

Development of 50 cm Photo-Detectors for Hyper-Kamiokande

Friday, July 6, 2018 2:00 PM (12 minutes)

Hyper-Kamiokande is a large water Cherenkov detector planned in Japan. It requires a large aperture photo-detector with a high photon detection efficiency to explore various neutrino physics and discover a nucleon decay. A photomultiplier tube (PMT), R12860 by Hamamatsu Photonics K.K., was developed with a box-and-line dynode to achieve high resolutions of charge and timing, compared with an R3600 PMT for Super-Kamiokande. Compared with the R3600 PMT, a single photon detection efficiency of the new R12860 PMT is doubled due to the high collection efficiency of 95% and a higher quantum efficiency of 30% at 390 nm wavelength. Recently the output dynamic range was improved and a dark count rate is being reduced. We evaluated an individual difference of the performance measuring 140 PMTs. Using an avalanche diode with a single structure inside of the bulb, we developed a 50 cm hybrid photo-detector (HPD), R12850 by Hamamatsu. The timing resolution was improved to be 3.6 ns (FWHM) by developing a preamplifier with a fast time response. A waterproofed HPD was prepared and installed into a 200-ton water Cherenkov detector at Kamioka, Japan. Several designs of a shockwave prevention cover by an implosion of the PMT in deep water were developed and tested. It enables a light weight or low cost. The recent development and improved performance of the 50 cm photo-detectors will be presented.

Primary author: NISHIMURA, Yasuhiro (The University of Tokyo)

Presenter: NISHIMURA, Yasuhiro (The University of Tokyo)

Session Classification: Detector: R&D for Present and Future Facilities

Track Classification: Detector: R&D for Present and Future Facilities