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A low-power, 64-channel ASIC for space applications for Cherenkov radiation detection

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This work describes the development of a 64-channel ASIC implemented in a commercial 65 nm CMOS technology. The electronics is designed to readout a camera plane composed by a matrix of Silicon Photo-Multipliers (SiPMs) where a current signal is induced by Extensive Airshowers (EASs). Latters are generated by Ultra-High Energy Cosmic Rays (UHECRs) and Cosmic Neutrinos (CNs) through Cherenkov radiation processes. A single channel records the full waveform of the associated event by storing the information in 256 cells arranged in a daisy chain architecture. Each cell is equipped with an analog memory, a Wilkinson Analog-to-Digital Converter (ADC) with 12-bits resolution and latches to locally save the data. The circuitry runs at a sampling rate of 200 MS/s and provides a hitmap of the 64 channels that can be elaborated by an FPGA. If the mapping is validated, the data are converted and sent off-chip with a dedicated serializer working at 400 MHz in Double Data Rate (DDR). The ASIC is characterized by a high configurability which makes the chip suitable for several investigations besides the space one. Indeed the user can select the partition of the channels to operate with slices of 32, 64 or 256 cells. The resolution is programmable as well in the range of 8-12 bits to guarantee an appropriate granularity for many applications and both to save conversion time and power.

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