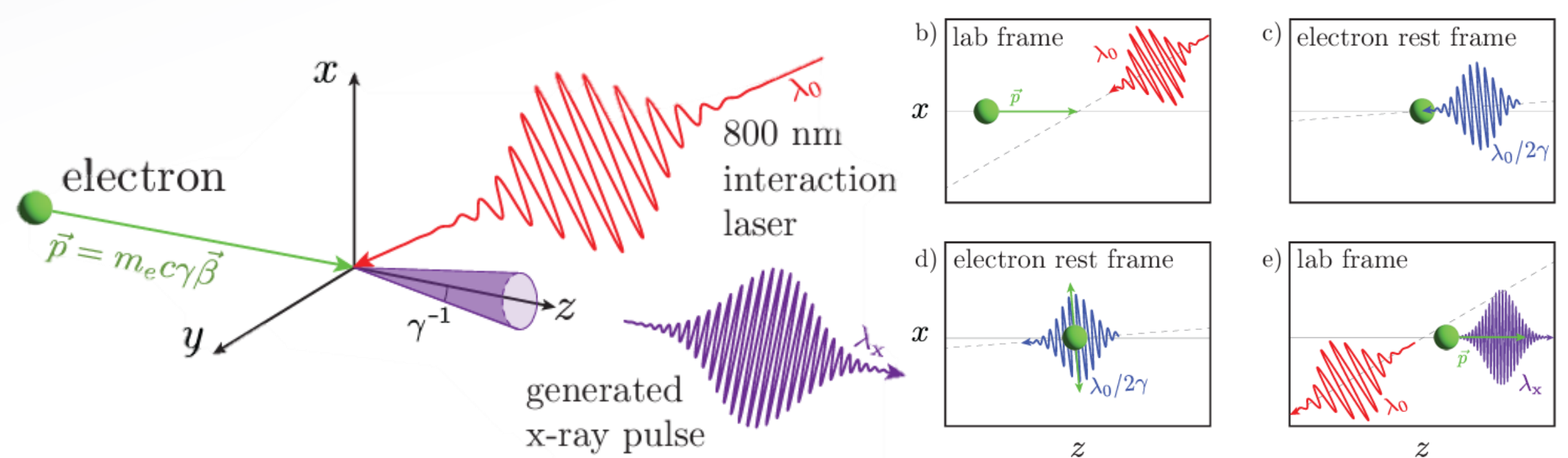


tunable x-rays from a lab-scale setup

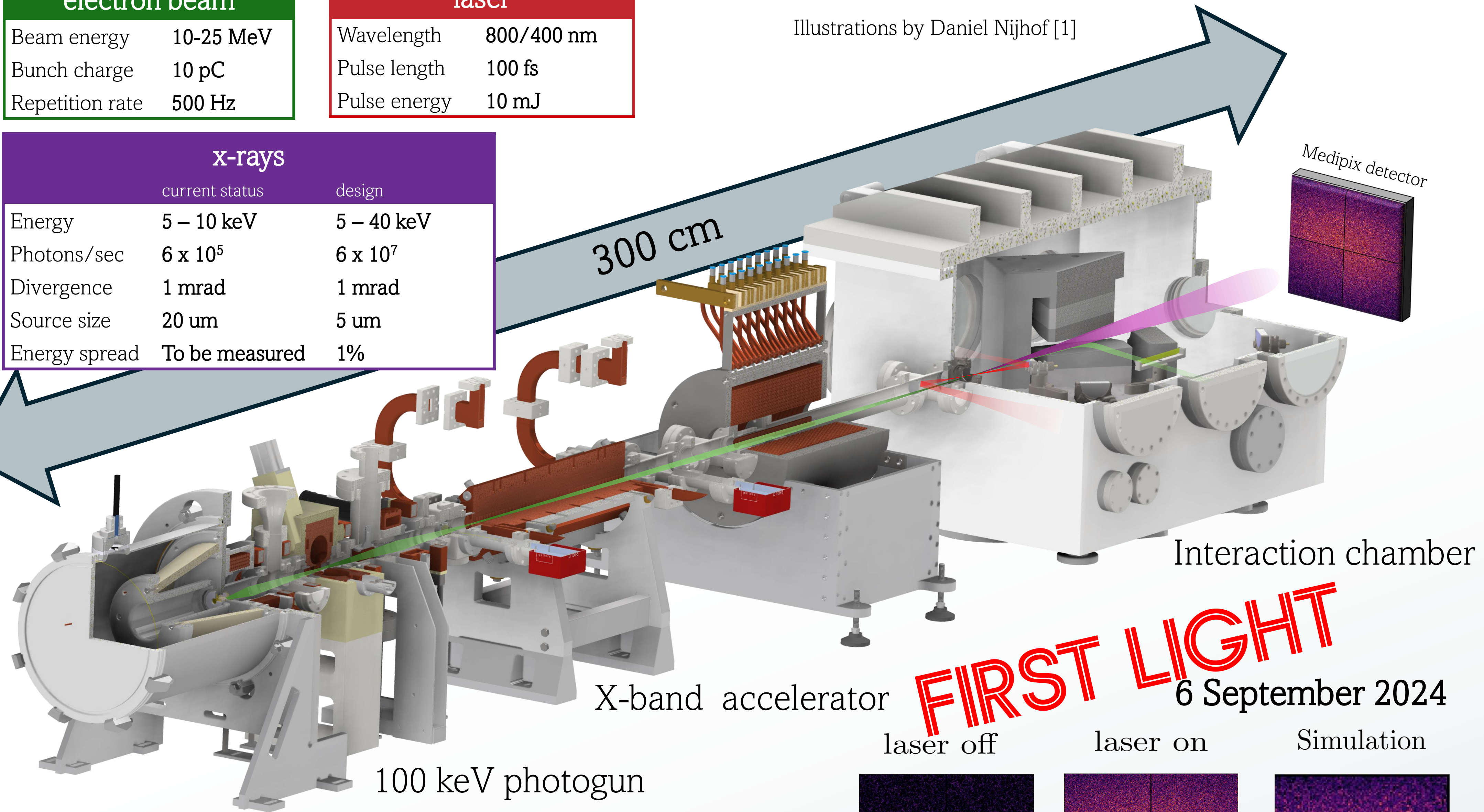
At Eindhoven University of Technology a lab-based tabletop x-ray source is being commissioned based on inverse Compton scattering (ICS). Here, relativistic electrons collide with a laser pulse producing monochromatic x-rays. This compact and tunable source will bridge the gap between conventional lab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

electron beam		laser	
Beam energy	10-25 MeV	Wavelength	800/400 nm
Bunch charge	10 pC	Pulse length	100 fs
Repetition rate	500 Hz	Pulse energy	10 mJ

x-rays		
	current status	design
Energy	5 – 10 keV	5 – 40 keV
Photons/sec	6×10^5	6×10^7
Divergence	1 mrad	1 mrad
Source size	20 μm	5 μm
Energy spread	To be measured	1%



Illustrations by Daniel Nijhof [1]



Interaction chamber

X-band accelerator

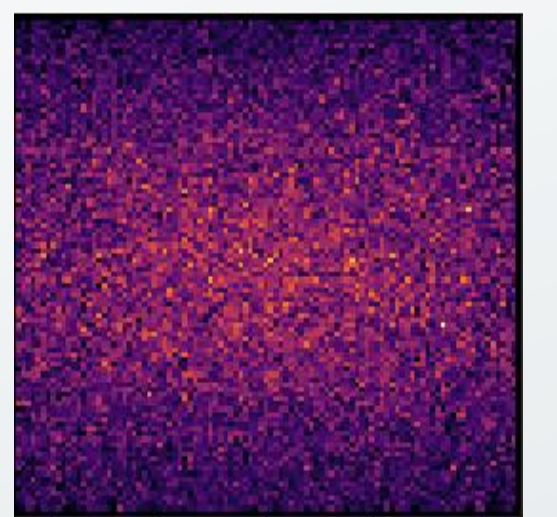
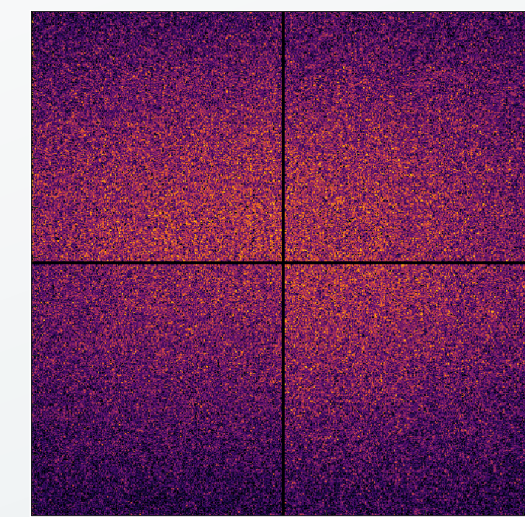
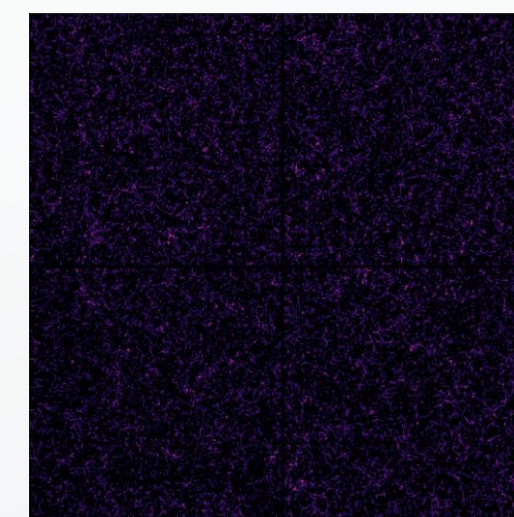
100 keV photogun

FIRST LIGHT
6 September 2024

laser off

laser on

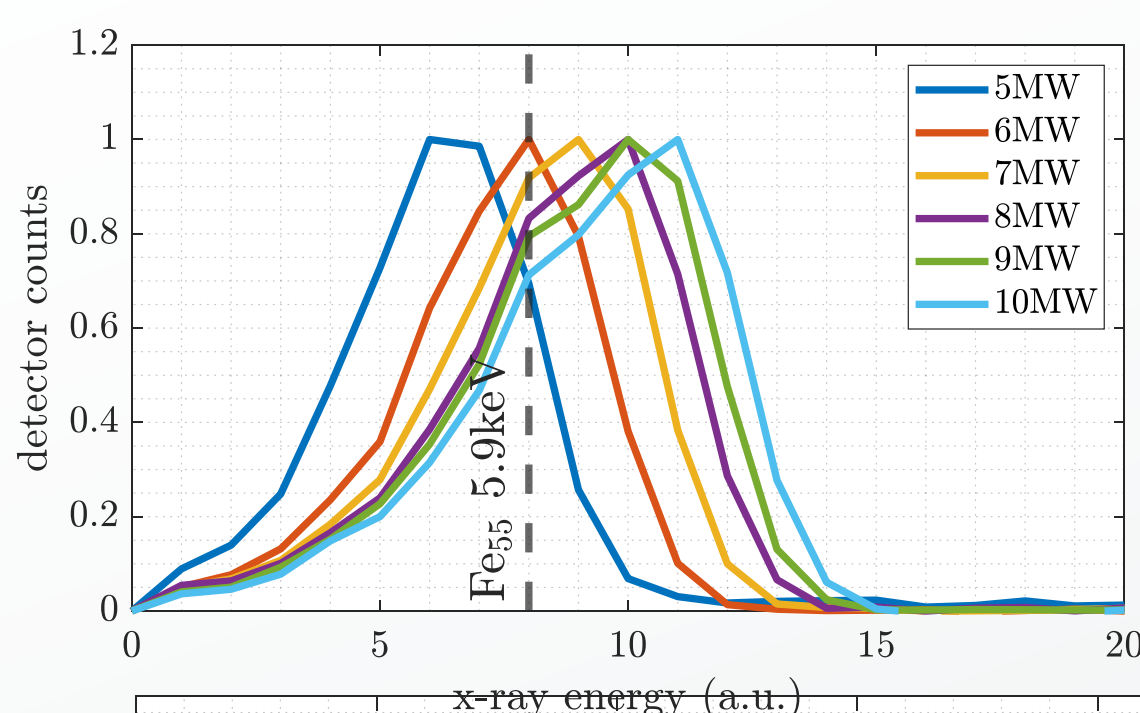
Simulation



Counts per shot: 1213

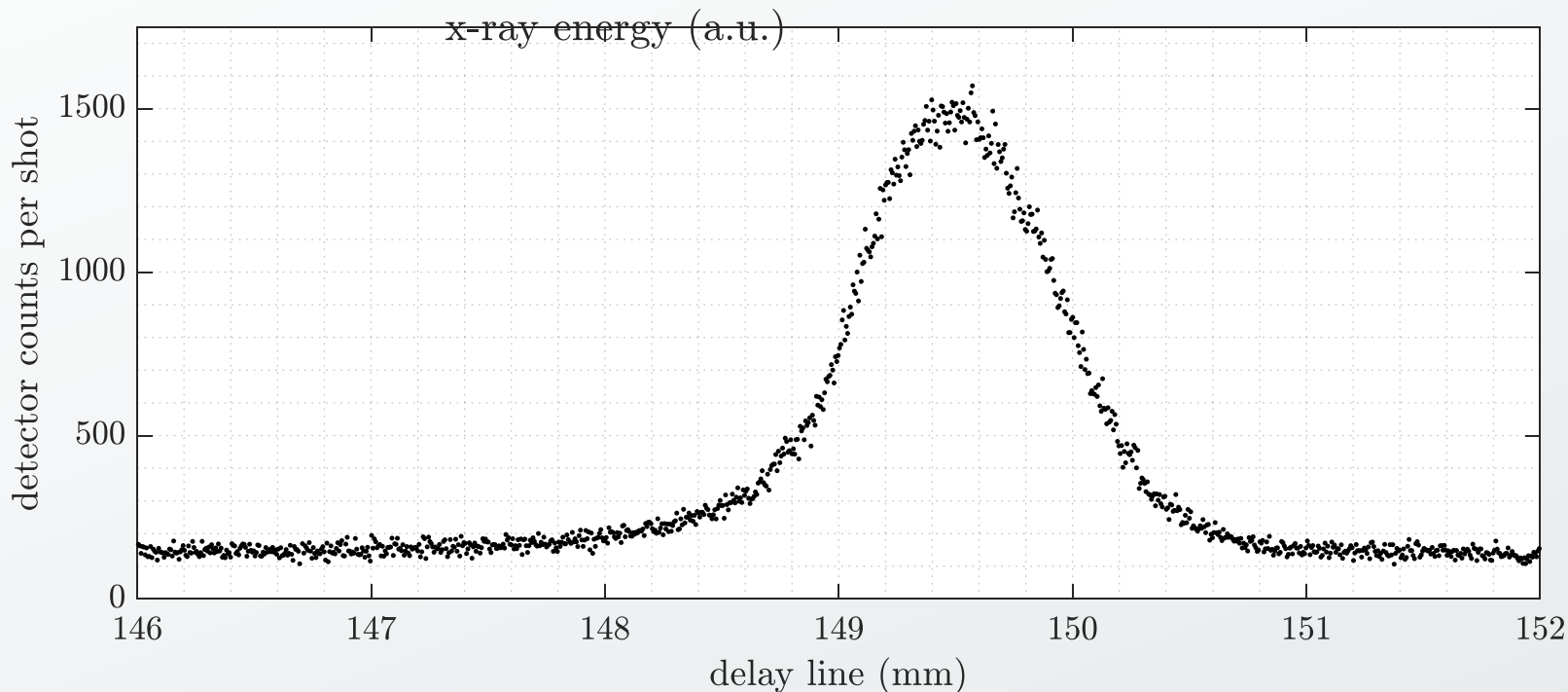
Counts per shot: 1668

→ 73% of theoretical prediction



Tunable x-ray energy

Time-over-threshold mode with medipix detector



delay line scan

Adjusting the timing between the electron bunch and laser pulse

Future developments

Thermionic gun [2]

burst mode operation

Soft x-rays

water window microscopy

Microbunching [3]

coherent amplification

References

- [1] Nijhof, D. F. J. (2024). "Ultracold electron source development and X-band acceleration for a compact ICS-based x-ray source."
- [2] Toonen, W. F., et al. "Development of a low-emittance high-current continuous electron source." Nucl. Instr. Met. 1013 (2021): 165678.
- [3] Schaap, B. H., et al. "Ponderomotive bunching of a relativistic electron beam for a superradiant Thomson source." Phys. Rev. Accel. Beams 26, 074401