

Development of RICH detector with SiPM readout for the charmed baryon spectroscopy experiment (E50) at J-PARC

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The J-PARC E50 experiment aims for charmed baryon spectroscopy utilising the high-momentum secondary particle beam line ($\pi 20$) at the J-PARC hadron experimental facility. Charmed baryons (Λ_c^+) will be produced in the reaction $\pi^- + p \rightarrow \Lambda_c^+ + \pi^-$ with a beam momentum of 20 GeV/c. The charmed baryons will be identified by reconstructing Λ_c^+ from its decay particles ($p + \pi^-$) and calculating the missing mass of the reaction. A Ring Imaging Cherenkov detector (RICH) is being developed in order to identify those decay particles which will be produced in a wide momentum range of 2–16 GeV/c.

A test detector was constructed. It consists of an aerogel Cherenkov radiator with refractive index $n = 1.04$ for particle identification in the low-momentum region, a spherical mirror with a curvature radius of 3 m, and a photon detection surface equipped with a hollow light concentrator and Multi-Pixel Photon Counters (MPPC).

Test experiments were conducted at the Research Center for Electron Photon Science, Tohoku University (ELPH) using positrons with a momentum of 0.8 GeV/c.

Parameters such as the thickness of the radiator, MPPC operating conditions are optimised. We also tested two types of cone-shaped light guides with entrance diameters of 50 mm and 30 mm, each having depths of 120 mm and 33 mm. The exit diameter was set to 8.5 mm to match the MPPC array used. The obtained result was compared with a GEANT4 simulation.

We will report an overall design of the detector, the result of the test experiment, including the angular resolution of the test detector and finally the perspective toward constructing the final version.

Collaboration

The J-PARC E50 collaboration

Role of Submitter

The presenter will be selected later by the Collaboration

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