Probing Correlations across pT Space via Assorted Two-Particle Azimuthal Correlations

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For

the PHENIX Collaboration

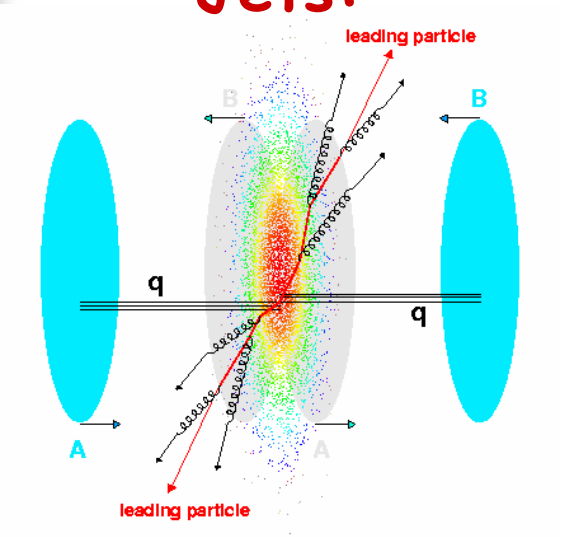
Outline

- Brief Motivation
- PHENIX subsystems used for correlation study
- Assorted Correlation Method
- Data
  - Typical Correlation Functions
  - pT reference study
- Model comparisons
- Summary/Outlook

Motivation

PHENIX@RHIC

Jets:

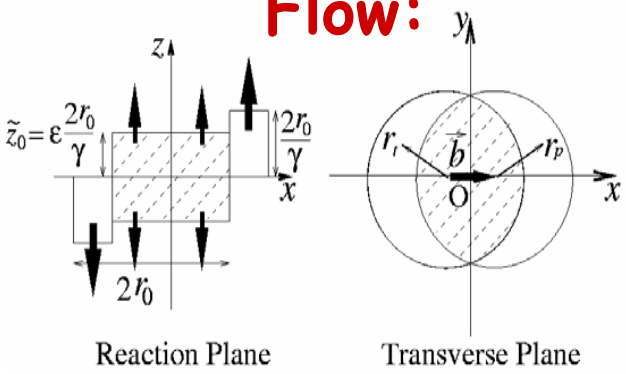


- Primarily from gluons at RHIC
- Produced early in the collision
- Probe hot and dense media that they traverse

CGC:

- Provides insights on Saturation Physics

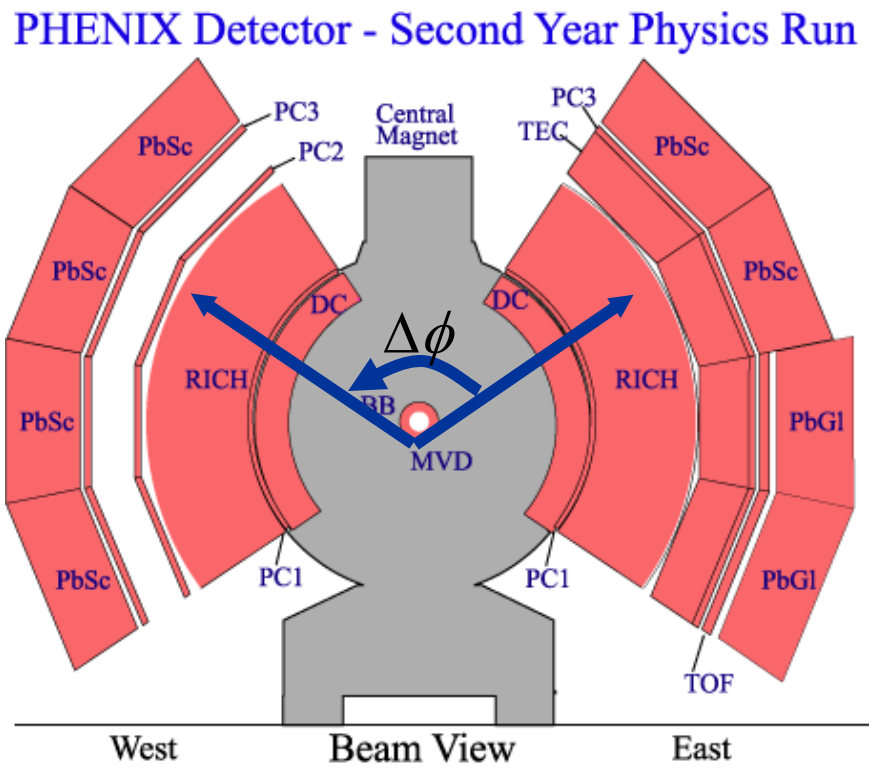
Flow:



- Primarily from pressure build-up
- Produced early
- Reflect conditions in collision zone (energy density etc.)

Correlation studies can provide information On the particle production mechanism, EOS, QGP formation …

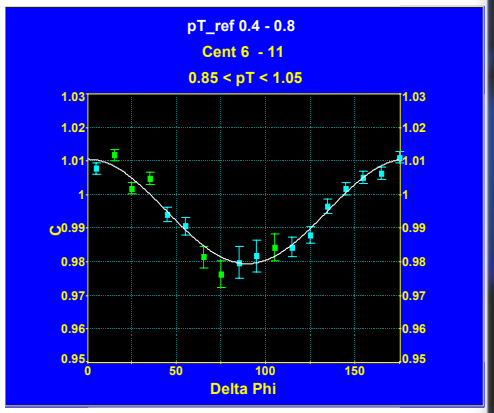
PHENIX Subsystems Used

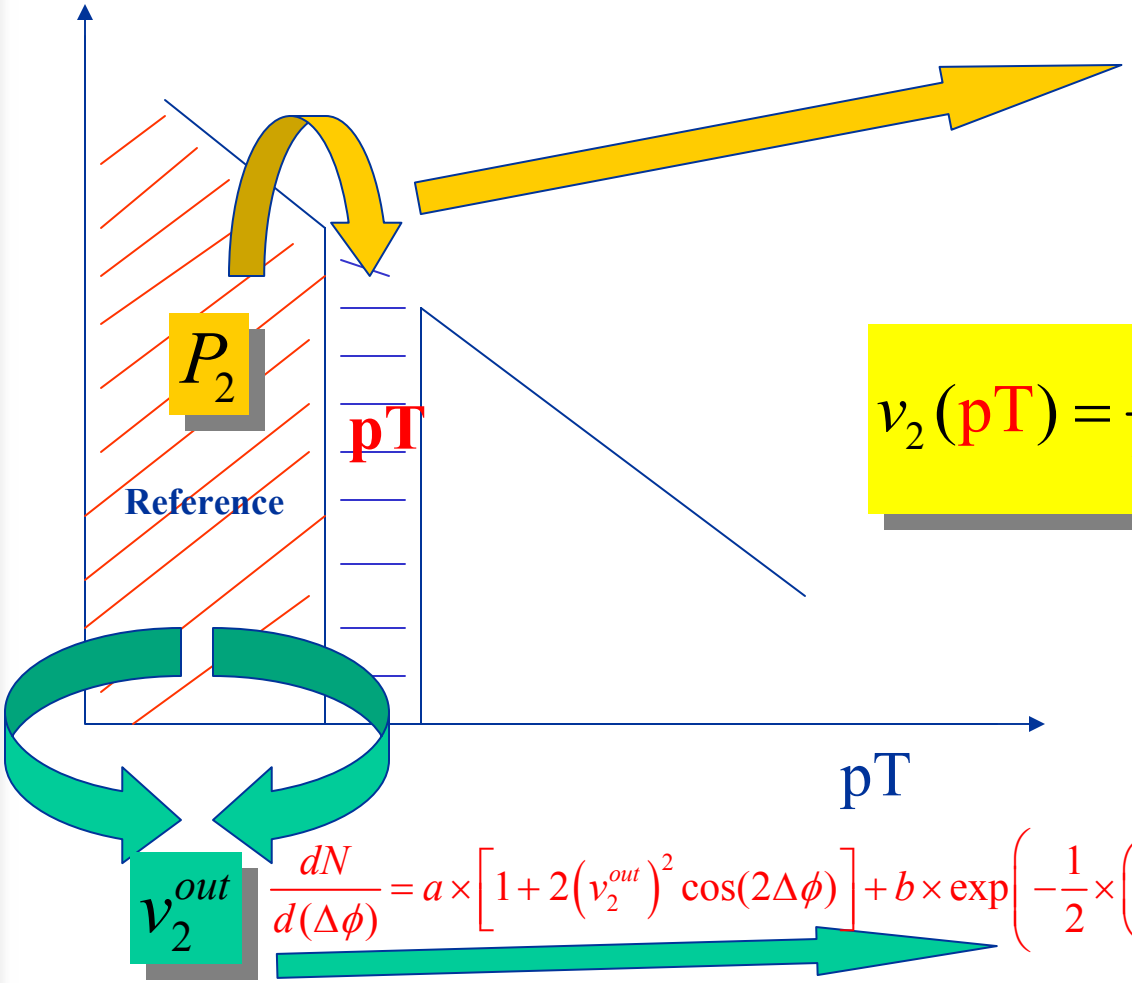


30 Million minimum bias events analysed

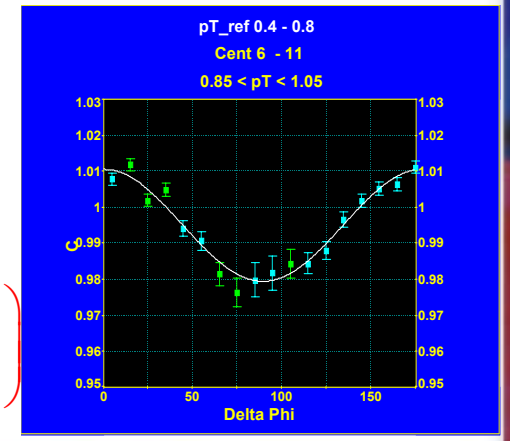
Extracting v2 via Assorted Correlations

$$\frac{dN}{d(\Delta\phi)} = a \times \left[1 + 2P_2 \cos(2\Delta\phi)\right] + b \times \exp\left(-\frac{1}{2} \times \left(\frac{\Delta\phi}{\sigma}\right)^2\right)$$



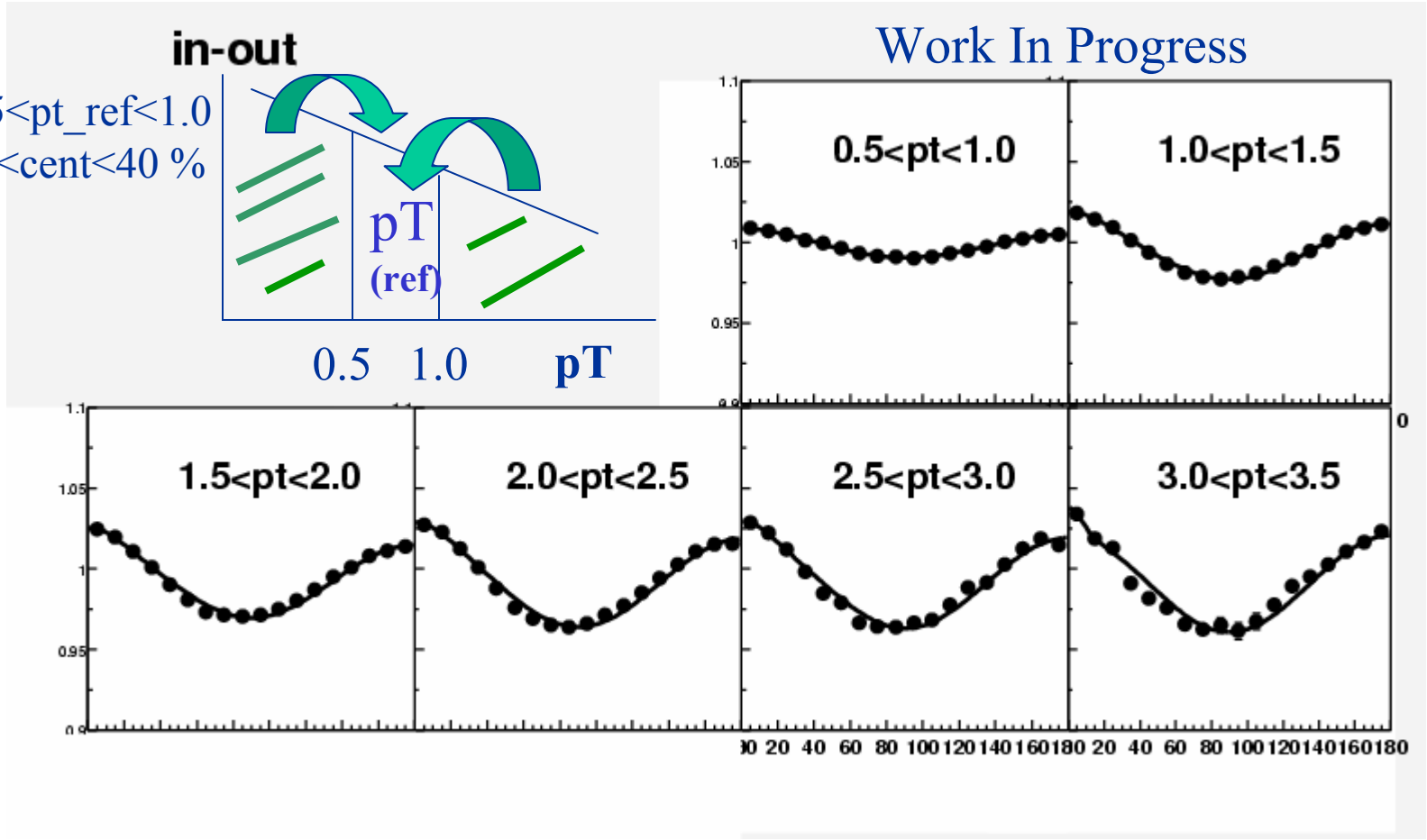


$$v_2(\mathrm{pT}) = \frac{P_2}{v_2^{out}}$$



$$\frac{dN}{d(\Delta\phi)} = a \times \left[1 + 2\left(v_2^{out}\right)^2 \cos(2\Delta\phi)\right] + b \times \exp\left(-\frac{1}{2} \times \left(\frac{\Delta\phi}{\sigma}\right)^2\right)$$

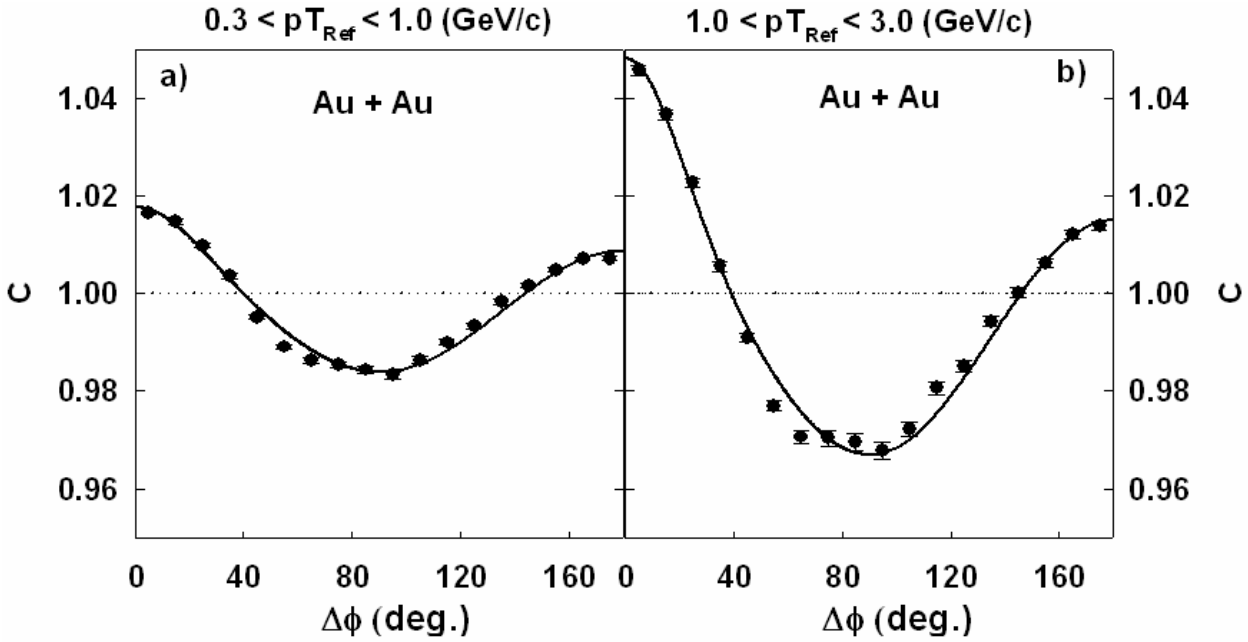
pT Dependence of Assorted Correlation Functions - Data



- Correlation functions show asymmetries and anisotropies
- Asymmetries and anisotropies develop with increasing pT

Reference Dependence of Asymmetries in the Assorted Correlation Functions

low pT reference high pT reference



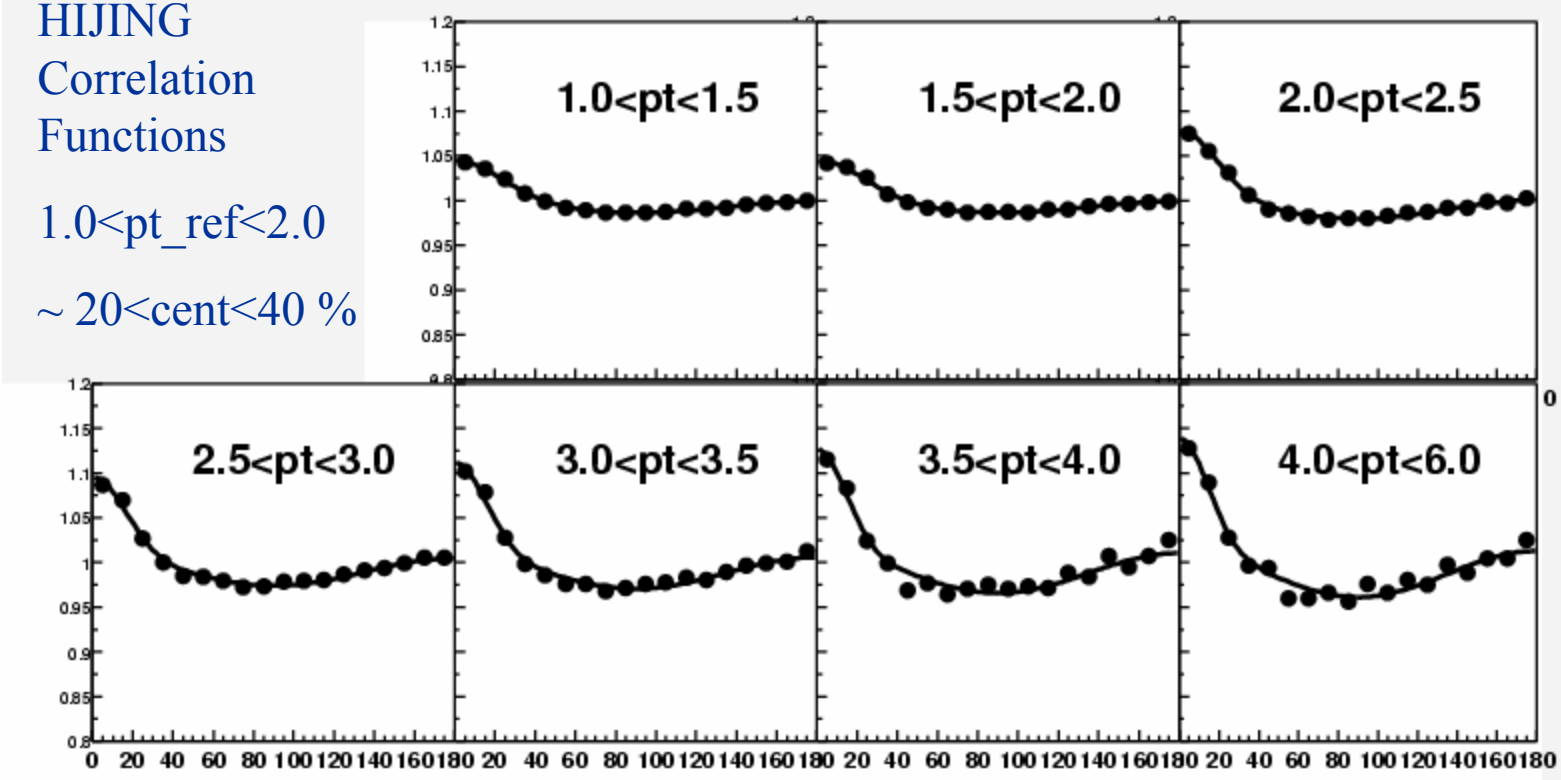
- Asymmetries are sensitive to the pT of the reference range.
- Asymmetries suggestive of jet-like correlations
- Low pT particles are correlated with high pT particles

pT Dependence of Assorted Correlation Functions - HIJING

HIJING Correlation Functions

1.0<pt_ref<2.0

~ 20<cent<40 %

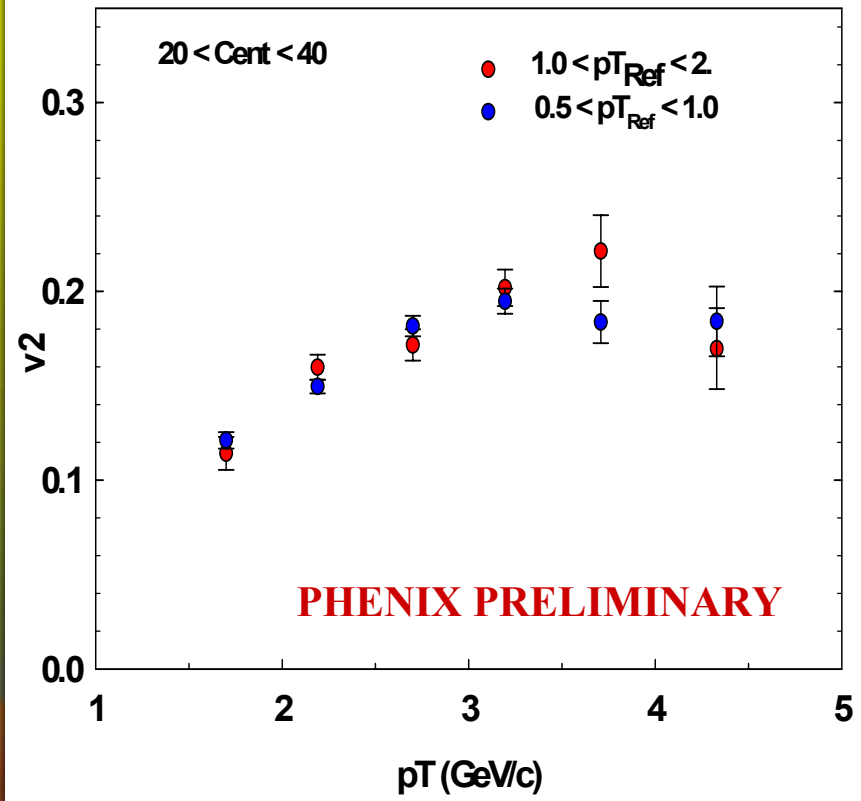


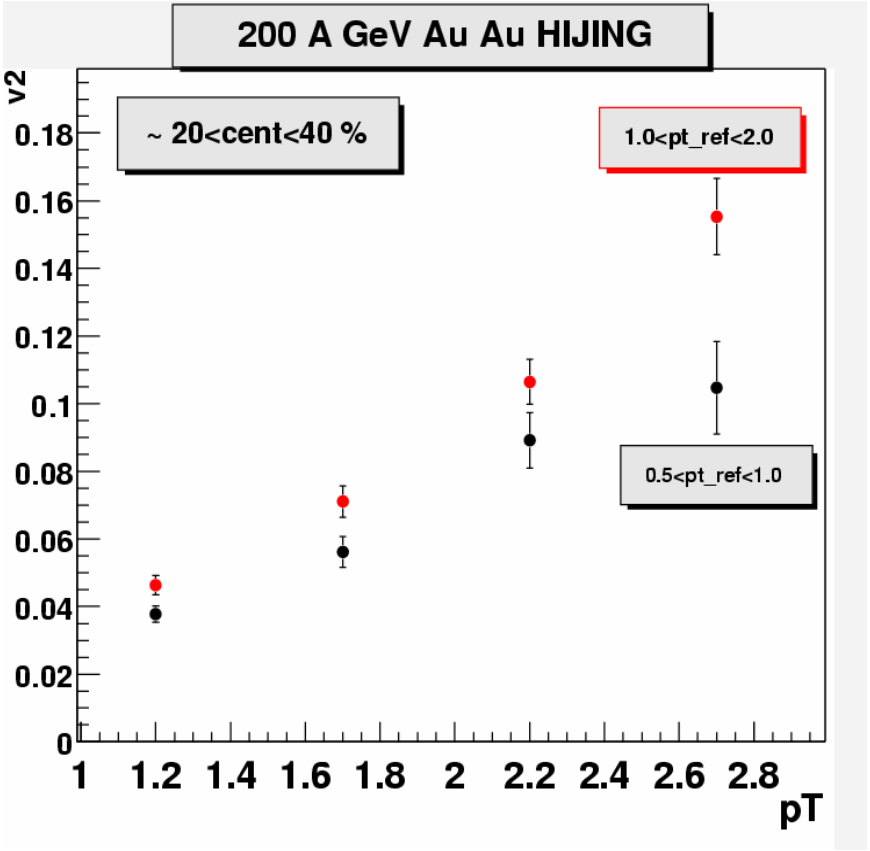
- Correlation functions show asymmetries and anisotropies
- Asymmetries and anisotropies develop with increasing pT

Reference Dependence of Anisotropies in the Assorted Correlation Functions

PHENIX @ RHIC

AuAu @ $\sqrt{s_{NN}} = 200\ GeV$



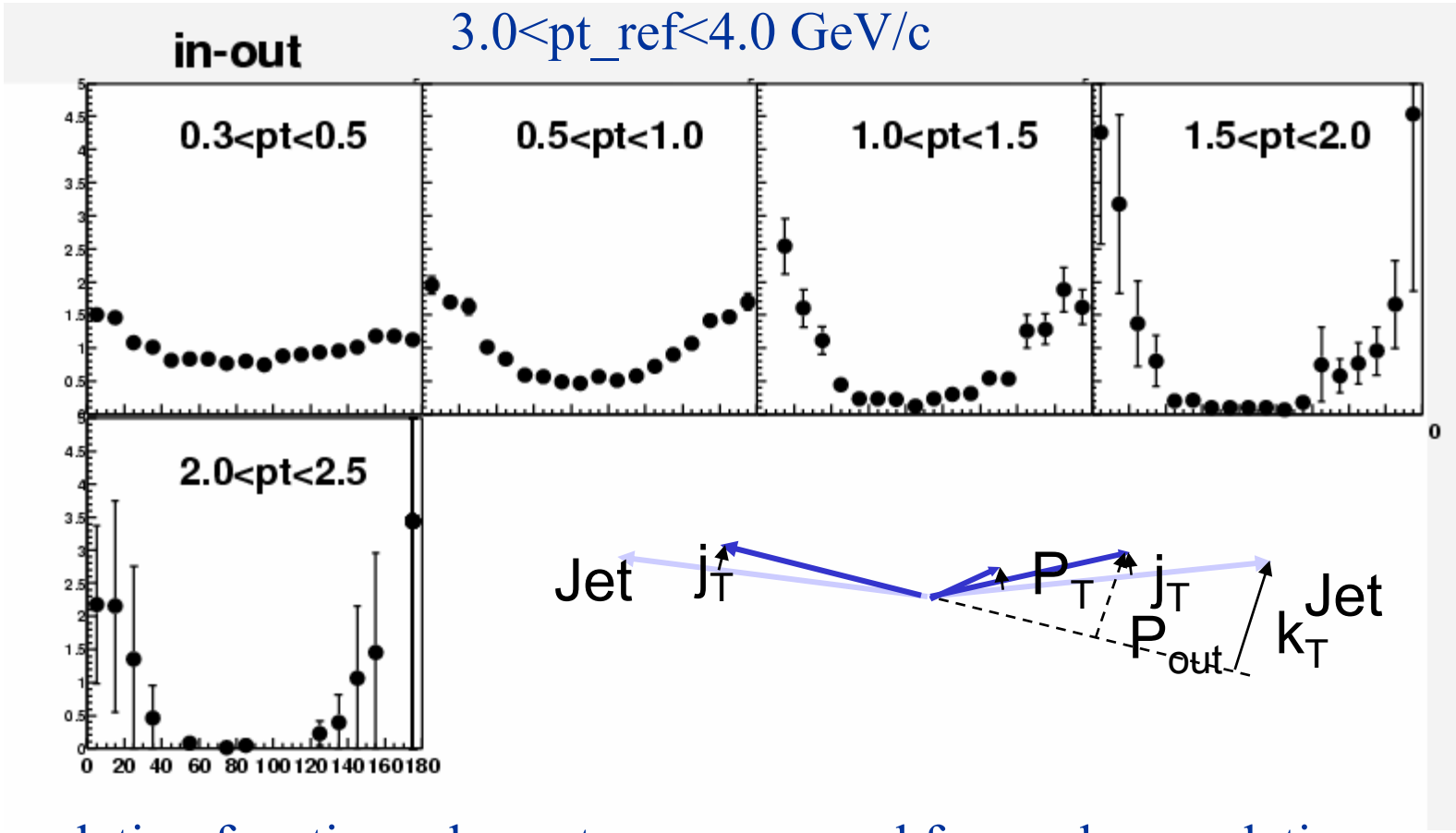


- Anisotropy independent of reference -> high-pT particles correlated with low-pT particles
- Anisotropy mildly dependent of reference

Conclusion and Outlook

- Assorted correlation technique is a powerful probe for testing correlations across pT space
- The azimuthal correlation functions for AuAu show asymmetries and anisotropies
- Asymmetries are suggestive of (mini) jet-like correlations
- High pT particles correlated with low pT particles
- The AuAu data shows v2(pT) obtained from the assorted method to be rather insensitive to the reference range over a broad pT range from low to high pT .
- (mini) jet dominated HIJING model gives v2(pT) which shows moderte sensitivity to reference range in the same pT range
- What connects high and low pT particles in the data? Any model attempting to describe the data needs to incorporate this.

Assorted Correlation Functions - PYTHIA



- Correlation functions show strong near- and far-angle correlations
- Correlation increases with increasing pT
- PYTHIA -> Correlation due to jet (even at low pT: tails of fragm. fct.)

pT Dependence of Assorted Correlation Functions - HIJING

HIJING Correlation Functions

0.5<pt_ref<1.0

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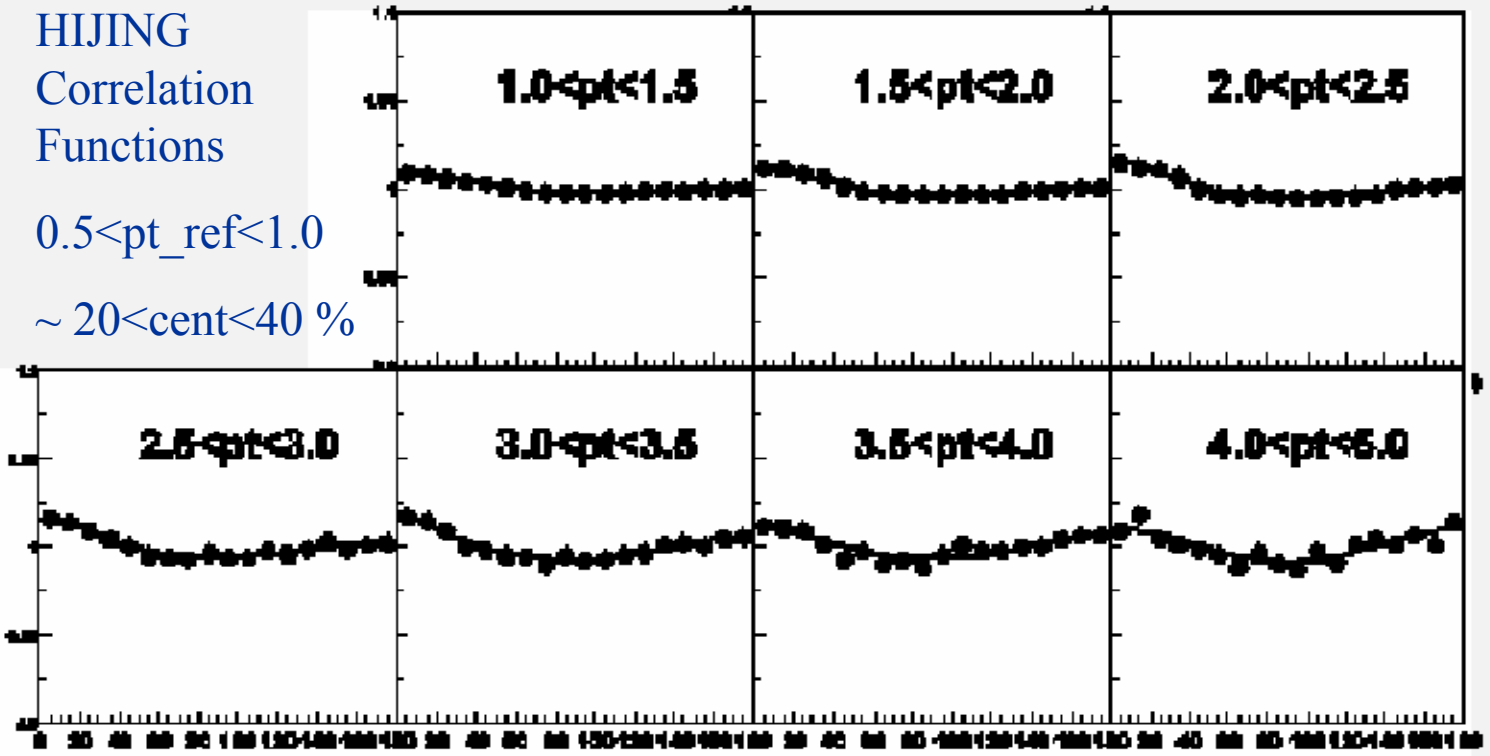

- Correlation functions show asymmetries and anisotropies
- Asymmetries and anisotropies develop with increasing pT
- Correlations of high-pT particles w/ low-pT particles weaker than in the data