Contribution ID: **45** Type: **Poster**

Development of CoRDIA: an Imaging Detector for next-generation Photon Science X-ray Sources

Monday, 23 May 2022 15:31 (1 minute)

Photon Science X-ray Sources (PSXSs) are divided between Synchrotron Rings (SRs), and Free Electron Lasers (FELs), having either low (<200Hz) or high (>=1MHz) repetition rate. SRs and low-repetition-rate FELs are usually served by imagers capable of continuous readout up to a few k-frame/s; while high-repetition-rate FELs need dedicated detectors capable of M-frame/s, but only for short imaging bursts.
However, PSXSs are also being upgraded: SRs evolve towards diffraction-limited operation, expected to increase brilliance by 2 orders of magnitude and asking for proportionally faster (continuously-operating) imagers. Several high-repetition-rate FELs are considering Continuous Wave operation, which will marginally reduce the repetition rate (to a few 100kHz), but will make short imaging bursts no longer an option.
A common need emerges, to bridge the gap and to provide imagers able to operate continuously, at a frame rate of few 100k frame/s.
Our collaboration is developing such an X-ray imager: our goals include continuous operation in excess of 100 kframe/s, single-photon sensitivity at 12 keV, a full well of 10k photon/pixel/image, and a 100μm pixel pitch. A readout ASIC is being developed for this purpose, compatible to traditional Silicon Sensor (for our main energy range), high-Z sensors (for shorter wavelenghts), and sensors with built-in amplification (for soft X-rays).
ASIC architecture includes an adaptive-gain charge-integrator (on the experience of the AGIPD detector), a battery of on-chip ADCs (embedded in the pixel array) and a fast readout system (on the principle of the GWT-CC developed by Nikhef for Timepix4). These stages are pipelined to allow for continuous writing-reading.
Exploratory prototypes of the ASIC circuital blocks have been designed in TSMC65nm are presently under test.
We plan to develop the imager it in two phases, first targeting the continuous readout scheme and the frame rate target, and later aiming at extending dynamic range and reducing noise.

Collaboration

Primary authors: MARRAS, Alessandro (Deutsches Elektronen-Synchrotron (DESY)); KLYUEV, Alexander (Deutsches Elektronen-Synchrotron (DESY)); WUNDERER, Cornelia (Deutsches Elektronen-Synchrotron (DESY)); PENNICARD, David (Deutsches Elektronen-Synchrotron (DESY)); KRUEGER, Hans (University of Bonn); GRAAFSMA, Heinz (Deutsches Elektronen-Synchrotron (DESY)); HAFIANE, Lamine (University of Bonn); LANGE, Sabine (Deutsches Elektronen-Synchrotron (DESY)); HEMPEREK, Tomasz (University of Bonn); LAURUS, Torsten (Deutsches Elektronen-Synchrotron (DESY)); TRUNK, Ulrich (Deutsches Elektronen-Synchrotron (DESY))

Presenter: MARRAS, Alessandro (Deutsches Elektronen-Synchrotron (DESY))

Session Classification: Photo Detectors and Particle ID - Poster session