

An Overview of Spin Physics at STAR

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With large acceptance and excellent particle identification, STAR has facilitated a variety of exciting measurements covering a wide range of physics topics. The versatility and precision of the STAR detector, accompanied by the unique capability of RHIC to collide polarized hadrons at various energies, has opened new avenues for investigations of the proton spin structure.

Calorimetry at STAR allows reconstruction of $W^\pm/Z$ bosons by tagging their decay electron. Measurements of the reconstructed $W^\pm$ in longitudinally polarized collisions probe asymmetric anti-quark helicity distributions in the proton sea. In transversely polarized collisions, the $W^\pm/Z$ bosons probe the sea-quark Sivers function and contribute to tests of the predicted sign change.

Jets can be reconstructed based on additional information provided by the STAR tracking system. The longitudinal double-spin asymmetry, A_{LL} , in inclusive jet and dijet production at STAR provides the first evidence of a positive gluon polarization with partonic momentum fraction $x > 0.05$. The tilt of the dijet opening angle in transversely polarized collisions provides a direct access to the first Mellin momentum of the Sivers function.

With the excellent particle identification at STAR, one can pick out hadrons within a jet. A_{LL} of jets that are tagged with a $\pi^\pm$ provides additional examinations of the sign of gluon helicity. Novel measurements of azimuthal distributions of identified hadrons in jets in transversely polarized collisions directly probe the collinear quark transversity via coupling to transverse momentum dependent (TMD) Collins fragmentation function.

The identified hadrons, without being tagged to a jet, provide additional probes of the proton spin structure. Azimuthal correlation between hadron pairs and the proton spin direction provides a complementary extraction of transversity via coupling to dihadron interference fragmentation function. Longitudinal and transverse spin transfers to $\Lambda(\bar{\Lambda})$ hyperons allow access to much unknown $s(\bar{s})$ helicity and transversity, respectively.

In this talk, an overview of spin physics at STAR will be presented.