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Characterization of charge sharing and fluorescence effects by multiple counts analysis in a Pixie-II based detection system.

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This work presents a systematic study of multiple counts detection in a Pixirad/Pixie-II detection system. To characterize the dependence of multiple counts from the energy and discriminator threshold, monochromatic photons have been employed. Measurements have been performed at the SYRMEP (SYnchrotron Radiation for Medical Physics) beamline of Elettra synchrotron, Trieste. For each energy, the beam has been attenuated to have a very low fluence rate at the detector. By combining this low fluence filtered-beam with a short acquisition time, the probability of detecting two or more photons in neighboring pixels in a single frame has been made negligible. With this setup, when multiple counts occur, clusters of different sizes (one, two or more adjacent pixels), each induced by a single interacting photon, appear in the recorded images. For each combination of energy and threshold, the number and the size of clusters have been quantified.

Results show that, when photons with energies below the Cd K-edge are employed, the plots of number and size of the detected clusters against the relative thresholds (i.e. Threshold/Energy) are independent from the energy of the impinging photons. In particular, when the relative threshold is set to 0.1, the relative frequencies of clusters corresponding to single, double and triple counts are respectively of 0.4, 0.4 and 0.2. Otherwise, when imaging with photons having energy above Cd K-edge, clusters of more than 4 pixels are observed. In this case, the number and the maximum size of the clusters increase with the energy of the impinging photons.

Collaboration

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