The Performance Of The KOTO CsI Calorimeter

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J-PARC KOTO experiment [1] aims to make the first observation of $K_L \rightarrow \pi^0\nu\nu$ decay. The branching ratio of the decay is predicted as 2.4×10^{-11} with a small theoretical uncertainty in the standard model [2]. Any difference from the prediction suggests an evidence of a new physics. The first period of the KOTO physics run was taken in 2013 and the analysis is ongoing.

We will search for this rare decay by measuring two photons from π^0 using a CsI electromagnetic calorimeter. The KOTO CsI calorimeter consists of 2716 undoped CsI crystals which had been used in FNAL KTeV experiment. The waveforms of signals from CsI crystals are recorded with flash ADCs. The cross sections of these crystals are 2.5cm (5cm) square for the center (outer) region. With these small cross sections, we can obtain shower shape information which is useful to distinguish signal events from some backgrounds.

The engineering run was conducted in 2012 to measure the performance of the CsI calorimeter. In the run, we observed electromagnetic showers which were made on the CsI calorimeter by electrons from $K_L \rightarrow \pi e\nu$ decays. The momenta and paths of those electrons were also measured by using a spectrometer which was placed in front of the calorimeter. By comparing measured result of the calorimeter with that of the spectrometer, energy and position resolutions of the calorimeter were derived. We also checked the consistency of electromagnetic shower shapes between the data and a Monte Calro simulation. This engineering run was the last chance to study the CsI calorimeter with charged particles because the spectrometer had to be removed to install veto detectors surrounding the decay volume.

In this talk, I will report the result of the engineering run, including the resolution of energy and position of the CsI calorimeter, and the consistency of shower shapes between the data and a Monte Calro simulation.

References

[1] J. Comfort *et al*, Proposal for $K_L^0 \rightarrow \pi^0\nu\nu$ Experiment at J-PARC (2006).

[2] J. Brod, M. Gorbahn and E. Stamou, Phys. Rev. D **83**, 034030 (2011)