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Measurement of Transverse Single Spin Asymmetry (A_N) of Neutral Pions (π^0) using Transversely Polarized $p^{\uparrow}p$ collisions at STAR

In proton-proton (pp) collisions involving a transversely polarized proton beam and an unpolarized proton beam, a left-right or azimuthal asymmetry is observed in the distribution of final-state scattered particles. The experimentally measurable quantity is known as the Transverse Single Spin Asymmetry (A_N). This asymmetry arises from fundamental Transverse Momentum Dependent (TMD) mechanisms involving the interplay between transverse momentum and spin of the participating partons and handrons. While perturbative Quantum Chromodynamics (pQCD) theory predicts very small A_N, experimental observations suggest otherwise. Previous measurements of A_N for neutral pions (π^0) at mid-rapidity ($|\eta| < 1$) indicate that it is consistent with zero; however, at forward rapidities ($3.3 < \eta < 5.5$), significantly larger values have been observed. Consequently, measurements in the intermediate rapidity range ($1.0 < \eta < 2.0$) are crucial for providing a comprehensive understanding of A_N and the underlying physics processes. The objective of this talk is to present the status of A_N for π^0 using the STAR Endcap Electromagnetic Calorimeter (EEMC) from STAR Run 2015 transversely polarized $p^{\uparrow}p$ collisions at a center-of-mass energy of 200 GeV. The EEMC's azimuthal coverage across the pseudorapidity range of $1.09 \leq \eta \leq 2.00$ will enable the determination of A_N at intermediate rapidities, and provide a complete picture of the A_N distribution.

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