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Development and characterization of a Schottky CdTe Medipix3RX hybrid photon counting detector with spatial and energy resolving capabilities

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A multichip CdTe-Medipix3RX [1] MERLIN [2] detector system was developed in order to bring the advantages of photon-counting detectors to applications in the hard X-ray range of energies. The detector head consisted of a 2 x 2 Medipix3RX bump-bonded to a 28 mm x 28 mm monolithic pixel array electron collection Schottky π -contact CdTe sensor. Schottky CdTe sensors undergo polarization, which increases with temperature, flux and the longer the HV is applied. To minimize polarization, the detector was water cooled and periodically the HV bias was refreshed. Results of the optimization of these parameters and evaluation of the image quality will be presented. Additionally, tests on beam line I15 at Diamond Light Source were used to evaluate the energy and imaging resolution, and the suitability of the detector for hard X-rays applications. The results of a powder diffraction experiment showing the diffraction pattern and its good consistency with the simulated data will be discussed. Furthermore, the detector was configured with 110 μm pixel pitch to make use of the Color Mode readout functionality of the Medipix3RX, where eight energy windows can be defined enabling simultaneous acquisition of both spatial and energy information. Results of the detector energy resolution and applications of the Color Mode feature will also be presented.

Collaboration

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