Contribution ID: **40** Type: **not specified**

Absolute gain calibration of 1 Mpix AGIPD detector at SPB/SFX instrument using EuXFEL X-ray beam

The European X-ray Free Electron Laser (EuXFEL) [1] is the world's most brilliant X-ray free-electron laser delivering up to 27.000 ultrashort (< 100 fs) spatially coherent X-ray pulses in the energy range between 0.25 and 20 keV, organized in 10 equidistant X-ray pulse trains per second. The facility went into its operation phase on July 1, 2017.

The 1 Megapixel AGIPD detector [2] is the primary detector used for User Experiments at one of the EuXFEL experimental end-station, SPB/SFX [3]. This 1 MPixel 2D X-ray imaging detector consists of 16 modules, grouped in four quadrants. Analogue memory cells built into each detector pixel, allow storage of up to 352 pulse-resolved images at MHz repetition rate. The images are subsequently read out and digitized during the 99.4 ms break between the XFEL X-ray pulse trains.

Precise absolute calibration of the detector gain, i.e. conversion of detector arbitrary units (ADU) to energy units (eV) using X-rays signal is essential to its performance. To perform the gain calibration for each detector pixel and memory cell we acquire low-intensity (~1-3 photons/pixel/pulse) fluorescence data. Using the collected data, we produce a signal spectrum for each pixel and memory cell. The distance between the 0-photon peak and 1,2,3 photon peaks provides information needed for the extraction of absolute gain value.

During the winter shutdown (December 2022-January 2023), we are going to upgrade the AGIPD detector at SPB/SFX by installing new modules. These modules have to be fully calibrated. For this purpose, together with SFX/SPB instrument, we planned the commissioning experiment with XFEL beam at the beginning of February 2023. A student will be given the possibility to participate in the dedicated calibration experiment at one of the EuXFEL beamlines (i.e. SPB/SFX) and later be involved in the analysis of collected data.

The amount of

- "physics" = 40-50%
- "computing" = 50%
- "engineering" < 5%

References

[1] W. Decking et al.:"A MHz-repetition-rate hard X-ray free-electron laser driven by a superconducting linear accelerator"Nature Photonics 14, 391–397 (2020)
[2] A. Allahgholi et al.,"The Adaptive Gain Integrating Pixel Detector at the European XFEL", Journal of Synchrotron Radiation, 26:74–82, (2019)
[3] A. P. Mancuso et al, "The Single Particles, Clusters and Biomolecules and Serial Femtosecond Crystallography Instrument of the European XFEL: Initial installation", Journal of Synchrotron Radiation, 26(3):660–676, (2019)

Field

A4: Development of experimental techniques (methodology oriented)

DESY Place

Hamburg

DESY Division

other

DESY Group

EuXFEL Detector Grop

Special Qualifications:

Basic knowledge of Python would be an asset.

Primary author: SZTUK-DAMBIETZ, Jolanta (Eur.XFEL (European XFEL))

Co-author: SIKORSKI, Marcin (Eur.XFEL (European XFEL))