

Getting to the high energy end (?) around 100TeV

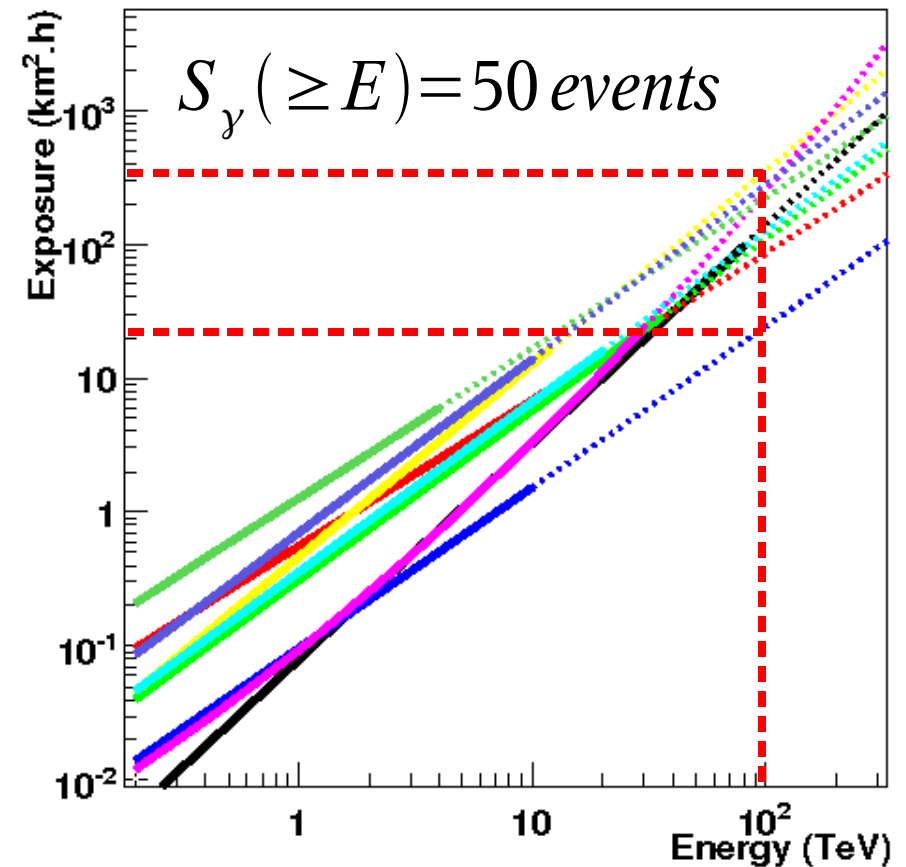
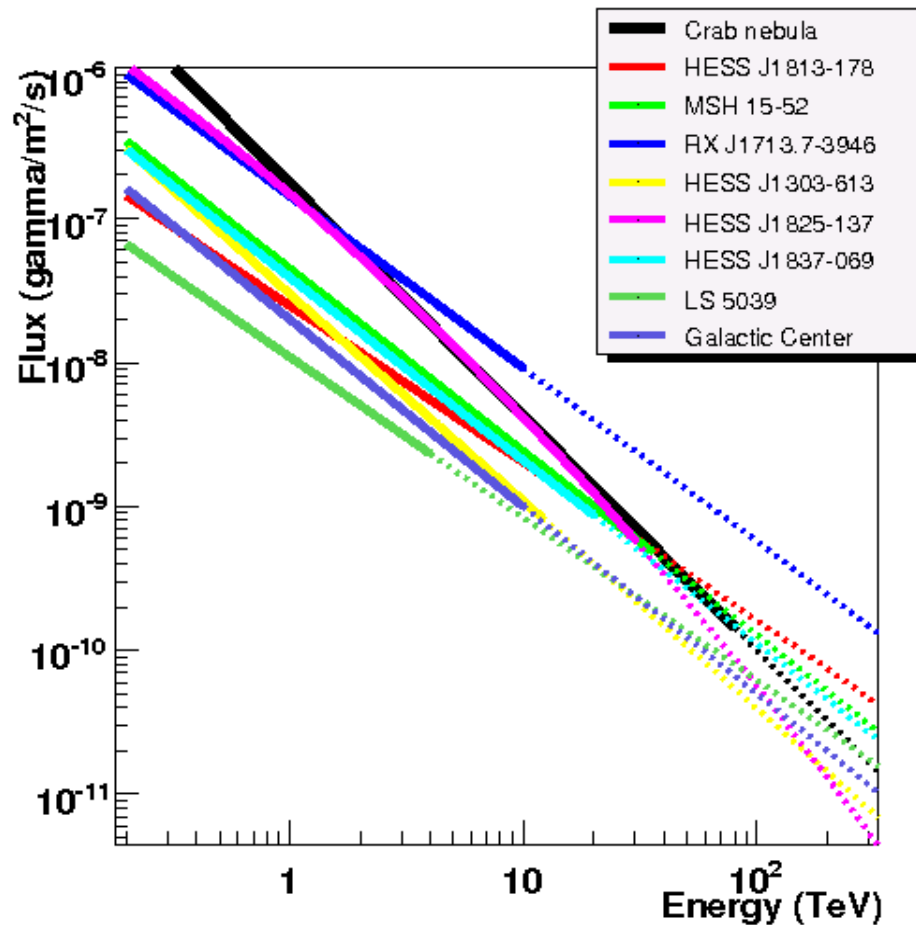
Stephan LeBohec and Pierre Colin

*Locating PeV Cosmic-Ray Accelerators:
Future Detectors in Multi-TeV Gamma-Ray Astronomy*

Adelaide, December 6-8 2006

$$\delta S_{\gamma}(E) = A_{\gamma}(E) \times \tau_{obs} \times \frac{d\Phi}{dE} \delta E$$

Exposure



$$\text{Need } A_{\gamma} \times \tau_{obs} > \sim 100 \text{ km}^2 \cdot \text{h}$$

For Cosmic Ray background dominated data:

$$\frac{S_{\gamma}}{\sqrt{B_{CR}}} = \sqrt{\frac{A_{\gamma} \times \tau_{Obs}}{\Omega}} \times \frac{\epsilon_{\gamma}}{\sqrt{\epsilon_{CR}}} \times \frac{\Phi_{\gamma}}{\sqrt{\Phi_{CR}}} > \sim 5$$

For Cosmic Ray background dominated data:

Maximize that:

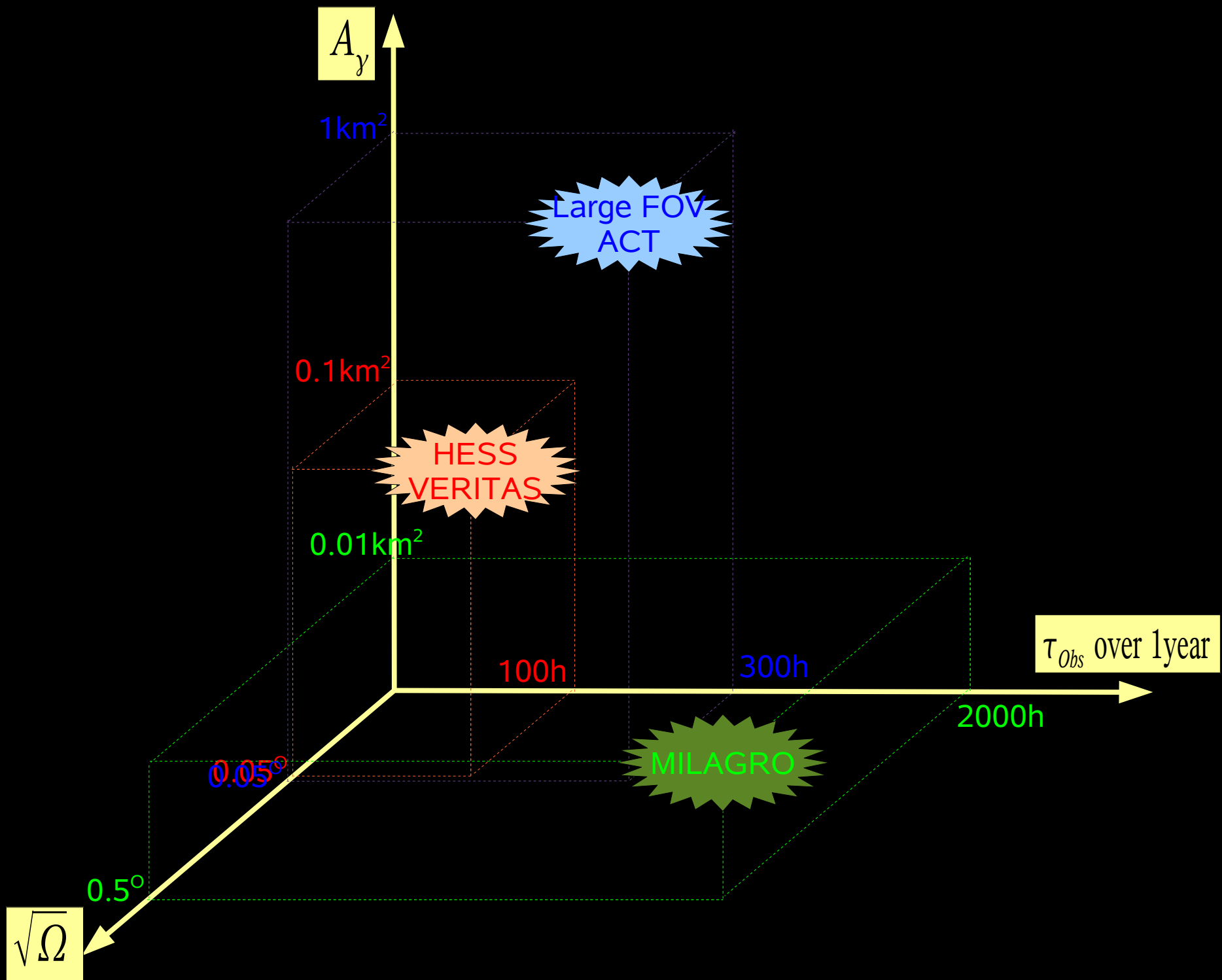
$$\sqrt{\frac{A_\gamma \times \tau_{Obs}}{\Omega}} \times \frac{\epsilon_\gamma}{\sqrt{\epsilon_{CR}}}$$

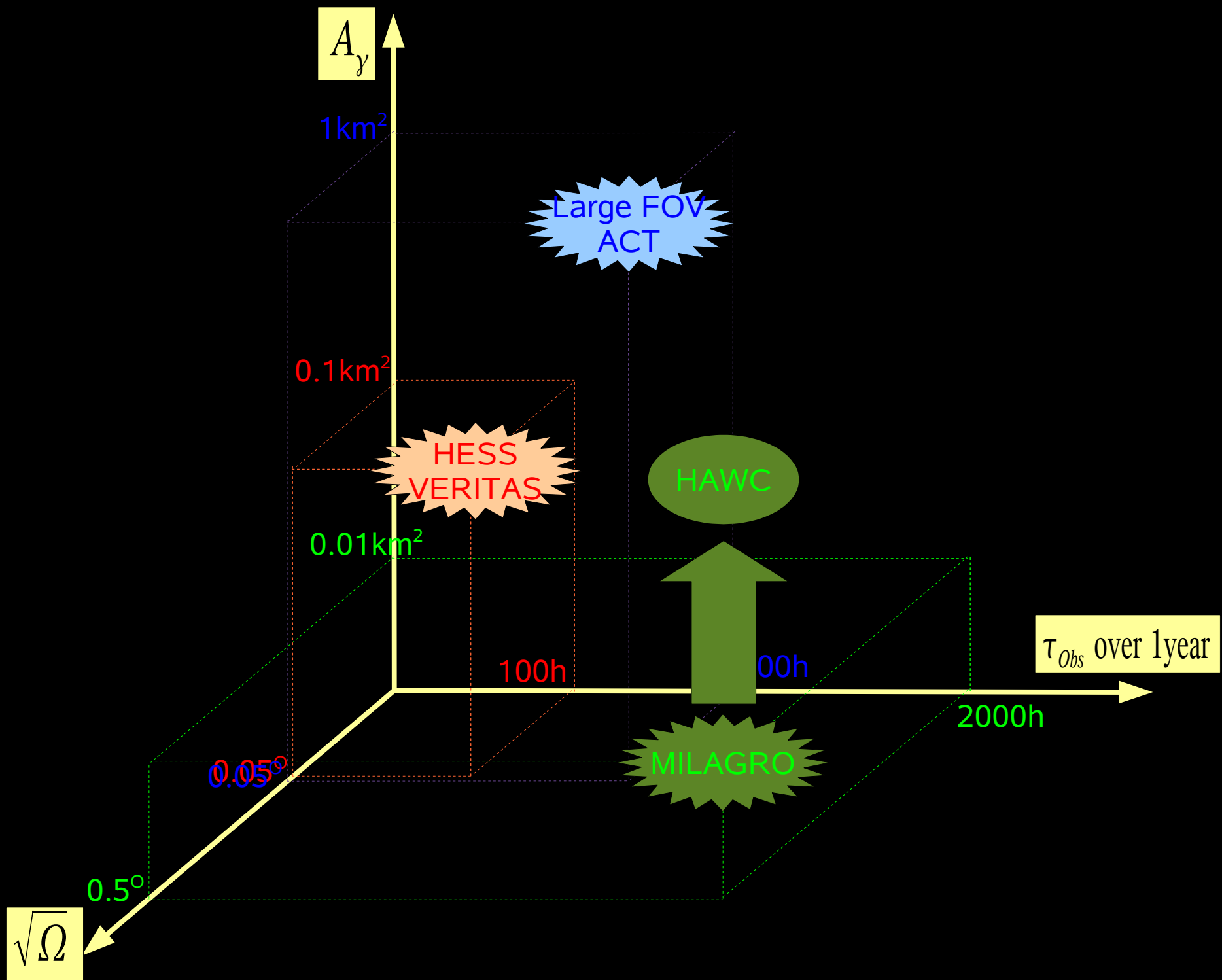
Four parameters...

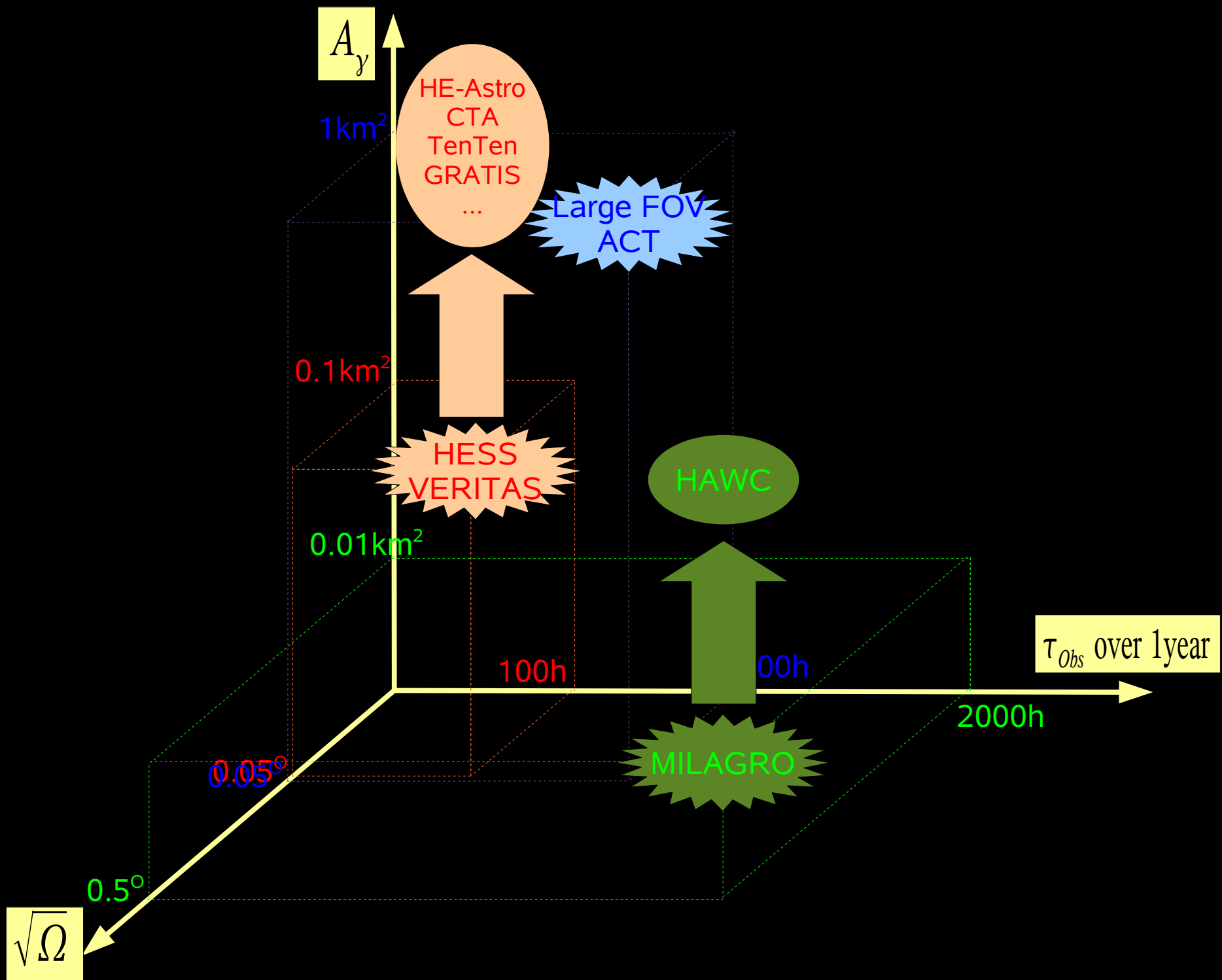
-> ...At least three directions

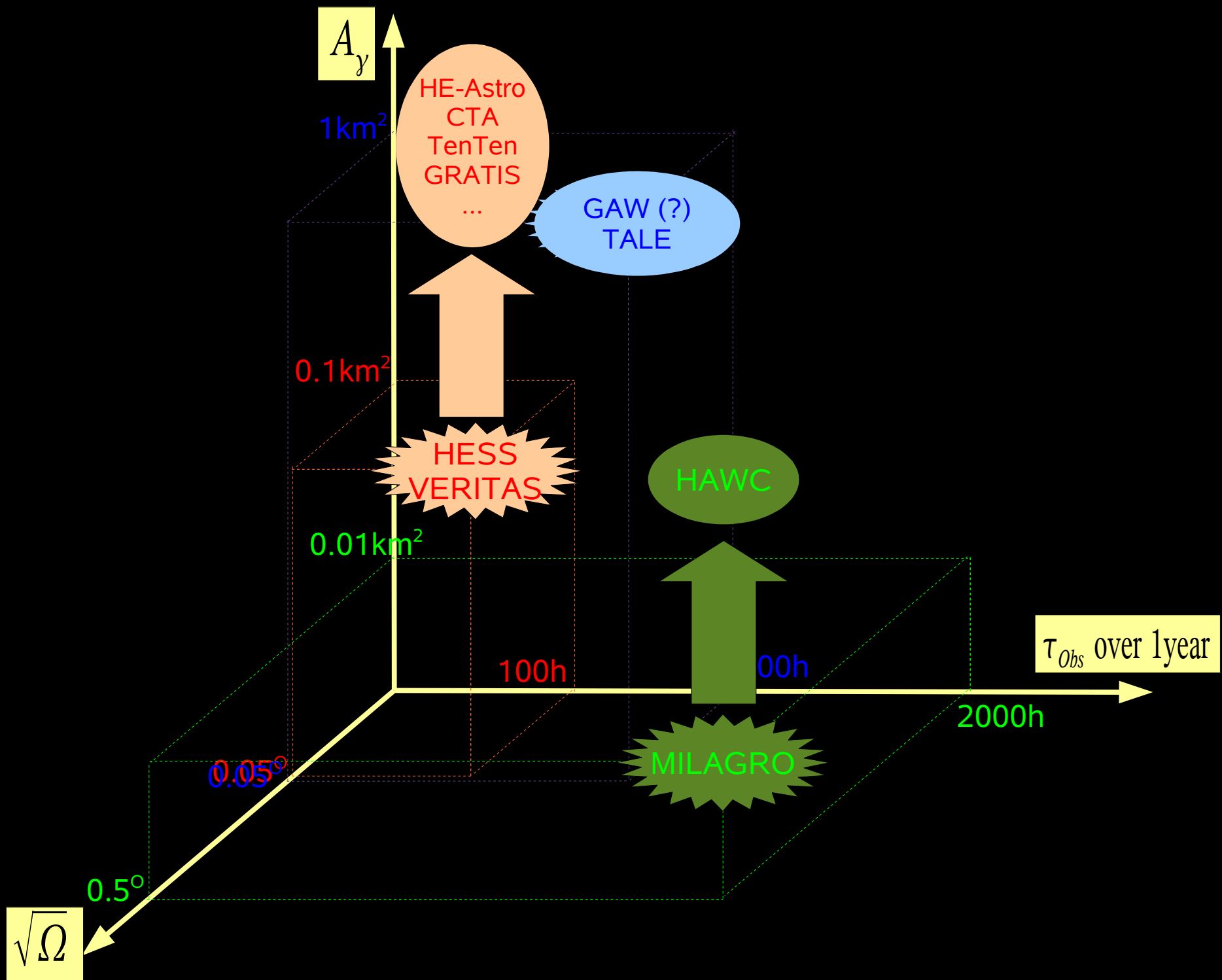
Two messengers:

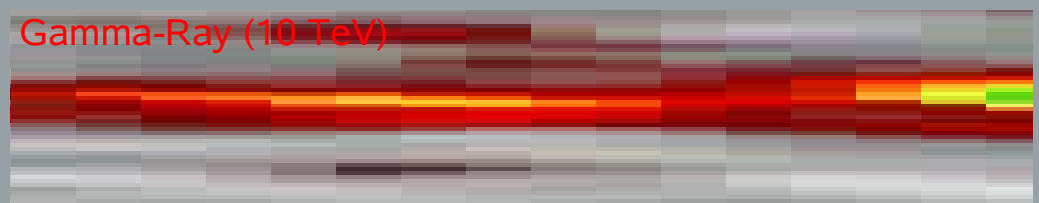
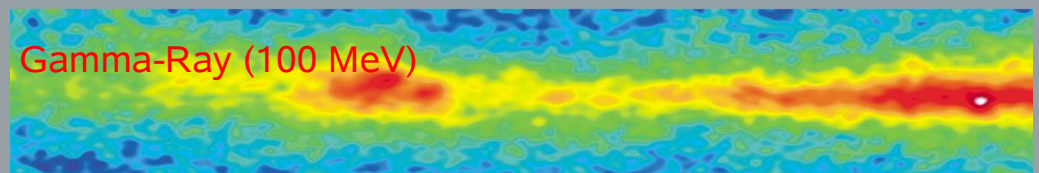
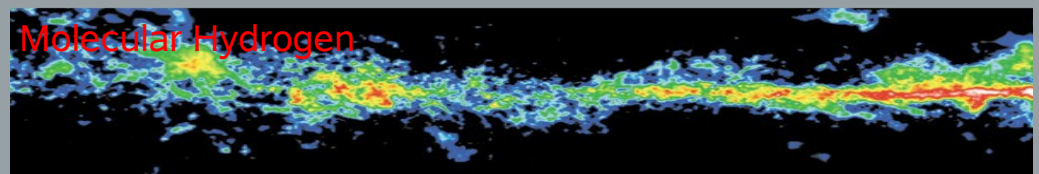
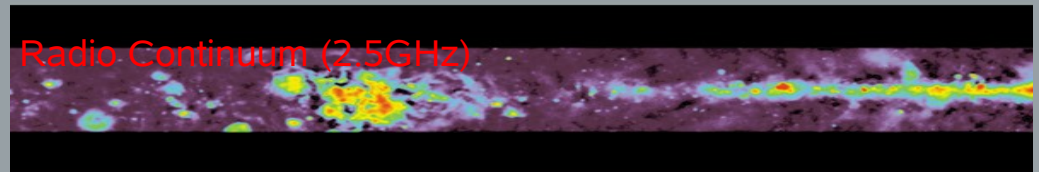
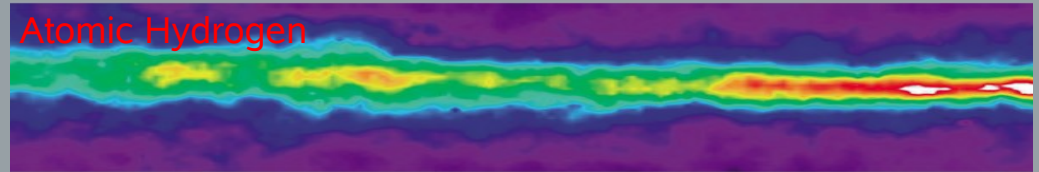
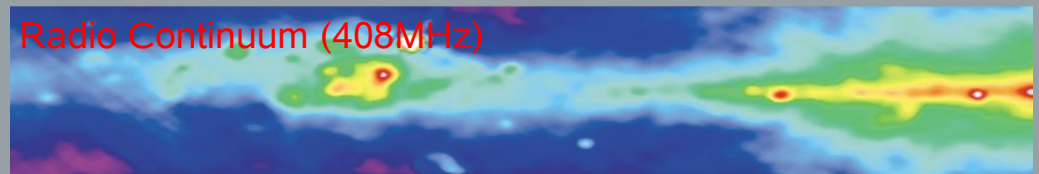
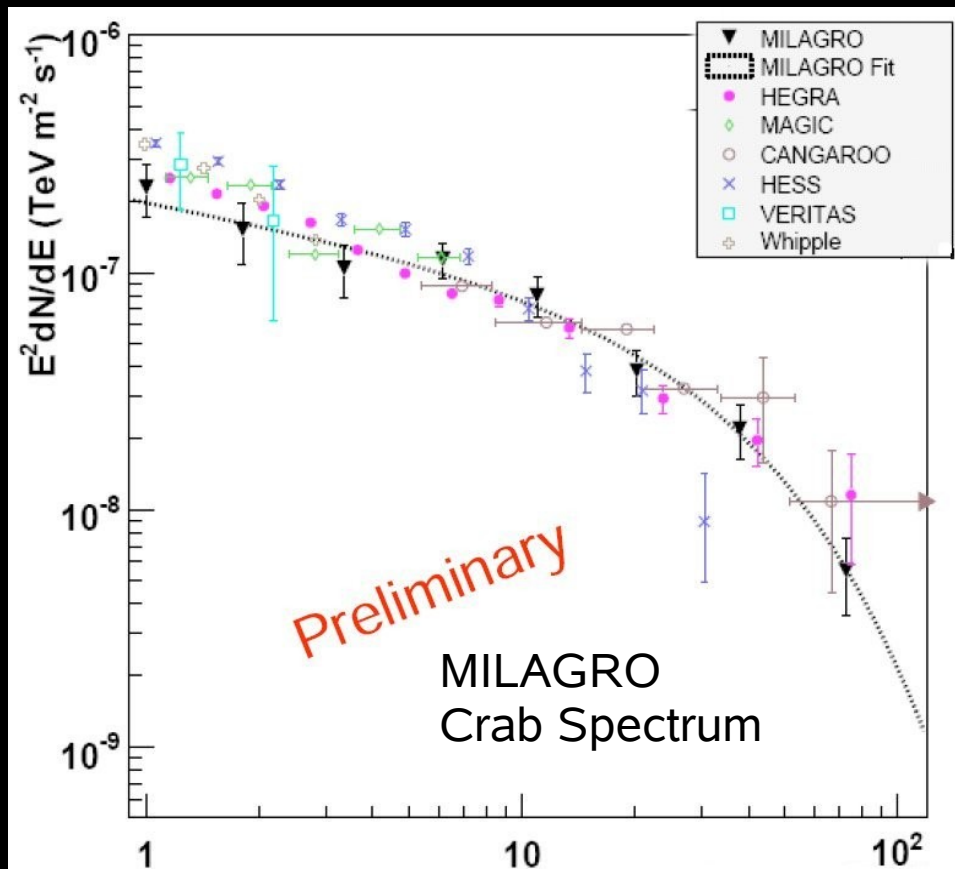
Charged particles and Cherenkov light

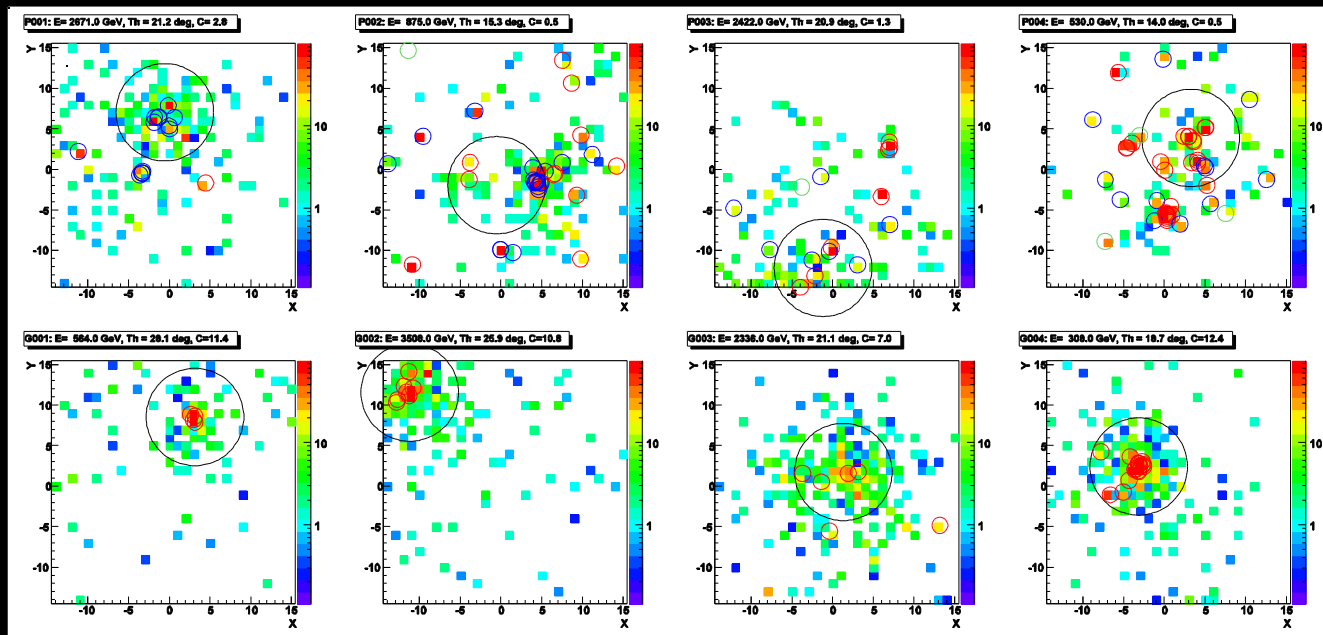
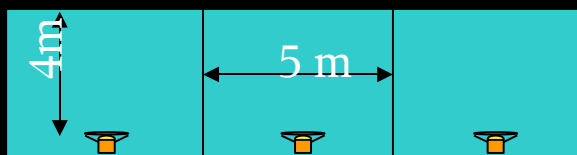
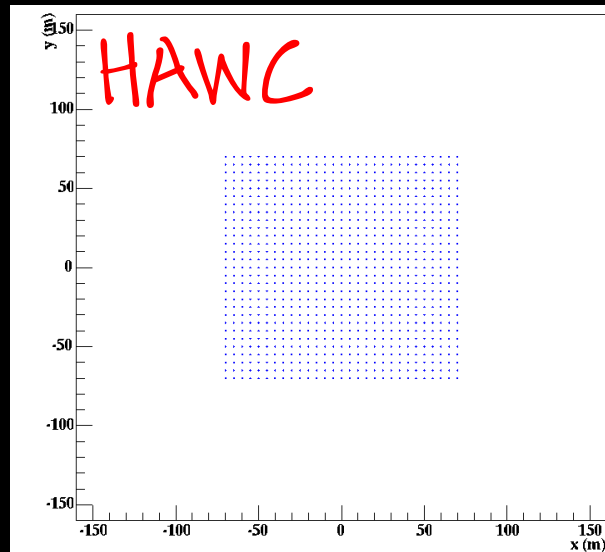




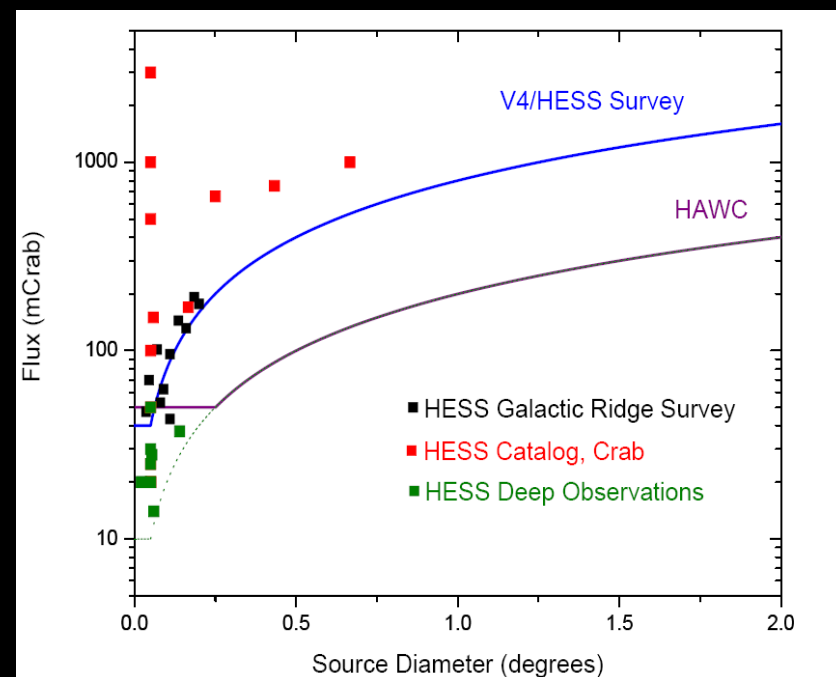
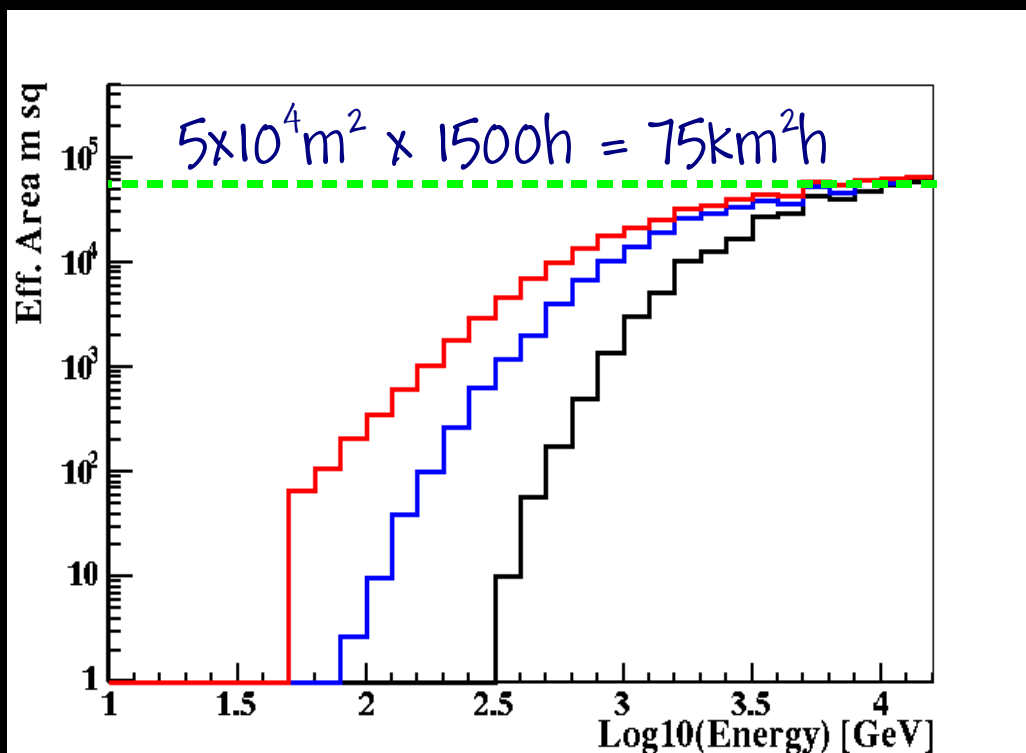








Angular resolution $\sim 0.25^\circ$

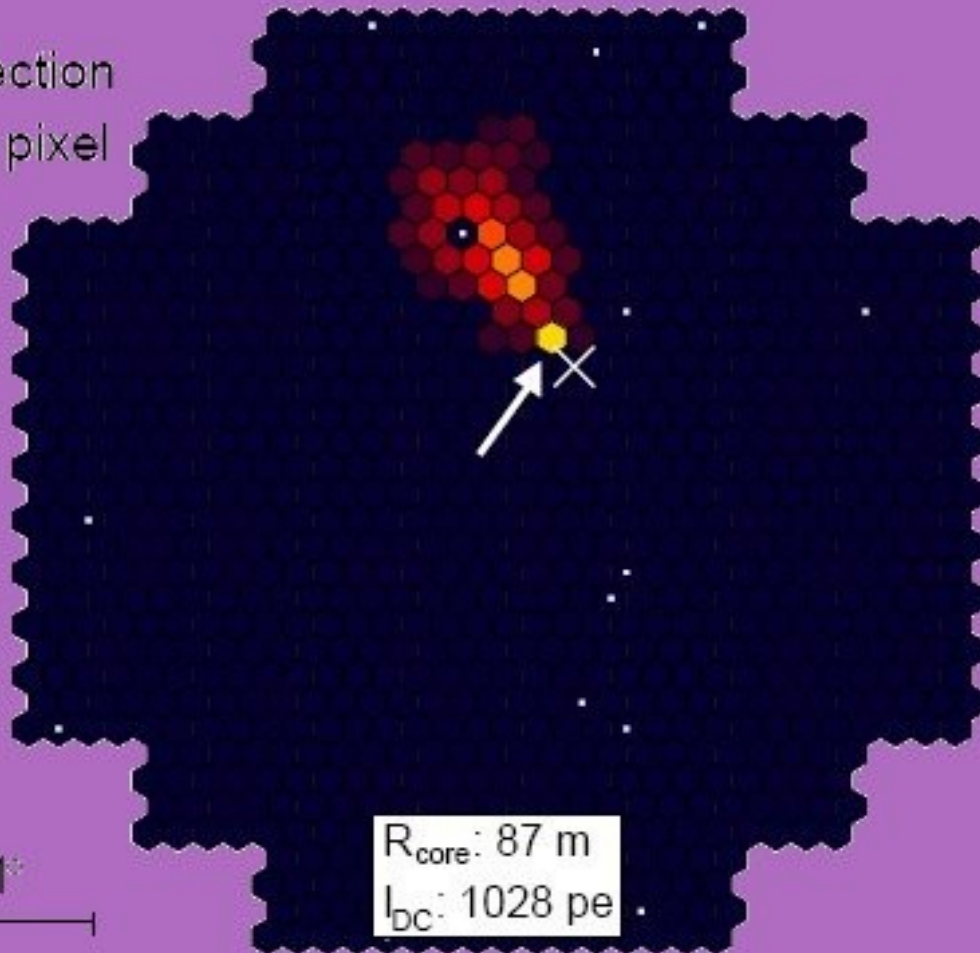


The Power of Imaging (Le Choque des photos)

H.E.S.S.



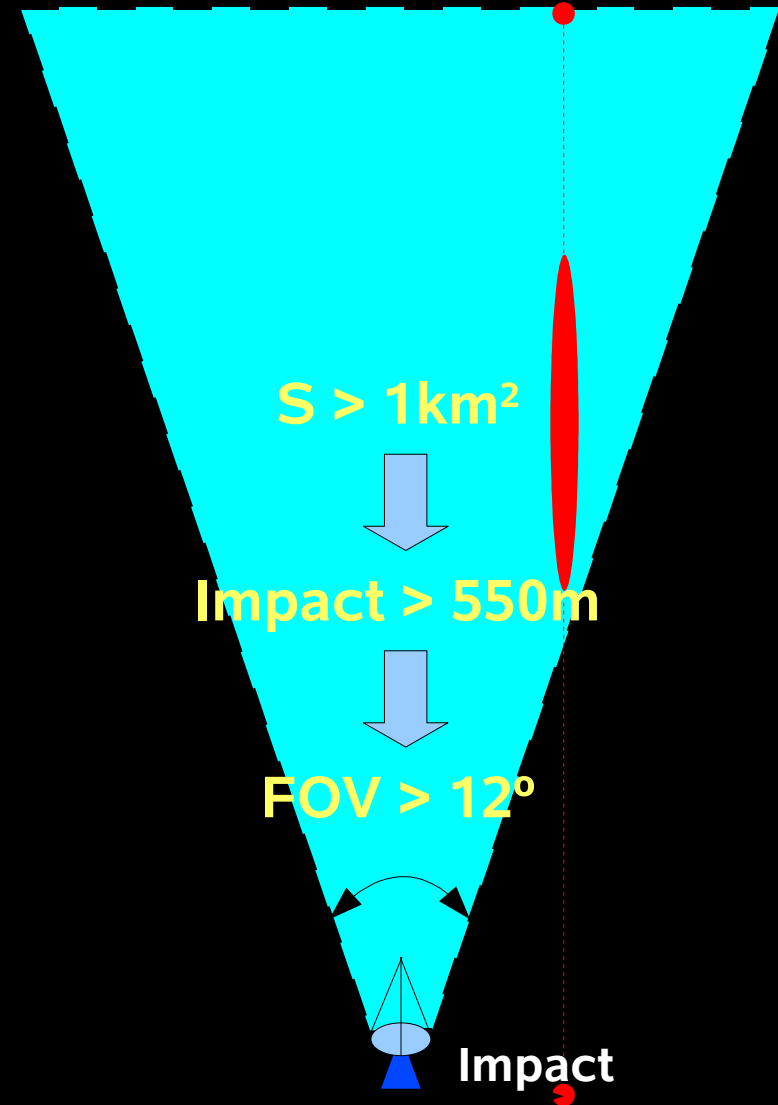
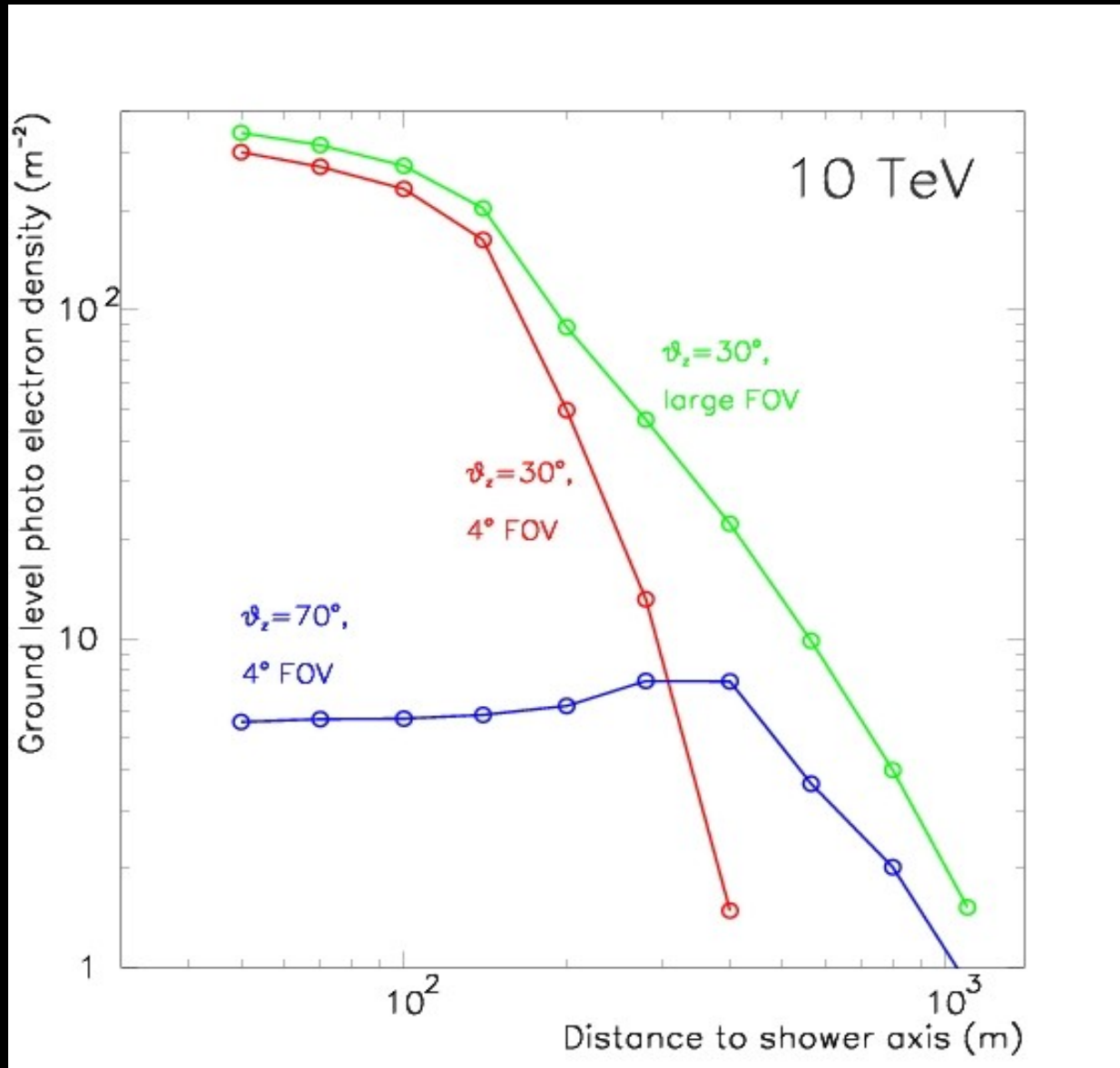
× direction
▪ Off pixel



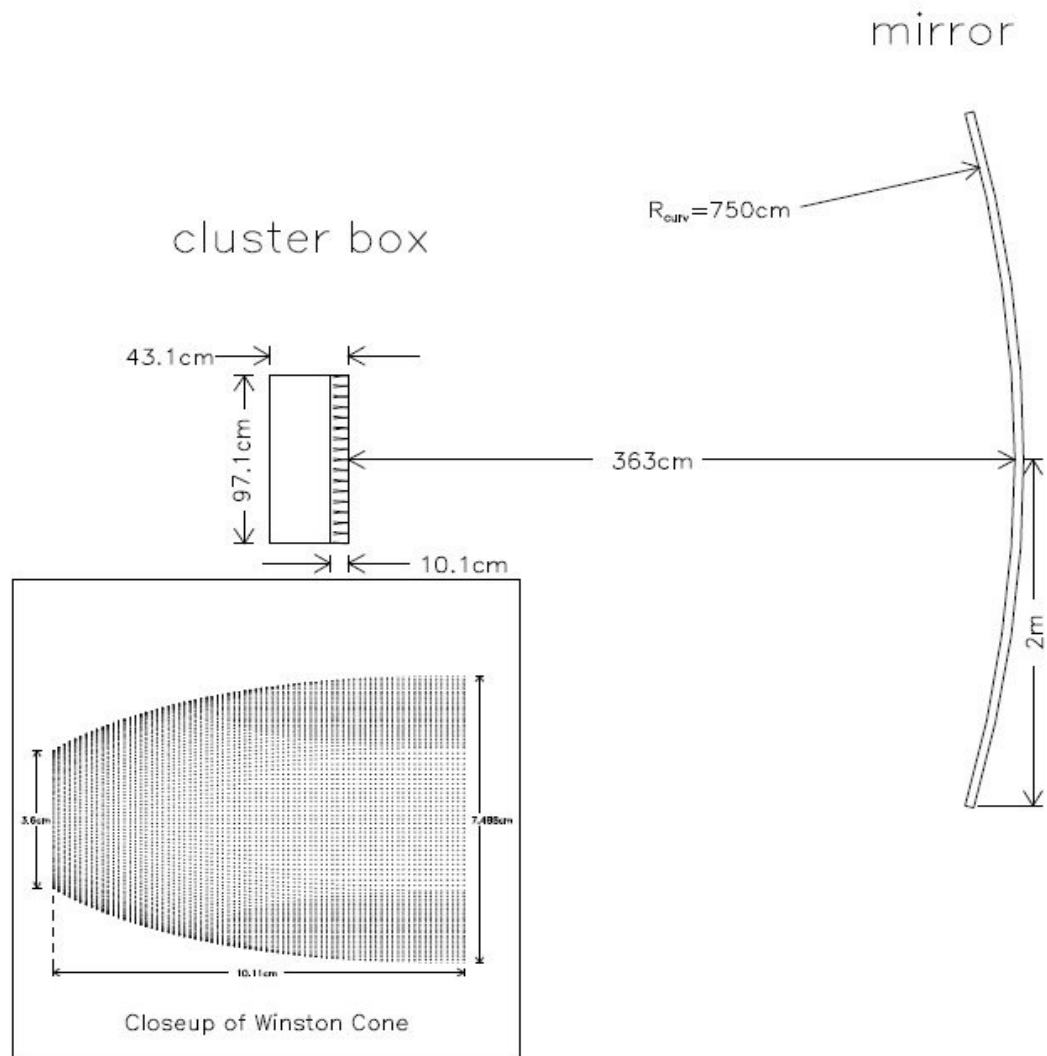
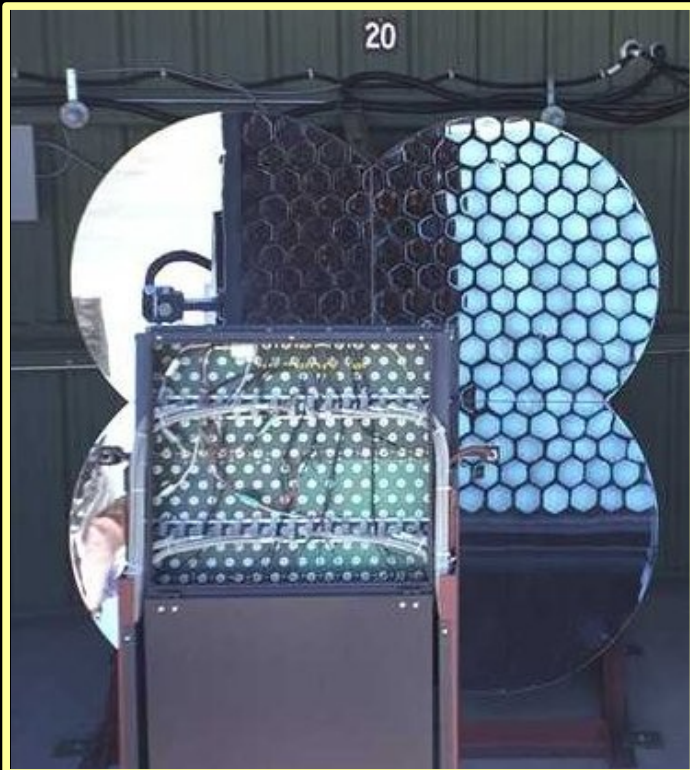
and also:
VERITAS,
MAGIC,
CANGAROO
MACE
GAW

...

IACT 100-300 hours/year

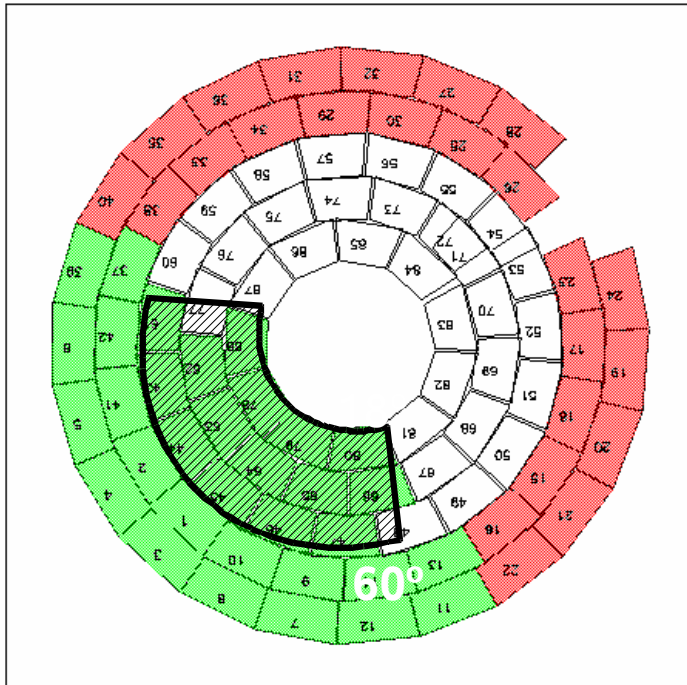


Telescope Array Low Energy Extension

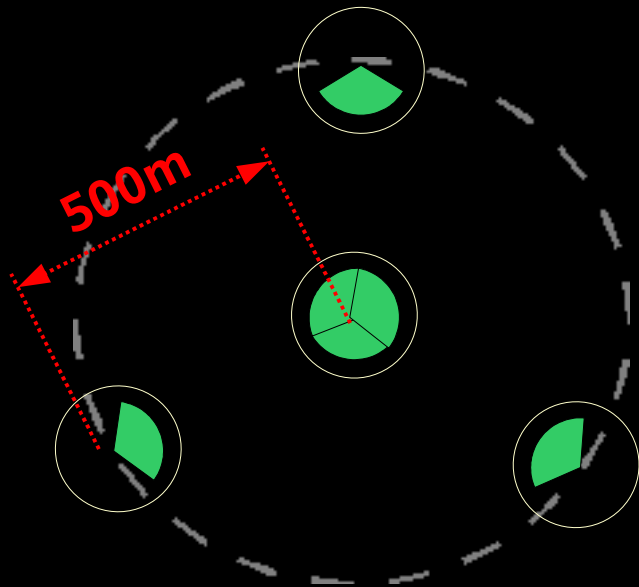
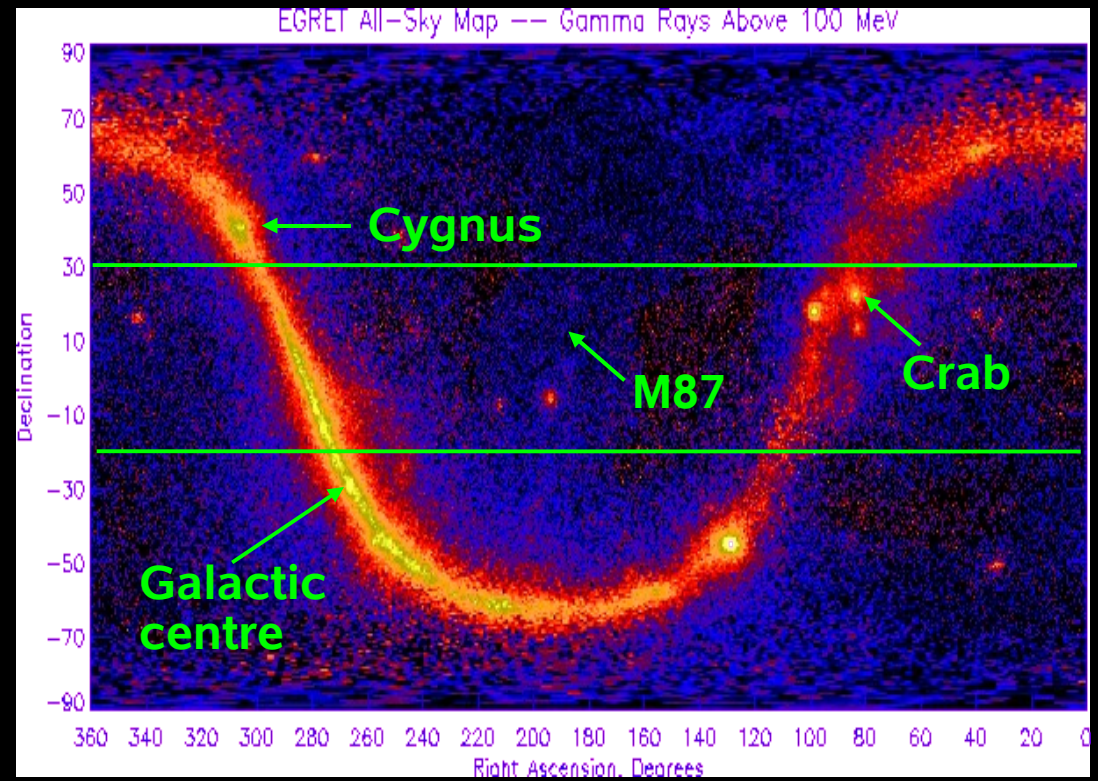


HIRES Camera: FOV = $16^\circ \times 16^\circ$
256 pixels of 1°

Delta, Utah, ~1,400m a.s.l.



5-Ring Mirror Configuration

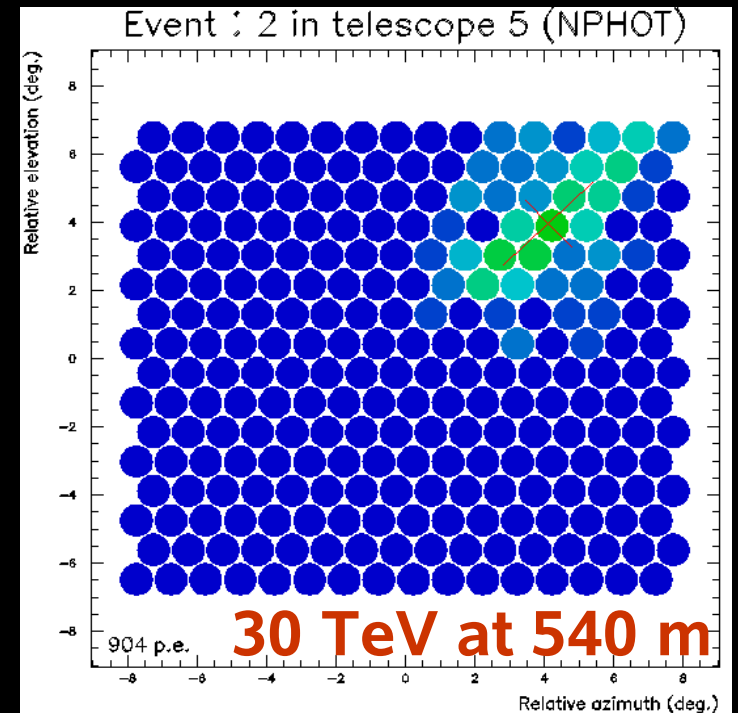
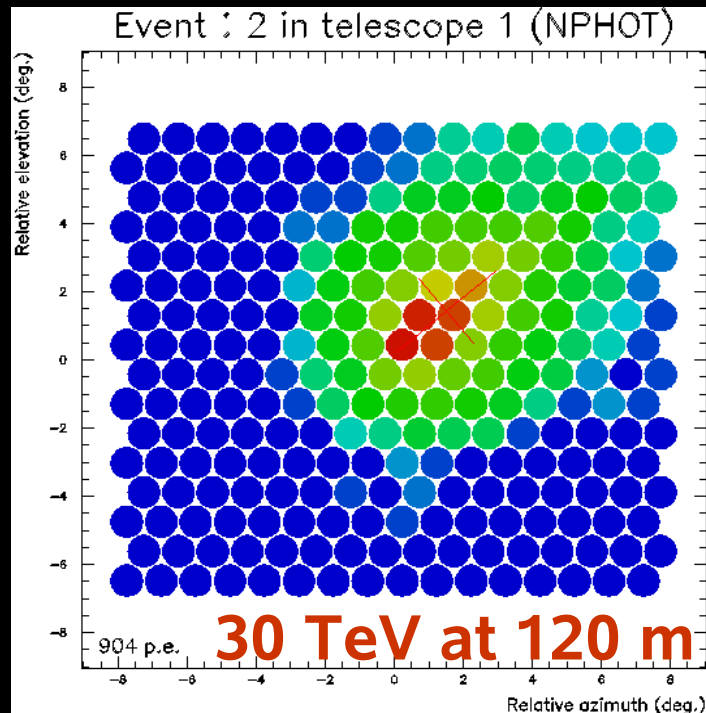
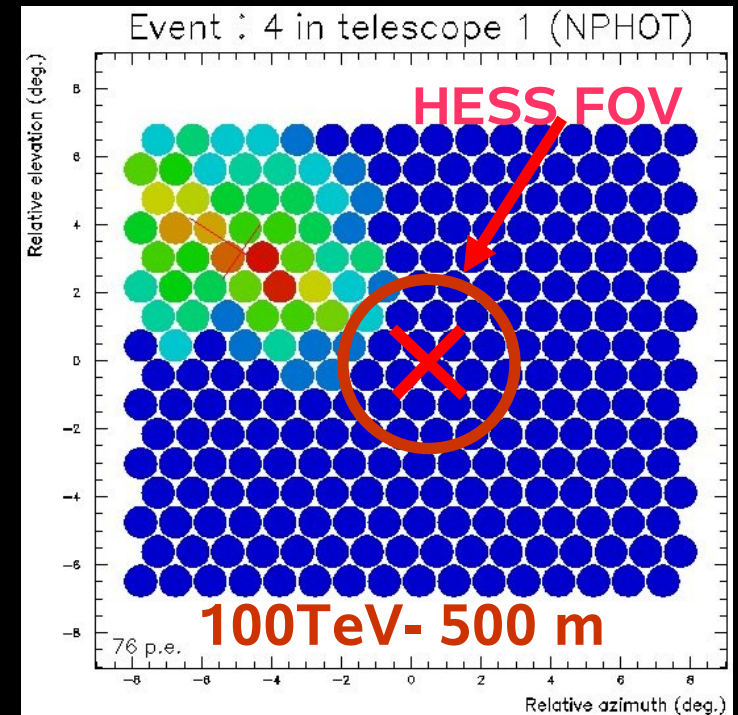


Simulations (GrISUtah)

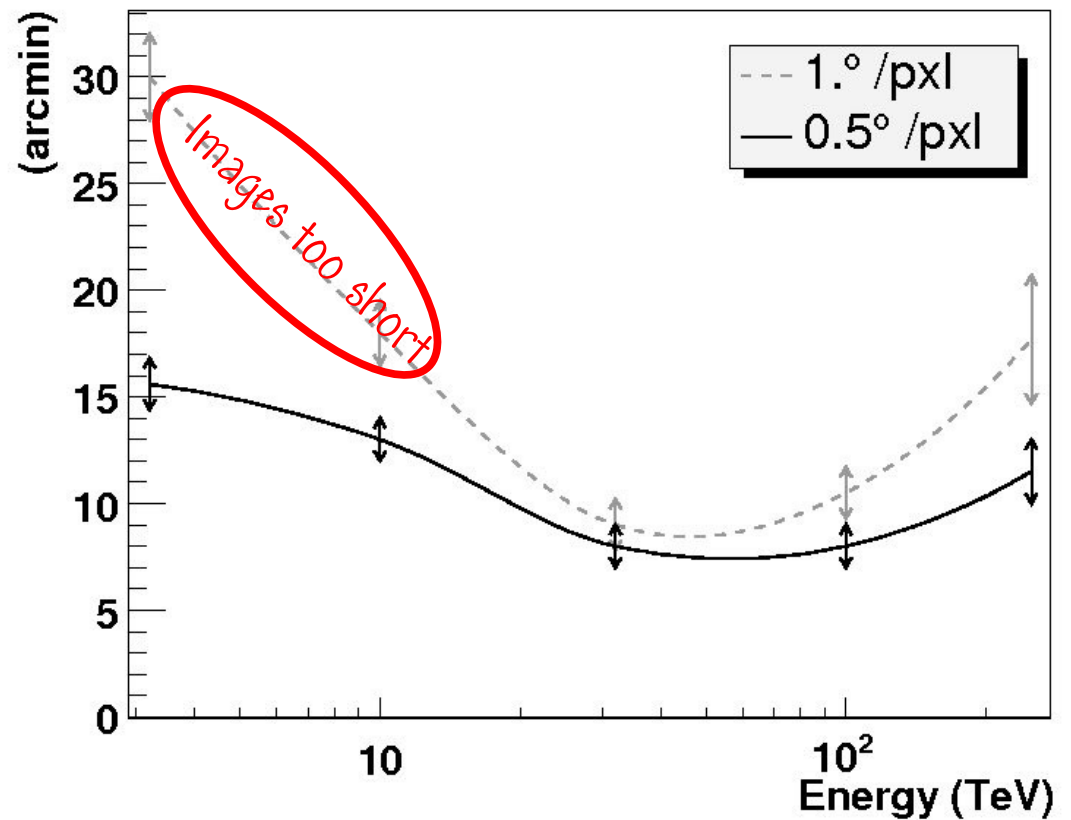
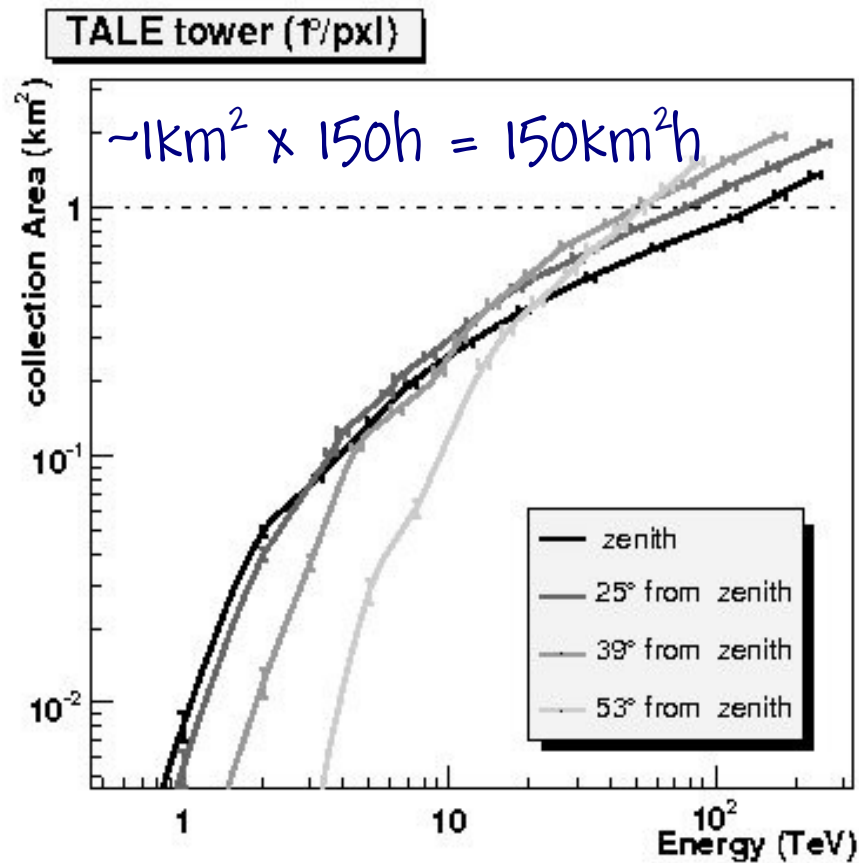
PMT pulse width = 100 ns

FADC 10 Mhz

Background: 30 p.e./ns/m²/sr



TALE Capabilities:



But sensitivity to MonteCarlo

G_{amma}

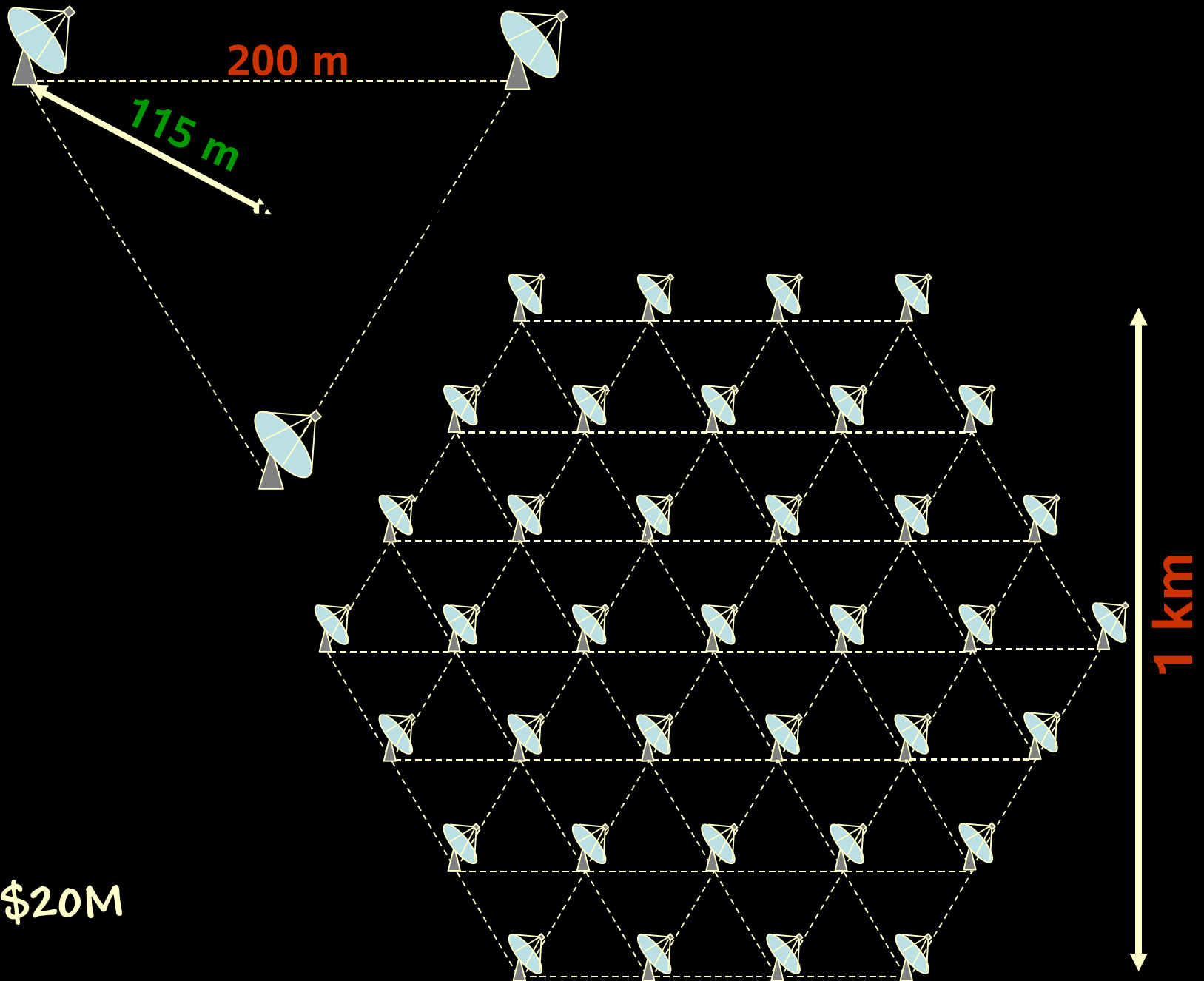
R_{ay}

$A_{\text{strophysical}}$

T_{elescope}

I_{maging}

S_{ystem}



~Budget < \$20M

37 Telescopes

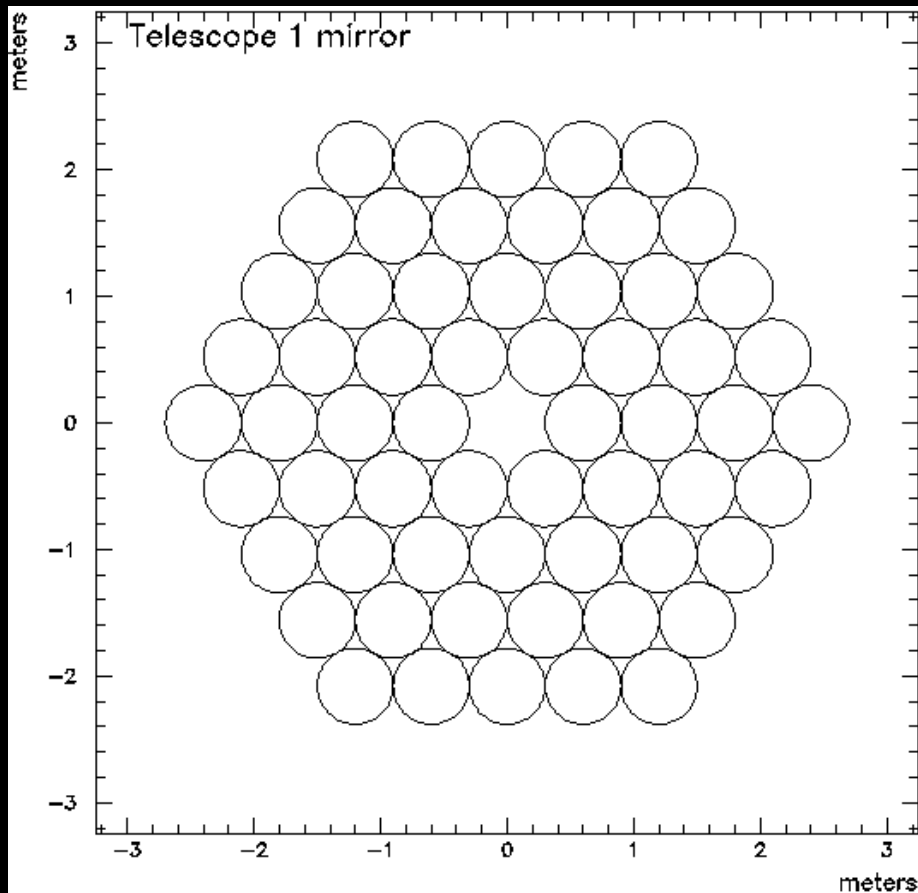


54 Triangles

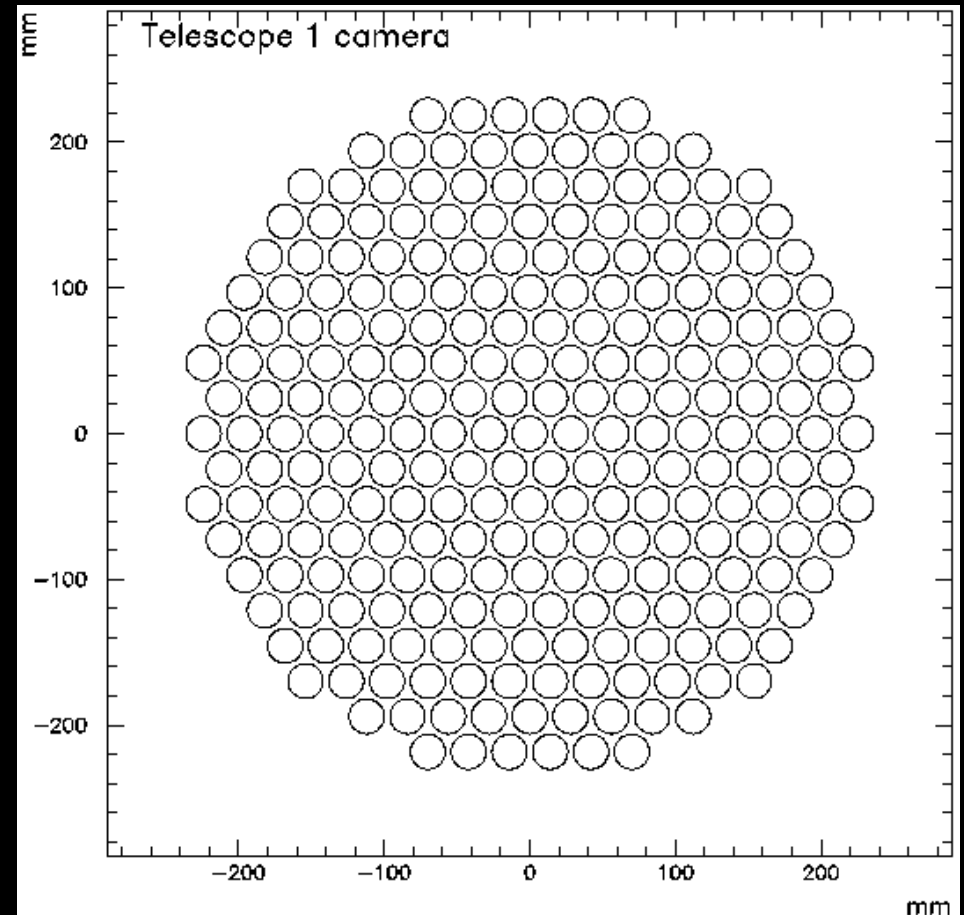


~1km²

Mirror: Ø5.4 m
60 facets of Ø60 cm
Focal: 6 m



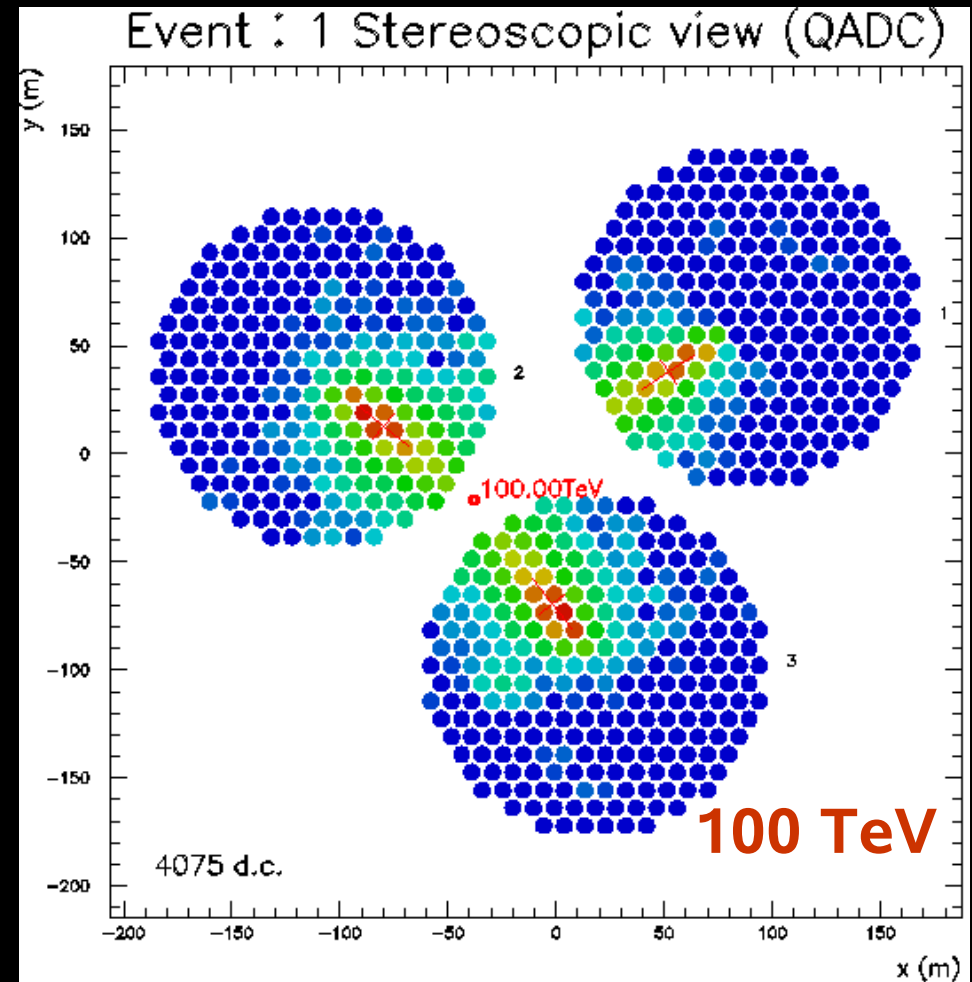
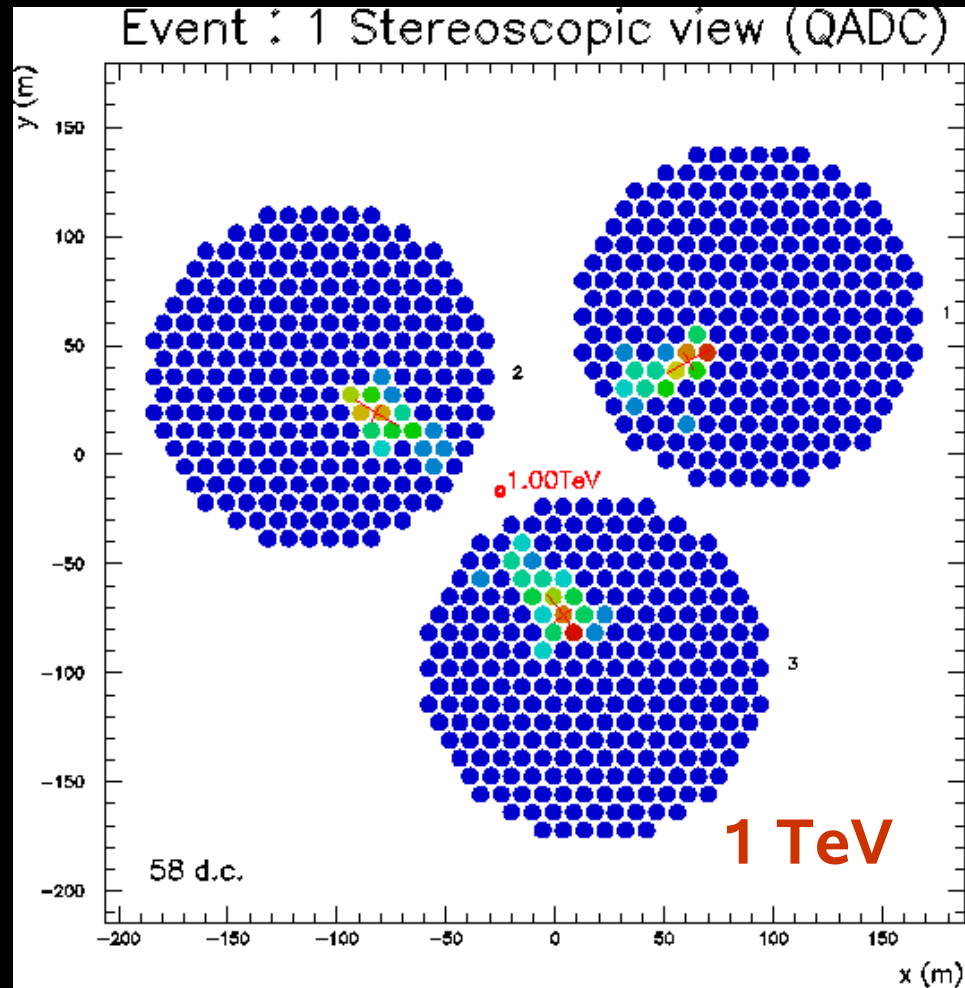
Camera: FOV = 4°
253 pixels of 0.25°

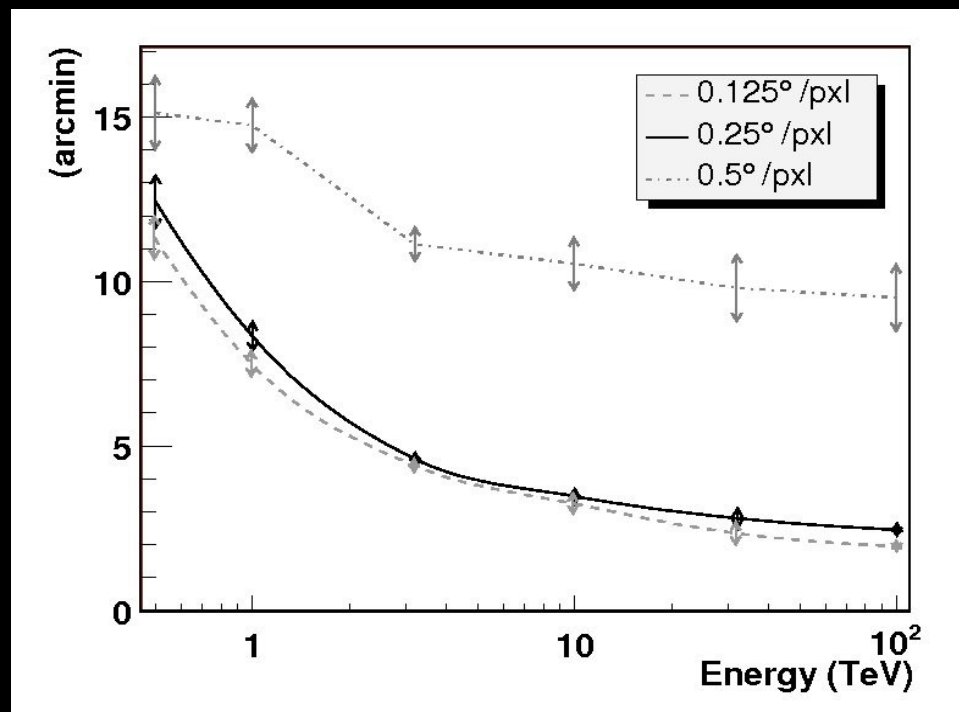
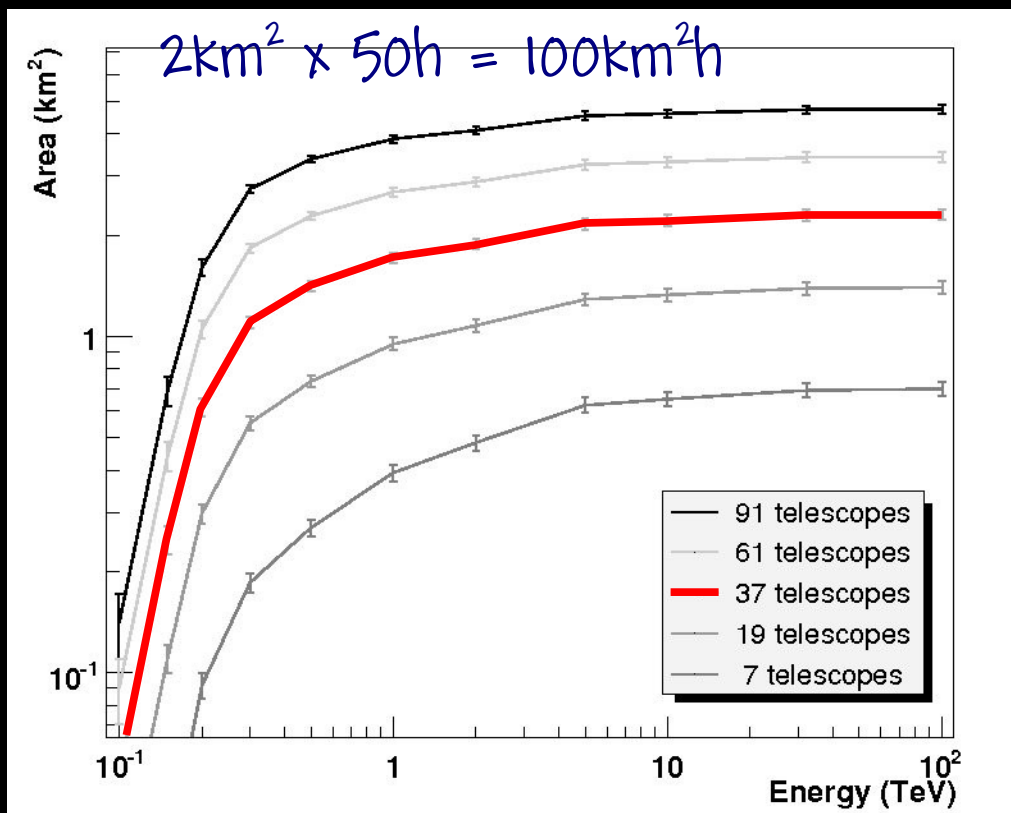
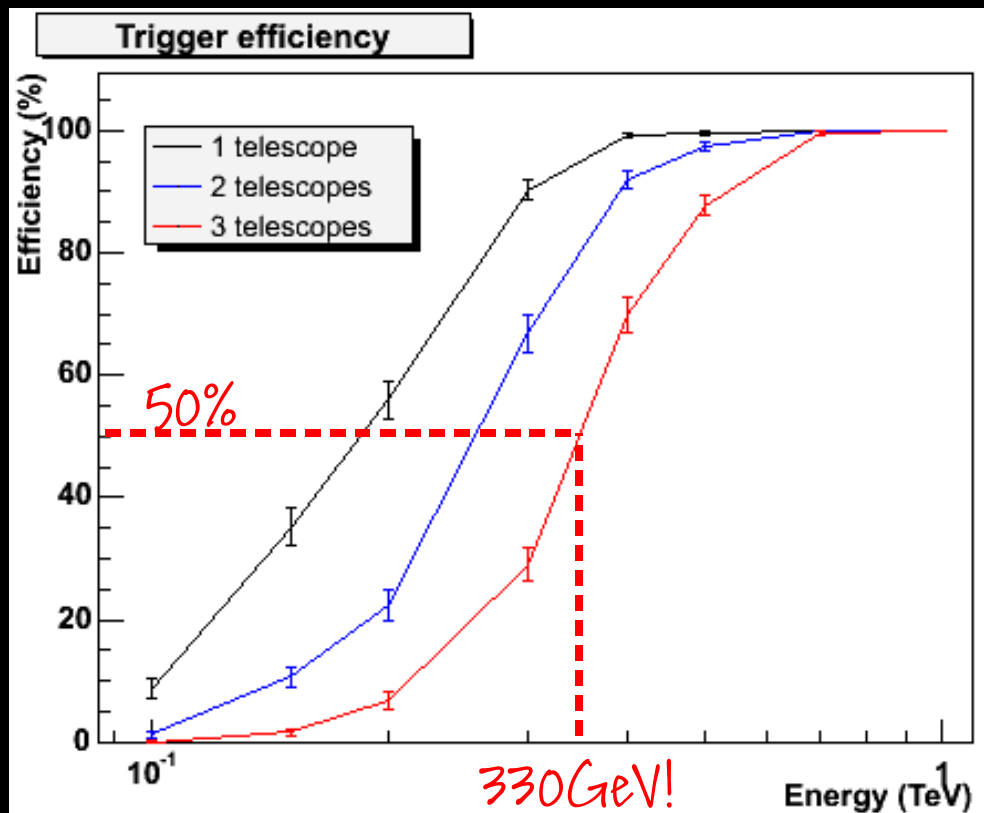


Electronics: Whipple 10m telescope

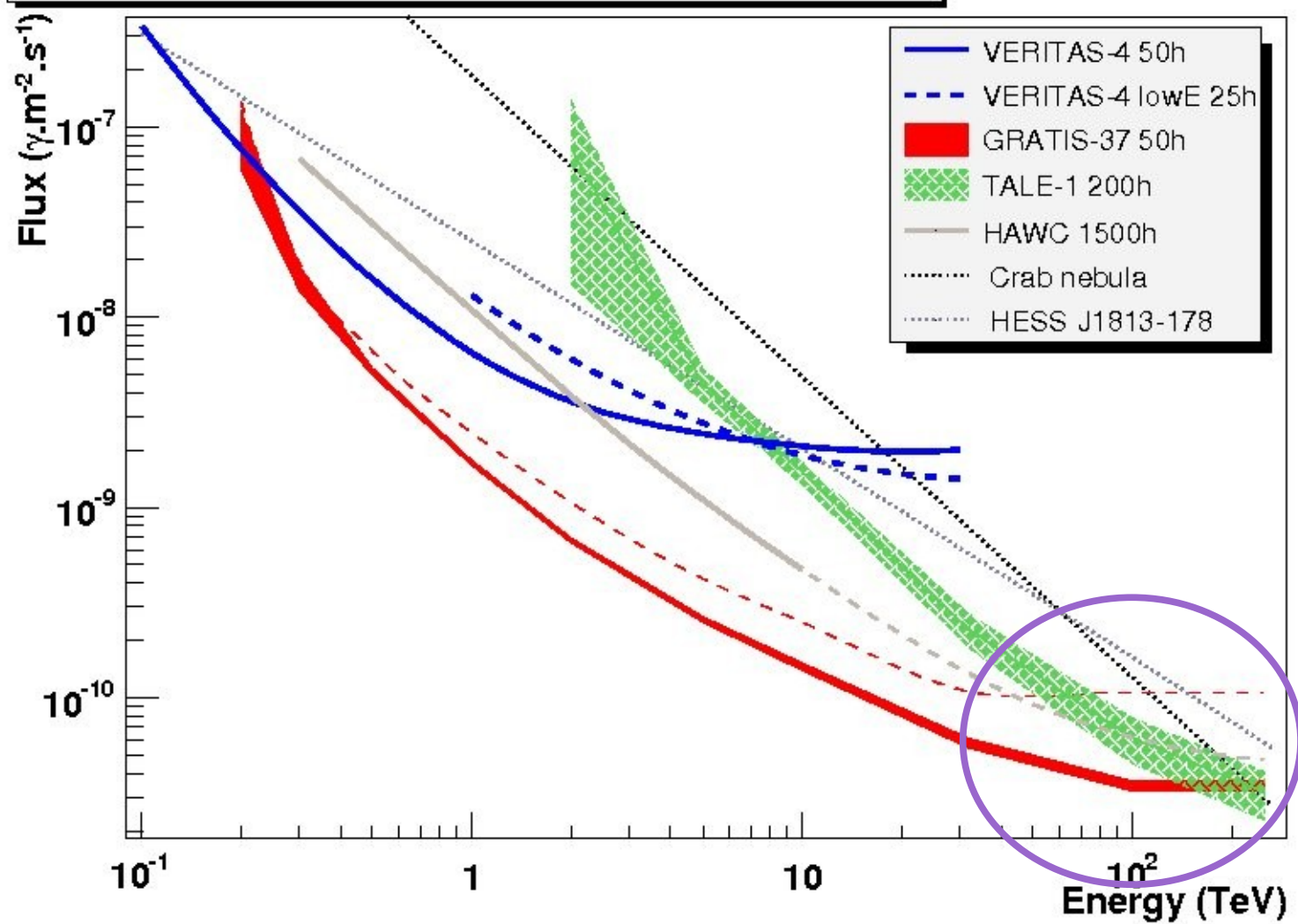
Simulation (GrISUtah)

Impact of shower core are in one triangle





One year sensitivity above E (5 σ & 10 events)



And what about Atmospheric Cherenkov Front Sampling



$40 \text{ stations}/(200\text{m})^2$
over 1km^2
= 1000 stations

& \$10,000/station
= 10M\$

CELESTE 50 units 7m 100GeV

ASGAT 6 units 6m 600GeV

Themistocle 18 units



MAGIC Etch A Sketch® SCREEN

NO CONCLUSION
Yet