A Visual Method for Demonstrating the Relative Performance of Cone Beam Reconstruction

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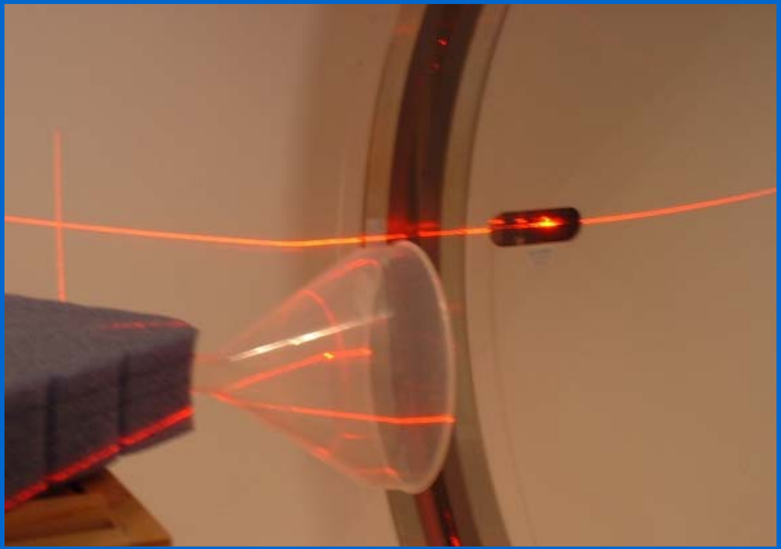
Background and problems

- 16-slice CT scanners introduced at RSNA `02
- Increased number of simultaneous slices leads to more pronounced cone-beam artefacts
- Manufacturers implemented cone-beam reconstruction techniques to combat artefacts in helical scanning
- What improvements do these new reconstruction techniques make?

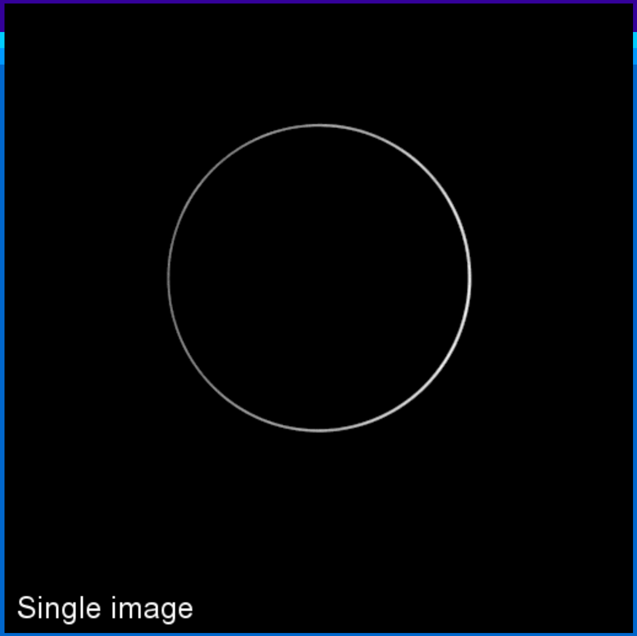
Aim

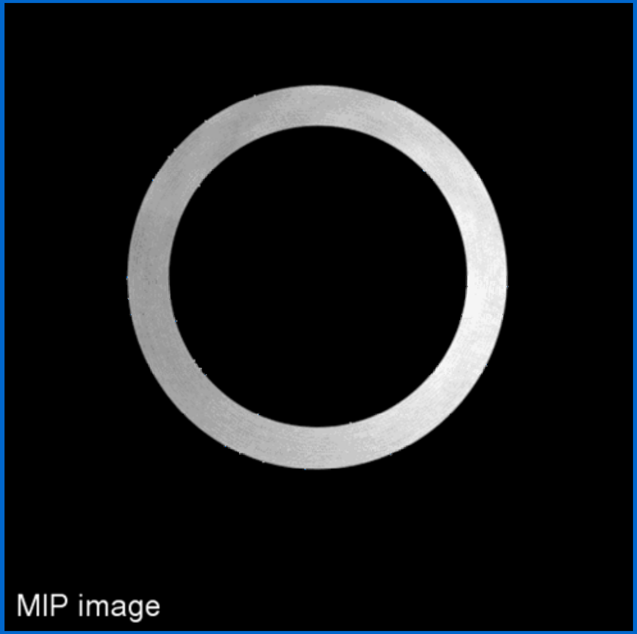
- Aim was to accentuate the cone-beam artefacts
- A thin-walled object with edges at an angle to the scan plane will achieve this
- Rate of change of funnel shape is constant along the z-axis
- Scanned in air, the funnel has high contrast (~ 500 HU)



Example images

- Scan the funnel using a helical protocol
- Single slices through the funnel appear as rings
- MIP image of many slices results in a wider ring
- If perfect the images should be uniform



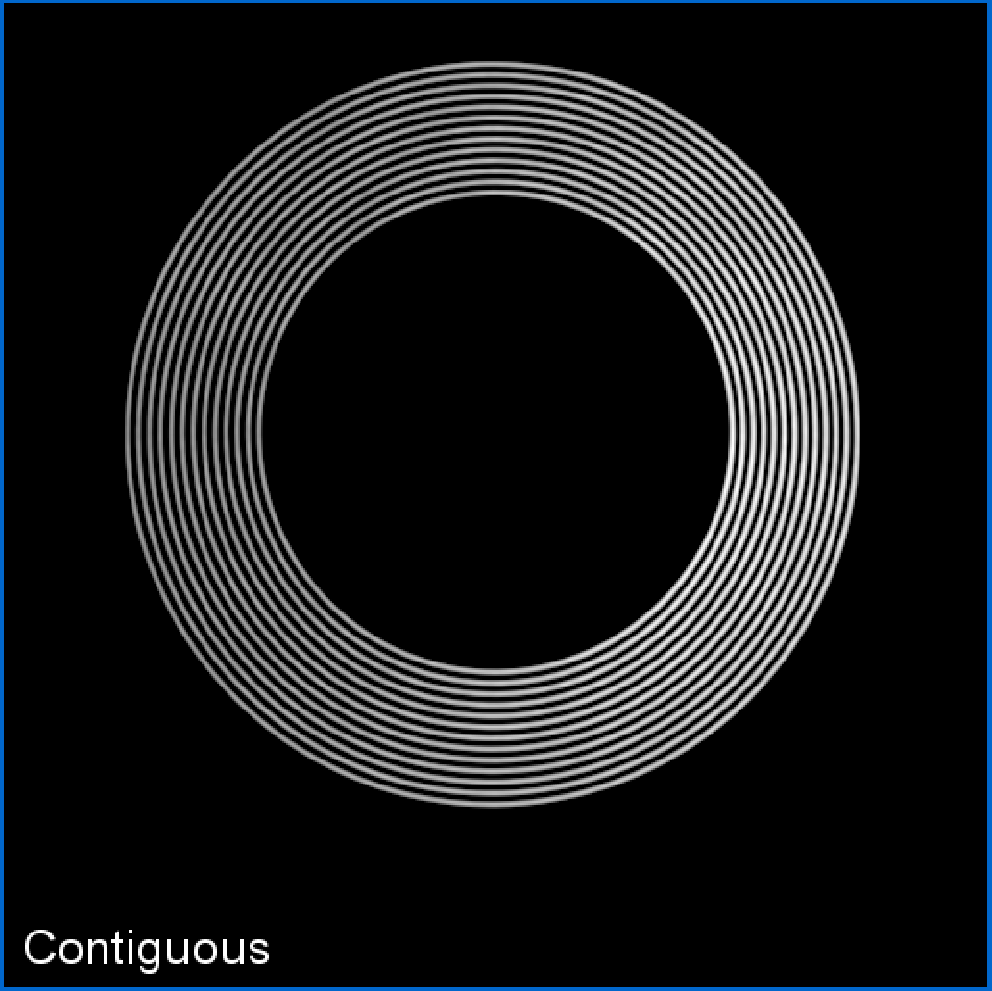


Reconstruction increment

- Reconstructing contiguous slices leads to discontinuities in the MIP images

- Reconstructing overlapping slices reduces this effect

- Images reconstructed every half a slice-width



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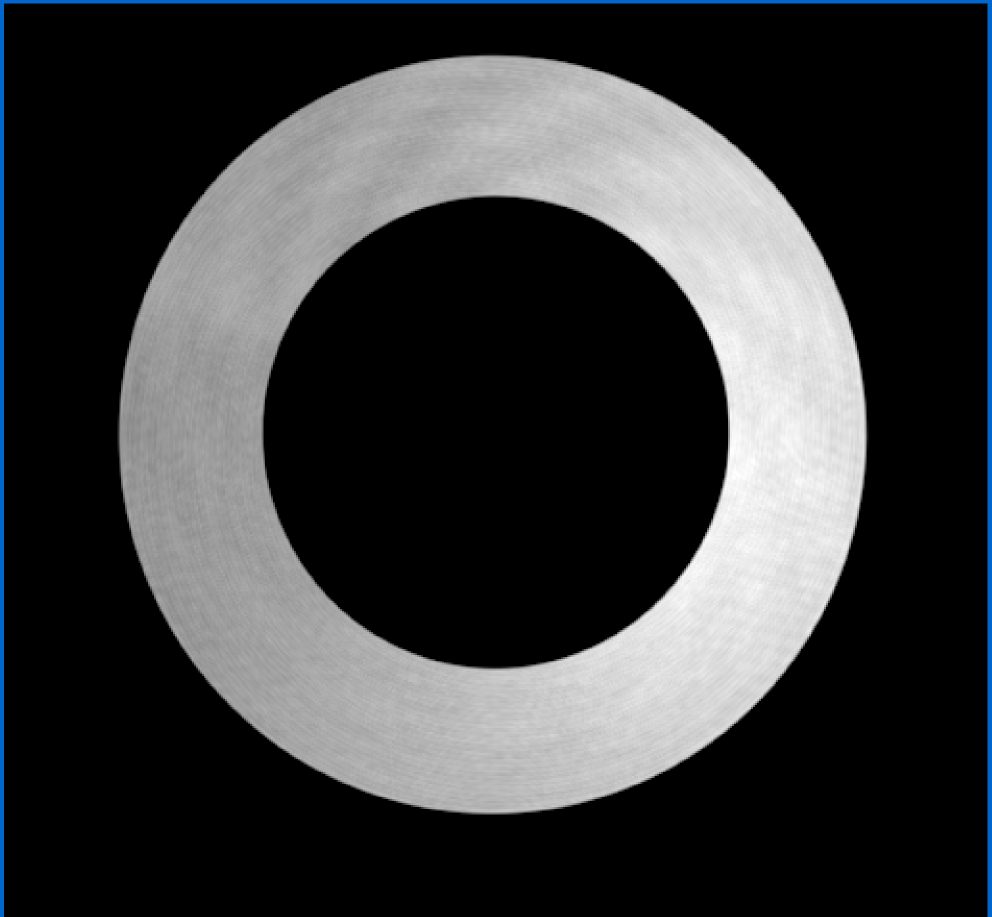
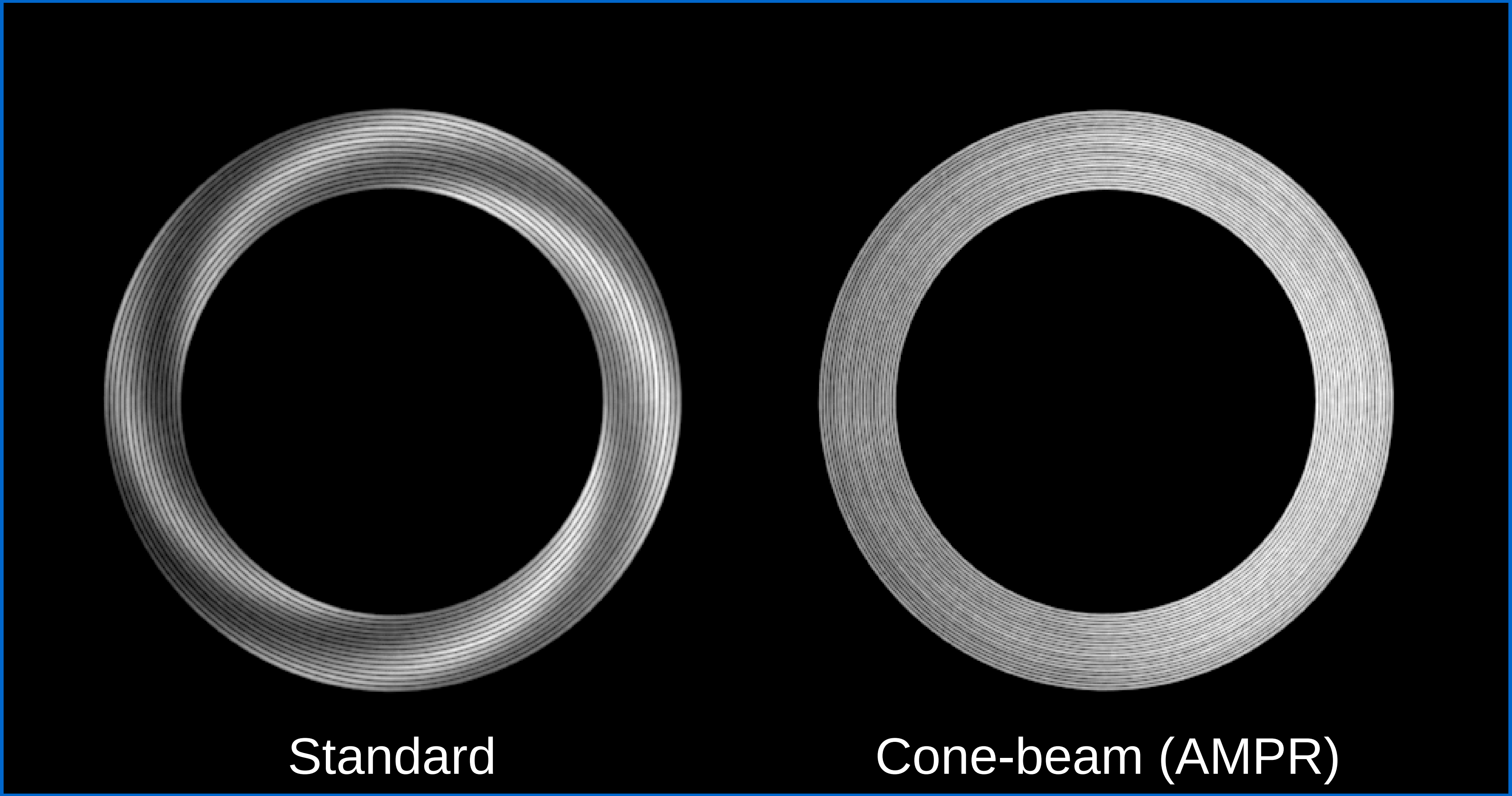

Every 1/10 slice width

Cone-beam algorithm on and off

- Low pitch (0.5), Siemens Sensation 16



Cone-beam algorithm on and off

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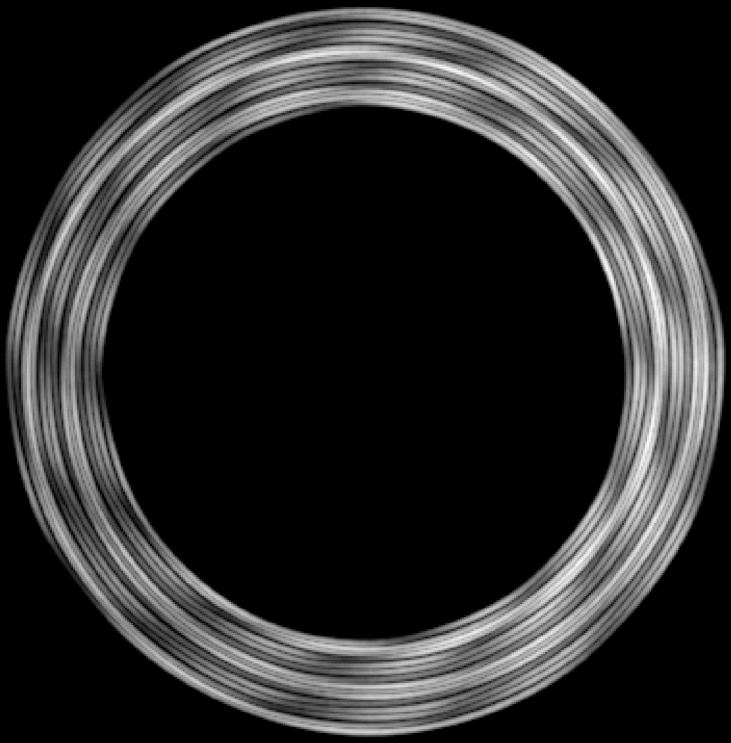
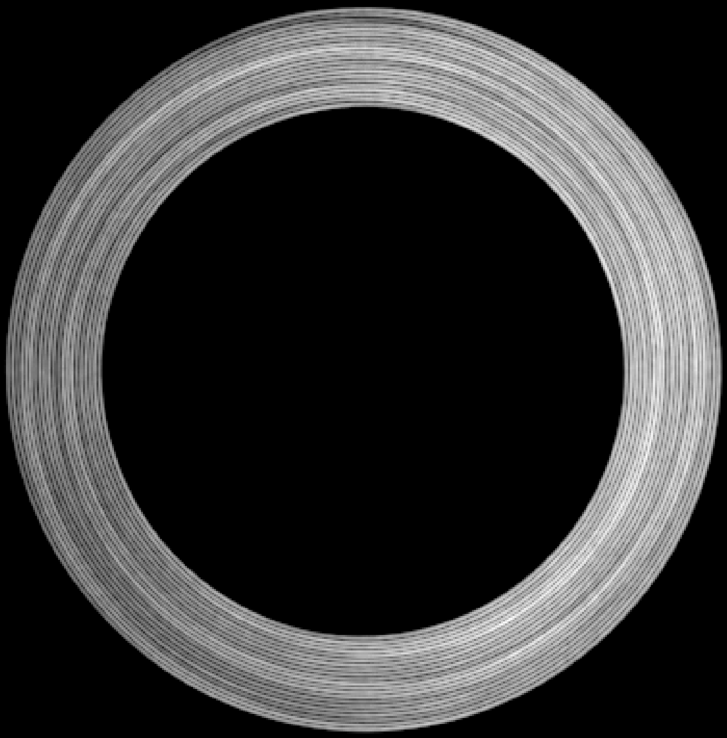


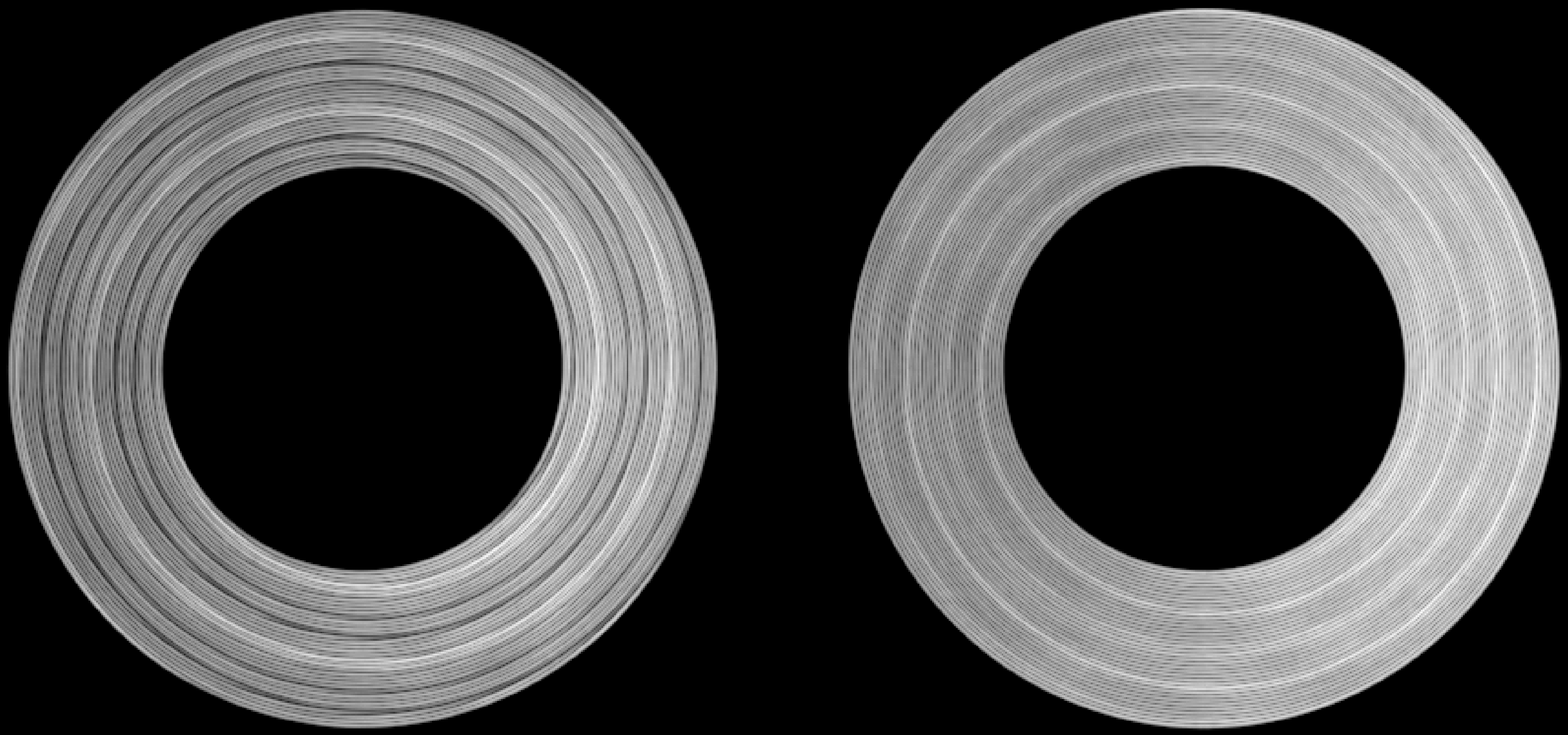
Standard



Cone-beam (AMPR)

Cone-beam algorithm on and off

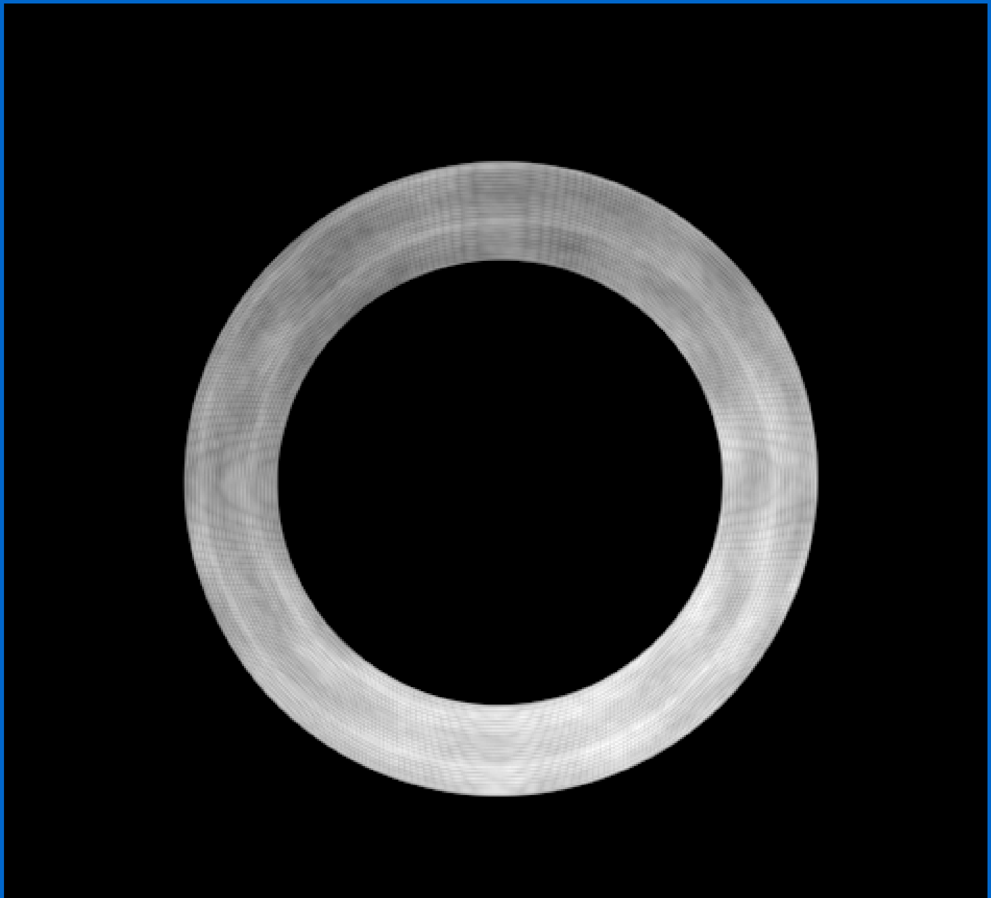
- High pitch (1.5), Philips Mx8000 IDT



Standard Cone-beam (COBRA)

Cone-beam algorithm on and off

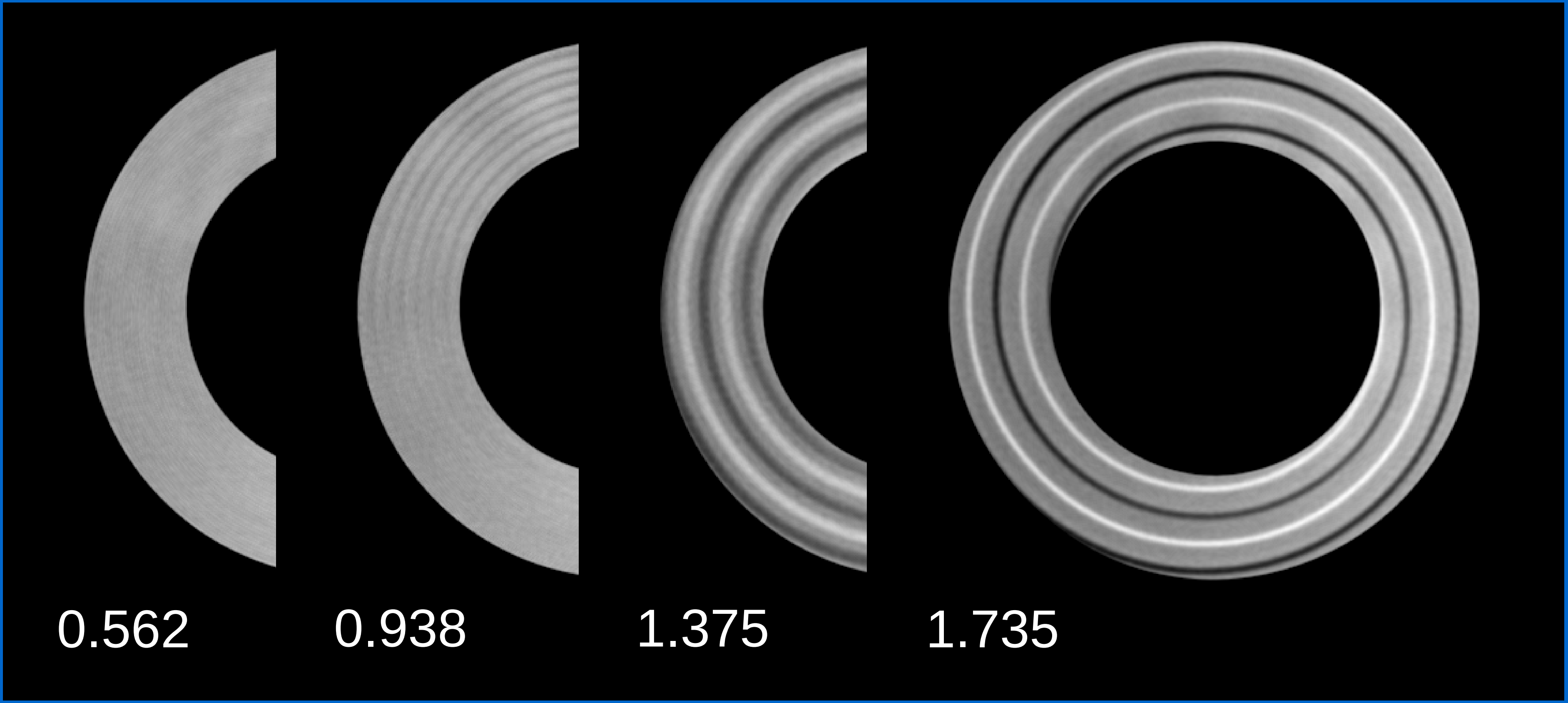
- High pitch (1.5), Toshiba Aquilion 16



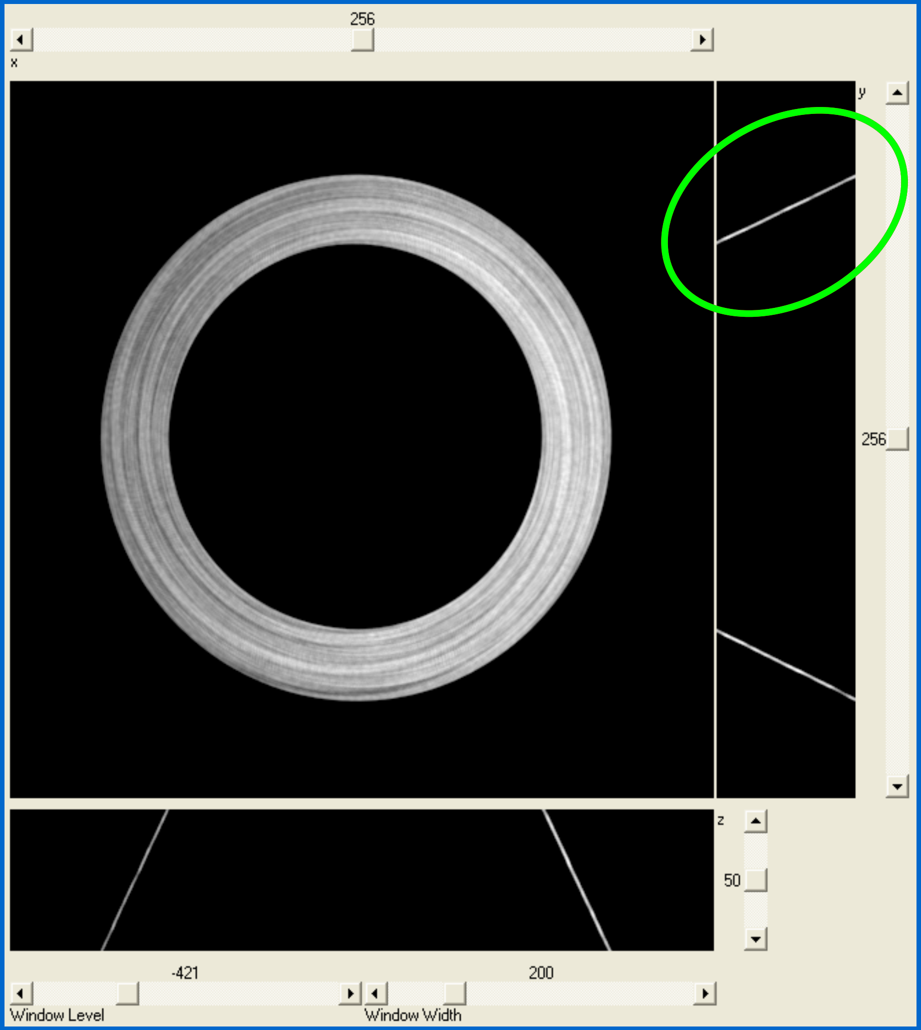
Cone-beam (TCOT)

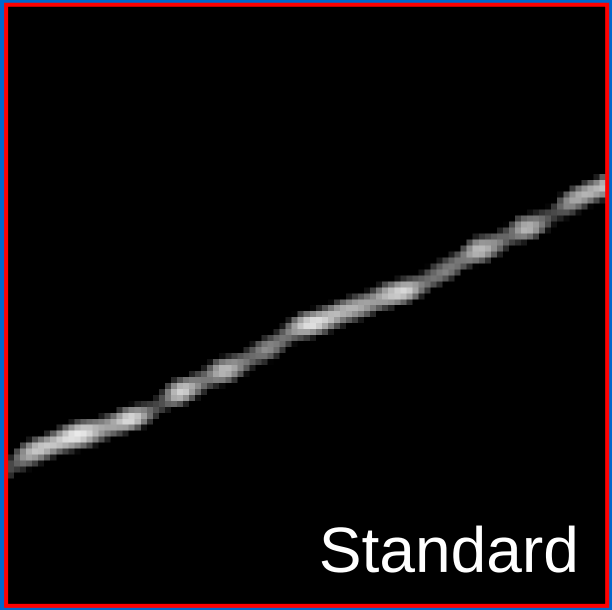
Cone-beam algorithm with pitch

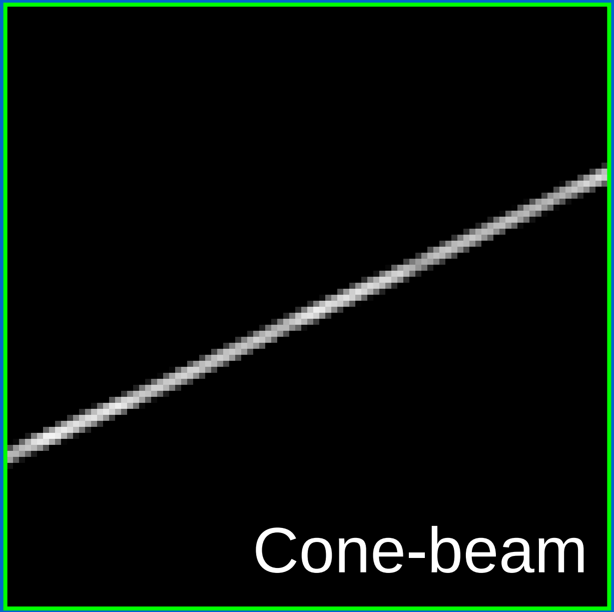
- GE LightSpeed 16, cone-beam reconstruction always on



Clinical relevance

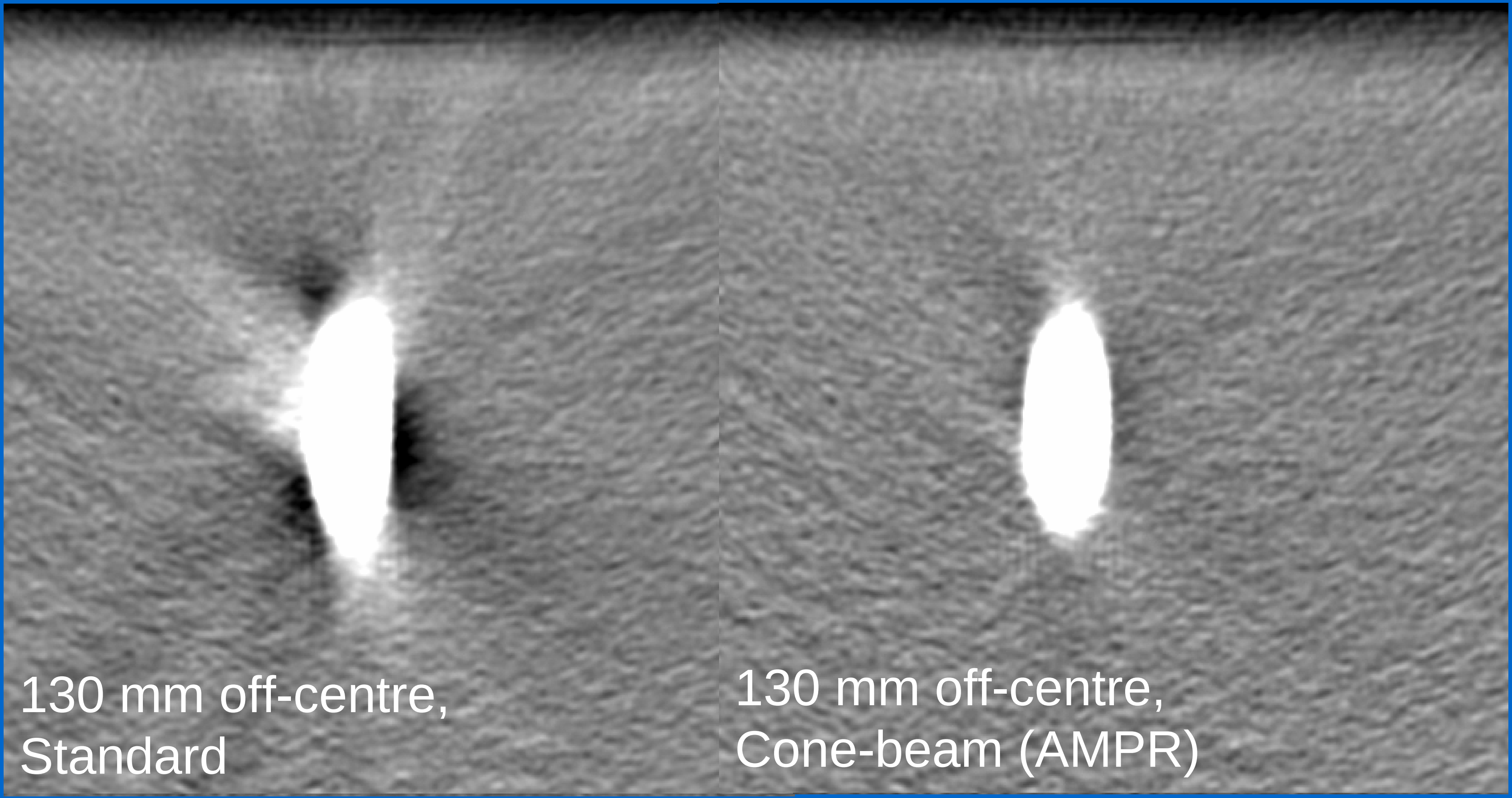






Inclined (60°) Teflon rod

- High pitch (1.5), Siemens Sensation 16



Conclusions

- Scanning a funnel or rod provides a visual method to assess the effectiveness of cone-beam reconstruction algorithms at reducing artefacts
- Images show clear improvements relative to standard reconstruction techniques
- There is potential for objective analysis of these results, such as plotting CT number profiles along the funnel radius