Poster Presentation

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Latest Hybrid Pixel Detectors for increased q/t-resolution in SAXS

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The PILATUS was the first Hybrid Pixel Detector available for SAXS. It has transformed data collection by its photon-counting technology, which enables noise-free X-ray detection with high dynamic range and excellent stability at high frame rates. These properties are essential for superior data quality in all scattering experiments, especially for optimal background correction when studying low-concentration samples. Besides optimal data quality at each sampling point, highest resolution is desired in most SAXS experiments both in q-range and in time. The newly developed EIGER pixel detector more than doubles the q-resolution that can be achieved when compared with PILATUS3 for the same sample-to-detector distance. EIGER features a pixel size of only 75 µm (in comparison: PILATUS3 has 172 µm). To characterize the spatial resolution of these detectors, point-spread functions were measured at the PTB laboratory at BESSY II, which show that the resolution is directly proportional to the pixel size with minimal cross talk between neighboring pixels. The EIGER 1M detector allows data acquisition at up to 3'000 frames per second. This enables unprecedented temporal resolution in time-resolved SAXS measurements and increases the speed of novel imaging techniques such as scanning SAXS/WAXS and coherent diffractive imaging applications, allowing images to be recorded faster or with higher spatial resolution. The design of the EIGER detector makes it vacuum compatible. Operation at low X-ray energies and correspondingly large scattering angles is another way of increasing q-resolution and also gives access to the lowest q data near the beam stop. In-vacuum detectors enable measurements with ultra-soft x-rays and thus high q-resolution. Moreover they optimize the data quality in scattering experiments by removing absorption and scatter caused from air and windows. An in-vacuum PILATUS 1M detector has been installed at the BESSY-2 FCM beamline and is applied for SAXS/GI-SAXS measurements at energies from 1.75 to 10 keV. For simultaneous SAXS/WAXS applications covering an even wider q-range, in-vacuum detectors with L-shaped detection surface are under development. These will detect the WAXS signal, while a clearance in the detector permits the direct beam to pass on to a SAXS detector placed at larger distance. These latest detector developments will be presented along with corresponding experimental results.

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