Hadron Spectra in Au+Au Collisions by STAR Experiment at RHIC

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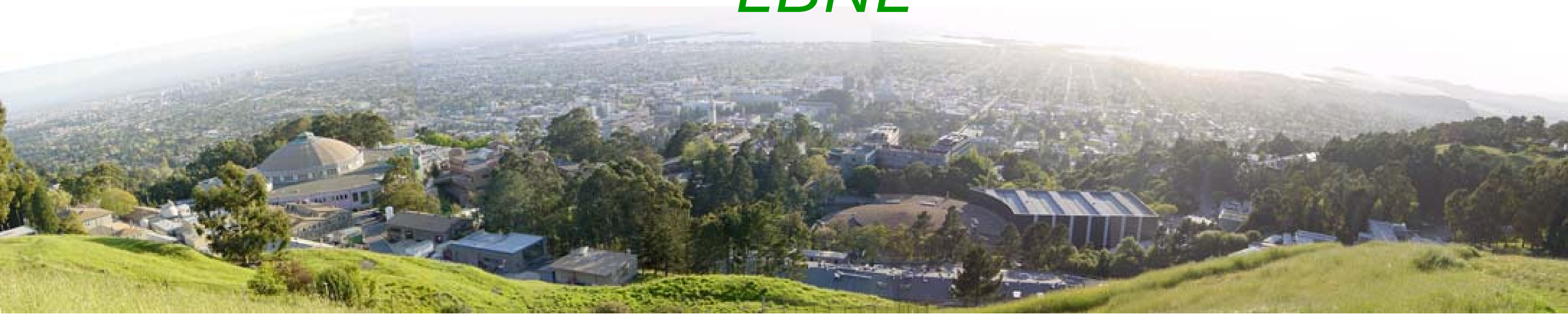
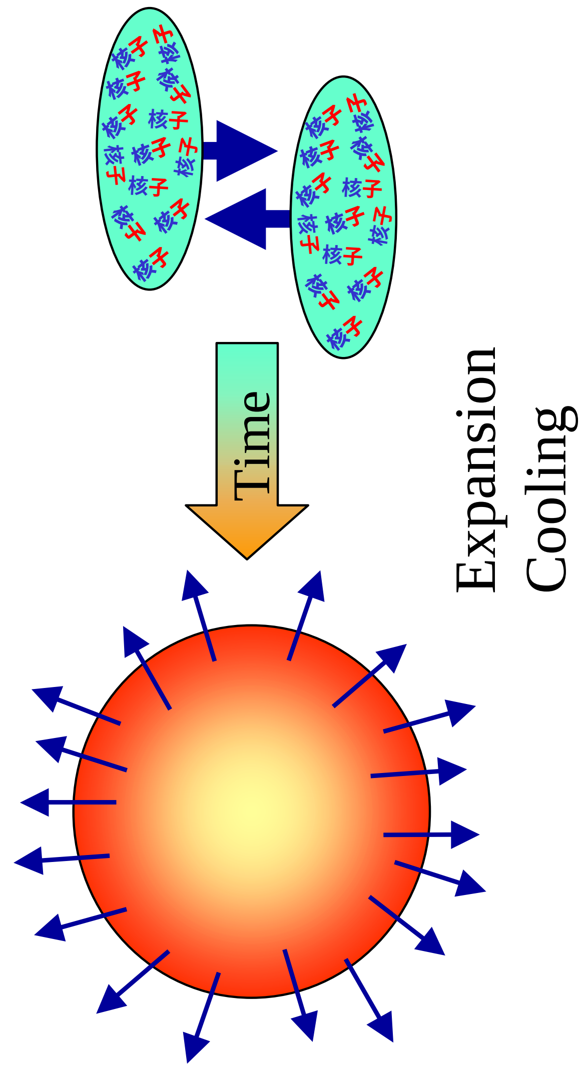
for the STAR collaboration

LBNL



Introduction

- Study of bulk properties
- Macroscopic approach
  - Chemical freeze-out
  - Thermal freeze-out
- Focusing on p_T distribution
  - Thermal freeze-out Temperature
  - Transverse flow



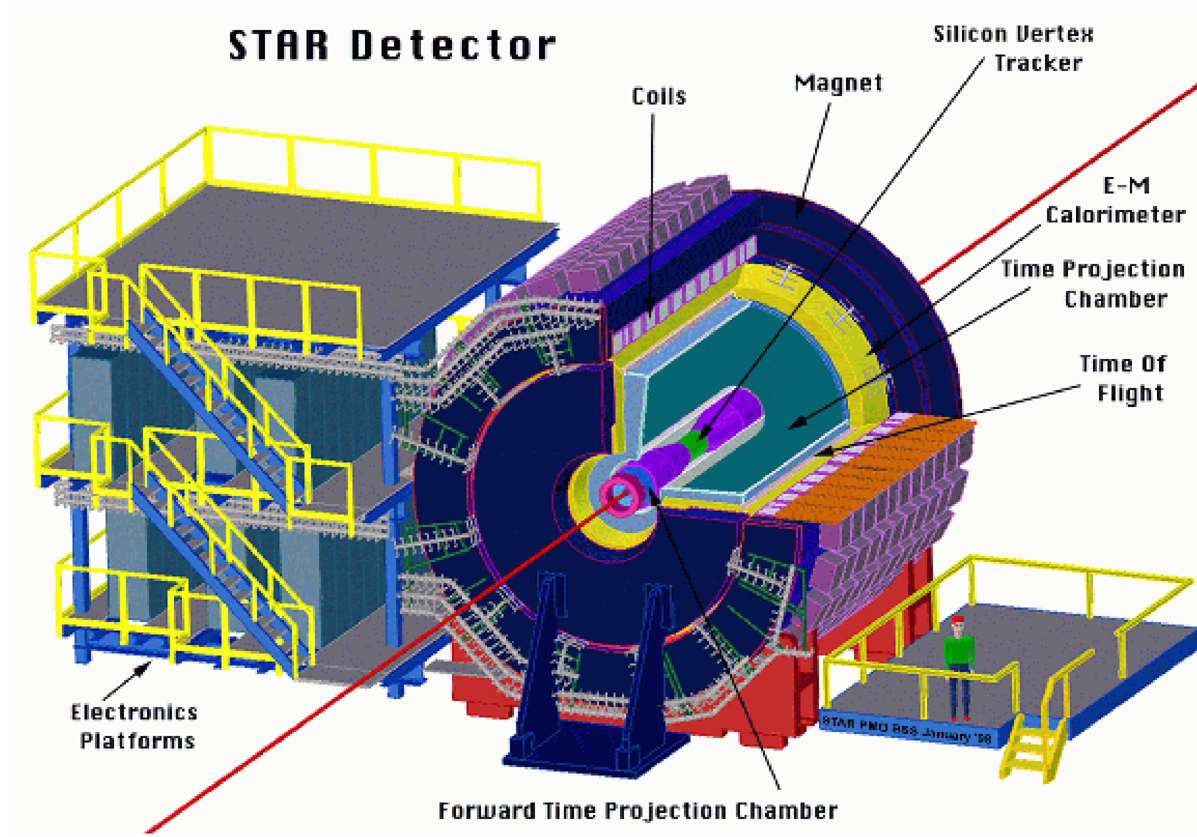
RHIC-STAR experiment

- Solenoidal Tracker At RHIC

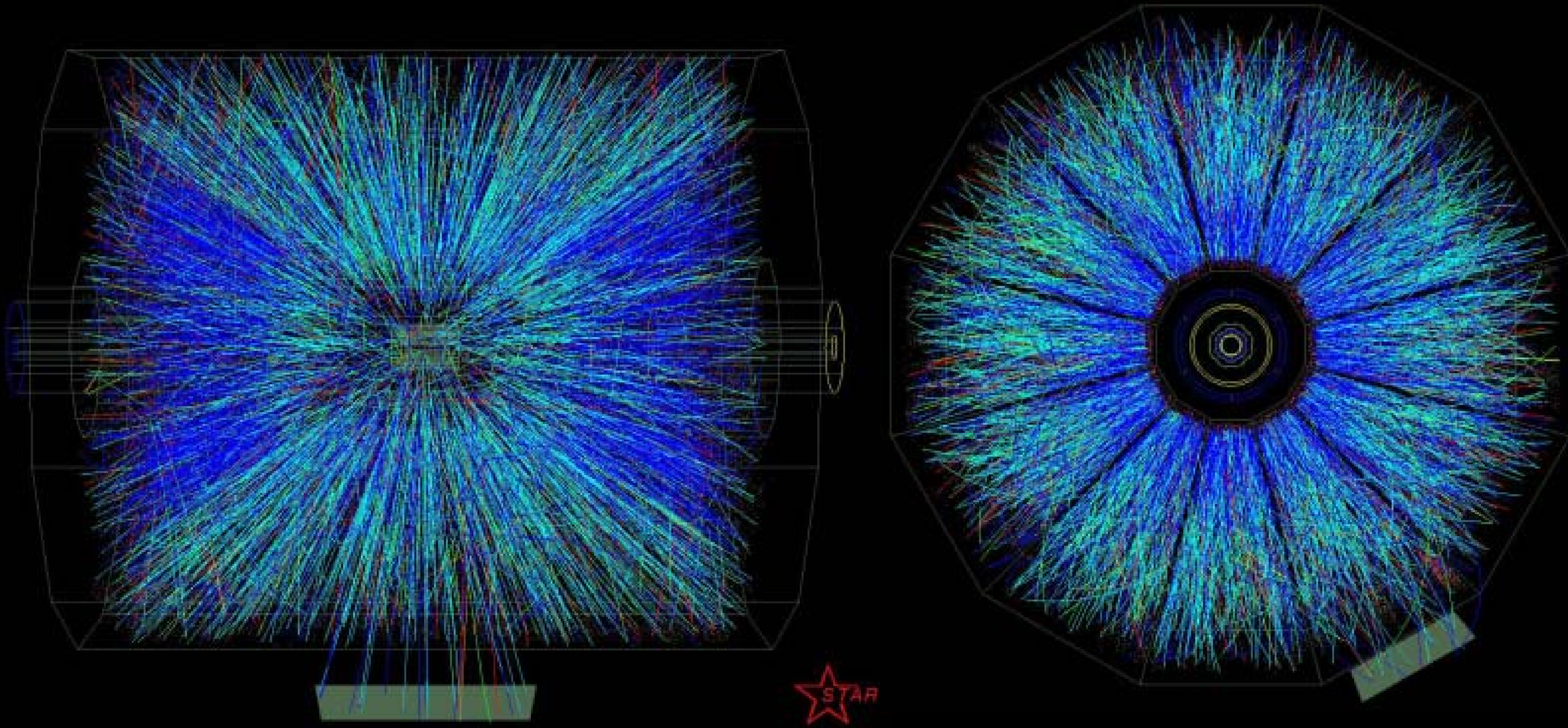
  ~40 Institutes/Universities

  ~300 Collaborators

- One of large experiments at RHIC
- 2π acceptance
- Excellent particle identification



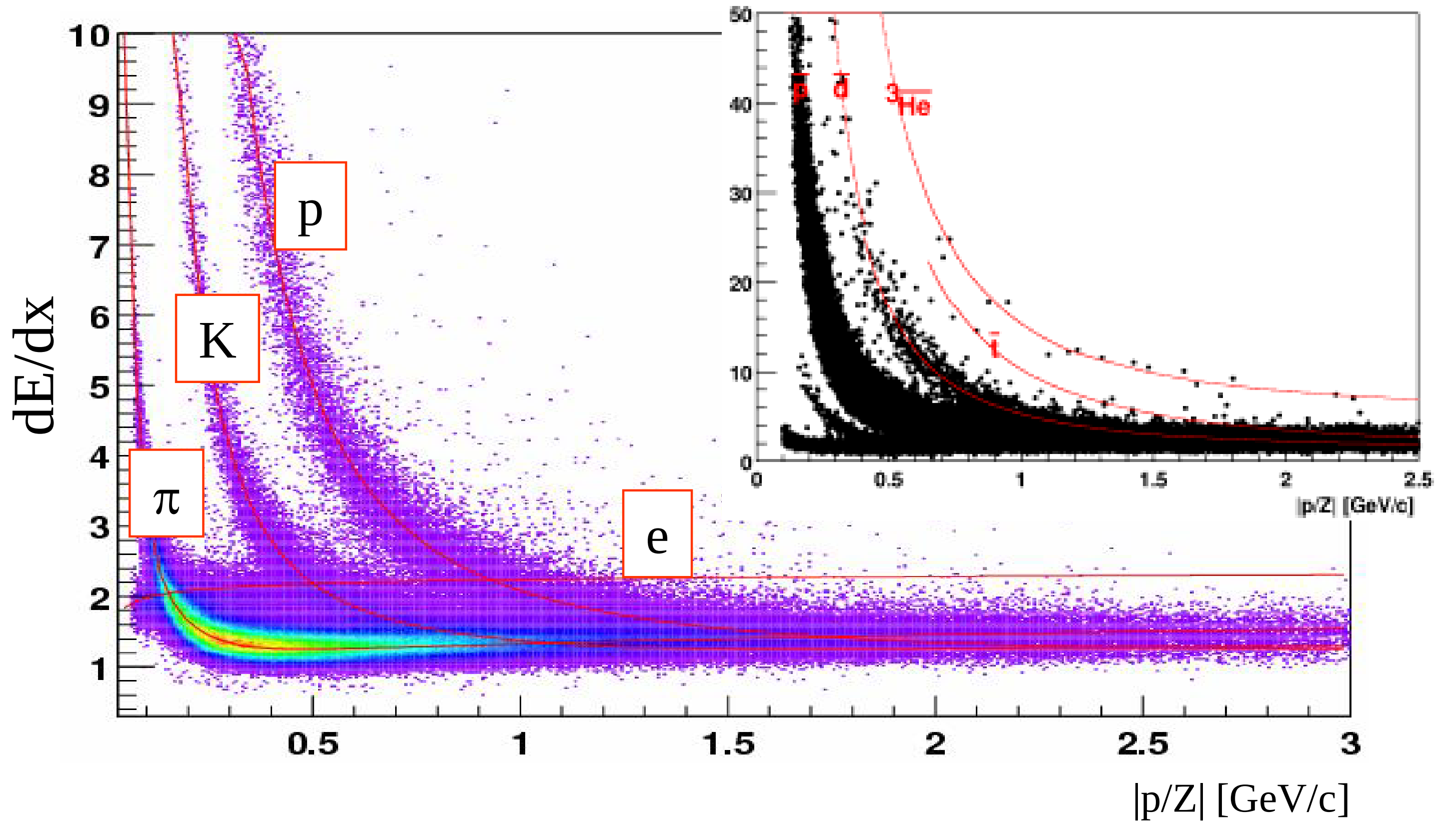
STAR Event



Tracks are reconstructed by online tracking

Particle Identification

- *dE/dx* by TPC : π,K,p,d,He,......
- Kink method :K
- RICH : 1-3 GeV/c for π/K, 1.5-5GeV/c for p
- Topology : Λ, Ξ, Ω, K^0_s
- Combinatrics : Δ, Λ, $\Lambda(1520)$, K^*, ϕ, ...
- TOF (year 2)
- EMC (year 2)



p_T Distribution / Kinetic Freeze-out

- Kinetic freeze-out
  - End of elastic interactions
  - Information of momentum is frozen
- Boltzmann distribution + flow effect

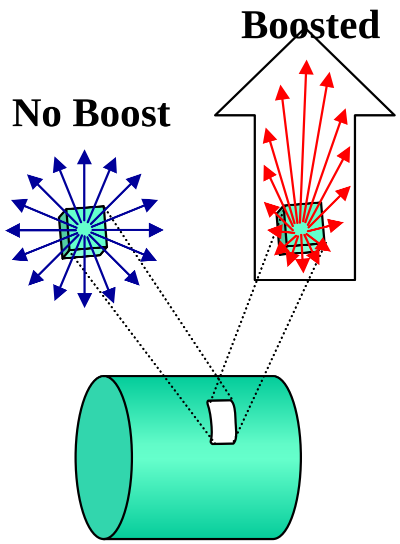
Blast wave model;
E. Schnedermann et al., PRC48(1993)2462

$$E\frac{d^3n}{dp^3} \propto \int_\sigma e^{-(u^\nu p_\nu)/T_{th}} p^\lambda d\sigma_\lambda$$

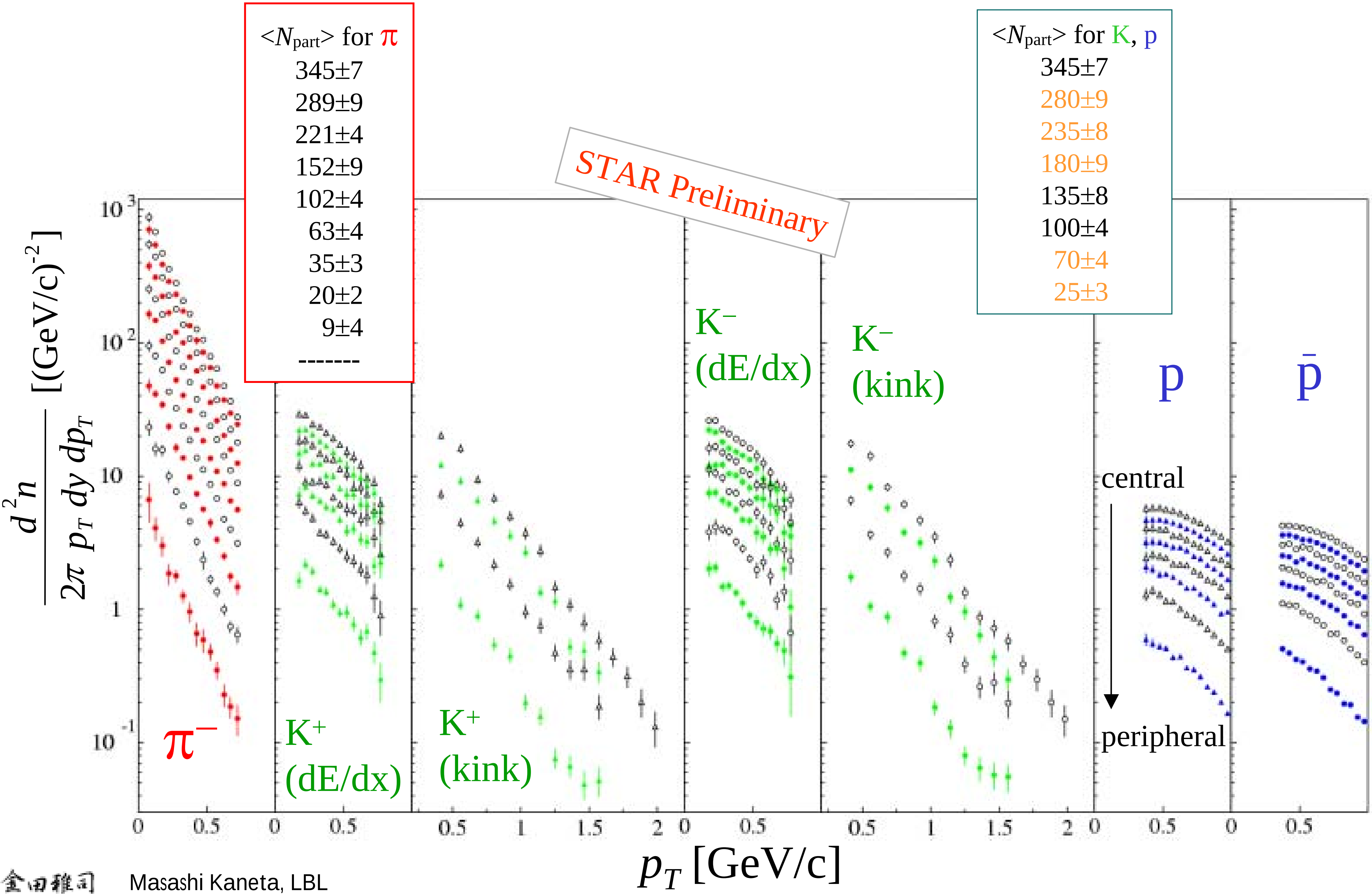
$$u^\nu(t,r,z=0) = (\cosh\rho, \vec{e}_r \sinh\rho, 0)$$

$$\rho = \tanh^{-1}\beta_r$$

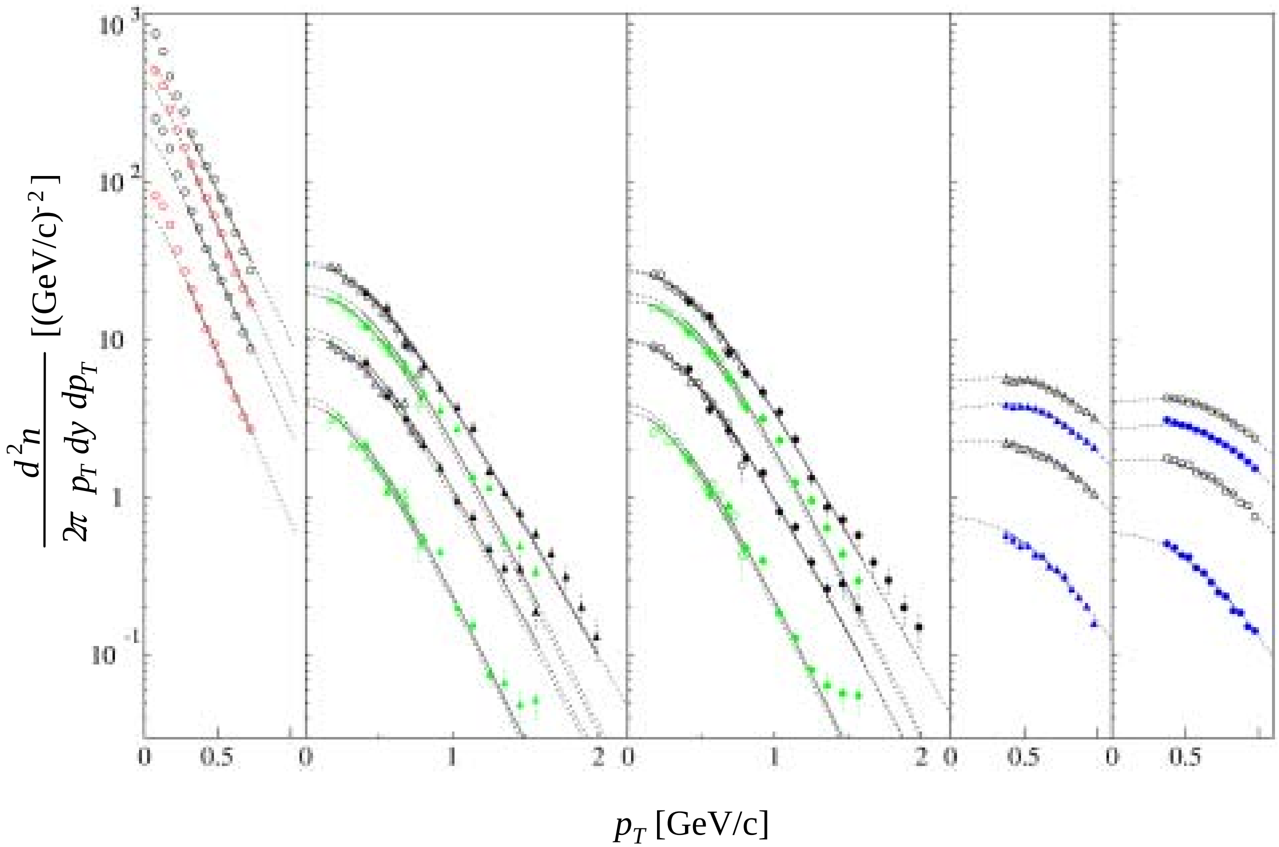
$$\beta_r = \beta_S\, f(x,p) = \beta_S (r/R)^n$$



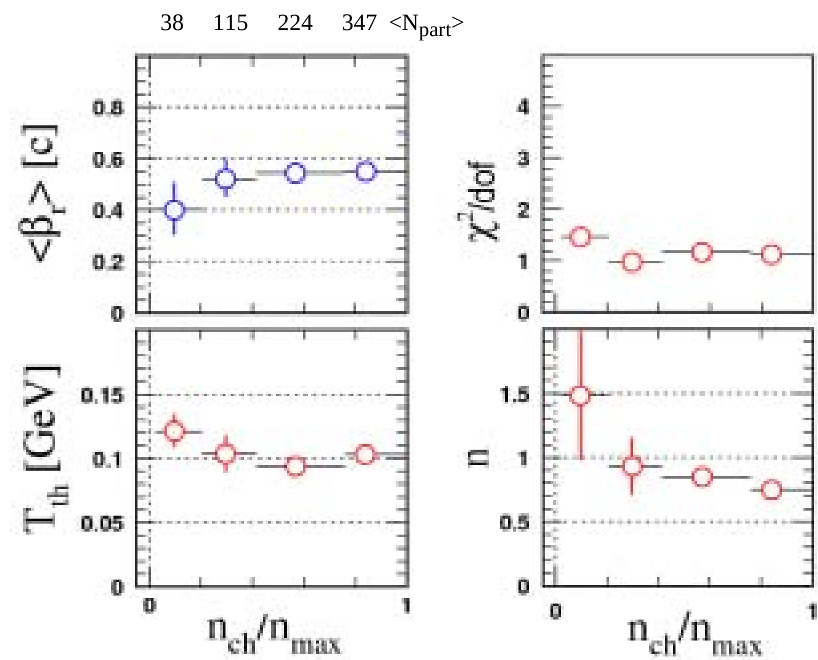
p_T distribution vs. Centrality



Centrality dependence of T_{th} and $<\beta_r>$

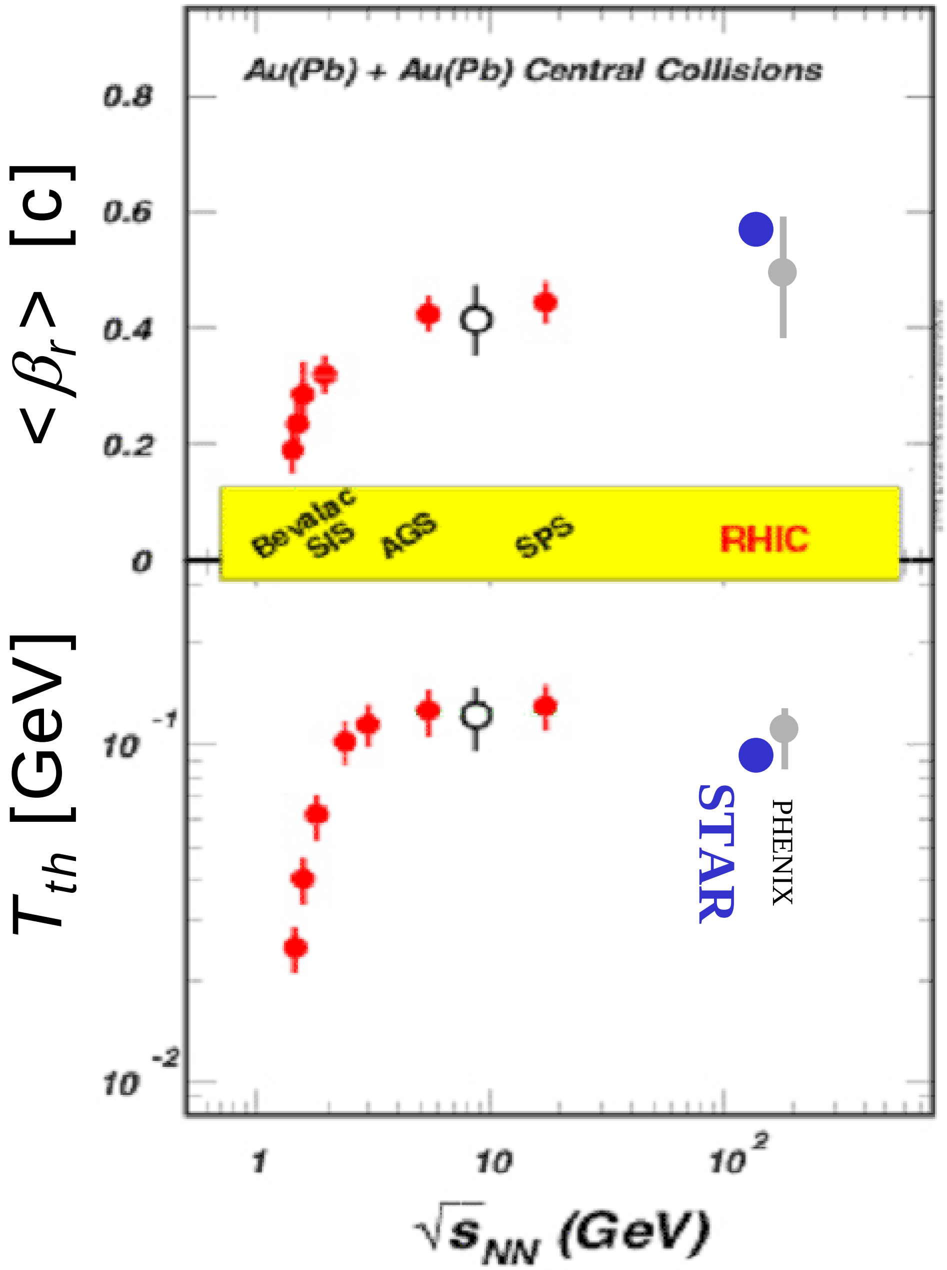


- Selected similar centrality region in π and K,p



- As a function of centrality
  - T_{th} ~ 100 MeV
  - $<\beta_r>$ goes up then saturated
  - Flow profile changed?

Bombarding Energy Dependence



- From SPS to RHIC
  - –Increasing flow
  - –Decreasing temperature
  - –Longer time for cooling at RHIC?

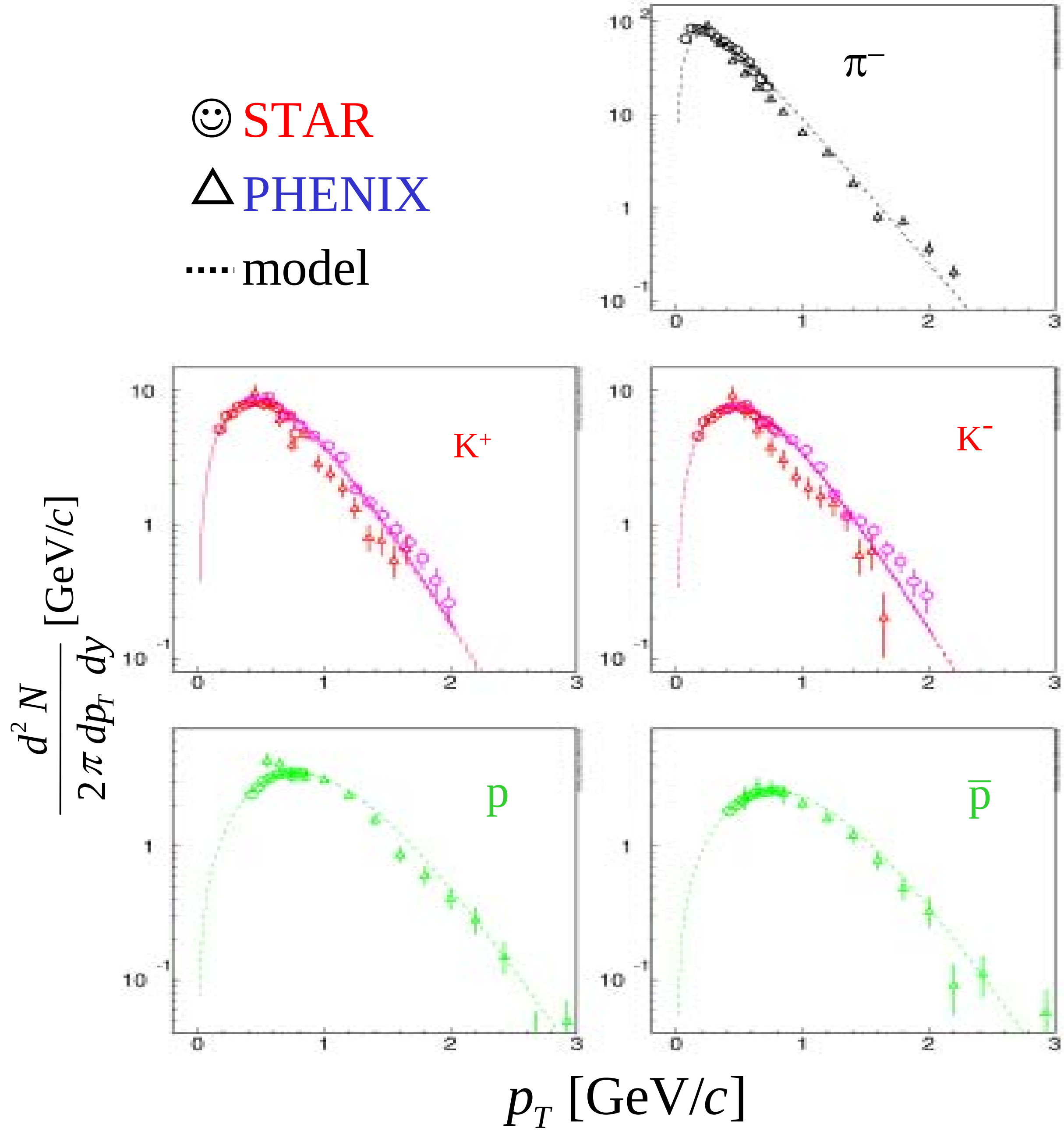
Summary

- The p_T distributions of π, K, and p are obtained as a function of centrality from RHIC-STAR at $\sqrt{s_{NN}}$=130GeV Au+Au
- The blast wave model describes the data over all of centrality

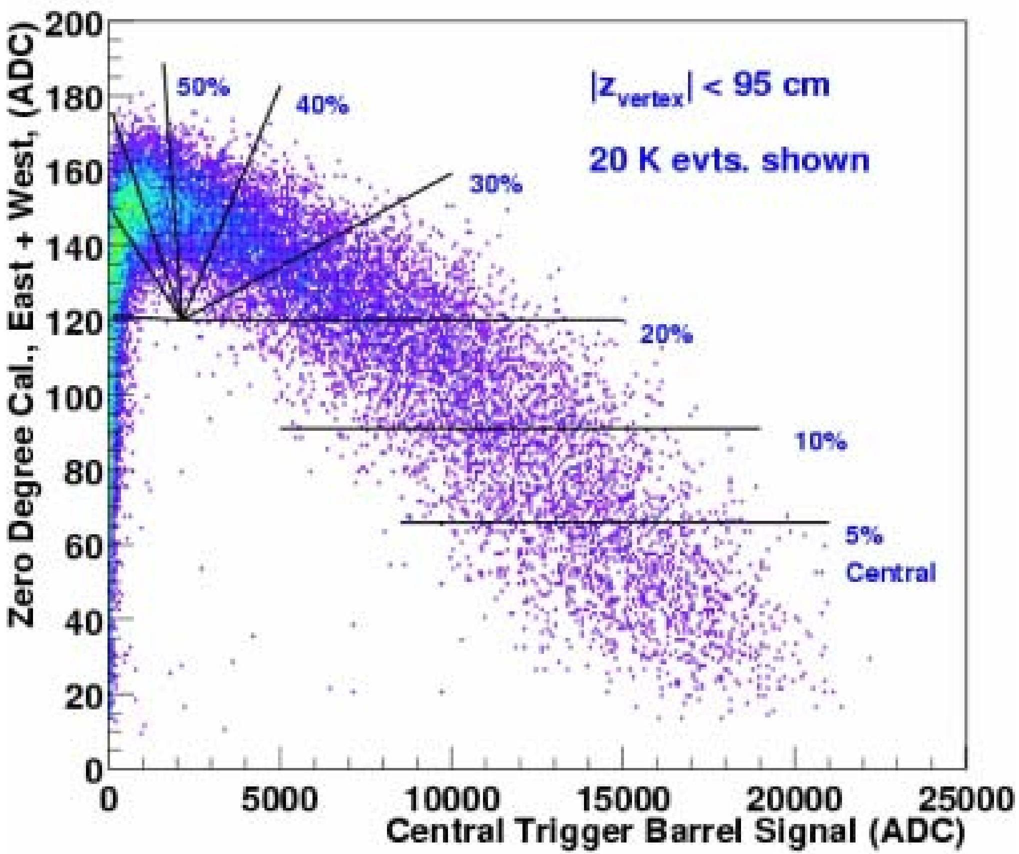
- As a function of centrality at RHIC
  - T_{th} ~ 100 MeV
  - $\langle\beta_r\rangle$ goes up then saturated (~0.55c)
  - Flow profile changed?
- From SPS to RHIC
  - Increasing flow
  - Decreasing temperature
  - Indicating longer time for cooling at RHIC?

STAR ⚔ PHENIX

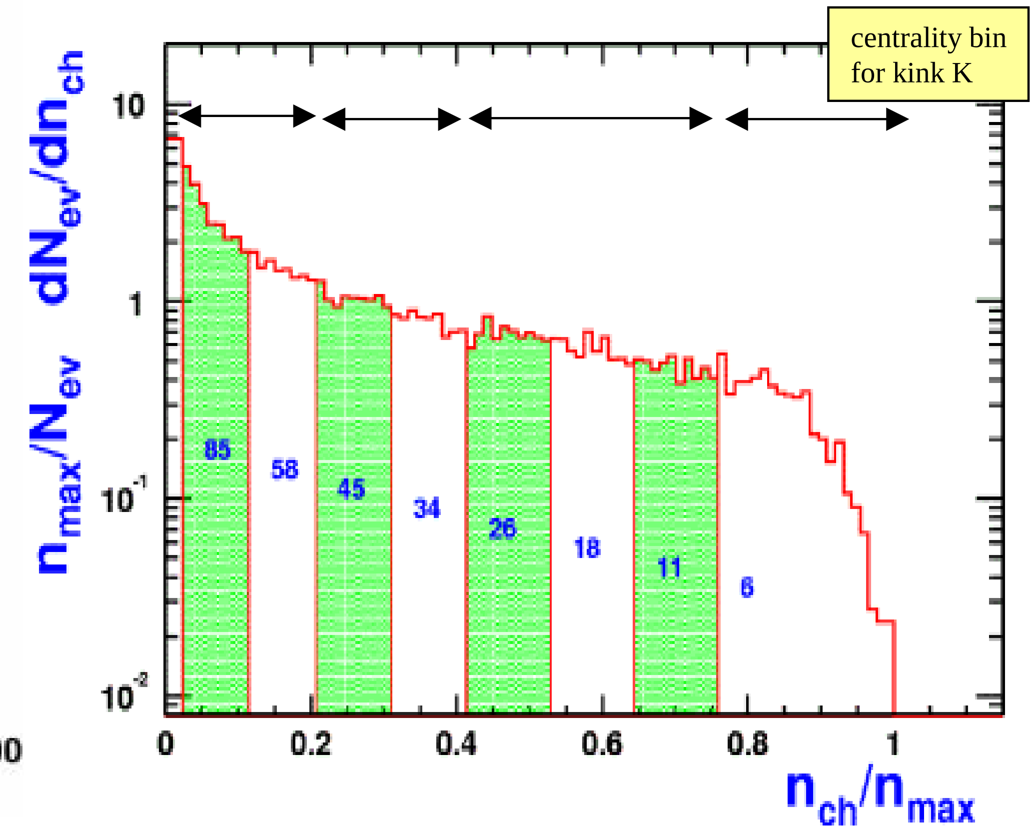
- PHENIX π and K show smaller yield at p_T>0.6 than STAR
  - upto factor of 2!!
- Protons have coincidence



Centrality

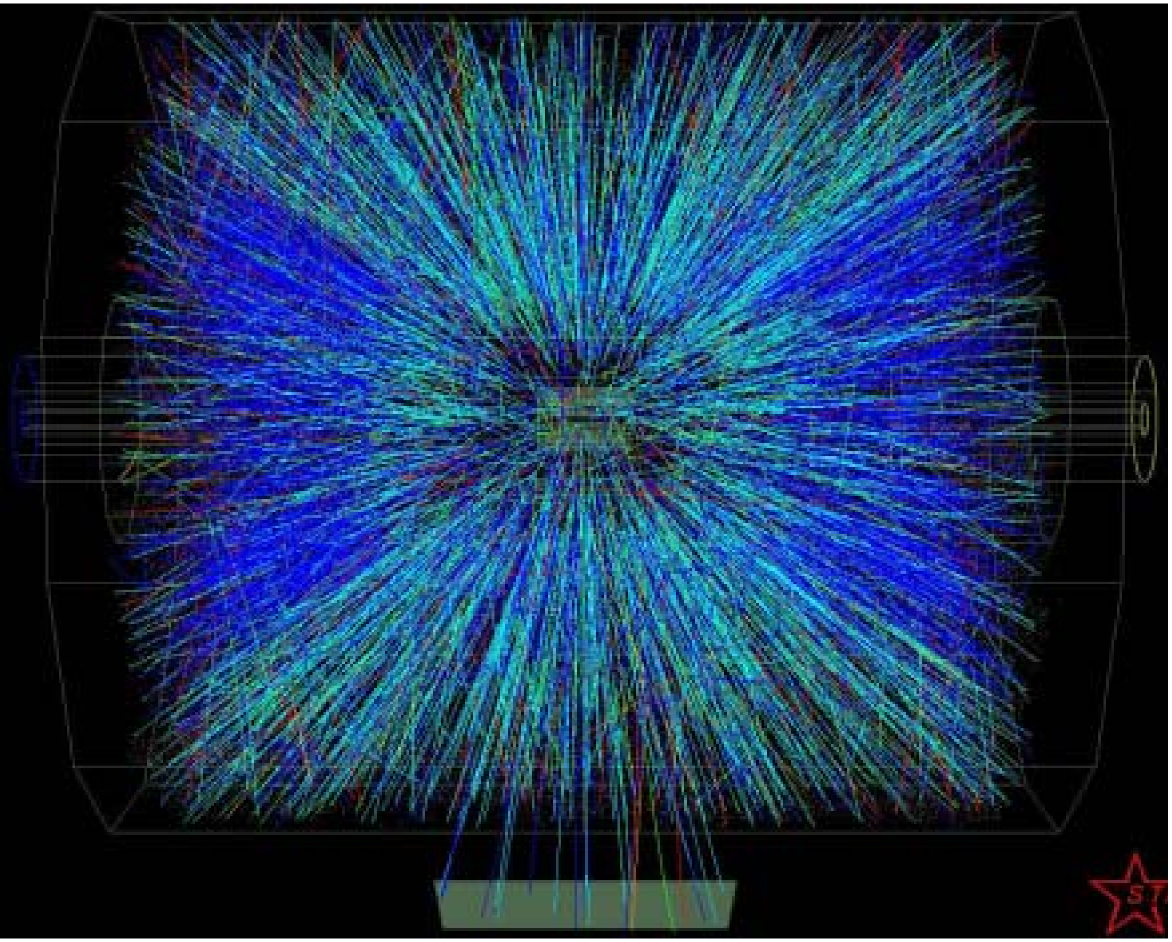


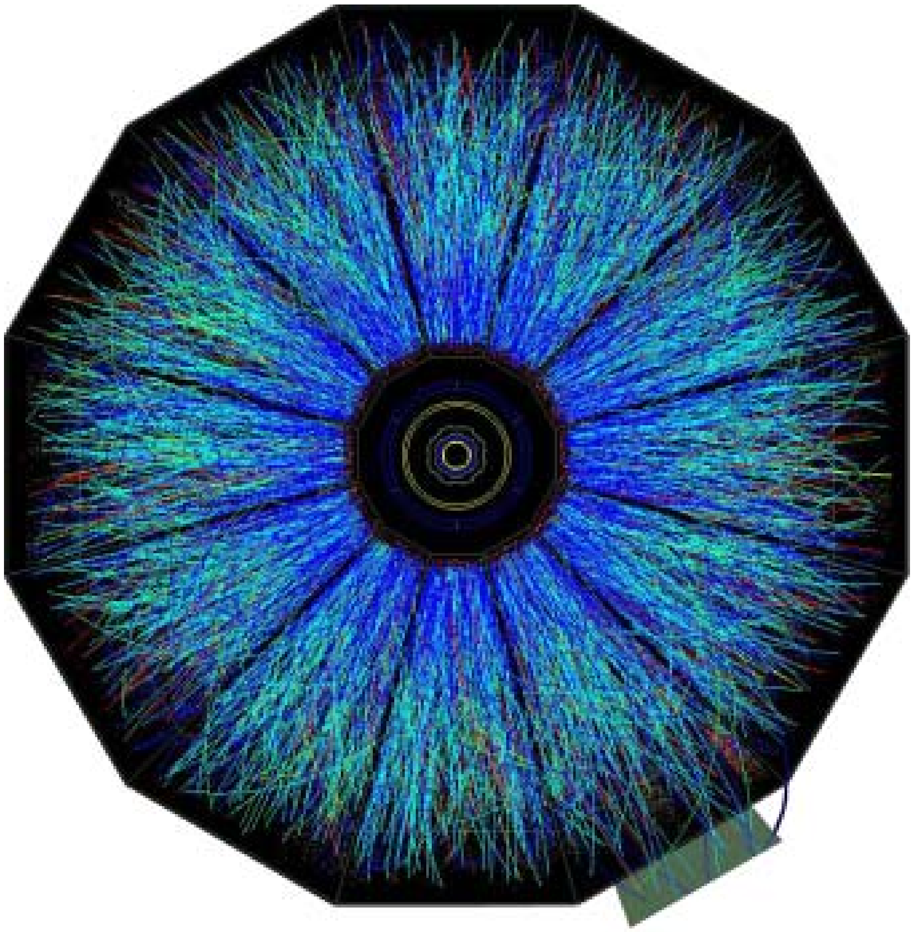
|z_vertex| < 95 cm
20 K evts. shown
50%
40%
30%
20%
10%
5%
Central
Zero Degree Cal., East + West, (ADC)
Central Trigger Barrel Signal (ADC)



centrality bin
for kink K
85
58
45
34
26
18
11
6
n_max/N_ev dN_ev/dn_ch
n_ch/n_max

STAR Event





Test of Flow Profile