Alert School:
Discrete Mechanics of Geomaterials

Experimental Sessions 2

3D

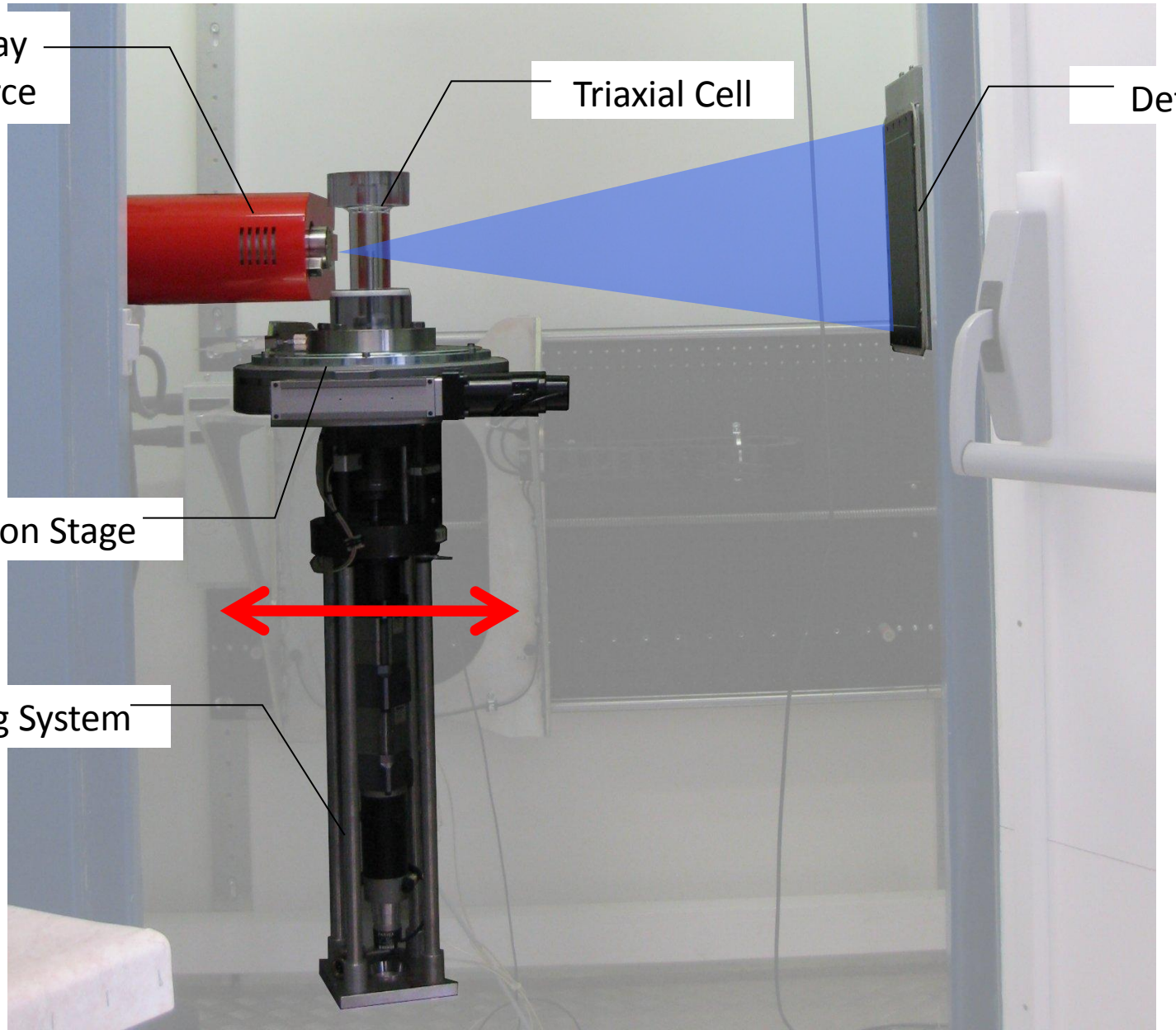
The Basic Idea…

- 3D non-destructive image of a geomaterial
- If this is done during loading we have 3D+t
- Analysis between images like in the last session can give kinematics… (too slow for this session)

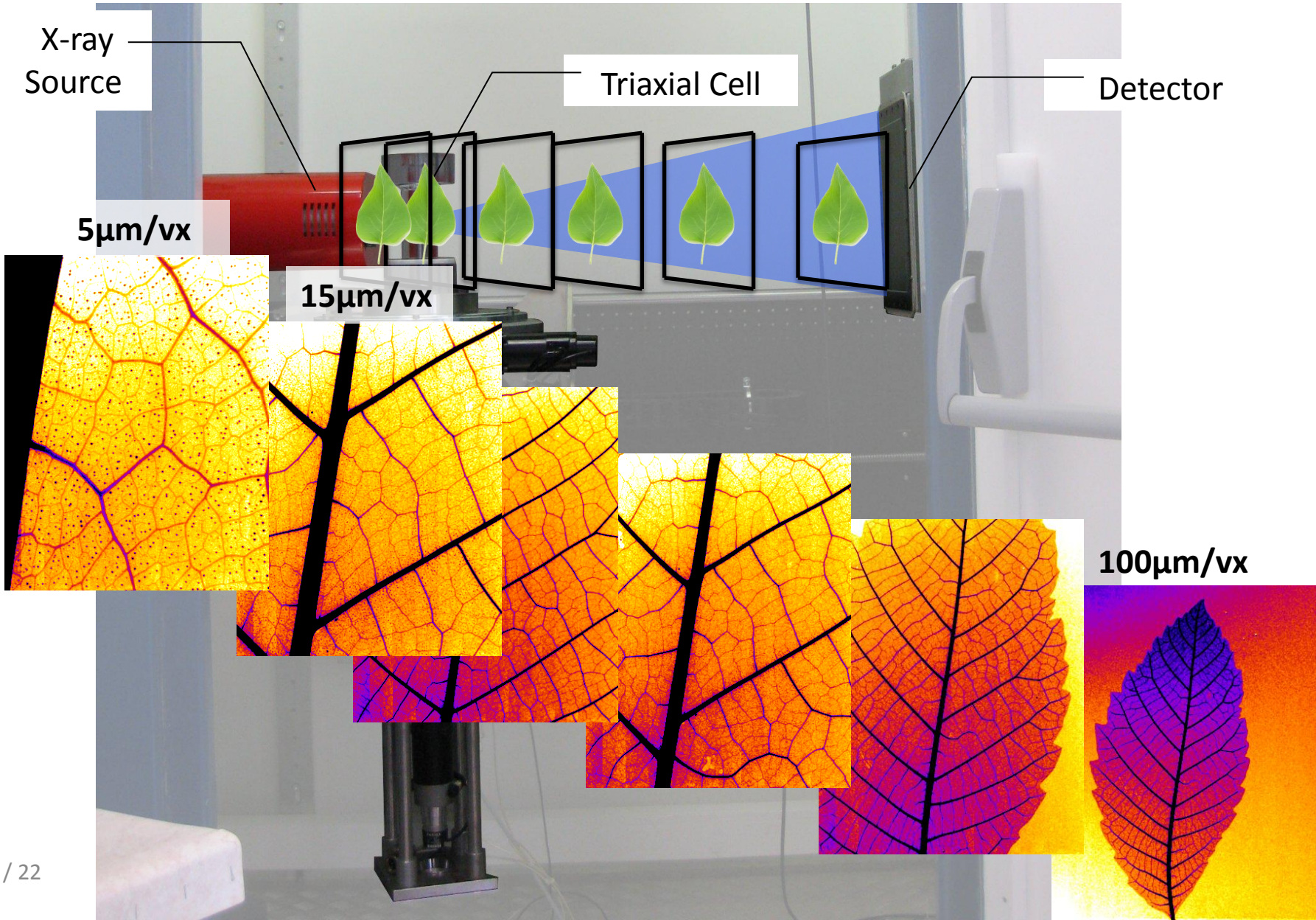
3D is not easy

- Big lesson: 3D is not like taking a photo...
  - A photo of sufficient quality is not easy
  - A tomography is another kettle of fish!

Experimental Characterisation



Experimental Characterisation



Scanning Principles

- X-ray source can vary energy and flux
- Taking many radiographs while rotating sample
- Reconstruction algorithms like Feldkamp Filtered Backprojection used today allow you to reconstruct a 3D model.

How long does it take?

- Synchrotron is very fast (high flux, monochromatic, parallel beam)

- Here we have tradeoffs:
  - Spot Size
  - Image quality (noise and dynamic range)
  - Movement of setup

Reconstruction

- In order to reconstruct, any algorithm needs to know where the image is rotating around

- In order to measure this we do a calibration, which sometimes needs to be corrected

Material

- Sand from:

Let’s go and scan!

Our Scan

- Our acquired images – where is the centre of rotation?
- Bad Tilt
- Bad Center of Rotation (COR)
- Good Reconstruction

3D Exploration

- We have a lot of data, things get slow
- Thickness of images
- Load images as a stack and look through them
- Stack reslicing concepts

3D Views

- Data reduction:
  - Greyscale depth
  - Scale
  - Cutting
- 3D Visualisation tools

Measurements

- Grain sizes?
- How many grains?
- …How can we separate the grains?

Next steps…

- 3D+T analysis – just like in 2D in the last session but much slower!
  - Either: DIC
  - Or… Particle Tracking!

- Thanks for your attention!