A single photo-electron calibration system for theNectarCAM camera of the Cherenkov Telescope ArrayMedium-Sized Telescopes

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This work focuses on the dedicated single photo-electron (SPE) calibration system developed to measure the gain of each pixel of NectarCAM, one of the proposed cameras for Medium-Sized Telescope (MST) of CTA. This study is vital for accurate analysis of the incoming gamma rays which involves reconstructing the gamma ray properties, namely the arrival time, direction and energy.

We discuss the production of a calibration screen which scans all the PMTs on the camera in order to perform gain measurements. With screen ready, we proceed to study the optimal scan positions of the screen required to cover the entire focal plane of the camera, to ensure coverage of all pixels and minimise the time required for calibration. Finally, we discuss the SPE analysis of data acquired in 2019 from a mini NectarCAM camera which was installed on the MST prototype telescope in Adlershof (Germany).

The study illustrates a high intensity map of the chosen screen for calibration which is sufficiently homogenous for SPE studies. Additionally after considering various time periods we deduced the total time taken for a complete scan over all PMTs to lie in the range of 17 to 28 minutes, with a total of 55 scan positions. Lastly, using Ctapipe we found the pixels illuminated by the screen and then with the aid of a SPE fitting algorithm we fit the reconstructed charge distribution accounting for pedestal subtraction for each of these pixels. We obtained a mean gain of 56 ADC/p.e. and associated standard deviation of 2.1 ADC/p.e over the mini camera. By studying the gain of each illuminated pixel, we found the gain variability to be ~4%.