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Isolating final state effects in high p_T π^0 production using direct photons in small system collisions with PHENIX

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PHENIX observed a 20\% suppression in the production of high p_T neutral pions in the most central (0-5\%) d+Au collisions at 200 GeV. Through the simultaneous measurement of high p_T direct photons (γ^{dir}) and π^0 production for event samples selected by event activity, the final state effects could be disentangled from cold-nuclear-matter effects and event-selection biases that are inherent in using the standard Glauber model. This isolation of final state effects is achieved by approximating the nuclear modification factor by the double ratio $R_{xA} = (\gamma^{dir}/\pi^0)_{pp}/(\gamma^{dir}/\pi^0)_{xA}$. While the cold-nuclear-matter effects in x+A collisions cancel in the $(\gamma^{dir}/\pi^0)_{xA}$ ratio, the effective number of binary collisions is given by $N_{\rm coll}^{\rm exp} = \gamma_{xAu}^{dir}/\gamma_{pp}^{dir}$, which eliminates the dependence on the Glauber model. In addition, many systematic uncertainties cancel in the double ratio. To shed light on the origin of the observed final state suppression and to test if it is consistent with energy loss in droplets of QGP, the results from d+Au collisions are compared to preliminary data from smaller (p+Au) and larger (^{3}He+Au) collision systems.

Category

Experiment

Collaboration (if applicable)

PHENIX

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