Results on Identified Hadron Spectra from the PHENIX Experiment at RHIC

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PHKENIX Space-time Evolution of System at RHIC



• Hadrons reflect the bulk property of created system and its evolution. • High p_T hadrons carry information at the early stage of the system.



In this presentation ...

1. Hydrodynamic Collective Expansion

- Identified charged hadron spectra and $< p_T >$.
- Hydro-dynamical model fit to the spectra.

2. Early Stage of the Collision System

- Neutral pions at high p_T (< 10 GeV/c).
- Particle compositions at high p_T : p/π ratio vs. p_T and centrality.

We present the first results of identified charged and neutral hadrons in Au+Au @ $sqrt(s_{NN}) = 200$ GeV at midrapidity from the PHENIX experiment.



Event Selection



• Centrality selection : Used charge sum of Beam-Beam Counter (BBC, $|\eta|=3\sim4$) and energy of Zerodegree calorimeter (ZDC) in minimum bias events.

• Extracted N_{part} based on Glauber model.



Particle Identification



- Charged particle PID by TOF p, K < 2 GeV/c proton, anti-proton < 4 GeV/c $\Delta \phi = \pi/4$
- π^{0} measurement by EMCal 1<p_T<10GeV/c 6 lead- Scintillator (PbSc) sectors 2 lead- glass (PbGl) sectors $\Delta \phi = \pi$



PHENIX Identified Single Particle Spectra



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 $< p_T > VS. N_{part}$



Clear mass dependence of <p_T> : π < K < proton (pbar)
 ⇒ Consistent with hydrodynamic expansion picture.
 Tats •Increase of <p_T> as a function of N_{part} and tends to saturate.



Hydrodynamic Model Fit



Simultaneous fit in range (mt -m0) < 1 GeV The top 5 centralities are scaled for visual clarity. Similar fits for positive particles.

Ref: E. Schnedermann, J. Sollfrank, and U. Heinz, Phys. Rev. C 48, 2462 (1993)

PHENIX Freeze-out Temperature and Flow Velocity



 β_T increases from peripheral to mid-central (N_{part} < 150) and tends to saturate for central collisions.

PHENIX Hadron Production at High p_T in AA



- R_{AA} =1 : Scale with # of binary collisions (N_{coll})
- R_{AA} >1 : Cronin effect observed in ISR and SPS
- R_{AA} <1 : Suppression
 Observed at RHIC in
 130GeV AuAu central data

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Nuclear Modification Factor





PH ENIX p_T Spectra for π^0 at 200 GeV



PHENIX R_{AA} for π^0 in Central and Peripheral







• proton yield is comparable with pions @ 2 GeV in central collisions, less in peripheral.

• Similar behavior have been seen for pbar/ π ratio. Tatsuya CHUJO/ BNL PANIC 2002, 10/1/2002



Baryon - Meson Ratio

- Strong flow effect from expansion for proton (less in pions) : enhancement of p and pbar yield at high p_T.
- 2. Pion suppression at high $p_{T_{.}}$
 - ⇒ May cause the observed comparable yield of p and π at 2 GeV/c in spectra in central AuAu.



Summary

We presented the first results of identified charged particles and neutral pions spectra at 200 GeV in AuAu at RHIC.

1. Identified Charged Hadron Spectra

- indication of a strong collective expansion at central collisions.
- <p_T > vs. mass : the heavier mass, the larger <p_T >.
- <p_T > vs. centrality : steep rise at peripheral to mid-central collisions.
- Hydro-dynamical model fit to the spectra

 $\Rightarrow \beta_T = 0.7$, $T_{fo} = 110 \text{ MeV}$

2. High p_T Hadron Production

- Observed strong neutral pion suppressions at High p_T in central AuAu.
- proton yield is comparable with pions @ 2 GeV in central collisions, less in peripheral.
 - ⇒ maybe due to 1) high pT pion suppression and 2) hydrodynamic flow effect for proton.





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