Tomography for metals (industry)

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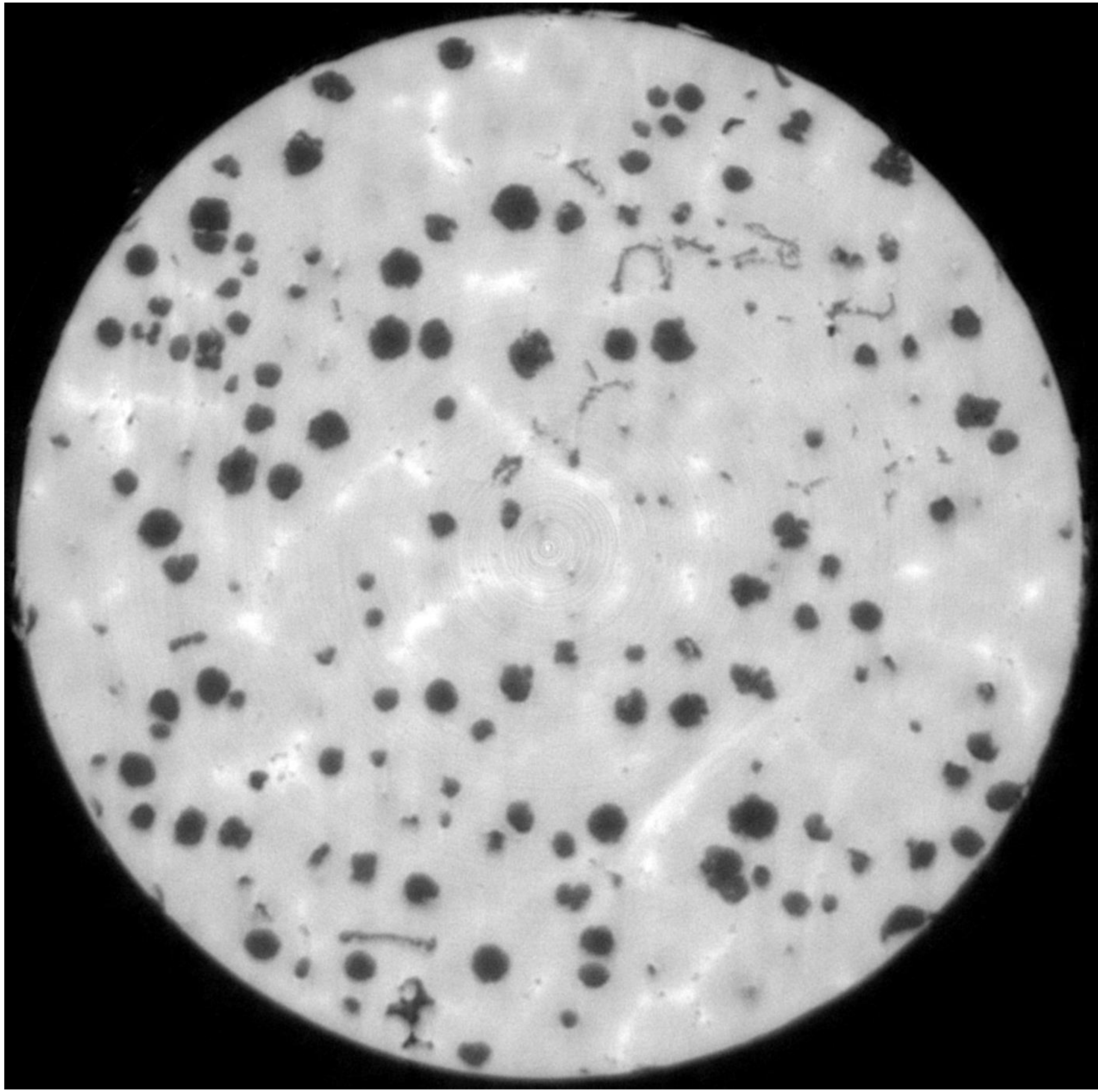
Why tomography on metals?

- Look for
  - Phases
    - Precipitation, particles, etc.
  - Porosity
    - Voids, defects, quality control, etc.
  - Damage
    - Cracks, delamination, etc.
- 2D, 3D, **4D**



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Ductile cast iron under tensile loading

- 4D study of deformation mechanisms
- Material from a truck engine
- Push to reduce emissions
  - Increased pressure and temperature in the engine = need for better materials

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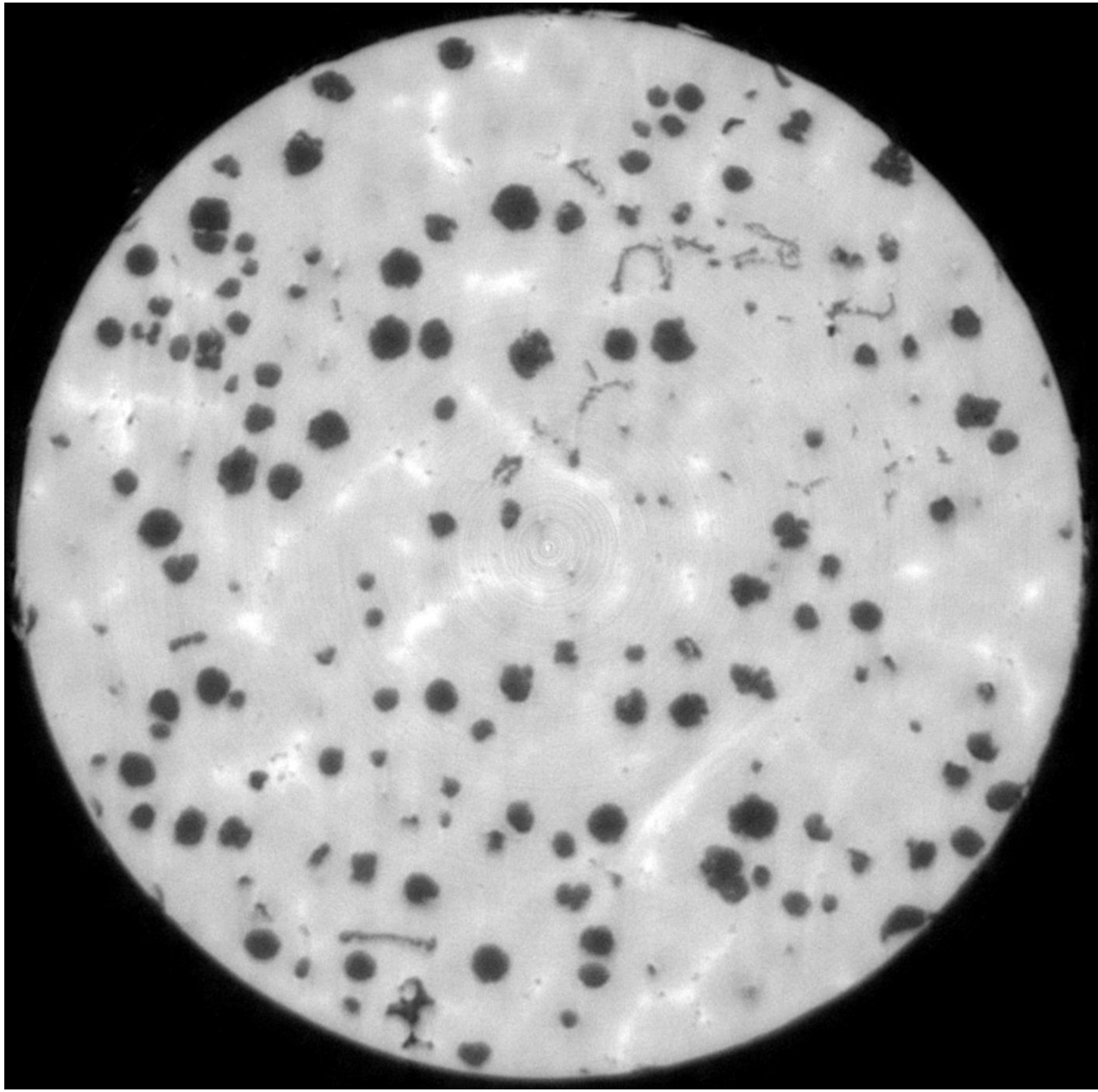
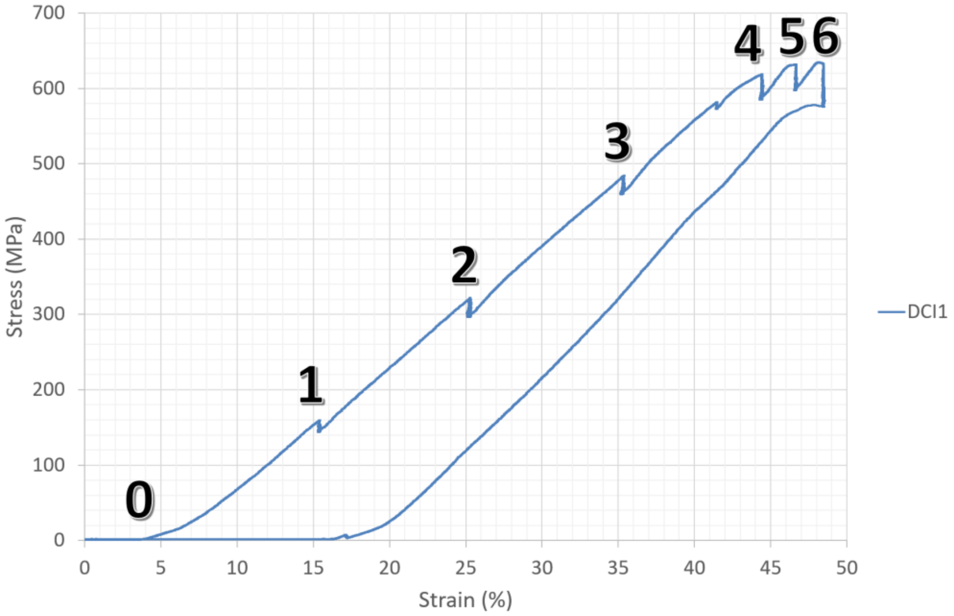
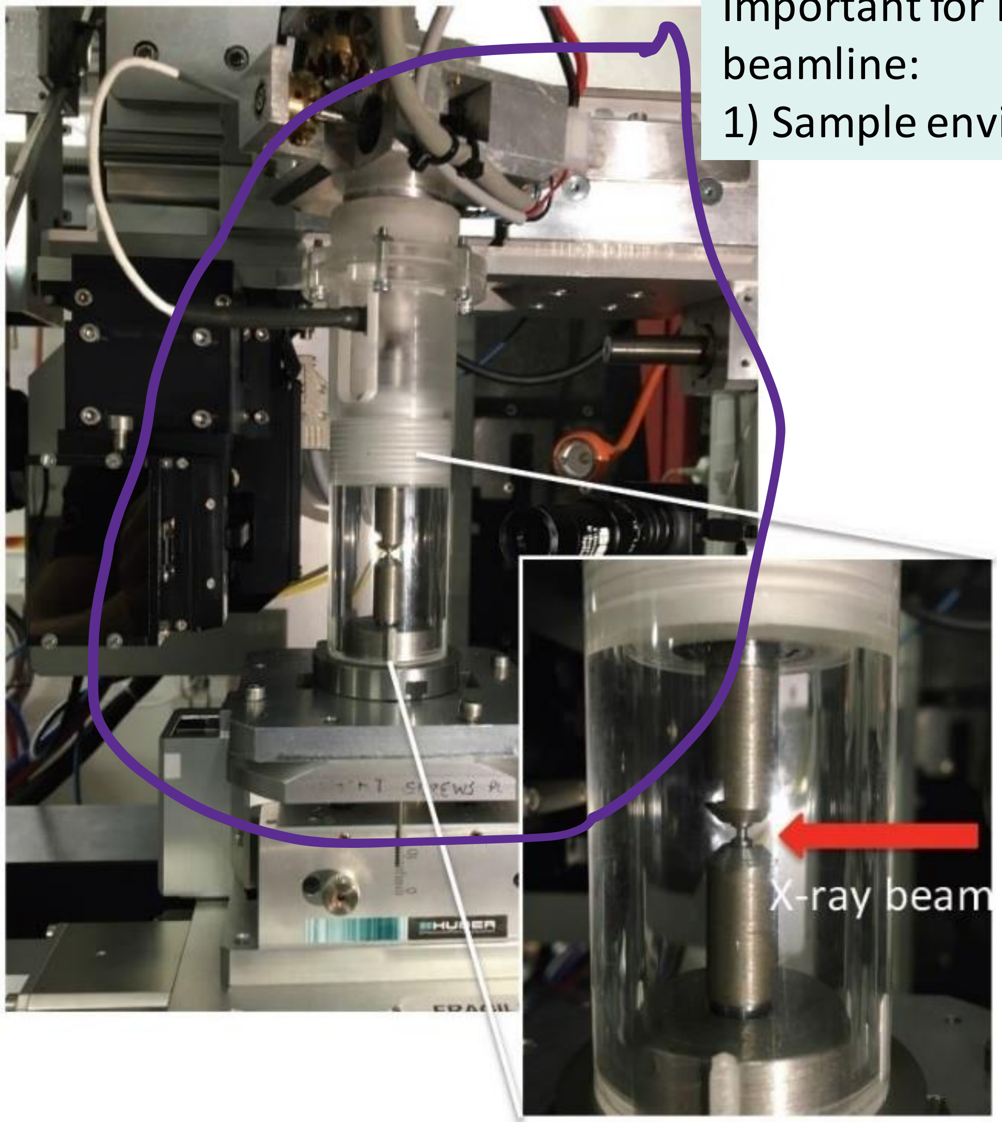


The experiment

- In-situ tensile loading
- Tomography + 3DXRD
- ID11 @ESRF
- Energy: ~60keV





Important for new beamline:
1) Sample environments

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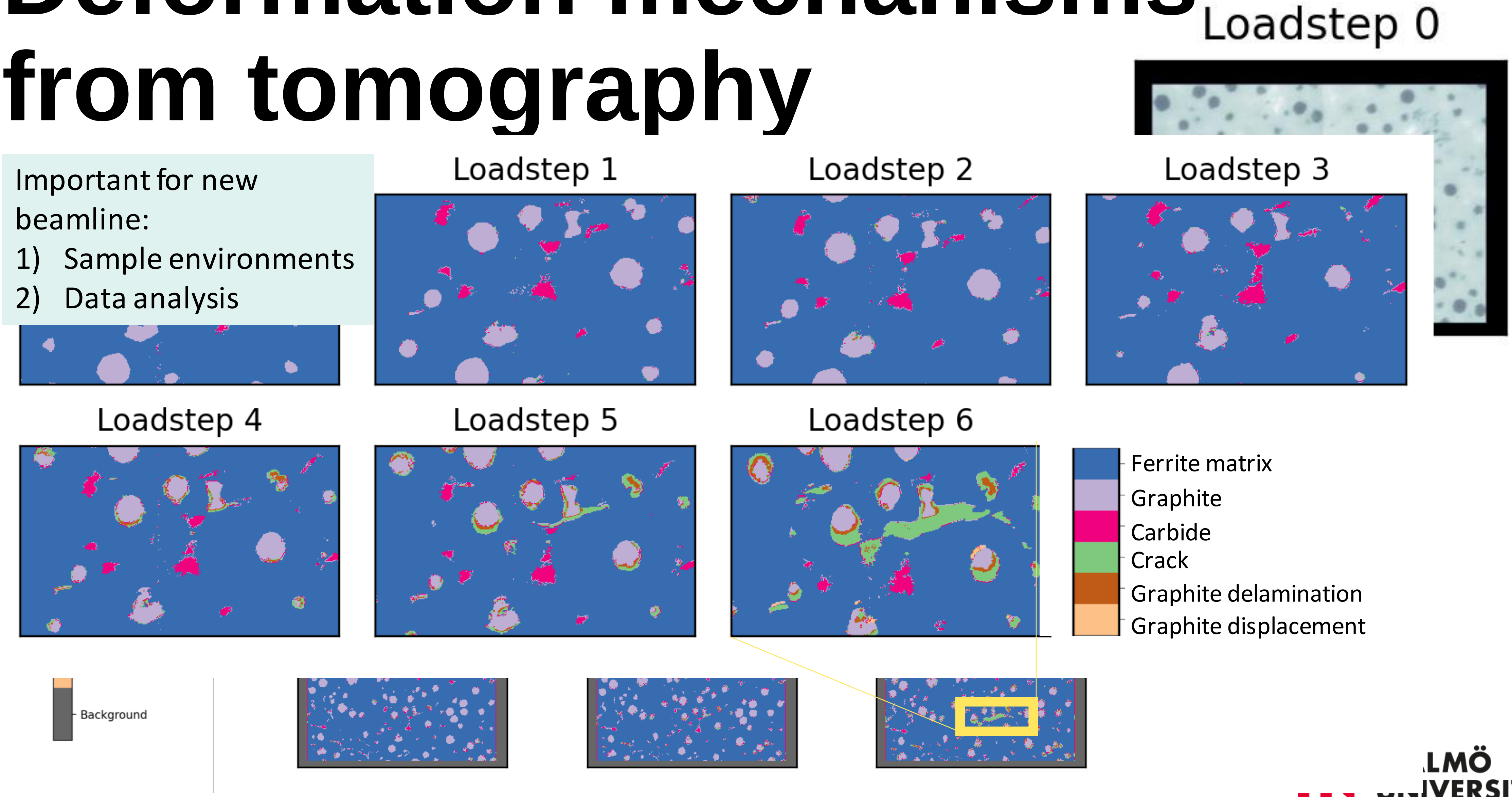
Deformation mechanisms from tomography

Important for new beamline:

1) Sample environments
2) Data analysis



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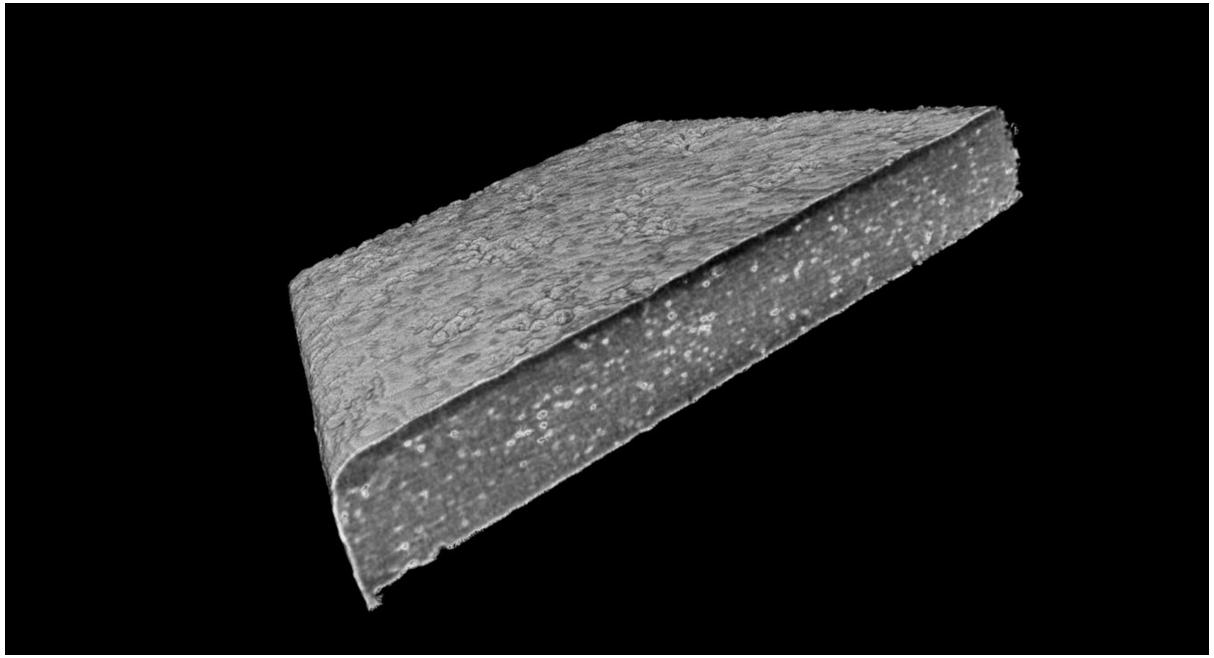
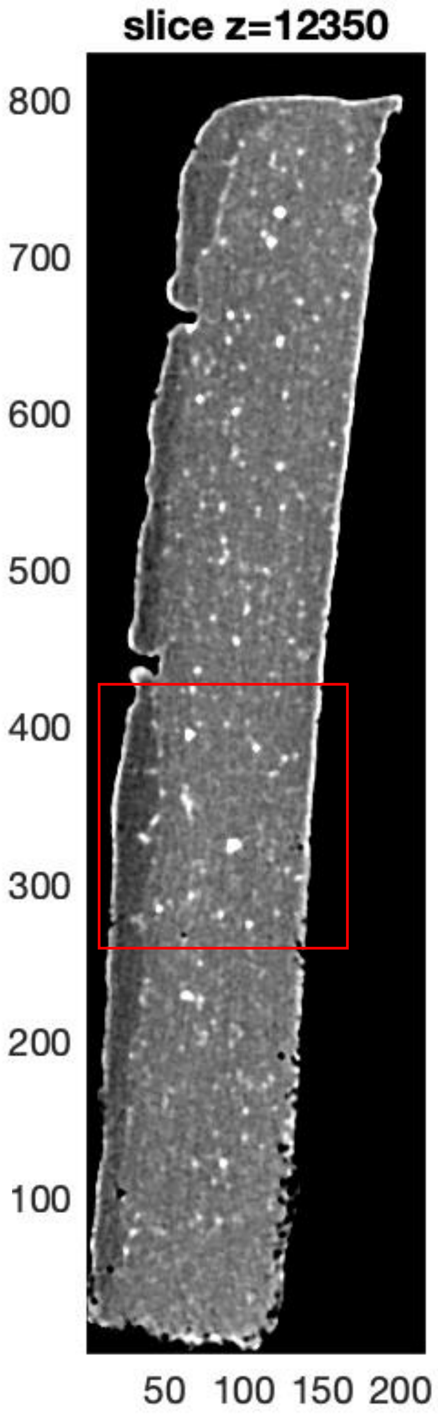
Liquid film migration in Al with braze cladding

Important for new beamline:
1) Sample environments
2) Data analysis
3) Laminography (?)





- Tomography from 4D Imaging lab (LTH)
- Braze layer is easily visible on one side
    - Density difference
    - Also large differences in crystallography

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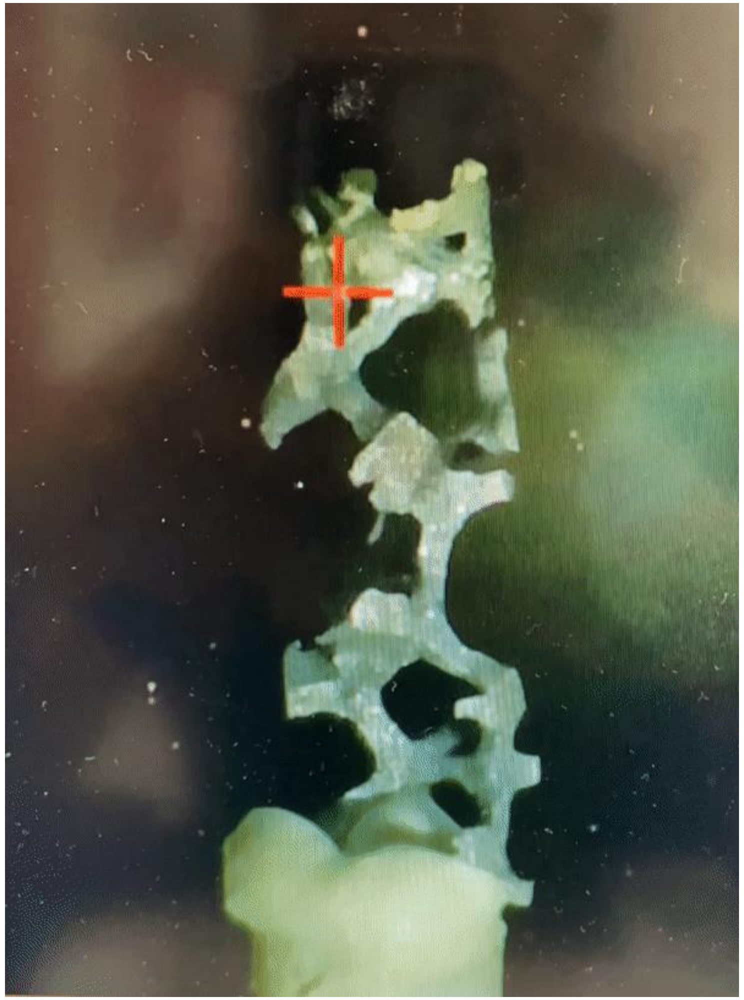
GRÄNGES

Stenqvist, *et al.* (2021), Adv. Eng. Mater
Tomography from 4D Imaging Lab, Lund University

Microstructural evolution in metal foams

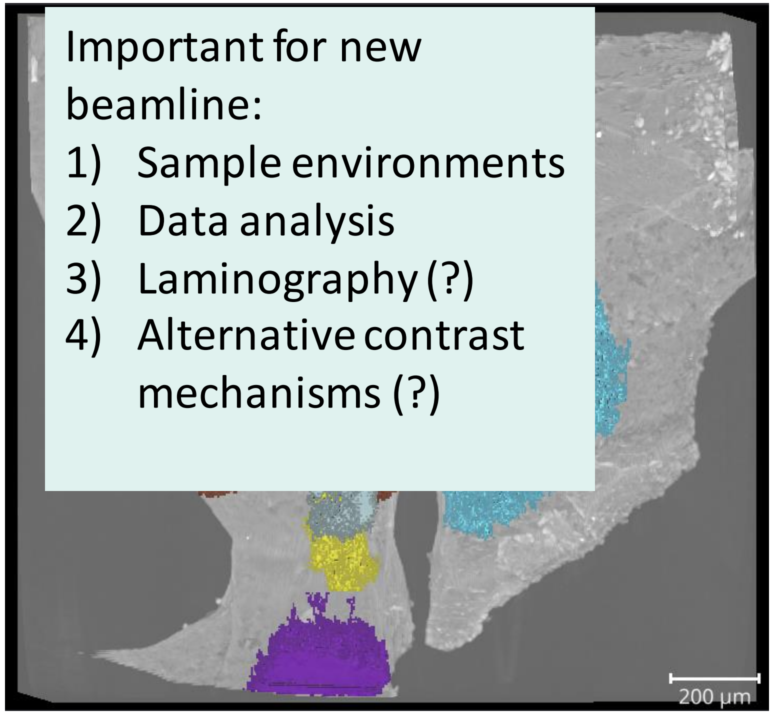
- Multimodal imaging (DCT, 3DXRD, PCT) of Al foams during heat treatment
- Grain growth and precipitation of Si-rich particles
- ID11 (ESRF)
- Energy: 38keV



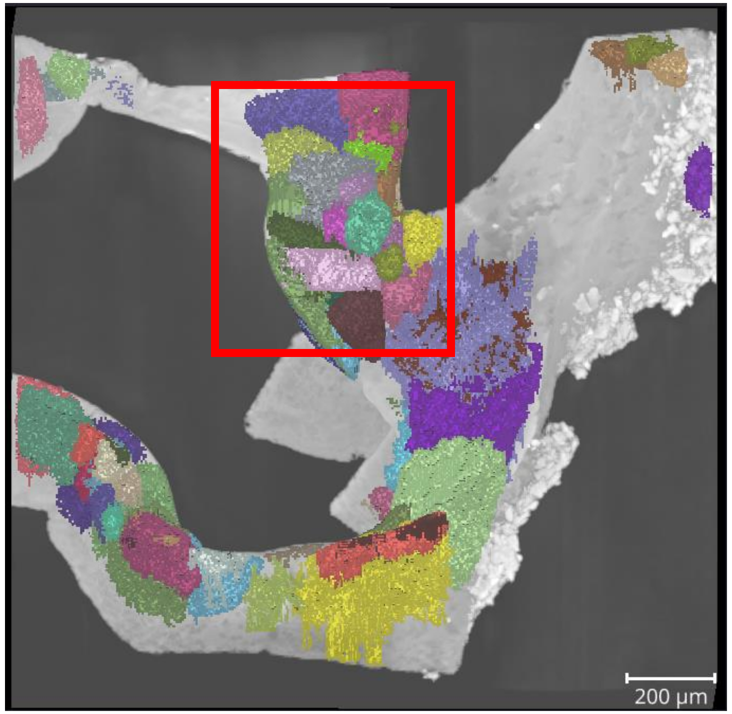
Grain evolution by diffraction contrast tomography

Important for new beamline:

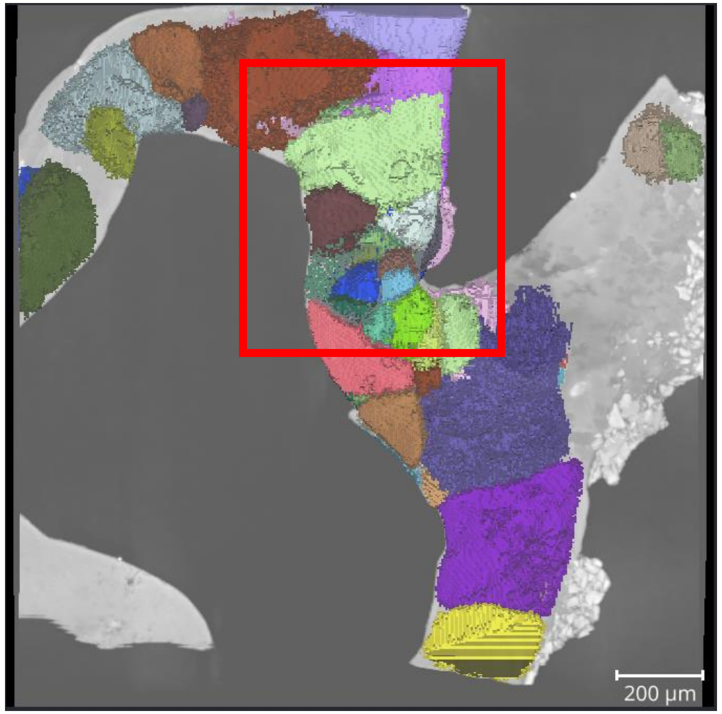
1) Sample environments
2) Data analysis
3) Laminography (?)
4) Alternative contrast mechanisms (?)



Initial



after annealing at 530°C for 8hr



after annealing at 165°C for 12hr

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