

Temperature dependence measurement of a hybrid photo-detector for Hyper-Kamiokande

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Hyper-Kamiokande is a proposed next generation underground water Cherenkov detector capable of observing leptonic CP violation, nucleon decay, supernova neutrino and so on. Because of its large volume, 20(25) times larger than that of Super-Kamiokande for total (fiducial) mass, the total cost of photo-detectors will be expensive. Therefore cost-effective and high performance large-area photo-detectors are required to realize such a large detector.

As one of photo-detector candidates, a hybrid photo-detector (HPD) [Fig.1], which is made of a phototube and an avalanche diode (AD), is under development. Because of its simple structure, the manufacture cost is expected to be low. And a fast drift time of electron and large bombardment gain bring a good timing resolution and high photoelectron detection efficiency.

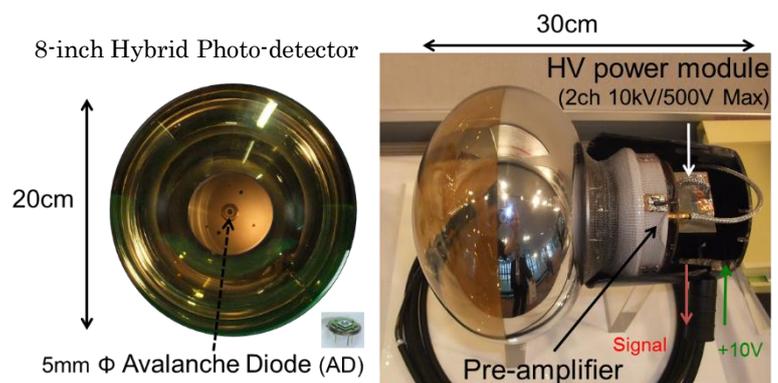


Fig. 1 The picture of Hybrid Photo-Detector

Performance of the HPD, including gain and noise, depends on its temperature. Especially, the AD in the HPD has strong temperature dependence, and it operates under vacuum environment in the HPD. Therefore, a change in the temperature of the AD is slower than that of the HPD. Because we cannot measure the temperature of the AD in the HPD directly, understanding the temperature dependence of the AD separately would help understanding the

temperature dependence of the HPD, which is our goal.

In this presentation, we will report the temperature dependence of the AD's and the HPD's performance, including gain and noise, then estimate the performance of the AD and the HPD in the actual operation environment of Hyper-Kamiokande.