INSIGNEO

Institute for *in silico* Medicine

CT2S Service

Non-invasive bone strength estimation

The University Of Sheffield.

Sheffield Teaching Hospitals NHS

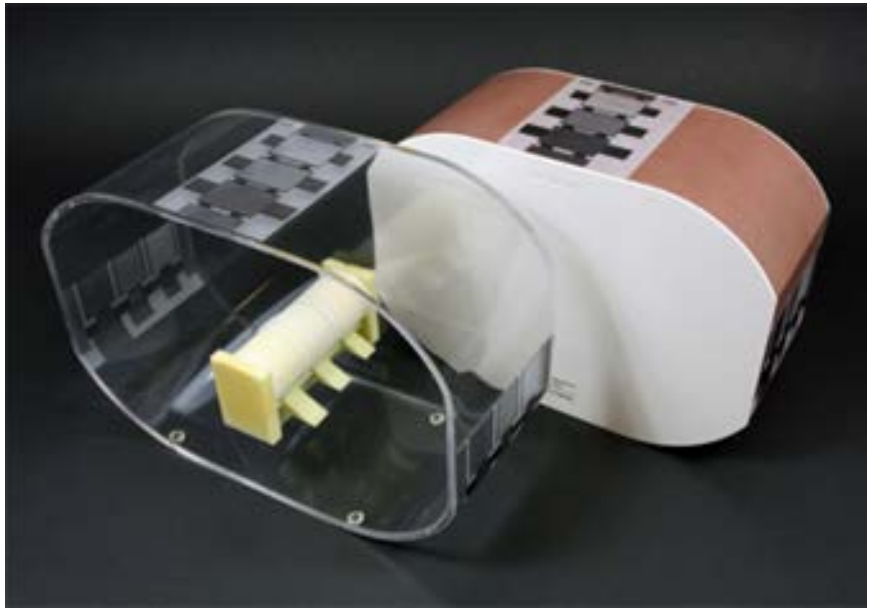
NHS Foundation Trust

Computed Tomography(CT) Scan

Patient undergoes a femoral CT scan

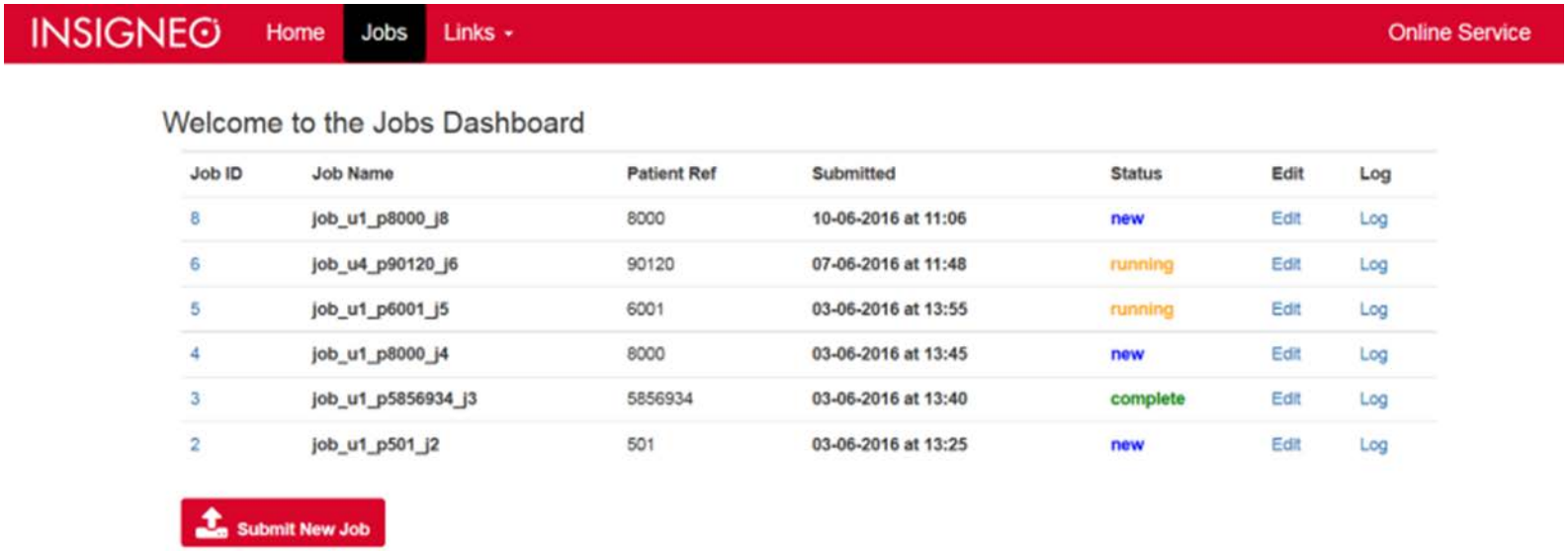
Please refer to CT protocol for CT settings

CT Calibration



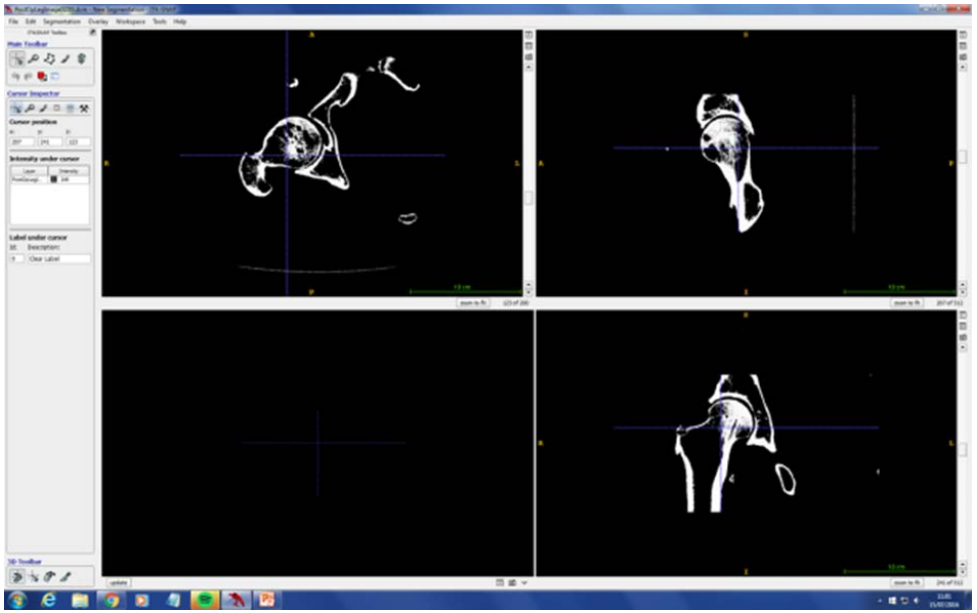
European spine phantom (ESP) is scanned on the same CT scanner with the same CT settings

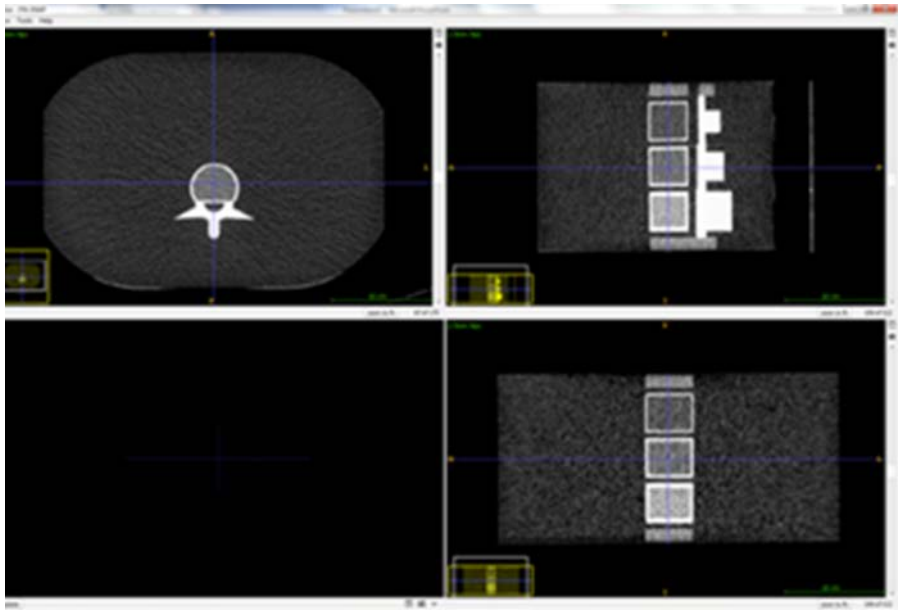
Job Submission



CT scan DICOMS of the patient and the ESP are submitted to the CT2S service through our website

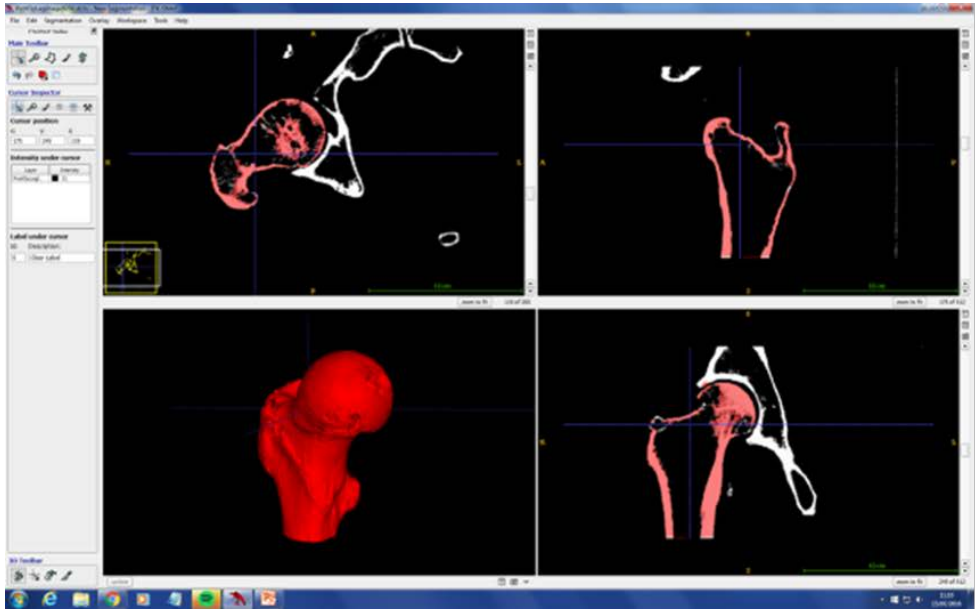
Image Visualization





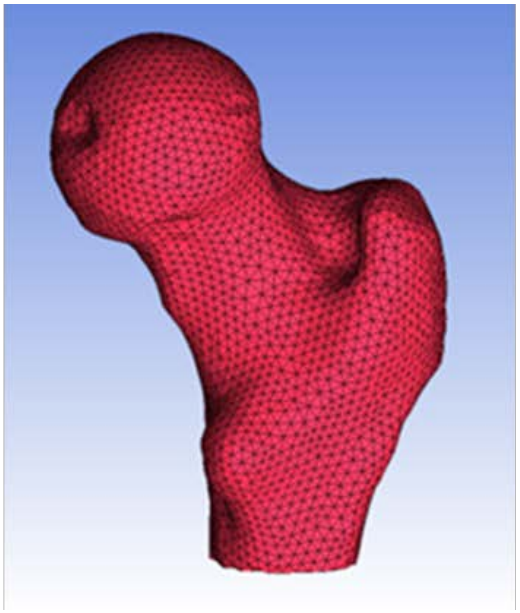
DICOM images are imported into image visualization software and checked against protocol requirements

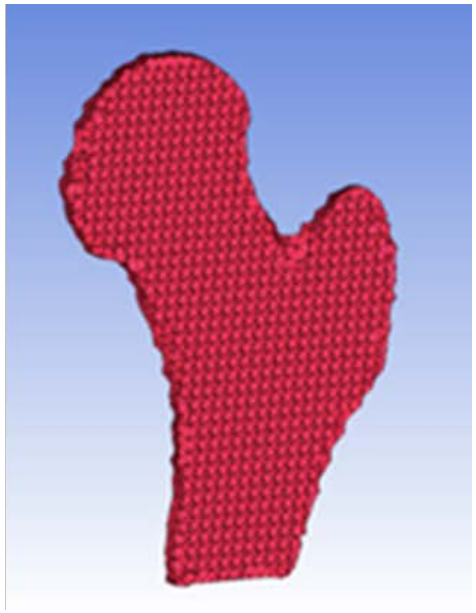
Image Segmentation



Semi-automatic segmentation is performed to extract the anatomy of the femur. Extracted surface is saved in the STL format

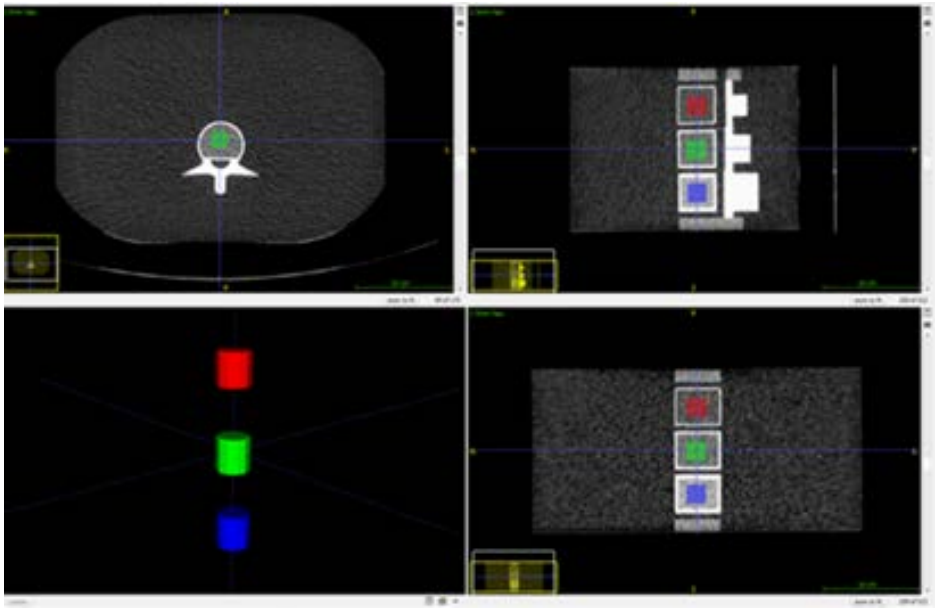
Volume Meshing

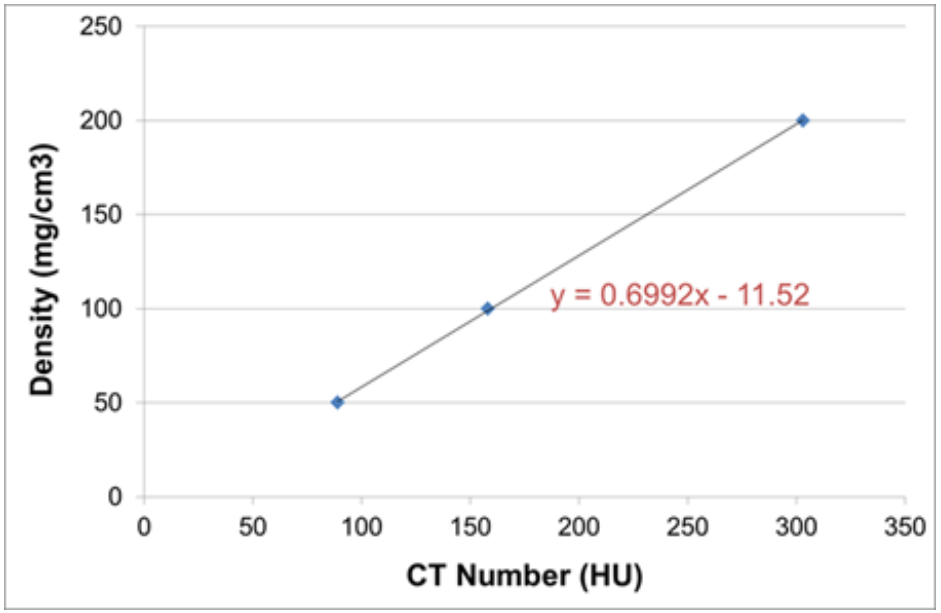




STL geometry is imported into ANSYS ICEM to generate a volumetric finite element (FE) mesh

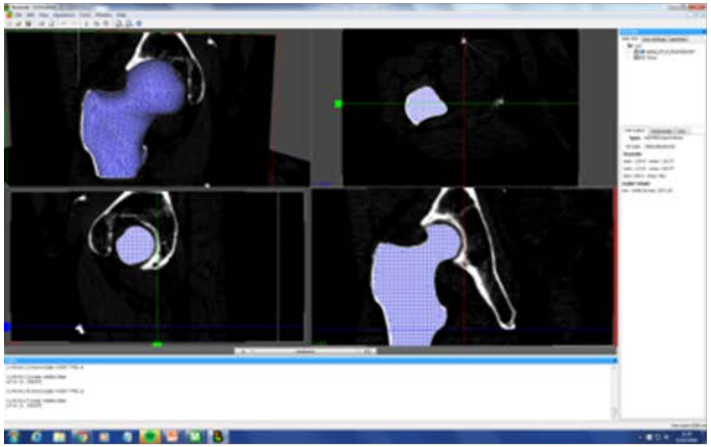
Calibration Equation

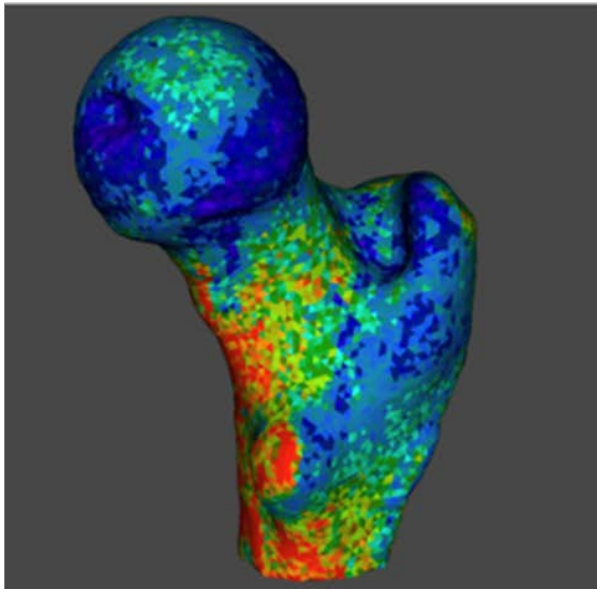




Density to grayscale calibration equation is derived from the ESP Ct scan

Material Mapping



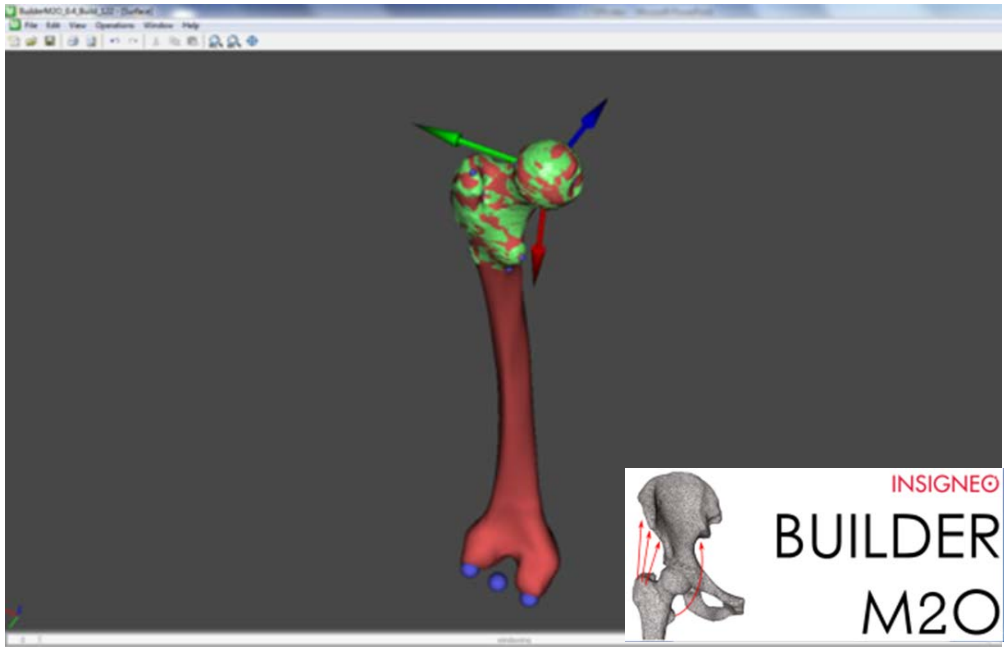


Meshed volume and the associated CT scan are then imported into BoneMat. Elastic modulus (E) is then mapped on to the mesh based on the greyscale value (HU).

$$\rho = a*HU + b \qquad E = 6.950(\rho)^{1.49}$$

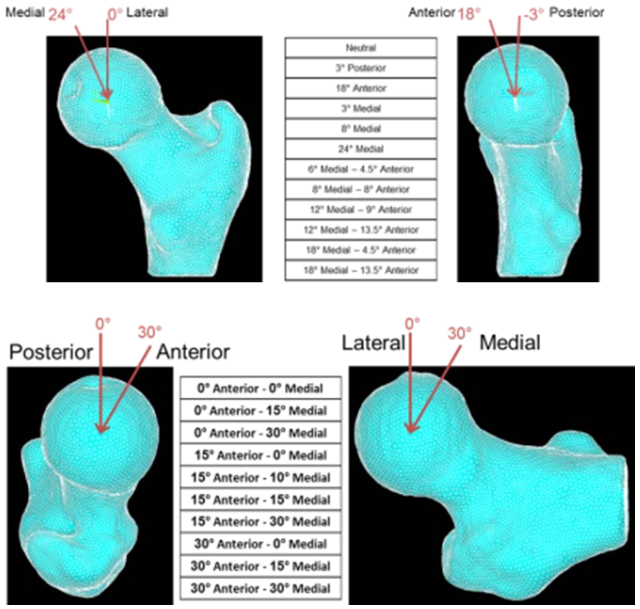
(a & b determined from ESP Calibration phantom)

Anatomical Landmarking



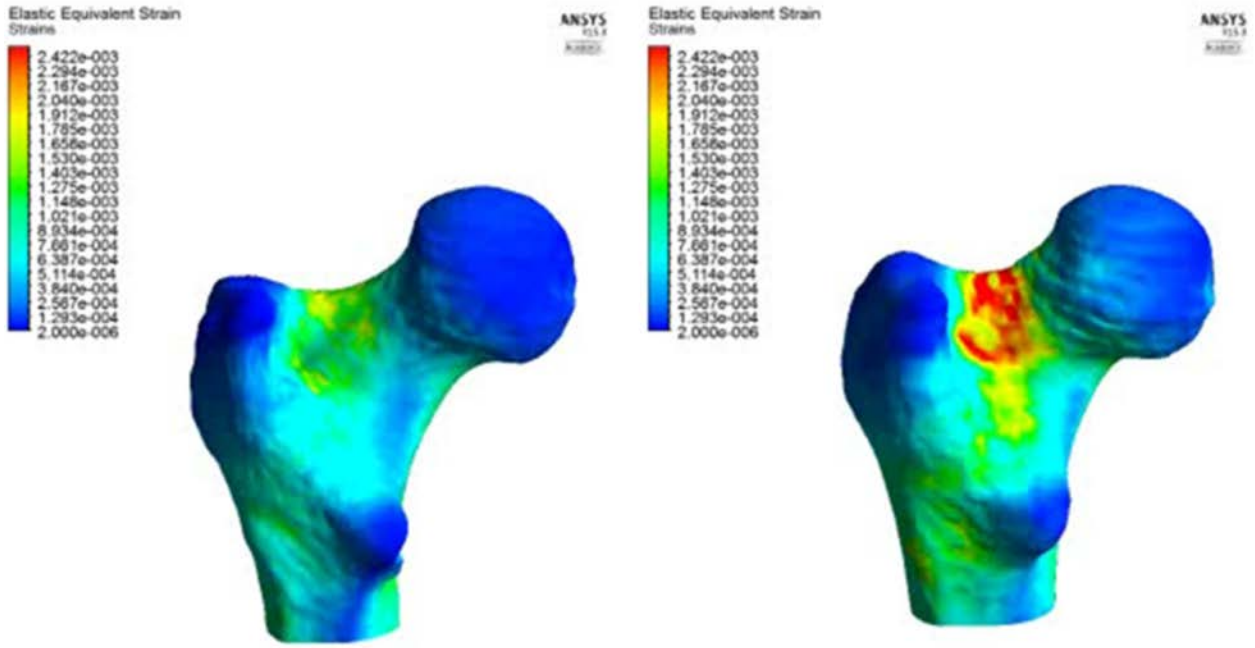
Anatomical landmarks are virtually palpated and a local reference system is generated using BuilderM2O

Finite Element (FE) Simulation



Multiple Stance and Side fall loading scenarios are simulated using ANSYS APDL macros

Femur Strength



Femur strength is estimated based on the tensile and compressive principal strains

Patient Report

Patient ID

Femur strength under stance

Femur strength under side-fall

Risk of Fracture

Patient report is generated and sent to the requesting client

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Thank You!

The University Of Sheffield.

Sheffield Teaching Hospitals NHS
NHS Foundation Trust

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