

Calibration and Performance of the Compact High Energy Camera SiPM Prototype Front-End Electronics proposed for the Cherenkov Telescope Array

The Compact High Energy Camera (CHEC) is a full-waveform camera, designed and proposed for the dual mirror Schwarzschild-Couder small sized telescope of the Cherenkov Telescope Array. CHEC-S is the second prototype and is based upon silicon photomultiplier (SiPM) photodetectors optimised for single photon counting and nanosecond timing. The camera water-cooled focal plane plate comprises a total of 2048 SiPM pixels organised as 32 independent sensor and front-end electronics (FEE) modules providing event detection and signal digitisation of Cherenkov light flashes. Each module comprises an 8 x 8 tile arrangement of SiPM pixels, coupled to a 64-channel preamplifier-buffer followed by an FEE module based around the TARGET chipset, which combines triggering and waveform capture functionality.

We describe test and calibration procedures performed at single module level focusing on characterising the SiPM photodetectors, optimised preamp-buffer and updated CHEC-S FEE readout module. We present end-to-end performance results for the readout chain from photodetector through to calibrated image data. Analysis results include; gain-matching, dynamic range, trigger efficiency, night-sky-background effects, event waveform characteristics, electronic channel crosstalk, SiPM angular dependency and optical crosstalk, and dependence on operating temperature.

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