APR10-2009-001053

Abstract for an Invited Paper
for the APR10 Meeting of
the American Physical Society

Nuclear Effects in Nucleon Structure and the Initial State in Heavy Ion Collisions at RHIC

MATTHIAS GROSSE PERDEKAMP, University of Illinois at Urbana Champaign

A program to study nuclear effects in parton distributions at low x through deuteron-gold collisions at RHIC will be presented. Using the highly asymmetric collision system avoids final state medium effects and provides sensitivity to initial state nuclear medium effects in the gold nucleus. The RHIC experiments took first d+Au data with $\int Ldt = 2.7\,\mathrm{nb}^{-1}$ at $\sqrt{s_{NN}} = 200\,\mathrm{GeV}$ in 2003. These data served as control sample to establish jet suppression at mid-rapidity as final state medium effect in heavy ion collisions and to study nuclear effects in hadron production at $\eta \sim 0$ and forward + backward rapidities. Compared to p+p measurements, the d+Au data show suppression of hadron production rates in the forward (deuteron) direction and an enhancement in the backward (gold) direction. Competing models exist that can explain the observed suppression and enhancement. For example, high parton densities in nuclei at low x may lead to gluon fusion causing saturation of the gluon distribution and thus the suppression of hadron production cross sections. This saturation has been described as the formation of the Color Glass Condensate (CGC). A conclusive measurement discriminating between different mechanisms has yet to be carried out. CGC calculations predict significant suppression of conditional yields for rapidity separated hadron pairs with one of the hadrons at forward rapidity. A first measurement of conditional yields using the 2003 data and the PHENIX muon arms, $1.2 < |\eta| < 2.4$, did not find significant differences between conditional yields for d+Au and p+p. A 30 times larger data set of d+Au collisions was sampled in 2008 with new forward detectors installed in STAR and PHENIX. The additional acceptance and larger statistics enable measurements of cross sections and conditional yields with increased precision and larger rapidity separation. First results from the 2008 data set will be presented. Current analysis plans and future plans for low-x physics at RHIC will be discussed.