Measurement of Identified Hadron Spectra and Yield Ratios in pp(*) and AuAu Collisions at $\sqrt{s_{NN}} = 200$ GeV

(*) For pp, only ratios are shown in this presentation.

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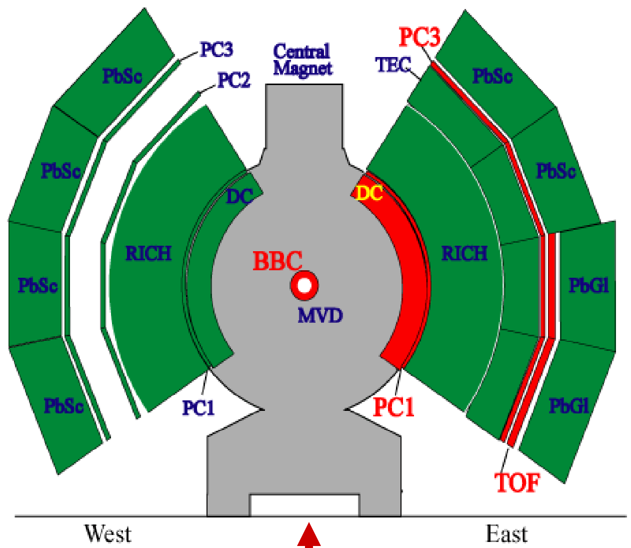
Physics motivations

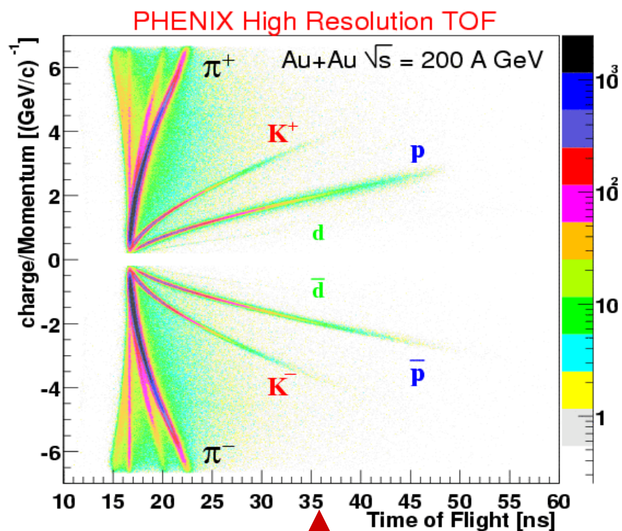
To characterize H.I. collisions, hadrons would become probes for the final stages (comparing to the earlier stage where hard scattering occurs), like kinetic freeze out (spectra shape), or chemical freeze out (particle yields, e.g. ratios),

and corresponding value for nucleon-nucleon (pp) collision is a base to see capabilities of any (non-)scaling behavior in yield or ratio, or their p_T dependences.

Phenix detectors for event selection and for PID

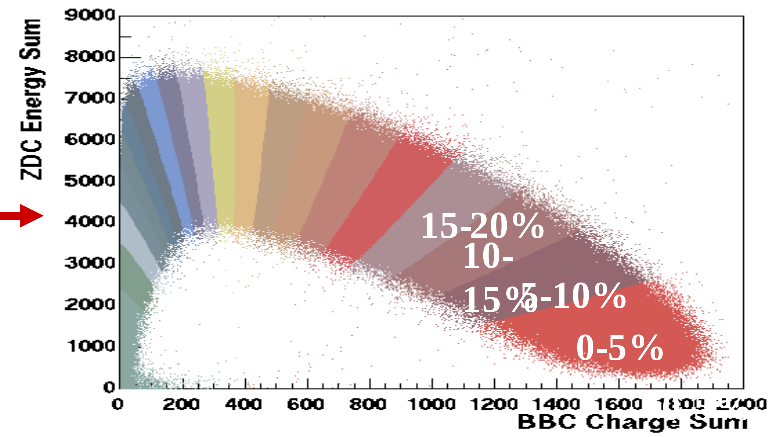


Subsystems used for PIDed hadron analysis

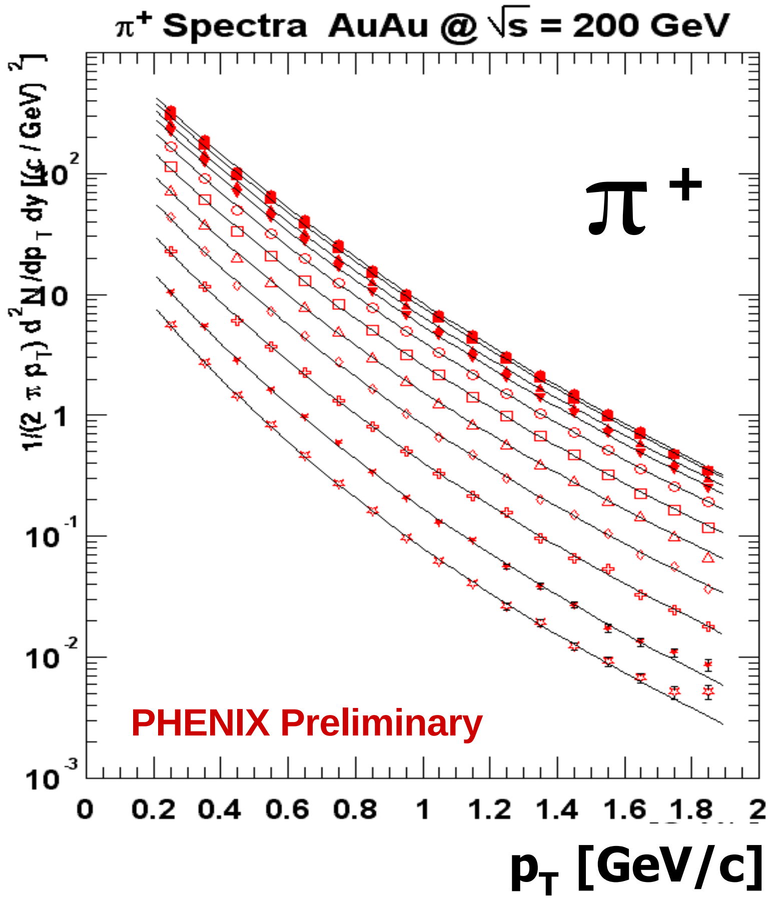


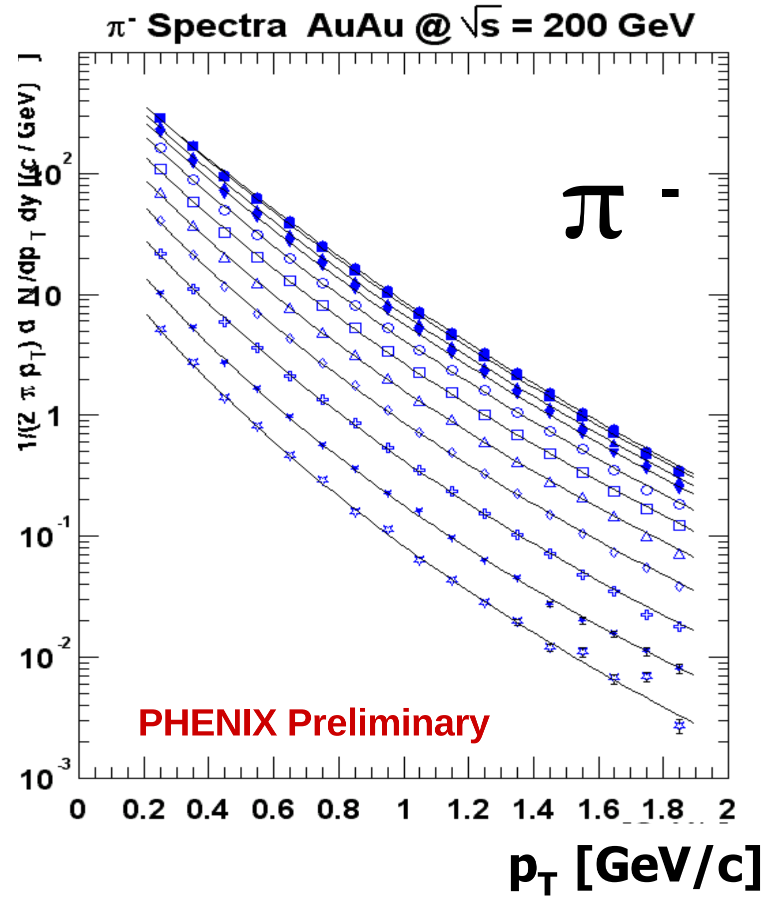
TOF inclusive time resolution is ~120ps

Centrality selection :
using charge sum of Beam-Beam Counter (BBC, | ? |=3~4) and energy of Zero-degree calorimeter (ZDC) in minimum bias events.
Extracted N_{part}: based on Glauber model.



Pion p_T spectra (centrality dependence)

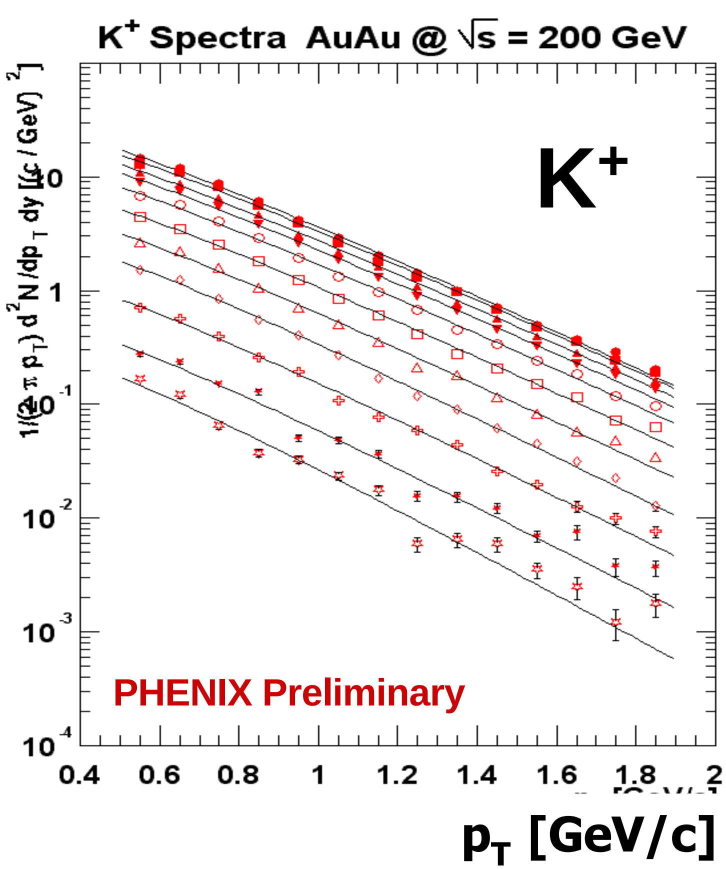


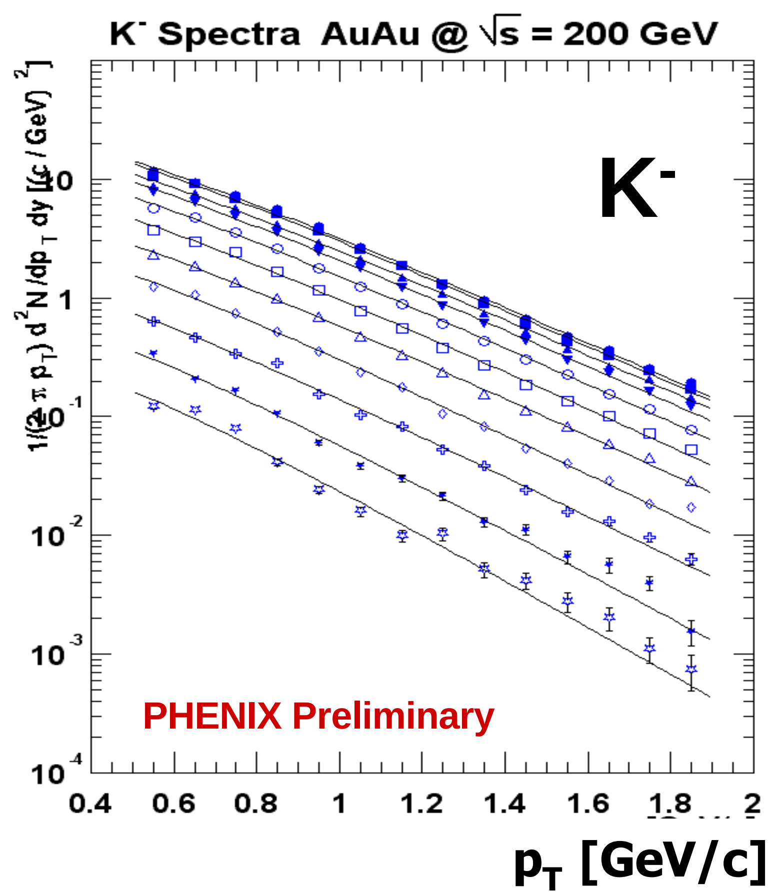


centrality
- 0 - 5 %
- 5 - 10 %
- 10 - 15 %
- 15 - 20 %
- 20 - 30 %
- 30 - 40 %
- 40 - 50 %
- 50 - 60 %
- 60 - 70 %
- 70 - 80 %
- 80 - 91 %

Characterized by <u>power law</u> ($A ?(p_T \; ? \; p_0)^{?\,n}$) for all centralities

Kaon p_T spectra



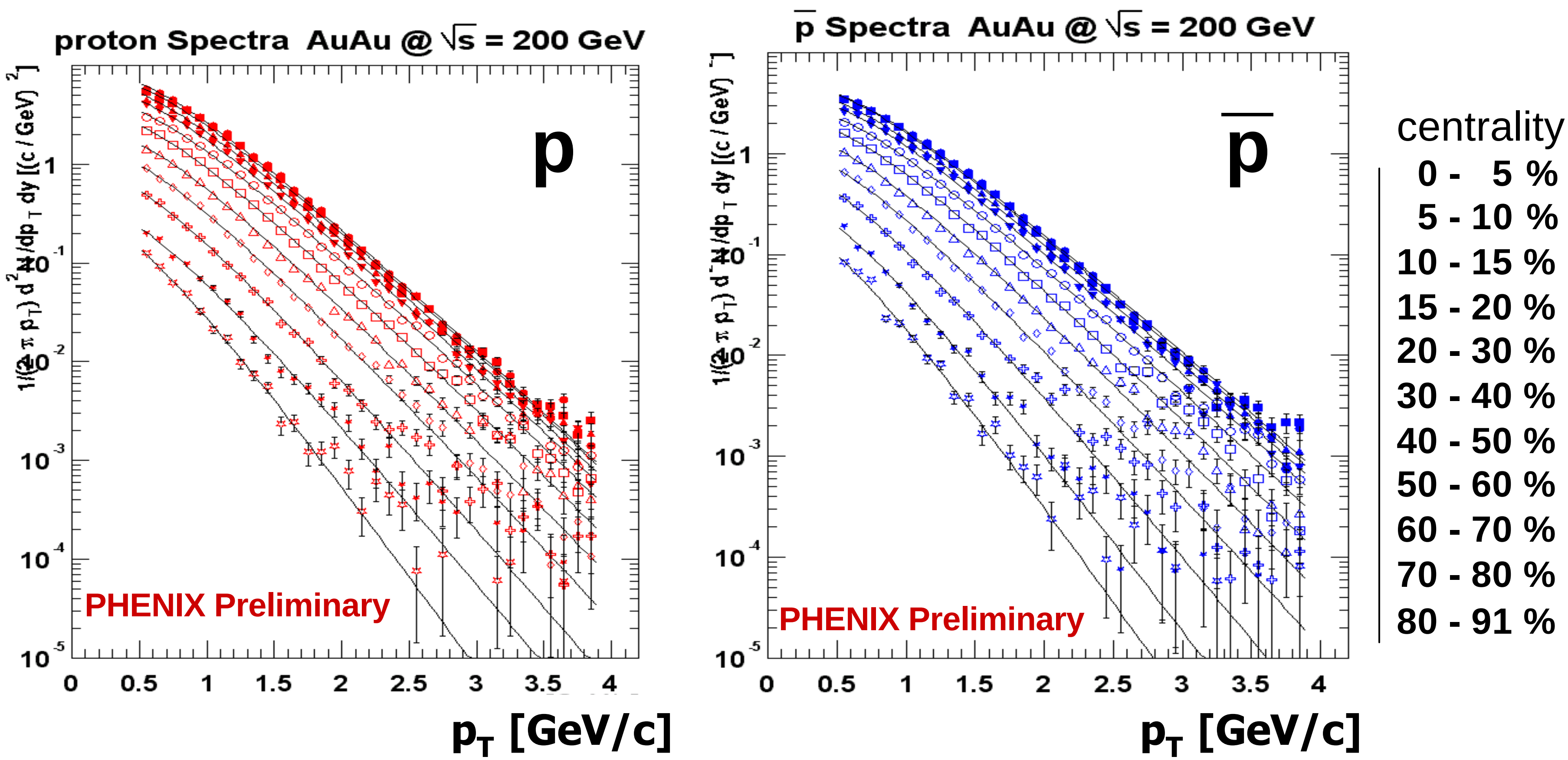


centrality

- 0 - 5 %
- 5 - 10 %
- 10 - 15 %
- 15 - 20 %
- 20 - 30 %
- 30 - 40 %
- 40 - 50 %
- 50 - 60 %
- 60 - 70 %
- 70 - 80 %
- 80 - 91 %

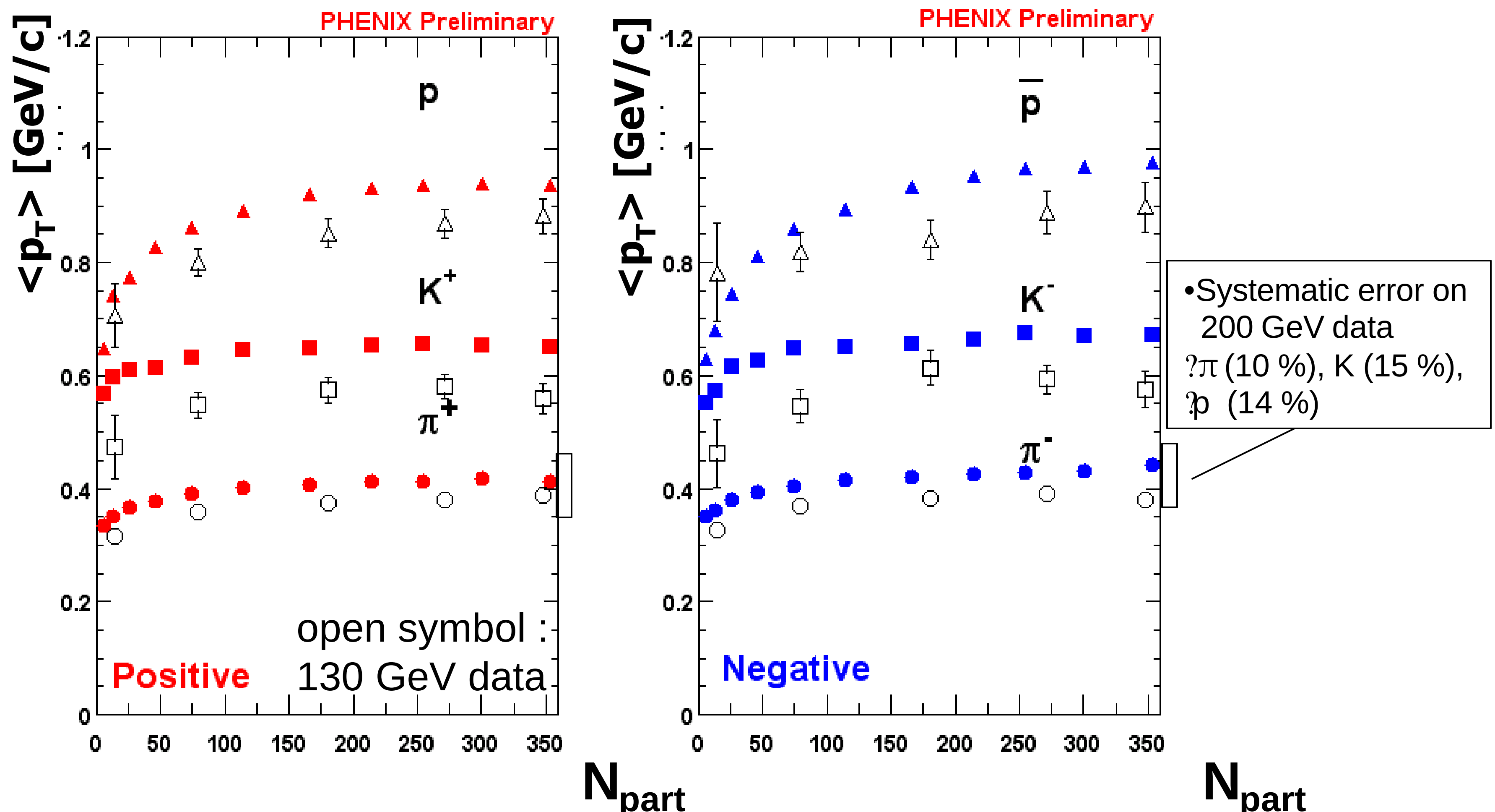
Characterized by <u>m_T exponential</u> ($A \cdot \exp(-m_T / T)$) shape for all centralities

p, pbar p_T spectra



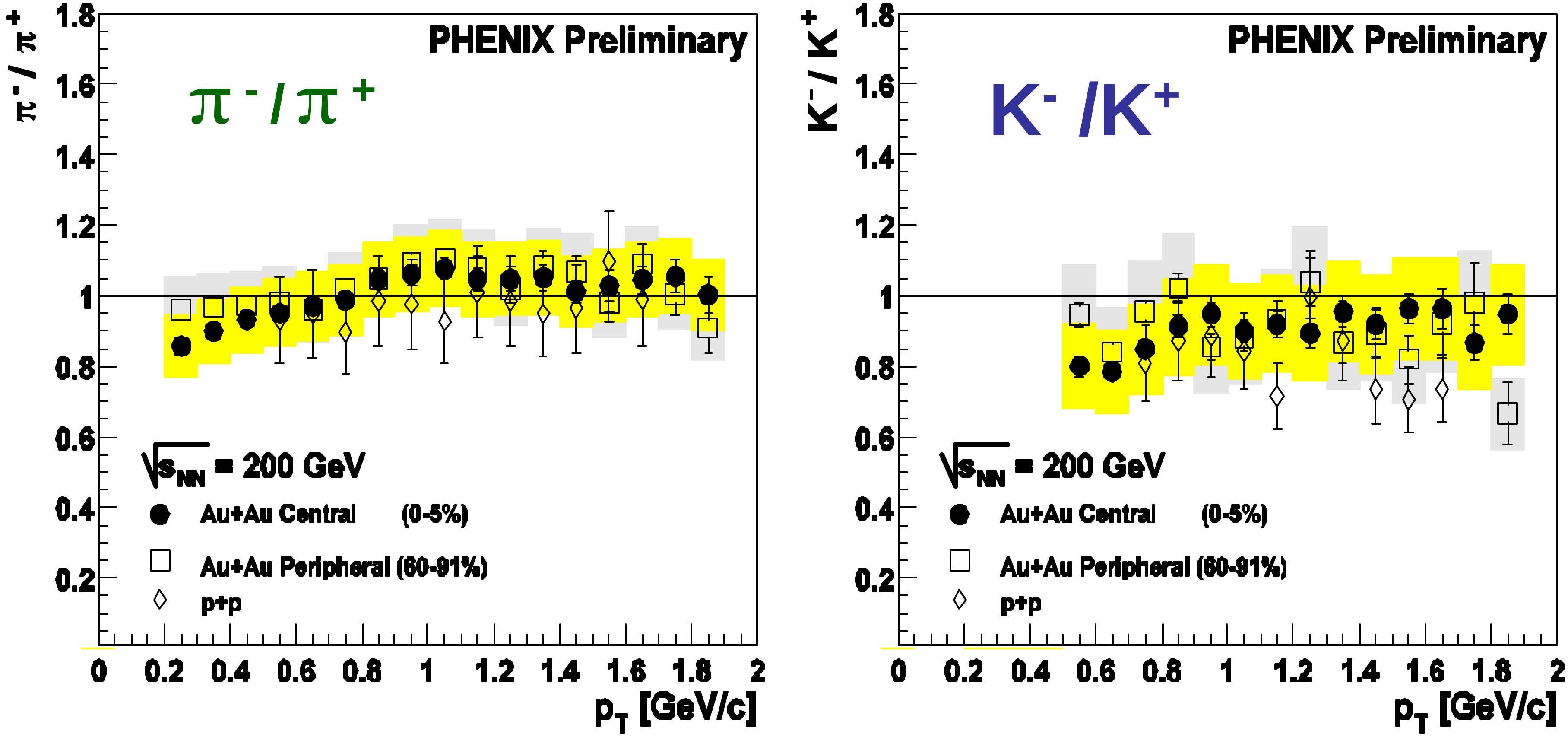
Characterized by **Boltzmann function(** $A \cdot m_T \cdot \exp(-m_T/T)$ **)shape for all centralities**

$\langle p_T \rangle$ vs. N_{part}



- **Increase of $\langle p_T \rangle$ as a function of N_{part} and tends to saturate**
  steep rise at peripheral to mid-central collisions.
- **Quantitatively consistent with expansion picture.**
  the heavier mass, the larger <pT> [π < K < proton (pbar)] .

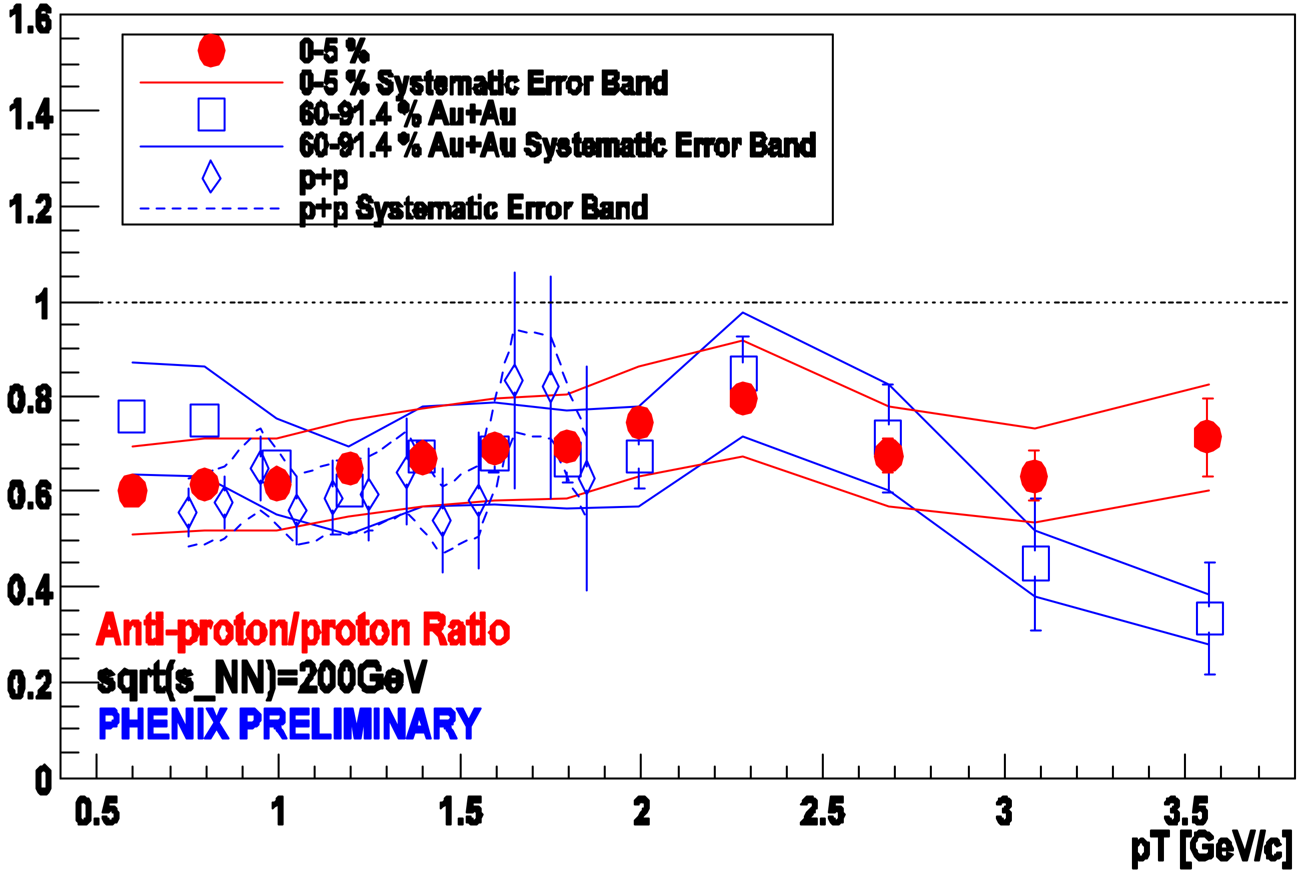
π, K (- /+) Ratio



- **Flat p_T dependence**
- **No centrality dependence**

For pp data, correction factor for efficiency, acceptance are derived from AuAu data, which is taken just before pp run.

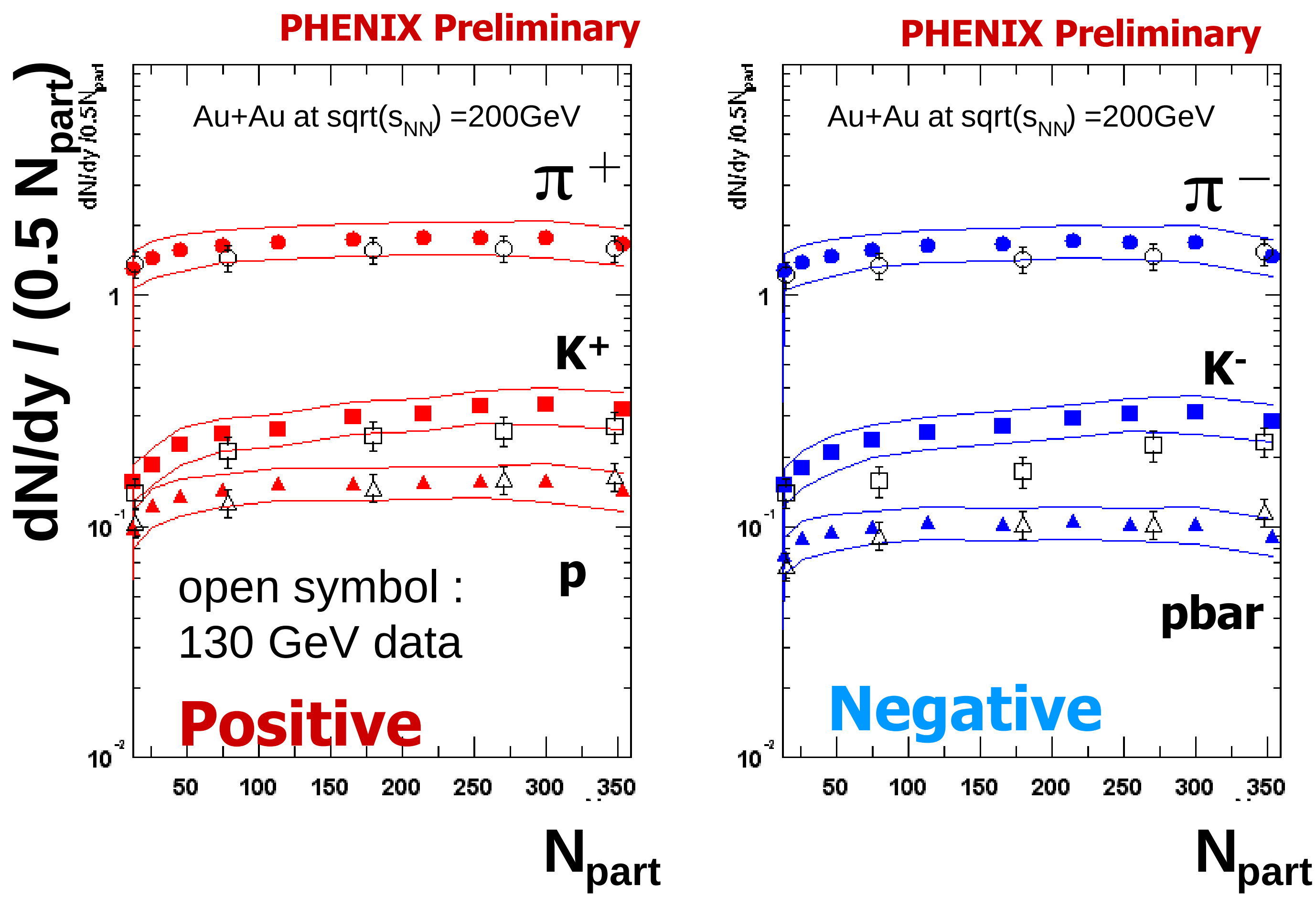
Anti-proton to Proton Ratio



- **Flat p_T dependence for central.**
- **Decreasing for peripheral > 3 GeV?**

For pp data, correction factor for efficiency, acceptance are derived from AuAu data, which is taken just before pp run.

Rapidity density (dN/dy) at mid-rapidyty



- **Similar centrality dependence 130 GeV and 200 GeV**

Summary

In $\sqrt{s_{NN}}$ = 200 GeV/c,

spectra (AuAu) are described, best by power law for pion, m_T exponential for kaon, and Boltzmann distribution for (anti-)proton,

mean p_T (AuAu) [as a function of N_{part}] is steeply rising from peripheral to mid-central, then tends to saturate,

dN/dy (AuAu) [as a function of N_{part}] has similar centrality dependencies with $\sqrt{s_{NN}}$ = 130 GeV, and

particle ratios (AuAu and pp) have flat p_T dependences, and no centrality dependences [for AuAu], except peripheral p-bar/p in > 3GeV/c (some decreasing).