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Detailed performance evaluation of a new 20-inch photomultiplier tube with a Box and Line dynode

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Content

Hyper-Kamiokande is a proposed future neutrino experiment with various physics goals such as the discovery of leptonic CP violation, nucleon decay, supernova neutrino, and so on, using a 1 Mton water Cherenkov detector. Because of the large volume, About 99000 of 20 inch photosensors are planed to set in the detector. (About 9 times as many as 20 inch photosensor in Super-Kamiokande) Considering a cost of photodetectors in Hyper-Kamiokande detector, more cost-effective and higher performance large-area photodetectors are desired.

A 20-inch diameter Box and Line PMT is a candidate photodetector for Hyper-Kamiokande, which has different type dynodes from PMTs in Super-Kamiokande (Hamamatsu R3600). Owing to an improvement on dynodes shape, a collection efficiency of photoelectrons becomes better than the R3600 PMT. In addition, a good timing resolution is obtained by a little variation of electrons' path during its multiplication. The first type of Box and Line PMT was developed in 2014 and the basic performances evaluation is ongoing to decide the photosensor for Hyper-Kamiokande.

In this presentation, I will describe the current evaluation status of the basic performance like 1 photoelectron charge distribution, timing resolution, gain, dark rate, and status of more detailed performance like after pulse rate measurement.

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