The dual radiator RICH detector for particle identification in the forward region of the future Electron Ion Collider spectrometer

EVARISTO CISBANI, Italian National Institute of Nuclear Physics - Rome Section and Italian National Institute of Health, LUCA BARION, MARCO CONTALBRIGO, Italian National Institute of Nuclear Physics - Ferrara Section, ALESSIO DEL DOTTO, Italian National Institute of Nuclear Physics - Frascati National Laboratory, CRISTIANO FANELLI, Thomas Jefferson National Accelerator Facility and Laboratory for Nuclear Science, Massachusetts Institute of Technology, PAWEL NADEL-TURONSKI, Stony Brook University, ROBERTO PREGHENELLA, Italian National Institute of Nuclear Physics - Bologna Section, ZHIWEN ZHAO, Duke University, EIC-ERD14 COLLABORATION — Excellent particle identification (PID), especially of hadrons over a large kinematic phase space, is a critical requirement to realize the rich experimental physics program at the future Electron-Ion Collider (EIC). We present the status of the development of a dual-radiator ring-imaging Cherenkov (dRICH) detector designed for PID in the forward hadronic endcap of the EIC spectrometer over an extended momentum range. The current dRICH design consists of 6 identical azimuthal sectors covering the full solid angle for pseudorapidities $1.5 < \eta < 3.4$ (polar angles: $5 < \theta < 25$ deg). Each sector includes a 4-cm-thick aerogel radiator ($n \approx 1.02$) followed by 1–1.5-m-long CFgas filled volume ($n \approx 1.0008$). Cherenkov photons from both radiators are focused by a spherical mirror onto the photo-detector surface which sits outside the detector acceptance. Studies based on detailed Monte Carlo simulations, Bayesian-driven detector optimization strategies and event-based PID reconstruction algorithm, show that the dRICH can provide continuous $K/\pi$ separation from $\sim 3$ to $\sim 50$ GeV/c, and electron identification from few hundred MeV/c to $\sim 15$ GeV/c. A small-scale, full features, prototype is being designed to validate the predicted performance and to study critical features of the proposed detector.

Evaristo Cisbani
Italian National Institute of Nuclear Physics and Italian National Institute of Health