Identified particle production in p+p collisions in √s = 62.4 GeV at STAR

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Abstract: It is important to study the particle production as a function of both transverse momentum (p_T) and particle species which provide crucial input for modeling of hadronic interactions and the hadronization process in high-energy collisions [1]. In this contribution, we present the results on $\pi^{\pm}$, $K^{\pm}$, p and pbar in p+p collisions at √s = 62.4 GeV from STAR experiment at the Relativistic Heavy Ion Collider. The results are obtained for the midrapidity region in the range |y| < 0.1. Charged hadrons are identified by using specific ionization energy loss at the low momentum region (up to 1.10 GeV/c) with STAR's Time Projection Chamber detector [2,3]. We present the p_T spectra, particle yields and various particle ratios. The results are compared with different models namely PYTHIA and PHOJET.

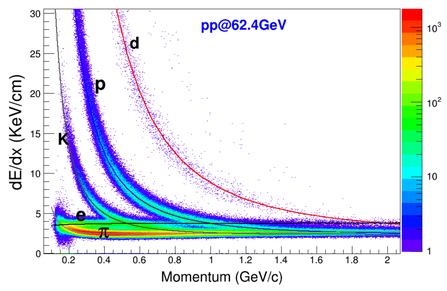
Introduction

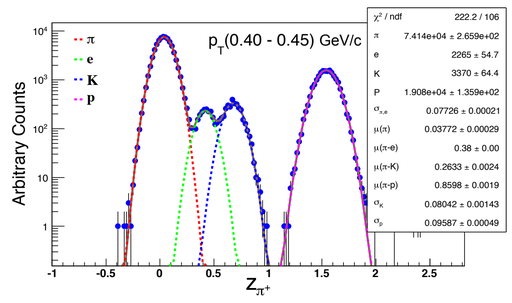
- Study of transverse momentum spectra, particle yields and ratios gives information about particle production mechanism in high energy collisions.
- They also provide useful information on the freeze-out dynamics.
- Results from the p+p collisions could be treated as a reference when analysing heavy ion results.

Data set used

Energy	62.4 GeV
# Events	~ 1.5 M (min bias trigger)
Detector used	TPC
$\|V_z\|$	< 30 cm
$\|V_r\|$	< 1 cm
dca	< 3cm (< 2cm for p & pbar)
Nhits	> 20
dEdx_pts	> 5
Nhits/Nhits_poss	> 0.52
|rapidity|	< 0.1

Particle Identification in STAR



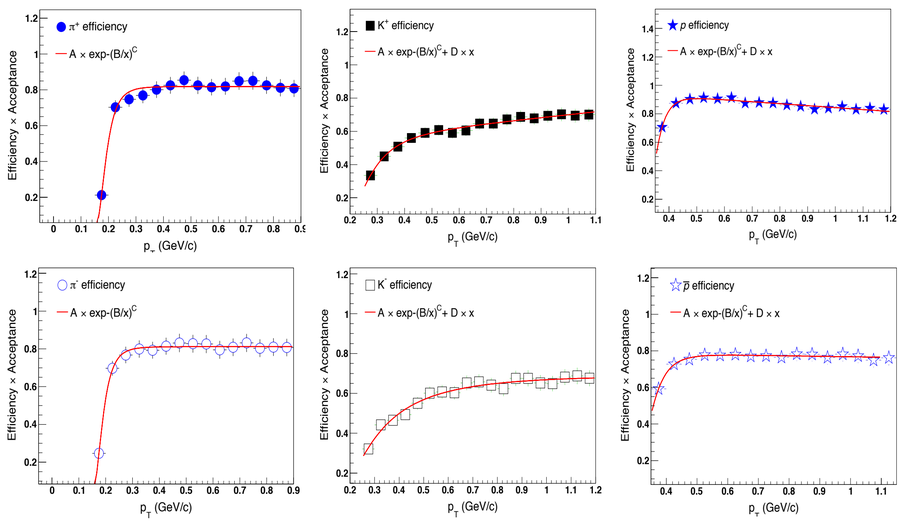


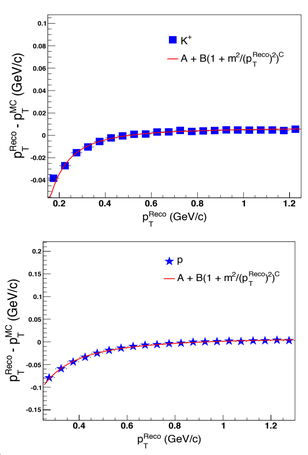
$$z_i = \ln\left(\frac{\langle dE/dx\rangle_{meas}}{\langle dE/dx\rangle_{theory}}\right)$$

Raw particle yields is obtained by using the "z_i" variable separately for different charged particles at different transverse momenta.

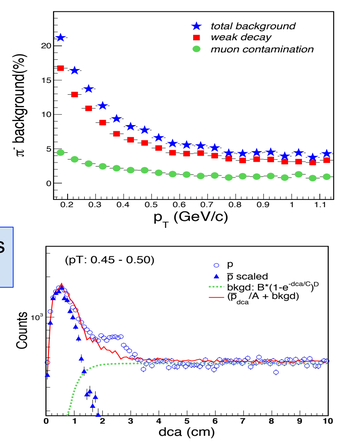
Corrections to Raw Particle Yields

Efficiency correction





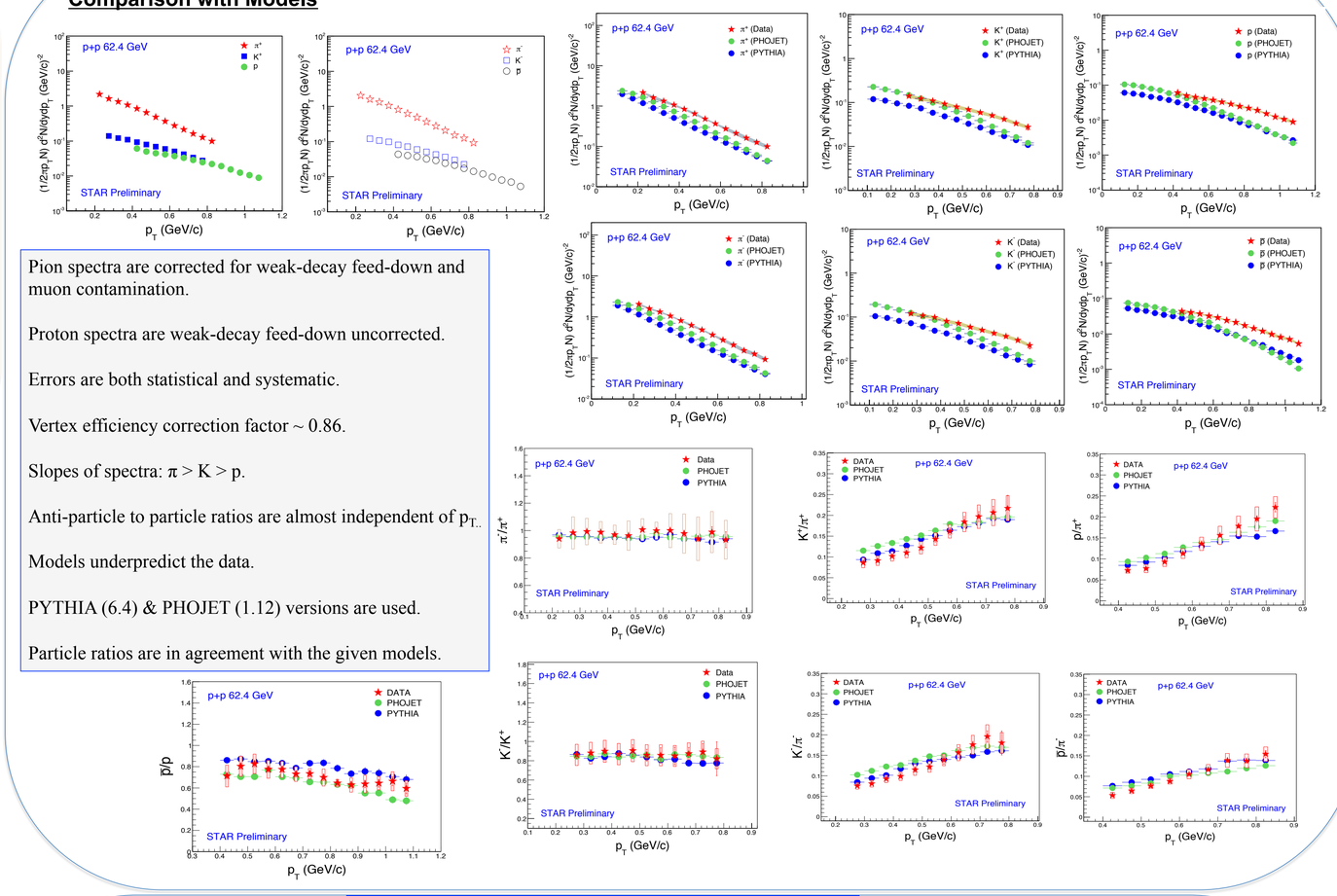
Energy loss correction



Background correction

(A) Particle Spectra and Ratios

Comparison with Models



Pion spectra are corrected for weak-decay feed-down and muon contamination.

Proton spectra are weak-decay feed-down uncorrected.

Errors are both statistical and systematic.

Vertex efficiency correction factor ~ 0.86.

Slopes of spectra: π > K > p.

Anti-particle to particle ratios are almost independent of p_T.

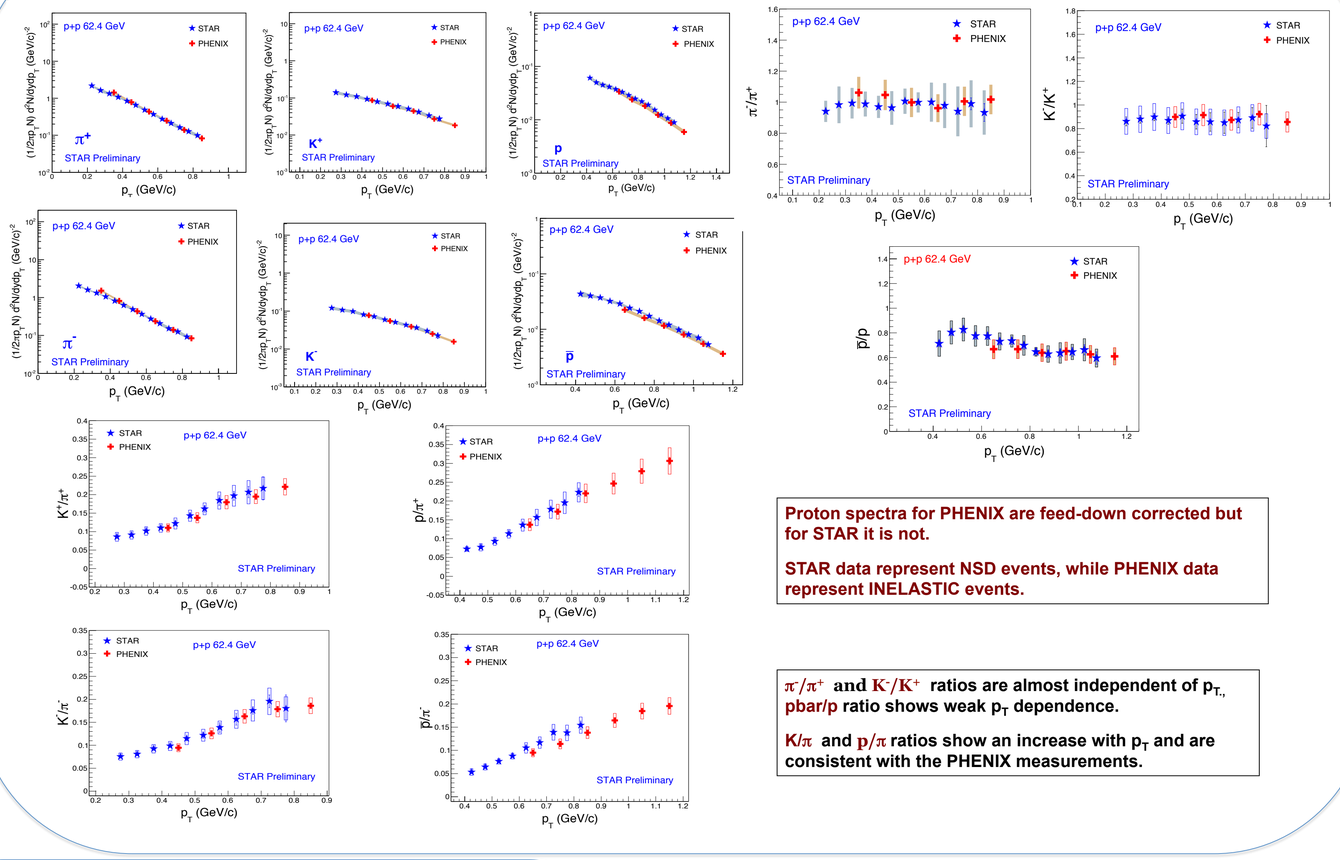
Models underpredict the data.

PYTHIA (6.4) & PHOJET (1.12) versions are used.

Particle ratios are in agreement with the given models.

(B) Particle Spectra and Ratios

Comparison with PHENIX



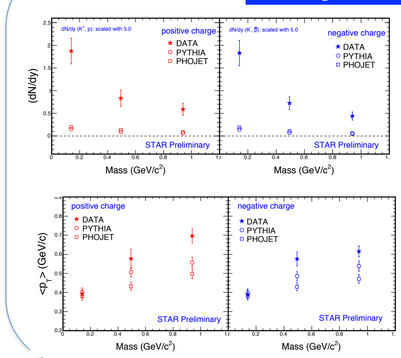
Proton spectra for PHENIX are feed-down corrected but for STAR it is not.

STAR data represent NSD events, while PHENIX data represent INELASTIC events.

π^-/π^+ and K^-/K^+ ratios are almost independent of p_T, pbar/p ratio shows weak p_T dependence.

K/π and p/π ratios show an increase with p_T and are consistent with the PHENIX measurements.

dN/dy and <p_T>



The <p_T> increases as a function of hadron mass.

The dN/dy shows a decreasing trend as a function of hadron mass.

The data compared with the models and the trend observed is similar for data and models, though the magnitude is very small in case of models.

Summary

- Transverse momentum spectra and particle ratios for π, K and p are obtained at p+p 62.4 GeV.
- Comparisons are made with PHENIX measurements at the same energy. Results are consistent.
- Transverse momentum spectra and particle ratios are obtained from the model calculations such as PYTHIA and PHOJET. Models show similar trends as data.
- The dN/dy and <p_T> are measured from the particle spectra. Models clearly underpredict the data measurements.

References

[1] H. Satz, *Rep. Prog. Phys.* 63 (2000) 151.
[2] H. Bichsel, *Nucl. Instrum. Meth. A* 562 (2006) 154-197.
[3] B. I. Abelev, et al., [STAR Collaboration] *Phys. Rev. C* 79 (2009) 34909.
[4] A. Adare, et al., [PHENIX Collaboration] *Phys. Rev. C* 83 (2011) 064903.

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