Low-cost FD array for GCOS

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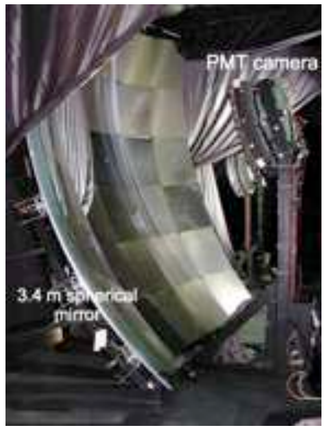
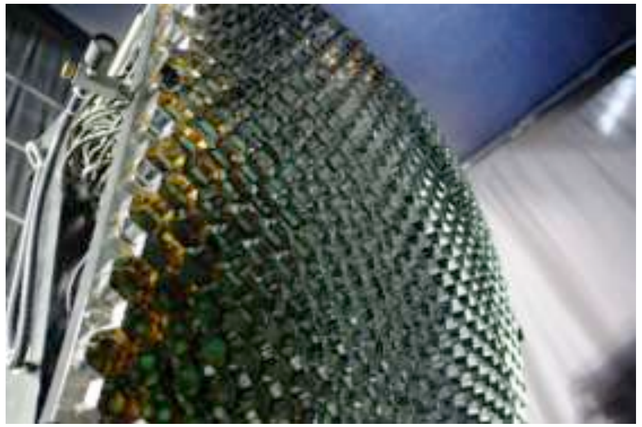
EAST Fluorescence detector Array of Single-pixel Telescopes

EAST: Fluorescence detector Array of Single-pixel Telescopes

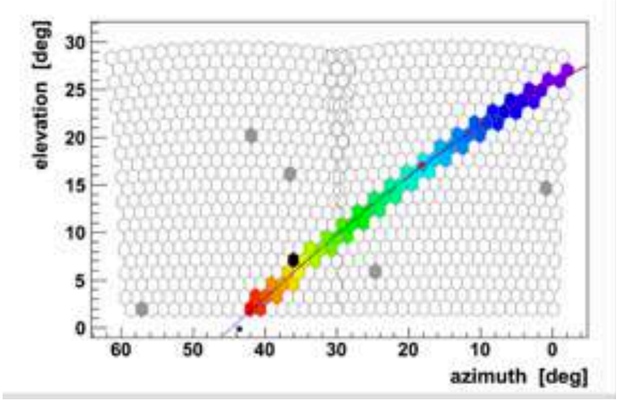
- **Target : > $10^{19.5}$ eV, ultrahigh-energy cosmic rays and neutral particles**
- **Huge target volume ⇒ Fluorescence detector array**

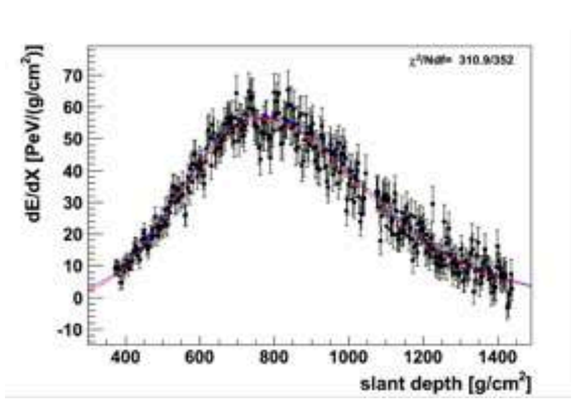
Fine pixelated camera



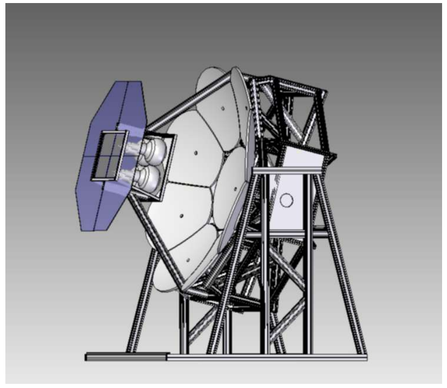


Too expensive to cover a huge area

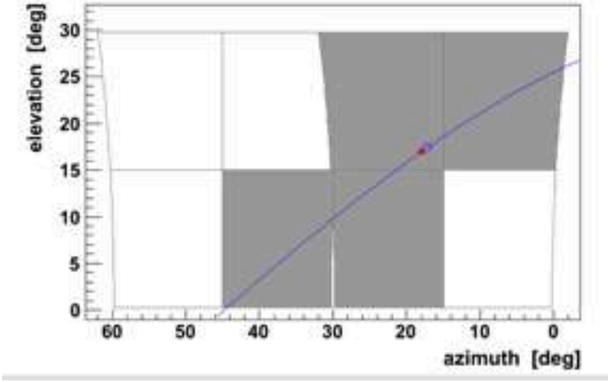


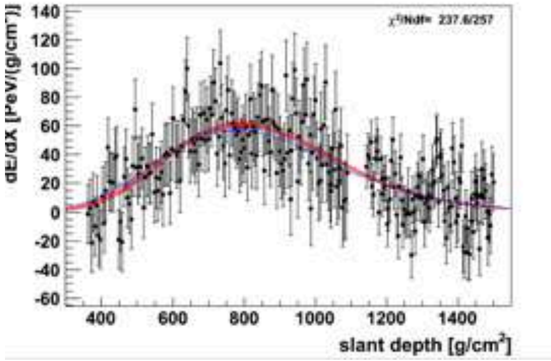


Smaller optics and single or few pixels



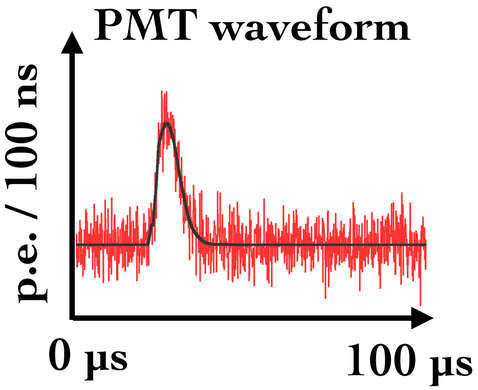
Low-cost and simplified telescope

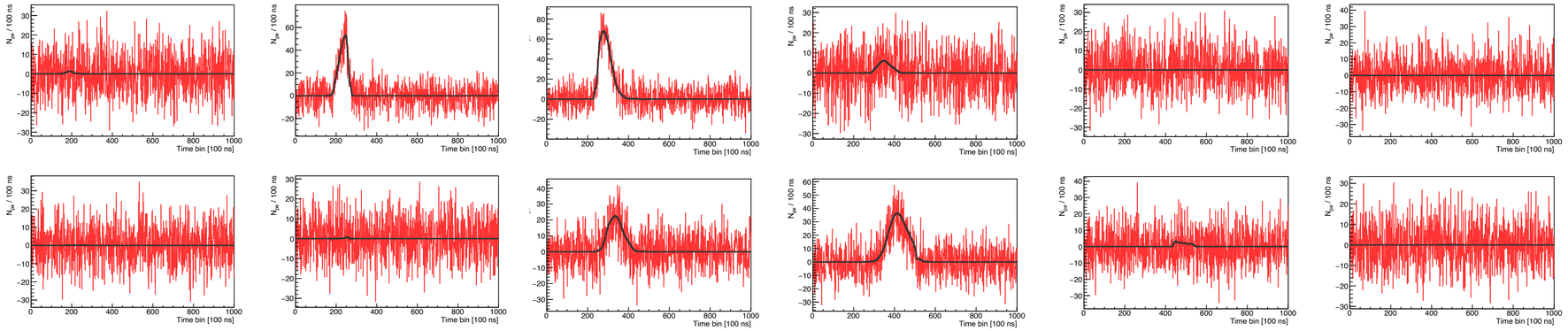


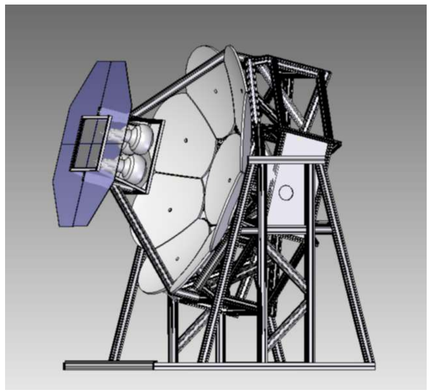


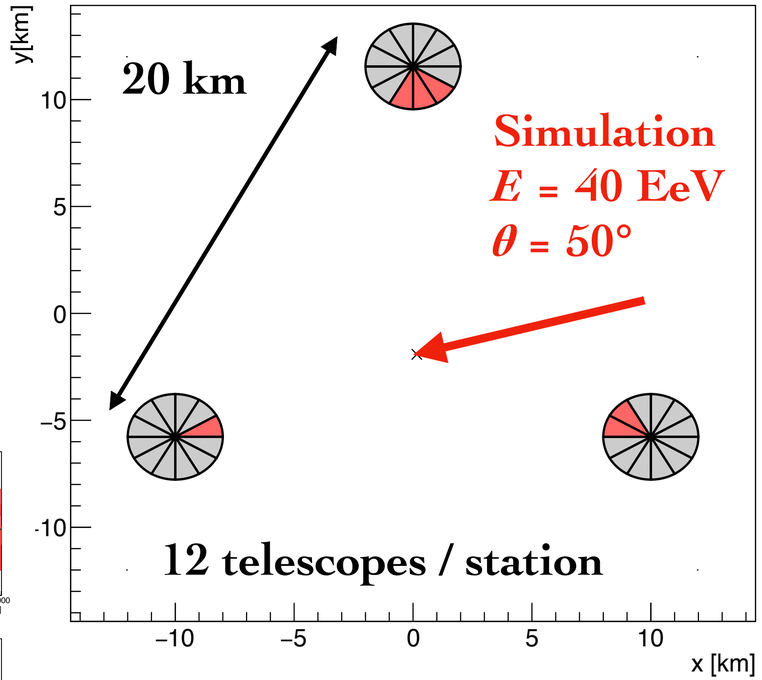
FAST Fluorescence detector Array of Single-pixel Telescopes

Fluorescence detector Array of Single-pixel Telescopes





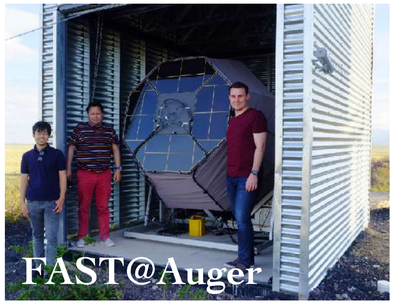


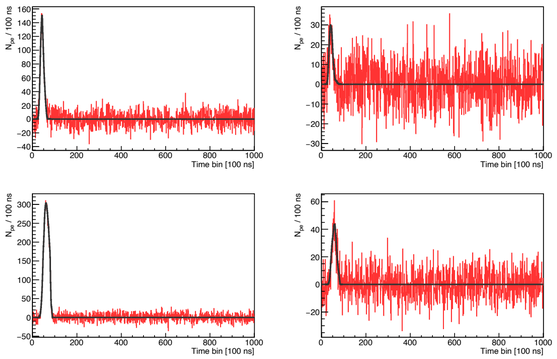


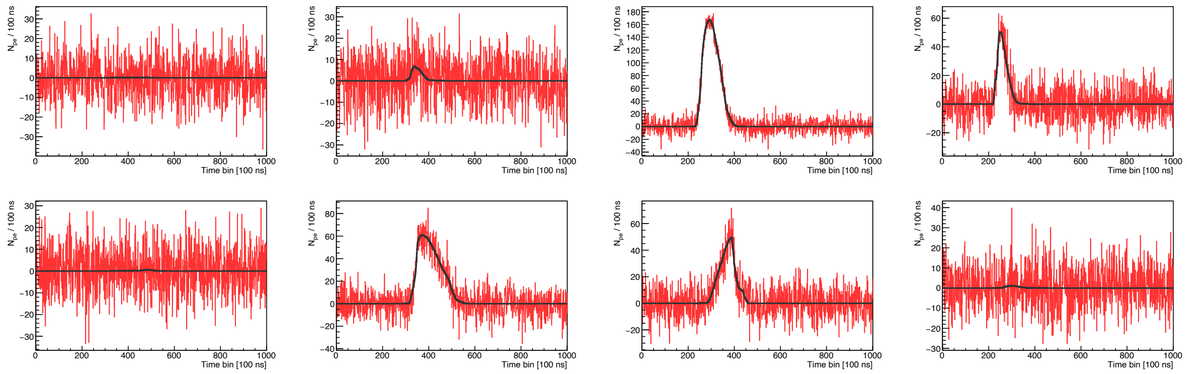
500 stations

→ **150,000 km²**

FAST telescope: 4 PMTs (20 cm diameter), 1 m² aperture (UV filter) Segmented mirror in 1.6 m diameter







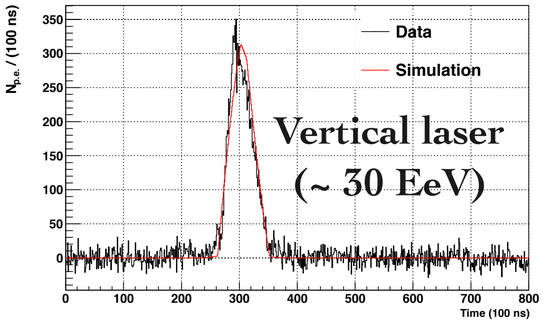
Field measurements to validate the FAST concept

Fluorescence detector Array of Single-pixel Telescopes

Feb. 2012

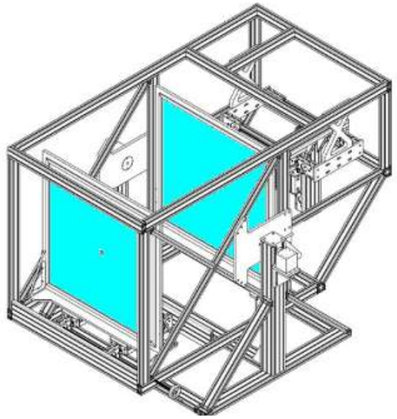
A conceptual design for a large ground array of Fluorescence Detectors

P. Privitera in UHECR 2012



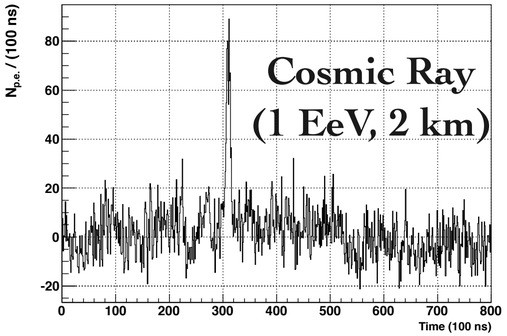
T. Fujii et al., Astroparticle Physics *74* (2016) 64-72

Apr. 2014



EUSO-TA optics
+
Single-pixel camera

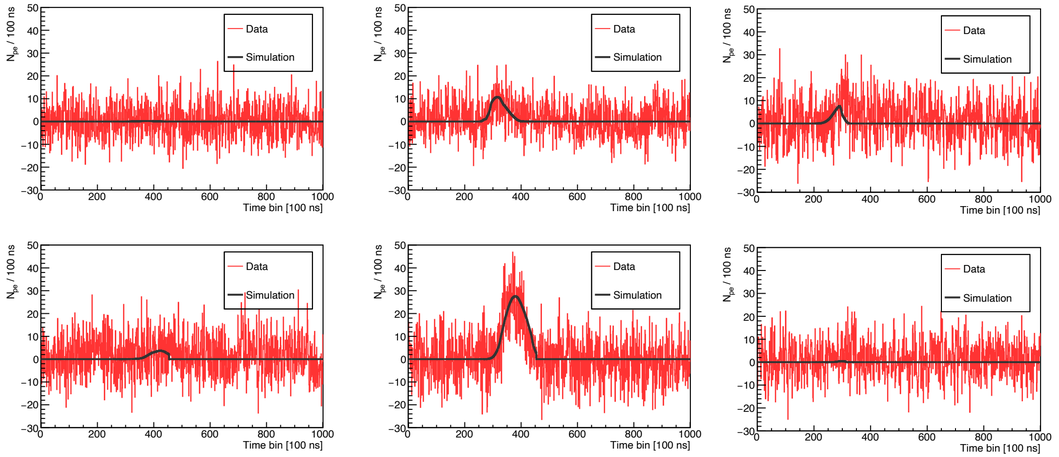
Oct. 2016

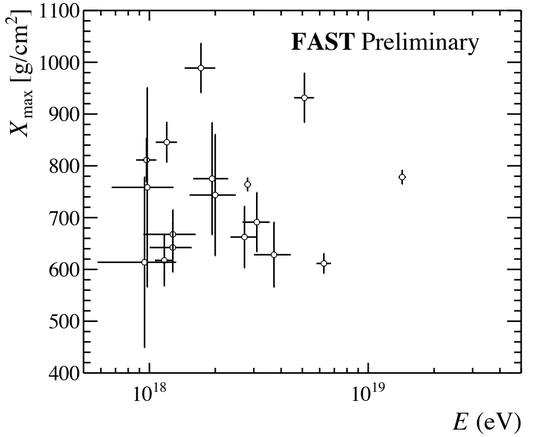


Sep. 2017

Oct. 2018

@TA





Apr. 2019

@Auger

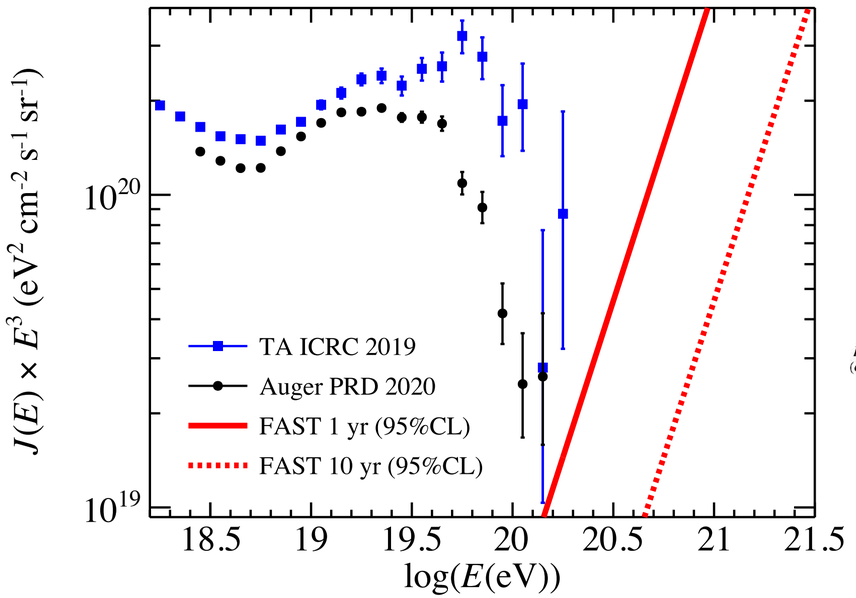
D. Mandat et al., JINST 12, T07001 (2017)

Measured signal: 18.8 EeV, 808 g/cm^2

T. Fujii et al., PoS (ICRC2021) 291 (2020)

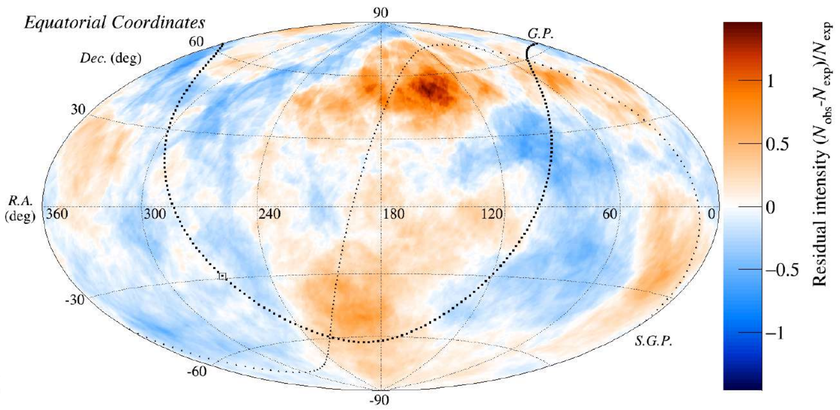
Brain-storming for possible GCOS detector

- **Low-cost FD array for sizable exposure at the highest energies**
  - Effective area: ~ 30,000 km^2
  - 100% efficiency above 20 EeV
  - **ΔE: 8%, ΔX_{max}: 30 g/cm^2 (Δ ln$A$ ~ 1)**
- **Dense and precise SD array for the highest photon search**
  - Photon search **at 1 EeV**
    - **10^{-5} γ/hadron separation** required
  - Multi-messenger synergies

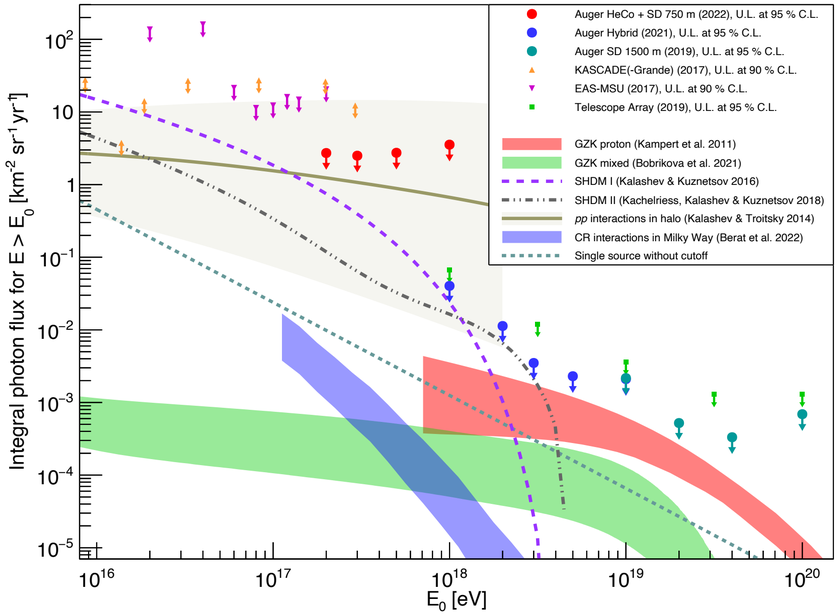


FAST collaboration, PoS (ICRC2021) 291 (2020), arXiv: 2107.02949

×10 statistic anisotropy search with mass composition of X_{max}



Integral photon flux limit



Pierre Auger collaboration, ApJ 933:125 (2022), arXiv: 2205.14864