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Development of soft X-ray area detectors at DESY

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With the increased brilliance of state-of-the-art Synchrotron radiation sources and the advent of Free Electron Lasers enabling revolutionary science with EUV to X-ray photons comes an urgent need for suitable photon imaging detectors.

With both Petra III and FLASH at DESY providing unique opportunities for experiments (also) with soft X-ray beams, DESY's Photon Science Detector Group is developing sensors to meet the diverse range of requirements presented by their users. These include a demand for soft X-ray area detectors with high frame rates, very large dynamic range, single-photon resolution with low probability of false positives, and (multi)-megapixels. Beyond involvement in the DSSC and Gotthard developments, as well as participation in the CAMP instrument, DESY is leading a collaborative effort with RAL and Elettra to develop the "Pixelated Energy Resolving CMOS Imager, Versatile and Large", short PERCIVAL, to fulfill the demand for high-performance soft-X-ray imagers.

PERCIVAL is a monolithic active pixel sensor (MAPS), i.e. based on CMOS technology. It will be back-thinned to access its primary energy range of 250 eV to 1 keV with target efficiencies above 90%. According to its preliminary specifications, the roughly $10 \times 10 \text{ cm}^2$, $4 \text{ k} \times 4 \text{ k}$ monolithic sensor will operate at frame rates up to 120 Hz (commensurate with most FELs) and use multiple gains within its 25 micron pixels to measure 1 to $\sim 10^5$ (500eV) photons.

Small-scale prototype systems are currently being manufactured. We will present the projected PERCIVAL performance parameters and project timeline. Continued input from the community is looked for during the workshop.

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