A PIXEL DETECTOR BASED SINGLE PHOTON COUNTING SYSTEM AS FAST SPECTROMETER FOR DIAGNOSTIC X-RAY BEAMS

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Recent advances in the semiconductor pixel detectors and read-out electronics allowed to build the first prototypes of single photon counting imaging systems that represent the last frontier of digital radiography. Among the advantages with respect to the commercially available digital imaging systems there are the direct conversion of the photon energy into electrical charge and the effective rejection of the electronics noise thanks to the thresholding process. These features allow the photon counting systems to achieve high imaging performances in terms of spatial and contrast resolution. Moreover, the now available deep integration techniques allowed reducing the pixel size and improving the functionality of the single cell and the read-out speed to cope with the high fluxes as in the diagnostic radiology.

In particular the single photon counting system presented in this paper is based on a 1 mm thick silicon pixel detector bump-bonded to the Medipix2 readout chip to form an assembly of 256 x 256 square pixels at a pitch of 55 micron. Each cell comprises a low noise preamplifier, two pulse height discriminators and a 13 bits counter. The maximum counting rate per pixel is 1 MHz. The chip can operate in double modality: it records the events with energy above a threshold (single mode) or between two energy thresholds (window mode).

Exploiting this latter feature, we present a possible application of such a system as a fast spectrometer to study the energy spectrum of diagnostic beams produced by X-ray tubes.

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