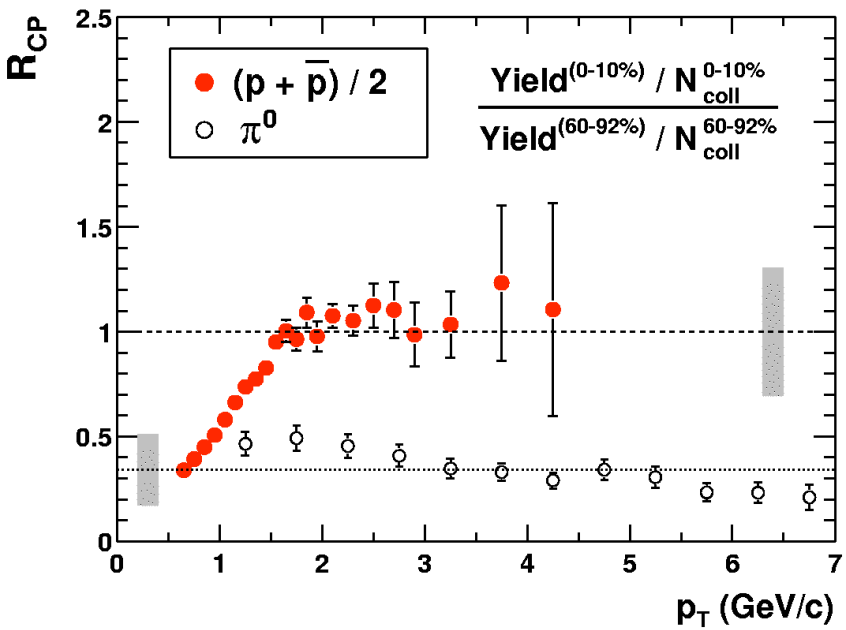
Identified Charged Hadron Production at $\sqrt{s_{NN}}$=62.4 GeV Au+Au in RHIC-PHENIX

Tatsuya Chujo
(Vanderbilt Univ)
for the PHENIX Collaboration

Physics Motivation



PHENIX: PRL 91, 172301 (2003), PRC 69, 034909 (2004)
Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV

- Strong suppression of π^0 yields above p_T ~ 2 GeV/c at RHIC, but no suppression for proton and antiproton at intermediate p_T (2-5 GeV/c): **"Baryon anomaly at RHIC"**.
- Quark recombination models are able to reproduce the data qualitatively.
- **But no SPS data for intermediate p_T baryons, don't know the applicability of recombination model works at SPS.**

Importance to measure the excitation function from SPS to RHIC:

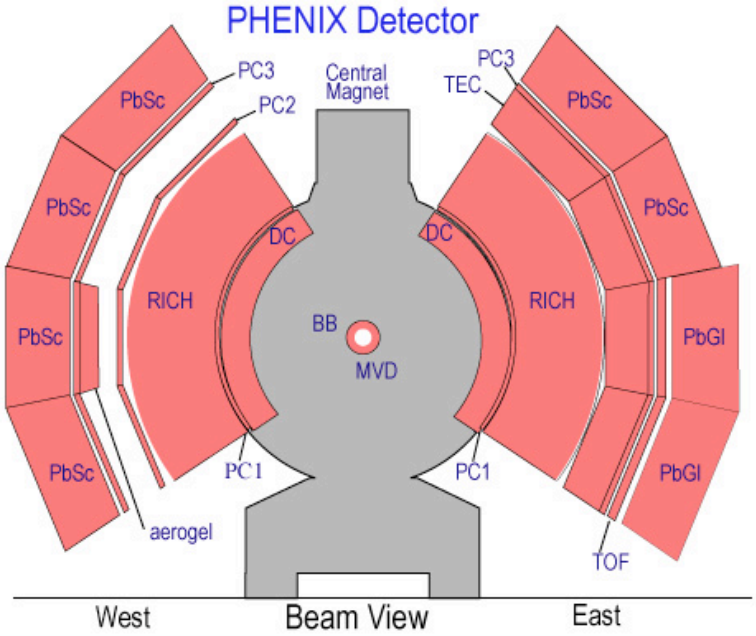
- **Onset of baryon anomaly.**
- **Baryon production and transport.**
- **Radial flow effect.**
- **Particle production at low p_T.**

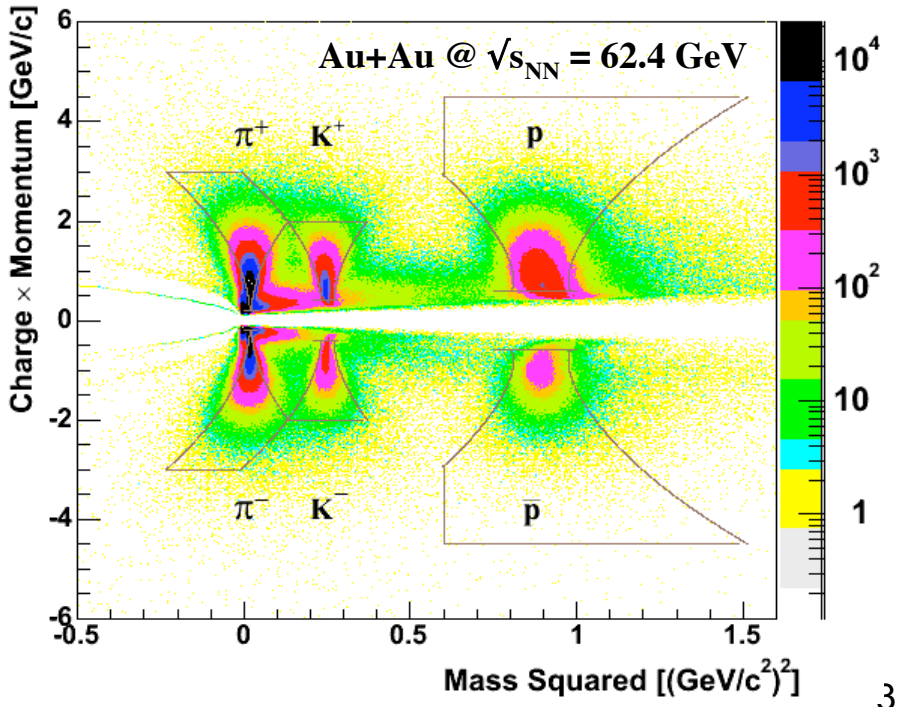
Au+Au at $\sqrt{s_{NN}}$ = 62.4 GeV data can fill the gap between SPS (17 GeV) and RHIC top energy.

Data Analysis

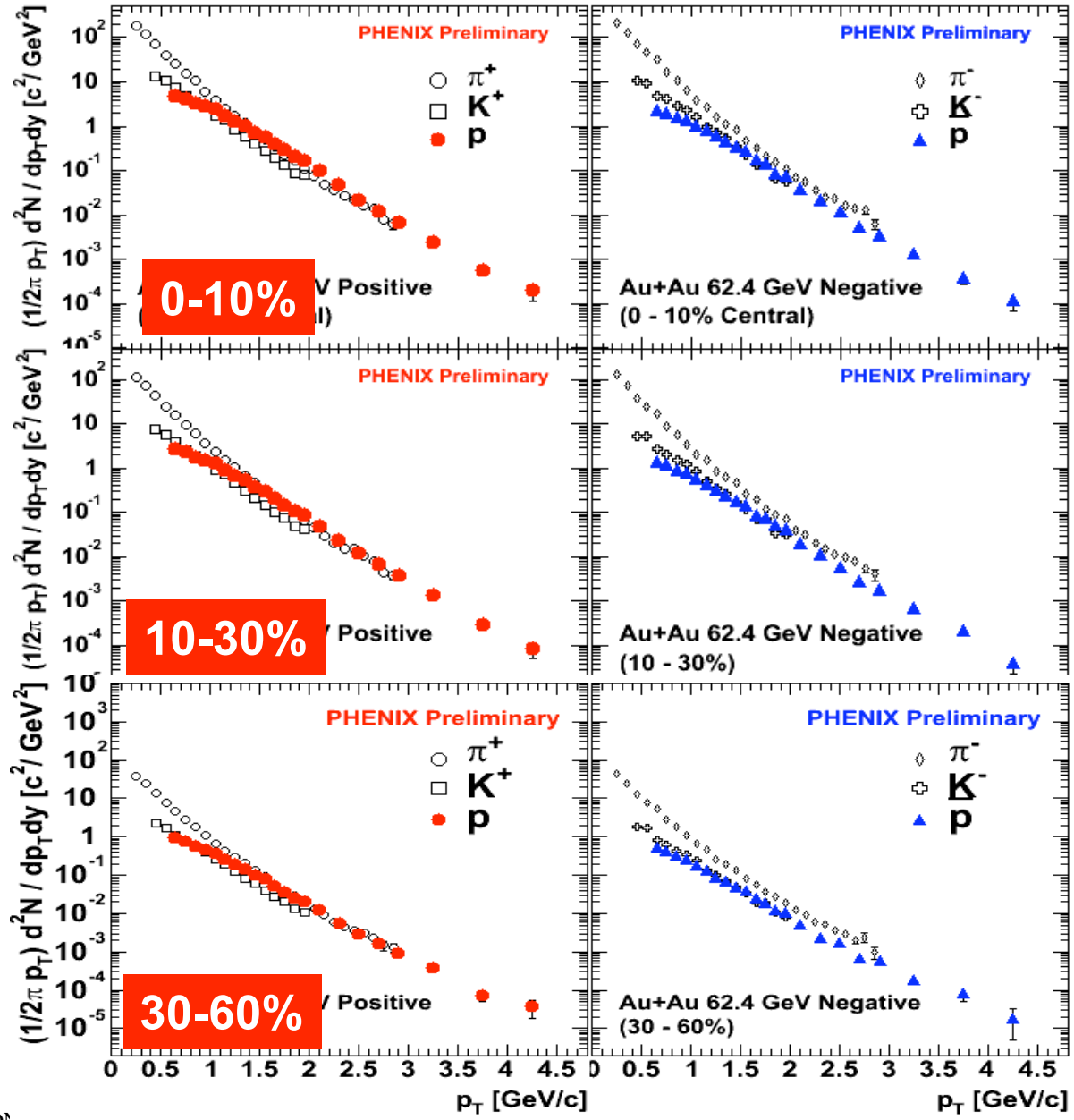
- **Data set:** Au+Au 62.4 GeV, data taken during Run4 (2004).
- **Statistics:** analyzed 37 M minimum bias (MB) events.
- **Detectors:** Drift Chamber, PC1, BBC and TOF for PID charged analysis.
- **Centrality:** subdivided MB events based on BBC charge distributions (0-10%, 10-30% and 30-60%).
- **Corrections:** Acceptance, in flight decay, detector occupancy using MC simulations.

❖ **NOTE: No weak decay feed-down correction applied.**



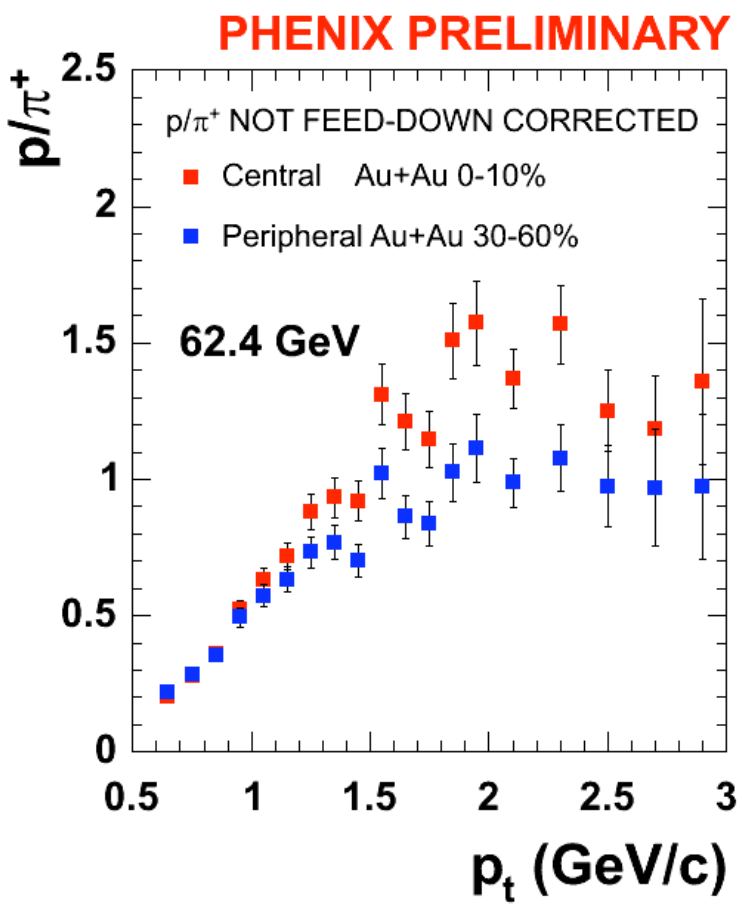


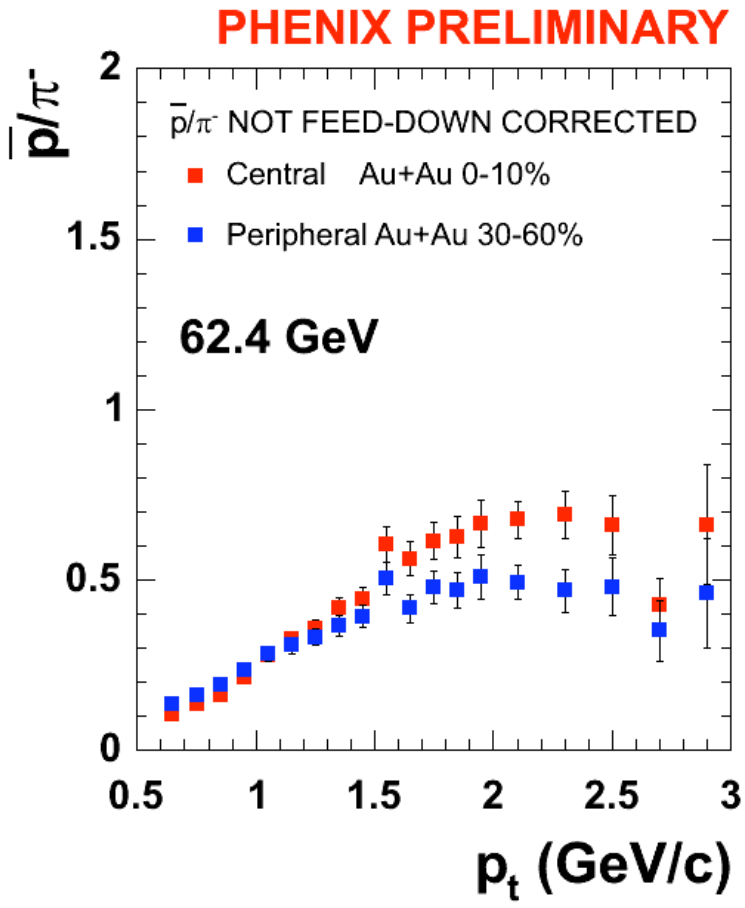
Results: p_T spectra (centrality dep.)



- Large fraction of protons are seen at intermediate p_T.
- Less for antiproton, for all centrality bins (up to 30-60%).

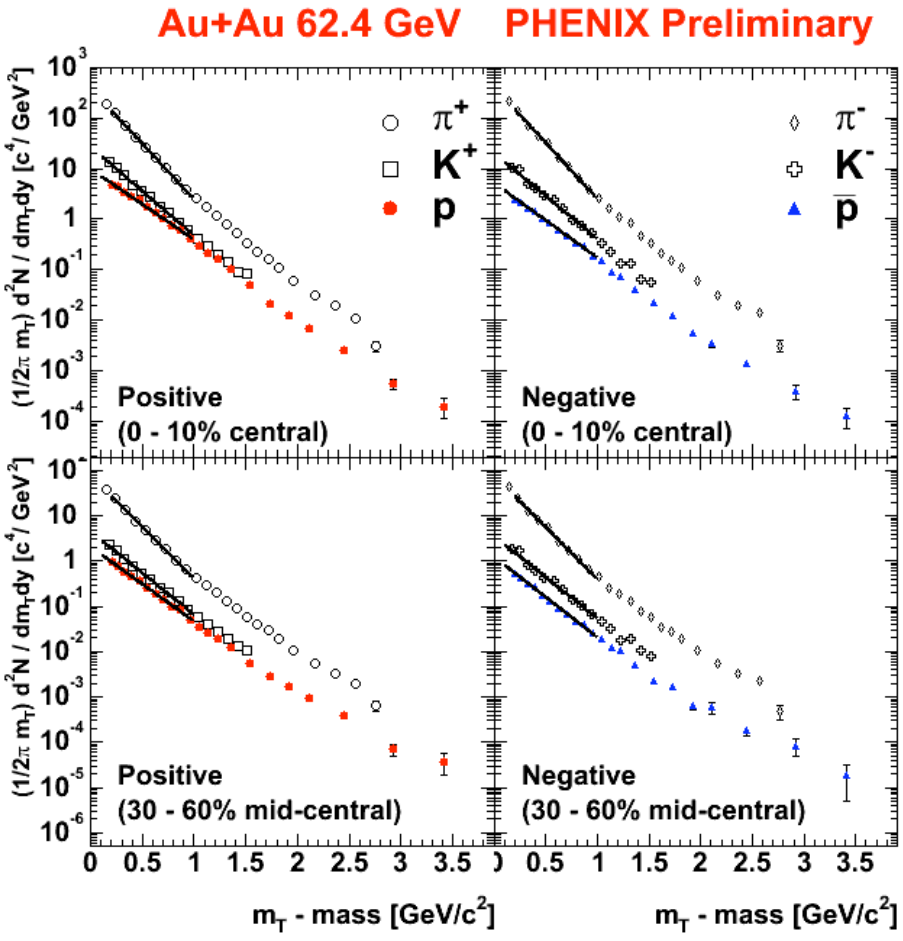
p/π ratios





- **$p/\pi^+ > 1$ at intermediate p_T** but **less for antiproton (pbar/π^- ~ 0.7)**.
- Weaker centrality dependence for both ratios than those of 200 GeV.
- **Indicating more baryon transport and less p-pbar pair production at 62 GeV than 200 GeV.**

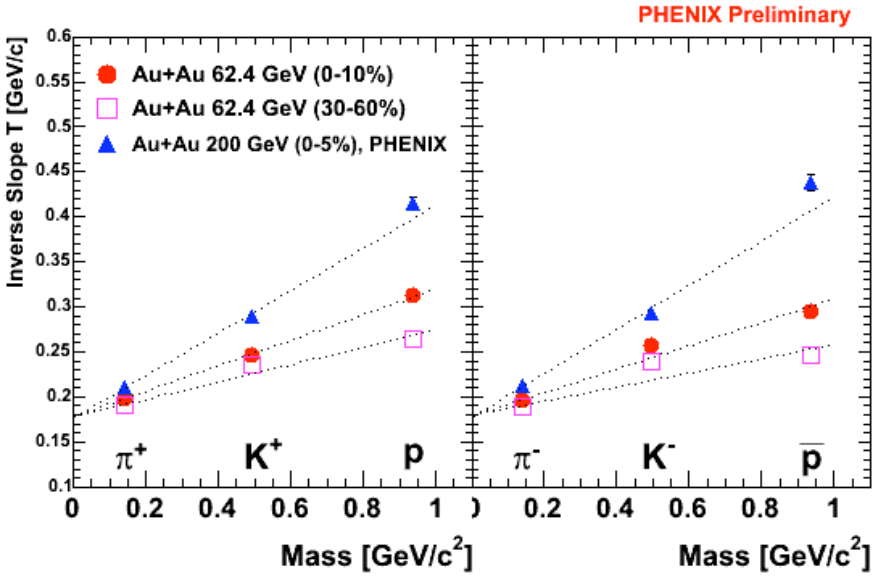
m_T spectra & inverse slops



Fitted by m_T exponential function.

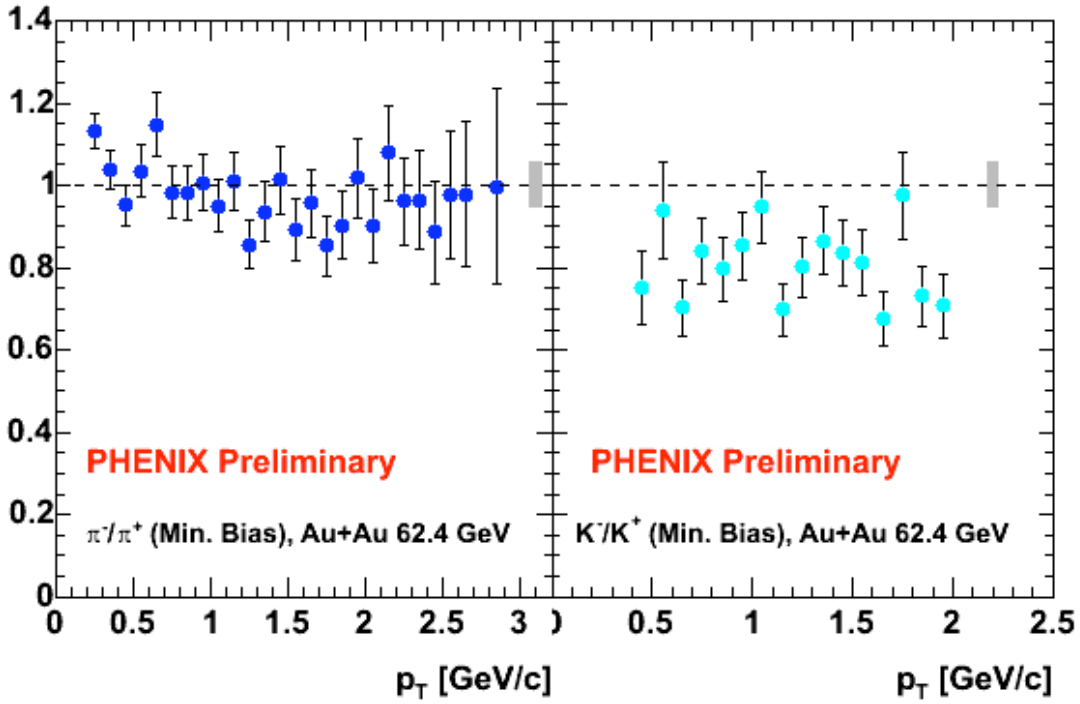
- Fit range:
- π: 0.2 - 1.0 GeV/c^2.
- p and K: 0.1 - 1.0 GeV/c^2.

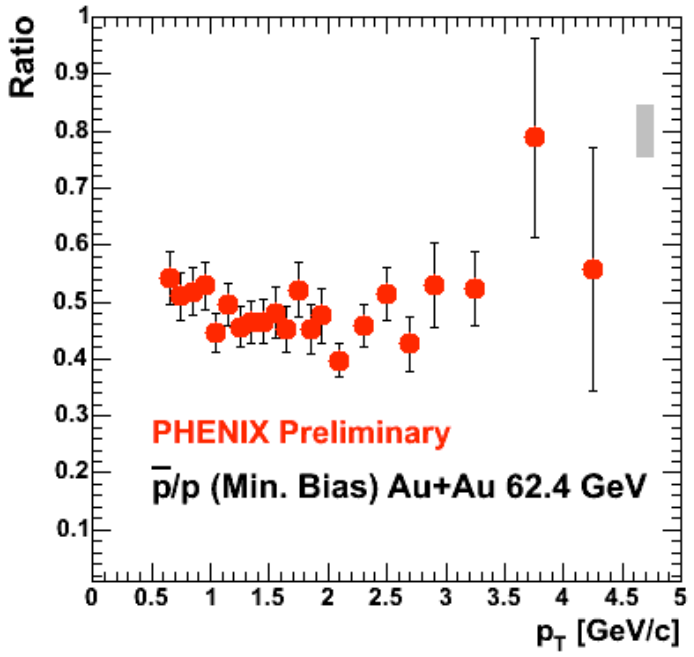
- Extracted inverse slopes



- **Large mass effect seen for central (radial flow effect).**
- **Slopes for 0-10% at 62 GeV are smaller than 200 GeV central.**

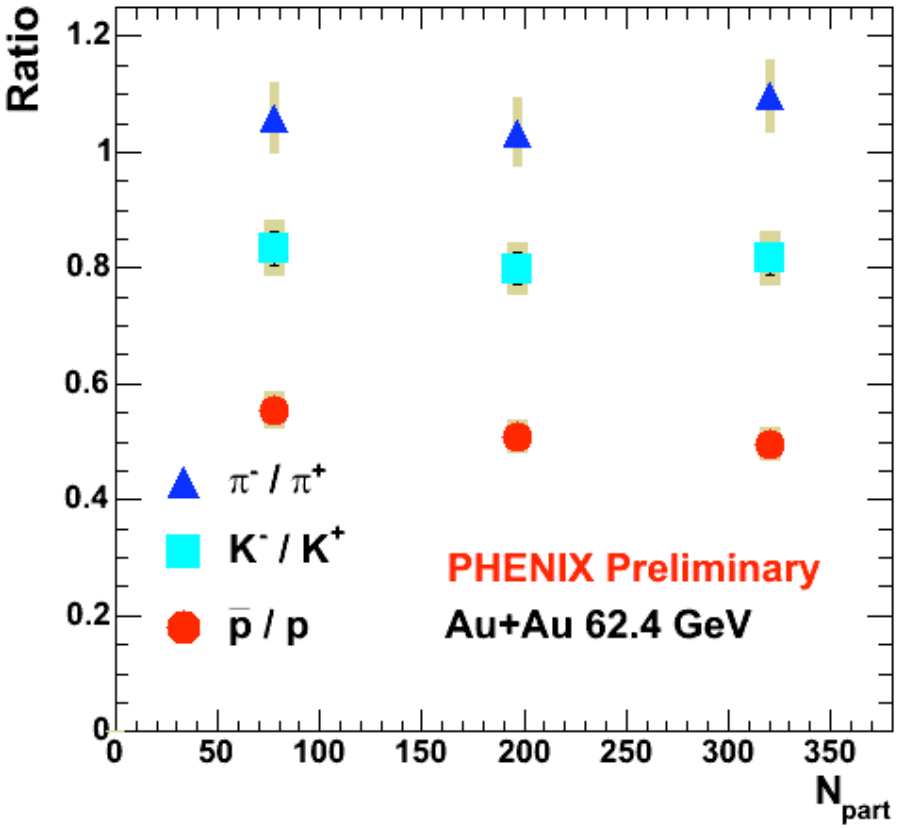
-/+ Ratios vs. p_T (Min. bias)





Flat p_T dependence for all ratios.

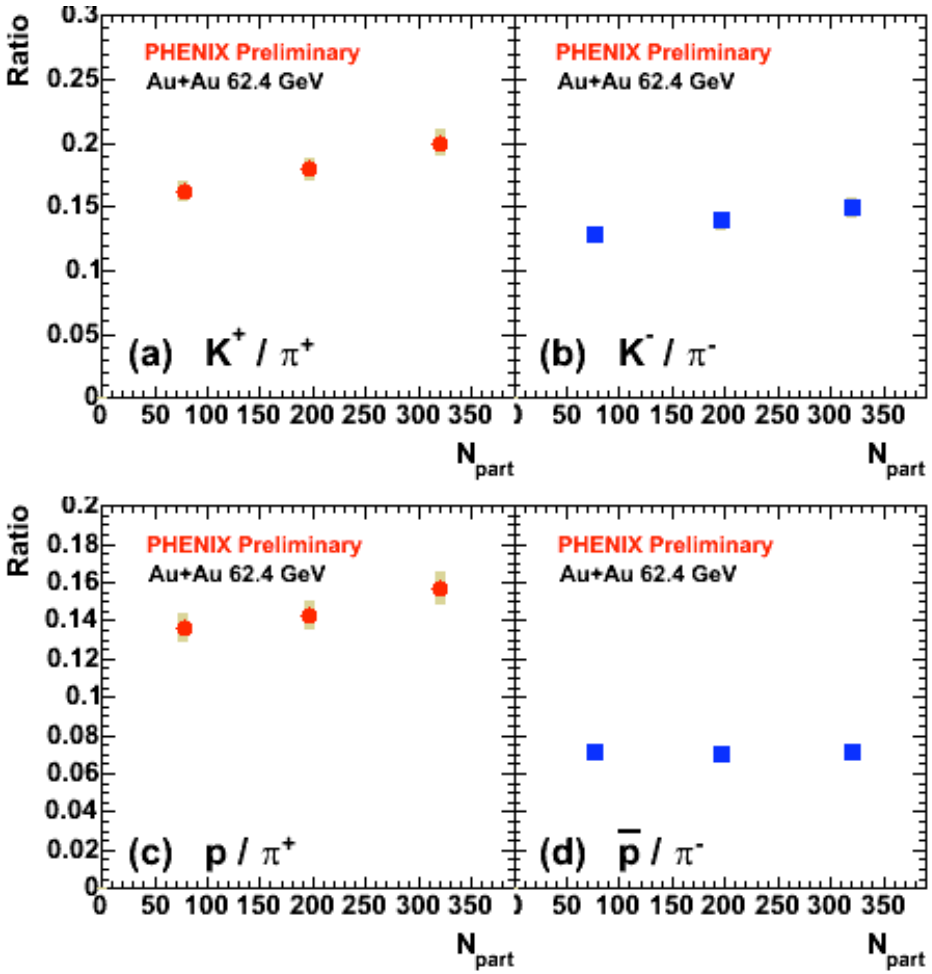
Centrality dep. of -/+ Ratios



Flat centrality dependence for all ratios from 0-10% to 30-60% centrality bins.

- **Particle ratios (Central 0-10%)**
  - π^-/π^+ = 1.097 ± 0.022 (stat.) ± 0.063 (sys.) PHENIX Preliminary
  - K^-/K^+ = 0.816 ± 0.027 (stat.) ± 0.046 (sys.) PHENIX Preliminary
  - pbar/p = 0.495± 0.012 (stat.) ± 0.029 (sys.) PHENIX Preliminary

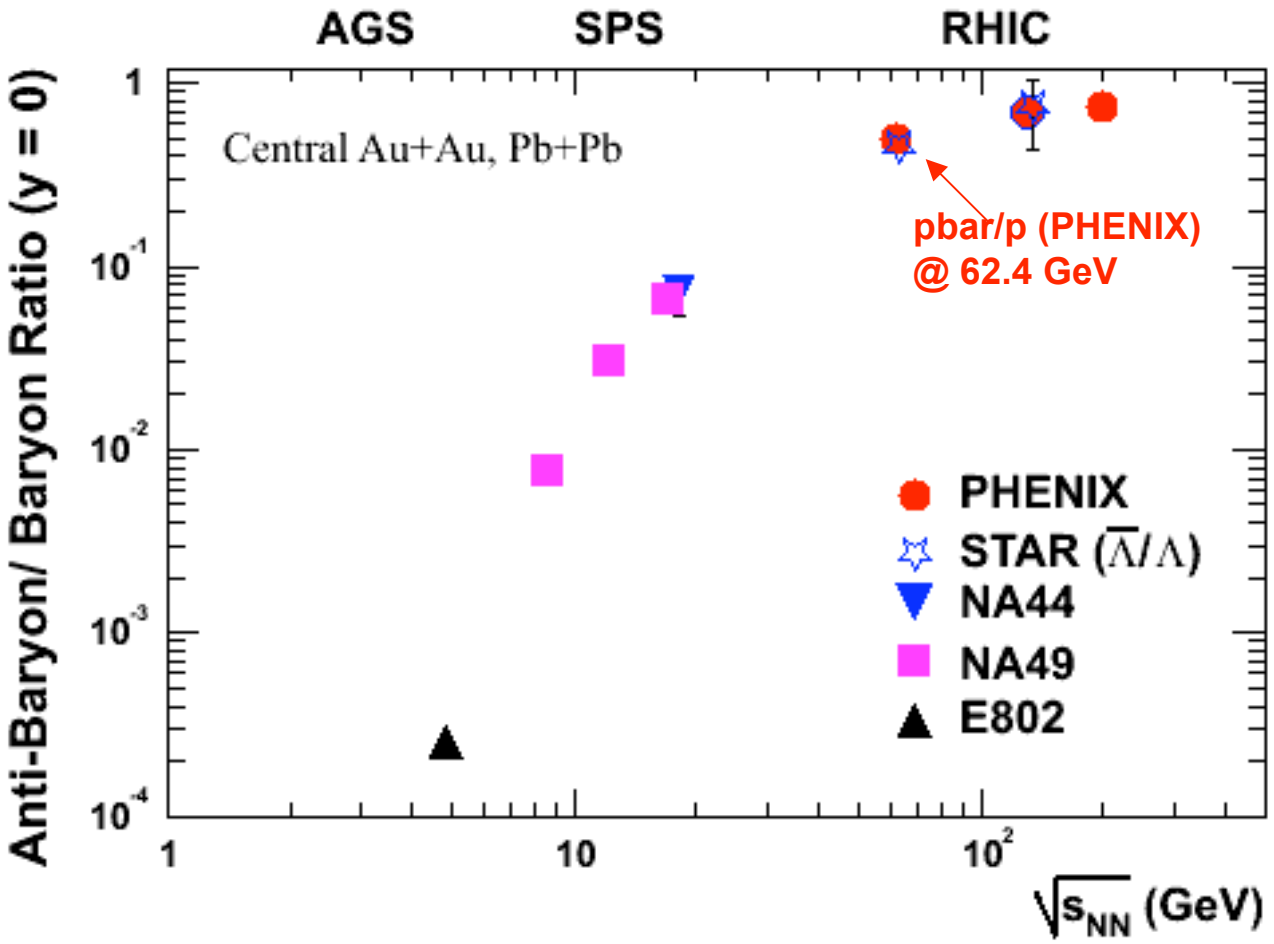
Centrality dep. of K/π and p/π



- Derived from dN/dy at mid-rapidity.
- In measured N_{part} range:
  - ❑ K/π: increasing as a function of centrality.
  - ❑ p/π^+: seems increasing.
  - ❑ pbar/π^-: constant.

- **Ratios (Central 0-10%):**
  - K^+/π^+ = 0.199 ± 0.003 (stat.) ± 0.010 (sys.) **PHENIX Preliminary**
  - K^-/π^- = 0.148 ± 0.005 (stat.) ± 0.008 (sys.) **PHENIX Preliminary**
  - p/π^+ = 0.156 ± 0.002 (stat.) ± 0.008 (sys.) **PHENIX Preliminary**
  - $pbar/\pi^-$ = 0.070± 0.002 (stat.) ± 0.004 (sys.) **PHENIX Preliminary**

Antibaryon/ baryon ratios vs. $\sqrt{s_{NN}}$ (@ mid-rapidity)



Experimental Data:

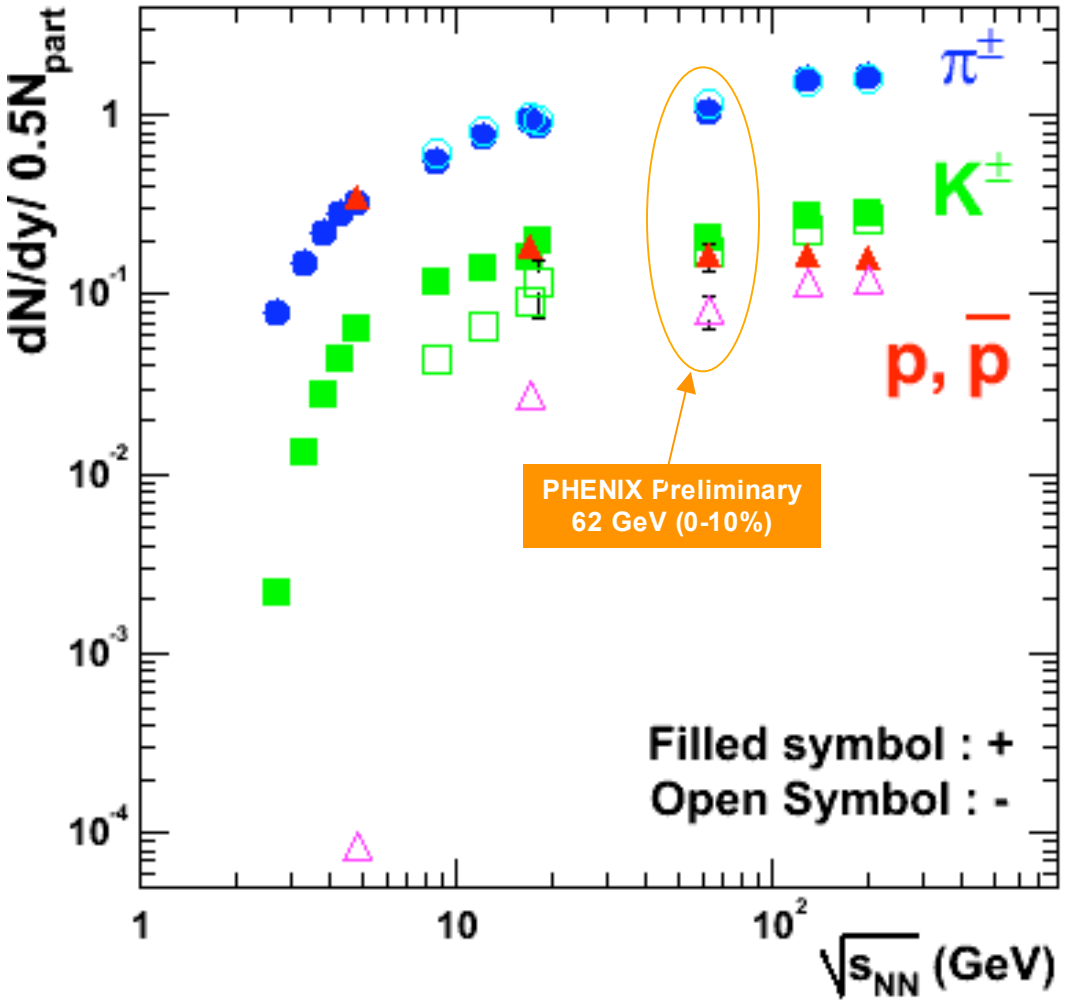
AGS:
- E802, 2650 PRL 83, (1998)

SPS:
- NA44: PRC 66, 044907 (2002)
- NA49: J. of Phys. G 30, S357 (2004)

RHIC:
- PHENIX
62 GeV (preliminary, no feed-down)
PRL 88, 242301 (2002), PRC 69, 034909 (2003), PRL 89 092302 (2002).
- STAR
62 GeV (Preliminary, HQ2004); 130 GeV
PRL 89, 092301 (2002).

- Follow the smooth curve from SPS to RHIC.
- Consistent with Λbar/Λ (STAR preliminary) at 62 GeV.

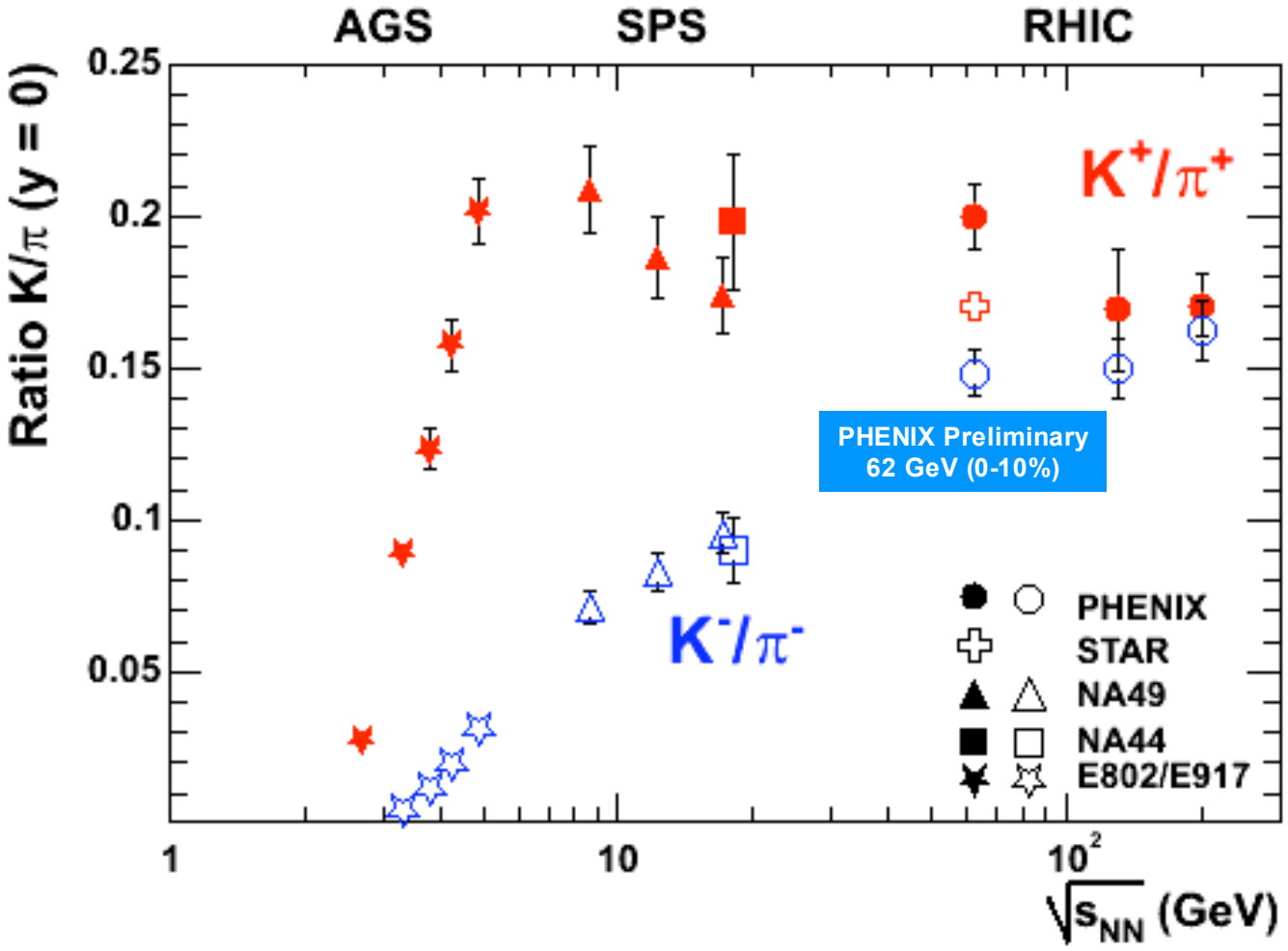
dN/dy vs. $\sqrt{s_{NN}}$ (central)



RHIC: PHENIX
SPS: NA44, NA49
AGS: E866, E917

dN/dy per N_{part} pair: smooth energy dependence from SPS to RHIC.

K/π vs. $\sqrt{s_{NN}}$



* STAR K^+/π^+: preliminary
data from SQM04, J. Takahashi

- K^-/π^- : follow the smooth curve from SPS to RHIC.
- K^+/π^+: similar to SPS top energy.

Summary

- We presented $\pi^{\pm}$,$K^{\pm}$,p and antiproton p_T spectra, inverse slopes, yields and particle ratios in Au+Au 62.4 GeV.
- Observed a large proton contribution at intermediate p_T, as seen in 200 GeV data, but less for antiprotons.
- Antiproton-to-proton ratio is ~0.5 at 62 GeV, which indicates less p-pbar pair production and larger baryon transport than 200 GeV.
- Smooth excitation function for both yields and ratios from SPS to RHIC.
- Outlook:
  - R_{AA} for PID charged hadrons by using ISR p+p data.