

Design and performance of the multi-PMT optical module for IceCube Upgrade

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The IceCube Upgrade is the first step towards the next-generation neutrino observatory at the South Pole, IceCube-Gen2, and will be installed in the central region of the existing array. The Upgrade will consist of 693 newly developed, densely spaced optical sensors and 50 standalone calibration devices, which will enhance IceCube's capabilities both at low and high neutrino energies. 402 of the new sensors will be multi-PMT Digital Optical Modules (mDOMs). Consisting of 24 small photomultipliers arranged inside a pressure vessel, the mDOM features a large sensitive area distributed nearly homogeneously over the full solid angle. The use of multiple, individually read-out PMTs allows directional information to be obtained for the registered photons and enables the use of multiplicity triggering within a single module, e.g., for background suppression. The challenges driving the mDOM development included tight restrictions on module size, data-transfer rate, and power consumption as well as the harsh environment in the deep ice at the South Pole. In this contribution we present the final mDOM design that meets these challenges.

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