

The Current Status of the HAWC Observatory

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23rd of June 2014

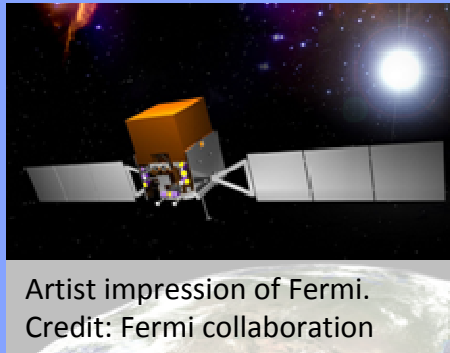


> 10 GeV Gamma-Ray Observatories

Wide Field of View

Continuous Operation

TeV Sensitivity



Fermi

AGILE

EGRET



HAWC

Milagro

ARGO

Tibet AS- γ



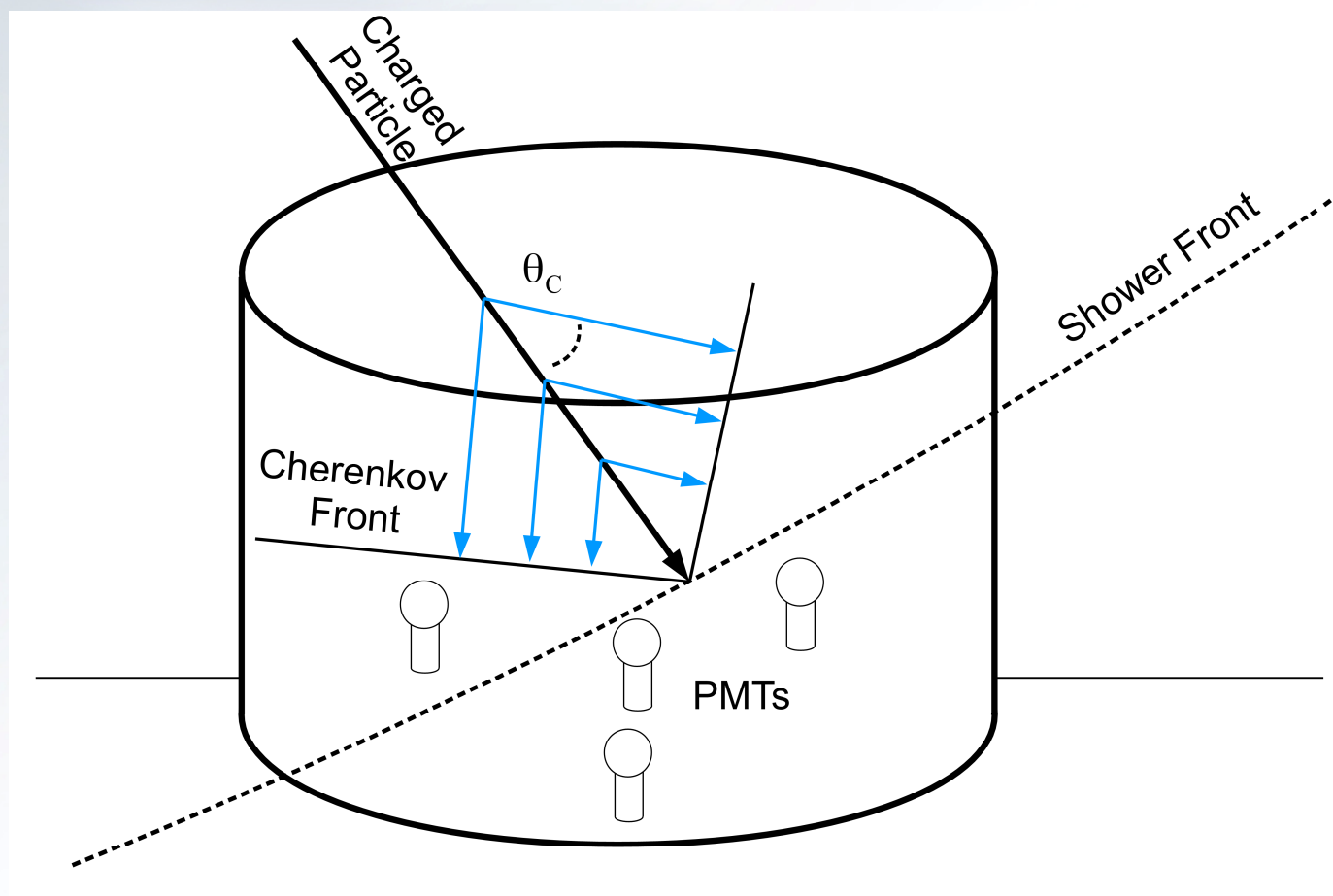
H.E.S.S.

VERITAS

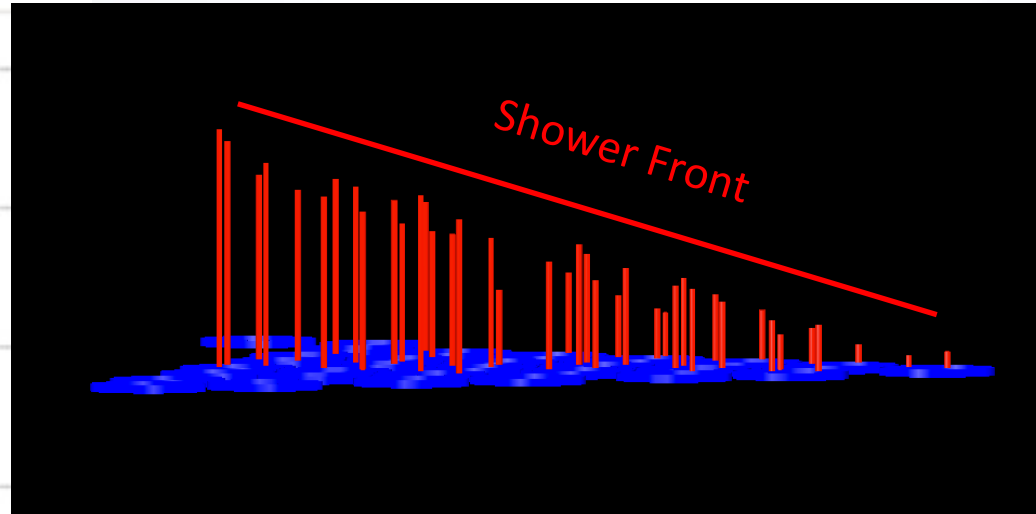
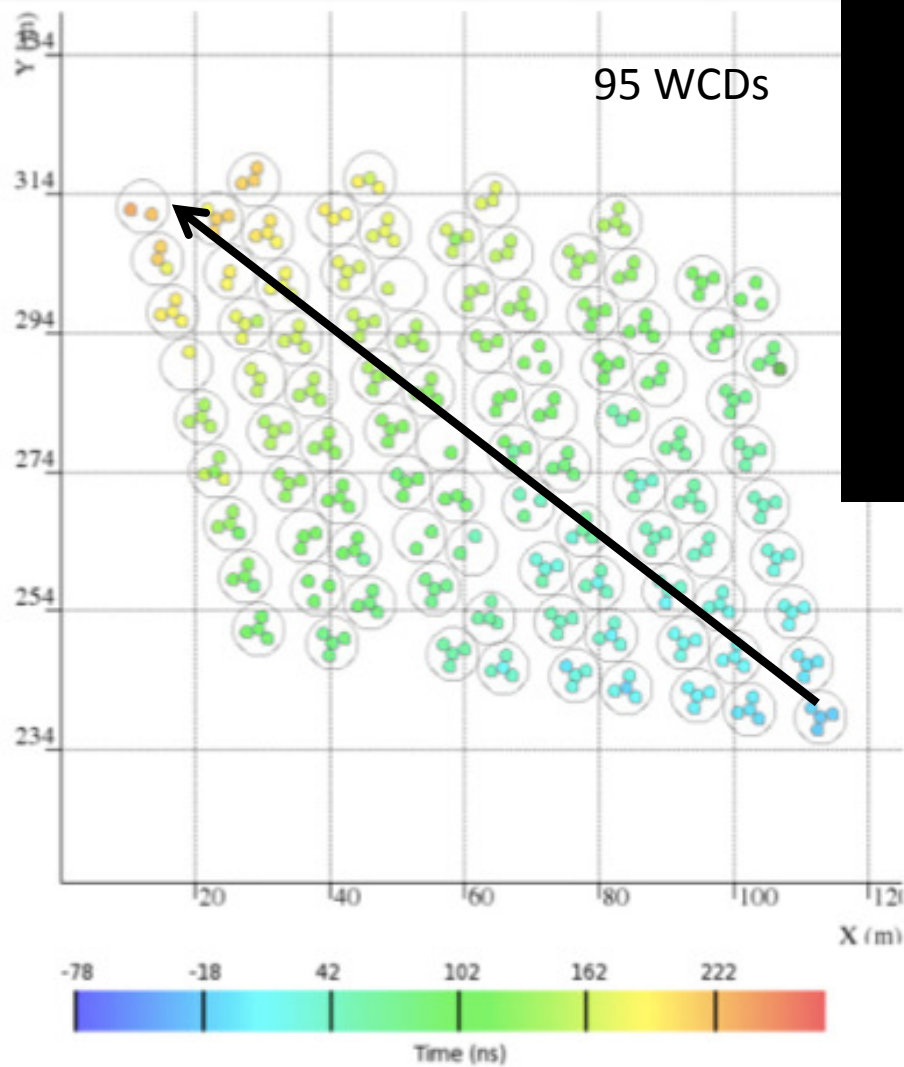
MAGIC

Water Cherenkov Detectors

Air Showers create secondary charged particles



Angular Reconstruction

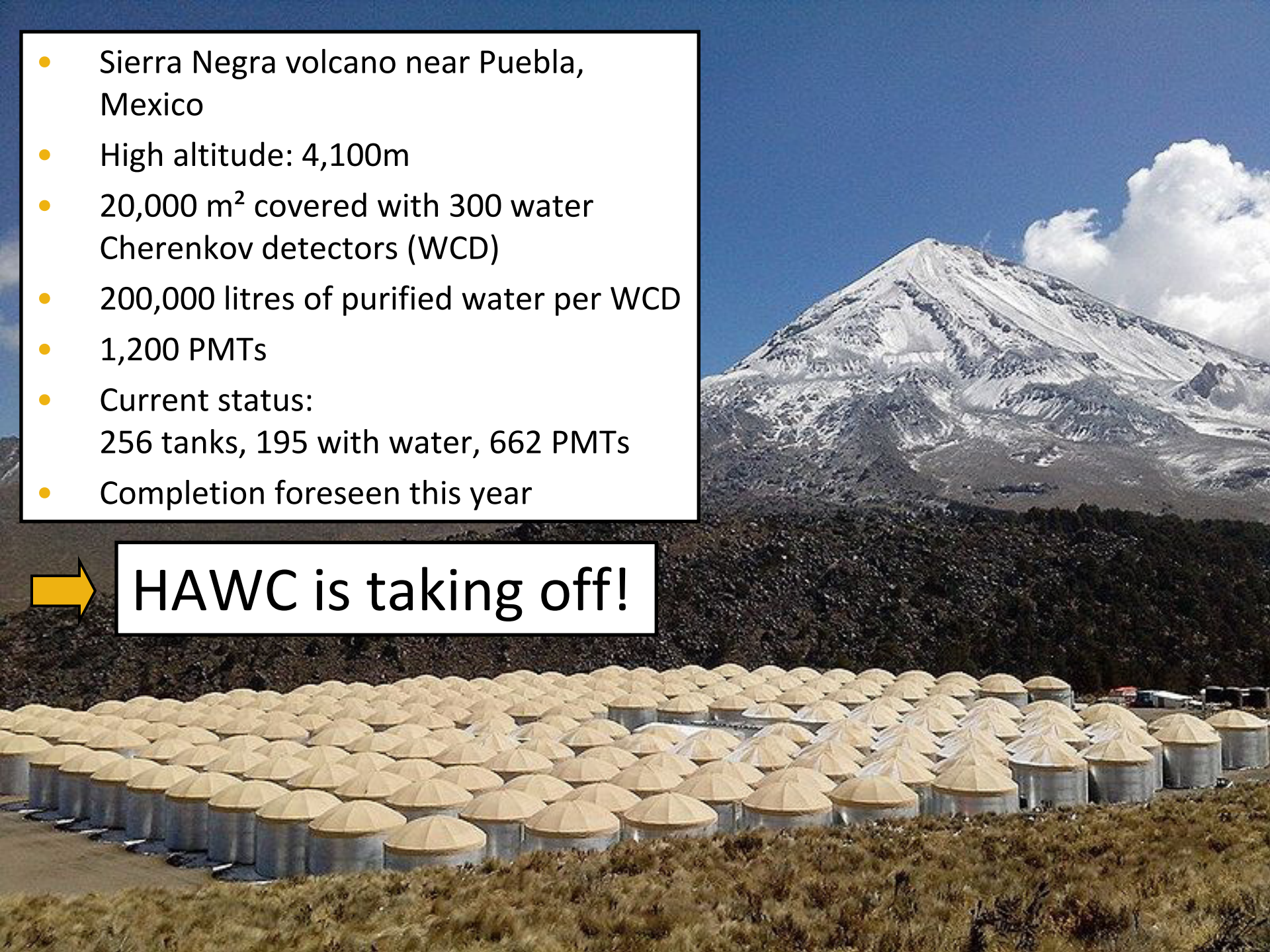


Timing fixes direction of incoming gamma ray

- Sierra Negra volcano near Puebla, Mexico
- High altitude: 4,100m
- 20,000 m² covered with 300 water Cherenkov detectors (WCD)
- 200,000 litres of purified water per WCD
- 1,200 PMTs
- Current status:
256 tanks, 195 with water, 662 PMTs
- Completion foreseen this year



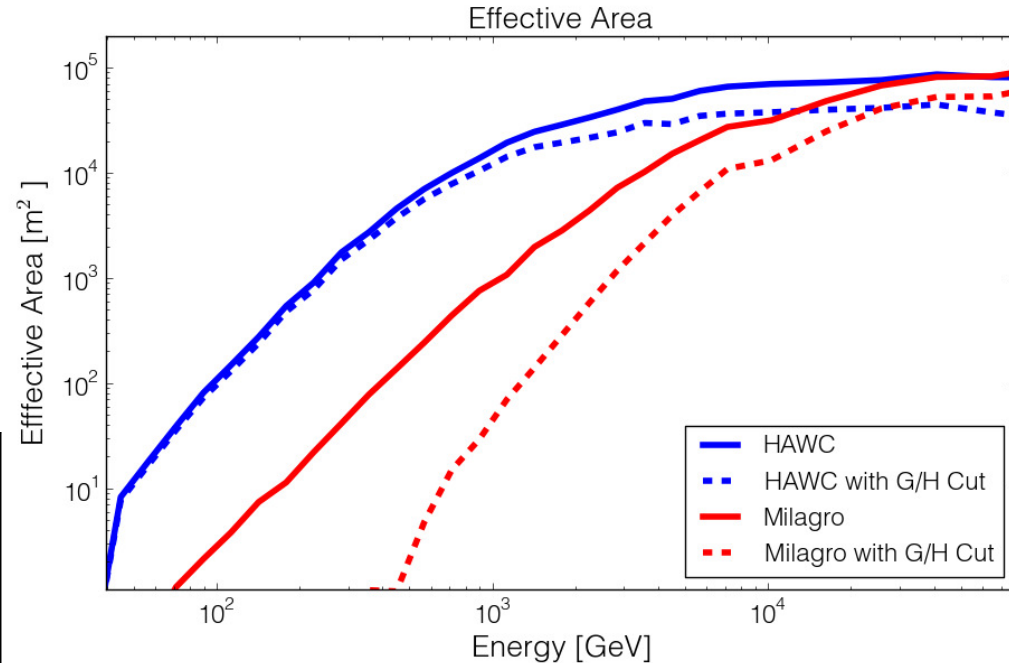
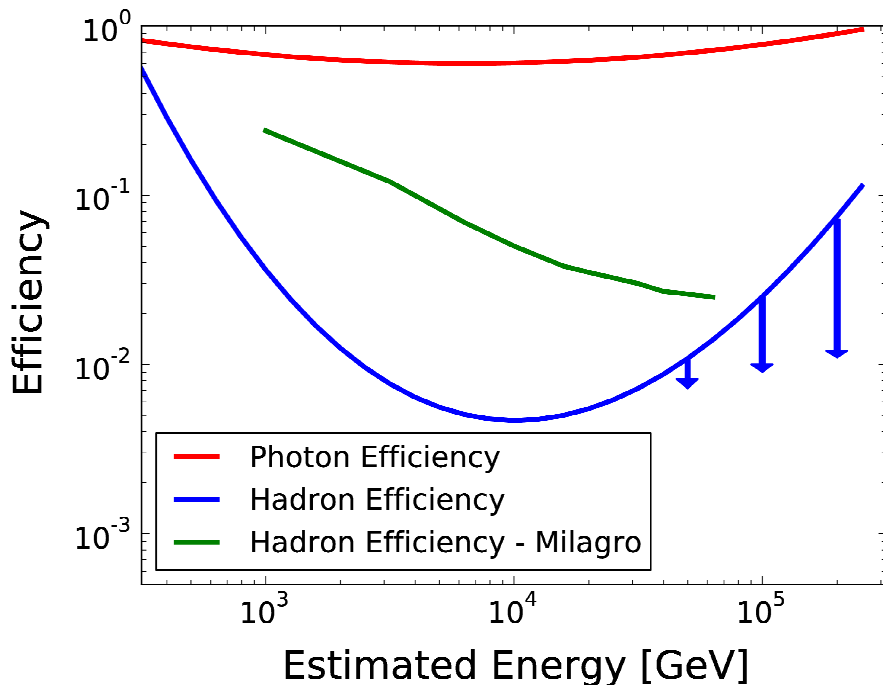
HAWC is taking off!



HAWC Performance

Abeysekara et al., Astropart. Phys. (2013)

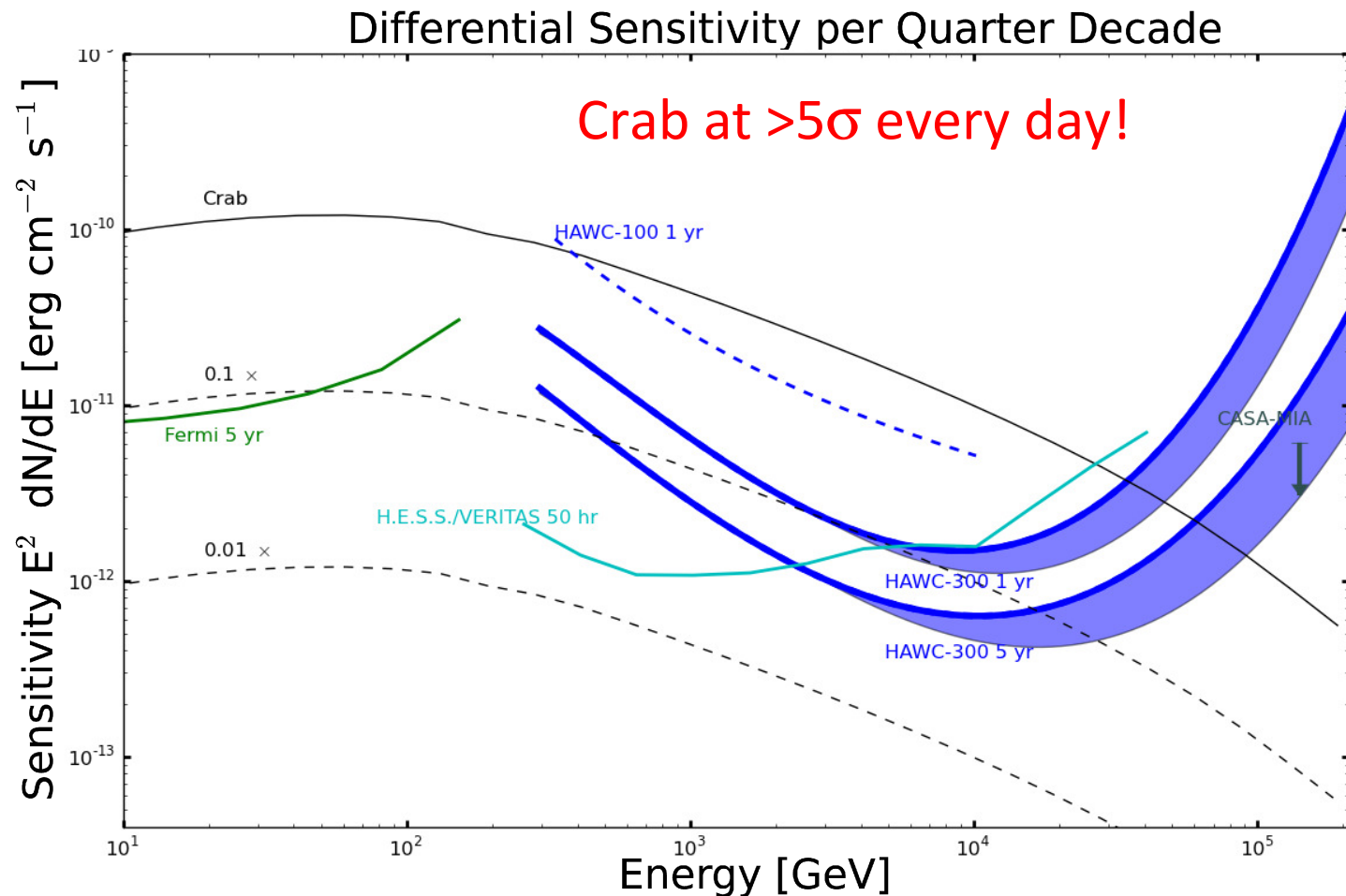
Higher altitude:
>5x more particles



Improved Hadron rejection (larger area, optical isolation)

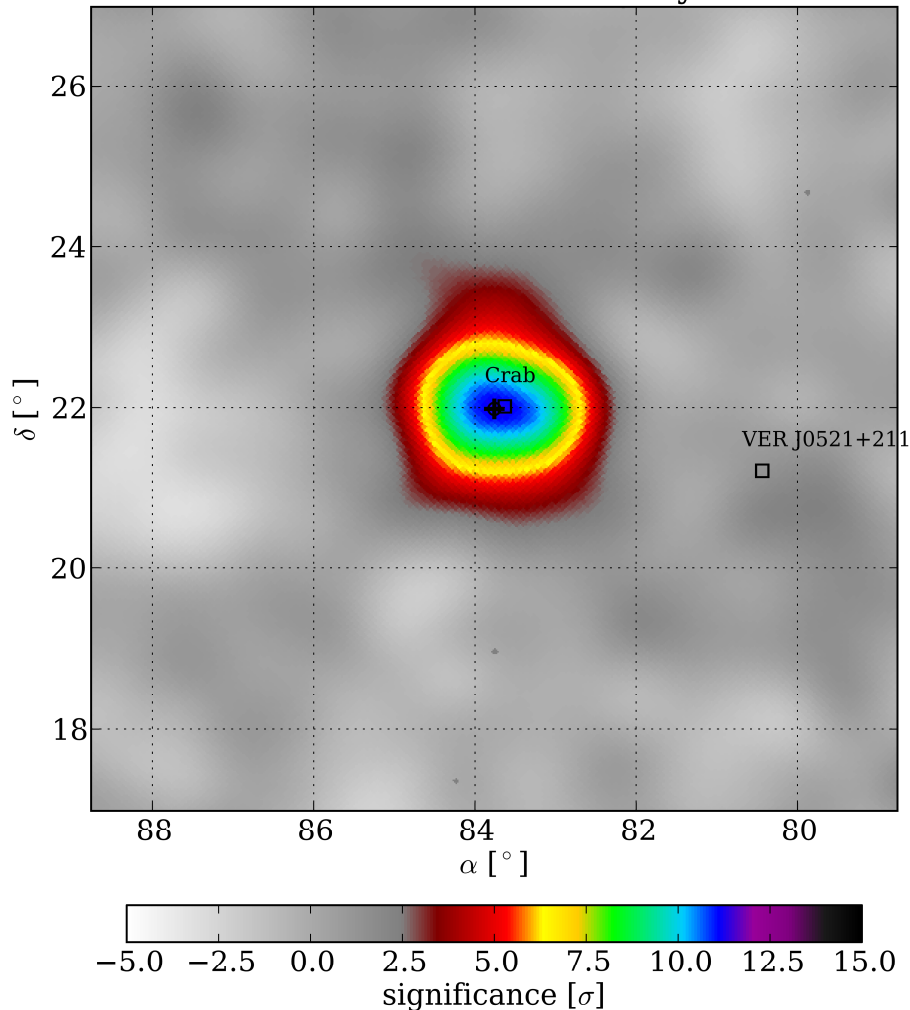
HAWC Performance

Abeysekara et al., Astropart. Phys. (2013)



Crab Nebula

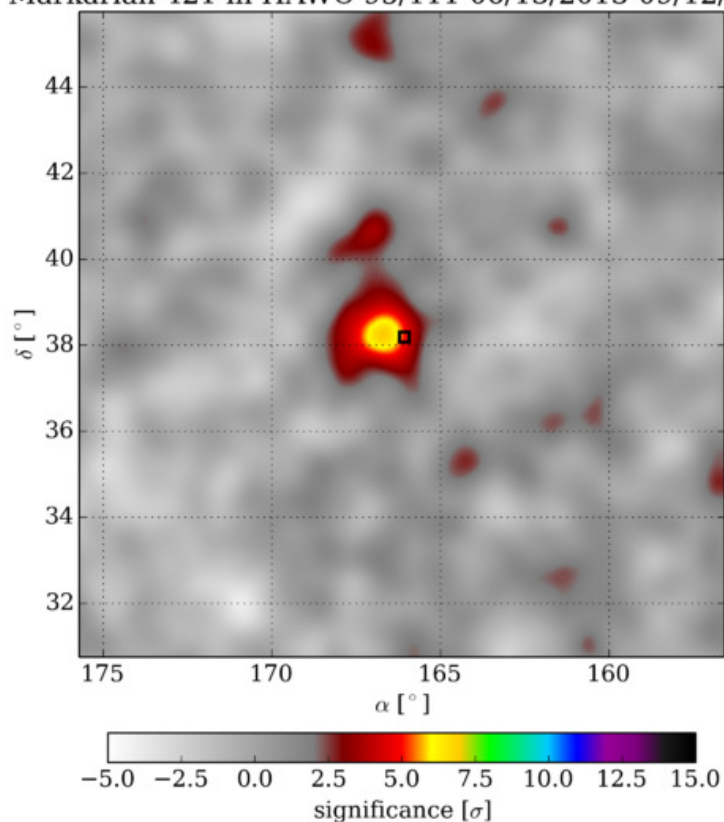
HAWC-95+111 154 days



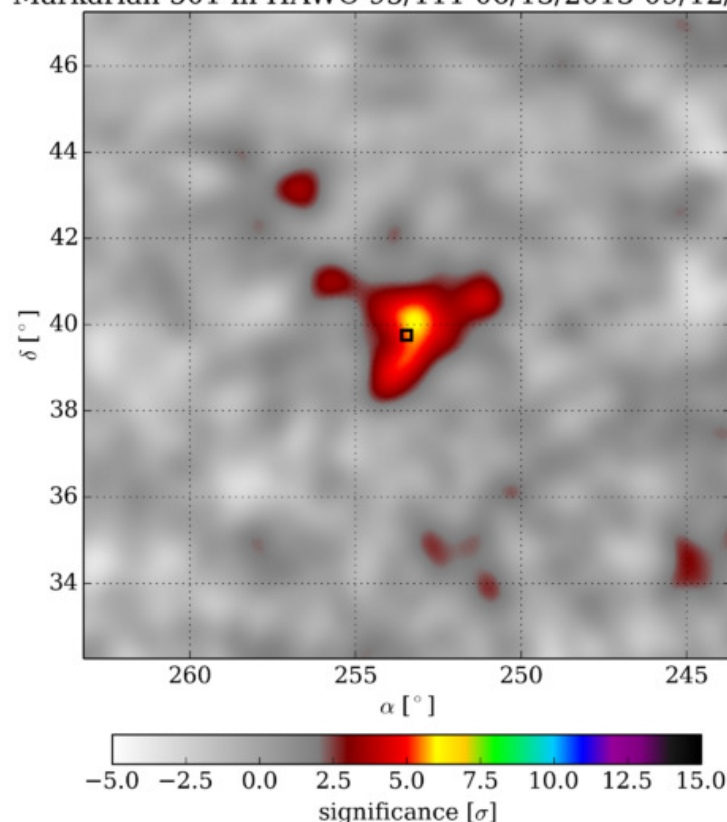
- 1/3 of HAWC array completed in Summer 2013
- Began operation with partial array (HAWC-95 = 95 tanks) (HAWC-111 = 111 tanks)
- Crab Nebula detected $> 10\sigma$

The Markarians

Markarian 421 in HAWC-95/111 06/13/2013-09/12/2013

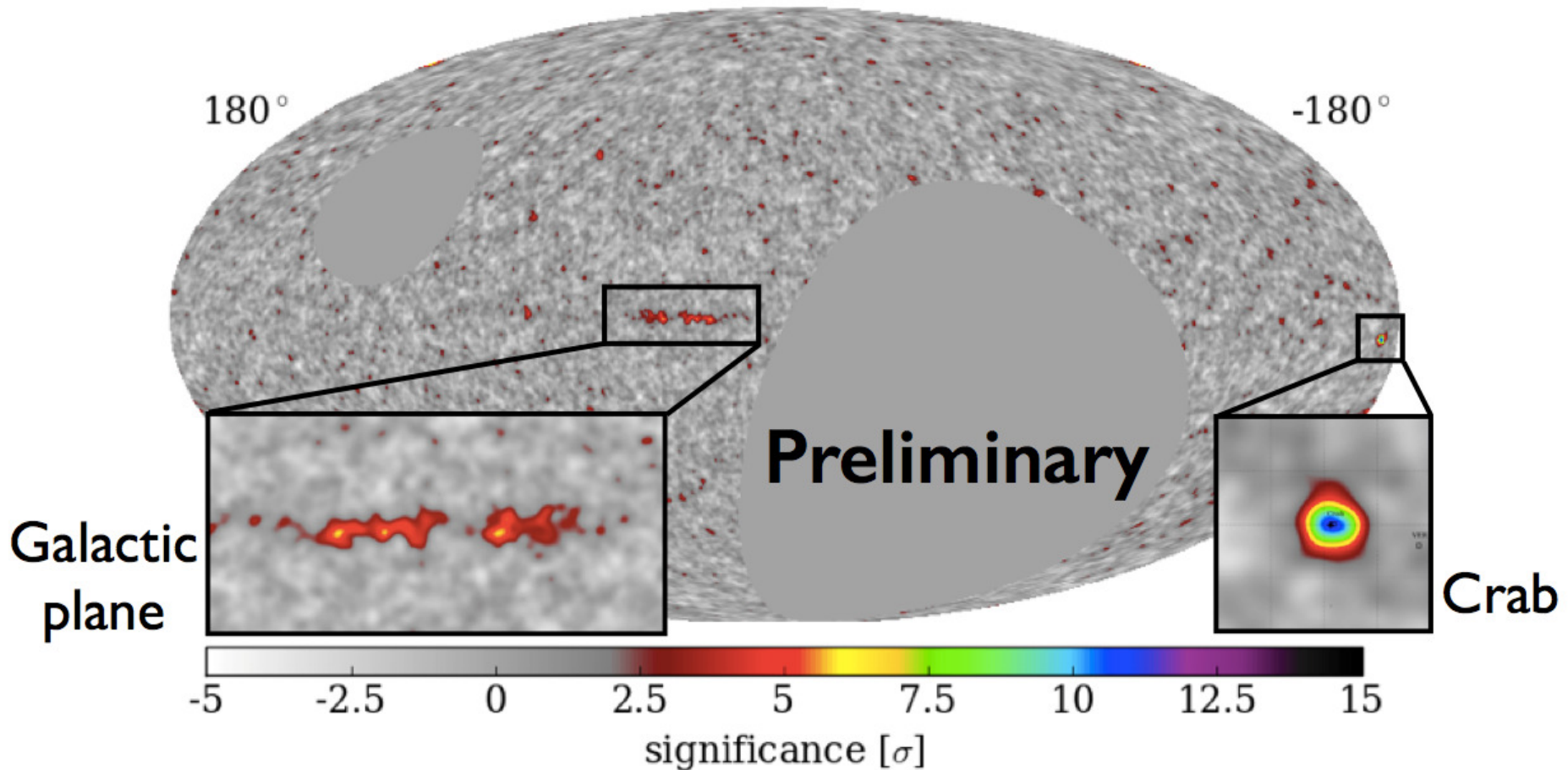


Markarian 501 in HAWC-95/111 06/13/2013-09/12/2013



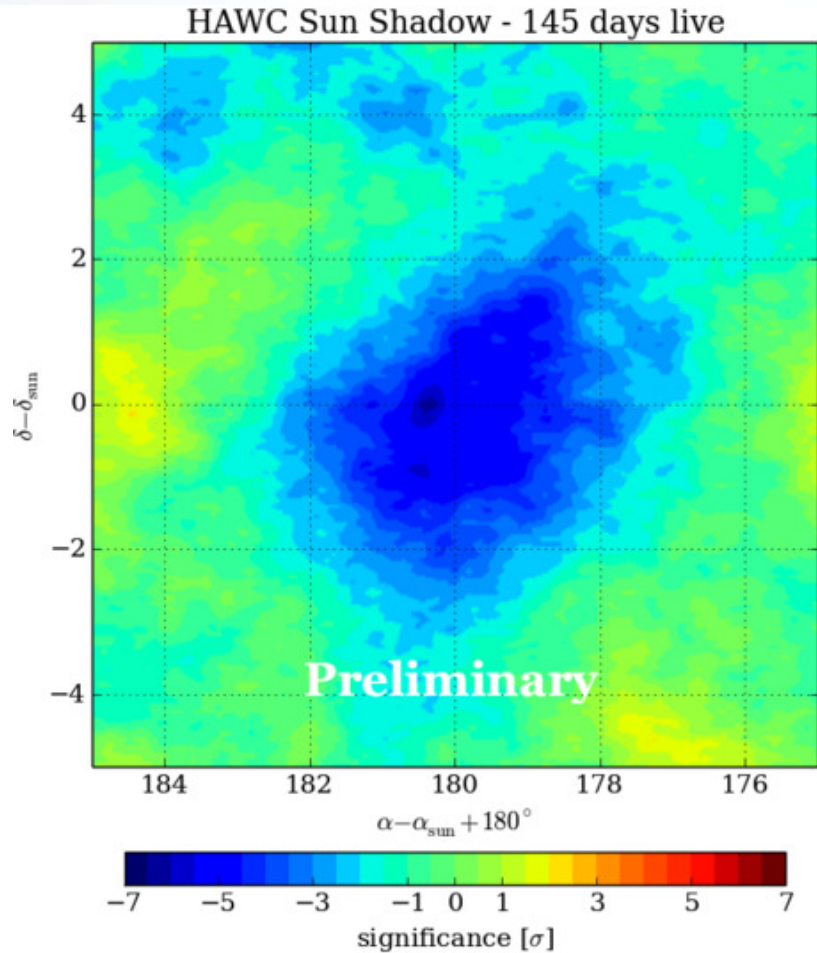
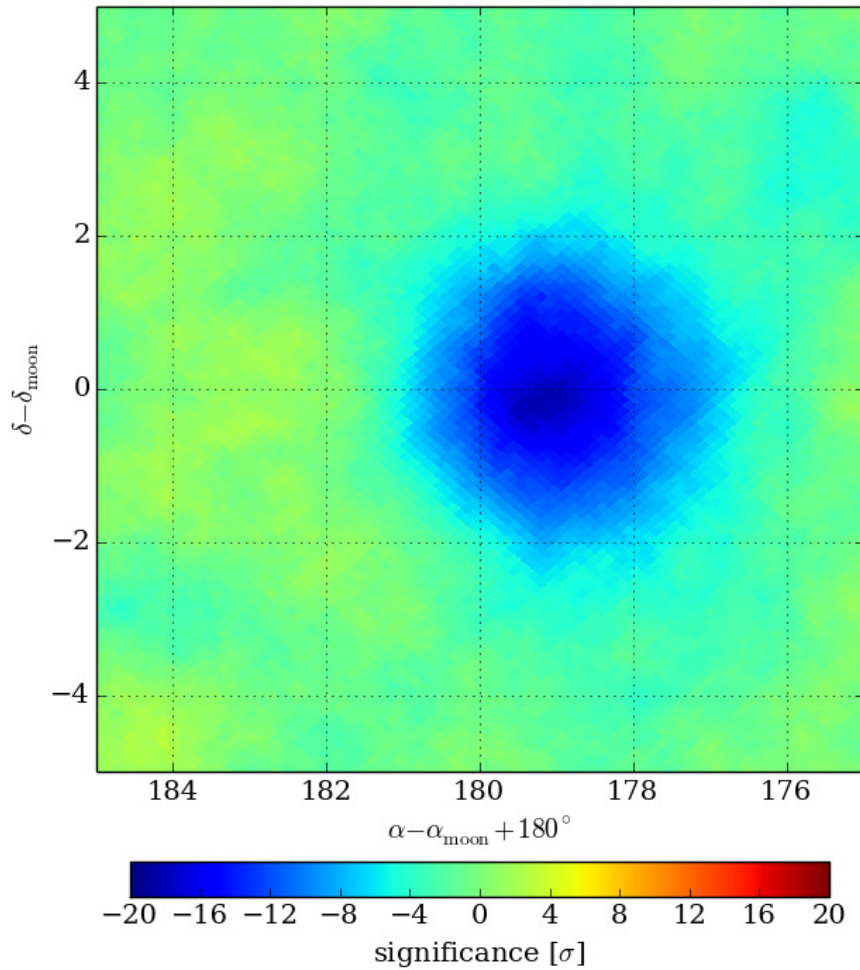
Continuous monitoring for AGN flares!!!

HAWC-95/111 Skymap (3 month of data 1/3 of detector)



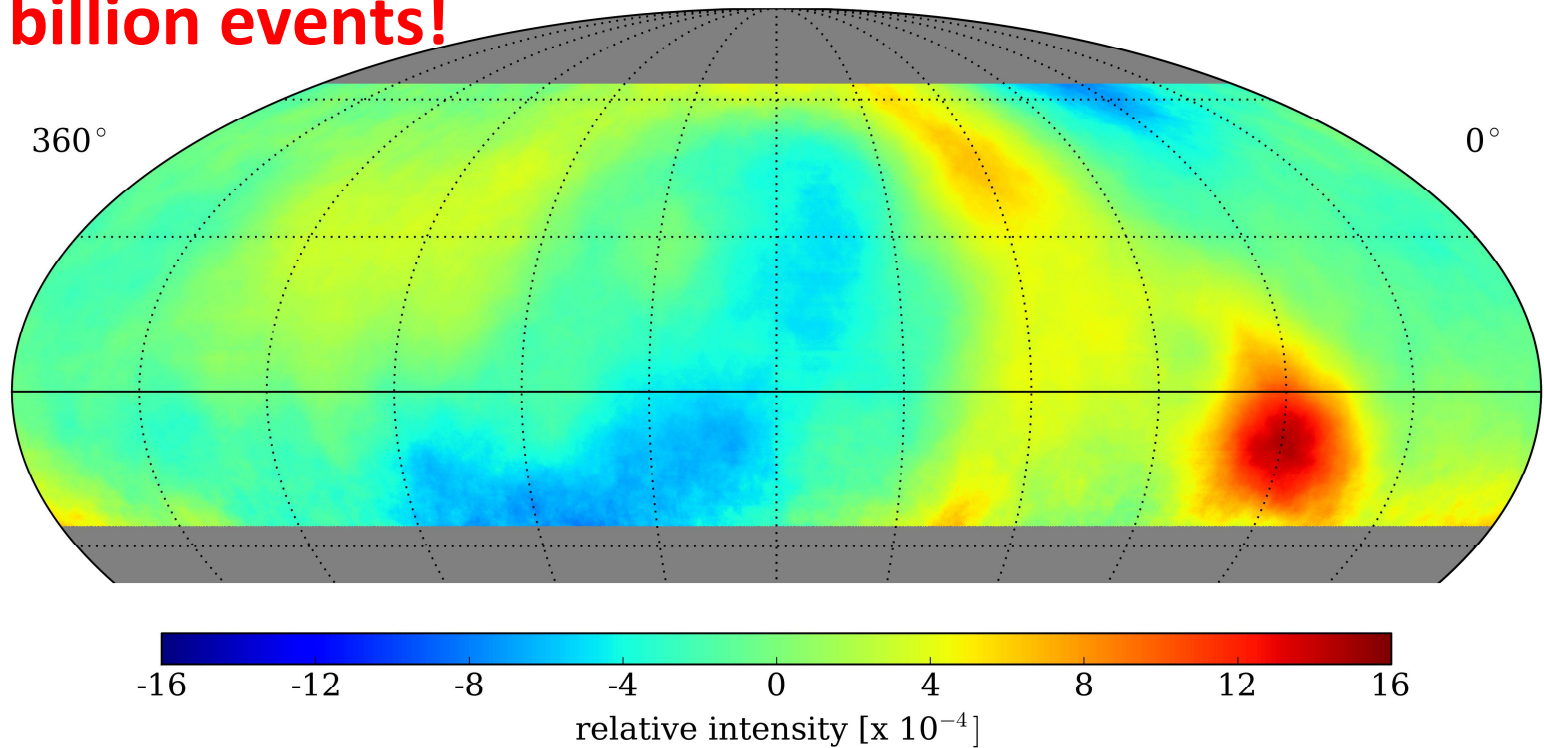
Caveats: absolute pointing uncertainties,
preliminary calibration...

Moon and Sun



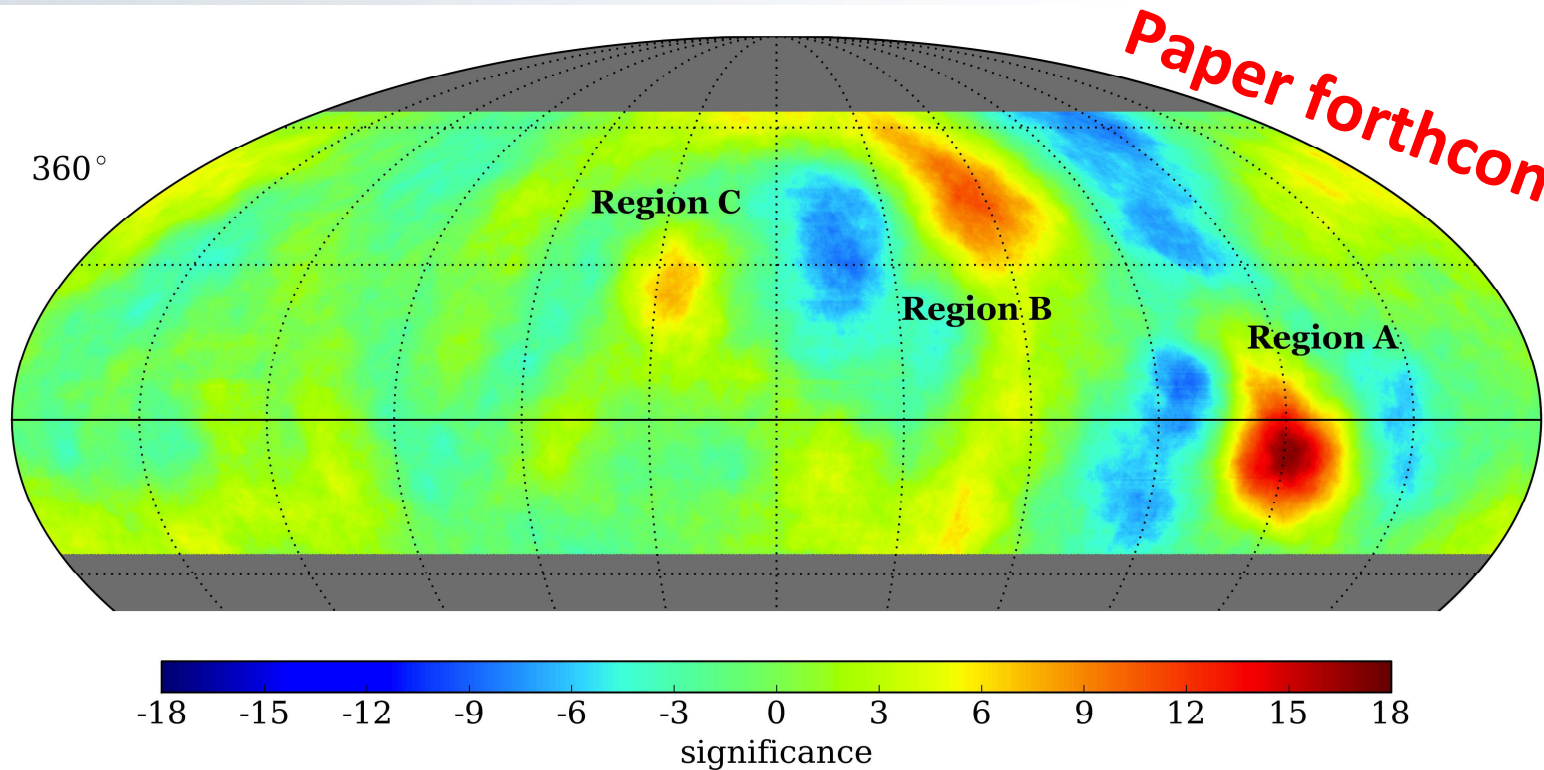
Cosmic Rays Anisotropy

50 billion events!



- 114 full sidereal days (solar dipole contamination)
- 1.2° median ang. res.
- 1.9 TeV median energy
- “Direct Integration”: Estimate background using data themselves
- Integration over 24h
- 10° smoothing

Cosmic Rays Anisotropy



- Fit di-, quadru- and octupole
- Subtract fit from map
- Three significant regions ($>5\sigma$ post-trial)
- 2 previously discovered (A&B)
- 1 recently announced (C)

Gamma-Ray Bursts

HAWC GRB detection methods

- Triggered (“Main”) DAQ
- Scaler DAQ

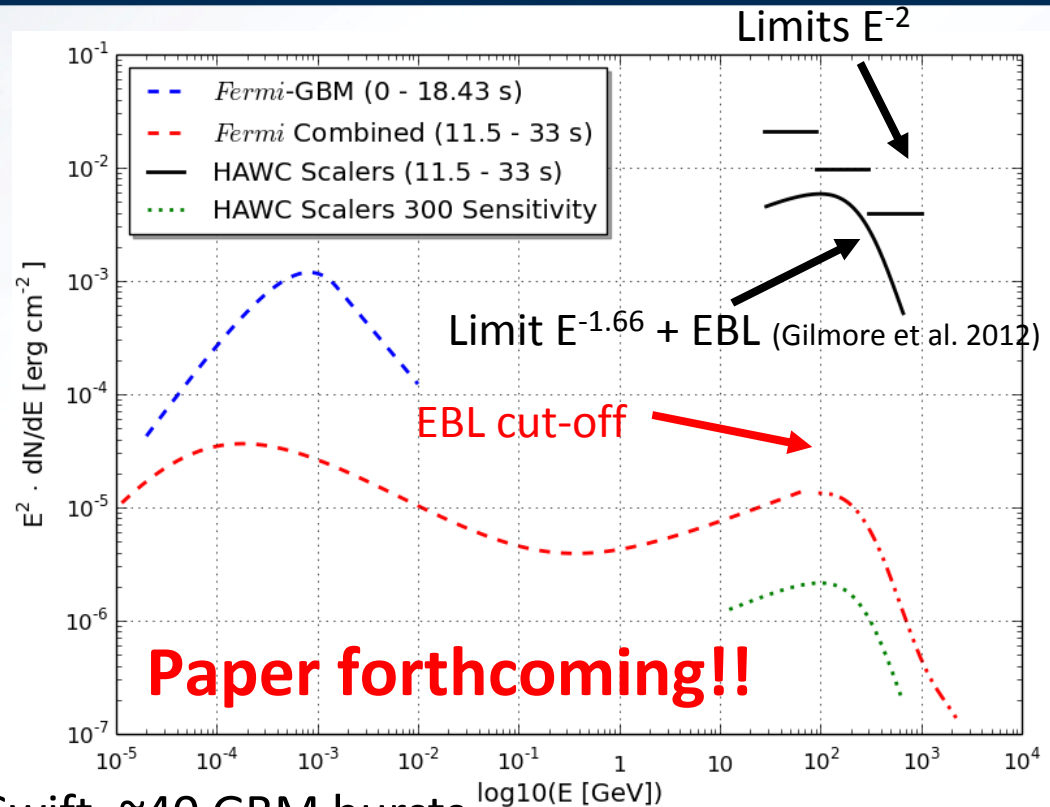
GRB 130427A at 33° elevation

- Only scaler DAQ data (29 tanks)
- Sensitivity is about 2 orders worse than at zenith
- Increased energy threshold

Main DAQ Analysis

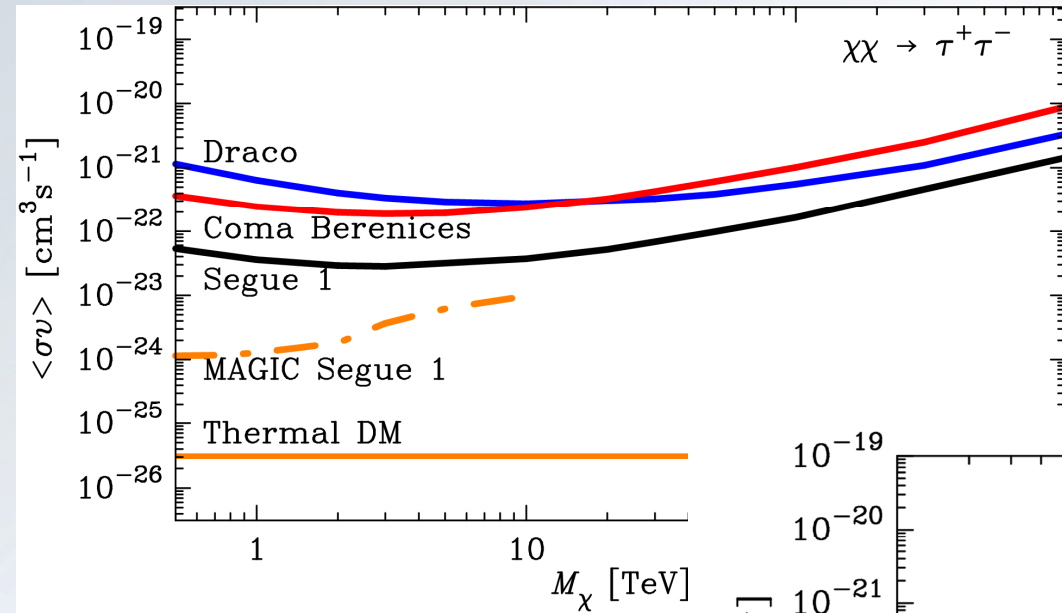
- Since summer 2013: 1 LAT, ~20 Swift, ~40 GBM bursts
- Quick look analysis that will run online
- Sophisticated likelihood analysis

➔ For more information, see talk in 2nd session



Dark Matter

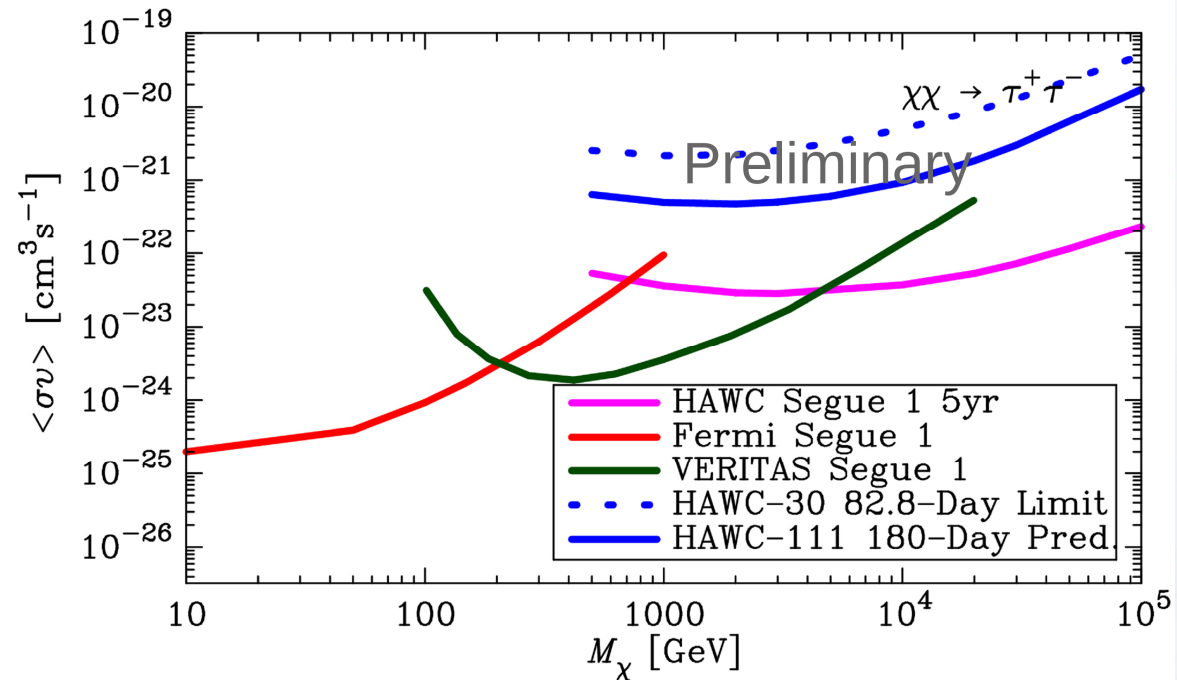
Submitted, arXiv:1405.1730



HAWC Sensitivity

- Dwarf Galaxies
- Virgo / M31
- Galactic Centre

First limits from partial array



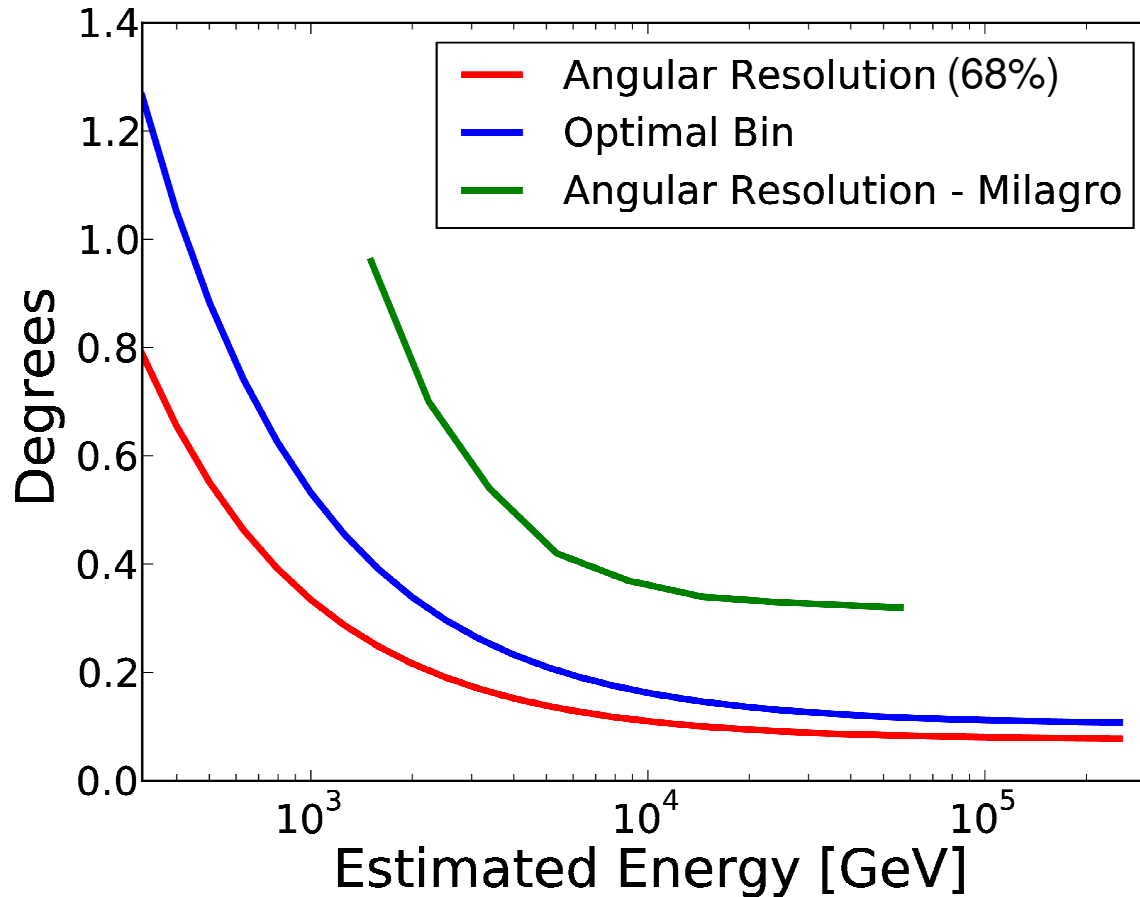
Summary

- HAWC is an exciting new gamma-ray experiment
- Wide field of view: catch transient events like GRBs and AGN flares
- Data analysis is ongoing
 - Gaining confidence in detector performance
 - Several paper forthcoming
 - Further analysis on the way
- HAWC-250 by August/September, full HAWC by end of the year

Backup

HAWC Performance

Abeysekara et al., Astropart. Phys. (2013)



Improved angular resolution

HAWC Performance

Abeysekara et al., Astropart. Phys. (2013)

