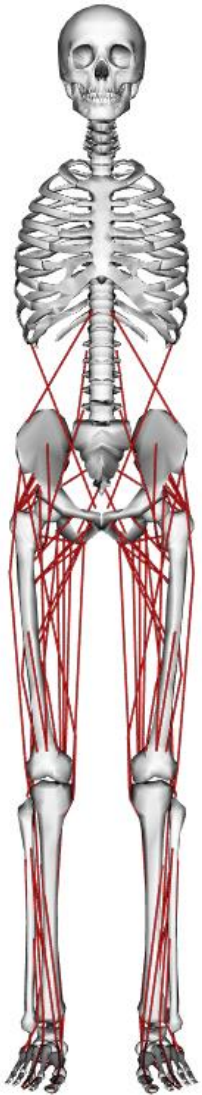


Assigning a marker set to a model

OpenSim Workshop

Introducing gait2392

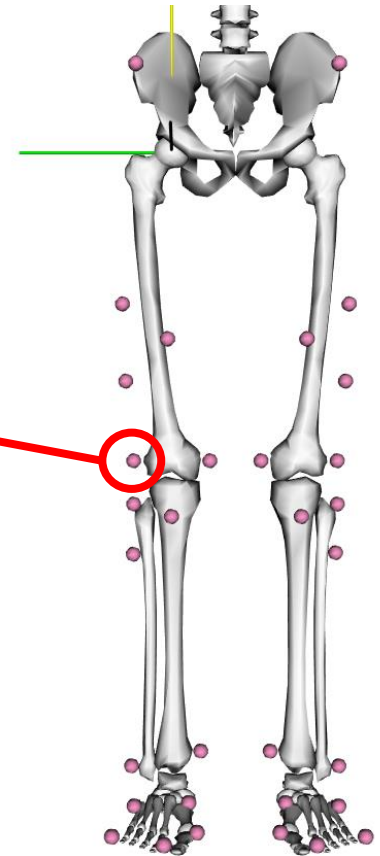


- Anthropometry (1.8 m and 75.16 kg)
- 23 dof, 92 muscle actuators
- Joints:
 - Lumbar joint: spherical joint (3 dof)
 - Pelvis-ground: free joint (6 dof, pelvis tilt: ~ 13 deg offset compared to CGA/ISB)
 - Hip: spherical joint (3 dof)
 - Knee: planar model (1 dof)
 - Ankle, subtalar and metatarsophalangeal joints: hinges (1 dof each)
- No markers yet.
- More details about the model and list of related publications at [OpenSim website](#).

Markers

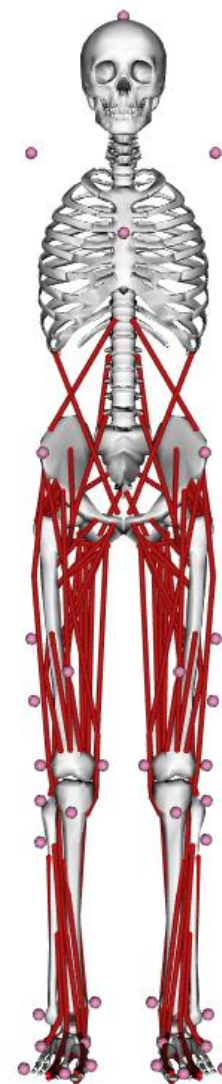
- Also referred to as “virtual markers” or “model markers”
- Rigidly connected to bodies
- Location expressed in local coordinates

```
<Marker name="R.Knee.Lat">
  <!--Body segment in the model on which the marker resides.-->
  <body>femur_r</body>
  <!--Location of a marker on the body segment.-->
  <location> -0.0034701 -0.426099 0.0613926</location>
  <!--Flag (true or false) specifying whether or not a marker should be kept f
  <fixed>false</fixed>
</Marker>
<Marker name="R.Knee.Med">
  <!--Body segment in the model on which the marker resides.-->
  <body>femur_r</body>
  <!--Location of a marker on the body segment.-->
  <location> 0.000330306 -0.443005 -0.0596931</location>
  <!--Flag (true or false) specifying whether or not a marker should be kept f
  <fixed>false</fixed>
</Marker>
```



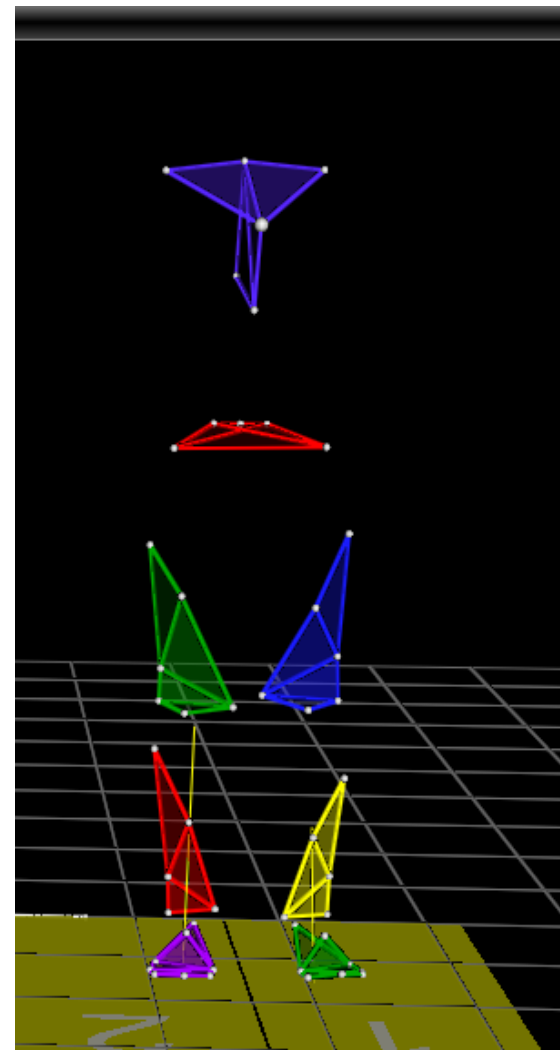
Marker set definition

- Marker editor to add/delete/move markers in the model
- Marker set to place similarly to experimental markers (same names!)
- Distinction between anatomical and technical markers
- Marker sets can be stored and imported using xml files



Let's visualize the experimental marker set

- Load the static file in MOKKA
- Load the provided configurations file to visualize segments (HandsOnMaterial>Mokka_config_file.mv)
- Note the markers on bony landmarks and markers on technical clusters

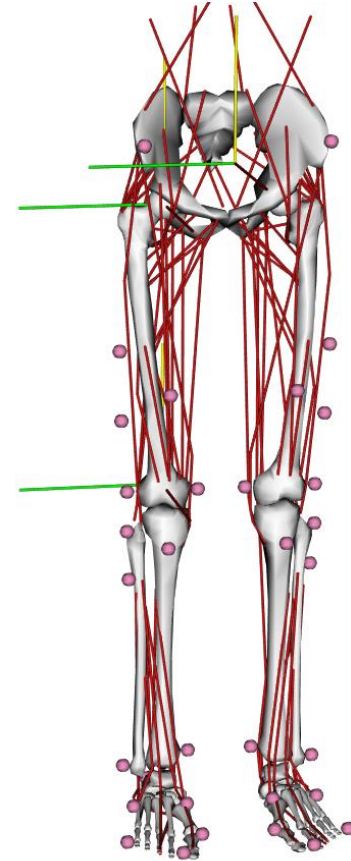
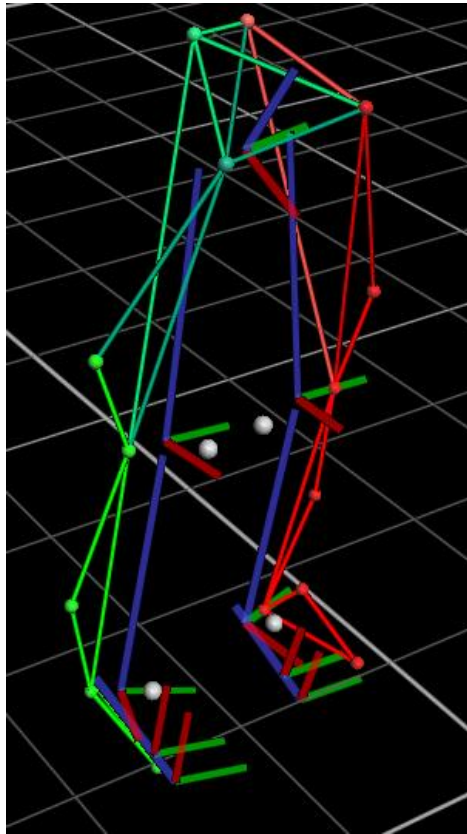


Let's add a marker set to an OpenSim model

- Load the gait2392 model in OpenSim
- Load the default marker set:
 - Scale Model>Add markers from file
 - untick “scale model” and “adjust model markers” boxes
 - Run button
- **How does this marker set compare to the one in the c3d trials?**

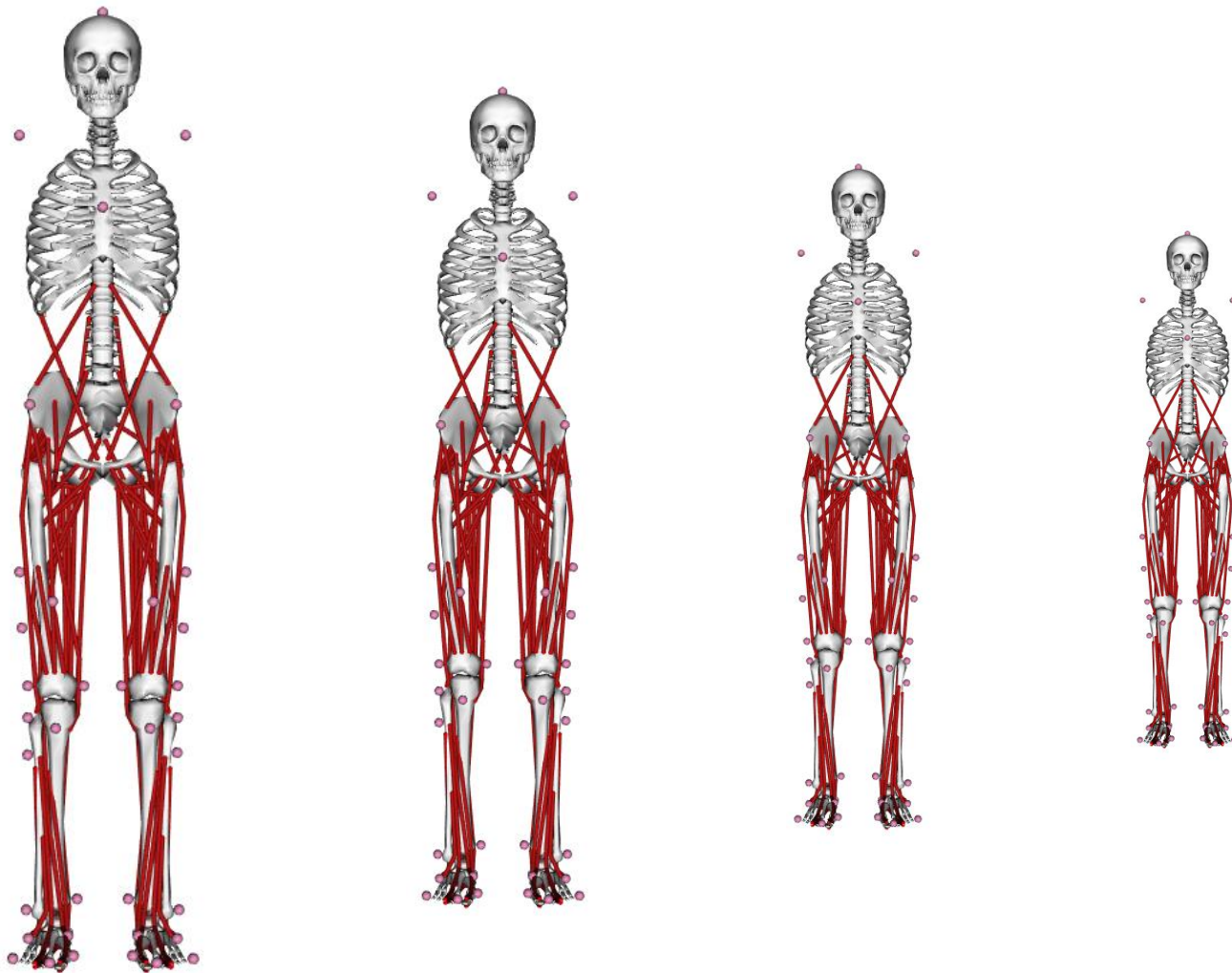


Demo of adjustment/creation of a marker set



Demo: suggested coordinates for markers

- You can assign to the missing markers on the right side these coordinates:
 - Rasis: 0.011 0.0056 0.128
 - Rpsis: -0.153 0.044 0.057
 - RKneeLateral: 0.007 -0.405 0.056
- You can add the left markers using Notepad++:
 - Copy the markers
 - Change “R” in “L” (names) and “r” in “l” (body names)
 - Multiply z coordinate by -1
 - Verify visually through the GUI

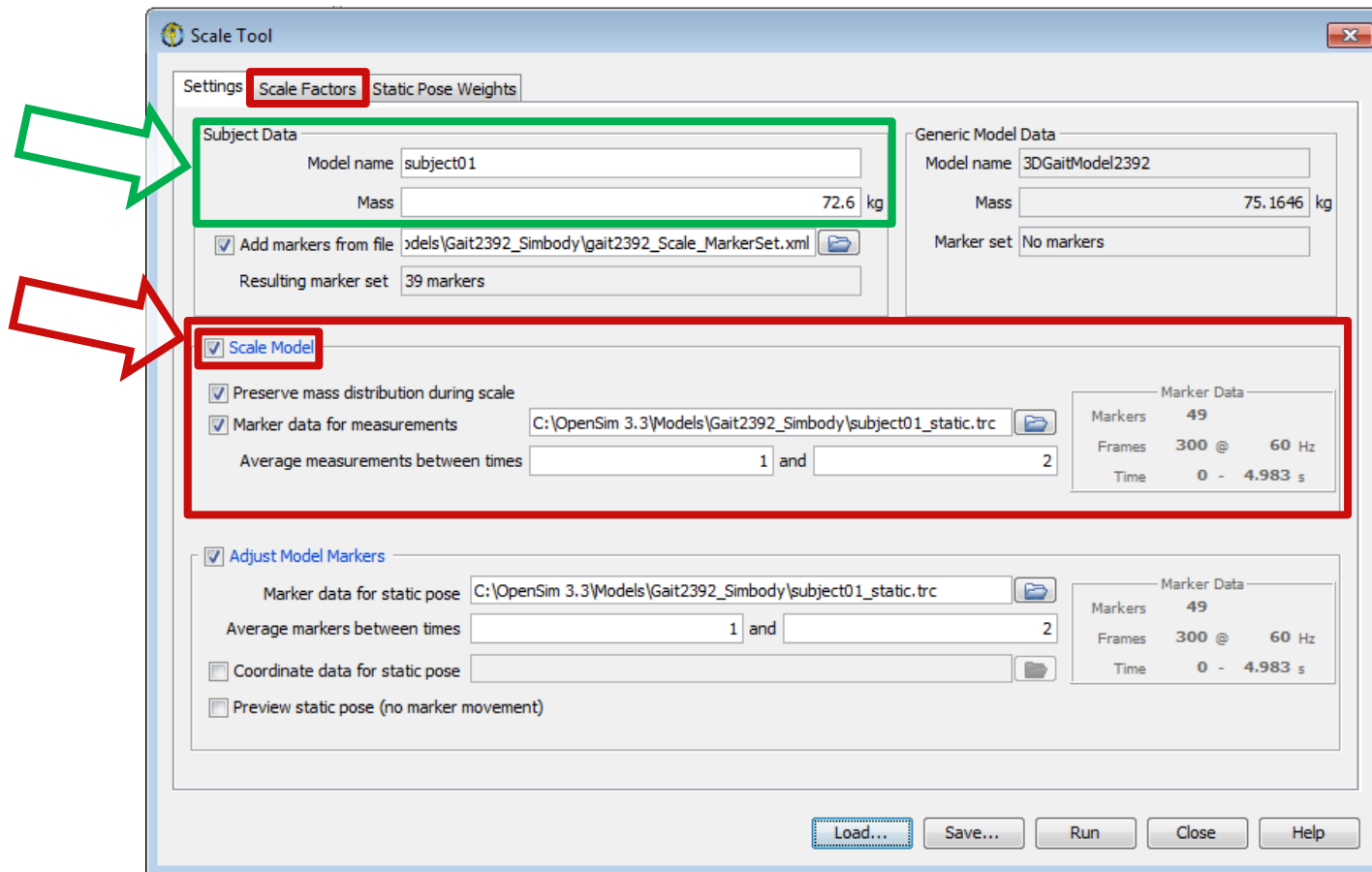


Scaling a model

OpenSim Workshop

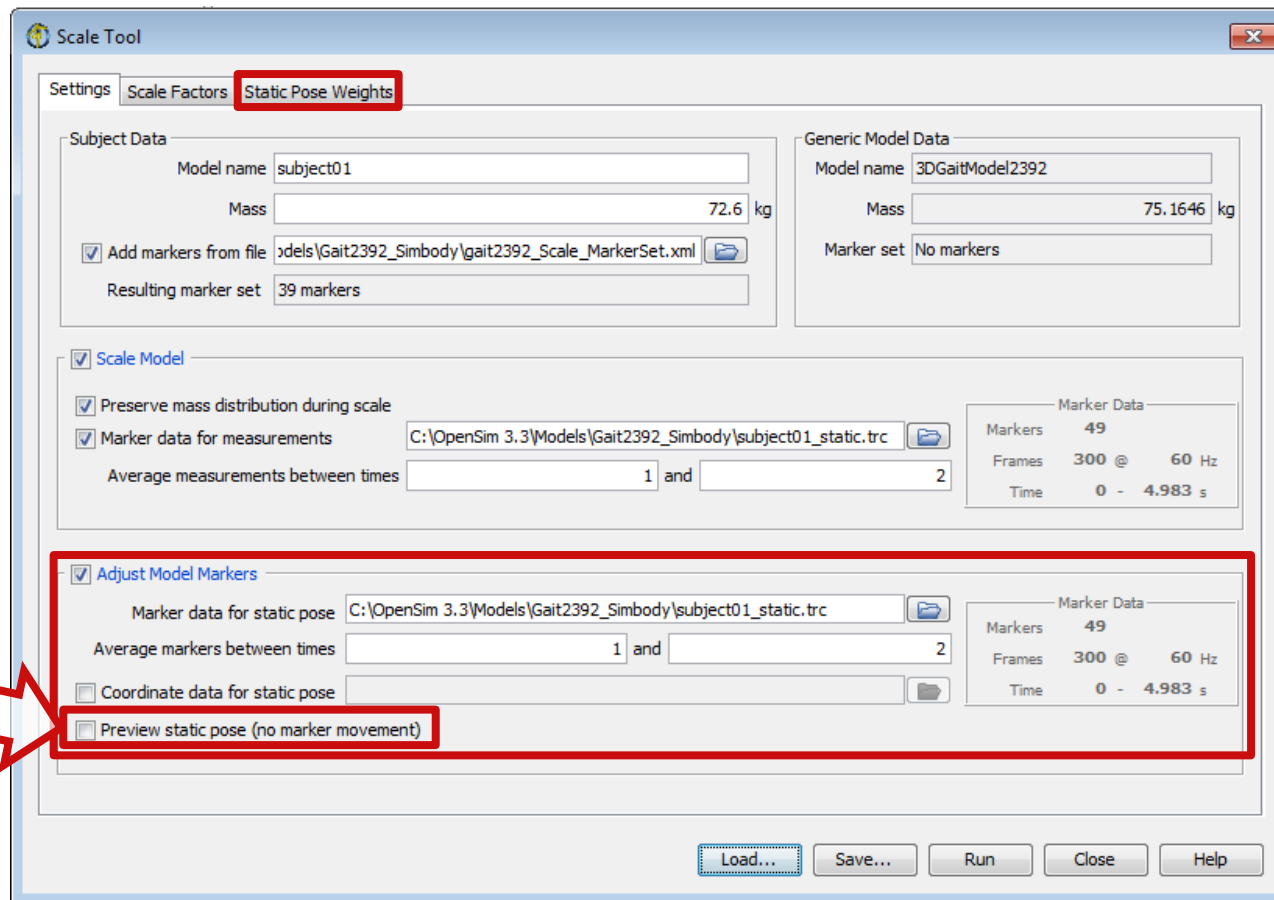
Scaling Tool: How does it work?

- Two steps:
 1. Scaling the anthropometry of the generic model



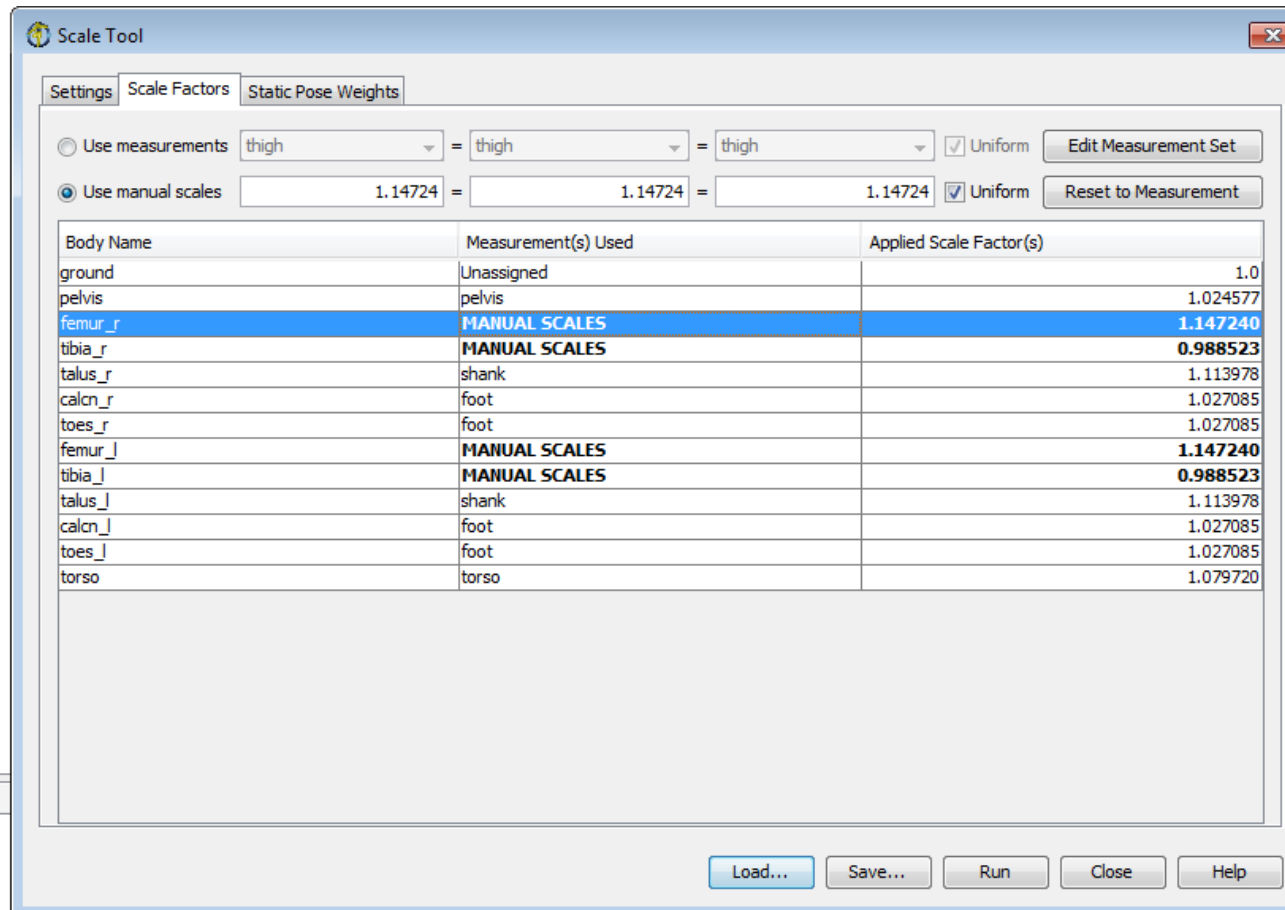
Scaling Tool: How does it work?

- Two steps:
 1. Adjusting the model
 2. Adjusting the model markers



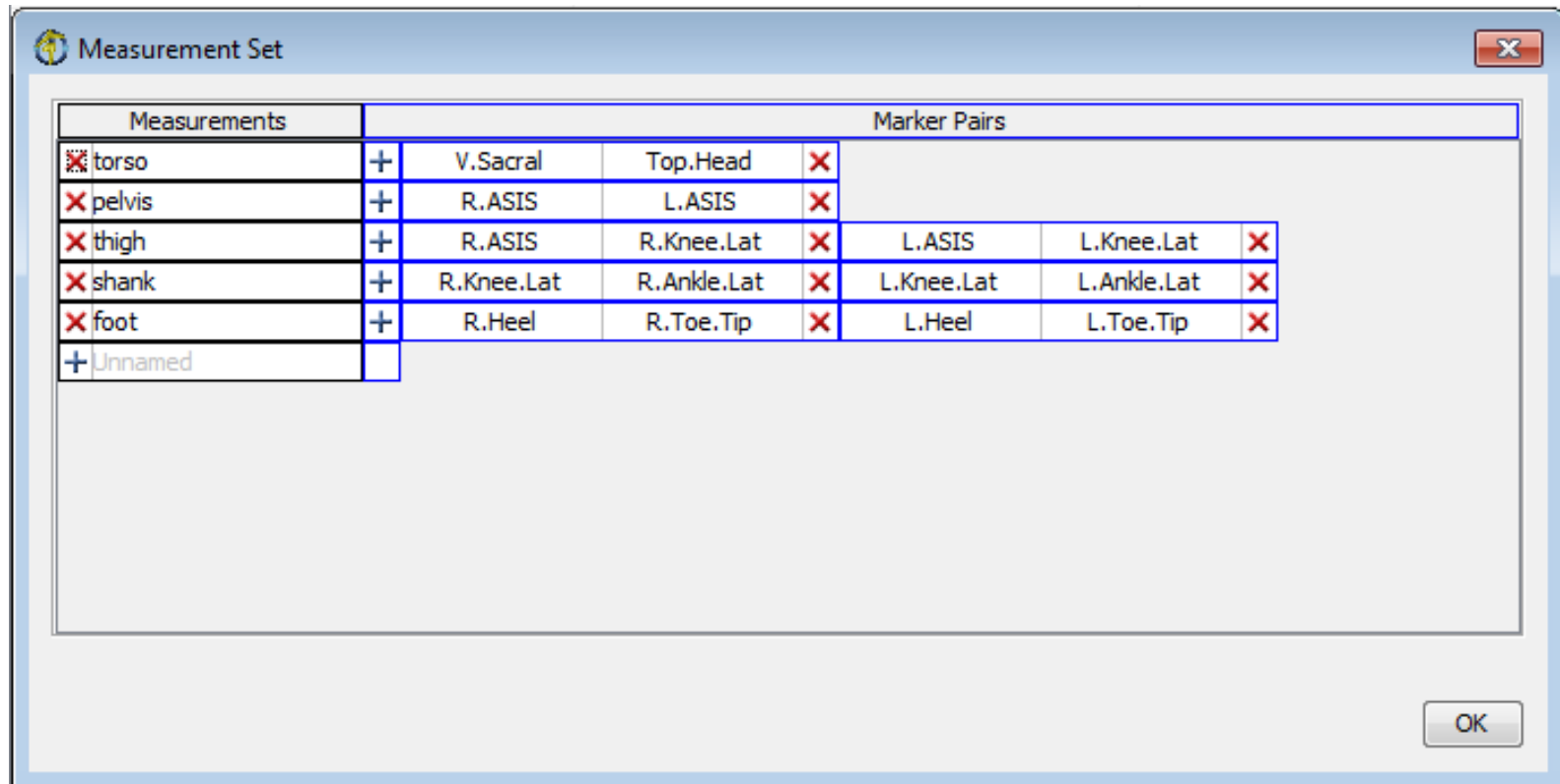
Scaling Tool: Scale Model

1. Scales the segments of a model based on:
 - a) Manual scales: scaling factors assigned manually



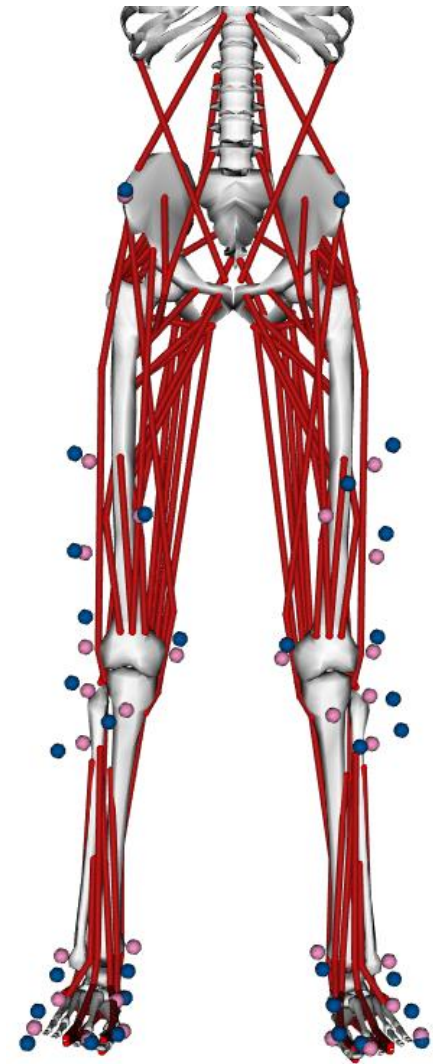
Scaling Tool: Scale Model

1. Scales the segments of a model based on:
 - a) Manual scales: scaling factors assigned manually
 - b) Measurements: scaling factors calculated from couple(s) of virtual and experimental markers

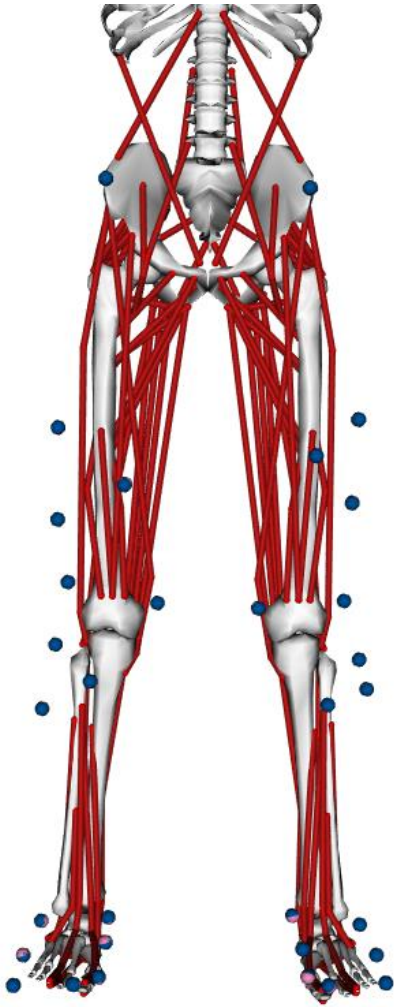


Scaling Tool: Adjust model markers

2. Scaled model position is obtained with an IK step, based on tracked markers (generally anatomical markers) and their weights.



Scaling Tool: Adjust model markers



3. MarkerPlacer adjusts marker locations to fit mean measured marker positions (useful to register technical markers)

Evaluating the scaling procedure

- Scaling is an iterative process
- Check the “Messages” window:
 - Maximum tracking error should be $< 2\text{cm}$
 - RMSE should be $< 1\text{ cm}$
- Use preview static pose to evaluate agreement of bony landmarks and joint centres.
- Evaluate joint coordinates against pictures taken during data collection (if available)

Notes on data we will use for the demo

- We are using data from patient with instrumented total knee prosthesis from <https://simtk.org/projects/kneeloads>
- Details:
 - Age: 86 years old
 - Height: 180 cm
 - Weight: 75 kg
 - Total knee replacement (TKR) on left side

Demo of scaling tool

