Azimuthal Transverse Single-Spin Asymmetries of Identified Hadrons Within Jets from Polarized pp Collisions at $\sqrt{s} = 200$ GeV

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Abstract

The Collins effect involves the convolution of the quark transversity in the proton with the spin-dependent Collins fragmentation function in pp collisions, leading to azimuthal modulations of identified charged hadron yields relative to the jet axis. Recently, a detailed calculation using the soft-collinear effective theory found that the Collins effect in pp collisions involves a mixture of collinear and transverse momentum dependent (TMD) factorization. It provides a direct probe of the Collins fragmentation function and enables testing its evolution, universality and factorization breaking in the transverse momentum dependent formalism. In 2018, STAR published the first measurements of Collins asymmetries for charged pions in jets in polarized pp collisions at $\sqrt{s} = 500$ GeV based on data taken during 2011. The results probe Q^2 scales one to two orders of magnitude larger than similar measurements in semi-inclusive deep-inelastic scattering (SIDIS) and are consistent with predictions based on global analyses of e^+e^- and SIDIS data. In 2012 and 2015, STAR collected $\sim$14 pb^{-1} and $\sim$48 pb^{-1} of transversely polarized pp data at $\sqrt{s} = 200$ GeV, respectively. These datasets provide the most precise measurement of the Collins effect in pp collisions, especially at the quark momentum fractions $0.1 \leq x \leq 0.4$. Preliminary results for Collins asymmetries of identified pions, kaons, and protons in jets at $\sqrt{s} = 200$ GeV and comparisons to theory predictions will be presented.