

AGIPD systems for the European XFEL, development and upgrades.

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The European XFEL is one of the newest X-ray facilities in the world with a very demanding requirements for the detectors operating at the experimental stations and recording high quality scientific data. Those requirements include high dynamic range from single up to $10^{>4}</sup>$ 12.5 keV-photons. The accelerator operates with a very specific time structure producing bunch trains of 2700 pulses at 4.5 MHz repetition rate. The trains are repeated with an infra-frequency of 10 Hz. These key features enable the conduction of modern physical experiments and at the same time put challenging requirements on the detectors.

The AGIPD (Adaptive Gain Integrating Pixel Detector) developed for the European XFEL is based on hybrid pixel technology using direct photon conversion in a semiconductor sensor bump-bonded to the front-end microelectronics. Each pixel of the AGIPD ASIC uses a charge-sensitive preamplifier with adaptive gain and 352 random-access memory cells in order to record as many images as possible from the bunch train, and transfer them to the back-end electronics between the bursts. The data is then transferred to the acquisition system via 16 10Gbit optical links. The detector is running in vacuum and also subject to considerable radiation dose. The first 1-megapixel system was delivered to the SPB instrument in summer 2017 and started operation already in September 2017. The second 1-megapixel was used for first experiments at the MID instrument in the early 2019. Two 2nd generation systems (4 and 1 megapixels) are to be delivered to SFX and HED instruments, utilizing modern back-end electronics and the latest version (1.2) of the AGIPD ASIC. Efforts on enhancement of the front-end hybrid production yield, upgrades of the 1st generation systems and the status of newer developments for AGIPD will be presented.

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