Azimuthal transverse single-spin asymmetries of inclusive jets and hadrons within jets from polarized pp collisions at RHIC-STAR

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Abstract

The study of the origins of transverse single-spin asymmetries has stimulated significant progress in the development of twist-3 formalism and transverse-momentum-dependent parton distribution functions (TMDs). Measurements of the azimuthal distribution of inclusive jets and identified hadrons within jets produced in transversely polarized hadronic interactions provide key insights into TMD physics. In particular, measurements of the Collins effect, which involves the interplay between the quark transversity and Collins fragmentation function, provide access to the final-state phenomena of TMD physics.

The STAR collaboration has previously reported measurements of Collins asymmetries from jet + $\pi^{\pm}$ production in transversely polarized proton-proton (pp) collisions at a center-of-mass energy of $\sqrt{s}$ = 500 GeV, based on data collected in 2011 with an integrated luminosity of 23 pb^{-1}. Furthermore, comprehensive studies of azimuthal transverse single-spin asymmetries for hadrons within jets from pp collisions at $\sqrt{s} = 200$ GeV were conducted using data from 2012 and 2015.

In 2017, STAR accumulated a significantly larger pp dataset, with an integrated luminosity of 320 pb^{-1} at $\sqrt{s}$ = 510 GeV, which is expected to substantially improve the precision of transverse single-spin asymmetry measurements, especially in the high jet transverse momentum region. This presentation reports preliminary results on azimuthal transverse single-spin asymmetries for charged pions within jets from transversely polarized pp collisions at $\sqrt{s}$ = 510 GeV. The comparison of Collins asymmetries between pp collisions at 200 GeV and 510 GeV can provide crucial insights into the energy evolution of the Collins function. Additionally, comparing experimental results from pp collisions with theoretical predictions derived from global fits to semi-inclusive deep inelastic scattering and e^+e^- annihilation data will allow tests of the universality of Collins asymmetries.