

Recent results on identified particle spectra from d + Au collisions at RHIC

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Understanding the Cronin effect [1], the enhancement of hadron spectra at intermediate p_T in $p + A$ collisions as compared to those in $p + p$ collisions, is important for the interpretation of the data in $A + A$ collisions. It is thought that the Cronin effect may result from initial state parton scatterings in high-energy nuclear collisions. In addition, the particle production in $A + A$ collisions relative to $p + p$ collisions showed a particle species dependence at the intermediate p_T . In order to further investigate these observations, and shed light on the initial conditions at RHIC, our goal is to analyze the rapidity dependence of various identified hadron production in $d + Au$ collisions at RHIC.

We report the status of identified hadron production from recent $d+Au$ collision data with $\sqrt{s_{NN}} = 200$ GeV, recorded by STAR in the year 2008. Specifically we will present the charged π and ϕ meson transverse momentum distributions. The experimental setup for this analysis has significantly reduced material ($\sim 1/10$) in relation to the previous run in 2003. The statistics are also roughly a factor of 3 higher.

The identified pion spectra for 0-20% central collisions is shown in Fig. 1. The year 2008 results have been compared to those from the year 2003 [2]. There is good agreement between the results from the two different data sets.

Fig. 2 shows the nuclear modification factor for phi mesons in $d + Au$ collisions. The nuclear modification factor (R_{AB}) is the ratio of the invariant yields of the produced parti-

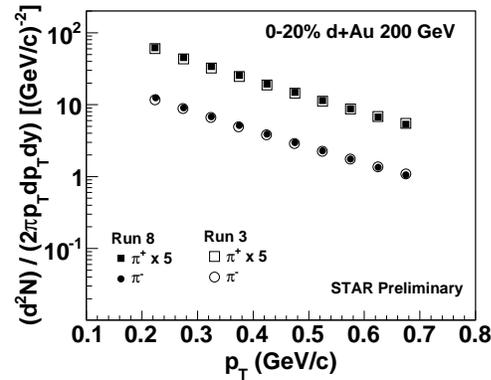


FIG. 1: Midrapidity ($|y| < 0.1$) identified pion spectra in $d+Au$ collisions (0-20%) at 200 GeV. The solid symbols correspond to p_T spectra from run 8 and open symbols correspond to p_T spectra from run 3. The p_T spectra of π^+ have been scaled by 5.

cles in nucleus (A) + nucleus (B) collisions to those in inelastic $p + p$ collisions scaled by the number of nucleon-nucleon binary collisions, is defined as

$$R_{AB}(p_T) = \frac{d^2 N_{AB}/dy dp_T}{\langle N_{bin} \rangle / \sigma_{pp}^{inel} \cdot d^2 \sigma_{pp}/dy dp_T} \quad (1)$$

where $\langle N_{bin} \rangle$ is the average number of binary nucleon-nucleon collisions per event, and $\langle N_{bin} \rangle / \sigma_{pp}^{inel}$ is the nuclear overlap function $T_{AB}(b)$.

Fig. 3 shows the rapidity asymmetry for ϕ mesons in $d + Au$ collisions. The rapidity asymmetry (Y_{asym}) is the ratio of particle yields at backward rapidity to those at forward rapidity, is defined as

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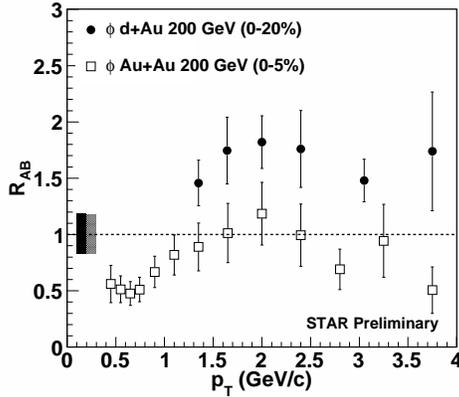


FIG. 2: p_T dependence of the nuclear modification factor R_{AB} for ϕ in 0-20% $d + Au$ and 0-5% $Au + Au$ [3] collisions at $\sqrt{s_{NN}} = 200$ GeV.

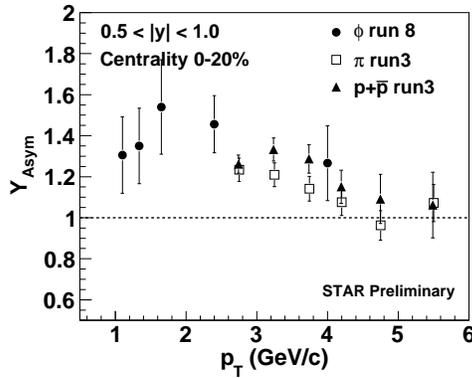


FIG. 3: Rapidity asymmetry factor (Y_{asym}) for ϕ for $0.5 < |y| < 1.0$ in 0-20% $d + Au$ collisions. For comparison $\pi^+ + \pi^-$ and $p + \bar{p}$ results from STAR [4] are also shown.

$$Y_{asym}(p_T) = \frac{Y_B(p_T)}{Y_F(p_T)} \quad (2)$$

where Y_F and Y_B are forward and backward particle yields, respectively.

The nuclear modification factor in $d + Au$ collisions are compared to that from central $Au + Au$ collisions with $\sqrt{s_{NN}} = 200$ GeV. It is observed that the nuclear modification factor is higher in $d + Au$ compared to central $Au + Au$ collisions. The rapidity asymmetry is compared to available corresponding results for pion and proton. No strong particle species dependence is observed. Details of the analysis and physical interpretation of the observations will be discussed.

References

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