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

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Abstract

By studying the polarized proton collisions, the structure of the protons can be understood in great detail. Transverse single spin asymmetries are an imbalance of the production cross-section to one side of the protons spin relative to the other. 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 a vector meson which is a $c\bar{c}$ bound state and it 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. In this presentation, we discuss the extraction of generated asymmetry with statistical errors.