Calibration procedures for the ASTRI Mini-Array Cherenkov cameras

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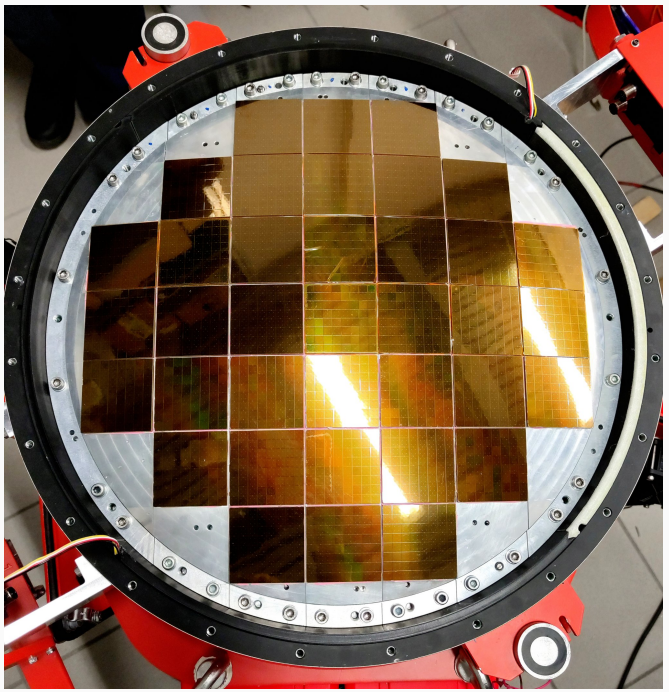
ASTRI Cherenkov camera

Focal plane

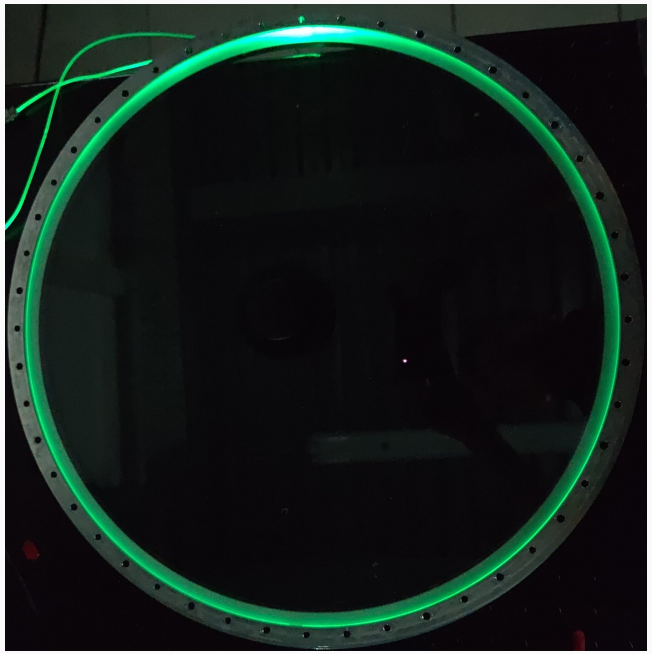
- 37 Photon-Detection Modules (PDMs) arranged to cover the spherical focal surface
- Each PDM has a 8×8 SiPM tile (Hamamatsu S14521) and two 32-channels CITIROC-1A ASICs

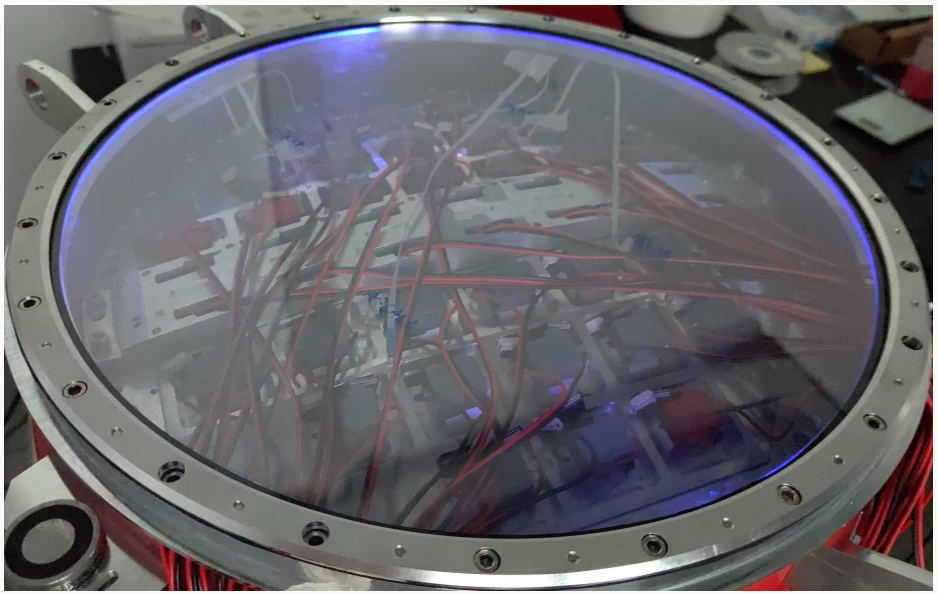


ASTRI Cherenkov camera

Embedded calibration system

- Two LEDs (green and blue) coupled with an optical fiber
- Both can operate in pulsed and continuous mode
- Both can operate simultaneously

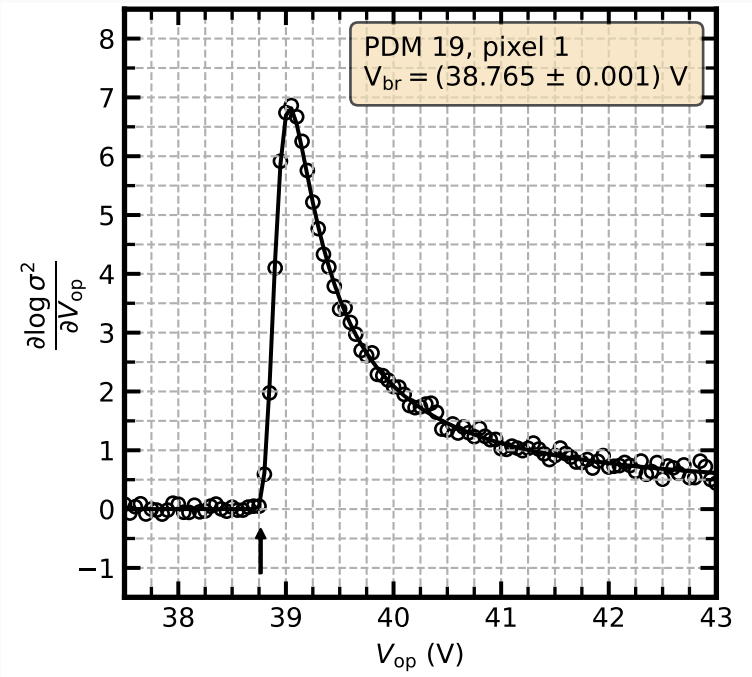


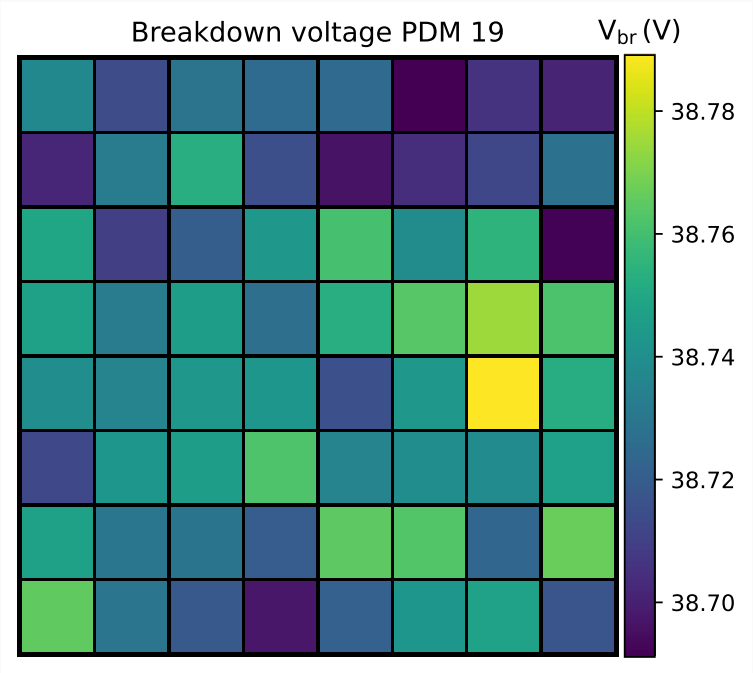


Main relative calibration procedures

Breakdown voltage determination

1. Illuminate pixels with a continuous light
2. Measure signal variance of each pixel as a function of the bias voltage
3. Fit the obtained curve with a model derived assuming a Borel distribution for cross-talk discharges

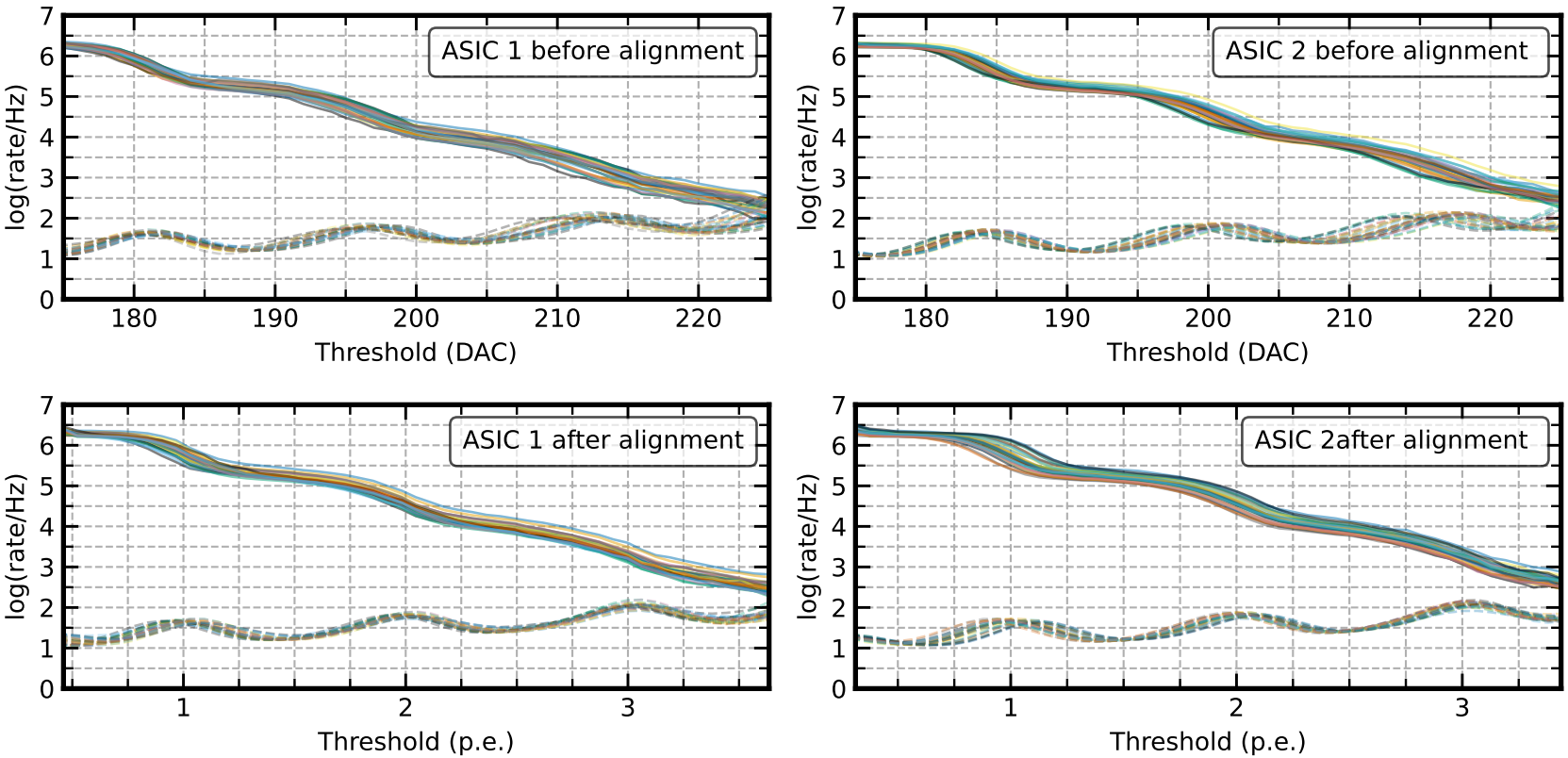




Main relative calibration procedures

Trigger channel alignment

Fix ASIC discriminator offsets by means of a programmable 4-bit DAC. The method is based on the measurement of the inflection points of the dark staircase curve (dark count rate as a function of discriminator threshold)



Main relative calibration procedures

Pulse-height distribution (PHD) analysis

- Based on a Gaussian smeared generalized Poisson distribution model
- Provides the calibration coefficients needed for the Cherenkov image analysis
  - pedestal position x_{ped}
  - photo-electron equivalent $\bar{g}$
  - pedestal dispersion σ_{ped}
  - cross-talk probability λ