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A cryogenic system for measuring in the VUV range the absolute quantum efficiency of light detectors with large sensitive area.

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Most of experiments for neutrino physics and rare event search exploit the scintillation light coming from liquefied noble gases. Light is usually emitted in the VUV range and is detected by large sensitive area detectors, typically photomultiplier tubes (PMT), directly immersed in the liquid and so operating at cryogenic temperature. Considering the great difficulties in producing large window other than glass, the VUV scintillation photons are first shifted to visible light by a wavelength-shifter deposited on the glass windows of the light detectors.

The measurement of the overall quantum efficiency (q.e. - wavelength shifter and photocathode) in VUV range at room temperature has already carried out, but this measurement at liquefied gases temperature is rather difficult and requires dedicated instrumentation and tests.

A system for this kind of measurement has been developed in our laboratory. This is made with a stainless steel vacuum chamber designed to house the PMT under test. The chamber is placed in a dewar filled with liquid nitrogen or liquid argon which brings the PMT to cryogenic temperature from the outside. The device temperature is continuously monitored by means of PT1000 sensors. VUV light from a deuterium lamp, directly connected to the vacuum chamber, is selected by a monochromator or by a narrow VUV filter and is used as a monochromatic light source to illuminate the PMT.
The system allows the measurement of either the variation of the photocathode behavior between room and cryogenic temperatures, as well as the absolute q.e. comparing the photocatode current with a NIST calibrated phododiode placed inside the chamber but kept at room temperature.

In this presentation, the main technical characteristics and performances of the system are shown together with results coming from preliminary tests on the 8” Hamamatsu R5912-MOD PMT.

Collaboration

Role of Submitter

I am the presenter

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