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Direct Charge Sharing Observation in Single-Photon Counting Pixel Detector

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Charge sharing is an important factor to be considered in pixel detector design for single-photon counting electronics. Its effect on such devices, if proper adjustment of the pixel threshold is not performed, is to give rise to false counts in the pixels neighbouring the hit one. Nevertheless, it is difficult to evaluate or measure, as single-photon counting electronics do not give information about the charge quantity collected in every single pixel. In this work we present the results obtained measuring an X-ray source with a CdTe detector bump-bonded to a Medipix2 chip. Medipix2 is a single-photon counting read-out chip that also features a small matrix of 3×3 pixels with an analog output. The signal generated by an incoming particle can therefore also be read-out through an oscilloscope, making possible a detailed study of charge sharing. The detector features a pixel pitch of 55 μm and a thickness of 1 mm. The measurements presented here were taken in the framework of our medical imaging research; therefore energies of interest are below 100 keV. This study has general impact on the design of pixel detectors; however its impact on the design and the operation of pixel detectors coupled to photon counting electronics is deeper.

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