

Gain stability of Hamamatsu R5912-MOD photo-multipliers at low temperature

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The Photon Detection System is a crucial component of the ICARUS detector in the Short Baseline Neutrino (SBN) Program at Fermi National Accelerator Laboratory (FNAL). It consists of 360 Photo Multiplier Tubes (PMTs) 8"Hamamatsu 5912-MOD and, since June 2020, it has been operated at the liquid Argon cryogenic temperature. During these years, the PMTs have shown gain losses as an aging effect. Using a climatic chamber at the INFN Sezione di Catania, we confirmed a stable gain for a single PMT 8"Hamamatsu 5912-MOD when operated at room temperature, and a persistent gain loss at temperatures around -70°C , although far from the liquid Argon one. No gain recovery was obtained bringing the PMT back to room temperature. We suspect that dynode deterioration due to temperature gradient plays a significant role in this phenomenon. During our test, the PMT was illuminated by a 520 nm laser source and operated in current mode. The laser beam was split into two optical fibers, the first one transmitting light through Neutral Density filters and then diffusing it over the surface of the PMT photocathode. The other optical fiber was used for an independent reference measurement of the injected light via a bolometric photodetector. In this presentation, the main technical characteristics of the measurement system are shown together with preliminary results which need further investigation to elucidate the underlying mechanisms driving the gain loss and to propose new mitigation strategies.

Collaboration

ICARUS Collaboration

Role of Submitter

I am the presenter

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