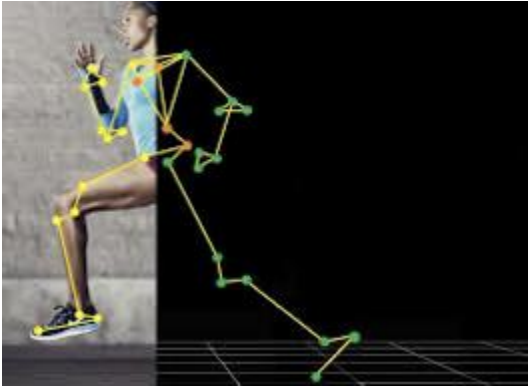# QUALISYS MANUAL

Movement Neuroscience Lab MNL

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**Introduction:**
Welcome to the Qualisys (QTM) Manual!

This manual will be a reference for all students in the MNL who have been assigned to Qualisys data processing. Raw data are collected in the MOCAP lab with participants having markers attached to their bodies and completing movement tasks (usually passing an object – handover task). To give you a better idea, take a look at figure 1 below, where you can see two participants with their markers attached to them completing their task.
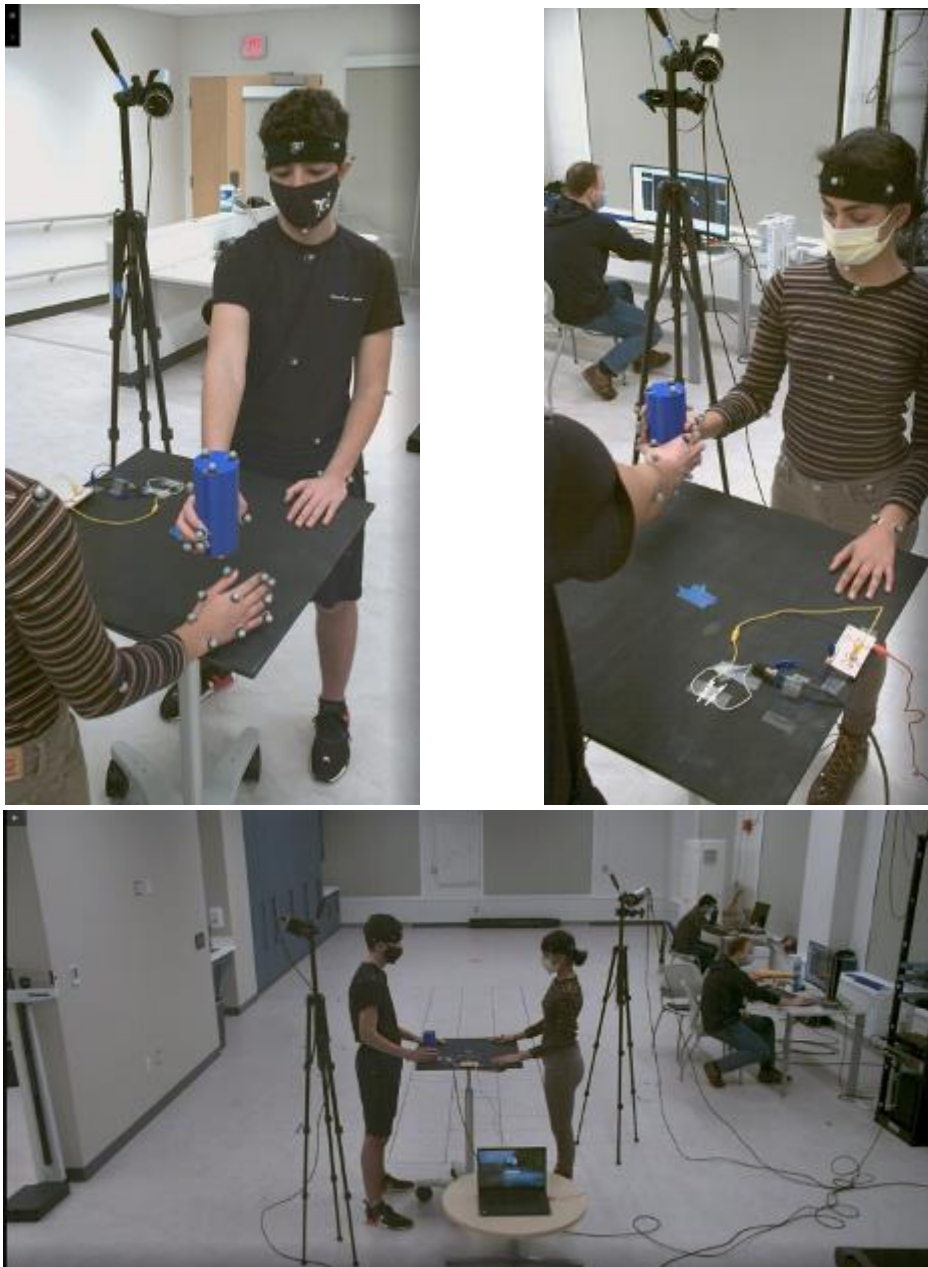
As you can imagine, these markers are not perfect. When we pull up the data on the Qualisys track manager software (QTM), we are often met with many markers that have what we call "gaps." These gaps are lapses in time where the cameras in the MOCAP lab were unable to capture any specific marker for whatever reason (usually a participant unintentionally blocking the camera's view). As a result, we need to try to "fill" these gaps to the best of our ability to make the data more smooth and easier to analyze. In this manual, we will go over different techniques to help guide you through the process of filling the gaps and processing the data from the QTM.
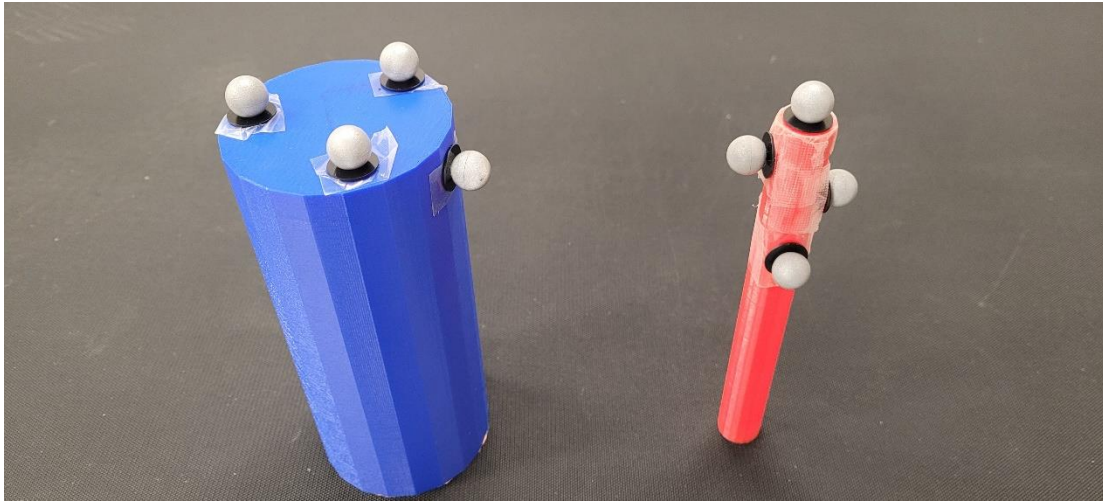
Marker Placement:

Right Hand (8 Markers)
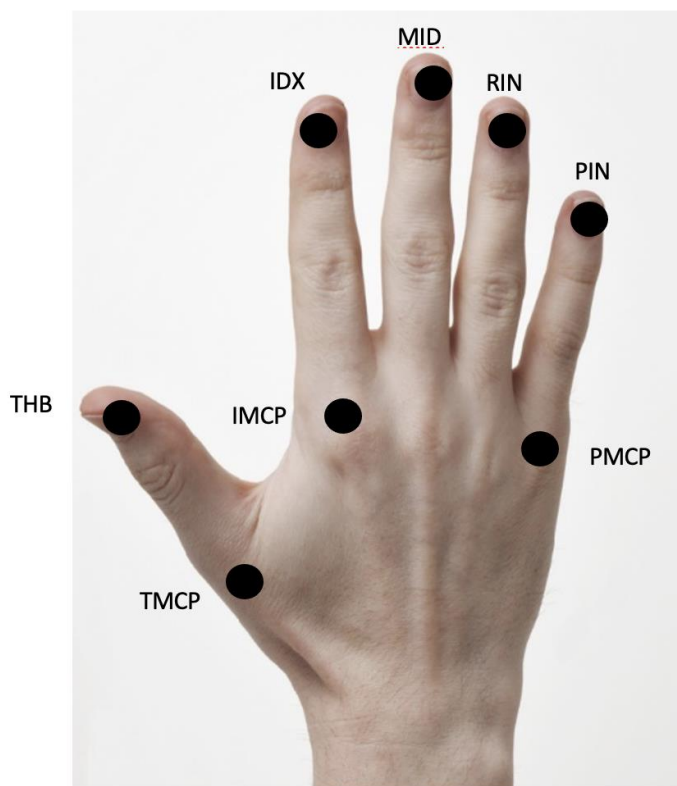
**Body (47 markers), Hellen Hayes model with modifications:**
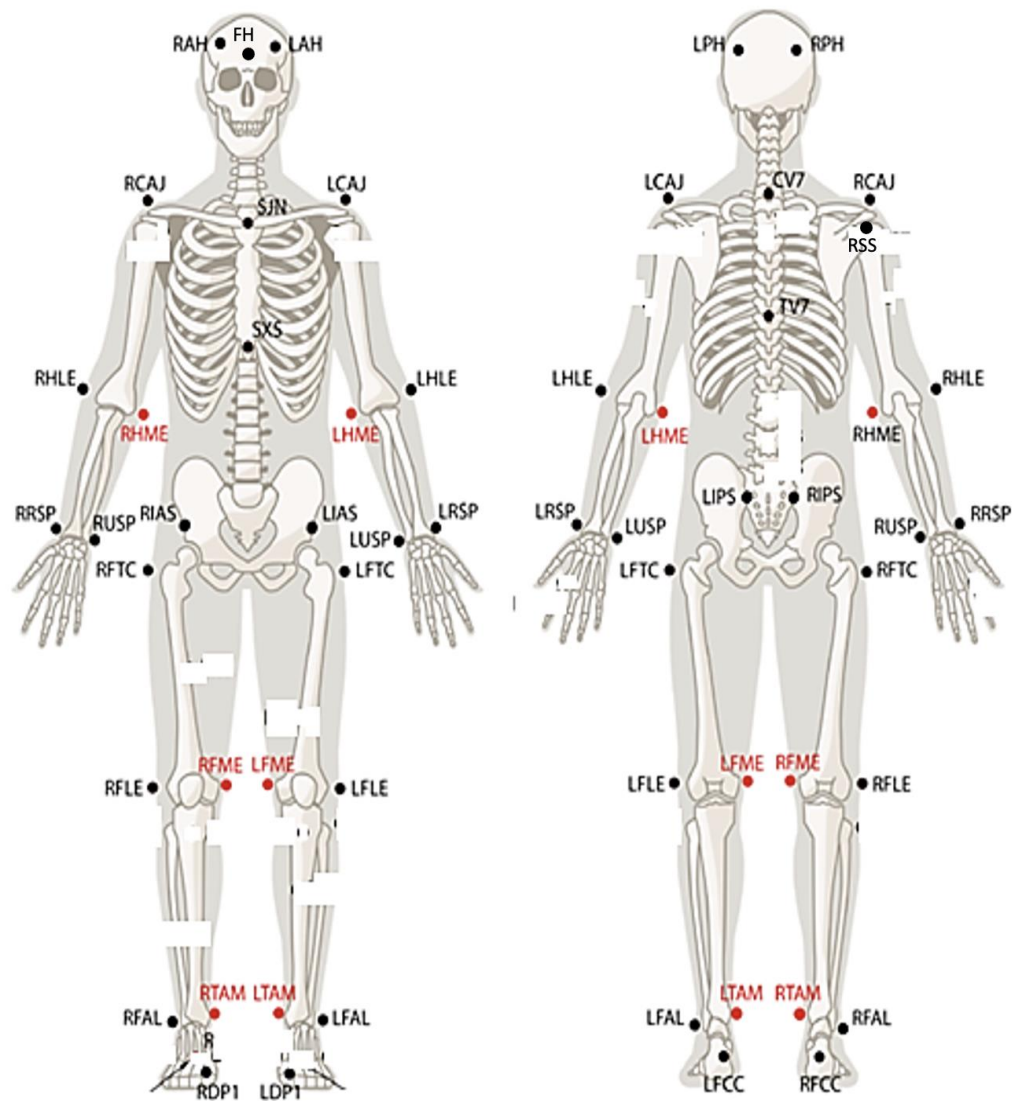
+ 4 markers on object (large – cylinder, small – pen)

Model Creation:

1. Open Qualisys Track Manager and select the specific project in the pop-up window titled "Manage Projects" (ex. Hand2Hand project) and click *open*
   a. The files can be accessed via the Z-Drive (ex: Z:\M3X_Grant\QTM\Hand2Hand, Z:\M3X_Grant: H2H_MOCAP_Marker_names)
      i. Tuniklab(Z:)-->M3X grant-->QTM-->Hand2Hand-->Data\
      ii. Under *View* in the toolbar at the top of the screen make sure to have "Project View" selected. It allows you to see the File name pane on the left-handed side of the screen.
   b. More files and trials will be added as time goes on
2. Select the desired trial to begin under the File name pane
   a. These will be located under the File name pane, each trial being contained in a specific folder
3. Press reprocess option in upper menu
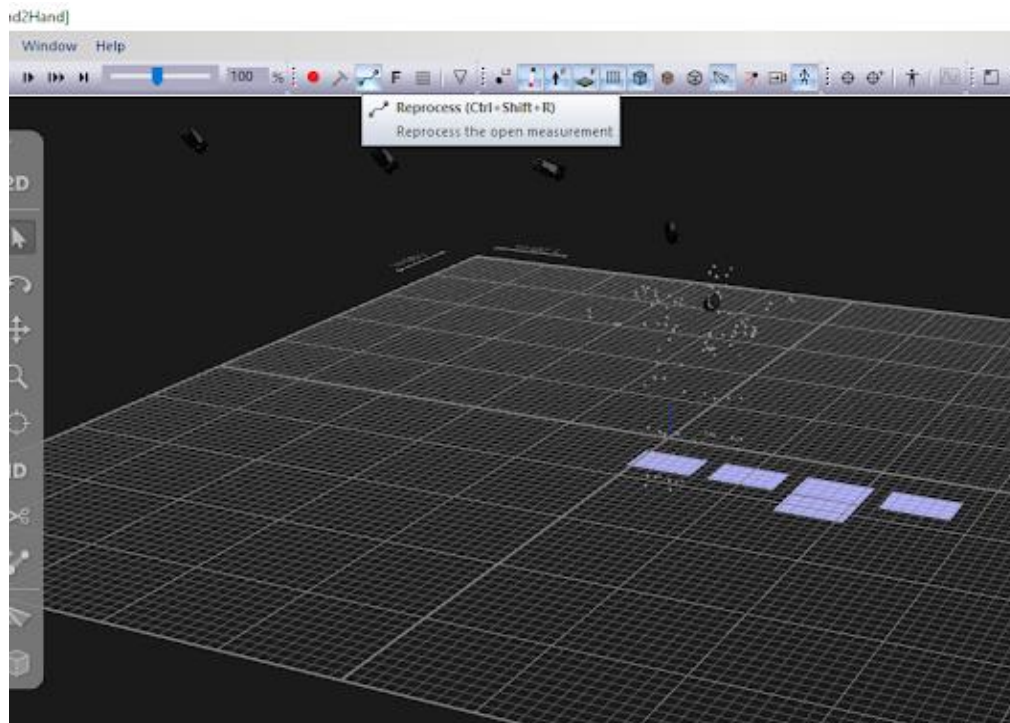
   a. Select 3D tracking and change margin of error to 15
   b. Change "Minimum ray count per marker:" to 2, then click *OK*
4. Click AIM in the toolbar (see picture below) and select apply model (make sure proper models and object are selected).
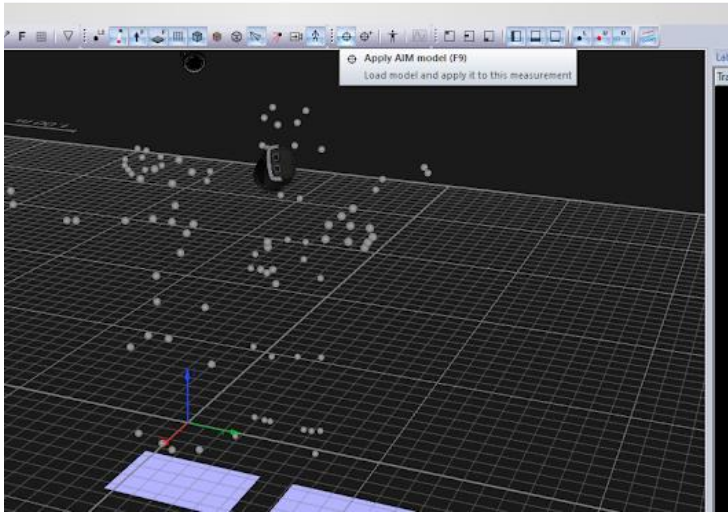
5. Make sure the proper models and objects are selected under "Filename"
   a. Choose the desired models (usually from the right panel, ex:Object_Pen.qam, Sub1, Sub2)
   b. Click *OK* (The model is now applied to the dots representing each marker on the screen)

Filling Gaps, Part 1:

1. In the top right "Labeled Trajectories", next to "Trajectory," click "Fill Level", so that the lowest percentages are at the top
2. When moving the cursor to underneath the section labeled "Identified Trajectories", a double arrow should replace your cursor
3. Click and pull up the unidentified and discarded trajectories
   a. Any gap-filled or trajectories less than 1% may be deleted and not used (sent to discarded section)
   b. Any trajectories greater than 1% must be moved to the unidentified trajectory section by pressing delete
      i. These trajectories will be covered in a later section

Filling Missing Trajectories:

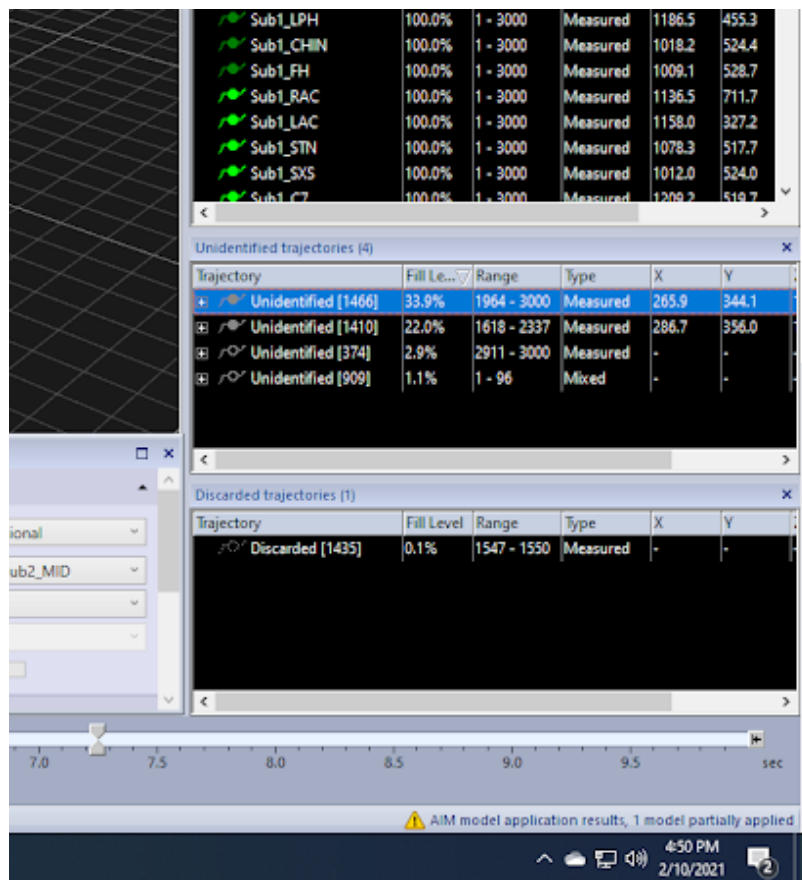Sometimes, even when the models are applied, some trajectories are missing. In which case, you will need to match the markers to their corresponding body part.

1. Select an unmatched (gray) trajectory
2. Drag the corresponding trajectory from the unidentified trajectories pane in bottom right to proper body part in the trajectory pane (i.e. trajectory SUB1_FH)
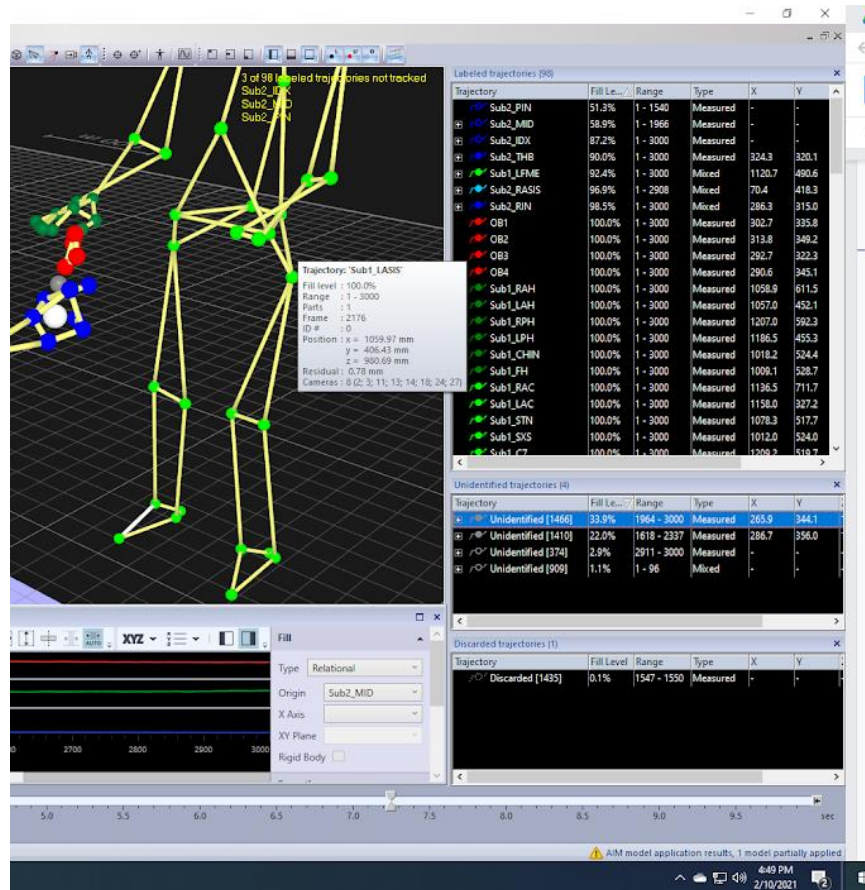
Filling Gaps, Part 2: Unidentified/Discarded Trajectories:

1. Select an unidentified trajectory under "Unidentified trajectories" panel, and find where it is in the movement pattern (marker lights up white in the model).
2. After identifying where it is, drag the marker from the unidentified section to the correct trajectory under "Labeled trajectories" panel.
   a. Ex. Unidentified trajectory>Sub1_IDX
3. Repeat this process until there are no unidentified or discarded markers of greater than 1% Fill level left.

Sub1_LPH	100.0%	1 - 3000	Measured	1186.5	455.3
Sub1_CHIN	100.0%	1 - 3000	Measured	1018.2	524.4
Sub1_FH	100.0%	1 - 3000	Measured	1009.1	528.7
Sub1_RAC	100.0%	1 - 3000	Measured	1136.5	711.7
Sub1_LAC	100.0%	1 - 3000	Measured	1158.0	327.2
Sub1_STN	100.0%	1 - 3000	Measured	1078.3	517.7
Sub1_SXS	100.0%	1 - 3000	Measured	1012.0	524.0
Sub1_C7	100.0%	1 - 3000	Measured	1209.2	519.7

Unidentified trajectories (4)

Trajectory	Fill Le...	Range	Type	X	Y
Unidentified [1466]	33.9%	1964 - 3000	Measured	265.9	344.1
Unidentified [1410]	22.0%	1618 - 2337	Measured	286.7	356.0
Unidentified [374]	2.9%	2911 - 3000	Measured	-	-
Unidentified [909]	1.1%	1 - 96	Mixed	-	-

Discarded trajectories (1)

Trajectory	Fill Level	Range	Type	X	Y
Discarded [1435]	0.1%	1547 - 1550	Measured	-	-

ional

ub2_MID

7.0   7.5   8.0   8.5   9.0   9.5   sec

AIM model application results, 1 model partially applied

4:50 PM
2/10/2021

Filling Gaps, Part 3:

1. Select given trajectory that is less than 100% (i.e. Sub_1_IDX)
2. Find gaps indicated by brown in central pane titled "Trajectory Editor"
3. Highlight gap by right clicking it and pressing fill (you may also simply press F)
   a. Alternative, you may click and hold area before gap and run cursor along the trajectory editor to highlight multiple gaps

9
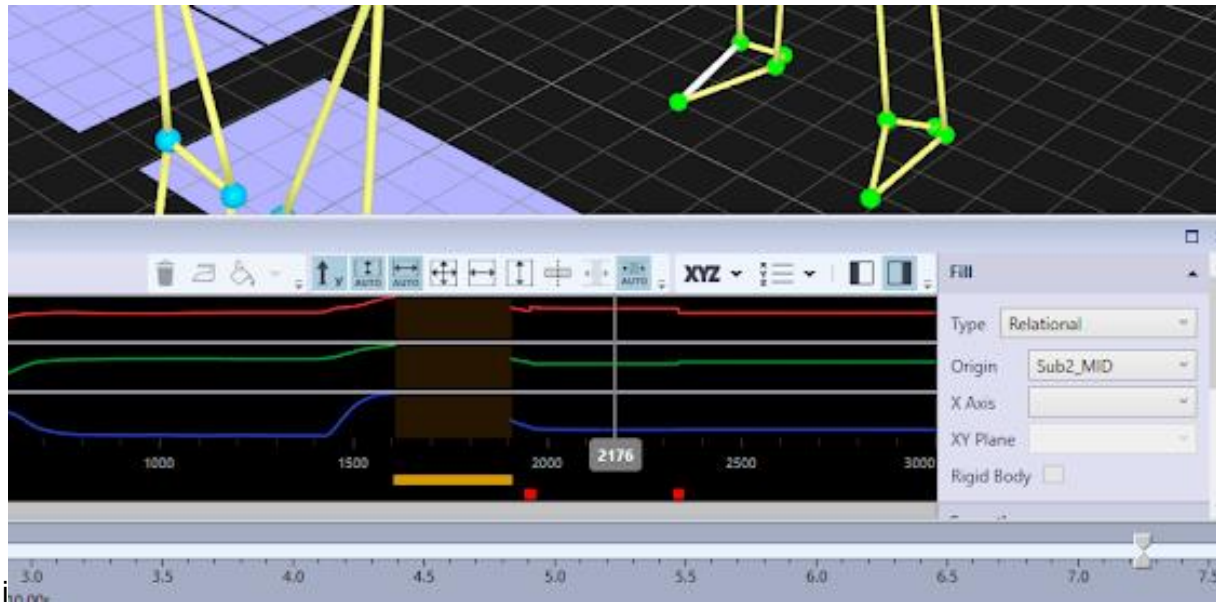
4. Run trial across recently filled timeframe
   a. If the gap you filled is realistic and normal, move on
   b. If abnormal movement pattern detected, proceed to step 5
5. Move cursor to the right of the central movement pane and to the left of discarded and unidentified trajectory panes
6. Your cursor should become a double-sided arrow
7. Click and move this arrow to the left to reveal the "Fill" section
8. Here, you may choose the best fill "type" specifications to fill the gap from the drop-down menu
   a. Relational filling (another method of filling gaps) will be covered in the next topic
9. Choose each version of filling to see which one is the most adequate and shows the most natural movement pattern by clicking and holding the cursor underneath the trajectory editor
   a. Note: Each version will not fill itself. After each fill, you will have to undo (ctrl+z), select the new version, and fill again
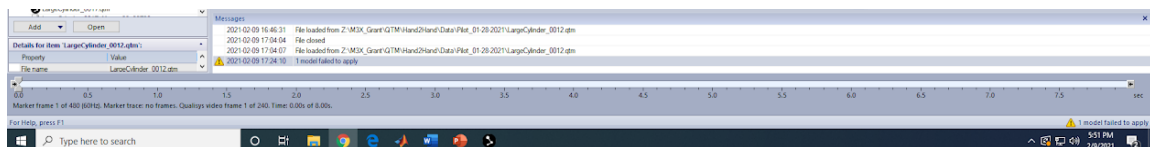
Relation/Virtual Filling:

Some filling options listed (polynomial, static, linear) will fill the necessary gaps, **but will leave the movement looking unnatural**. This is especially so with the fingers, specifically at the point when handing objects over. In this case, relational/virtual filling is another option available to make the movement seem as realistic as possible.
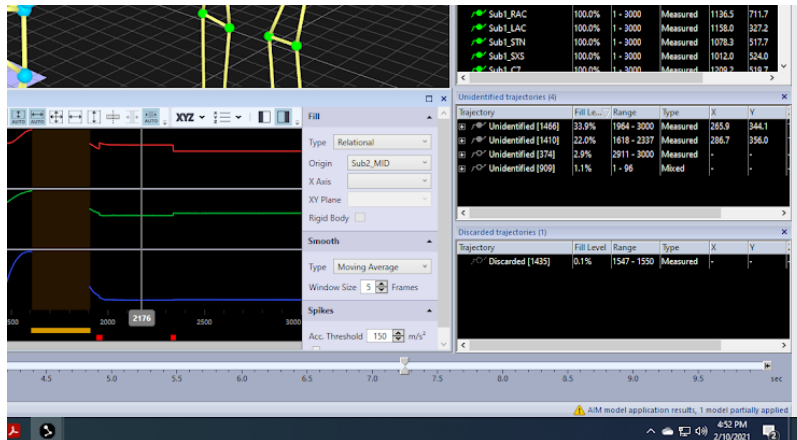
1. First, select the gap that you wish to analyze.
    a. Follow the above steps, but instead of choosing polynomial, static or linear, choose "Relational" or "Virtual"
2. From there, three options will appear. Origin, X-Axis, and XY-axis. These are options that allow you to choose markers in relation to the marker in question.
3. For origin, choose a marker close to the marker in question.
    a. Ex: (SUB1 Ring finger may be paired with SUB1 Middle finger) (Sometimes, only this step is needed, so you will need to experiment)
4. For X-axis and XY-axis, it is best to choose markers near the marker in question as well.
    a. If this does not work, or not work as well, try markers farther away, but avoid straying too far away
    b. Usually what works best is to try a few combinations of markers, and pick whichever one follows the path the best
5. Fill and check movement for any anomalies by running through movement. This step is very important as you don't want to make any changes and have the changes be unrealistic when the model is run.

Saving:

1. Save the work by clicking the save icon in the upper left corner
   a. This can also be performed by pressing Control+S
2. Save the work into a TSV, or Excel, file.
   a. File>Export>To TSV
      i. If any changes were made, you may overwrite any existing copies
3. Save the work into a MAT, or MATLAB, file.
   a. File>Export>To MAT
      i. If any changes were made, you may overwrite any existing copies
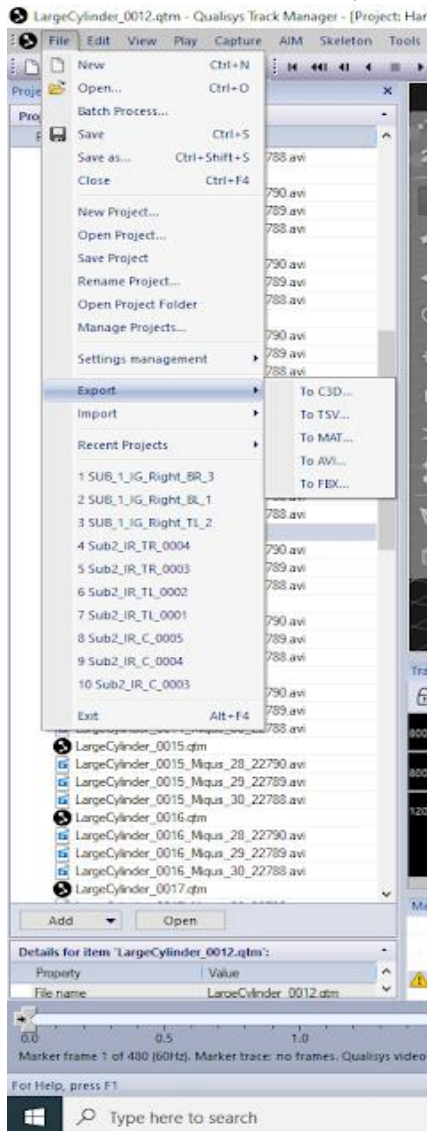
Glossary/Reference Table:

Marker names:
- FH: Forehead
- LAH: Left Anterior Head
- RAH: Right Anterior Head
- LPH: Left Posterior Head
- RPH: Right Posterior Head
- CHIN: Chin
- STN: Sternum Jugular Notch
- SXS: Sternum Xiphisternal Joint
- C7: Cervical Vertebrae 7
- Th7: Thoracic Vertebrae 7
- RCAJ/RAC: Right Acromion
- LCAJ/LAC: Left Acromion
- RHLE: Right Humerus Lateral Epicondyle
- RHME:Right Humerus Medial Epicondyle
- RUSP: Right Ulna-Styloid Process
- RRSP: Right Radial-Styloid Process
- THB: Right Thumb Tip
- TMCP: Right Thumb metacarpophalangeal joints
- IMCP: Right Index metacarpophalangeal joints
- PIN: Right Pinky Tip
- PMCP: Right Pinky metacarpophalangeal joints
- MID: Right Middle Tip
- RIN: Right Ring Tip
- LHLE: Left Humerus Lateral Epicondyle
- LHME: Left Humerus Medial Epicondyle
- LUSP: Left Ulna-Styloid Process
- LRSP: Left Radial-Styloid Process
- RASIS: Right Anterior Superior Iliac Spine
- LASIS: Left Anterior Superior Iliac Spine
- RPSIS: Right Posterior Superior Iliac Spine
- LPSIS: Left Posterior Superior Iliac Spine
- RFT: Right Femur greater Trochanter
- LFT: Left Femur greater Trochanter
- RFME: Right Femur Medial Epicondyle
- RFLE: Right Femur Lateral Epicondyle
- LFLE: Left Femur Lateral Epicondyle
- LFME: Left Femur Medial Epicondyle
- RLM: Right Lateral Malleolus
- RMM: Right Medial Malleolus
- R2MH: Right 2nd Metatarsal Head
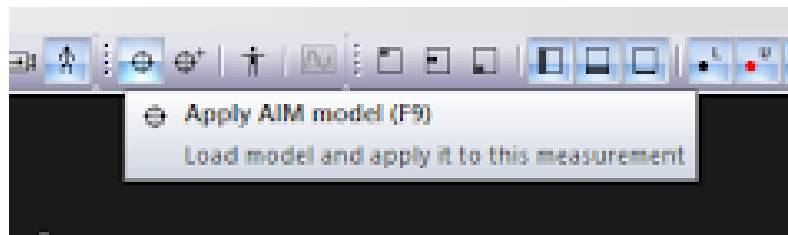- RPC: Right Posterior Calcaneus

- LLM: Left Lateral Malleolus
- LMM: Left Medial Malleolus
- L2MH: Left 2nd Metatarsal Head
- LPC: Left Posterior Calcaneus
- OB1: Object marker 1
- OB2: Object marker 2
- OB3: Object marker 3
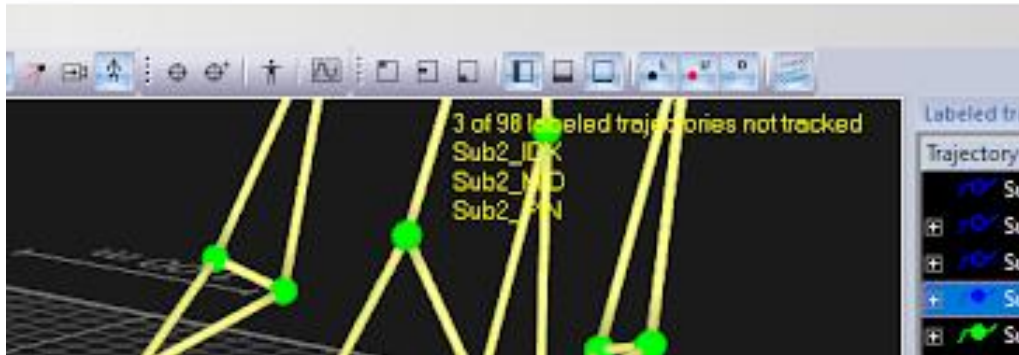- OB4: Object marker 4

Action Table:
Reprocess
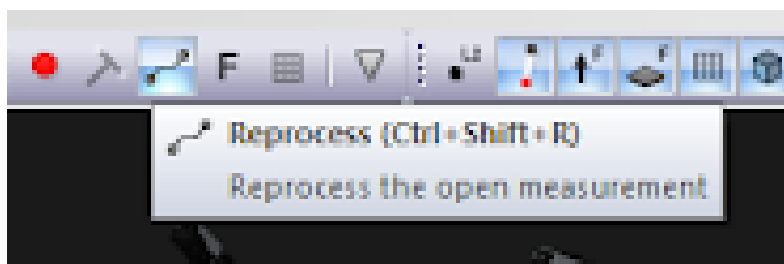
Apply AIM Model

Troubleshooting:

- Trajectory Editor/other panes not appearing
  - On the upper toolbar of the screen, the same one containing AIM and reprocess, there are a series of buttons that will allow you to show and hide specific panes (i.e. the trajectory editor, labeled trajectories, etc)

- Relational filling does not work
  - This could mean one of two things
    - a) You still have some discarded or unidentified trajectories to add
    - b) You may need to try using a different marker
      - For example, when trying to fill a gap for Sub2_PIN, and you have already tried Sub2_RIN as the origin, try instead using Sub2_MID
- Trouble visualizing movement
  - If this is the case, you can press the spacebar to play the movement the way it was performed by the participant. This helps to visualize how the movement should look and how successful gap filled trajectories are.