Vector-Meson Reconstruction and Muon ID with the ePIC Backward Calorimeter

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Abstract

As the day-1, general-purpose detector at the upcoming Electron-Ion Collider (EIC) at Brookhaven National Laboratory, ePIC will enable various novel frontiers of nuclear physics research in polarized deep-inelastic electron-proton and electron-nucleus scattering. Several calorimeters aid in particle and jet reconstruction, including the barrel, the forward (proton/nucleus-going), and the backward (electron-going) hadronic calorimeters. Our research is focused on detection of vector-meson decay products including muons in the latter calorimeter, the nHCal, designed in alternating layers of steel and scintillating tiles. We study diffractively produced ϕ-mesons, $e\text{Au} \to e\phi(\to K^+K^-)$, generated with the Sartre event generator. This process allows to eventually gain insight into the spatial distribution of quarks and gluons. We will discuss the geometrical acceptances for the decay kaons with respect to the three ePIC hadronic calorimeters. We will demonstrate that the additional backward acceptance provides access to a more complete set of vector-meson decay topologies and that the nHCal is crucial for low values of x-Bjorken. We will give an outlook to ongoing studies that aim to optimize the nHCal design for muon ID and reconstruction.