

The search for high-altitude sites in South America for the SWGO experiment.

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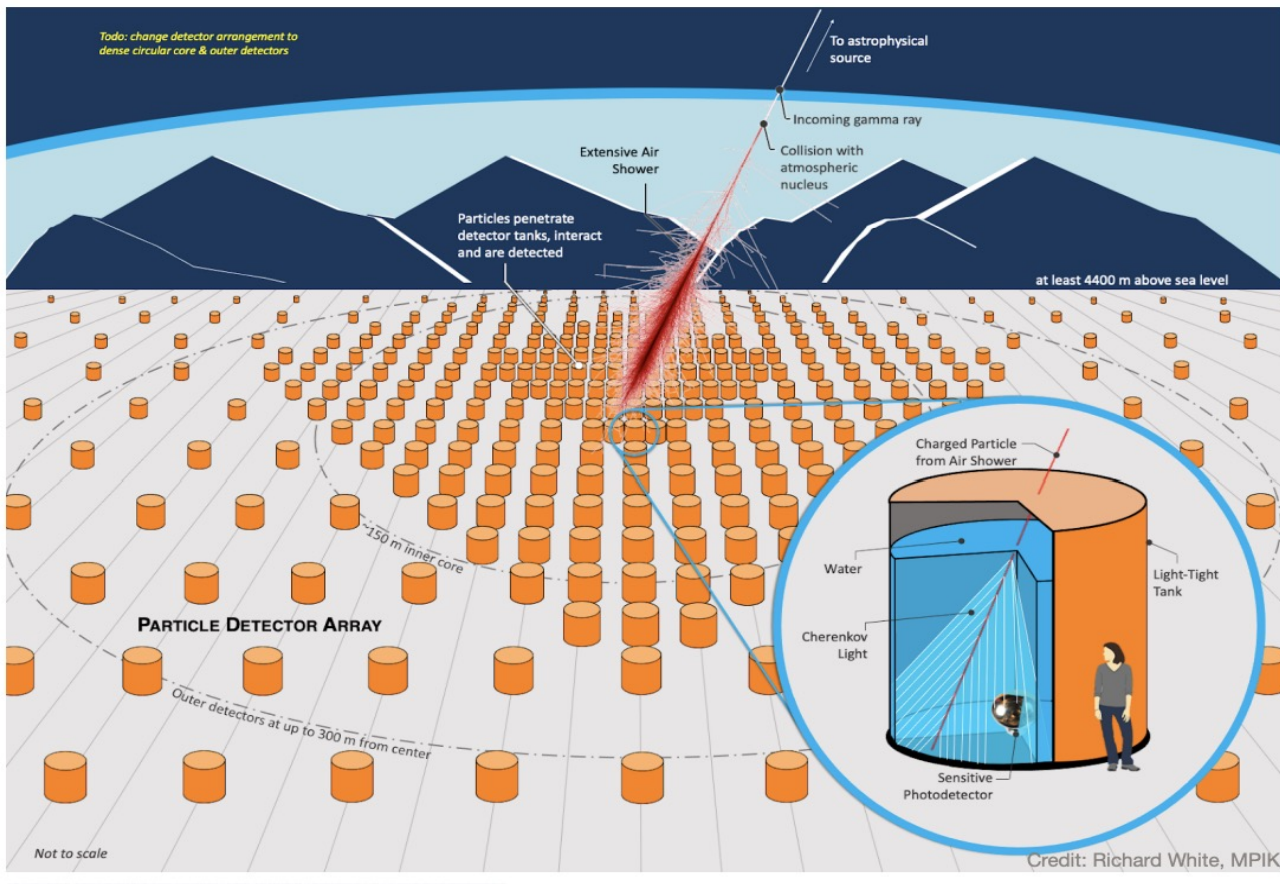
Abstract

The Southern Wide-field Gamma-ray Observatory (SWGO) is a project for a new generation of extensive air shower front detectors, based primarily on the water Cherenkov technique, to be located in the Southern Hemisphere, where no other instrument of that kind is currently operating in the TeV gamma-ray energy range. The reference configuration of SWGO foresees an array of about 6,000 water Cherenkov tanks deployed over a circle of 320 m diameter, about 80,000 m² area. In order to reach a sensitivity at energies around and below 1 TeV competitive with current and future detectors, SWGO will be placed at altitude above 4,400 m a.s.l. Preliminary site searches have found several candidate sites in Argentina, Bolivia, Chile and Peru. The major challenge will be the water provision, considering that at least 10⁵ m³ of water will be required. This poster presents the challenges and status of the SWGO site search in South America.

The SWGO Concept

The SWGO aims to cover **an extended energy range**, from around 100 GeV to the PeV scale. Its **general design concept** consists in a large (circa 80,000 m²) and high fill-factor (~ 80%) core array of water Cherenkov detector (WCD) units, surrounded by an outrigger array of WCDs, arranged in a low fill-factor grid and covering an area of at least 200,000 m². The array is to be deployed above 4.4 km a.s.l. in the Andes.

The **WCD detector units** are optically isolated water volumes instrumented with photo-detectors and able to sample the shower front to provide time and particle energy density information, as well as muon tagging for background rejection.



General requirements

Building an array of several thousand detectors at altitude larger than 4,400 m a.s.l. is a challenging endeavour. Labour at those altitudes is exhausting and special attention shall be paid to logistics: carrying material and water to remote places can require thousands of long trips. The main challenge is related to the water provision: water may be scarce in some sites or precious to the environment or the local communities. The requirement in terms of power and ethernet bandwidth are instead not challenging. The idea is to operate SWGO for at least a decade.

Site Selection

Four South American countries have proposed one or more candidate sites: Argentina, Bolivia, Chile and Peru. A short description of the main site characteristics is reported in Tab. 1. A geographical map is shown in Fig. 1. A more in-depth discussion country by country is given afterwards. Some pictures of the different sites are also shown in Fig. 2.

Argentina

Argentina hosts two candidate sites in the Salta region: the Cerro Vecar site at 4,800 m a.s.l, that is currently hosting also the LLAMA and QUBIC experiments and the Alto Tocomar site, a plateau right below the Cerro Vecar mountain, at 4,430 m a.s.l.

Bolivia

Bolivia offers the site close to the ALPACA installation, in the Chacaltaya region, at 4700 m. The site is 1h far from La Paz (highest capital in the world) and has ample water content. The land is owned by local communities.

Chile

The two proposed Chilean sites, Pajonales and Pampa La Bola, lie within the recently formed Atacama Astronomical Park (AAP), which surrounds the ALMA site and hosts several international telescopes. It is connected by a paved highway to San Pedro de Atacama (tourist town at 45 km distance) and Calama (busy airport and water provision, at 150 km).

Peru

Peru is currently providing three proposed sites: Imata, in the Arequipa region, candidate site for a tank-based or pond-based detector; Yanque, a similar solution but at higher altitudes, and the small lakes Cochachaca and Cocha Uma near the lake Sibinacocha in the Cuzco region, the sole candidate for a lake-option detector. The owners of the lands in Peru are the districts.

Tables and Figures

Country	Site Name	Latitude	Altitude [m a.s.l.]	Other installations
Argentina	Alto Tocomar	24.19 S	4,430	
	Cerro Vecar	24.19 S	4,800	LLAMA, QUBIC
Bolivia	Chacaltaya	16.23 S	4,740	ALPACA
Chile	Pajonales	22.57 S	4,600	ALMA and others
	Pampa La Bola	22.56 S	4,770	ALMA and others
Peru	Imata	15,50 S	4,450	
	Yanque	15.44 S	4,800	
	Sibinacocha	13.51 S	4,900	

Table 1: Locations of SWGO candidates sites in South America



Figure 1: Geographical map of SWGO candidate sites (obtained with Google Earth).



Figure 2: Pictures of some of the candidate sites. From top to bottom and left to right: Pajonales and Pampa La Bola (Chile), Cerro Vecar and Alto Tocomar (Argentina), Sibinacocha (Peru)

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