Single-Spin Transverse Asymmetry in Neutral Pion and Charged Hadron Production at PHENIX

Abstract

The Relativistic Heavy Ion Collider (RHIC) at Brookhaven National Laboratory (BNL) began operation as the first polarized proton collider in 2001. From data collected in the 2001-2002 run, the PHENIX experiment has measured the single-spin transverse asymmetry (A_N) for neutral pion and non-identified charged hadron production at $x_F \tilde{} 0$ over a transverse momentum range of ~0.5 to 5.0 GeV/c from polarized proton-proton interactions at a center of mass energy ($\sqrt{s}$) of 200 GeV. Interest in these measurements arises from the observation of large (~10-30%) single-spin transverse asymmetries in $pp_{\uparrow} \longrightarrow \pi X$ at forward angles by the E704 collaboration at Fermilab ($\sqrt{s} = 19.4$ GeV) and the STAR collaboration at RHIC ($\sqrt{s} = 200$ GeV), as well as single-spin, azimuthal asymmetries in semi-inclusive deep-inelastic scattering by the HERMES collaboration at DESY. Such large asymmetries were initially surprising because at leading-order, pQCD predicts only small effects. Recently it has been argued that these large asymmetries may be produced by initial-state effects (e.g. the Sivers effect), final-state effects (e.g. transversity with the Collins effect), higher-twist contributions, or a combination of the three. In this talk, we will report on the results of these measurements.