Improvement and Modelling for the Output Linearity of the Photomultiplier-Tube for High-Precision Neutrino Measurement

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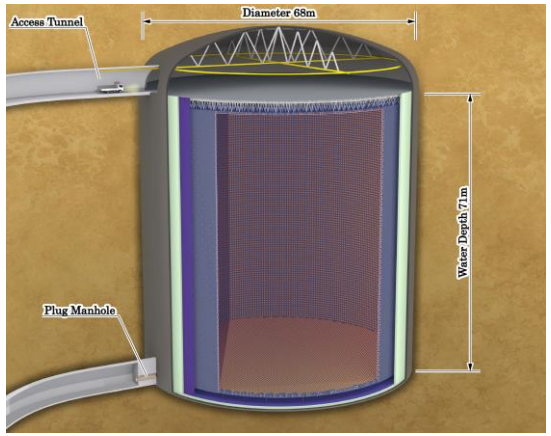
for the Hyper-Kamiokande Collaboration

Hyper-Kamiokande (HK) is a water-Cherenkov detector with 40,000 photomultiplier-tubes (PMT), which plans the operation in 2027.



Photon counting performance of the PMTs is important for high-precision measurement.

To improve the conversion precision from the charge detected by PMT to the number of photons

Two approaches

1. Improvements of PMT base bleeder circuit
2. A trial of modelling non-linearity response

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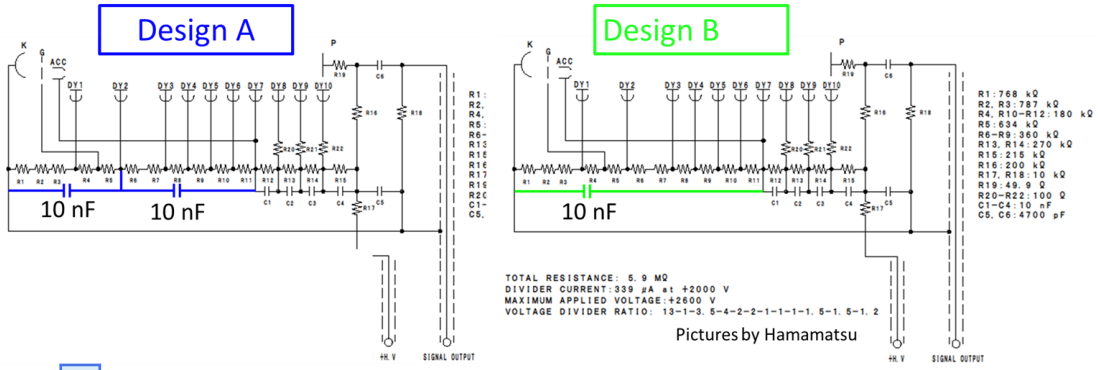
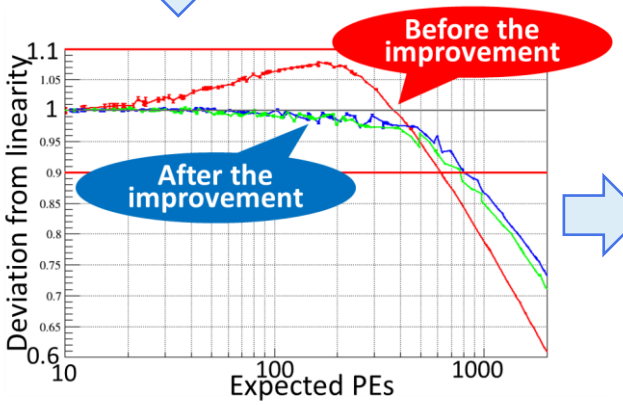
Bleeder circuit improvement

* The best designs of improvements in 10 trials

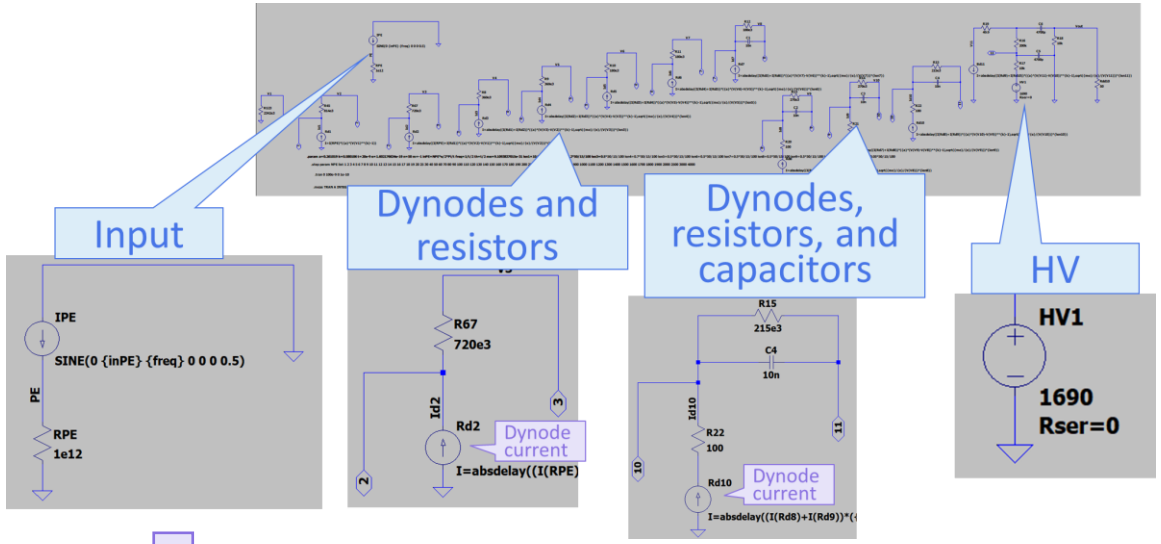


Result

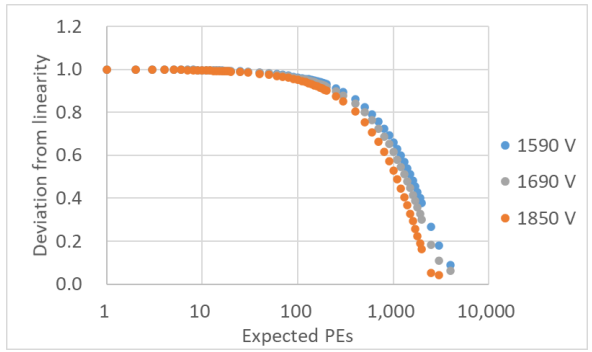


The **improved circuit might be used for HK** if the improvement will finish soon!

Trial of modelling by using LTSpice



Result



We are aiming to improve the energy determination accuracy by making better the calibration.