Searching for Gluon Saturation in d+Au Collisions at PHENIX

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Abstract

Much of my recent work has focused on measurements using the PHENIX forward detectors in high energy deuteron-gold collisions [1-2], enabling us to study cold nuclear matter effects in nucleon structure at low x. The high gluon densities in Lorentz-contracted gold nuclei make it possible to probe for gluon saturation or color glass condensate effects in the absence of quark-gluon plasma [3]. Past RHIC experiments have shown a suppression in nuclear modification factors (R_{dA}, R_{cp}) for $\sqrt{s_{NN}}$ = 200 GeV d+Au collisions in the forward (deuteron) direction [4-6]. Multiple theories can explain the observed suppression (including saturation), but a conclusive measurement discriminating between the models has yet to be carried out. Two new forward electromagnetic calorimeters (Muon Piston Calorimeters, $-3.7 < \eta < -3.1$, $3.1 < \eta < 3.9$) allow the PHENIX experiment to further study forward di-hadron correlations, which have been predicted to show dramatic effects due to gluon saturation [7]. In particular, I will show azimuthal correlations of di-hadron pairs at different pseudorapidities; the forward pseudorapidity correlations are especially interesting because it is expected that they provide a test of gluon saturation down to $x \approx 10^{-3}$ in the Au nucleus. The analyses presented are based on the high integrated luminosity data sample of d+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV taken at RHIC in 2008. In addition to analysis work, I shall also present a short history Muon Piston Calorimeter, and discuss my contributions to the detector construction, calibration, and reconstruction algorithm.

References

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