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Improvement of Energy Resolution in KamLAND-Zen by Implementing Signal Amplifier for Low-gain PMTs

KamLAND-Zen is a neutrinoless double-beta($0\nu2\beta$) decay search experiment using ^{136}Xe installed in the KamLAND detector. KamLAND mainly consists of 1 kt liquid scintillator and 1,879 photomultiplier tubes(PMTs).

One of the dominant background sources in the $0\nu2\beta$ decay energy region around the Q-value of 2.459 MeV is $2\nu2\beta$ decay due to the finite energy resolution. Since the only way to separate $0\nu2\beta$ decay from $2\nu2\beta$ decay is energy information, the energy resolution is important in the high sensitive search.

However, the number of unused PMTs is increasing due to the decreasing gains. It makes the energy resolution of KamLAND worse. To recover the energy resolution, the signal amplifiers for such "low-gain PMTs" were developed and installed.

I will report the recovery of the PMT performance and the improvement of the detector energy resolution by the signal amplifiers.

Mini-abstract

Signal amplifiers can improve the performance of low-gain PMTs and the detector energy resolution.

Experiment/Collaboration

KamLAND-Zen

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