Event Plane dependent dihadron azimuthal correlations with event shape engineering in Au+Au collisions at $\sqrt{s_{NN}}$=200GeV

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Abstract

Dihadron azimuthal correlations with high p_T trigger particles are a valuable tool to study the interactions between jets and the QGP medium. Previously, it was shown that dihadron azimuthal correlations are expected to depend on the azimuthal angle of trigger particle relative to the event plane[1]. However, in-medium path length can additionally differ in the same multiplicity class because of the evolution of the system, and thus the strength of long-range correlations (flow), is sensitive to fluctuations in the initial geometry. Event shape engineering (ESE) has been proposed as a powerful method to select the events which have different strength of flow[2].
We present a study of dihadron correlations for different selections of trigger particle's azimuthal direction with respect to the event plane in Au+Au collisions at $\sqrt{s_{NN}}$ = 200GeV utilizing ESE.

Motivation

➢ **Why distinguish "Left" and "Right"?**
Event Plane(EP) dependence of correlations has been measured in Au+Au collisions[1], but in this measurement **Left** / **Right** difference with respect to Ψ_2 leads to a **different in-medium path length**.

➢ **Why event shape engineering (ESE)?**
The amplitude of flow is sensitive to the initial geometry of the system. By selecting the size of the flow vector ($|Q_2|$), we can choose different strength of flow. The difference of jet modification in strong flow events and in weak flow events could be measured.

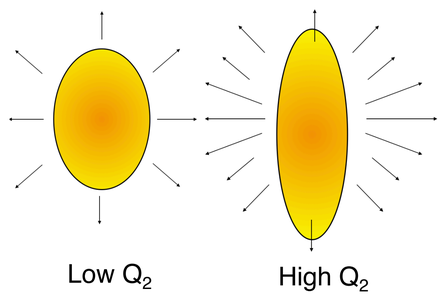
Analysis method

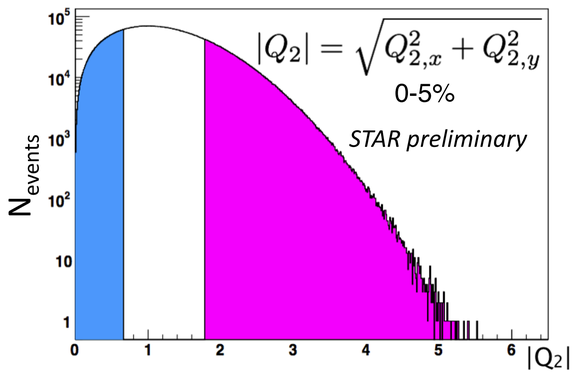
Statistical errors are smaller than marker size.

✓ Event classification

➢ Q_2 cut with TPC EP in each centrality class

$$|\overrightarrow{Q_2}| = \sqrt{{Q_{2_x}}^2 + {Q_{2_y}}^2} \qquad Q_{2_x} = \sum w_i \cos(n\phi_i) \quad Q_{2_y} = \sum w_i \sin(n\phi_i)$$



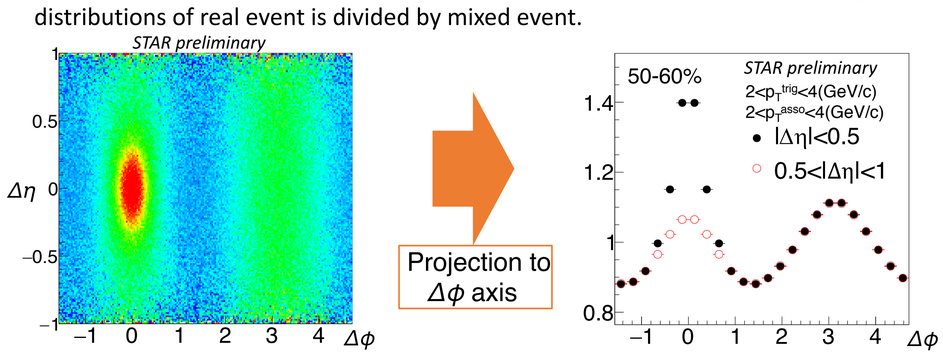


✓ Correlation Function

$$C(\Delta\phi, \Delta\eta) = \frac{\int d(\Delta\phi)d(\Delta\eta)Y^{mix}(\Delta\phi, \Delta\eta)}{\int d(\Delta\phi)d(\Delta\eta)Y^{real}(\Delta\phi, \Delta\eta)} \cdot \frac{Y^{real}(\Delta\phi, \Delta\eta)}{Y^{mix}(\Delta\phi, \Delta\eta)}$$

$$\Delta\phi = \phi^{asso} - \phi^{trig}$$
$$\Delta\eta = \eta^{asso} - \eta^{trig}$$

➢ In order to remove the effect of acceptance and efficiency of detectors from signals , distributions of real event is divided by mixed event.

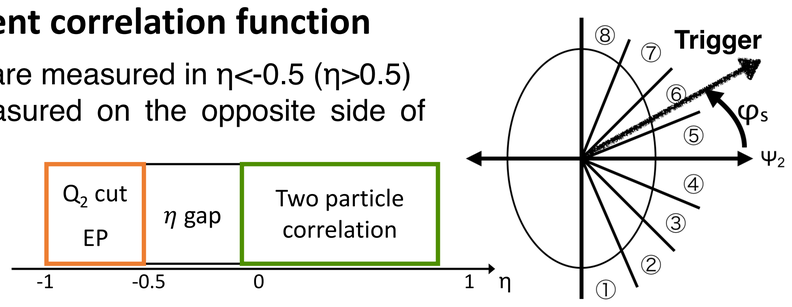


Event Plane dependence

✓ **Event Plane dependent correlation function**

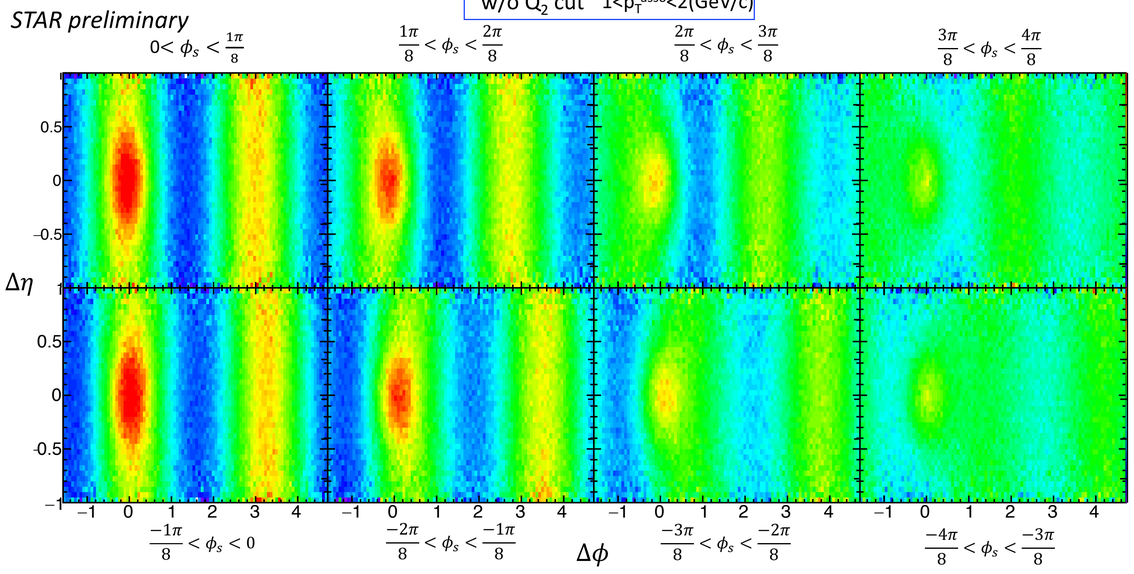
➢ Both Q_2 and EP(Ψ_2) are measured in η<-0.5 (η>0.5)
➢ Correlations are measured on the opposite side of TPC, at η>0 (η<0).

$$\phi_s = \phi^{trig} - \Psi_2$$



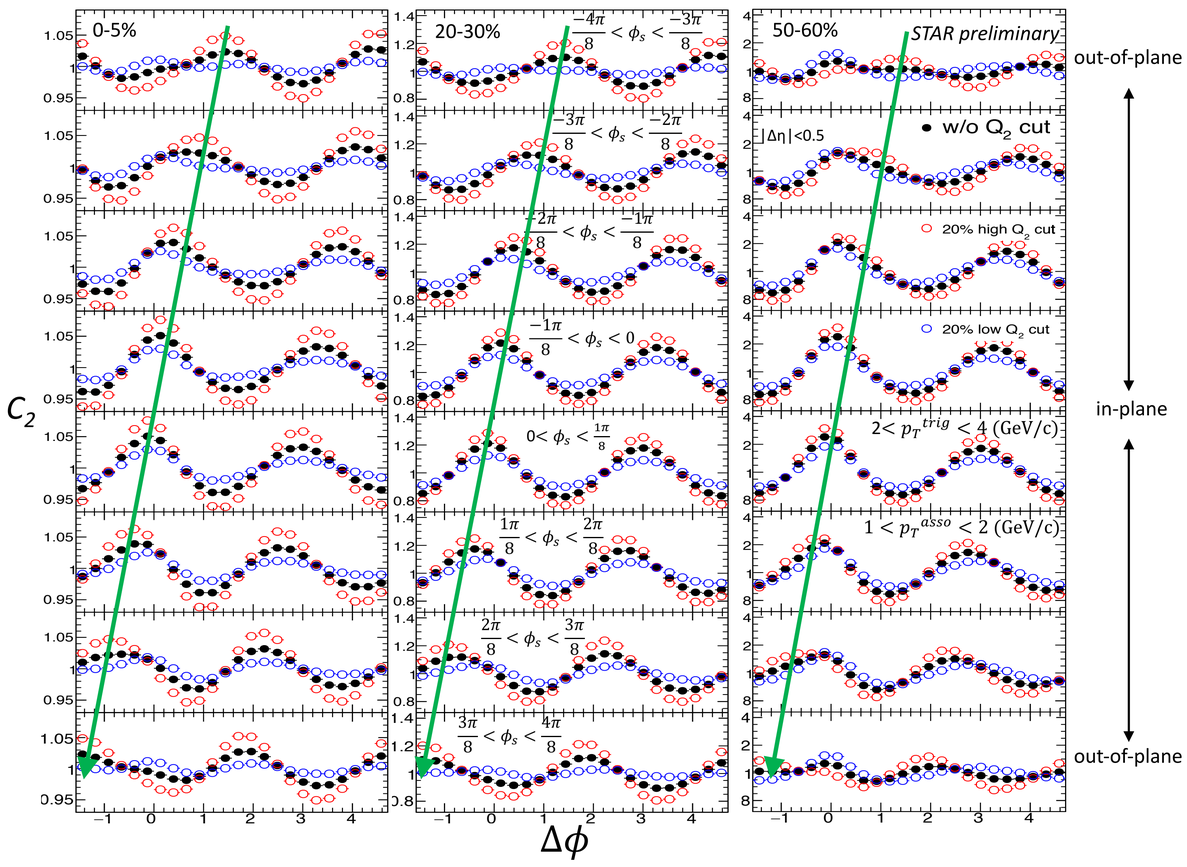
Correlations as a function of ϕ_s

50-60% 2<p_T^{trig}<4(GeV/c)
w/o Q_2 cut 1<p_T^{asso}<2(GeV/c)



➢ In Δϕ, Δη correlations, long-range azimuthal correlation can be seen regardless of the trigger particle's angle (ϕ_s).
➢ Mirror symmetric distributions with respect to Δϕ=0 can be seen in each panel.

✓ **Q_2 dependence of correlation function**



➢ Peak positions shift as a function of ϕ_s.
➢ Q_2 dependence can be seen in each centrality class.

Summary & Outlook

➢ Peak positions of correlations shift as a function of ϕ_s.
➢ Long-range correlation can be seen regardless of ϕ_s.
➢ Q_2 dependence can be seen in raw correlation functions.
➢ Background subtractions will be done.
➢ Correction of event plane resolution will be done.
➢ Systematic uncertainties will be calculated.

References

[1] Adamczyk L *et al.* (STAR) 2014 *Phys. Rev.* **C89** 41901
[2] Jurgen Schukraft, *et al.* 2013 *Phys.Lett.* **B719** 394-398

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