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Real-time Attenuation Control System of incident beam using hybrid pixel detector with specific architecture

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The purpose of attenuators system on a synchrotron beamline is to adapt intensity of the incident beam accordingly to the experimental conditions, samples and used detectors. The SixS (Surfaces and interfaces x-ray Scattering) beamline is equipped with a unique fast attenuation system prototype developed at SOLEIL Synchrotron. It adjusts in a real time the beam intensity in function of the photon flux received by a 2D photon counting detector (XPAD being used in this case) by rapidly acting on the direct attenuators. The system guarantees operating the detector within its linear range even during a long continuous scans, and in the same time a protection against beam damage, and with varied intensity of the beam (e.g. X-ray reflectivity and surface x-ray scattering experiments).

The presented system performs a cyclic real-time estimation of the flux received by every pixel during acquisition of an image. The pixels matrix is searched for clusters (at least two pixels) that exceed allowed levels of counts/s. The beam attenuation is then immediately changed accordingly. This process does not require reading a complete image but takes advantage of the specific architecture of the XPAD detectors family, and exploits an extra counter bit which can be accessed during exposure. Therefore, the real-time system is fast compared to an image read out and analyzed offline and the reactivity can be up to 250 Hz. The processing logic has been implemented in a new platform: the generic Panda hardware platform, developed in collaboration between SOLEIL Synchrotron and Diamond Light Source

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