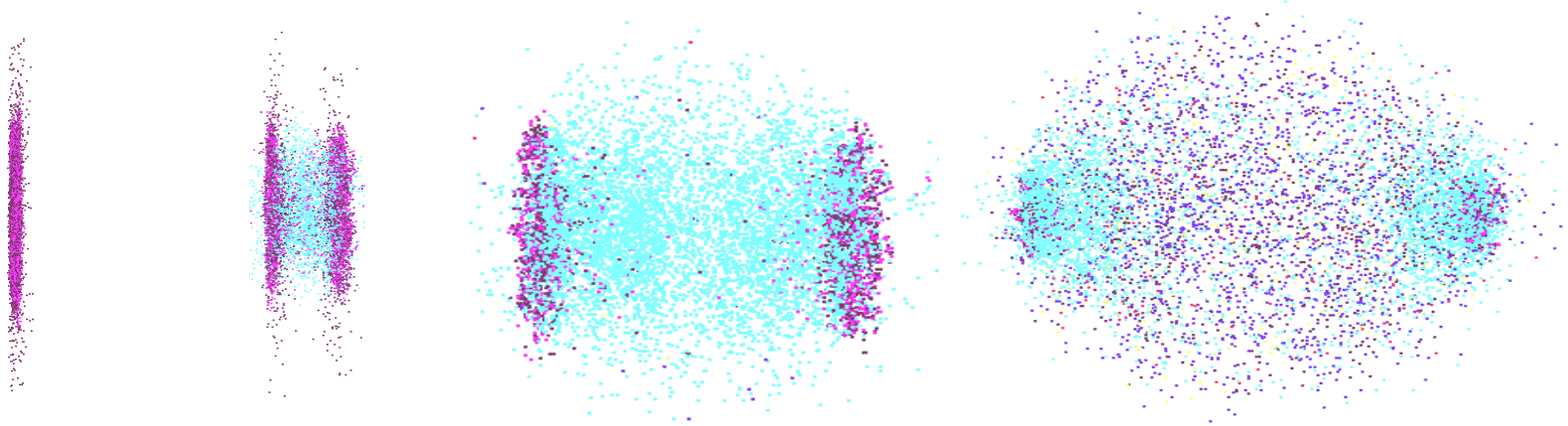
Charged Particle High pt Spectra at PHENIX



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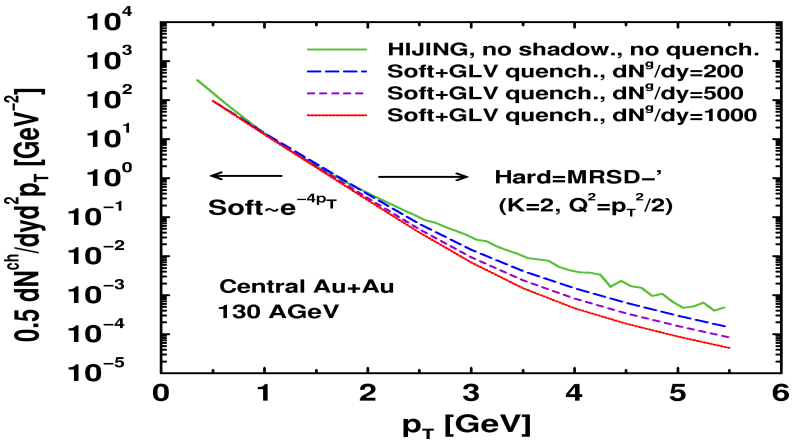
For the PHENIX Collaboration

PHENIX @ RHIC

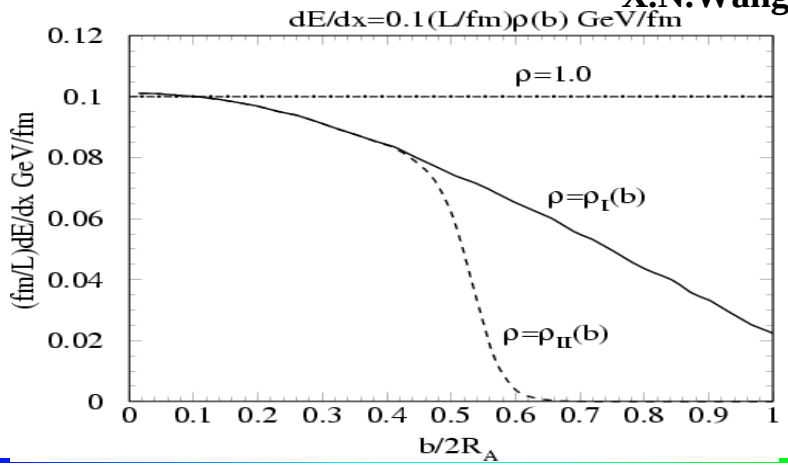
QGP and Charge Particle High pt Physics

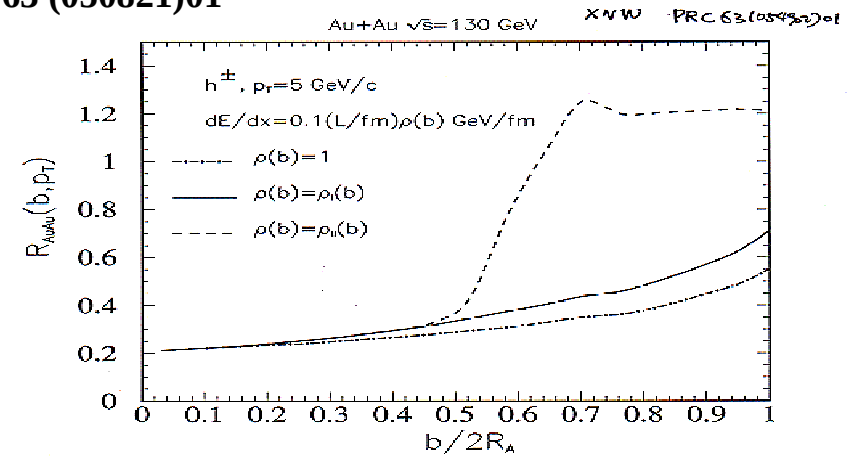
- **Hard parton fragments carries information of QGP**
  - **Suppression of high pt spectra**
  - **Strong centrality dependence**
  - **In which pt and centrality?**

M.Gyulassy, I.Vitev, X.N.Wang PRL 86 (2001) 2557

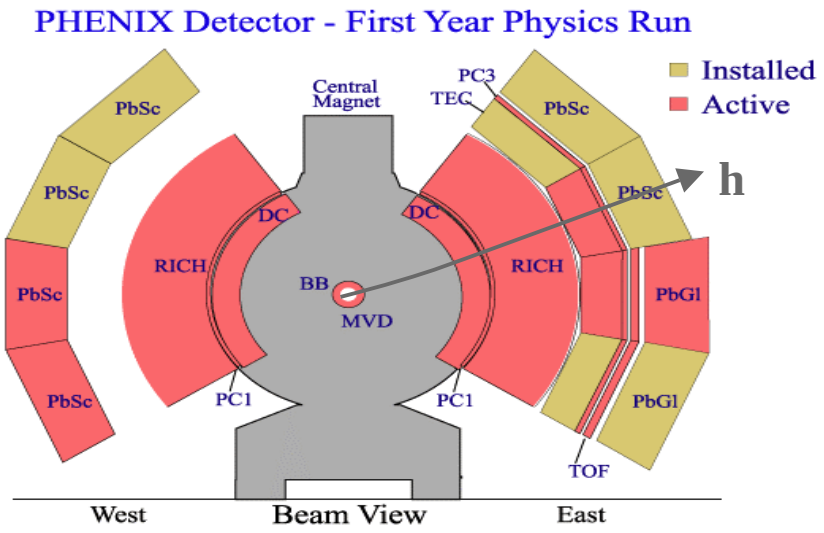


X.N.Wang PRC 63 (050821)01

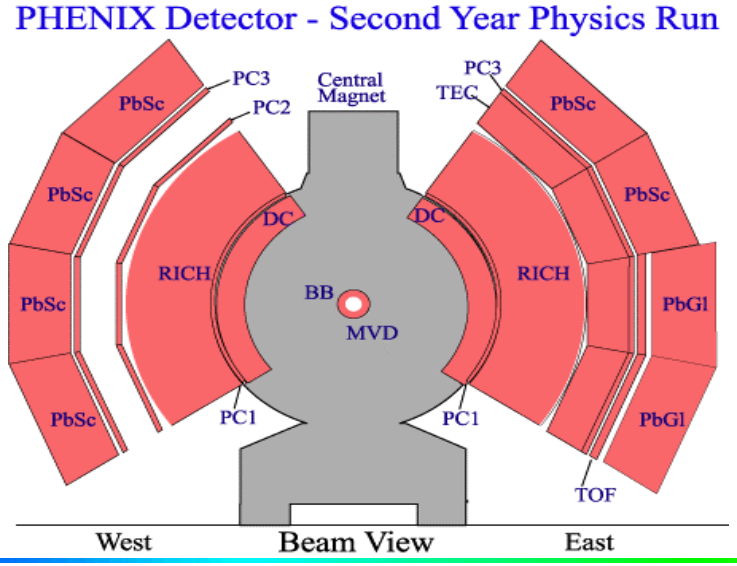




PHENIX Setup

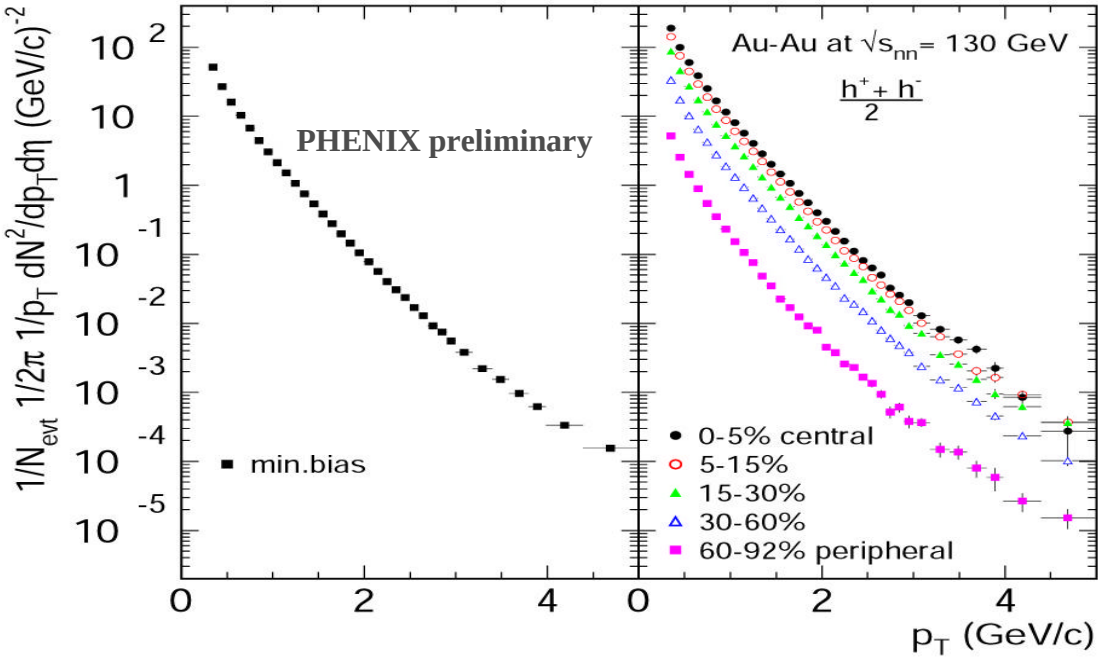


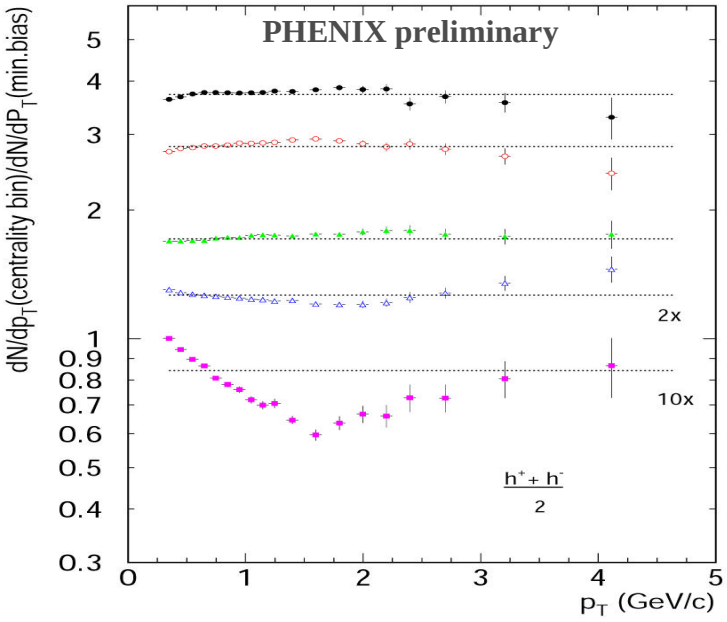
- **Global Observables**
  - **event characterization**
    - **ZDC, BBC**
- **Charged Particles**
  - **tracking & momentum**
    - **East arm DC, PC1, PC3**
- **1.4M minimum bias events**



- **More background rejection power by new tracking subsystem**
- **~170 events total(92 minimum bias)**
- **spectra can be measured independently in west and east arms**

High pt Charged Hadron Spectra at 130GeV/c

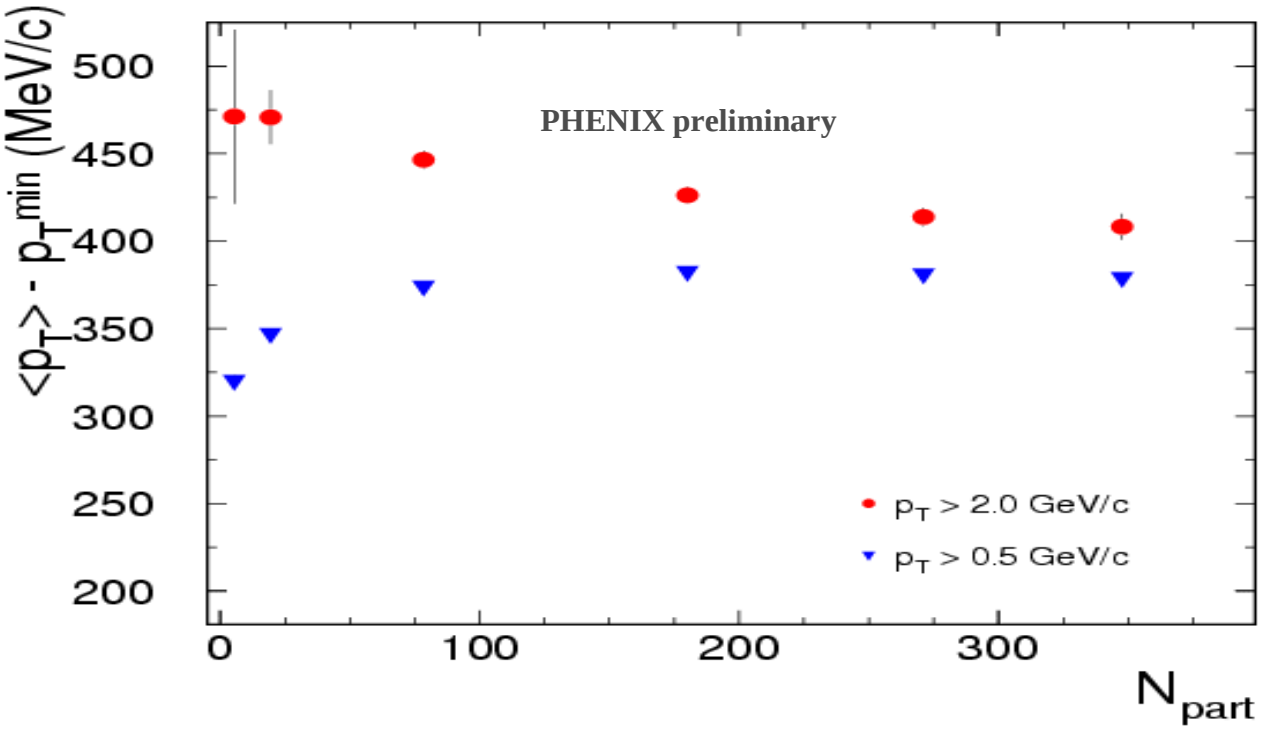




- **Centrality dependence of charged particle production**
  - **Charged hadron spectra in bins of centrality show a gradual loss in concavity as they evolve from peripheral to central collisions.**
  - **The loss in concavity is consistent with the effect one might expect from suppression**

Change in Shape

- **Local inverse slope characterize the spectra shape**
  - **It is more convenient to calculate Mean pt above a pt cut $\langle p_T \rangle - p_T^{min}$**
  - **Centrality dependencies at high pt region are clearly different from low pt region**
    - **Hydrodynamic collective flow at low pt.**
    - **Suppression at high pt.**

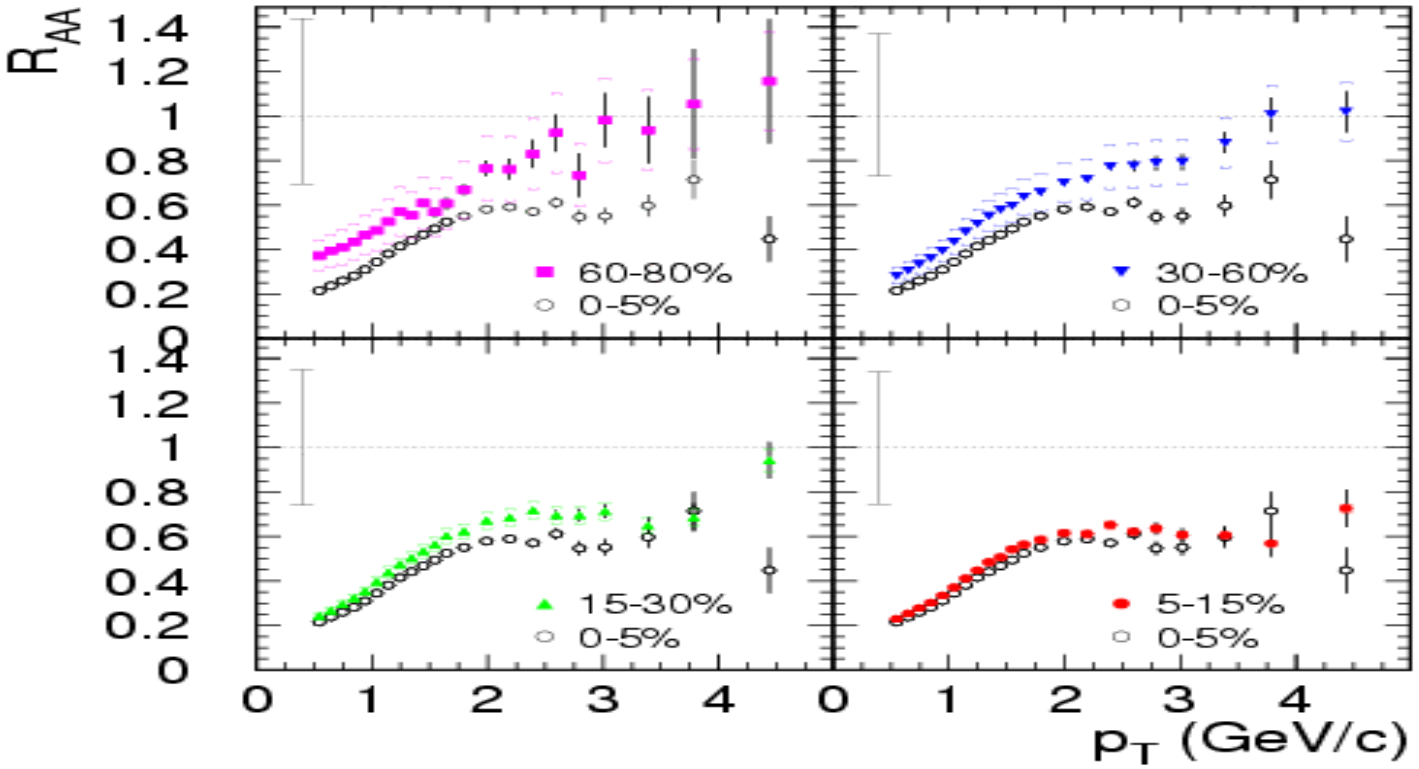


Comparison with NN references I

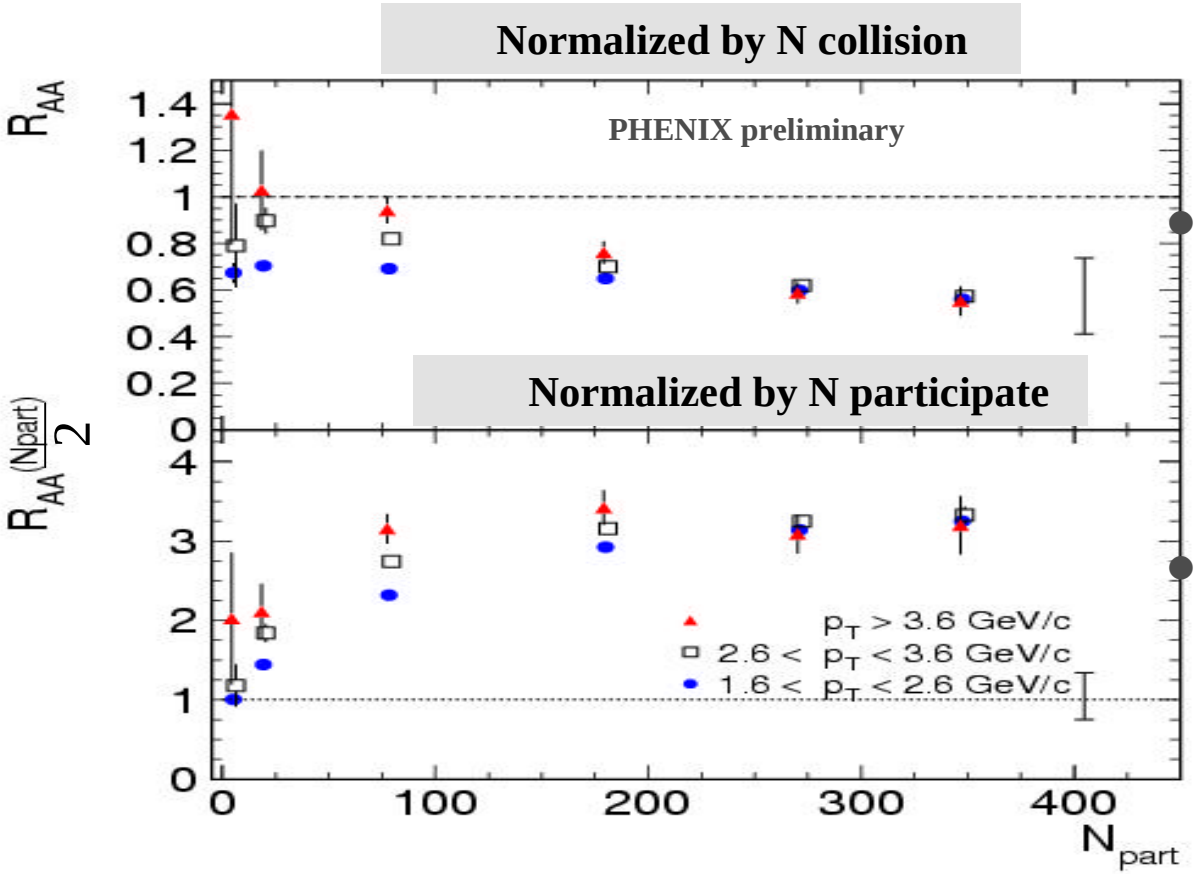
- **R_{AA} for 5 centrality bin**
  - **Peripheral $R_{AA} \rightarrow 1$**
  - **Central R_{AA} saturates ~ 0.6 at pt >2GeV/C**
  - **Changes in behavior in 30-60% bin.**

$$R_{AA} = \frac{1/N_{evt}\, d^2N_{AA}/dp_T d\eta}{(\langle N_X \rangle / \sigma_{inel}^{NN}) d^2\sigma^{NN}/dp_T d\eta}$$

PHENIX preliminary



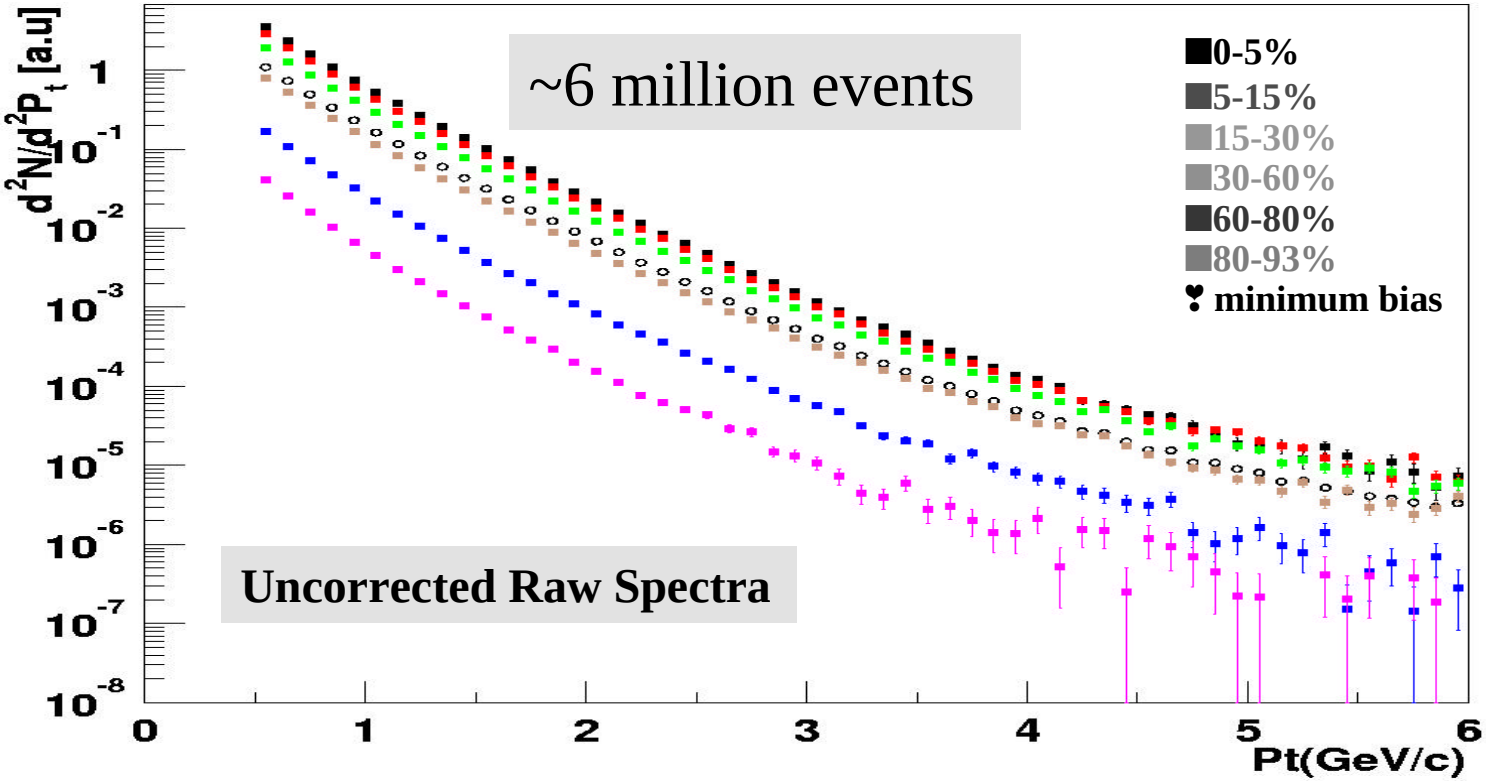
Comparison with NN references II



- **Soft and hard production have different scaling behavior: R_{AA} and $R_{AA}^{(part/2)}$**
- **Ratio for central are the same for 3 pt intervals reflects the saturation of R_{AA} at high pt**
- **With increasing pt, $R_{AA}^{(part/2)}$ saturates at successively lower Npart, most of this changes occurs in the range of Npart below 100-150 which sits within 30-60% centrality bin.**

Run2 analysis status

- ✓ 92 million minimum bias + 80 million level2 triggered events
- ✓ Momentum resolution dp/p < 1%p(3.5% for Run1)
- ✓ West arm (DC PC1 PC2 PC3), No random association background
- ✖ Open issue : background from decay and photon conversion at pt > 6 GeV/c

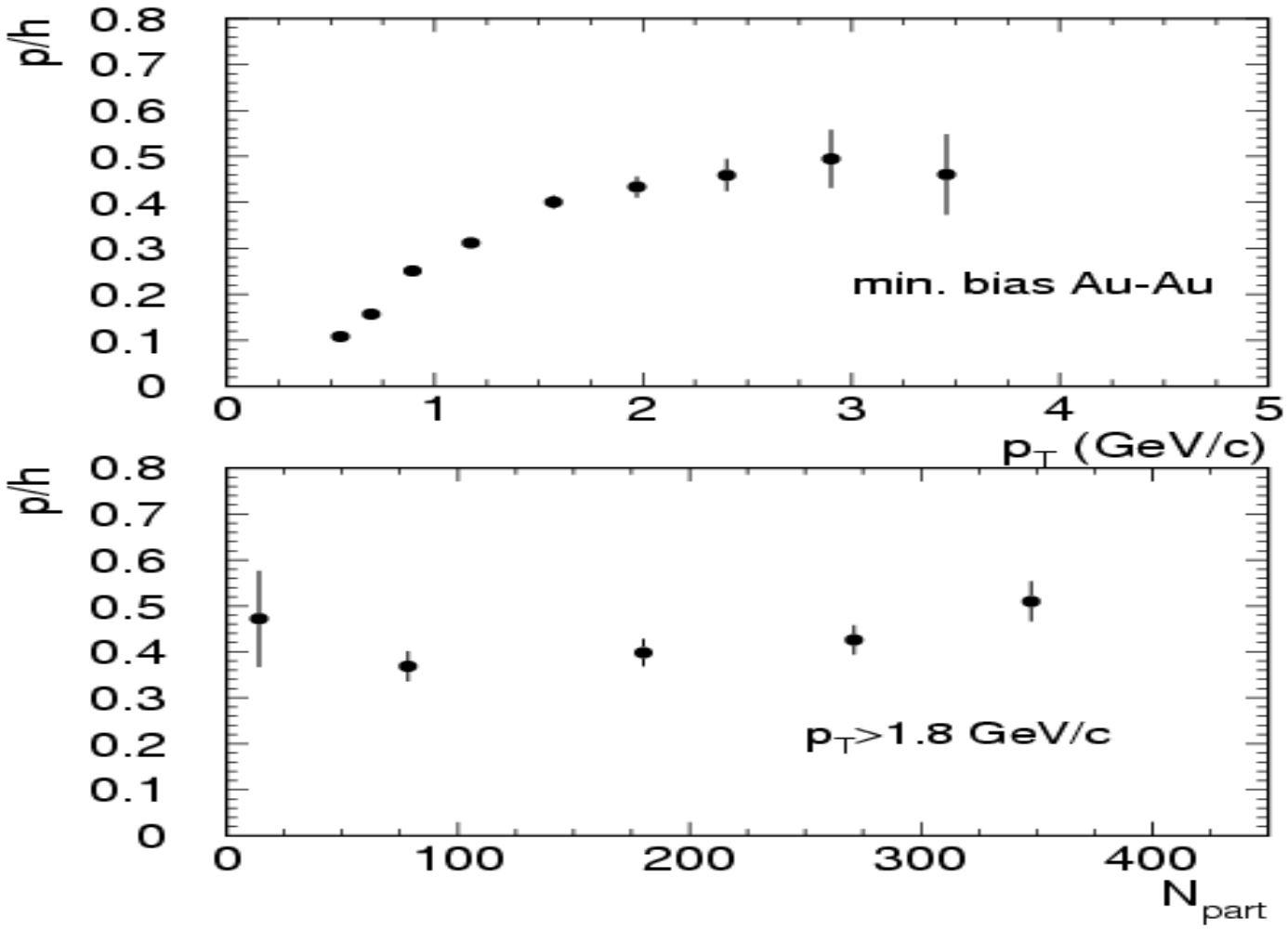


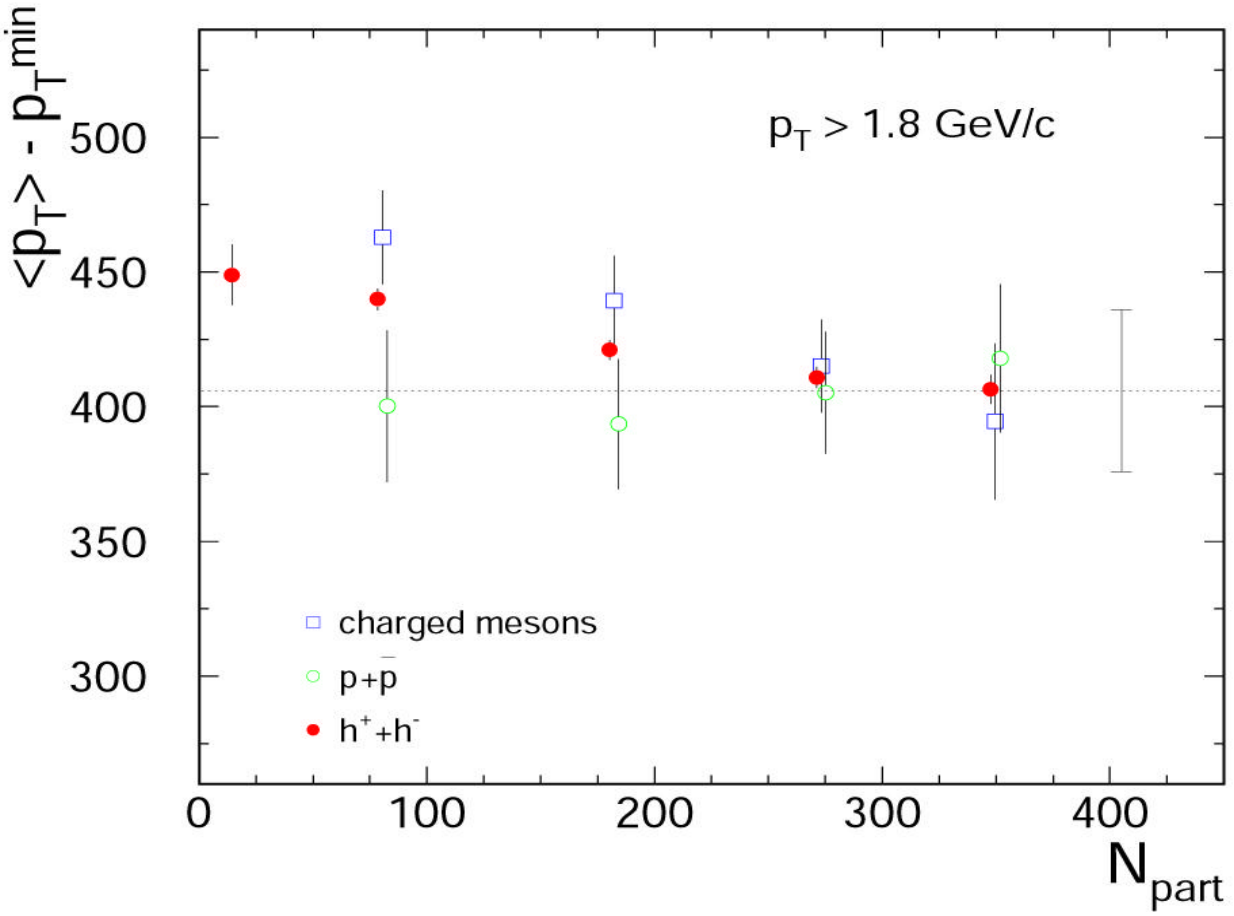
Conclusion and outlook

- **Charged particle momentum spectra have been measured for different centrality selection up to 5GeV/c at 130 GeV**
  - **Particle production is suppressed at high pt relative to binary NN scaling.**
  - **At pt>2GeV/c, inverse slope decreases with centrality, the trend is opposite at low pt.**
  - **For pt>2GeV/c , R_{AA} in central collisions saturates at 0.6.**
  - **At high pt, $R_{AA}^{(part/2)}$ saturates at 3 for Npart >150.**

- **In Run2, PHENIX tracking detectors are fully operational**
  - **92 million MB Au - Au (plus 80 million level2 events)**
  - **~ 200 million MB Proton - Proton events**
  - **Momentum resolution dp/p< 1%p(GeV/c)**
  - **Need to address background problem at pt>6GeV/c**
  - **Expect accurate measurement of R_{AA} at high pt**

Proton Contamination

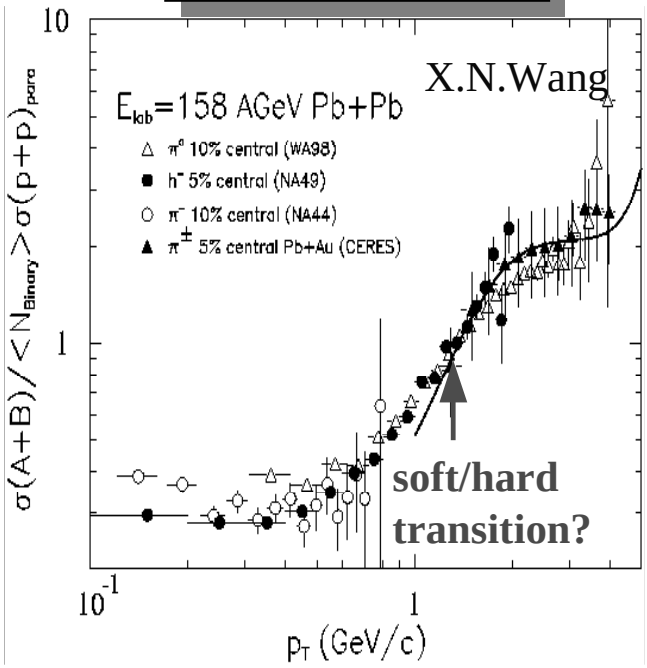


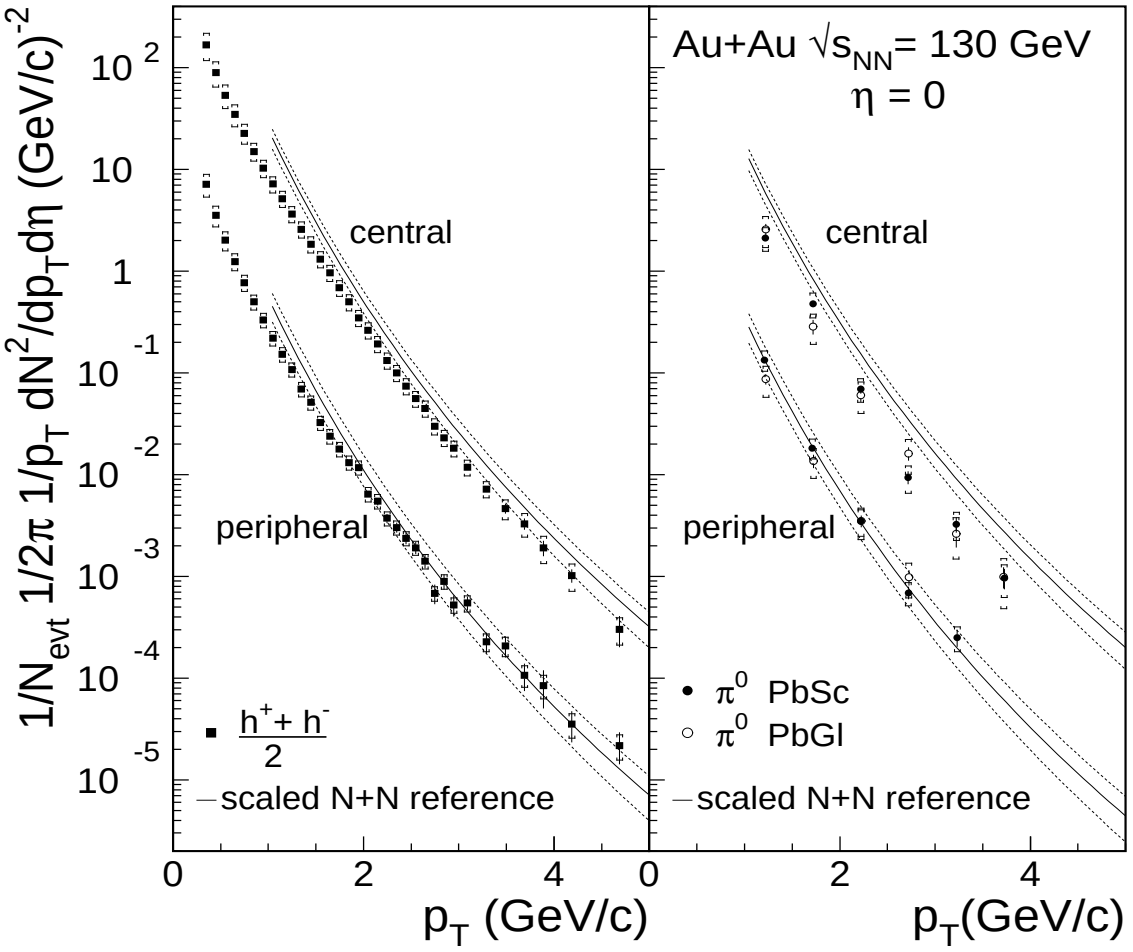


gradual onset of suppression with centrality and p_T

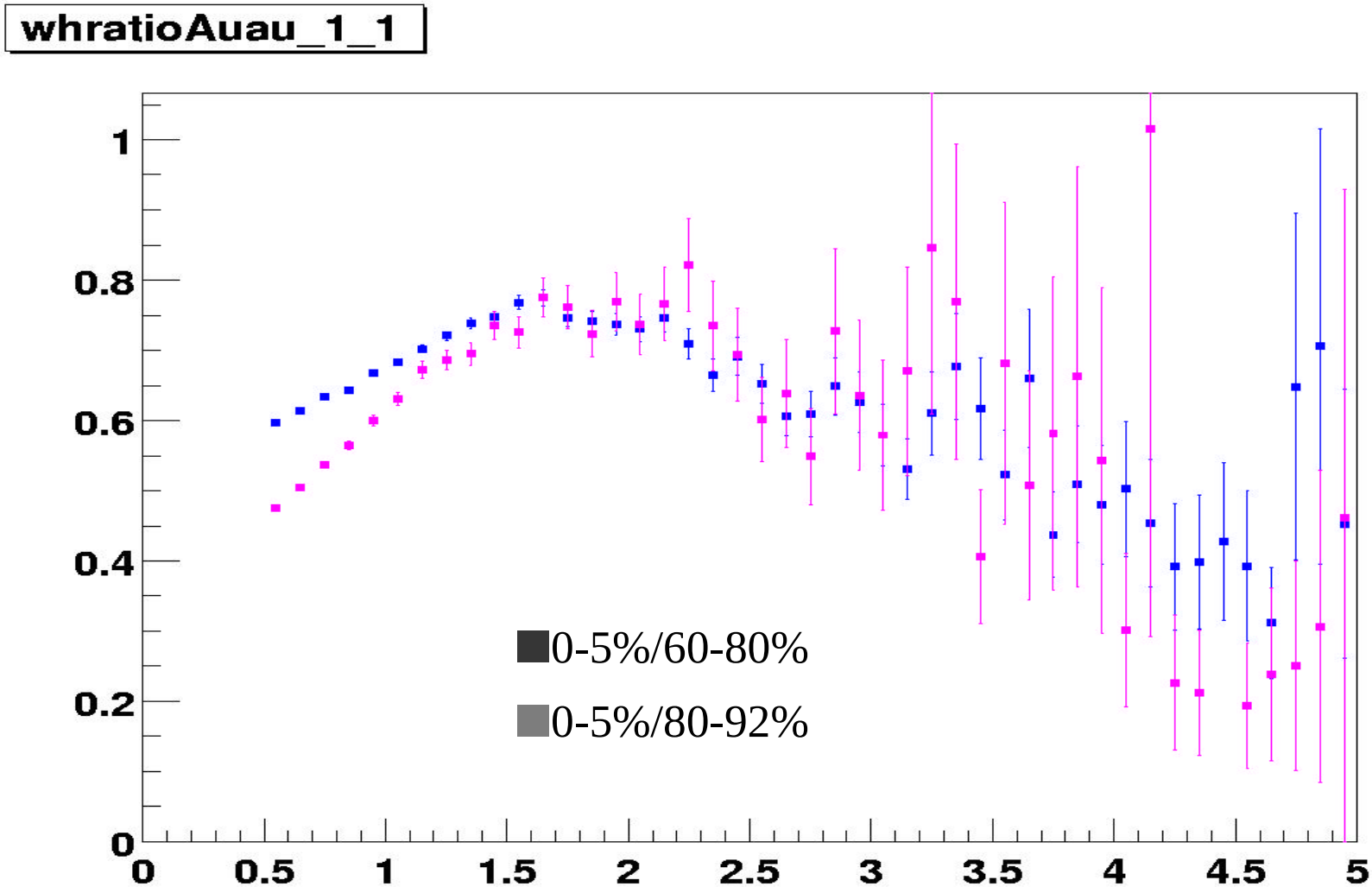
Phys. Rev. Lett. , (2001)

CERN - SPS

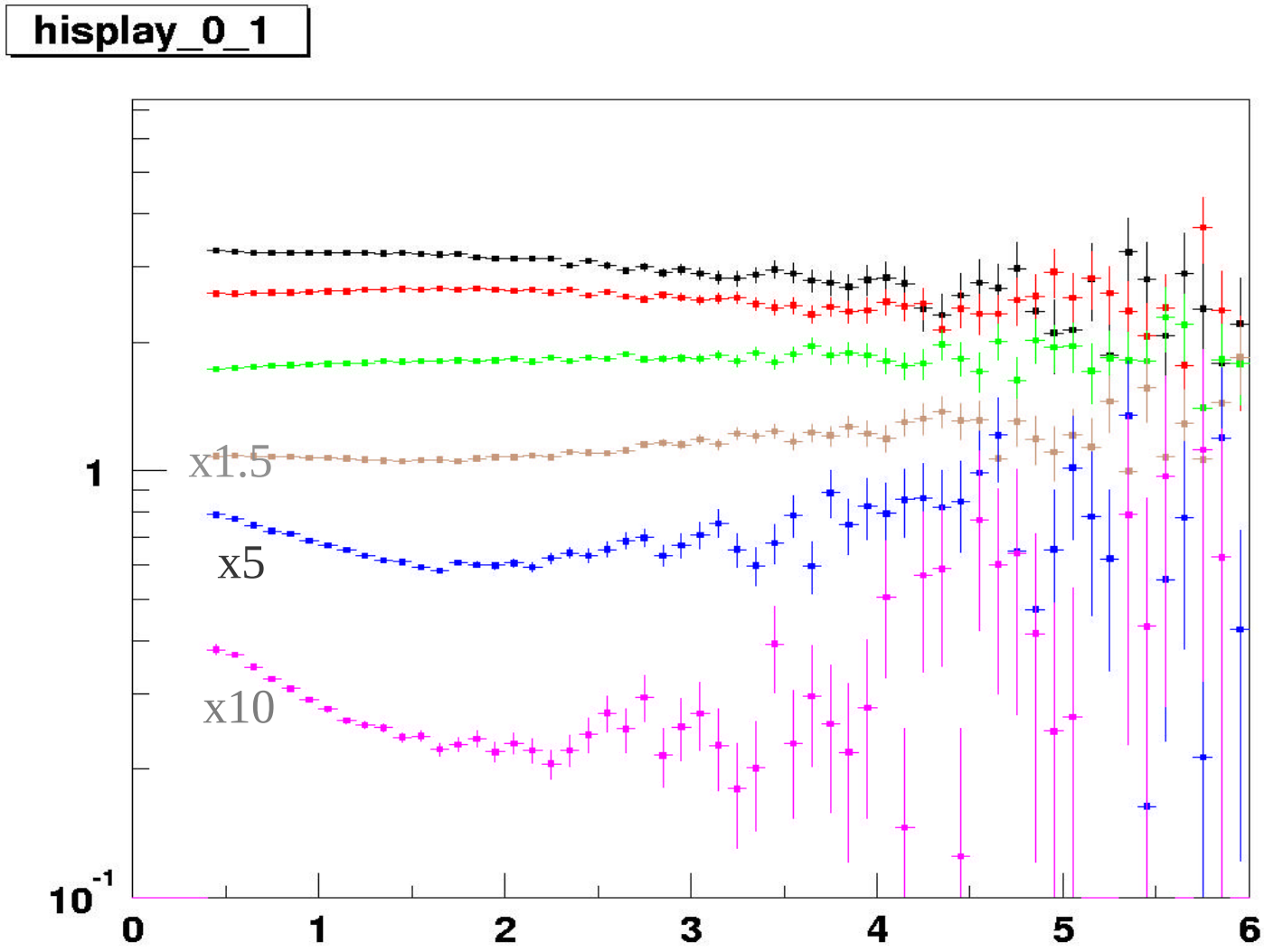




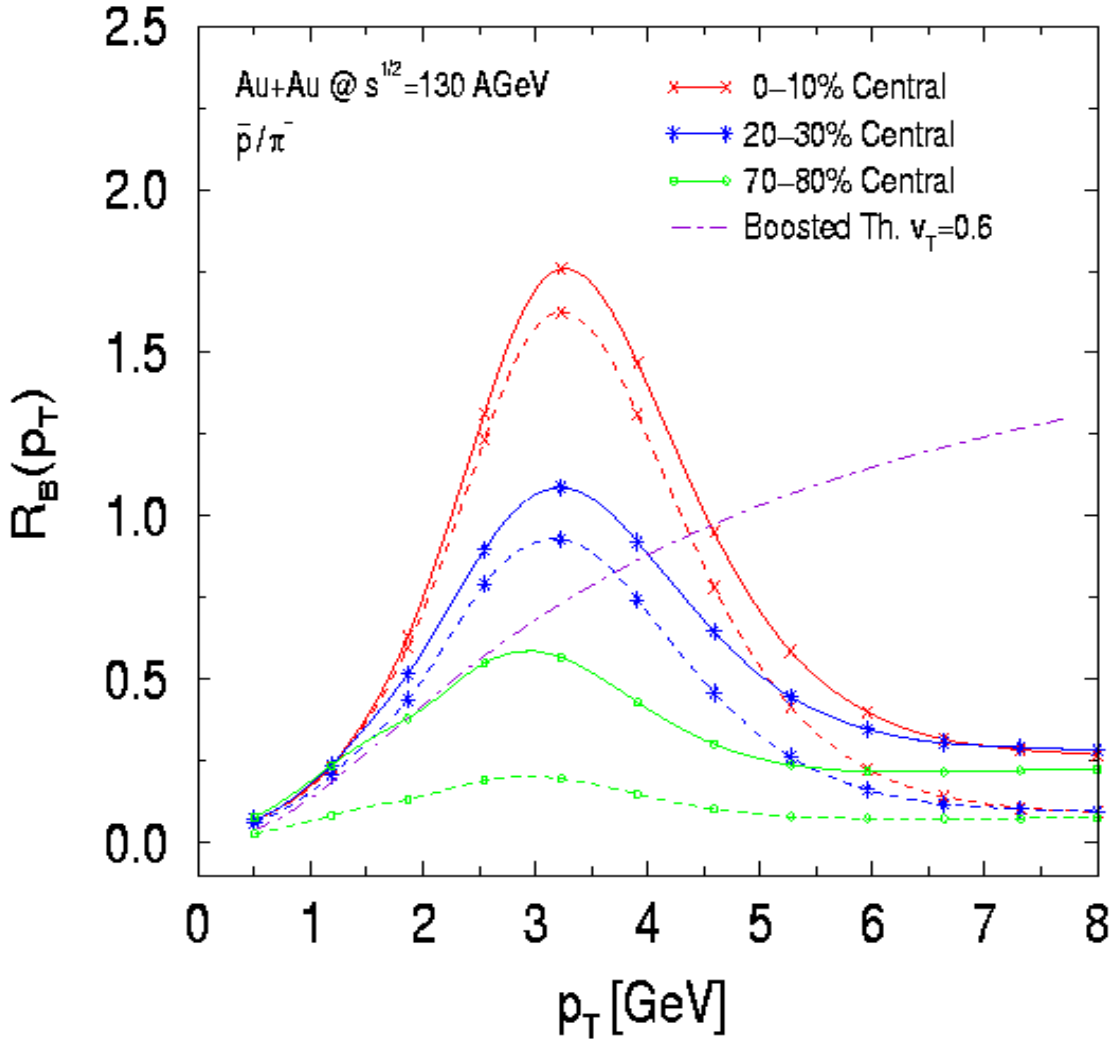
Slides not to be shown

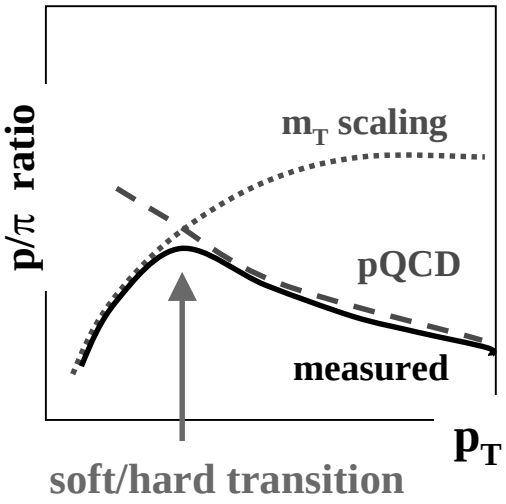


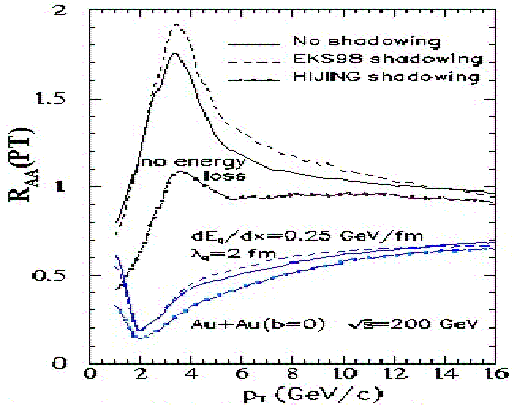
Ratio of 6 centrality bin / minimum bias

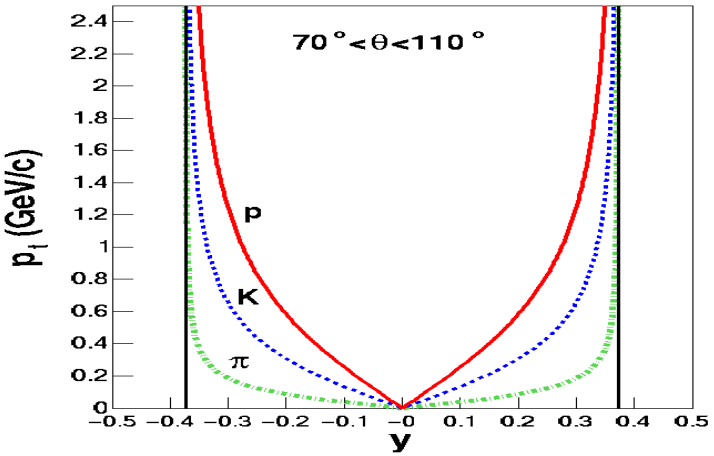


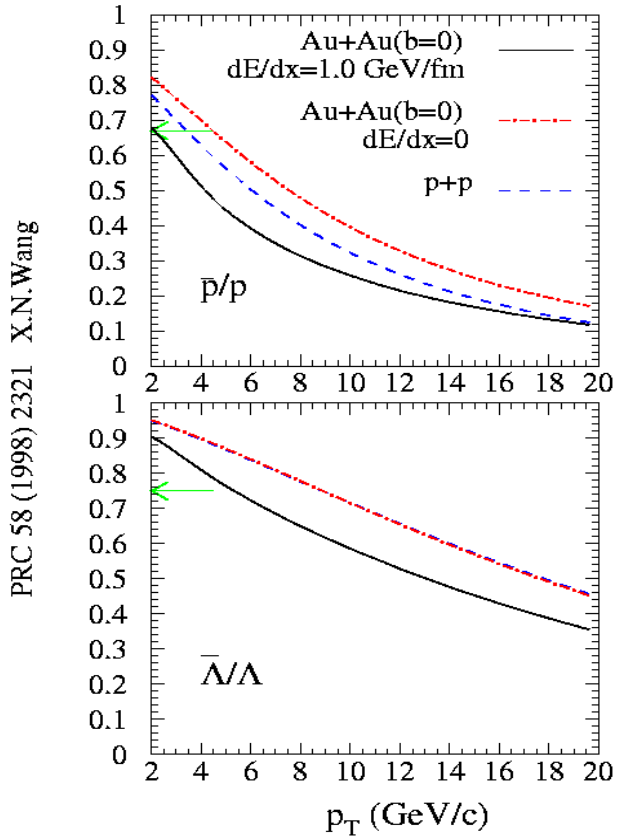
calculation by I.Vitev




p/π ratio
m_T scaling
pQCD
measured
p_T
soft/hard transition


No shadowing
EKS98 shadowing
HIJING shadowing
no energy loss
dE_g/dx=0.25 GeV/fm
λ_g=2 fm
Au+Au(b=0) √s=200 GeV
R_AA(PT)
p_T (GeV/c)


70°<θ<110°
p
K
π
p_t (GeV/c)
y


Au+Au(b=0)
dE/dx=1.0 GeV/fm
Au+Au(b=0)
dE/dx=0
p+p
p̄/p
Λ̄/Λ
p_T (GeV/c)
PRC 58 (1998) 2321 X.N.Wang