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Quintuple-GEM CsI Ring Imaging Cherenkov Detector

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The next frontier in QCD research involves the construction of an Electron-Ion Collider (EIC), whose desired capabilities will include particle identification up to ˜ 60 GeV/c. Particle identification capabilities require a momentum spectrometer and a precision velocity measurement. Here, we achieve velocity resolution via a RICH detector by measuring the Cherenkov angle of the radiation, from which we derive particle velocity. This research presents performance capabilities of an R&D endeavor to develop a quintuple Gas Electron Multiplier (GEM) RICH detector, whose purpose is to resolve particle velocity at high momenta for future use in an EIC environment. The advantages of a GEM-based photon detector include its ability to operate well in the presence of strong magnetic fields, and additionally offers a low cost per unit area, in comparison with conventional photon detection technologies. We demonstrate detector performance via the detection of Cherenkov rings on a hexagonal array of readout pads, from which we obtain a coarse resolution measurement of ring radius. From this data we also calculate the number of photons per ring, applying a 3-sigma pulse height cut. Detector performance is also demonstrated under both forward and reverse-bias conditions at varied gain to demonstrate the plateau in photoelectron yield. The experimental results presented herein were performed at the newly established End Station Test Beam (ESTB) Facility at the Stanford Linear Accelerator Center (SLAC) in Menlo Park, CA, and demonstrates successful use of the facility by the inaugural group of outside users.

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