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COMETH: a CMOS pixel sensor for a highly miniaturized high-flux radiation monitor

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The need for miniaturized and versatile real-time radiation monitors has become a general trend for spacecraft applications. It requires a highly integrated detection system with the ability to identify ion species in a high flux mixed environment. We have proposed [1] a new strategy to meet these requirements with a single CMOS pixel chip.

This sensor is based on a matrix of $50 \times 50 \mu\text{m}^2$ pixels, read out in rolling-shutter mode, and features columns ended by 3-bit ADCs with tunable threshold. An embedded digital algorithm extracts the particle properties from the hit information to provide the radiation flux on-line.

A reduced scale prototype with 32×32 pixels and 32 column ADCs has been designed and fabricated in a $0.35 \mu\text{m}$ process. The layout of the identifying and counting algorithm, downstream the pixel matrix, was developed in the same process. A full simulation of this layout for a subset of columns was used to check the algorithm output against many inputs.

Test results obtained with X-rays, β - particles and laser illumination, confirm previous simulations addressing gain and linearity. Column ADCs also show expected features. Those measurements validate the possibility to monitor proton and electron fluxes up to $107 \text{ particles} \cdot \text{cm}^{-2} \cdot \text{s}^{-1}$ and distinguish proton from electron for energies lower than 50 MeV.

[1] Y.Zhou et al., JINST 7 (2012) C12003.

*COMETH: Counter for Monitoring the Energy and Type of charged particles in High flux

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