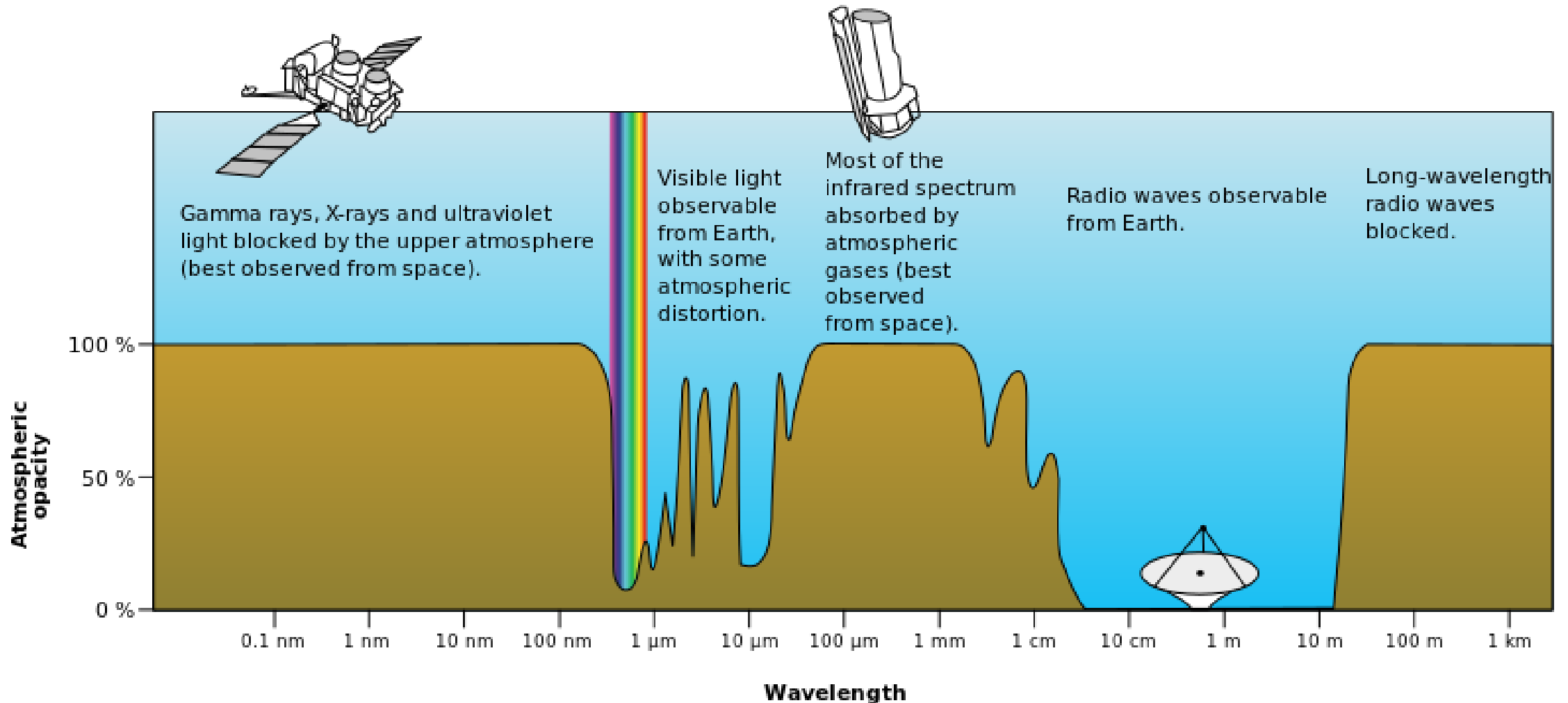


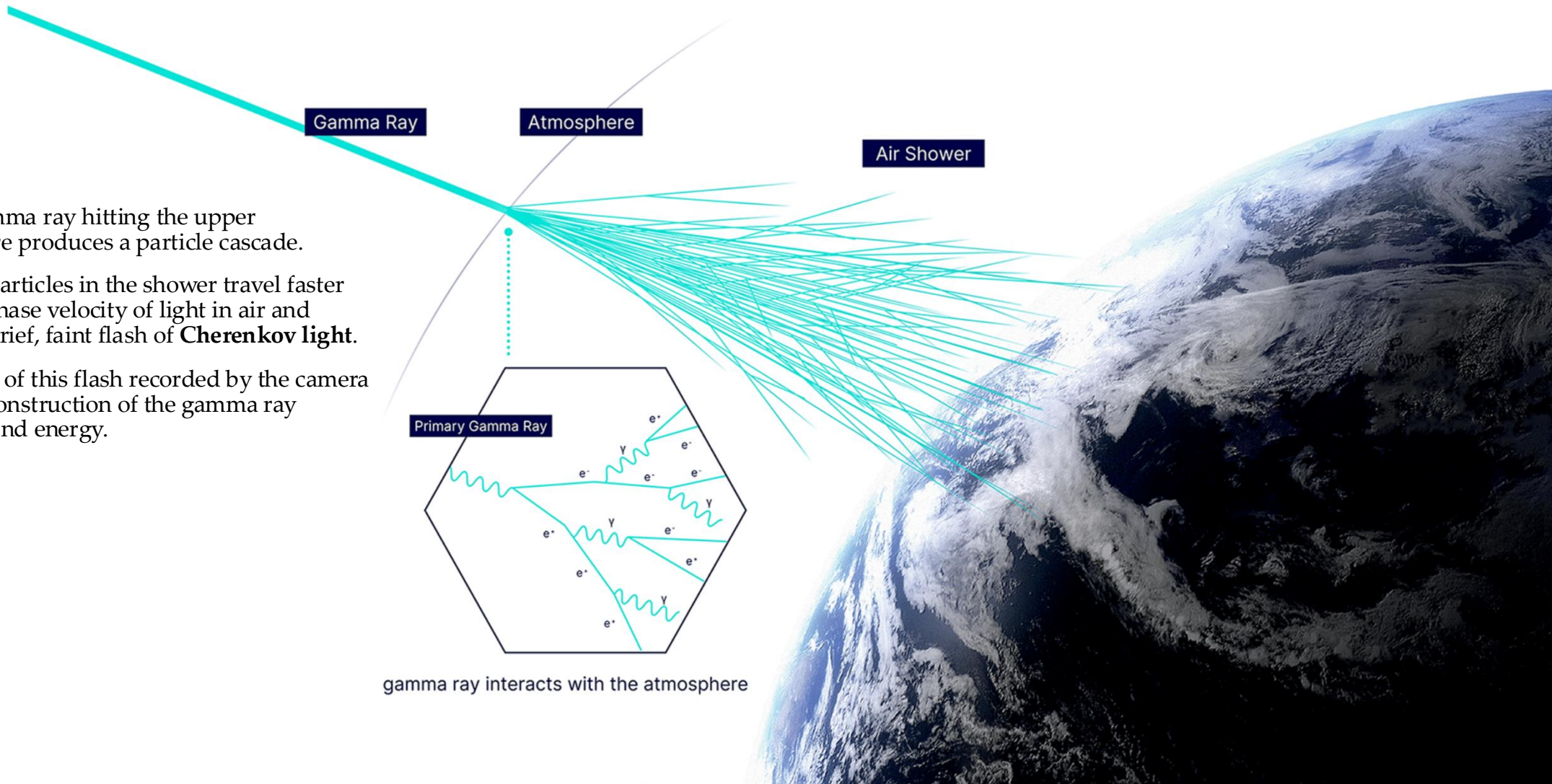
The CTAO SST Camera: Status and Dutch Contribution

Vadym Voitsekhovskiy
Netherlands Astronomy Conference 2026



Gamma rays do not reach the ground directly. Instead, we detect them from satellite or as atmospheric particle showers.

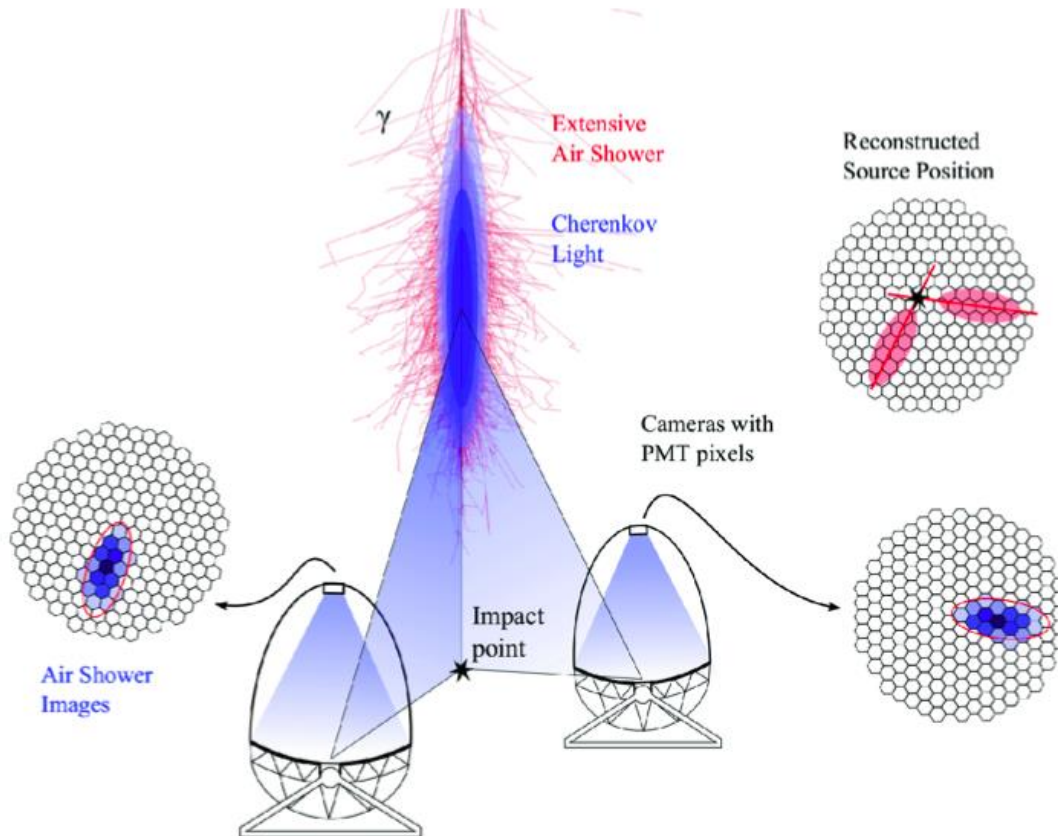




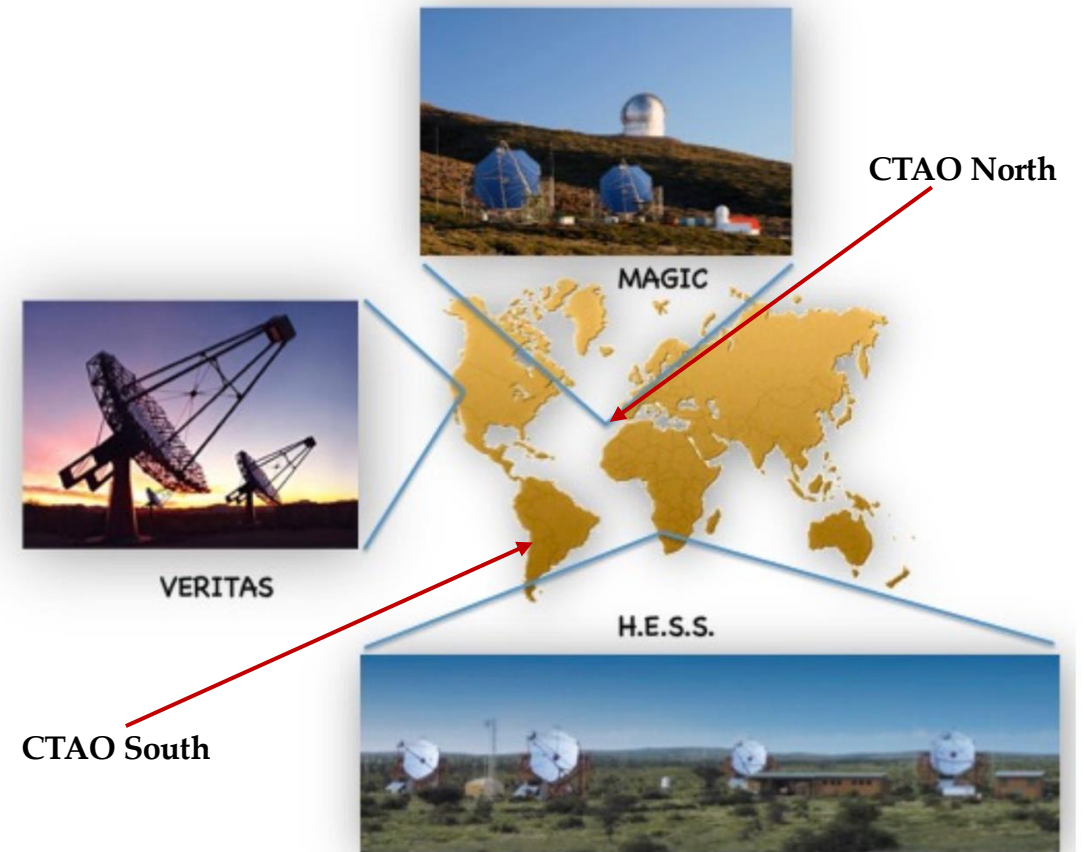
- A TeV gamma ray hitting the upper atmosphere produces a particle cascade.
- Charged particles in the shower travel faster than the phase velocity of light in air and radiate a brief, faint flash of **Cherenkov light**.
- The image of this flash recorded by the camera allows reconstruction of the gamma ray direction and energy.

gamma ray interacts with the atmosphere

- Observatories that detect gamma rays using extensive air showers are called **Imaging Atmospheric Cherenkov Telescopes (IACTs)**.
- Multiple telescopes are arranged in an array to enable stereoscopic observations, which significantly improves angular resolution and background rejection



Location of the three major IACTs currently in operation: H.E.S.S., MAGIC and VERITAS



CTAO - Cherenkov Telescope Array Observatory

LARGE-SIZED TELESCOPES (LST)

LOW ENERGY RANGE (~10 TO 100 GeV)

23 M DIAMETER REFLECTOR

MEDIUM-SIZED TELESCOPES (MST)

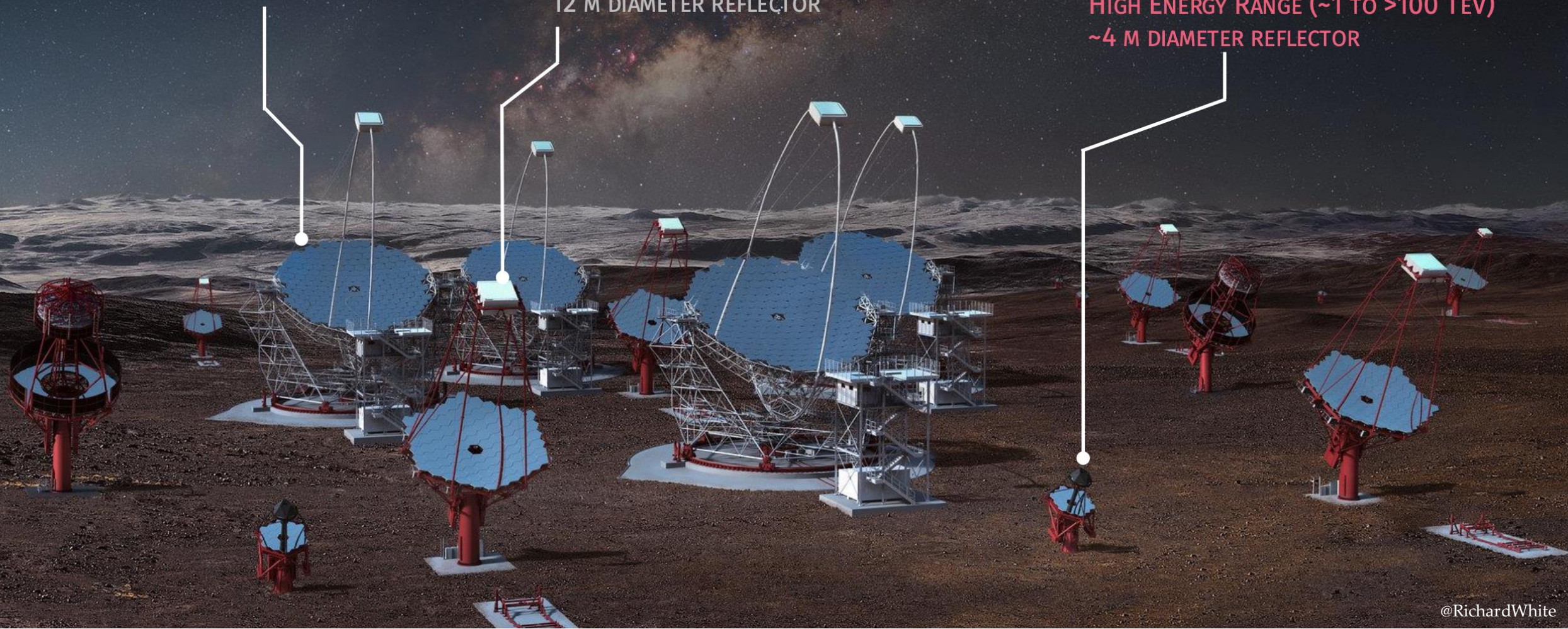
CORE ENERGY RANGE (100 GeV TO FEW TeV)

12 M DIAMETER REFLECTOR

SMALL-SIZED TELESCOPES (SST)

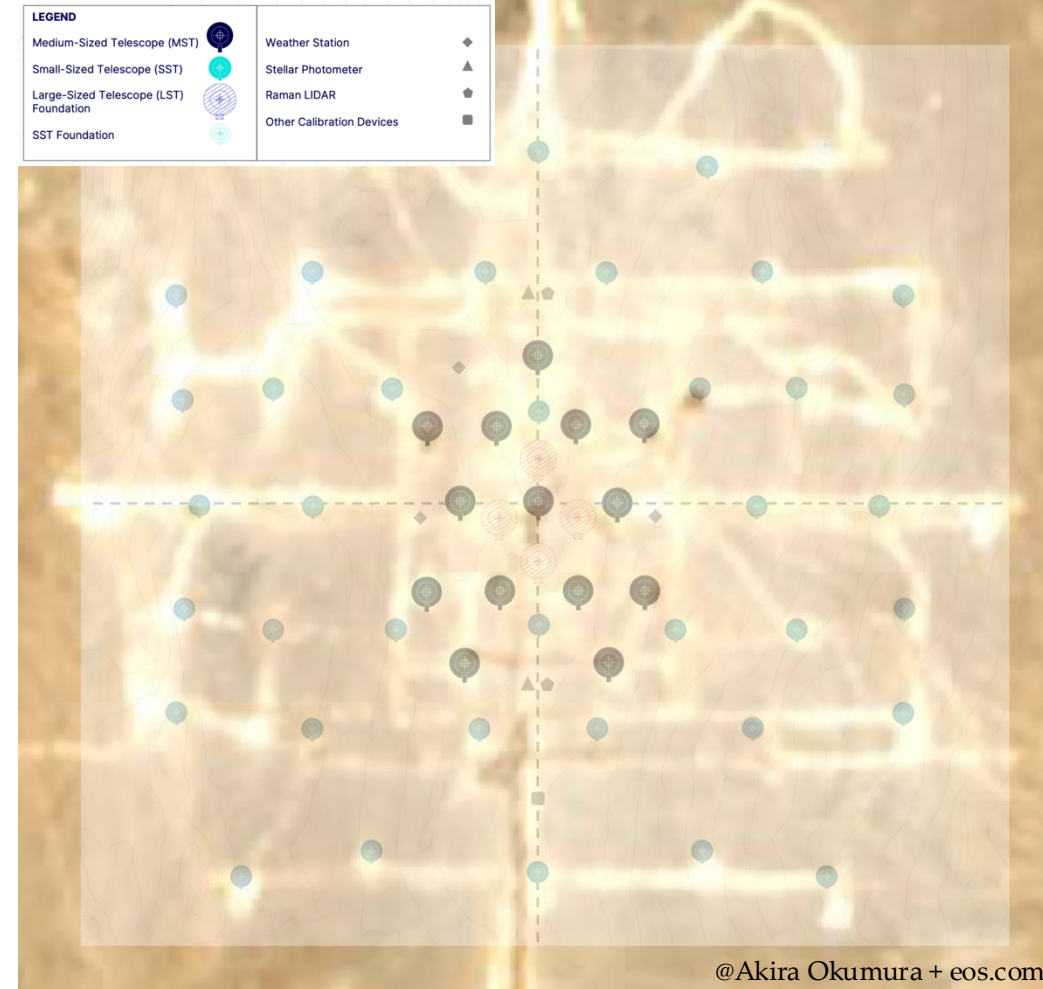
HIGH ENERGY RANGE (~1 TO >100 TeV)

~4 M DIAMETER REFLECTOR



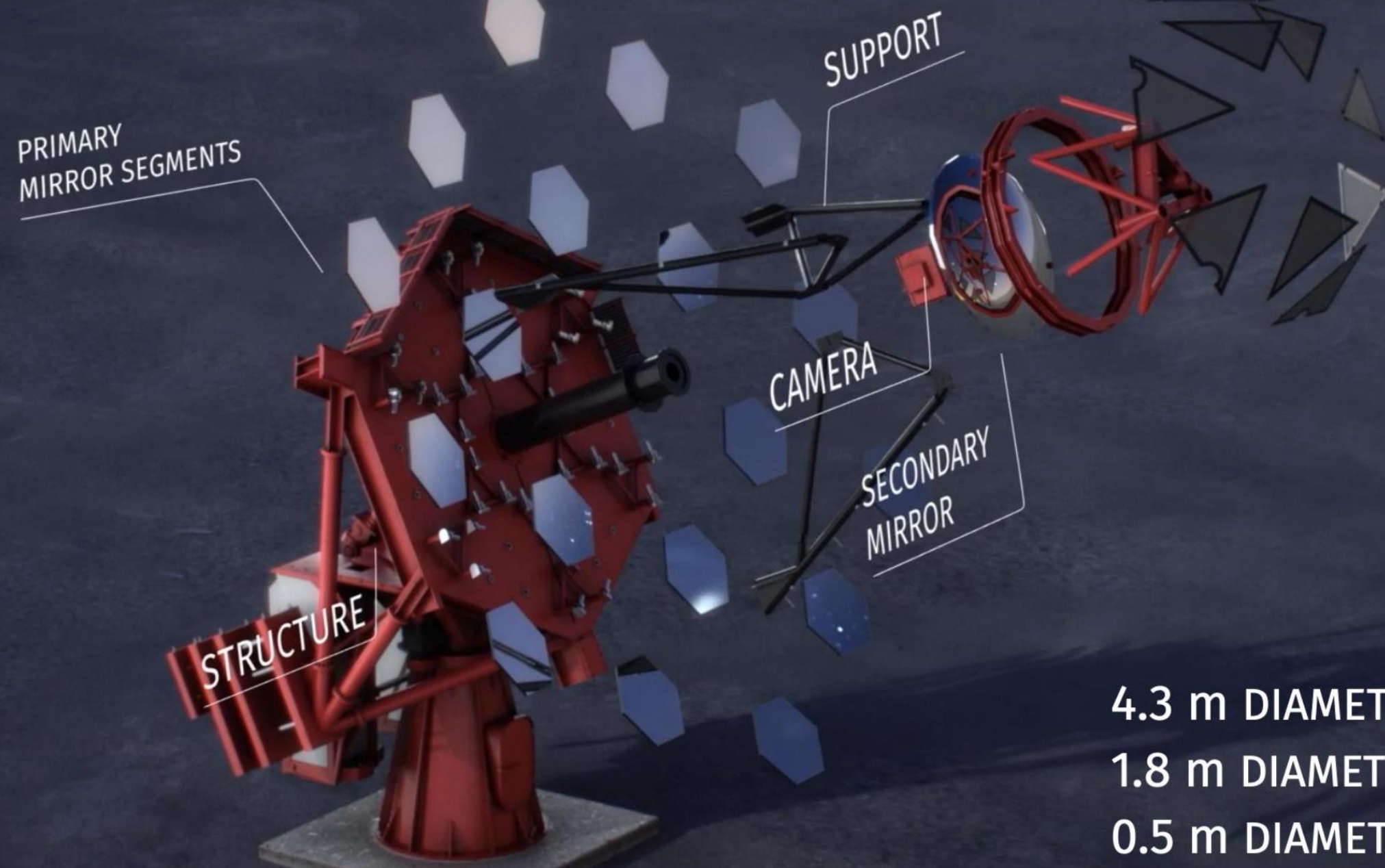
Satellite view of Atacama desert with overlaid infrastructure layout

CTAO-South will host ≈ 37 SSTs spread over several km² many small, cost-efficient telescopes outperform a few large telescopes at the highest energies



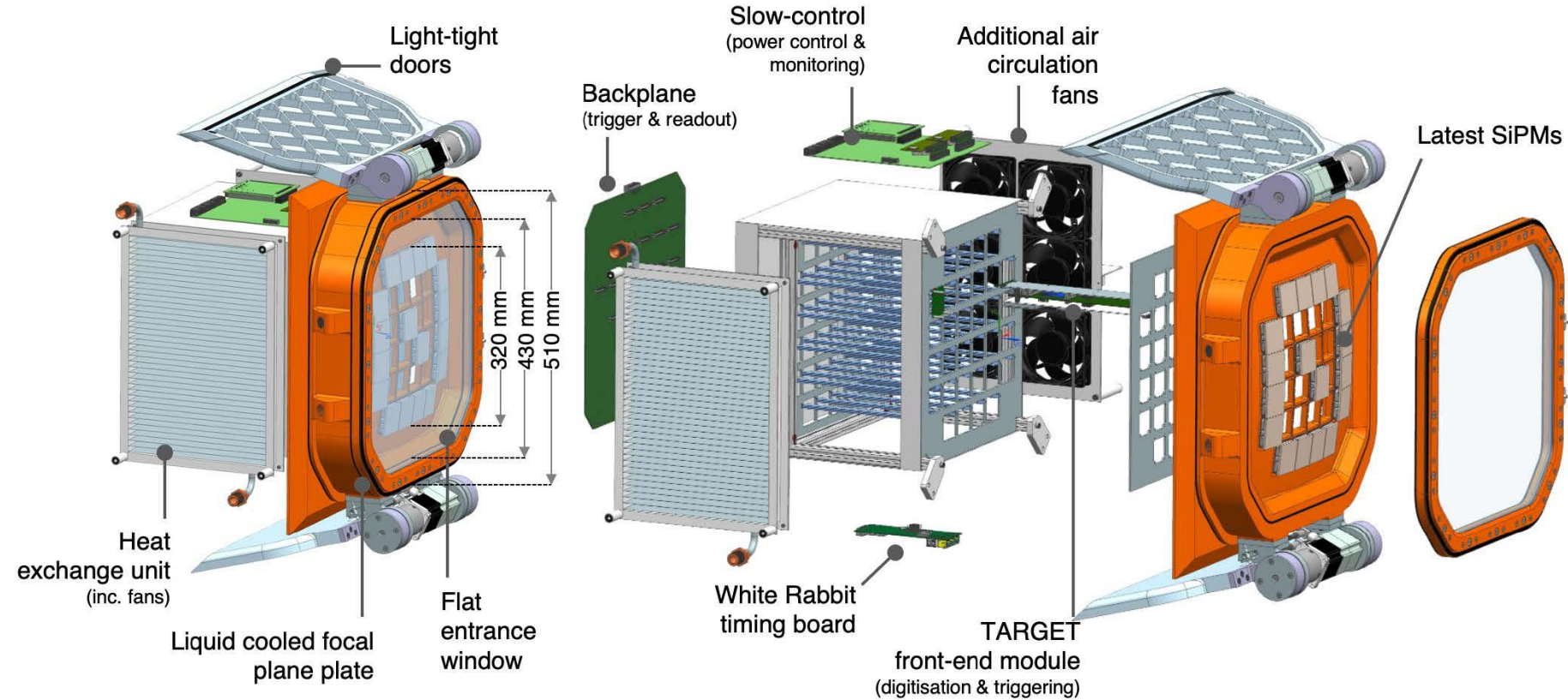
@Akira Okumura + eos.com

Small-sized telescope

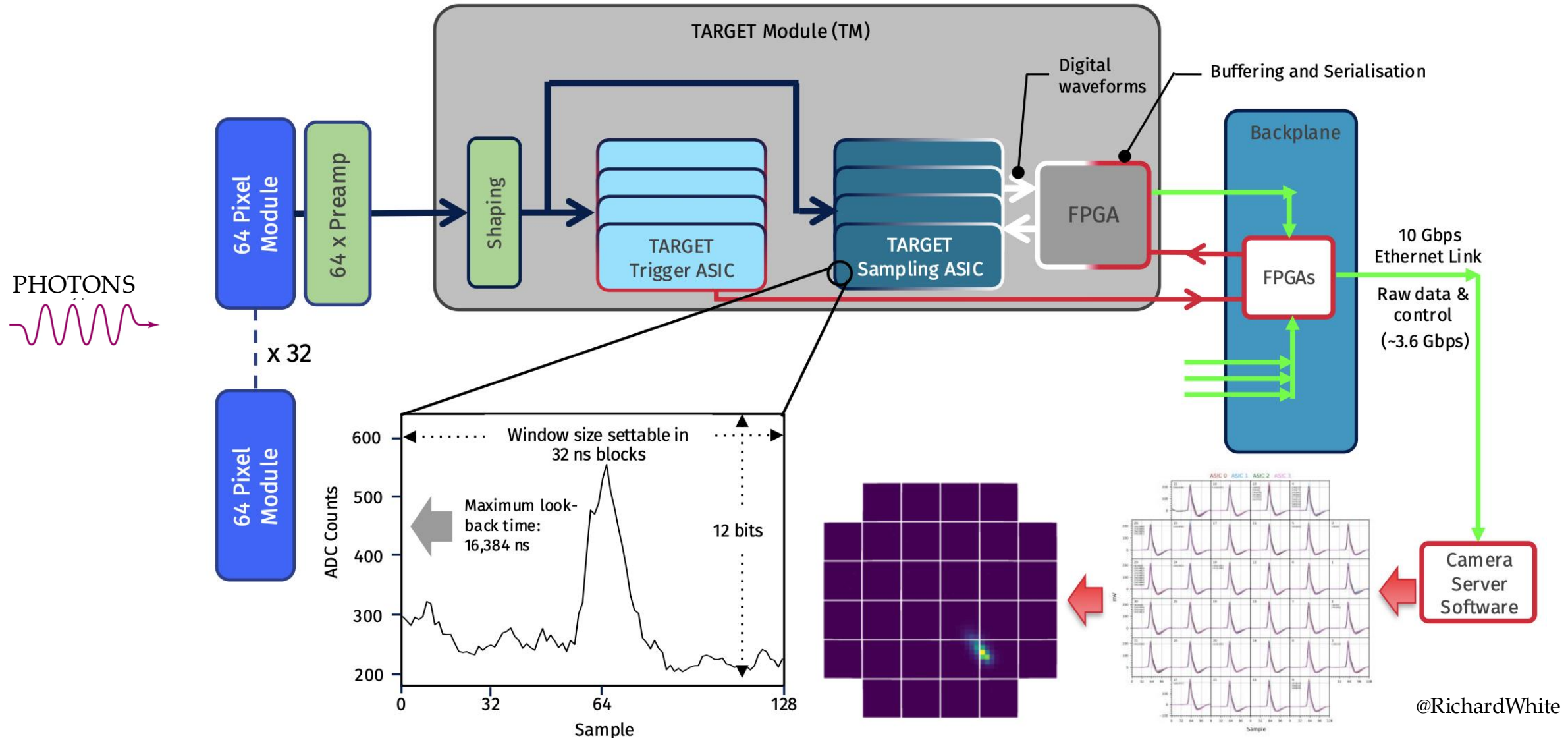


4.3 m DIAMETER PRIMARY
1.8 m DIAMETER SECONDARY
0.5 m DIAMETER CAMERA

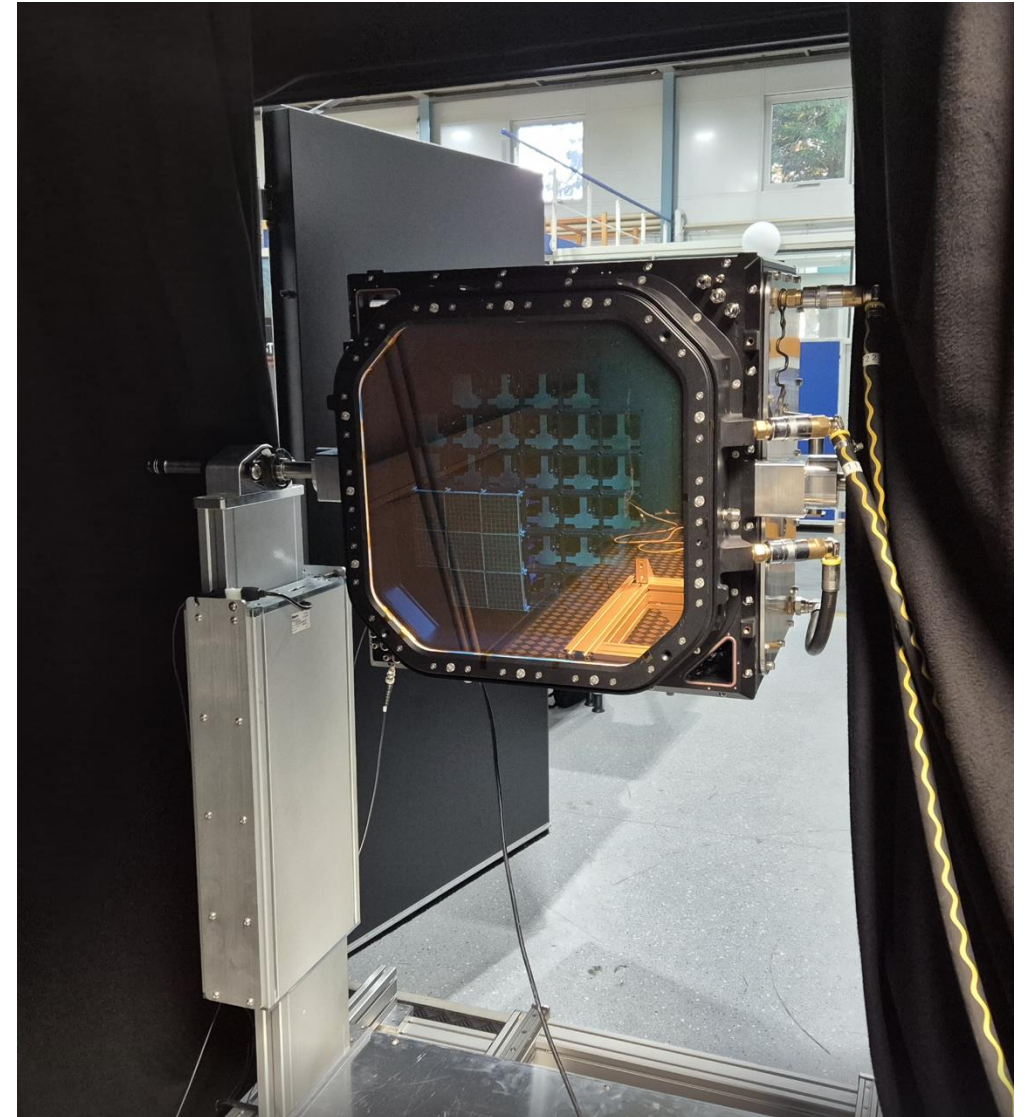
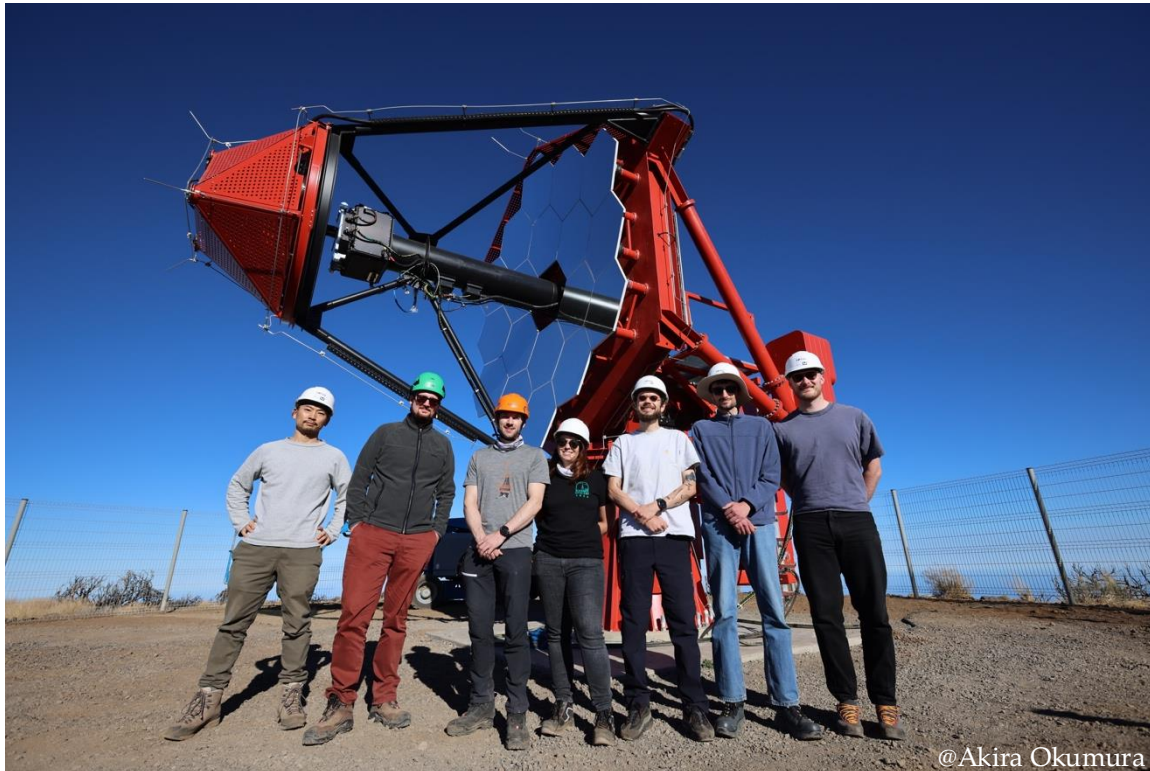
- Records flashes lasting only a few nanoseconds
- 2048 silicon photomultiplier pixels
- Samples signals every 1 ns
- Compact camera: < 1 m size, ~95 kg
- Sensitive to single photons
- Designed for gamma rays up to ~300 TeV

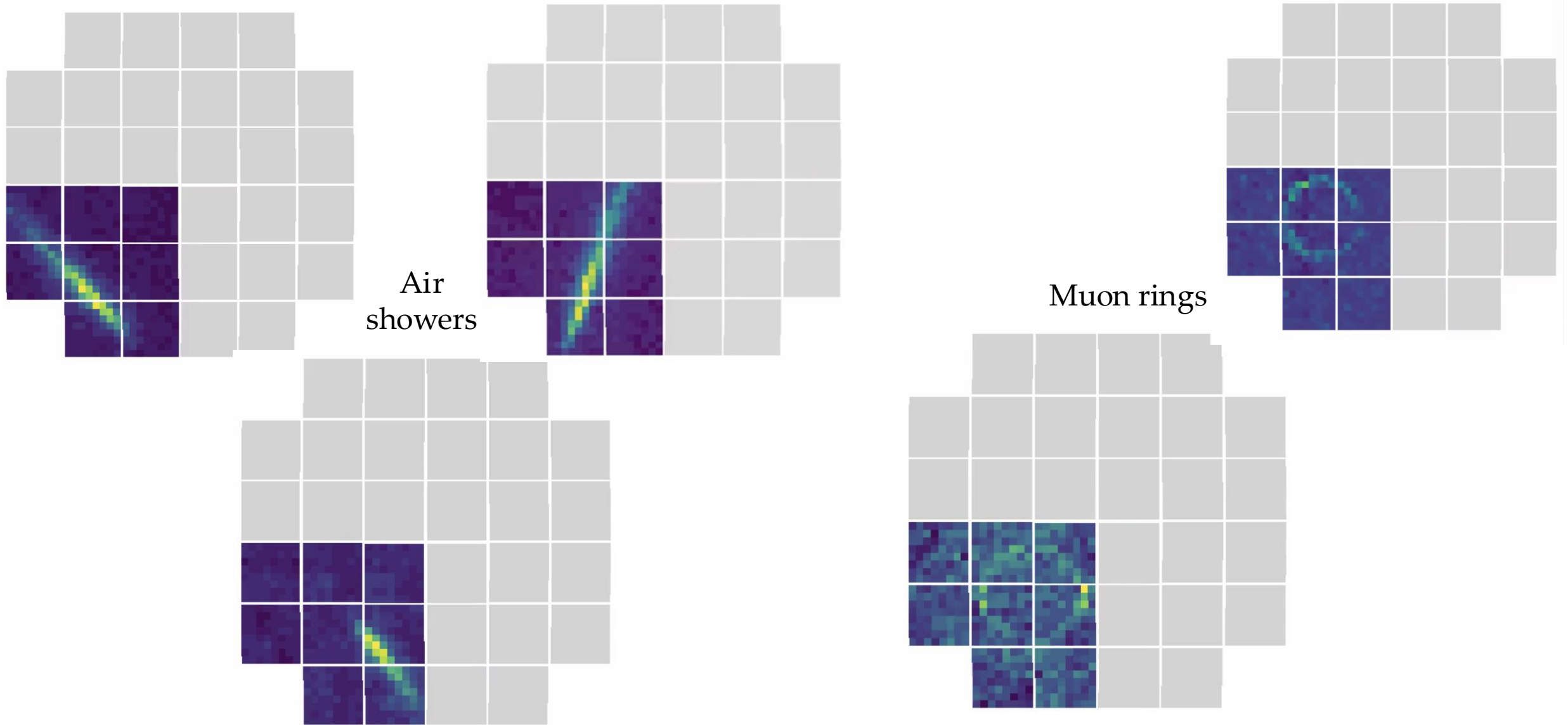


arXiv:2110.14527



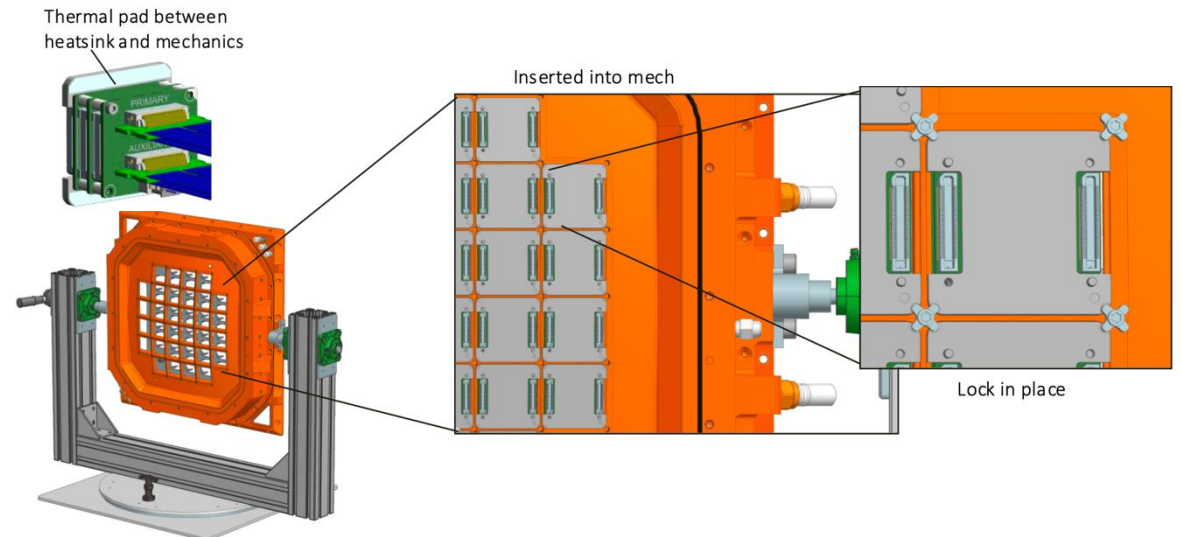
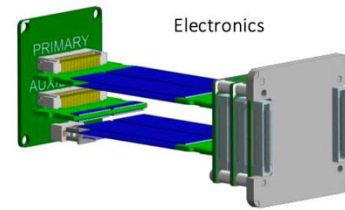
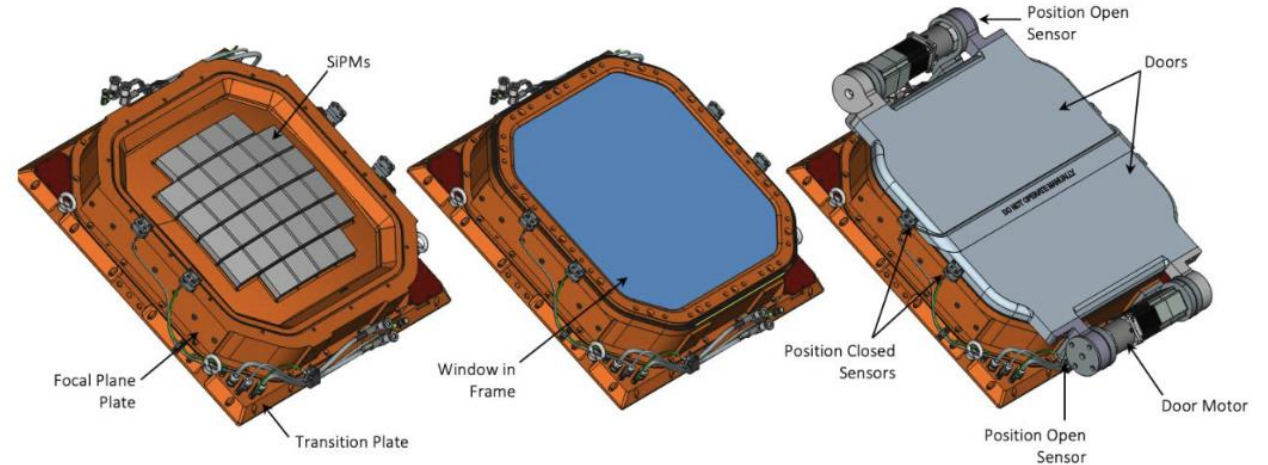
- In July 2025 we performed successful on-sky tests of QCAMi on Tenerife
- QCAMi - full mechanics, final design quartz window, 512 installed pixels ($\frac{1}{4}$ of the focal plane), ~ 4 deg FoV



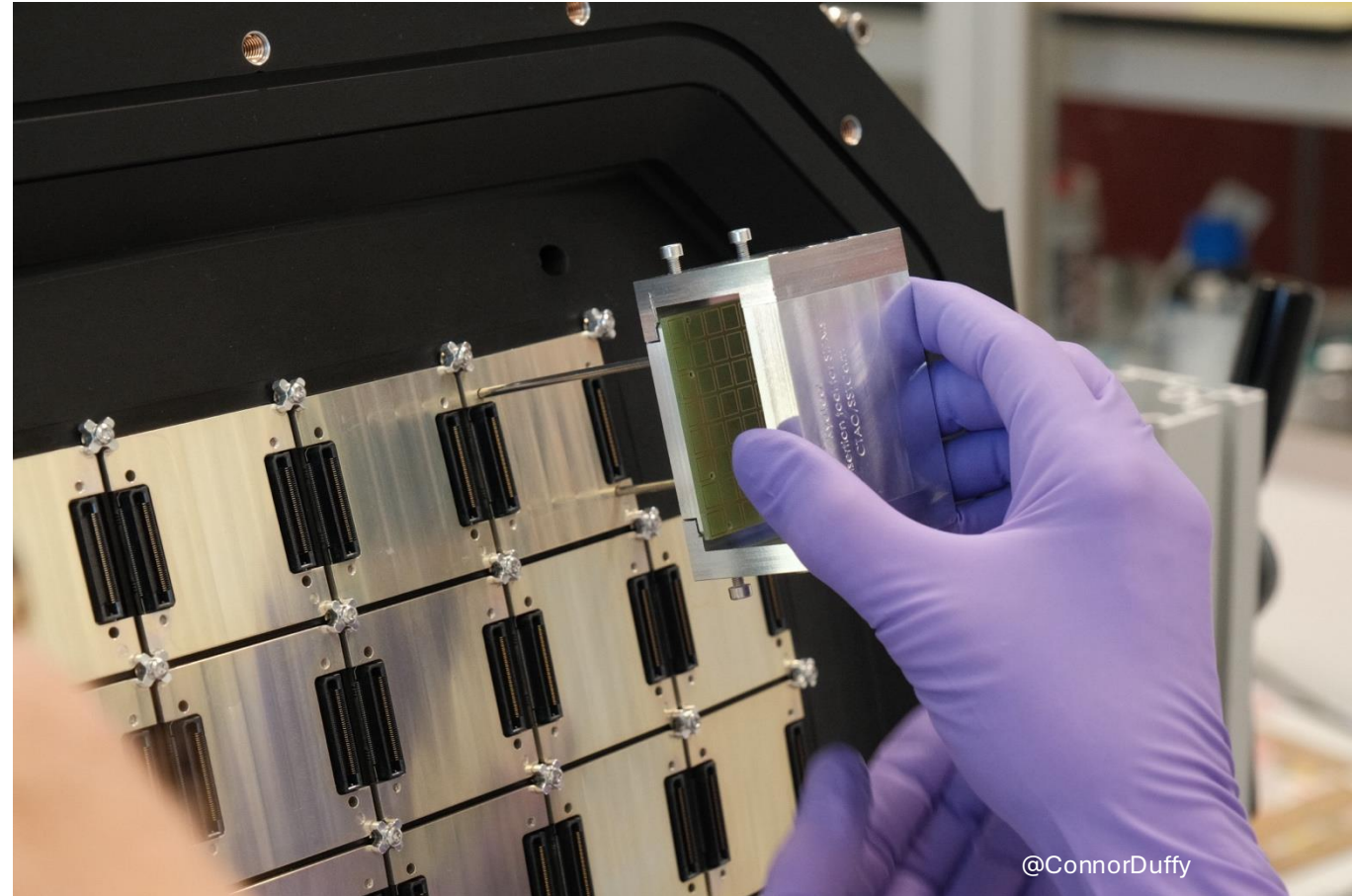
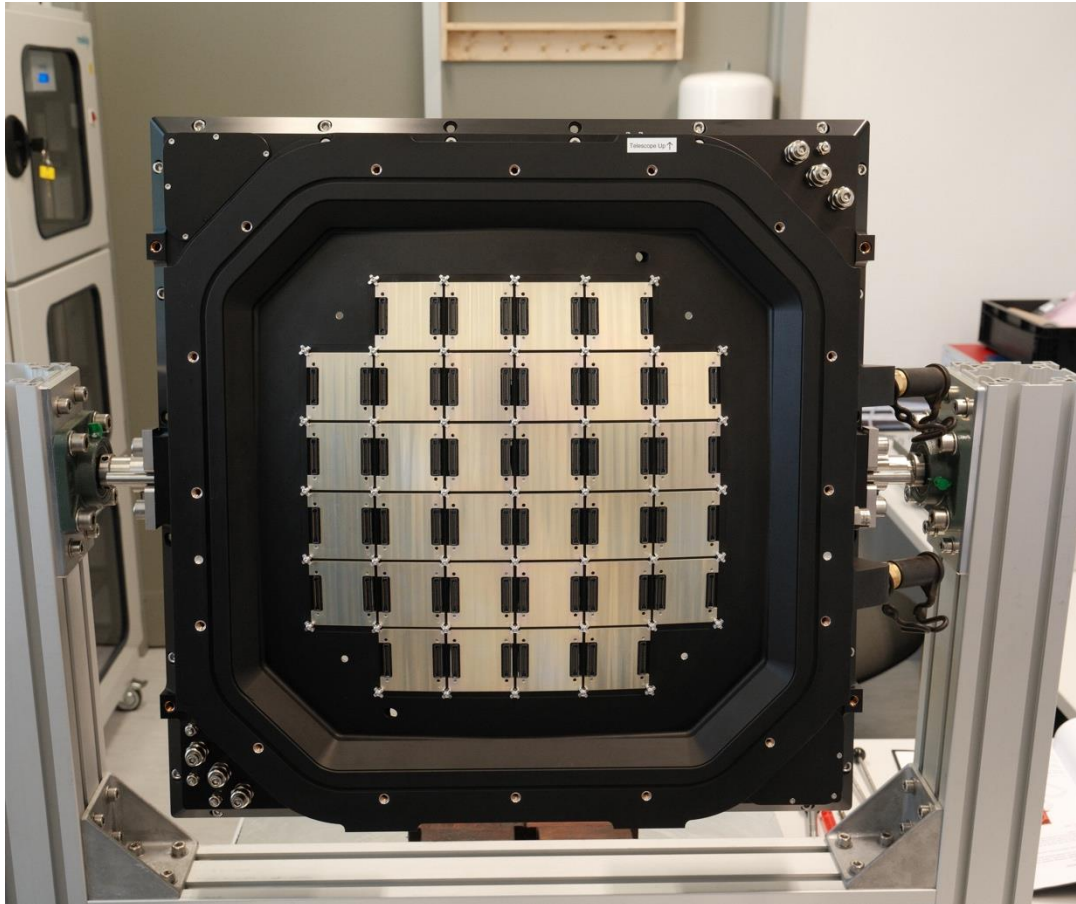


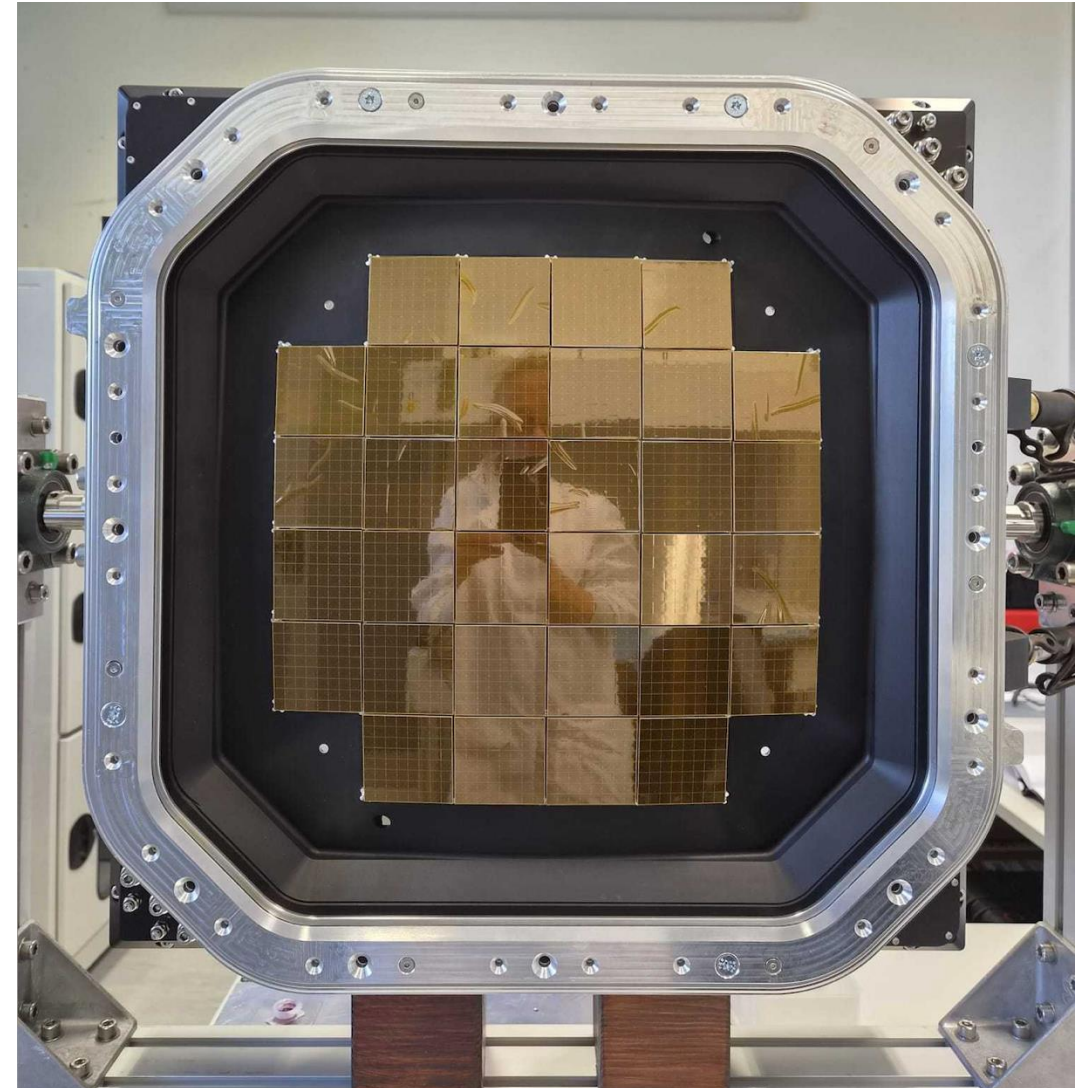
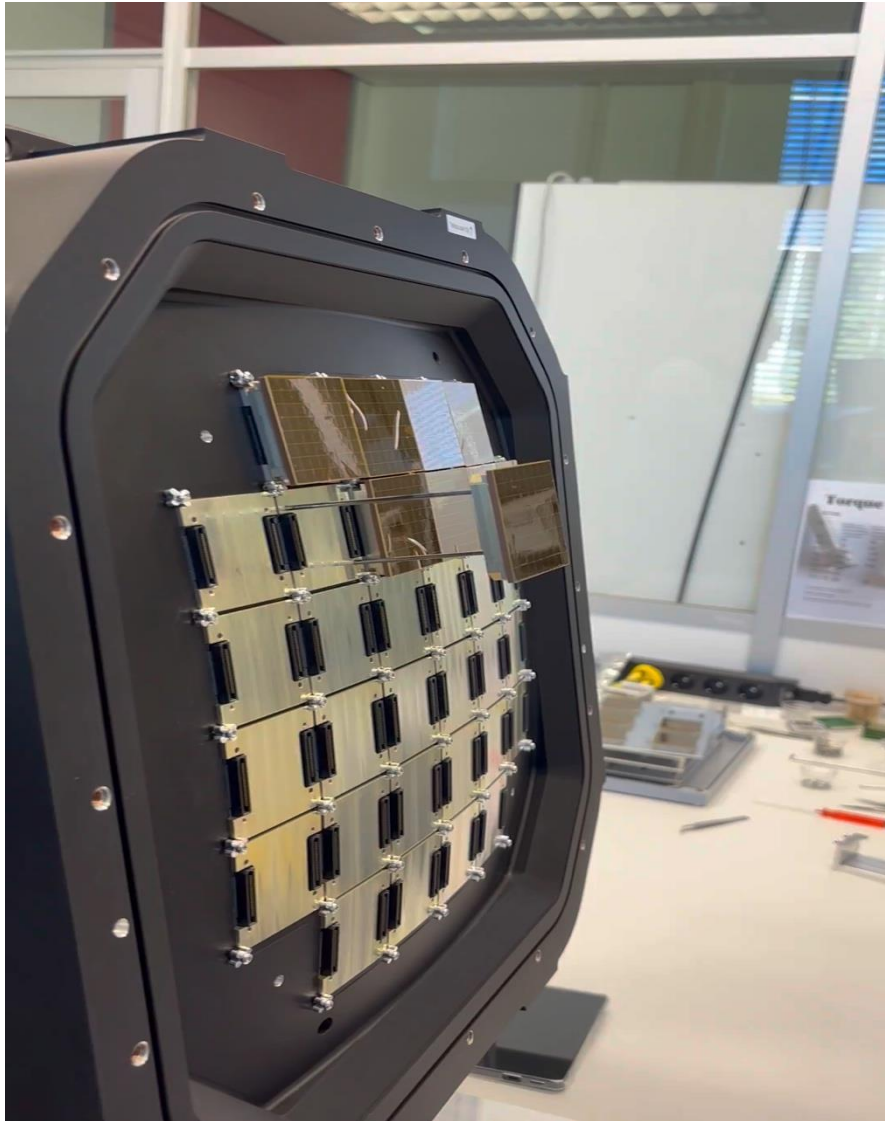
The Dutch contribution is funded by an NWO-Groot grant led by the University of Amsterdam (PI: *J. Vink*), with University of Amsterdam, NOVA, and University of Groningen as partners.

- **UvA** - software coordination and pointing calibration of the SST cameras (*V. Voitsekhovskiy*)
- **RUG / NOVA** – calibration, qualification, assembly and integration of the focal plane assembly (*C. Duffy, M. Bekema*) and deputy project management (*C. Duffy*)

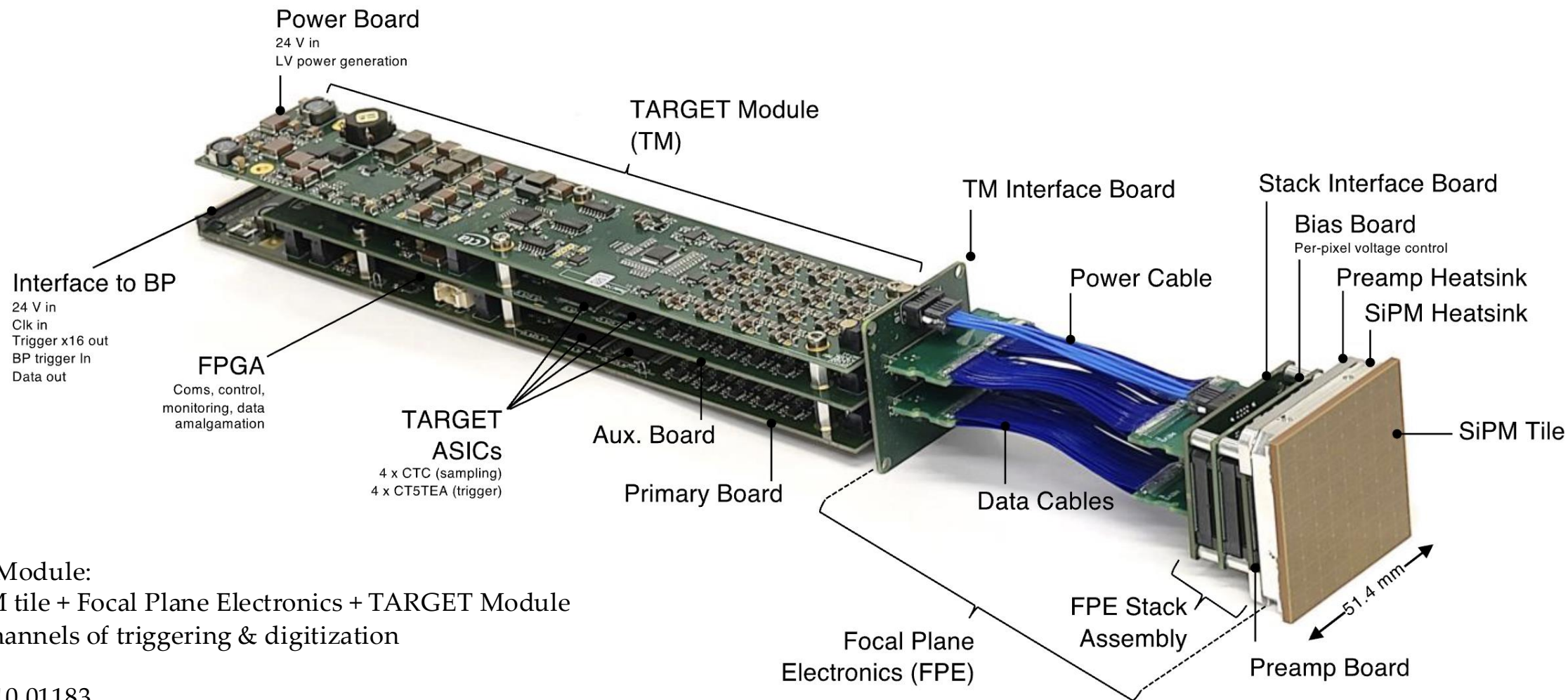


Last Friday, we started to install SiPM tiles onto the camera focal plane in the lab at RUG.





- CTAO will explore the gamma-ray sky from 20 GeV to beyond 300 TeV
- The SST camera combines fast SiPM imaging with nanosecond waveform digitisation
- Dutch groups contribute to software, calibration, and focal-plane integration
- **Status & timeline:** Engineering Camera (ECAMi) nearing completion → system tests May 2026 → on-site tests at CTAO-South Nov 2026 → serial production 2027

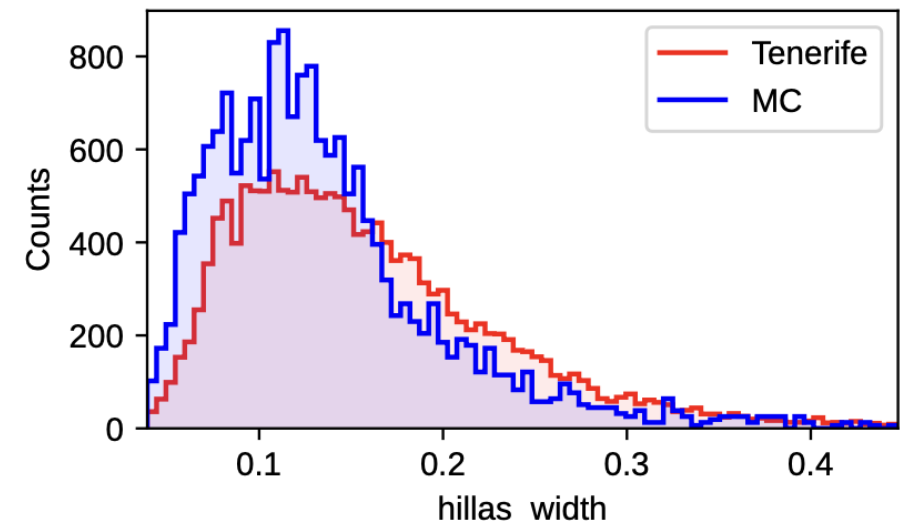
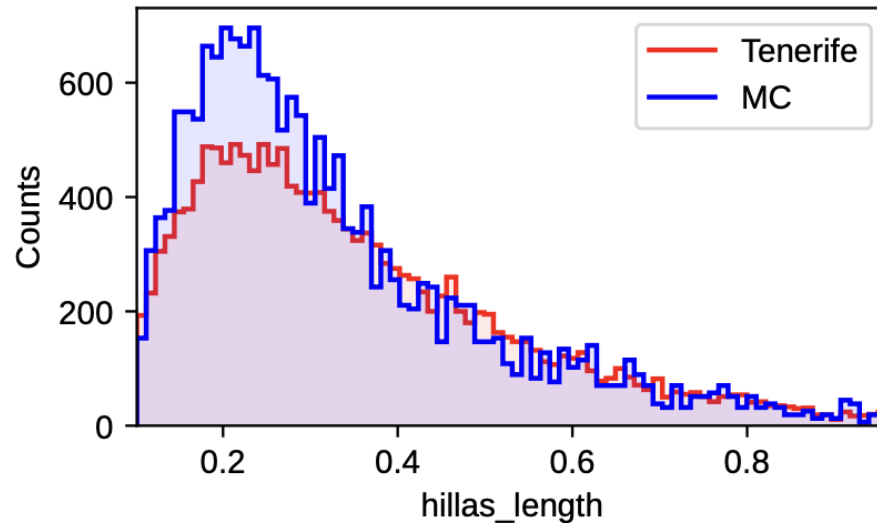
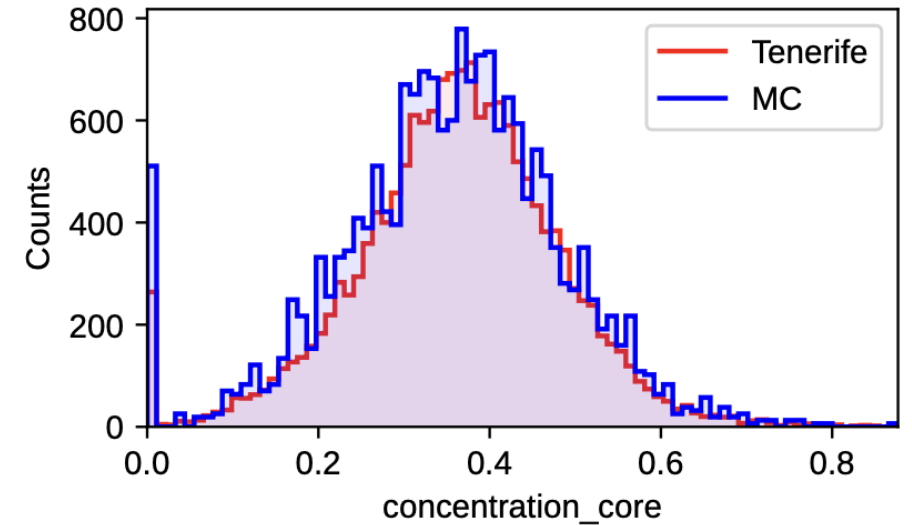
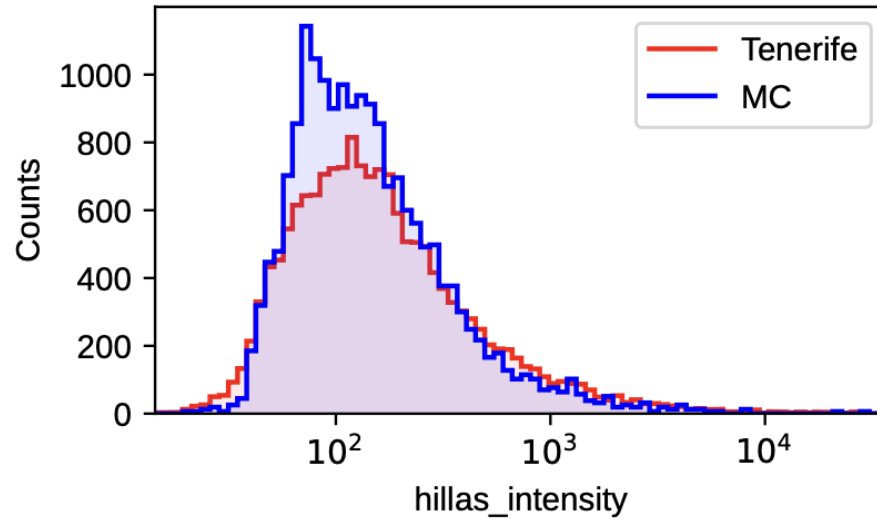


Camera Module:

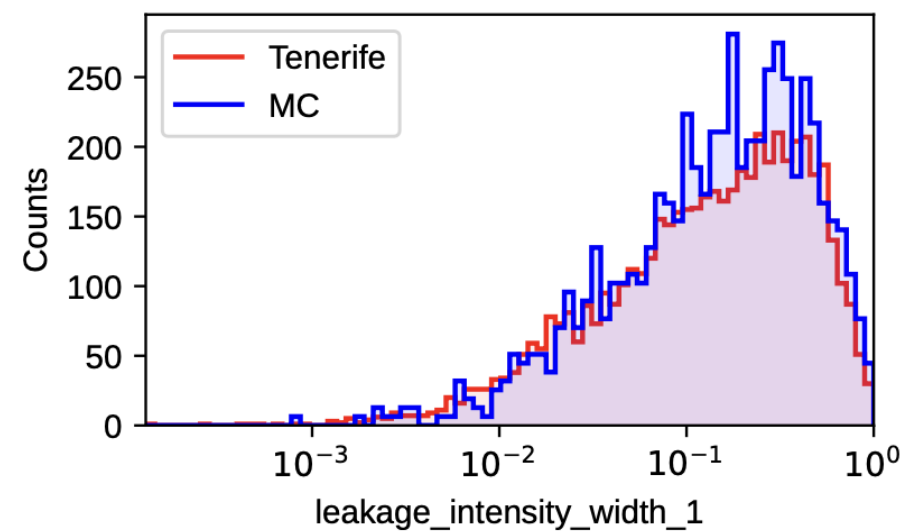
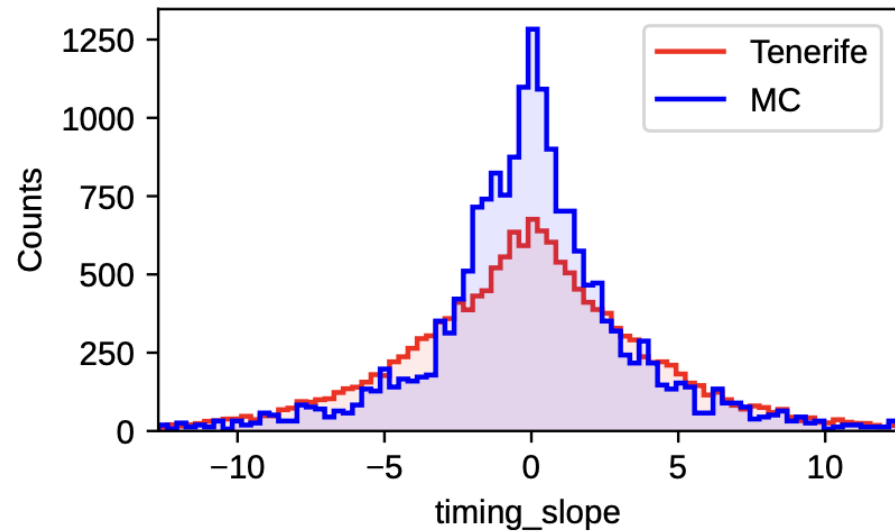
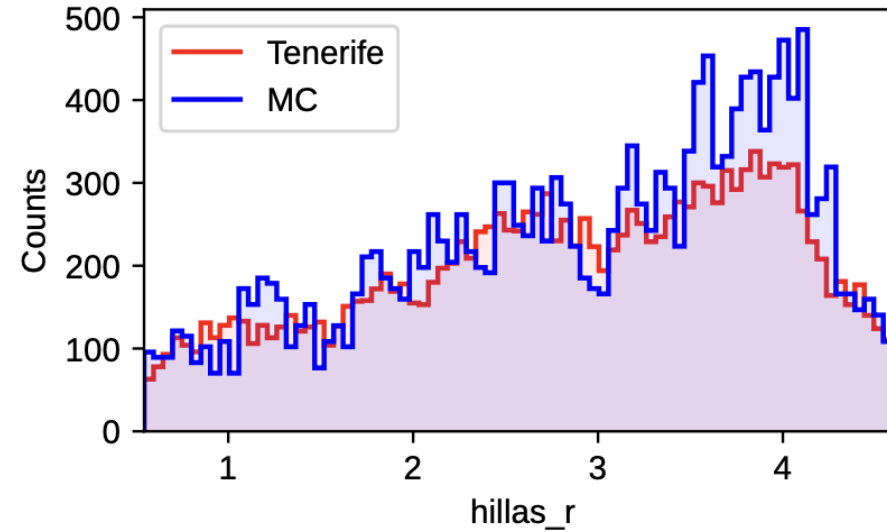
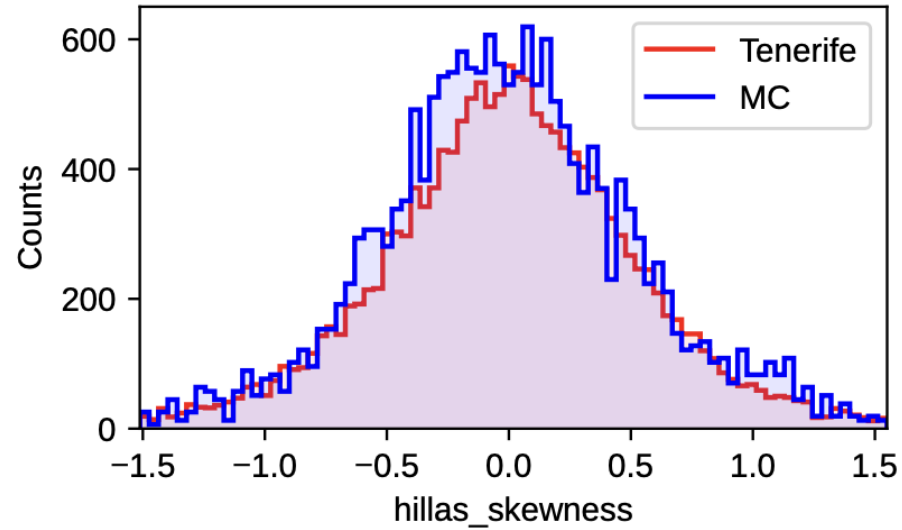
- SiPM tile + Focal Plane Electronics + TARGET Module
- 64 channels of triggering & digitization

arXiv:2310.01183

Comparison of Hillas parameter distribution between data taken by QCAMi on Tenerife and simulations ("MC"). The simulated data is scaled to match observation time, and scaled by 1.5× to estimate the full cosmic ray spectrum.



Simulation vs Real Data comparison pt.2



SST Camera Design

