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A prototype tank for the SWGO detector

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Context. The Southern Wide-field Gamma-ray Observatory (SWGO) is an international collaboration working on realizing a next-generation observatory located in the Southern hemisphere, which offers a privileged view of our galactic center.
Aims. Istituto Nazionale di Fisica Nucleare (INFN) is working on the construction of a prototype water Cherenkov detector at Politecnico di Milano using a flexible testing facility for several candidate light sensors and configurations.
Methods. An analytical study of extensive air showers and muons has been carried out using the HAWC observatory simulation software known as HAWCSim to examine the correlation between the detection capabilities of the prototype tank and its water level. Consequently, a level appropriate for the tests and an installation site that could handle the pressure has been determined. A structure able to hold different types of detectors in multiple configurations has been designed. A CAD model in SolidWorks has been realized for load simulations. Finally, the structure was built and tested in Politecnico's labs.
Results. The simulations showed a linear increase in detection efficiency with the water level, as well as an increase in the number of photoelectrons (PE) detected and a reduction of the dispersion of the detection time of the first photon. The photomultipliers' holder has been designed in two versions: a large hexagonal one capable of handling many sensor configurations and a small cross-shaped one, more simple and economical, for starting the tests with the reference configuration. The second structure has been built and tested; its pieces will be recycled for the larger one afterward. The first tests will start as soon as the tank construction is completed.

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