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Pattern Recognition Algorithm for Charge Sharing Compensation in Single Photon Counting Pixel Detectors

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Thanks to the detector technology development based on high Z materials (GaAs, CdTe, CZT, etc.), the hybrid pixel detectors with direct photon–to–charge conversion become more and more popular, even in medical applications. Single photon counting systems aim at good position resolution and operation with high X-ray flux, so making a pixel size smaller is a general tendency in such systems. However for the detector pitch of about 100 μm and smaller the effect of charge division is present in about 20-30% cases of all incoming photons, while for the smaller pixel size this effect is even more pronounced. In this presentation we analyze different algorithms implemented in integrated circuits of a pixel architecture and we propose a new algorithm to eliminate the effect of charge sharing called Multithreshold Pattern Recognition algorithm (see Fig. 1). The algorithm is extensively tested for X-ray energy range 20-160 keV and finally implemented in the design of readout chip with pixel pitch of 100 μm in CMOS 130 nm process. Operation at four different energy threshold allows a photon counting in selected energy windows and fast hit allocation.

Fig. 1. Three approaches examples of choosing a proper energy threshold for hit allocation.

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