A Proximity-Focusing RICH Detector for the ePIC Experiment at the EIC

The Electron-Proton/Ion Collider Experiment (ePIC) will be a large, multi-purpose detector to be installed at the Electron-Ion Collider (EIC) being built at Brookhaven National Laboratory. As robust particle identification (PID) capabilities are essential for fully realizing the EIC science program, ePIC contains several PID subsystems spanning different angular ranges. PID capability in the electron-going endcap is provided by a proximity-focusing Ring Imaging Cherenkov detector (pfRICH) designed to deliver 3-sigma separation between pions and kaons for momenta up to 7 GeV/c. It will also aid with electron-hadron discrimination at low momentum and assist in the determination of the collision time (t_0).

The pfRICH design consists of a cylindrical vessel 130 cm in diameter and approximately 49 cm in length. The face closest to the interaction point holds aerogel tiles (n = 1.04) which serve as the radiator, while the opposite face contains the photosensors. The baseline photosensors are the High-Rate Picosecond Photon Detectors (HRPPDs) by Incom, which combine a large, finely pixelated, active area (104x104 mm^2, 32x32 pixels), high quantum efficiency (peak values greater than 30%), low dark count rate (hundreds to several kHz/cm^2), and very good spatial and temporal resolution. In particular, single photon timing resolutions of 15 to 20 ps will enable a precise t_0 measurement and aid in extending hadron PID capabilities to lower momenta.

This contribution will summarize the design of the pfRICH as well as ongoing fabrication and component testing efforts. GEANT-based performance simulations and integration into the ePIC geometry and reconstruction framework will also be discussed.