Physics with the STAR RICH

G.J.Kunde

for the Yale/Cern/Bari

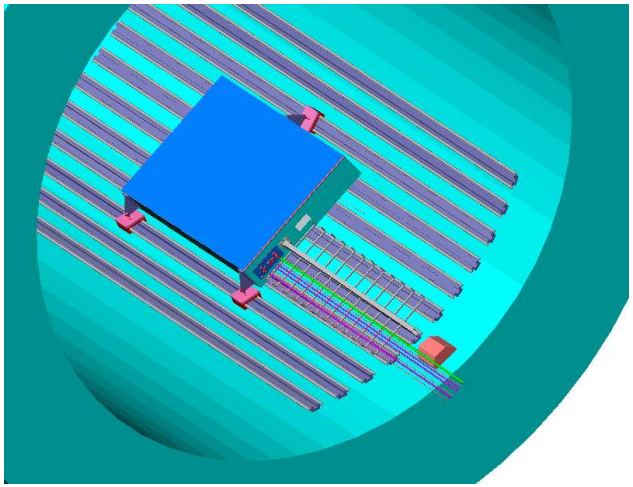
RICH-Collaboration

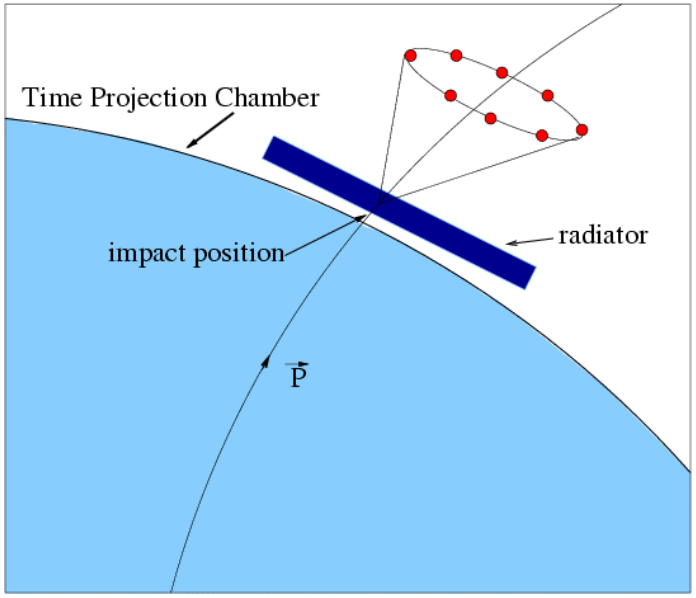
Outline

- Ring Imaging Cherenkov Detector
- Acceptance and PID Range
- Spectra
- Kaon Interferometry
- Partonic Energy Loss

Ring Imaging Cherenkov Detector I

- PID for Kaon/Pion/Proton
- Momentum from TPC
- Located at y=0

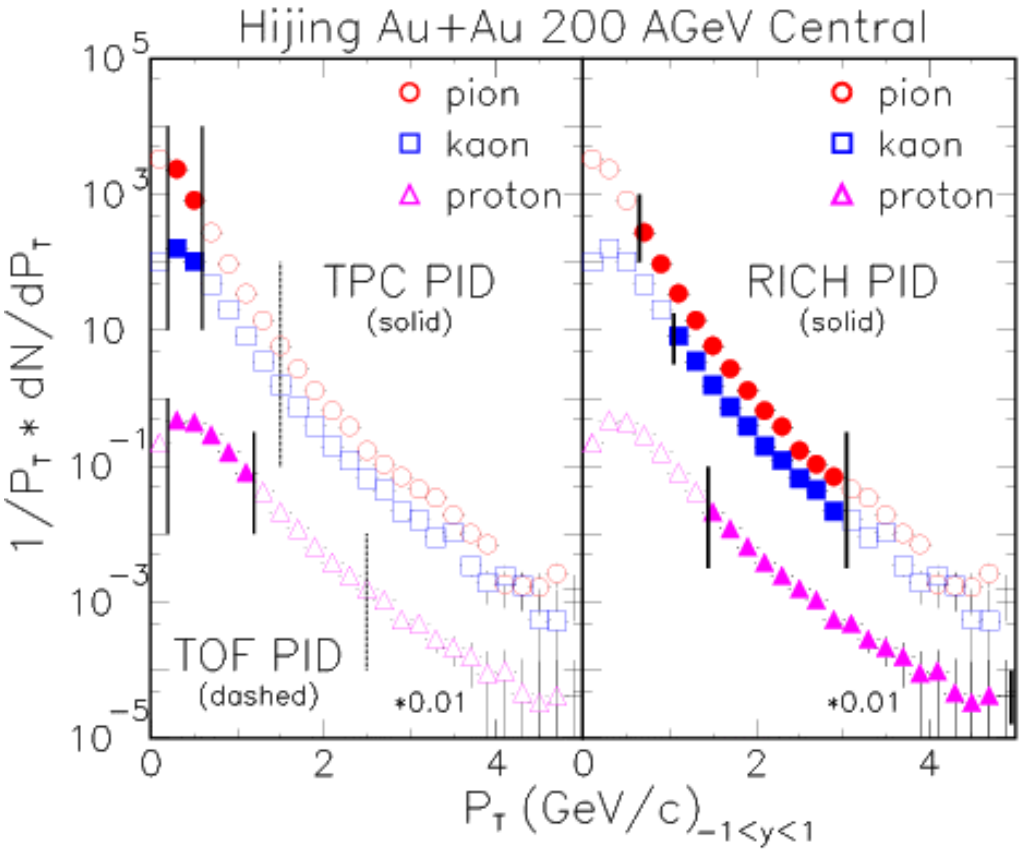




- PID-Ranges:
- 1-3 GeV/c for K/pi
- 1.5-5 GeV/c for p/anti-p

Ring Imaging Cherenkov Detector II

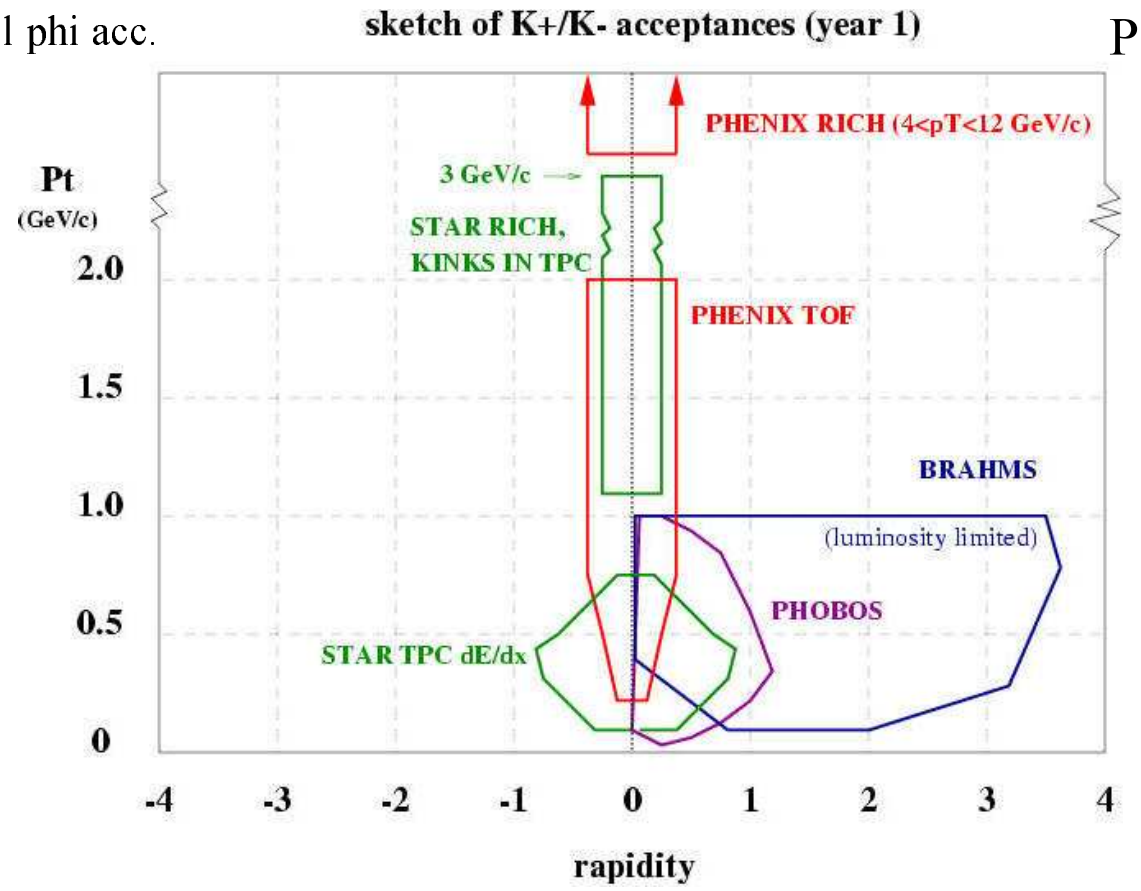
- TPC gives PID for Majority of Particles
- RICH adds Inclusive PID for High-Pt



Ring Imaging Cherenkov Detector III

RICH: small phi acc.

Courtesy of P.Jacobs



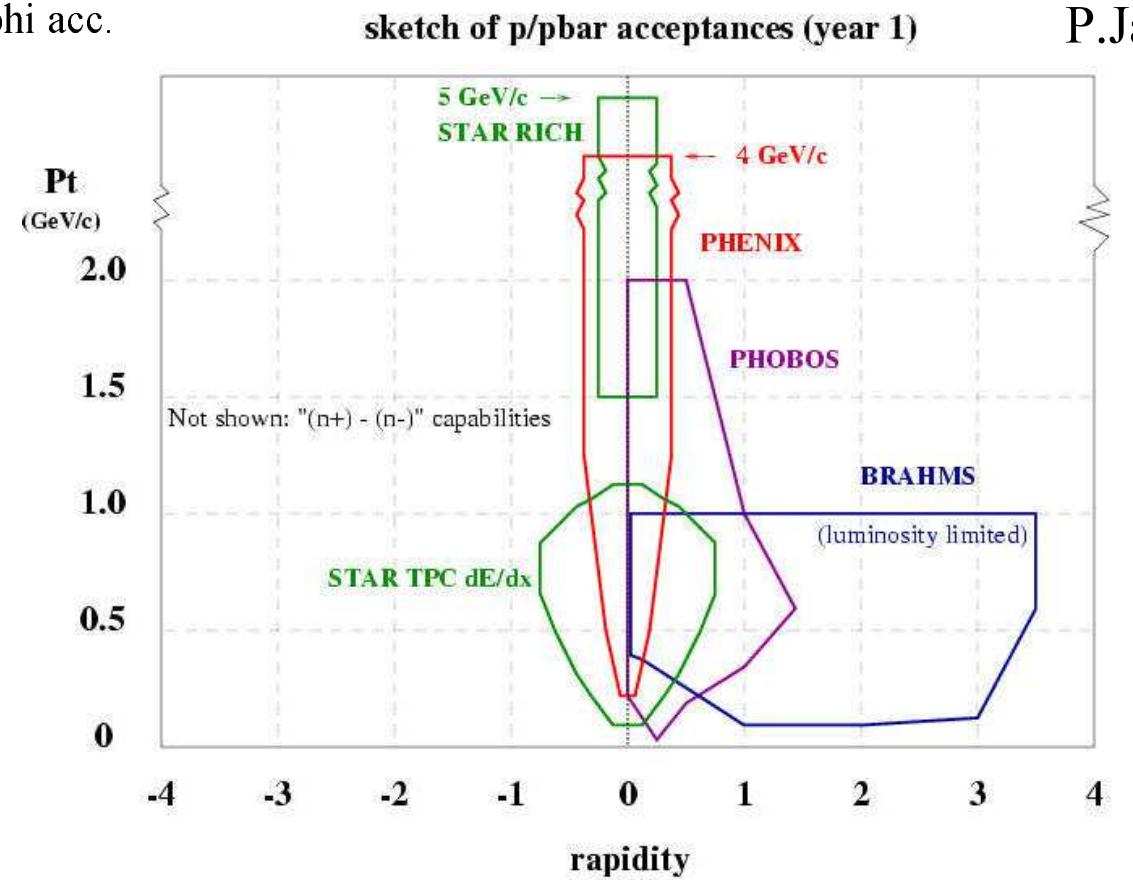
- Event Selection with Full Event Information

Ring Imaging Cherenkov Detector III

5 GeV/c

RICH: small phi acc.

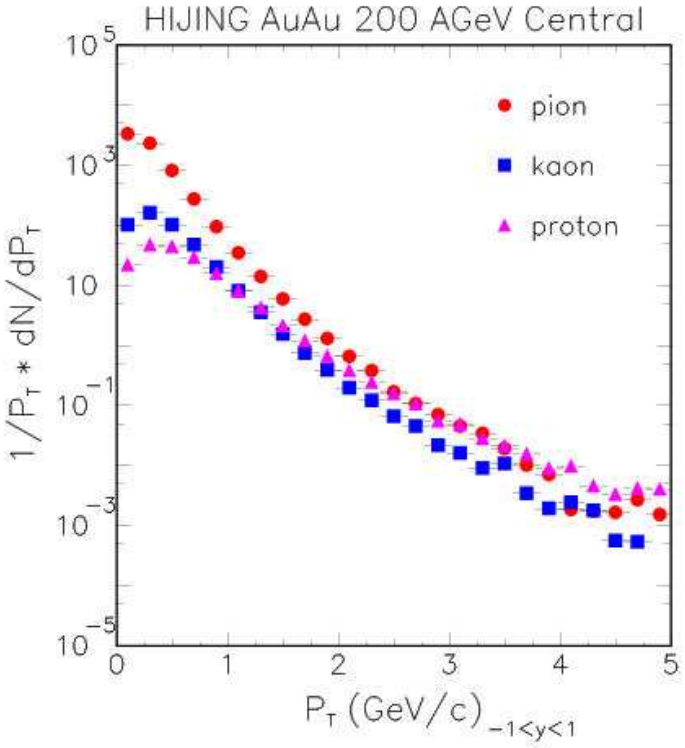
Courtesy of P.Jacobs

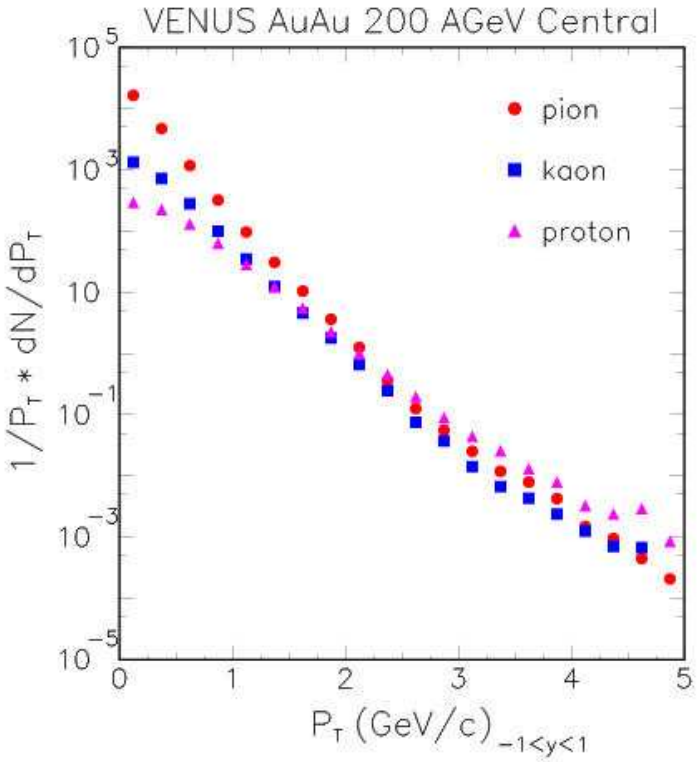


- Tagging of Spectra

Spectra I

BGSG: 'The detailed rapidity and transverse momentum spectra of hadrons provide barometric information of pressure gradients during the explosive expansion of the QGP drop.'

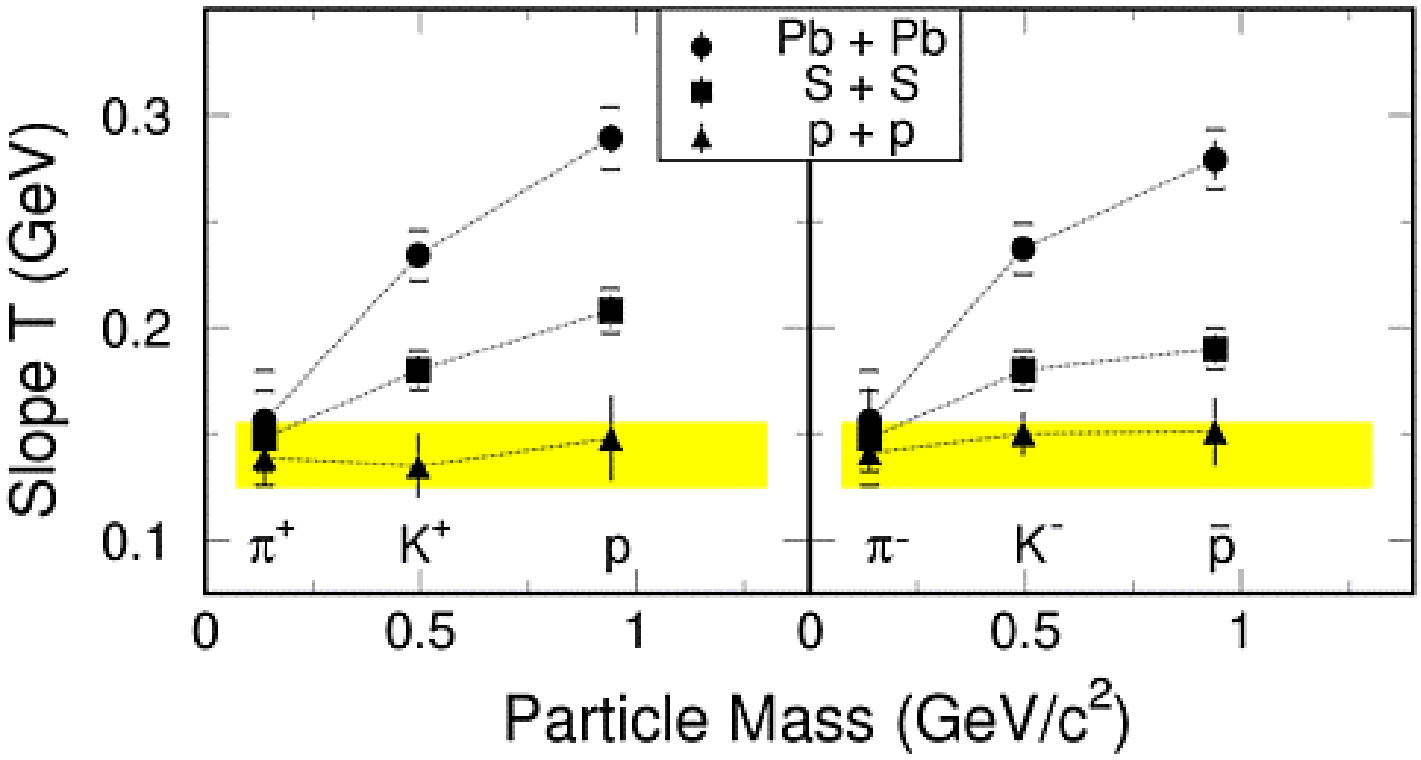




- Double Differential Distributions over Wide Range

Spectra II

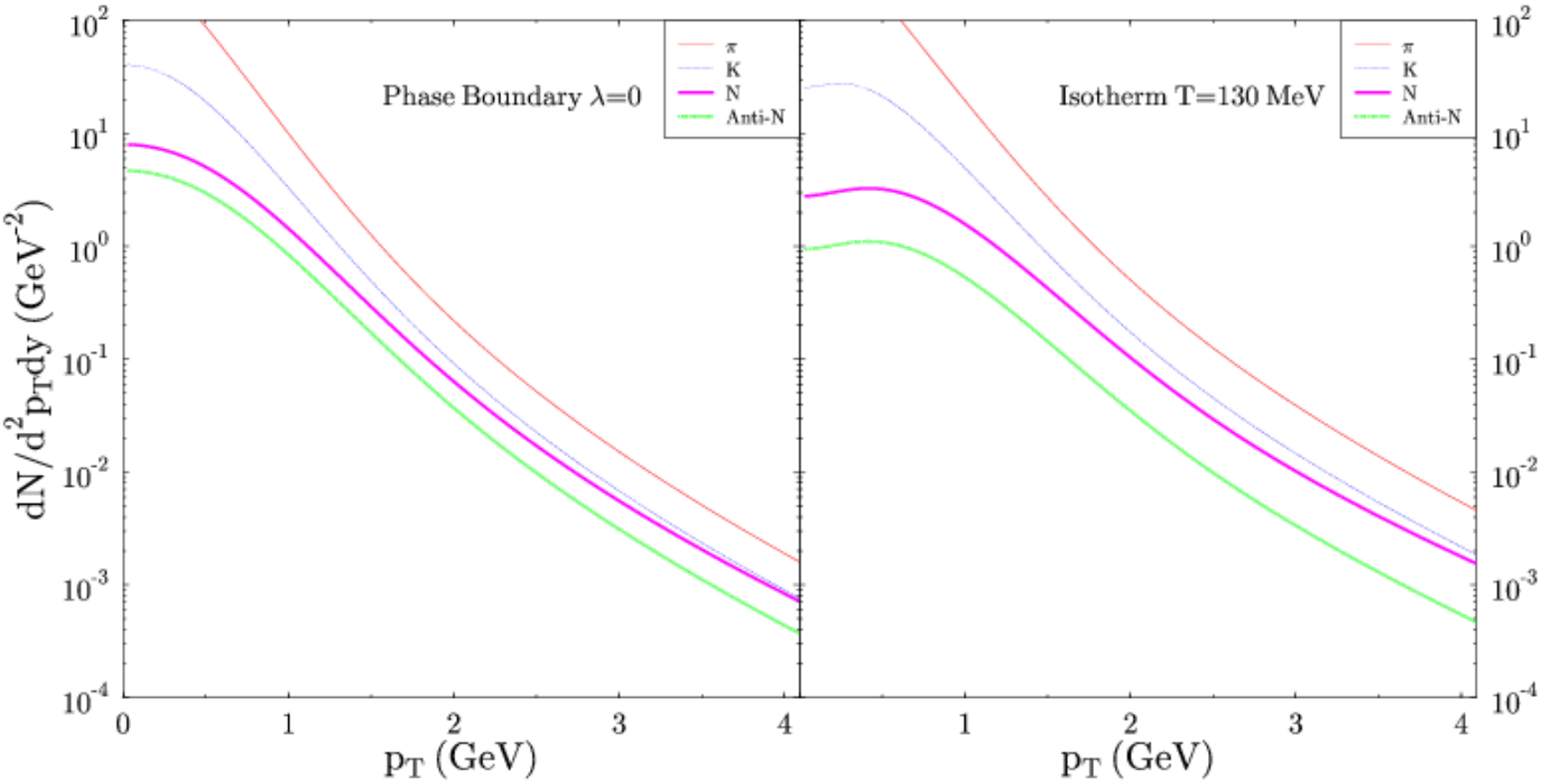
NA44



- Combining Information from TPC and RICH Allows the Study of Hydrodynamic Properties

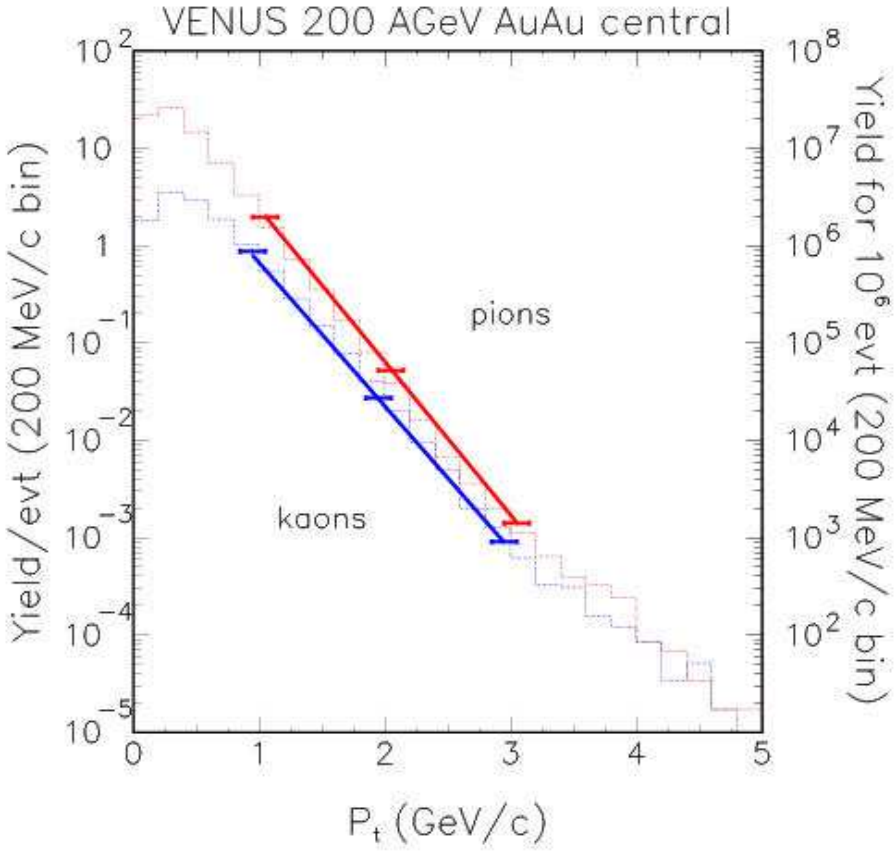
Spectra III

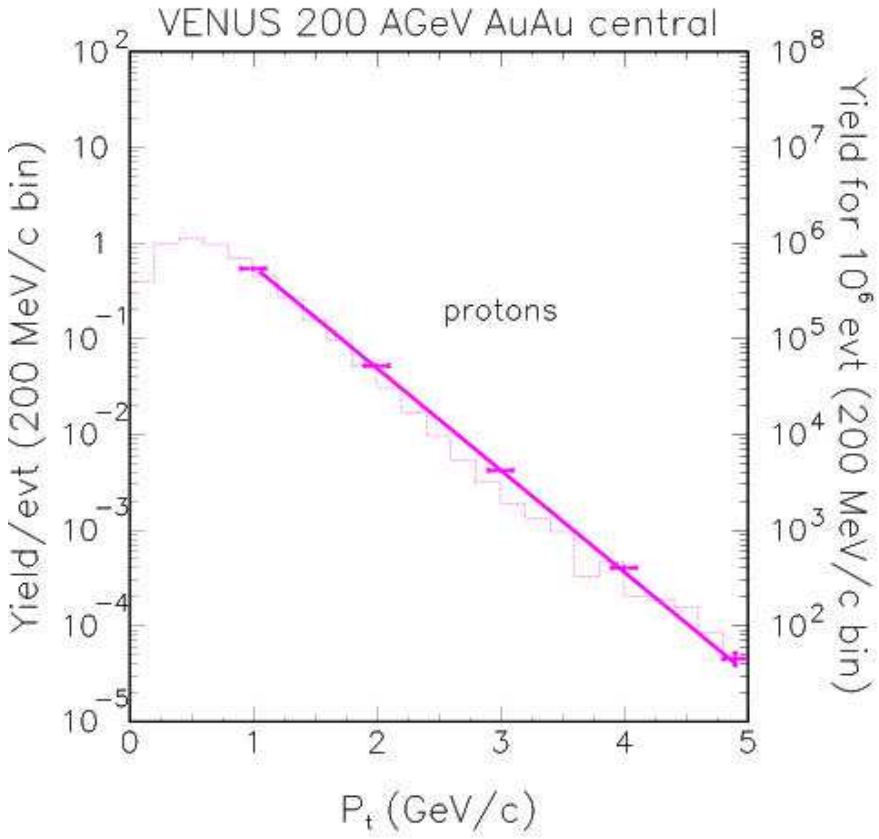
A.Dumitru



- Plasma Expansion and Hadronic Flow

Spectra Quality



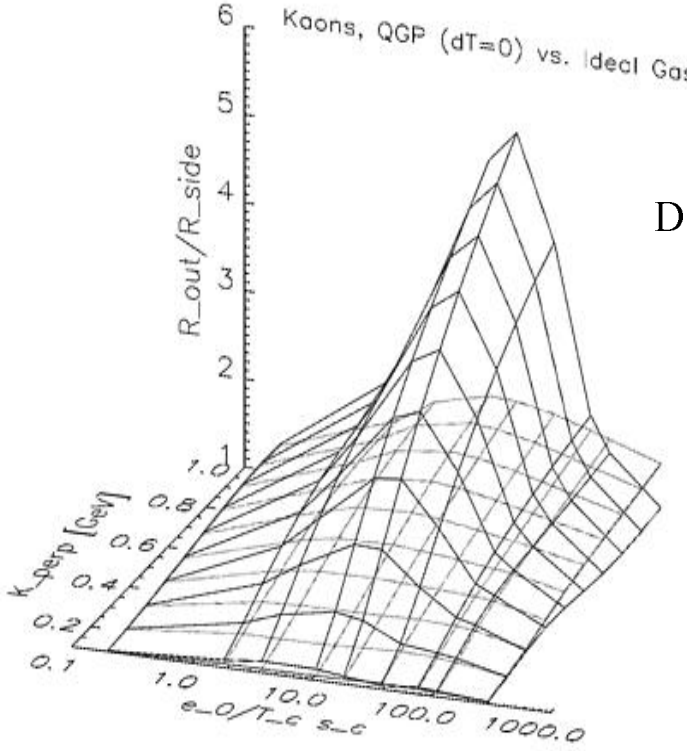


- Examples for 1 Million Central Events

Kaon Interferometry I

BGSG:'Quantum statistical interference pattern in pipi,KK,pp correlations provide somewhat cloudy lenses with which the space-time geometry of hadronic ashes of the QGP can be viewed.'

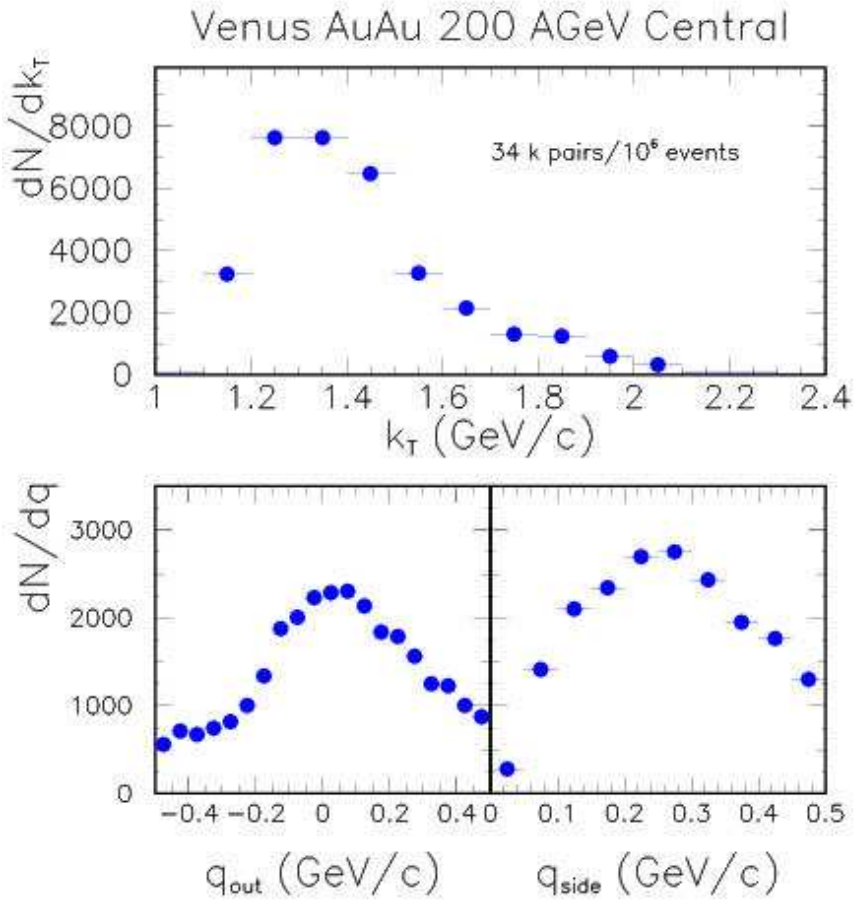
- Kaons are less Influenced by Feeding
- Long Lifetime Causes *large* Rout/Rside Ratio
- Effect more Pronounced at High-Pt



D.Rischke

Kaon Interferometry II

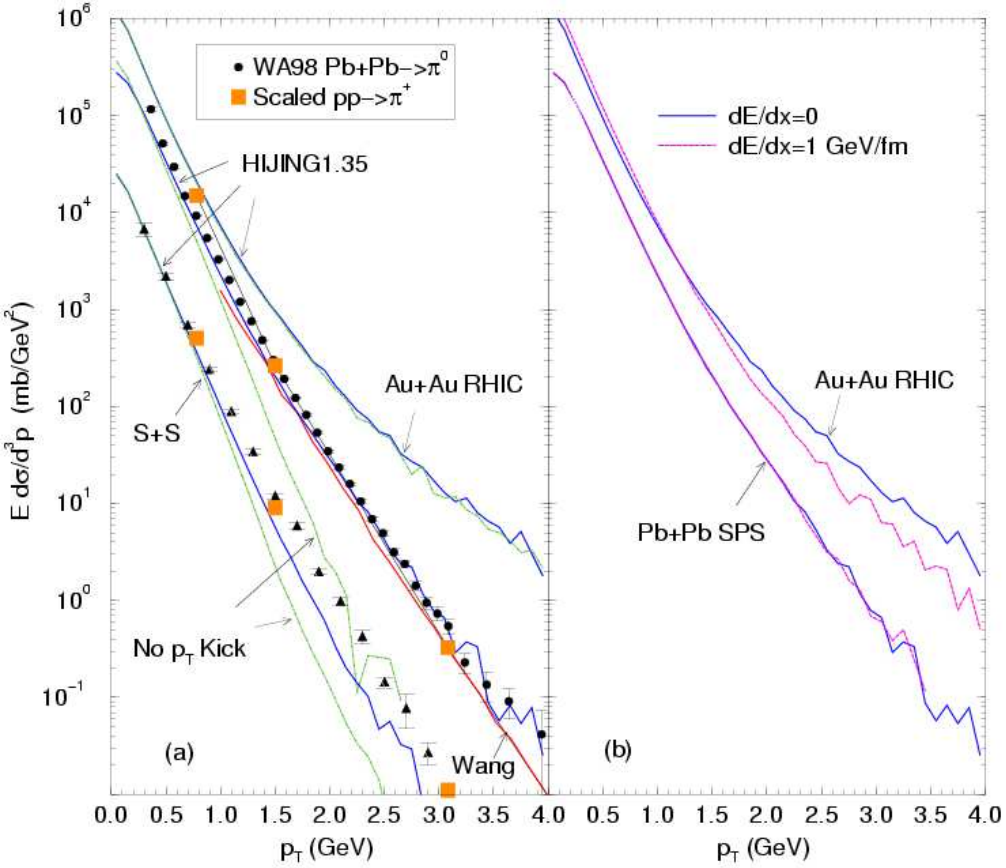
- $K^+ K^+$ and $K^- K^-$ Correlations
- $K^+ K^-$ Correlation
  - Time ordering
- Expected Quality
  - Feasible despite small acceptance
  - Level 3 trigger should improve statistics



Partonic Energy Loss I

M.Gyulassy and P.Levai

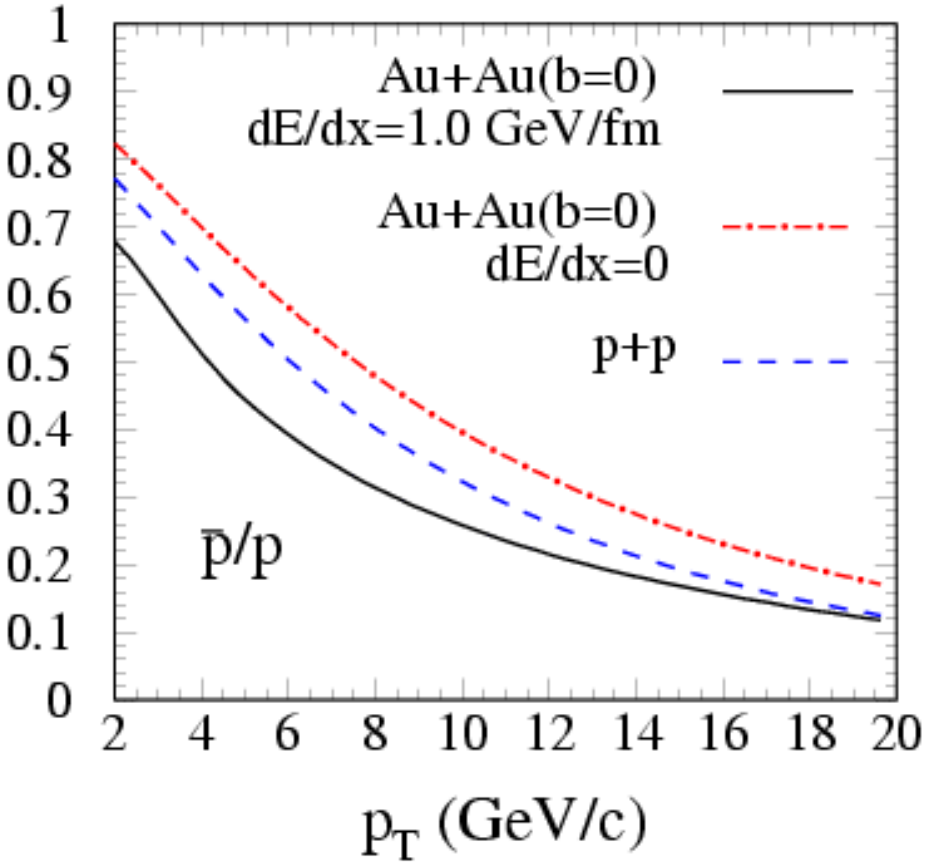
- @ RHIC
  - Small soft component
  - Energy loss important
- Spectra of Identified Particles



Partonic Energy Loss II

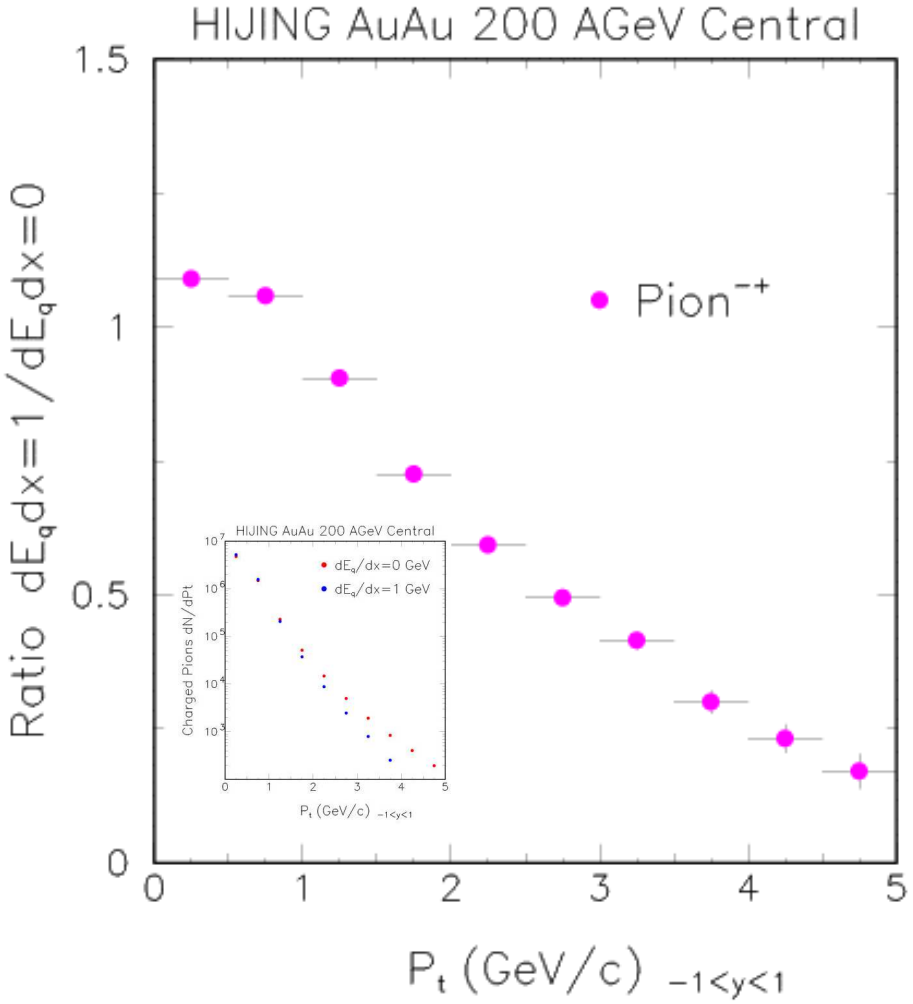
X.N.Wang

- Proposed Ratio to Study Gluon vs. Quark Jets
  - pp run required
  - Calculation done in pQCD



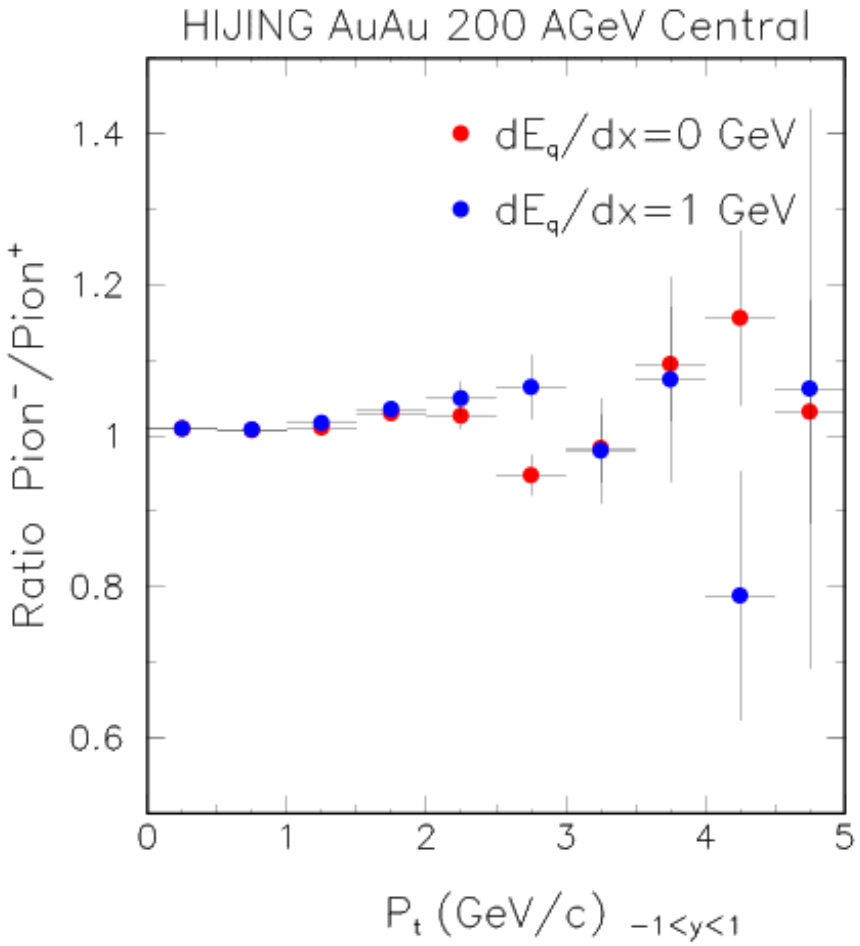
Partonic Energy Loss III

- Focus on RICH Observables
- Charged Pions
  - Spectra strongly influenced by energy loss (Normalization ?!)



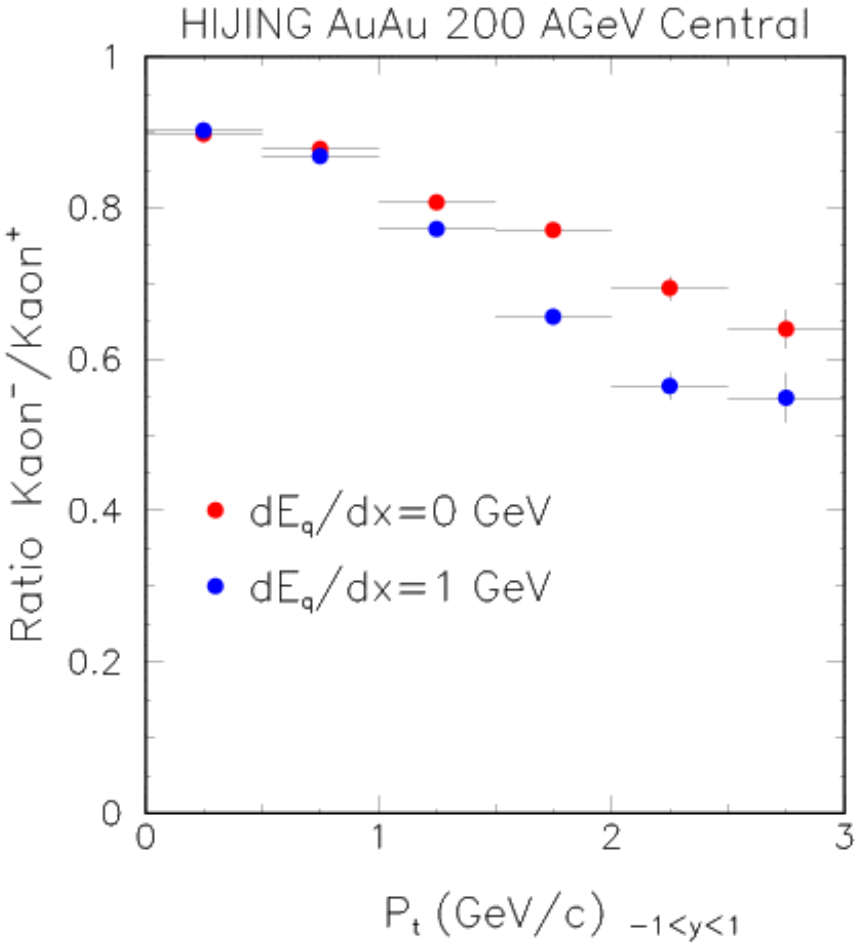
Partonic Energy Loss IV

- Charged Pion Ratio
  - Quark content should favor negative pions (d/u Ratio 1.14)



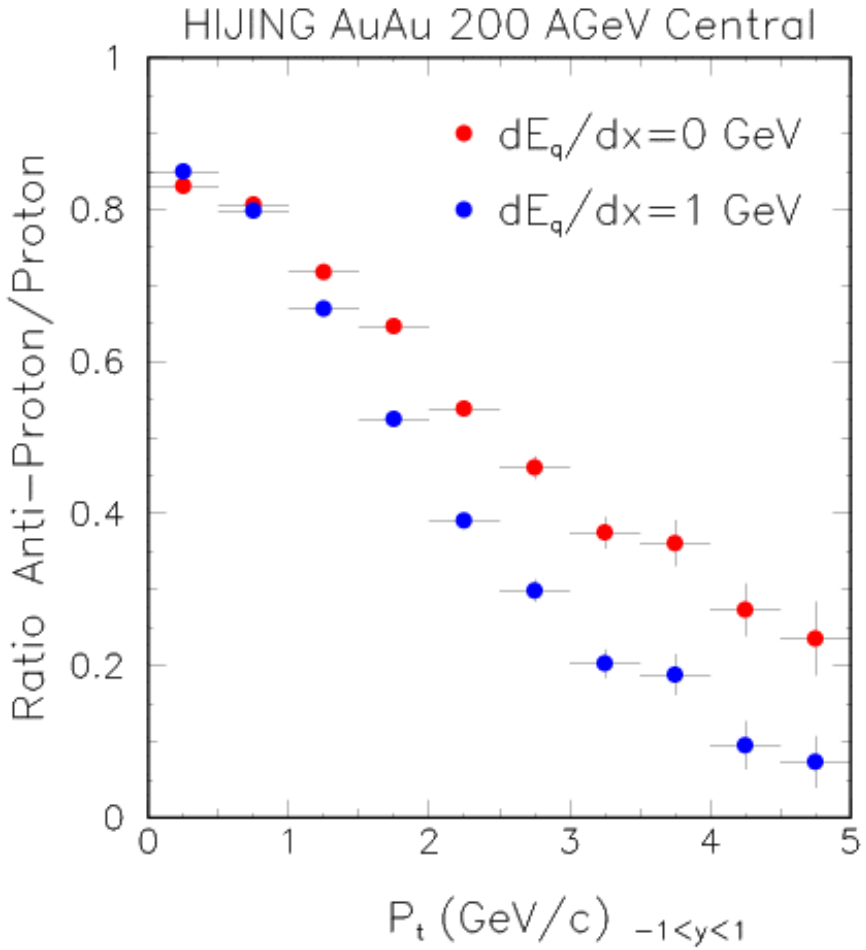
Partonic Energy Loss V

- Charged Kaon Ratio
  - K^- production has contribution from gluons
  - Effect in RICH range



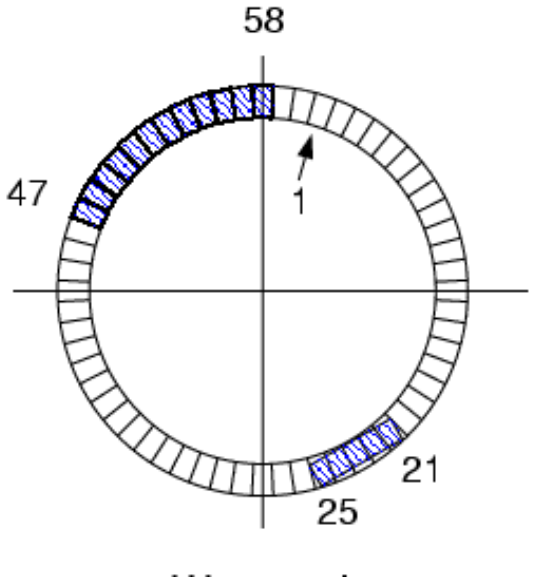
Partonic Energy Loss VI

- Anti-Proton to Proton Ratio
  - Strong effect in RICH range



Partonic Energy Loss VII

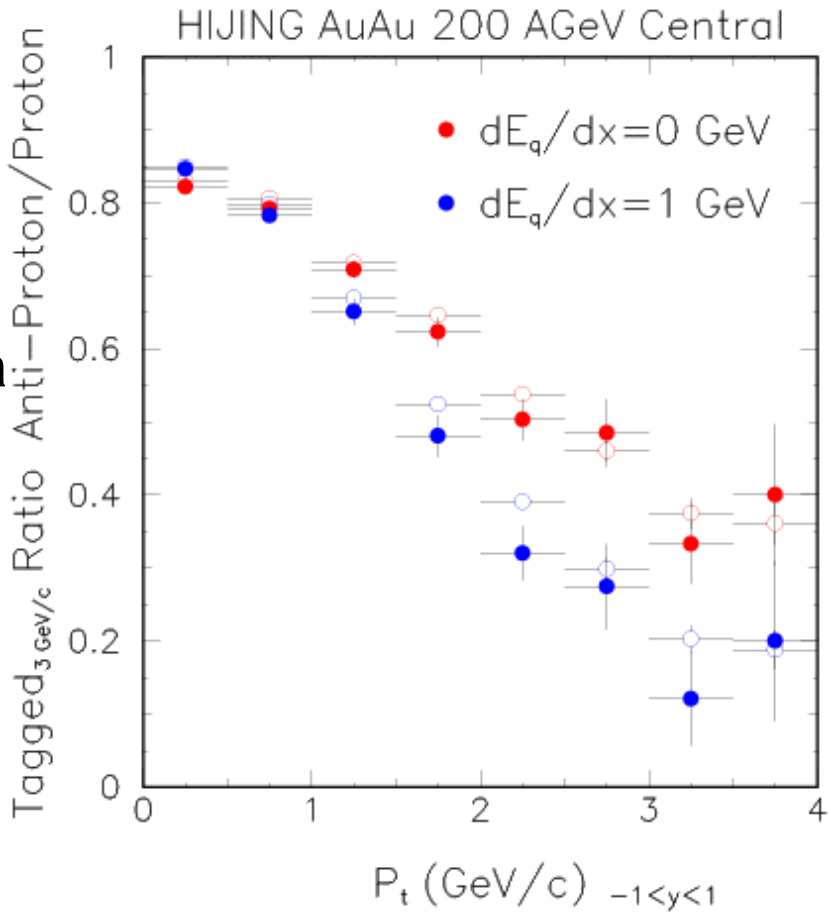
- Tagging of Spectra
  - Hard photon
  - Fast particle
- Hard photon
  - Very small cross section
  - Possible with EMC
- Fast Particle
  - Possible with TPC/EMC



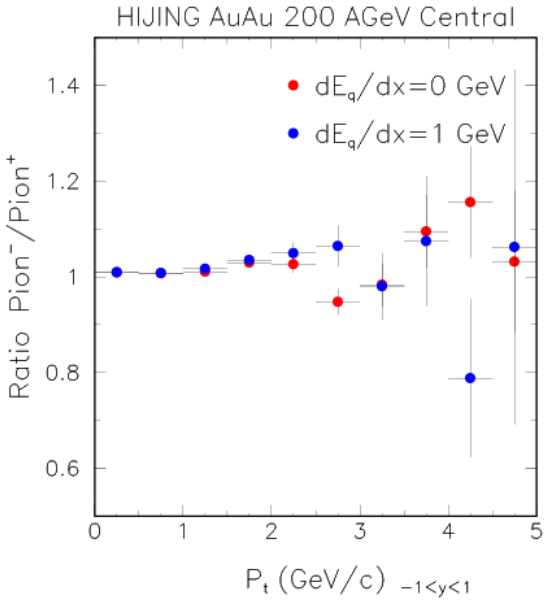
EMC Configuration 1st Year

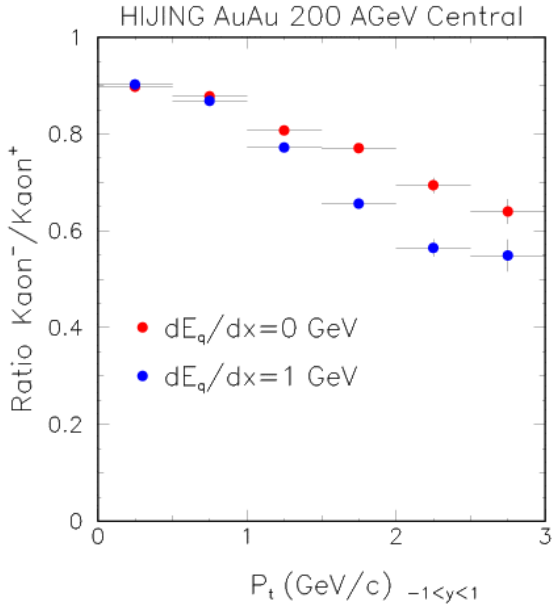
Partonic Energy Loss VIII

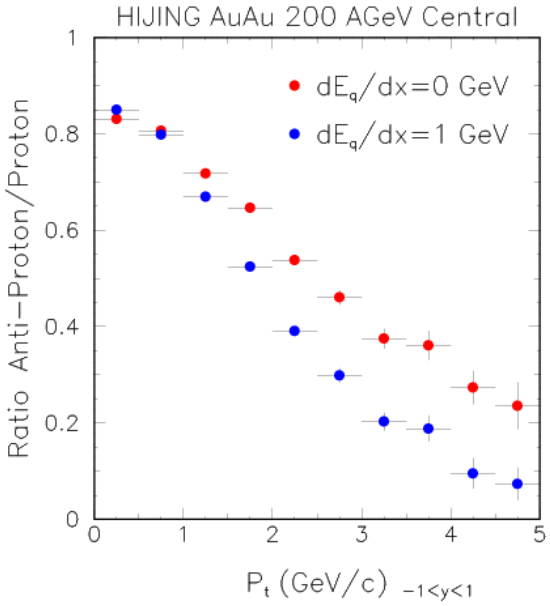
- Fast Particle Tagging
  - Require that there is one particle with high Pt in 10 degree cone on opposite side
- Small Effect for 3 GeV/c. Study in Progress ...



Summary







- Partionic Energy Loss Via Identified Particle Ratios

People

- Yale Relativistic Heavy Ion Group
  - J.W.Harris, G.J.Kunde, J.Dunlop, B.Lasiuk, N.Smirnov, T.Ullrich,
  - M.Calderon, M.Horsley, J.McGuire,S.Sainis
- Yale High Energy Group
  - R.D.Majka, J.Sandweiss+W.Emmet
  - E.Finch, Z. Xu
- CERN HMPID Group
  - F.Piuz, Y.Andres, A.Braem, M.Davenport, B. Goret, R.Gregory, G.Lion, A. DiMauro,
  - P.Martinengo, A.Morsch, G.Paic, J.Raynaud, J.C.Santiard
- Bari HMPID Group
  - E.Nappi, N.Colonna, D. Cozza, D. DiBari, D.Elia, R.Fini, B.Ghidini, F.Posa, S.Stucchi, G.Tomasicchio