

# The Southern Gamma-ray Survey Observatory



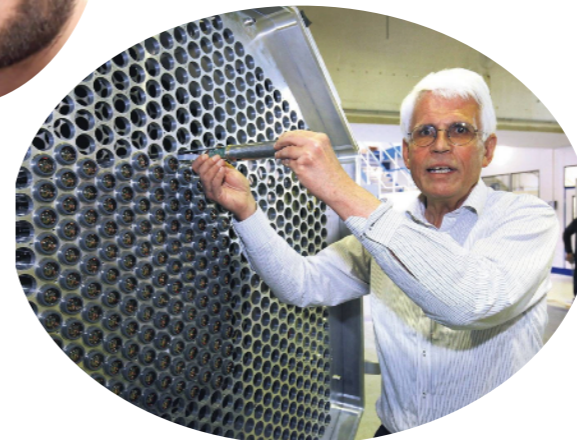
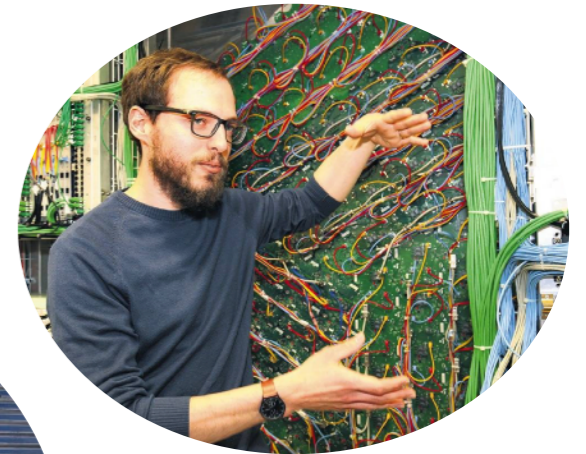
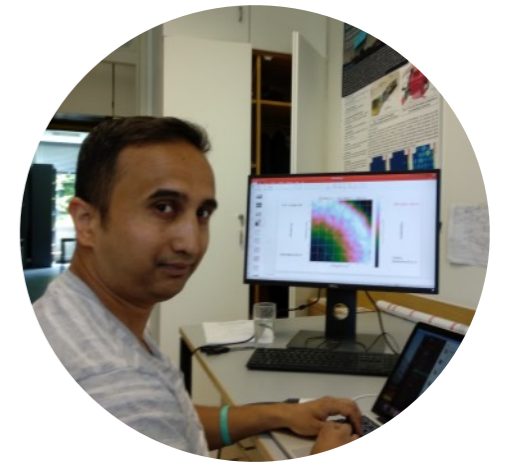
# The who...

## SGSO-Alliance

[www.sgso-alliance.org](http://www.sgso-alliance.org)

**SOUTHERN  
GAMMA-RAY  
SURVEY  
OBSERVATORY**

## Team MPI-K



### Who are we?

Individual(s)	Institution	Country
Jim Hinton	Max-Planck-Institute für Kernphysik, Heidelberg	Germany
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Fabian Schüssler	IRFU / DPhP, CEA, Université Paris-Saclay	France
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Andrew Smith	University of Maryland, College Park	USA
Adrian C. Rovero	Instituto de Astronomía y Física del Espacio (IAFE, CONICET-UBA)	Argentina
Andres Sandoval	Instituto de Física, UNAM	Mexico
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Elisa Prandini	University of Padova	Italy
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Marcos Santander	University of Alabama	USA
Segev BenZvi	University of Rochester	USA
Giuseppe Di Sciascio	-	Italy
Mike DuVernois	University of Wisconsin-Madison	USA
Stefan Westerhoff	University of Wisconsin-Madison	USA
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Stefan Funk	Erlangen Centre for Astroparticle Physics (ECAP), University of Erlangen-Nuremberg	Germany
Andrew Taylor	DESY-Zeuthen	Germany
Javier G Gonzalez	University of Delaware	USA
Juan Carlos Díaz	Universidad de Guadalajara	Mexico

**currently  
112 members**

# The Why...

- ▶ Science case written down in white-paper
  - on the arXiv
  - Living document
- ▶ Four Main Themes
  - Unveiling cosmic-ray accelerators
  - Monitoring the Transient Sky
  - Probing Physics Beyond the Standard model
  - Cosmic-Ray Observations

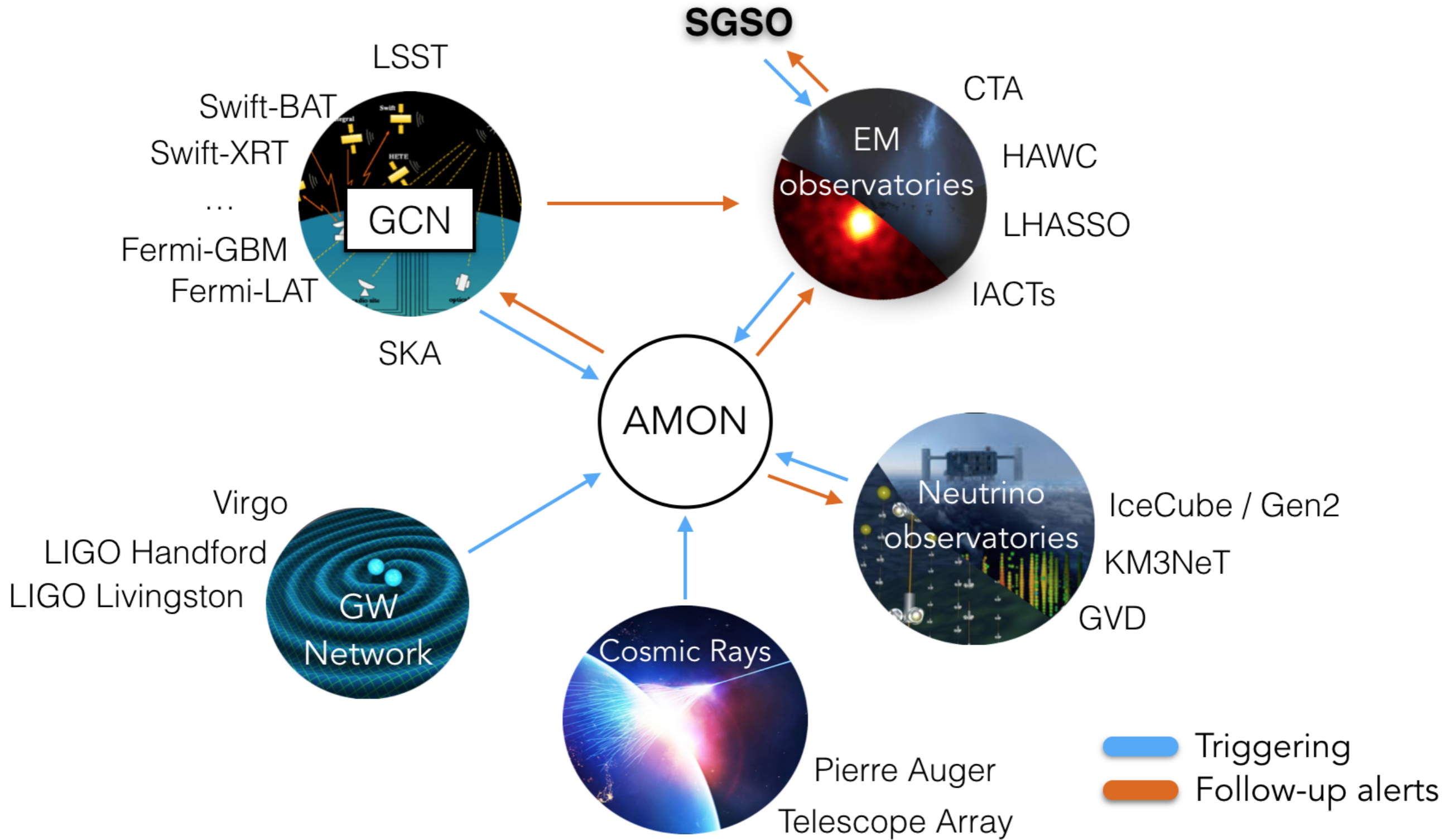
## 1 Science Case for a Wide Field-of-View 2 Very-High-Energy Gamma-Ray Observatory 3 in the Southern Hemisphere

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14 J. P. Lenain<sup>ifsc</sup>, K. Liu<sup>ifsc</sup>, R. López-Coto<sup>icn-unam</sup>, M. Madrid<sup>ifsc</sup>,  
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18 A. Sandoval, M. Santander<sup>ua</sup>, T. Sako<sup>icrr</sup>, T. K. Sako<sup>icrr</sup>, K. Satalecka<sup>desy</sup>,  
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**ONLINE:**  
**arXiv:1902.08429**

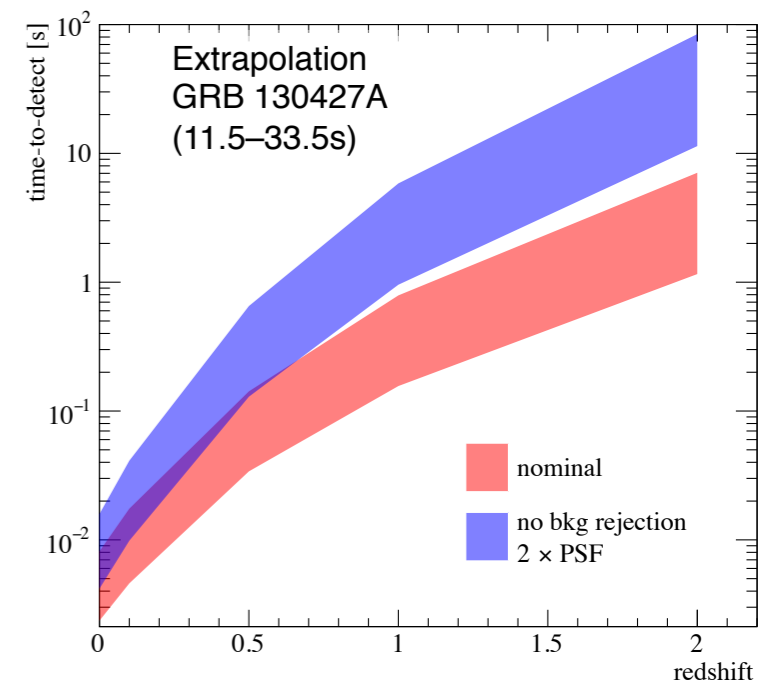
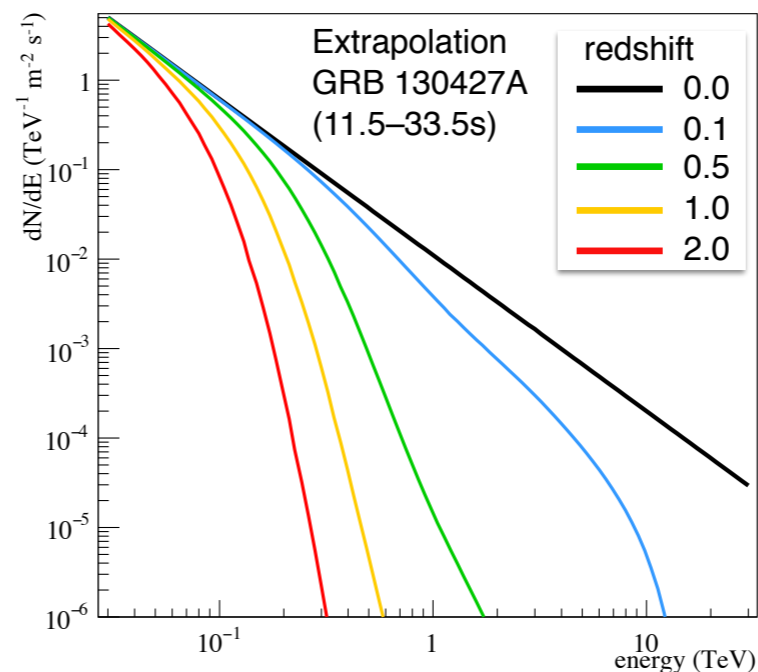
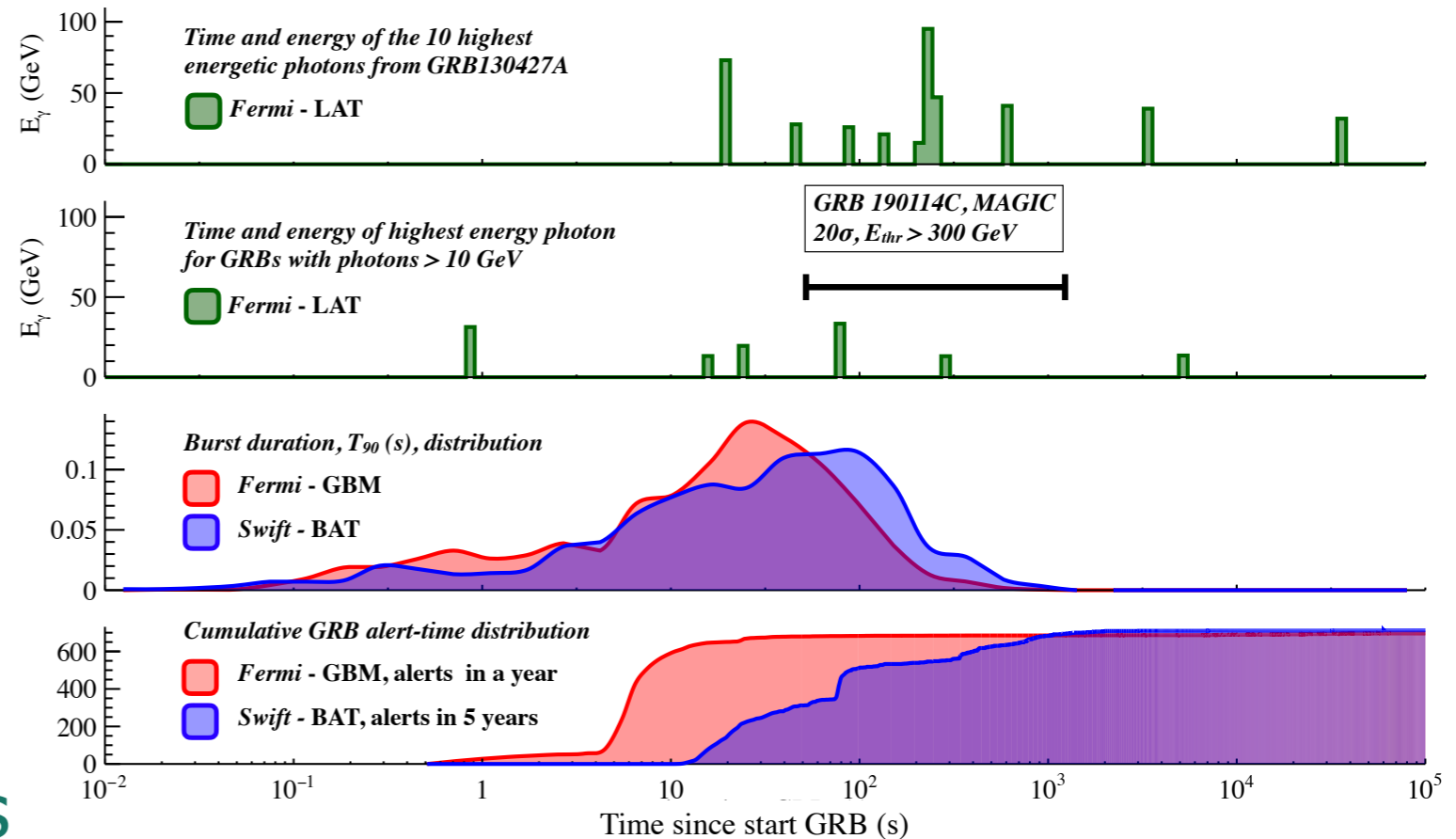
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# The Why... Monitoring the Transient Sky



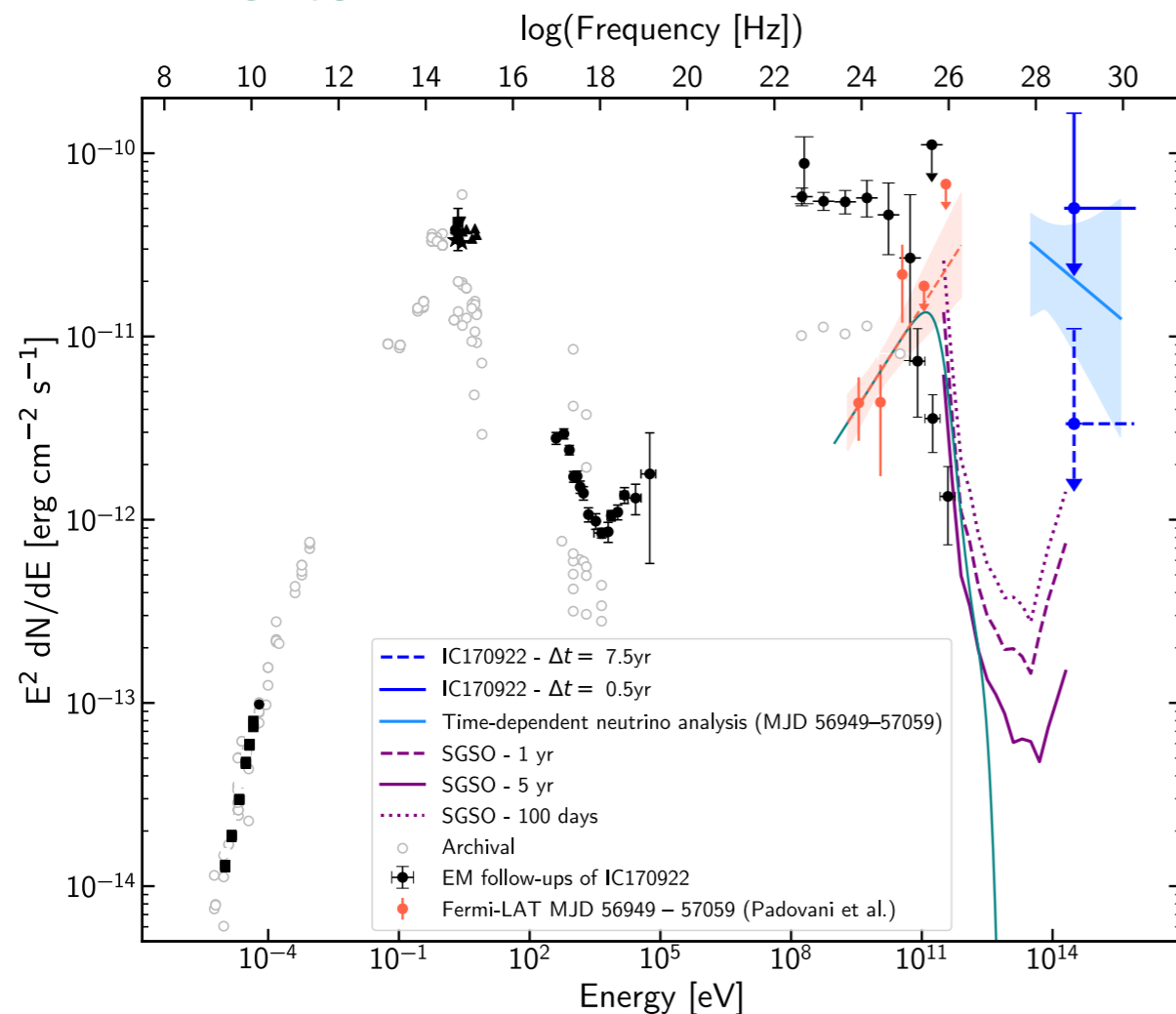
# The Why... Monitoring the Transient Sky

- ▶ Gamma-ray Bursts
  - Detectable bright VHE bursts exist
  - Prompt emission
- ▶ Fast Radio Burst
- ▶ Gravitational Waves
- ▶ Follow-up and issue alerts
  - Alert CTA
  - Large sample to follow-up over a wide-range of time scales.
- ▶ Archival Searches

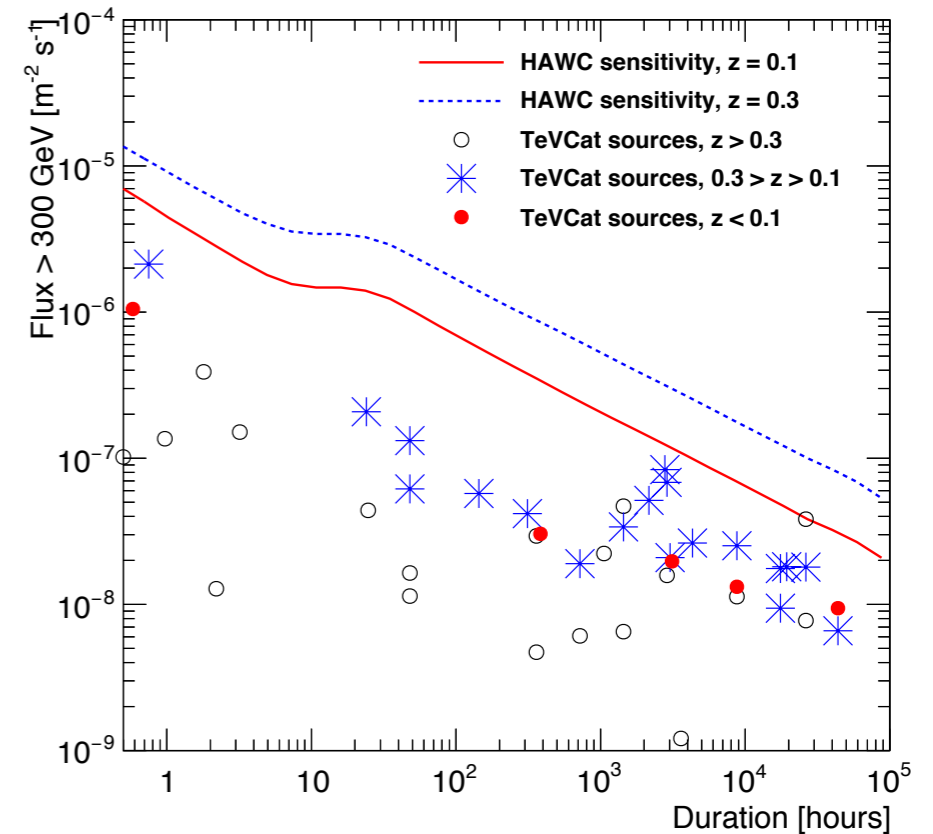
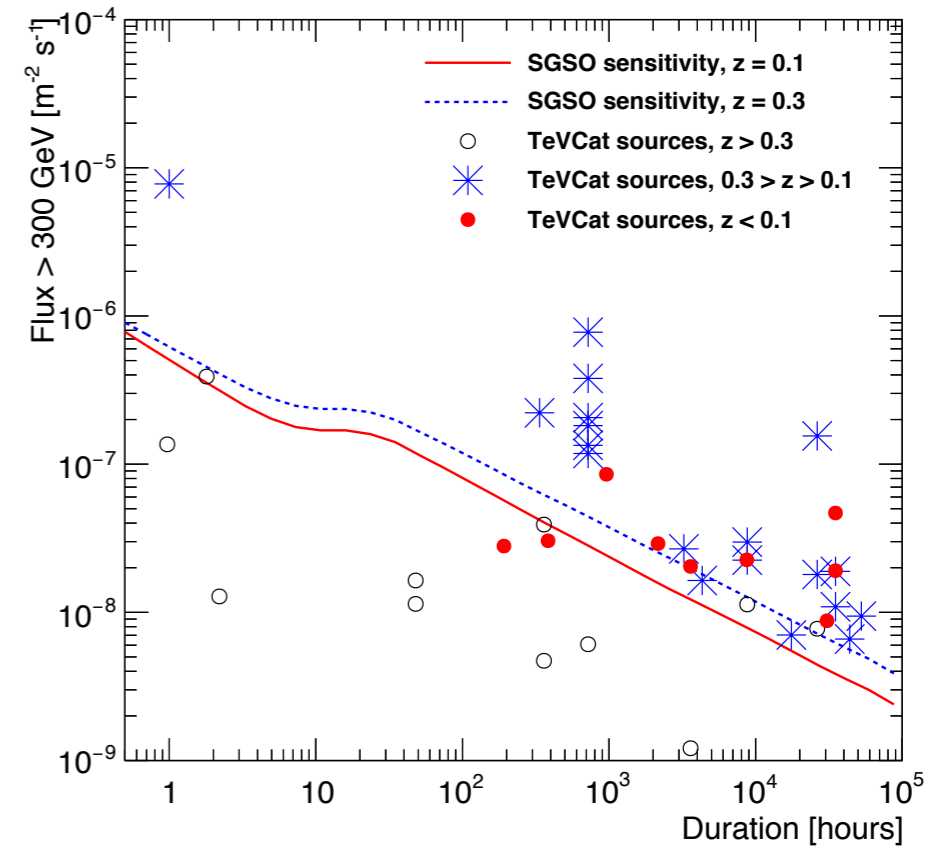


# The Why... Monitoring the Transient Sky

- ▶ Active Galactic Nuclei
  - Flares
  - Longterm variability
  - Alerts

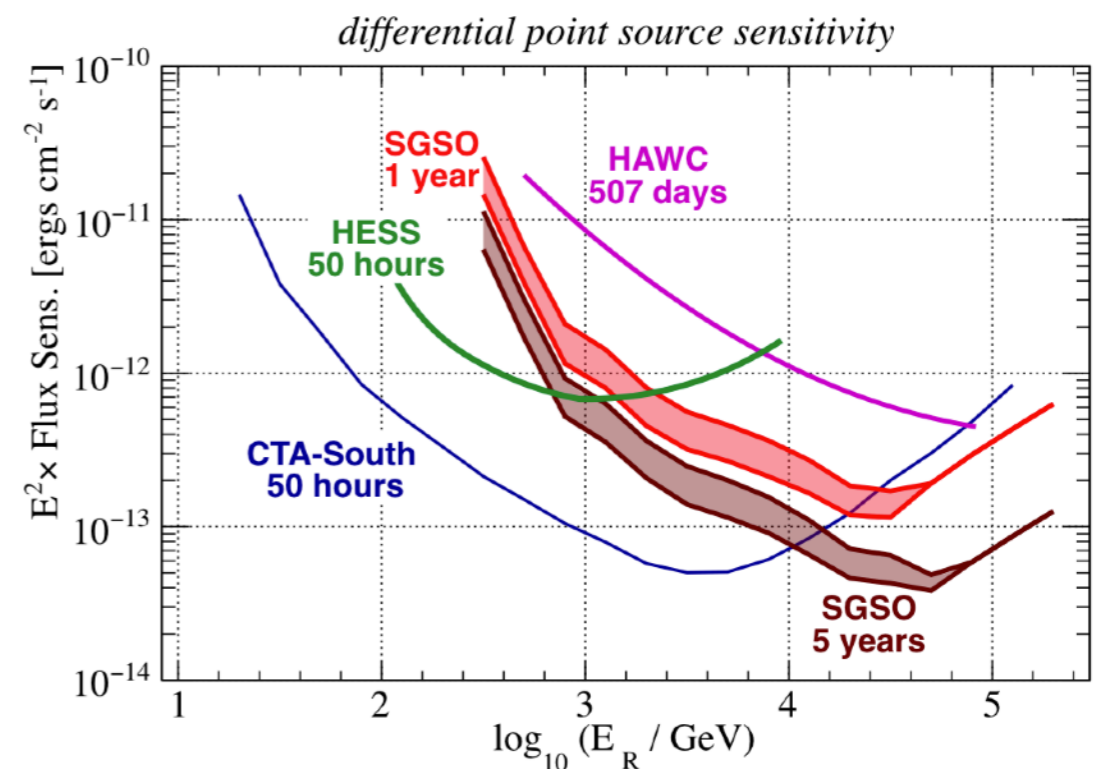
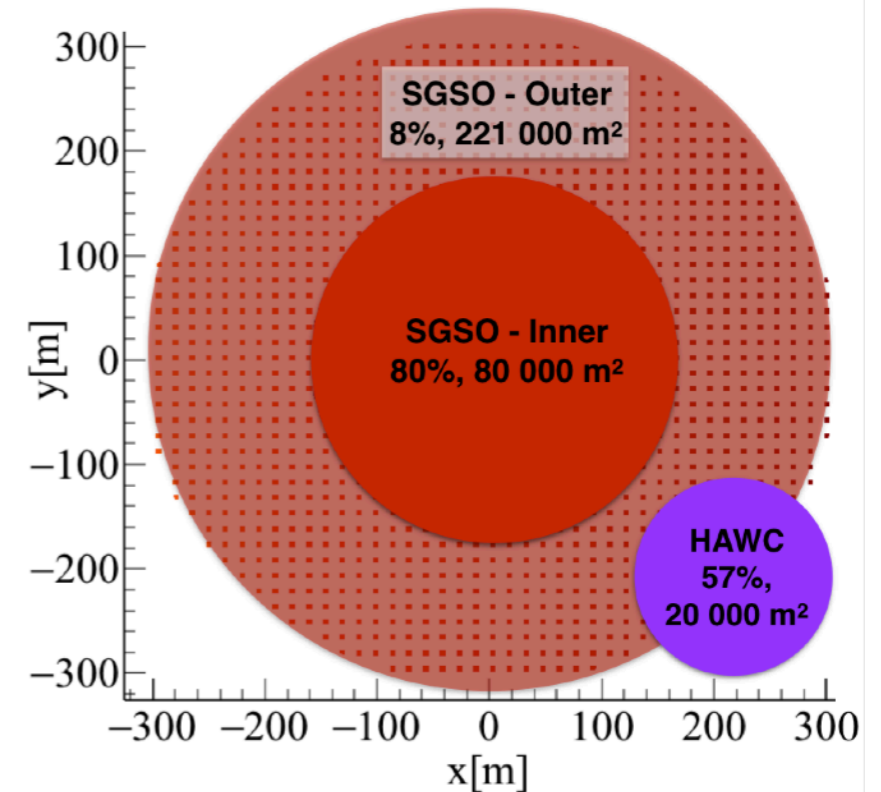


## Neutrino follow-up

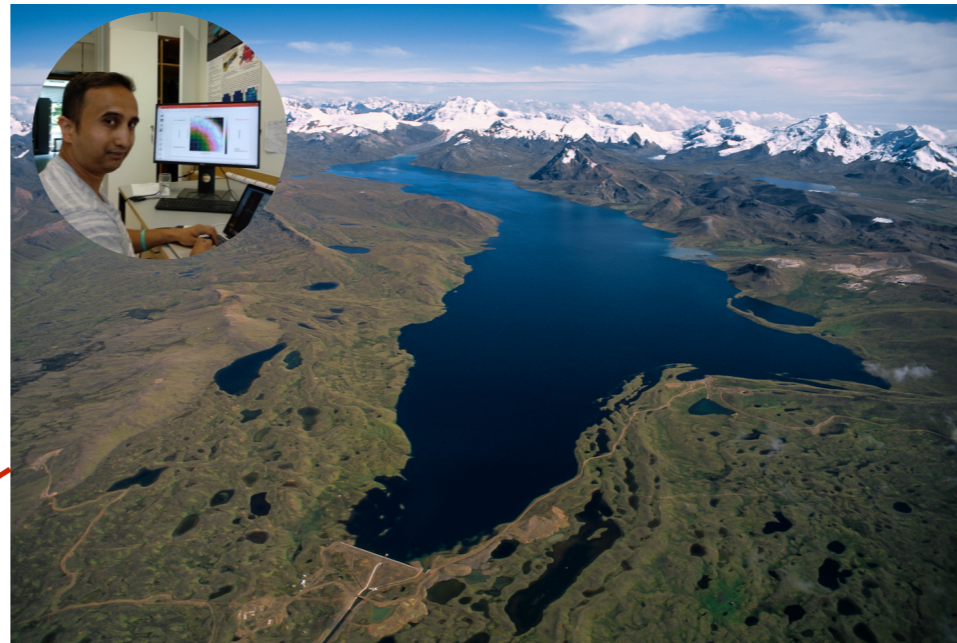


# The Why... Unveiling cosmic-ray accelerators

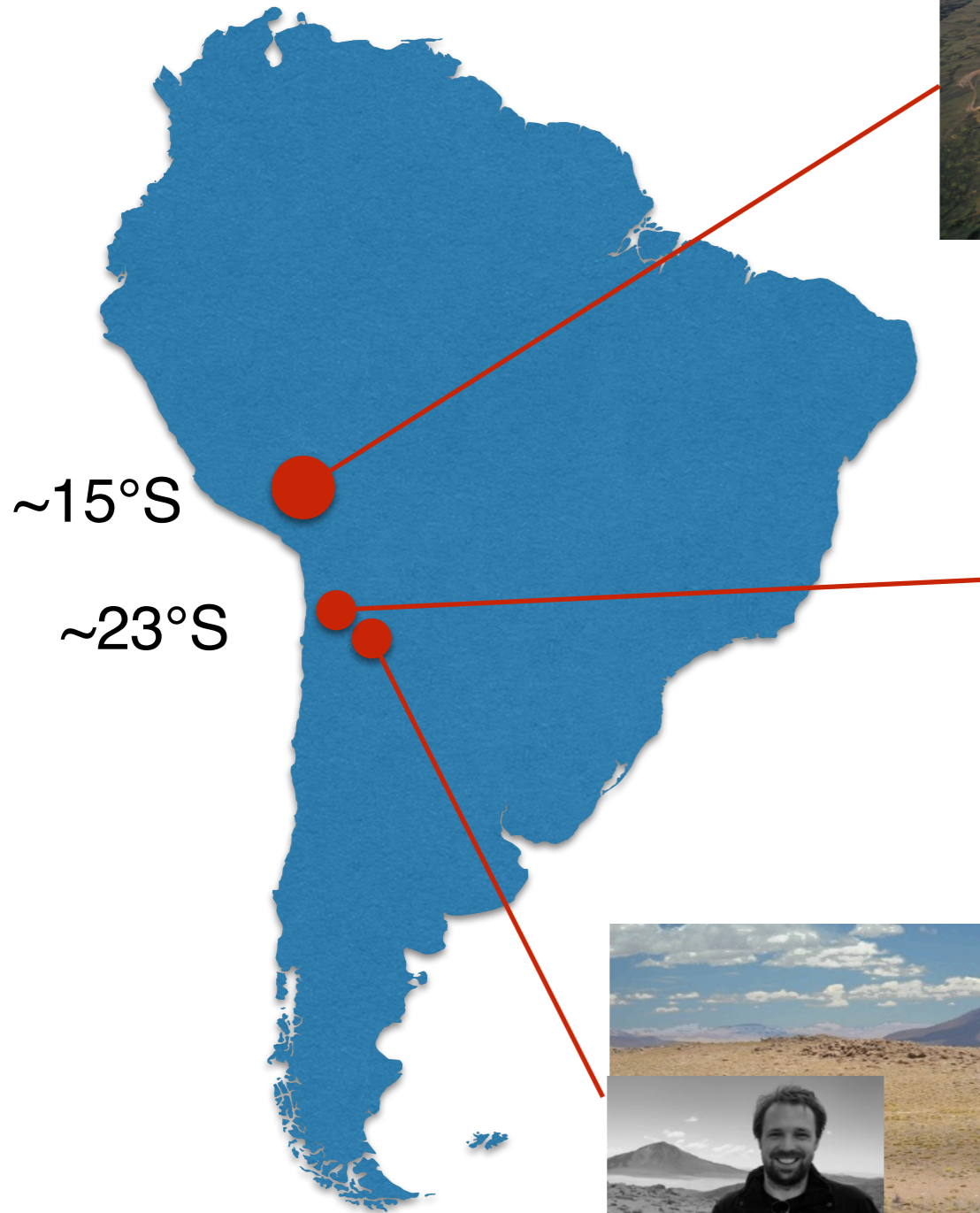
- ▶ The high-energy frontier
  - If big enough, it can compete with CTA in sensitivity
  - Unbiased Survey at the highest energies
  - Measure cutoff (or lack thereof) for all TeV galactic sources in the South



# The Where...



Peru:  
Several high altitude lakes and sites.  
Not singled out one option => Sam will investigate!!



Chile:  
ALMA site, 5km  
Good facilities  
Might become too expensive

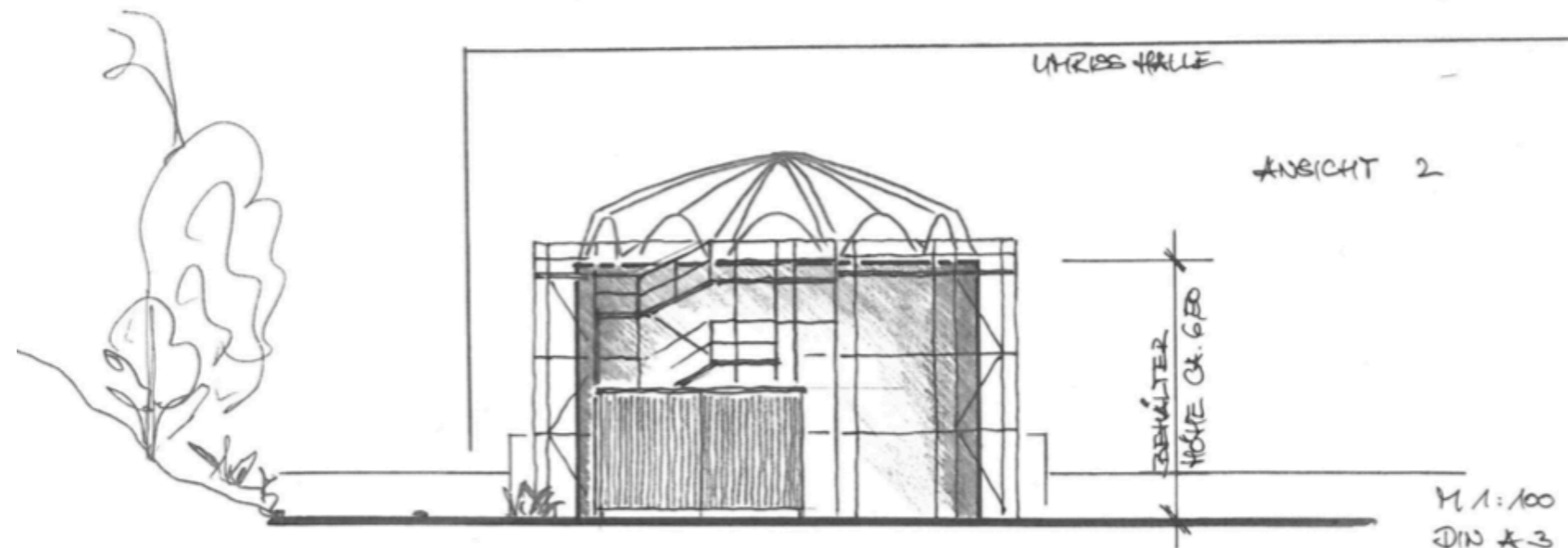
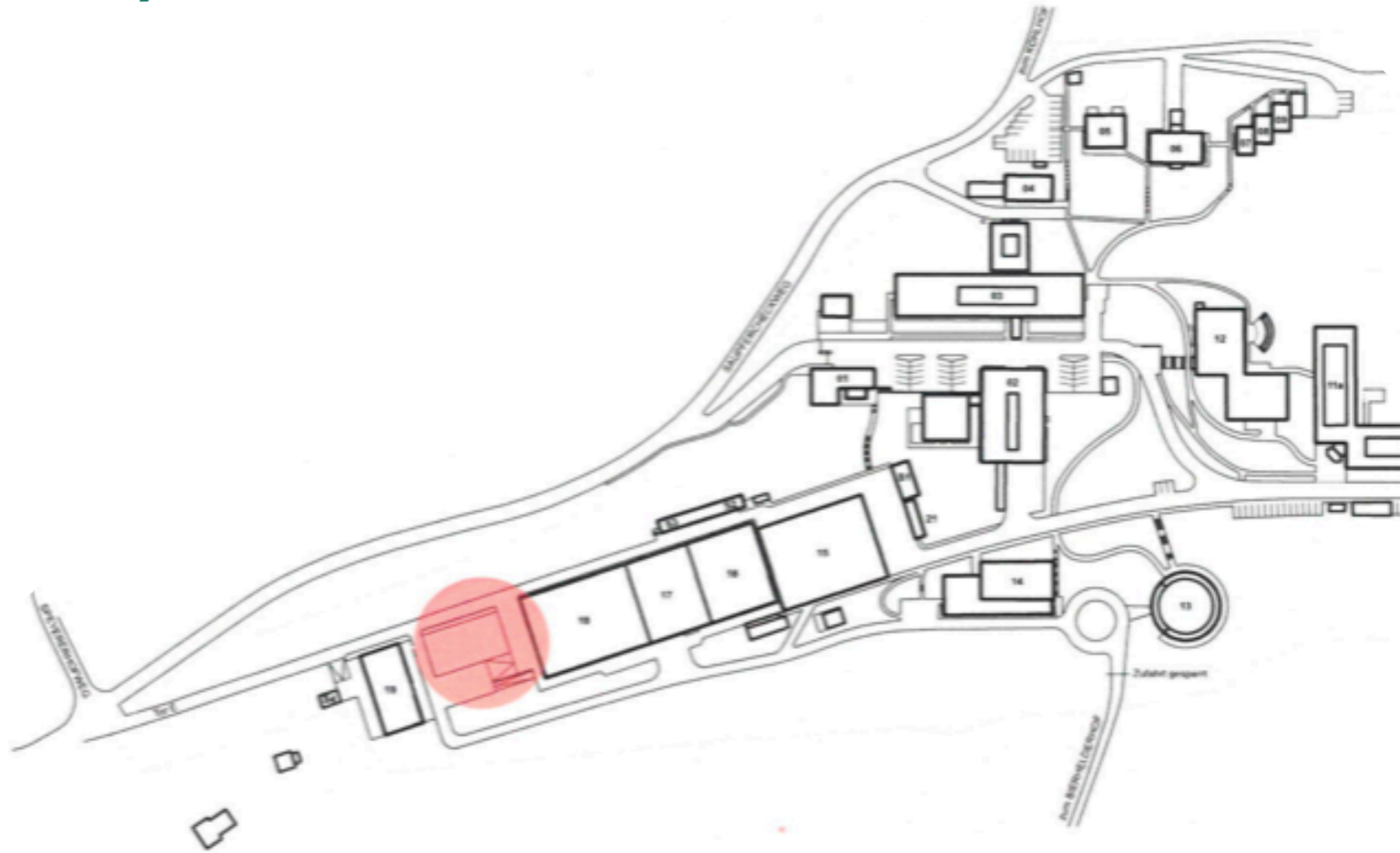


Argentina:  
CUBIC site,  
4.8 km  
Several experiments.



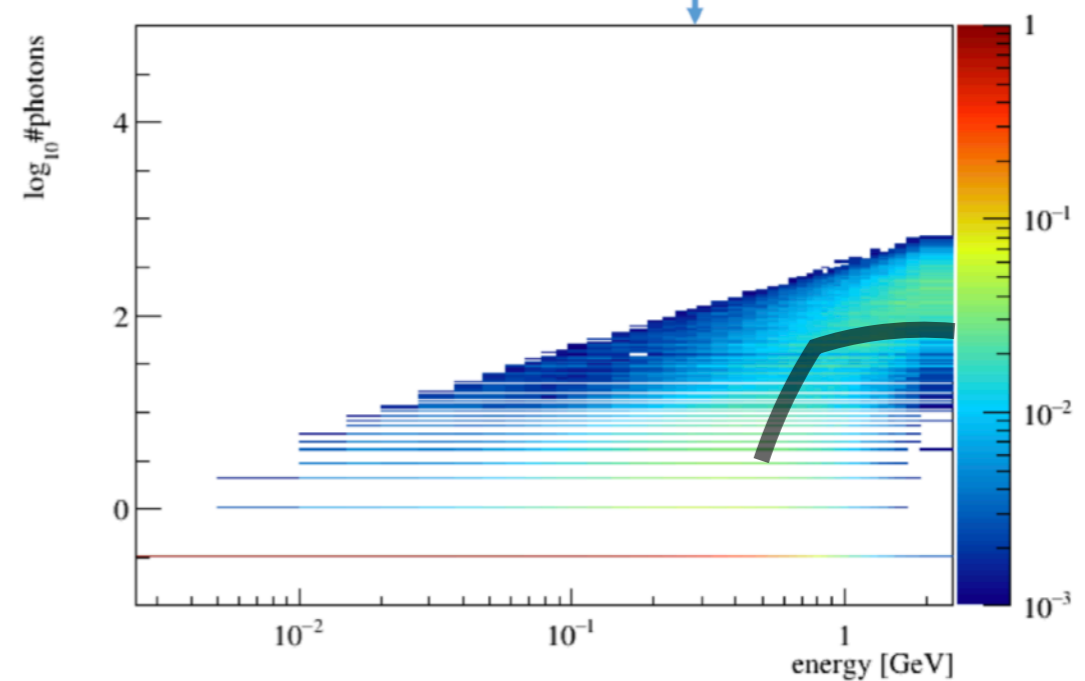
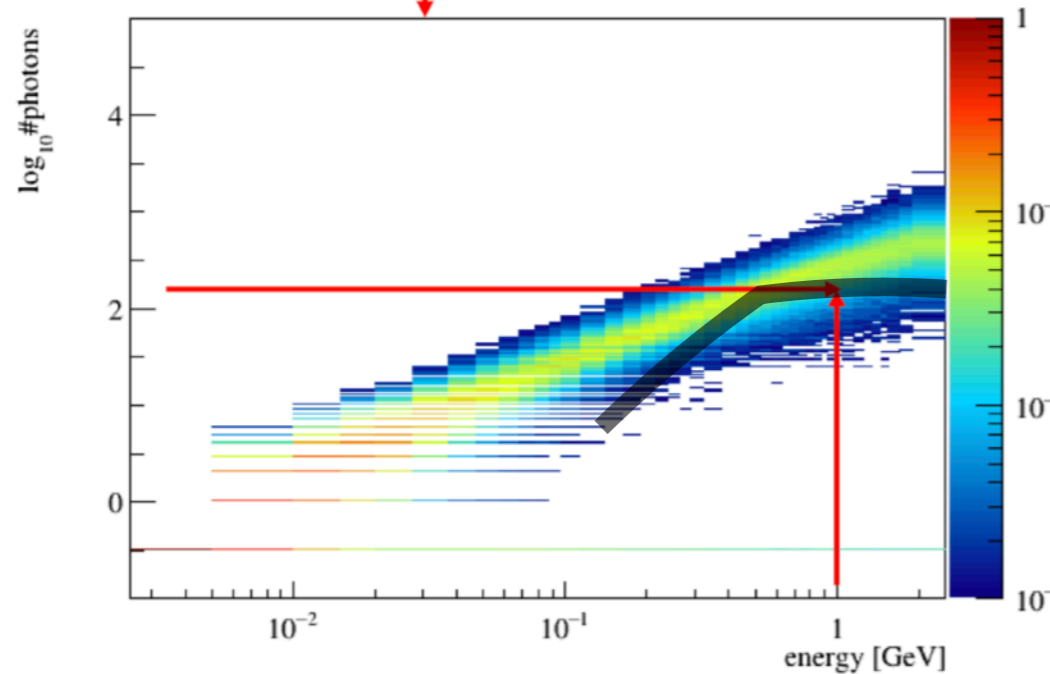
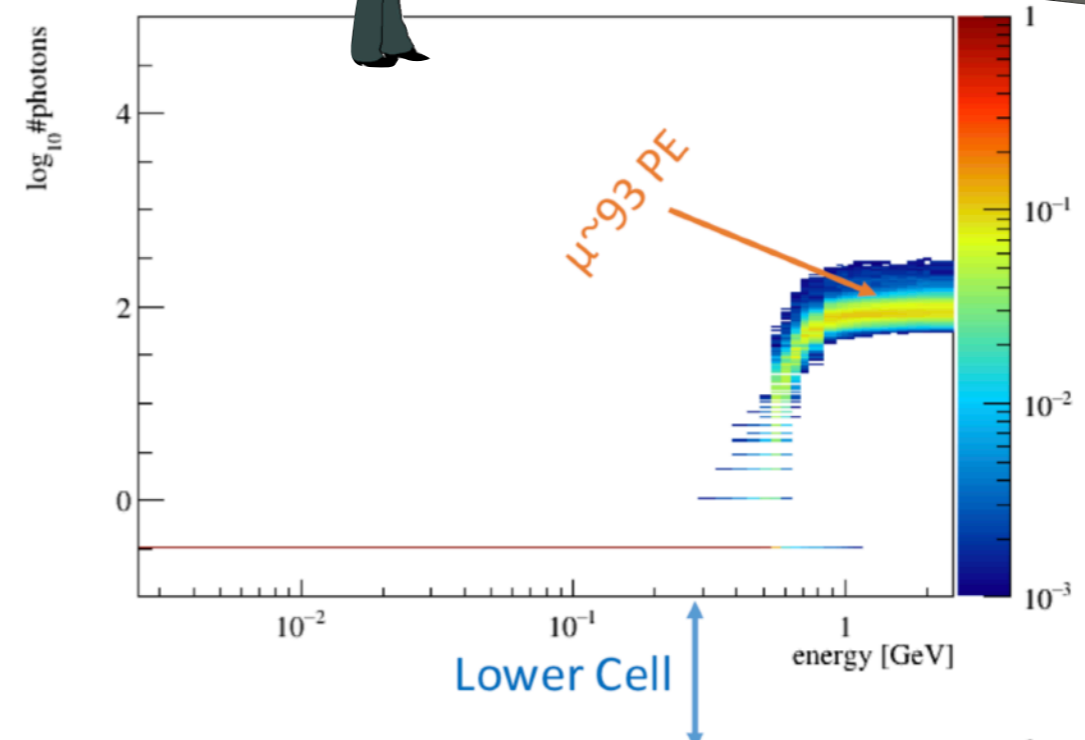
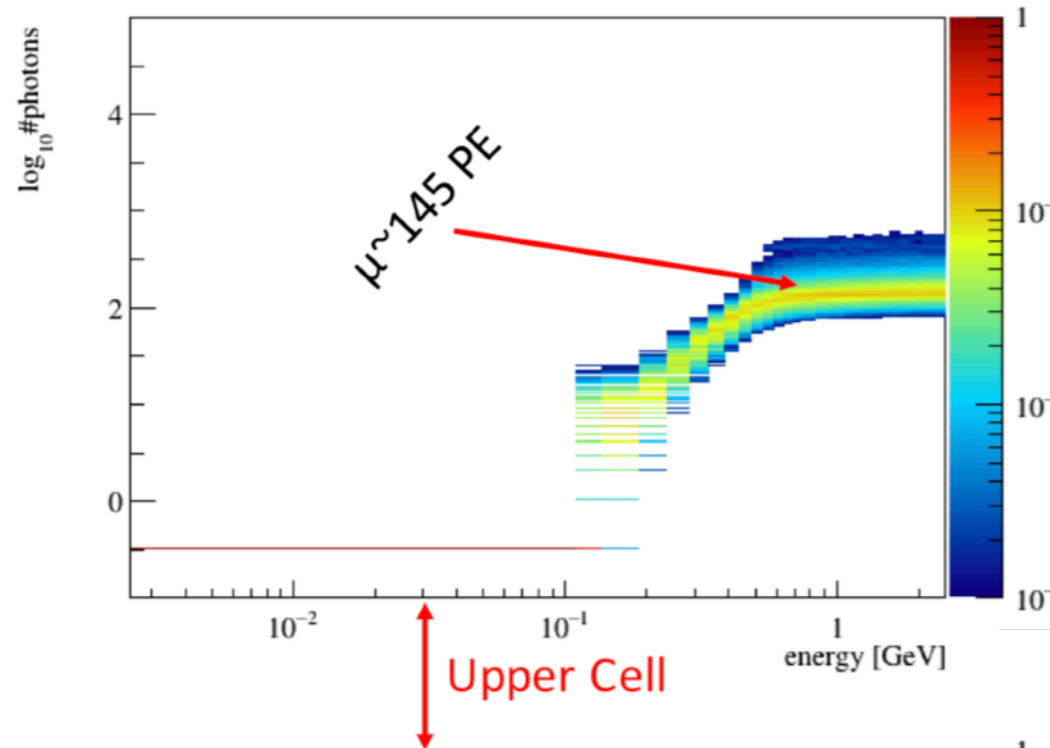
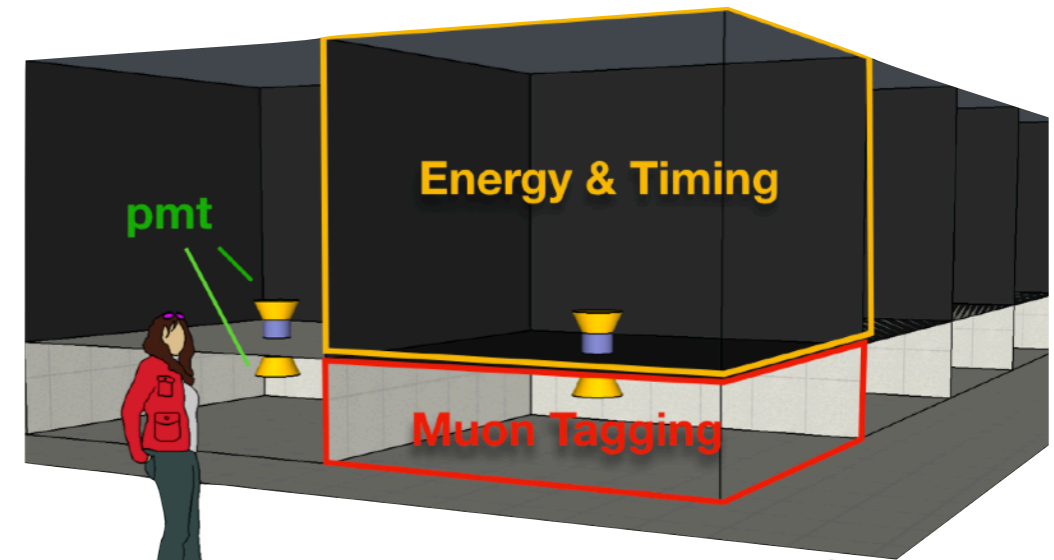
# The How... Local Test Facility

- ▶ A large water tank
  - 6.5 m height
  - 10 m diameter
- ▶ 5 x 8" PMTs
- ▶ Test Single unit concept
  - Light tightness
  - Deploy infrastructure
  - Readout



R5912-100

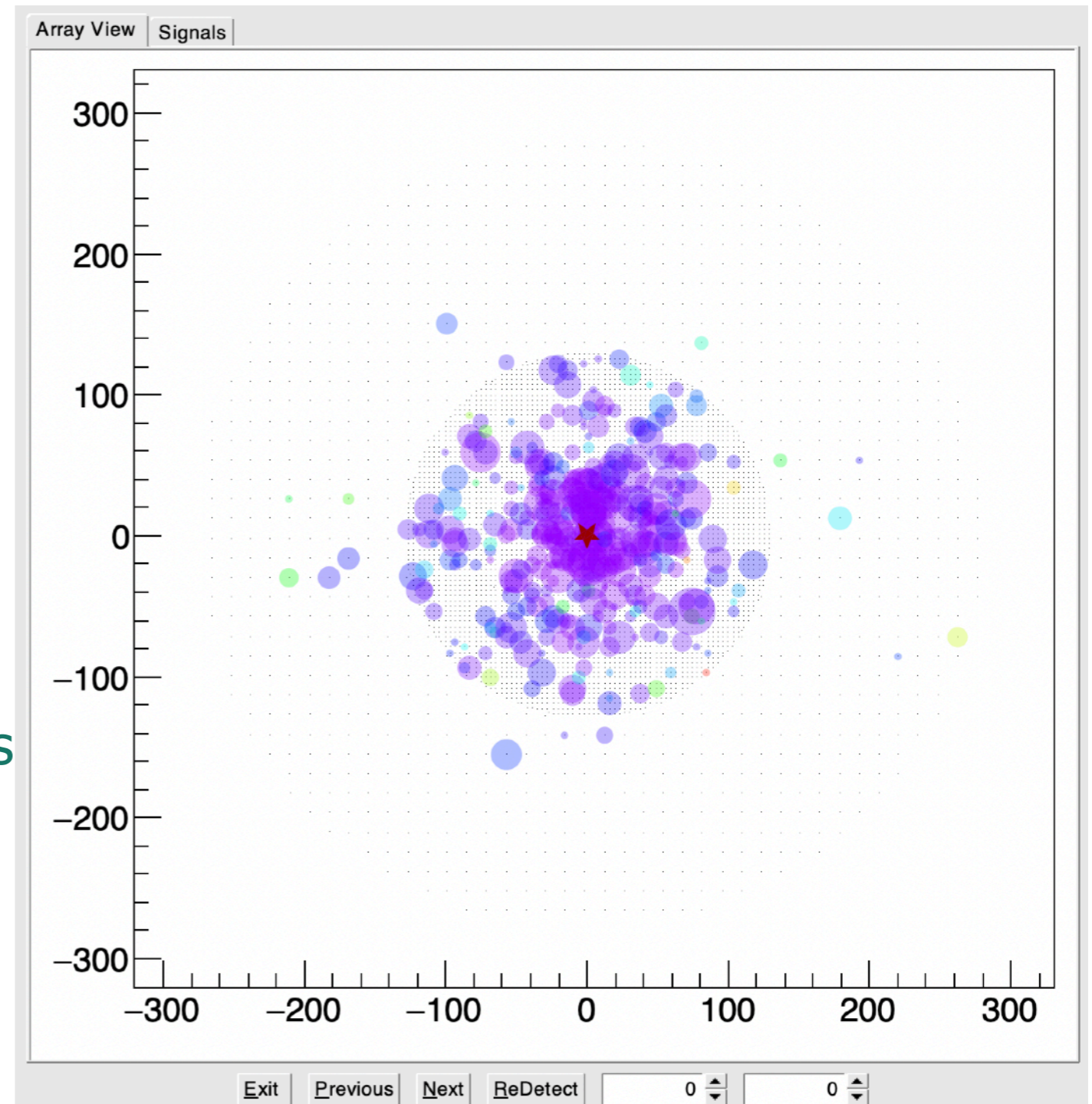
# The How... Simulations



# The How... Simulations

- ▶ Array Simulation
  - Simple version done
- ▶ Convergence to a joined software framework
  - Use/Borrow/Steel HAWC-framework ?
- ▶ Reconstruction
  - Likelihood Template methods
- ▶ Study impact of designs choices on performance
- ▶ Workshop in Heidelberg March 4-6

<https://indico.in2p3.fr/event/18564/>



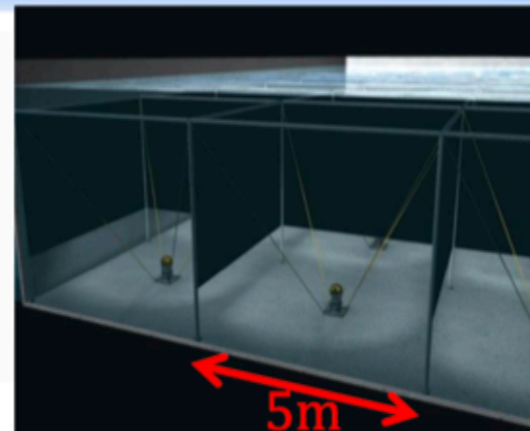
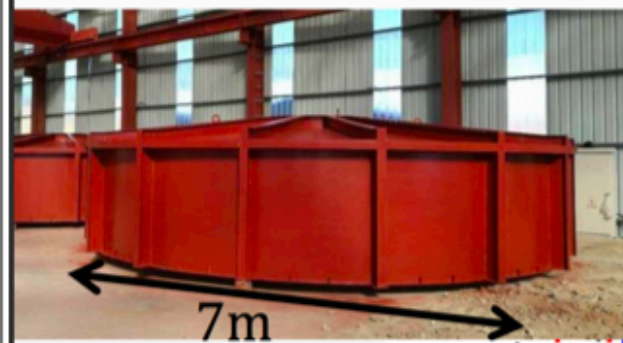
## What is next... Focus for the coming period (1 - 2 years):

- ▶ Site selection
- ▶ Simulations
- ▶ Hardware / prototype
  - Mechanics
  - Photon sensors
  - Readout, trigger, processing
- ▶ Funding: Started ANR/DFG proposal with University of Erlangen (Stefan Funk) and Saclay (Fabian Schussler)
- ▶ Collaboration

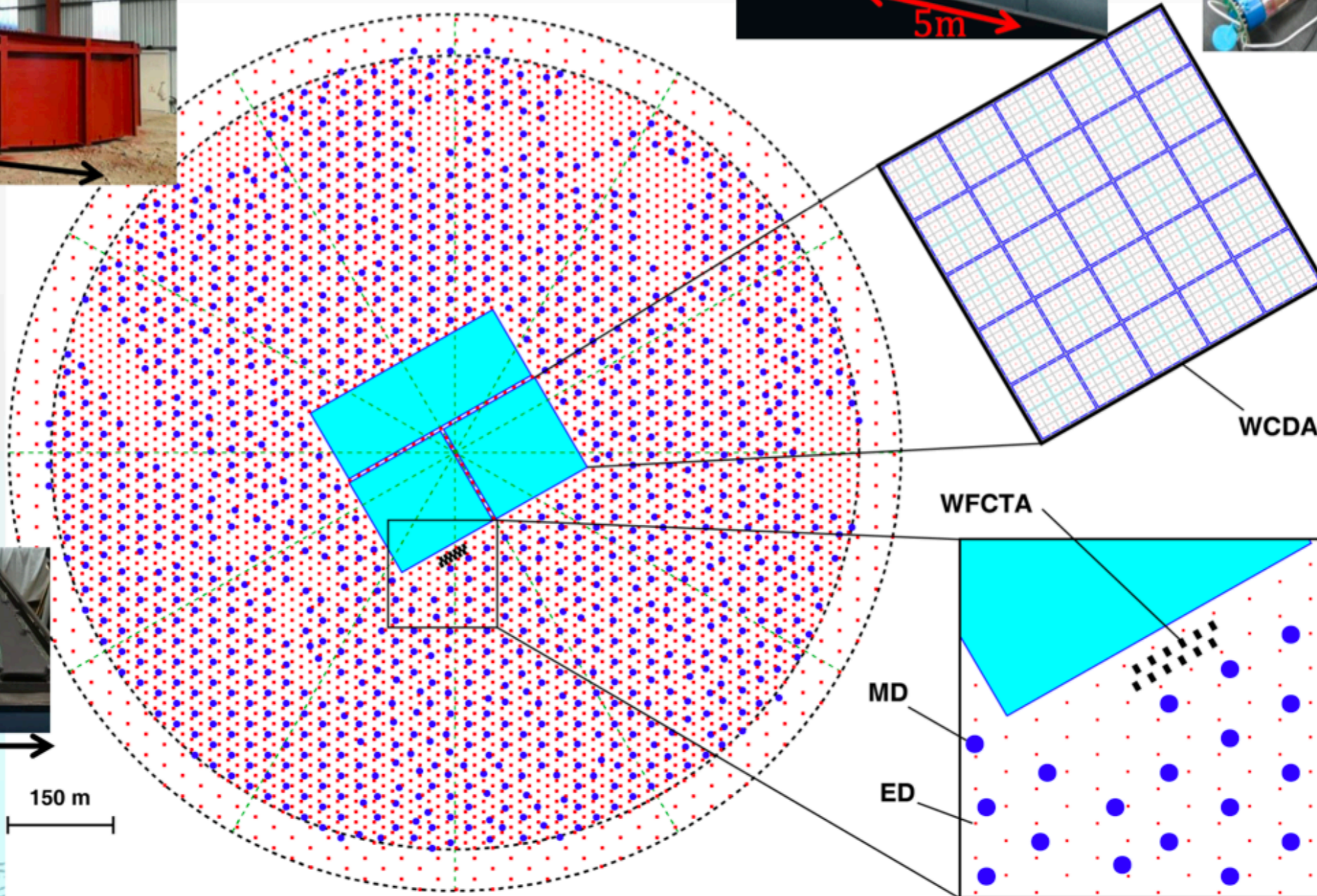
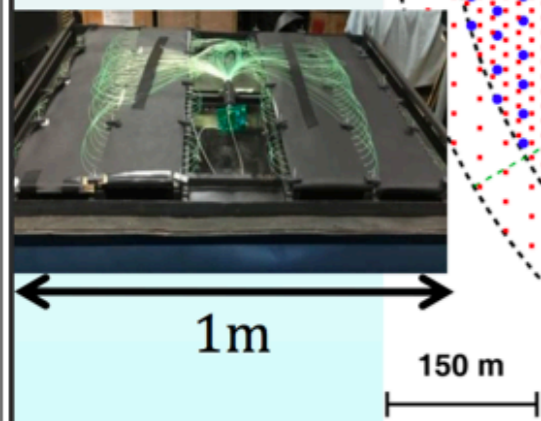
~Back-up

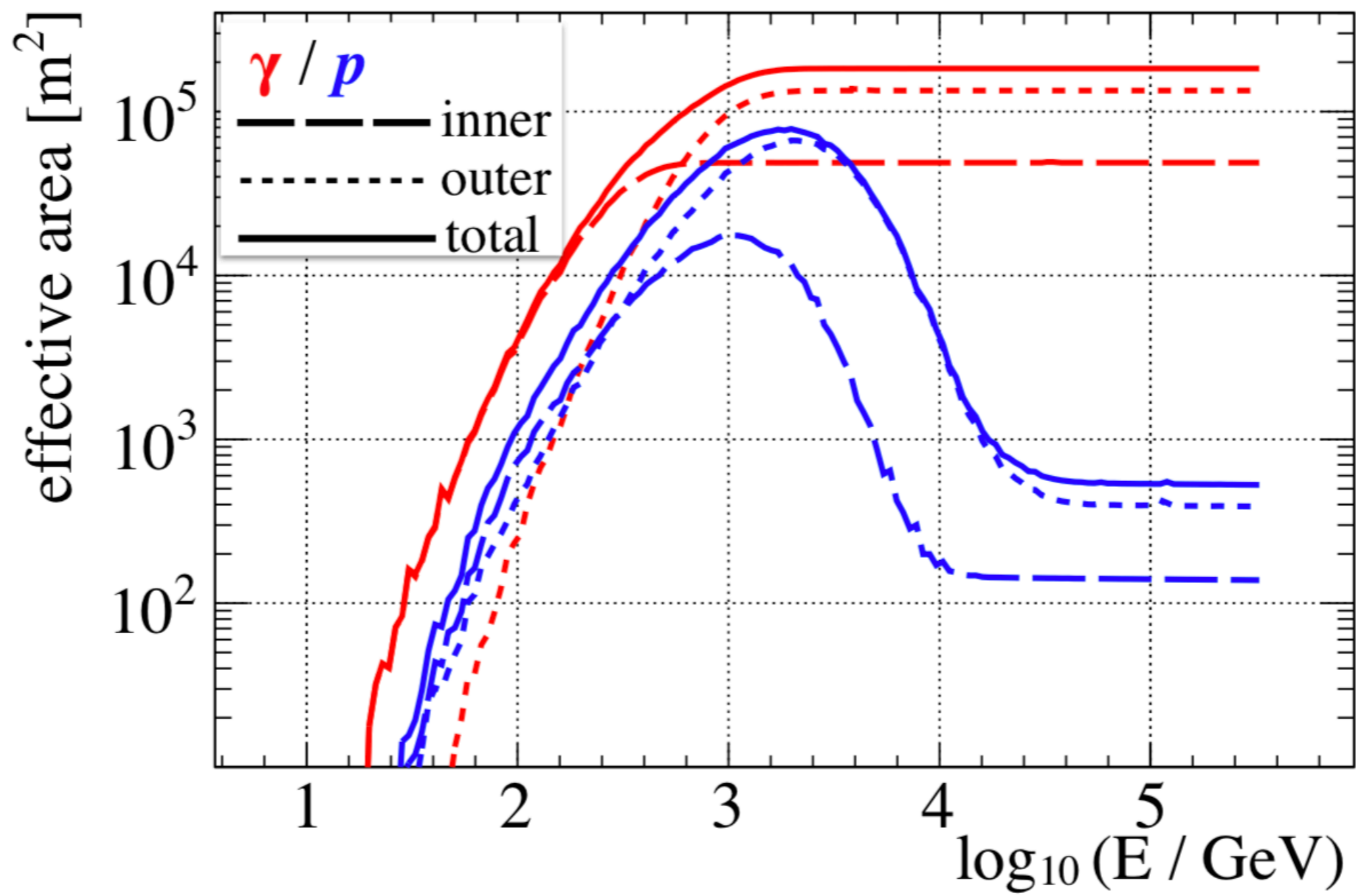


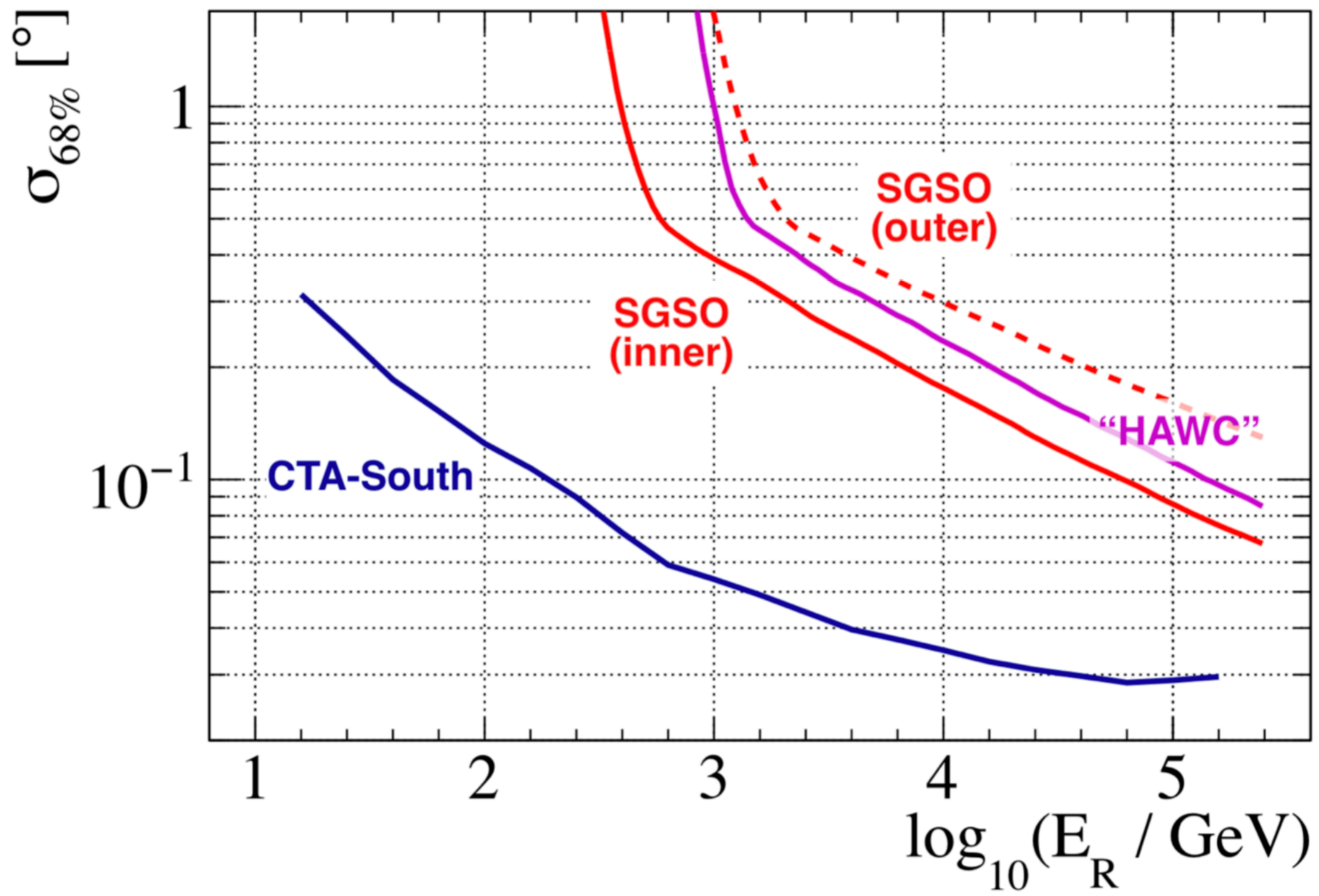
# Detector Layout in LHAASO



From  
Zhen Cao -  
TeVPA 2018

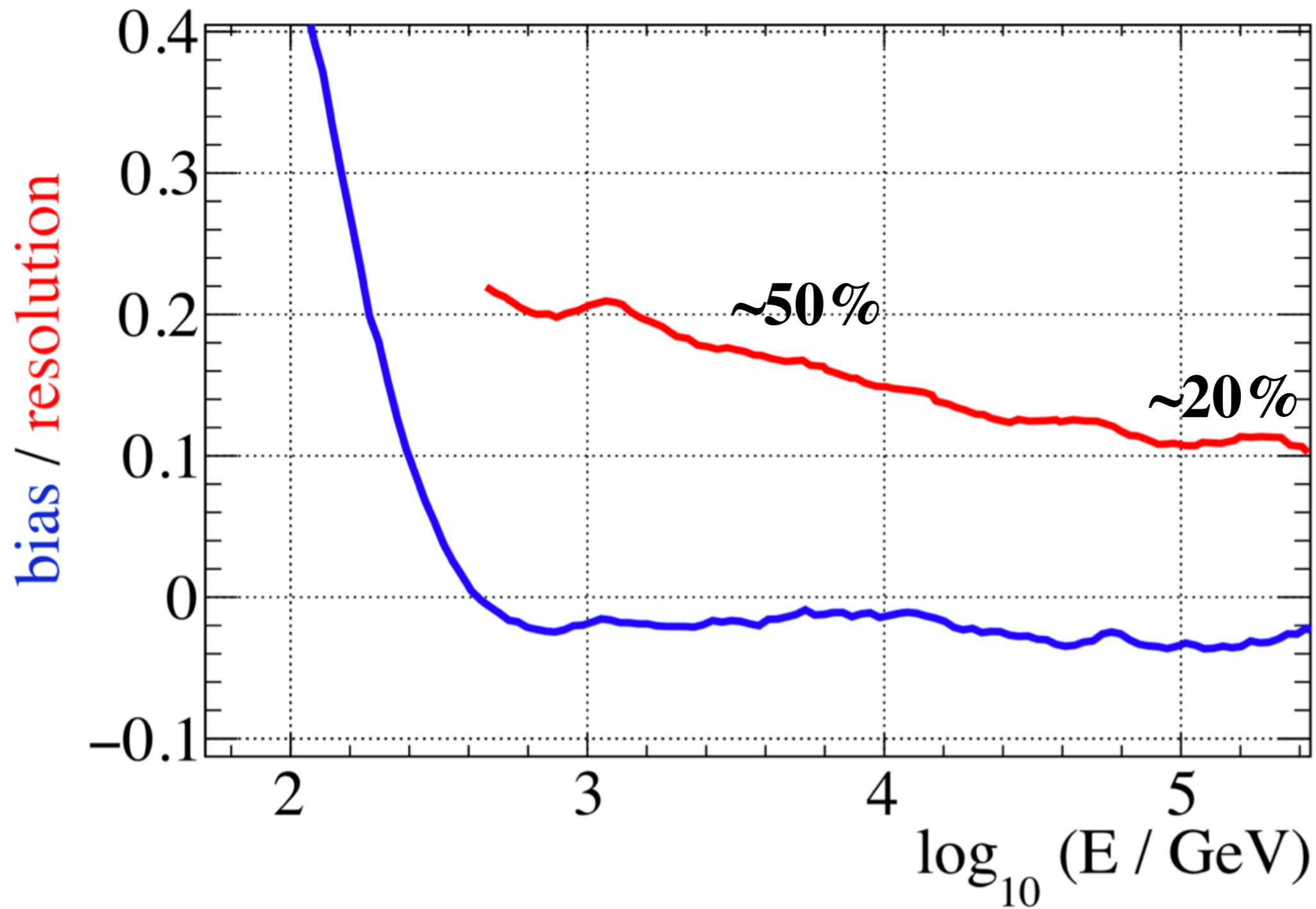




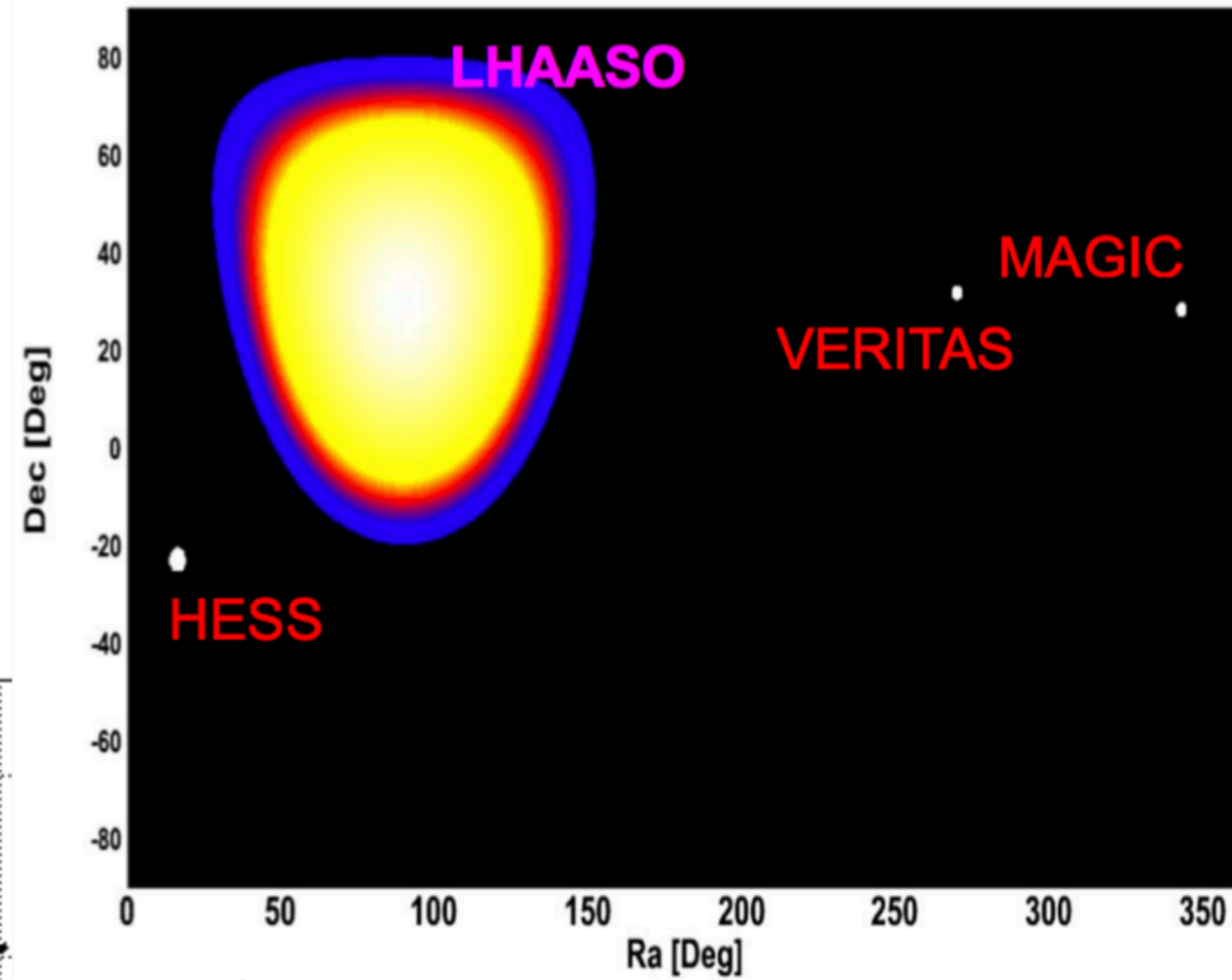
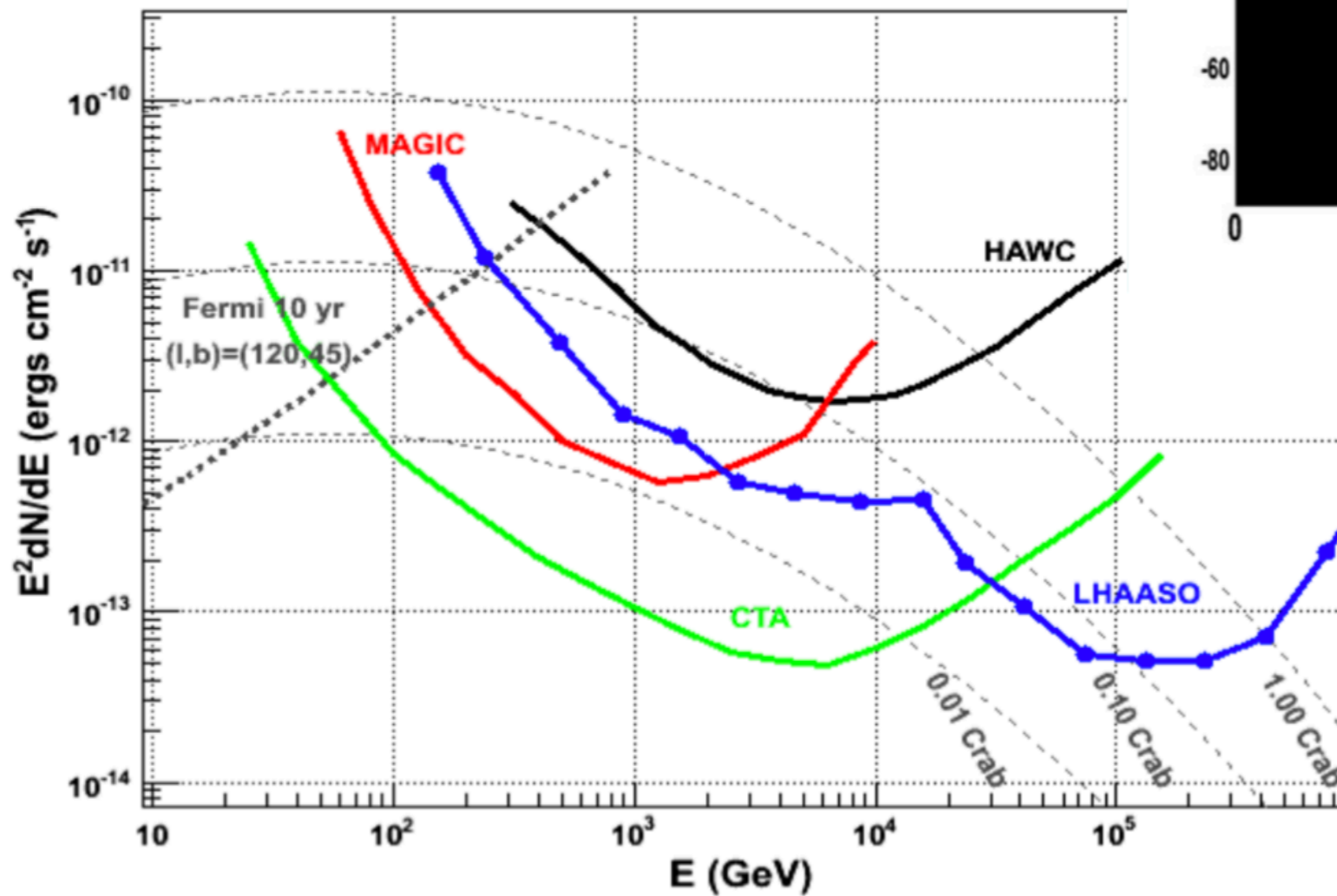




$$\Delta = (\log_{10} E_R - \log_{10} E_T)$$



# LHAASO



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