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Advanced FPGA-Based Readout Electronics for Strip Detectors

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In this article we aim to investigate the performance of strip detectors as spectrometers by measuring typical sources of ionizing particles, such as photons or alpha-particles, having a well-defined energy. To this end a 128-strip low noise FPGA-based readout system was fabricated alongside a corresponding dedicated software tool and connected to a Si strip sensor.

In addition, adequate equalization and calibration methods were developed in order to get a more uniform response from the channels and hence better energy resolution. In order to read all 128 channels of the sensor employed, 4 independent readout ASICs, featuring 32 channels each, had to be used.

In the current investigation a sigma of 1.6 keV was obtained for the mean of all channels within the energy range of 15-60 keV, outperforming comparable Si hybrid-pixel detectors typically having a sigma of 2.3 keV. Using a 6-sigma distance to the electronic noise level it was still obtained a system threshold level of 3 keV.

This research provides valuable information for multiple applications in which strip detectors could be used efficiently to replace hybrid-pixel detectors.

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