Single transverse spin asymmetries of forward neutron production in $\sqrt{s_{NN}} = 200$ GeV polarized p+A collisions at PHENIX

Minjung Kim for the PHENIX Collaboration

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The first high energy polarized proton-nuclei collisions at RHIC in 2015 give us opportunities to study unexplored reaction mechanisms of hadron production in the forward region. In PHENIX, single transverse spin asymmetries (A_Ns) of forward ($6.8 < \eta < 8.8$) neutron production in $\sqrt{s_{NN}} = 200$ GeV p+Al, and p+Au collisions are measured, and an unexpected strong A-dependence in A_N is found.

The cross section and A_N from the $p + p$ data, which covers the non-perturbative region ($p_T < 0.2$ GeV/c), have been well described by a one pion exchange (OPE) model in Regge theory. In the OPE model, A_N arises mainly from the interference of the helicity flip amplitude via pion exchange and the helicity nonflip amplitude via a_1-Reggeon exchange. However, this model cannot describe the observed A dependence.

Since our data covers small $-t$ range (< 0.5 (GeV/c)^2), electromagnetic interaction may not be ignorable for the large Z nucleus, and ultra peripheral collisions (UPC) and Coulomb nuclear interference (CNI) can also play important role in asymmetry. In order to study competing effects, a correlation study using beam beam counters (which detect charged particles at $3.1 < \eta < 3.9$) was done which can reduce or enhance their relative contributions. The resulting asymmetries demonstrated drastic dependence depending on hit requirements in the beam beam counters.

In this talk, the A_N results and current progress in the interpretation of the data will be presented.