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Development of new 50-cm diameter photodetectors for Hyper-Kamiokande

Hyper-Kamiokande is a proposed future neutrino experiment with physics goals such as the discovery of leptonic CP violation, nucleon decay, supernova neutrino, and so on, using a 1 Mton water Cherenkov detector. Considering the cost fraction of photodetectors in Hyper-Kamiokande detector, more cost-effective and higher performance large-area (50-cm diameter in the current plan) photodetectors than those of Super-Kamiokande are desired.

Two types of photodetectors, Box-and-Line photomultiplier tube (PMT) and Hybrid photodetector (HPD), have been developed to improve the physics sensitivity of Hyper-Kamiokande.

These photosensors have also been considered to use the photocathode with higher quantum efficiency than those of Super-Kamiokande.

The Box-and-Line PMT uses a different dynode type from that of Super-Kamiokande. It has a better photon collection efficiency and faster time response than Super-Kamiokande PMT.

On the other hand, the HPD consists of a phototube and an avalanche diode.

The manufacturing cost of the HPD is expected to be low because of its simple inner structure. Furthermore, its fast drift time of electron and large bombardment gain bring a good timing resolution and photoelectron detection ability.

Some prototypes of those 50-cm diameter Box-and-Line PMT and HPD have been newly developed and the evaluations of these prototypes have been started from 2014. In this conference, I will describe the first evaluation of timing resolution, single photoelectron, charge resolution, and the other performance of them.

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