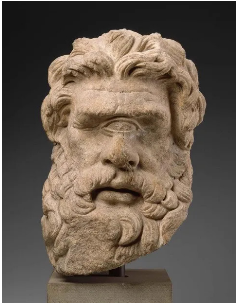
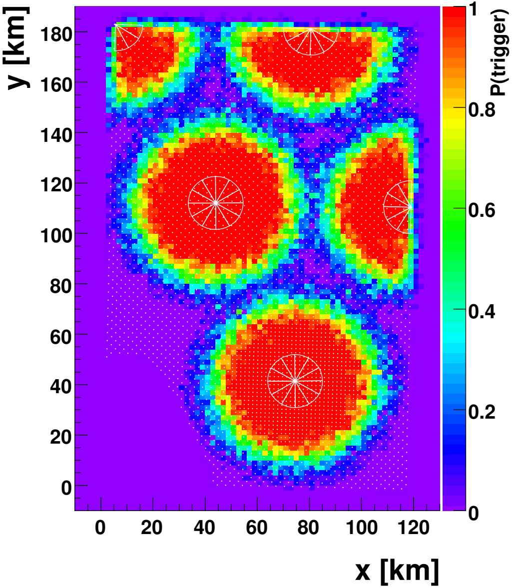
Cyclops Design For GCOS

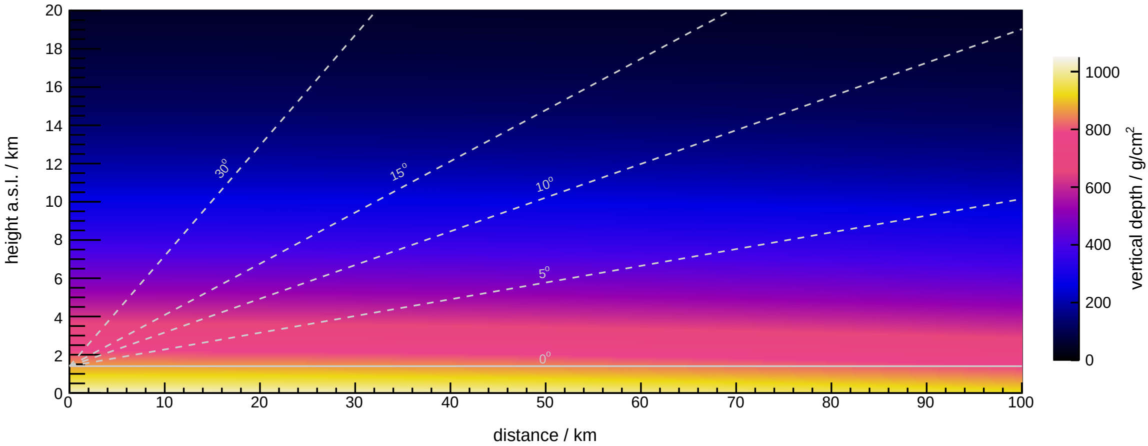
- one or few 360 degree ("Cyclops") FD sites
- single point of maintenance & operation
- high-quality maximum viewing distance (Auger South FD APP 34 (2011) 368):
  - $R_{\mathrm{max}} \approx 30$ km at 10^{19} eV
  - $R_{\mathrm{max}} \approx 45$ km at 10^{20} eV



cyclopes at Auger North, 10^{19} eV:

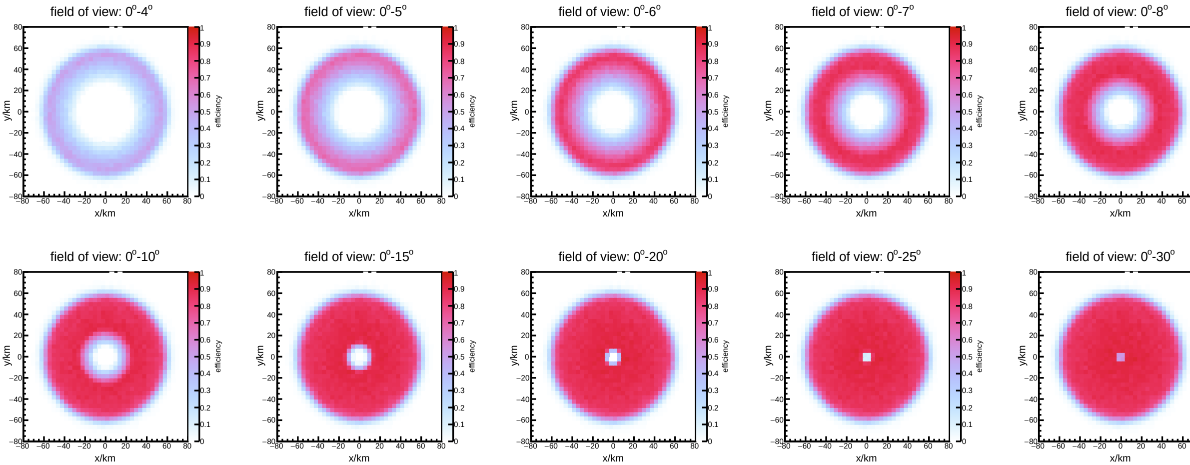


FD Field of View



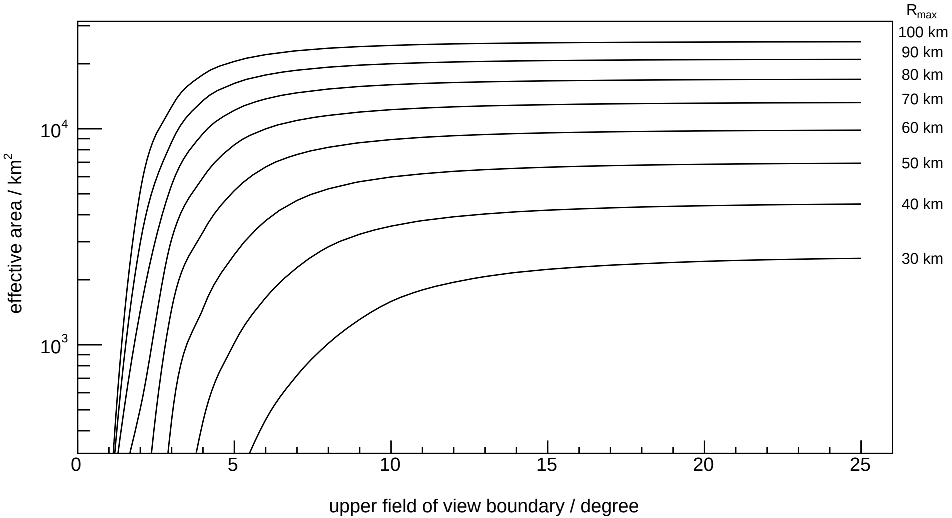
Important range at UHE: $X_{\max} \in (700, 900)$ g/cm^2 (slant depth!)

FD Field of View



Cut on viewable range $X_{\text{low}} < 700$, $X_{\text{up}} > 900$ g/cm^2

Effective Area vs. Upper Field of View Boundary



small field of view needed at UHE (large R_{max}), $\alpha_{\mathrm{max}} \lesssim 10^\circ$

GCOS Cyclops FD: Small Elevation Range, Large Area, Small Pixels

e.g. MACHETE Design J. Cortina et al. APP (2016) 46

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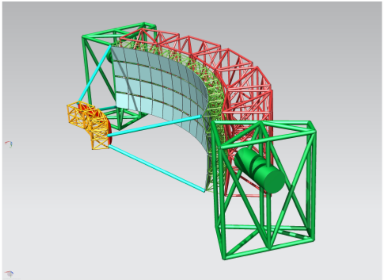

Figure 7: Proposed optics for *Trinity* based on the MACHETE optics. The primary mirror is composed of 68, 1 m^2 mirrors. the focal plane (red curved surface) is populated with 3,300 pixels each consisting of a solid non-imaging light concentrator coupled to an SiPM. The field of view covered by one telescope is $5^\circ \times 60^\circ$.

- 2 MACHETE rings $\rightarrow 360^\circ \times 10^\circ$ FoV
- cost: $\sim$ 10 M$ Trinity whitepaper arXiv:1907.08727
- 0.3° pixel, effective aperture 10 m^2
- $(S/N)_{\mathrm{FD}} \propto \sqrt{A/\Omega_{\mathrm{pix}}} \rightarrow (S/N)_{\mathrm{Cyclops}}/(S/N)_{\mathrm{Auger}} = \sqrt{10\ \mathrm{m}^2/0.3^{\circ 2}} \Big/ \sqrt{3\ \mathrm{m}^2/1.5^{\circ 2}}$ = **9**

$\rightarrow$ optimization for GCOS needed & check dual use ν+UHECR