

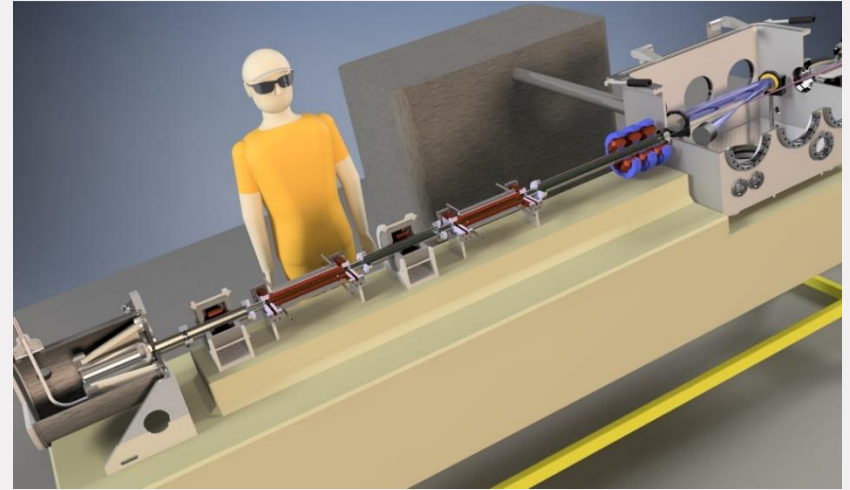


Smart*Light in Eindhoven, status and plans

CLIC meeting, 7 December 2022

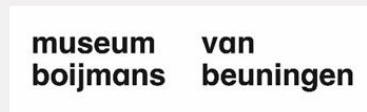
Peter Mutsaers, Daniel Nijhof, Rick van den Berg, Ids van Elk, Tom Lucas, Xavier Stragier, Linda Stoel, Samu Oosterink, Marco van der Sluis, Hein van den Heuvel, Eddy Rietman, Harry van Doorn, Bram Klein, Frans van Setten, Jom Luiten

Smart Light

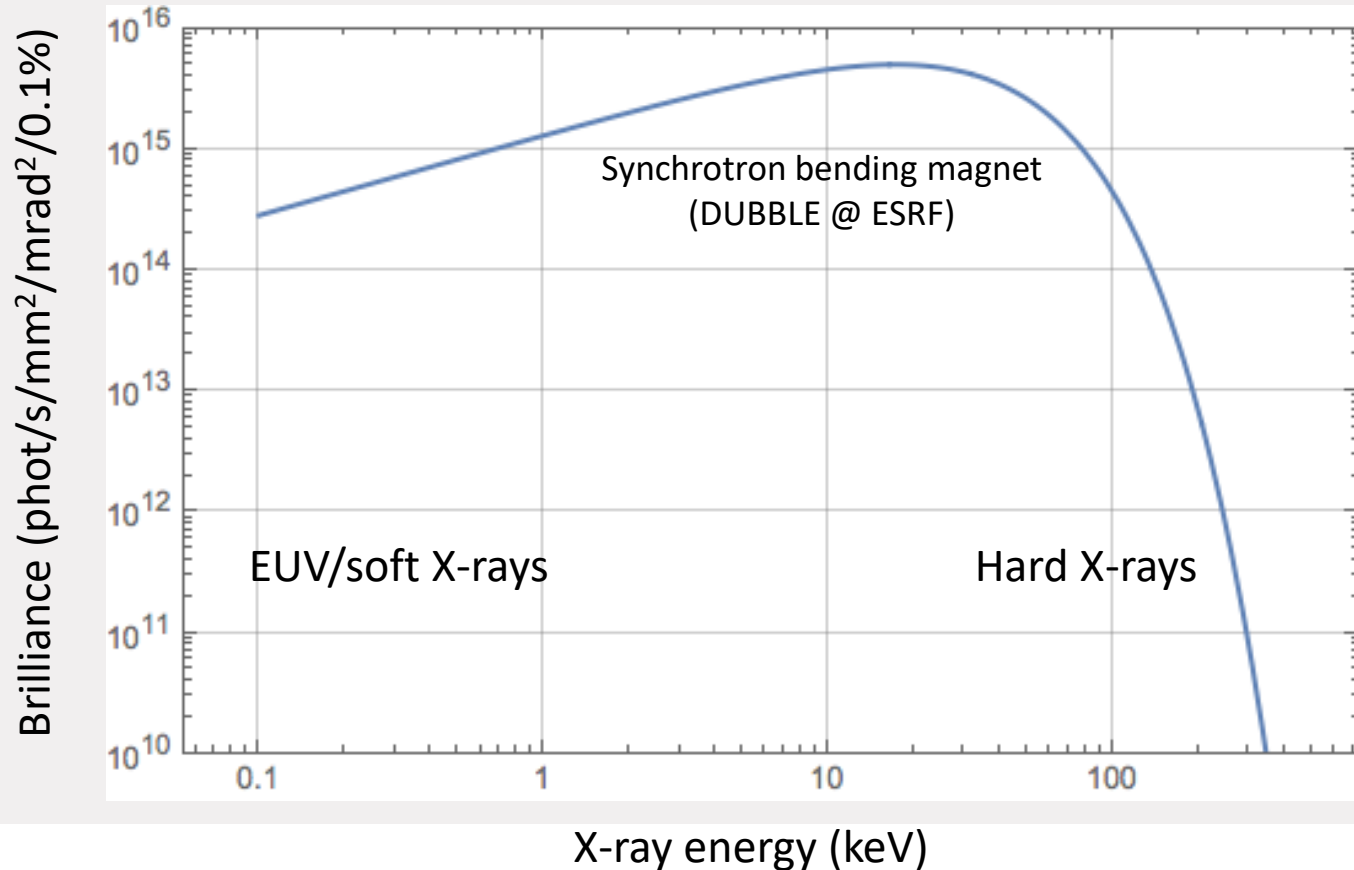


Interreg 
EUROPESE UNIE
Vlaanderen-Nederland
Europees Fonds voor Regionale Ontwikkeling

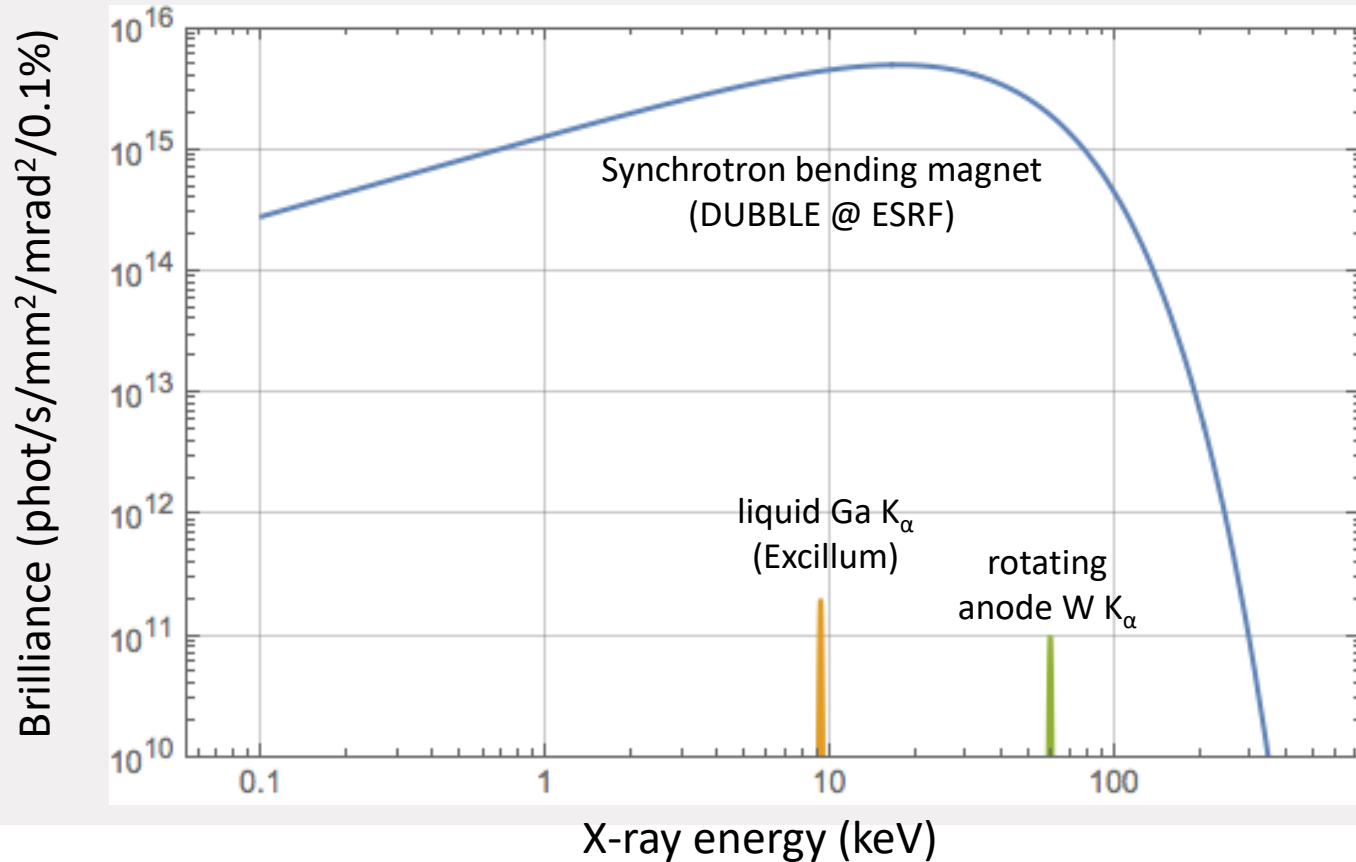




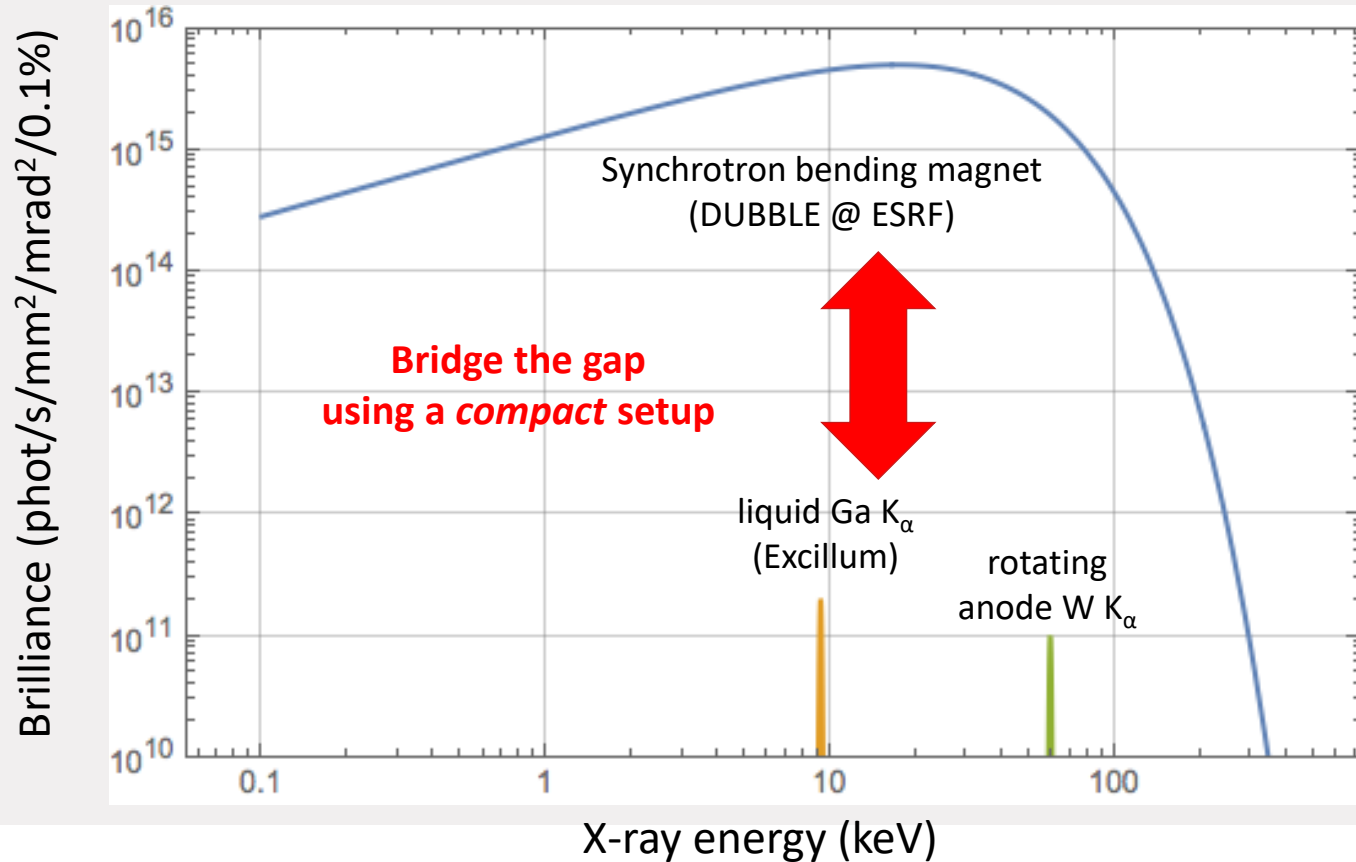
Brilliance synchrotrons



Brilliance



Brilliance

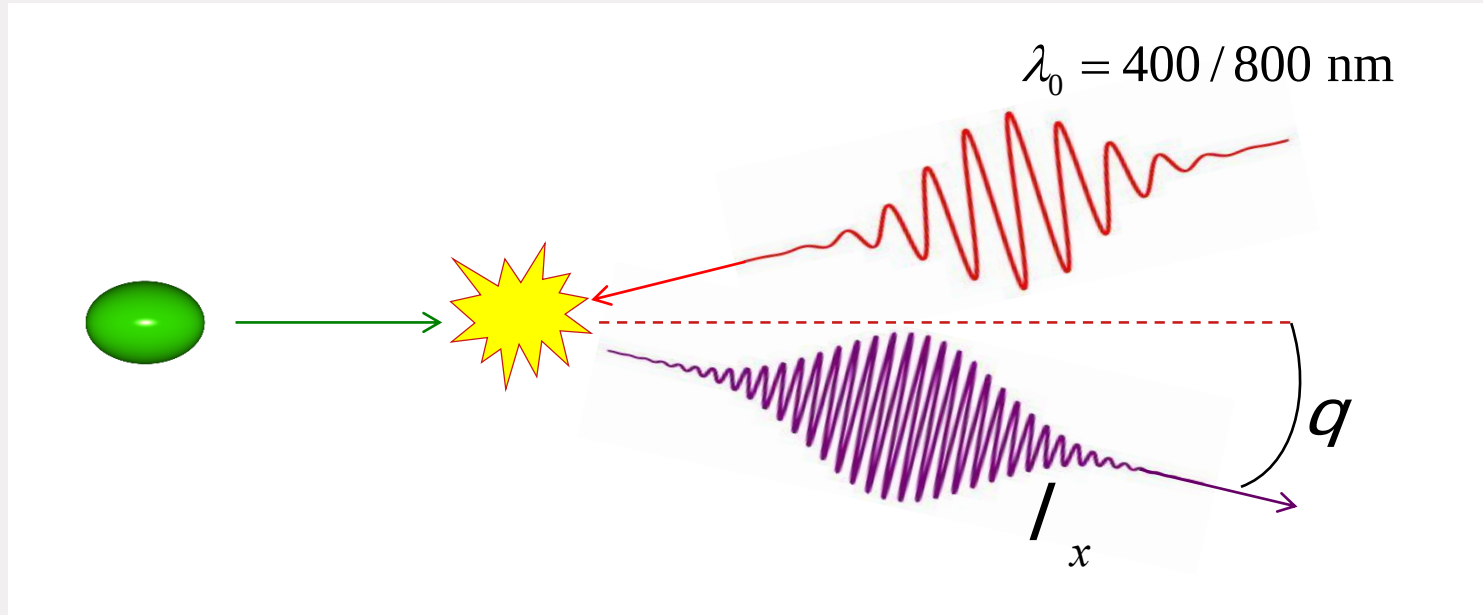


X-ray generation by Inverse Compton Scattering (ICS)

$$\lambda_X = \lambda_0 \frac{1 - \beta \cos \theta}{1 + \beta}, \quad \beta = \frac{v_z}{c}$$

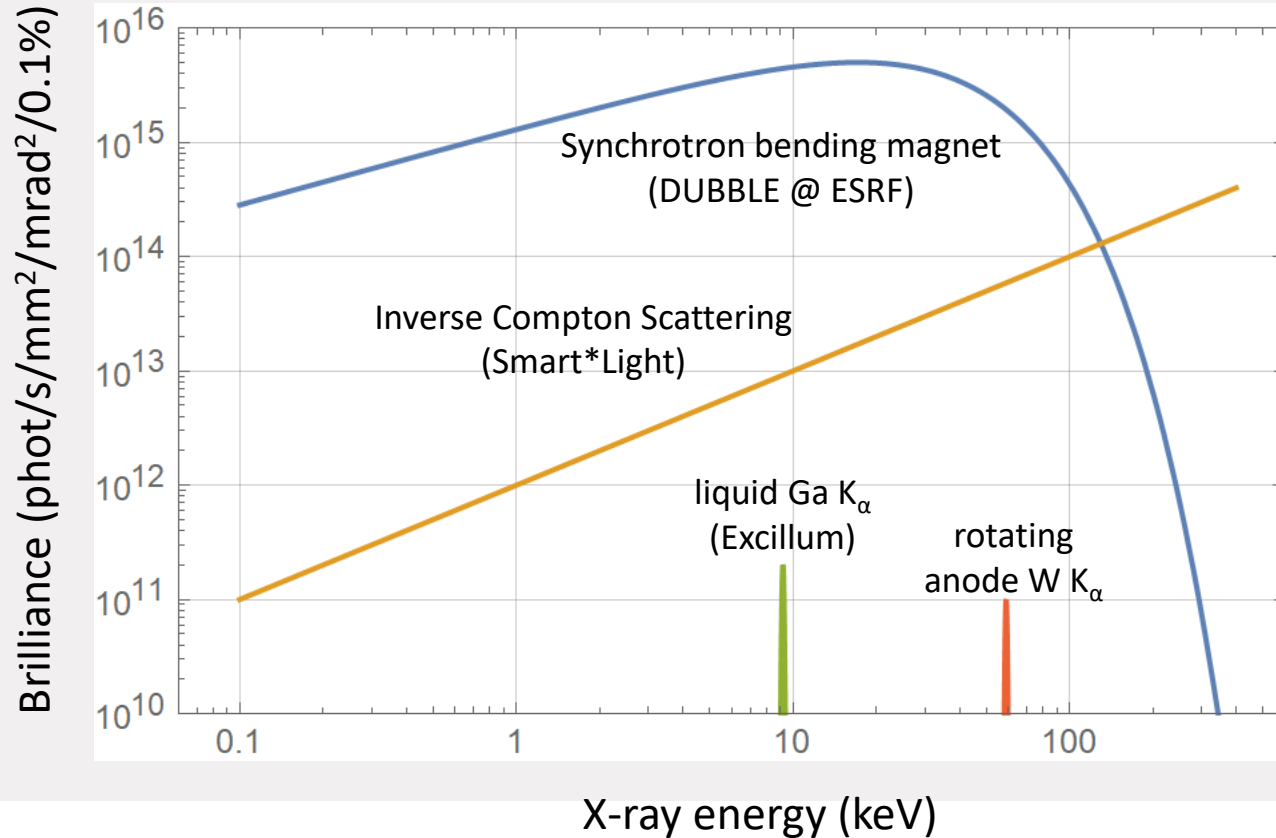
(double) relativistic Doppler shift

X-ray generation by Inverse Compton Scattering (ICS)

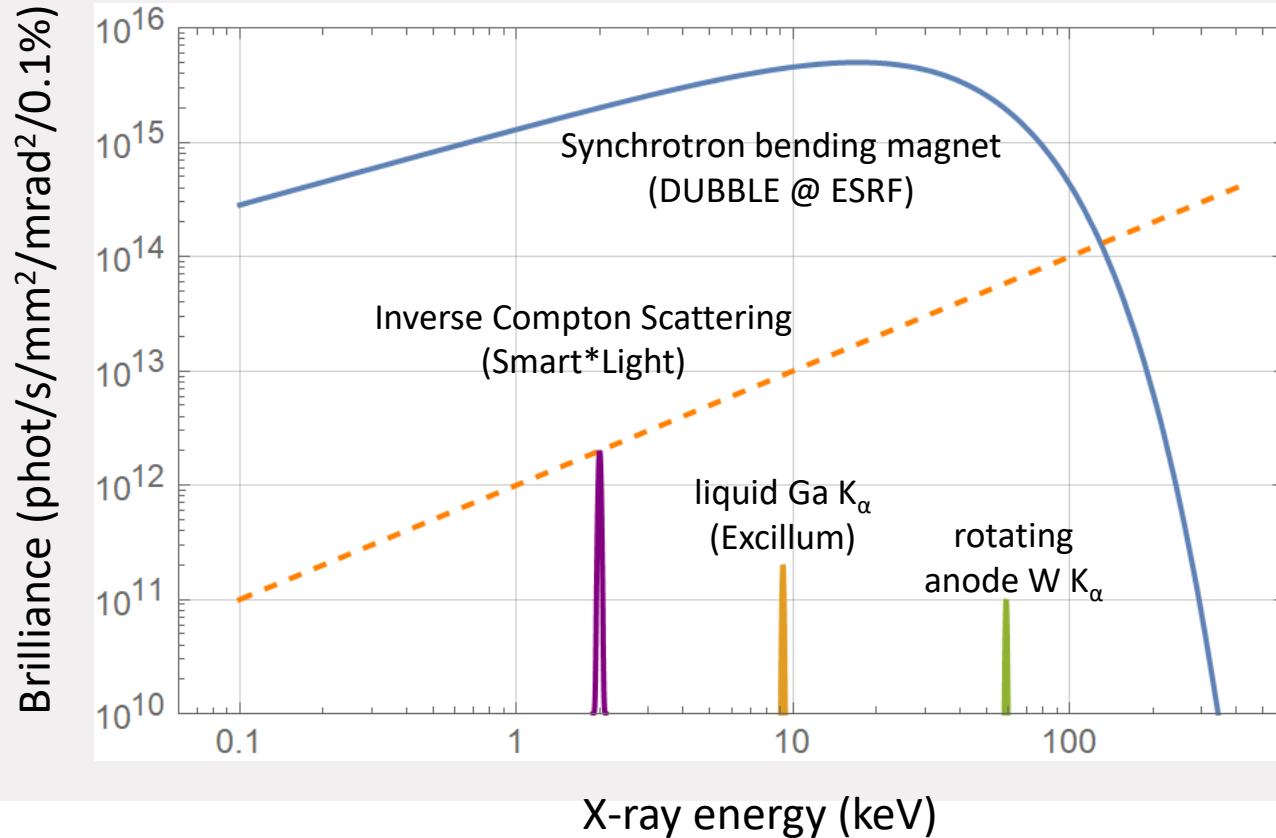


$$I_x = \frac{I_0}{4g^2} (1 + g^2 q^2)$$

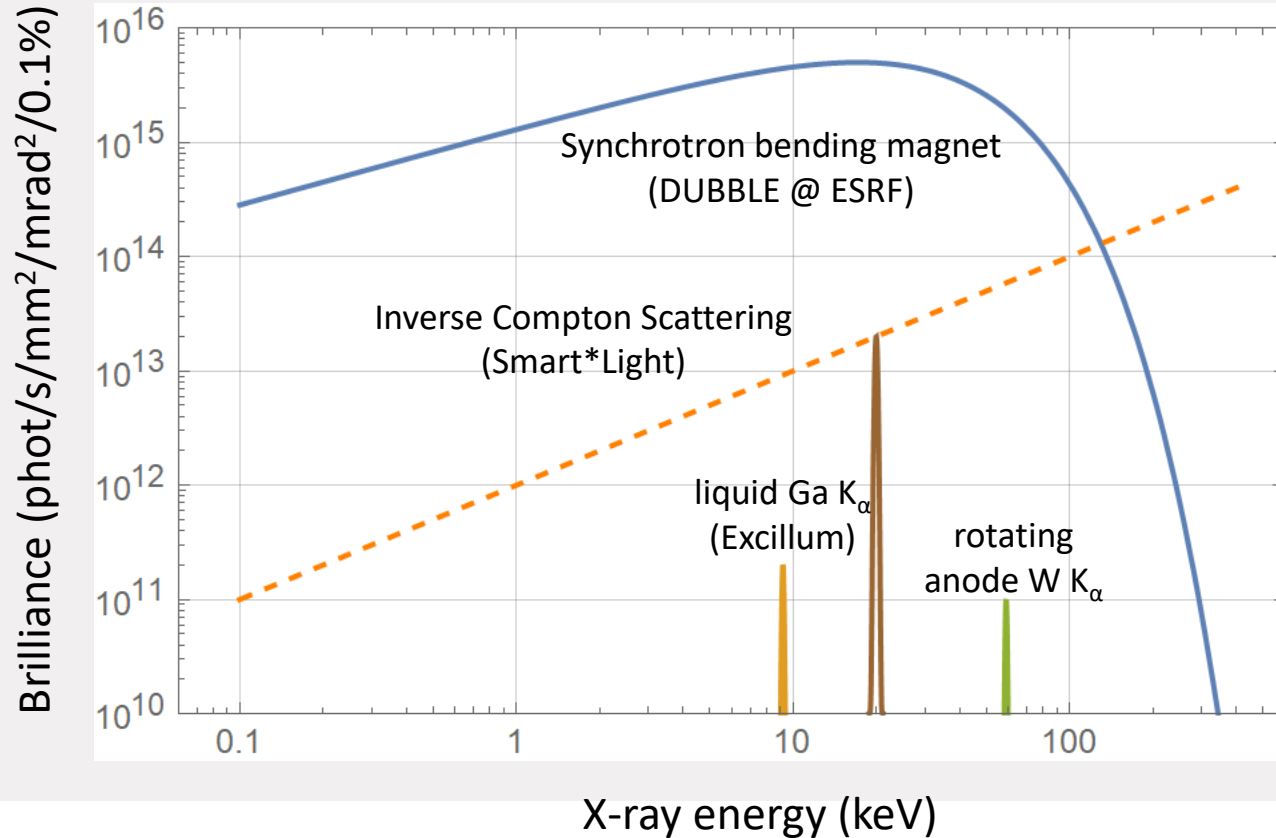
Brilliance



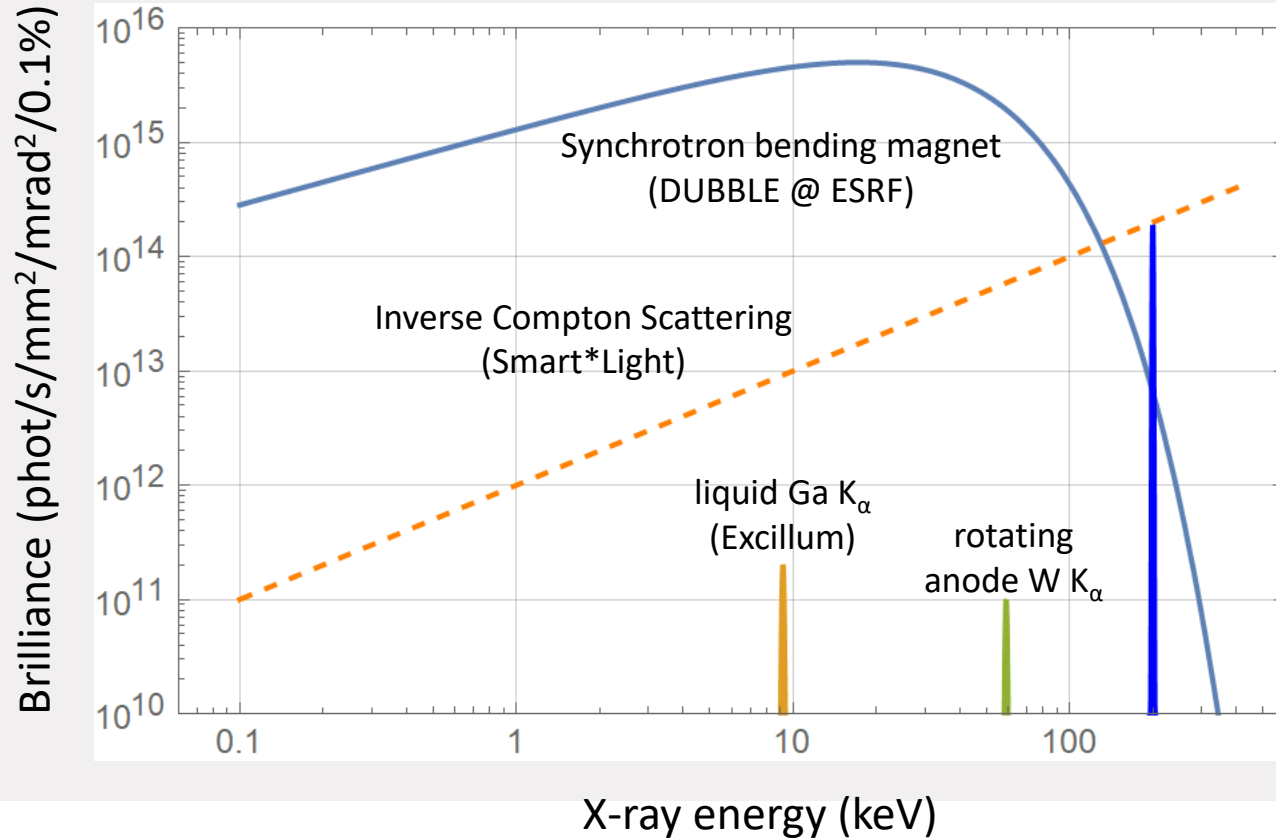
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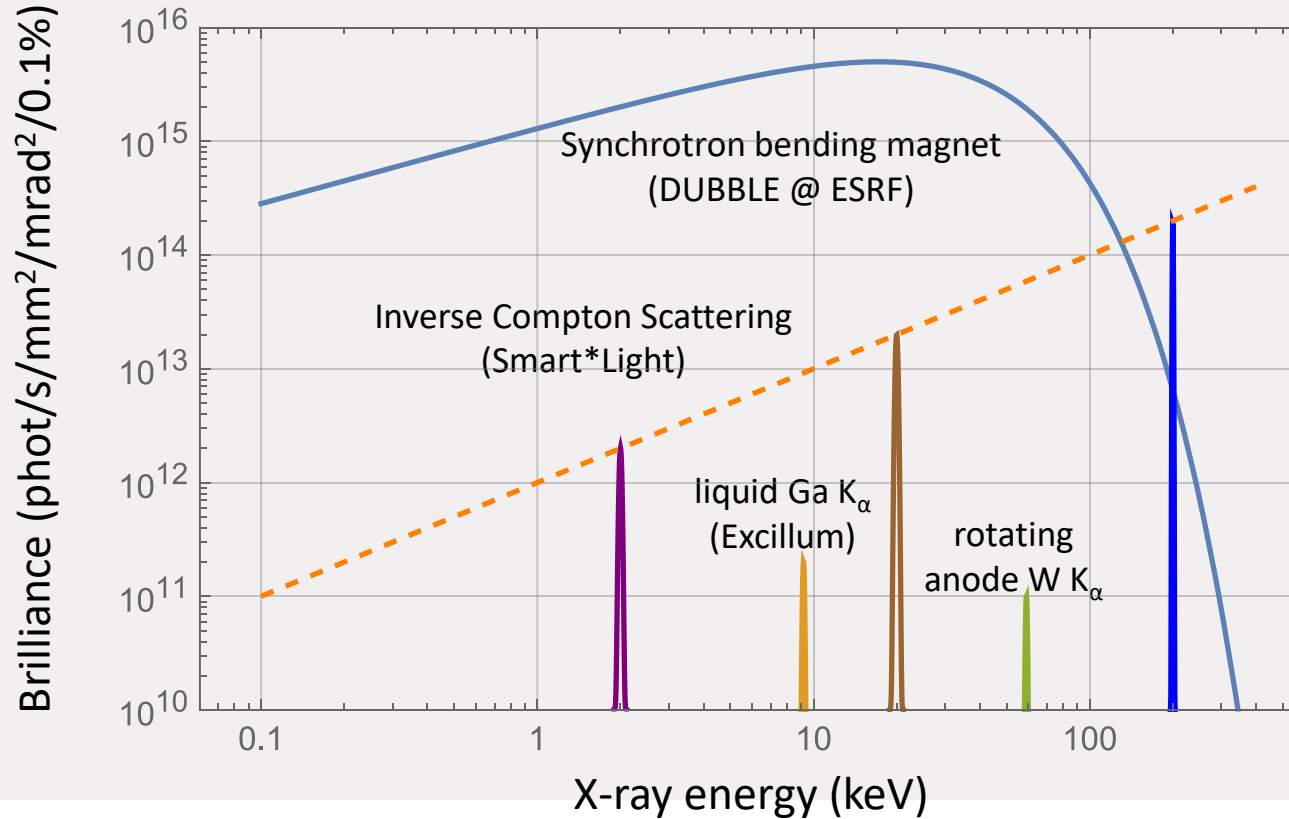
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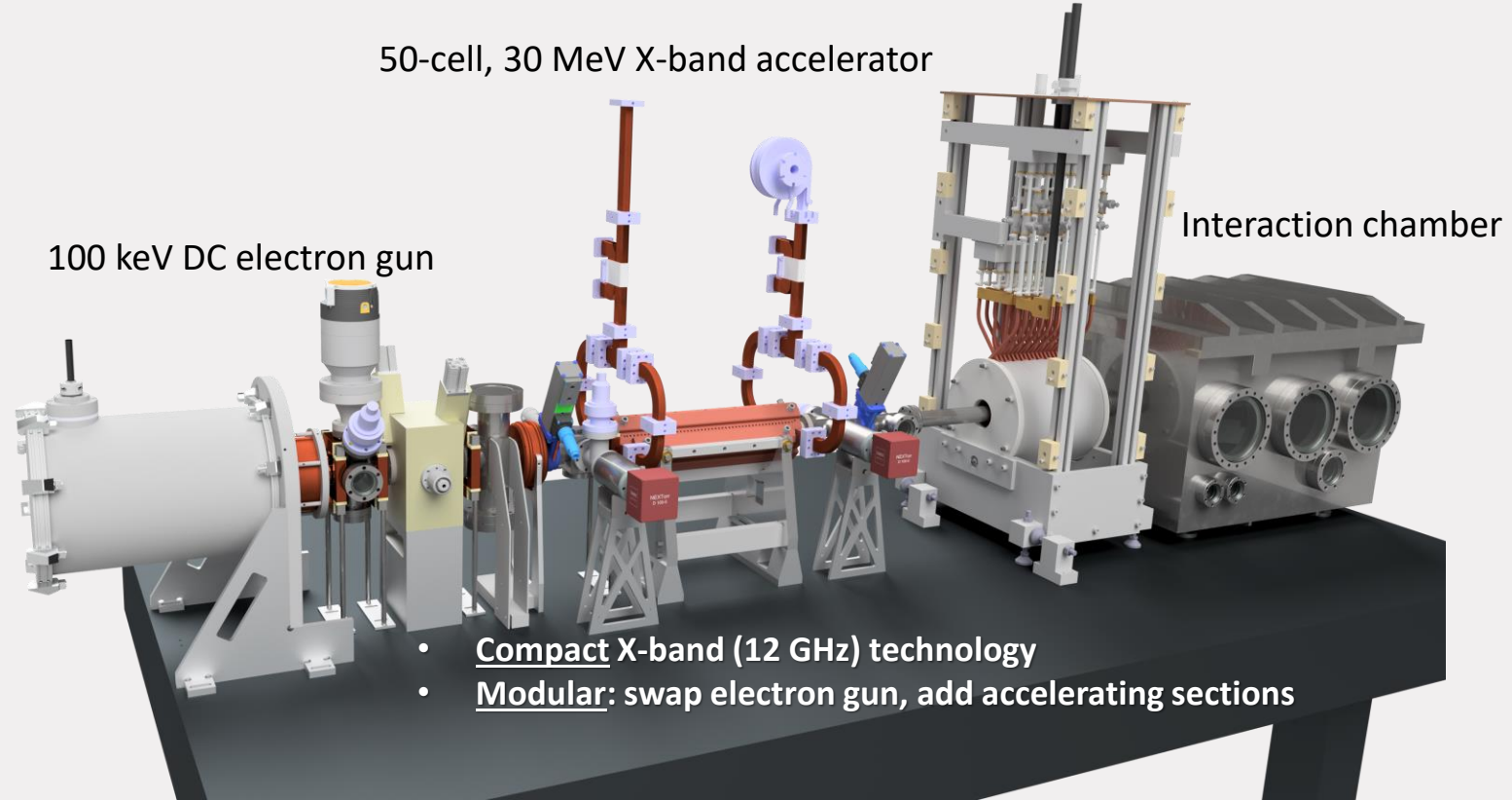
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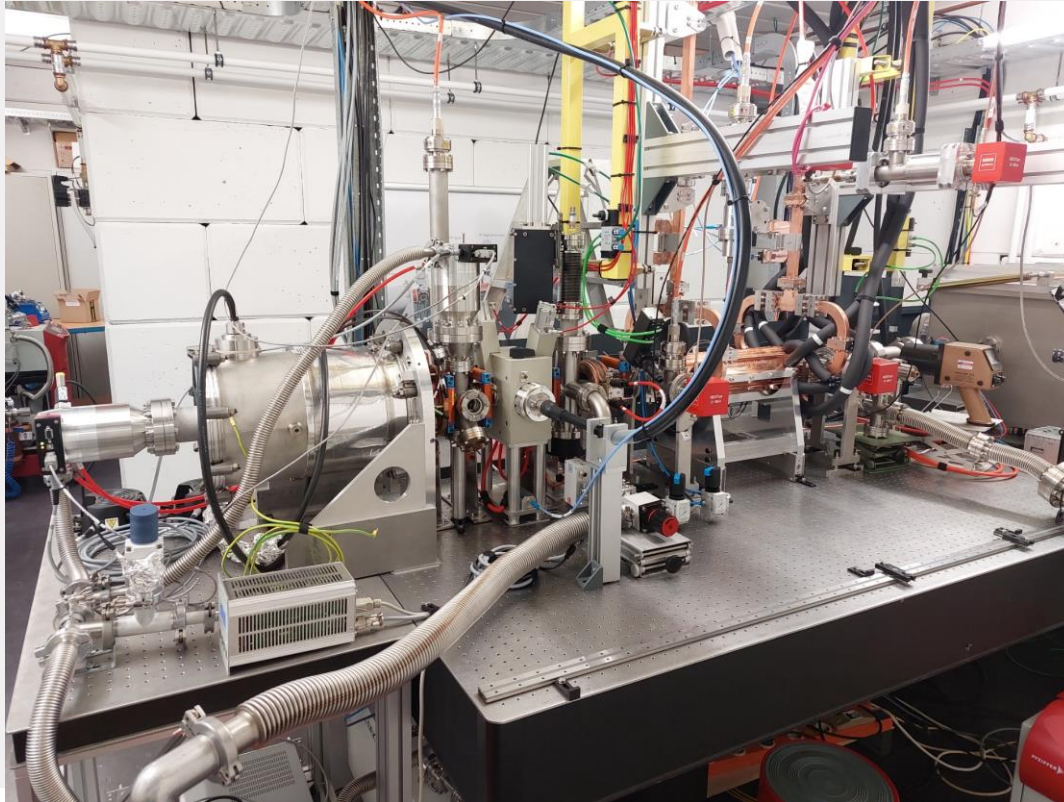
Brilliance



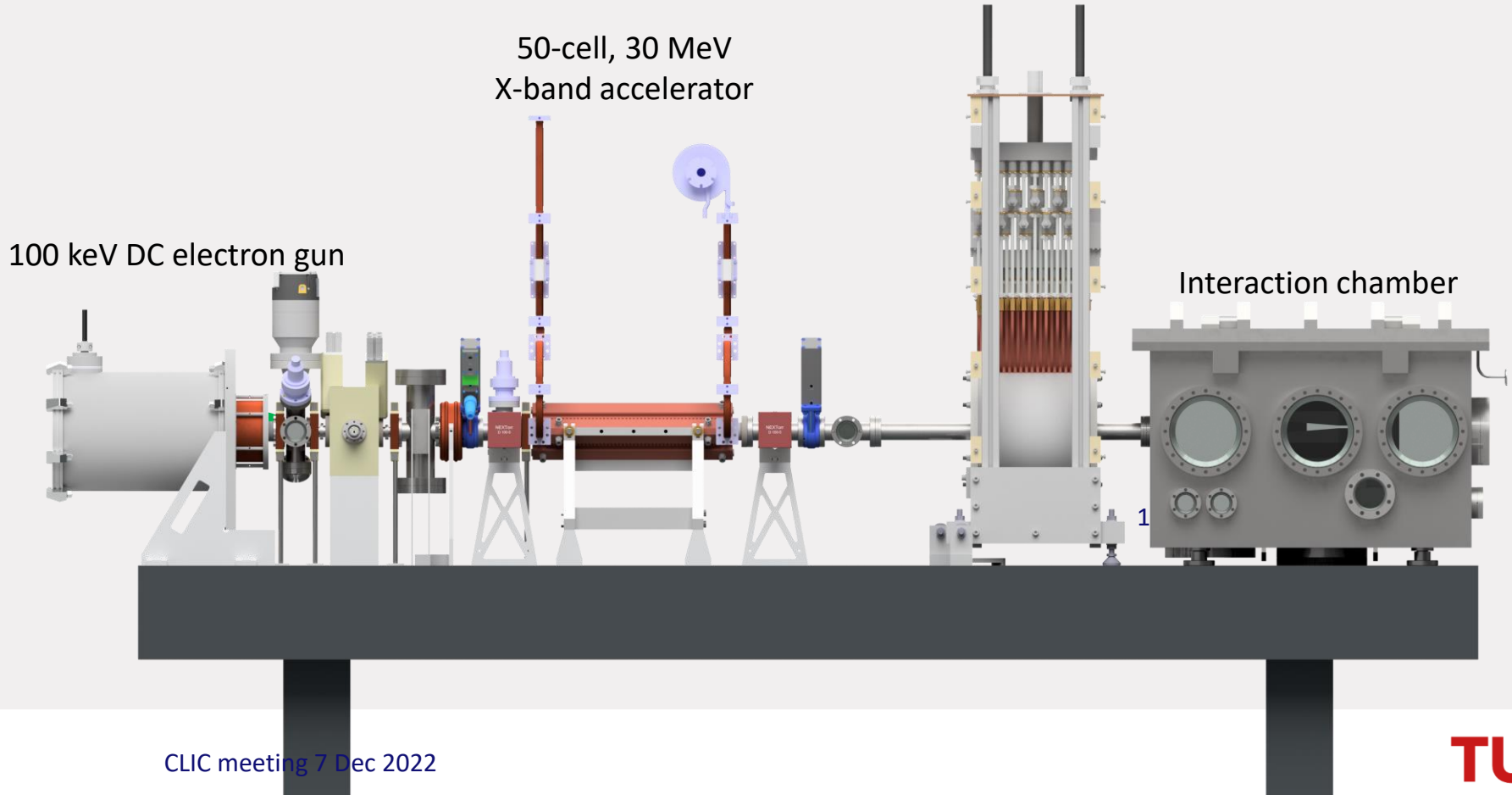
Smart*Light: a linear-accelerator-based ICS source



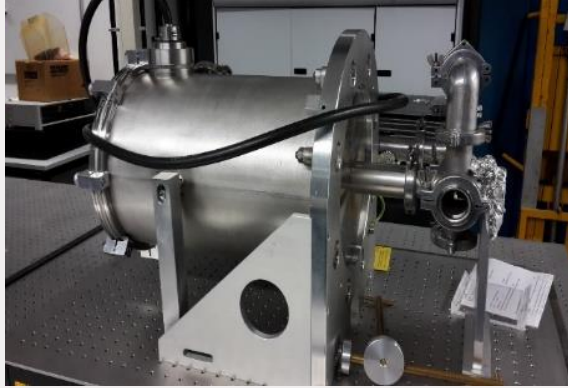
Smart*Light: a linear-accelerator-based ICS source



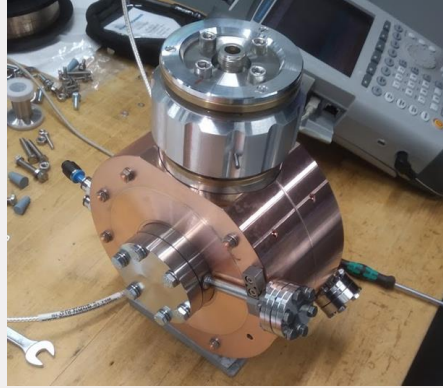
Smart*Light: a linear-accelerator-based ICS source



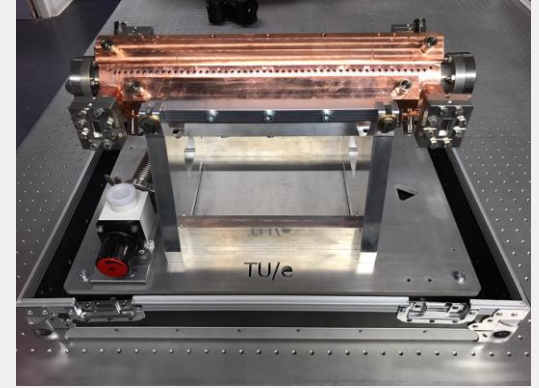
Electron beam line components



TU/e 100 kV DC photogun

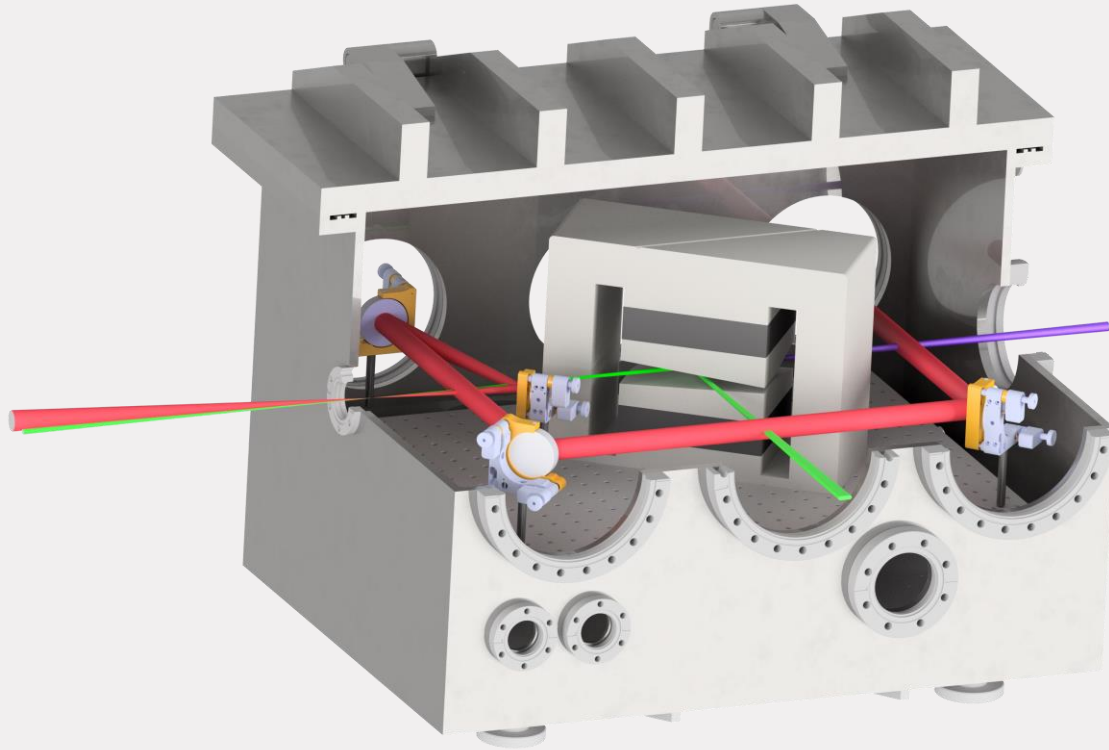


TU/e buncher cavity



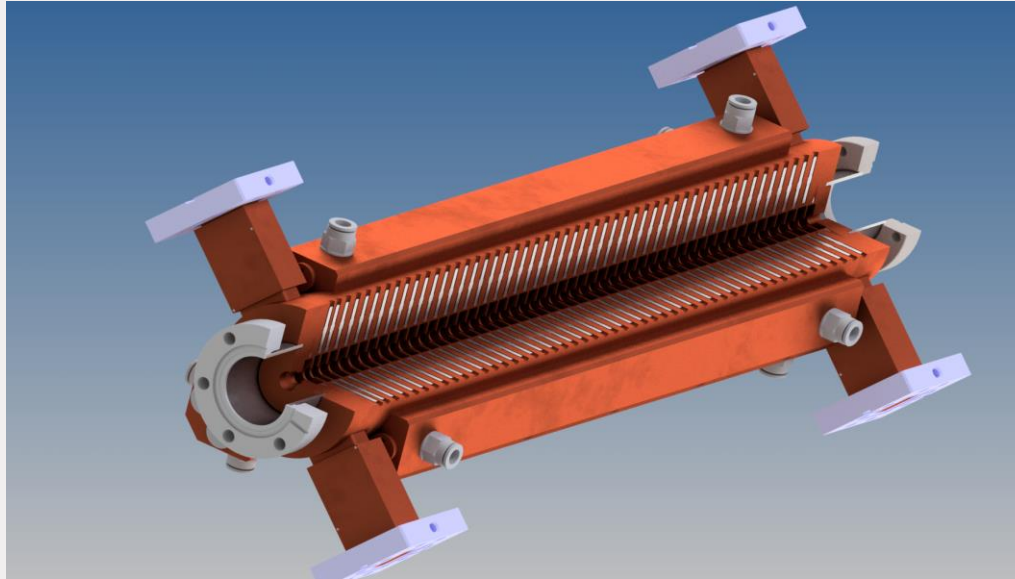
Specially designed X-band accelerator
for 100 keV injection

Interaction chamber



TU/e design of 50-cell X-band accelerator

Design based on 24-Cell CLIC standard



First few cells adjusted to allow injection at 100 keV;
Acceleration to 30 MeV at 75 MV/m gradient.

LLRF testing

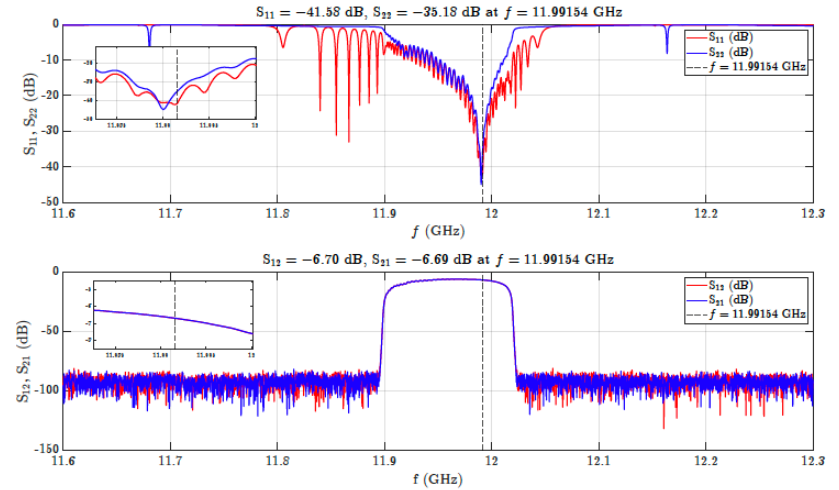
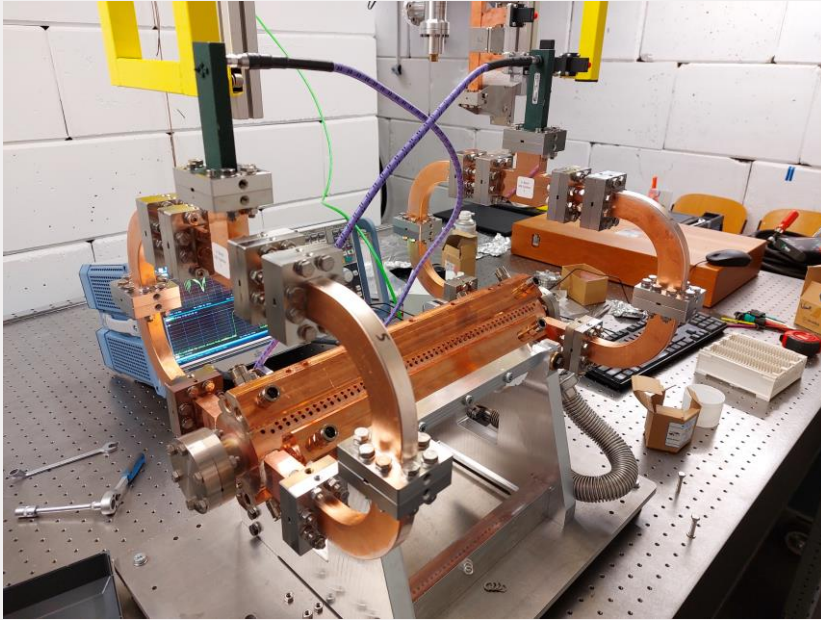
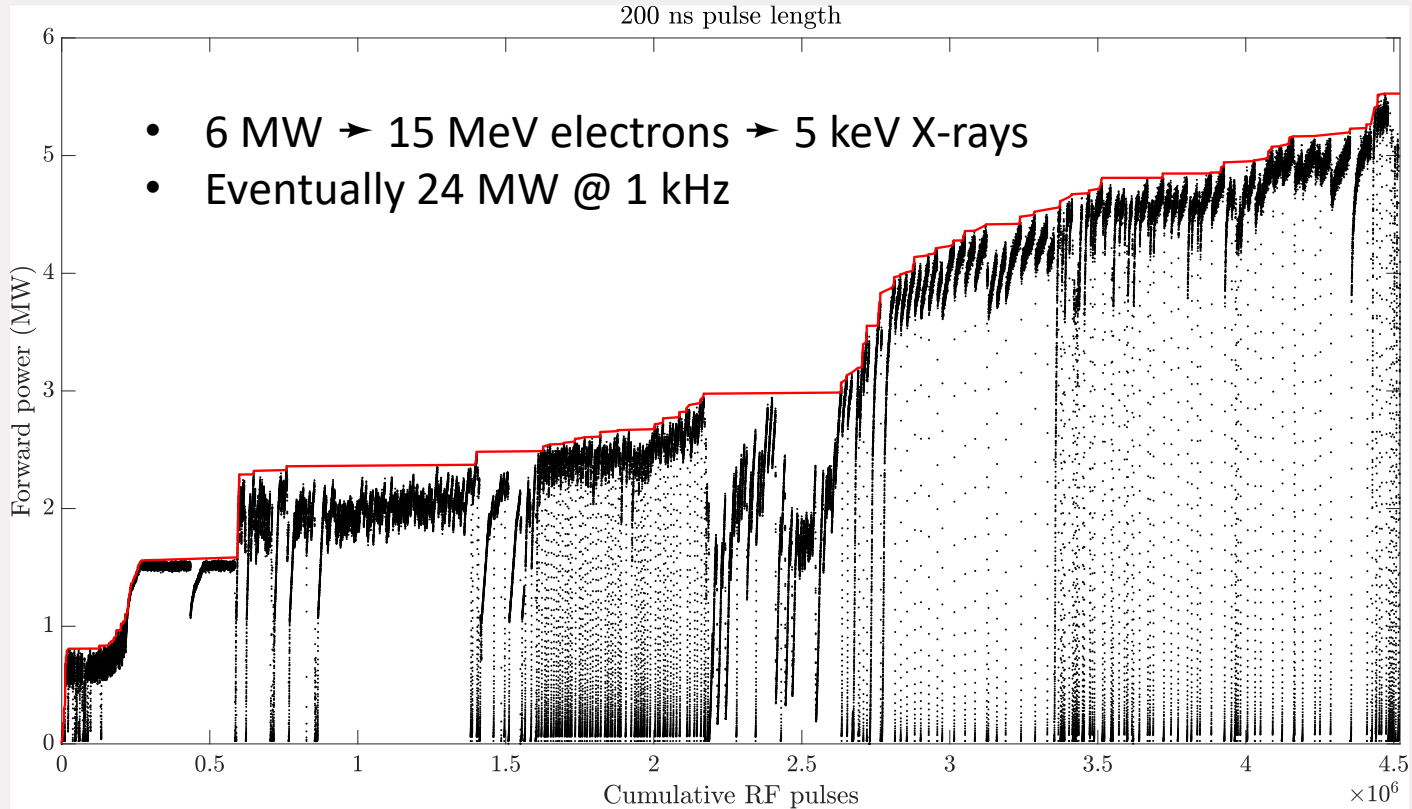
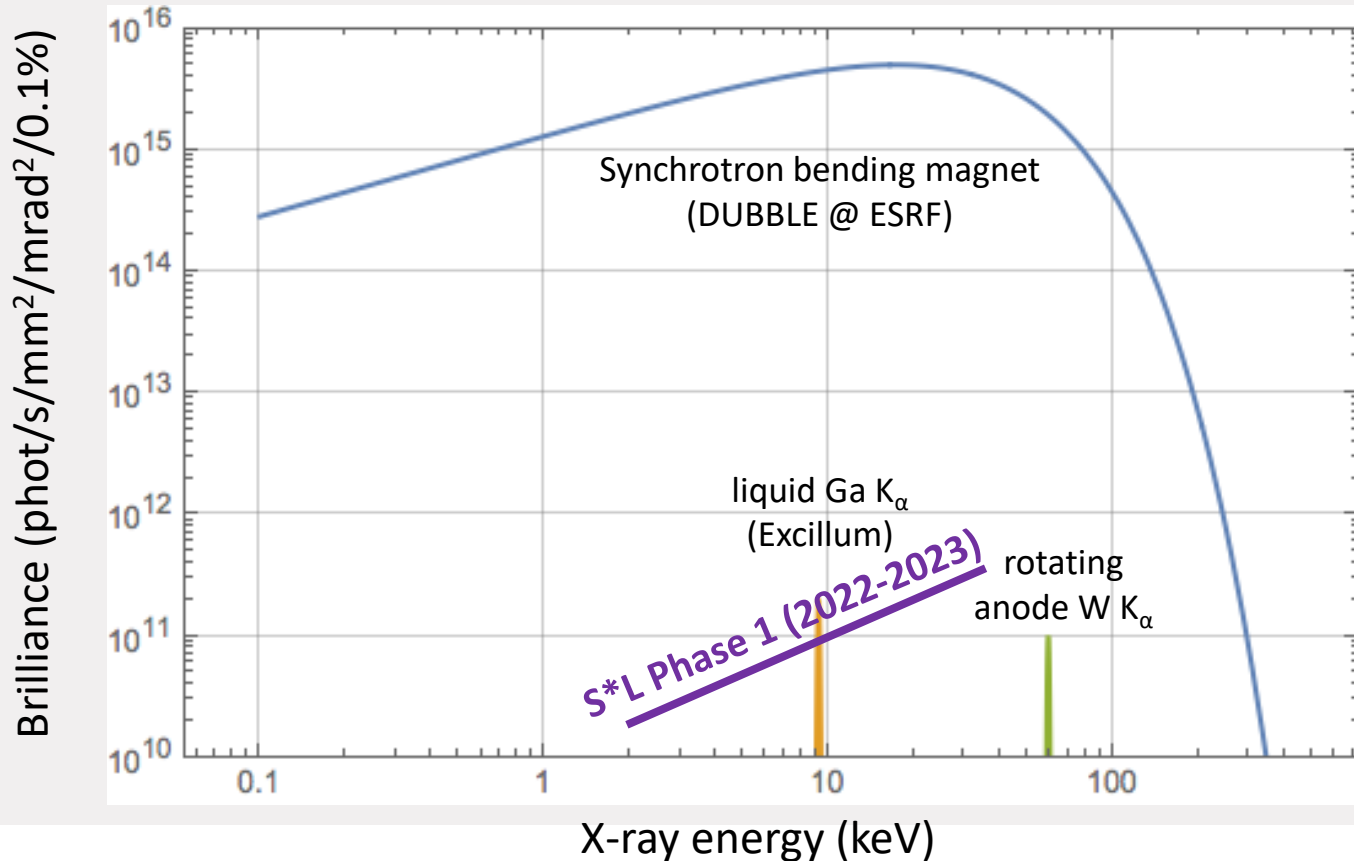


Figure 3: The absorption $S_{11,22}$ and transmission $S_{12,21}$ as a function of the frequency f . The dashed line indicates the corrected resonance frequency of the structure.

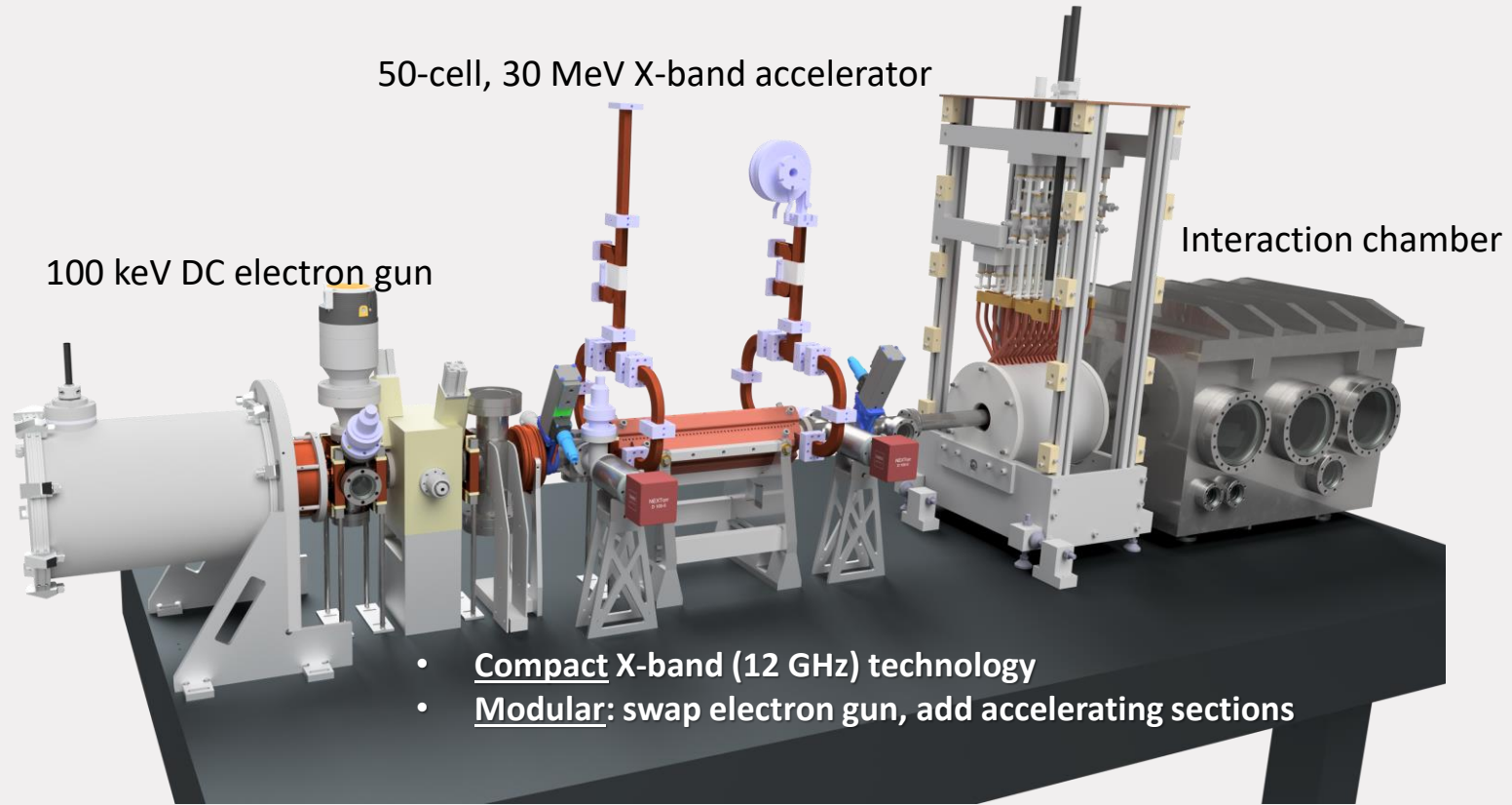
High power conditioning @ 10 Hz



Smart*Light estimated performance



From Smart*Light...

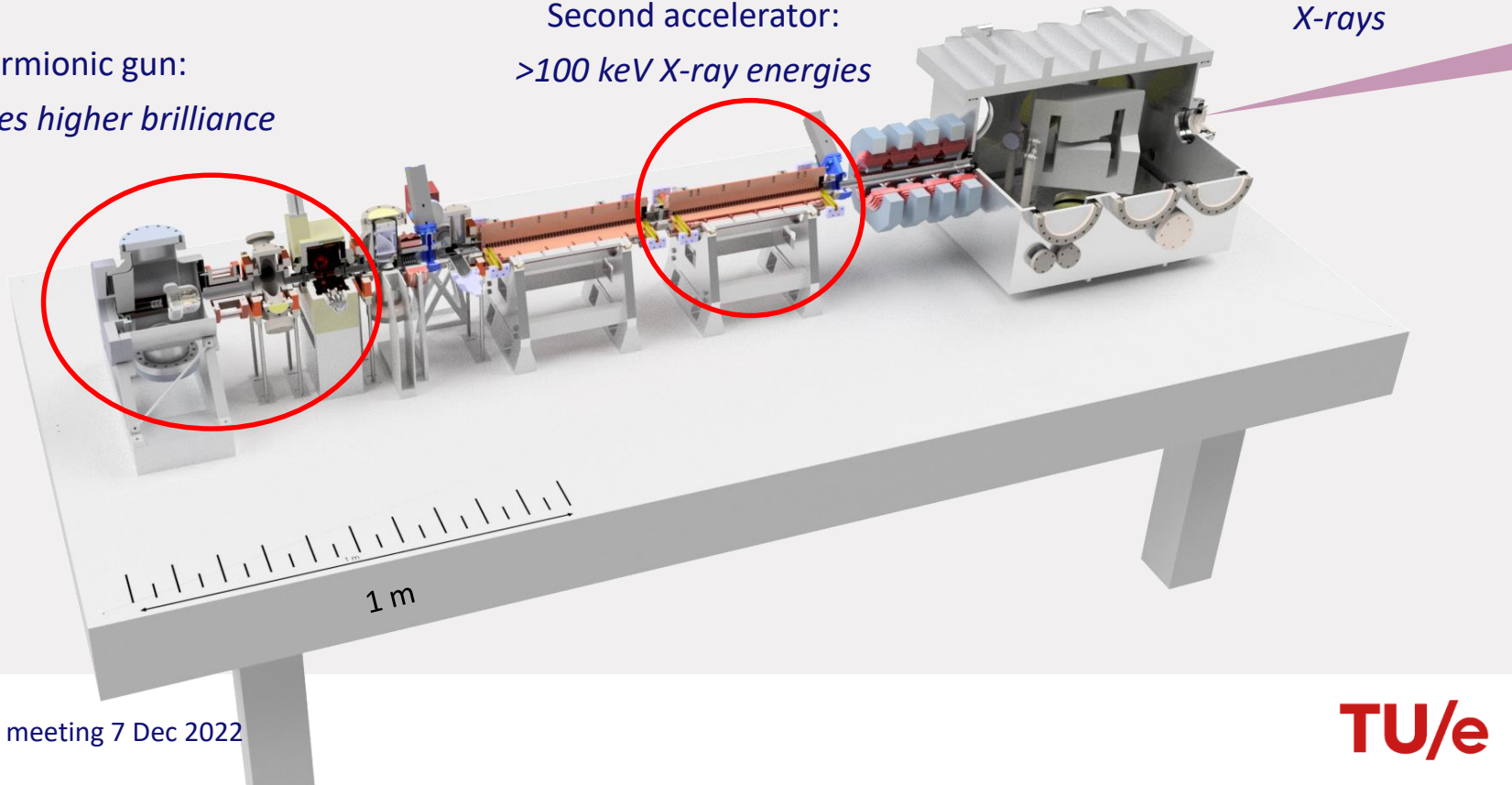


...to HardLight

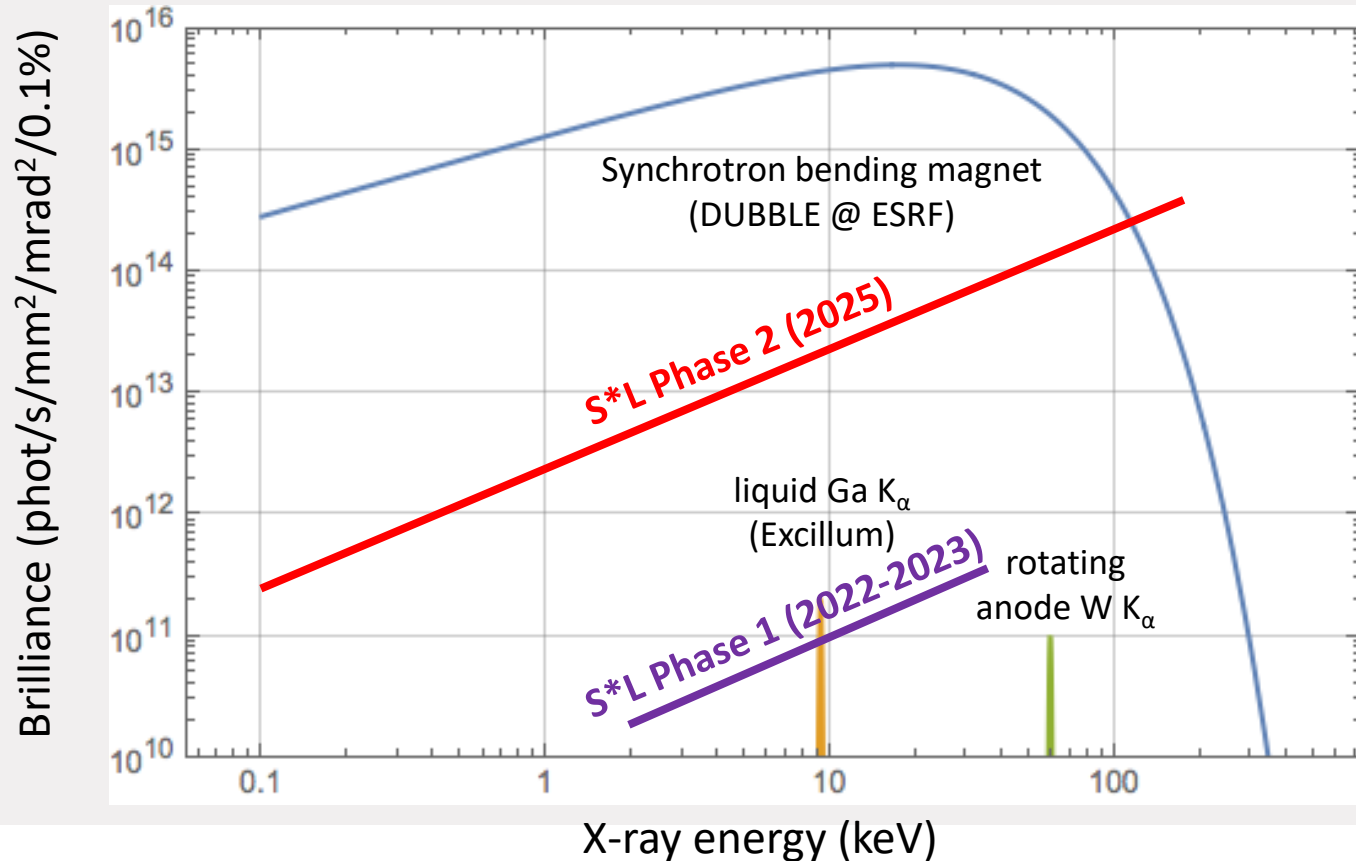
Thermionic gun:
>100 times higher brilliance

Second accelerator:
>100 keV X-ray energies

X-rays



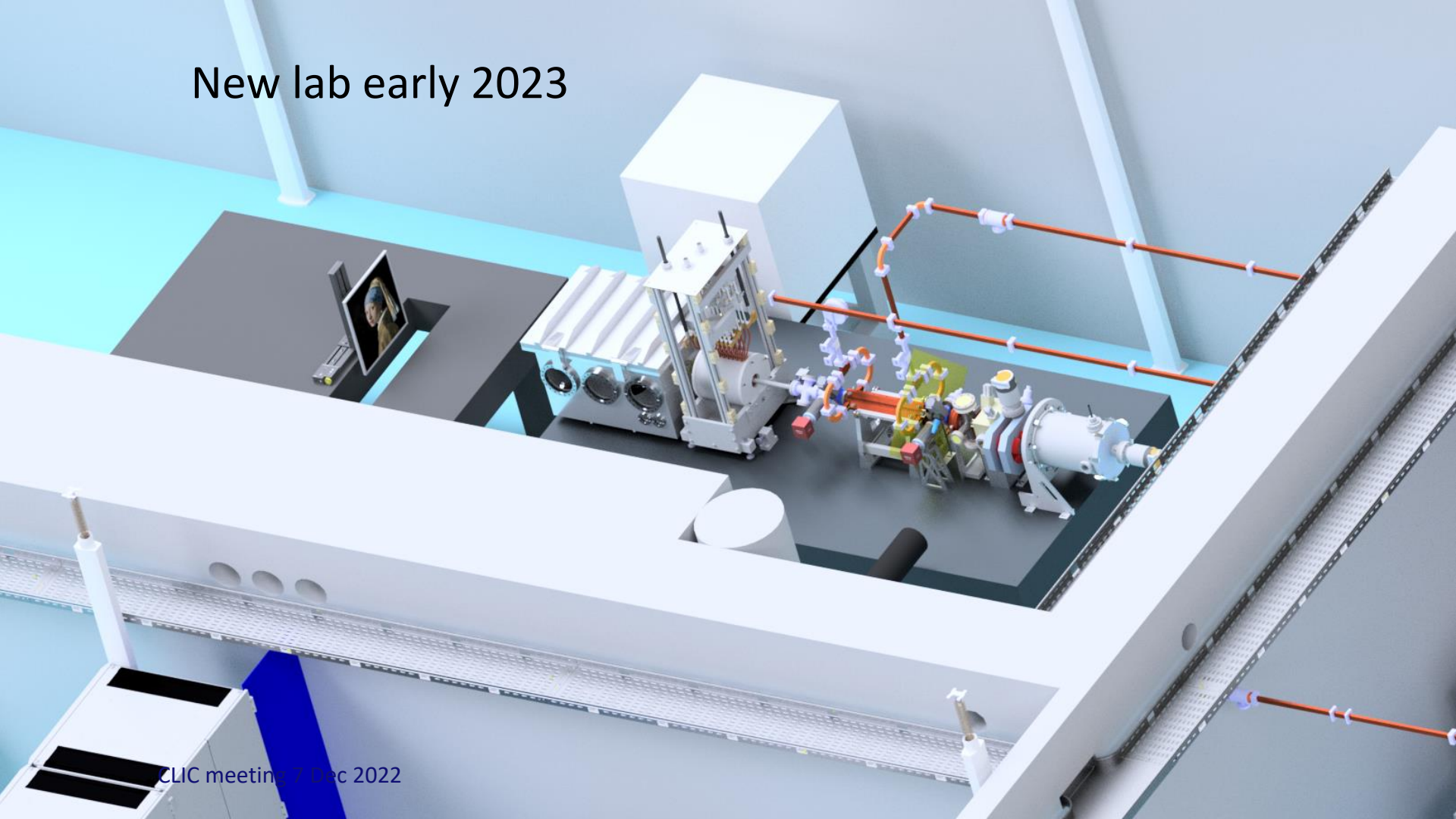
Smart*Light estimated performance



New lab early 2023

February 2023: basement Qubit

New lab early 2023



Summary

- Smart*Light: Inverse Compton Scattering Source for tunable, monochromatic hard X-ray beams in a compact setup
- Achievable hard X-ray brilliance several orders of magnitude higher than current lab sources
- Achievable hard X-ray brilliance at high energies comparable to synchrotron bending magnet radiation (DUBBLE @ ESRF)
- Construction underway; first light in 2022-2023, full performance in 2025.

