The Inner Baseline Array Design of the Southern Wide-field Gamma-ray Observatory

Hazal Goksu on behalf of the SWGO Collaboration
Max Planck Institute for Nuclear Physics
hazal.goksu@mpi-hd.mpg.de

The Southern Wide-field Gamma-ray Observatory (SWGO) is a planned next-generation ground-based water Cherenkov detector array designed for high-energy gamma-ray astronomy. It will consist of a dense, tightly packed inner array surrounded by a sparse outer array. The baseline design for the inner array consists of optically isolated steel tank units, each housing a light-tight bladder and photosensors. This modular, scalable system allows for optimization and expansion based on scientific needs.

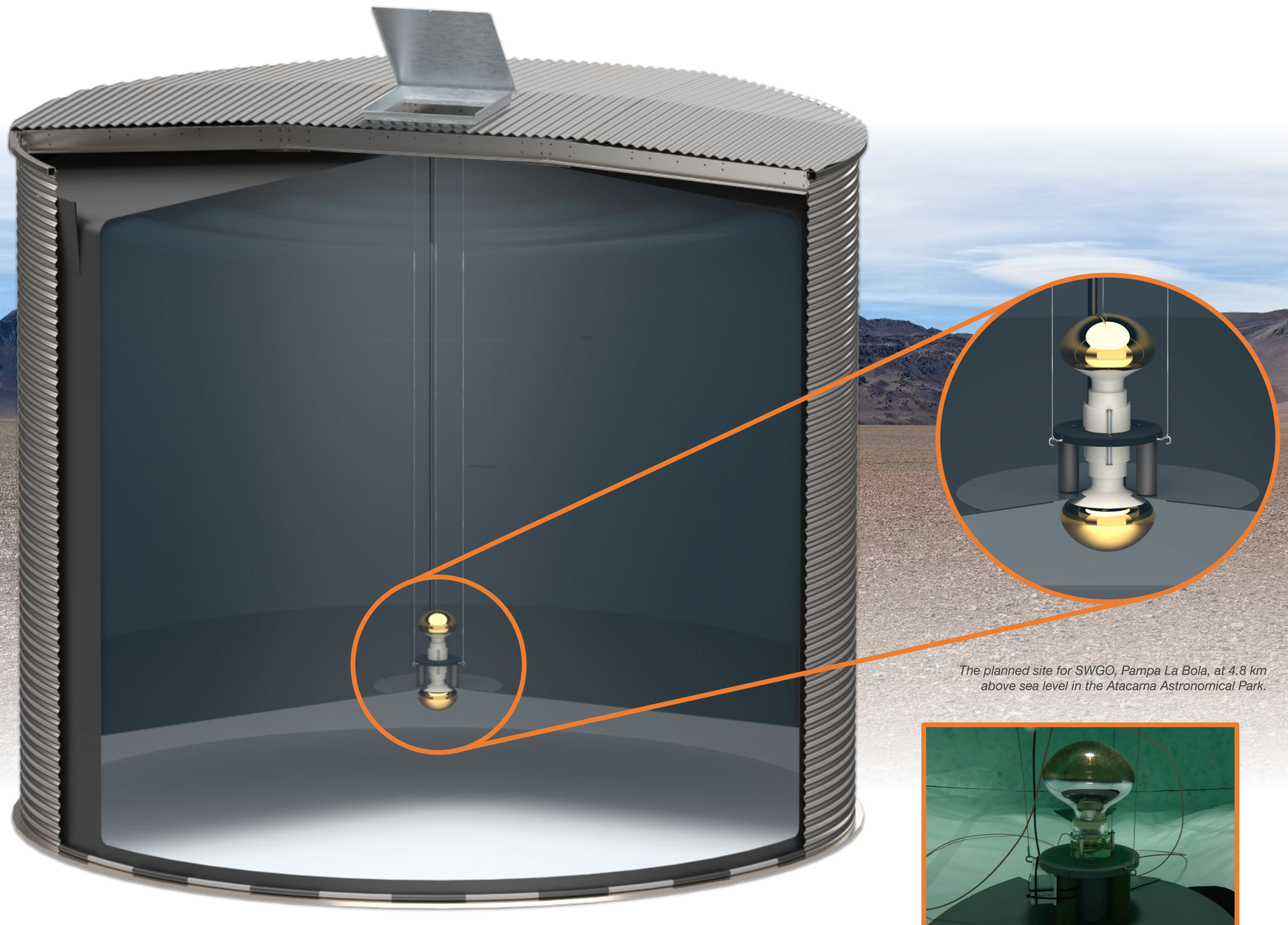
Steel Tanks

The baseline water Cherenkov detector (WCD) unit will be a cylindrical steel tank with a radius of 5.2 m and a height of 4.1 m, to be assembled on site. The WCD tank will contain two optically separated chambers, housing a double-PMT unit.

The prototype tank assembled at the HAWC site, together with some U.S. members of the SWGO Collaboration

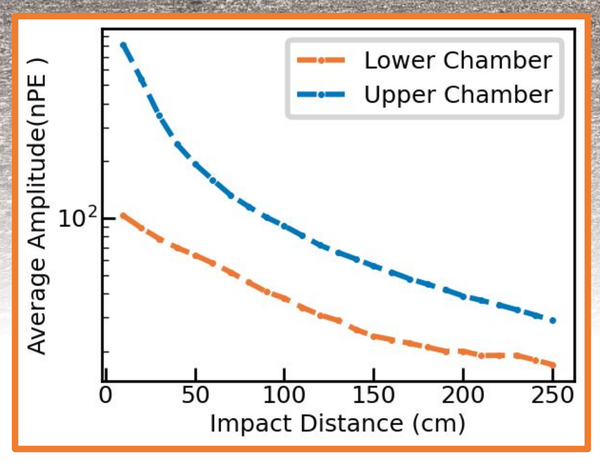
Double-layered bladders

The steel tank houses a 4 m high custom LDPE bladder, with a membrane optically separating a lower chamber of 80 cm in height from the upper chamber. There are two large-area photomultiplier tubes (PMT) in the bladder, one for each chamber. The lower chamber enables background rejection via muon identification, and is lined with reflective Tyvek material.



Expected Tank Response

Vertical 1-2 GeV Muons



The planned site for SWGO, Pampa La Bola, at 4.8 km above sea level in the Atacama Astronomical Park.

Prototype Unit Development

Several prototype detector units are being assembled on various sites. A tank is already assembled on the HAWC site, and another is being assembled in Heidelberg, Germany. Other sites of prototyping include Rio de Janeiro, Brazil and Temple, USA. We evaluate factors such as the the assembly of the units, electronics, single detector unit performance and PMT deployment.

PMT Mechanics & DAQ

The double-PMT unit features a 10-inch downward-facing PMT and a 10-inch upward-facing PMT, connected by PVC plates. Support cables secure the unit to a hatch at the top of the bladder. Signals are sent to field nodes, each serving 55 WCDs, equipped with heating, cooling, insulation, and a programmable logic controller. Signal digitization uses *FlashCam* electronics, following a first-level trigger.

Link to Proceedings

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