Particle ratios in PHENIX at RHIC

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Motivation

PHENIX

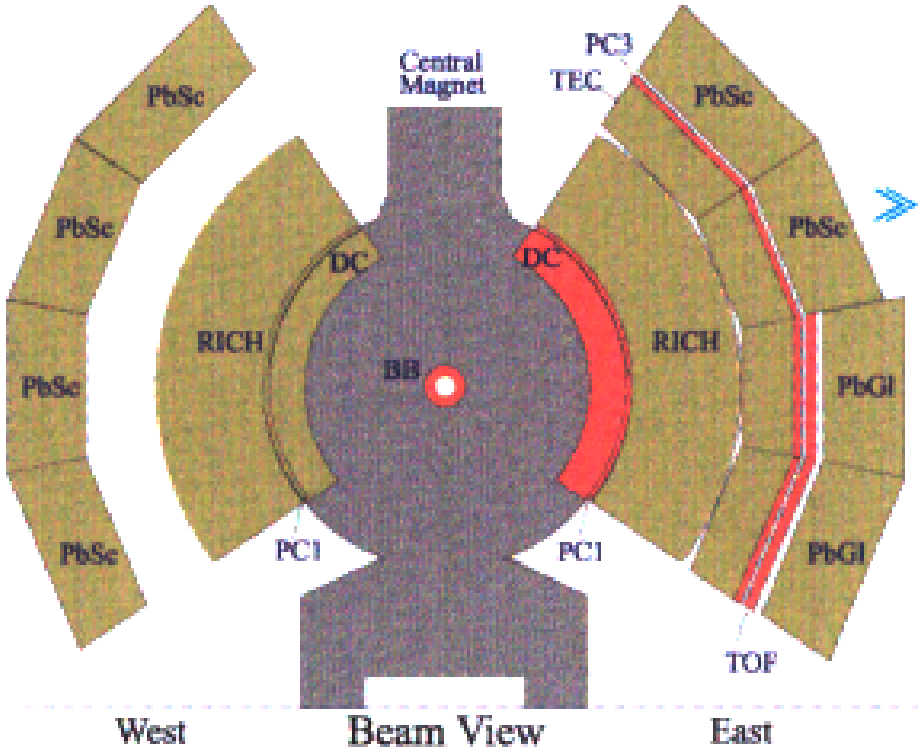
- Investigation of particle production mechanism in heavy ion collisions.
- What can we learn from Hadron physics
  - Hadrons have basic information about collision dynamics.
    - Freeze-out temperature.
    - Expansion velocity.

    } ⇒ Single particle spectra
    - Source size at Freeze-out. ⇒ HBT, coalescence radius
    - Chemical potential of quarks. ⇒ Particle ratios
  - This information will define boundary conditions of collision dynamics. This will be a first step to investigate whether Quark-Gluon-Plasma is formed or not.

Outline

- Particle ratios in Au+Au collisions at $\sqrt{s_{NN}}$=130 GeV
  - Experimental setup
  - Particle identification
  - Identified Hadron spectra
  - Particle ratios
    - as a function of Centrality and P_T
  - Conclusion.

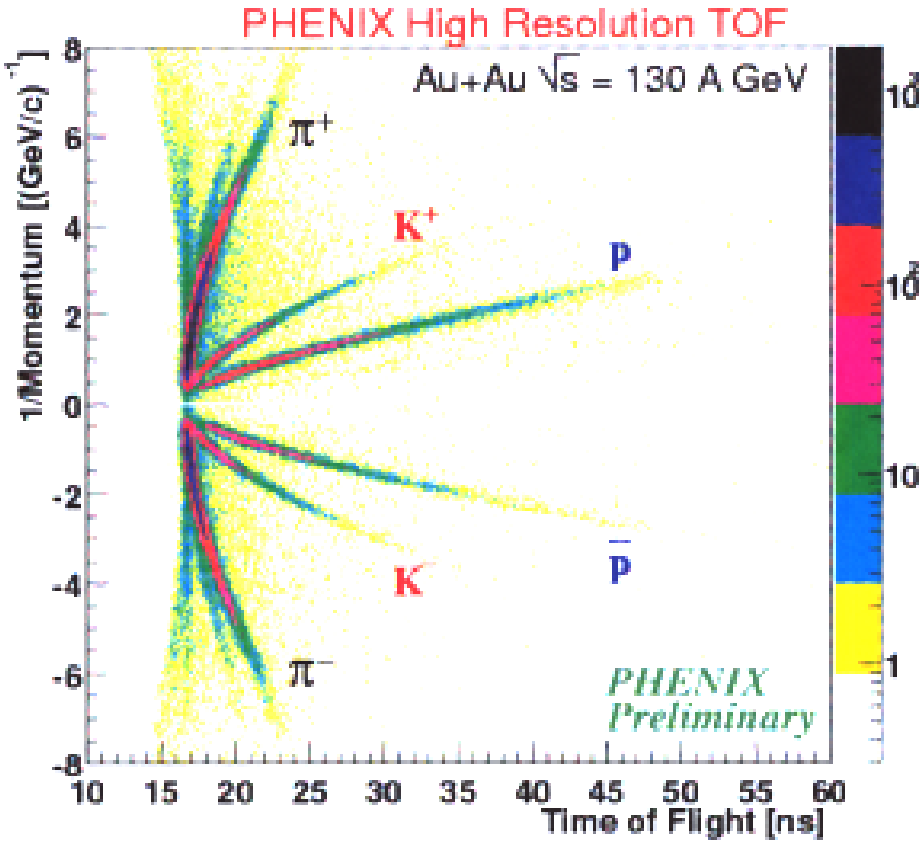
The PHENIX Experiment

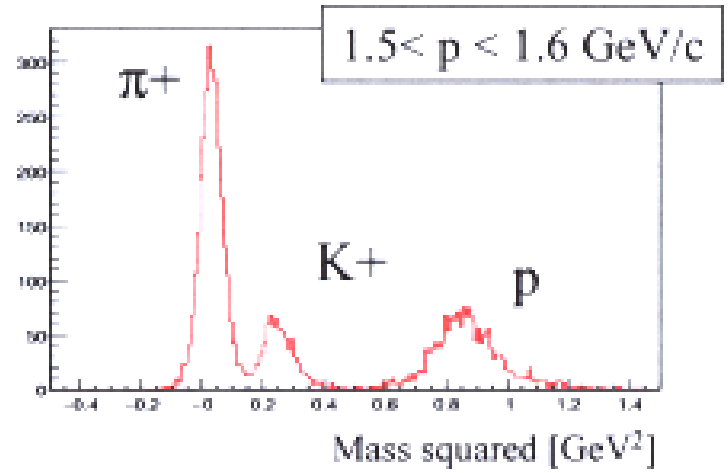


- Tracking system.
  - DC + PC1 + PC3.
- Hadron Identification.
  Time-of Flight measurement
  (Beam/Beam Counter -ToF)
  Time of Flight resolution
  ~120 ps.

Particle identification

- Particle identification via Time-of-Flight.

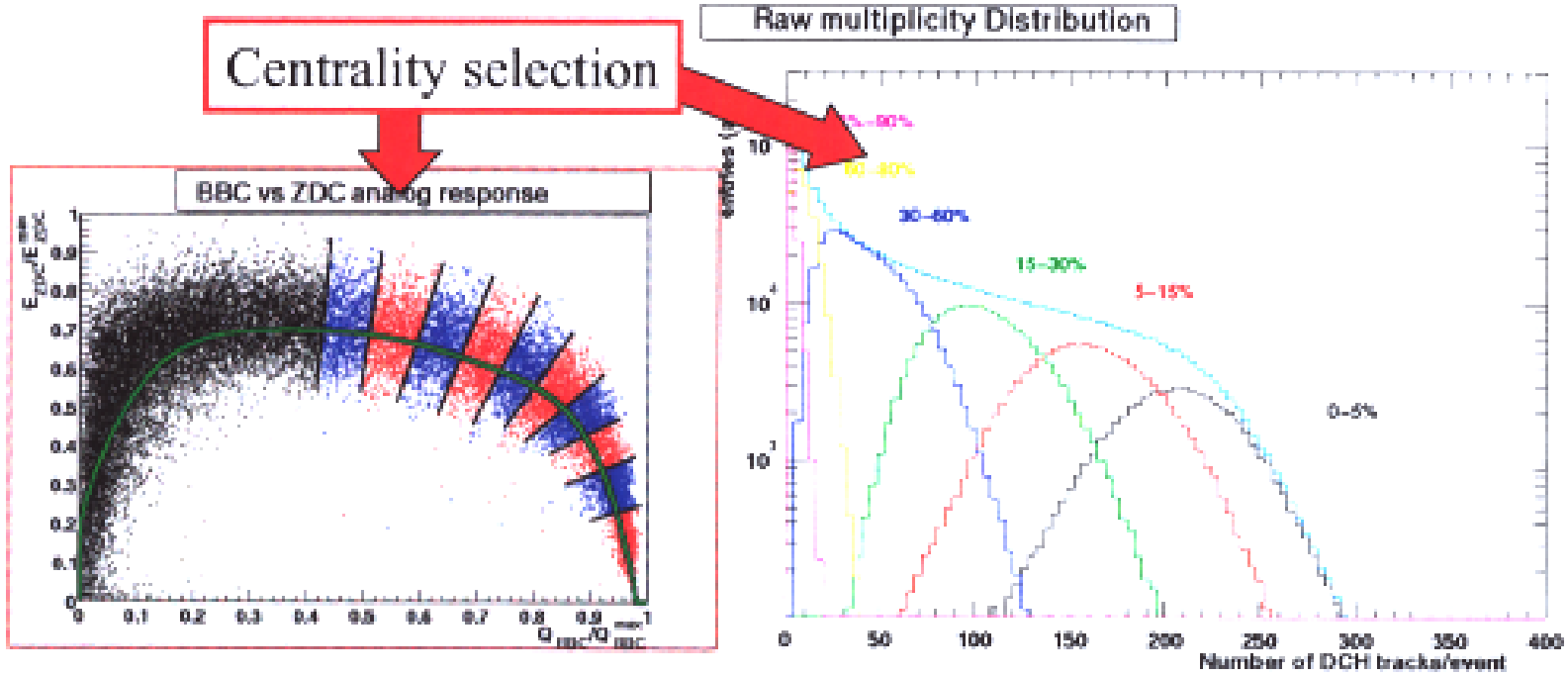




π/K separation < 1.6 GeV/c
Proton separation < 3.5 GeV/c

The PHENIX Experiment (II)

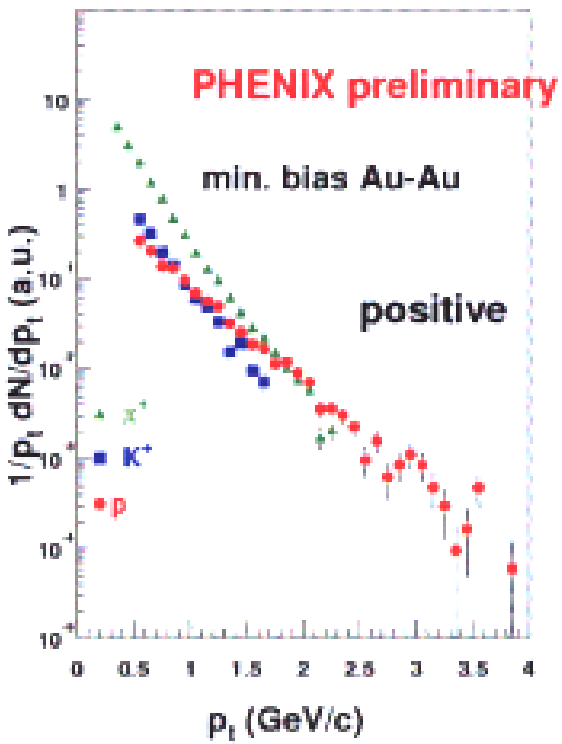
- Centrality definition
  - Centrality selection based on the correlation between Beam-Beam Counters(BBC) and Zero Degree Calorimeter(ZDC).

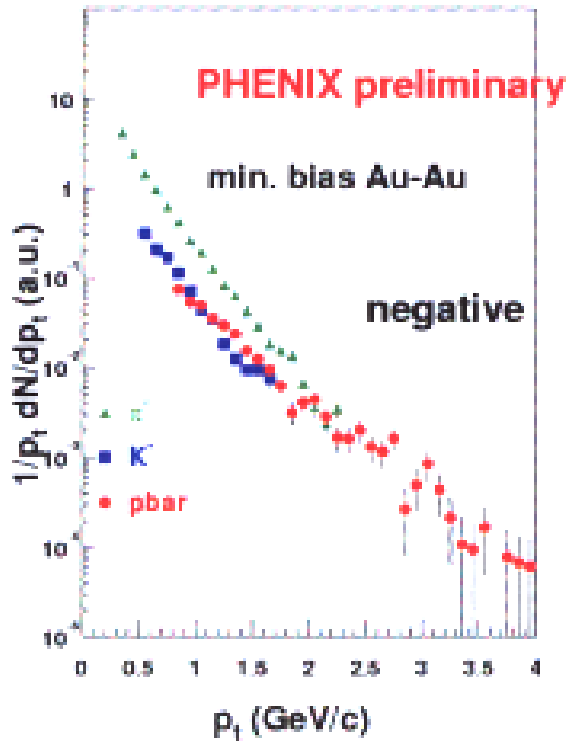


Identified Hadron spectra

PHENIX

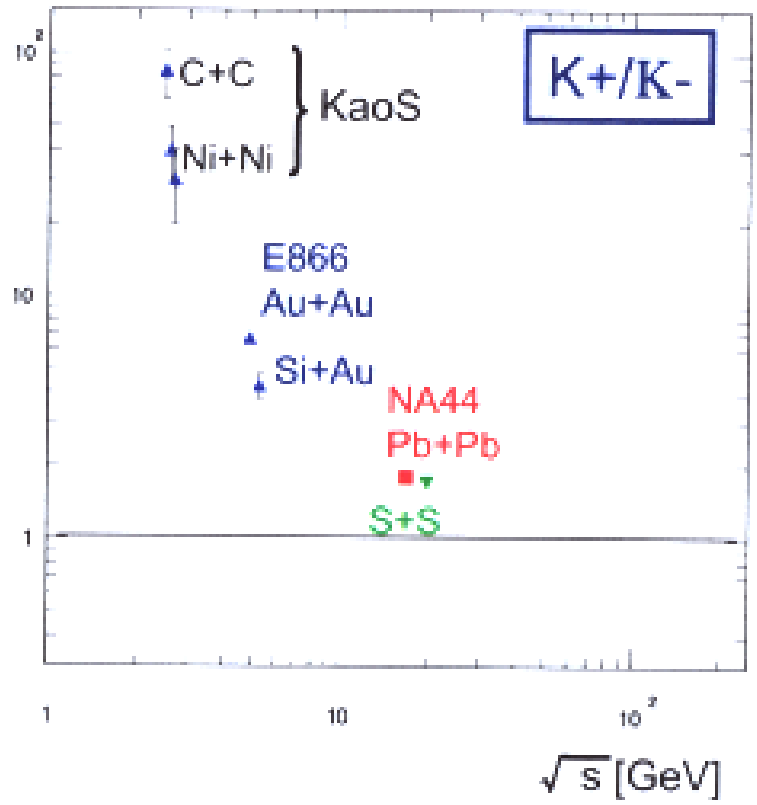
- Single particle spectra of pion, kaon, proton and their anti particles.
  Au+Au collisions at $\sqrt{s_{NN}}$=130 GeV, Minimum bias data.



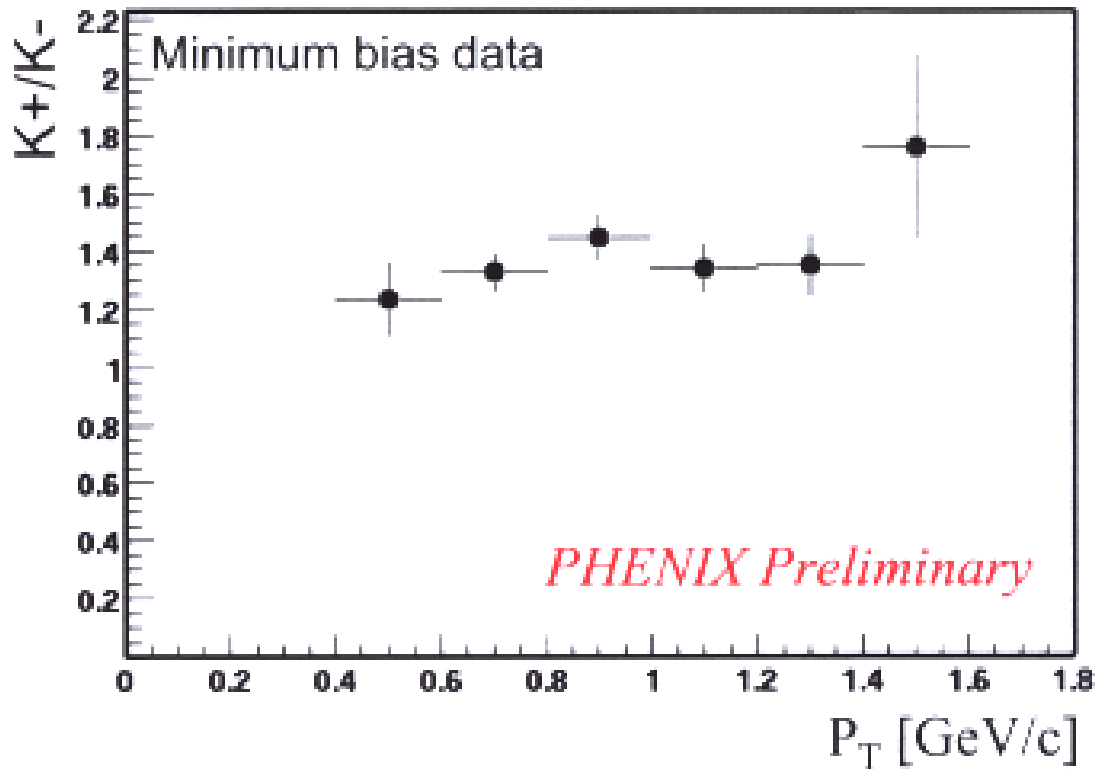


K+/K- ratio

- Expectation from previous experiments
  - K+/K- ratio decreases with increasing $\sqrt{s}$
  - K+/K- ratio in p+p collisions
    - $\sqrt{s}$ = 23 GeV => 1.6
    - $\sqrt{s}$ = 53 GeV => 1.4

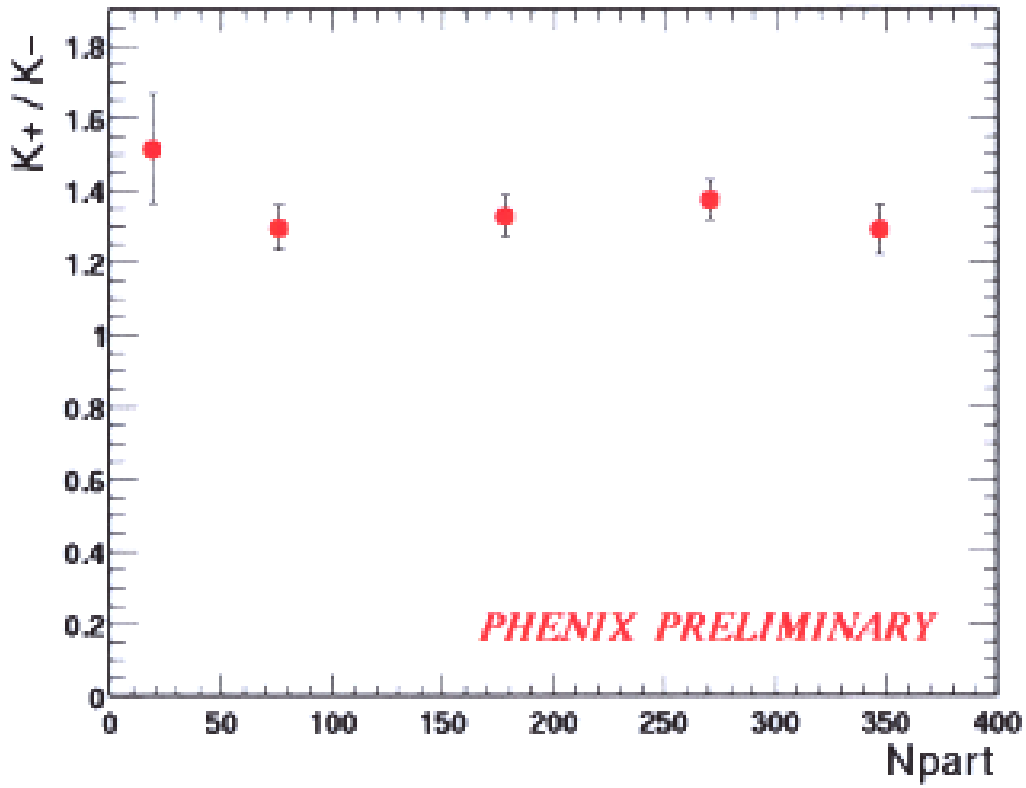


K+/K- ratio as a function of P_T



- Within the statistical errors, K+/K- does not depend on P_T over the measured range

K+/K- ratio as a function of centralit



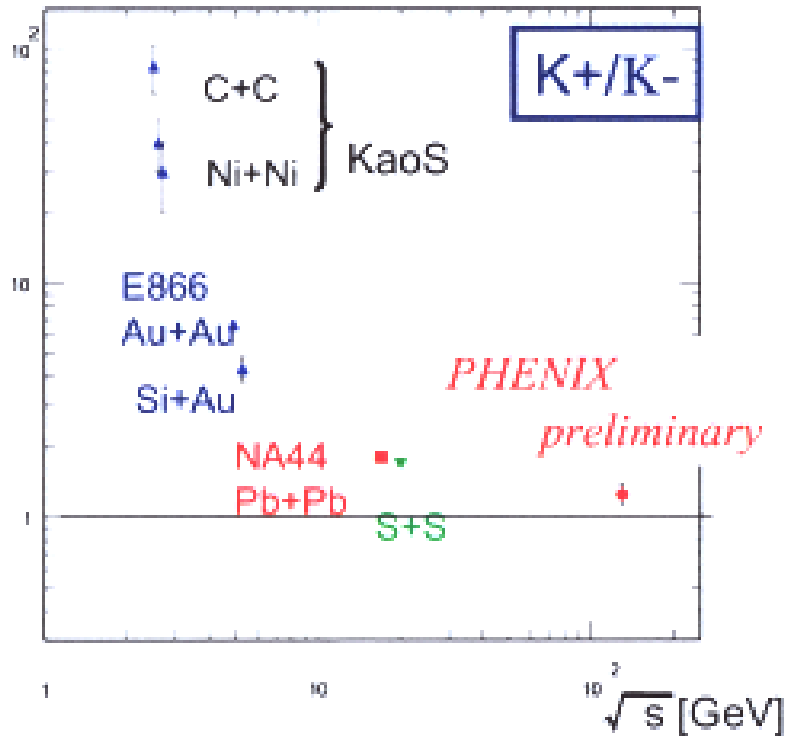
- No dependence as a function of centrality.
- Same trend are measured in SPS and AGS

Summary of K+/K- ratio

- K+/K- ratio as a function of $\sqrt{s}$
  (0.5GeV/c <PT<1.8GeV/s)

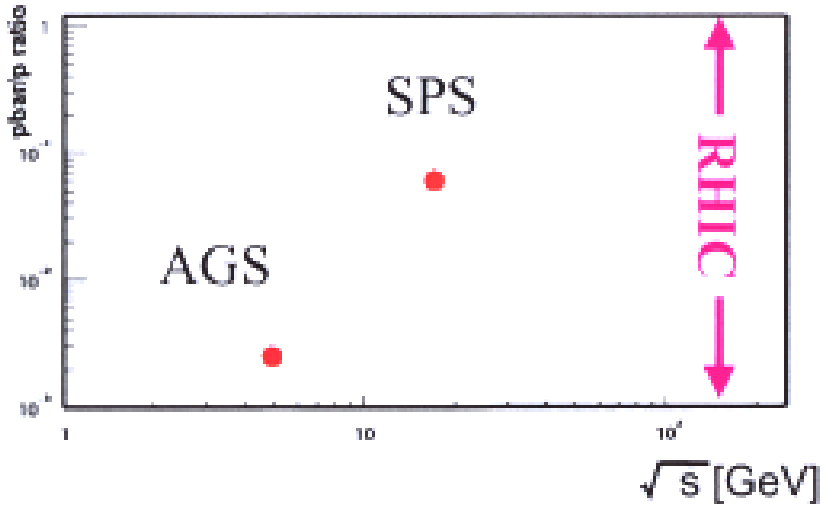
  K+/K-
  = 1.29±0.07(stat) ±0.19(sys.

- K+/K- production at RHIC follows the trend observed in the experiments at SIS, AGS and SPS.



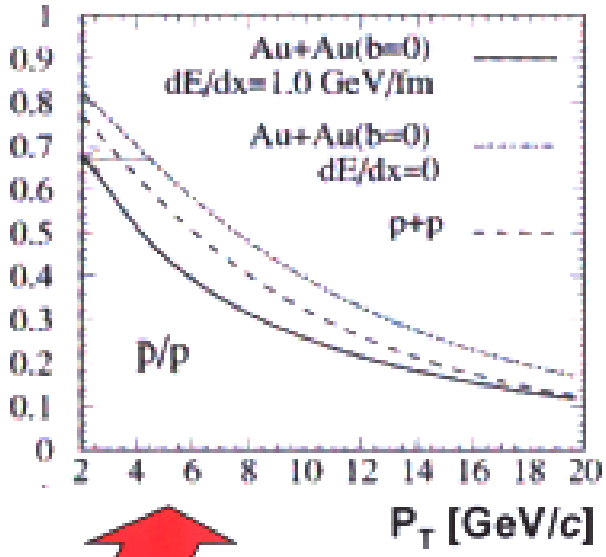
pbar/p ratio

- pbar/p ratio is increasing from AGS to SPS.

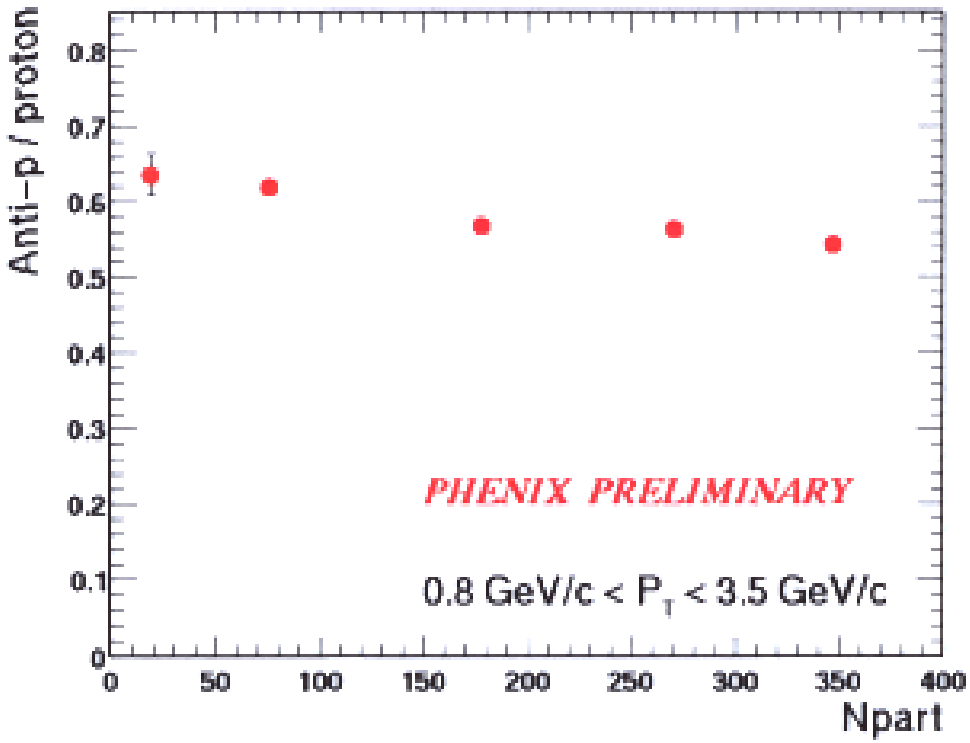


- Another topics in pbar/p ratio
  - Jet quenching
    pbar/p ratio at high P_T.

X.N.Wang, PRC58(1998)2321



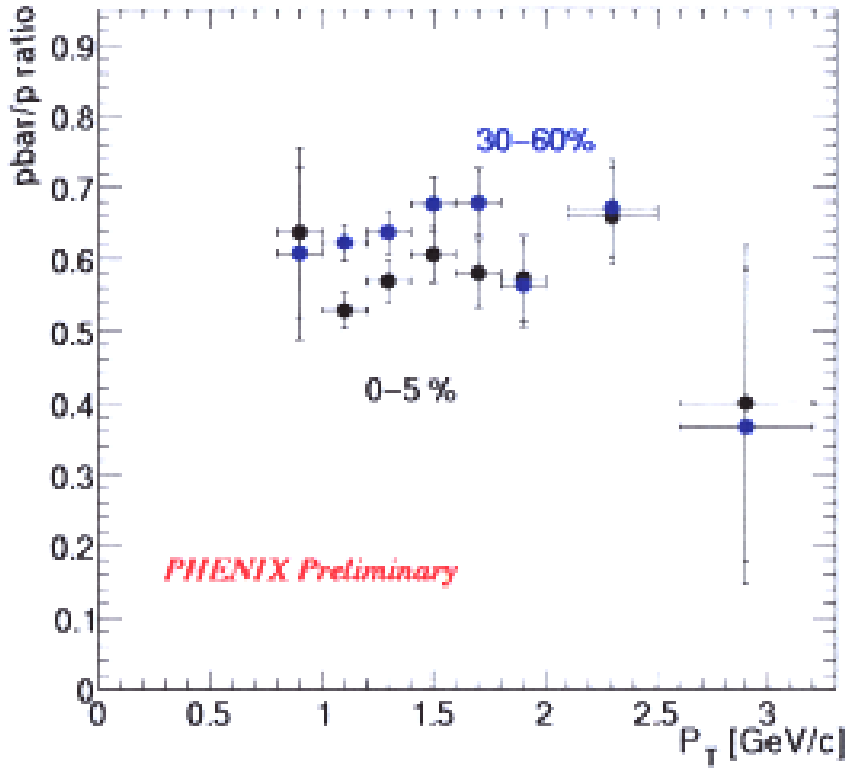
pbar/p ratio as a function of centrality



- Systematic errors ~15%
  Systematic error is not depends on Npart.

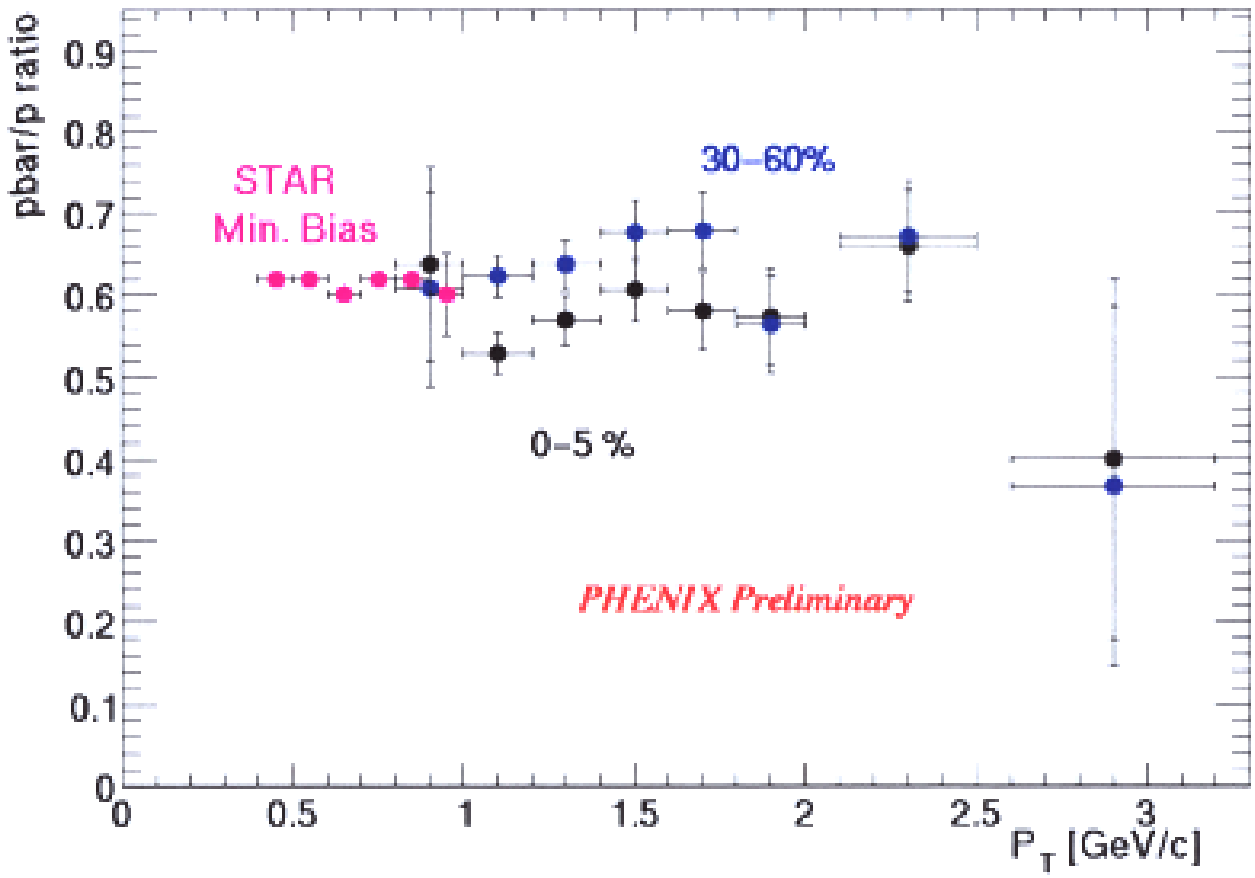
- No strong dependence as a function of centrality.

pbar/p ratio as a function of P_T



- pbar/p ratio shows constant as a function of P_T up to 3 GeV/c.
- It is vary hard to extract pbar/p ratio at P_T above 3 GeV/c due to small statistics.

pbar/p ratio as a function of P_T



Conclusion

PHENIX

- Particle ratios in Au+Au collisions at $\sqrt{s}$=130 GeV are presented.
- No clear centrality dependence are seen in K+/K-, pbar/p ratios.
- K+/K- and pbar/p ratios show no dependence with P_T. (Kaon; P_T<2.0 GeV/c, Proton; P_T<3.0 GeV/c)
- Particle ratios@ 5% most central event
  - K+/K- = 1.29±0.07(stat.)±0.19(sys.)
  - pbar/p = 0.54±0.01(stat.)±0.08(sys.)