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Neutron-insensitive gamma-ray detector with aerogel for rare neutral-kaon decay experiment

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A novel gamma-ray detector which is highly sensitive to photons but insensitive to neutrons has been developed for the rare neutral-kaon decay experiment (KOTO experiment) at J-PARC.
This experiment aims to study the KL->pi0nunubar decay with an electromagnetic calorimeter and hermetic veto detectors surrounding the the decay region.
The veto counters located in the beam should be able to detect such photons as to be escaping to the direction with high efficiencies under the huge neutron flux of 500MHz.

This detector consists of a series of modules of lead and aerogel pairs.
Incident photons are converted to electrons and positrons in lead sheets and the photons from their Cerenkov radiation in the aerogel sheets are viewed by photomultiplier tubes.
Since protons or charged pions, which are mainly produced by neutrons, do not emit the Cerenkov light because of their small velocity, excellent blindness to neutrons can be achieved while keeping high photon detection efficiency around 99.9% for the energies larger than 1 GeV.
The half of the modules of the detector were installed and used as an in-beam photon veto detector in the first physics data taking of the KOTO experiment.
The detector operated stably during 1 week of data taking and the expected performance on photon detection was confirmed as a result of evaluation using KL->3pi0 decay events.

In this presentation, the design of this detector, stability and performance studies in the physics data taking, and the future prospects will be reported.

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