Identified Charged Hadron p_T Spectra in Au+Au Collisions at RHIC-PHENIX

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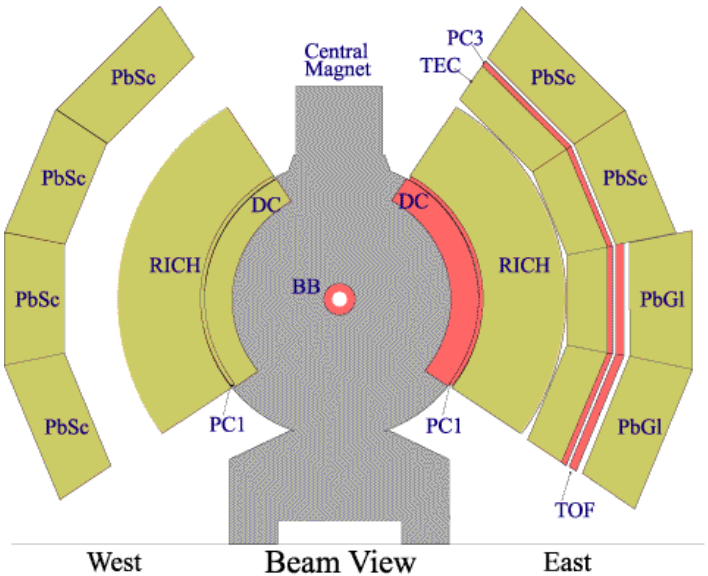
Introduction

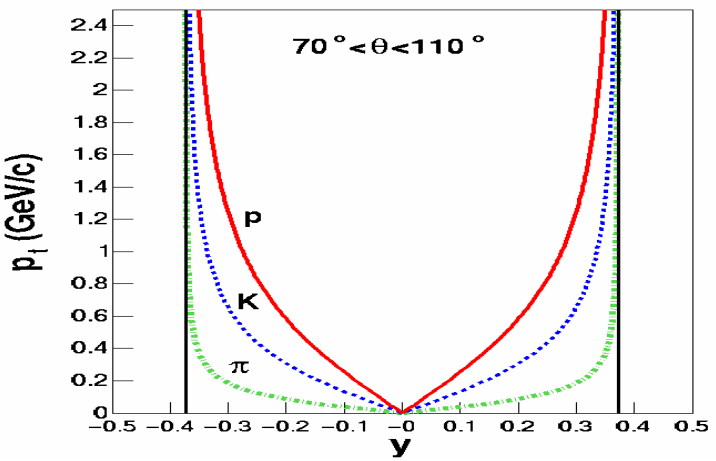
- **Identified charged hadron spectra at RHIC**
  - p_T spectra : Having the entire history of dynamical evolution of the system.
    - $<p_T>$ vs. particle mass, centrality.
    - Centrality dependence of spectra shape.
    - Freeze-out temperature and expansion velocity based on the hydro dynamical model (radial flow).
  - Suppression of hadron yield at high p_T by parton energy loss in hot and dense matter.

- In this presentation,
  1. PHENIX detector system used in this analysis.
  2. Results of identified single particle spectra in Au+Au @ 130 GeV (Run1) from PHENIX, *K. Adcox et al., (PHENIX) nucl-ex/0112008.*
  3. Status of Au+Au 200 GeV (Run2) analysis.
  4. Summary and outlook.

Detectors for Identified Hadron Analysis



Geometrical Acceptance @ TOF

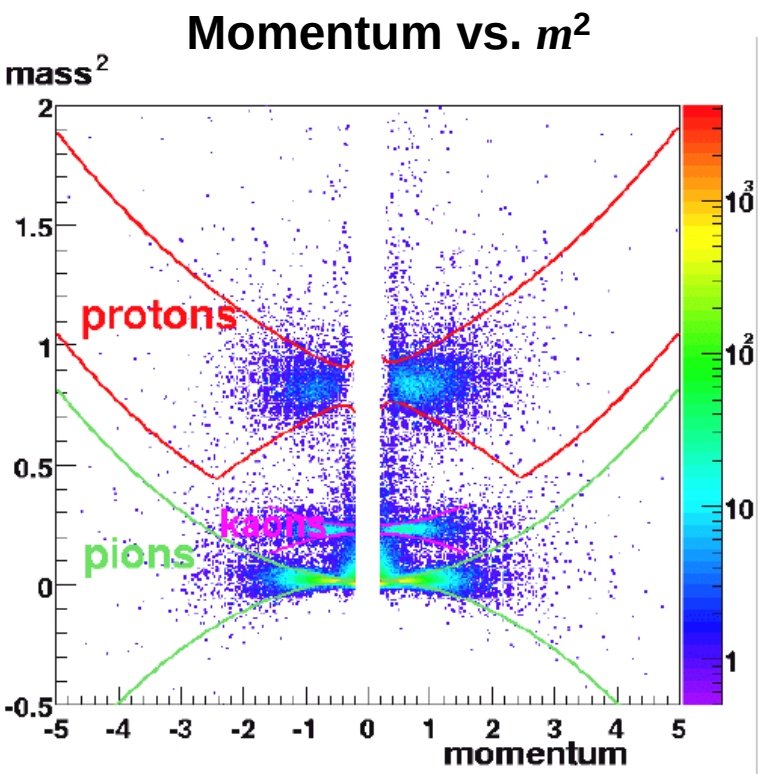


- **Beam-Beam Counter (BBC)**
  - *z vertex, start timing for TOF*
- **Time-of-Flight (TOF)**
  - *stop timing measurement*
- **Drift Chamber (DC)**
  - *momentum, flight path length*
- **Pad Chamber 1 (PC1)**
  - *additional track-z information to Dch*

- Rapidity coverage : $|\eta| < 0.35$
- ϕ coverage : $\pi/4$
- p_T range : > 0.2 GeV/c
- Overall TOF resolution : ~100 ps (Run1).
- Momentum resolution :

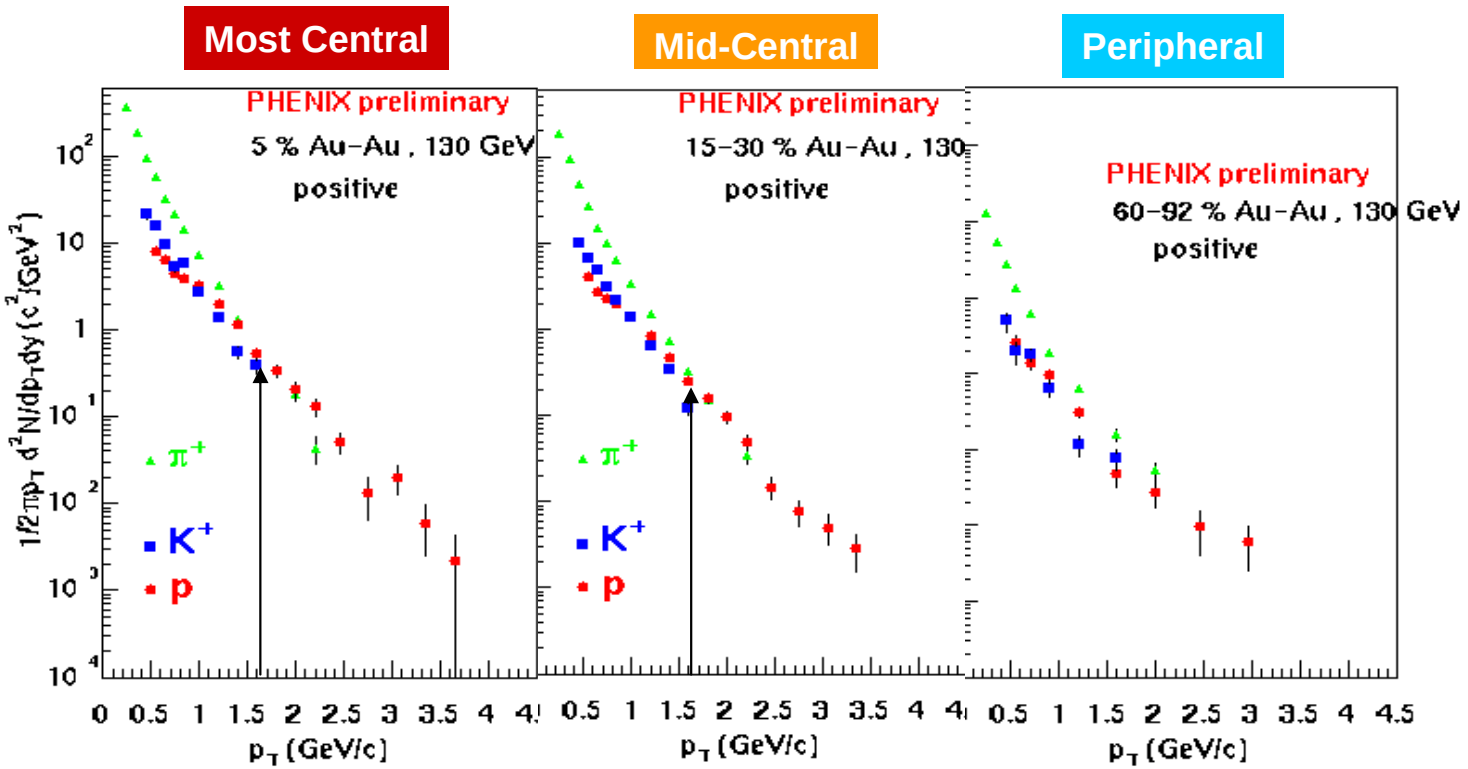
  $\delta p/p = 0.6\ \% \oplus 3.6\%\ p$ [GeV/c] (Run1)

PID and Corrections to Raw Spectra



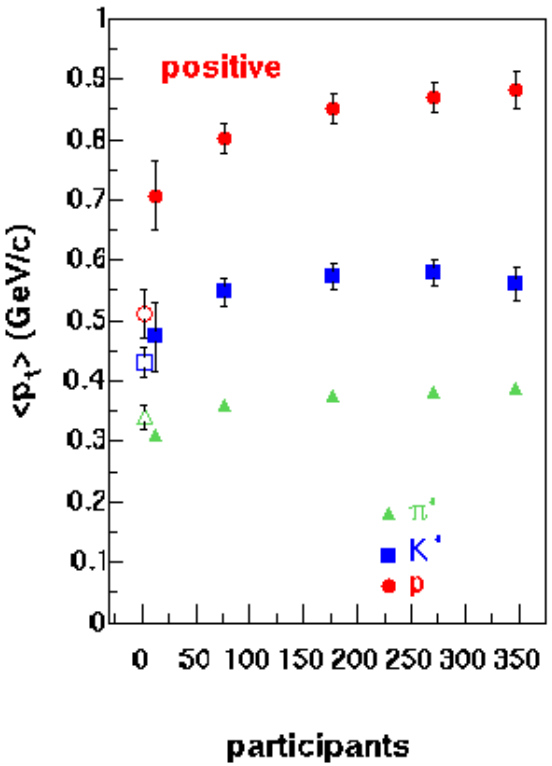
- **Charged hadron Identification by TOF**
  - Identified in m^2 vs. momentum space.
  - Applied 2.0 σ momentum dependent PID cut.
- **Corrections to raw spectra**
  - Based on single particle Monte Carlo simulation.
  - Geometrical acceptance @ TOF
  - Decay correction for π, K
  - Multiple scattering effect.
  - Software reconstruction efficiency.
  - Multiplicity dependence of track reconstruction (embedding MC in real data).

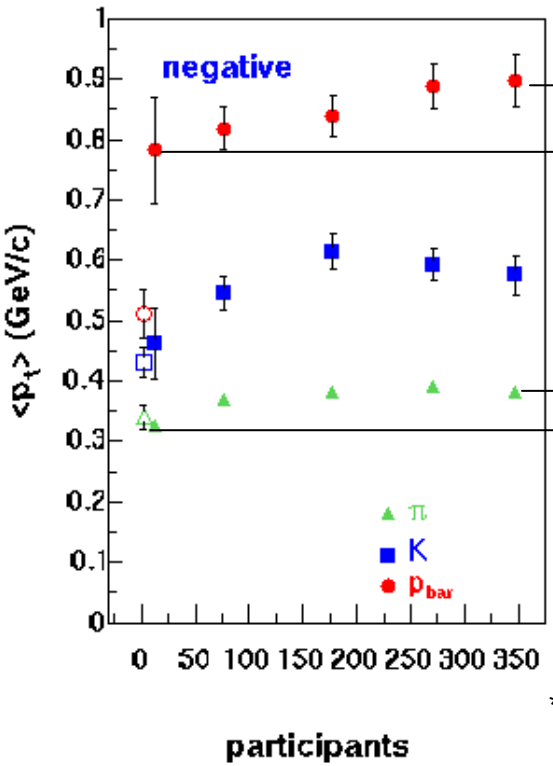
Particle Composition @ High p_T



- Nucleons dominate mesons at ~ 1.5-2 GeV/c (π/p crossing).
- Centrality dependence of π/p crossing point ?
- Suppression of high p_T pions (PRL 88, 022301 (2002)) and radial flow in the protons may explain the observed crossing region in the spectra.

Centrality dependence of $<p_T>$



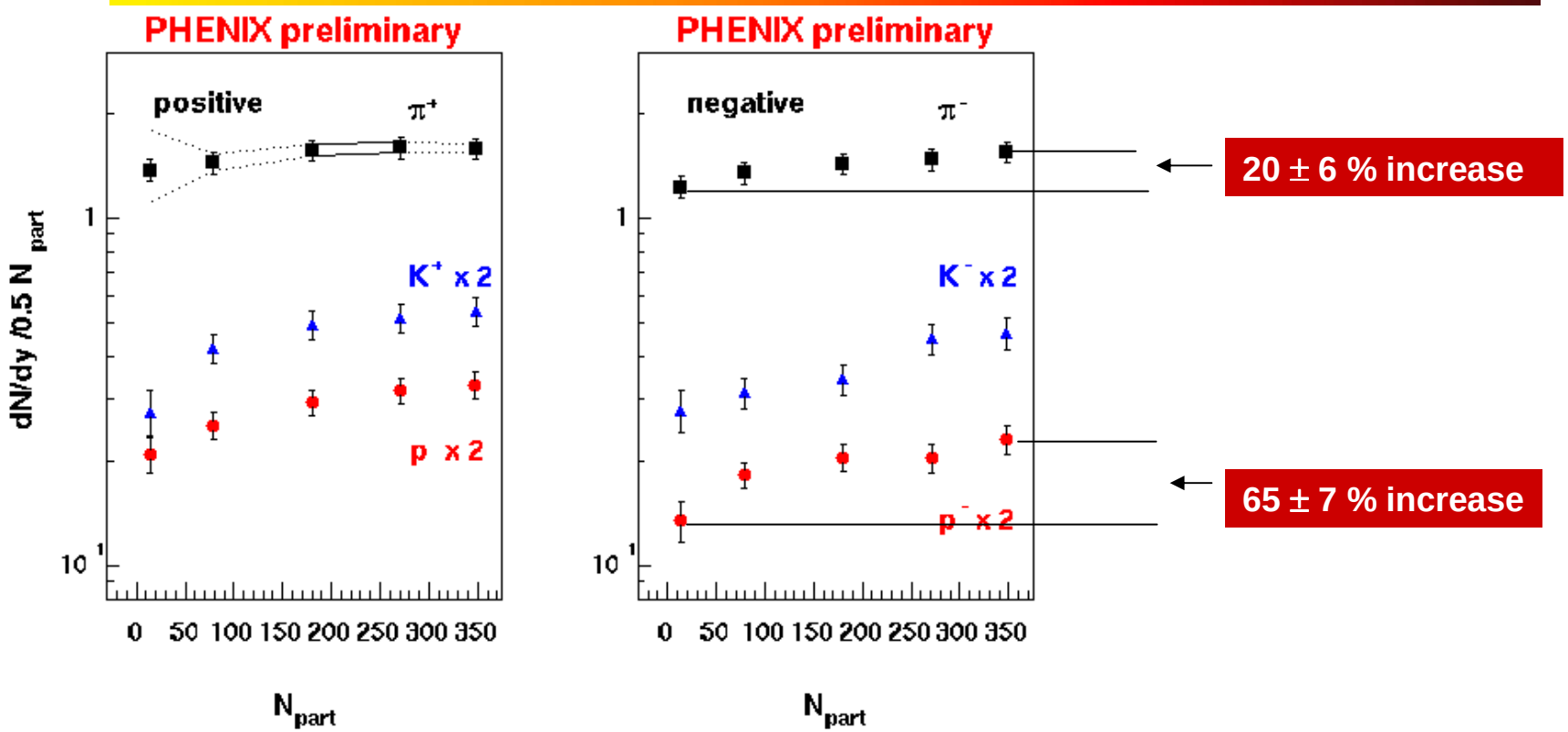


20 ± 5 % increase

* Open symbol : extrapolation form pp

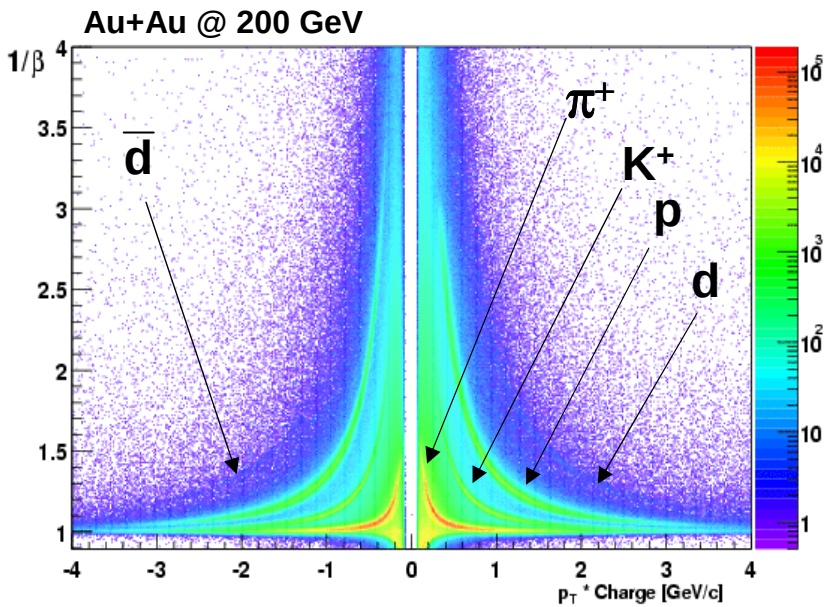
- $<p_T>$ increase with N_{part} and particle mass - consistent with radial flow.
- (Anti) proton $< p_T >$ significant increase from pp collisions.
- The same relative increase from peripheral to central for all particles species.

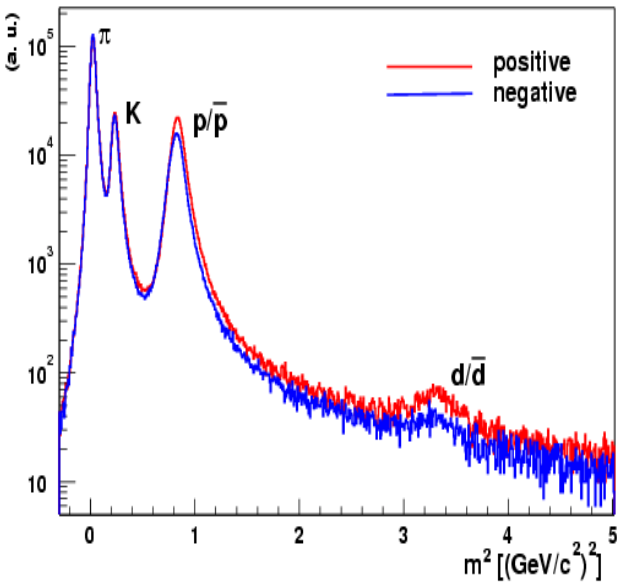
Centrality Dependence of Particle Yield



- (Anti) proton yields per participant pair rise faster than pion yields with N_{part}.
- Similar behavior in K^+, K^-, π^+ and π^-.

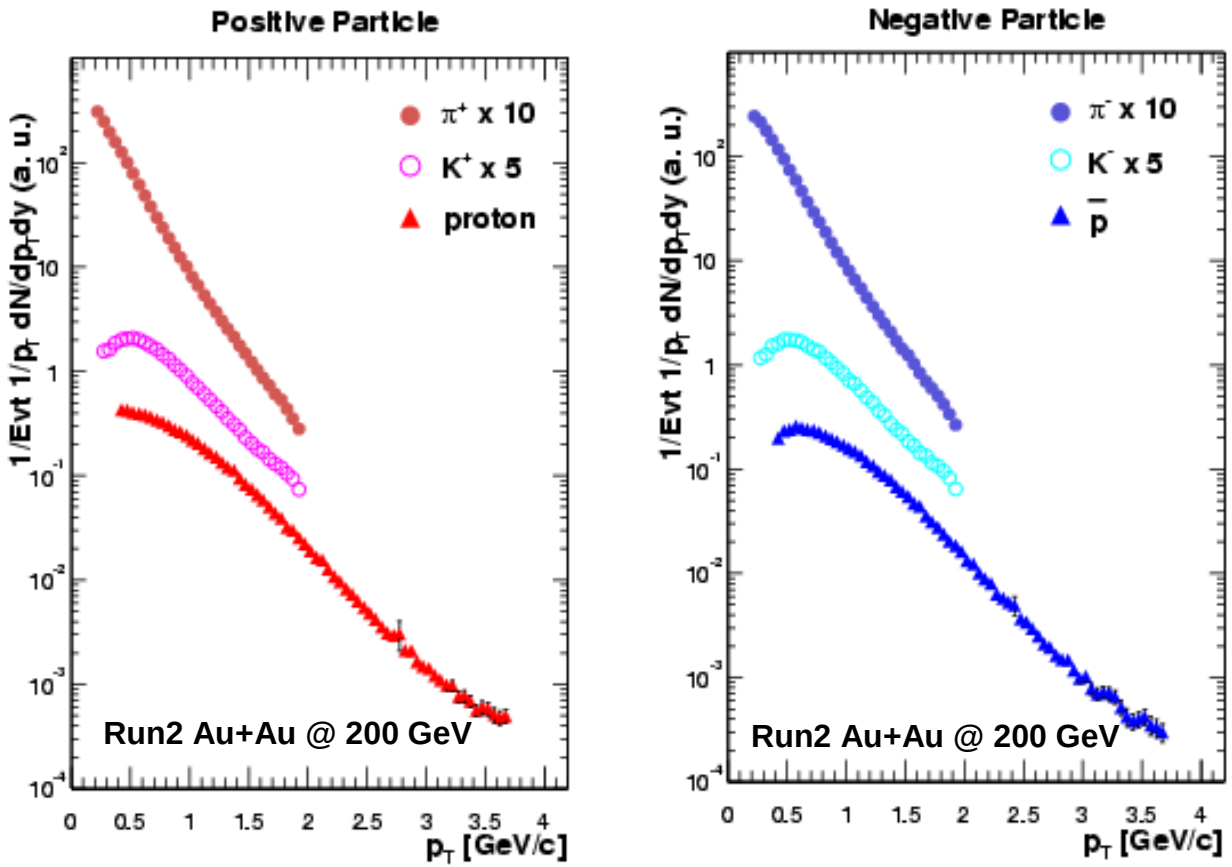
Status of Run2 (Au+Au @ 200 GeV) Analysis





- **Collected 92 million minimum bias triggered events in Au+Au at 200 GeV.**
- Analyzed 15 Million event within 30 cm z-vertex.
- π/K separation < 2 GeV/c , 2 σ K/proton separation < 4 GeV/c.
- Observed deuteron and anti-deuteron.

Minimum Bias Raw p_T Spectra



- Well enough statistics for the precise measurements of p_T spectra at high p_T region (spectra shape, $<p_T>$ and yield vs. centrality).
- Deuteron and anti-deuteron spectra from Run2.

Summary and Outlook

We measured identified single particle charged Hadron spectra in Au+Au @ 130 GeV

- Nucleons dominate mesons at ~ 1.5-2 GeV/c (π/p crossing).
- $<p_T>$ increase with Npart and mass (consistent with radial flow pict.).
- (Anti) proton yields per participant rise faster than pion yields with N_{part}.

Outlook for 200 GeV data analysis

1. Precise measurements of p_T spectra in 200 GeV data.
2. Centrality dependence of $<p_T>$, spectra shape and yield at high p_T.
3. Conclusion on π/p crossing (vs. centrality).
4. Comparison with pp data.
5. Deuteron and anti-deuteron spectra.