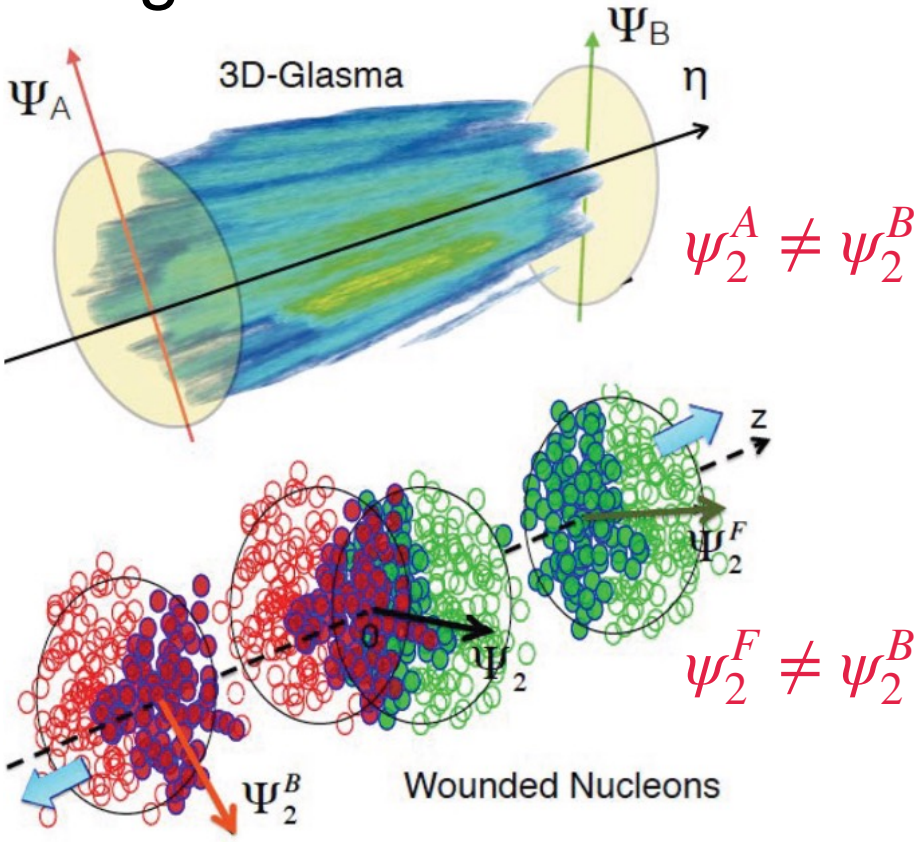
Longitudinal De-correlation of Anisotropic Flow at RHIC-STAR

Gaoguo Yan (闫高国) for the STAR Collaboration
Shandong University （山东大学）

Abstract: Studies of longitudinal de-correlation of anisotropic flow provide unique constraints on the three-dimensional structure of the initial stages and dynamical evolution of the quark-gluon-plasma in heavy-ion collisions. We present the centrality and collision energy dependence of $r_n(\eta)$ $(n = 2,3)$, for 19.6, 27 and 54.4 GeV Au+Au collisions.

Longitudinal de-correlation



How to measure

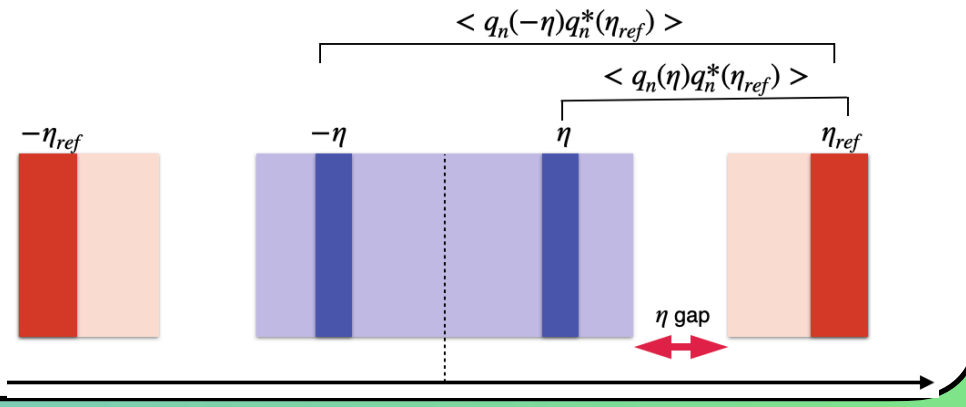
Event-by-event fluctuation

$$V_{n\Delta} = v_n^a(p_T^a, \eta^a) v_n^b(p_T^b, \eta^b) e^{in(\psi_n^a - \psi_n^b)}$$

Observable:

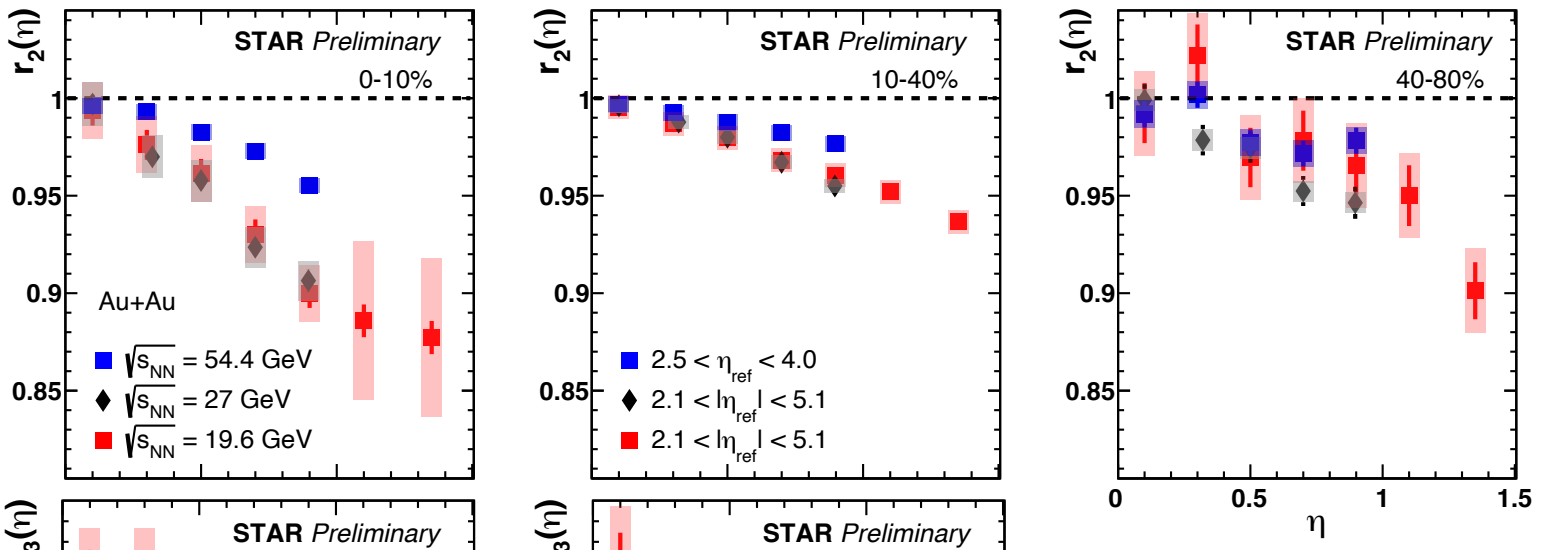
$$r_n(\eta) = \frac{< q_n(-\eta) q_n^*(\eta_{ref}) >}{< q_n(+\eta) q_n^*(\eta_{ref}) >}$$

$$= \frac{< v_n(-\eta) v_n(\eta_{ref}) cos\{n[\psi_n(-\eta) - \psi_n(\eta_{ref})]\}) >}{< v_n(+\eta) v_n(\eta_{ref}) cos\{n[\psi_n(+\eta) - \psi_n(\eta_{ref})]\}) >}$$

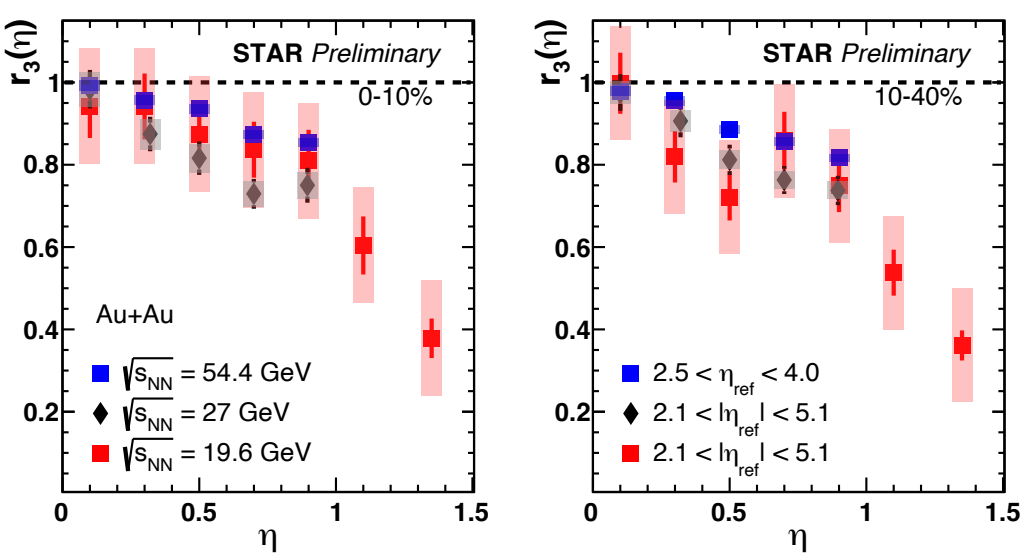


Collision energy dependence

$r_2(\eta)$



$r_3(\eta)$



- Centrality and energy dependence
- The 3rd order de-correlation is 2-3 times stronger than 2nd order
- Non-linear collision energy dependence?

Outlook

Using STAR BES-II data to further study collision energy dependence

Study system size dependence: Au+Au, Zr+Zr/Ru+Ru, O+O collisions

Forward upgrade ($2.5 < \eta < 4.0$): de-correlation in a larger η range

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