Contribution ID: **32** Type: **Poster**

Performance Evaluation of a Ring Imaging Cherenkov Detector with High-Momentum hadron beams at J-PARC

Monday, September 15, 2025 3:50 PM (1 hour)

We are preparing a spectroscopy experiment of Ξ and Ω baryons at the $\pi 20$ beamline, a secondary particle beamline of the high-momentum beamline at J-PARC. We utilize negatived kaons as incident particles with momenta ranging from 5.0 to 8.5 GeV/c. An unseparated secondary beam contains, however, approximately 100 times the amount of pions as a background, and the number of secondary particles arrived is 6.0×10^7/spill. Therefore, a beam particle identification detector with a π misidentification probability below 0.03% is required. For this purpose, we use a Ring Imaging Cherenkov detector (beam-RICH).

The beam-RICH detector is composed of an aerogel radiator, a spherical mirror, and photon detectors based on Silicon Photomultipliers (SiPMs). The optical performance was evaluated using a positron beams, achieving an angular resolution of 4.57 mrad for a single photoelectron. For particle identification, we adopted the "Global likelihood approach," which is a method originally introduced in the LHCb collaboration, which assumes several particle hypotheses and calculates the expected number of detected photons for each. Particle identification is performed based on the differences in the log-likelihood values derived from these expectations. Simulation results demonstrate that a K^- detection efficiency exceeding 96% at 5.0 GeV/c has been achieved while keeping a misidentification rate below 0.03%.

In January 2025, we performed a beam test at the J-PARC high-momentum beamline using secondary hadron beams with momenta of 3, 5, and 10 GeV/c. The measurements were complemented by tracking information from tracking detectors and low-momentum particle identification using threshold-type Cherenkov detectors.

We present the detector design and construction, the evaluation results from two kind of beam tests. Additionally, we report the secondary particle composition of at the J-PARC high-p beamline, with particular emphasis on the evaluation of the K fraction.

Author: TODA, Taiga (University of Osaka)

Co-authors: NOUMI, Hiroyuki (RCNP); SUZUKI, Ken (The University of Osaka); SIROTORI, Kotaro (RCNP); NARUKI, Megumi (Kyoto University); TOMIDA, Natsuki (Kyoto University); OKAZAKI, Rintaro (Kyoto University); HONDA, Ryotaro (KEK IPSN); SUZUKI, Shota (Kyoto University); AKAISHI, Takaya (RCNP); HORI, Yusuke (Kyoto University)

Presenter: TODA, Taiga (University of Osaka)

Session Classification: Poster Session

Track Classification: R&D on Cherenkov light imaging systems for future experiments