



VERITAS

(VERY ENERGETIC RADIATION
IMAGING TELESCOPE ARRAY SYSTEM)

Brian Humensky

U. of Chicago

DPF Riverside Aug 30, 2004

Outline

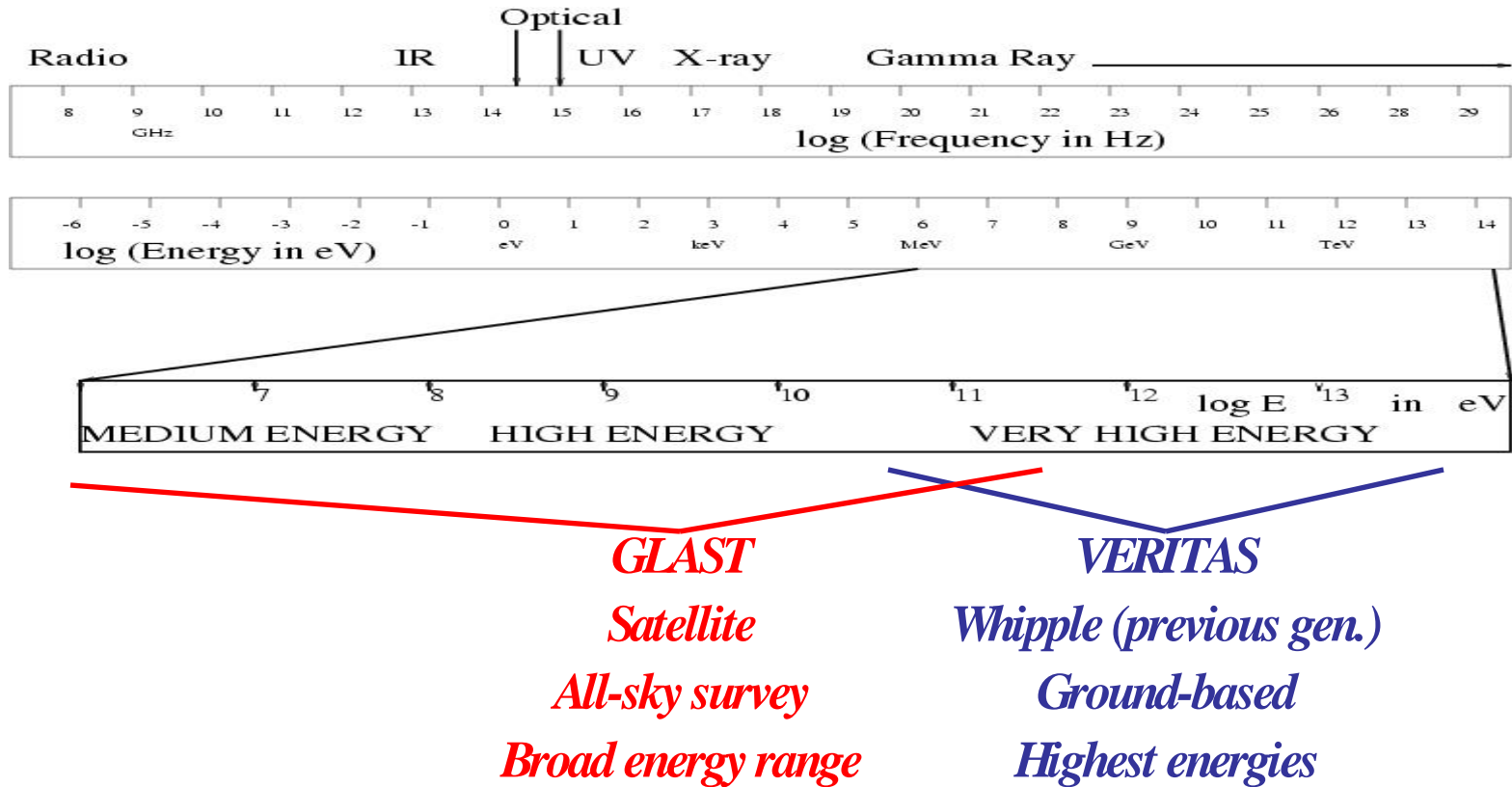
- Science Motivation
- VERITAS Project
- Prototype Results
- Summary and Outlook

The VERITAS Collaboration

- 
- Iowa State University
 - Leeds University
 - McGill University
 - National University of Ireland, Dublin
 - Purdue University
 - Smithsonian Astrophysical Observatory
 - University of California, Los Angeles
 - University of Chicago
 - University of Utah
 - Washington University, Saint Louis
 - Galway-Mayo Institute of Technology
 - Cork Institute of Technology

**Funding from
NSF/DOE/
Smithsonian/PPARC/
SF/NSERC**

Gamma Ray Astrophysics



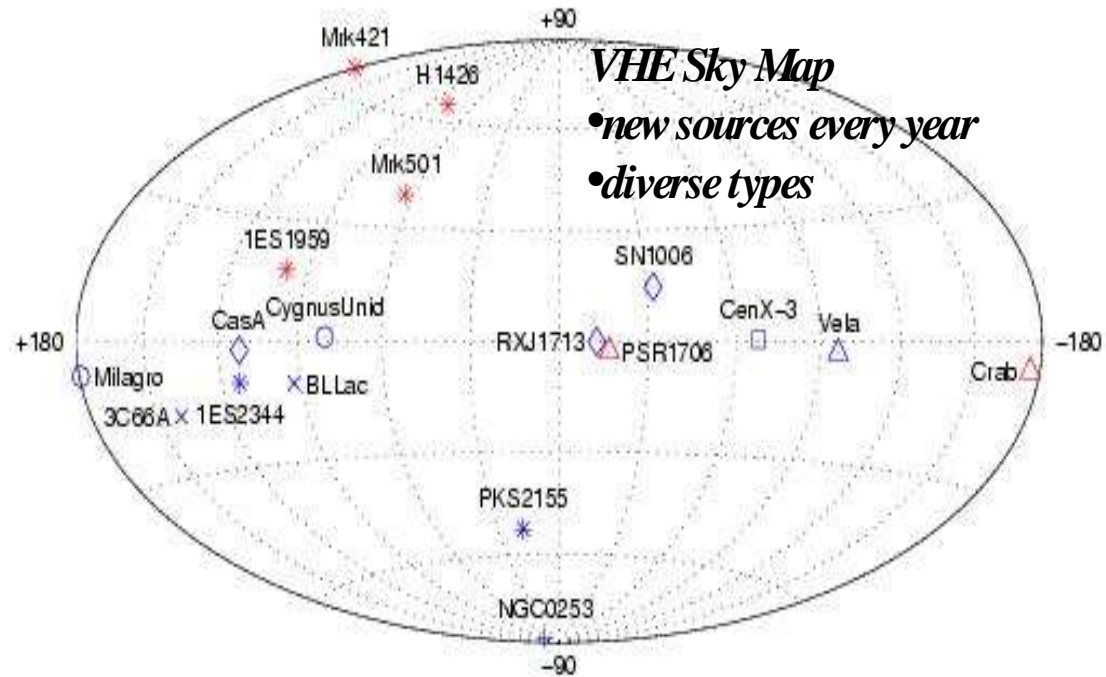
What are the origins of cosmic rays and VHE gamma rays?

- Astrophysical Particle Accelerators: objects with extreme magnetic, gravitational potentials, shock acceleration
- Physics Beyond the Standard Model: neutralinos, relics from the early universe, particles from high mass scales, etc.

Sources of VHE Gamma Rays

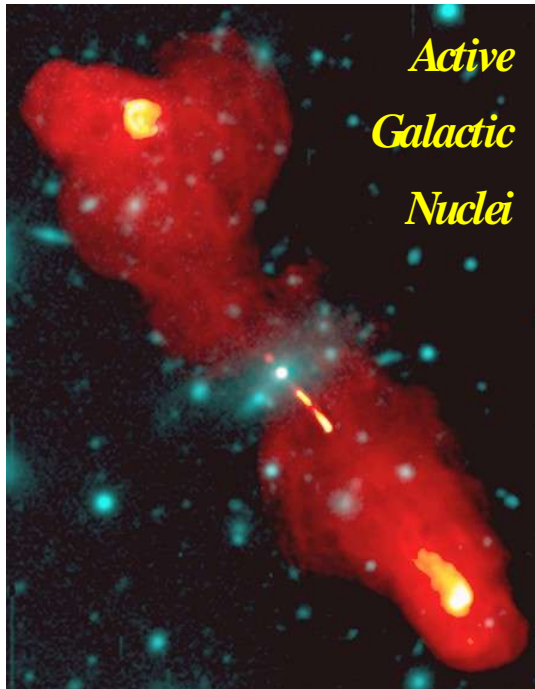


Crab Nebula – Standard Candle



VHE Sky Map

- *new sources every year*
- *diverse types*

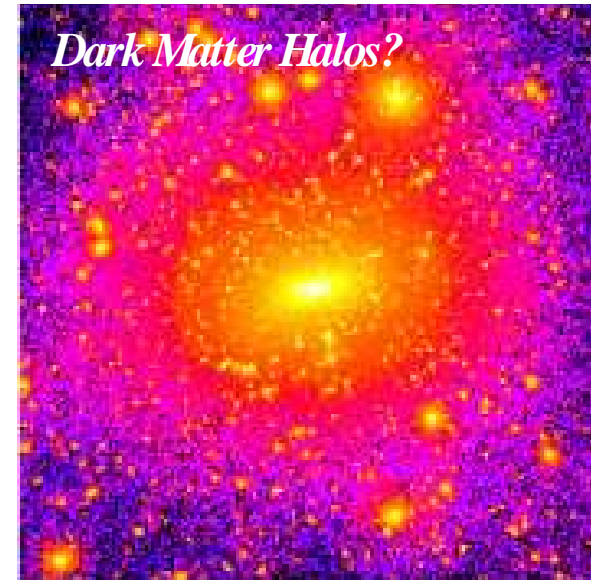


*Active
Galactic
Nuclei*

Also:

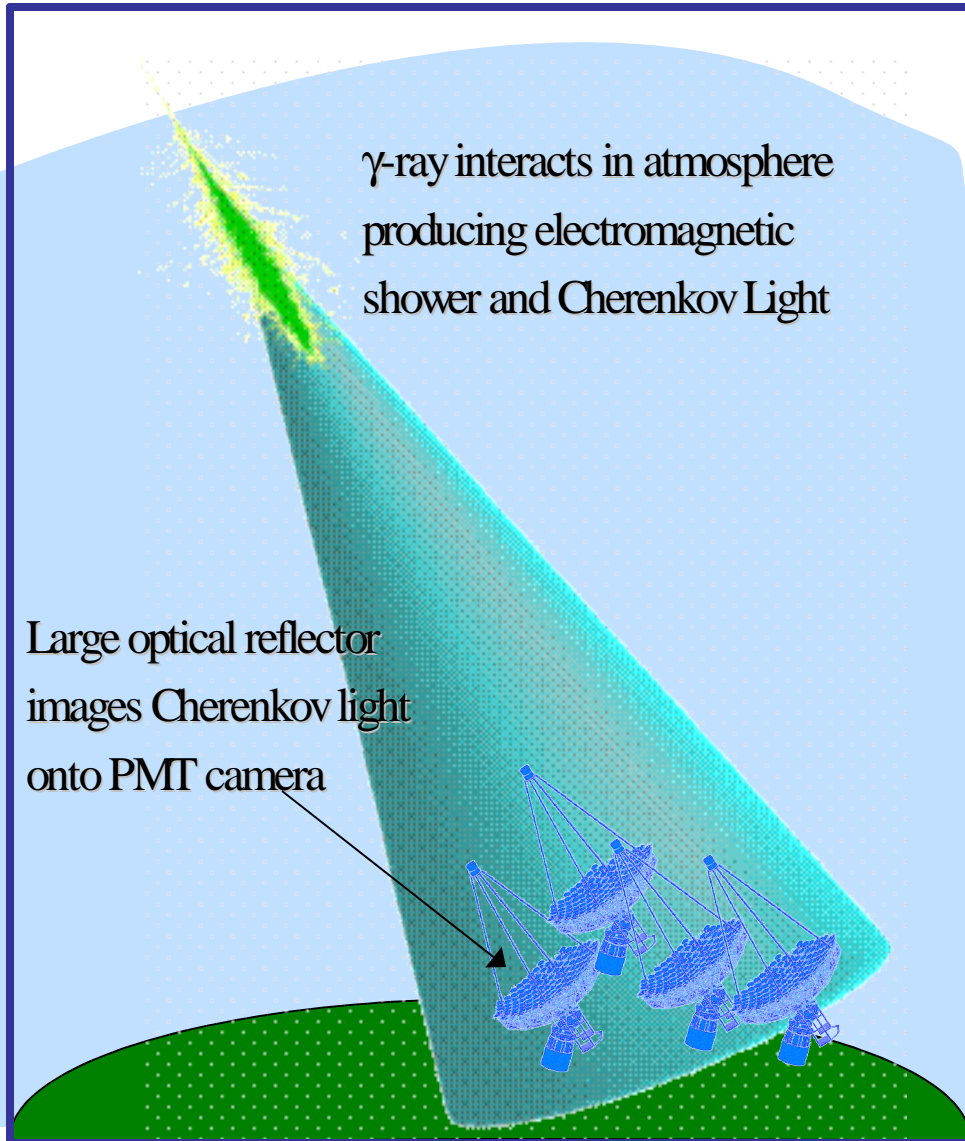
- *Supernova Remnants*
- *Starburst Galaxies*
- *Pulsar Binary*

- *Pulsars?*
- *Gamma Ray Bursts?*
- *Galactic Plane?*

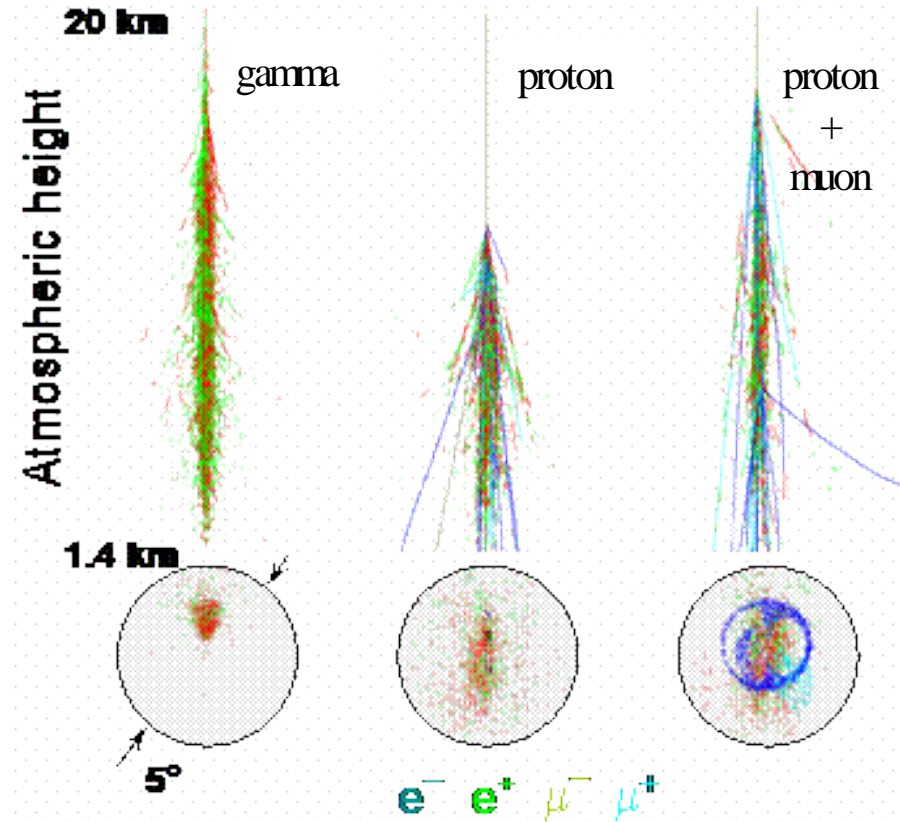


Dark Matter Halos?

Imaging Air Cherenkov Technique



Effective area is the size of the lightpool $\sim 10^5 \text{ m}^2$



Imaging Cherenkov telescopes:

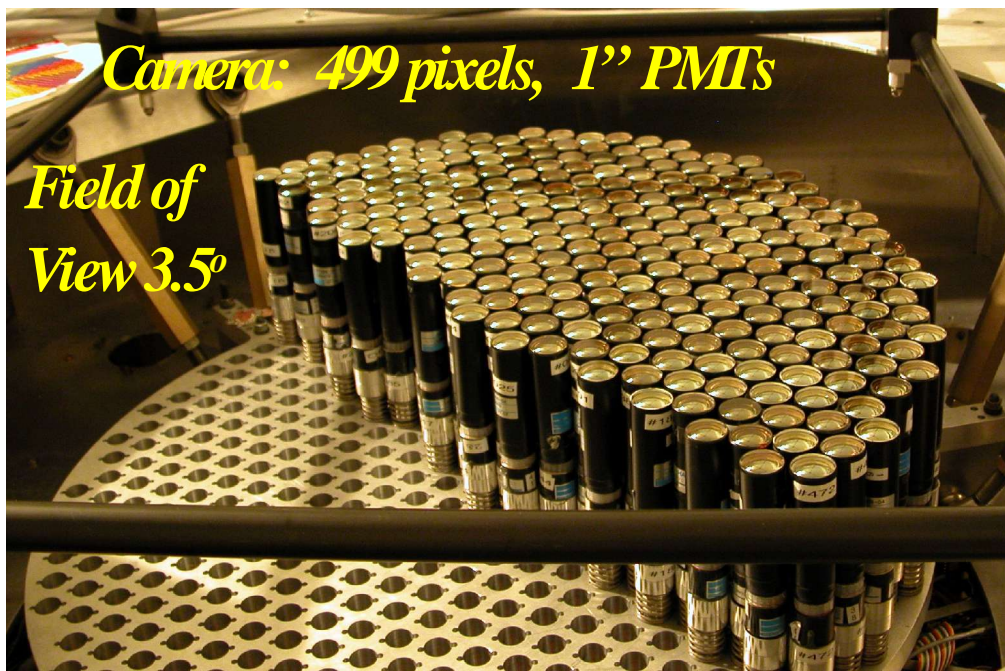
- Distinguish compact images of gamma-ray showers from more irregular images of hadron showers.
- Source direction lies along major axis.

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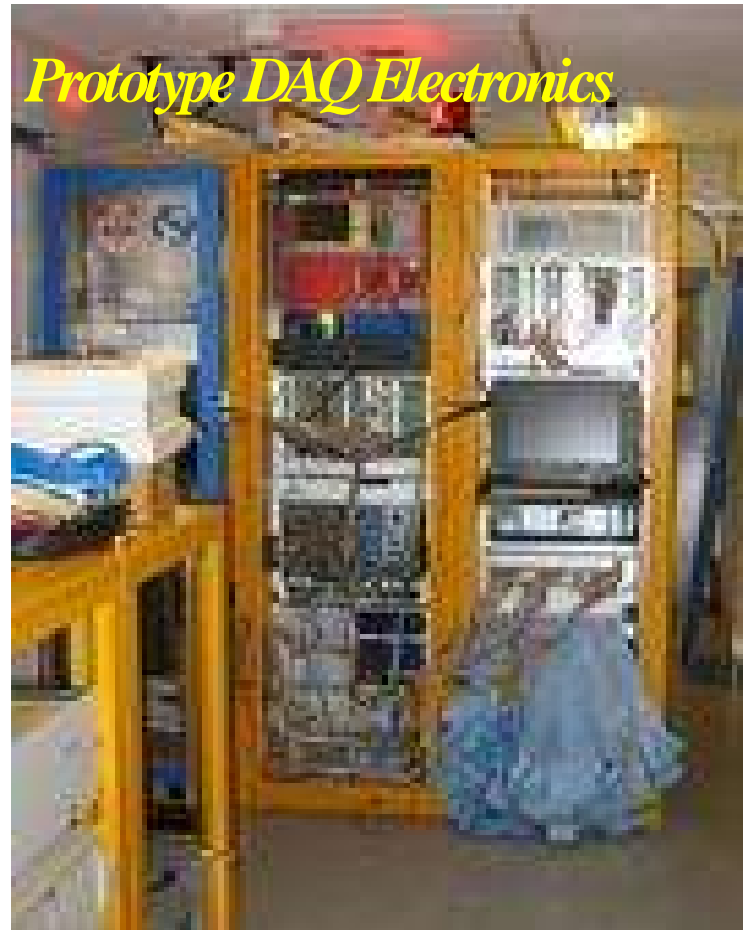
- **Array of 12-m diameter f/1.0 imaging air Cherenkov telescopes**
- **Located on Kitt Peak in Southern Arizona, USA**
- **Sensitivity: <0.005 Crab at 200 GeV (50hr, 5σ)**
- **Slewing Speed: 0.7 degrees/sec**
- **Photon Angular Resolution: $< 0.05^\circ$**
- **Energy Resolution: $\Delta E/E = 0.15$ to 0.20**

*VERITAS Camera
and Electronics*



Camera: 499 pixels, 1" PMTs

*Field of
View 3.5°*



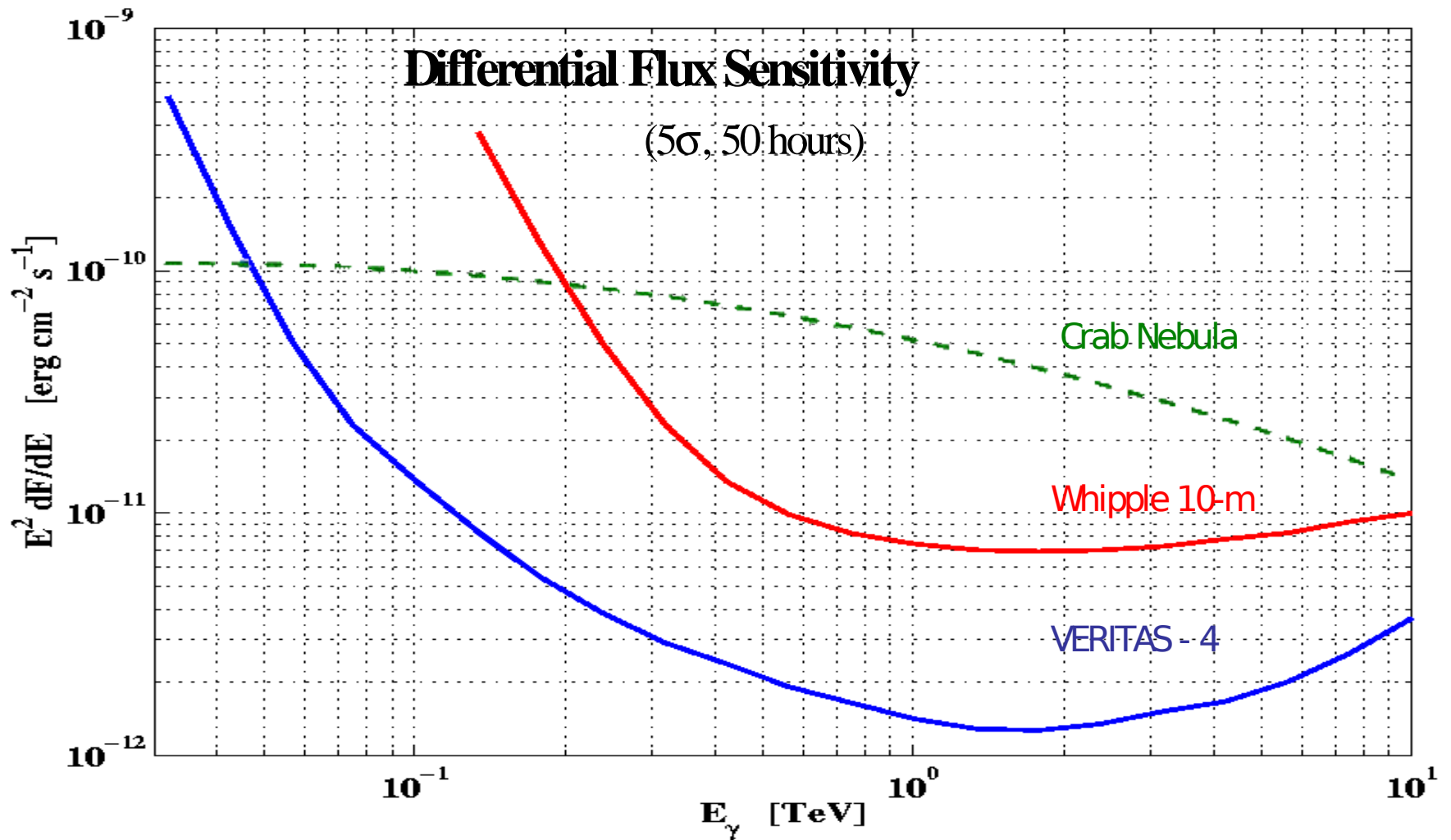
Prototype DAQ Electronics



*Custom 500 MHz
Flash ADC Boards*

*Full array trigger for stereoscopic
observations: rate ~ few 100 Hz*

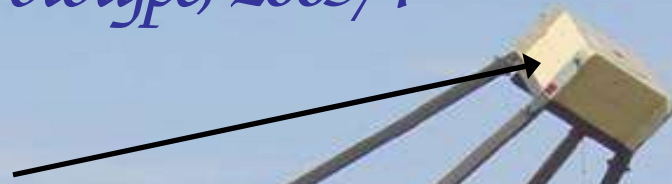
Expected Performance



- VERITAS-7:
- Lower energy threshold, greater sensitivity
 - Flexibility
 - Track multiple targets simultaneously

VERITAS Prototype, 2003/4

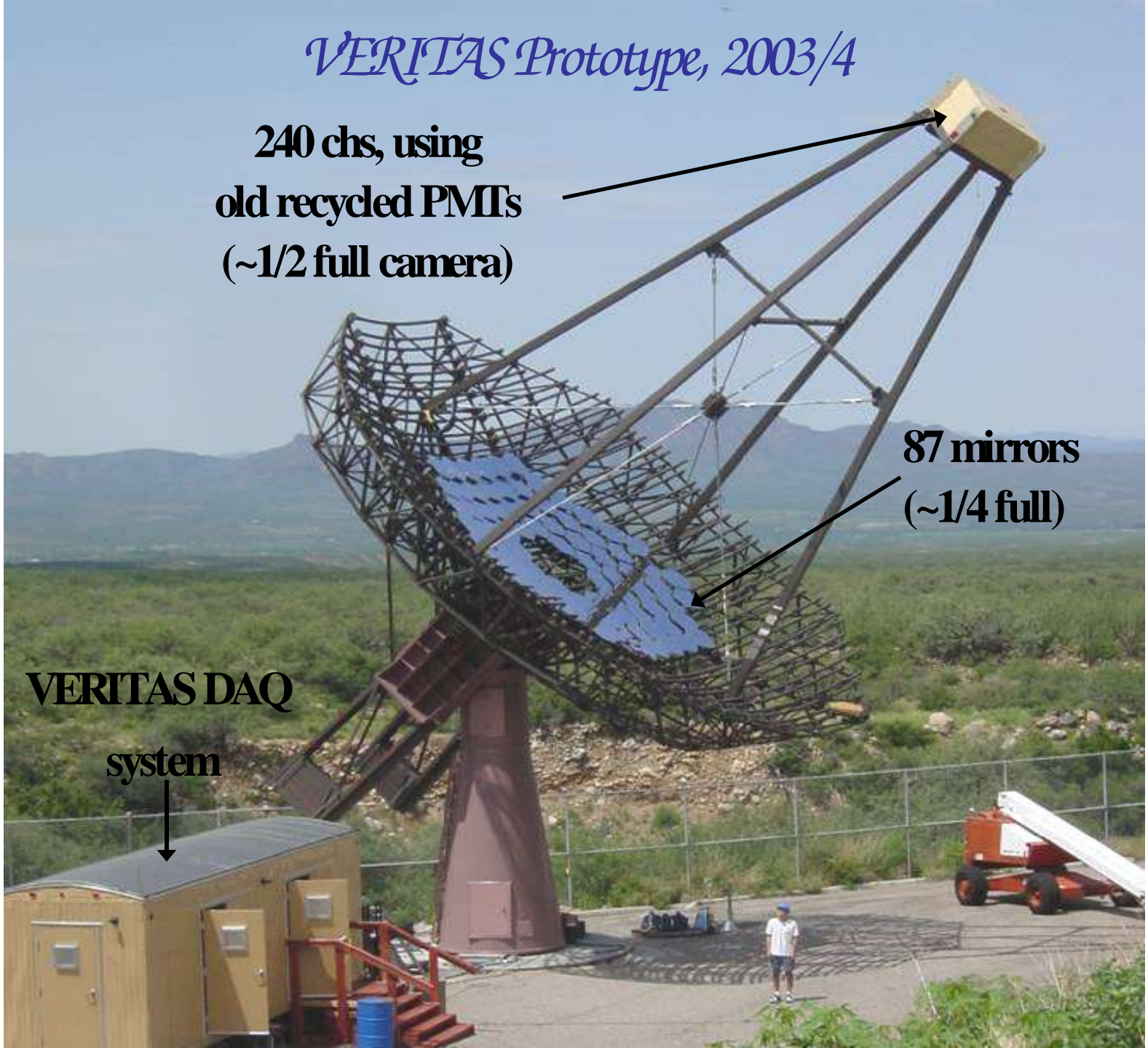
**240 chs, using
old recycled PMTs
(~1/2 full camera)**



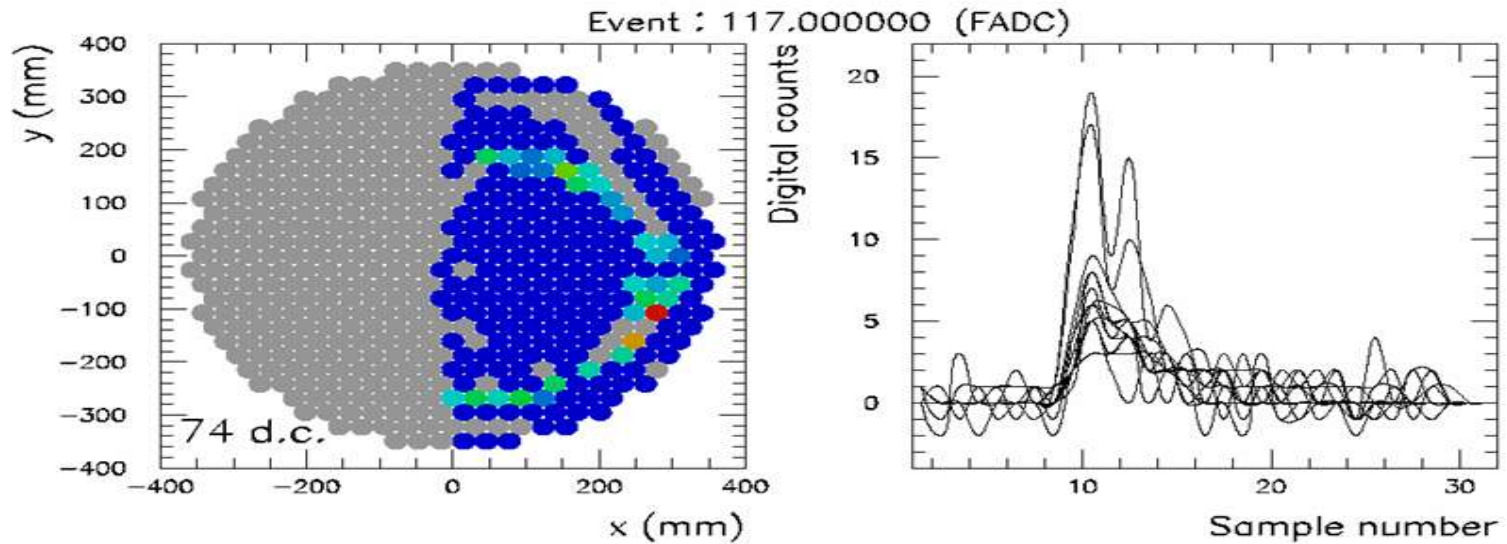
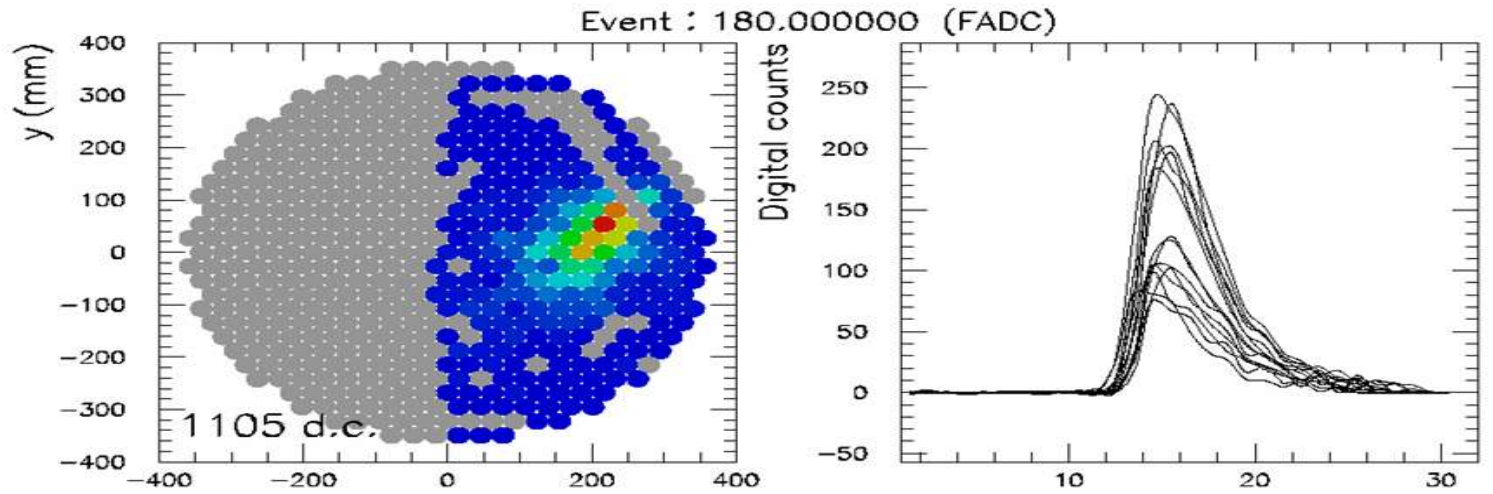
**87 mirrors
(~1/4 full)**



**VERITAS DAQ
system**



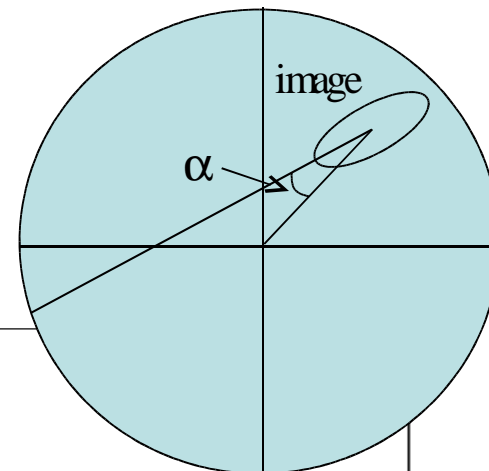
Prototype Observations: A Couple Events



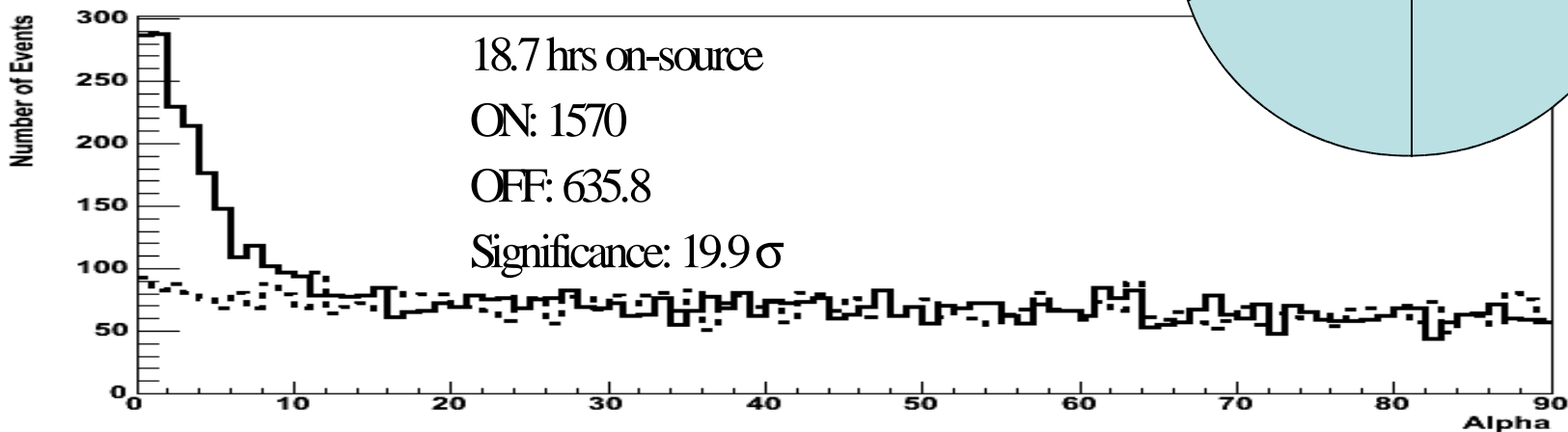
Prototype Obs. of Mrk 421 AGN

Alpha parameter: angle between image direction
and camera center

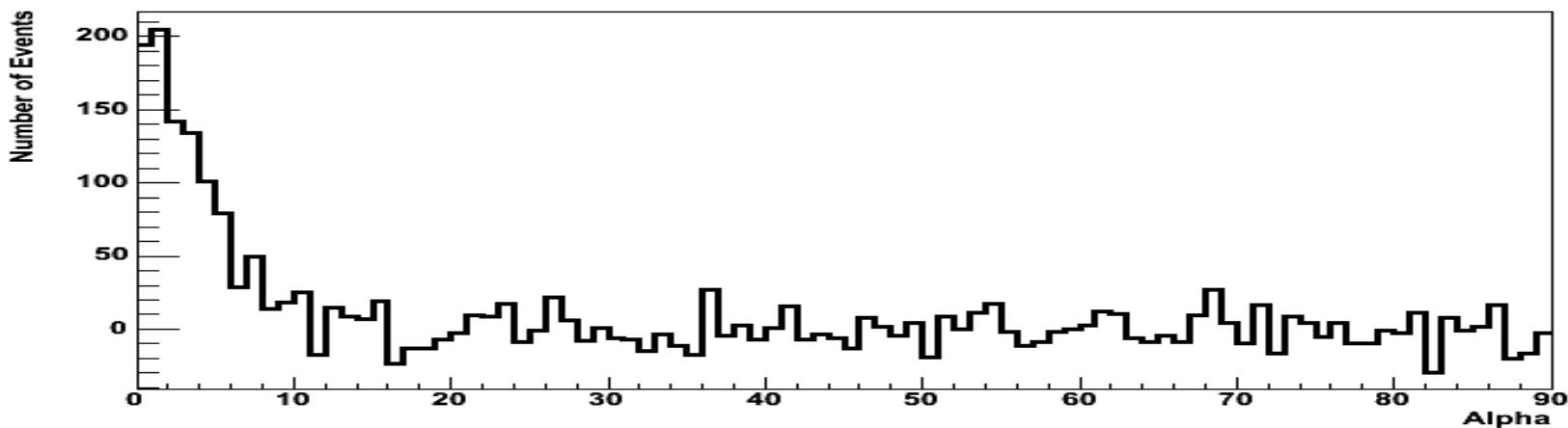
→ Expect gamma rays to point towards
center of camera



Alpha ON and OFF



Alpha Difference ON - OFF



VERITAS Timeline and Outlook

