Accessing the TMD distributions from longitudinal single-spin asymmetries of $W^{\pm}$ bosons at RHIC

Understanding the three-dimensional spin structure of the nucleon is one of the key questions in QCD. Among the transverse-momentum-dependent (TMD) PDFs, the TMD helicity distributions in particular are poorly constrained. Measurements of the longitudinal single-spin asymmetry (A_L) of $W^{\pm}$ bosons in polarized proton-proton collisions at RHIC provides a unique opportunity for accessing the flavor separated TMD helicity distributions of quarks and anti-quarks. The $W^{\pm}$ bosons can be identified through their leptonic decay channel ($W \rightarrow e + \nu$), and their full kinematics can be constructed by using a recoil-based method. In this talk, we will present the motivation, analysis procedures, and the status of the A_L measurement as functions of $W^{\pm}$ transverse momentum and rapidity, based on the dataset collected by the STAR experiment in longitudinally polarized $p + p$ collisions at $\sqrt{s} = 510$ GeV in 2013.

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