

New Perspectives



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Extraction of Transverse Single Spin Asymmetry in J/ψ Production in $p\vec{p}$ Interactions at 120 GeV Beam Energy

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Estimates are presented for the SpinQuest experiment to extract the Transverse Single Spin Asymmetry (TSSA) in J/ψ production as a function of the J/ψ transverse momentum (p_T) and Feynman- x (x_F). SpinQuest is a fixed-target Drell-Yan experiment at Fermilab, using an unpolarized 120 GeV proton beam incident on a polarized solid ammonia target. Such measurements will allow us to test models for the internal transverse momentum and angular momentum structure of the nucleon. J/ψ is predominantly produced by strong interaction via quark-antiquark annihilation and gluon fusion. A non-zero asymmetry provides information on the orbital angular momentum contribution of “sea-quarks” to the spin of the nucleon. Simulated data were generated using the SpinQuest/E1039 simulation framework. Gaussian Process Regression (GPR), which is a powerful technique used in machine learning, was used to predict the background under the J/ψ invariant mass peak by fitting the Radial-basis function (RBF) kernel in side-band regions on either side of the J/ψ peak. We used this trained kernel to predict the background in the J/ψ peak region. After subtracting the background, we used iterative Bayesian unfolding to make corrections for the detector inefficiencies and smearing effects. In this presentation, we discuss results on predictions for the expected absolute error of the asymmetry (A_N) for a few p_T and x_F bins for 10 weeks of running.

Primary author: NAWARATHNE, Dinupa (New Mexico State University)

Presenter: NAWARATHNE, Dinupa (New Mexico State University)

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