

## New Large Aperture Photodetectors for a Water Cherenkov Detector

Three types of 50 cm-diameter photo-detectors were newly developed for a future large water Cherenkov detector, Hyper-Kamiokande. These detection performance was largely improved by adopting different amplification systems from a conventional 50-cm photomultiplier tube (PMT) in Super-Kamiokande.

A new PMT with a box-and-line dynode was completed by optimizing the surface curvature, alignment inside and circuit to maximize the performance with a detailed evaluation of the response, as R12860 by Hamamatsu Photonics K.K. (Hamamatsu). Compared with the conventional 50 cm PMT, it achieved a double detection efficiency and half resolutions for both timing and charge with a high pressure tolerance up to 1.25 MPa.

Another type is a 50 cm hybrid photo-detector using an avalanche diode (Hamamatsu, R12850). High eight kilovolts are applied, therefore a built-in power supply and cable with a water tight connector were developed accordingly. The preamplifier for the large junction capacitance was also developed. It showed the highest resolutions in the 50-cm photodetectors.

In addition, a 50-cm micro-channel plate PMT was developed for Hyper-Kamiokande as GDB-6203 by North Night Vision Technology Co., LTD in China based on a PMT for the Juno experiment. The timing resolution was improved for a use in water Cherenkov detectors.

A lot of progress to realize three photodetectors is reported including various studies such as a cover for the photodetector, the dark count rate, tests in water.

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**Session Classification:** Poster Session A

**Track Classification:** Cherenkov Detectors