Contribution ID: **307** Type: **Poster**

Viability Test of 20-cm Hybrid Photodetector in a Water Cherenkov Detector

New photodetectors utilizing semiconductor electronics or improved detection efficiency are expected to increase physics sensitivity in future neutrino experiments. In order to assess the usability of the new photodetectors in a water Cherenkov detector, we started a viability test with a hybrid photodetector (HPD). The HPD has a 20-cm diameter, and is
equipped with an avalanche diode. In addition to the HPD, we are testing a high quantum efficiency (HQE) 50-cm photomultiplier tube (PMT), model R3600, manufactured for Super-Kamiokande by Hamamatsu Photonics K.K.

From the summer in 2013, the primary test started with eight 20-cm HPDs and five HQE 50-cm PMTs, installed in a 200-ton water tank in the Kamioka mine, Japan. These were compared with the standard PMTs used in Super-Kamiokande. The performance, stability and usability of the new photodectors are being tested in a long term operation of a few years. Our goal is to establish a technique to operate the photodetectors safely over ten years without failure. The measurements and test status after half a year are presented.

Based on these initial test results, a 50-cm diameter HQE HPD is also under development and will be tested soon in the same water tank. These evaluations will be completed by 2016 ready for future neutrino experiments.

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Track Classification: Atmospheric Neutrinos