

Position Measurement Points – Experiments by Forman et al. (2015)

Preliminary Definitions as of March 2022

The measurement points described here are intended exclusively for comparison between the initial position of the PMHS obtained in the Forman experiments (Forman et al., 2015) and the initial position of the HBM used.

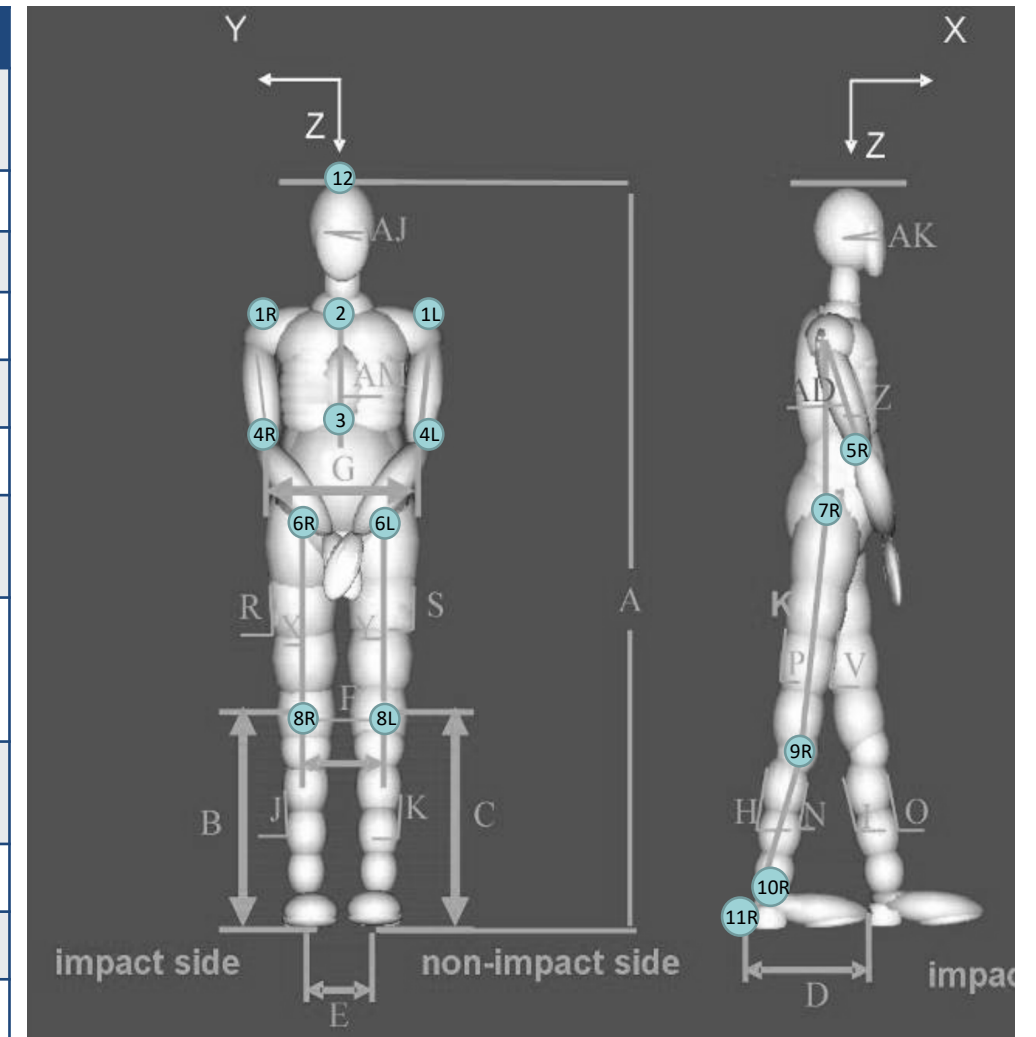
The nodes were defined to best match the likely placement in the experiment. Due to the soft tissue geometries of the HBM and the distances or angles to be measured, some nodes were chosen to be on the bone surface instead of the skin surface as in the experiment.

In addition to the definition itself, the respective nodes of the GHBMC v1.6 Pedestrian (red) and the THUMS V4.02 Pedestrian (blue) are also shown exemplarily.

Reference

J. Forman, H. Joodaki, A. Forghani, P. Riley, V. Bollapragada, D. Lessley, B. Overby, S. Heltzel, J. Crandall (2015): Biofidelity Corridors for Whole-Body Pedestrian Impact with a Generic Buck. IRCOBI Conference Proceedings (pp. 357-372, IRC-15-49), France.

#	Node Name	Used for ...
1 R/L	Acromion	Humerus lateral (acrom.-lat. epicond.) Torso Angle (acrom.-troch.)
2	Upper Sternum	Torso Angle (centerline)
3	Lower Sternum	Torso Angle (centerline)
4 R/L	Lat. Epicondyle	Humerus lateral (acrom.-epicond.)
5 R/L	Olecranon	Elbow to Elbow Width
6 R/L	Acetabulum	Femur Anterior (centerline)
7 R/L	Gr. Trochanter, Lateral	Femur Lateral (Gr. Troch-knee) Torso Angle (acrom.-troch.)
8 R/L	Knee, Anterior	Knee Height Knee to Knee Width Femur Anterior (centerline)
9 R/L	Knee, Lateral	Tibia Lateral (mid knee-lat. malleolus) Femur Lateral (Gr. Troch – knee)
10 R/L	Lat. Malleolus	Tibia Lateral (mid knee-lat. malleolus)
11 R/L	Heel	Heel to Heel Distance
12	Head	Height (from platform)



1 Acromion

Node on the superior surface of the Acromion, located most lateral and anterior

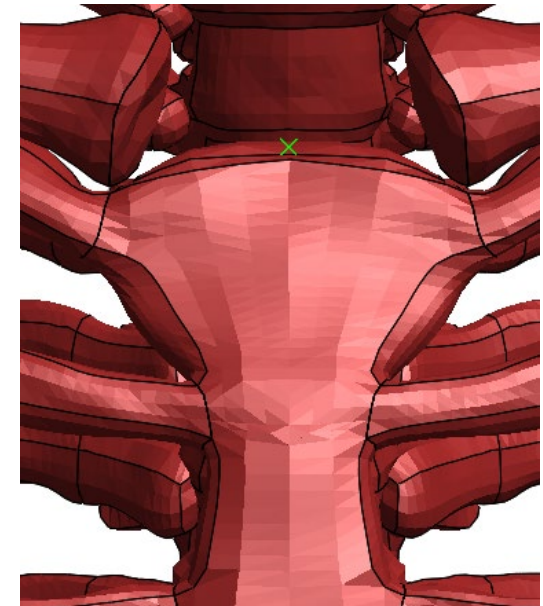
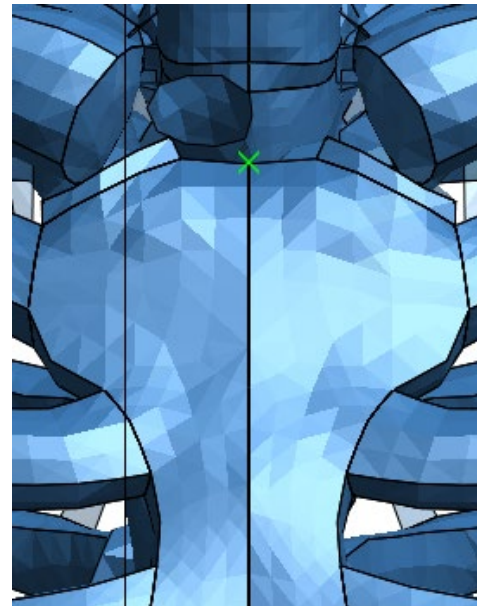
MODEL	NODE ID L	NODE ID R
THUMS Ped V4.02	89009433	89509433
GHBMCM Ped v1.6	3046239	5009750



2 Upper Sternum

Most caudal and anterior point of the Incisura jugularis

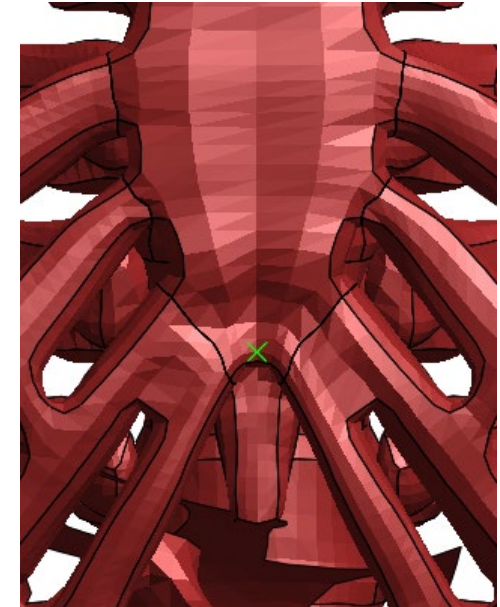
MODEL	NODE ID
THUMS Ped V4.02	84085784
GHBMCM Ped v1.6	4187038



3 Lower Sternum

Most caudal and anterior point of the body of the Sternum on the junction between the body and the Xiphoid

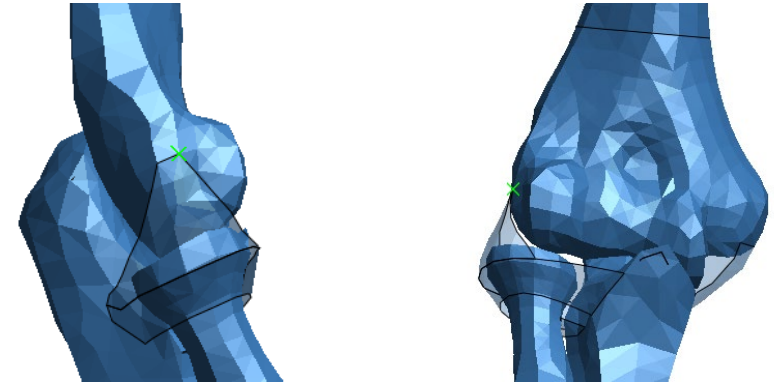
MODEL	NODE ID
THUMS Ped V4.02	89015762
GHBMCM Ped v1.6	4142640



4 Lat. Epicondyle

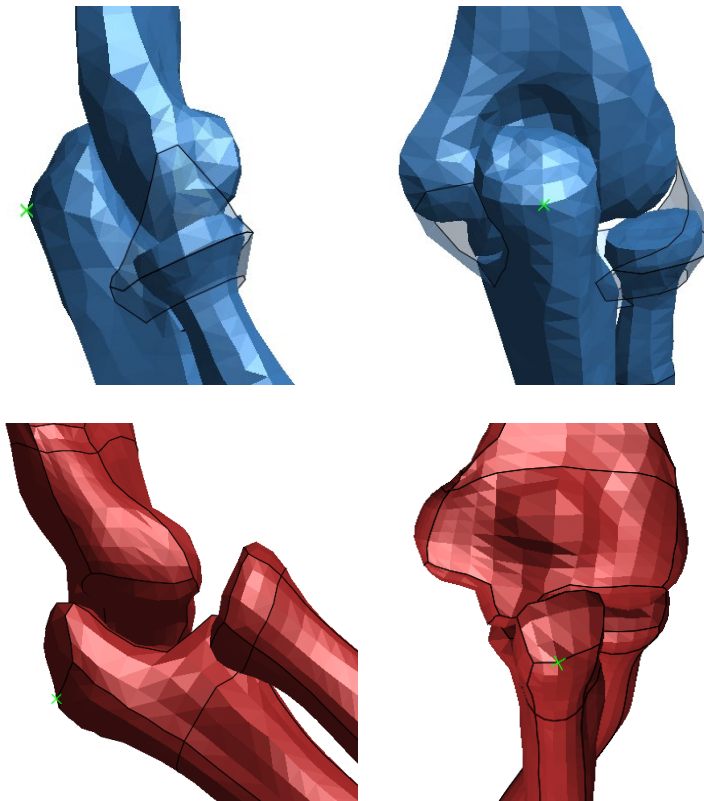
Anatomically most lateral point on the surface of the distal lateral humerus epicondyle

MODEL	NODE ID L	NODE ID R
THUMS Ped V4.02	86006391	85006391
GHBMCM Ped v1.6	3030322	5029192



Most protruding point at the dorsal, proximal part of the ulna that is not involved in the joint

MODEL	NODE ID L	NODE ID R
THUMS Ped V4.02	86002858	85002858
GHBMCM Ped v1.6	3046451	5025832



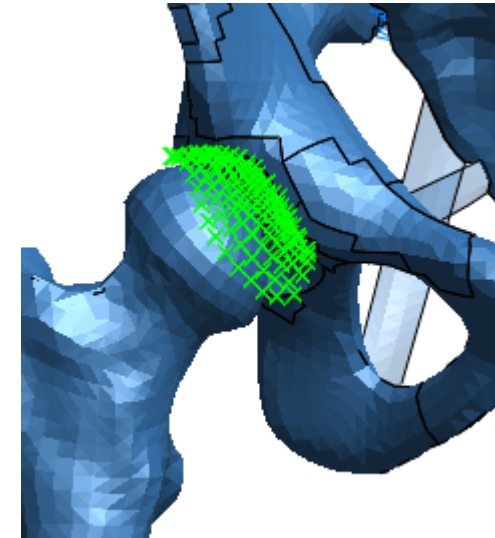
6 Acetabulum

Center of the acetabulum on the left and right hip bone

Center = point equidistant from the points on the surface

Method

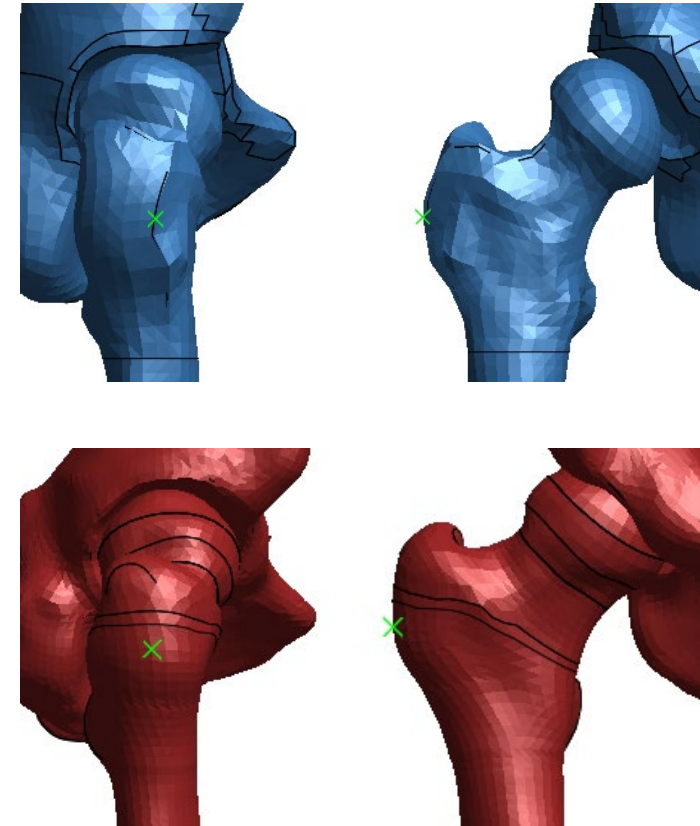
- 1) Select all nodes on the convex surface with a nearly constant radius
- 2) Find the point that is equidistant to the surface points, with the distances being minimal



7 Greater Trochanter, Lateral

Most lateral point of the greater trochanter

MODEL	NODE ID L	NODE ID R
THUMS Ped V4.02	82103671	81103671
GHBMCM Ped v1.6	7031925	9050269



Most anterior, central point of the patella

MODEL	NODE ID L	NODE ID R
THUMS Ped V4.02	82071152	81071152
GHBM Ped v1.6	7082289	9078770



Most lateral point at the junction between the meniscus and the tibial plateau

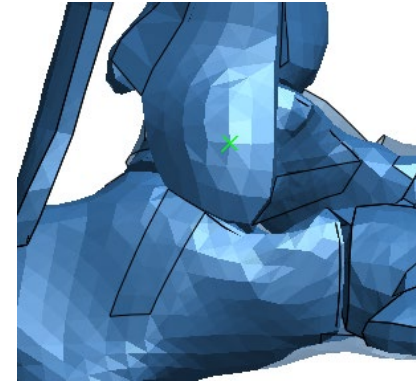
MODEL	NODE ID L	NODE ID R
THUMS Ped V4.02	82071354	81071354
GHBM Ped v1.6	7013314	9014612



10 Lat. Malleolus

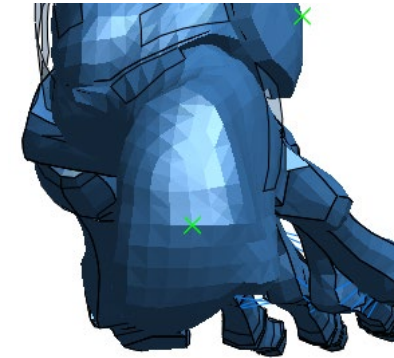
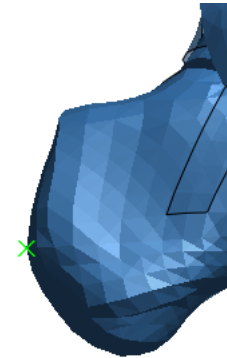
Most lateral point of the lateral malleolus

MODEL	NODE ID L	NODE ID R
THUMS Ped V4.02	82002002	81002002
GHBM Ped v1.6	7024862	9026165



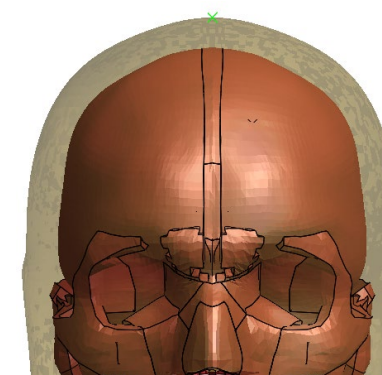
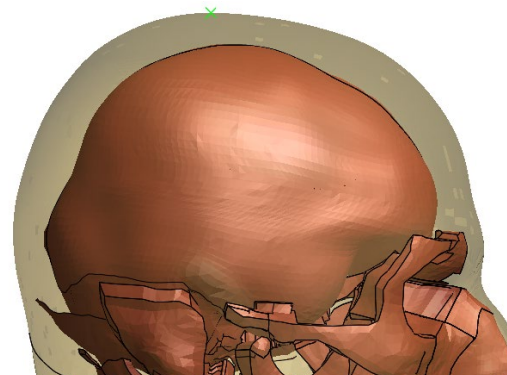
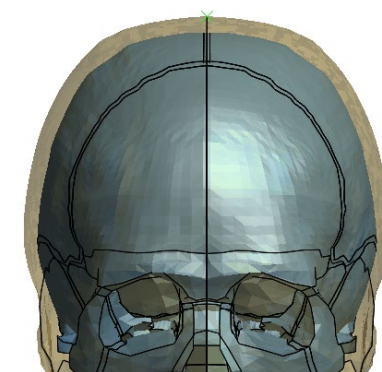
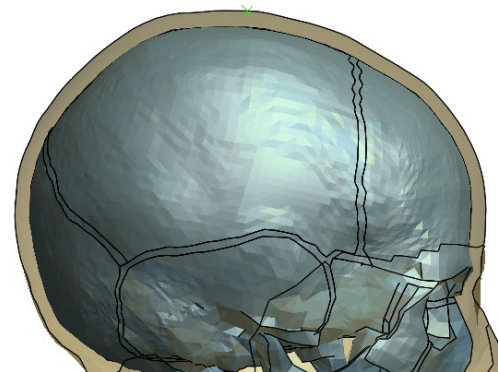
The most posterior point of the calcaneal tubercle

MODEL	NODE ID L	NODE ID R
THUMS Ped V4.02	82000168	81000168
GHBMCPed v1.6	7097326	9095006



Most superior node on the skin surface of the head

MODEL	NODE ID
THUMS Ped V4.02	88278692
GHBM Ped v1.6	1189240





Contact Details

Laura Rahm

Biomechanics and Accident Analysis
University of Munich (LMU)

laura.rahm@med.uni-muenchen.de | +49 89 2180 73365