Measurement of Neutral Pion Transverse Momentum Distributions at $\sqrt{s_{NN}} = 130$GeV Au+Au Collisions

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One of the proposed QGP signatures is the jet-quenching effect[1]. In the Quantum Chromo Dynamic(QCD) calculation, the scattered partons arising from collisions are predicted to lose greater energy in the QGP matter than in the hadron matter. The hard π^0 fragmented from the jet can be used as a probe to detect the energy loss in the QGP matter. Below, we present the result of π^0 measurement at $\sqrt{s_{NN}} = 130$GeV Au+Au collisions.

The PHENIX[2] experiment is one of four experiments being conducted at RHIC. In 2000, RHIC produced collisions of gold ions at beam energies of up to 65GeV per nucleon with $5 \times 10^{25}\mathrm{cm}^{-2}\mathrm{sec}^{-1}$ luminosity. The two photons decayed from π^0 were measured by the PHENIX EMCal[3] with -0.35 to 0.35 rapidity coverage. To identify photons, we applied time-of-flight and shower profile cuts, which helped reduce the nonphoton background by a factor of 2 to 20 depending on the energy region. After combinatorial background subtraction, and acceptance and efficiency corrections[4], the π^0 yields were obtained in different centrality collisions.

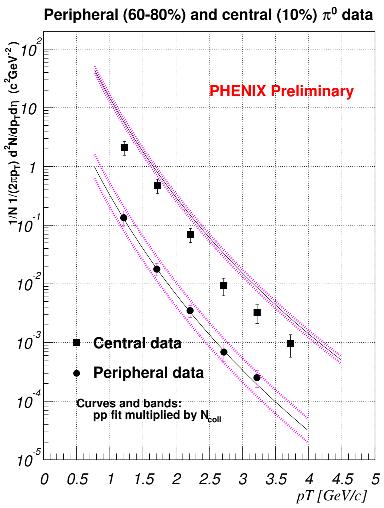

Fig. 1. The yields per collision for π^0 as a function of p_T for $60-80\%$(lower squares) and $0-10\%$(upper squares) centrality event samples with references (line) to the yield per collision in N+N collisions of π^0 scaled up by $\langle N_{binary}\rangle$. The error bars indicate the quadrature sums of systematic and statistical errors, and bands of reference indicate the uncertainty in the N+N reference and in the determination of $\langle N_{binary}\rangle$.

Figure 1 shows the yield per event as a function of p_T for $60-80\%$ and $0-10\%$ centrality event data. In the peripheral, the data shows consistency with the $p+p$ data scaled by the number of binary collisions (=20), which is determined using the Glauber model. Figure 2 shows the ratio of yield per collision in the central to that in the peripheral, each divided by $\langle N_{binary}\rangle$. The ratio in the p_T lower than 2GeV, which is dominated by soft π^0, obeys $\langle N_{participant}\rangle$ scaling, so that the ratio is obviously smaller than 1. In higher p_T, the π^0 ratio shows a significant suppression from $\langle N_{binary}\rangle$ scaling. The square shown in the figure is the ratio for charged hadrons[5] which also indicates suppression.

In conclusion, we observed a significant suppression of the π^0 yield in central collisions relative to out expectation from binary scaling in higher p_T, where the hard π^0 from the jet dominates.

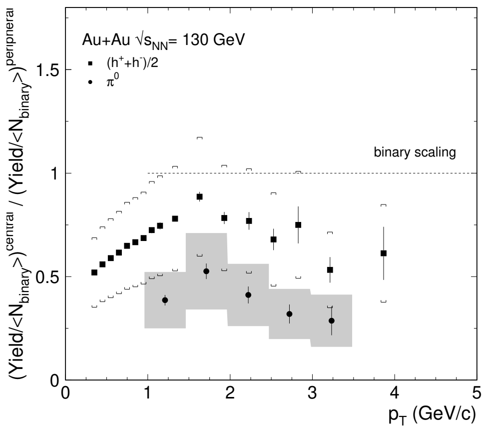

Fig. 2. π^0(square) and $(h^+ + h^-)/2$(circle) ratio of yield per event in the central to that in the peripheral Au+Au collisions as a function of p_T, with divided by $\langle N_{binary}\rangle$ for that class. The surrounding bands (shaded for π^0's, brackets for $(h^+ + h^-)/2$) are the quadrature sums of (i) the parts of the systematic errors on the spectra that do not cancel in the ratio, and (ii) the uncertainty in $\langle N_{binary}\rangle$.

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