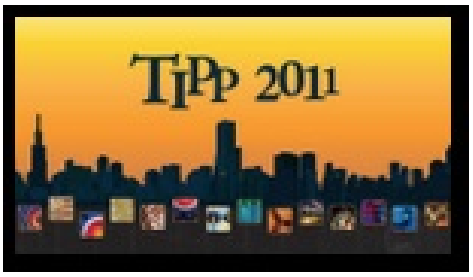

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The time Calibration system for KM3NeT Neutrino Telescope

KM3NeT is a future deep-sea Research Infrastructure hosting a cubic kilometre-scale neutrino telescope and facilities for marine and earth sciences in the Mediterranean Sea. The consortium is made up of 40 institutes from 10 European countries, and includes all the groups that have developed the pilot projects, ANTARES, NEMO and NESTOR.
The KM3NeT telescope will consist of a three-dimensional array of optical modules arranged on vertical "detection units (DUs)", anchored to the sea floor and held in tension by submerged buoys.
The time resolution of this detector has to be known with great accuracy since the angular resolution of the track reconstruction depends on the accurate measurement of the relative arrival times of Cherenkov photons reaching the photon sensors. The intrinsic, unavoidable limitation in time resolution (chromatic dispersion and PMT transit time spread) imply that the calibration system of a water-based neutrino telescope must provide a precision at the nanosecond level
The experience with the ANTARES deep sea neutrino telescope has shown that a distributed system of external light sources illuminating the photon detectors with short (˜ 5ns FWHM) time-referenced light flashes is very useful to ensure the time calibration of the detector and to measure water optical properties.
Whilst the basic timing calibration concept applied in ANTARES will be retained, the larger spacing between photo-detectors required in a cubic-kilometre-scale detector results in modified requirements for the KM3NeT system.
A three-dimensional system of optical emitters has been studied: several LED models have been tested, and four models preselected as suitable for use in KM3NeT were incorporated into ANTARES for in-situ testing. Based on the resulting data, several LED beacons will be integrated in the forthcoming deployment of a pre-production KM3NeT detection unit planned for autumn 2011.

The design, optimization and construction of the KM3NeT optical time calibration devices are described.

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Author: Dr EMANUELE, Umberto (IFIC)

Presenter: Dr EMANUELE, Umberto (IFIC)

Track Classification: Detectors for neutrino physics