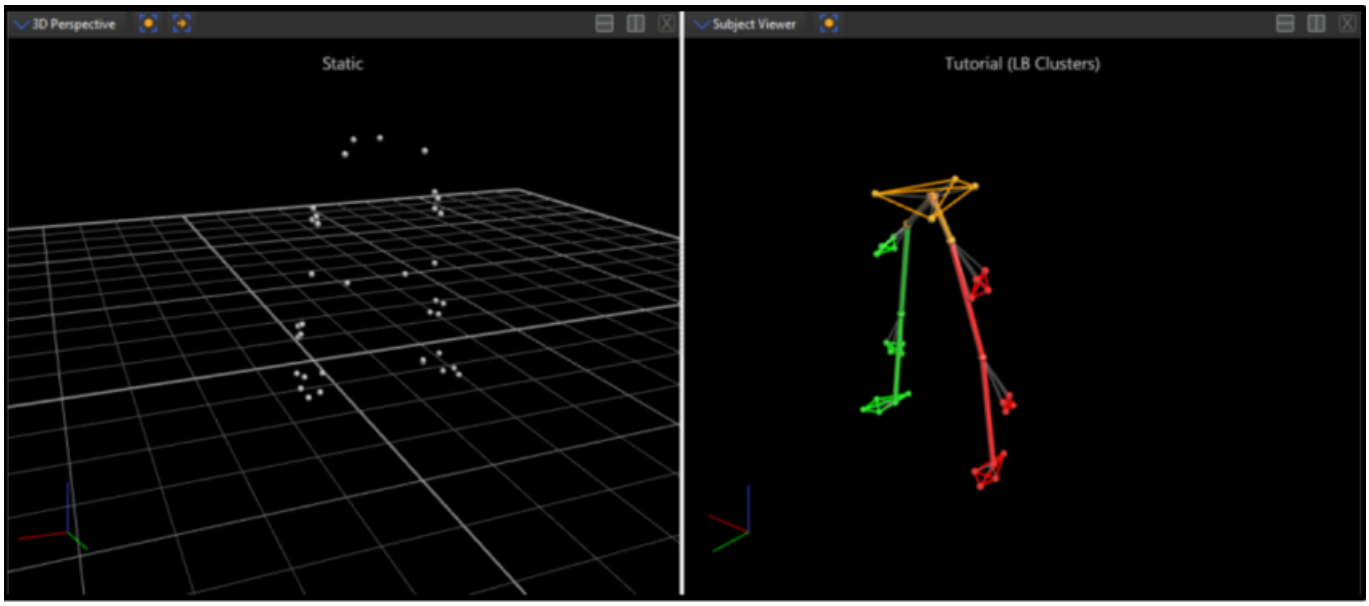
- Capture a static trial.

3. Creating a New Subject from a Labeling Skeleton Template

- Load the desired Vicon Labeling Skeleton Template(VST) (one provided by Vicon or a custom VST)
- Vicon Labeling Skeleton Template is a Vicon Nexus file type to describe the relationship between segments, joints, and marker sets.



Below are two different viewing options in Nexus that visualize the marker set and the VST. The recorded static trial shows markers in both the 3D Perspective and Subject Viewer, containing the markers, segments, and joints defined by Vicon.

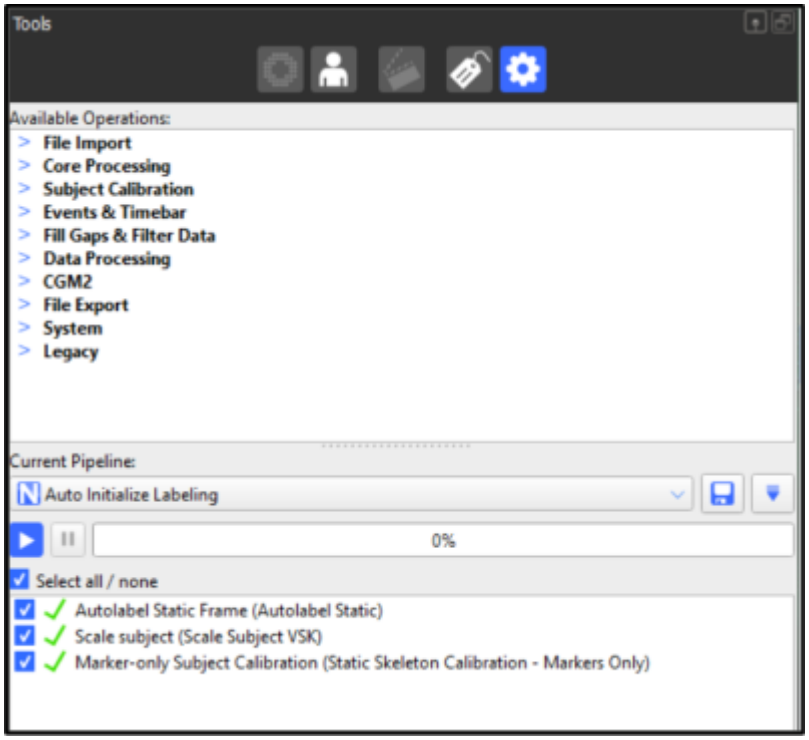


4. Reconstruct the Static Calibration Trial

- To reconstruct the markers, on the **Tool Bar** click the Reconstruct button or run the **Reconstruct Pipeline**.

5. Auto Initialize Labeling Pipeline

- Run the first step of the pipeline individually (**Auto Label Static Frame**) to assess the labeling quality and correct any incorrect labels.
- Once satisfied, run the following two steps in the pipeline to scale the subject and create a Vicon Labeling Skeleton file(VSK) and to automatically label the markers.



6. Export as a C3D File

- From the **Tools** tab, select the appropriate export command. To integrate with Visual3D, export the static trial as a **C3D file**.

Step 1b - Dynamic Trial

1. Capture Dynamic Trial

- Record the dynamic trials of interest.

2. Run the Reconstruct and Label Pipeline

- To reconstruct the markers, on the **Tool Bar** click the Reconstruct button or run the **Reconstruct Pipeline**.

3. Gap Filling and Cropping

- When Nexus reconstructs each marker on a subject, the ideal outcome is a smooth, continuous trajectory throughout the trial. In practice, however, breaks may occur in the trajectories when certain markers cannot be reconstructed. Reference here for more information on how to do this, Filling gaps in trial data.
- Crop the trial if the subject starts or ends outside the data capture volume. Reference here for more information, Cropping trials.

4. Export as a C3D File

- From the **Tools** tab, select the appropriate export command. To integrate with Visual3D, export the static trial as a **C3D file**.

Step 2 - Visual3D

Once the static file has been properly labeled and scaled to the subject, the C3D file can be imported into Visual3D for further processing, analysis, and visualization.

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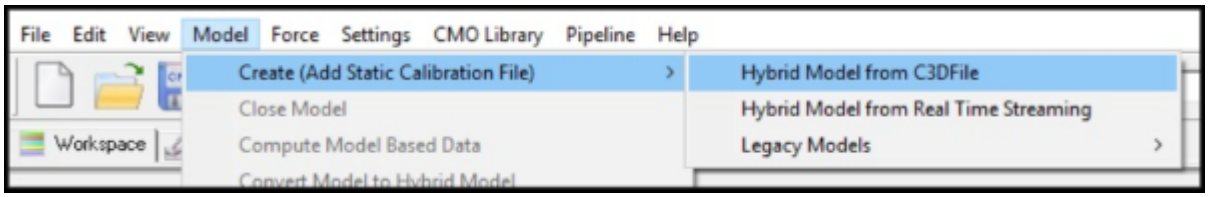
1. Import the Static File

- From the **Model** menu, select **Create → Hybrid Model from C3D file**.
- Select *Static.c3d* and click **Open**.

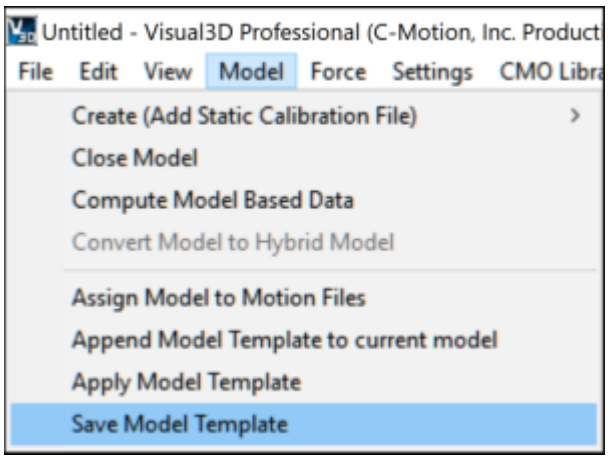


2. Build the Model

- In the **Model** tab, build the model based on the marker set used.
- In this example, the Plug-In Gait Lower Limb tutorial was used as instruction to build the lower body model.

3. Save Model Template (.mdh file)

- Go to **Model → Save Model Template** to save the model as an `.mdh` file.

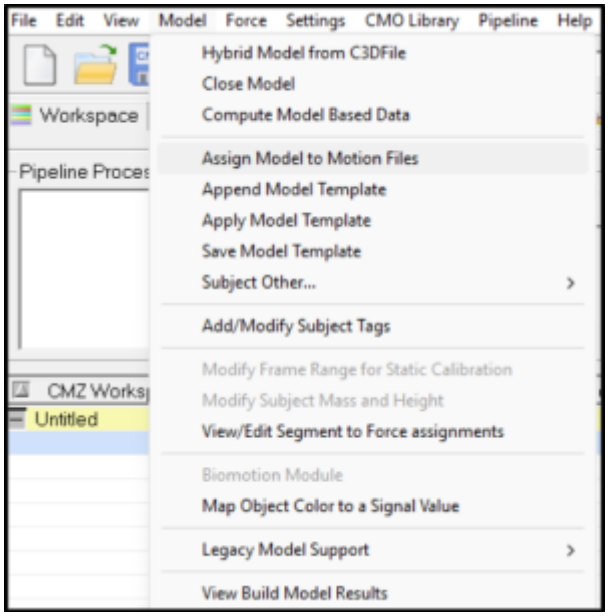


4. Open the Motion Files

- In the **Workspace** tab, open the motion file(s).
- Ensure **Insert new files into your currently open workspace** is selected.

5. Assign the Model to the Motion Files

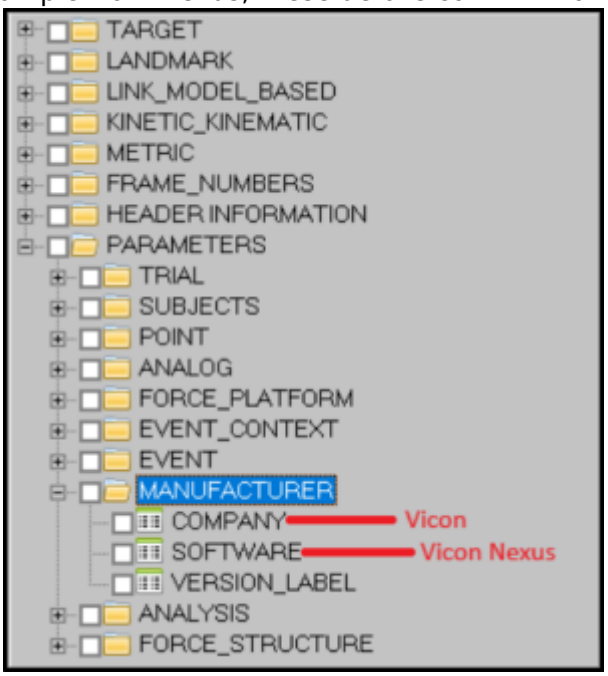
Now that the model has been built, it can be applied to the motion files of interest.



6. Validate the Origin Location within a C3D File

Once the dynamic files have been imported, you can verify the file's origin to ensure it was created in Vicon.

In the Datatree, under the **Manufacturer** folder, the Company, Software, and Version Label fields are listed for the C3D file. In this example from Nexus, these details confirm that the file originated from Vicon, specifically Vicon Nexus.



7. Analysis

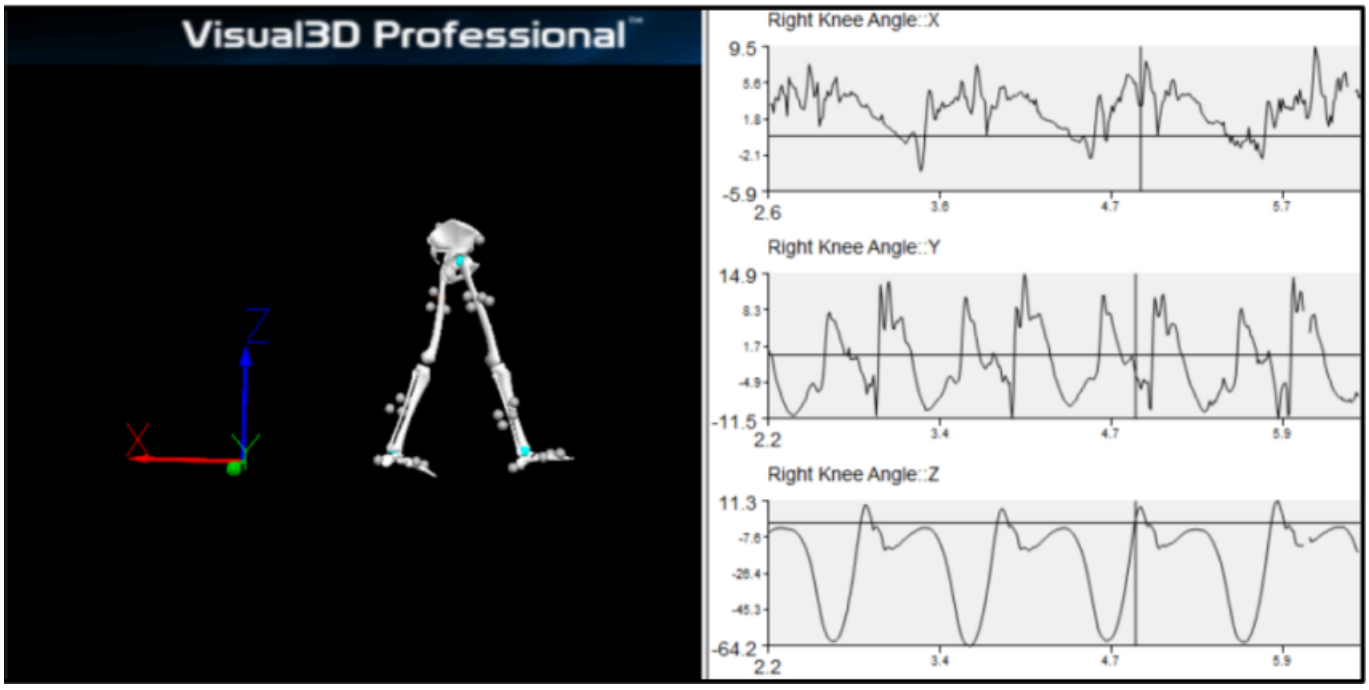
Analysis can begin once the model template has been applied to the motion files. Within the **Models** tab, or using the Compute Model Based Data Pipeline, computations such as joint angles can be performed (e.g., knee joint angles).

Example pipeline command:

```
Compute_Model_Based_Data
/RESULT_NAME=Right Knee Angle
/SUBJECT_TAG=ALL_SUBJECTS
/FUNCTION=JOINT_ANGLE
/SEGMENT=RSK
```

```
/REFERENCE_SEGMENT=RTH
/RESOLUTION_COORDINATE_SYSTEM=
! /USE_CARDAN_SEQUENCE=FALSE
! /NORMALIZATION=FALSE
! /NORMALIZATION_METHOD=
! /NORMALIZATION_METRIC=
! /NEGATEX=FALSE
! /NEGATEY=FALSE
! /NEGATEZ=FALSE
! /AXIS1=X
! /AXIS2=Y
! /AXIS3=Z
! /TREADMILL_DATA=FALSE
! /TREADMILL_DIRECTION=UNIT_VECTOR(0,1,0)
! /TREADMILL_SPEED=0.0
;
```

After the above command is run in the pipeline or after the use of the compute model based dialog the following signal will appear in LINK_MODEL_BASED. Seen below, the skeletal model beside the calculated right knee signal



By following these steps, you can efficiently transition from marker-based data collection in Vicon Nexus to biomechanical modeling and analysis in Visual3D. Ensuring accurate labeling, calibration, and export will produce reliable and reproducible results for your motion capture workflow.