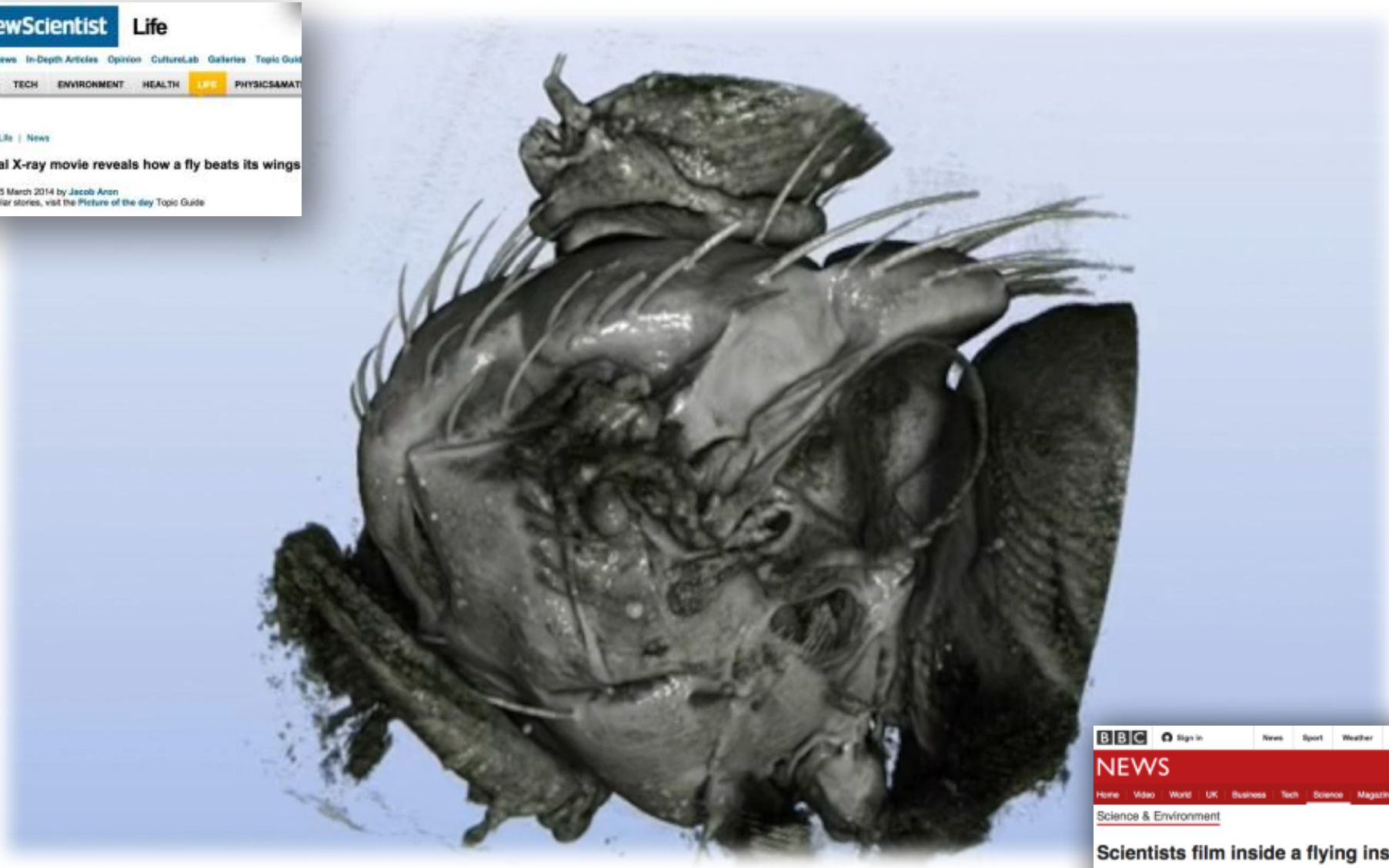
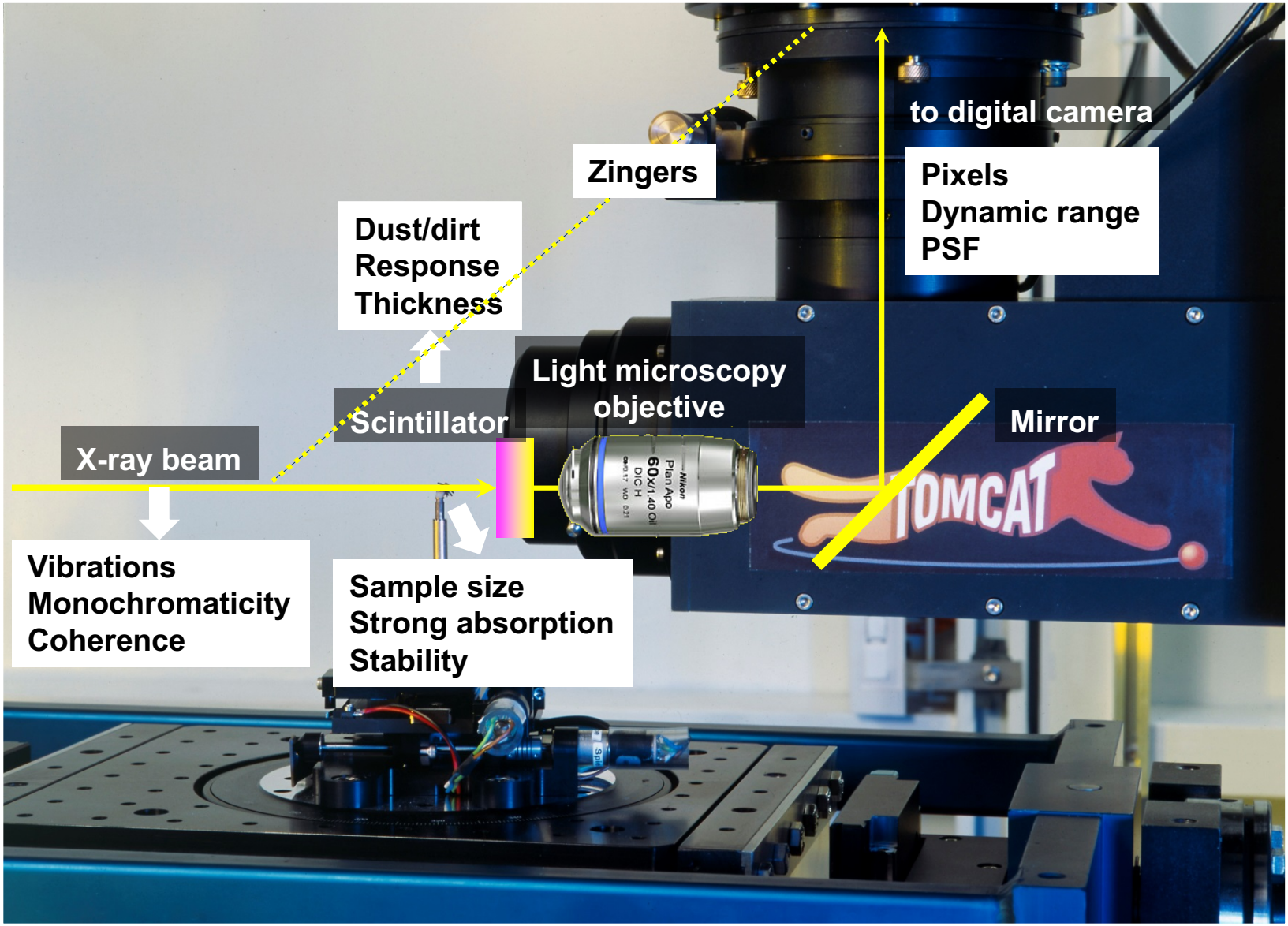
Muscles and tracheal network *during* flight



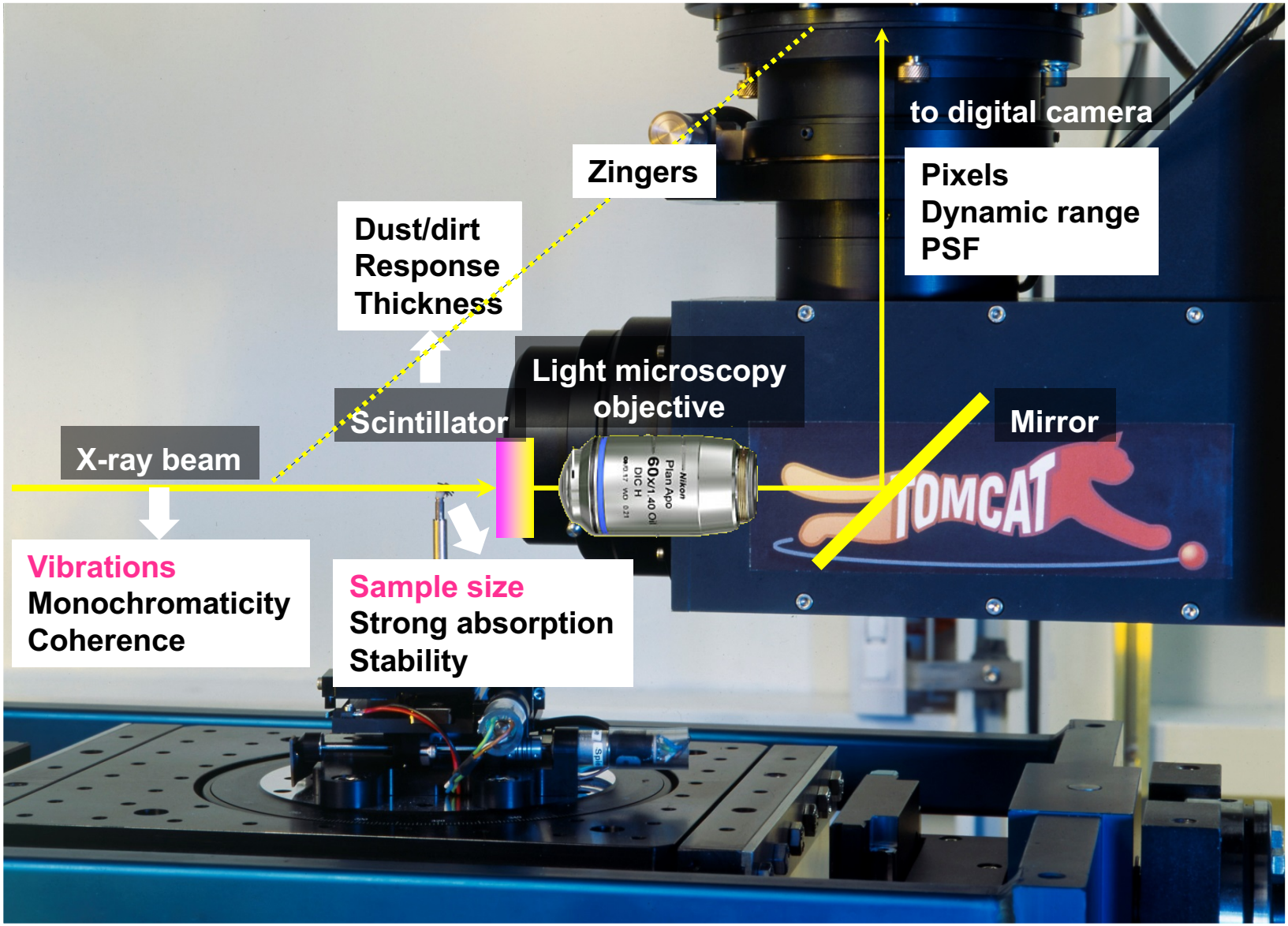
Walker et al., PloS Biology (2014) & Mokso et al., SciRep (2015)

Practical issues

Practice – Standard microtomography setup



Practice – Standard microtomography setup



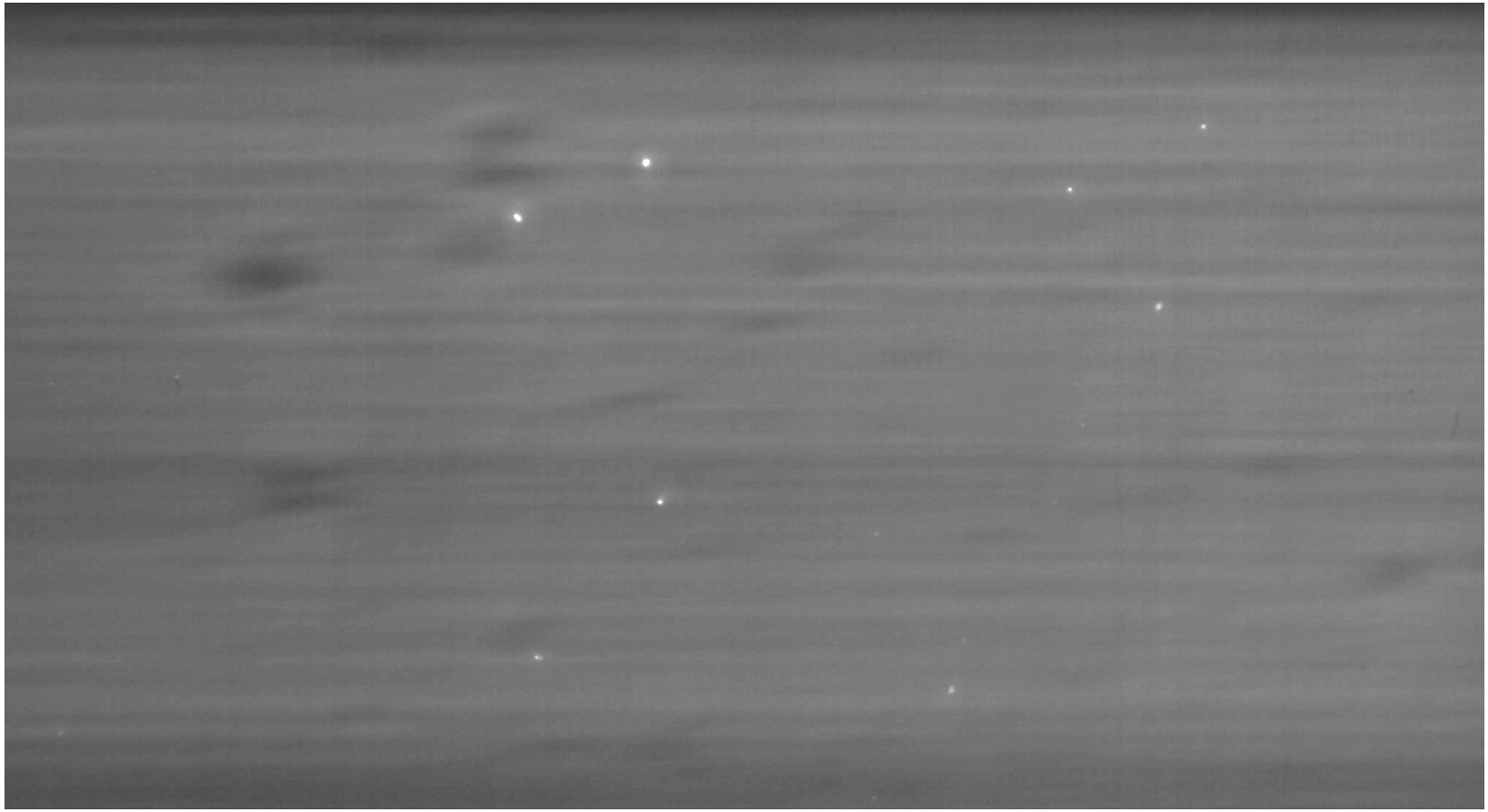
Flat field correction

- Beer-Lambert law

Measurement → $I(E) = I_0(E)e^{-\int \mu(E)dl}$

Flat field correction → $-ln\frac{I(E)}{I_0(E)} = \int_L \mu(E)dl$

Flat field correction



Exposure time: 1 ms
Frame time: 25 fps (40x slower)

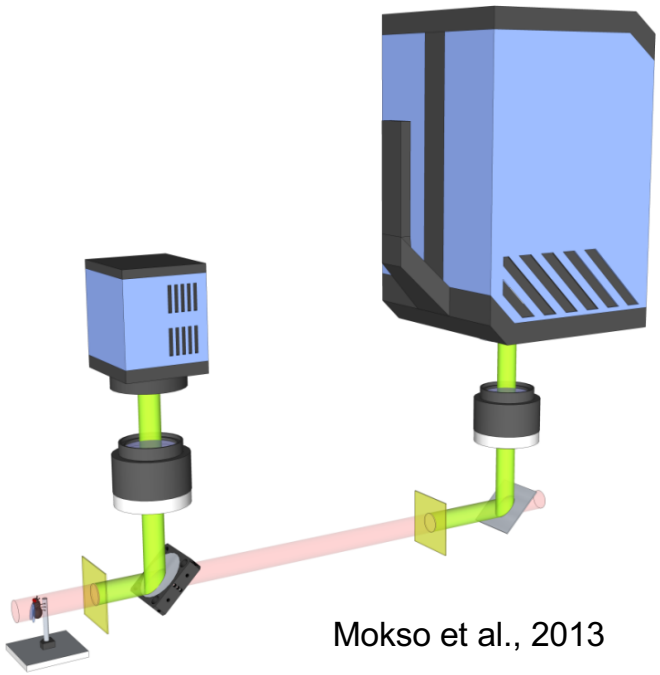
Flat field correction

- Resulting artifacts
  - Ring/band artifacts
  - Non-quantitative
  - Resolution degradation

- Solutions
  - Average flat-field or intermediate flat-fields
  - Flat-field tracking
  - Adaptive time-dependent normalization

    Titarenko et al., 2010
  - Dynamic intensity normalization using eigen flat field

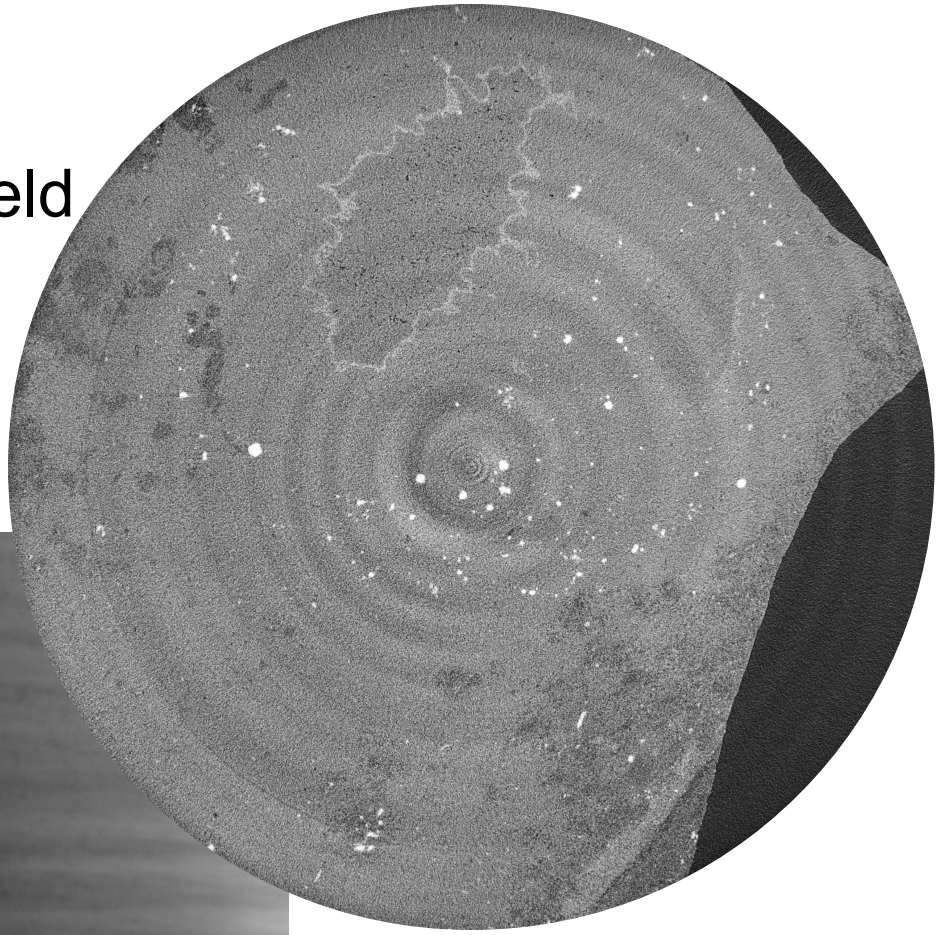
    Van Nieuwenhove at al., 2015
  - Dual camera acquisition



Mokso et al., 2013

Flat field correction

- Correction with average flat field
  - 100 flat field images
  - 40 keV



Courtesy of S. Bengtson

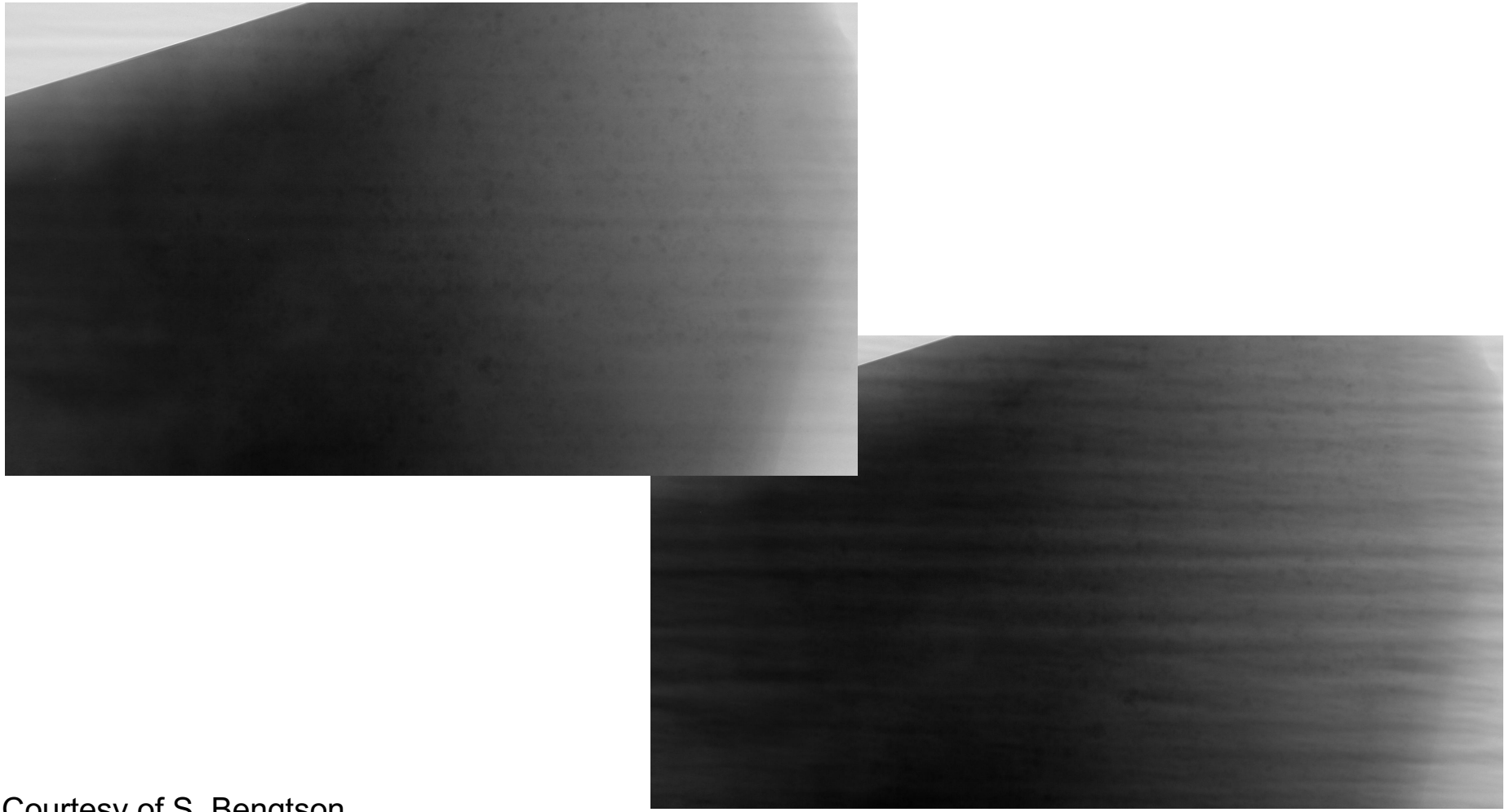
Flat field correction

- Dynamic intensity normalization using eigen flat fields
  - Principal Component Analysis of flat fields
  - Selection of most important eigen flat fields
  - Projection specific flat field as linear combination of most important eigen flat fields.

Van Nieuwenhove at al., 2015

Flat field correction

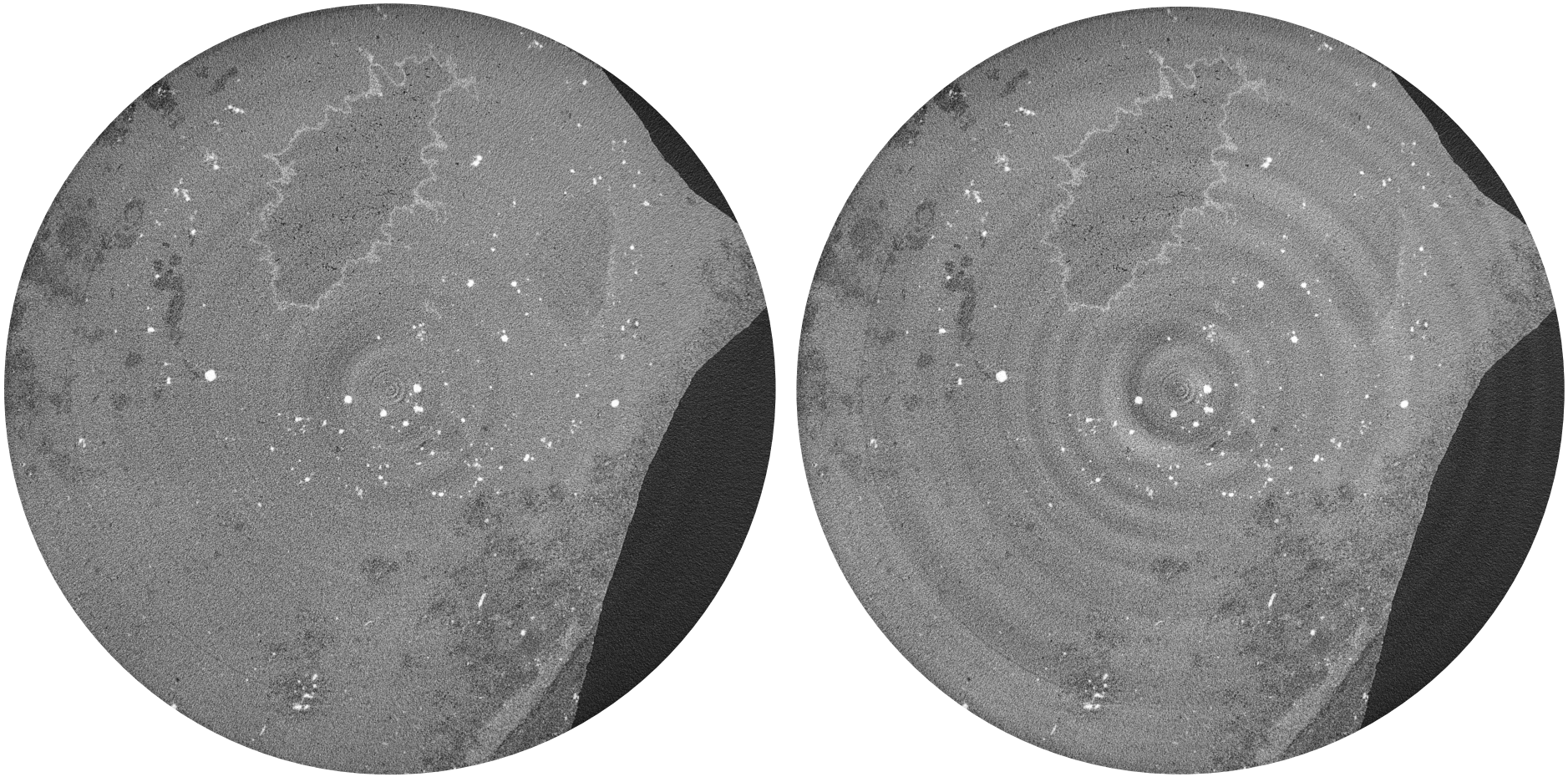
- Dynamic intensity normalization using eigen flat field



Courtesy of S. Bengtson

Flat field correction

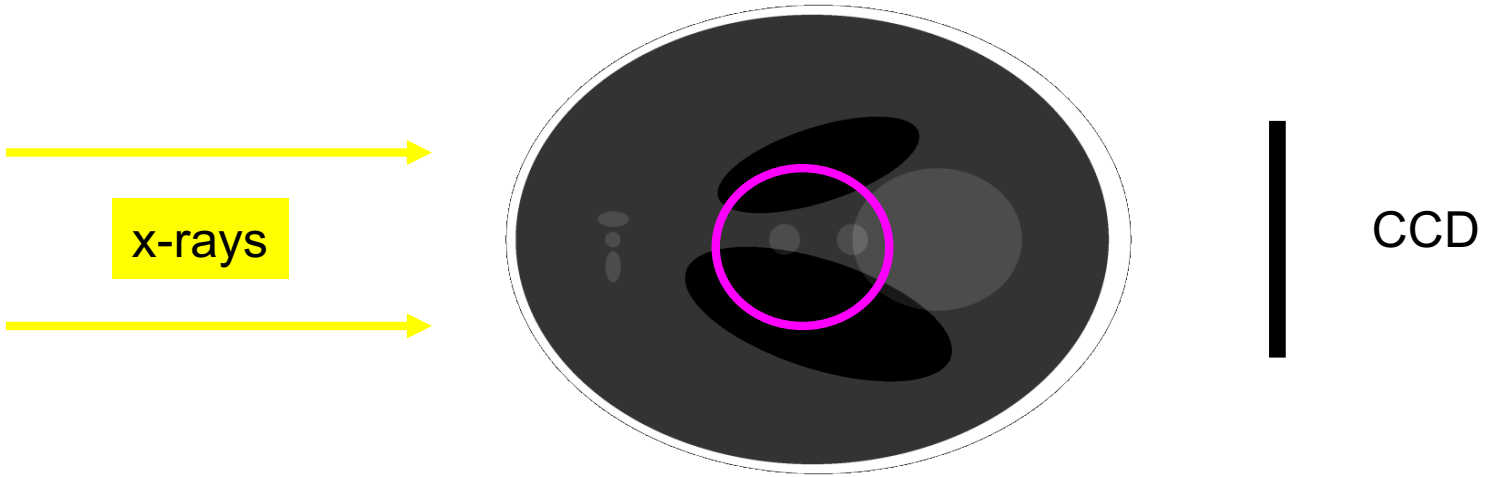
- Dynamic intensity normalization using eigen flat field



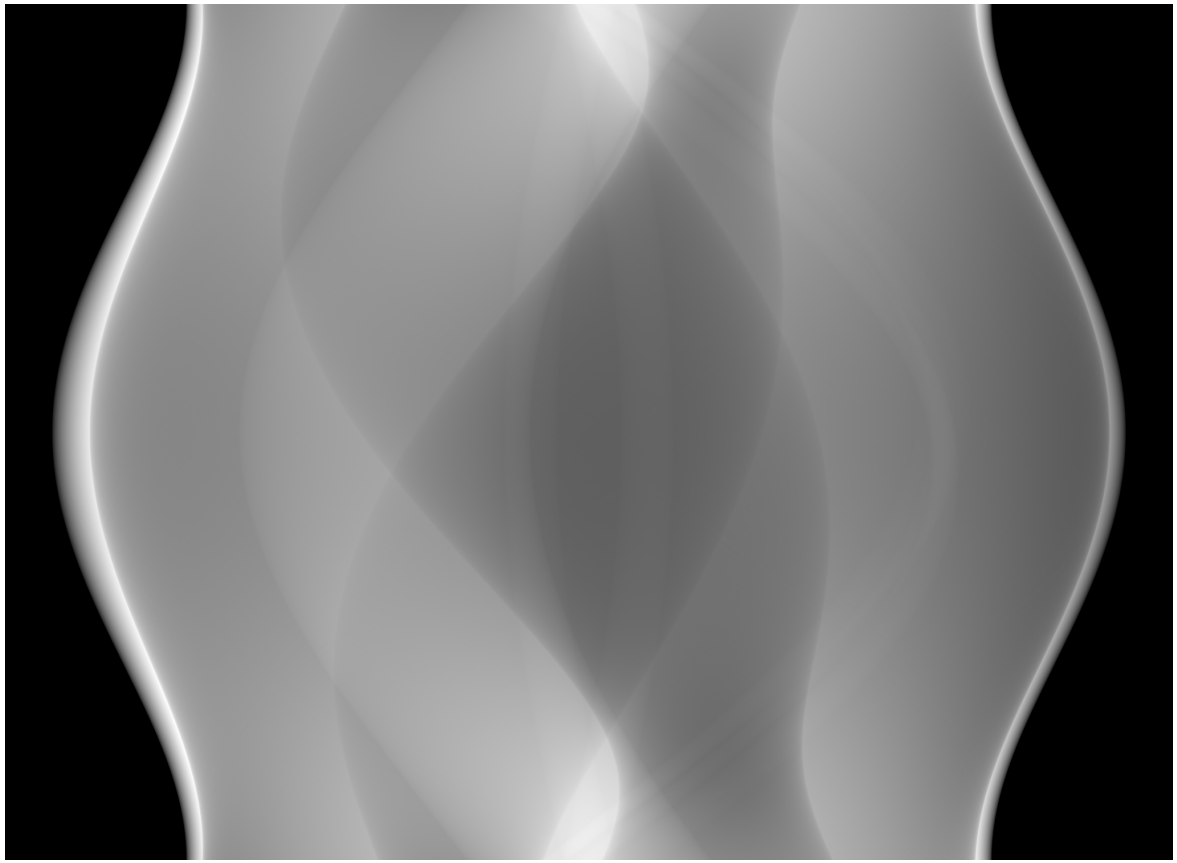
Courtesy of S. Bengtson

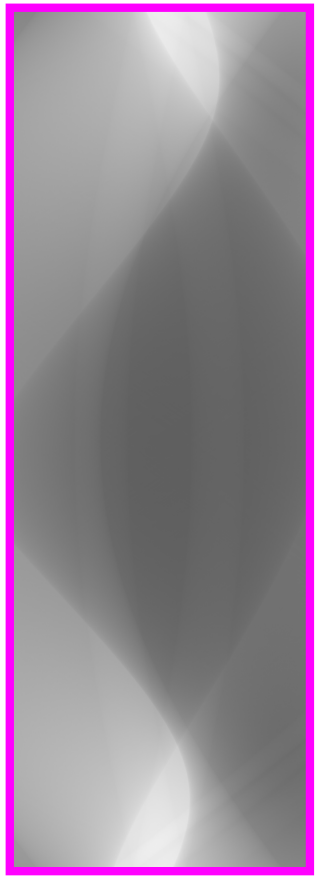
Local tomography artifacts

- Large object at low resolution – insufficient resolution for features of interest
- Tesselation – time consuming, computationally heavy
- Larger detectors – expensive, inefficient
- ➢ Ill-posed reconstruction problem

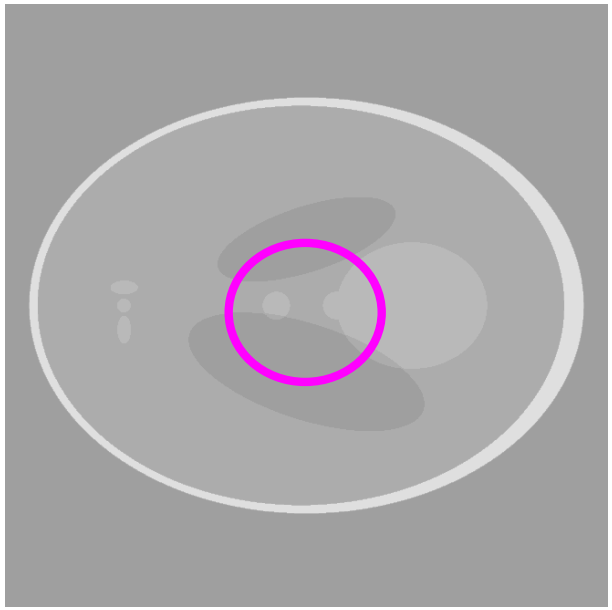


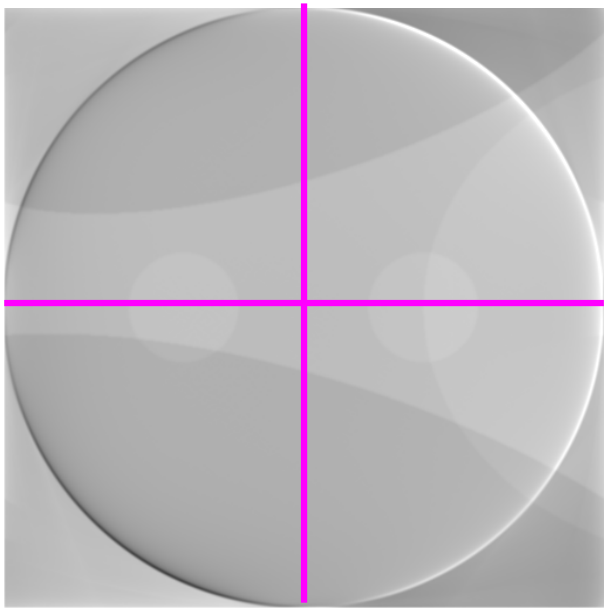
Local tomography artifacts

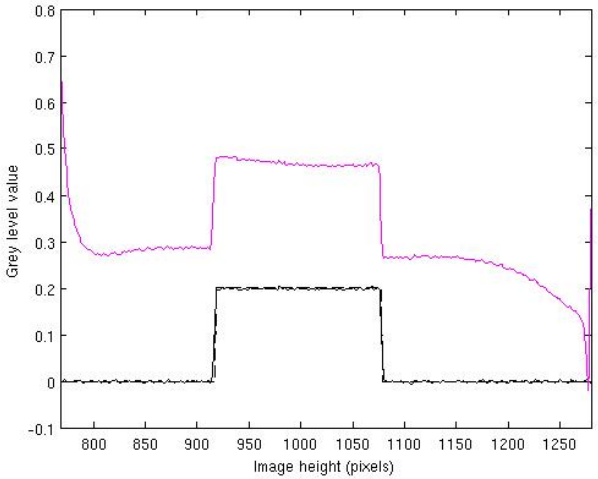


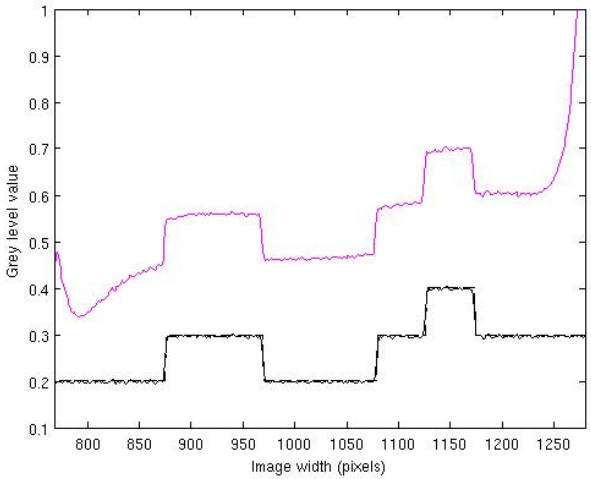


Local tomography artifacts

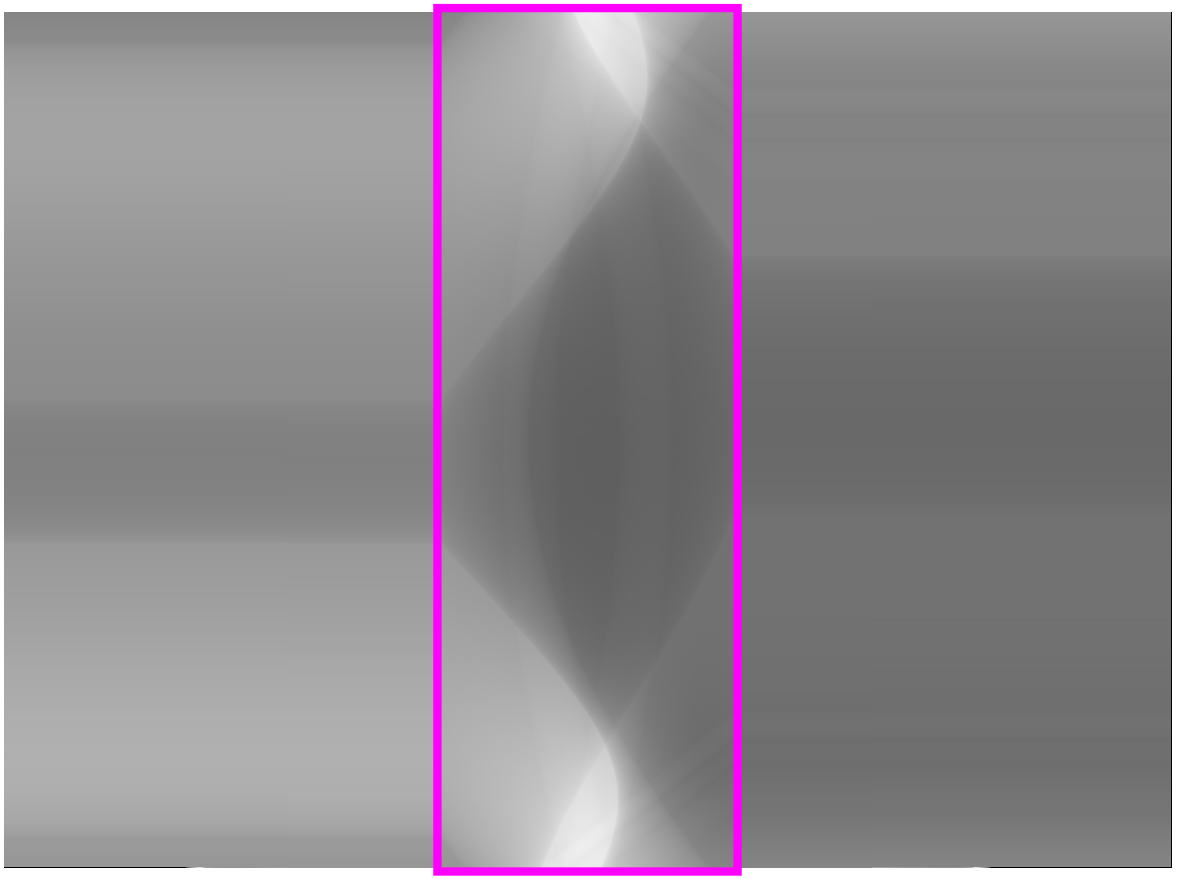






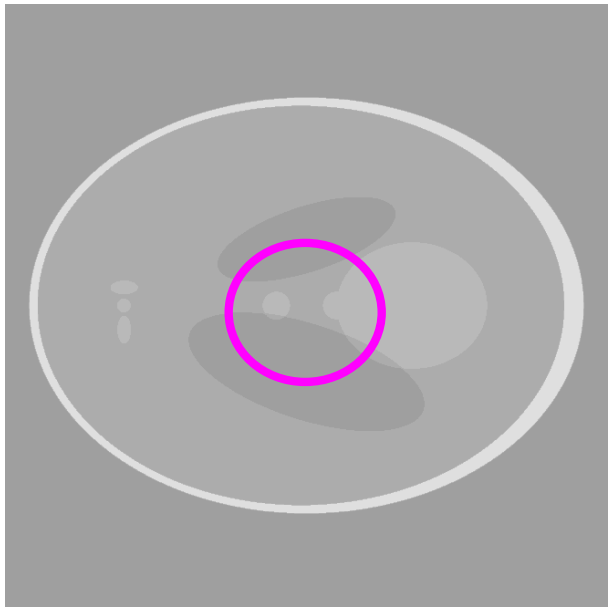


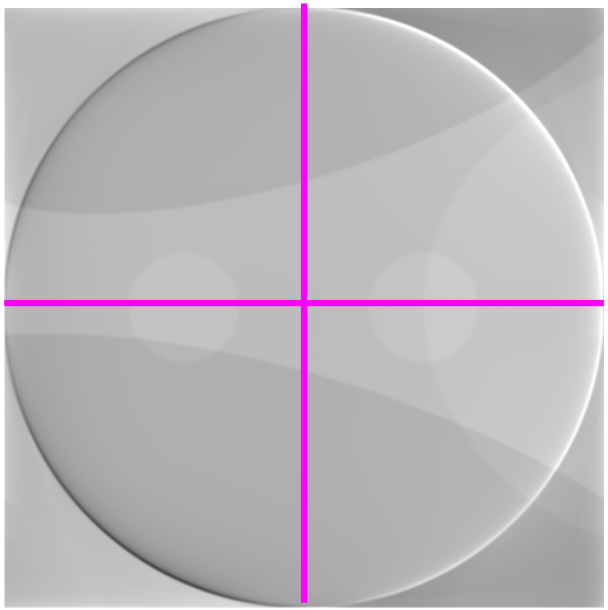
Local tomography artifacts

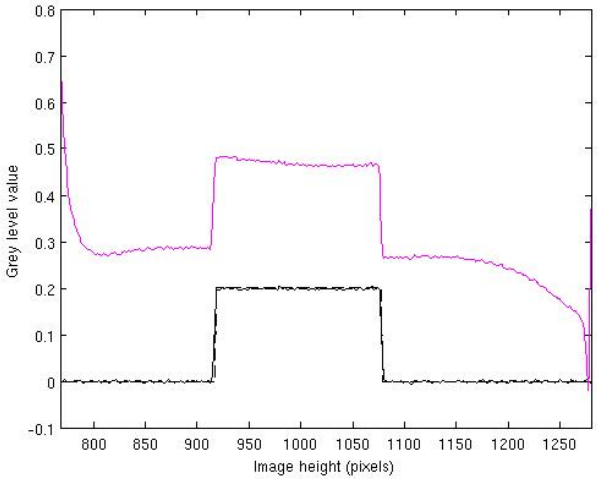


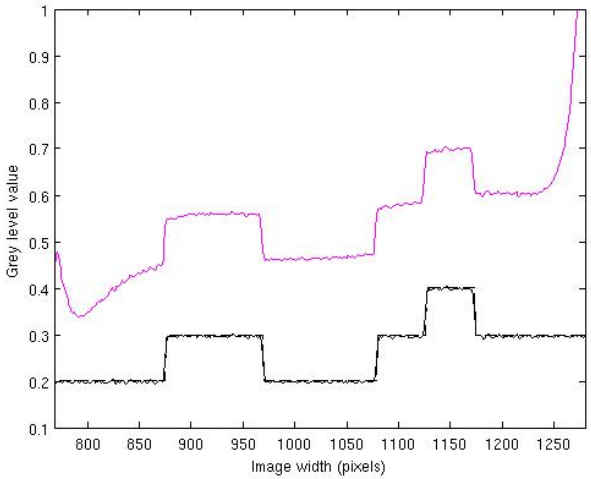
Marone et al., SPIE, 2010
Kyrieleis et al., J. Microscopy, 2010

Local tomography artifacts

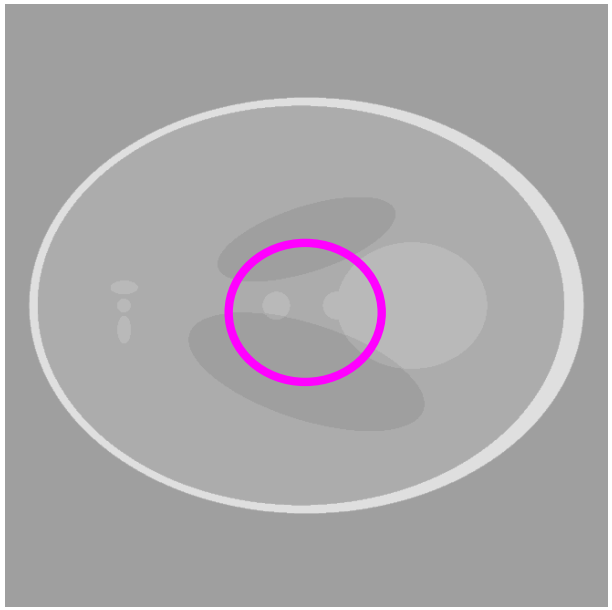


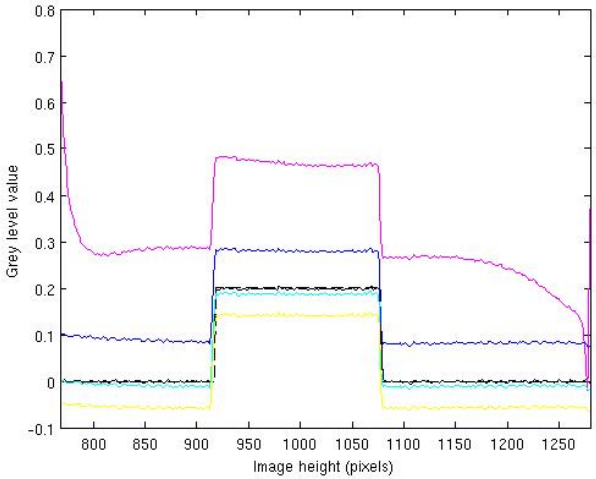


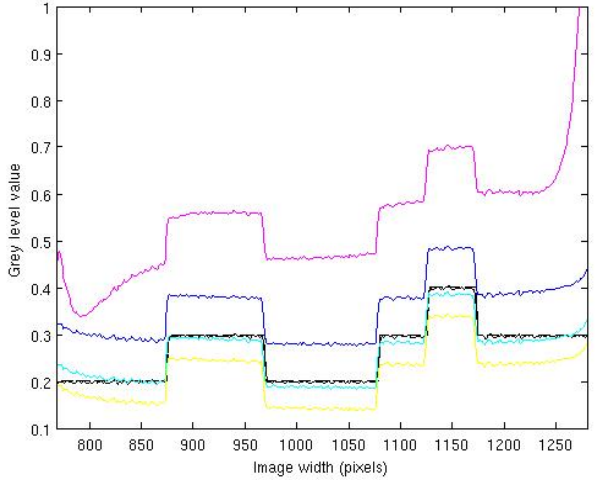




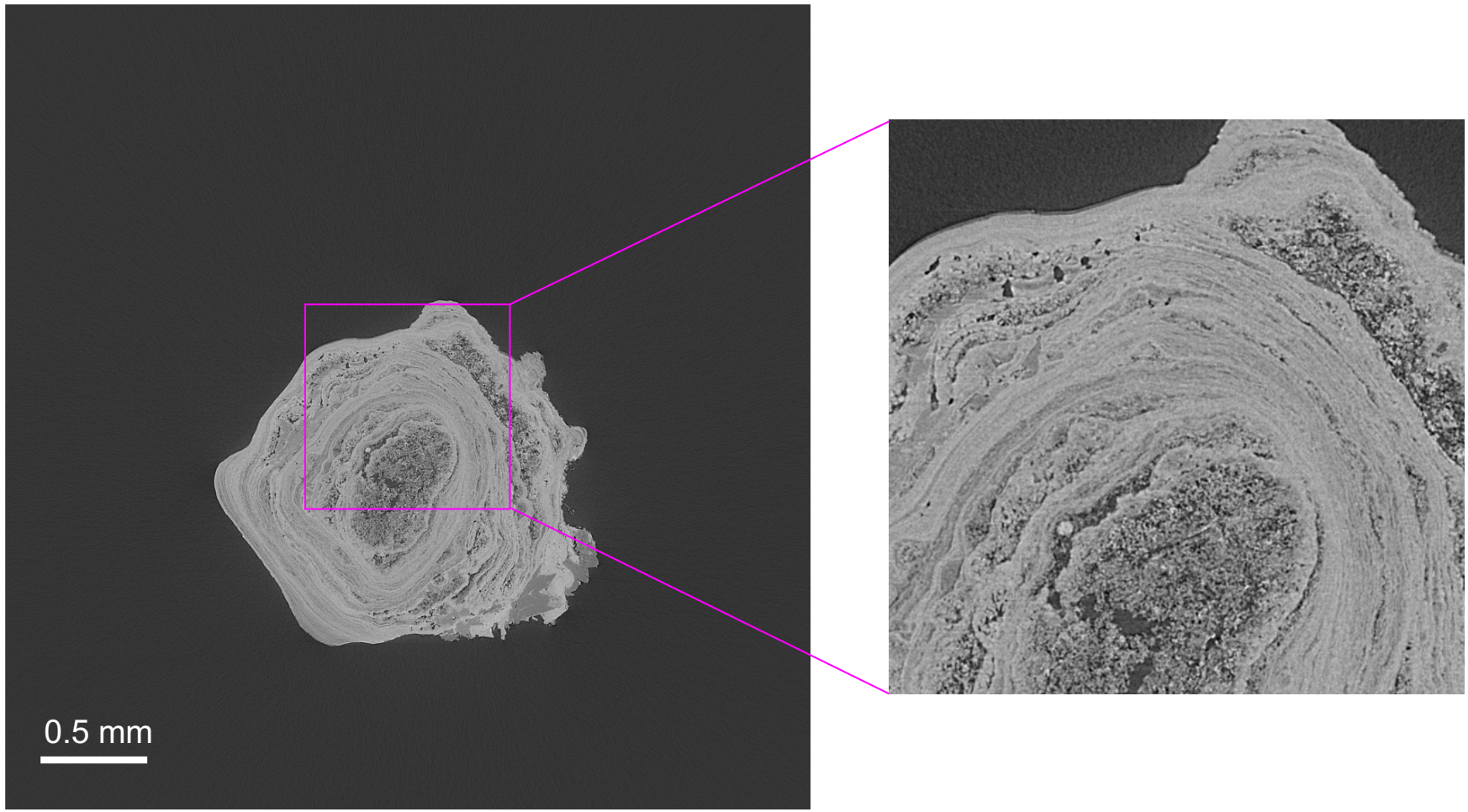
Local tomography artifacts







Local tomography artifacts



Marone et al., SPIE, 2010