Poster Presentation

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AGIPD detector for Serial Femtosecond Crystallography Apparatus at European XFEL

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The European X-ray Free-Electron Laser (XFEL.EU) [1] will provide ultra-short, highly-intense, coherent x-ray pulses at an unprecedented repetition rate, transforming experiments in many scientific areas, including serial femtosecond crystallography (SFX). For the purpose of SFX experiments at the XFEL.EU, a dedicated endstation is being developed to be installed within the Single Particles, Clusters and Biomolecules (SPB) instrument [2]. The setup will refocus the beam spent by SPB into a second interaction region, thereby enabling two parallel experiments. In order to overcome various challenges in XFEL crystallography, and to optimize the output for SFX experiments at XFEL.EU, the Adaptive Gain Integrating Pixel Detector (AGIPD) [3] is currently under development and is to be implemented in the SPB instrument, including a 4 Megapixel version for the SFX apparatus. The AGIPD is a hybrid-pixel detector with pixels of 200 x 200 micron^2 each. The gain of each single pixel dynamically and independently adapts to the incoming signal. Thus, diffraction patterns of high dynamic range can be recorded, with the measured signal within a single data frame ranging from single photons and up to 1e+4 photons at 12 keV. Moreover, the AGIPD is designed to store over 350 data frames from successive pulses prior to digitization and read-out, thereby enabling operation at the European XFEL with its challenging repetition rate with 10 Hz pulse trains and a 4.5 MHz intra-train repetition rate. Furthermore, the incorporation of a veto system in AGIPD will allow one to potentially store only the frames that contain diffraction data from actual crystal hits, which ultimately increases the efficiency of the detector and DAQ systems dramatically. In the present work, we will review the design of the 4Mpix AGIPD for the SFX apparatus and discuss simulations and tests of its expected performance under the conditions foreseen for SFX experiments at the XFEL.EU.

[1] *M. Altarelli, et al., Tech. Rep., DESY, Hamburg, Germany (2007), http://xfel.desy.de/technical_information/tdr/tdr/,* ***[2]*** *A. P. Mancuso, et al, Technical Design Report: Scientific Instrument SPB, 2013, XFEL.EU TR-2013-004,* ***[3]*** *J. Becker at al., Performance tests of an AGIPD 0.4 assembly at the beamline P10 of PETRA III, JINST 8, 2013, P06007*

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