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Calibration of the ICARUS cryogenic photo-detection system at FNAL

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The ICARUS T600 LAr TPC is located at shallow depth on the Booster Neutrino Beam at Fermilab. To reduce the cosmic rays background, in addition to a full coverage cosmic ray tagger, a system based on 360 large area Hamamatsu R5912-MOD PMTs is used, to detect scintillation light at 128 nm from ionizing particles. An important asset for this system is the calibration in gain and time of each PMT. This calibration is based on a custom laser diode system, where laser pulses at 405 nm are delivered to each PMT. Laser pulses arrive to a 1x36 optical switch and then to a UHV flange, by a 20 meters long optical patches. Light is then delivered to the ten PMTs connected to a single flange, by 7m long injection optical patches. Extensive tests of the used components and care in the design of the optical system have guaranteed a sizeable signal with minimal distortions to each PMT, as respect to the original one,even in a situation where available power is low. Gain equalization has reached a 1% resolution, starting from an initial 15% from gain measurements at room temperature. In this procedure data from background photons are used.
Timing calibration, to take into account the different delay in time of the different electronic channels, due to temperature excursions, ... is still in progress. The status of the construction of the laser system and its possible upgrades, as well as performances of the calibration procedure will be reported.

Collaboration

on behalf of the ICARUS collaboration

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