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Can the EIC ^{3}He beam polarization be precisely measured by HJET?

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The requirements to hadron polarimetry at future Electron Ion Collider (EIC) include measurements of the absolute helion (^{3}He, h) beam polarization with systematic uncertainties better than $\sigma_P^{\text{syst}}/P \leq 1\%$. Here, we consider a possibility to utilize the Polarized Atomic Hydrogen Gas Jet Target (HJET) for precision measurement of polarization of the ~ 100 GeV/n helion beam.

Since 2005, HJET serves to determine absolute proton beam polarization at the Relativistic Heavy Ion Collider with accuracy $\delta^{\text{syst}} P/P \sim 0.5\%$. Concurrent measurement of the beam and target (the jet) spin correlated asymmetries allows one to relate the beam polarization $P_{\text{beam}} = P_{\text{jet}}\, a_{\text{beam}}/a_{\text{jet}}$ to the well known jet polarization $P_{\text{jet}} \sim 96 \pm 0.1\%$. Thus, the proton beam polarization can be measured with actually no knowledge of the proton-proton analyzing power $A_{\text{N}}^{pp}(t)$.

To adapt the method for the EIC helion beam, it is necessary to know the ratio of $p^{\uparrow}h$ and $h^{\uparrow}p$ analyzing powers $A_{\text{N}}^{ph}/A_{\text{N}}^{hp}$, which depends on the corresponding hadronic spin-flip amplitudes r_5^{ph} and r_5^{hp}. A prospect to derive these amplutudes from the proton-proton one, r_5^{pp}, measured at HJET will be discussed.

Potentially, results the ^{3}He beam polarization measurement can be affected by the helion breakup in the scattering. However, since only low energy recoil protons are detected at HJET, the breakup component in the acquired data is expected to be strongly suppressed. To figure out identification of the breakup events in the ^{3}He beam measurement at EIC and to evaluate elastic data contamination by such events, the HJET experimental data obtained with ~ 10 GeV gold and deuteron beams was analyzed.

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