Experimental Astroparticle Physics

PRC open session, 22.10.2015, DESY, Hamburg

Groups & People:

H.E.S.S.: Klepser, Stegmann

Magic: Bernardini, Garczarczyk

VERITAS: Maier, Pohl, Schlenstedt

CTA: Bühler, Garczarczyk, Knapp, Maier, Schlenstedt, Stegmann, Wischnewski

FERMI: Bühler, Ackermann

IceCube: Ackermann, Bernardini, Franckowiak (start Nov), Kowalski, Nanhauer

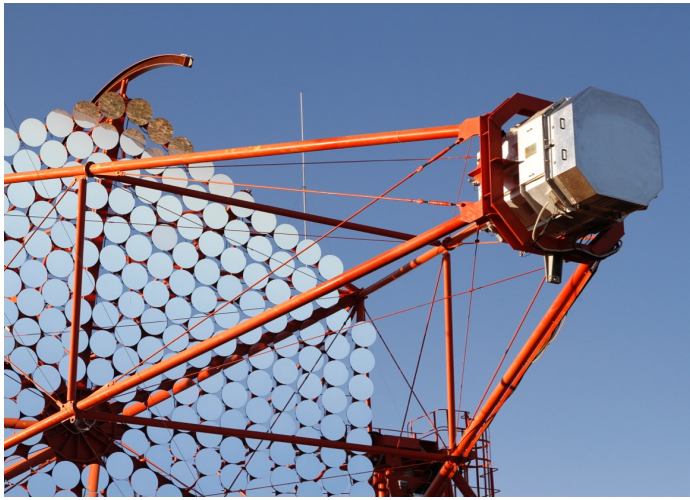
Zwicky Transient Facility: Franckowiak (start Nov), Kowalski

HELMHOLTZ ASSOCIATION

DESY

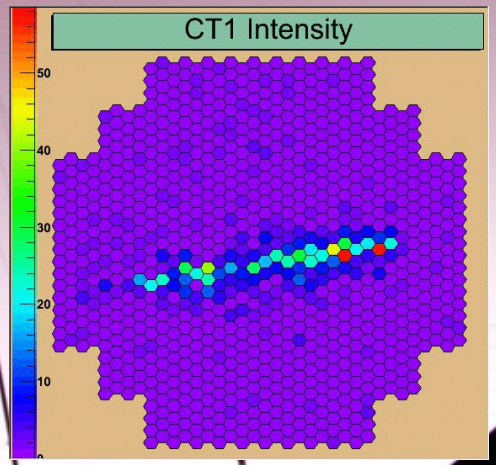
H.E.S.S. I Camera Upgrade

- Redesign of Camera electronics for lower dead time and down time
- July 2015: Deployment of first camera
- Installation could be finished within the planned schedule of 3 weeks



August 15: First light!

- First cosmic gamma-ray showers

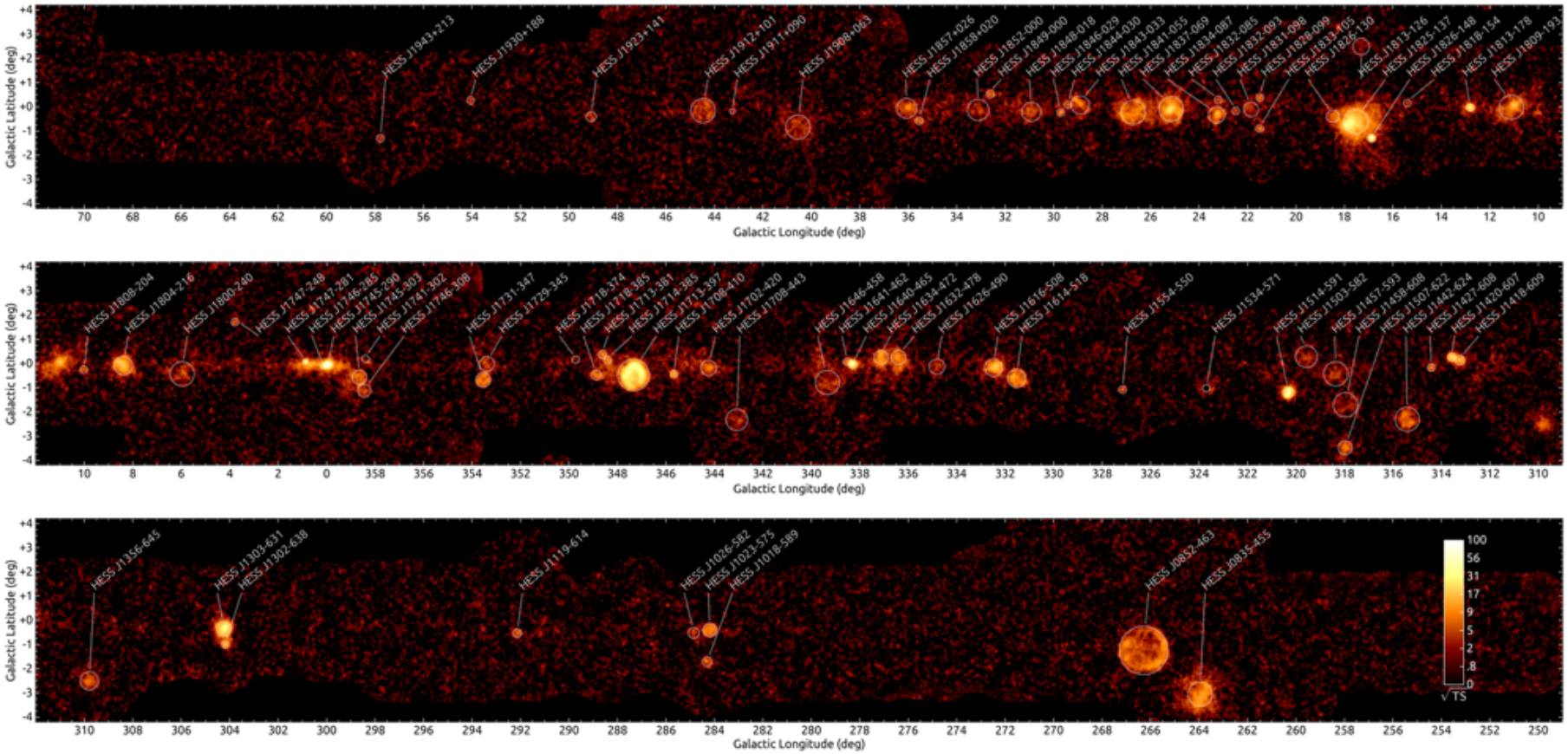


Plan for Cameras 2-4

- Production has already begun
- Tentative deployment in September 2016

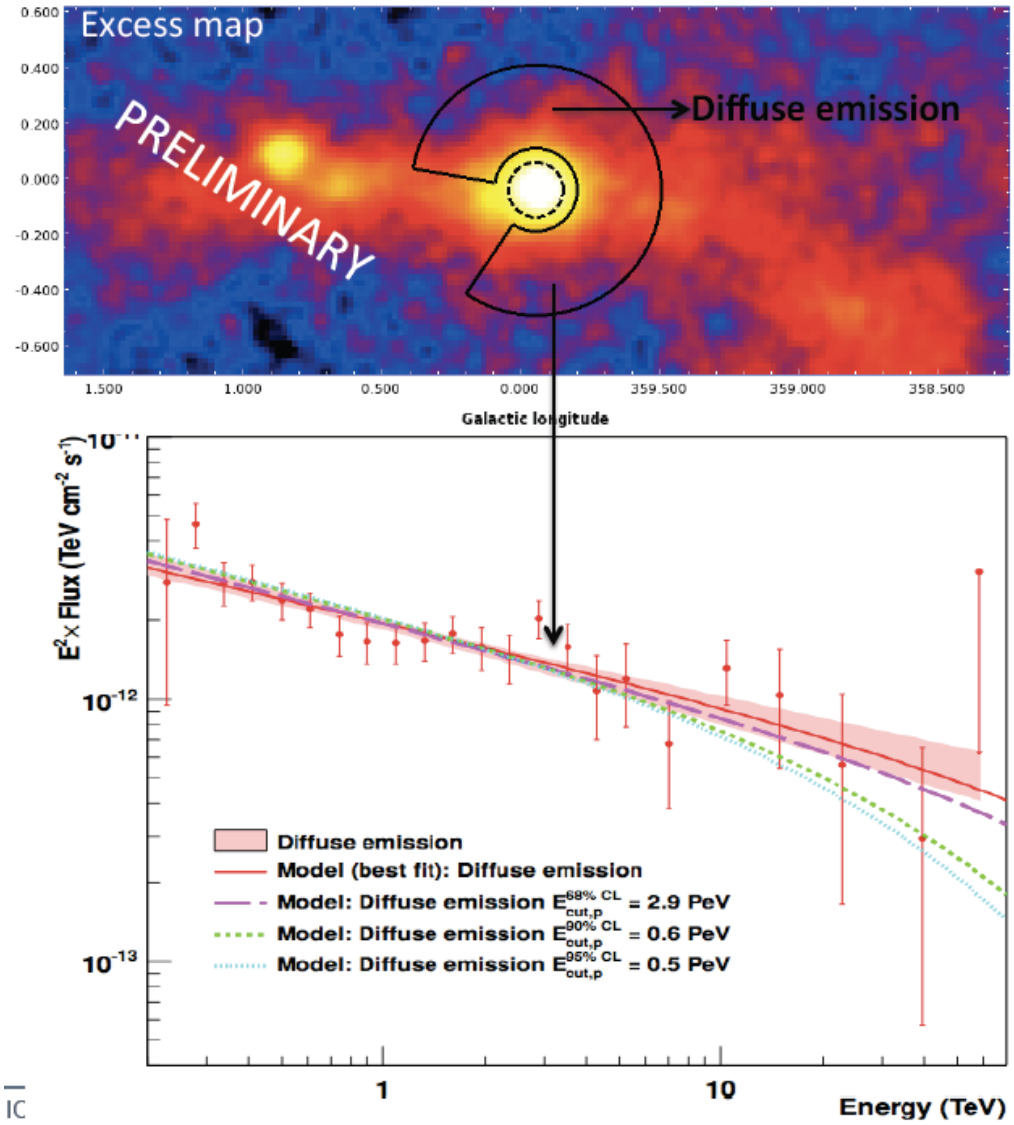
H.E.S.S. Science 2015

- Work on A&A special issue around galactic plane scan
- Some results shown on ICRC 2015



A Pevatron in the Galactic Centre

- Very hard spectrum of diffuse emission
- 1/R profile suggests continuous injection and diffusive propagation
- Conclusion: Central PeV accelerator injecting particles in quasi-continuous fashion
- Detection of first cosmic PeVatron!

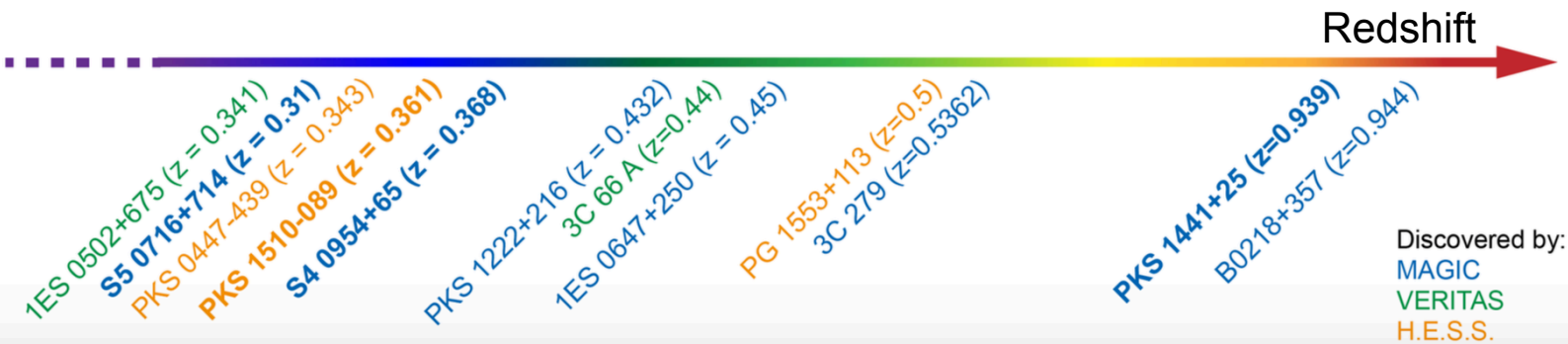


High redshift, low energies → flaring detector: MAGIC

Astronomical Telegram – ATEL!

- ATEL #6999 "*MAGIC detects Very High Energy gamma-rays from S5 0716+714*" G.Pedaletti @DESY analyzer
- ATEL #7080 "*Discovery of Very High Energy Gamma-Ray Emission from the FSRQ S4 0954+65 with the MAGIC telescopes*" → G.Pedaletti @DESY analyzer and leading the publication
- ATEL #7416 *"Discovery of Very High Energy Gamma-Ray Emission from the distant FSRQ PKS 1441+25 with the MAGIC telescopes*" (z=0.939)
- ATEL #7542 "*MAGIC detects an increased activity from PKS 1510-089 at very high energy gamma-rays*" G.Pedaletti @DESY analyzer
- ATEL #7660 "*MAGIC detects an increased activity from BL Lacertae at very high energy gamma-rays*" "Archetipical" Bl Lac celebrates the MAGIC collaboration meeting held at DESY Zeuthen
- ATEL #7844 "*Discovery of Very High Energy Gamma-Ray Emission from the intermediate BL Lac S2 0109+22 with the MAGIC telescopes*" G.Pedaletti @DESY taking data in La Palma

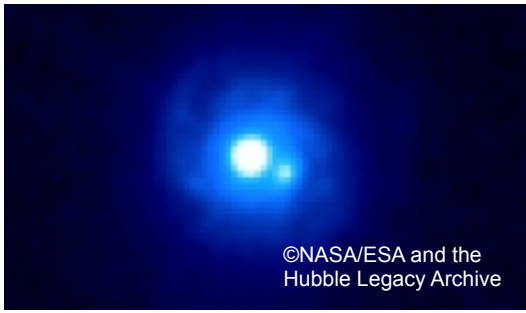
2015

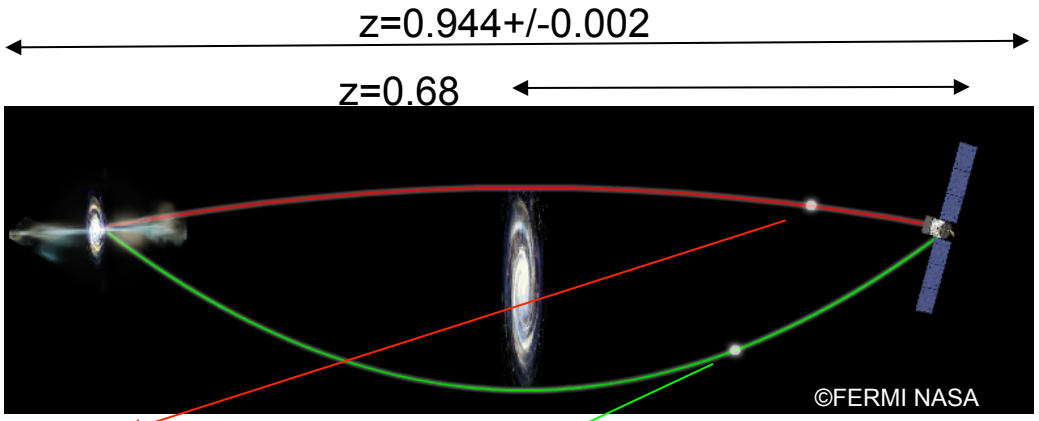


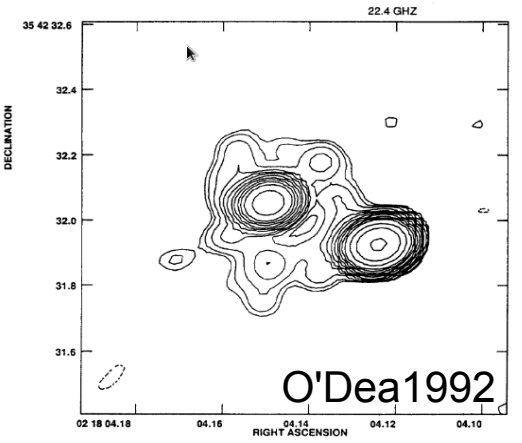
Farther and farther: B0218+357

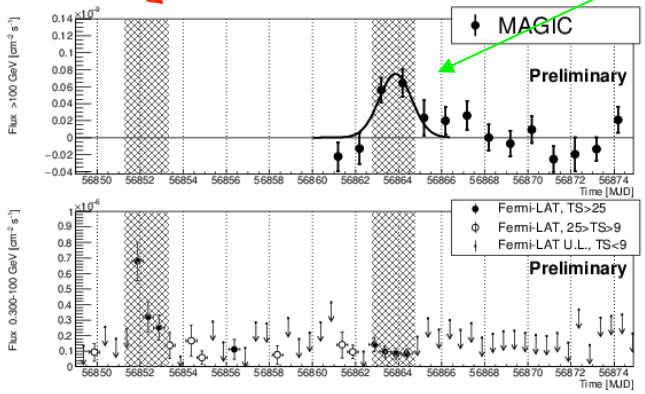
>A flare in Fermi from B0218+357 is detected on July 13/14 2014, full moon MAGIC

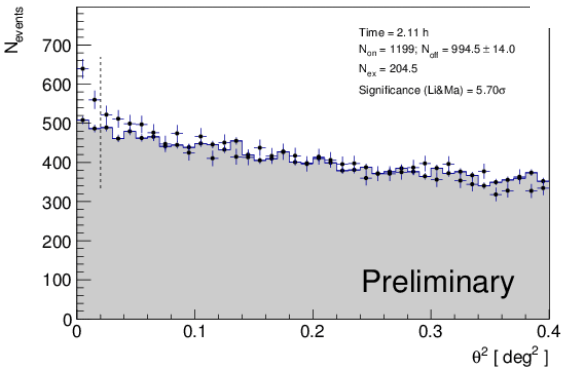
>Expected delay of ~11days → MAGIC triggers, we get it → at z~1 is an excellent probe of EBL



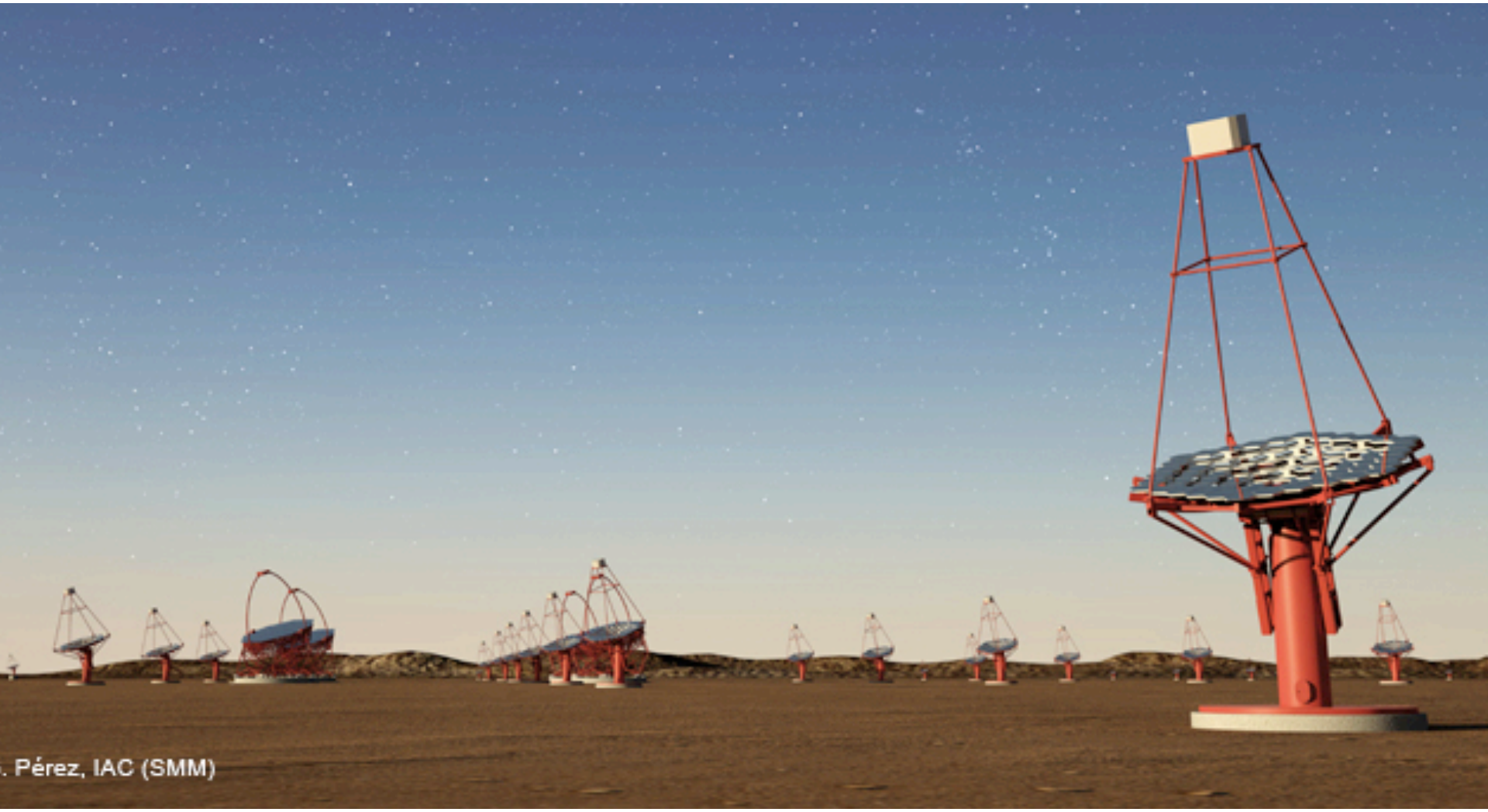








CTA

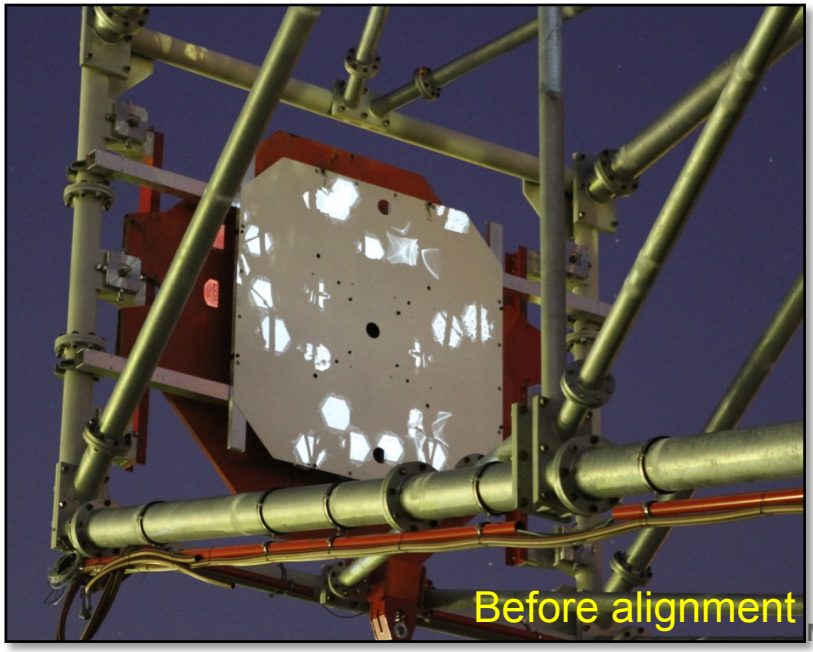


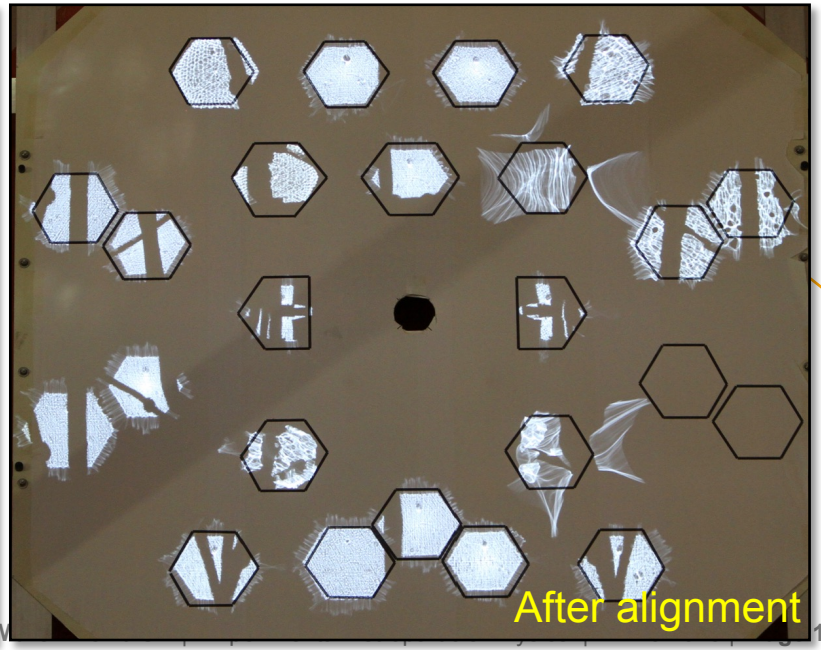
CTA Involvement at DESY

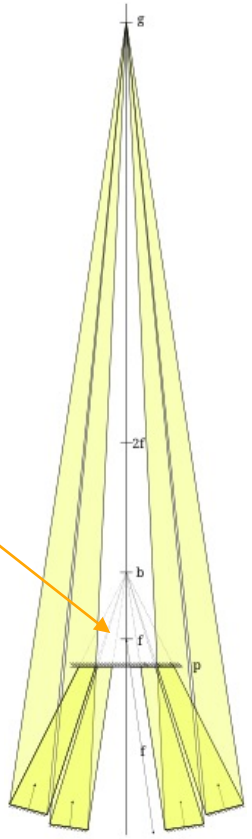
- Medium-Sized Telescopes MST
  - Design and build structure, drive and safety system
  - Project Management responsibility
- Array Control
  - Work Package Array operation
  - Work Package On-site hardware
  - Timing System
  - Project Management responsibility, central activities
- Sensitivity Studies, e.g. CTA layout
- Data structures and pipelines
- High level software (ctools)

MST: New Mirror Alignment Method

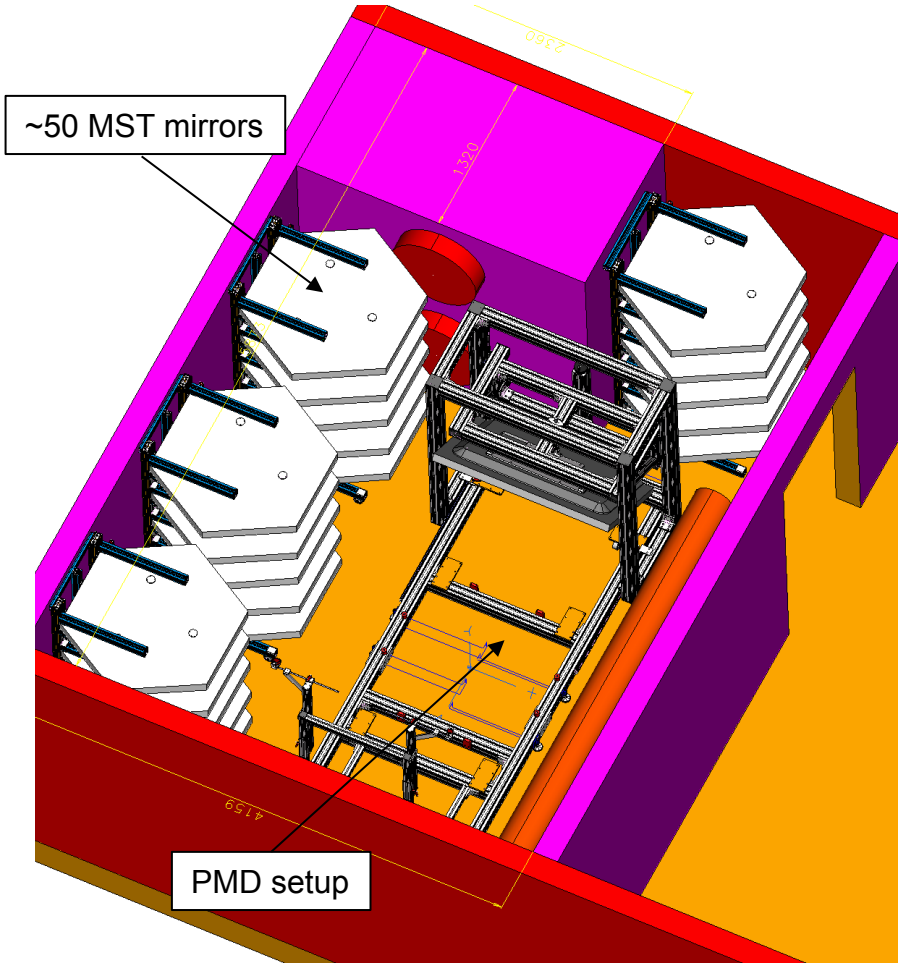
- Difficult to align individual mirror facets under bright night sky conditions in Berlin
- Bokeh (out of focus) method applied:
  - Nearby artificial light source
  - Ray-tracing of the image in focal plane







MST: Mirror Evaluation at DESY

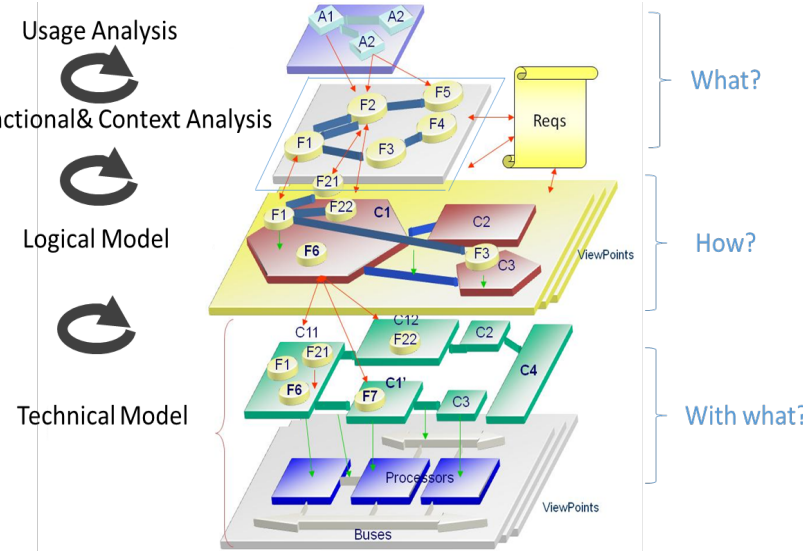


DESY climate chamber

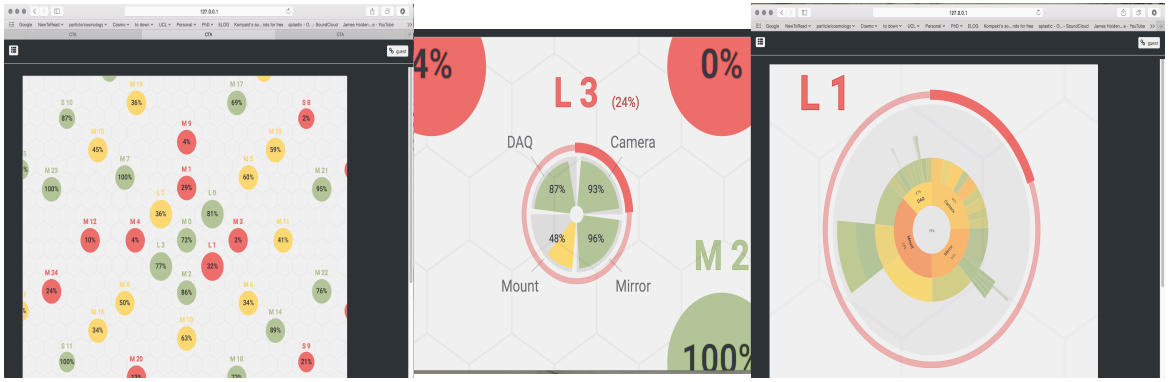
- Three mirror stakeholders for MST: CEA, IFJ-PAN, MLT
- New prototype mirrors in production, being delivered to DESY and CTA Mirror Test Facilities (MTF)
- Tests performed at DESY:
  - Point Spread Function, focal length and focused reflectivity – measurements using 2f setup and Phase Measuring Deflectometry
  - Long term performance with varying temperature cycling (-20º … 30ºC)

Array Control (ACTL)

- Project leadership and management, Software architecture (see right Fig.).
- Design and implementation of the central control and operator GUI elements (see bottom).



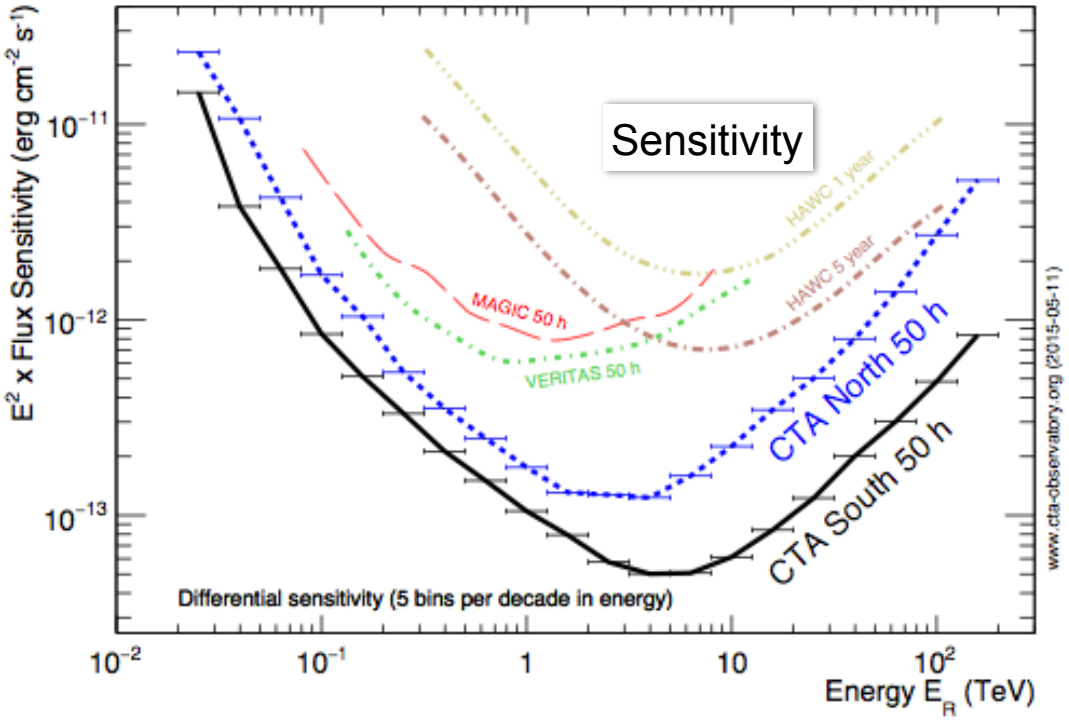
Conceptual view of the adopted system architecture approach, based on SysML

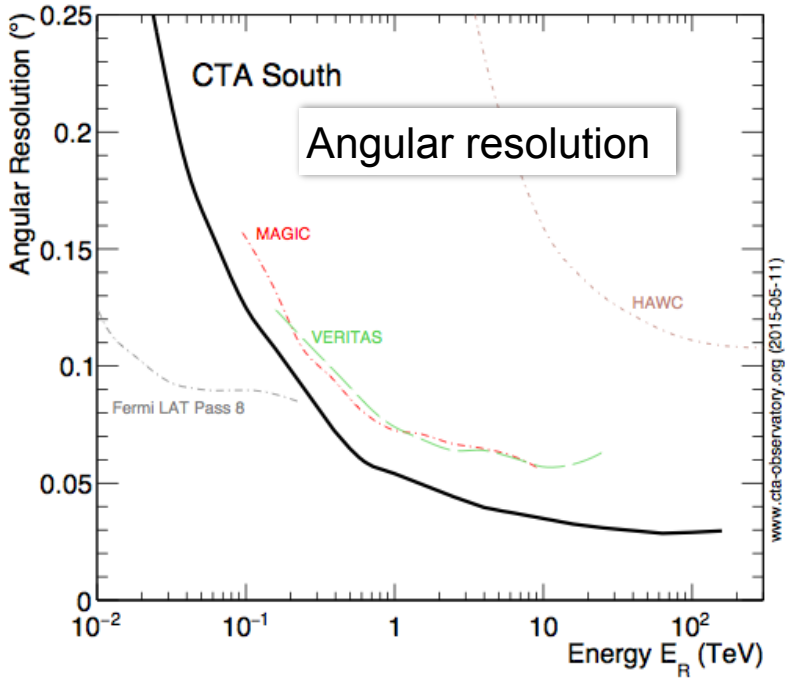


Semantic zooming of CTA operator GUI prototype

CTA Performance

DESY group one of the key player in MC group: large input into site evaluation; next step is optimisation of array layout





CTA Public Performance Page:
https://portal.cta-observatory.org/CTA_Observatory/performance/SitePages/Home.aspx

News from Cherenkov Telescope Array CTA

- Critical Design Review June 2015
  - Delivery of Detailed Technical Design Reports for all Work Packages
  - Plans for pre-production and production for 70-100 telescopes on Southern Array and 20 telescopes on Northern Array
  - Towards CTA Cost Book and Schedule
- CTA Headquarters

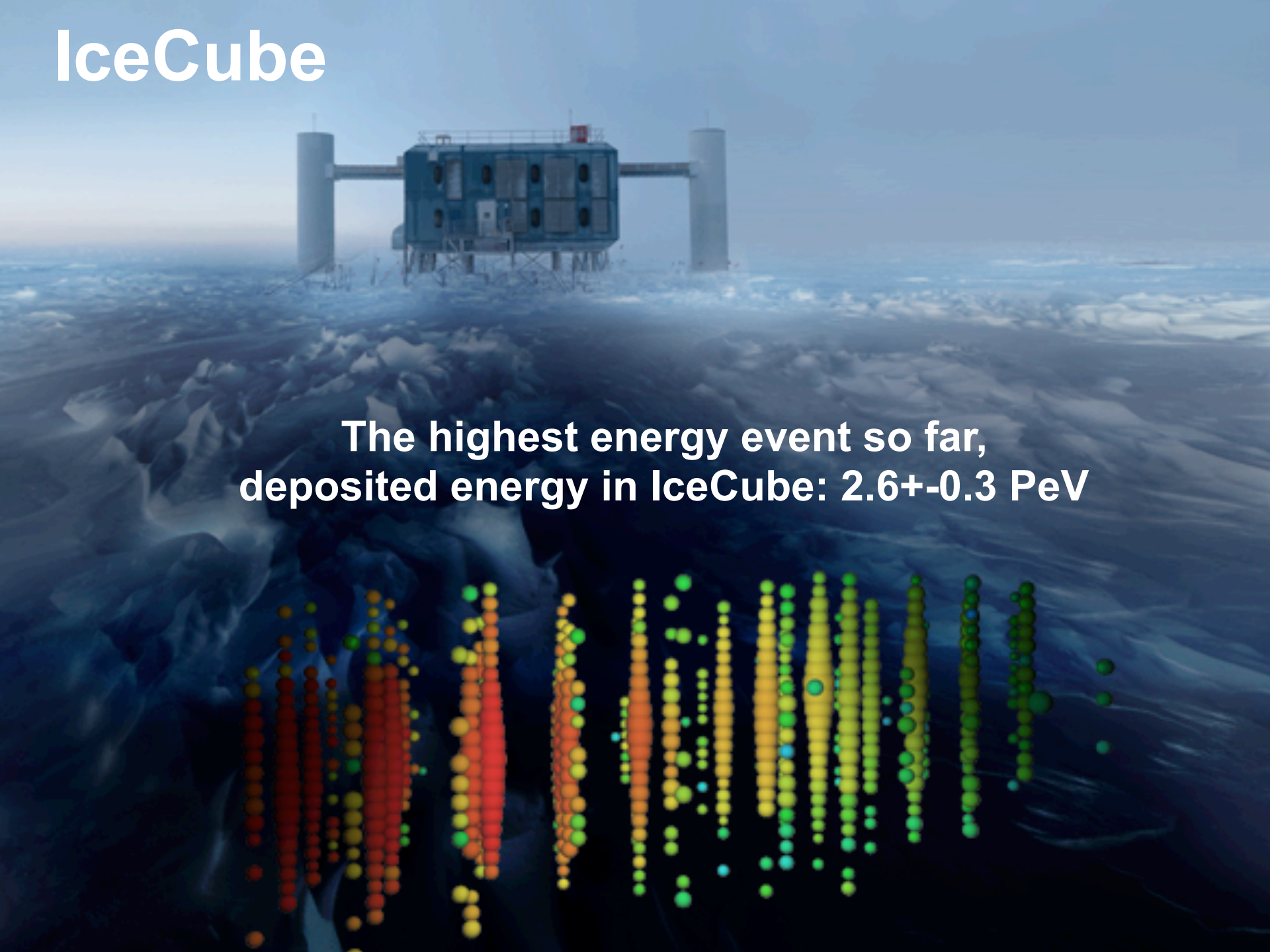
  Expression of Interest by Germany (DESY, Zeuthen), Italy (INAF, Bologna), Brazil (Rio de Janeiro)

  Call for proposals early October 2015

  Deadline for applications Nov 22, 2015

  Decision spring 2016
- Towards a CTA site decision: decision to start detailed negotiations in July with ESO (Chile) and Spain (La Palma)

IceCube



The highest energy event so far,
deposited energy in IceCube: 2.6+-0.3 PeV

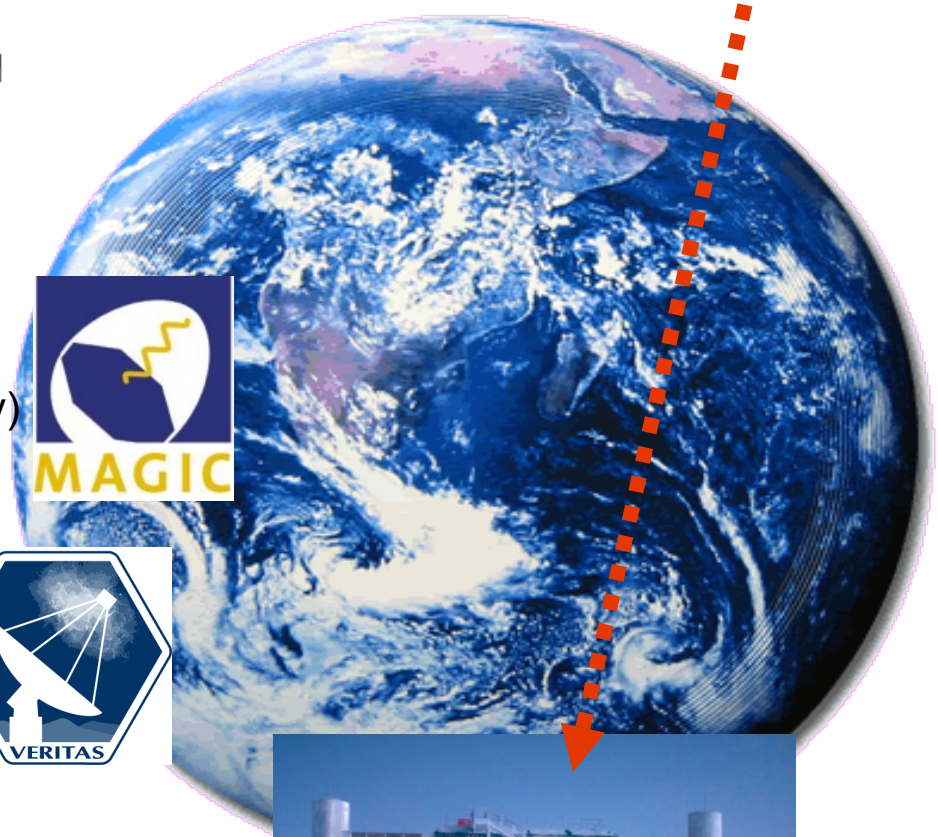
IceCube neutrino follow-up

AGN/SN/GRB

Swift (X-Ray)

PTF (optical)

PALOMAR TRANSIENT FACTORY



MAGIC

(Gamma-Ray)

MAGIC

DESY

VERITAS

(Gamma-Ray)

VERITAS

iridium

IceCube

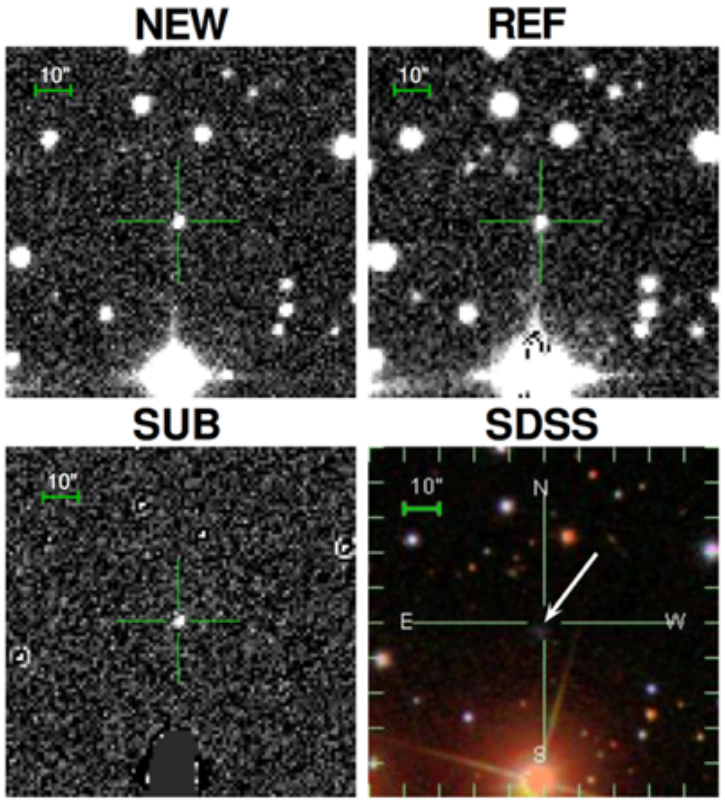
SOUTH POLE NEUTRINO OBSERVATORY

IceCube neutrino follow-up

Swift (X-Ray)

PTF (optical)

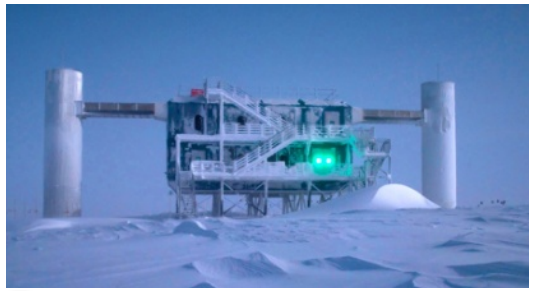
PALOMAR TRANSIENT FACTORY



DESY

Detection of Supernova IIN:
PTF12csy; chance coin. ~2%
Astrophys. J. (2015)

iridium



IceCube
SOUTH POLE NEUTRINO OBSERVATORY

IceCube online data processing pipeline

Farm for online reconstruction

Trigger
2000 Hz

Level 1
30 Hz

Neutrino-
Level
0.002 Hz

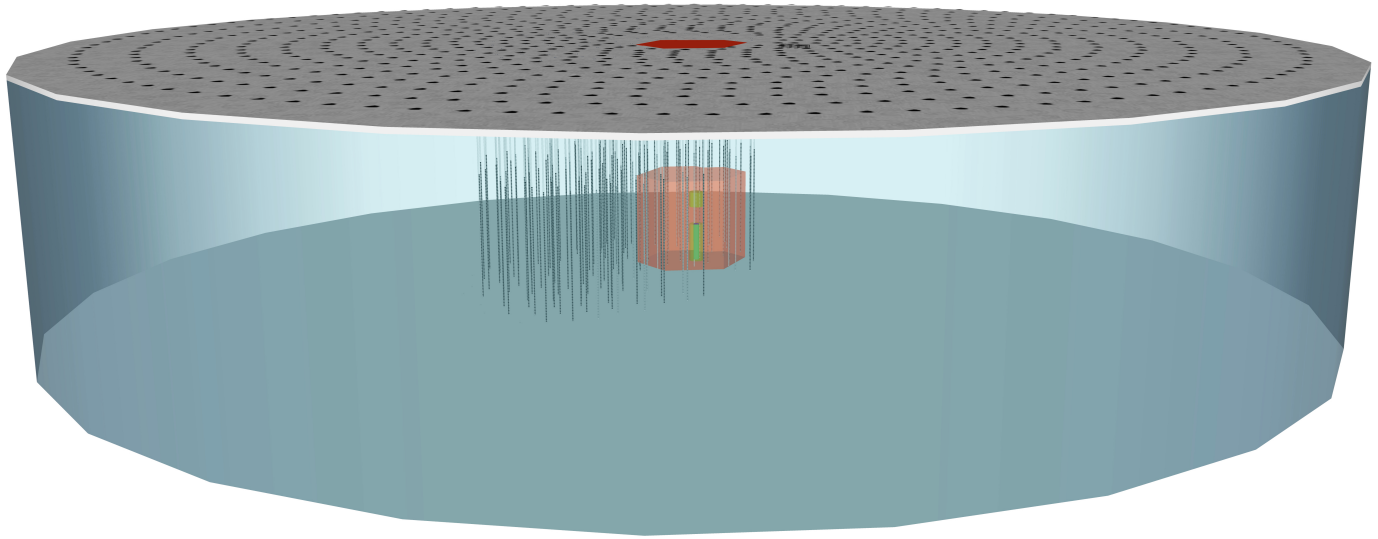
Single neutrinos send North

Upgrade by T. Kintscher and A. Stasik (DESY)

Gen2: High Energy Baseline

Conceptional design lead by DESY and U. Wisconsin.
First full analysis pipeline available (J. van Santen, DESY)

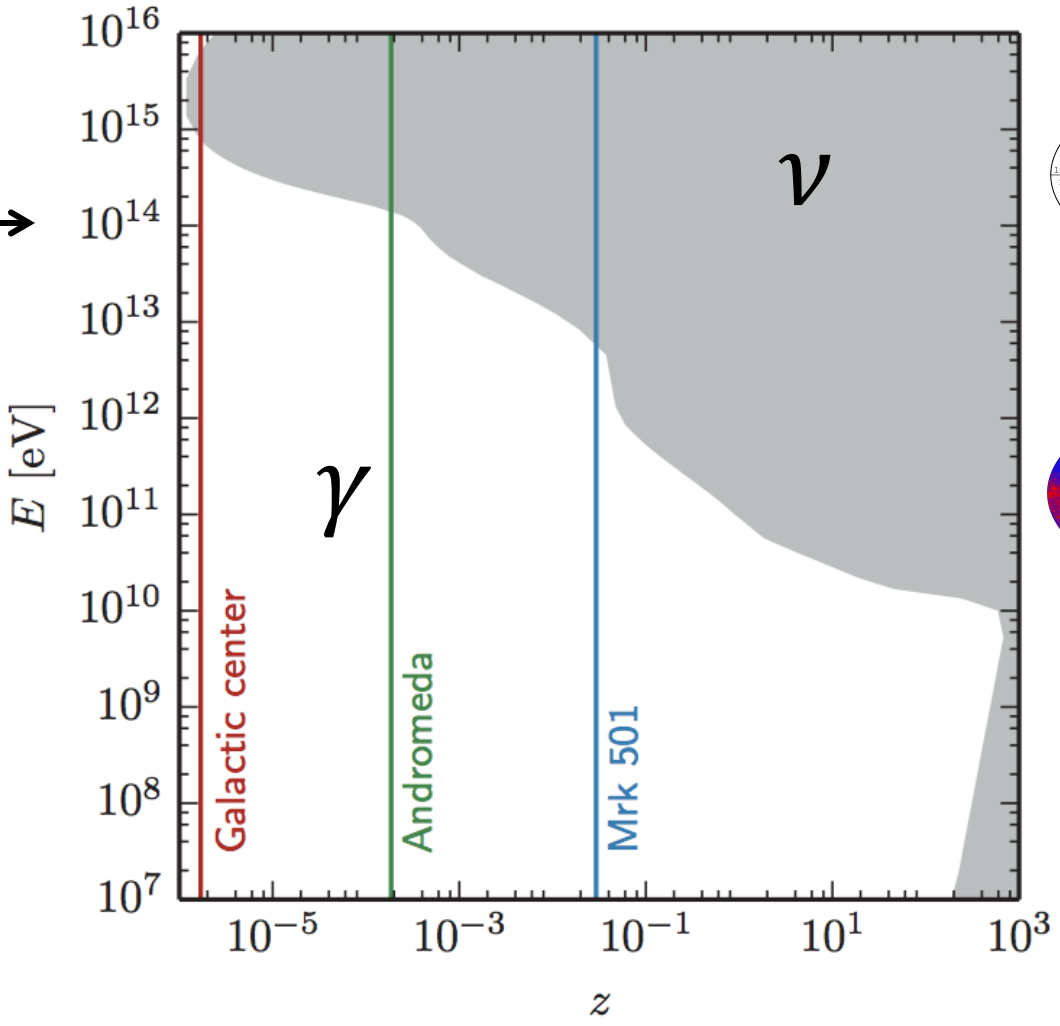
Surface: 75 km^2 / 100 TeV threshold

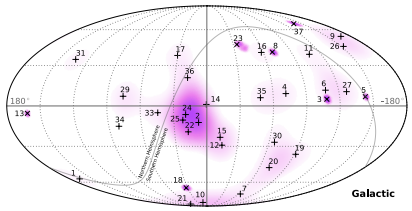


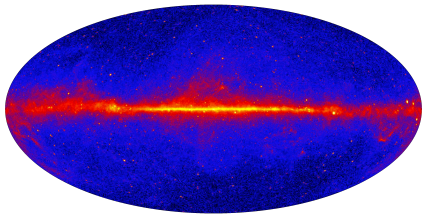
InIce: 120 strings, 240 m spacing

Gen2: science case

100 TeV →

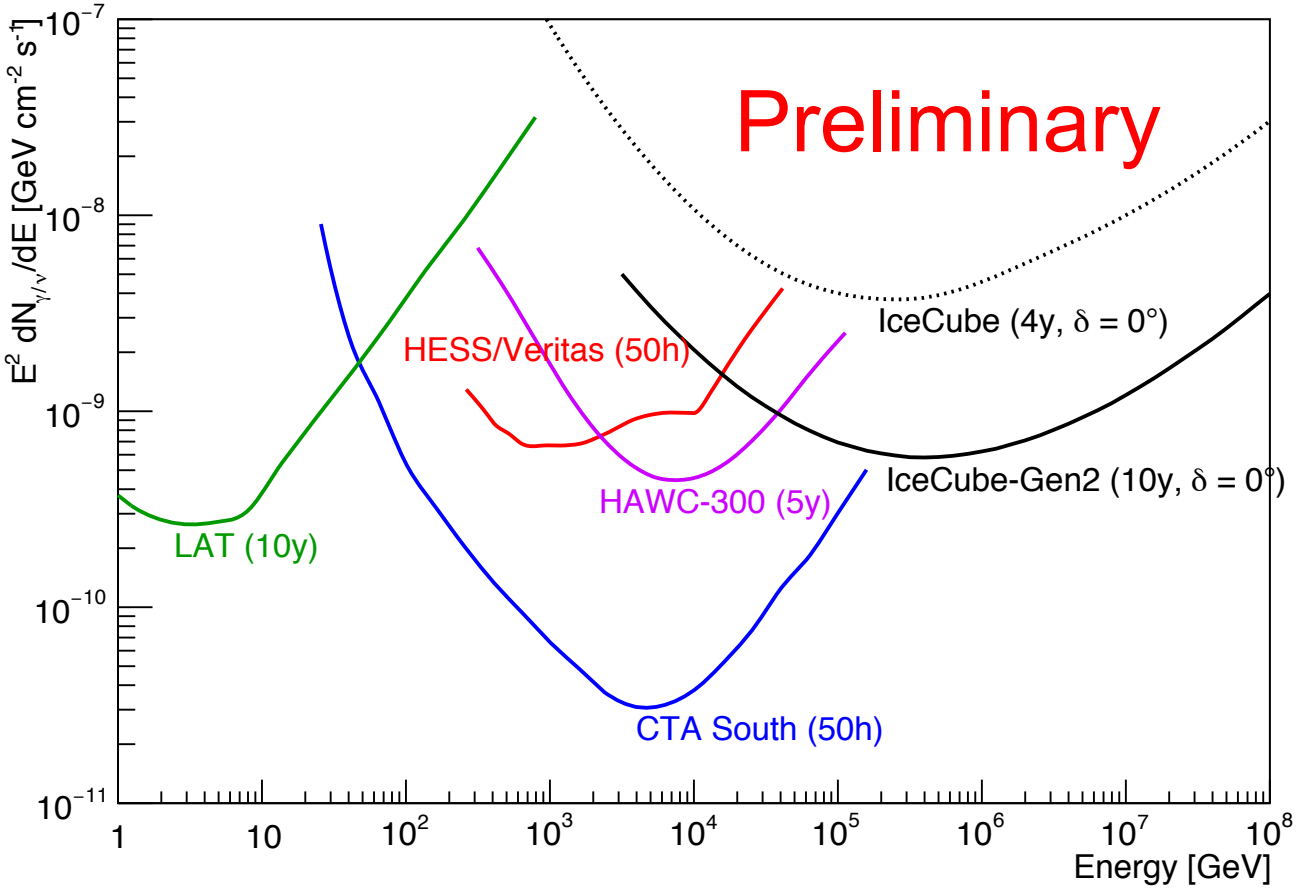






neutrino astronomy is THE window to the extragalactic Universe above 100 TeV

Point Source Sensitivity



Ackermann, van Santen

Conclusion

- Running experiments deliver top science
- CTA is ramping up well DESY key player
- IceCube-Gen2 starting to take shape