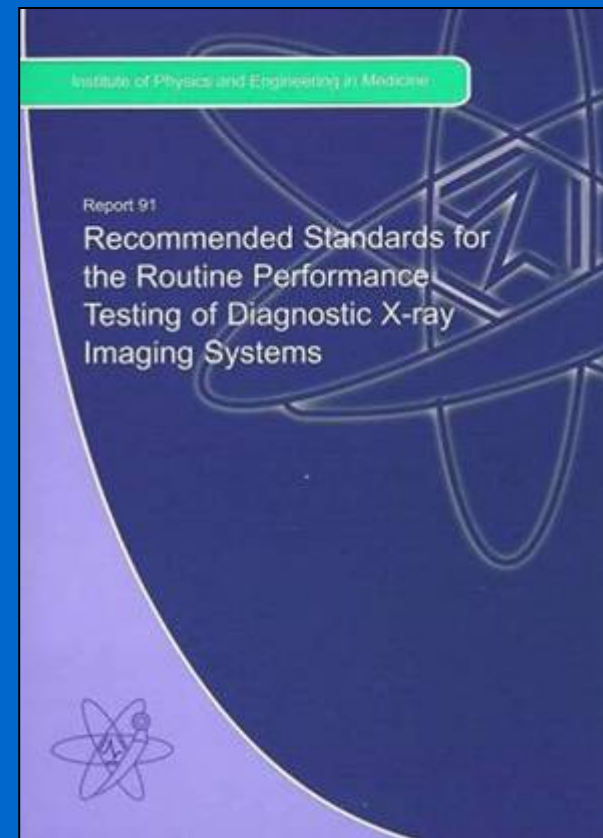


QA for MSCT - beyond IPEM 91

IPEM 91

- IPEM Report 91 (2005)
 - Recommended Standards for Routine Performance Testing of Diagnostic X-Ray Systems
- Chapter 12 CT
 - Image quality
 - CT number calibration
 - Radiation dose
 - Mechanical tests

 - Axial, helical images
 - Inner and outer detector rows

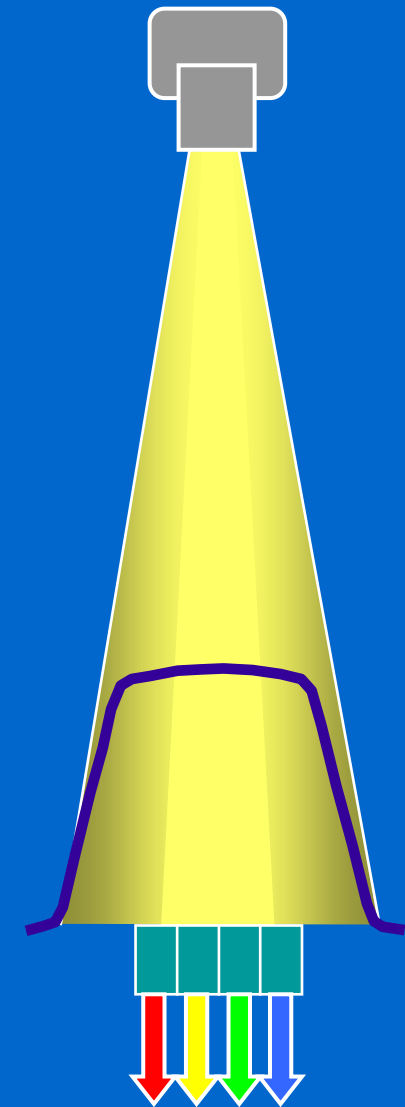
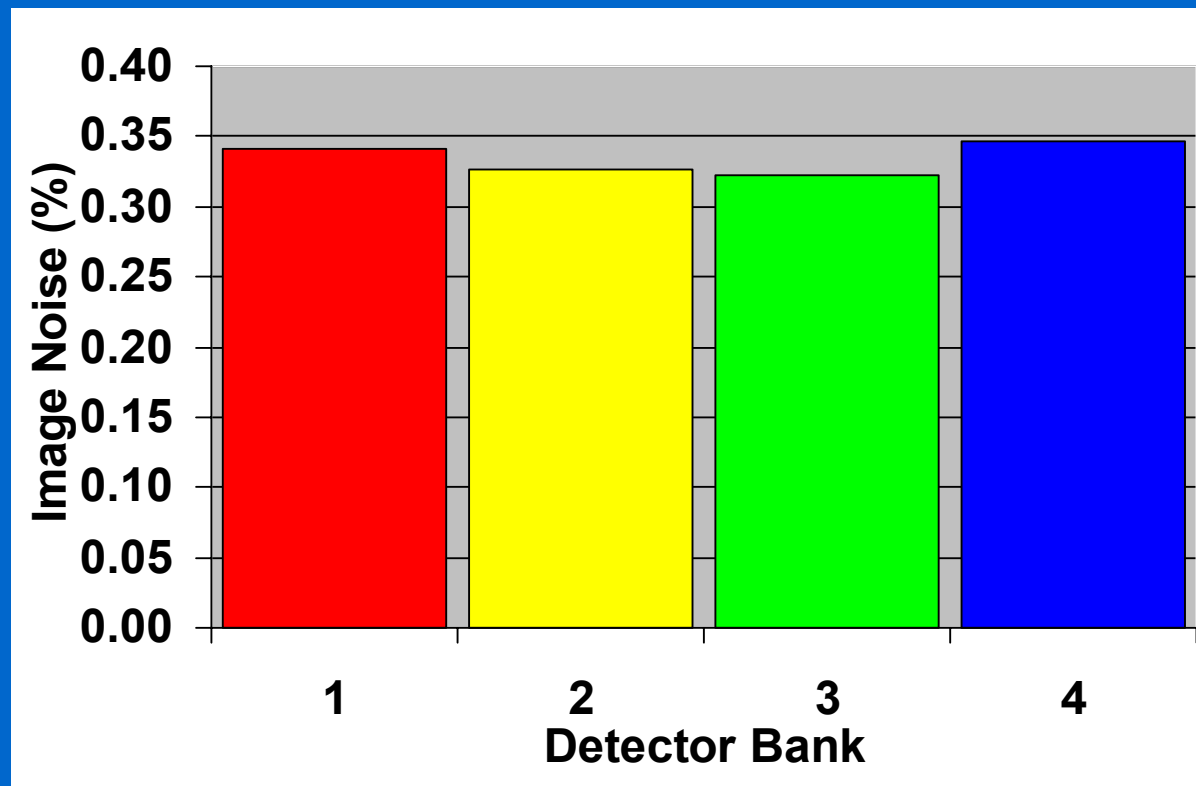


Beyond IPEM 91

- All the slices?
- MPRs
- AEC
- Cone beam artefacts
- Other issues ?

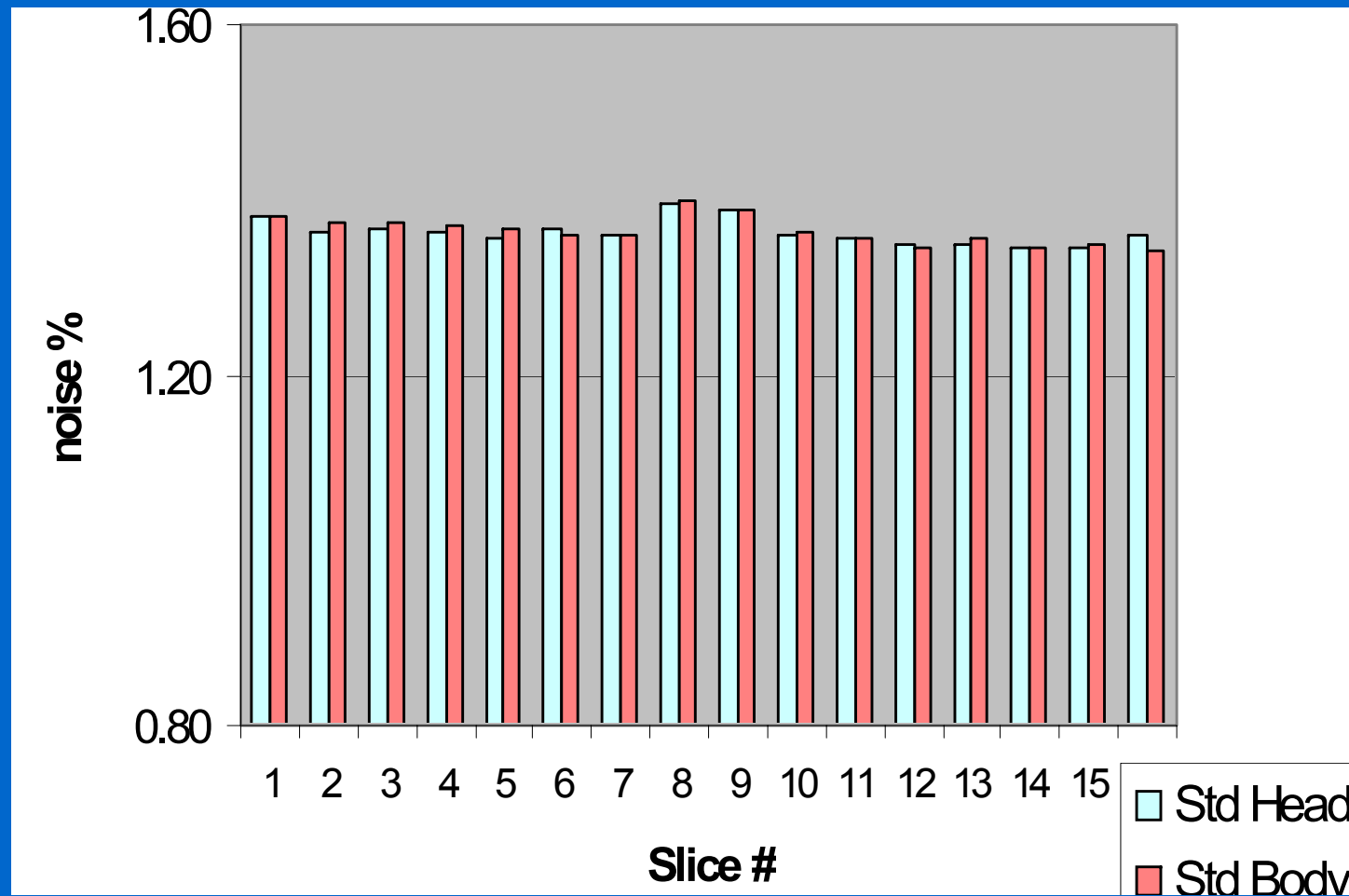
All or some of the slices ?

- Four slice, outer slices noise ~ 5% high



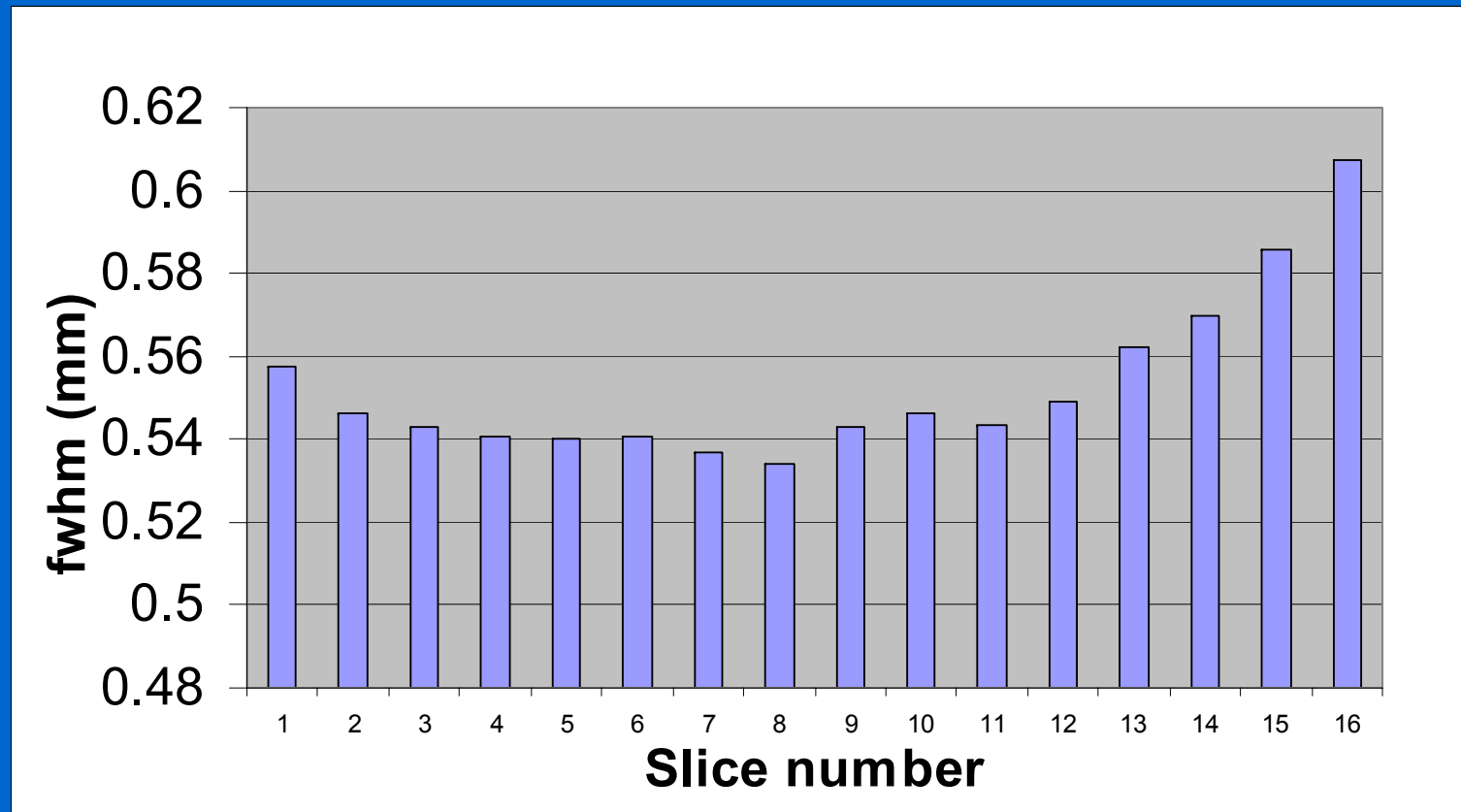
All or some of the slices ?

- Noise 16 slice – not so predictable



All or some of the slices ?

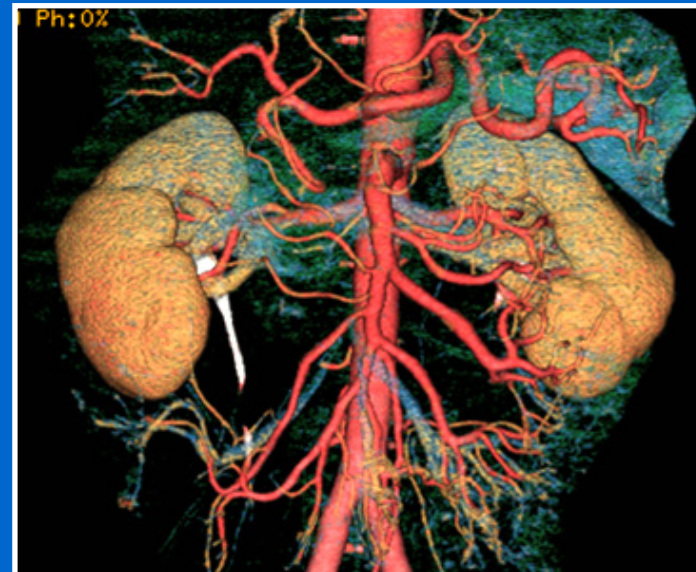
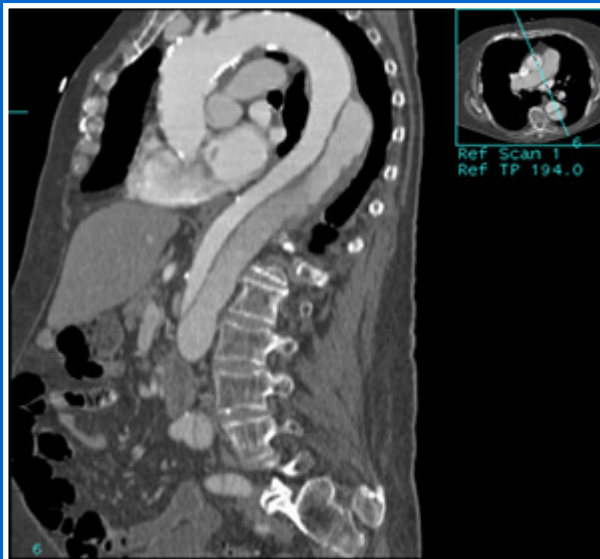
- Z-sensitivity (slice thickness) 16 slice



- QC is about change – does this graph matter ?
- Test some or all ?

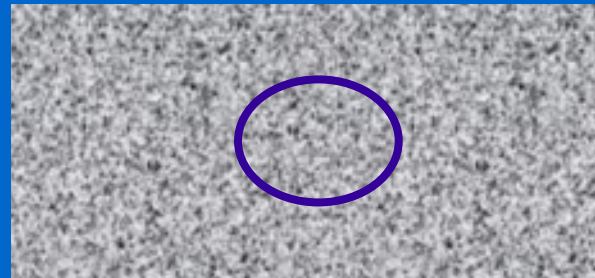
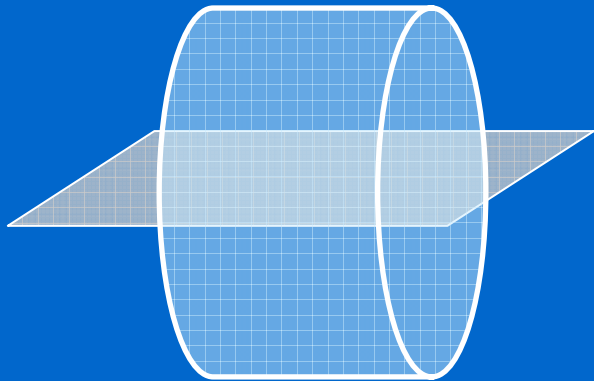
Volume Imaging

- Volume imaging
 - MPRs, 3-D
- Should it be tested?
 - directly ?
 - indirectly?



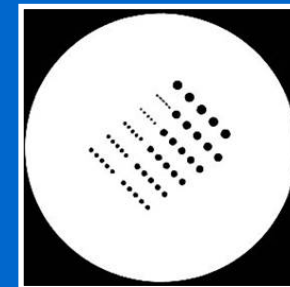
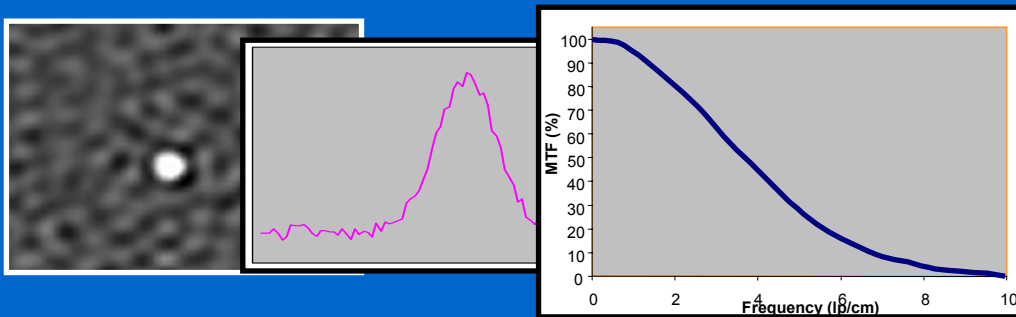
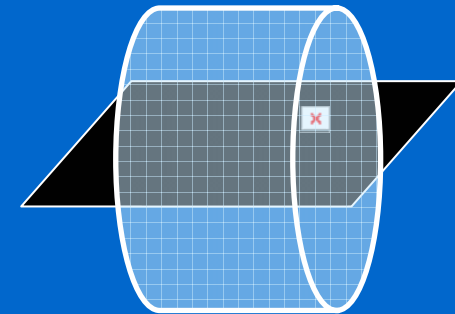
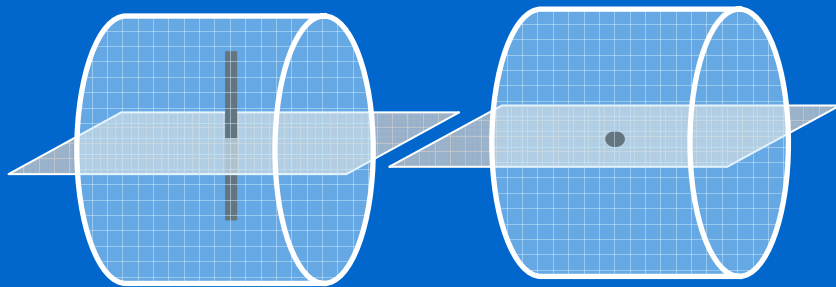
MPR Direct Testing

- Noise



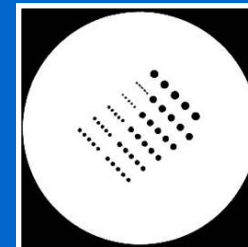
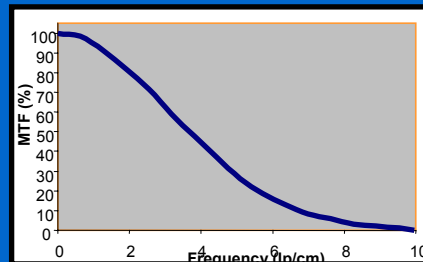
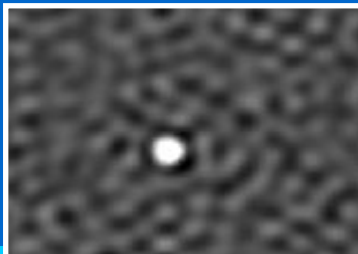
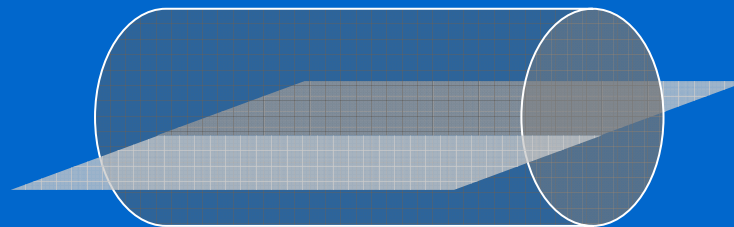
MPR Direct Testing

- Resolution
 - bead or wire orientated appropriately (PSF -> MTF)
 - Visual repeating pattern



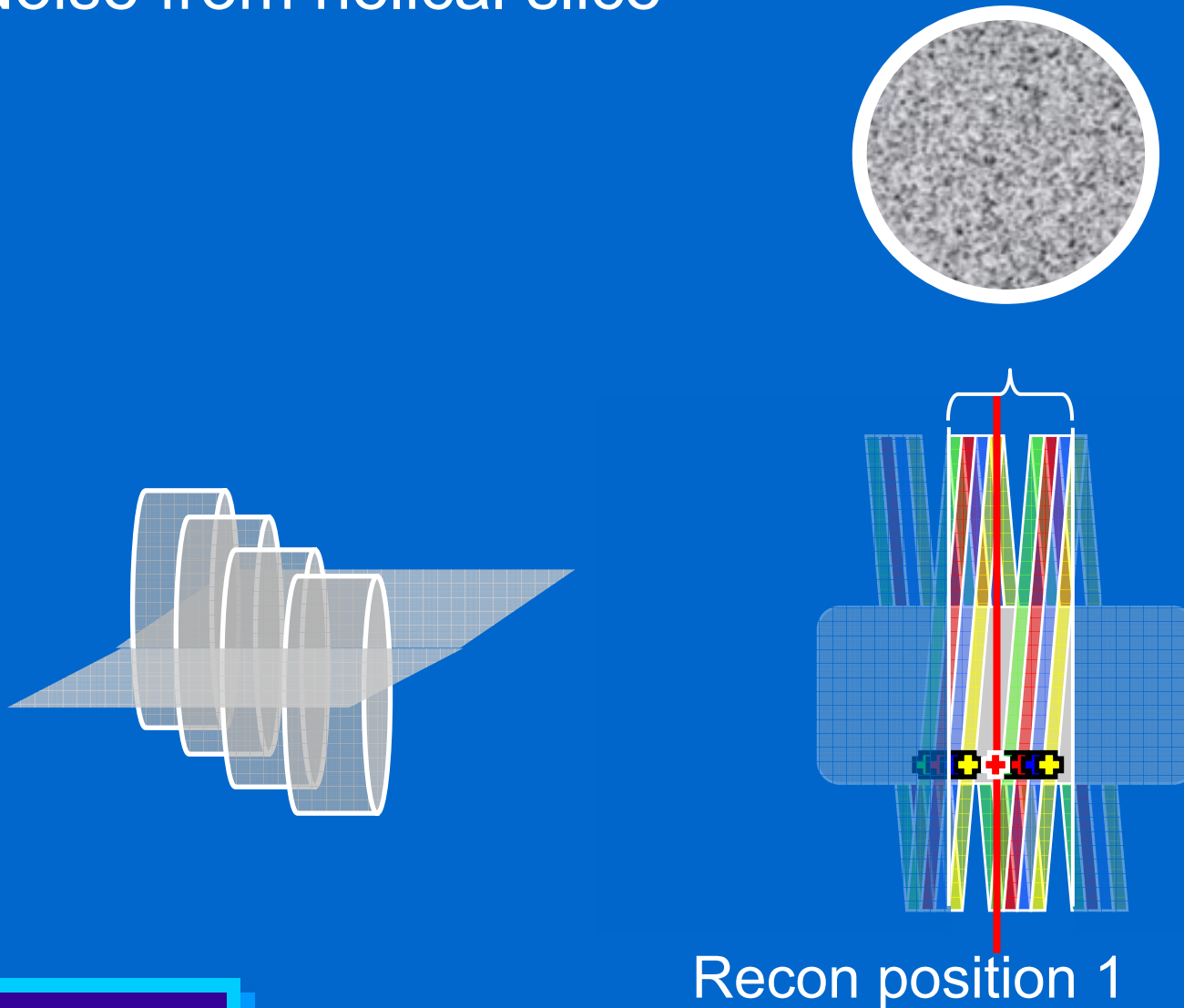
MPR Direct Testing

- Advantage
 - What you see is what you get
 - Takes into account any special reconstruction or interpolation algorithms
- Disadvantage
 - MTF analysis, but fwhm PSF or visual can be fine



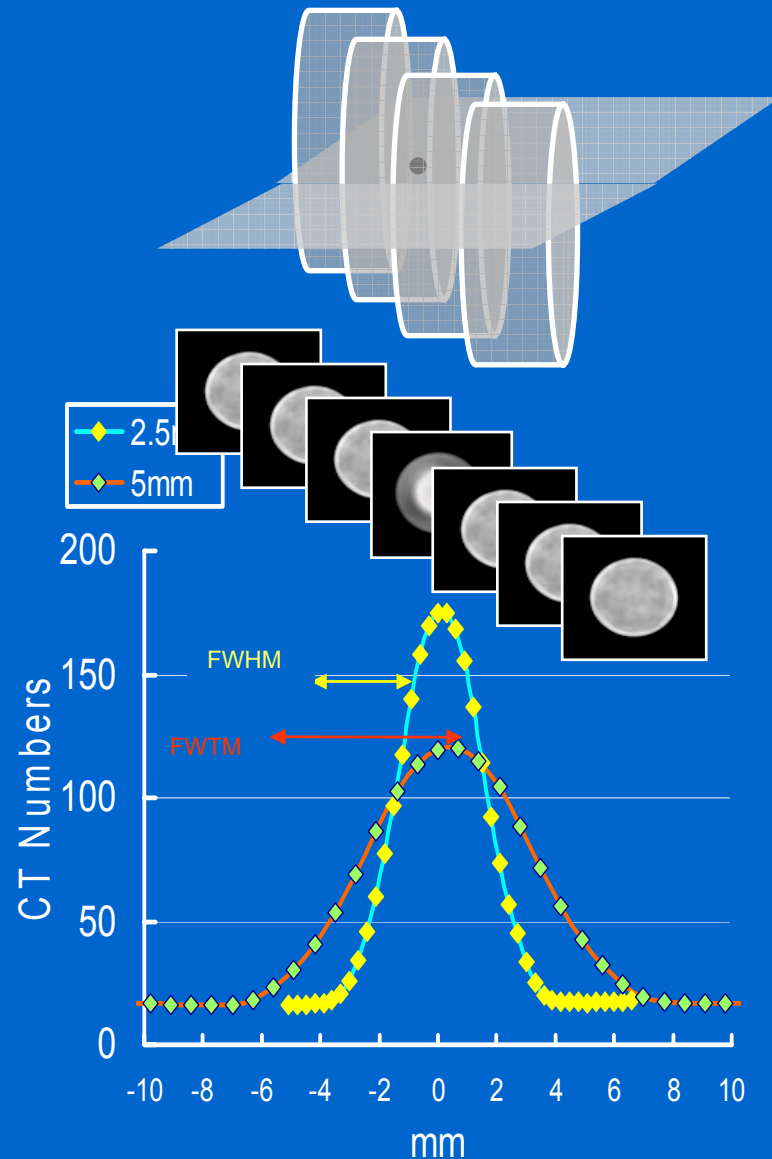
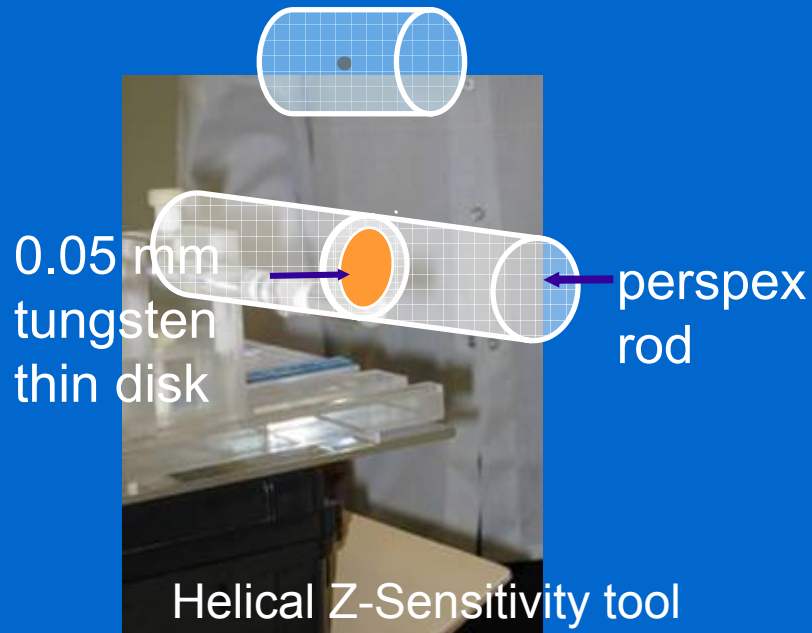
MPR Indirect Testing

- Noise from helical slice



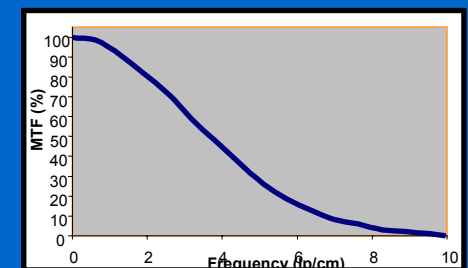
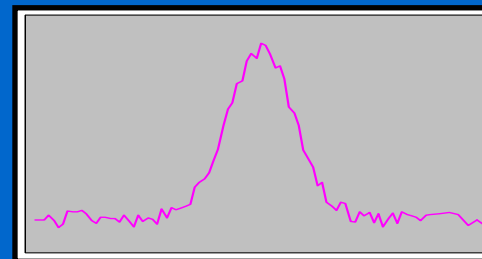
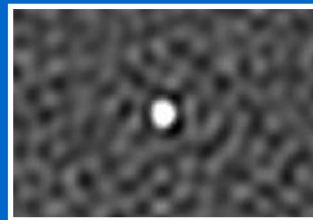
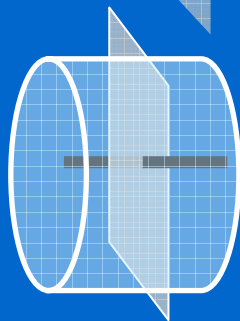
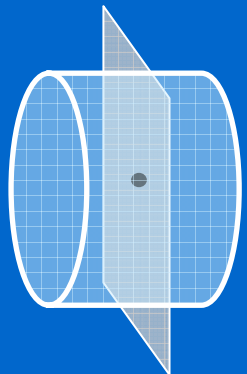
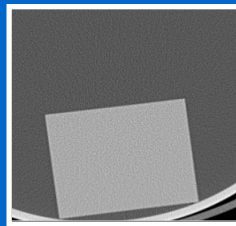
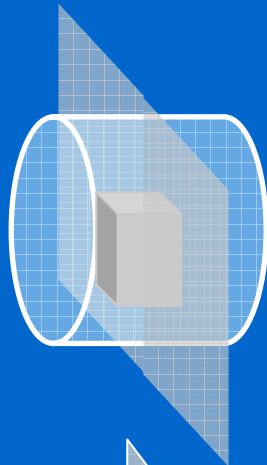
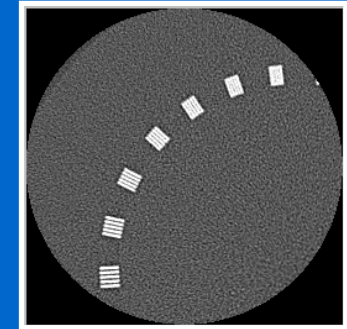
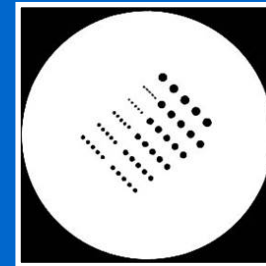
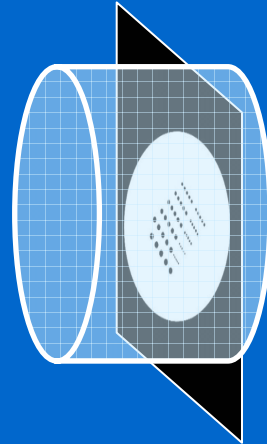
MPR Indirect Testing

- 3-D resolution
 - z-axis (helical z-sensitivity)



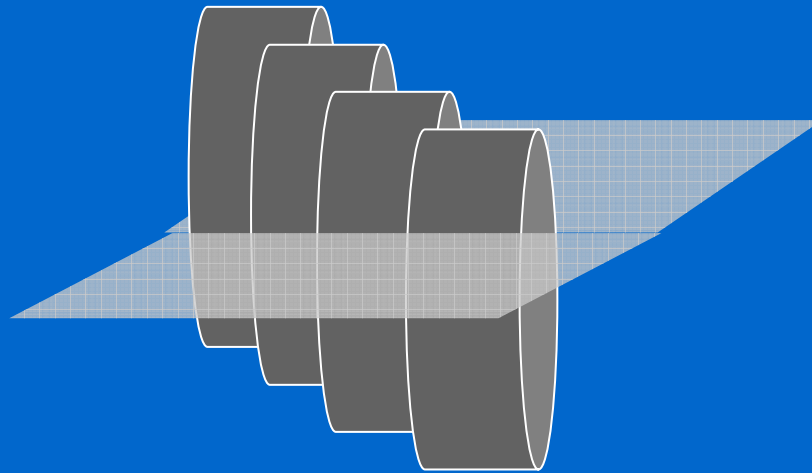
MPR Indirect Testing

- 3-D resolution
 - x-y (scan plane)



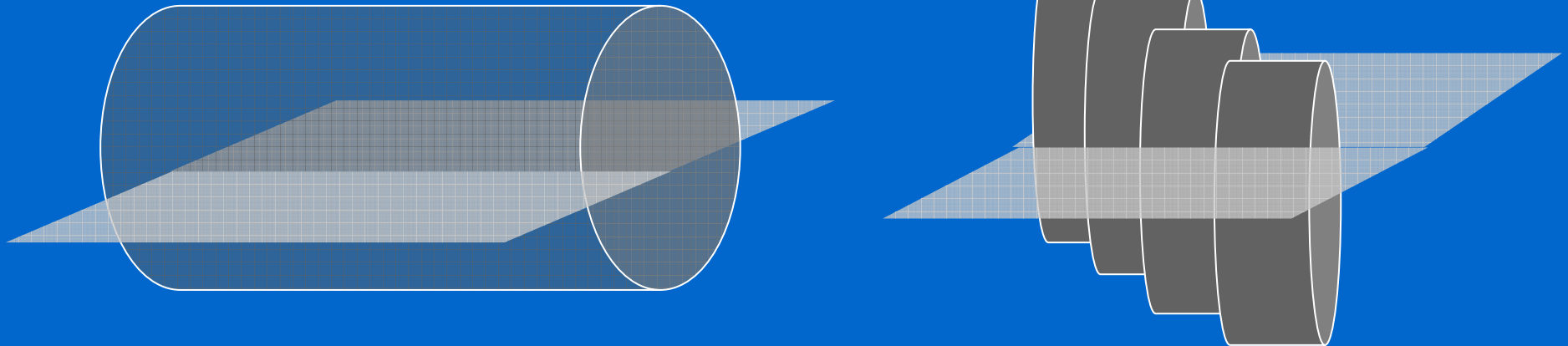
MPR Indirect Testing

- Advantage
 - Doing these tests anyway
- Disadvantage
 - Is it ok ? Recon is from raw data not from slices
 - But looking for change...
 - Doesn't take into account special interpolation algorithms in the 3-D



MPR Testing

- Should it be tested ?
 - Directly or indirectly ?



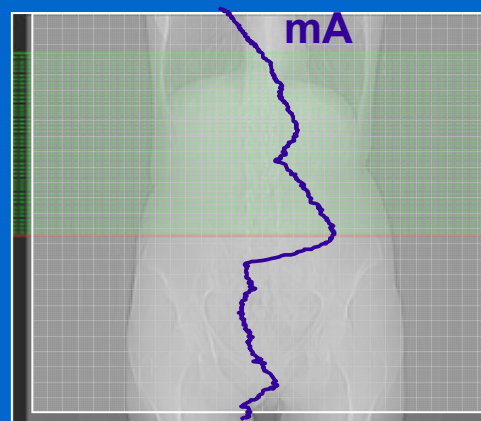
Testing the AEC

- Tube current modulation
 - Patient size, z-axis, rotational
 - Axial and helical modes

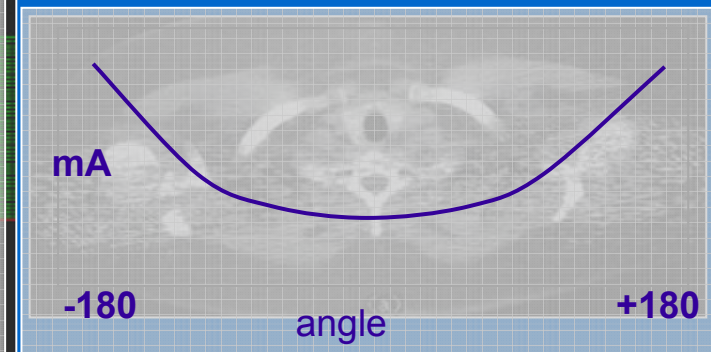
From patient to patient



Along patient length

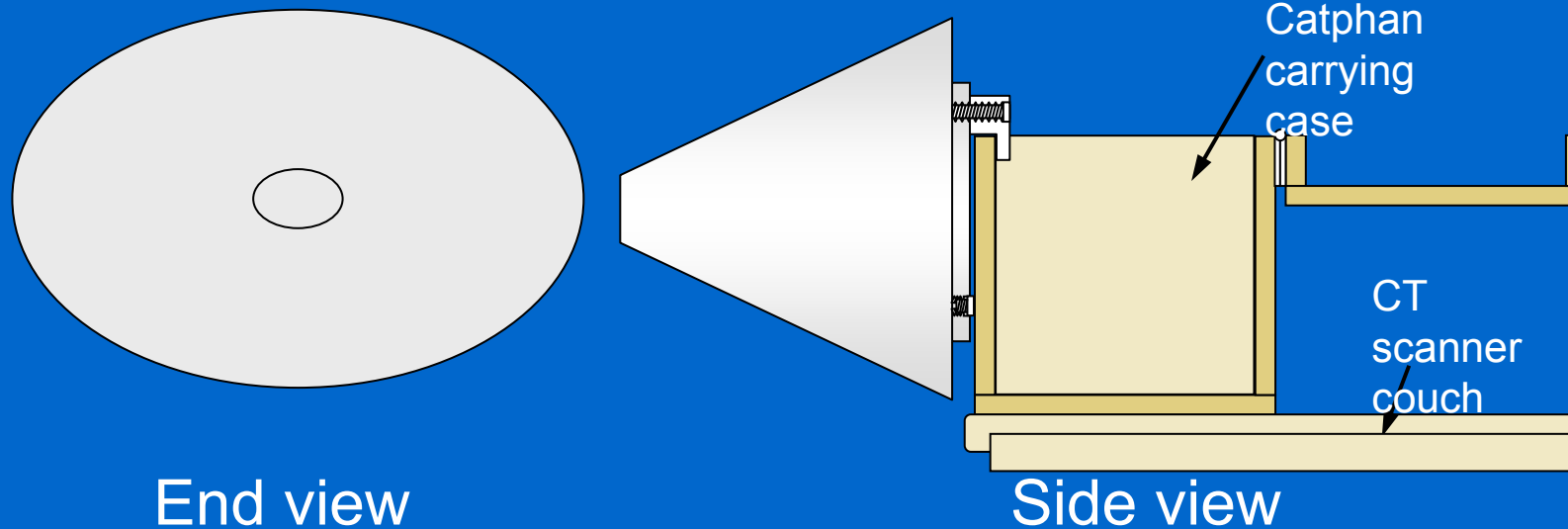


Around the patient



Testing the AEC

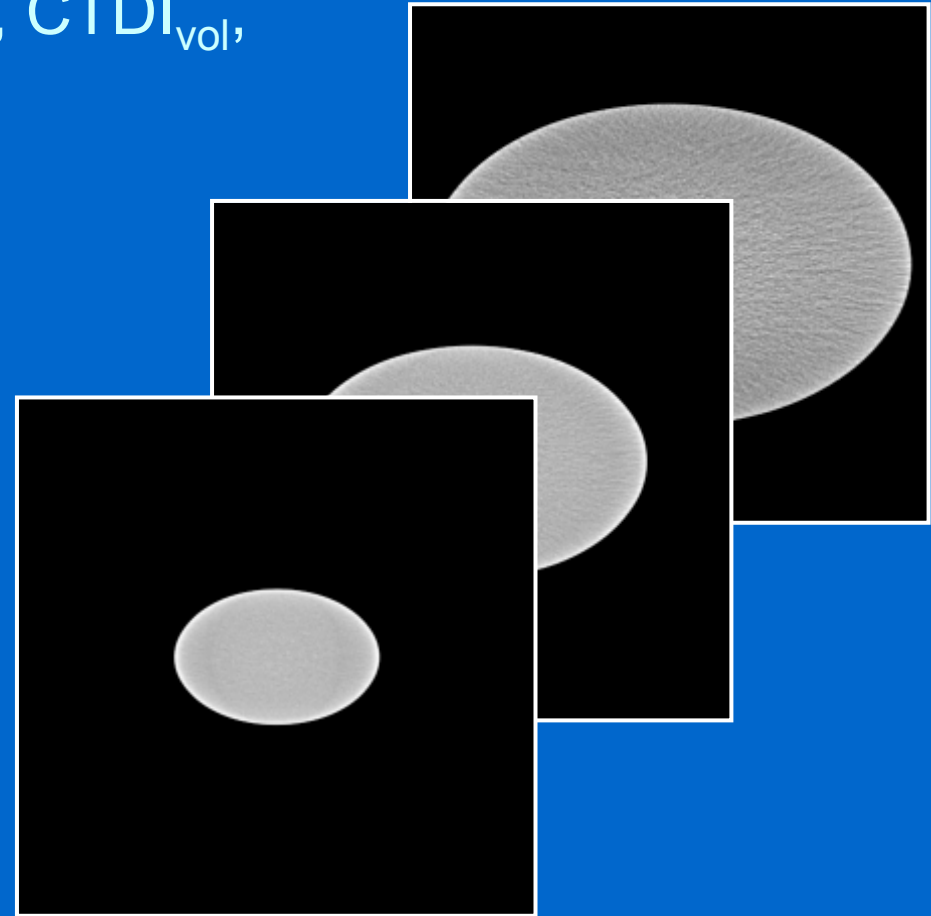
- Test object to vary in z-axis and rotationally
 - eg Perspex phantom, conical with elliptical cross section



- Based on 'Apollo' phantom developed by Muramatsu, National Cancer Centre, Tokyo
- Nick Keat – now at GSK

Testing the AEC

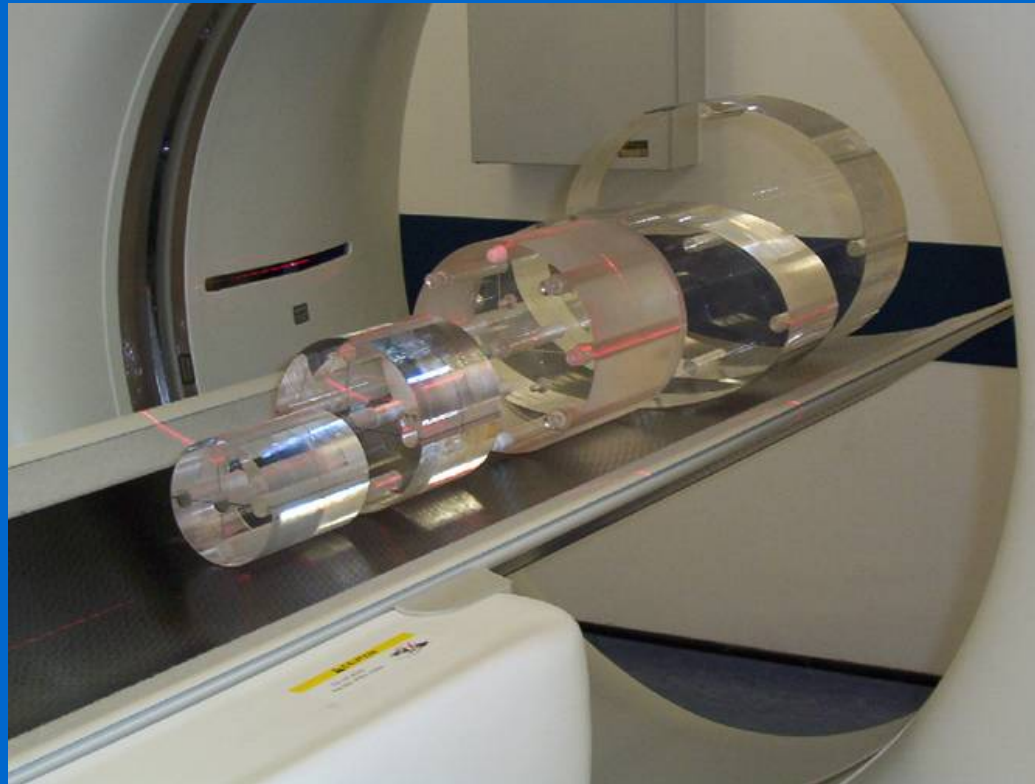
- Image along length of phantom – AEC off, on
 - Monitor image noise, mA, $CTDI_{vol}$,



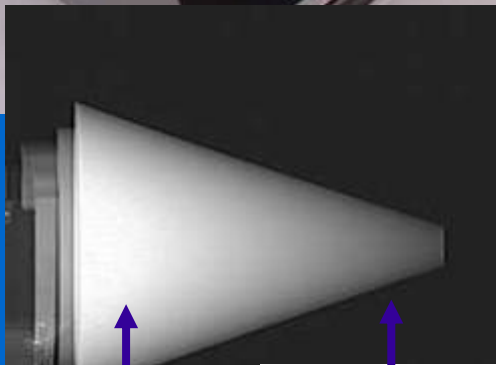
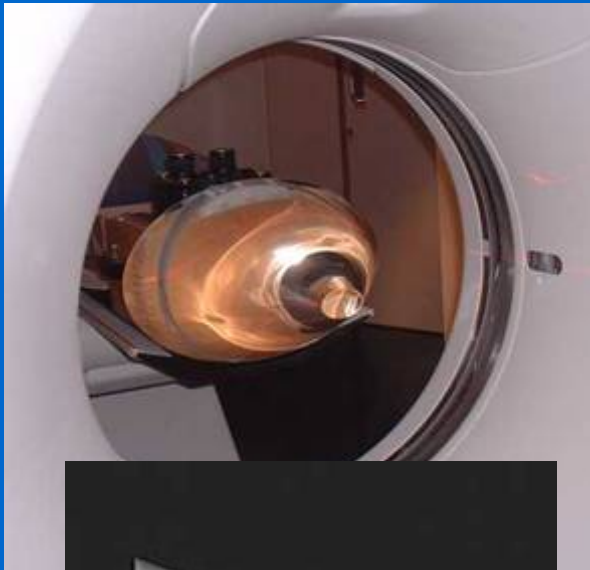
AEC off, Constant mA

Testing the AEC

- Circular, elliptical phantoms of various sizes
 - Scan short lengths over each section
 - Monitor image noise, mA, $CTDI_{vol}$,

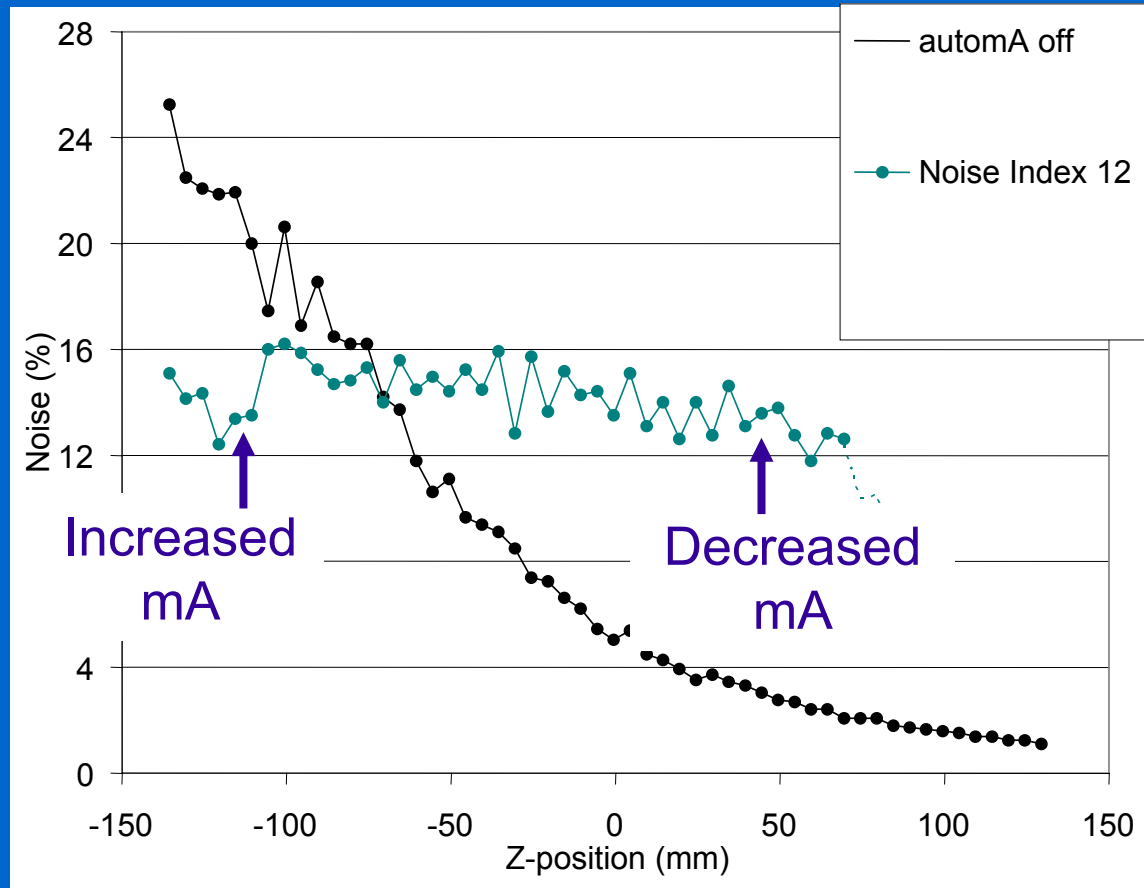


Testing the AEC



Increased
mA

Decreased
mA

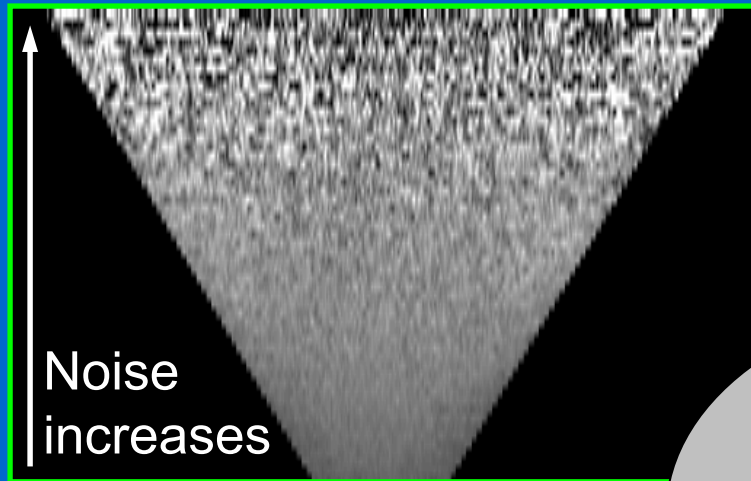


GE LightSpeed¹⁶

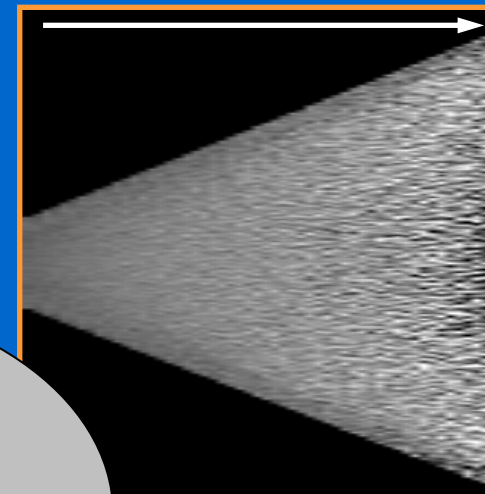
www.impactscan.org/bluecover.htm

Testing the AEC – Viewing with MPR

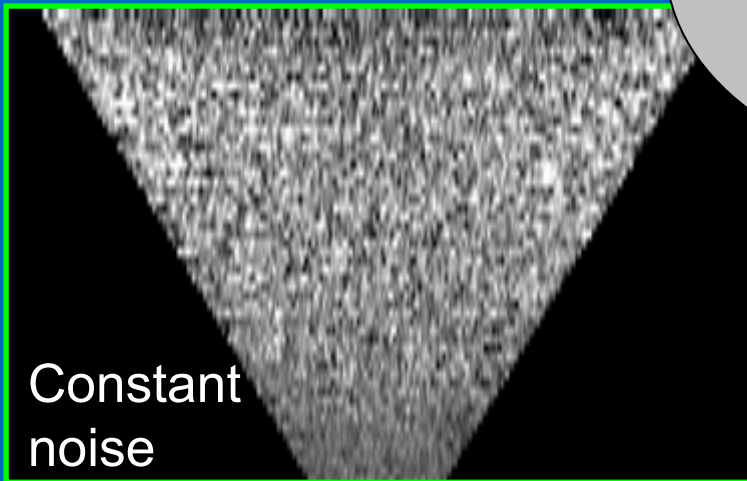
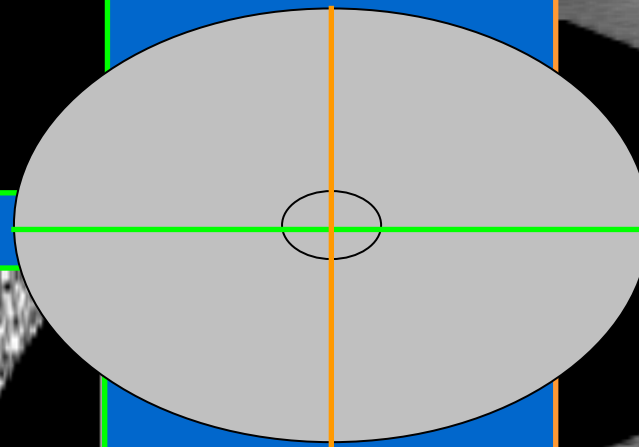
Coronal view



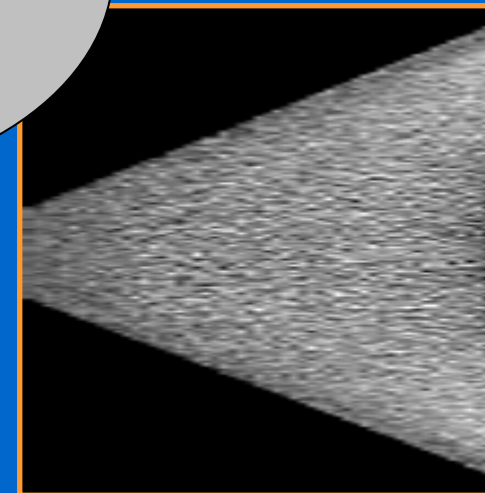
Sagittal view



z-axis
AEC off



z-axis
AEC on

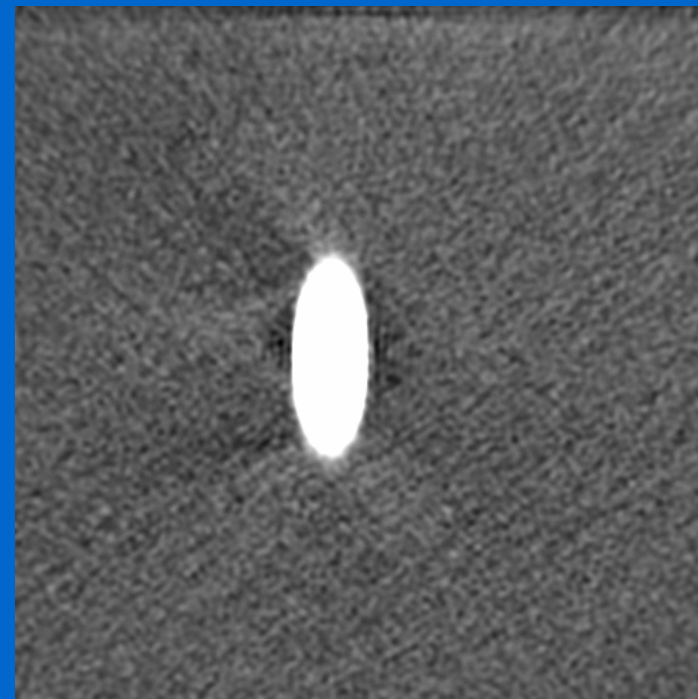


Testing the AEC

- Should this be a described test ?
- In a specified phantom ?
- How often?

Cone beam artefact

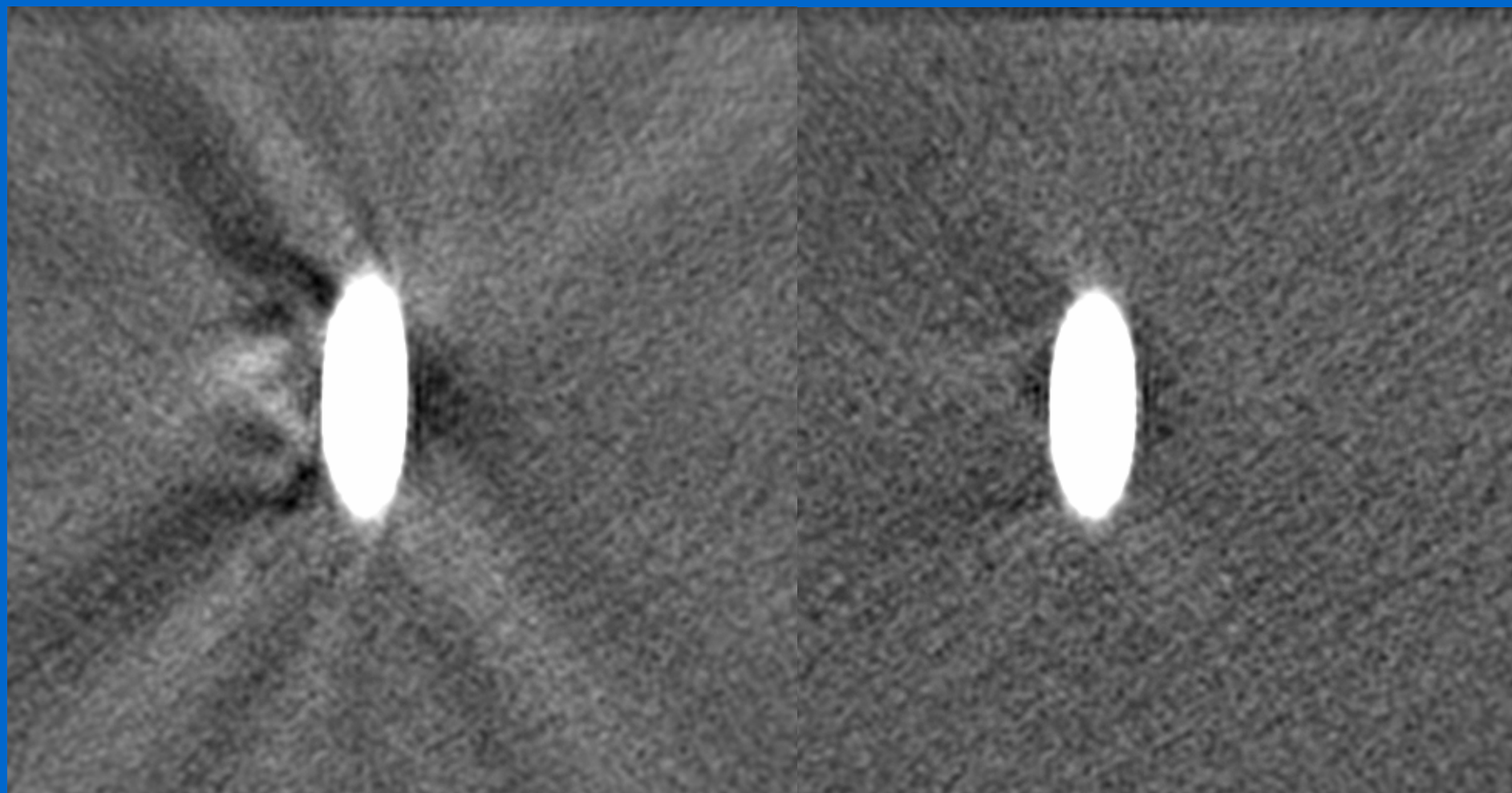
- Teflon (PTFE) rod in water, to simulate rib at an angle to scan plane



AMPR Algorithm

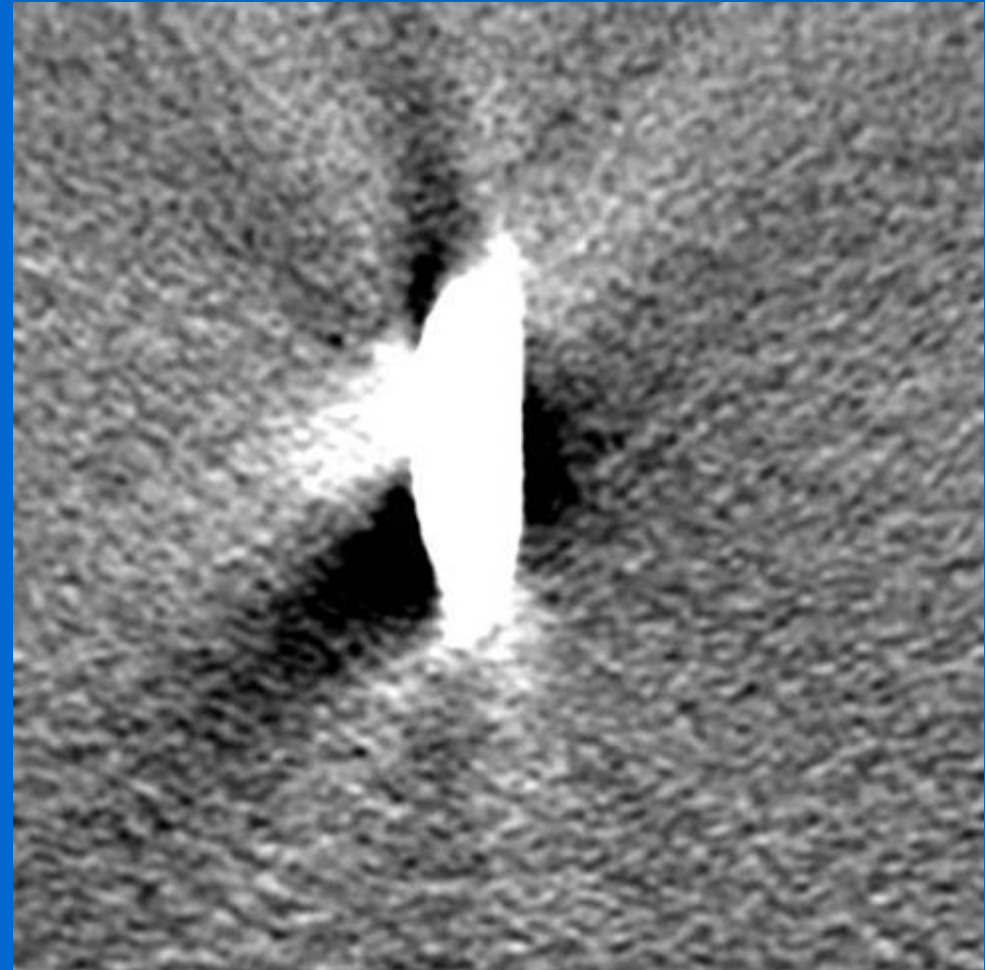
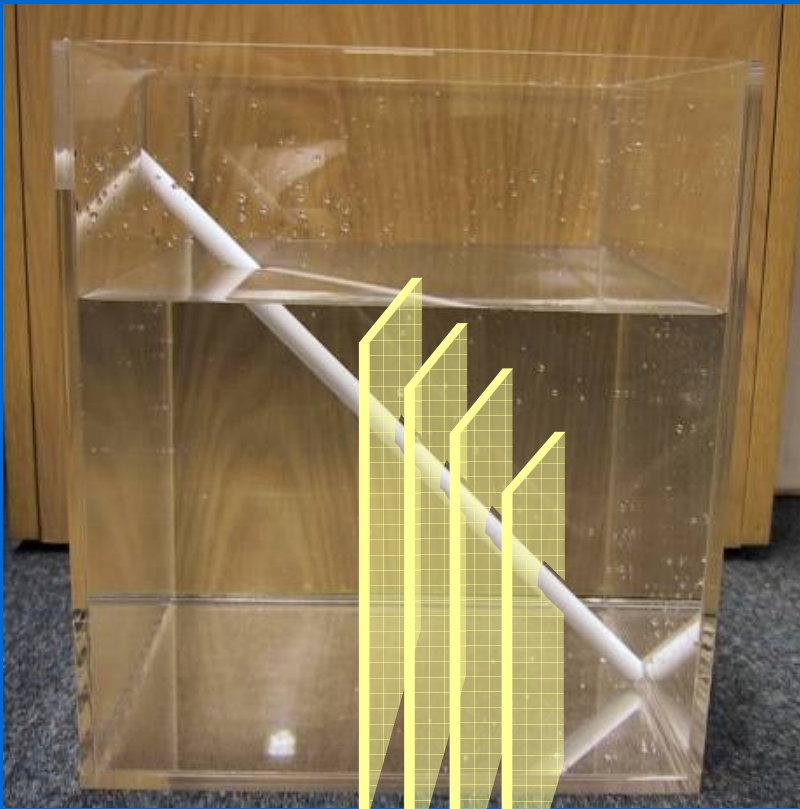
Standard reconstruction

AMPR



Windmill artefact in consecutive images

- Teflon (PTFE) rod in water, to simulate rib at an angle to scan plane (60° , $\text{Pitch}_x = 1.5$, 16×1.5 mm acquisition, 5 mm image)



Testing the cone beam artefact

- Should this be a described test ?
- In a specified phantom ?
- How often?

Beyond IPEM 91

- All the slices ?
- MPRs (+3-D), AEC, cone beam artefacts
 - Should these be included in routine testing ?
- Should there be anything else ?

