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Status and performance of mass-produced IceCube Upgrade mDOMs

IceCube Upgrade, which will be completed in the beginning of 2026, will enhance the sensitivity of the current IceCube in the GeV range and improve understanding of the ice properties. Around 700 new modules will be deployed deep in the ice along seven strings within a horizontal circle of roughly 100 m in diameter, and most of the modules are spaced 3 m vertically. IceCube Upgrade consists primarily of two types of Cherenkov photon detectors, approximately 280 Dual optical sensors in an Ellipsoid Glass for Gen2 (D-Eggs) and 400 multi-PMT Digital Optical Modules (mDOMs).

Here, we present the status of production and acceptance testing for mass-produced mDOMs. As of February 2025, the majority of mDOMs have already been produced and tested. After the production, in-module devices, including PMTs, are tested for every module, both in a climate chamber for various temperatures and in a lab for precise measurements using a laser. Each mDOM contains 24 PMTs nearly isotropically distributed to achieve uniform photon sensitivity, making the integration and testing complicated. To reduce the testing time, we have developed parallelized and automated software. As a milestone, all the 128 modules on the first two strings have already been shipped to the South Pole after the testing.

Collaboration(s)

IceCube

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