Development of a CMOS imager for experiments at synchrotron radiation and free electron lasers

Over the last decade, synchrotron radiation sources have seen a significant increase in brilliance, and the availability of free electron lasers has made entire new research fields accessible to investigations with X-rays. These advances in light source capabilities have resulted not only in a host of scientific advances and discoveries, but also in a need for a new generation of X-ray imaging detectors that can match the sources' capabilities in terms of frame rate and image dynamic range while recording image information with fine granularity over a large – preferably uninterrupted – (multi) megapixel area with single-photon sensitivity. Developing such next-generation imagers is both costly and time-consuming, and the requirements at many photon science facilities are similar enough to invite a collaborative effort. The Percival ("Pixellated Energy Resolving CMOS Imager, Versatile And Large") imager is being developed by a collaboration of the "Deutsches Elektronen Synchrotron" (DESY, Germany), Rutherford Appleton Laboratory (RAL, UK), Elettra Sincrotrone Trieste (Italy), Diamond Light Source (DLS, UK), Pohang Light Source (PAL, South Korea) and Soleil (France) to answer this need for the soft X-ray regime.

The PERCIVAL Imager consists of a CMOS sensor with 1408 x 1484 pixels (pixel-size 27 x 27 μm^2), which is being developed by RAL, the control and readout front-end electronics developed by DESY and Elettra, and a data back end developed by DLS. The sensor is available in two flavours: a back-thinned and back illuminated version for soft x-ray imaging and a scintillator coupled front side illuminated sensor for hard x-ray imaging/ computer tomography.

The PhD project proposed in Trieste encompass the entire interdisciplinary range of detector development including mechanics, electronics, simulation, calibration, coding, data acquisition, scientific experimentation at synchrotron and free electron laser sources and data analysis. The relative weight of the latter can be adjusted to the candidate's interest. The work will be mainly carried out in the state of the art instrumentation laboratory of Elettra Sincrotrone Trieste in a collegiate environment but also abroad during experimental sessions with collaborators at the participating light sources.

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