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Exploration of hadronization through heavy flavor production at the future Electron-Ion Collider

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The proposed Electron-Ion Collider (EIC) will utilize high-luminosity high-energy electron+proton ($e + p$) and electron+nucleus ($e + A$) collisions to solve several fundamental questions including searching for gluon saturation and studying the proton/nuclear structure. Due to their high masses ($M_{c,b} > \Lambda_{QCD}$), heavy quarks do not transfer into other quarks or gluons once they are produced. This feature makes the heavy flavor product an ideal probe to explore how a heavy flavor hadron is formed from a heavy flavor quark, which is referred to as the heavy quark hadronization. A series of heavy flavor hadron and jet simulation studies have been carried out with the newly developed EIC project detector conceptual designs. We will present reconstructed heavy flavor hadron mass and heavy flavor jet transverse momentum spectrums, the projected nuclear modifications of heavy flavor hadrons inside jets, and heavy flavor jet substructure distributions in $e + p$ and $e + A$ collisions with the EIC project detector design and the projected integrated luminosities at the EIC. These proposed EIC heavy flavor measurements will provide a unique path to constrain the accessed gluon parton distribution functions within the high Bjorken-x ($x_{BJ} > 0.1$) region, explore the flavor dependent fragmentation functions and reveal the heavy quark nuclear transport properties in cold nuclear meidum, which can constrain the initial and final state effects for previous and ongoing heavy ion measurements at the Relativistic Heavy Ion Collider (RHIC) and the Large Hadron Collider (LHC).

Submitted on behalf of a Collaboration?

No

Participate in poster competition?

Primary author: LI, Xuan (Los Alamos National Laboratory)

Presenter: LI, Xuan (Los Alamos National Laboratory)

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