

Scattered Kaon Study in the KOTO Experiment at J-PARC

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The KOTO experiment aims to explore physics beyond the Standard Model (SM) by measuring the branching ratio of $K_L \rightarrow \pi^0 \nu \bar{\nu}$, which is predicted to be $(3.0 \pm 0.3) \times 10^{-11}$ by the SM[1]. The $K_L \rightarrow \pi^0 \nu \bar{\nu}$ decay is characterized by a pair of photons from the π^0 decay and no other detected particles. The decay is identified by observing two photons with large transverse momentum on an undoped Cesium Iodide (CsI) electromagnetic calorimeter and no other signals on the hermetic veto detectors.

Kaons decay outside the beam line with final product of two photons, such as $K_L \rightarrow \gamma\gamma$ and $K_L \rightarrow \pi^+ \pi^- \pi^0$, can appear to have large transverse momentum due to kaon scattering and beam interaction with the detectors. These off-axis kaon decay events can impact the upper limit of $K_L \rightarrow \pi^0 \nu \bar{\nu}$ branching ratio. Aluminum targets located at the upstream of the KOTO detector and inside the decay-volume were used to study kaon beam profile, which provided off-axis kaon decay vertex information. The beam profile provided insights on background contributions to the signal. Studies on the kaon beam profile and background identification from kaon scattering will be presented.

Reference

[1] A. J. Buras, D. Buttazzo, and R. Knegjens, “ $K^+ \rightarrow \pi^+ \nu \bar{\nu}$ and $K_L \rightarrow \pi^0 \nu \bar{\nu}$ in the Standard Model: Status and Perspectives”, J. High Energ. Phys. \textbf{2015} 166 (2015)

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