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First demonstration of on-chip interpolation using a single photon counting microstrip detector

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Despite being used in many X-ray applications, hybrid single photon counting detectors are limited in spatial resolution due to the diffusion of the charge produced by single photons between neighbouring electronic channels, also called charge sharing.

In this work, we demonstrate that interpolation can be used to increase the number of virtual channels and improve the effective spatial resolution in a single photon counting microstrip detector.

With respect to reducing the physical strip pitch, this comes with the additional advantage of overcoming the technological challenge of increasing the number and density of interconnects between the sensor and the readout electronics.

We describe a digital communication scheme between neighboring channels, implemented for the first time in the MYTHEN III microstrip detector, which exploits charge sharing to obtain a spatial resolution better than the strip pitch. The interpolation is achieved directly on-chip at the time that the photons are absorbed reducing the data throughput and the computational effort and allowing a higher photon flux compared to interpolation using analogue detectors.

Here, we show the first results obtained with this interpolation mechanism, characterizing the spatial resolution in terms of Modulation Transfer Function (MTF) when varying several parameters (photon energy and flux, chip thresholds and settings, sensor voltage, thickness and strip pitch).

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