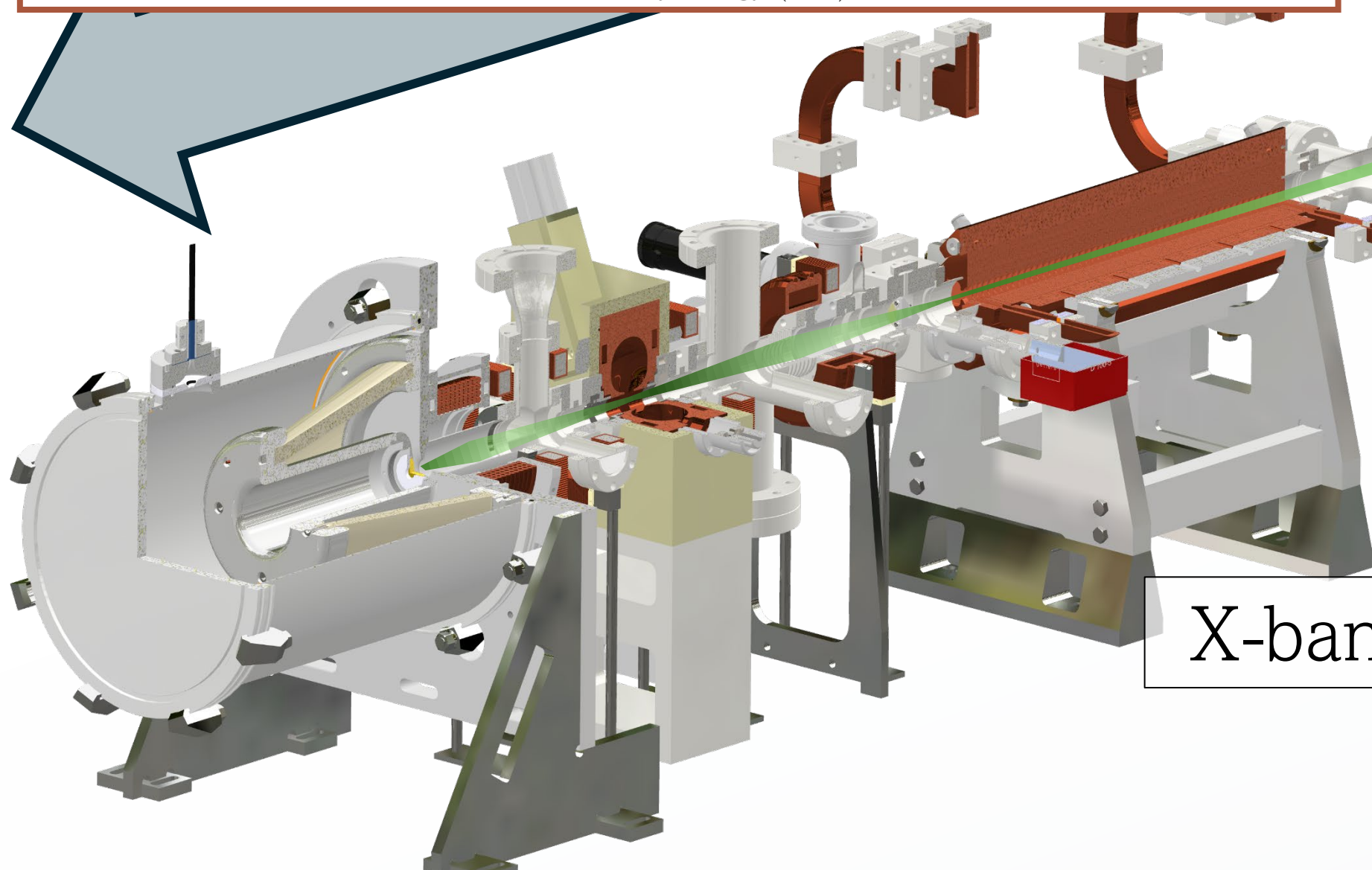
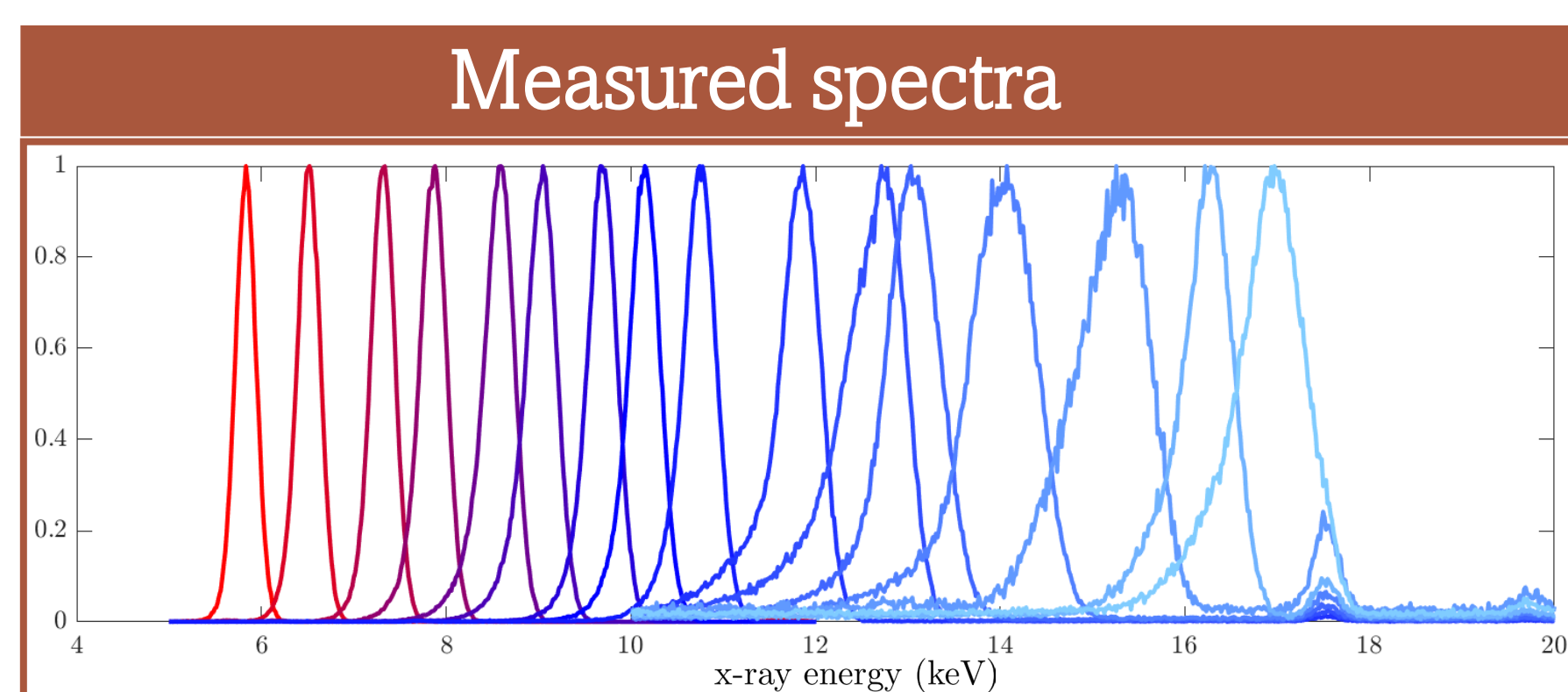


Tunable x-rays from a lab-scale setup

At Eindhoven University of Technology a lab-based tabletop x-ray source is being commissioned based on inverse Compton scattering (ICS). Here, relativistic electrons collide with a laser pulse producing monochromatic x-rays. This compact and tunable source will bridge the gap between conventional lab sources and synchrotrons, making high quality x-rays better accessible for a wide range of applications.

Electron beam	
Beam energy	10-25 MeV
Bunch charge	10 pC
Repetition rate	500 Hz

x-rays	
Energy	5 – 40 keV
Photons/sec	6×10^7
Energy spread	2%



100 keV DC photogun

X-band accelerator

300 cm

Interaction chamber

Medipix detector

Bright soft x-rays from inverse Compton scattering?

Designs for ICS sources often focus on hard x-rays. For soft x-rays ICS sources are considered to be inefficient. This inefficiency can be attributed to the low electron beam brightness owing to the low electron energy

Utilizing a **grazing collision**, rather than a head on collision, allows one to vary the x-ray energy by several orders of magnitude, whilst maintaining the favorable properties of the high energy electrons.

Additionally, **decreasing the electron bunch charge** allows for a tighter electron focus. Not only does this improve x-ray coherence, but it also allows for a tighter laser pulse focus, resulting in an overall increase in the source performance.

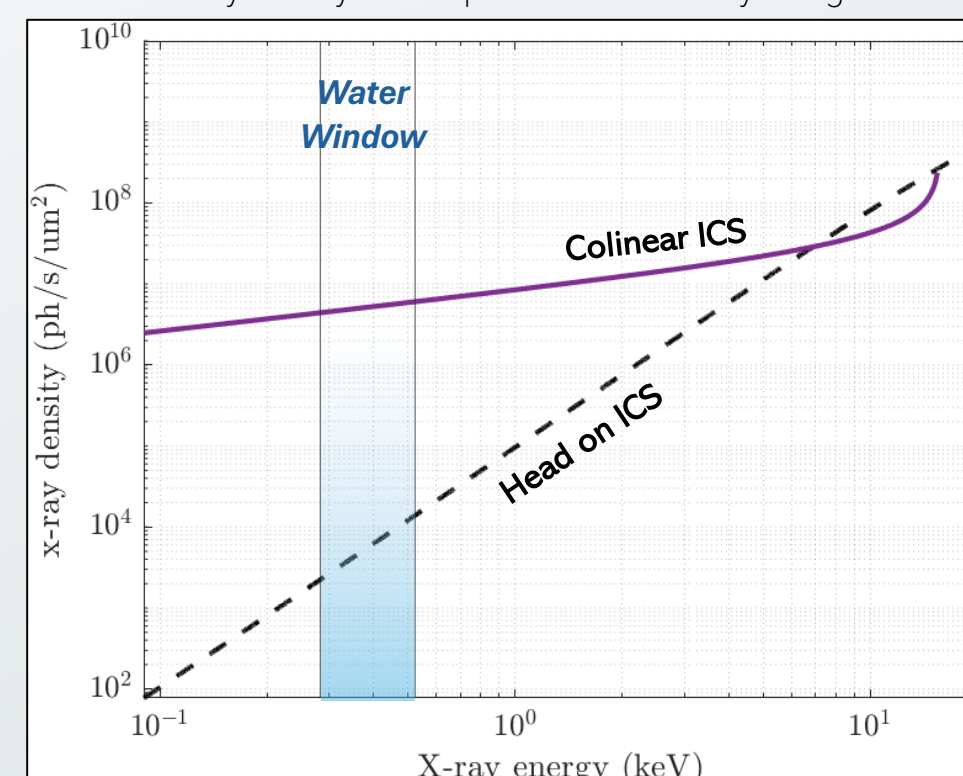
Head on collision

Grazing collision

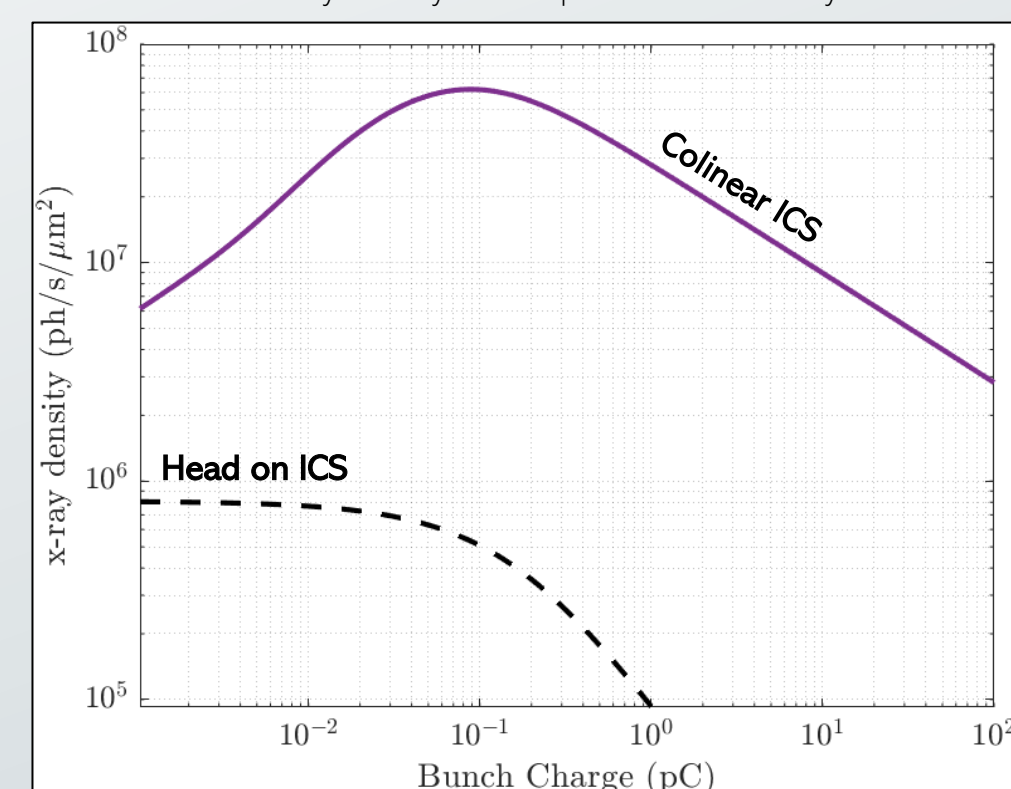
Low bunch charge



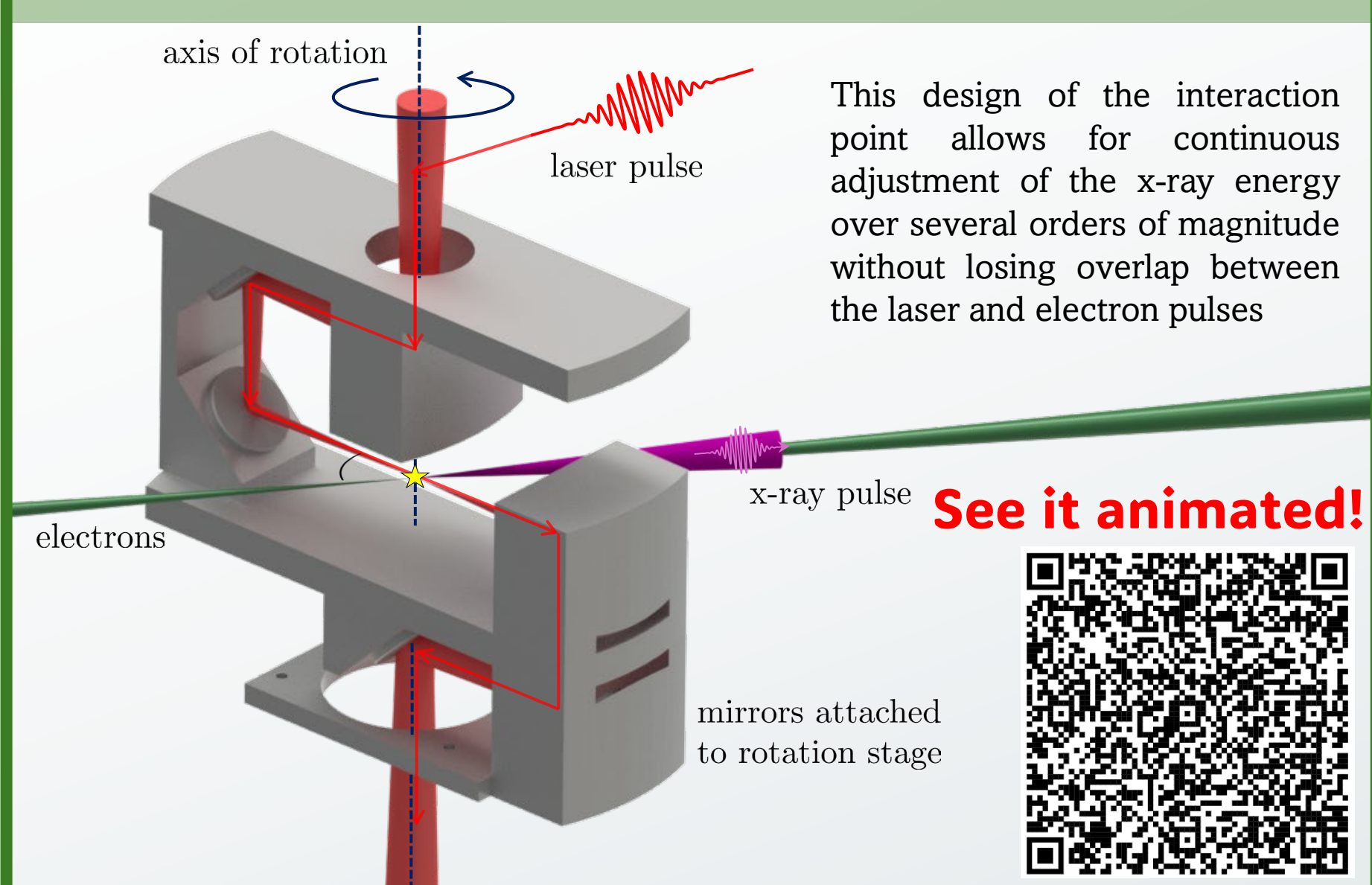
x-ray density on sample for different x-ray energies



x-ray density on sample for 2.3 nm x-rays



Interaction Carousel



References

[1] Nijhof, D. F. J. (2024). "Ultracold electron source development and X-band acceleration for a compact ICS-based x-ray source."