



Autonomous Reaming for Total Hip Replacement

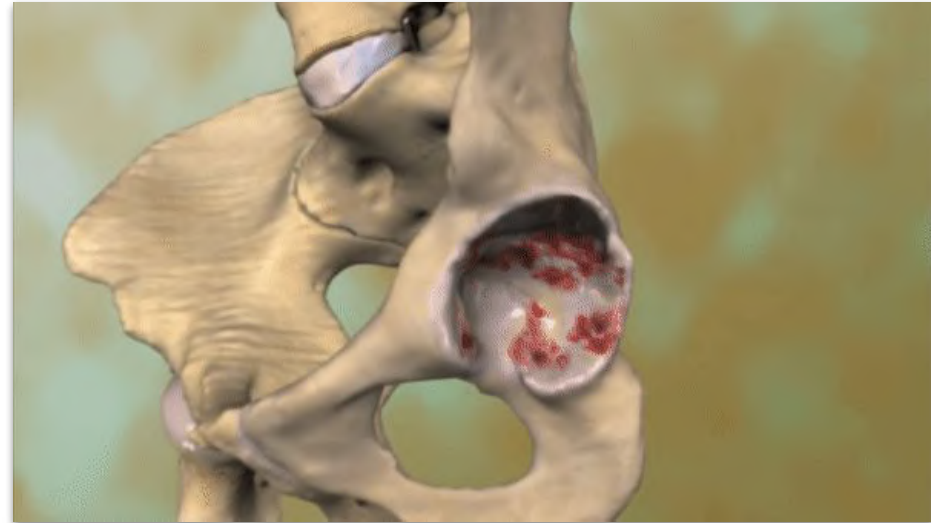
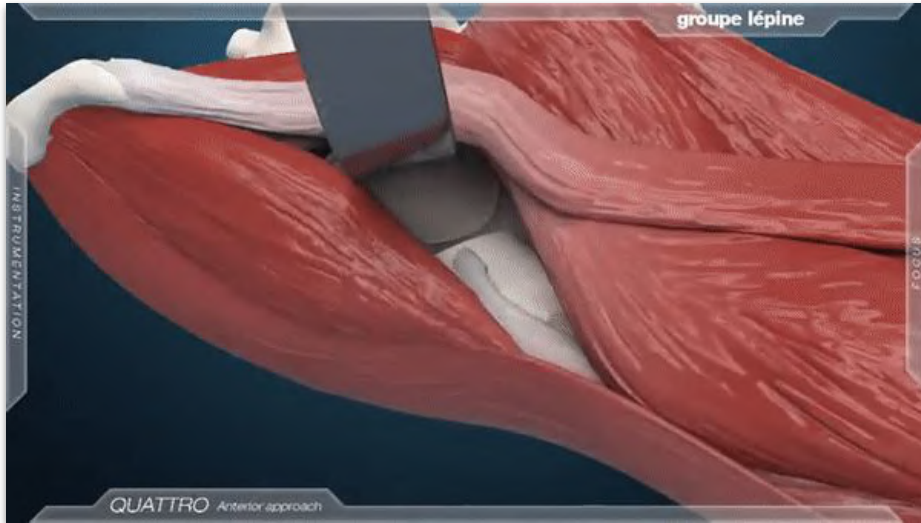
Public Presentation

December 5th, 2022

Team C

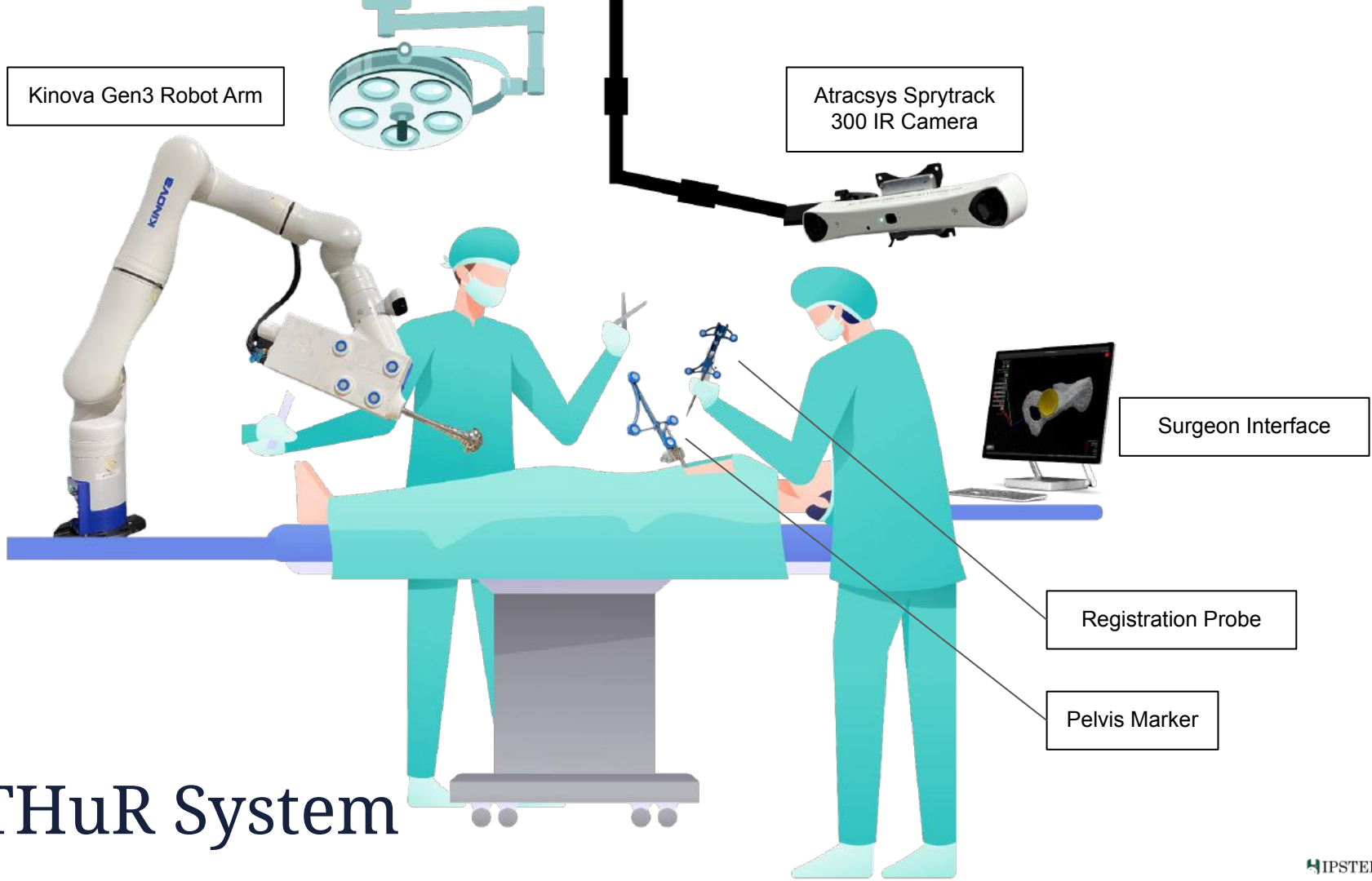


Total Hip Replacement



Kinova Gen3 Robot Arm

Atracsys Sprytrack
300 IR Camera



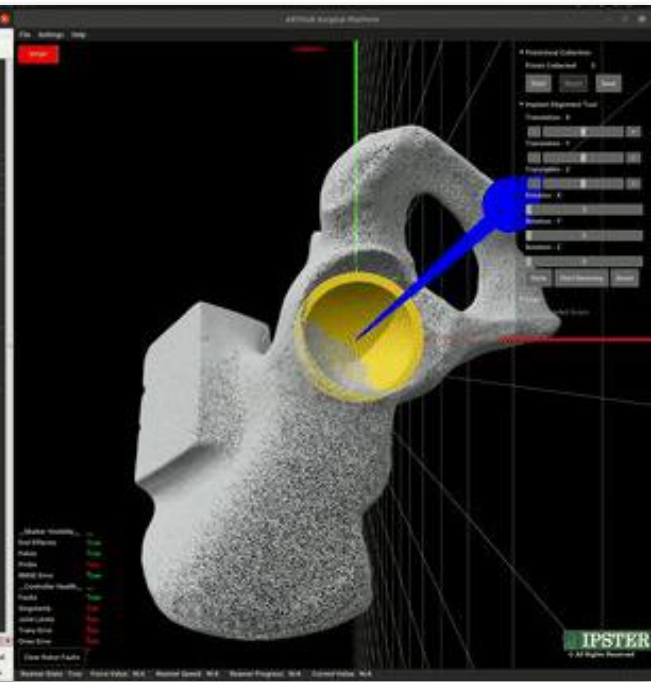
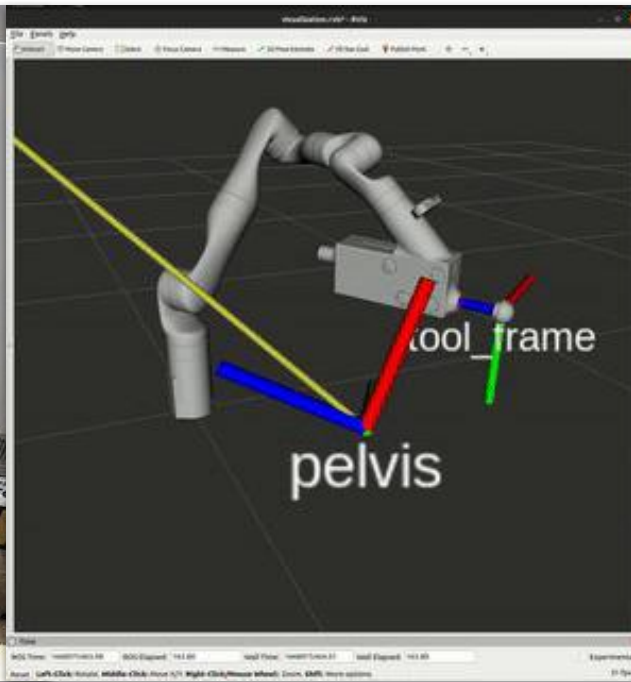
Surgeon Interface

Registration Probe

Pelvis Marker

ARTHuR System

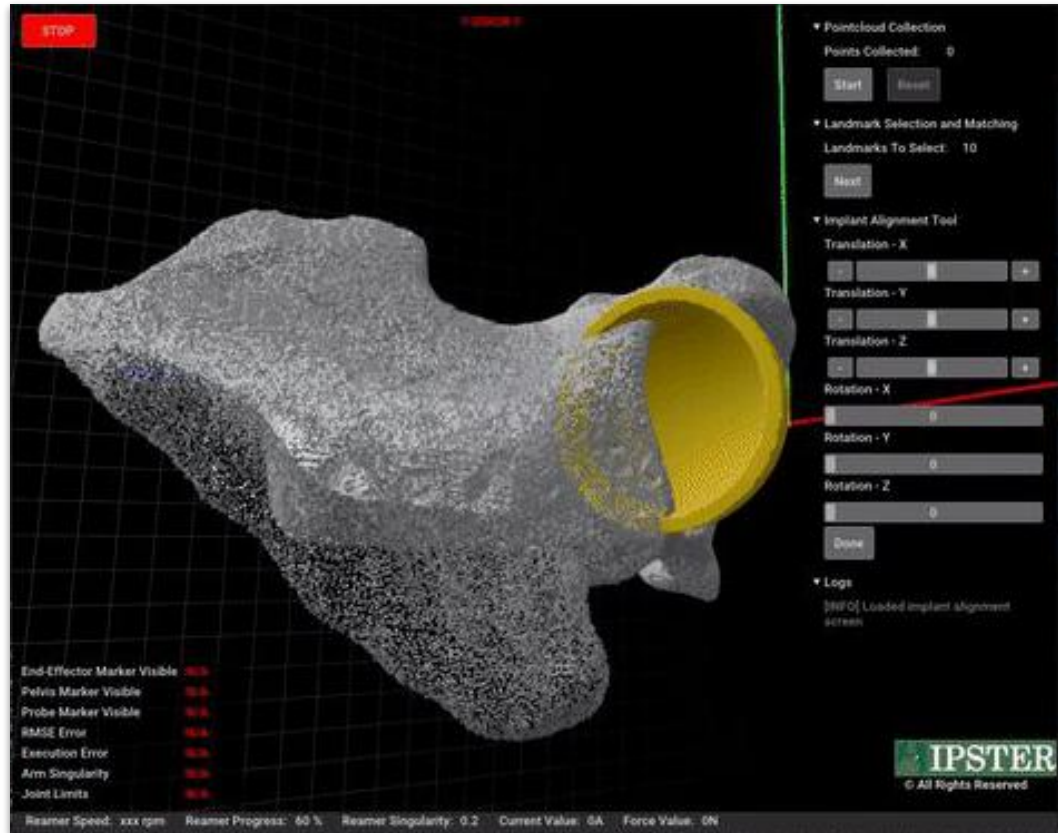
Pointcloud Collection



Landmark Selection + Registration



Implant Alignment Tool (Surgeon UI)



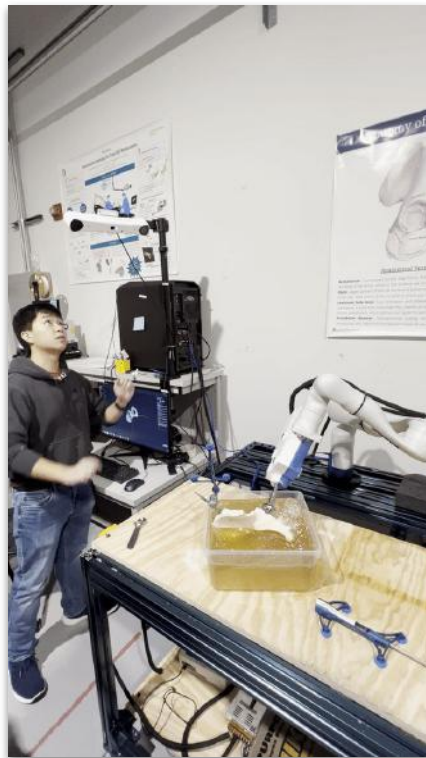
Free Motion Mode and Alignment



Task Prioritization Controls



Pelvis Alignment



Camera Alignment



Singularity Avoidance

Most Critical

**Pelvis
Alignment**

**Camera
Alignment**

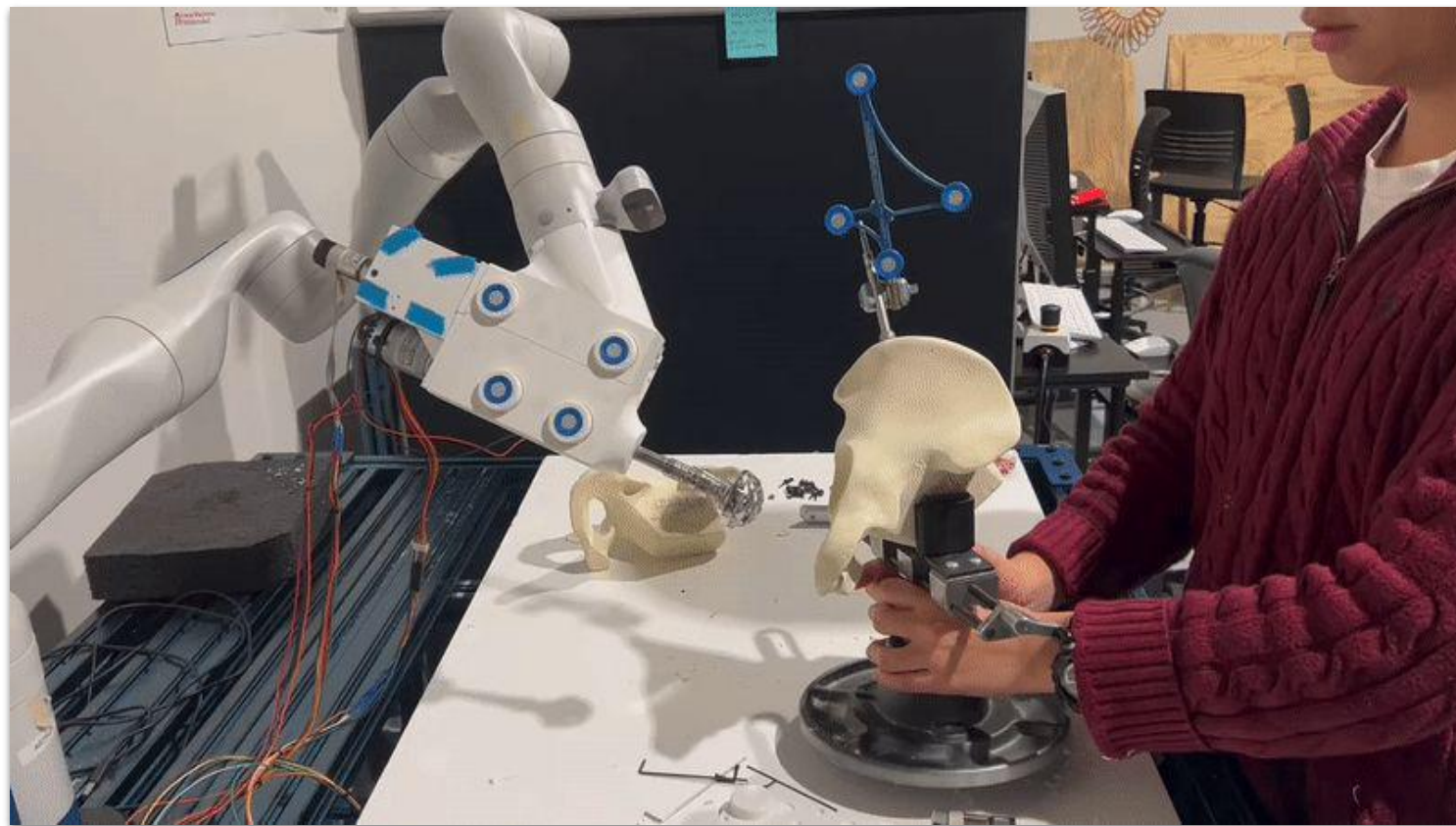
**Joint Limit
Avoidance**

**Singularity
Avoidance**

Least Critical



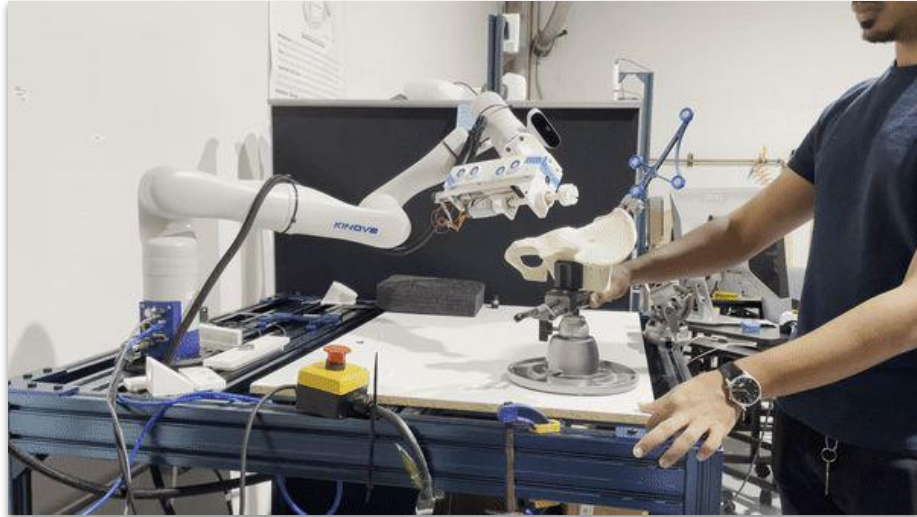
Dynamic Compensation



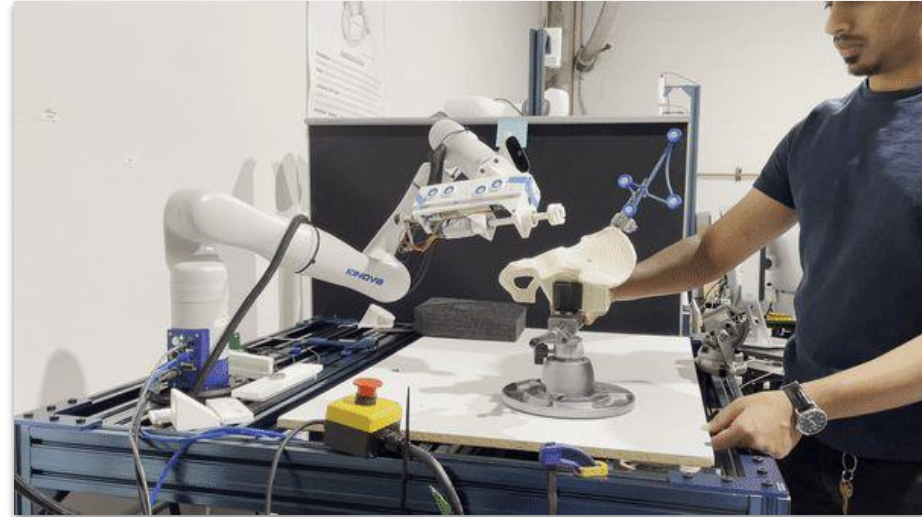
Reaming Force Controls



WatchDog

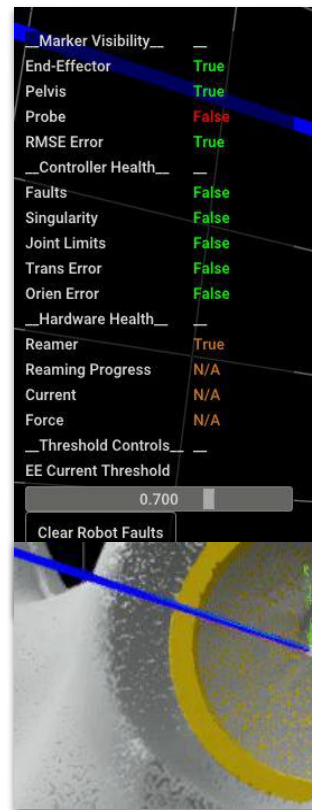
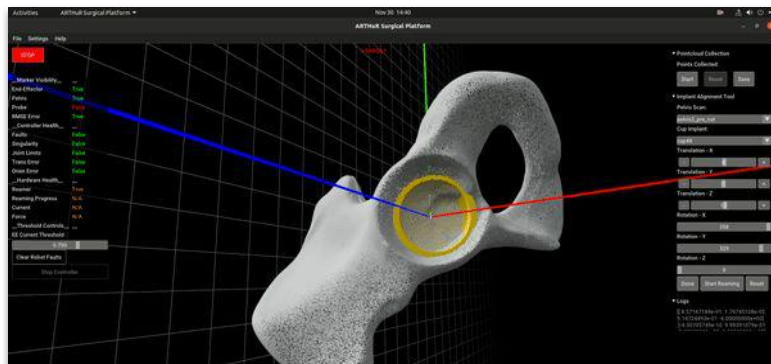


Pelvis not visible
(patient decides to run away)

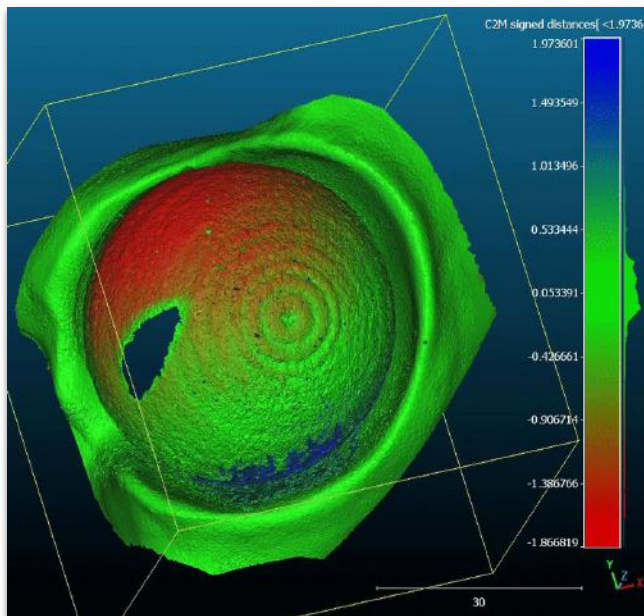


Stops controller at any fault

WatchDog

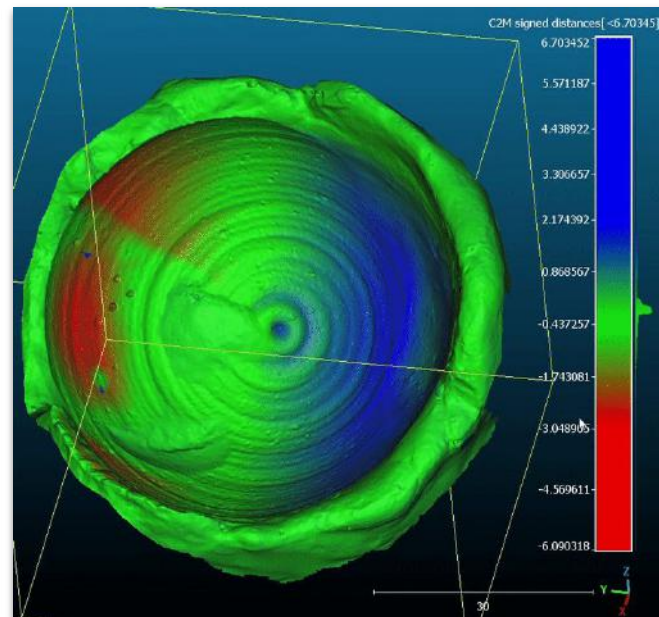


System Validation



Maximum Error: +2.0 mm

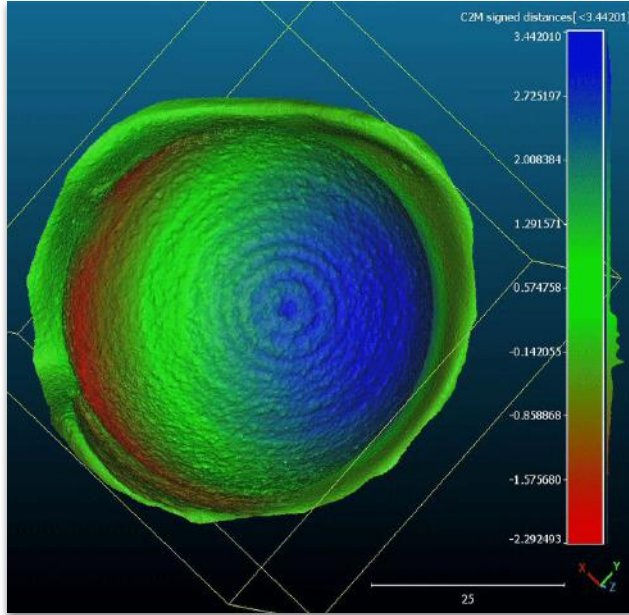
Average Error: 0.29 mm



Maximum Error: -3.0 mm

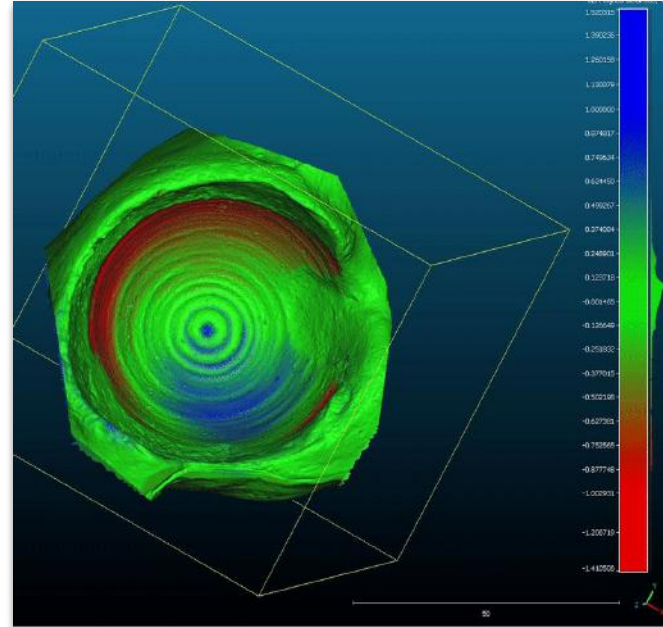
Average Error: 0.43 mm

System Validation



Maximum Error: +3.4 mm

Average Error: 0.95 mm



Maximum Error: -1.3 mm

Average Error: 0.42 mm