Development of a test bench for the characterization of the Laser Beacon of KM3NeT/ORCA

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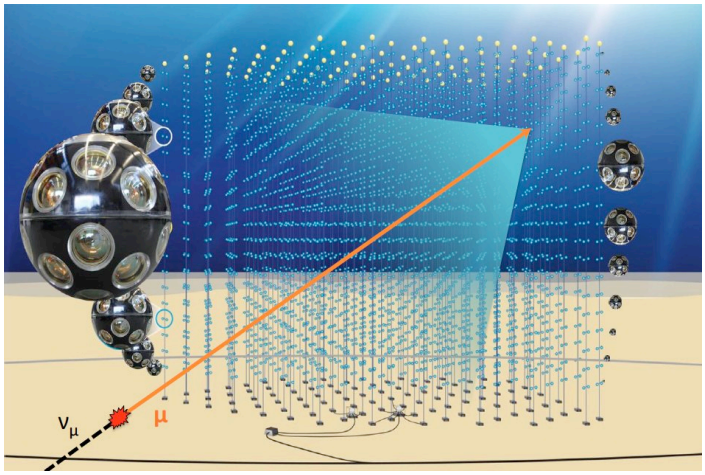
Master Internship project proposed by the KM3NeT group at Laboratoire Astroparticules et Cosmologie (APC)



ORCA (Oscillation Research with Cosmics in the Abyss) is the low-energy branch of KM3NeT, the next-generation neutrino Cherenkov detector currently being built in the Mediterranean Sea with the aim of measuring the neutrino mass ordering and searching for high-energy cosmic neutrino sources [1]. The ORCA detector will consist of a dense configuration of 115 vertical strings with an horizontal spacing of 20m, anchored on the seabed off the shore of Toulon, France (see figure right). Each string supports 18 digital optical modules (DOMs) with a vertical spacing of 9m. With this configuration, ORCA will focus on the study of atmospheric neutrino oscillations in the energy range 1-100 GeV, with 5.7 Mton of instrumented seawater. The electro-optical cable and main junction box for the ORCA detector are already installed on the seabed and the first detection lines are expected to be deployed in the upcoming months.

The KM3NeT group at APC is in charge of the design, construction and qualification of the first Calibration Unit (CU), to be deployed on the ORCA site. The CU will host specific instruments dedicated to the calibration of the neutrino telescope and to the monitoring of environmental conditions (water temperature, pressure and salinity, sea current velocity,…). Among those instruments, a new Laser Beacon and its container have been designed, to be used both for time calibration of ORCA DOMs and for measurements of the water optical properties (see fig. right, bottom). A battery will supply the necessary power to flash the Laser, and the powering and triggering of the Laser will be controlled by a custom Laser Power Management Interface (LPMI) card. The optical flange of the container incorporates an opal light diffuser sealed to a glass rod whose dimensions are being evaluated in order to match the requirements of both ORCA and ARCA (the high-energy branch of KM3NeT.

We propose a **M2 internship to perform a complete characterization of the Laser Beacon that will be integrated on the first KM3NeT CU**. This task includes the adaptation of an existing test bench at APC, a black box equipped with a motorized scanning device previously used for the characterization of optical modules for deep-sea experiments (ANTARES and KM3NeT). It will require a redesign of the LabView interface that monitors the scanning system, in order to perform measurements of the laser emission at different distances and angles. The characterization will also include electronic tests (LPMI card, laser control and triggering) and qualification of the full Laser Beacon container. The intern will collaborate on this project with the members of the KM3NeT group at APC (4 permanent physicists, and 4 engineers with expertise in project management, electronics, mechanics and quality control). It is expected that he/she will contribute to the redaction of technical documents related to his work (in English), and that he/she will present his work during the regular (phone) meetings of the KM3NeT Calibration group (~ 25 engineers and physicists from 5 European countries).

[1] S. Adrián-Martínez et al. [KM3NeT Coll.], *Letter of Intent for KM3NeT Phase 2.0,* J.Phys. G43 (2016) no.8, 084001