

Two Wavelengths in One Source: The New High Performance In- And Ga- MetalJet in Mülheim

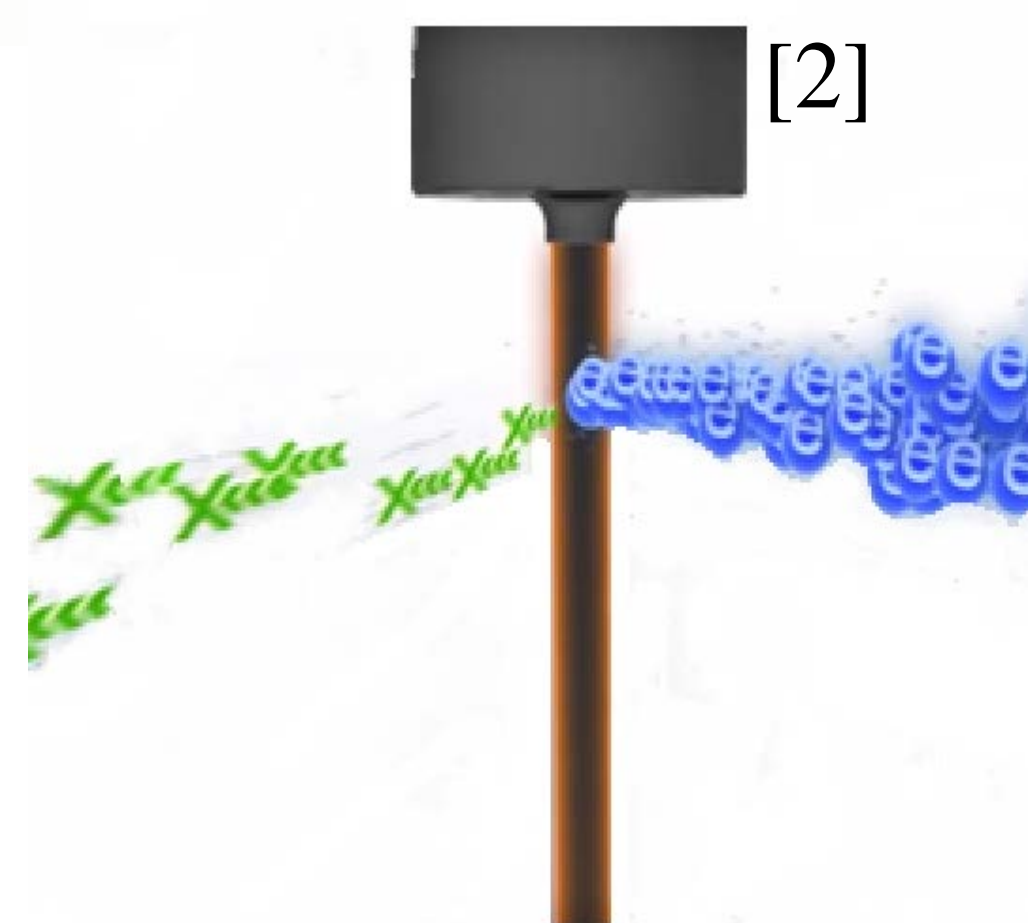


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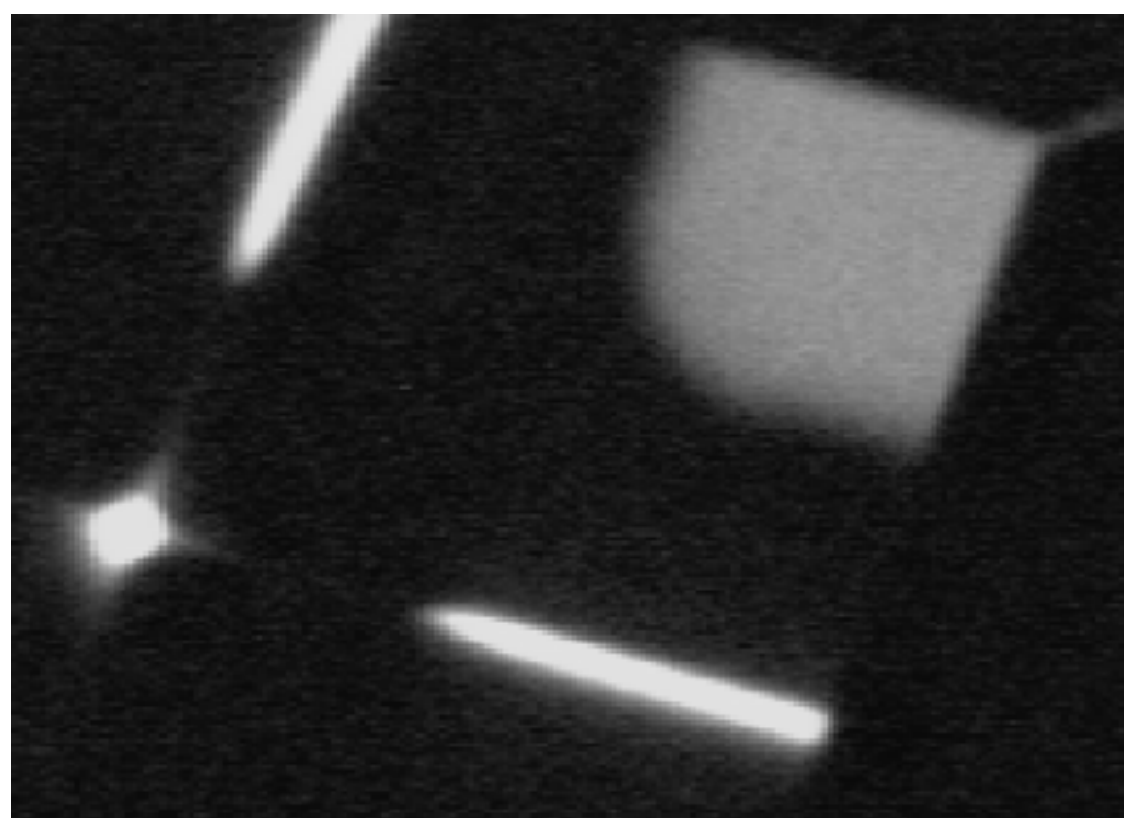
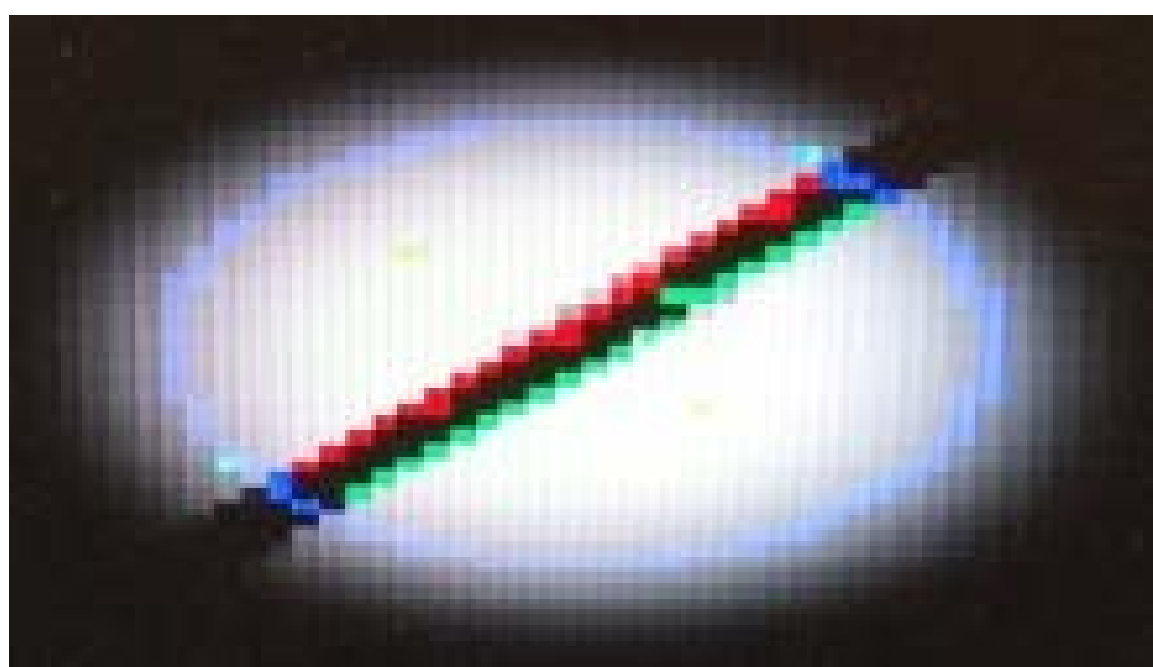
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Design and function

The MetalJet D2+ is a multipurpose X-ray source based on liquid metal anode technology [1]. A highly accelerated electron beam is focused on a molten metal target. To guarantee a constant target surface, the molten metal alloy is pressed through a nozzle assembly which forms a cylindrical jet. Every electron impact produces a characteristic X-ray of the target metal and some Bremsstrahlung. After passing the electron beam the alloy flows into a pump and is recycled. The alloy used contains mainly **Ga** and **In**. The electron beam size and shape can be set by changing the excitation of the magnetic lenses. A double focusing Montel multilayer optic [3] increases the photon flux densities up to a maximum value which is comparable to synchrotron like fluxes densities. The alternative wavelength can be selected simply by exchanging the mirror optics.

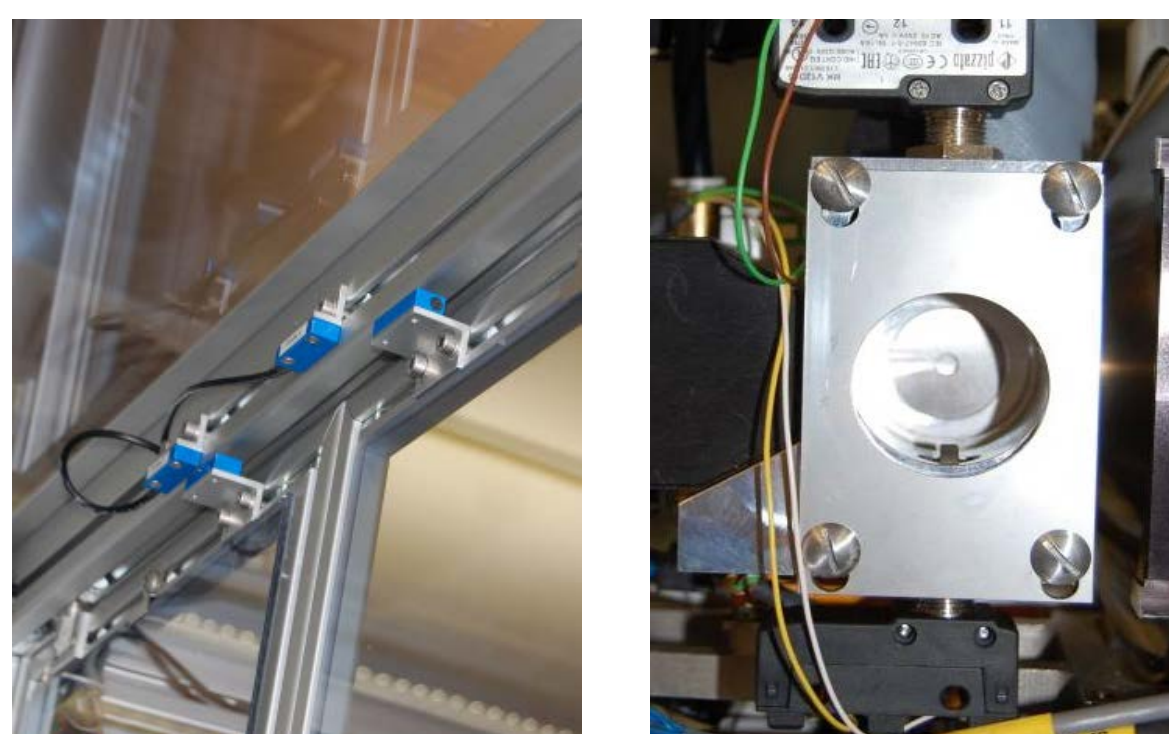


ExAlloy I2	
Element	Content / w%
Ga	47
In	37
Sn	16



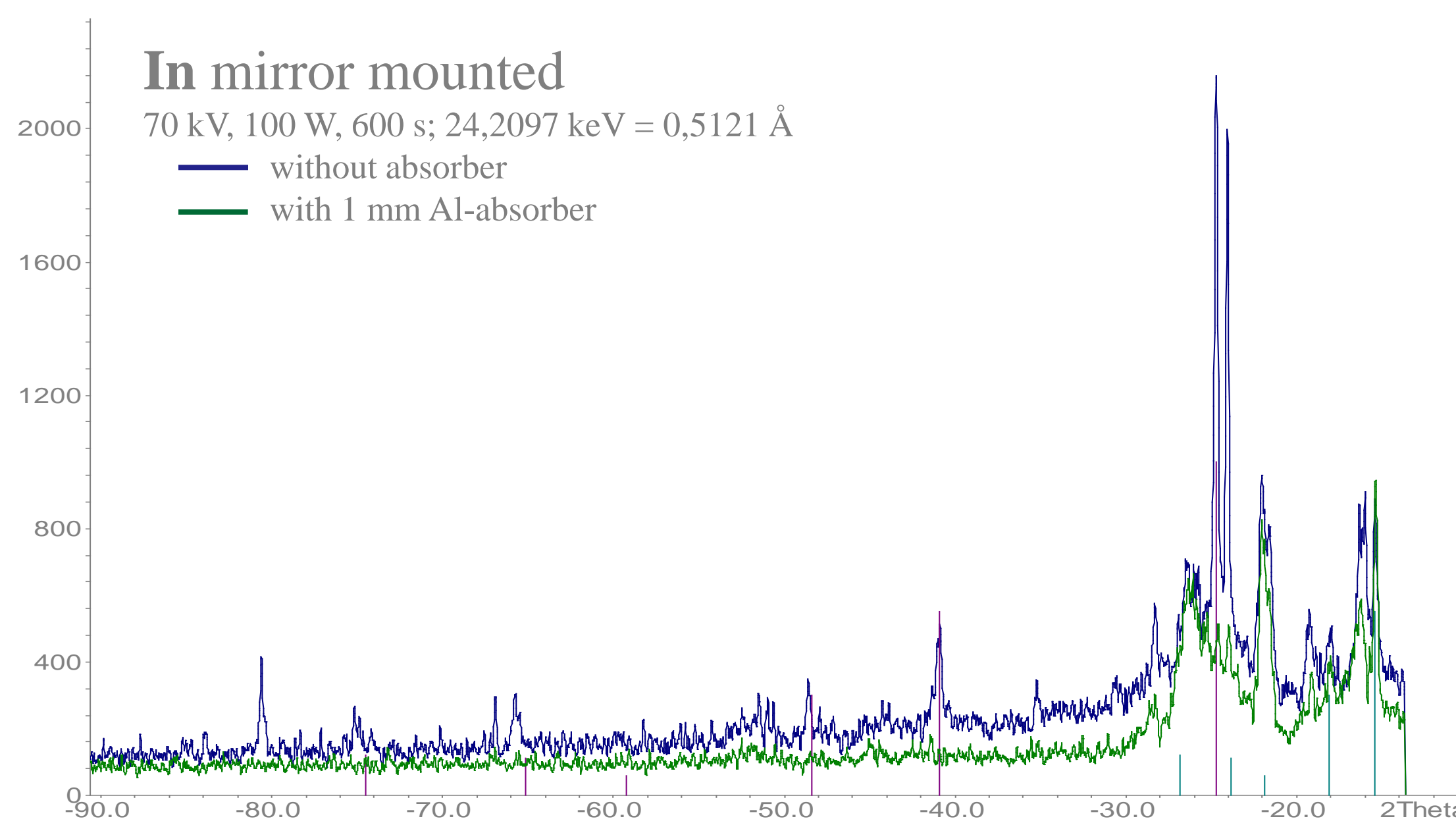
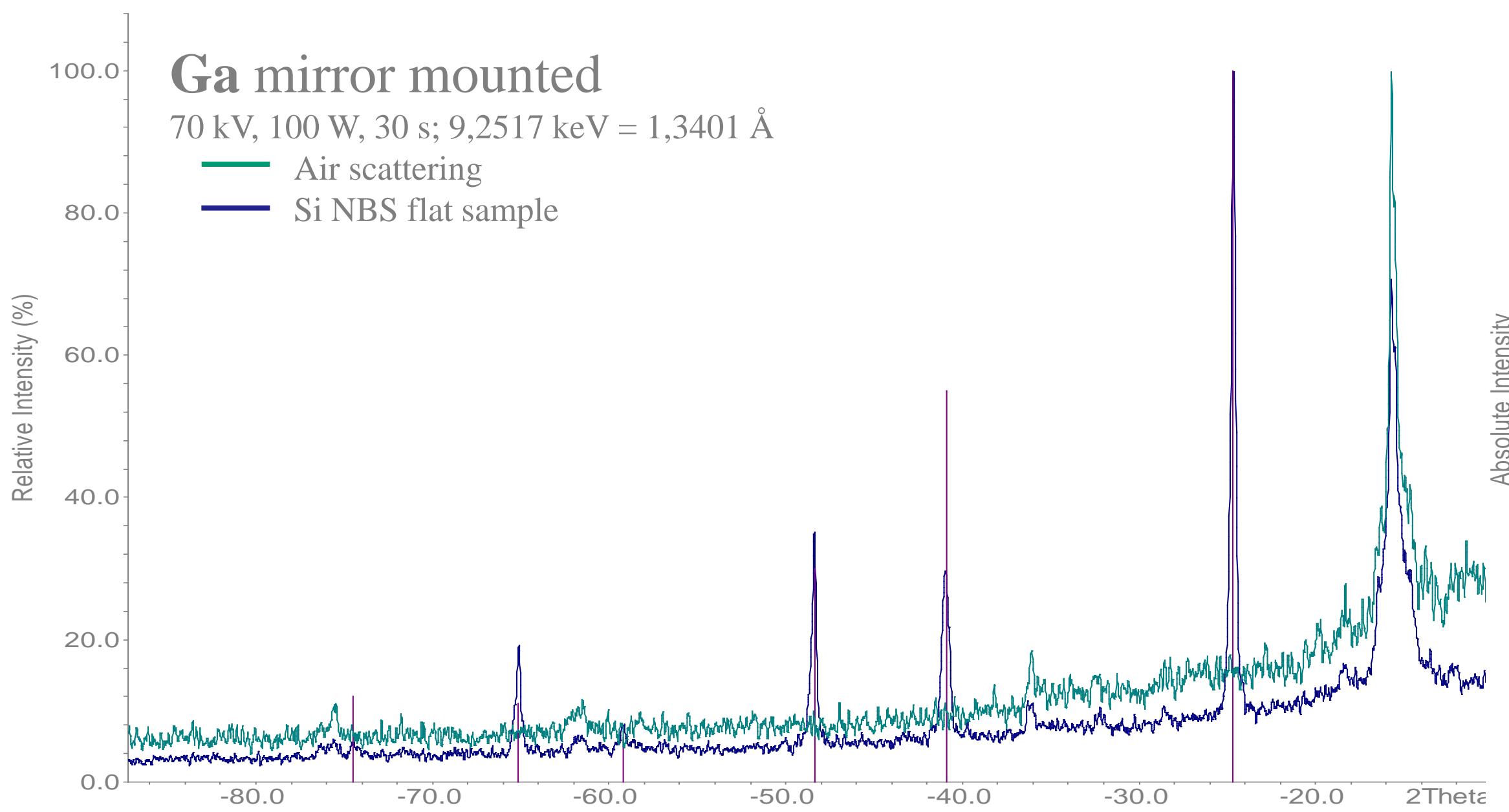
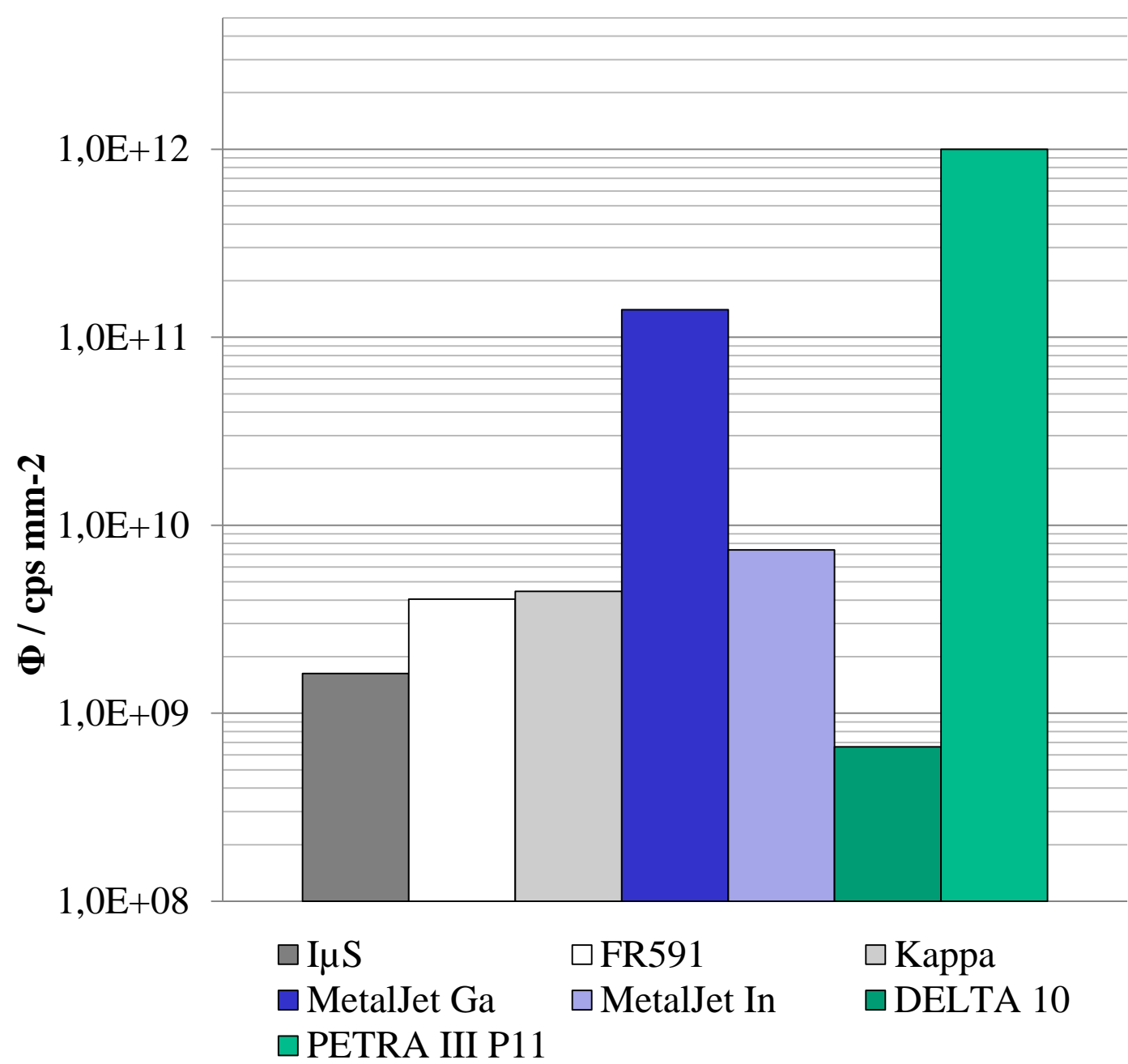
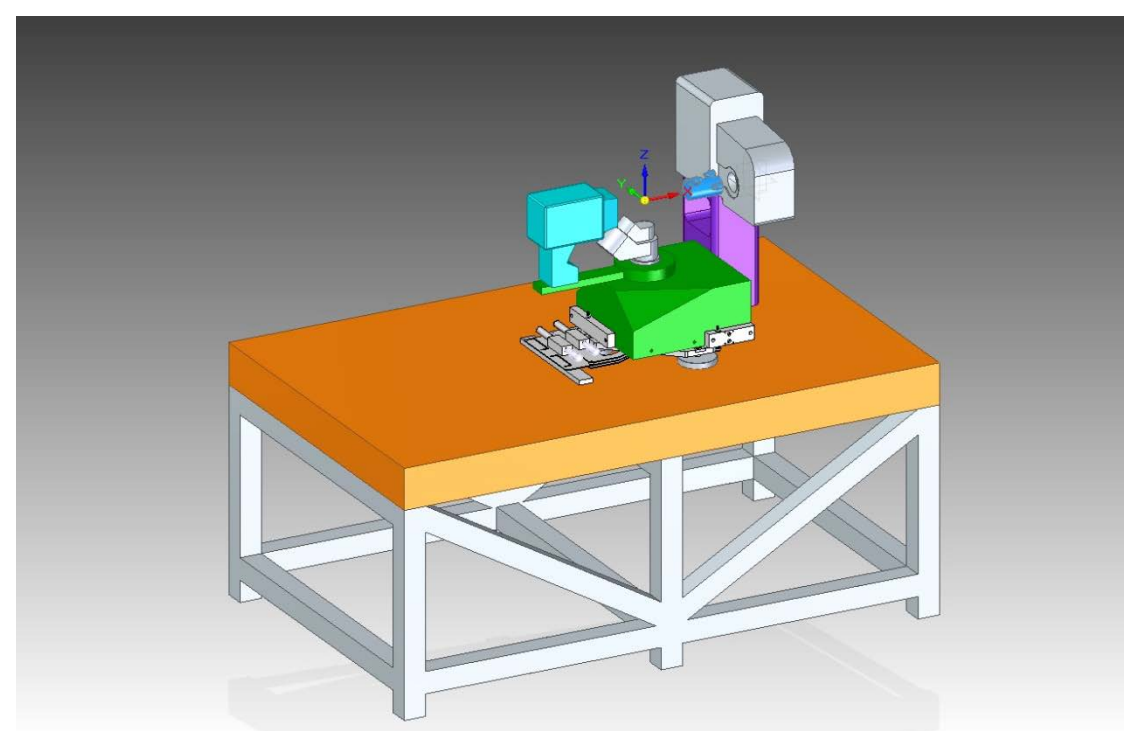
Radiation protection and safety devices

At maximal operation conditions the electrons are accelerated up to 160keV, defining the upper limit of the energy of the Bremsstrahlung. This requires additional lead shielding because the delivered housing is only designed for 70keV. Double redundant magnetic safety switches were implemented to ensure the shutter safety. High voltage is only permitted if a mirror is mounted.



Planned experimental setup

- Four circle kappa single crystal goniometer.
- CryoJet for low temperature measurements and air sensitive samples.
- CdTe detector with preferably two energydiscrimination levels.
- Possibility of operating as a dual port source for both wavelengths.
- Single crystal diffraction of small crystals: 20µm and less.
- Electron density studies.



Powder diffraction

A proof of principle experiment with both **Ga**- and **In**-radiation and a flat polycrystalline silicon specimen reveals spectral impurities in case of the indium set-up. Due to total reflection of low energy X-rays on the mirror surface parasitic diffraction

peaks assigned to **In-K α** and **In-K β** are observed. A 1mm aluminium absorber reduces the intensity of these peaks to nearly background level. Experiments using a 2D photon counting area detector with energy discrimination are currently build.

References:

- [1] O. Hemberg, M. Otendal, H. M. Hertz; *Appl. Phys. Lett.*, **2003**, Vol. 83, 1483.
- [2] Excillum A.B.; MetalJet-D2 X-ray Source Documentation, **2013**, Sweden
- [3] F. Hertlein, S. Kroth, C. Michaelsen, A. Oehr, J. Wiesmann; *Adv. Eng. Mat.*, **2008**, 10, 686 .

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