



Contribution ID: 150

Type: Poster

Calibration and characterization software framework for the high data rate soft X-rays PERCIVAL imager

Wednesday 10 July 2019 16:37 (2 minutes)

The PERCIVAL detector is a large Monolithic Active Pixel Sensor (MAPS) dedicated to soft X-ray experiments, in the primary energy range of 250 eV to 1 keV, for synchrotron and FEL facilities. A first 2 million pixels system is being developed. Its sensitive area is $\sim 4 \times 4 \text{ cm}^2$ with a pixel pitch of 27 μm . Due to the absorption lengths of photons in the soft X-ray region, the sensor must be Back-Side Illuminated (BSI) and a specific process applied for the thin back-entrance window to enable use with soft X-rays. To cope with a large dynamic photon flux range detection (1 to 5×10^4 photons at 250 eV), the 3T pixel architecture is enhanced by a smart gain system able to adapt its photo-detection sensitivity.

A software framework is being developed for calibrating and characterising the sensors. It will be able to manipulate data containing the 12 (+3) bits digitised signal, which are stored as HDF5 files utilizing the virtual dataset architecture. The calibration constants will be calculated from raw data and will be applied during the acquisition - prior to writing disk - or during the off-line analysis. The modularity of the code, written in Python-3, will ensure that developers and/or users can plug and play with different analysis methods to perform a calibration or a characterization of the sensor, or to analyze corrected data acquired with the imager.

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Session Classification: Poster Exhibition 2, Posters ID 81 - 182, chair: Christer Frojdh

Track Classification: general