SWGO
The Southern Wide-field Gamma-ray Observatory

SWGO: the Southern Wide-field of view Gamma-ray Observatory

Andrea Chiavassa

Università degli Studi di Torino & INFN

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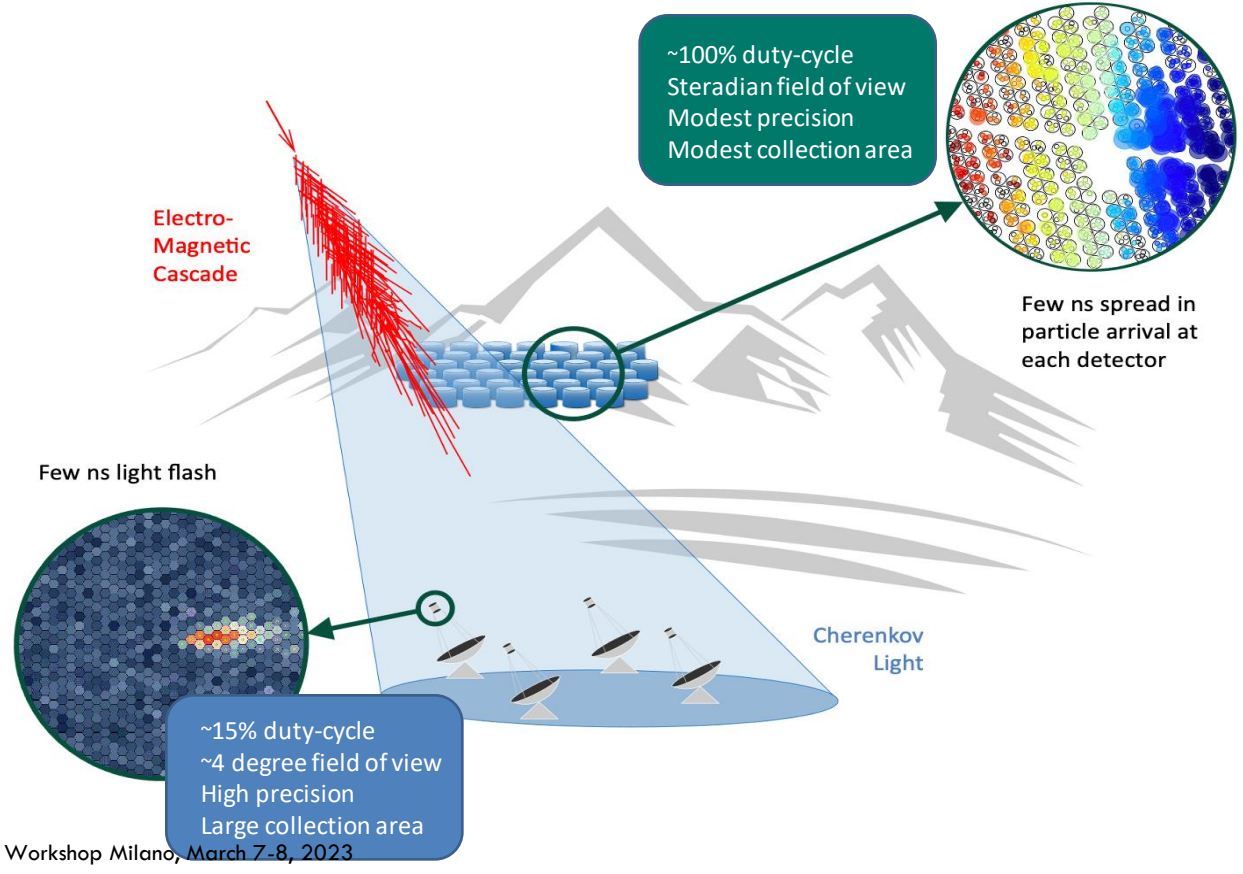
γ-ray observations from the ground



SWGO

- SWGO: The Southern Wide-field Gamma-ray Observatory is a gamma-ray observatory based on ground-level particle detection, with close to 100% duty cycle and order steradian field of view.
- SWGO is currently in the R&D phase.
- Located in South America at a latitude between 10° and 30° south.
- At an altitude of 4.4 km or higher.
- Based primarily on water Cherenkov detector units.
- With a high fill-factor core detector with area considerably larger than HAWC and significantly better sensitivity, and a low-density outer array.

SWGO Science cases

- Detection of short timescale phenomena
  - Low energy threshold for detection of short timescale (<1 hr) transient events down to 100 GeV.
- Search for PeVatrons
  - Improved sensitivity up to ~PeV to search for Galactic particle accelerators.
- PWNe and Gamma-ray Halos
  - Unique potential for accessing the high-energy end of the Galactic Population.
- Dark Matter and Diffuse Emission
  - Unique access to the Galactic Center and Halo at the high-energy end of the spectrum
- Cosmic Rays
  - Complement to LHAASO for anisotropy studies, with the possibility of reaching low angular scale
  - Good muon counting implies good mass resolution for composition studies.

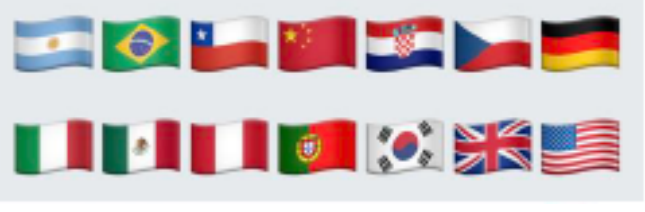
SWGO Scientific requirements

Design Implications

- Decreasing of the low-energy threshold to 100 GeV, at 10^{-11} erg/cm^2 s (5 years)
  - → Combination of improved design and background rejection, plus high-altitude site (>4400 m a.s.l.)
- Large collection area (~km^2) to achieve good sensitivity above 1 TeV (up to few PeV)
  - → Aim to push sensitivity <10^{-13} erg/cm^2 s in the 100-300 TeV energy range
- Muon counting capability
  - → For cosmic rays studies and background rejection
- Improved angular (0.2°) and energy resolutions (<30%) above 10 TeV.

SWGO Collaboration

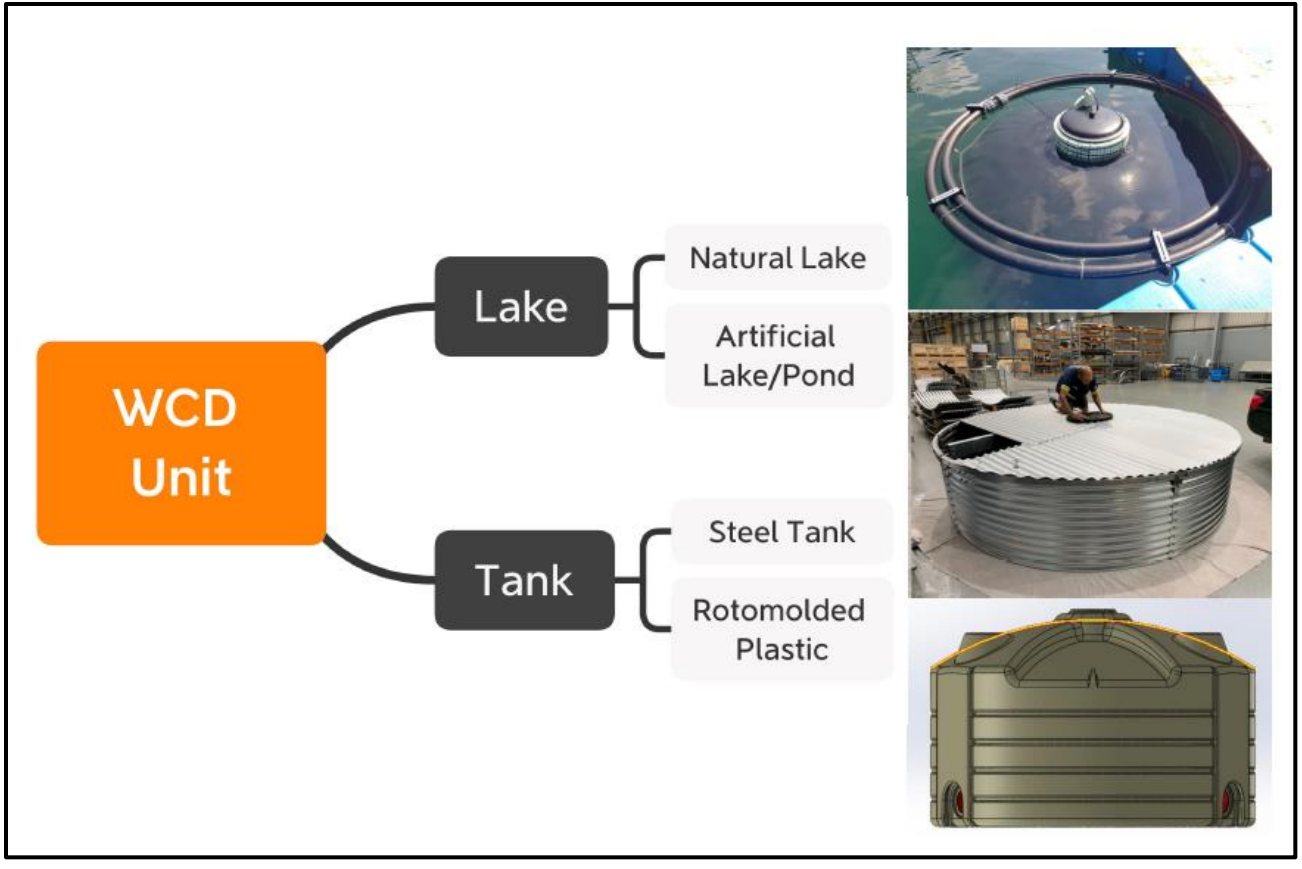
- www.swgo.org
- SWGO partners
  - → 66 institutes in 14 countries
  - → + supporting scientists



SWGO R&D Phase

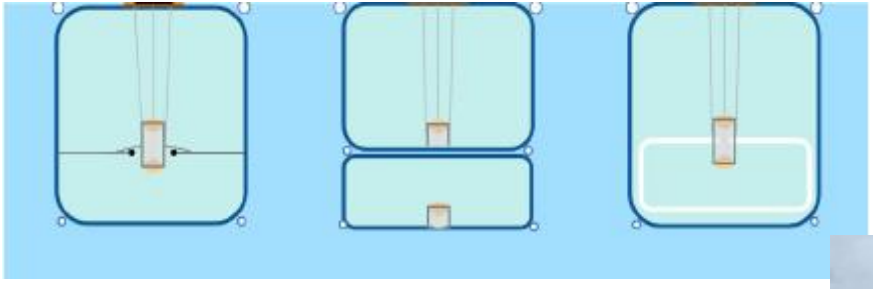
- The primary deliverable of the SWGO R&D phase is a detailed project proposal which will form the basis of funding requests in the partner countries and provide the overall plan for construction and operation

	SWGO R&D Phase Milestones	
✓	**M1**	R&D Phase Plan Established
✓	**M2**	Science Benchmark Cases Chosen
✓	**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

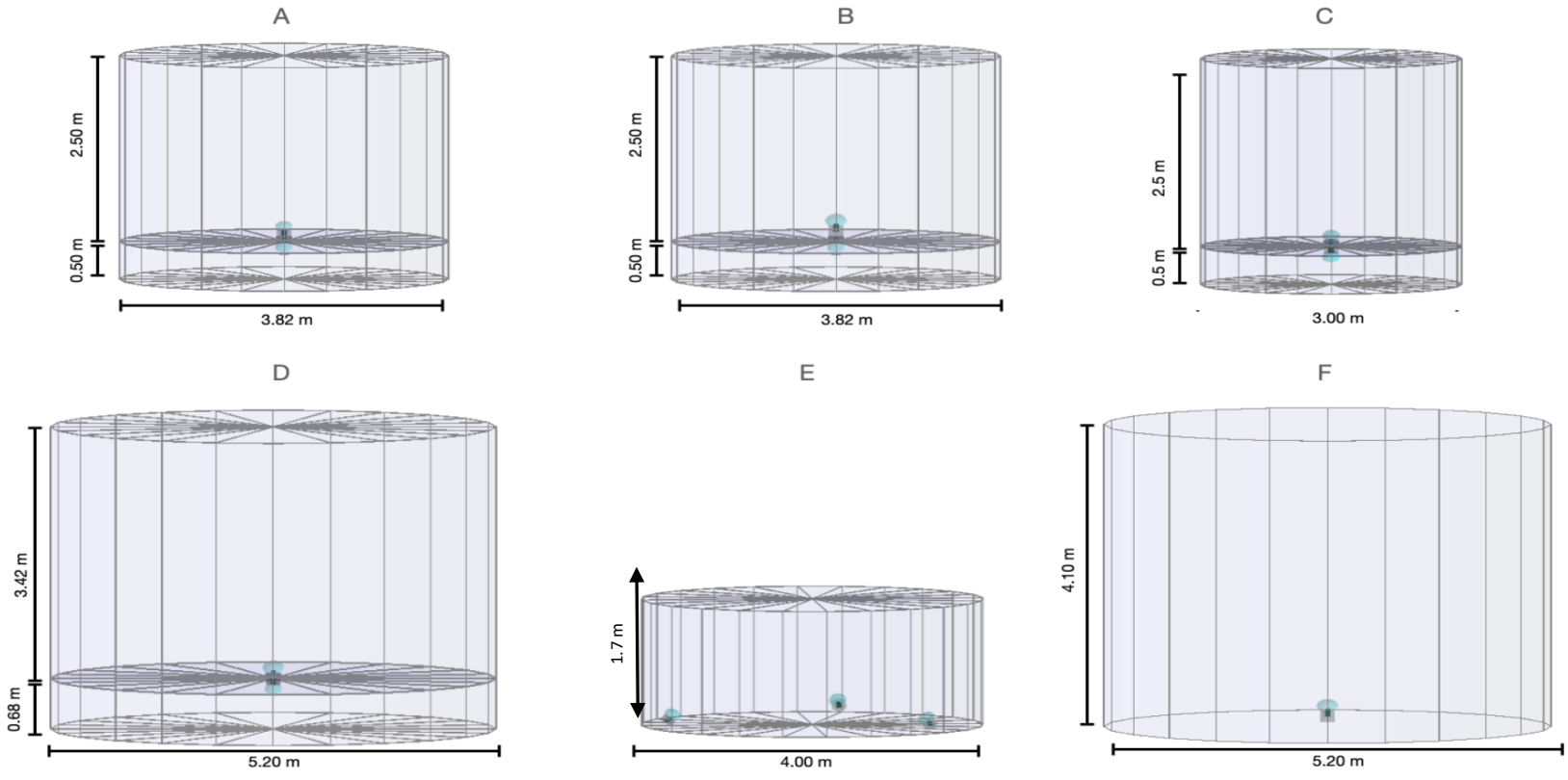

WCD Unit
Lake
Natural Lake
Artificial Lake/Pond
Tank
Steel Tank
Rotomolded Plastic

Prototyping

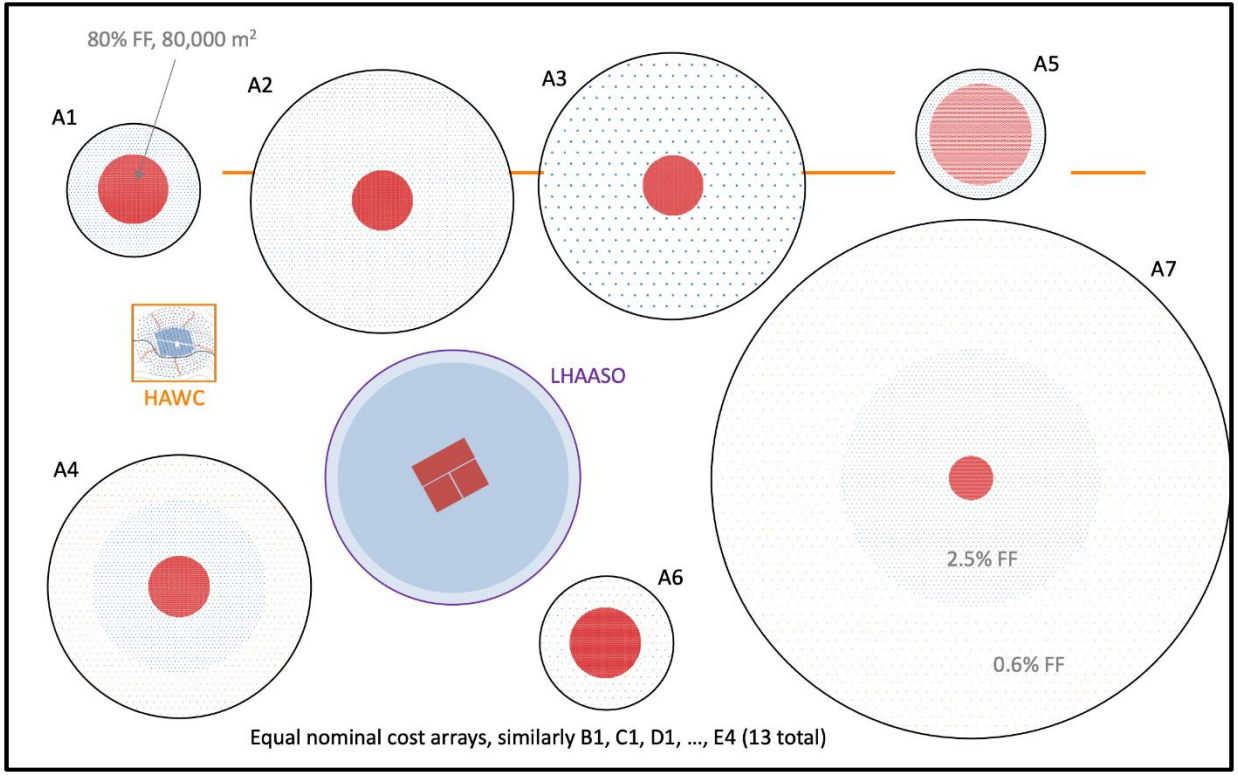
- Detector prototypes are in preparation:
  - → Tank option: Milano, HAWC, Salta, Chile, Perù
  - → Lake option: LHAASO, Heidelberg.



Comparison of the performances of different tank units and layouts

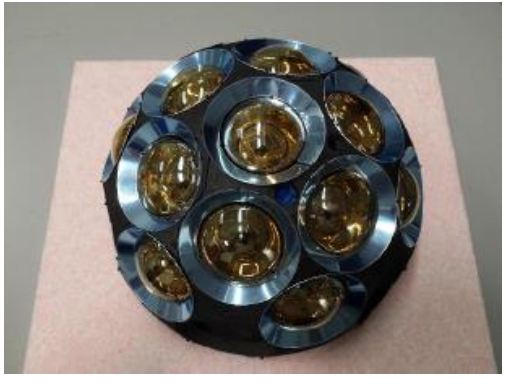


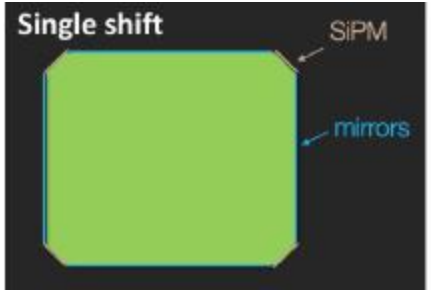
Candidate configurations



Photodetectors

- Baseline is a single PMT located at the centre of both upper (upward facing) and lower (downward facing) layers
- 8" - 10" PMT
- Alternative dome containing 7 3" PMT
  - Low cost
  - Dynamic range
- Wavelength shifters





Site Visit Team

- October 2022 a SWGO team visited the sites proposed by Argentina, Chile and Perù and met the local institutions.
  - Requirements:
    height above 4400 m, availability of a km^2 surface.
  - Access, water availability, power, data transfer, nearby villages.
  - Perù
    - Yanque (tanks), Imata (tanks/pond) and Sabinacocha (lake)
  - Chile
    - Pampa La Bola (tanks), Pajonales (tanks)
  - Argentina
    - Cerro Vecar (tanks) and Alto Tocomar (tanks)

- A report by the team is in preparation
- The final decision is expected by the end of 2023

Perù

Yanque – 4850 m

Imata – 4500 m

Perù

Cochauma – 4800 m

Cochachaca – 4800 m

Sibinacocha – 4850 m

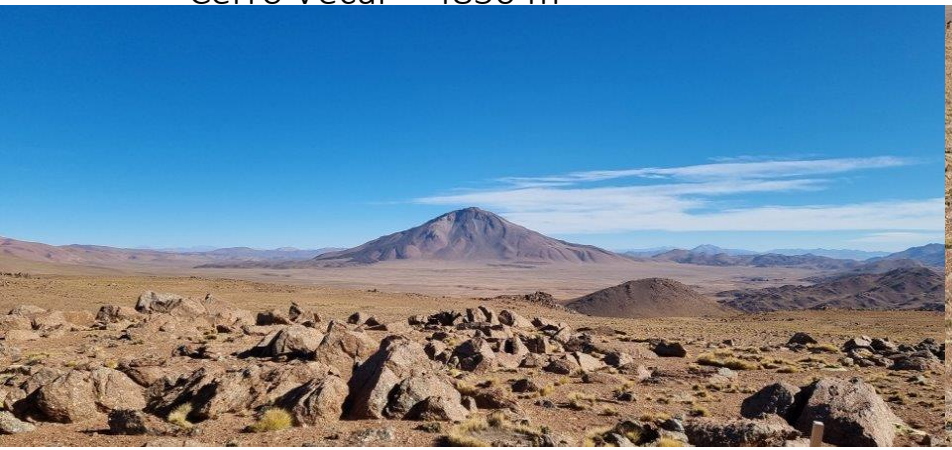
Chile

Pampa la bola – 4850 m

Pajonales – 4600 m

Argentina

Cerro Vecar – 4850 m



Alto Tocomar – 4430 m

Conclusions

- Strong motivation for a wide field of view, high duty cycle observatory in the Southern hemisphere
- Sinergies with CTA-South
- Complementary location for all sky studies with LHAASO and HAWC
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- End of 2023 preferred site identified
- Half 2024 Design Finalised
- 2025-26 → engineering array
- 2027-30 → construction phase