Contribution ID: **141** Type: **Oral presentation**

Comparison of a CCD and an APS for Soft X-ray Diffraction

Wednesday, 6 July 2011 14:55 (20 minutes)

We compare a new Active Pixel Sensor (APS) to a Princeton Instruments PIXIS-XO: 2048B Charge Coupled Device (CCD) used by Diamond Light Source (DLS). Despite CCDs being established in the field of scientific imaging, APS are an innovative technology that offers advantages over CCDs. These include faster readout, higher operational temperature, in-pixel electronics for advanced image processing and cost.

The APS employed was the Vanilla sensor designed by the MI3 collaboration and funded by the RCUK's Basic technology grant Funded by MI3 and RCUK technology grant. This sensor has 520 x 520 pixels, of size 25 microns. The readout can be by either an on-chip digital ADC applied to the multiplexed data from the pixel array, or as analogue data from a region of interest digitised later off-chip. The digital mode can operate a full frame readout of up to 20 Hz, whereas the analogue mode can readout a Region of Interest (ROI) at up to 500 Hz (for a 45 x 45 pixel region). The sensor had been back-thinned to the epitaxial layer by E2V. This was the first time that a back-thinned APS had been demonstrated at a beam line at DLS.

A typical synchrotron experiment was repeated using DLS'standard CCD and the novel APS. Soft X-rays (˜700 eV) were used to produce a diffraction pattern from a permalloy sample. The pattern was imaged at a range of integration times. The CCD had to be operated at -55℃ whereas the Vanilla was operated over a range from 20℃ to -20℃. We show that the APS detector can operate with integration times two orders of magnitude less than the CCD, with the Signal to Noise ratio only reduced from 104 to 103. This novel technique allows the capture of data in real time at up to 500 Hz. The detection efficiency of the APS is shown to be the same as that of the CCD and the response is shown to be linear, with no charge blooming effects at the longest integration times.

The experiment has allowed a direct comparison of back thinned APS and CCDs in a real soft x-ray synchrotron experiment.

Primary author: Mr STEWART, Graeme (University of Glasgow)

Co-authors: Dr ANDY, Blue (University of Glasgow); Dr PARKES, Chris (University of Glasgow); Dr ANDREW, Clark (RAL); Dr MANEUSKI, Dima (University of Glasgow); Dr MARCHAL, Julien (Diamond Light Source); Dr TARTONI, Nicola (Diamond Light Source); Dr STEADMAN, Paul (Diamond Light Source); Dr BATES, Richard (University of Glasgow); Prof. DHESI, Sarnjeet (Diamond Light Source); Dr RENATO, Turchetta (RAL)

Presenter: Mr STEWART, Graeme (University of Glasgow)

Session Classification: Front-end Electronics and Readout II

Track Classification: Front-end Electronics and Readout