The Activities of the Korean Group for Hyper-Kamiokande

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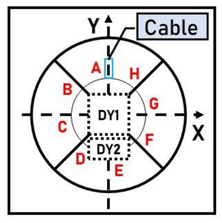
on behalf of Korean HK group

INTRODUCTION

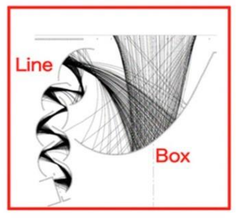
Hyper-Kamiokande (HK) is a next-generation water cherenkov detector. The effective volume of the detector will be approximately five times that of Super-Kamiokande. The physics goals of HK include measurements of the leptonic CP phase, searches for proton decay, and observations of atmospheric neutrinos as well as neutrinos from solar and supernova explosions.

PRE-CALIBRATION OF ID SENSOR

[R12860-22]

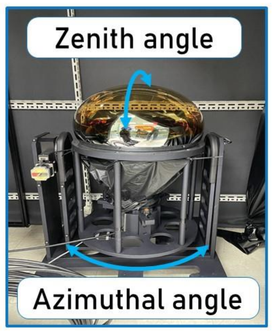


[Dynode & Cable Configuration]

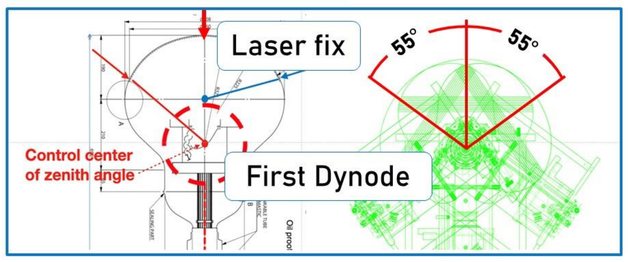


SPECIFICATION

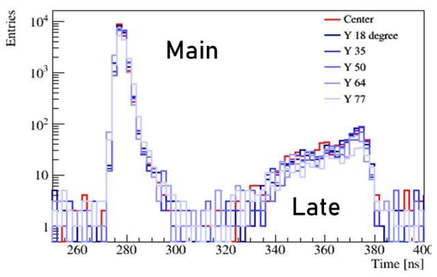
- Box (Efficient collection) & Line (Uniform drift path) dynode
- High Quantum Efficiency **(30%)**
- Gain: **1E + 07**

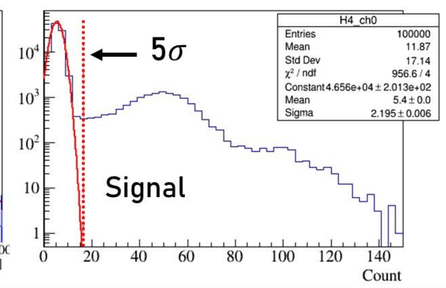


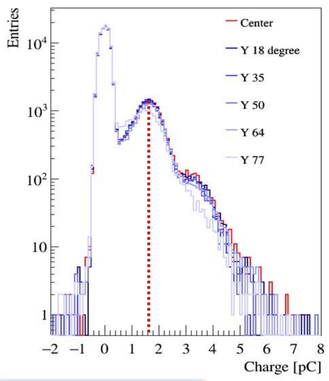
Rotation System



PMT Response (Time, Pulse Height, Charge)



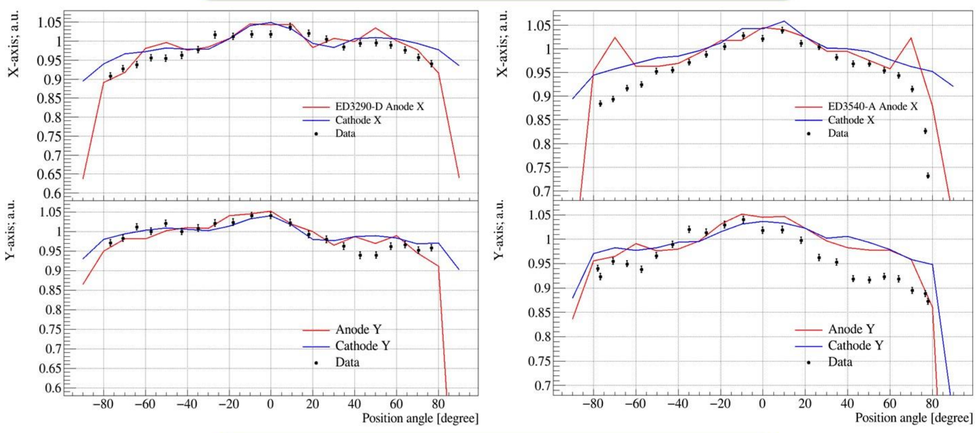




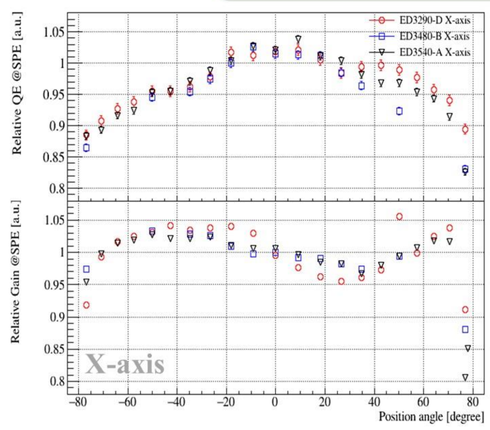
- SPE: 1.593 ± 0.006 [pC]
- Charge Resolution: 30.1%
- Transit time: 1.535 ± 0.01 [ns]
- Late pulse: Main + 100 [ns]

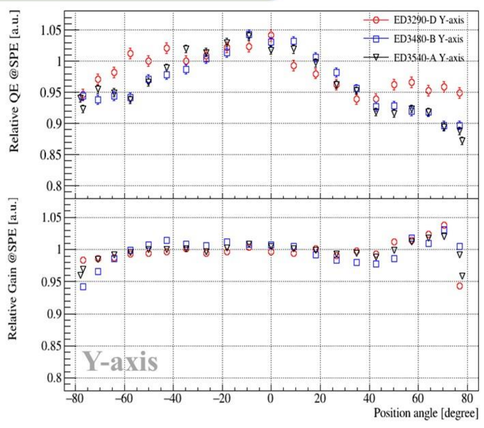
UNIFORMITY MEASUREMENT

Comparison with Hamamatsu



Comparison with 3 PMTs

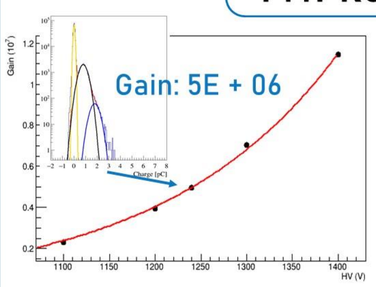


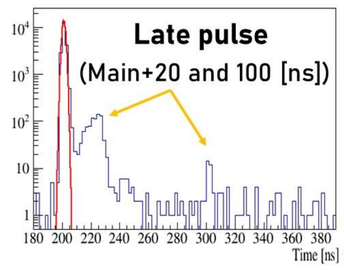


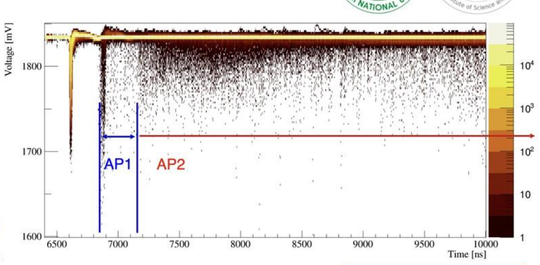
- Korean group developed the PMT rotation system to measure the uniformity of cathode.
- The measurement result of **relative QE** shows the similar tendency with cathode and anode current provided by company.
- This system was sent to HK site and test will be started from this November.

TEST OF OD SENSOR CANDIDATE

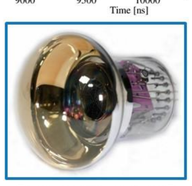
PMT Response (Gain curve, Time, Afterpulse)



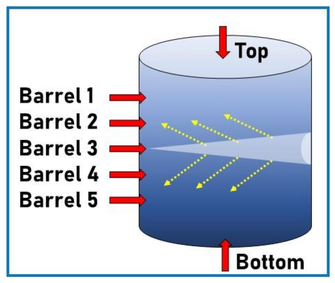




- The **3-inch PMT** for the Outer detector are currently in a bidding competition between **Hamamatsu** and **NNVT**, and the properties of **NNVT 3-inch PMT** have been measured.

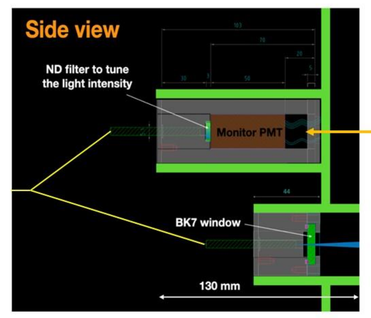

[NNVT-2031]

LASER CALIBRATION

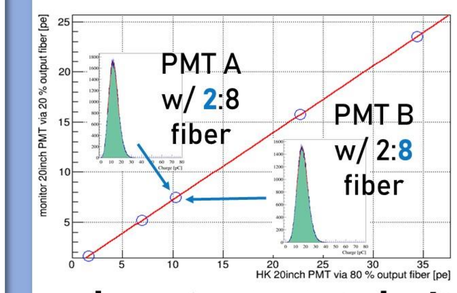


[Injector Position]

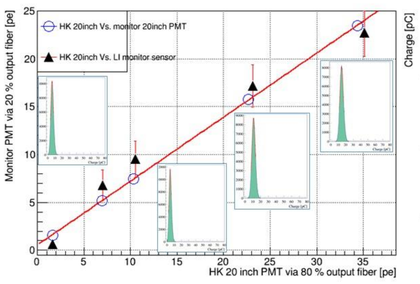
[1x2 Coupler]



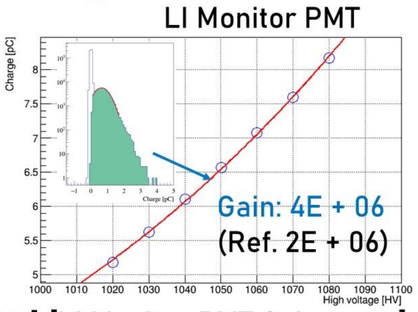
[H10721-110]
LI Monitor PMT



[Laser Coupler Tested]



[Charge Linearity of LI Monitor PMT]

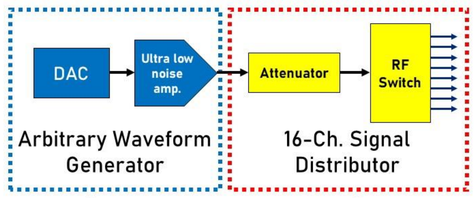


[LI Monitor PMT Gain curve]

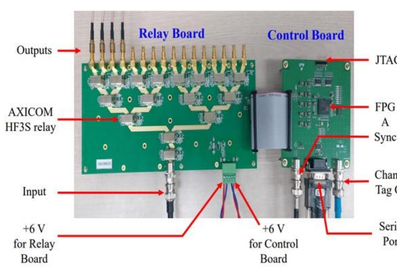
- **Korea laser system** will measure the water parameters to monitor water quality with systematic error less than **1 %**.
- The performance of all components are tested and the design will be completed by the end of 2024 and the production and installation are scheduled in 2025.

ELECTRONICS

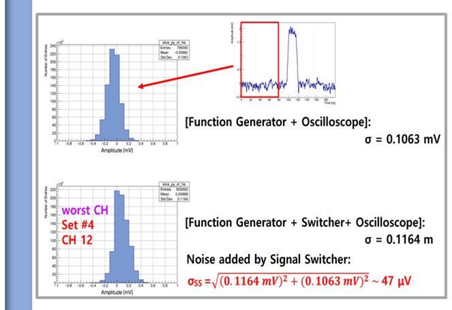
16-Channel Switching System



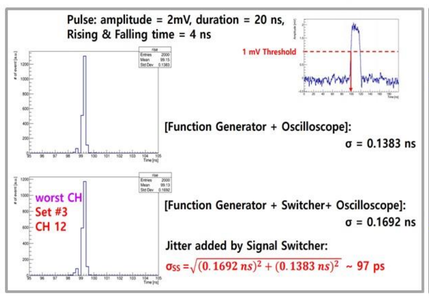
[Digitizer Calibration]



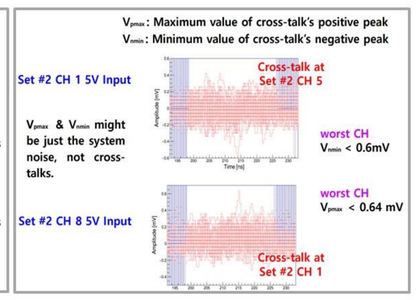

[Four sets of Switch Box]



[Noise Test]



[Time Jitter Test]



[Cross-talk Test]

- We have confirmed through various tests that it can be used for digitizer calibration.
- We are currently producing 15 new sets necessary for the HK electronics mass test.

SUMMARY

- The Korean group is leading various main projects (Pre-calibration of ID sensor, Test of OD sensor, Laser calibration, Electronics R&D) of HK construction.
- HK is under construction and planning to start at the end of 2027.