

Status of



The Southern Wide-field Gamma-ray Observatory

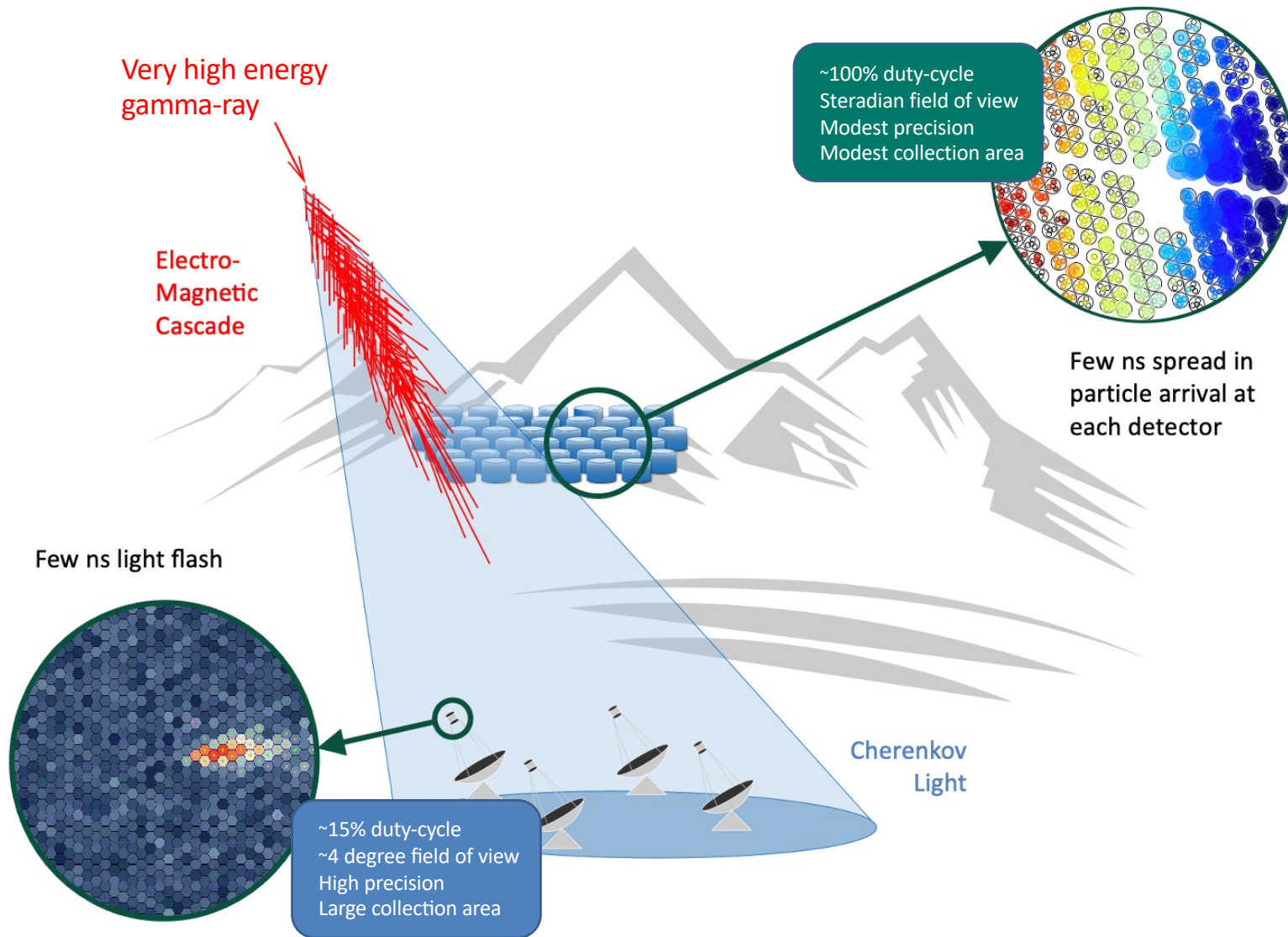
Jim Hinton

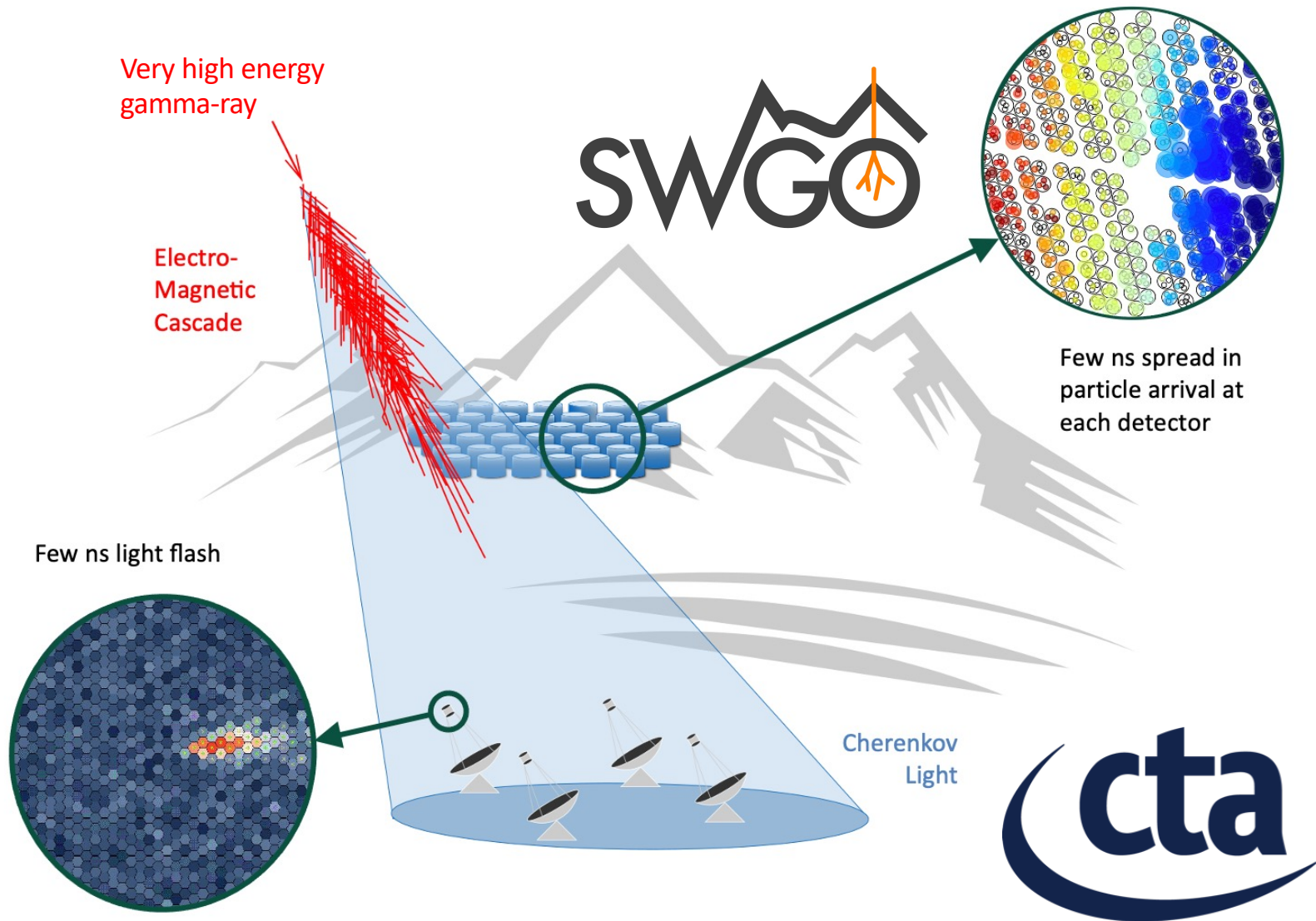


MAX-PLANCK-INSTITUT
FÜR KERNPHYSIK
HEIDELBERG

for the SWGO Collaboration

www.swgo.org





HAWC

180°

-180°

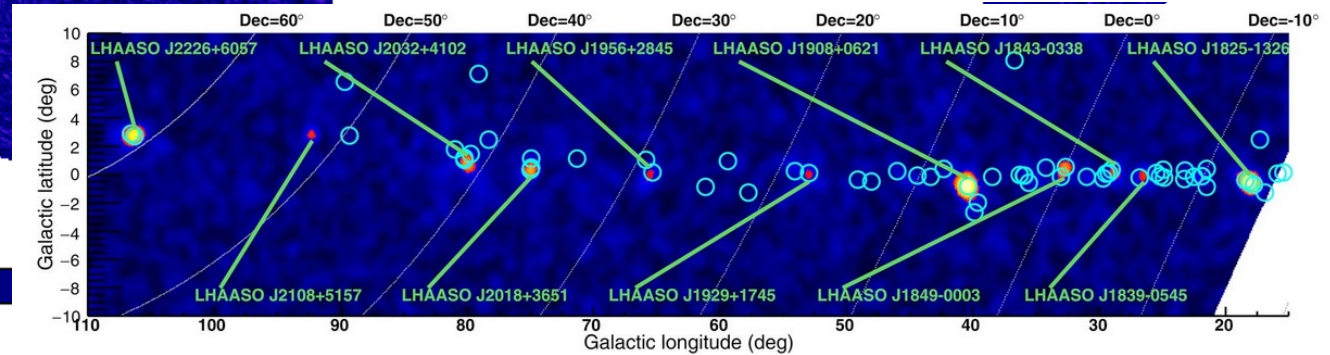
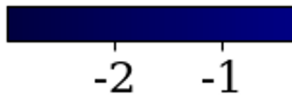
Ultrahigh-energy photons up to 1.4 petaelectronvolts from 12 γ -ray Galactic sources

Zhen Cao , F. A. Aharonian , [...]X. Zuo

Nature 594, 33–36 (2021) | [Cite this article](#)

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LHAASO



significance [σ]

For 0.4° sources

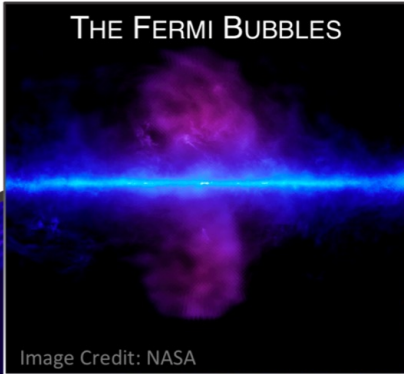
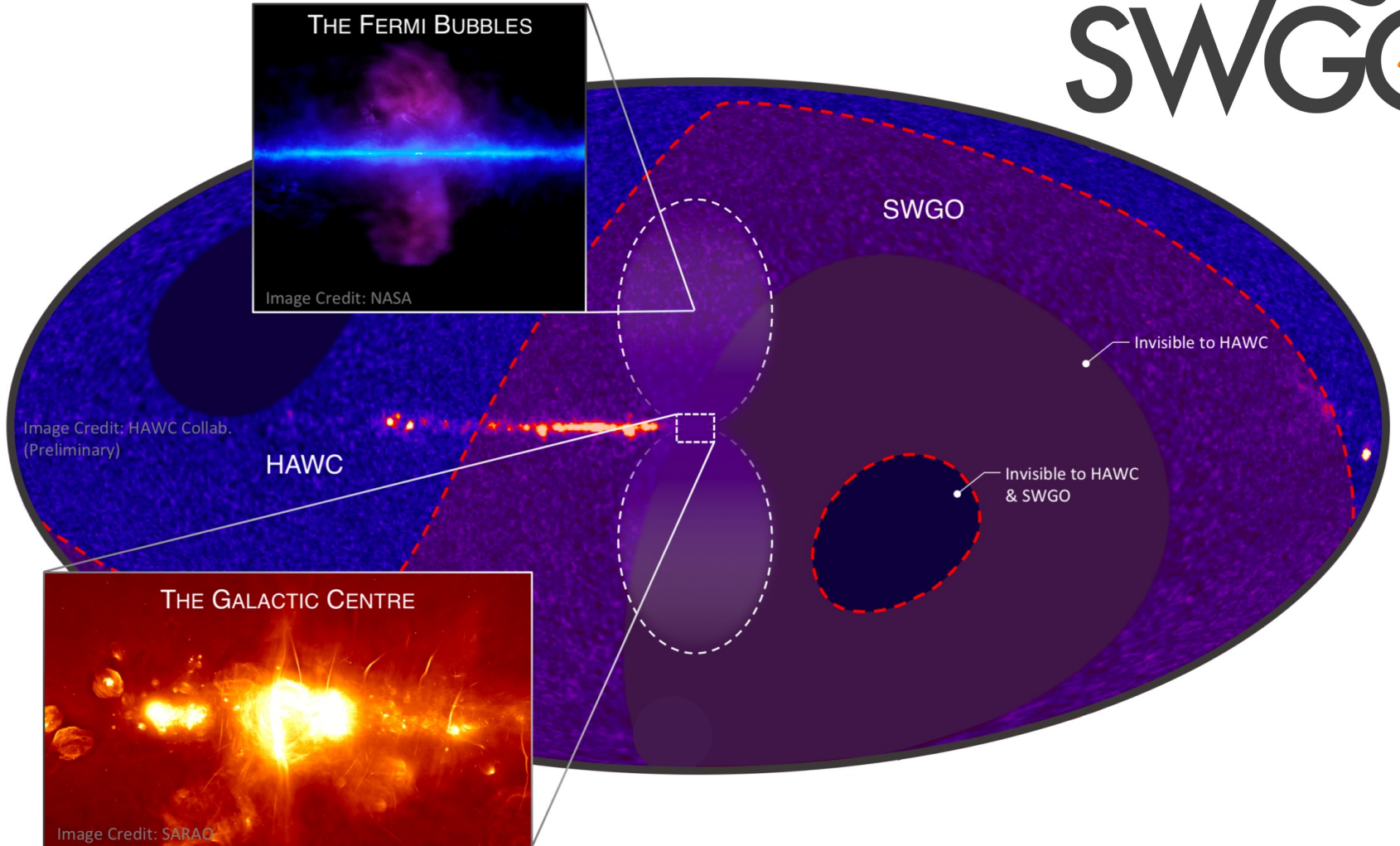
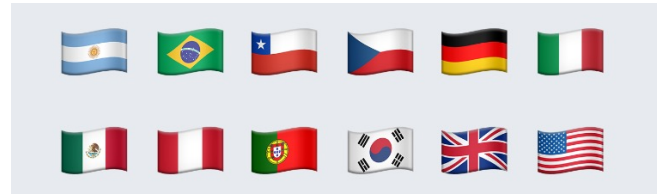


Image Credit: HAWC Collab. (Preliminary)



Status & Plan



SWG0 R&D Phase Milestones

✓	M1	R&D Phase Plan Established
✓	M2	Science Benchmarks Defined
✓	M3	Reference Configuration & Options Defined
	M4	Site Shortlist Complete
✓	M5	Candidate Configurations Defined
	M6	Performance of Candidate Configurations Evaluated
	M7	Preferred Site Identified
	M8	Design Finalised
	M9	Construction & Operation Proposal Complete

◎ SWGO partners

- 47 institutes in 12 countries*
- + supporting scientists

◎ R&D Phase

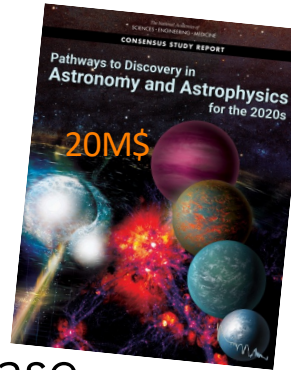
- Kick off meeting Nov 2019
- Expected completion 2023
 - ✓ Site and Design Choices made
- Then:

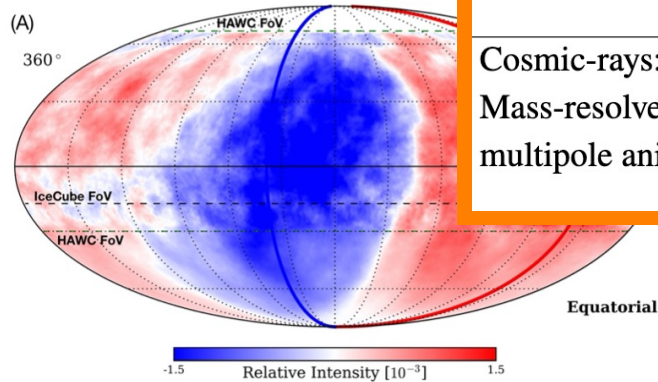
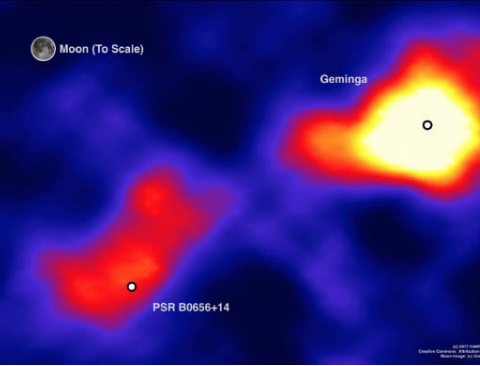
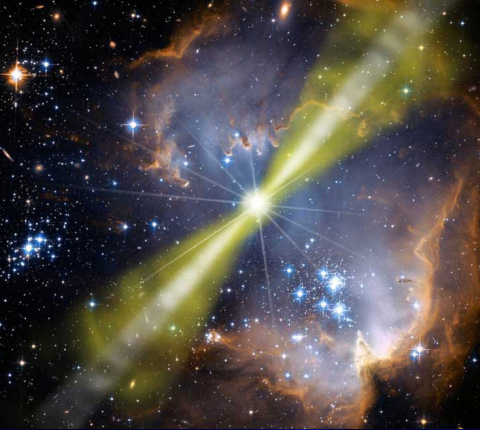
◎ Preparatory Phase

- Detailed construction planning
- Engineering Array

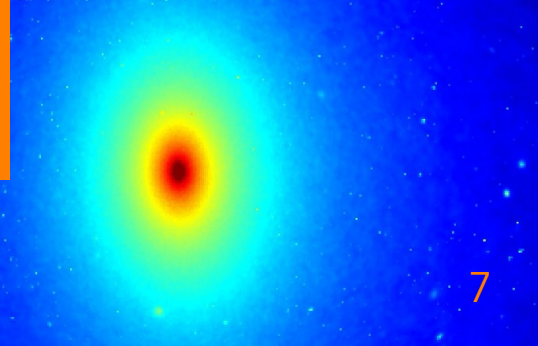
◎ (Full) Construction Phase

- 2026+





Science Case	Design Drivers
Transient Sources: Gamma-ray Bursts	Low-energy sensitivity & Site altitude ^a
Galactic Accelerators: PeVatron Sources	High-energy sensitivity & Energy resolution ^b
Galactic Accelerators: PWNe and TeV Halos	Extended source sensitivity & Angular resolution ^c
Diffuse Emission: Fermi Bubbles	Background rejection
Fundamental Physics: Dark Matter from GC Halo	Mid-range energy sensitivity Site latitude ^d
Cosmic-rays: Mass-resolved dipole / multipole anisotropy	Muon counting capability ^e



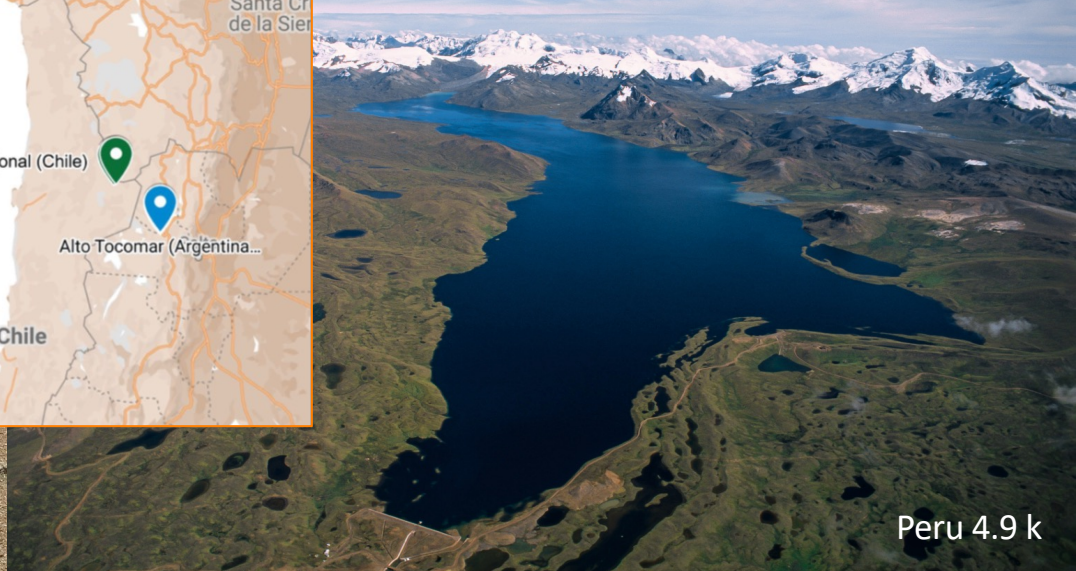
Bolivia 4.7k



Chile 4.8 k



Argentina 4.8 k



Peru 4.9 k

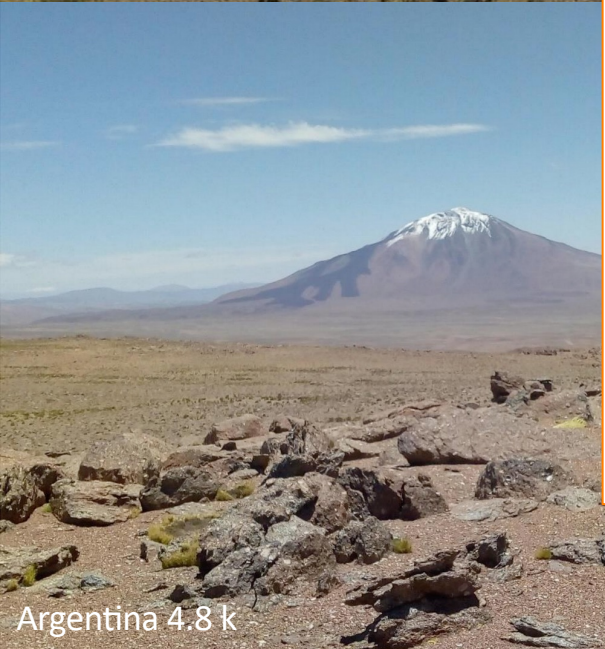
Bolivia 4.7k



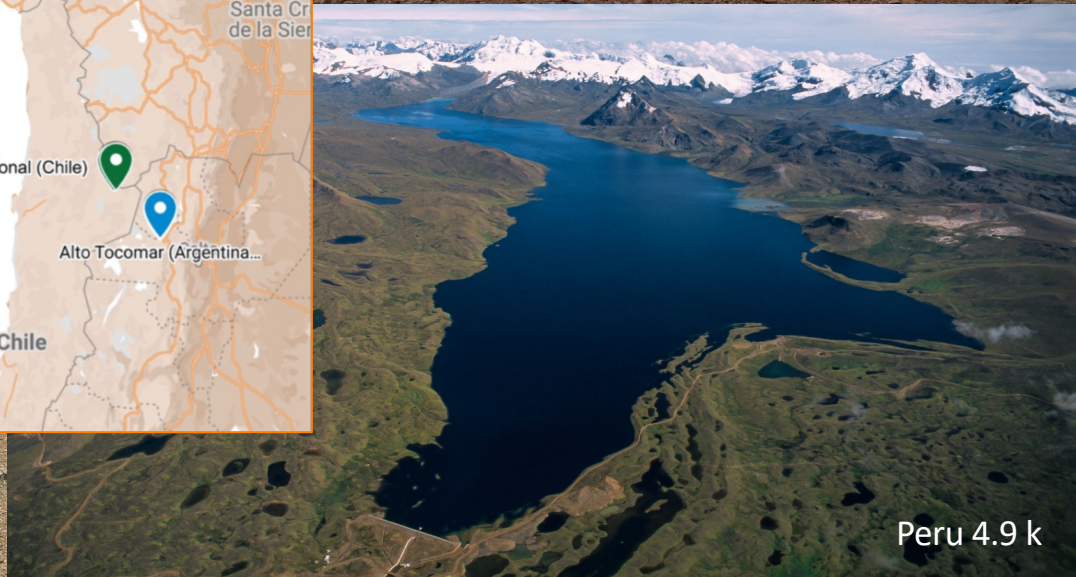
Chile 4.8 k



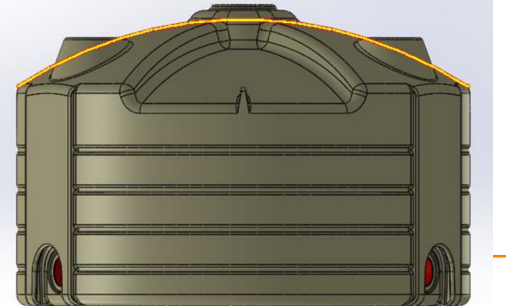
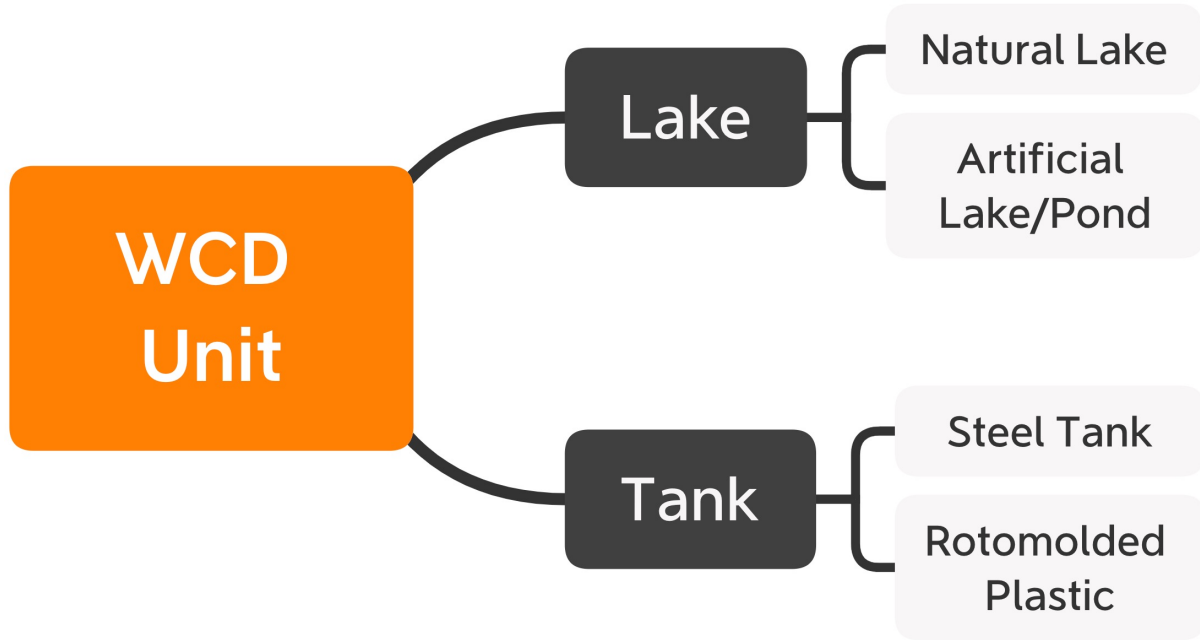
Site shortlisting: September 2022
 Site team visits: October 2022
 Preferred Site identified: Autumn 2023
 On-site prototyping activities: from 2022

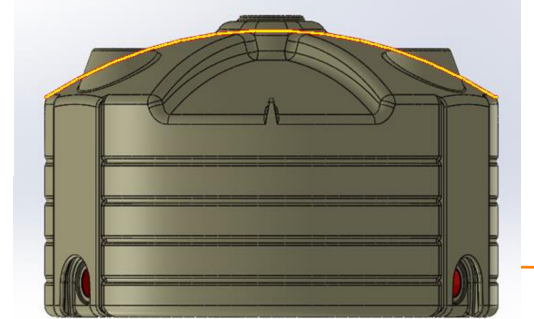
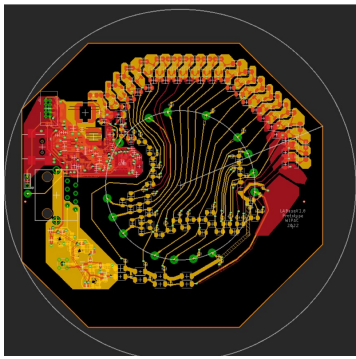


Argentina 4.8 k



Peru 4.9 k





WCD Unit

Lake

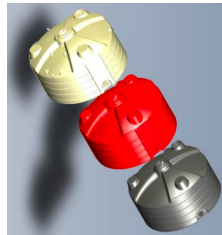
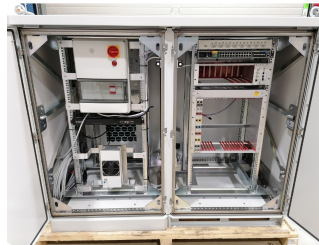
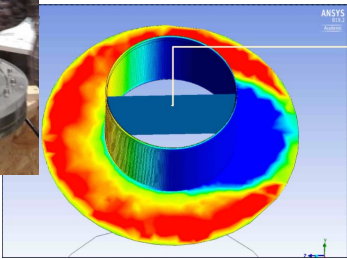
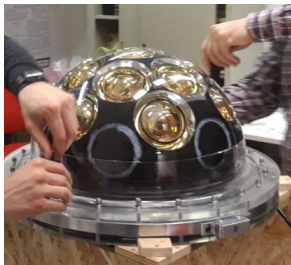
Natural Lake

Artificial Lake/Pond

Tank

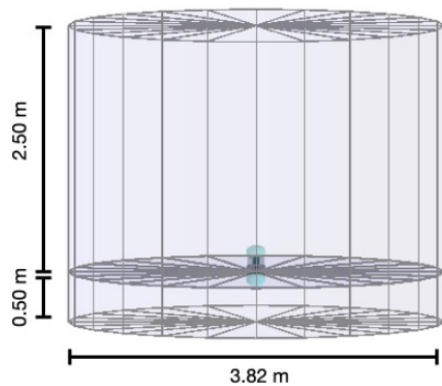
Steel Tank

Rotomolded Plastic

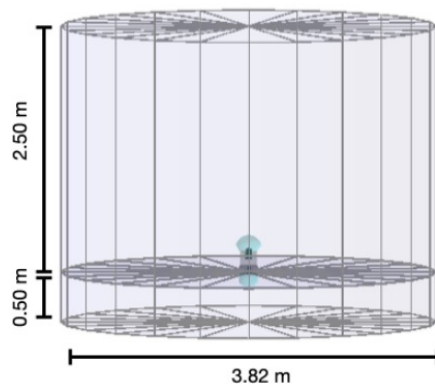


*cooperation with KM3Net, MoU in prep.

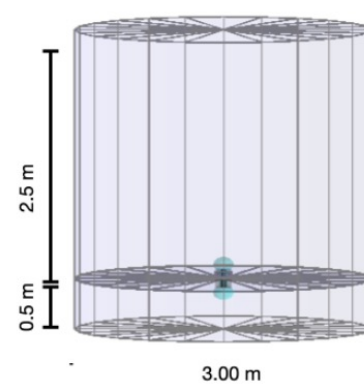
A



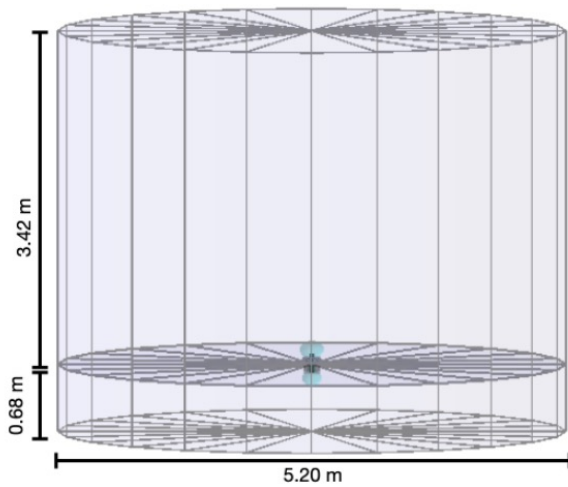
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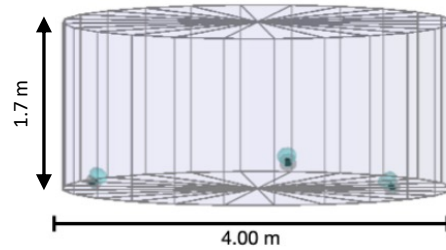
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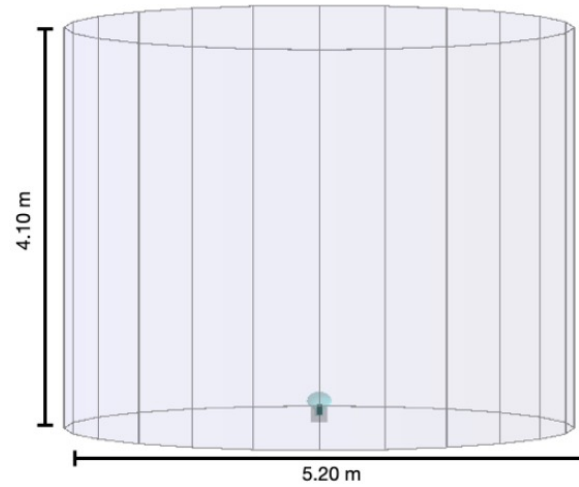
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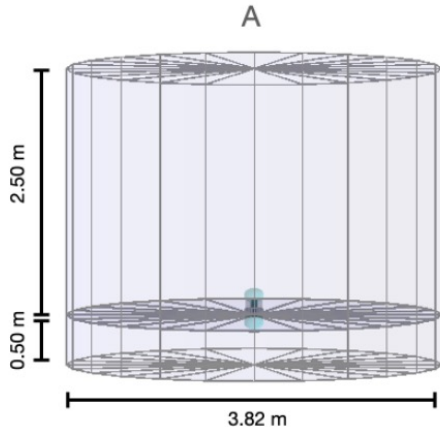


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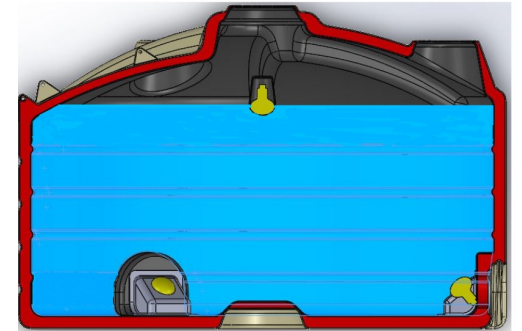
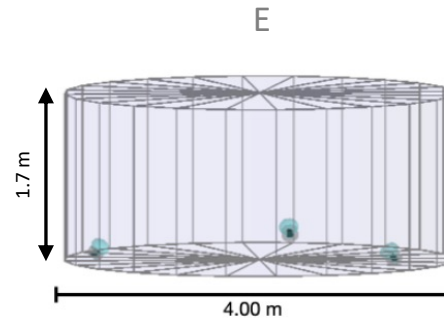
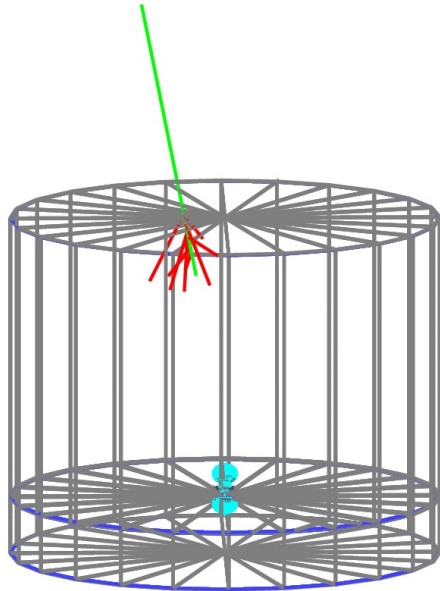
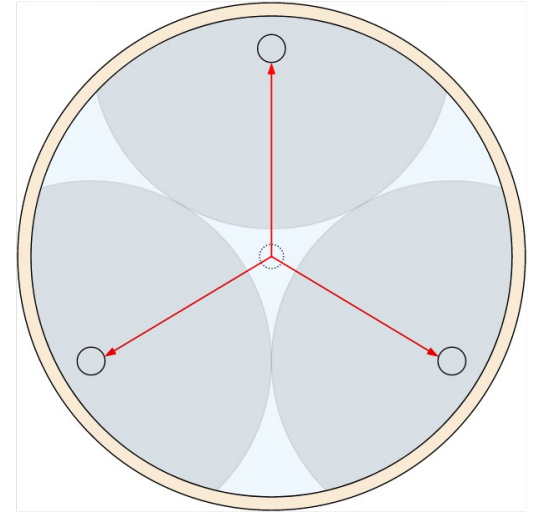


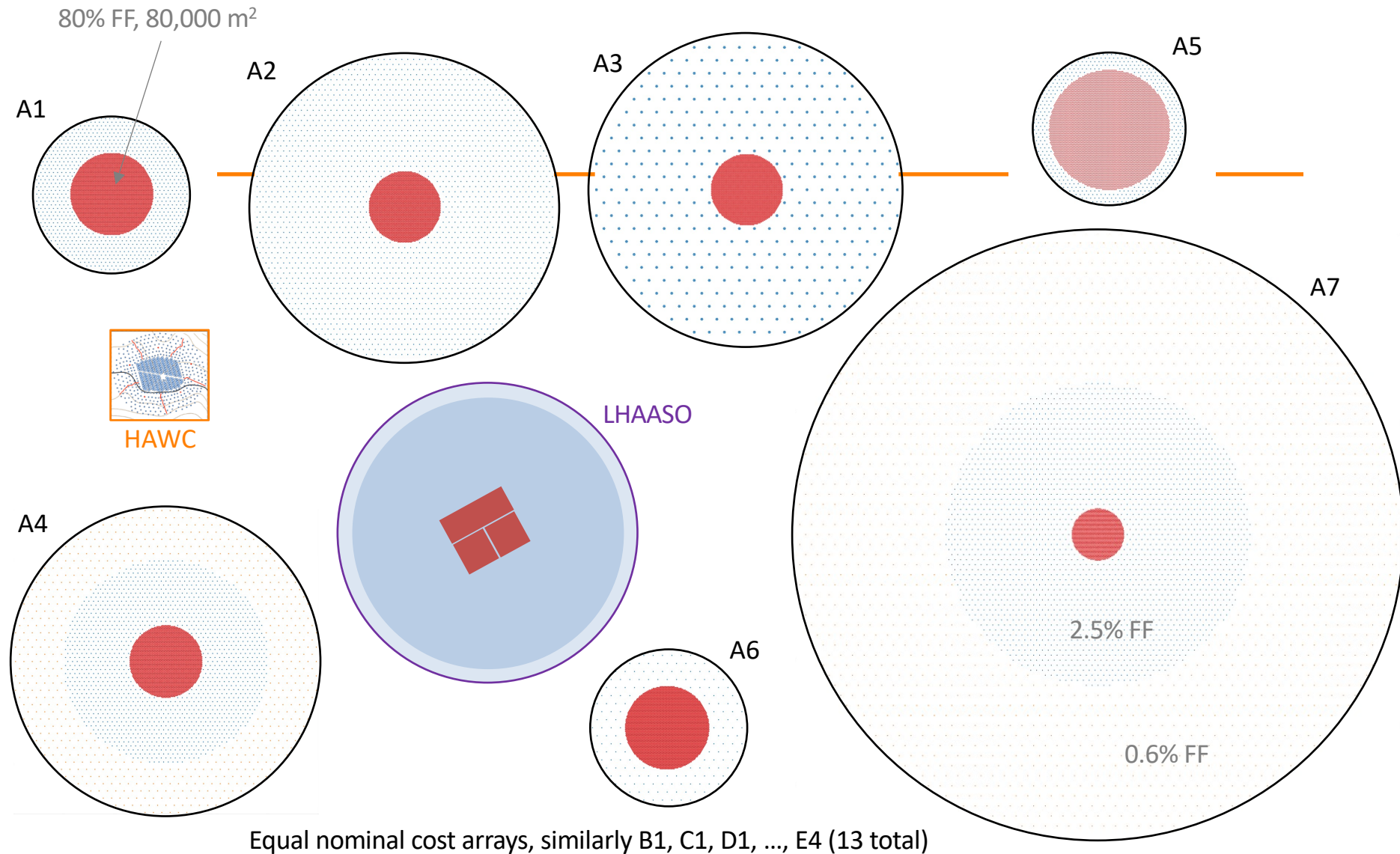
F





Muon identification a key element of background rejection – two approaches under evaluation





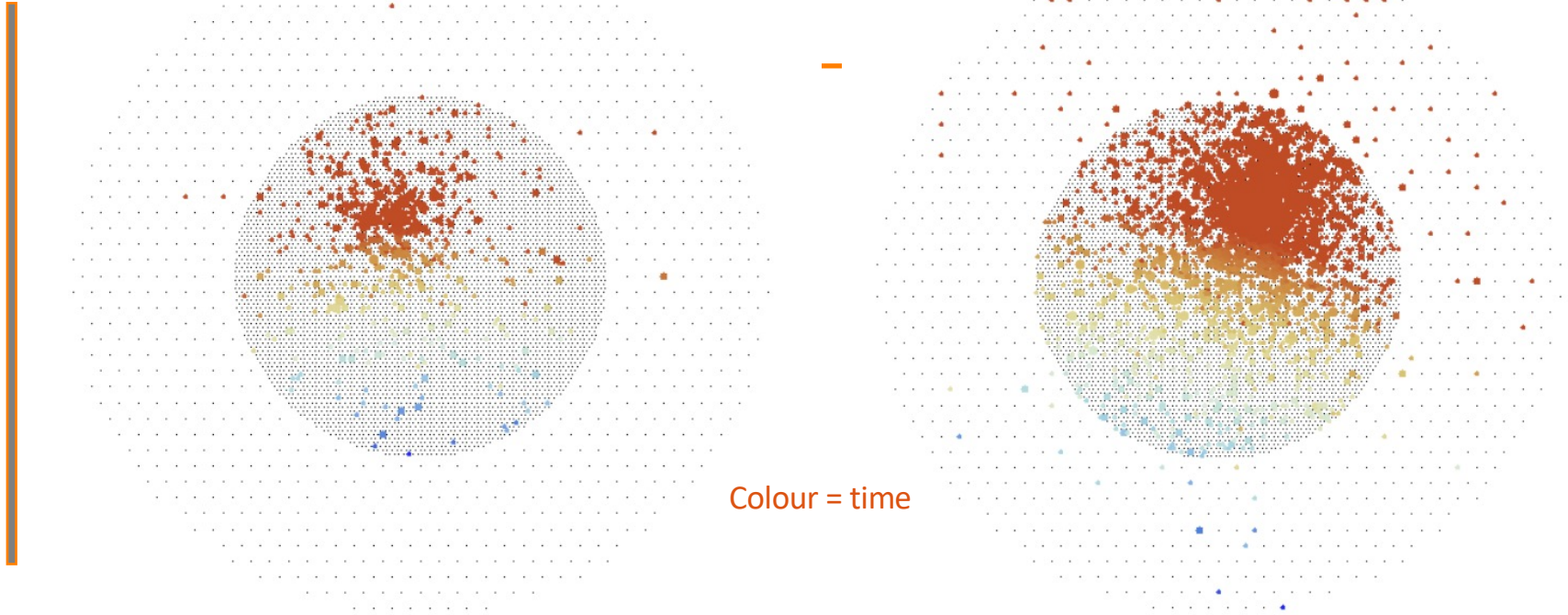
A1

600 GeV

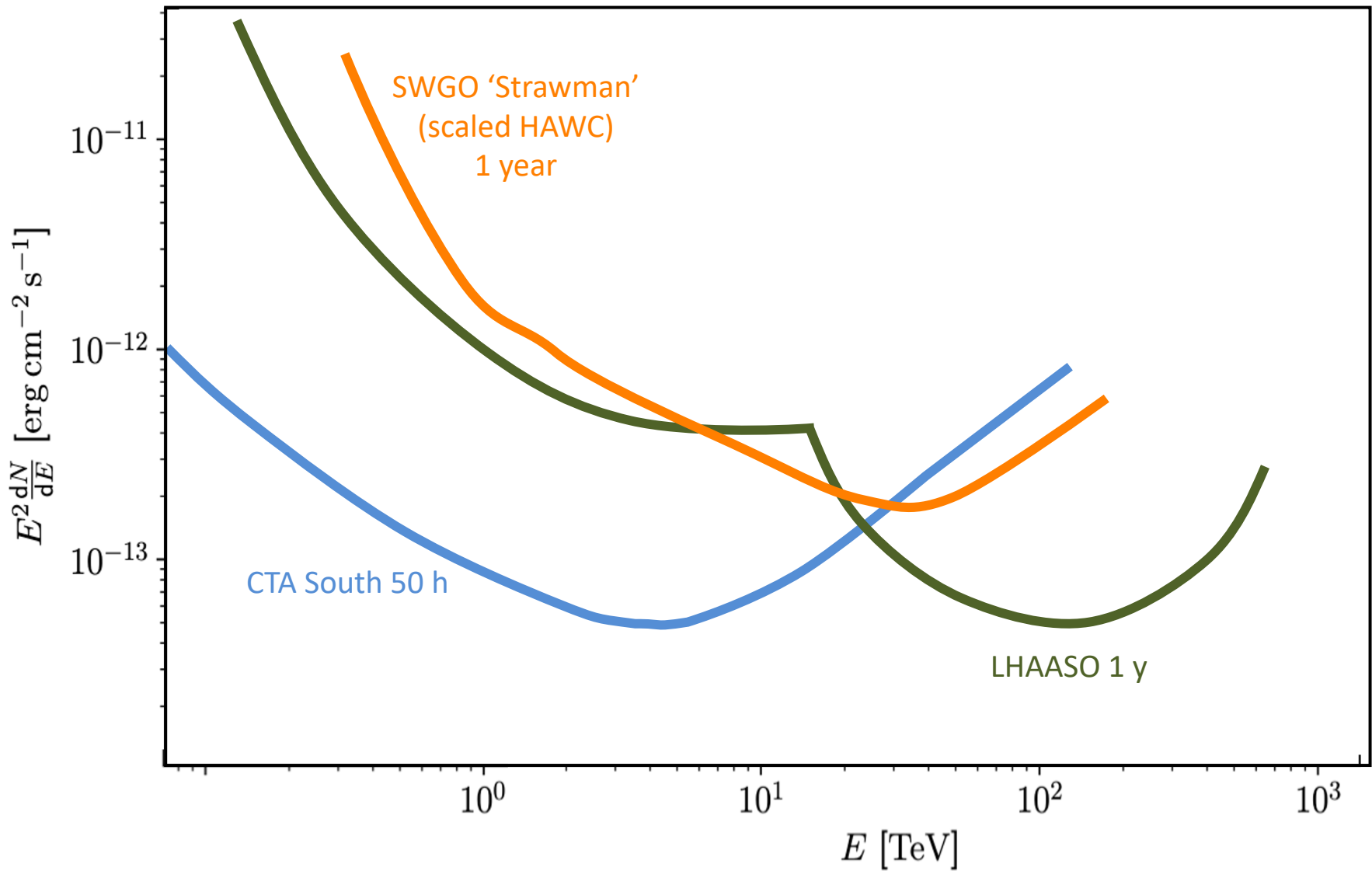
14 TeV

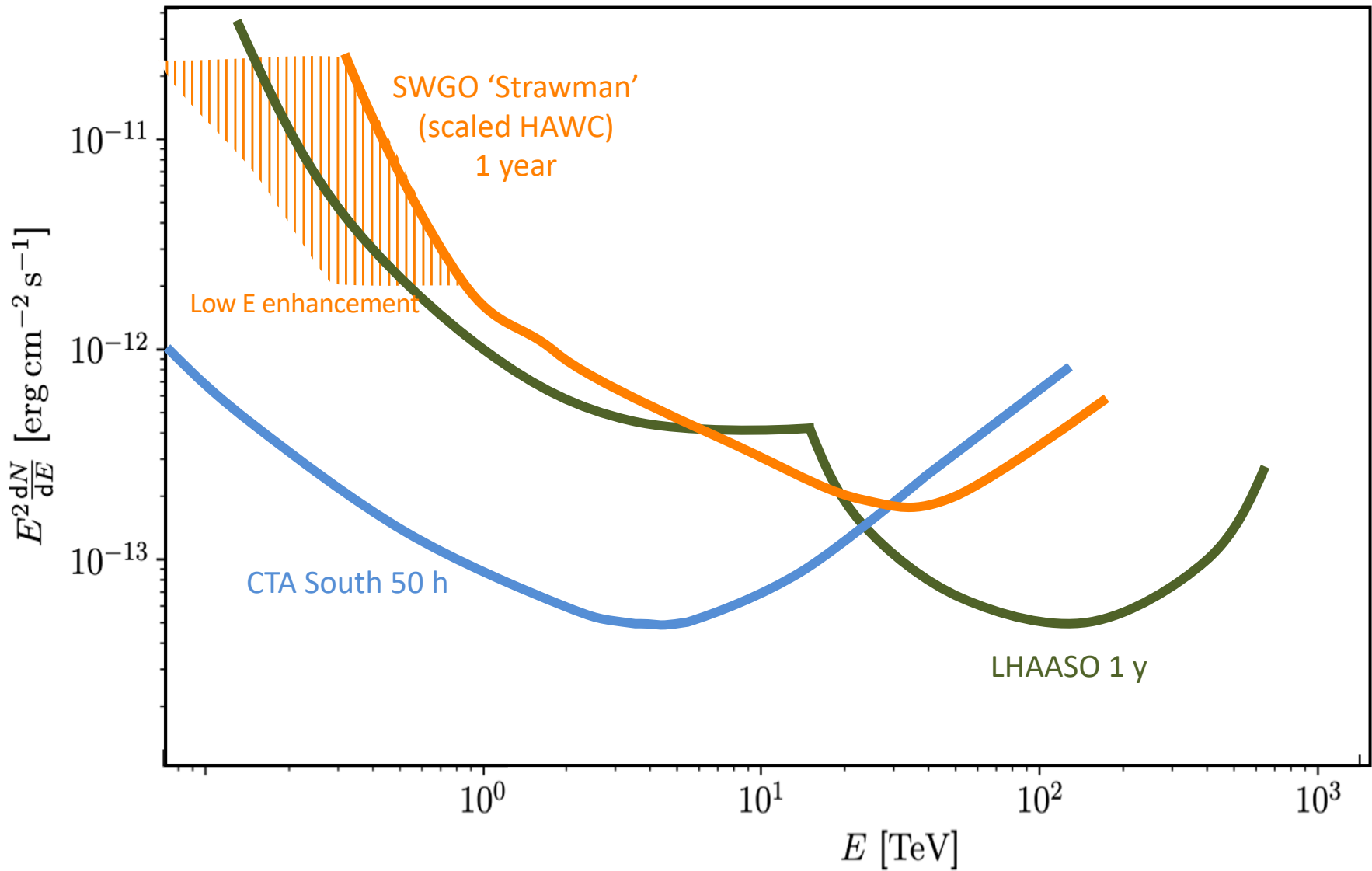
500 m

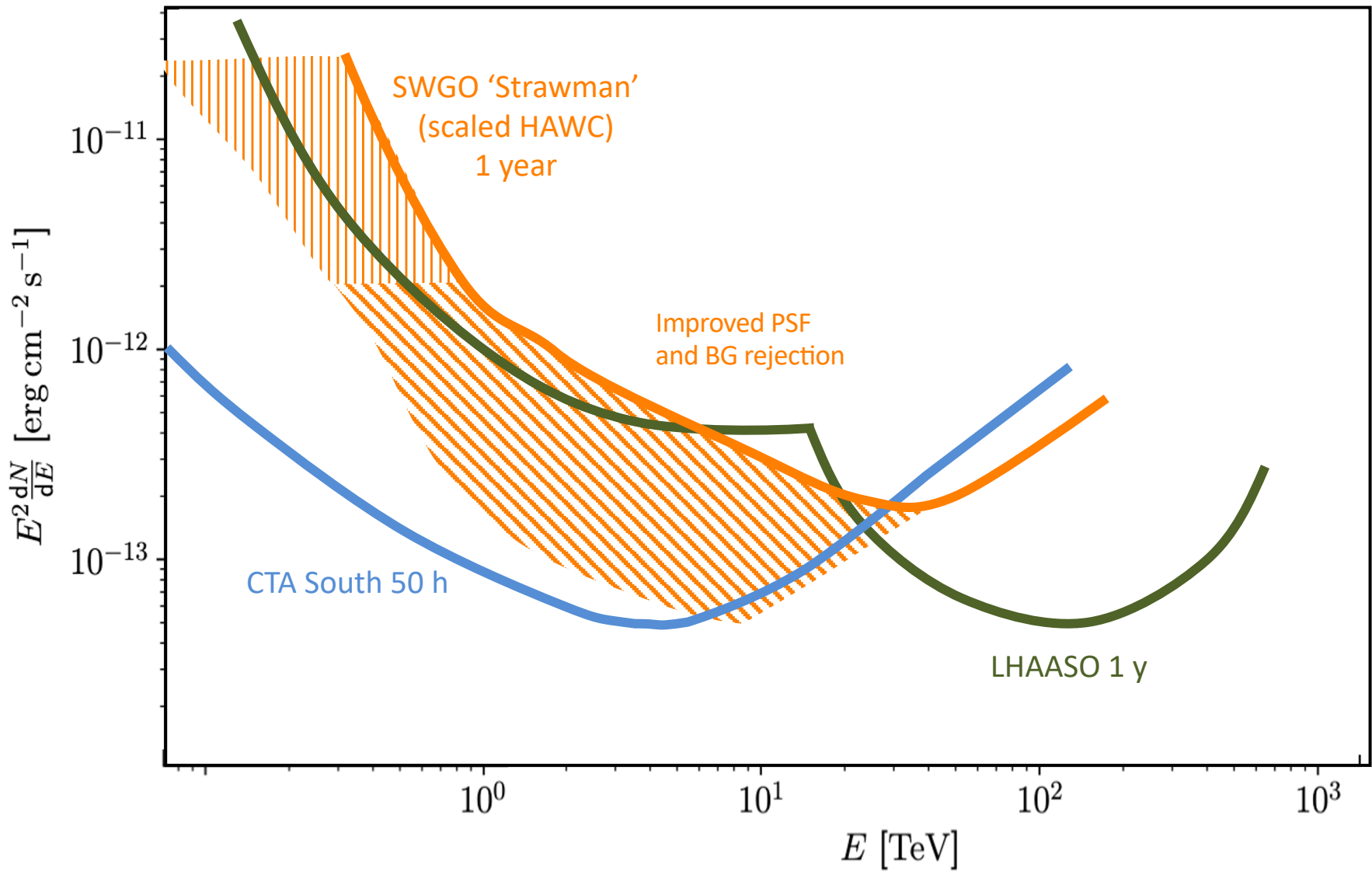
35 degree zenith angle

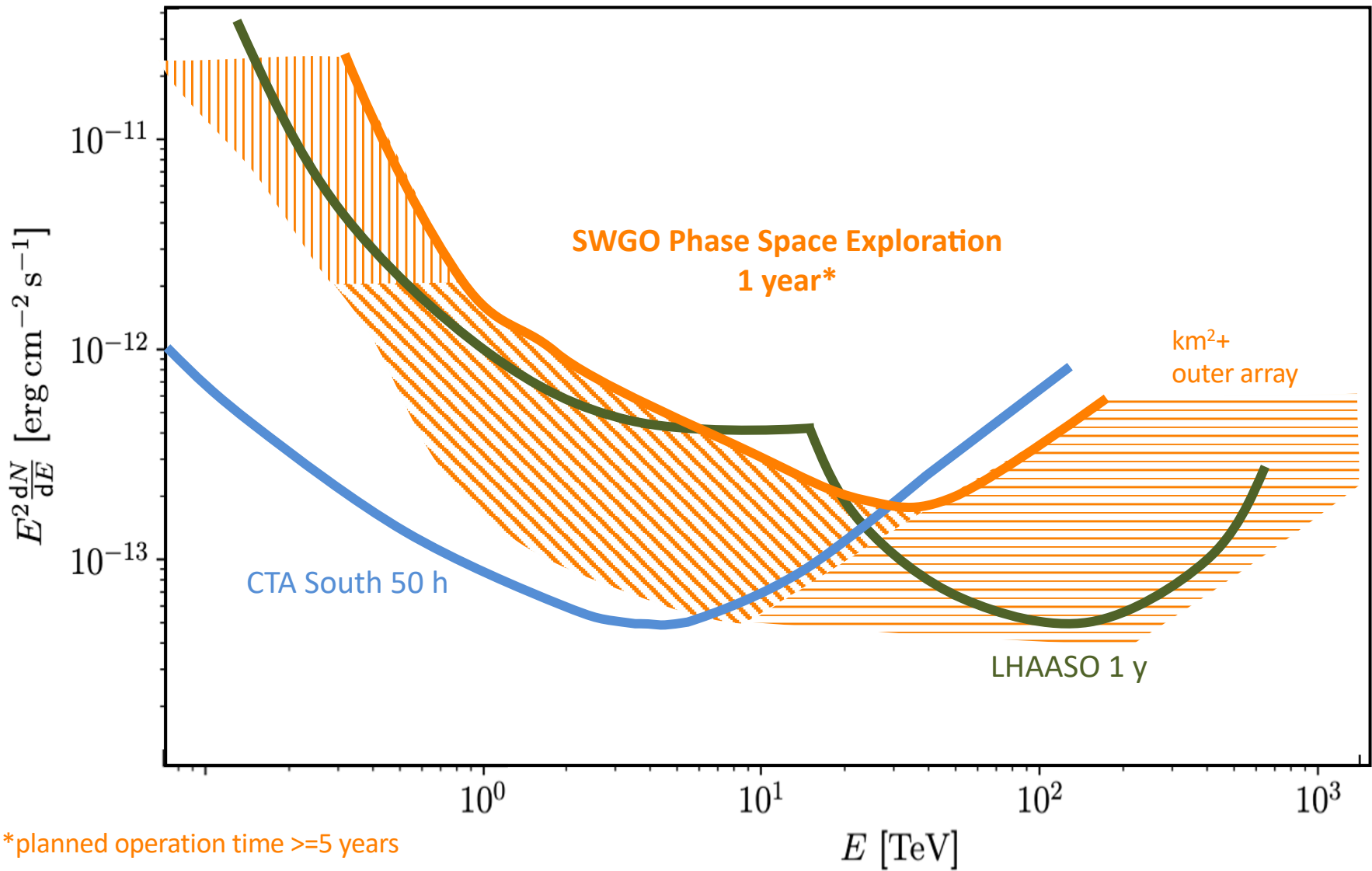


- ⊙ Larger detector array and increased altitude w.r.t. HAWC
 - Very precise measurements possible even below 1 TeV

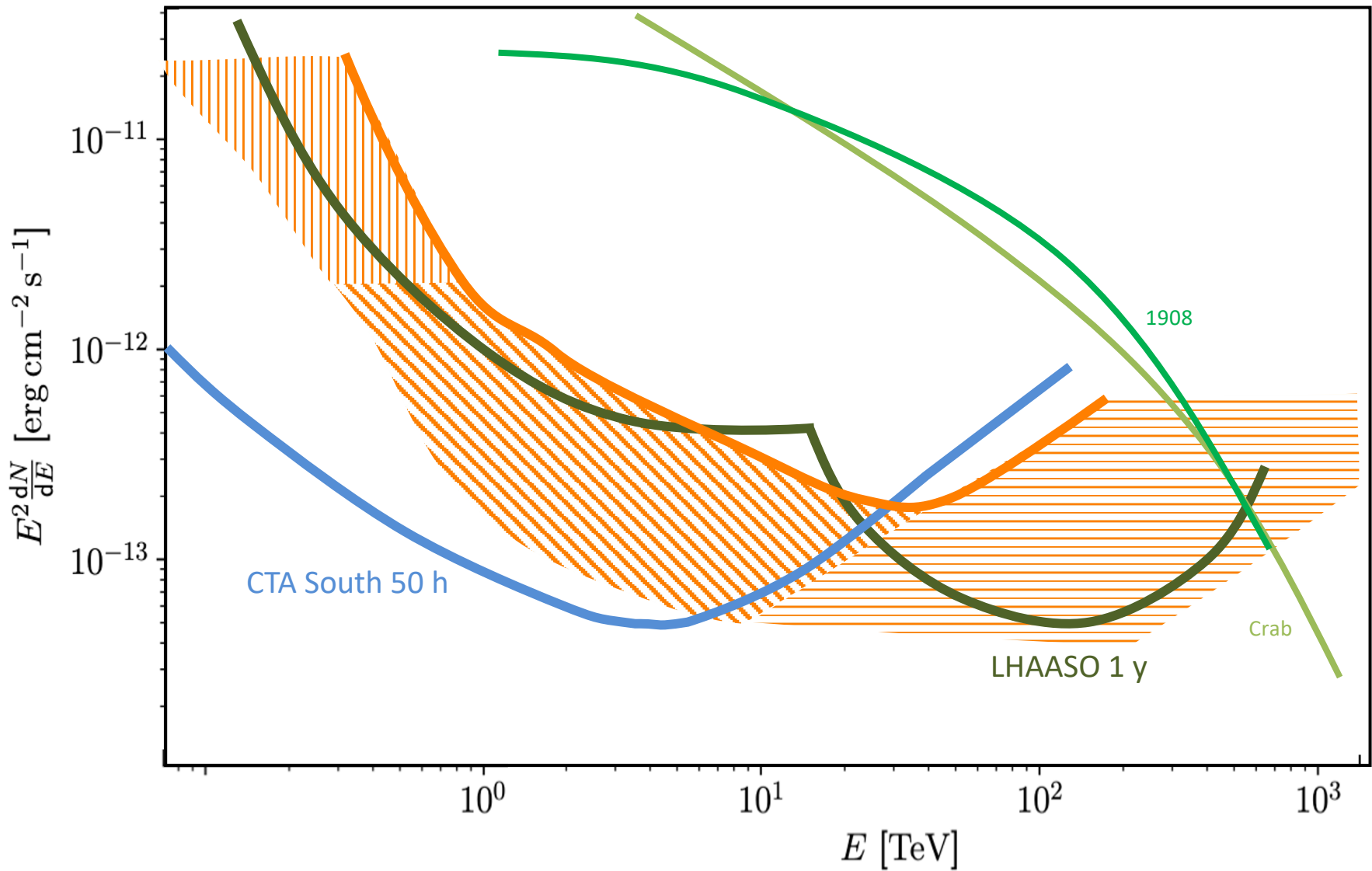


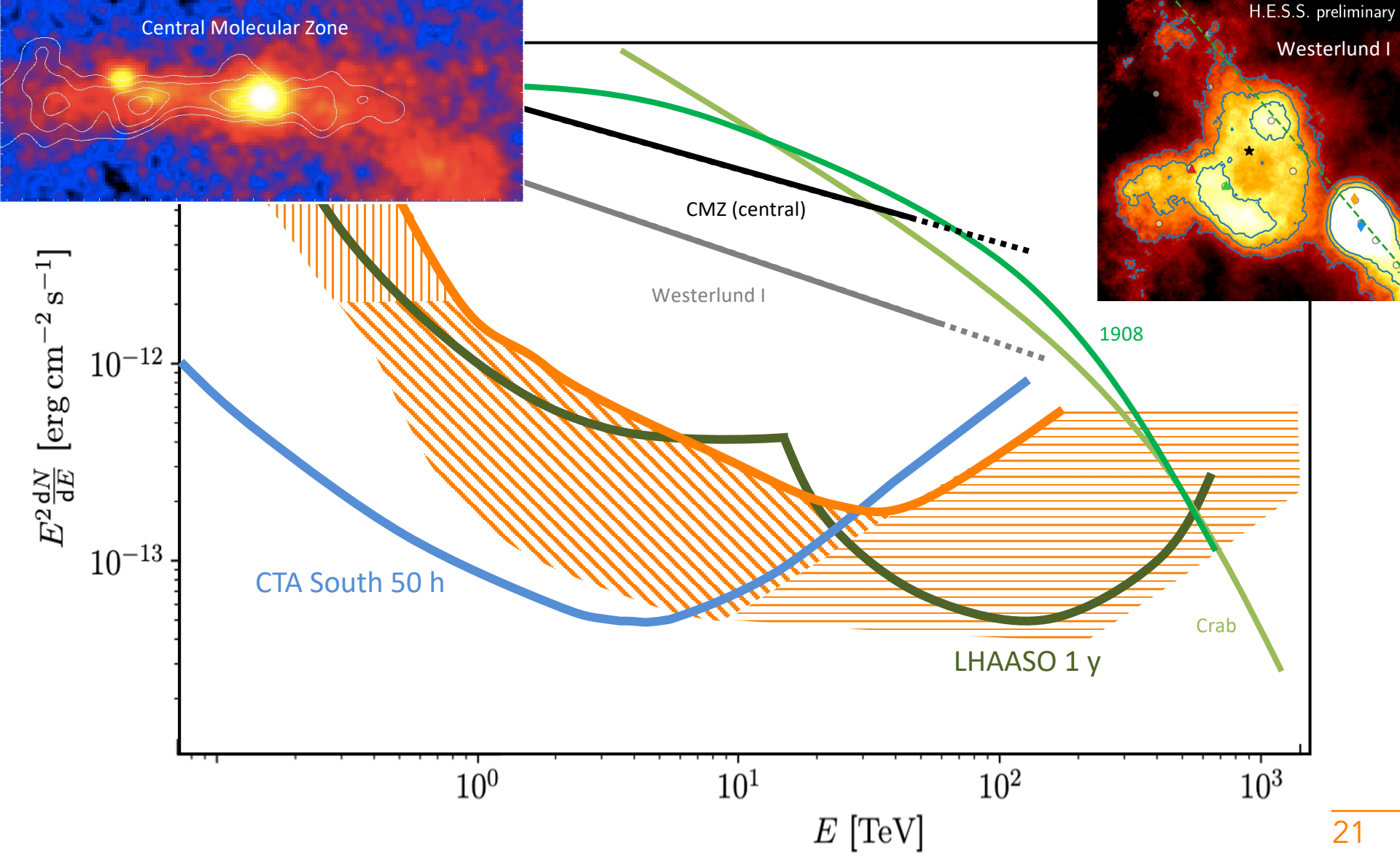




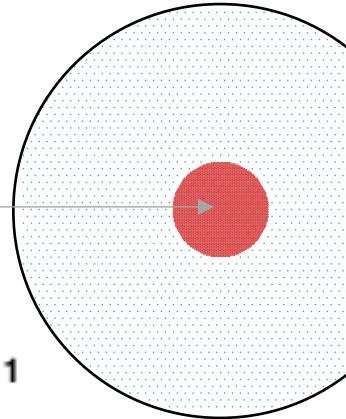
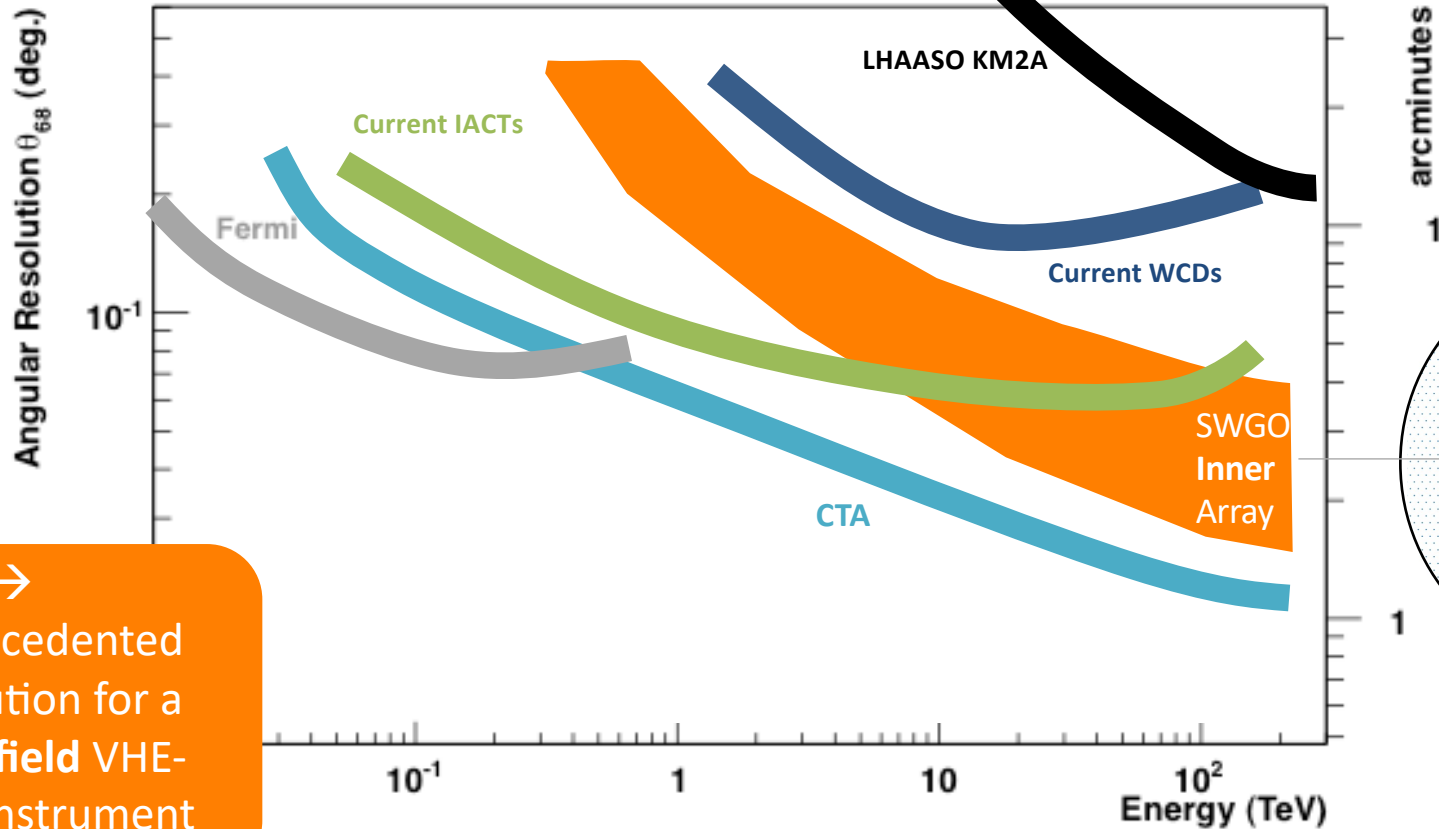


*planned operation time >=5 years





Resolution?



Goal →
unprecedented
resolution for a
wide field VHE-
UHE instrument

Neutrino Synergies

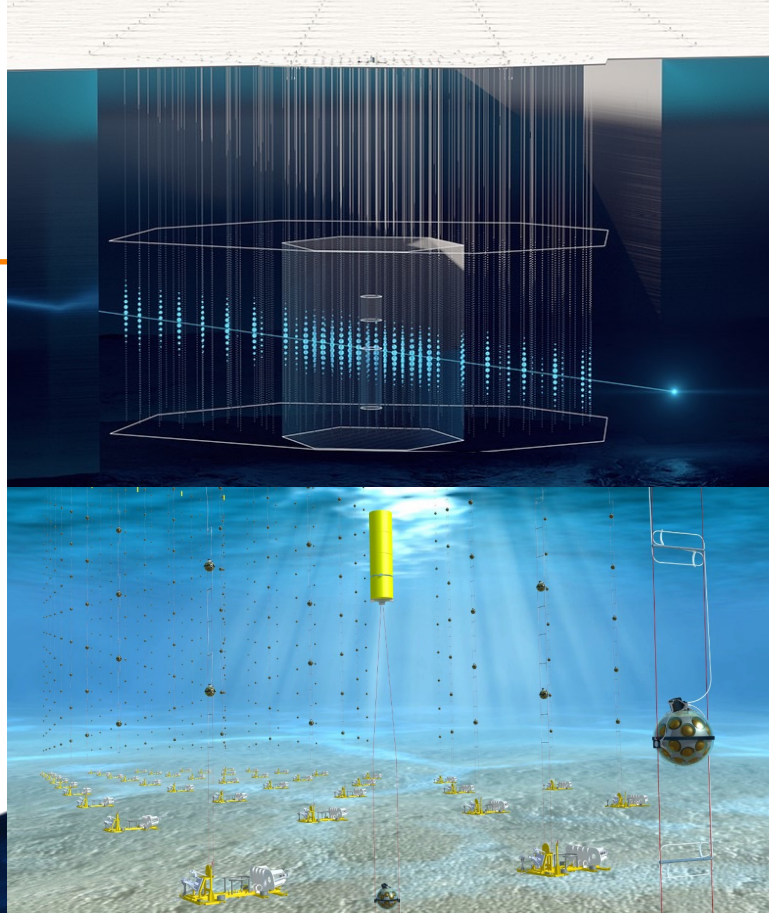
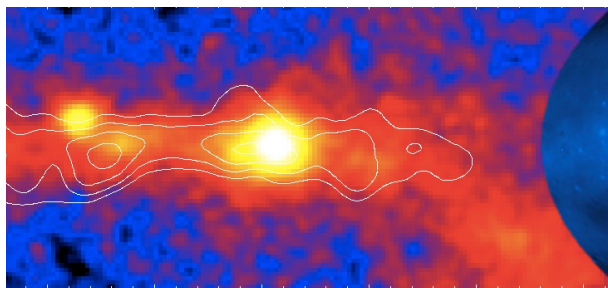
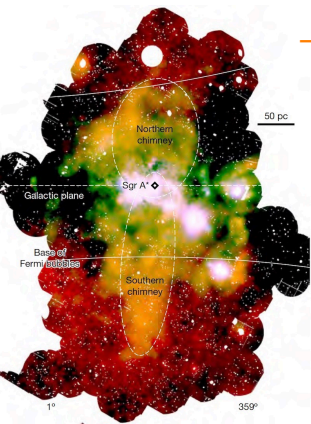
⊙ SWGO+LHAASO

→ Full sky map of TeV-PeV γ emission

⊙ Strongly complements new generation of neutrino instruments

→ Mapping out diffuse emission / separating IC from pion decay emission, Dark Matter search +++

→ Nearby transients/flares



Transients



Credit: NASA

- ⊙ Instantaneous / short-timescale sensitivity of ground-particle detectors is much worse than IACTs! Especially at low E!

Order of magnitude **1 minute sensitivity**: Fermi-LAT: 10^{-7} , SWGO: 10^{-9} , CTA: 10^{-11} erg/cm²/s

Fermi: 1 GeV

CTA/SWGO: few 100 GeV

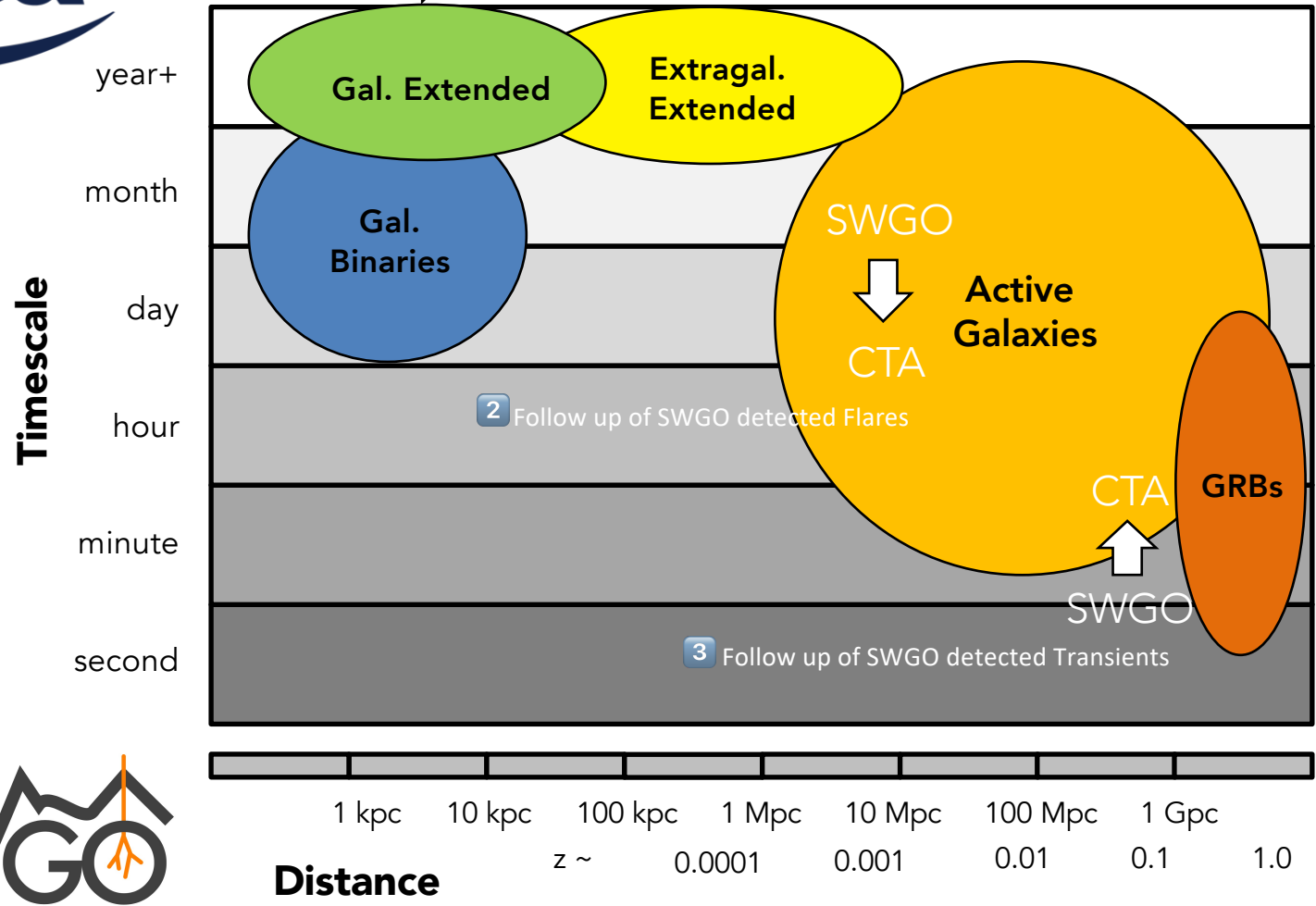
- ⊙ So why are they still interesting for transients?

- **100% duty cycle** → higher rate of high luminosity and/or nearby events (nearby bursts are very important → GWs, EBL systematics, ++)
- **Zero observation delay** - can potentially catch events with fluxes many orders of magnitude higher
- **No need to trigger!**
 - ✓ Blind searches and can check offline for 'slow' alerts
 - e.g. afterglow triggers from optical and radio → look back!
 - e.g. cubesats ++ many new / near future alert sources which can come **hours late**

SWGO can bring the 10s deg² error boxes (GBM, GW) down to ~arcmin size



SWGGO → CTA **1** Follow up of SWGO detected Galactic Sources



¿Te gustaría saber más?

Thanks for listening!

CONTACTO:
swgo_spokespersons@swgo.org

www.swgo.org



Collaboration Meeting 23-27 May 2022



The Southern Wide-field Gamma-ray Observatory