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

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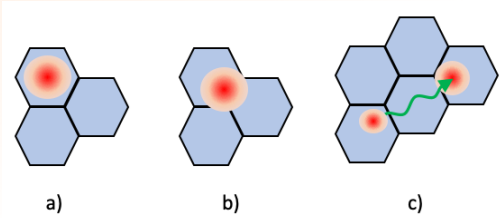
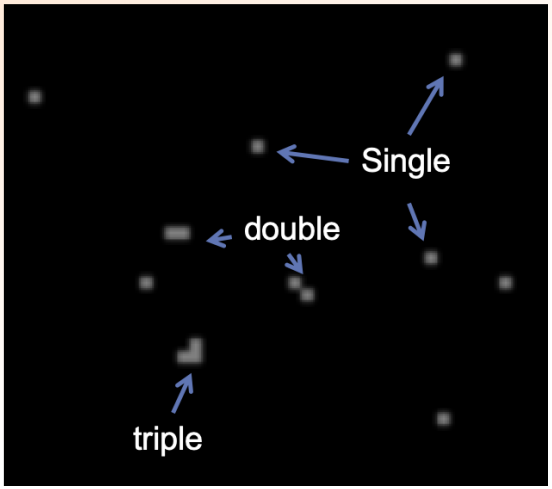
- The imaging performance of X-ray Photon Counting Detectors (XPCD) based on high Z crystal sensors is mainly affected by the simultaneous detection of a single interacting photon by different pixels. Such multiple counts worsen the spatial resolution and cause loss of spectral resolution.
- In this work we presents an experimental study for the systematic characterization of multiple counts detection in a Pixirad-I/Pixie-II system.

The detection system: Pixirad/Pixie II

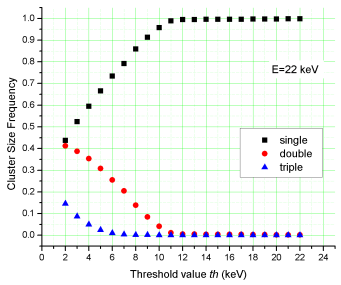


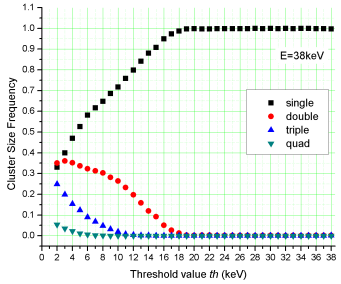
An interacting photon releasing all its energy can be registered by a single pixel a) or by a "cluster" of different adjacent pixels due to charge sharing b). Fluorescence can lead to multiple counts, even from disjointed clusters c).

We acquired large stacks of images, for each of which only few photons interact in the whole sensor



- We observed, in single images, the presence of "clusters" of different size
- **By counting the clusters of different size, we studied the dependence of the multiple counts on the energy of the impinging photons and on the discrimination threshold**





Using photons of energy below the Cd K-edge and relative threshold (Threshold/Energy) 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. Choosing appropriate values of the discrimination thresholds, multiple counts can be avoided with no loss in detection efficiency.

When imaging with photons having energy above Cd K-edge, clusters of more than 4 pixels are observed. In this case the threshold can be set to record only "primary" events, at the cost of a reduction in the detection efficiency.