Contribution ID: **578** Type: **not specified**

Recent results and prospects on exploring the helicity structure of the proton at RHIC in high-energy polarized proton-proton collisions

Friday, July 17, 2009 11:00 AM (25 minutes)

One of the primary goals of the high-energy spin physics program at RHIC is to determine the polarized gluon contribution, ΔG, to proton spin.
The most recent STAR measurements of the longitudinal double-spin asymmetries, A_{LL}, for the inclusive production of jets, neutral and charged pions at mid-rapidity from collisions at a center of mass energy of $\sqrt{s} = 200$ GeV will be presented.
STAR has also begun measurements of di-jet production, and is preparing for future measurements of gamma+jet production. At leading order, both processes provide access to the initial parton kinematics, allowing a direct determination of the parton momentum dependence of $\Delta g(x)$.

The production of $W^{-(+)}$ bosons provides an ideal tool to study the spin-flavor structure of the proton, in particular contribution from the sea anti-quarks. $W^{-(+)}$ bosons are produced in $\bar{u} + d\,(\bar{d} + u)$ collisions and can be detected through their leptonic decays, $e^- + \bar{\nu}_e\,(e^+ + \nu_e)$, where only the respective charged lepton is measured.
The suppression of QCD background over W boson signal events by several orders of magnitude is accomplished by using the highly segmented STAR Electromagnetic Calorimeter (EMC) allowing for hadron suppression based on shower shape analysis, requiring an isolation criteria suppressing jet events, and vetoing di-jet events based on the measured away side energy.
Results of full scale simulations and reconstruction of expected W and QCD background yields will be shown. The STAR experiment has recently completed collecting data for exploratory run 9 with longitudinaly polarized p+p collisions at $\sqrt{s} = 500$ GeV.
The current analysis status and plans for future STAR measurements at $\sqrt{s} = 500$ GeV in polarized proton-proton collisions will be presented.

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Session Classification: VI. QCD in Hadronic Physics

Track Classification: QCD in hadronic physics