

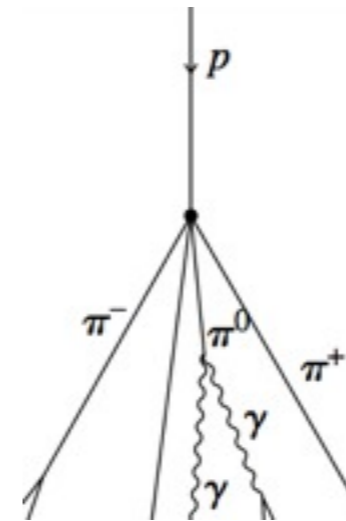
# Studying the Diffuse Gamma-Ray Emission from the Cygnus Region with HAWC and Fermi

Hugo Ayala

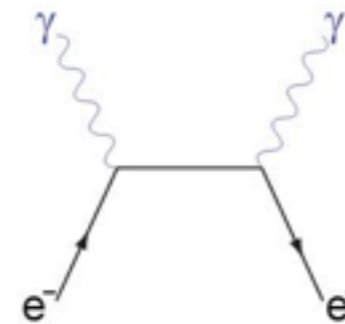


# Galactic Diffuse Gamma-Ray Emission

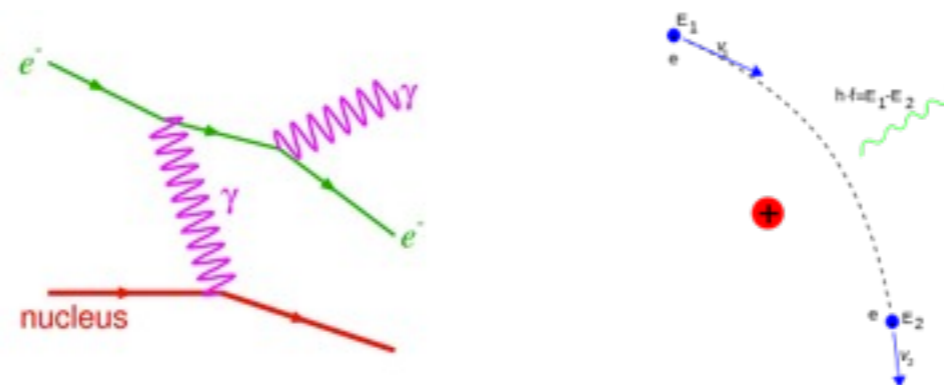
- Diffuse gamma-ray emission is produced by the interaction of cosmic rays with radiation fields (CMBR) and interstellar matter in the galaxy
- Physical processes
  - Nuclei collision  $\Rightarrow \pi^0 \Rightarrow \gamma$



- Inverse Compton Scattering

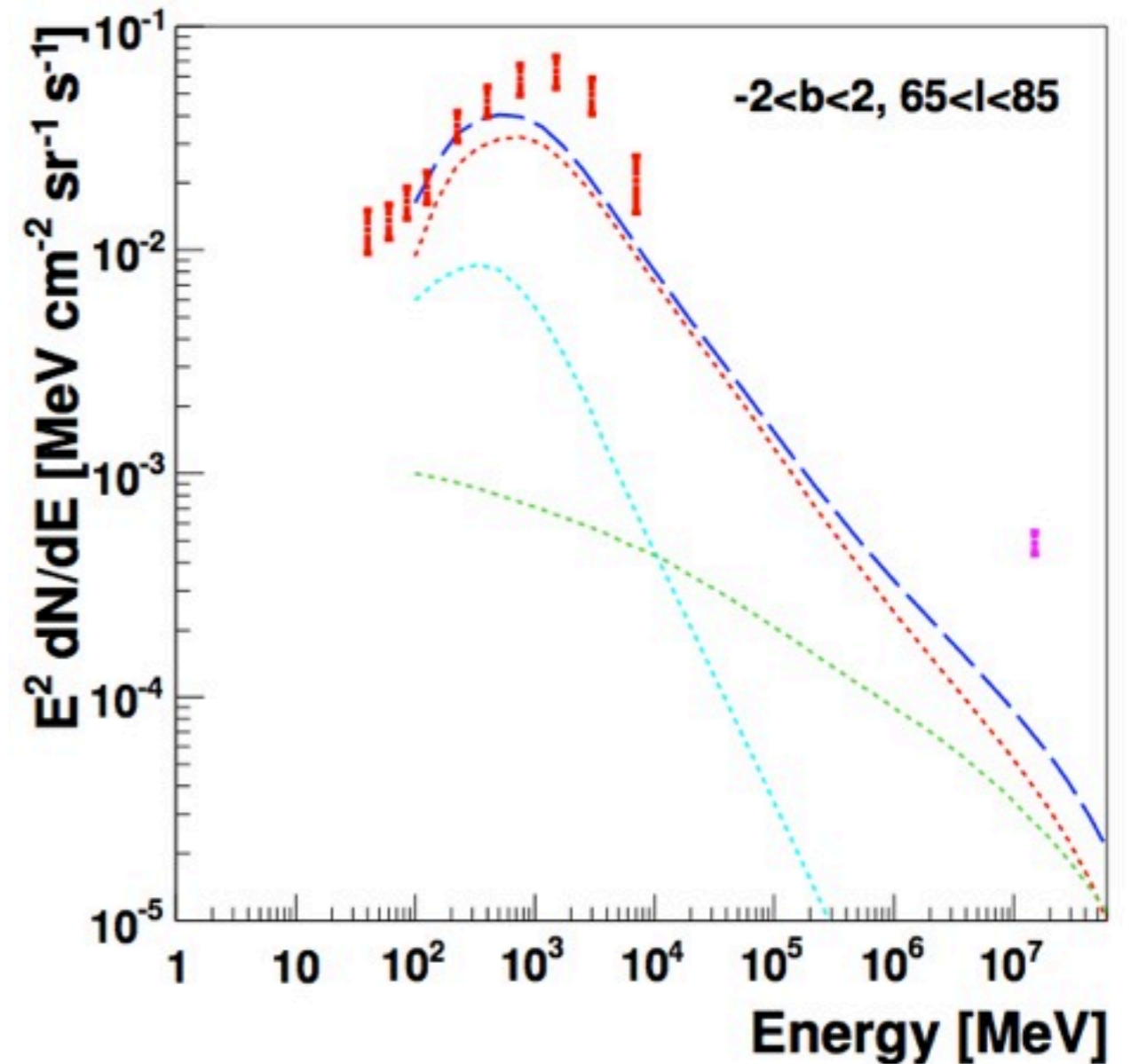


- Bremsstrahlung



# Galactic Diffuse Gamma-Ray Emission

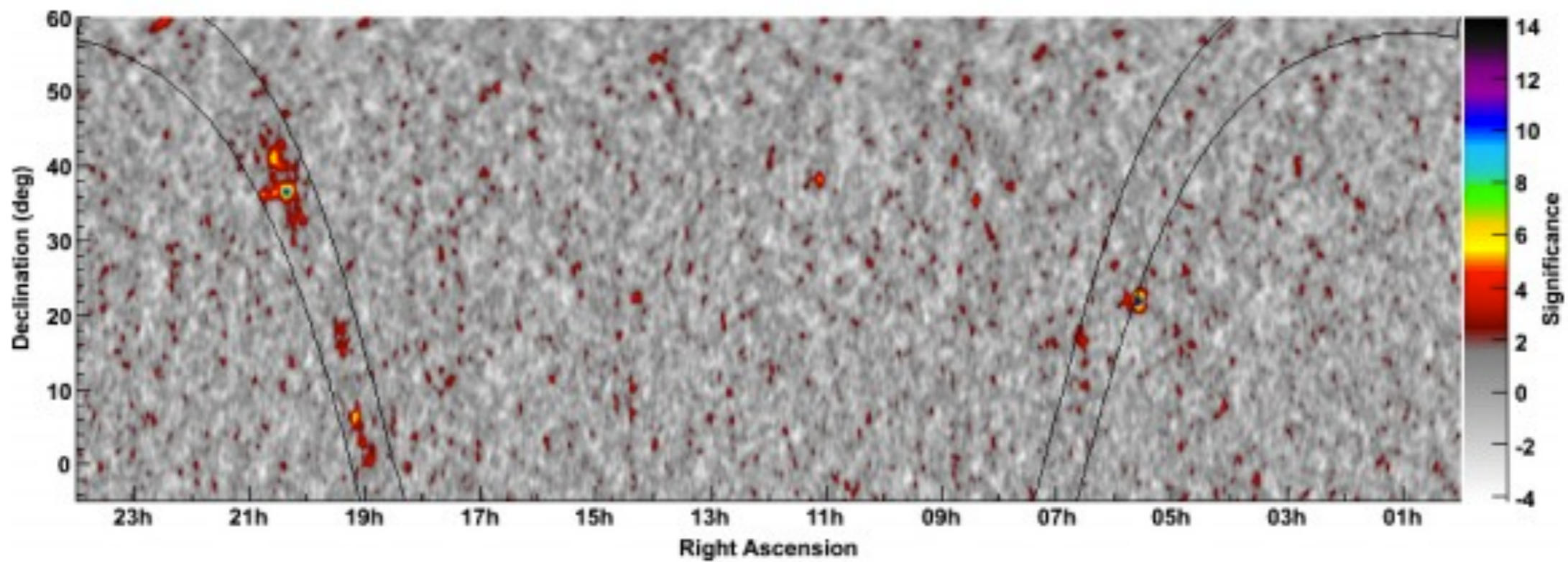
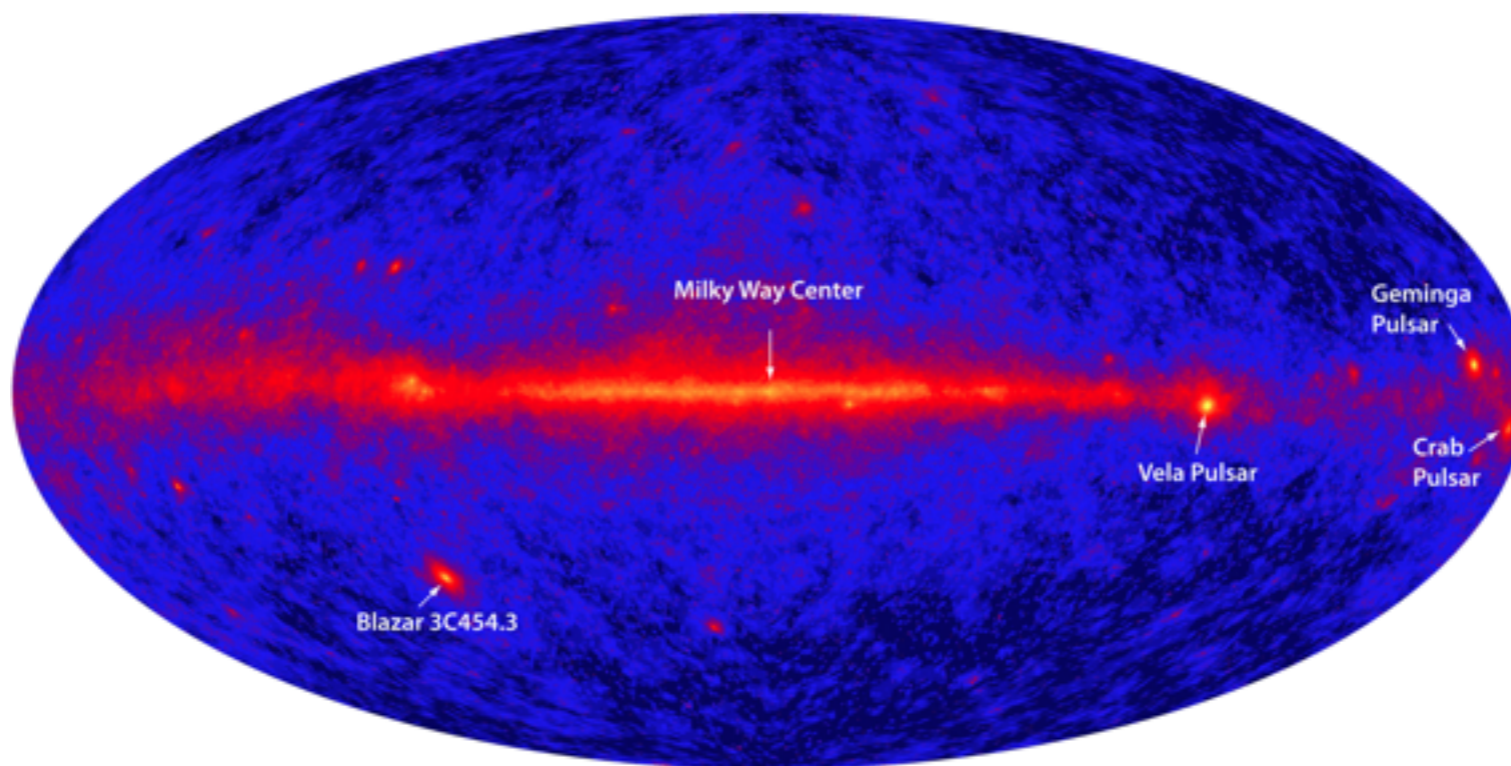
- Diffuse gamma-ray emission probes the acceleration and propagation of cosmic rays.
- Each process has a characteristic spectrum that we can analyze



# Motivation

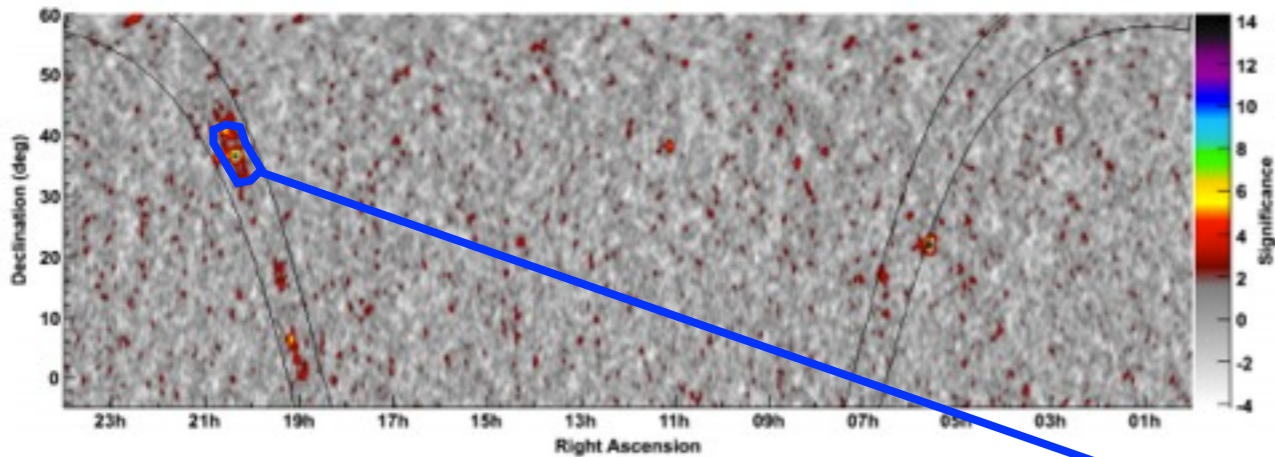
- The diffuse emission at TeV energies is unique since it traces the transitional energy regime between 'sea' and freshly released Cosmic Rays
- The detection of extended/diffuse gamma-ray emission at close to 100 TeV near acceleration sites would be a sign of cosmic-ray acceleration up to  $10^{15}$  eV in galactic sources
- TeV sky appears to show more small scale structures than the sky at MeV-GeV energy (except the Fermi Bubbles)





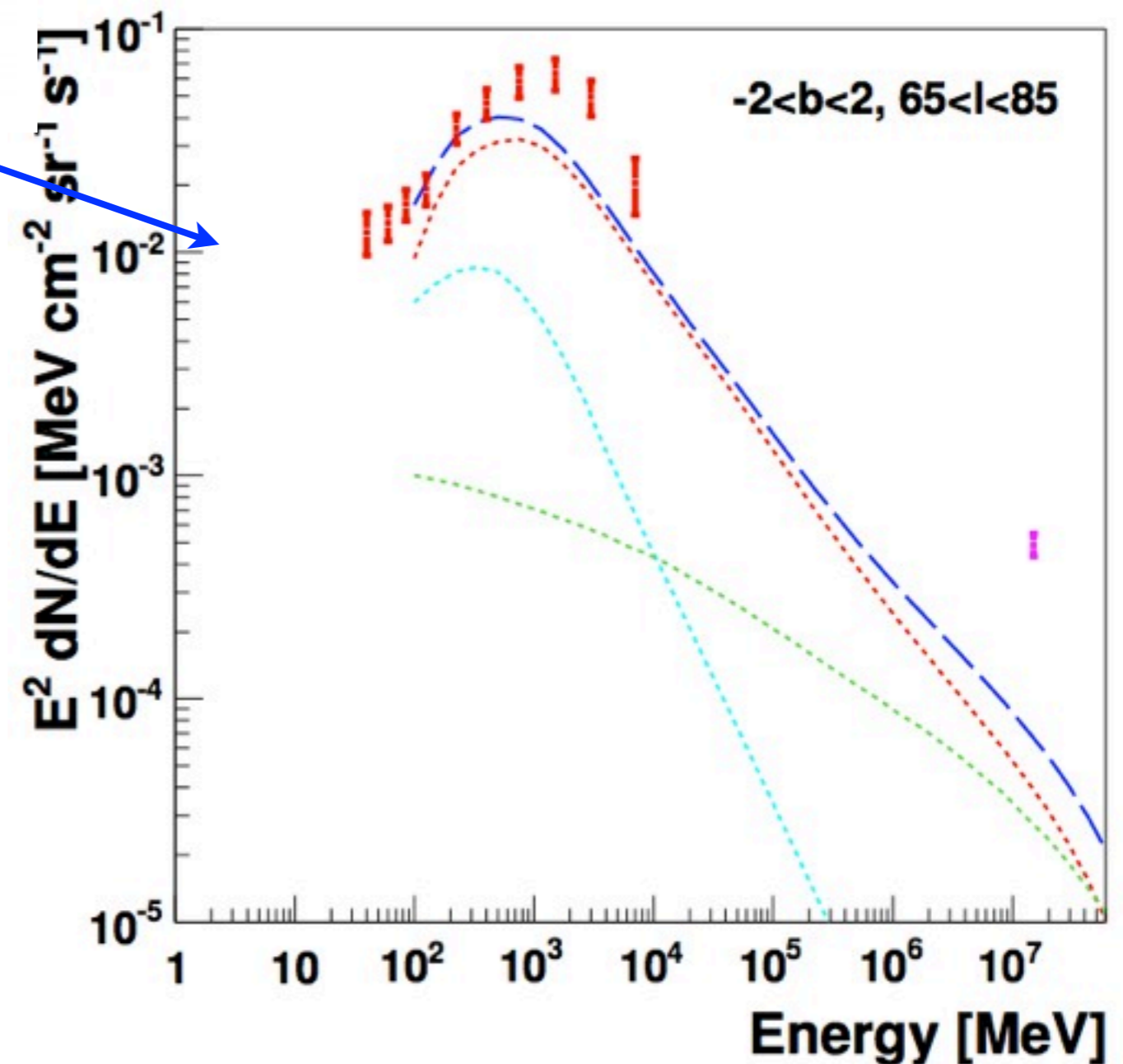


# Cygnus Region



- Flux measurement by Milagro obtained from 8 years of data

Blue: Total predicted flux  
Red: Pion Contribution  
Green: Inverse Compton Contribution  
Blue: Bremsstrahlung



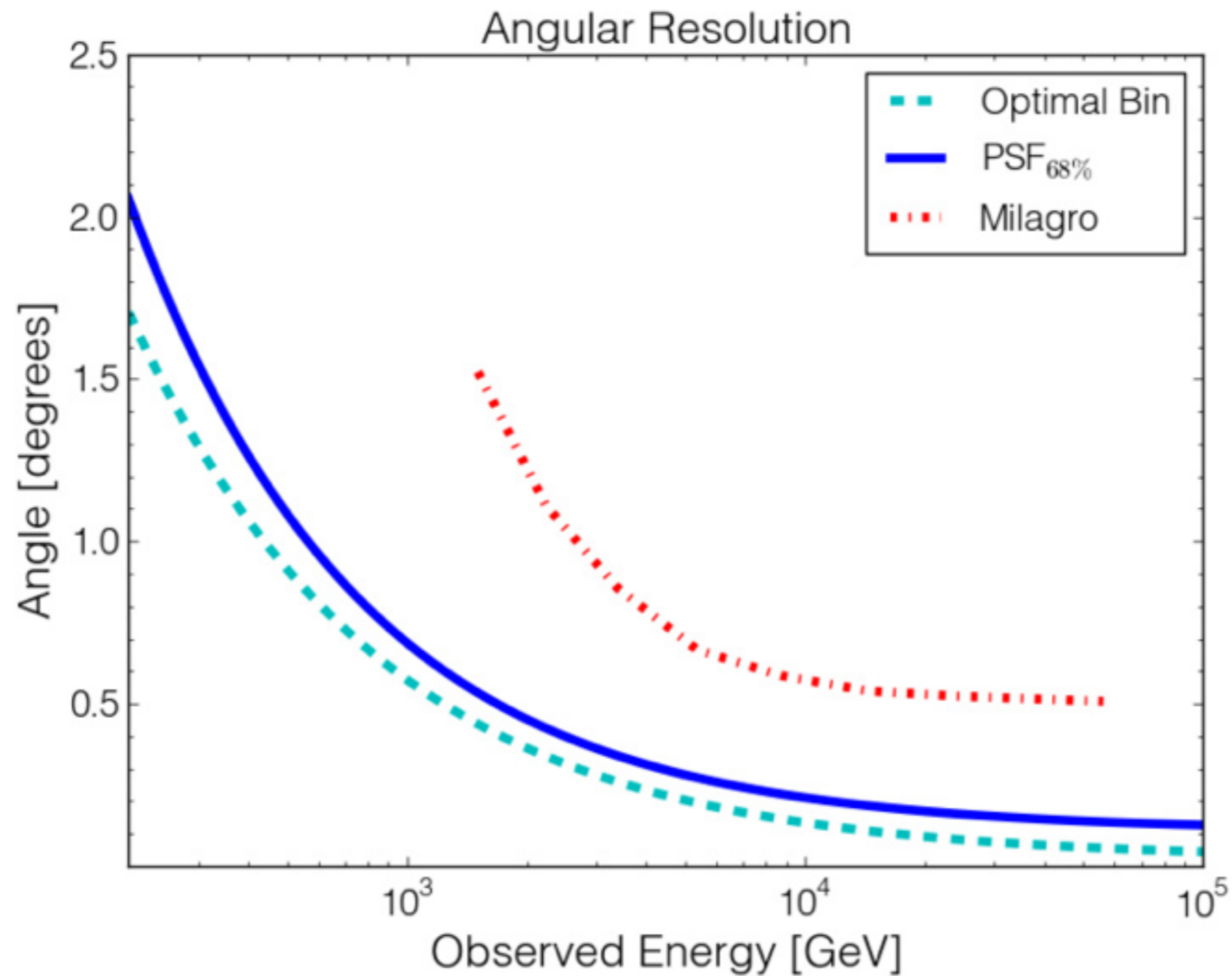
# HAWC



- High Altitude Water Cherenkov Detector
- Being built in Mexico at 4100 mts. a.s.l
- Energy range 100GeV to 100TeV
- Area of 20000m<sup>2</sup>
- Each WCD has 4 Photomultiplier tubes to detect Cherenkov light

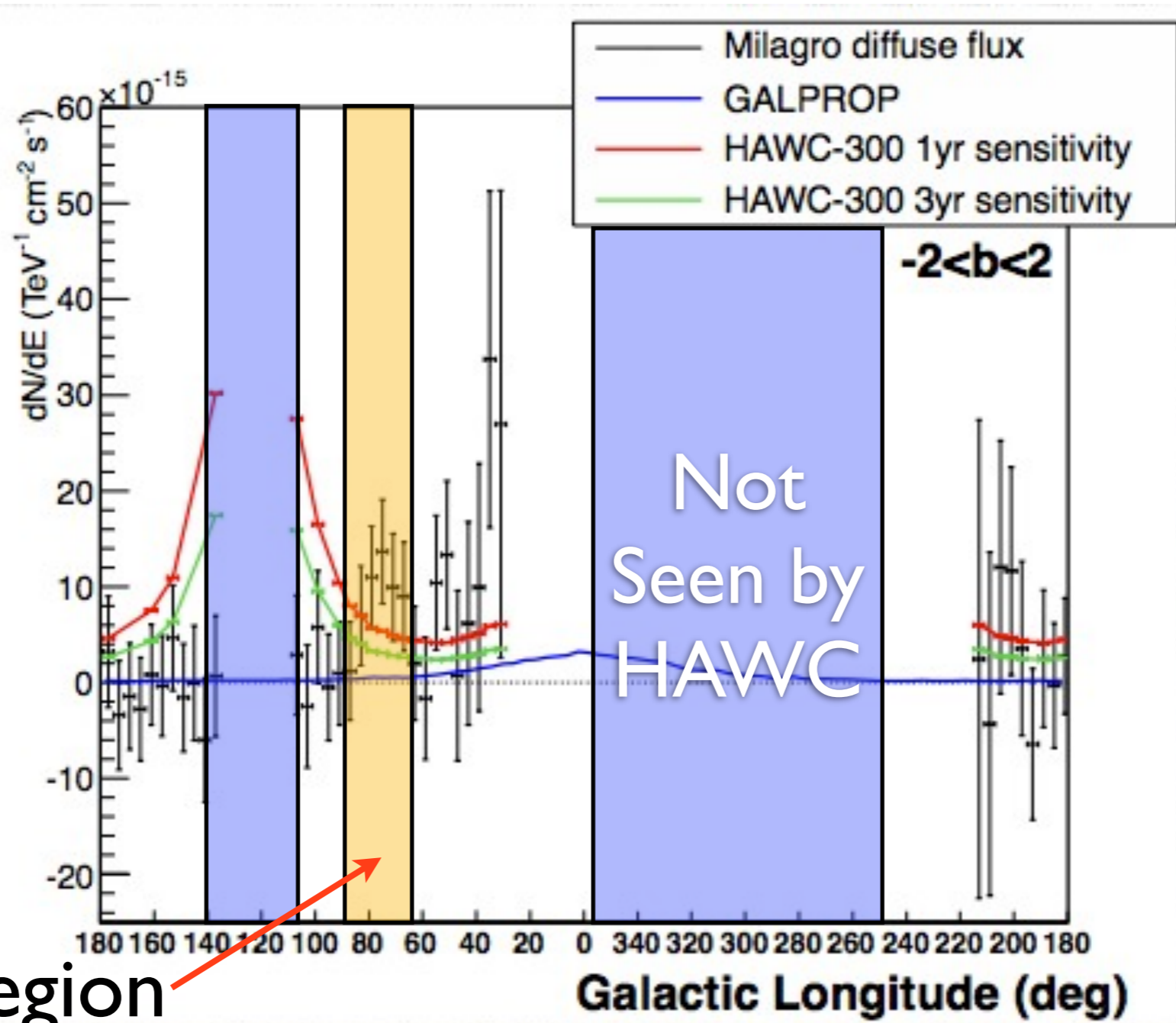


# Angular Resolution



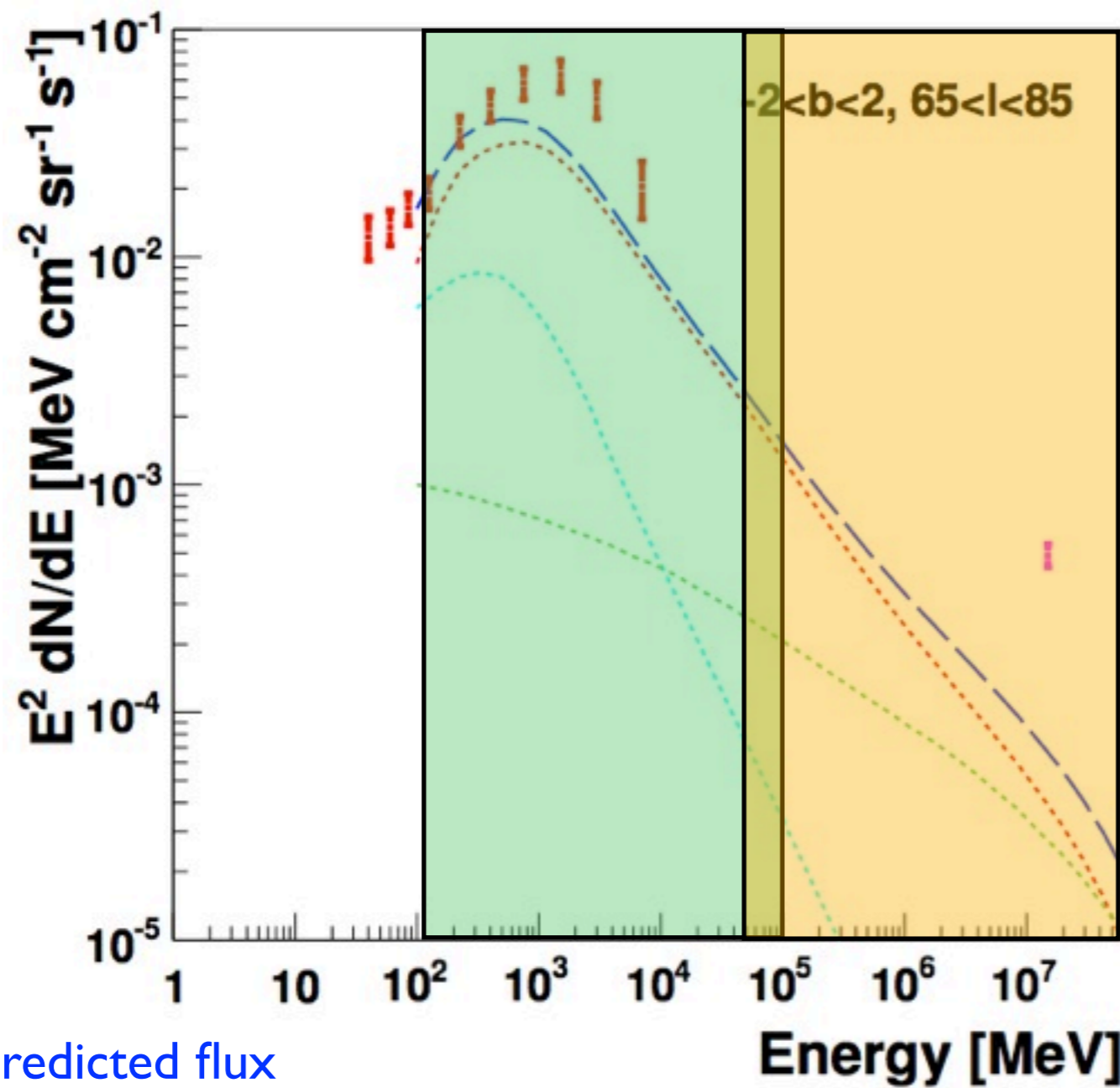


# Sensitivity to Diffuse Gamma-Ray Emission



Cygnus Region

# Cygnus Region: What is next?



Fermi

HAWC

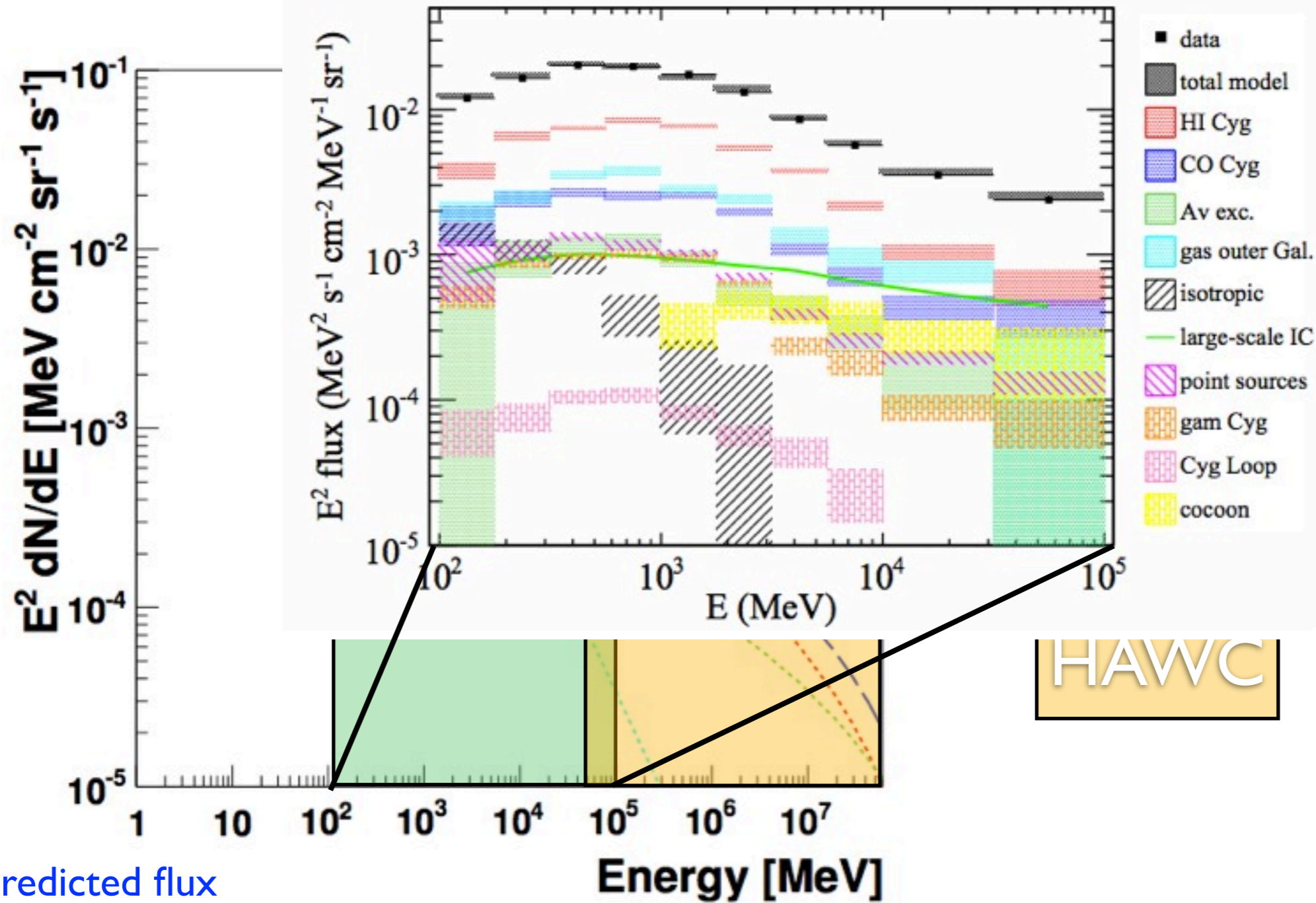
Blue: Total predicted flux

Red: Pion Contribution

Green: Inverse Compton Contribution

Blue: Bremsstrahlung

# Cygnus Region: What is next?



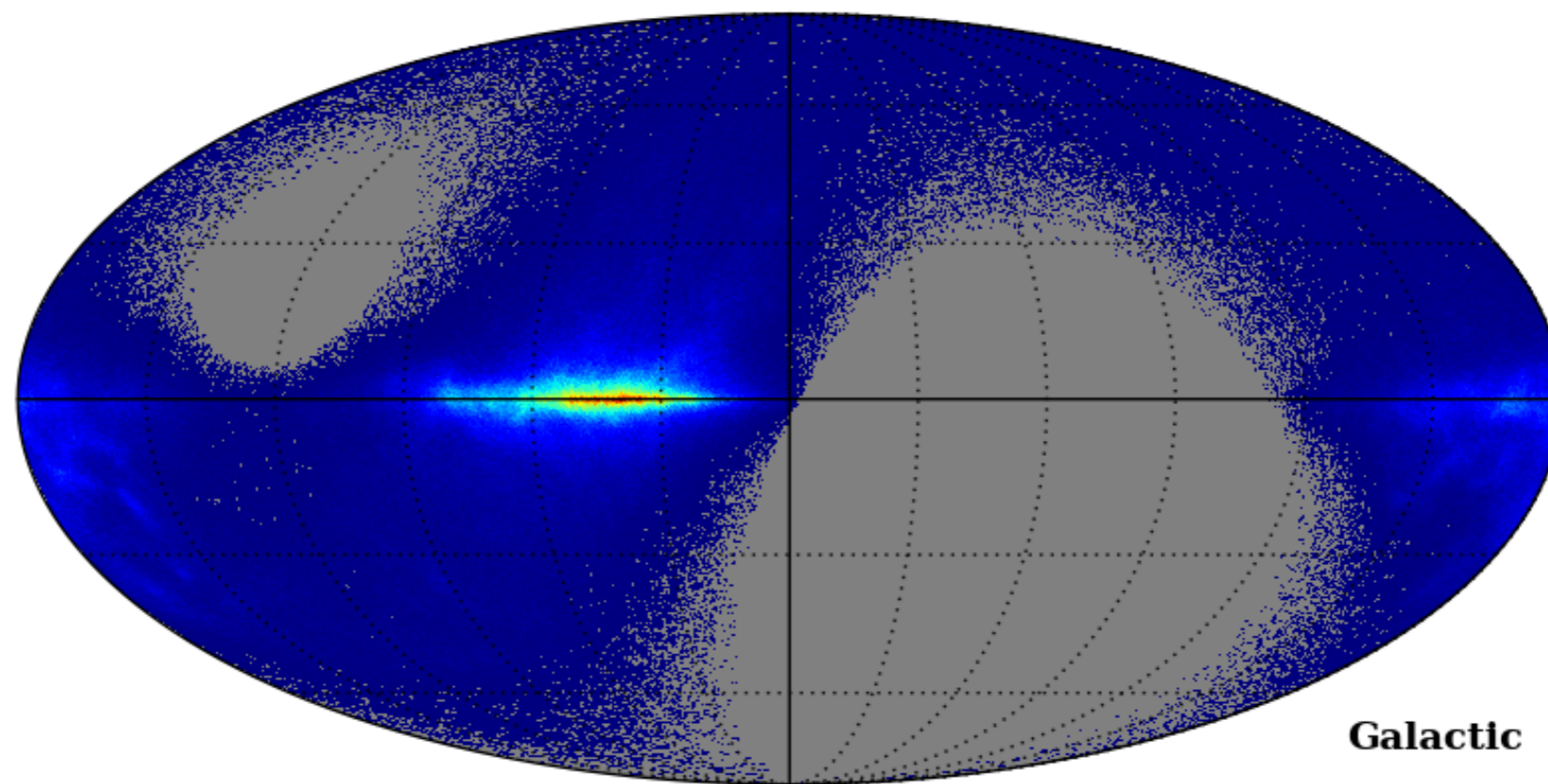
Blue: Total predicted flux  
 Red: Pion Contribution  
 Green: Inverse Compton Contribution  
 Blue: Bremsstrahlung



# Some preliminary work

- One year simulation of the Diffuse Gamma-Ray Emission.

Binsize =  $0.44^\circ$



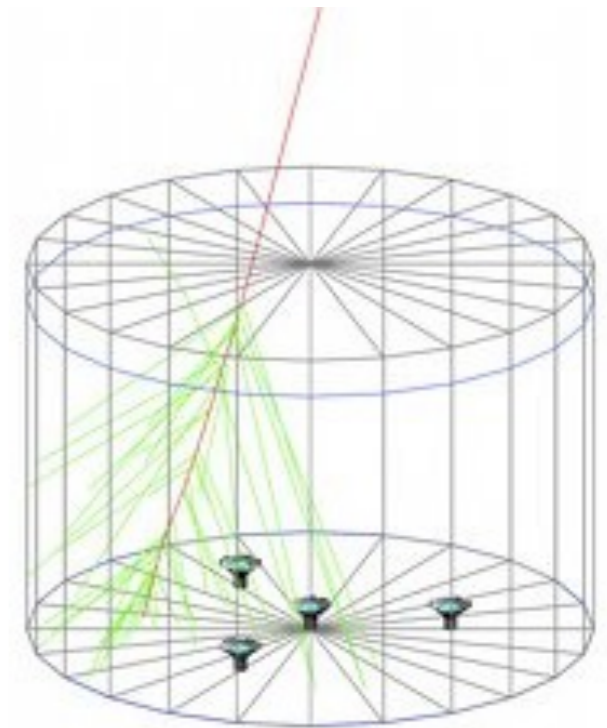
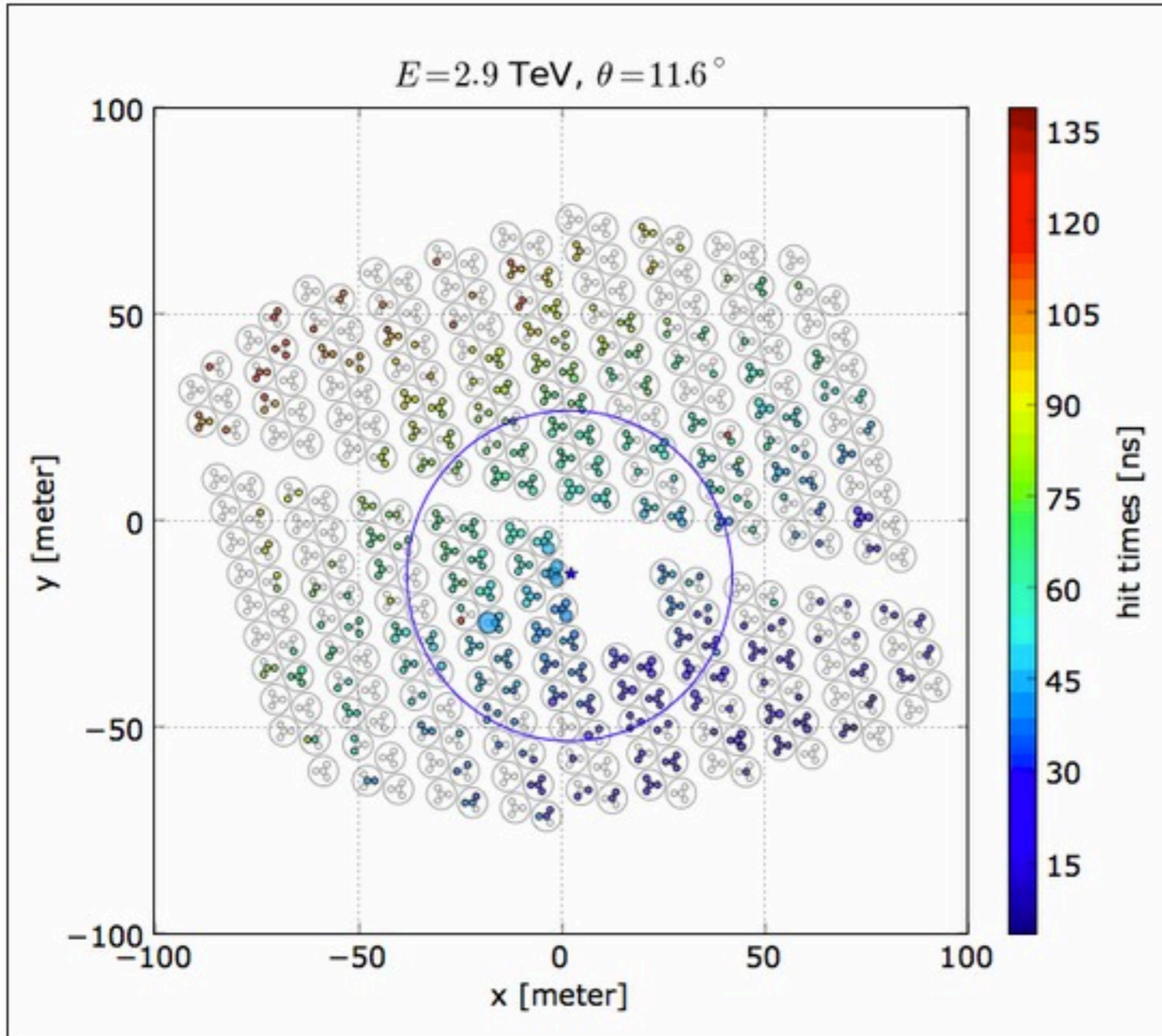
# Summary

- **HAWC** is a ground-based gamma-ray detector that will study the galactic diffuse gamma-ray emission with **unprecedented sensitivity**
- **HAWC** will be able to study large extended sources and to probe the propagation and acceleration of high energy cosmic rays close to the accelerator sources.
- **HAWC** will be able to describe the Cygnus Region better than its predecessor Milagro.

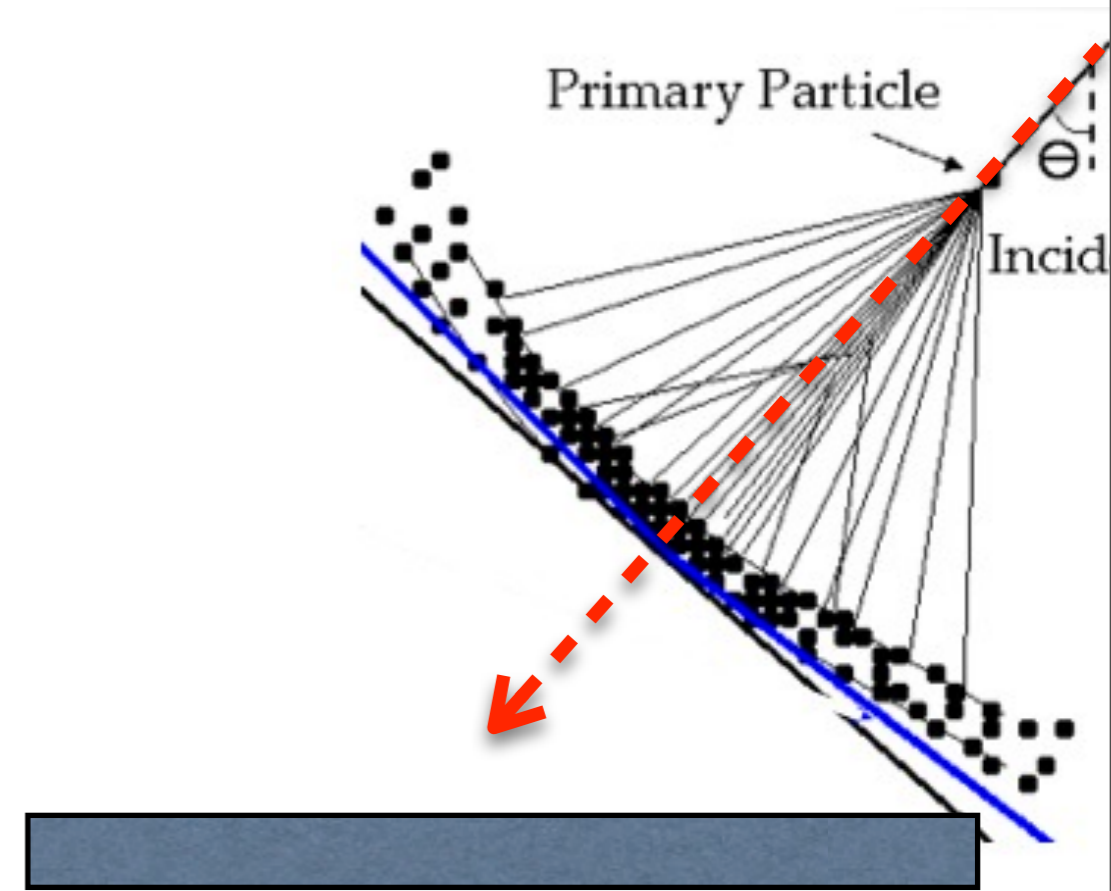
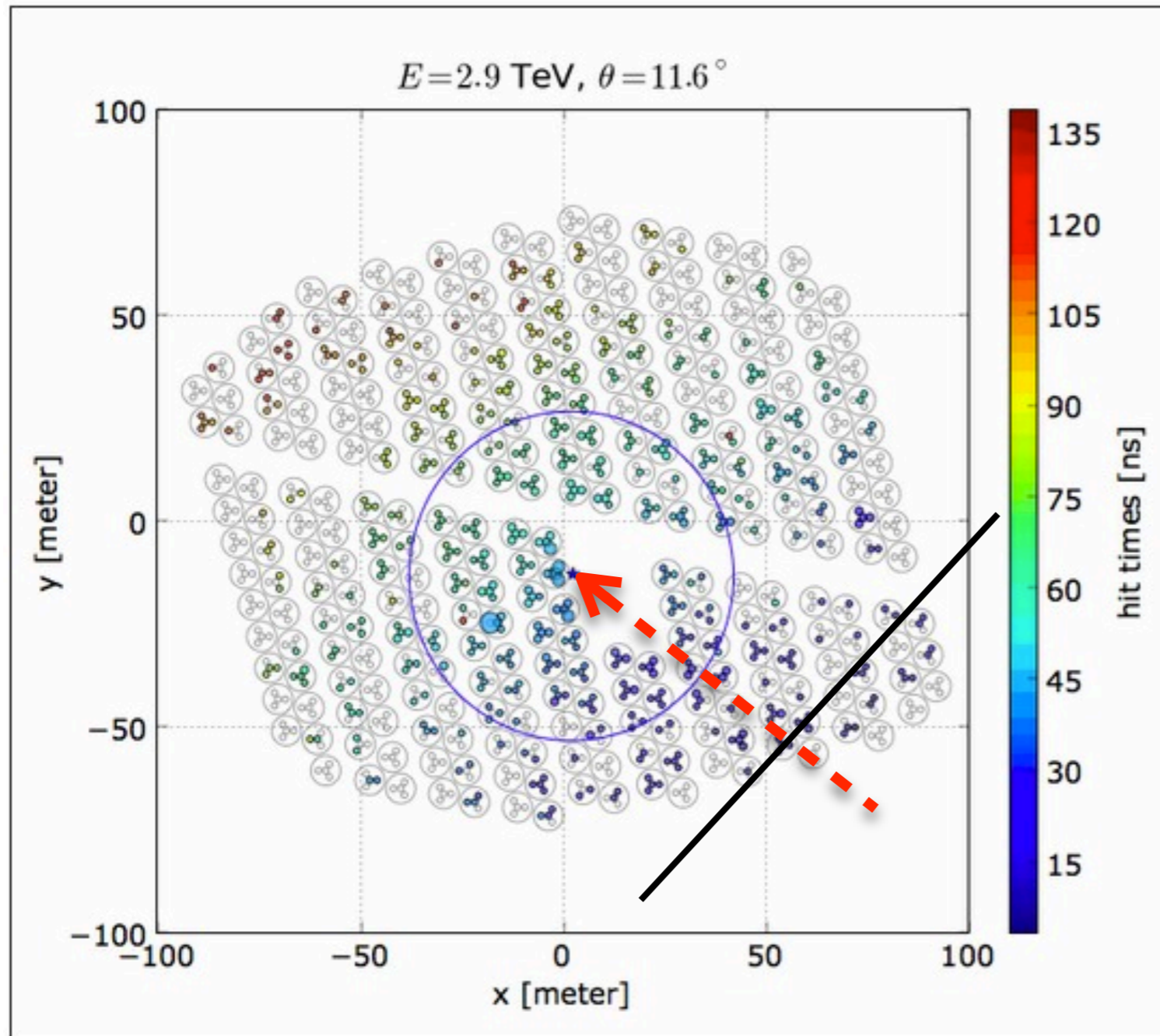
# Back-up



# How does HAWC work?

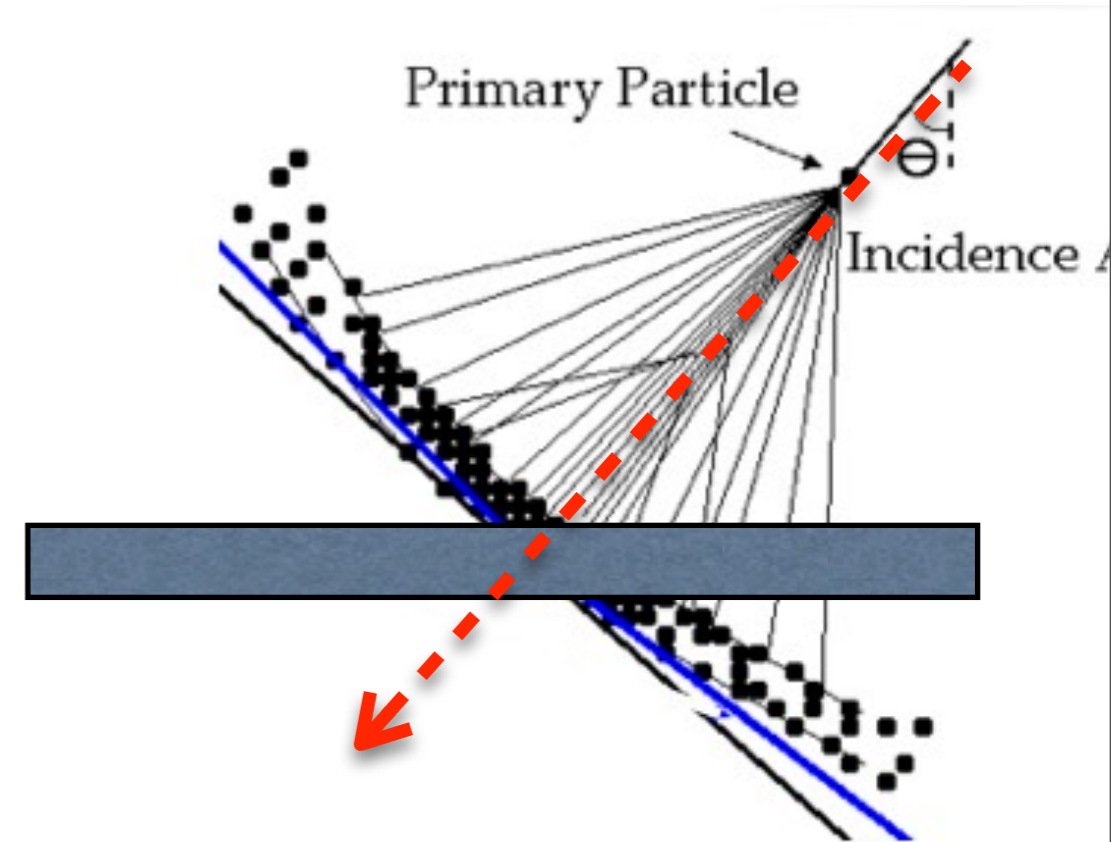
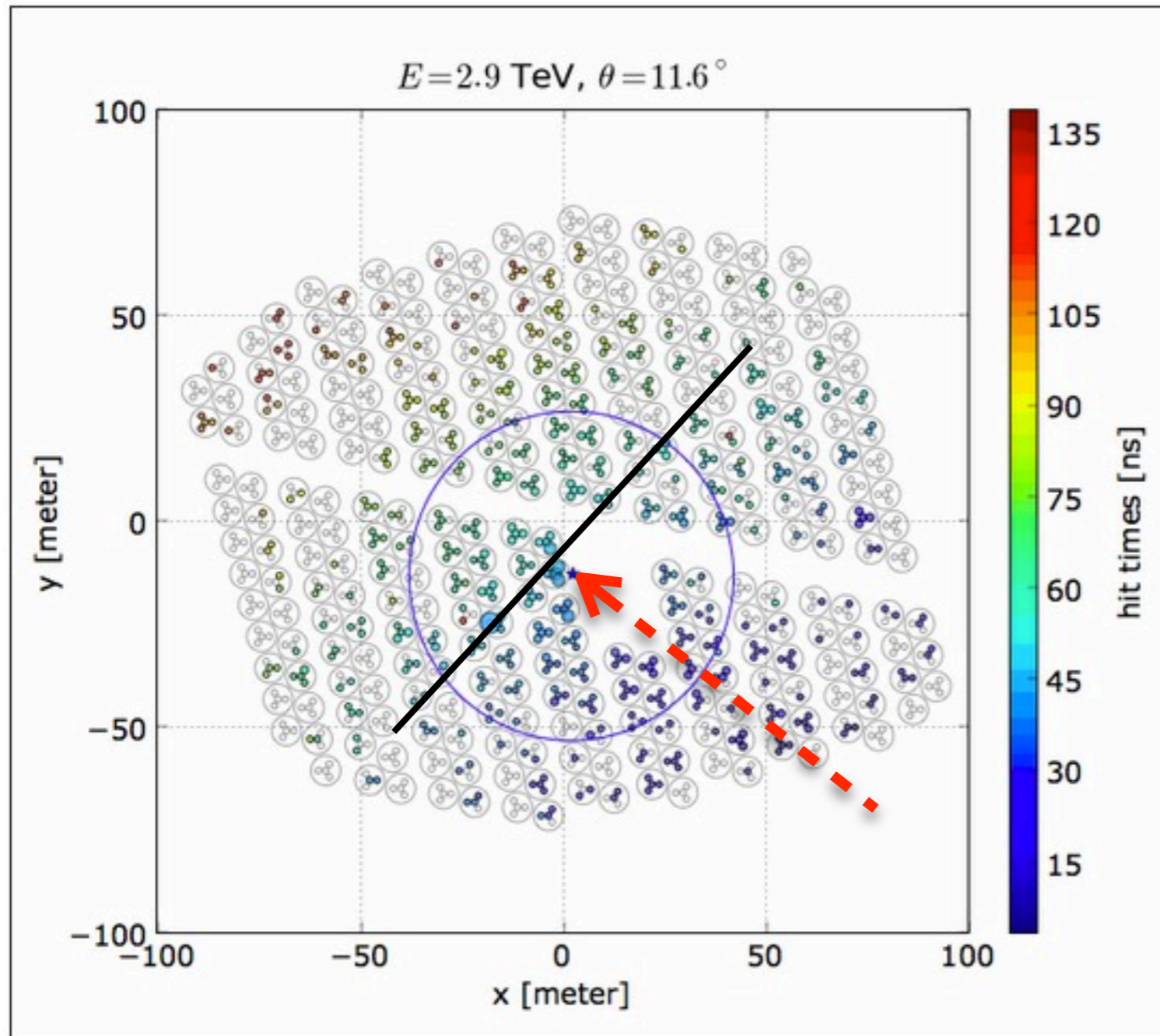


# How does HAWC work?



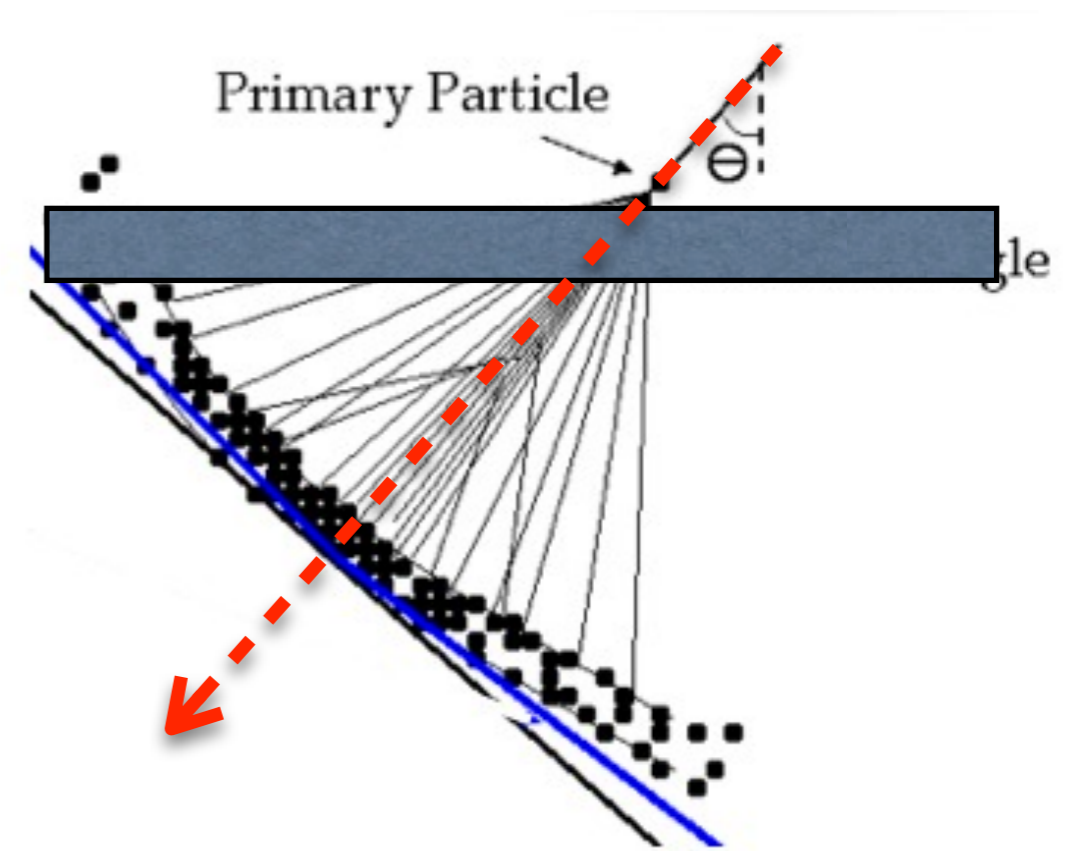
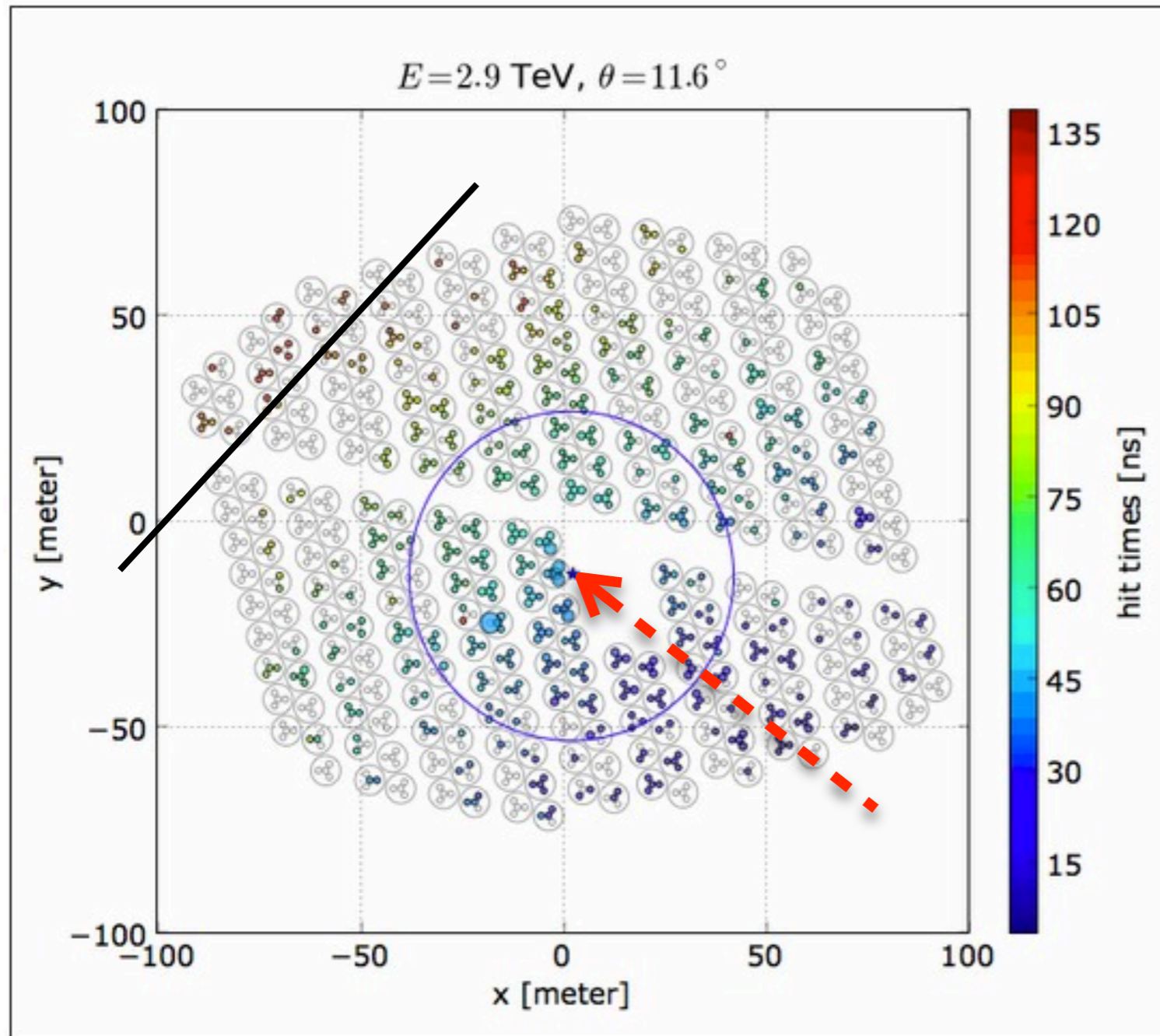


# How does HAWC work?





# How does HAWC work?



# Detector Sensitivity

