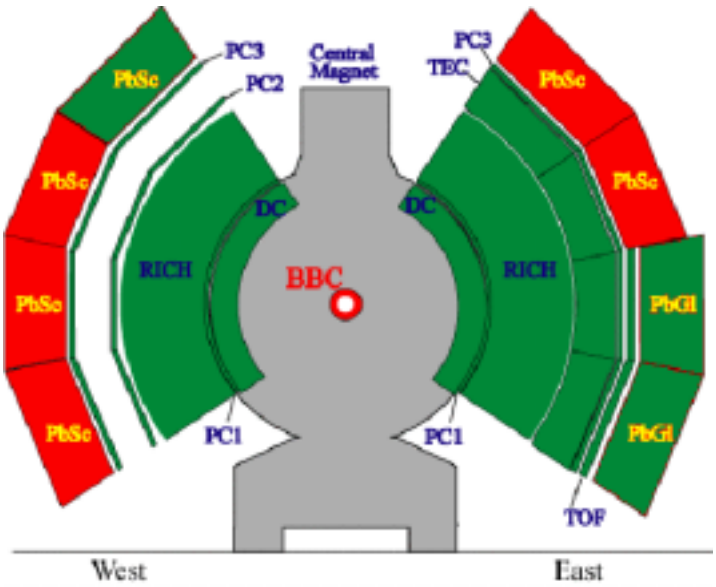
Physics Motivation

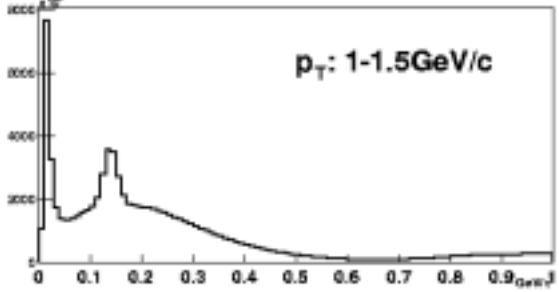
- Provide a testing ground for precision perturbative QCD
  - Baseline for future polarized pp collision analysis and asymmetry measurement
- Data baseline for high p_T heavy ion physics
  - Compare with peripheral Au+Au collisions as consistency check
  - Compare with central Au+Au collisions
    - Especially for high p_T physics in Au+Au
- In this talk, we compare the π^0 cross section with a NLO pQCD calculation and AuAu data and provide reliable data for heavy ion data comparison.

RHIC-PHENIX

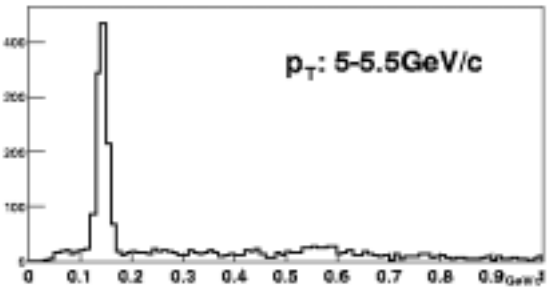
- RHIC run2002 pp run
  - Integrated luminosity 0.15pb-1
  - Analyzed luminosity 0.03pb-1
    - half of runs are analyzed.
    - Vertex position cut +-30cm
    - 140M events
- EMCalorimeter
  - 2 Arm × 4 sectors
    - Lead Scintillator(PbSc) 6 sectors(15552 channels)
    - Lead Glass (PbGl) 2sectors (9216 channels)
  - ~5m distance from collision point
    - $|\eta|<0.38$ $\phi = 180°$
- Analysis
  - 5 sectors PbSc is used in this analysis
    - 1 PbSc/2 PbGl needs time to do fine tuning of calibration



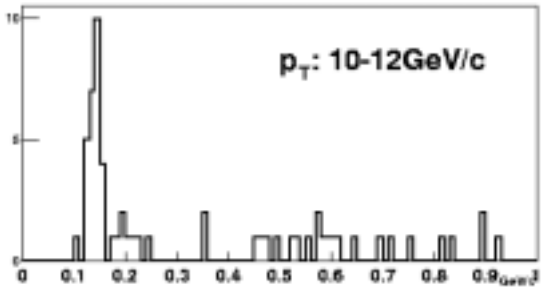
π^0 Measurement



- Invariant mass spectrum
- The background is smaller than that of heavy ion collisions
  - 1-1.5GeV/c N/S = 200%
  - p_T>5GeV/c N/S = 10%



- 2x2 trigger worked very well
  - Rejection Factor = 90
  - Measured 1-15GeV/c π^0
    - 30 π^0 at 10-12GeV/c
    - 10 π^0 at 12-15GeV/c



Analysis Procedure

$\varepsilon^{(MB)}$ 51%

Minimum Bias(MB) Trigger efficiency

Luminosity normalization

$$\varepsilon_{\pi 0}^{(MB)}(p_T) = \frac{N_{\pi 0}^{(MB\&4\times4)}}{N_{\pi 0}^{(4\times4)}}$$

π^0 efficiency in Min. Bias trigger 75% flat

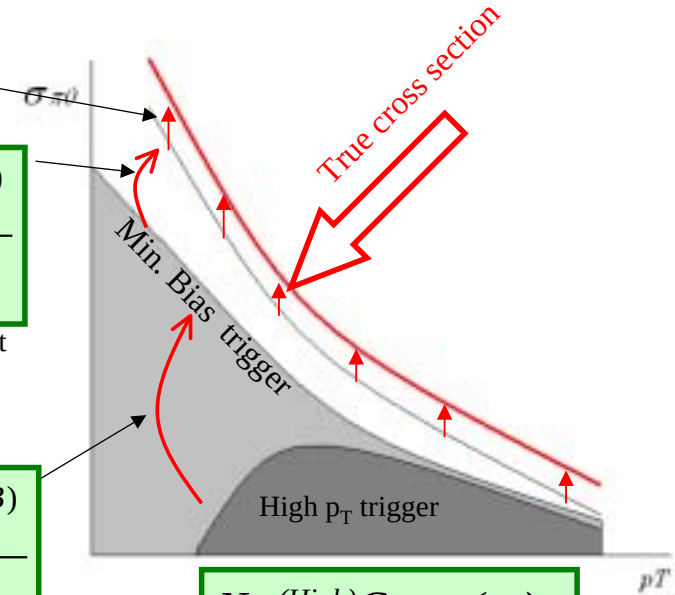
Slope correction for Min. Bias trigger

$$\varepsilon_{\pi 0}^{(High)}(p_T) = \frac{N_{\pi 0}^{(2\times2\&MB)}}{N_{\pi 0}^{(MB)}}$$

80% flat for p_T> 3GeV

π^0 efficiency in 2x2 trigger

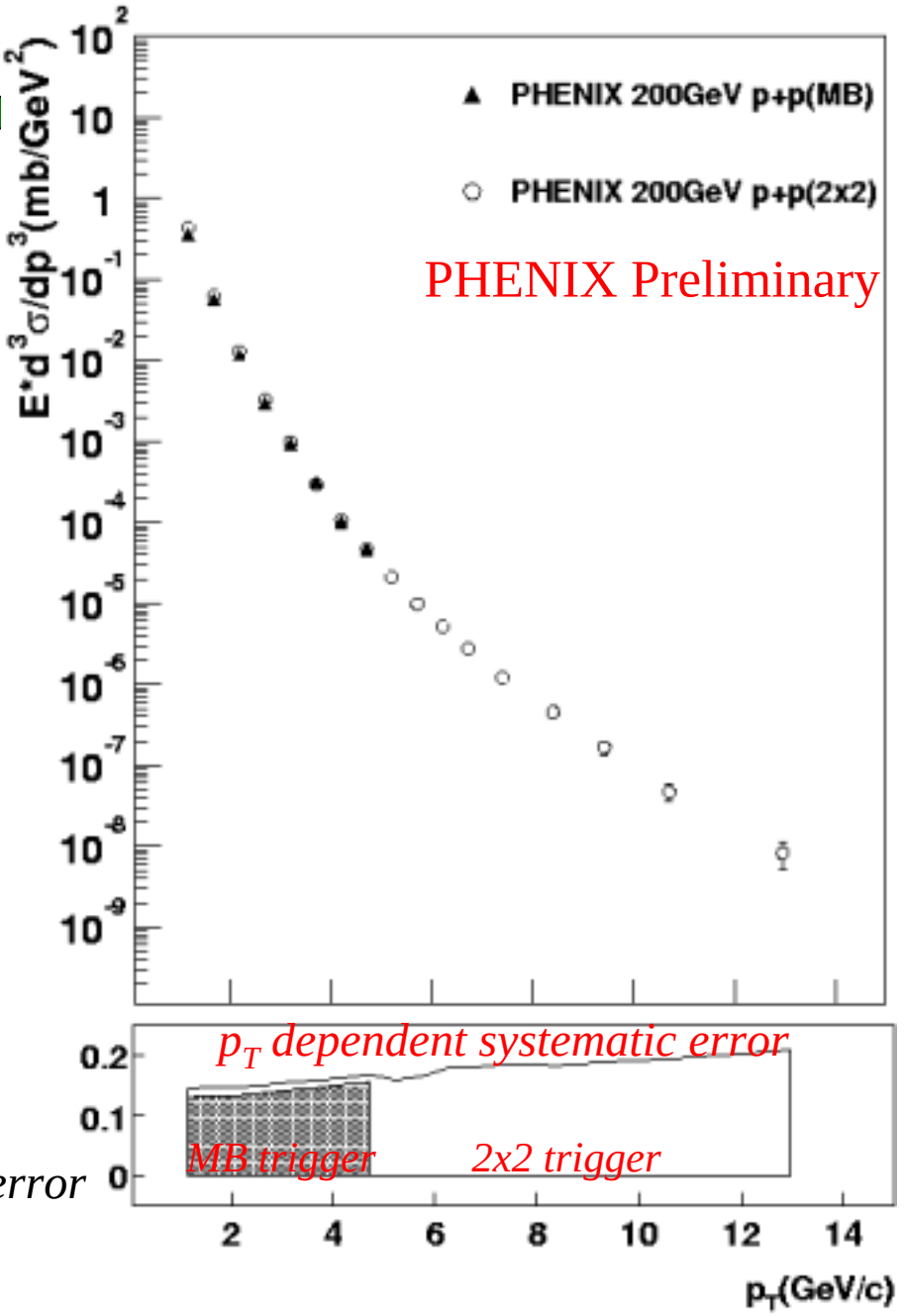
"turn-on" curve for trigger



$N_{\pi 0}^{(High)} C_{\pi 0}^{reco}(p_T)$

π^0 Inclusive Cross Section

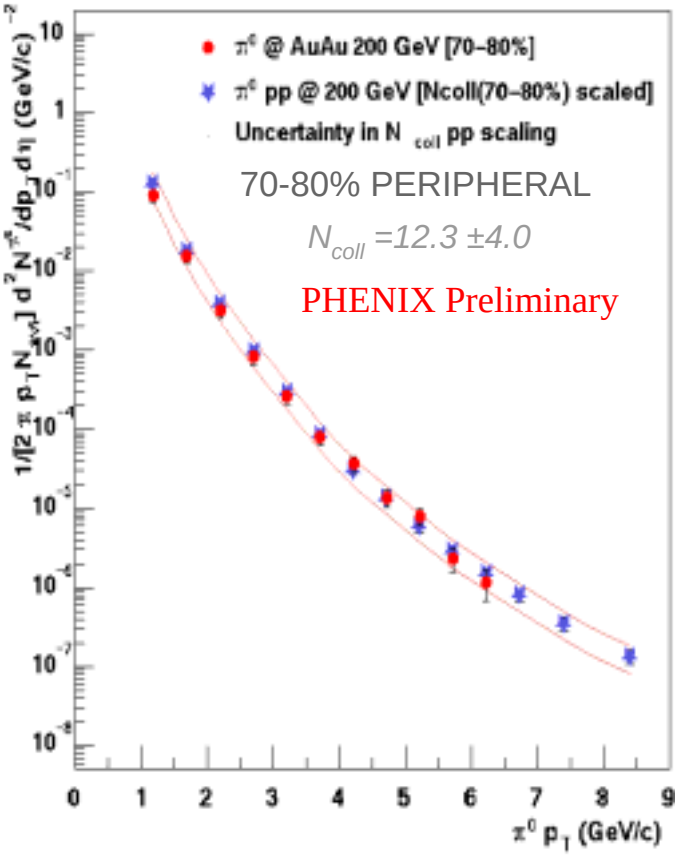
- Cross section measured over 8 orders of magnitude.
  - 1-13GeV/c
- Two triggers
    - Minimum Bias(MB) trigger
    - 2x2 trigger
  - They are consistent within systematic error.
  - To minimize the systematic error
    - Min. Bias data for 1-3GeV/c
    - 2x2 trigger for 3-15GeV/c



Normalization systematic error 30% is not included here.

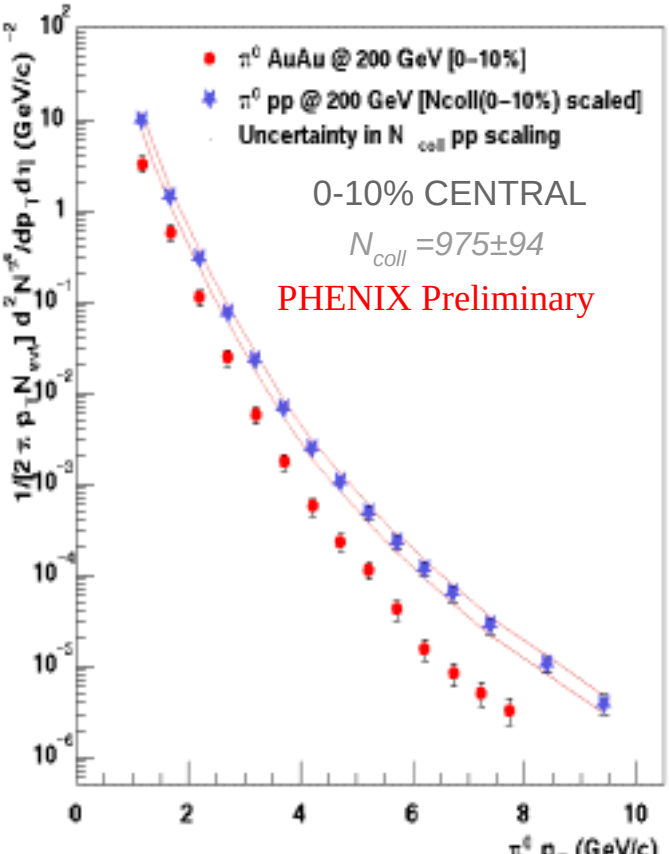
Comparison with AuAu Peripheral

- AuAu 200GeV peripheral data is up to 6GeV/c
  - The pp data is scaled up by the number of collision.
- They are consistent within Ncoll scaling



Comparison with AuAu Central

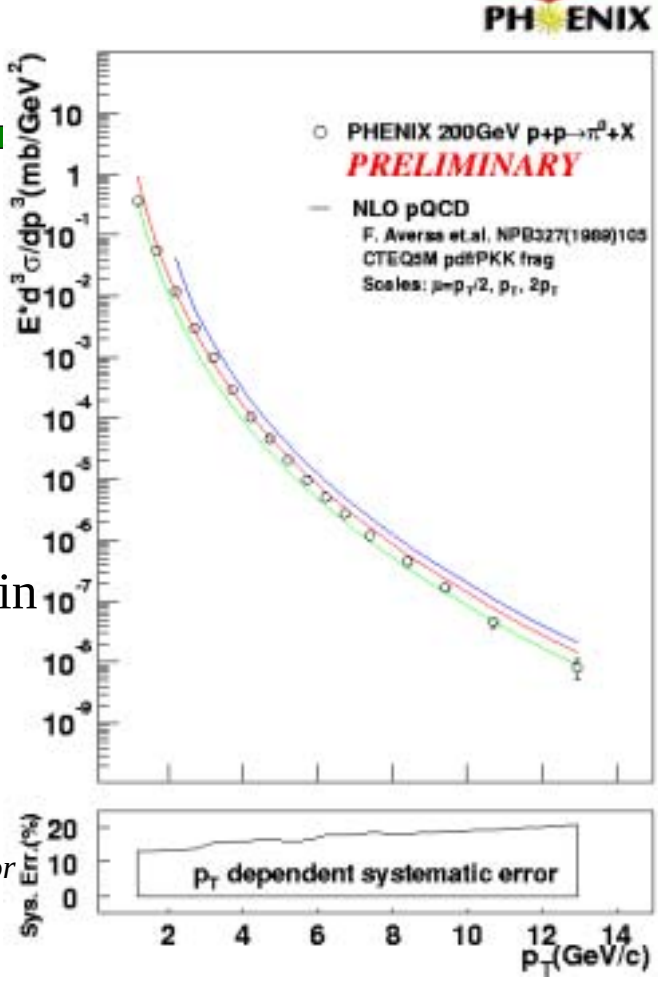
- AuAu 200GeV central data is up to 8GeV/c
  - The pp data is scaled up by the number of collision.
- AuAu data shows large suppression.
  - The suppression is dependent of pT
  - This might be understood by the jet quenching effect.



Comparison with QCD Calculation

- NLO pQCD calculation
  - CTEQ5M pdf
  - Potter-Kniehl-Kramer fragmentation function
  - $\mu = p_T/2, p_T, 2p_T$

    Thanks to W.Vogelsang
- Consistent with data within the scale dependence.



Normalization systematic error 30% is not included here.

Comparison with QCD Calculation

- The deviation of the pQCD calculation is depicted
  - The pQCD calculation with one a set of PDF/FF is consistent within the systematic error of the data and the scale selection

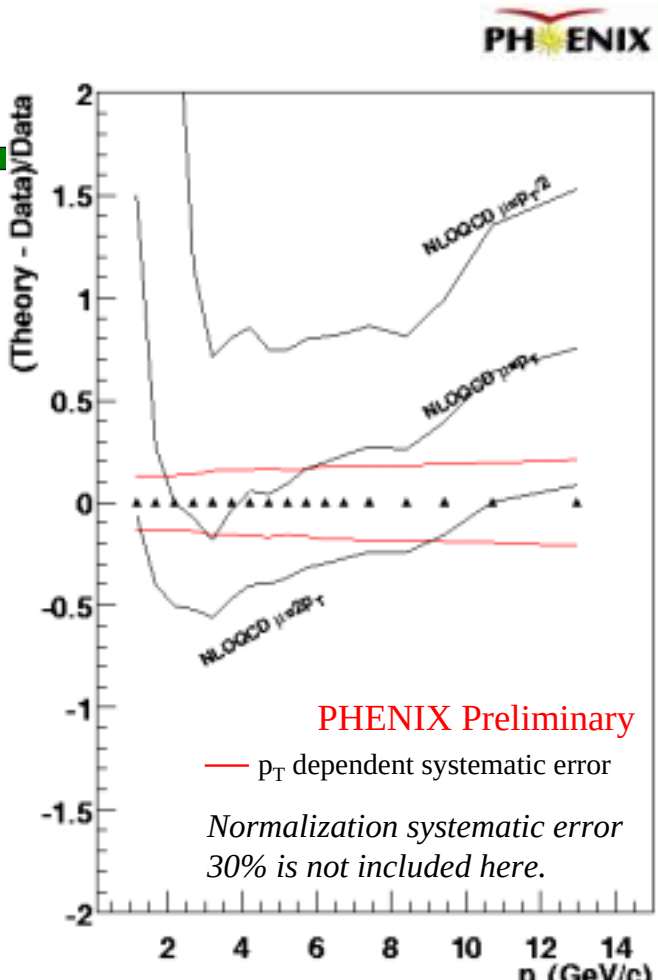
O.K. So everybody is happy!!!
Let's go to drink beer!!!

Wait!!!!!

What I want to say in this workshop is

"Our data might be one more reference point for study of PDF and FF."

- Dear all, please don't stop your head and hand !!!



Conclusion

- Measured π^0 cross section.
  - Photon trigger worked well
    - 8 orders of magnitude, 1-13GeV/c
    - Rejection factor = 90
  - Results from two triggers (Min. Bias and 2x2) are consistent within systematic error
- Comparison with UA1 extrapolation
  - Extrapolation underestimates data at high p_T
  - The data will be an important reference for A+A
- Comparison with AuAu
  - Consistent with AuAu peripheral
  - AuAu central shows large suppression
- Comparison with pQCD with NLO calculation
  - pQCD calculation agree with data