Centrality Dependent Identified Hadron Production at y=0 and y~1 at RHIC

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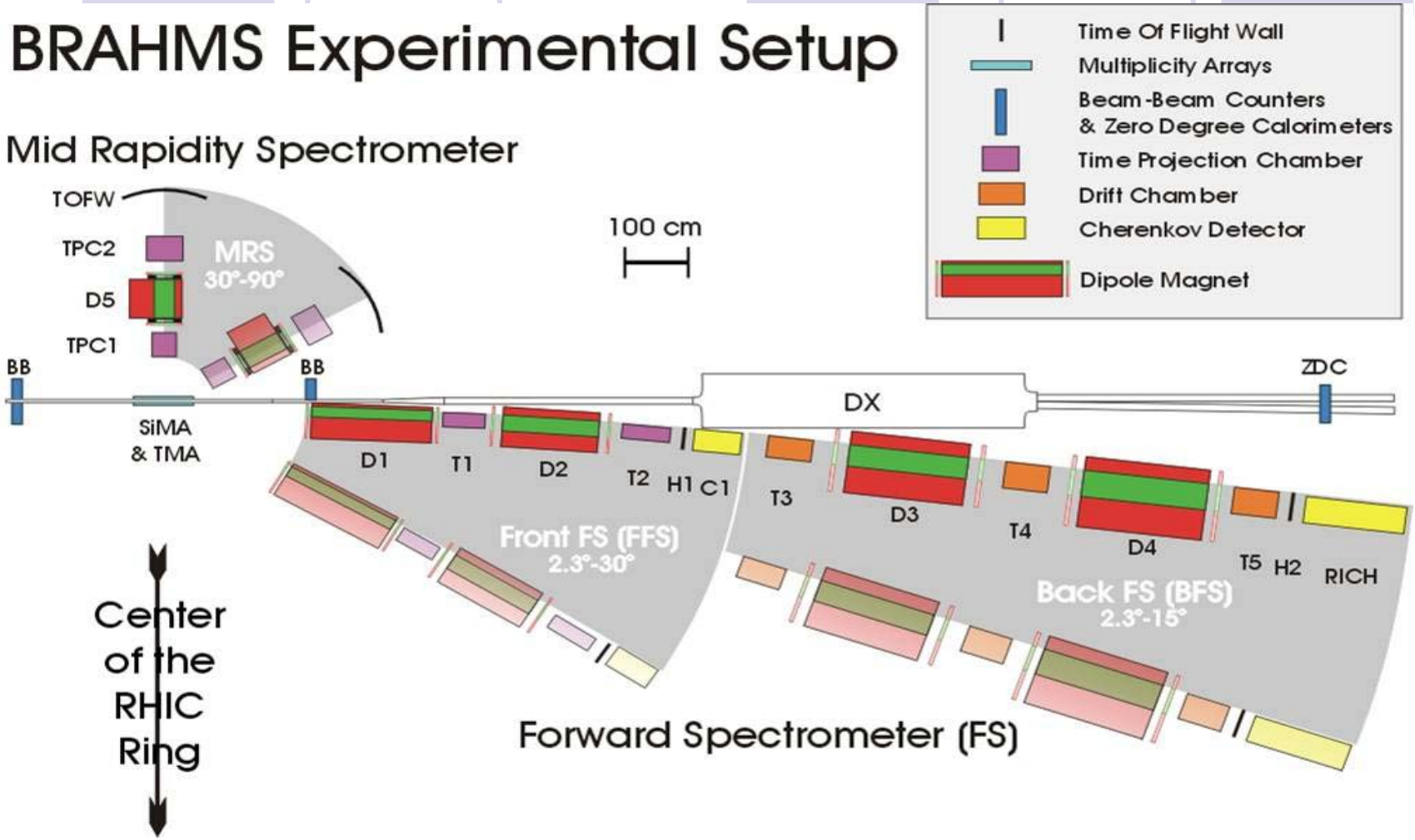
Motivation

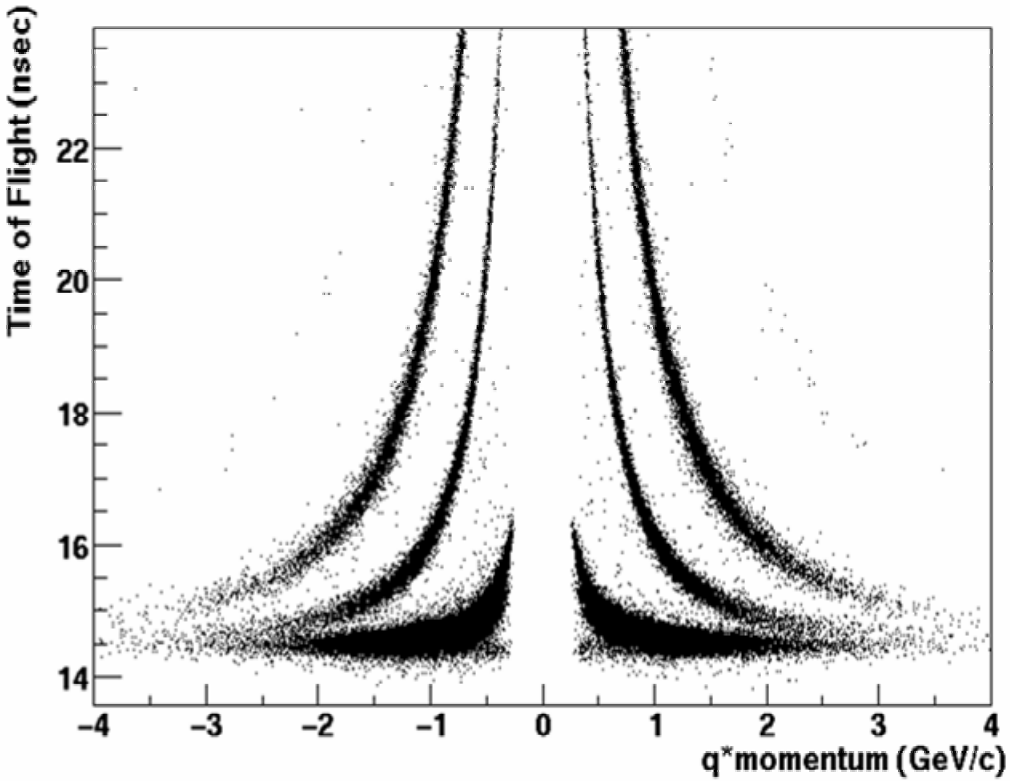
- Produced hadrons carry information about the collision dynamics and the space-time evolution of the system from the initial to the final stage of the collision.
- Measurement of the transverse momentum spectra of identified hadrons as a function of rapidity and centrality allow us to characterize the expansion of the emitting source.
- Chemical composition at freeze-out can be deduced from particle ratios and yields.

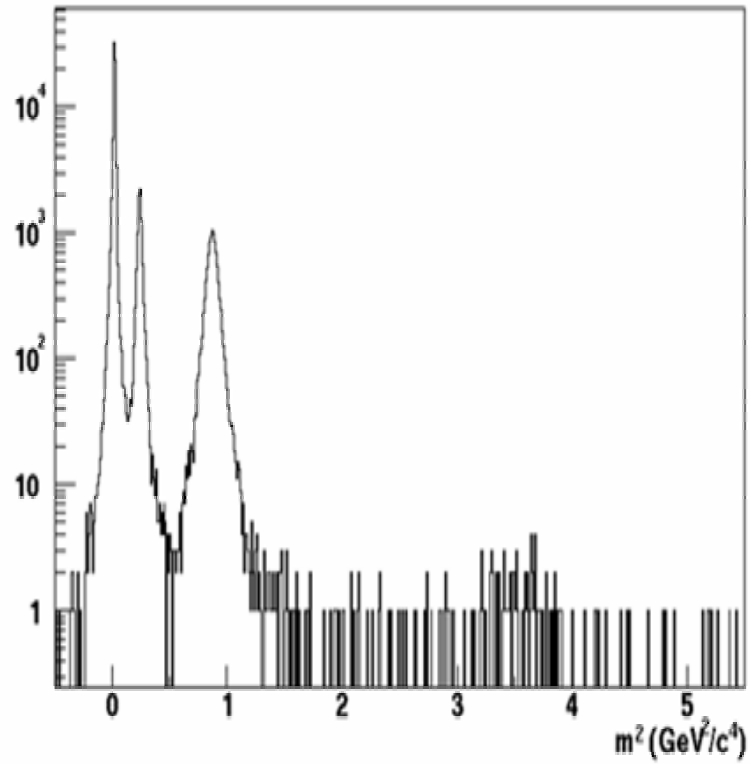
BRAHMS Experimental Setup



$\sqrt{s_{NN}}$ = 200GeV Au+Au data at y=0 and y~1

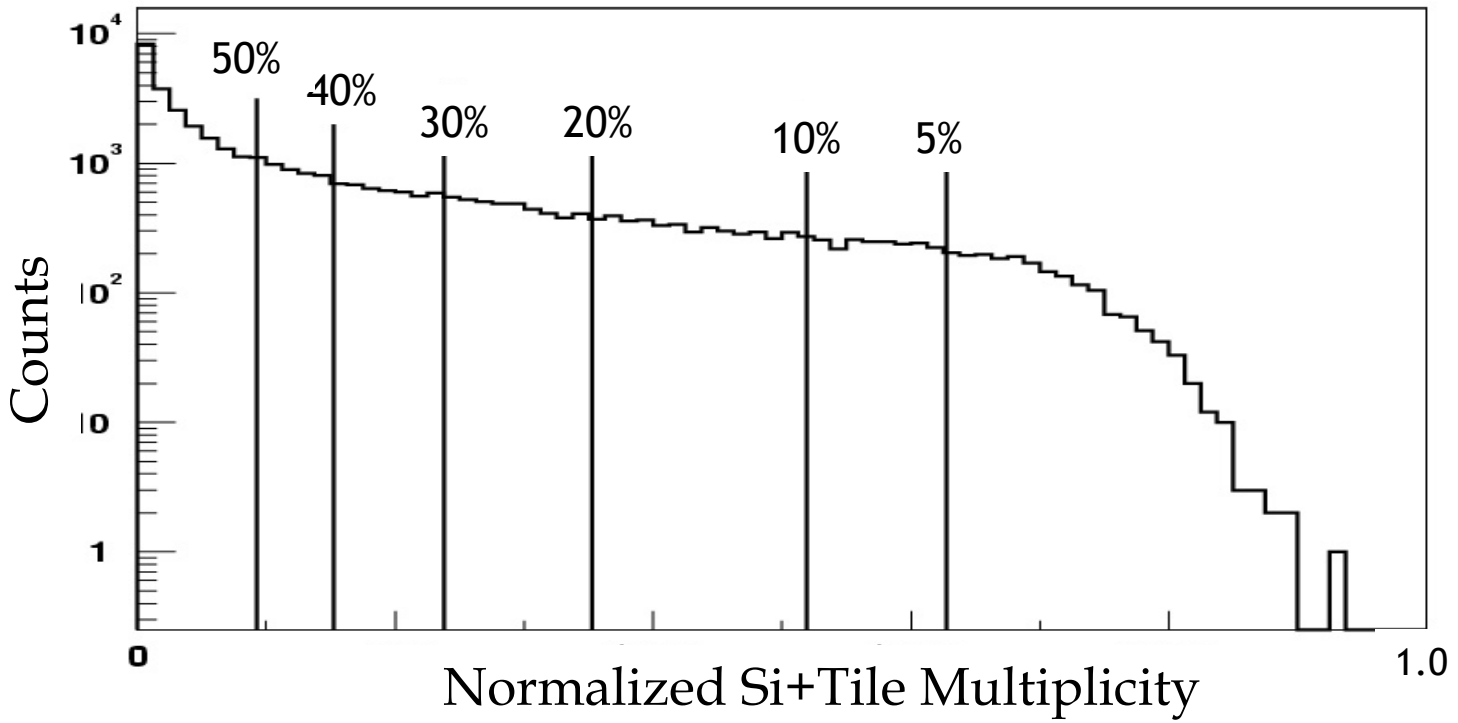
MRS Particle Identification





- 125 slats : Time-of-Flight resolution ~ 75 *p*sec
- π/K separation ~ up to 2.5 GeV/c
- K/p separation ~ up to 4.0 GeV/c

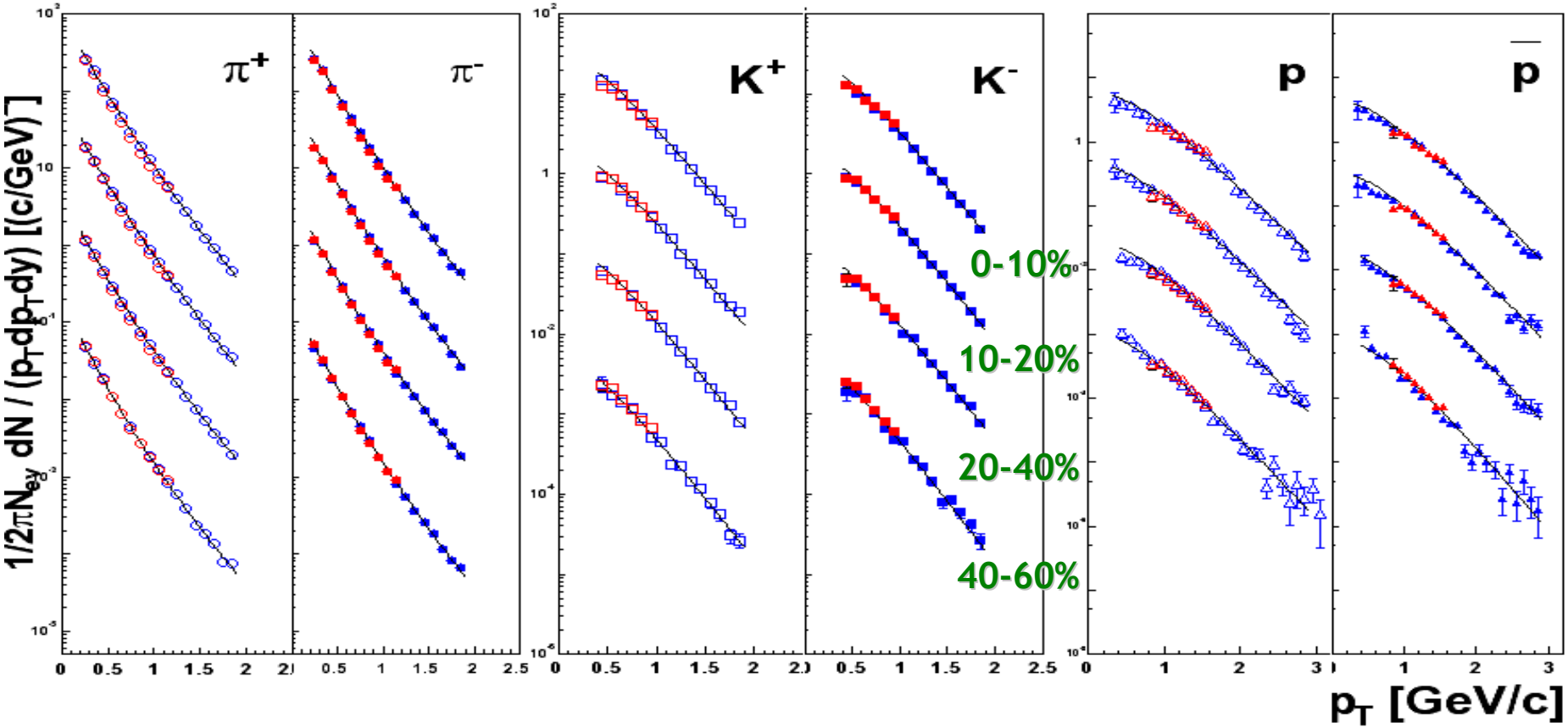
Centrality Determination



- Measured by the Centrality Detector (SiMA+TMA)
- Corrected for Vertex position dependence
- Npart is calculated using HIJING

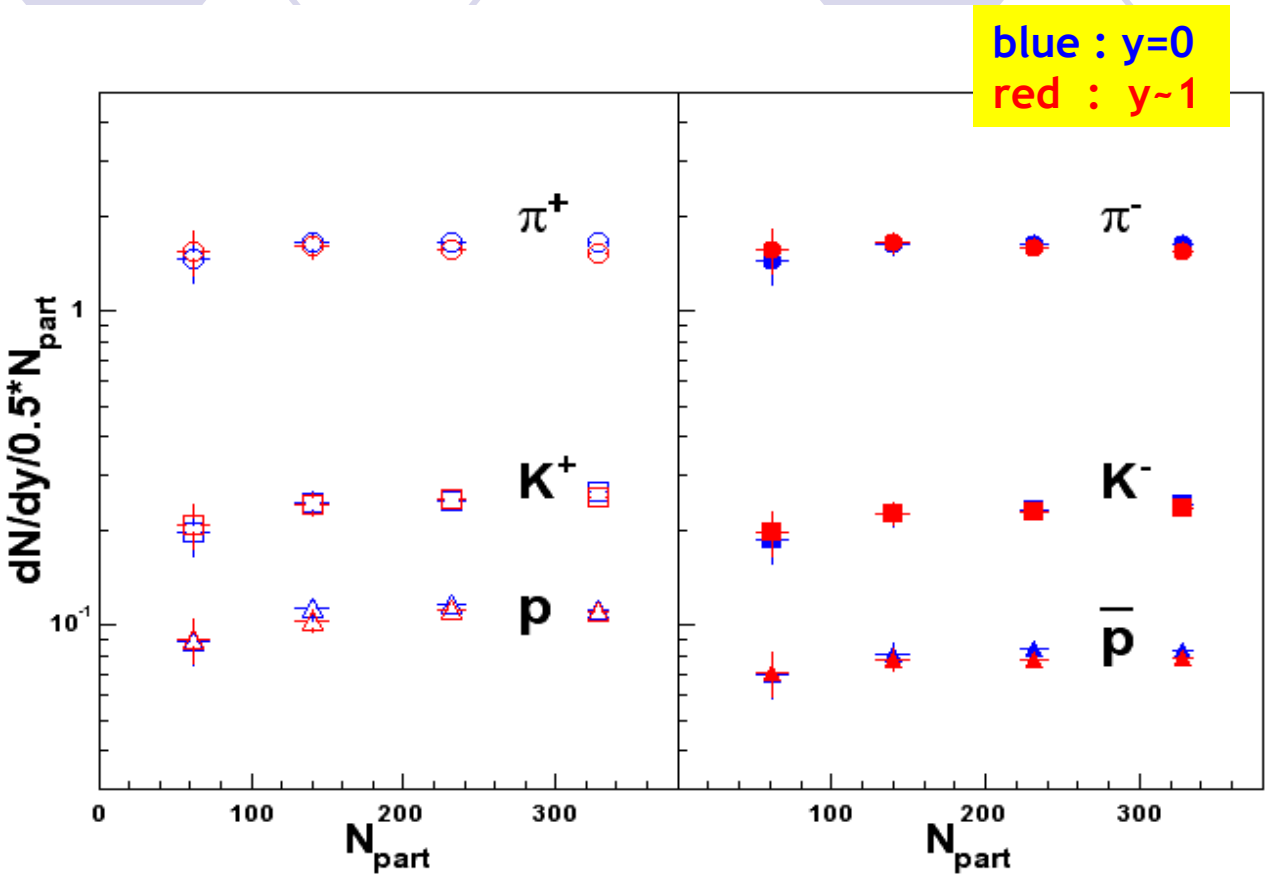
p_T Spectra at y=0, y~1

blue : y=0
red : y~1



- π spectra : characterized by power law fit
- K, p spectra : characterized by m_T exponential fit
- Little difference between y=0 and y~1 for π, K, p

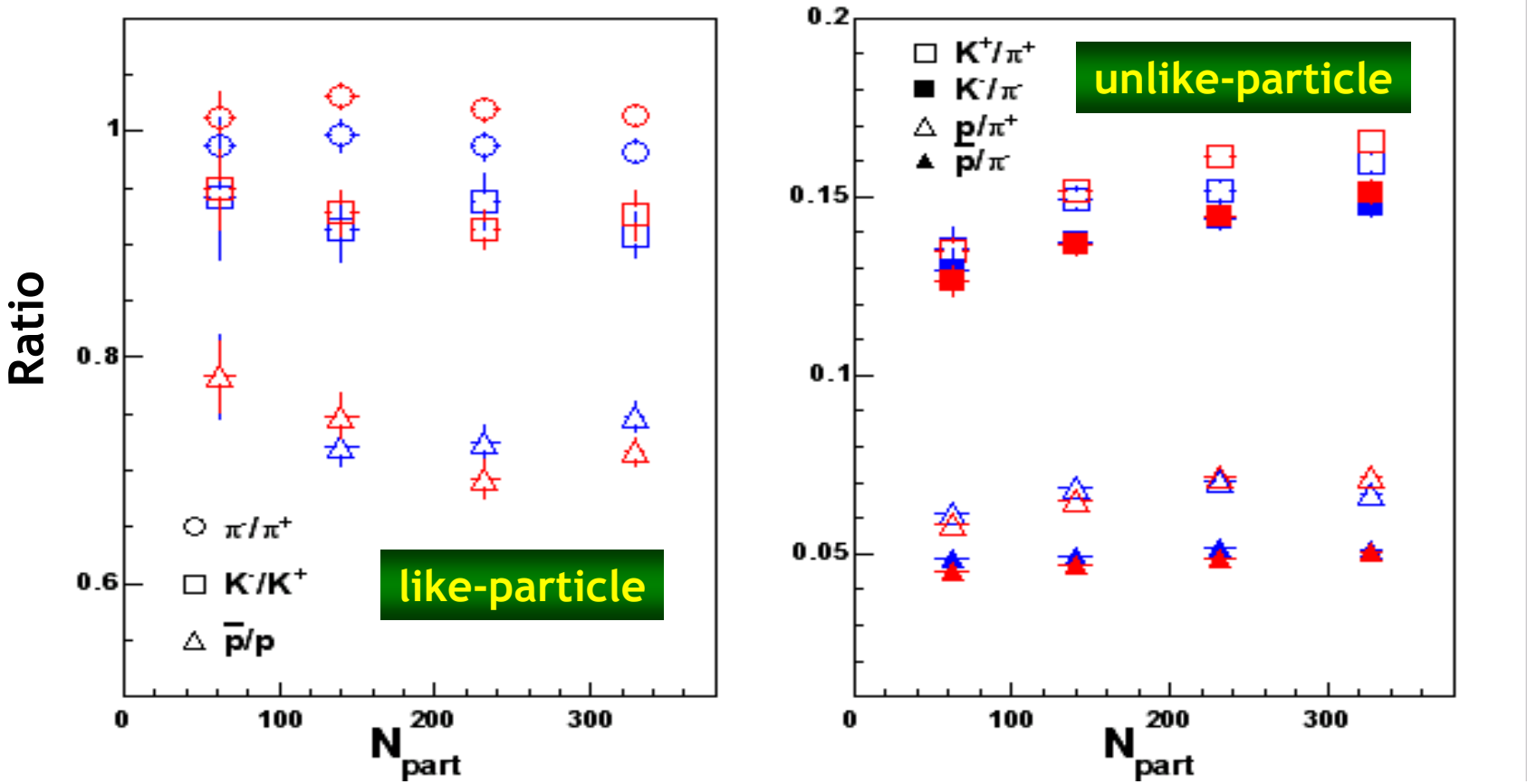
dN/dy



- dN/dy ~ slightly increase or flat with N_{part}
- K, p yield rises faster than π yield.

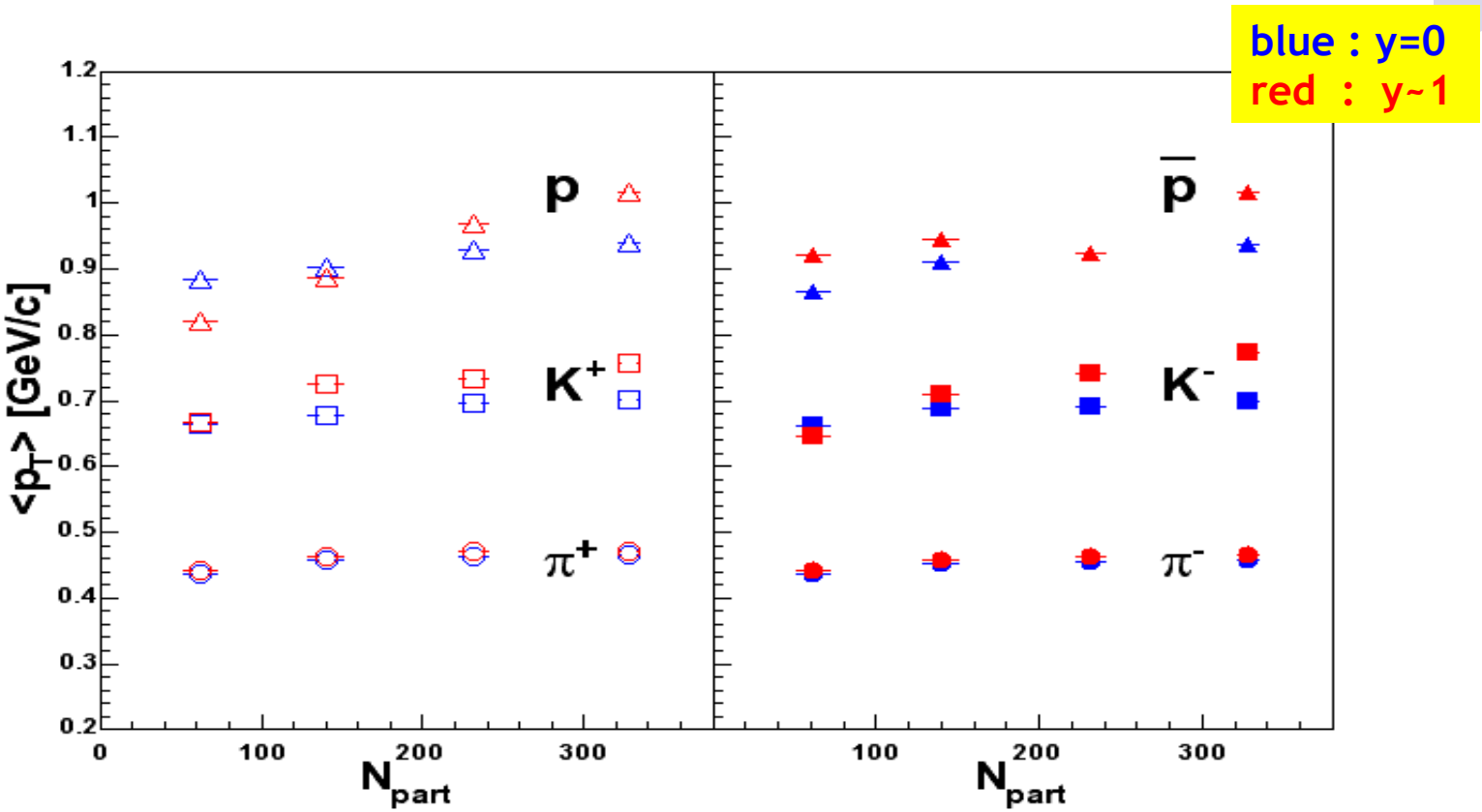
Particle Ratios vs. N_{part}

blue : y=0
red : y~1



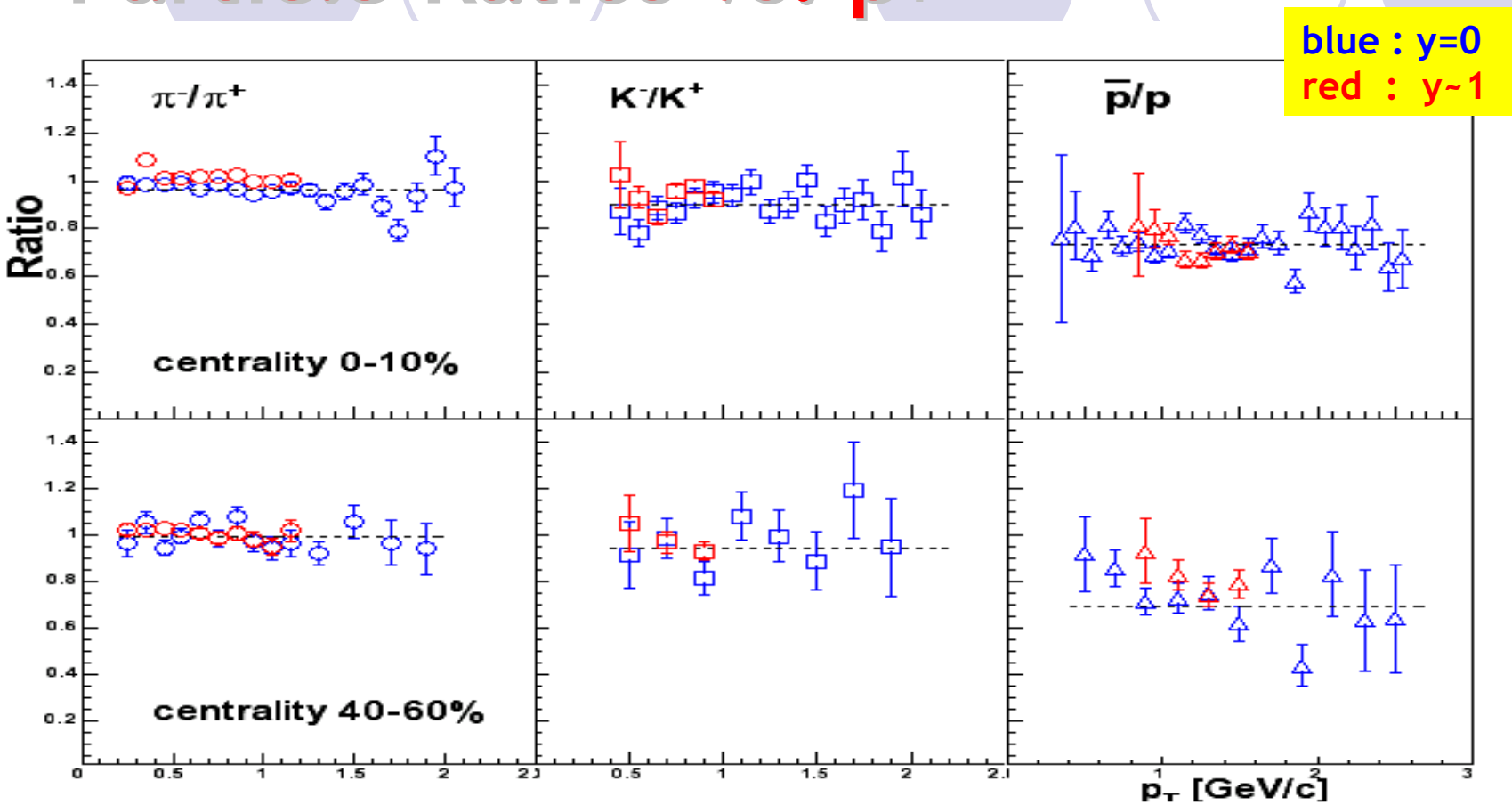
- The like-particle ratios are not dependent on N_{part}.
- The unlike-particle ratios slightly increase or are flat.

<p_T>



- <p_T> increases with N_{part}.
- The heavier the mass, the larger the <p_T>.

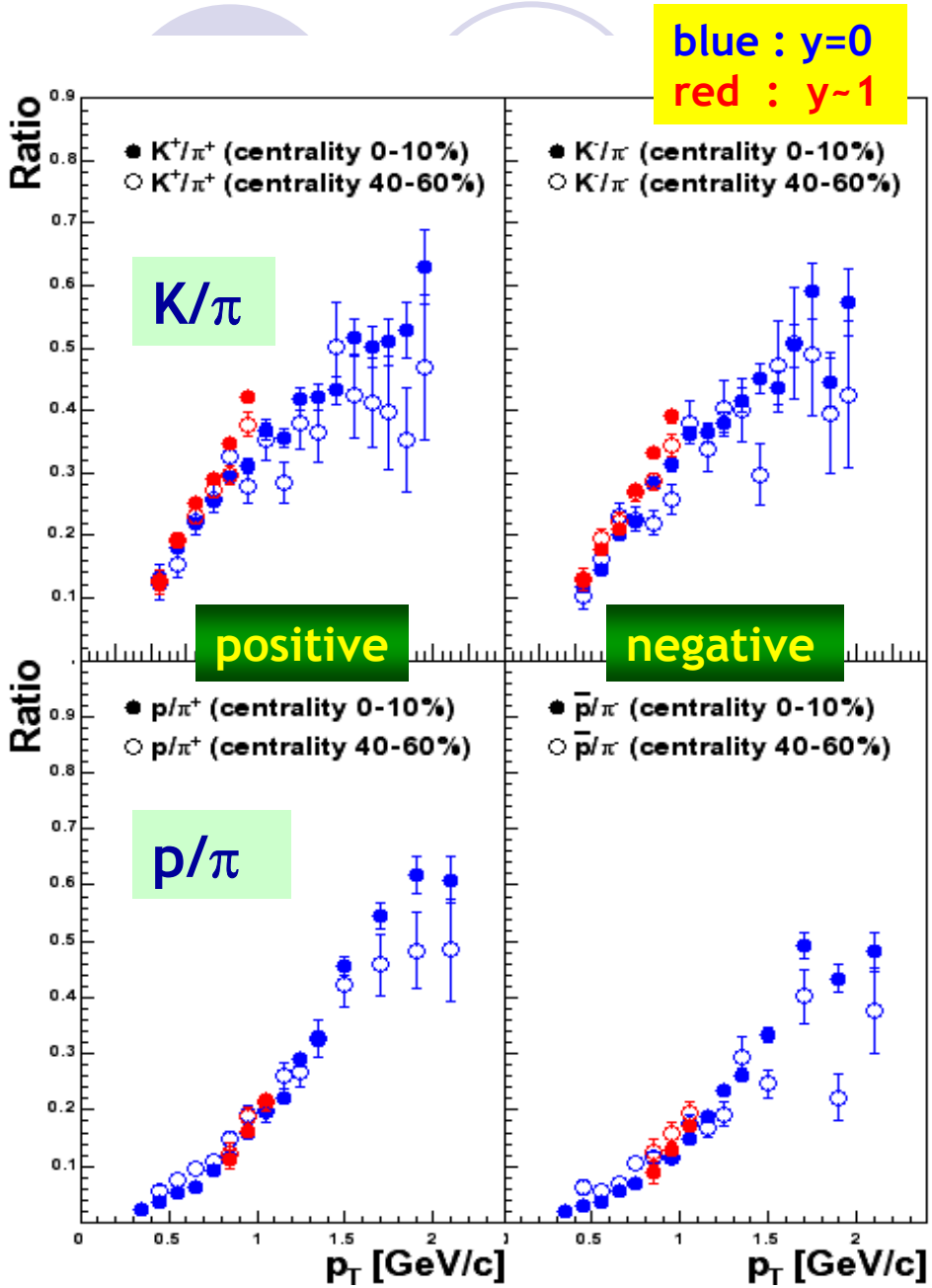
Particle Ratios vs. p_T



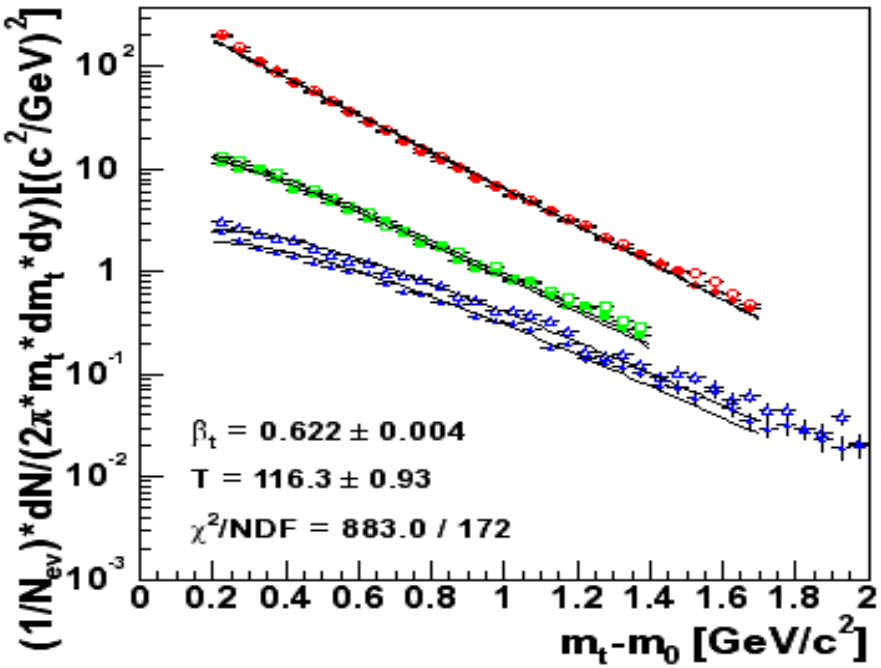
- No significant p_T dependence
- No centrality dependence : R(central)~R(peripheral)
- Similar behavior at y=0 and y~1

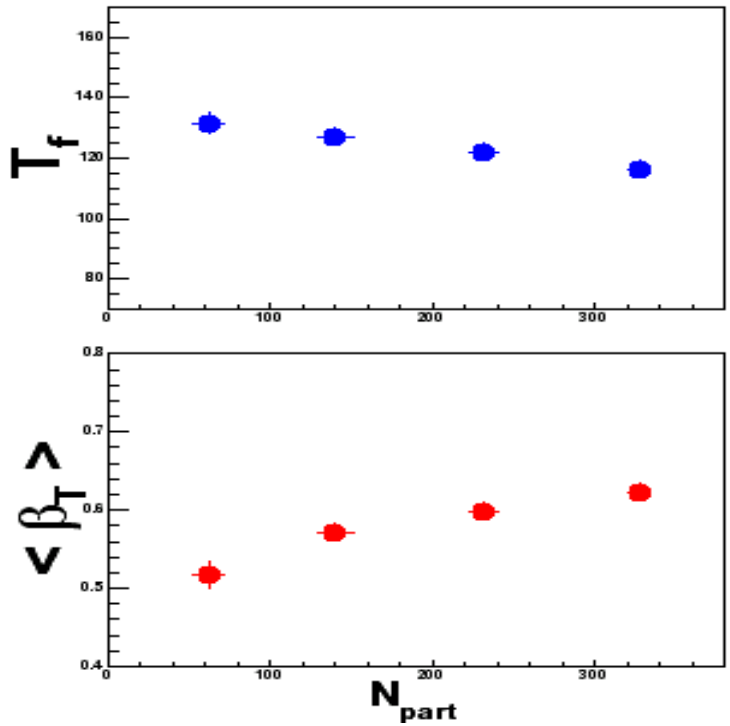
K/π, p/π ratios

- K/π ratios increase with p_T and the increase is similar in central and peripheral collisions up to 1.5 GeV/c.
- p/π ratios show a centrality dependence at high p_T.
- No rapidity dependence, similar results between y=0 and y~1



Hydrodynamic Model Fit at y=0





- T_f ~ 116-132 MeV, β_T ~ 0.62-0.52
  from 0-10% to 40-60% central
- $\langle \beta_T \rangle$ increases at RHIC, T_f is similar to AGS~SPS.
  -> details : See JH Lee's talk [HC.003]

Summary

- BRAHMS has measured the centrality dependence of particle production at y=0 and y~1 and investigated reaction mechanisms and dynamics.
- Particle spectra can be well fitted with a power law in p_T (π) and with an exponential function in m_T (K, p).
- BRAHMS results suggest a picture of radial expansion, i.e. $\langle p_T \rangle$ vs. mass and centrality
- These observations are consistent with the hydrodynamical model fit.
- No p_T, centrality dependence for like-particle ratios
- K/π, p/π ratios show an increase as a function of p_T and centrality dependence.
- No significant rapidity dependence between y=0 and y~1