Image-based fracture prediction: application to aging and cancer

David Mitton, Benjamin Delpuech, Rémy Gauthier, Edison Zapata, Cyril Confavreux, Max Langer, Françoise Peyrin, Hélène Follet

Univ Lyon, LBMC, Creatis, Lyos

UNIVERSITÉ DE LYON

Lyon 1

IFSTTAR

Aging

Fracture?

90% of the fractures over 65 y.o. related to falls
(Dubousset et al. Bull Acad Med. 2014)
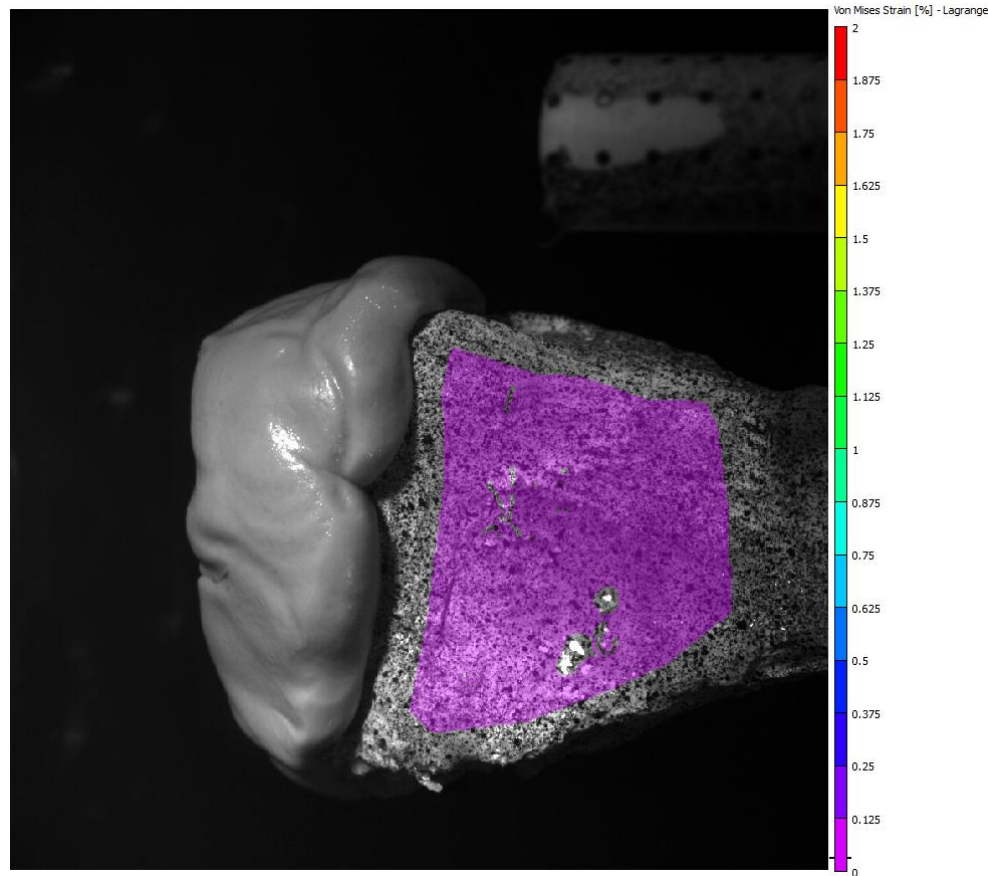
Fracture related to fall

Femoral neck

Radius

Fracture of the radius
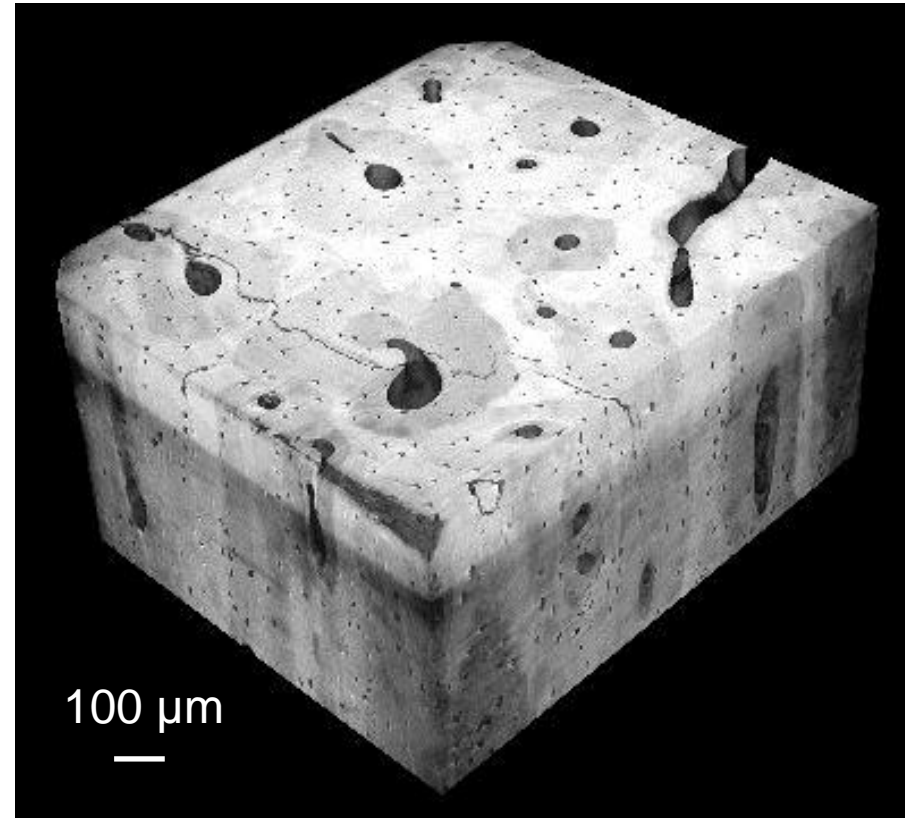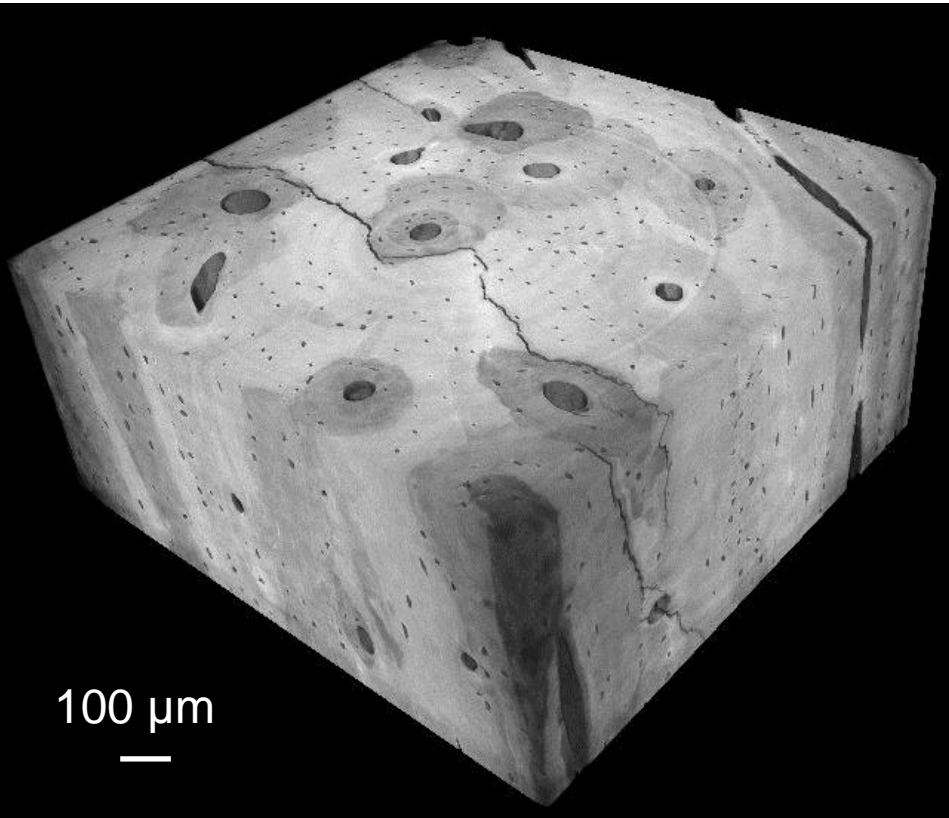
Zapata et coll. J. Biomech 2017

Cortical bone fracture?

Gauthier et coll. JMBBM 2017

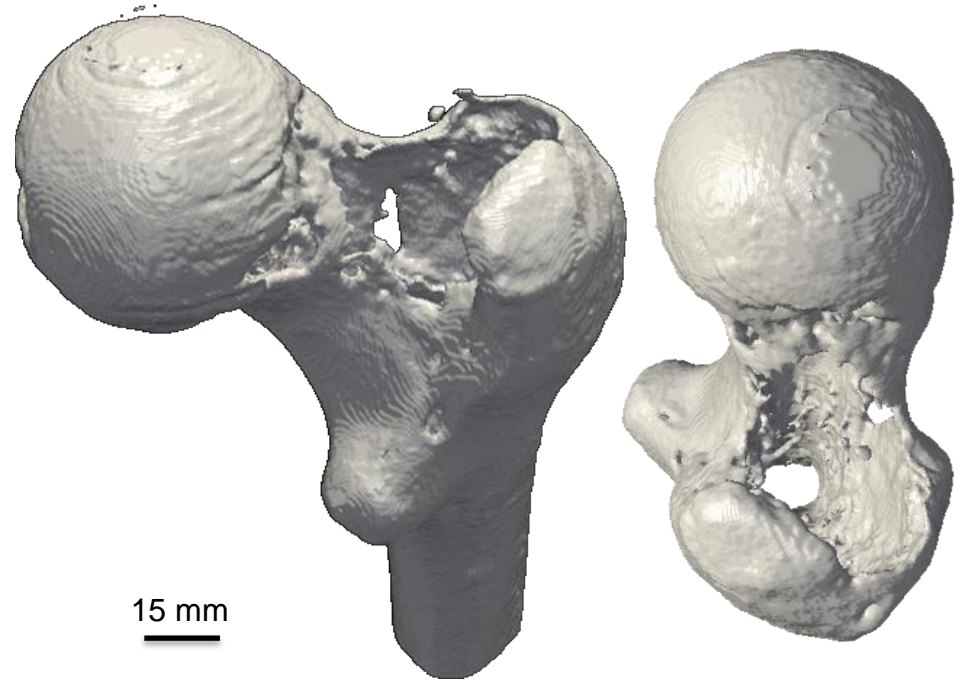Quasi-static

Fall

Metastatic bone

Fracture risk?

Coronal view

QCT

3D reconstruction

15 mm

Tumor properties?

PRIMES
UNIVERSITE DE LYON

Lyos

CREATIS

LBMC

Needs

- Fracture prediction to:
  - choose the best treatment (osteoporosis)

  - optimize locomotor strategy and oncology program to prevent bone fractures (cancer)

Image-based models?

Methodology: image-based model
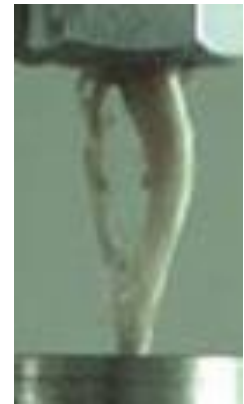

3D reconstruction from QCT

Meshing
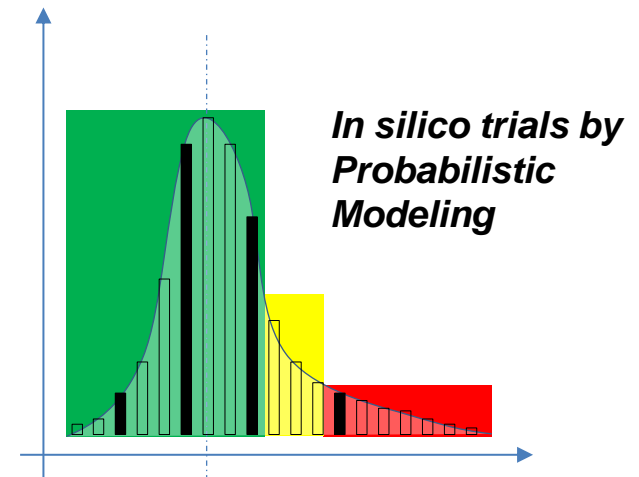
Finite element analysis

Validation

Take home messages

Validation

Probabilistic approaches

In silico clinical trials

In silico trials by Probabilistic Modeling

Applications:
- tools for clinicians to improve patient care

- medical device engineering