π^0-Charged Hadron Azimuthal Correlations

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Outline

- Motivations for two particle correlation functions: azimuthal anisotropy (elliptic flow)
- Analysis from the PHENIX experiment from Au-Au at $\sqrt{s_{NN}} = 200$ GeV
- Use PHENIX capability to measure high-p_T π^0 and extract the v_2 flow parameter

Motivation - Azimuthal Anisotropy / Elliptic Flow

- Non-central collisions → pressure gradient
- Particles correlated with reaction plane

Molnar & Voloshin, nucl-th/0302014

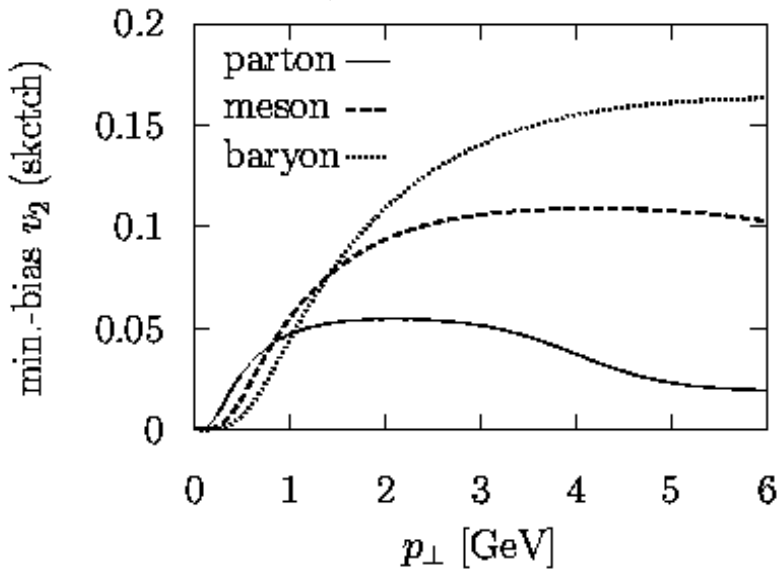
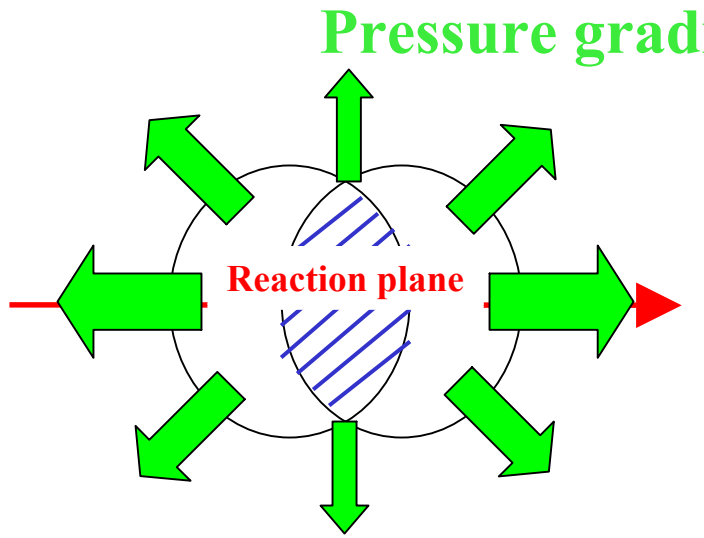


FIG. 1: Qualitative behavior of baryon and meson elliptic flow as a function of $p_\perp$ from quark coalescence.



$v_2 = \langle \cos(2\phi) \rangle$

- Quark Coalescence – large saturated v_2
- meson & baryon flow differs

Correlation Functions and v_2 Extraction

$$C(\Delta\phi) = \frac{dN_{real}/d\Delta\phi}{dN_{mix}/d\Delta\phi}$$

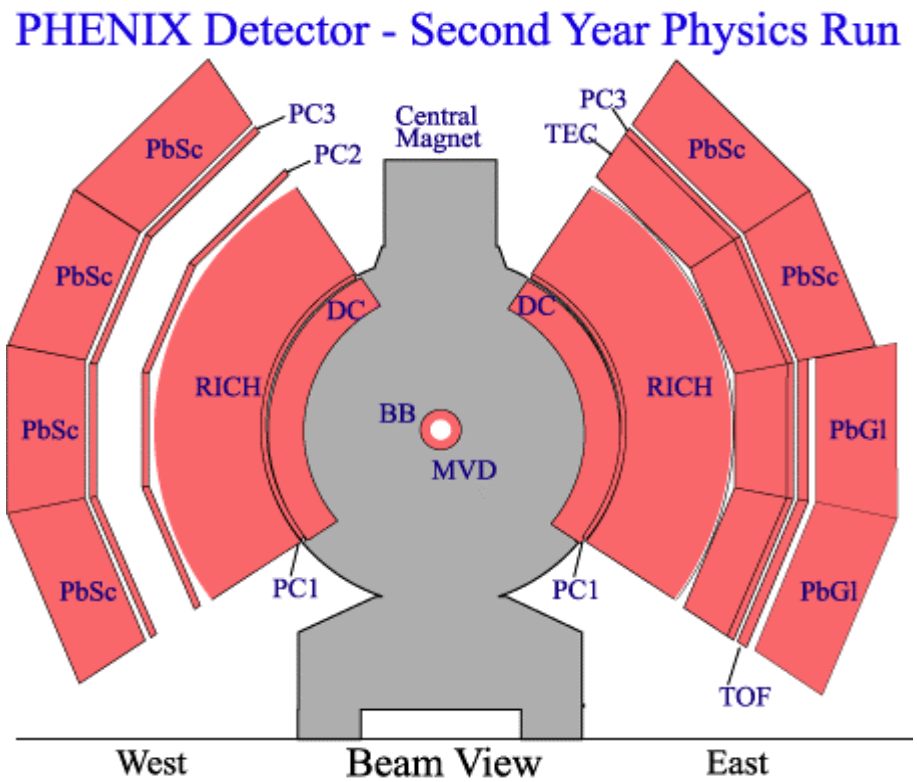
- Numerator: pairs within event.
- Denominator: pairs within different events.
- Detector efficiencies and acceptance cancels.

The Correlation Function for two-particle correlations is given as:

$$C(\Delta\phi) = 1 + 2v_2^{\pi^0} v_2^{h^{+/-}} \cos(2\Delta\phi)$$

- Need $h^{+/-}$ - $h^{+/-}$ Correlation Function in a reference p_T bin

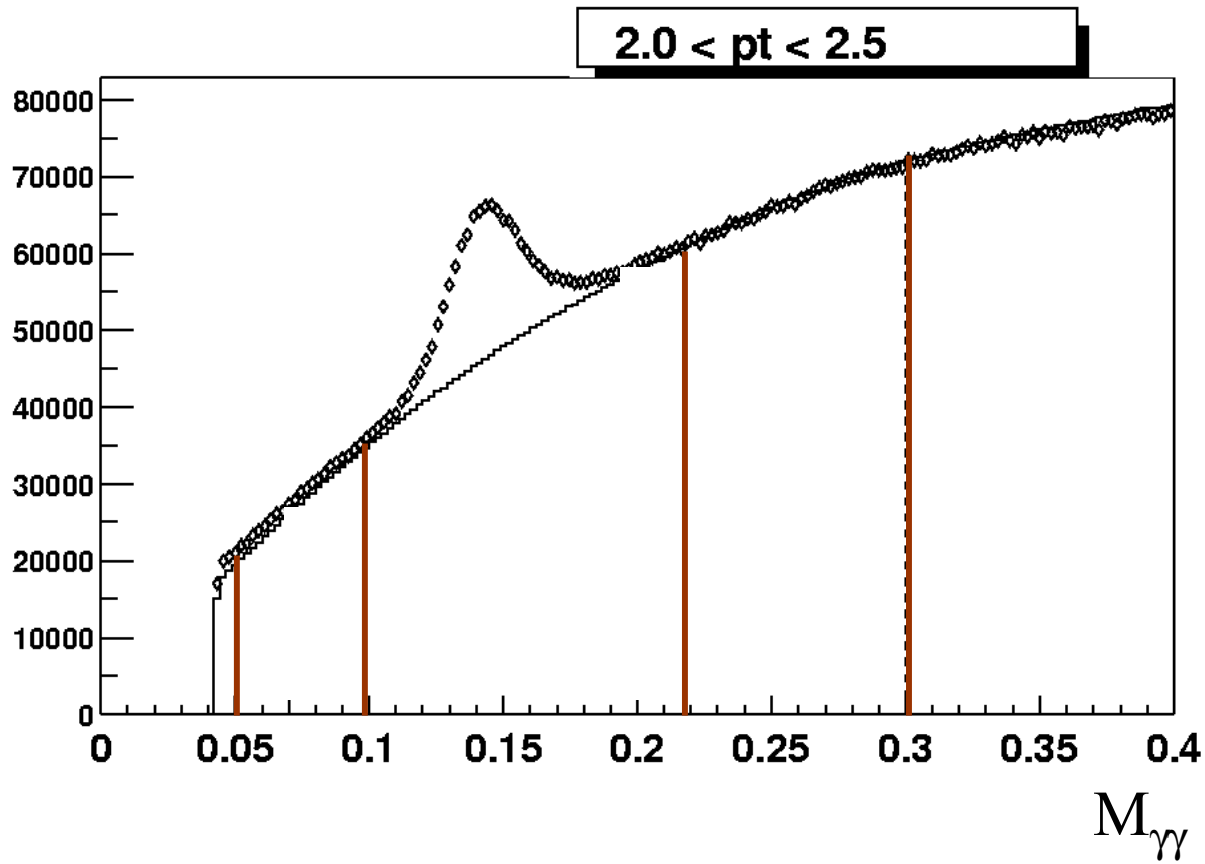
PHENIX Experiment



- Drift Chamber (DC) and Pad Chamber 1 (PC1) for tracking
- RICH rejects e^+,e^-
- EMCal (PbSc, PbGl) for high-p_T γ's reconstruct π^0's

Extracting v_2

- Candidate π^0 – all γ pairs under peak
- Background = Combinatoric γ pairs in mass
- Bin mass towards background v_2 estimate



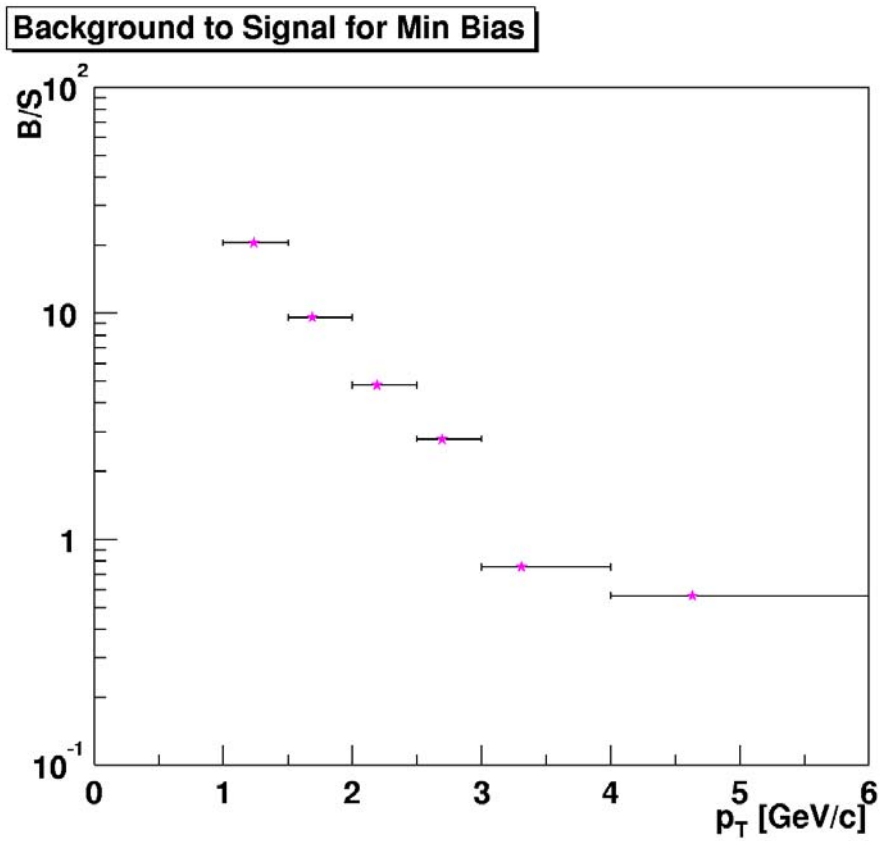
Correcting the π^0 v_2

$$v_2^{measured} = \frac{S v_2^{\pi^0} + B v_2^{B}}{S + B}$$

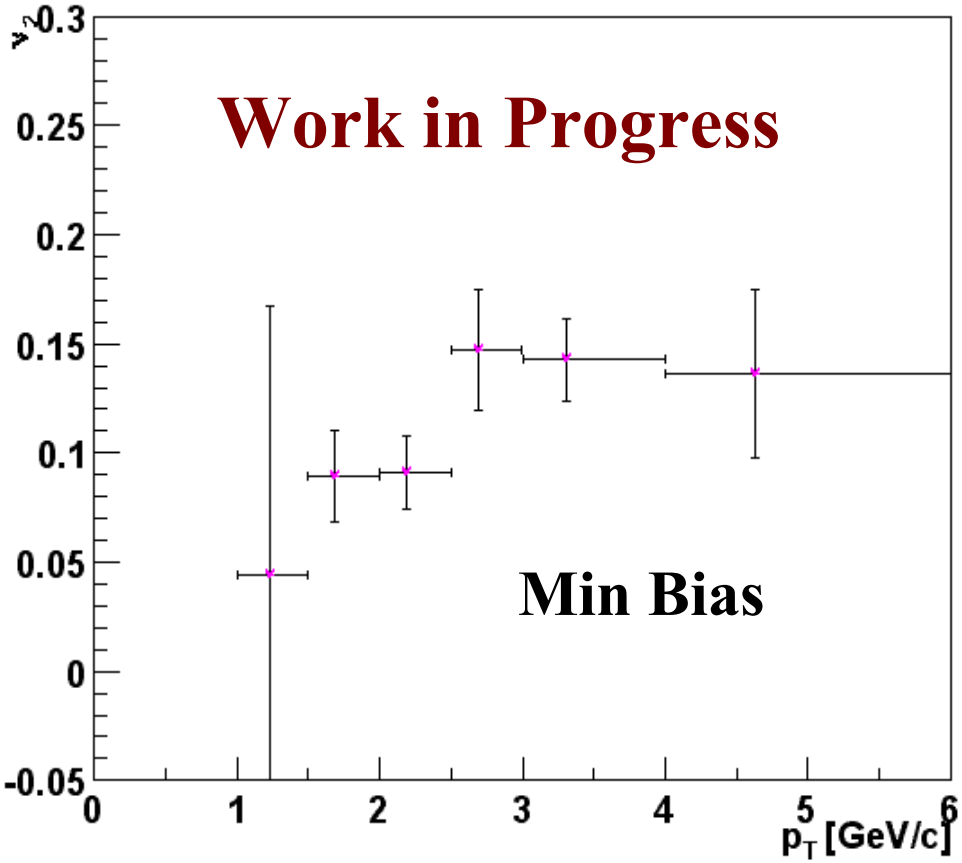
$$v_2^{\pi^0} = v_2^{measured} + {}^{B}\!/_{S}\left(v_2^{measured} - v_2^{B}\right)$$

To measure π^0 v_2:

- $v_2^{meausred}$ extracted in mass
- Measure v_2 outside π^0 mass bins.
- v_2^{B} obtained from a linear fit with the v_2 outside π^0 mass bins.



Corrected π^0 v_2



- v_2 rises to and saturates at 0.15 for $p_T > 3$ GeV
- Large error bars due to extrapolation of the v_2^B as well as the B/S.

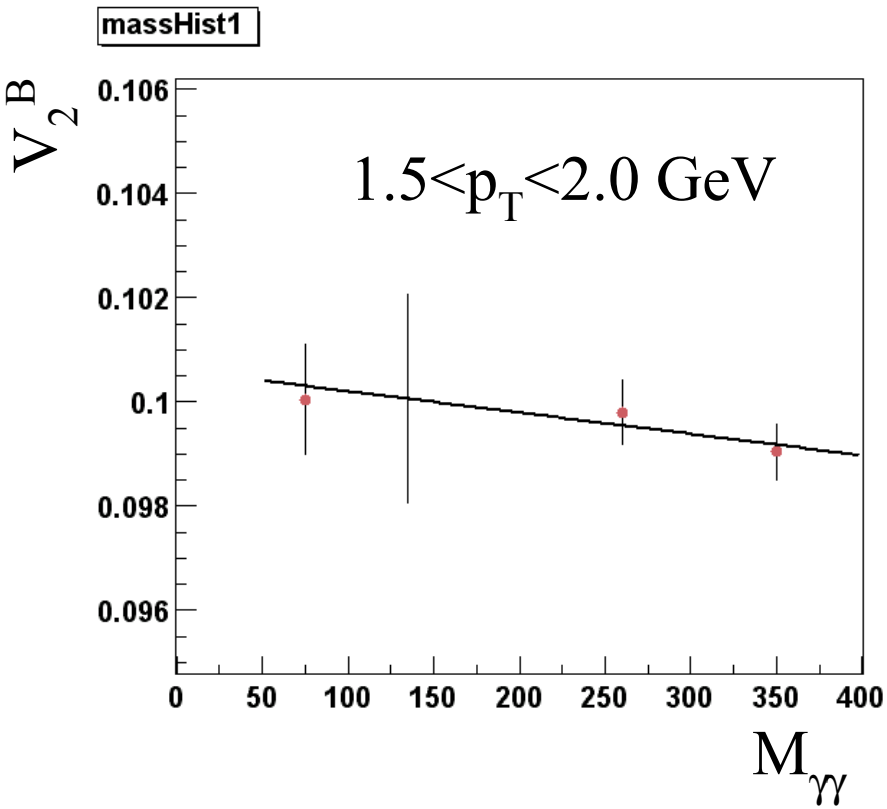
Summary

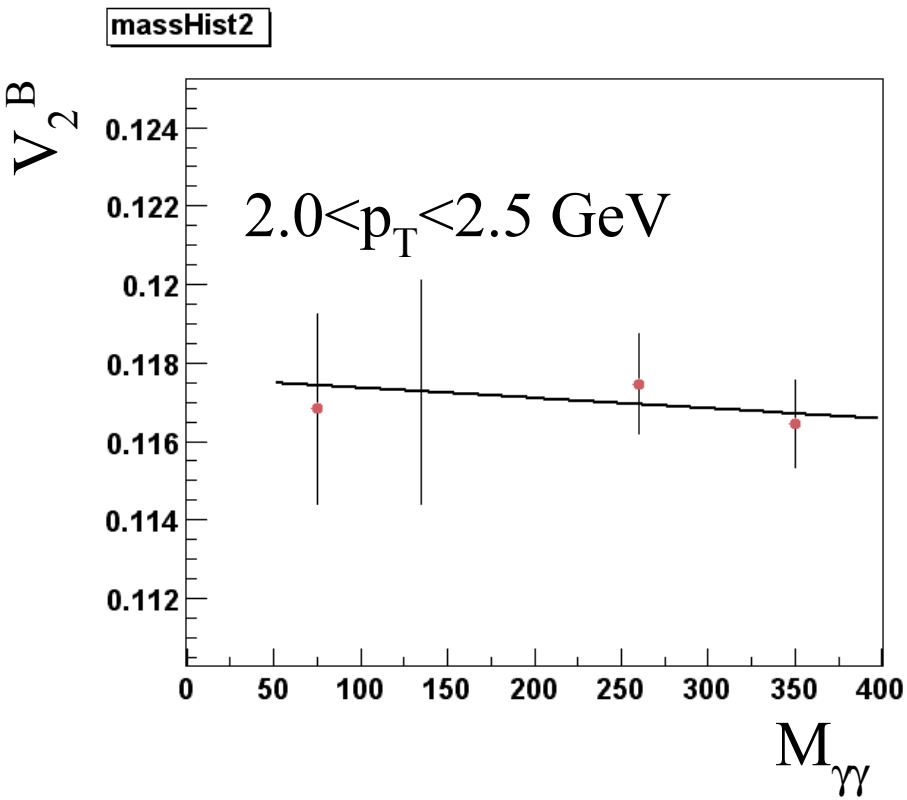
- Presented work in progress on π^0-$h^{+/-}$ correlations from $= 200$ GeV Au-Au at the PHENIX experiment.
- Presented initial correction to the π^0 v_2.
- Future work: Good PID for high-p_T π^0, have v_2 for p-p, d-Au, and next Au-Au run.

Extracting v_2^B

Point extracted from linear fit to the data points outside π^0 mass.

Error bars calculated by the extreme v_2^B values of the data points.





π^0 Corrected v_2 & Reaction Plane v_2