

Wedge-Based Side Readout for Minimizing Uncertainty in the Optical Path of Cherenkov Photons

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This study aims to improve the radiator structure of a system that achieved a 30 ps CTR to approach a 10 ps CTR. The 30 ps CTR was achieved using a 3 mm lead-glass, which introduces a timing uncertainty of 18.2 ps depending on the interaction depth. To improve upon this, a wedge-based side readout is proposed. This structure uses a wedge-shaped light guide to correct for the time difference depending on the interaction depth. To validate this structure, simulations were conducted on four different detector structures: a 3 mm thick flat back readout, a 1 mm thick flat back readout, a 3 mm thick wedge-based side readout, and a 1 mm thick wedge-based side readout. The flat back readout showed a linear increase in timing uncertainty with thickness, while the wedge-based side readout showed negligible difference in timing uncertainty even as the radiator thickness increased from 1 mm to 3 mm. Although the wedge-based side readout has the disadvantage of degraded sensitivity, it can improve sensitivity by cascading multiple detectors.

Field

Detectors and electronics

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