

The KM3NeT Multi-PMT DOM and Detection Unit

The KM3NeT Collaboration is constructing new-generation neutrino detectors in the Mediterranean Sea. The main goals are the study of the high-energy neutrino flux (KM3NeT/ARCA, off-shore Capo-Passero, Italy) and the determination of the neutrino mass ordering (KM3NeT/ORCA, off-shore Toulon, France). The basic detection element, the Digital Optical Module (DOM), houses 31 three-inch PMTs inside a 17 inch glass sphere. The aim is to measure photons emitted by products of neutrino interactions in the sea-water with nanosecond precision. The multi-PMT concept yields a factor three increase in photocathode area, compared to a design with a single 10 inch PMT, leading to a significant cost reduction. Moreover, this concept allows for an accurate measurement of the light intensity (photon counting) and offers directional information with an almost isotropic field of view. We will discuss these aspects and the enabling technologies, which include 3D-printed support structures, and custom low-powered PMT bases, which provide the HV and digitization of the analog signal. An FPGA based readout system transfers all sub-ns timestamped photon signals to shore via optical fibers. Additionally, the required mechanical and optical/electrical system on which 18 DOMs each are deployed as vertical strings, called detection units, will be discussed.

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