

Smart*Light: A Tabletop, High Brilliance, Monochromatic and Tunable Hard X-ray Source for Imaging and Analysis.

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At Eindhoven University of Technology a tabletop Inverse Compton Scattering (ICS) hard X-ray source will be built (Fig. 1) within the next couple of years as part of the European Interreg program [1] between the Netherlands and Belgium. This compact and affordable X-ray source will bridge the gap between conventional lab sources and synchrotrons (Fig.2). X-ray photon energies up to 100 keV will be generated which will find applications in fields as diverse as material science, cultural heritage and medical imaging.

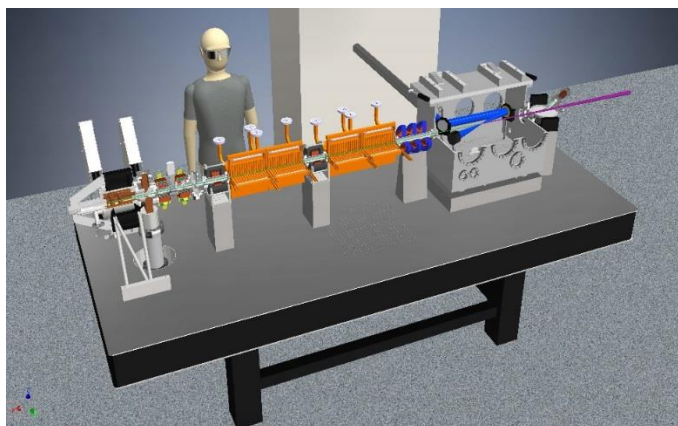


Figure 1: Impression of the tabletop ICS. Left: electron source; middle: two CLIC accelerator sections; right: interaction point between laser pulse and electron bunch; purple line: produced X-rays.

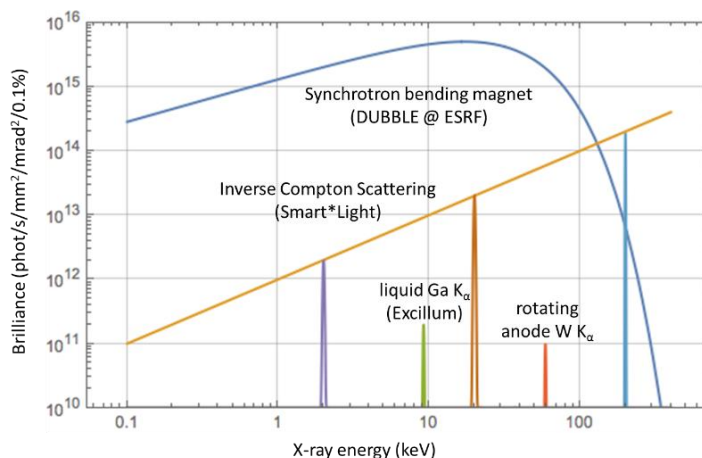


Figure 2: X-rays produced by different sources: Synchrotron bending magnet radiation, currently available best lab sources (liquid gallium and rotating tungsten anode) and ICS (Smart*light).

The physical basis is the ICS process in which photons from a laser beam are bounced off a relativistic electron bunch, turning them into X-ray photons through the relativistic Doppler effect (Fig. 3). Recently developed X-band linear accelerator technology by the CLIC program from CERN [2] will be used to accelerate the electron bunches to relativistic speeds and will keep the setup compact, monochromatic and easily tunable.

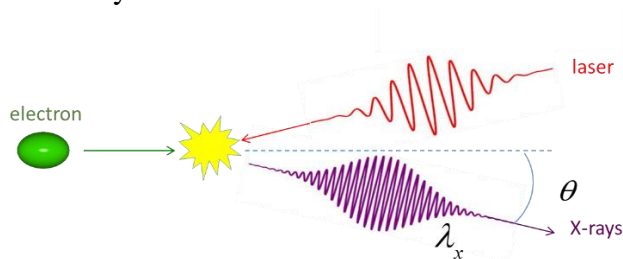


Figure 3: Invers Compton process. Laser pulse collides with an electron bunch at relativistic speed and produces X-rays.

An overview of the project will be shown together with simulations of the electron beamline and the properties of the produced X-rays.

References:

- [1] Official Interreg Smart*Light page: [Smarthttp://www.grensregio.eu/projecten/smart-light](http://www.grensregio.eu/projecten/smart-light)
- [2] Official CLIC project website: <http://clic-study.web.cern.ch/>