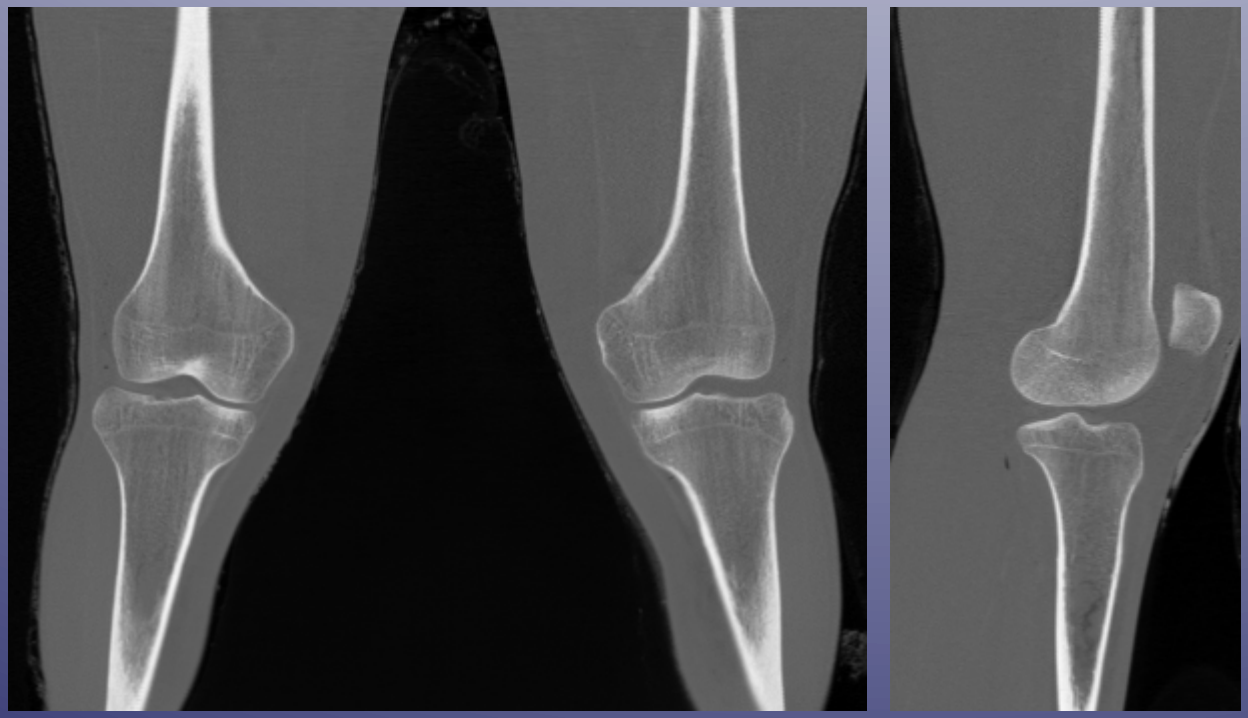
FEM of a Bone Preserving Implant TSI™ Tissue Sparing Implant

Sponsored by
Joint Implant Surgery
and
Research Foundation

JISRF internal report 2008 performed by Exponent, Inc.

Cadaver CT Data



Right hip
39 y.o. male
5' 11", 199 lbs

Visible Human Project *- Digital image dataset of complete human male and female cadavers in MRI, CT and anatomical modes*

United States
National Library of Medicine
National Institutes of Health

Models

Intact

484,748 elements

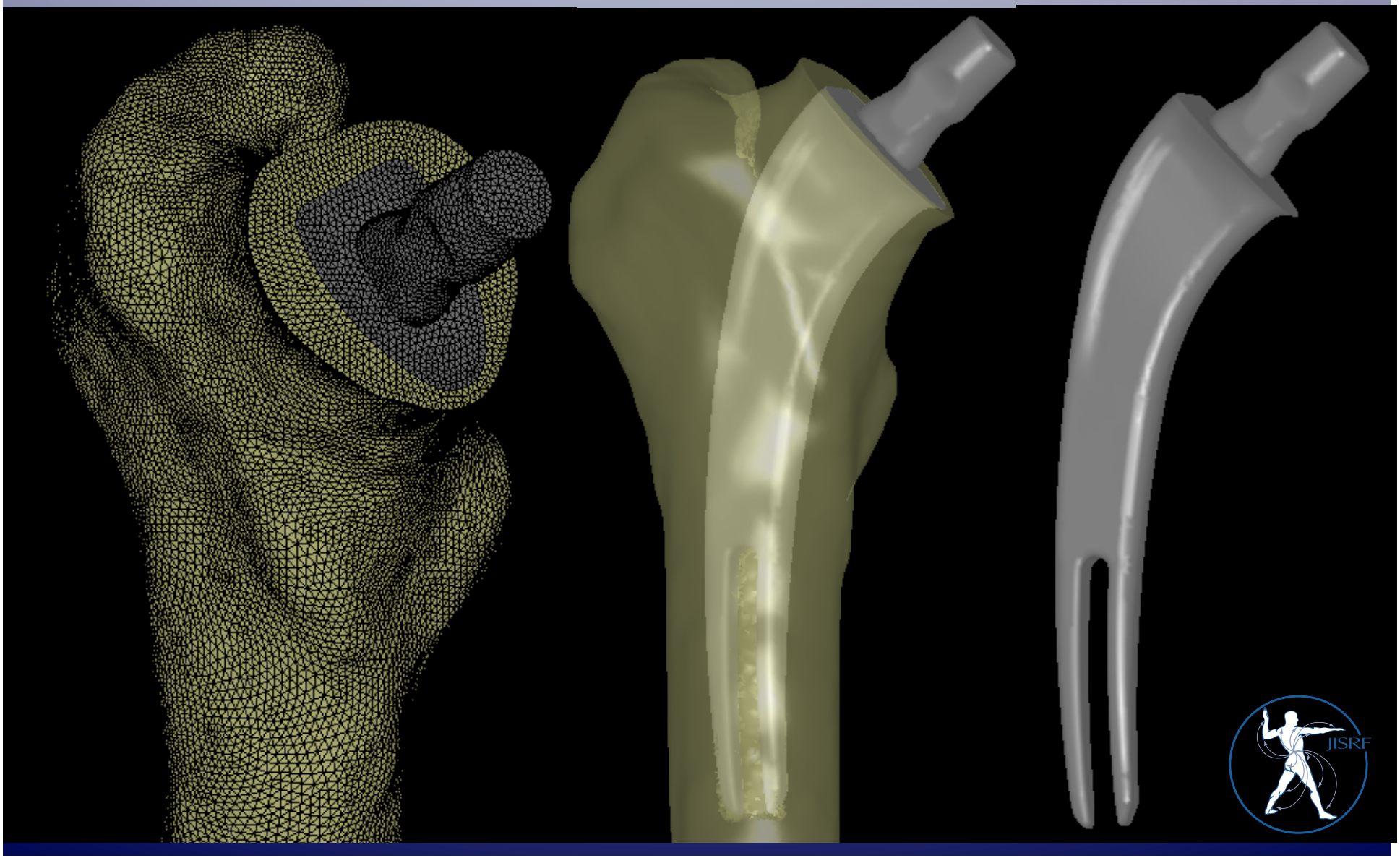
Short Stem TSI™

510,344 elements

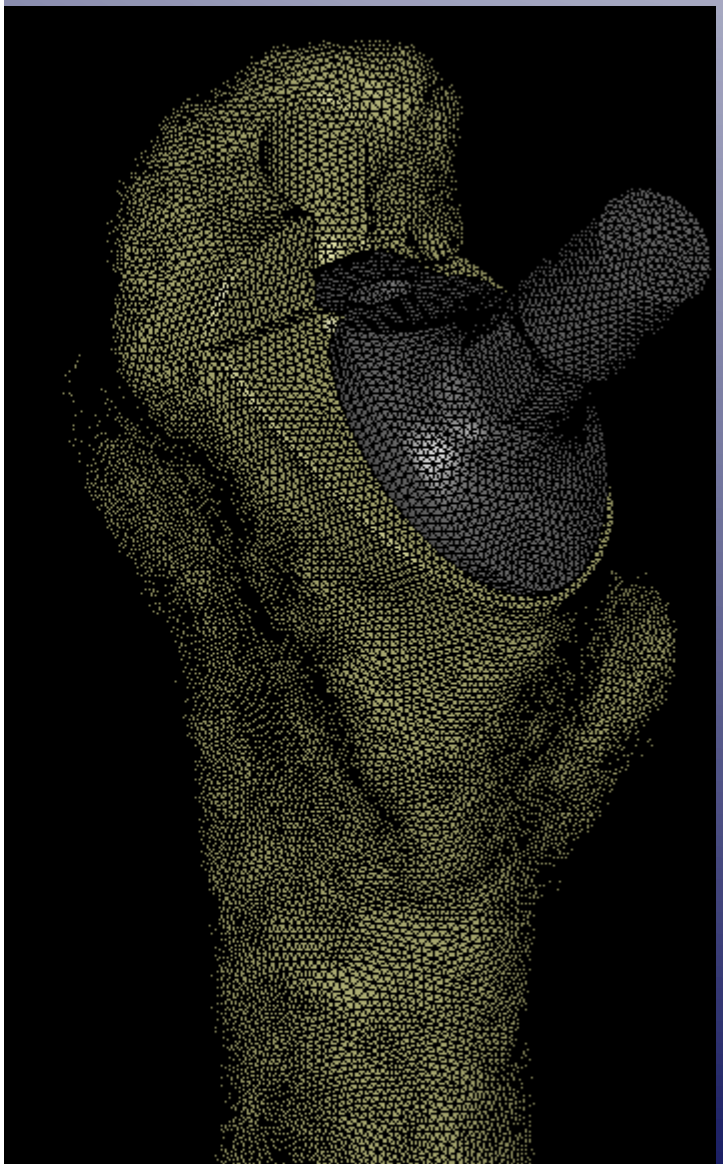
Long Stem AML® style

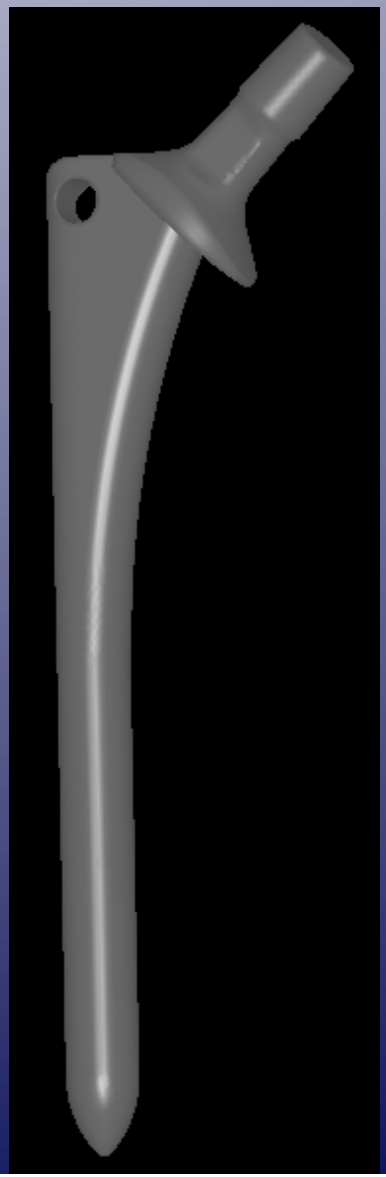
760,502 elements

Short TSI™ Stem
Size 4



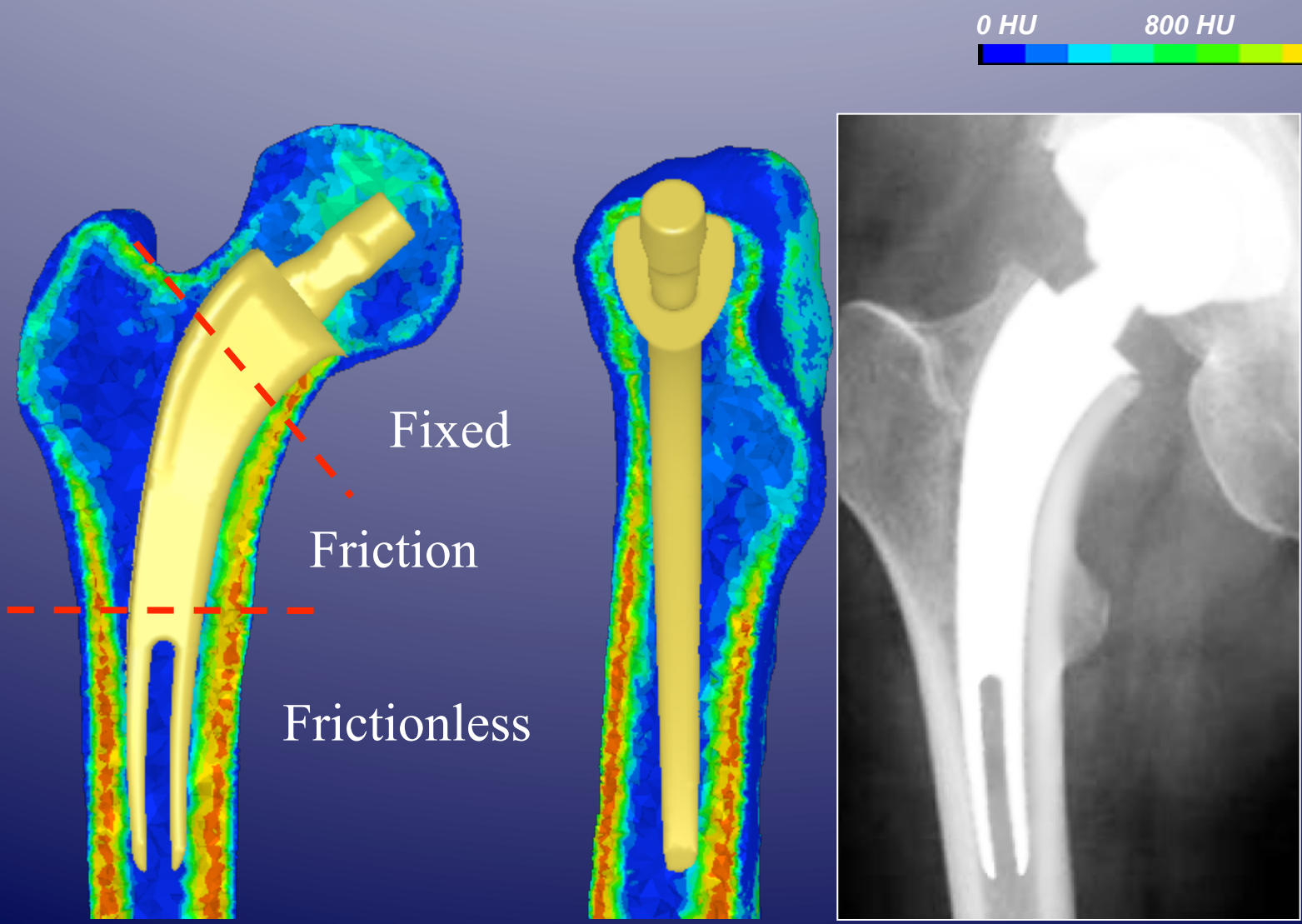
Long Stem





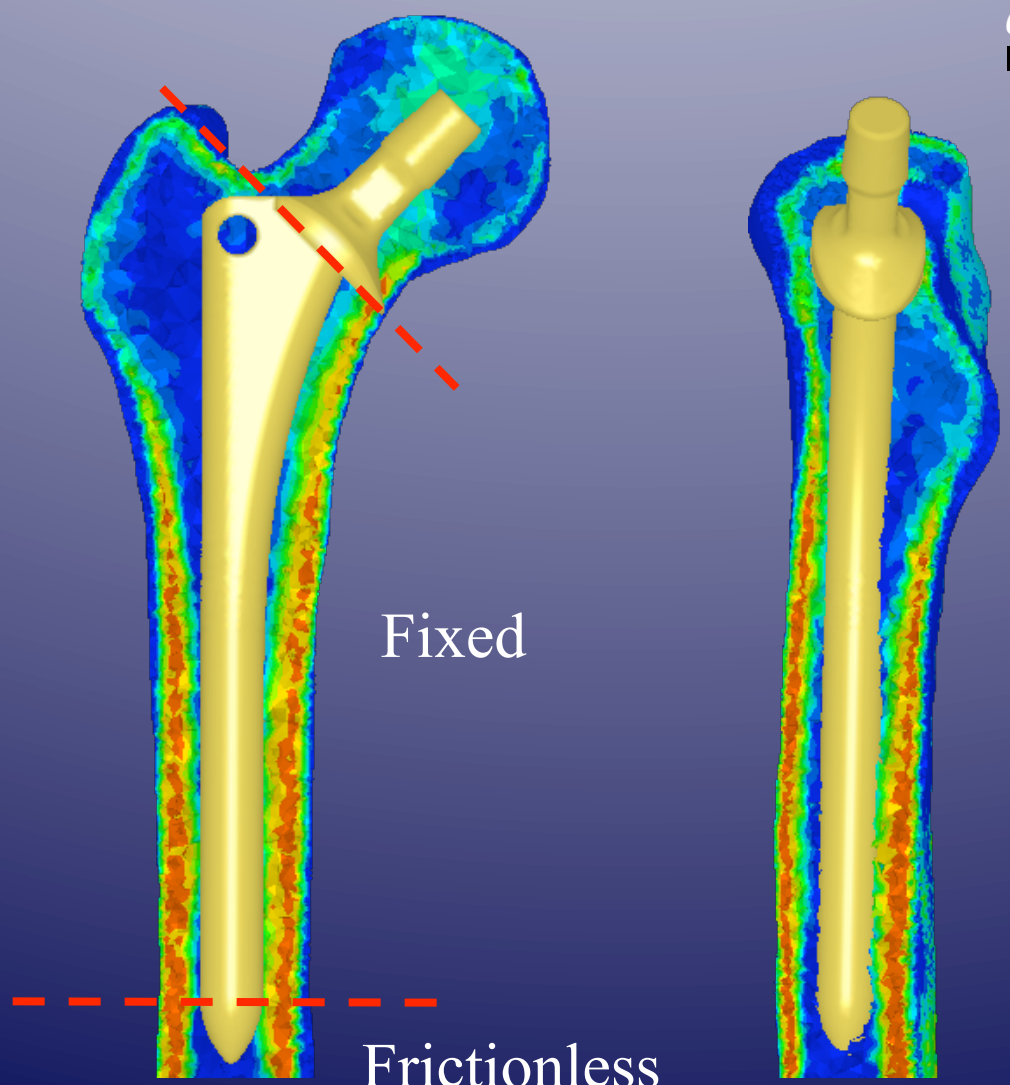
Implant Placement and Fixation

Short TSI™ Stem



Implant Placement and Fixation

Long Stem



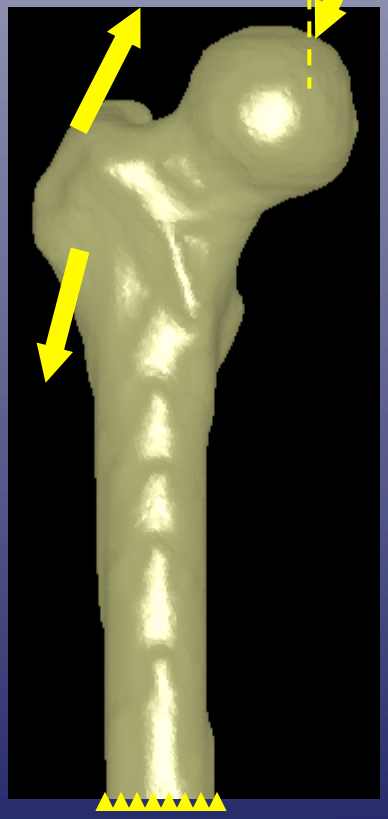
Loads and Boundary Conditions

Peak Gait

1783 N (2.4x BW)
Peak gait load
(level walking)

784 N (1.0x BW)
abductor and tensor fascia
lata muscle loads

13°



710 N (0.9x BW)
vastus lateralis
muscle load

Distal femur fixed

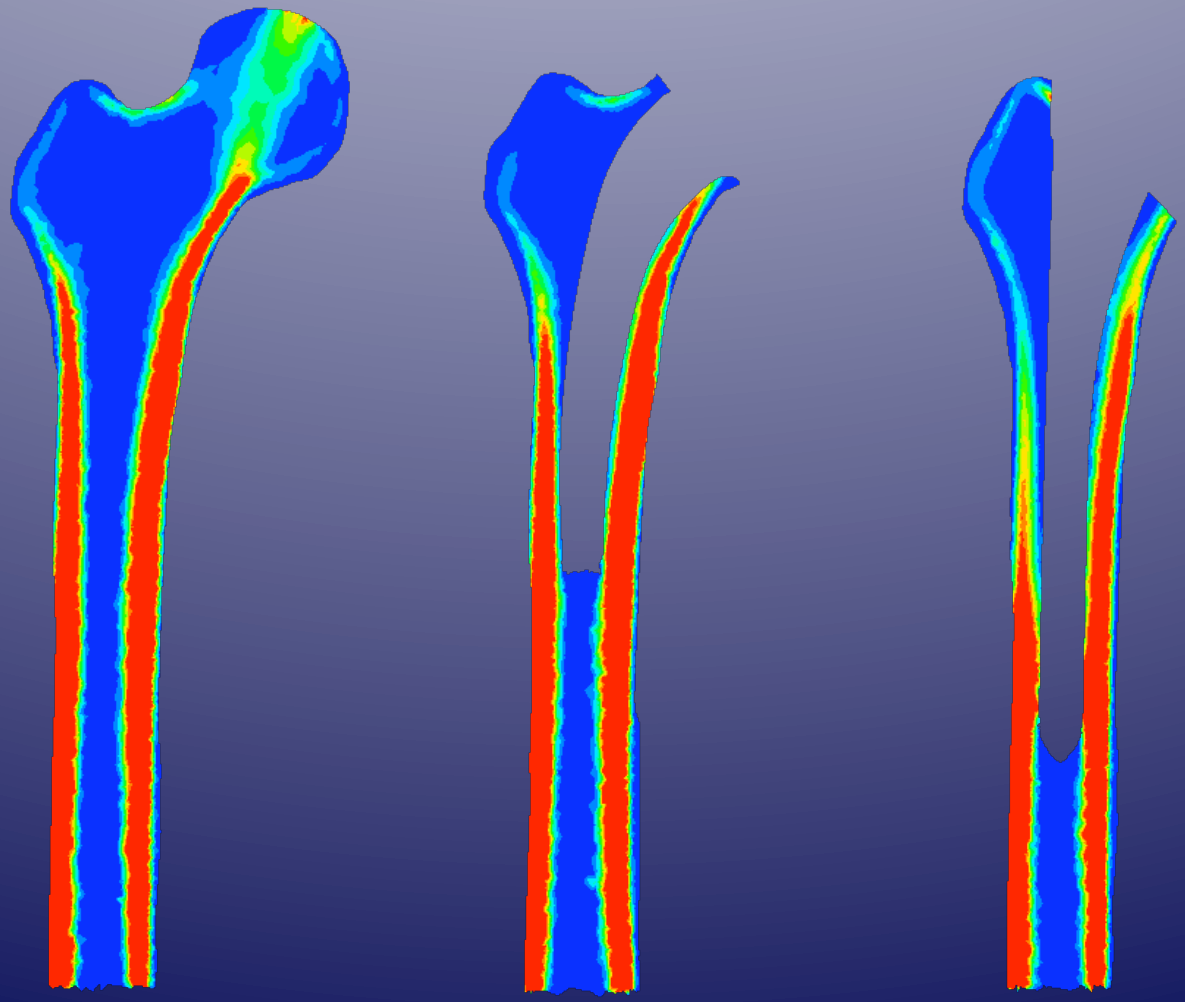
[Heller *et al.*, J. Biomech, 2005]

von Mises Stress

Peak Gait

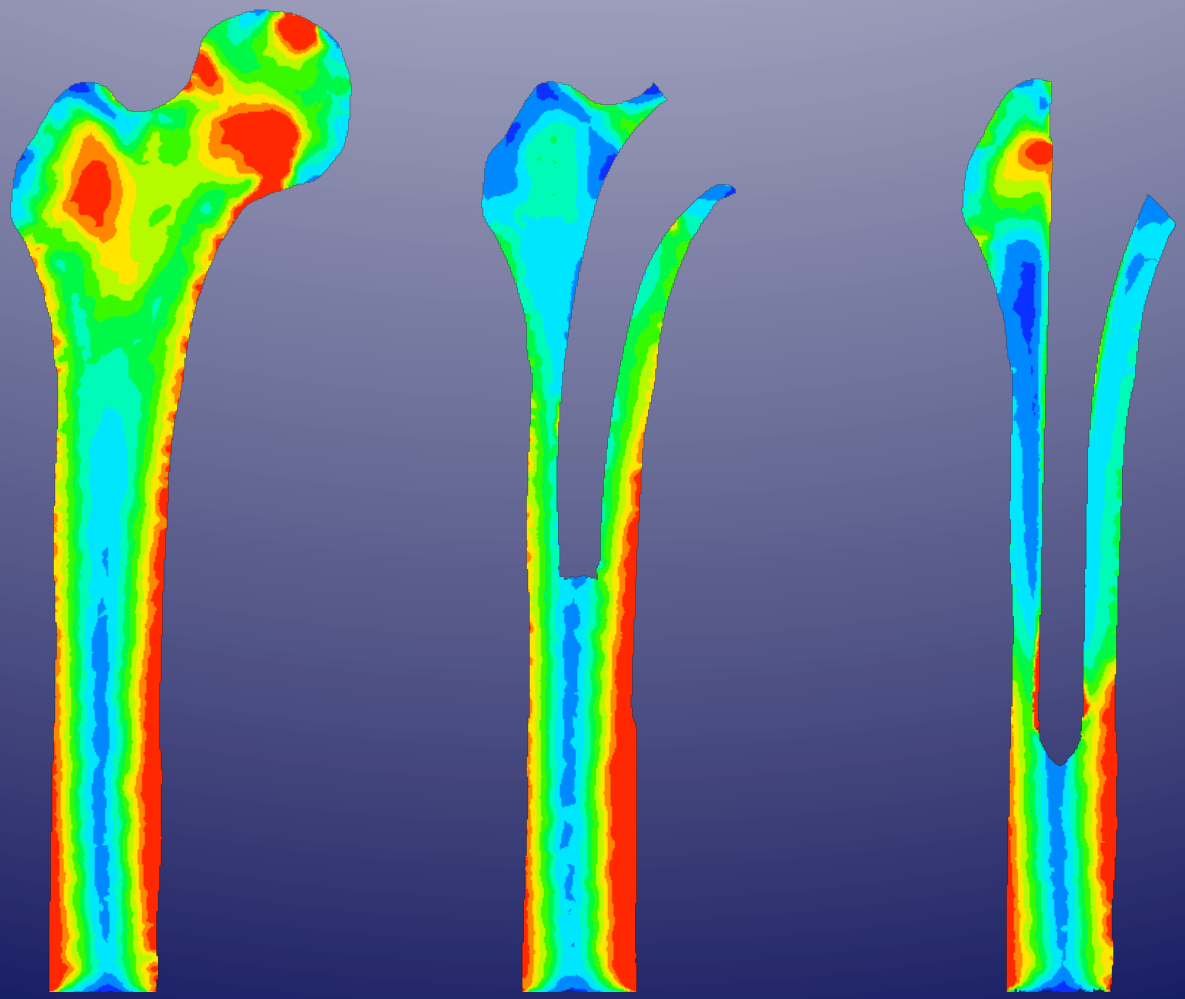
0 MPa 5 MPa 10 MPa

Intact *Short TSI™ Stem* *Long Stem*



von Mises Strain
Peak Gait

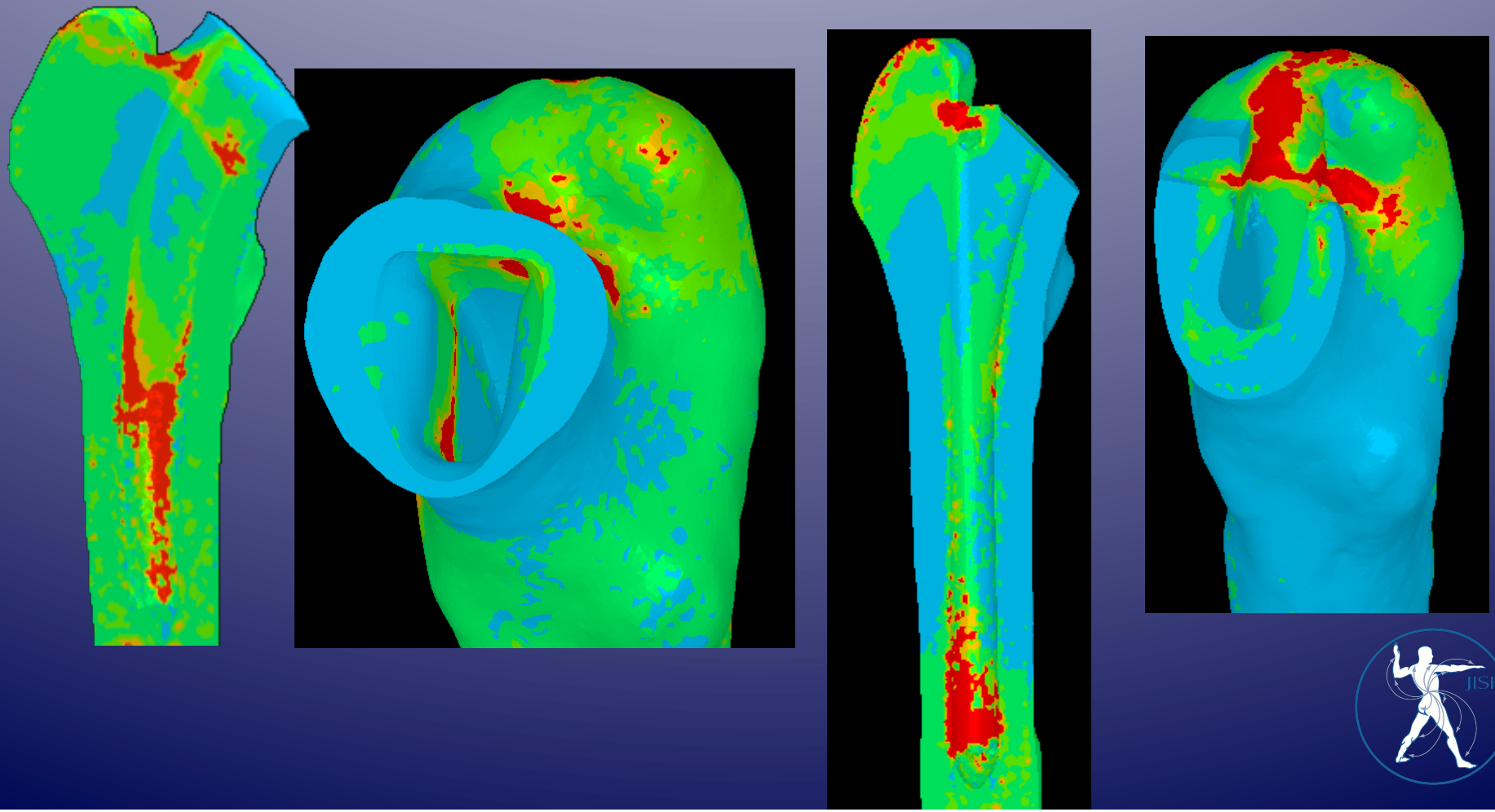
Intact *Short TSI™ Stem* *Long Stem*



Remodeling Stimulus
Peak Gait

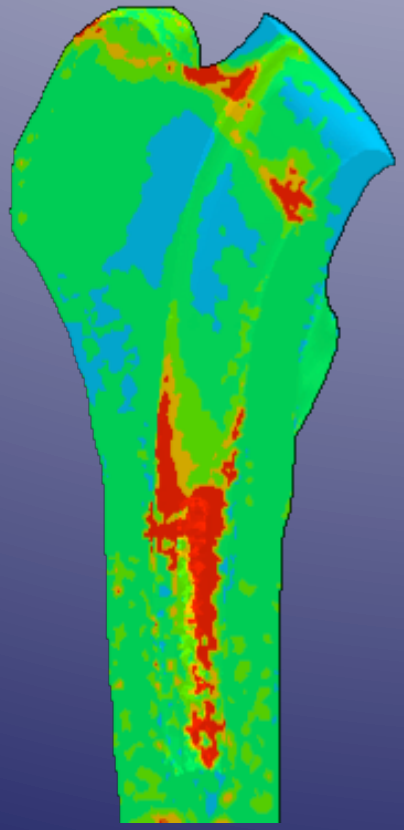
Short TSI™ Stem

Long Stem

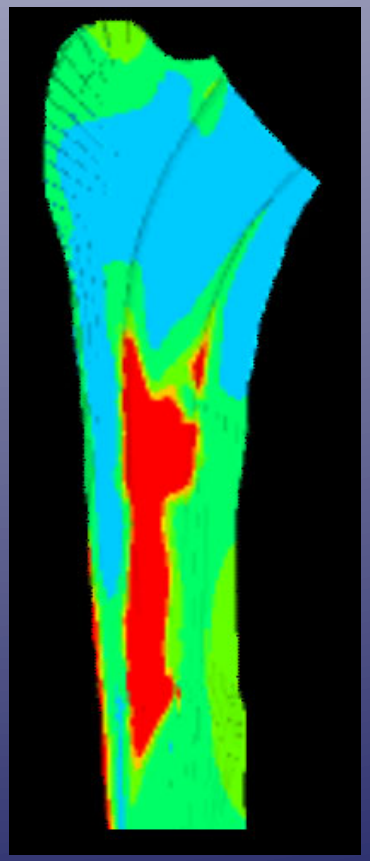


Remodeling Stimulus
Peak Gait

Short TSI™ Stem



Biodynamic*



*different donor

Discussion

- Less bone resorption for short TSI™ stem vs. long AML® style stem
- Less bone resorption for short TSI™ stem vs. Biodynamic
- Other factors
  - Single donor
  - Undersizing effects unknown
  - Positioning effects unknown