The EIGER Detector Systems for the Swiss Light Source

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Introduction and Objectives

EIGER[1] is a single photon counting hybrid pixel detector developed at the Paul Scherrer Institute (PSI) for X-ray detection in the energy range from a few to 25 k*e*V. EIGER has been specifically designed for synchrotron applications, such as coherent diffraction imaging and ptychography[2], X-ray photon correlation spectroscopy[3], small and wide-angle X-ray scattering and protein crystallography. EIGER features a small pixel size (75x75 um^2), a high frame rate (up to 22 kHz) and a low dead time between frames (down to 4 us). A 32 bit dynamic range can be obtained by data summation on-board before transferring the data to a PC.

Results and Discussion

An EIGER module consists of a total of 500 kpixels, covering an active area of 8x4 cm^2. The EIGER modules are the building blocks of large area detectors: a 1.5 detector and a 9 Mpixel one are being produced for the cSAXS beamline at the Swiss Light Source at PSI. The high frame rate capabilities are preserved for the multi-module detectors due to the fully parallel data processing.

The EIGER detector is able also to detect low energy electrons in the 10-20 k*e*V energy range. We present an experiment in which an EIGER single chip (2x2 cm^2) is operated as a detector for photo-emission electron microscopy (PEEM) as a replacement of the traditional setup with microchannel plates, phosphor screen and CCD-camera. Due to the ideal signal to noise ratio and the small pixel size of EIGER, the detector shows excellent imaging capabilities. Measurements of the electronic and magnetic properties of Fe nanoparticles validate the detector's good performance.

Conclusions

In the presentation, the performance of the EIGER detector, first applications at synchrotrons and the progress towards the operation of large detector systems will be presented. Plans for the development of an EIGER detector, optimized for detection of electrons for PEEM applications will also be discussed.

References

[1] R. Dinapoli et al., (2011), Nucl. Instr. Meth. A, 650 79.
[2] M. Guizar-Sicairos et al., (2014) Optics Express 22 - 12 14859.
[3] I. Johnson et al., (2012) J. Synchrotron Rad., 19 1001.