Elliptic flow of inclusive charged hadrons in relativistic heavy-ion collisions using the PHSD model

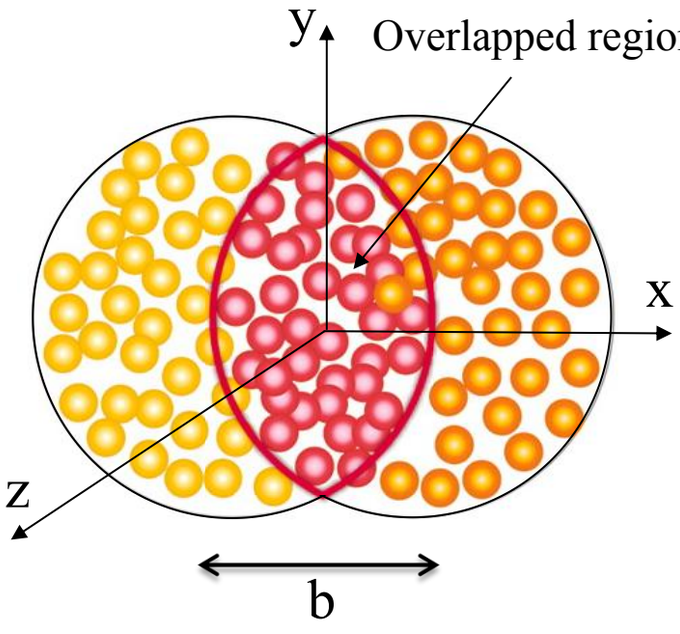
Vipul Bairathi[1] , Sonia Kabana[1]

[1]*Instituto de Alta Investigación, Universidad de Tarapacá, Arica, Chile*

Waseem Bhat[2], Towseef Bhat[2], Shabir Bhat[2], Farooq Mir[2]

[2]*University of Kashmir, Srinagar, Jammu and Kashmir, India*

Introduction: Collective Flow

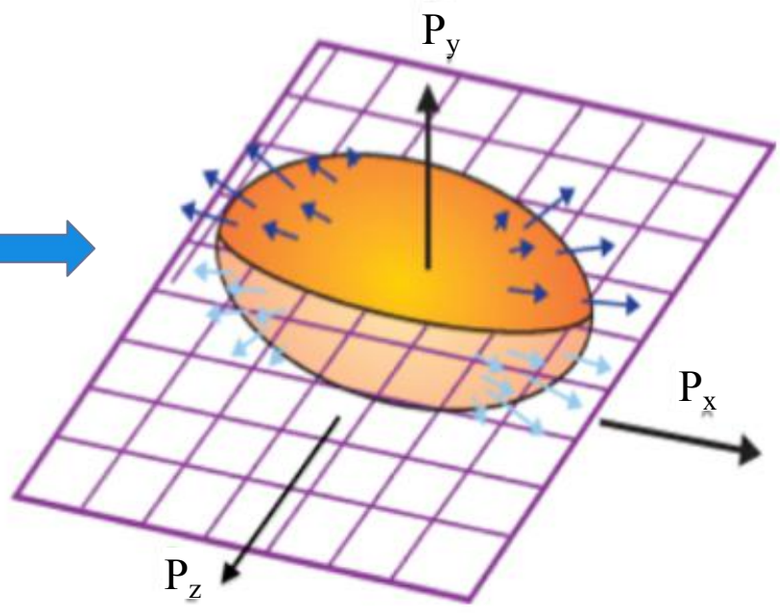


Interactions

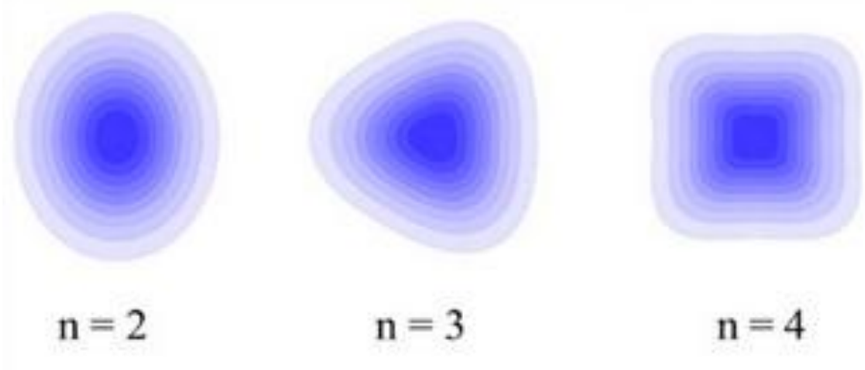
↓

Pressure(P)

$$y > x \rightarrow \frac{\partial P}{\partial x} > \frac{\partial P}{\partial y}$$



Different flow harmonics



Elliptic flow (v_2)

Momentum space anisotropy in the azimuthal angle distribution of produced particles with respect to the reaction plane.

- **Sensitive to initial conditions of collisions**
- **Sensitive to transport properties (η/s) of system**
- **Probe for the particle production mechanism (e.g. quark coalescence)**

- *P. Klob, U. W. Heinz, Nucl. Phys. A715, (2003) 653c*

Flow Measurements

- **Single particle distribution:**

$$E\frac{d^3N}{dp^3} = E\frac{d^2N}{2\pi p_T dp_T d\eta}\left[1 + 2\sum_{n=1}^{\infty} v_n(p_T,\eta)\cos\{n(\phi - \Psi_n)\}\right]$$

anisotropic flow $v_n = \langle\cos[n(\phi - \Psi_n)]\rangle$, Ψ_n = nth-order reaction plane angle

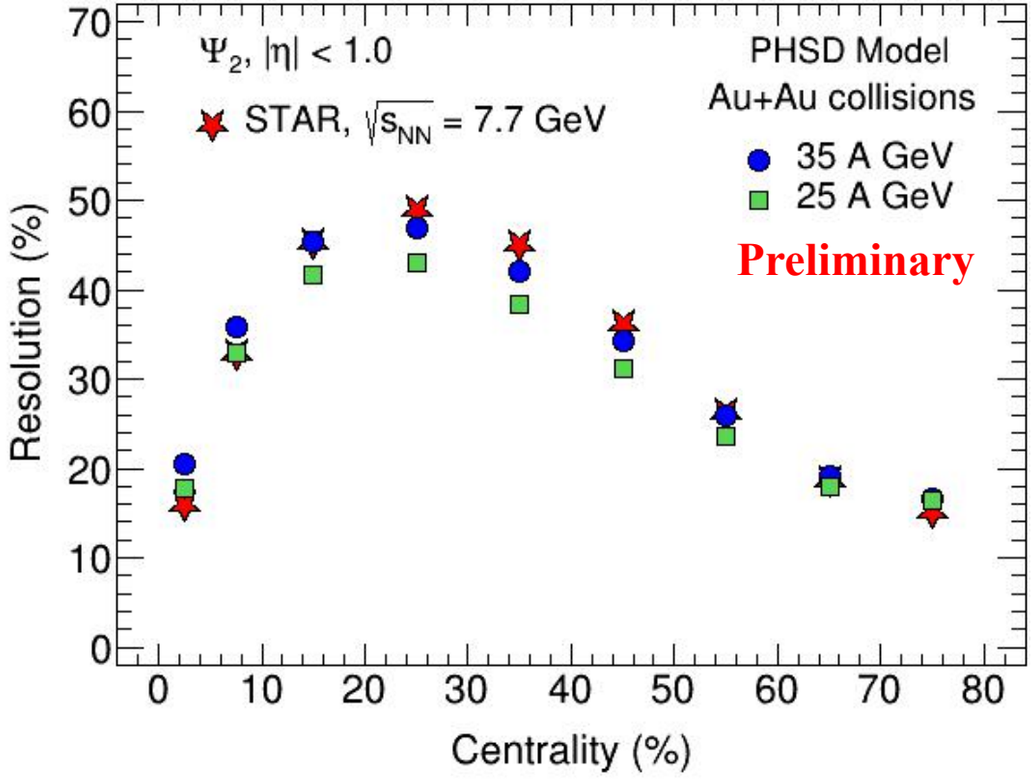
- **η-sub event plane method**

$$\Psi_n = \frac{1}{n}\tan^{-1}\left(\frac{\sum_{i=1}^{M} w_i \sin(n\phi_i)}{\sum_{i=1}^{M} w_i \cos(n\phi_i)}\right)$$

$$R_n = \sqrt{\langle\cos[n(\Psi_n^A - \Psi_n^B)]\rangle}$$

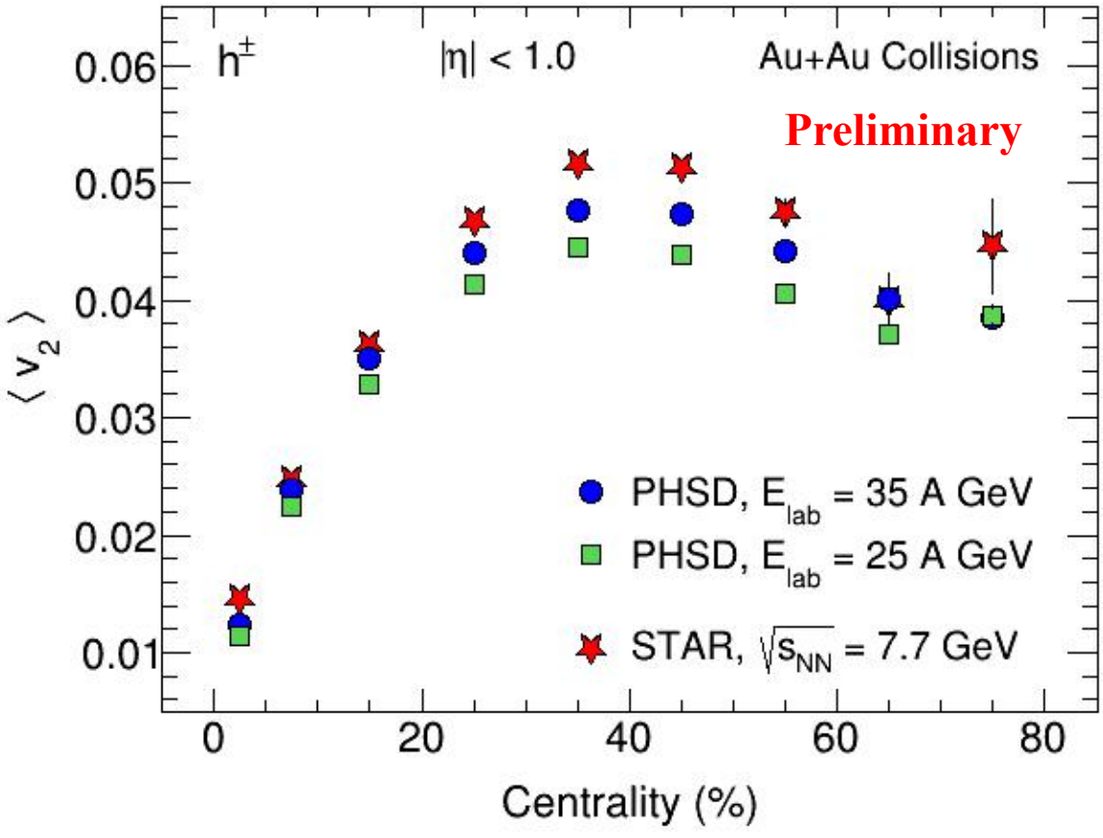
Event plane angle calculated in two sub-events A ($0.05 < \eta < 1.0$) and B ($-1.0 < \eta < -0.05$).

$$R_{full} \approx \sqrt{2}\, R_{\eta sub}$$



- *A.M. Poskanzer & S.A. Voloshin, Phys.Rev. C 58 (1998)*
- *L. Adamczyk et al. (STAR), Phys. Rev. C 88, 014902 (2013)*

Results: Charged Hadrons Elliptic Flow

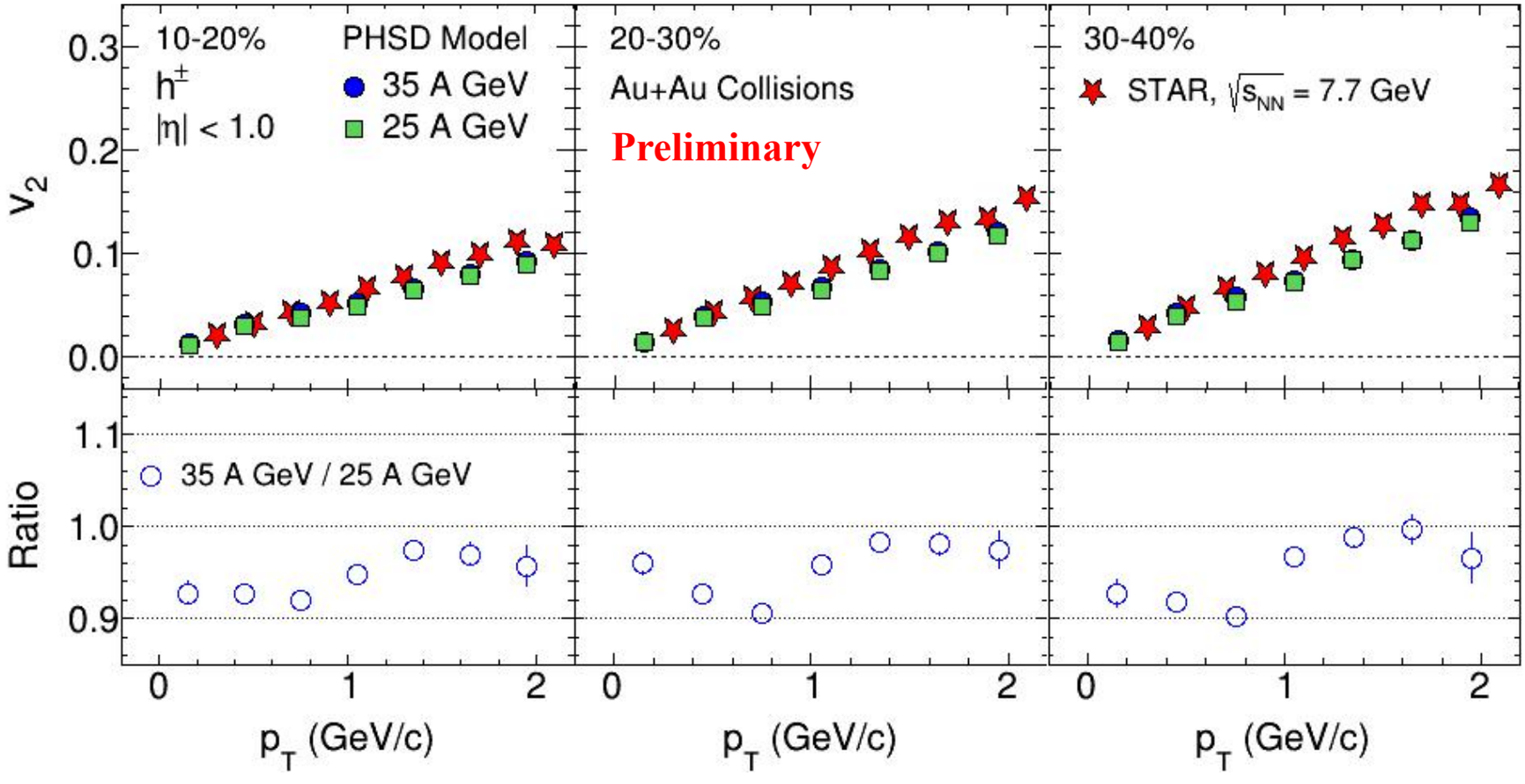


- Elliptic flow $\langle v_2 \rangle$ increases from central to peripheral collisions showing strong centrality depdendence.

- $\langle v_2 \rangle$ with respect to $\psi_2\{\eta\text{-sub}\}$ in Au+Au collisions at E_{lab} = 35 A and 25 A GeV from the PHSD model show similar centrality depedence as in Au+Au collisions at $\sqrt{s_{NN}}$ = 7.7 GeV from the STAR experiment.

- *L. Adamczyk et al. (STAR Collaboration), Phys. Rev. C 86, 054908 (2012)*

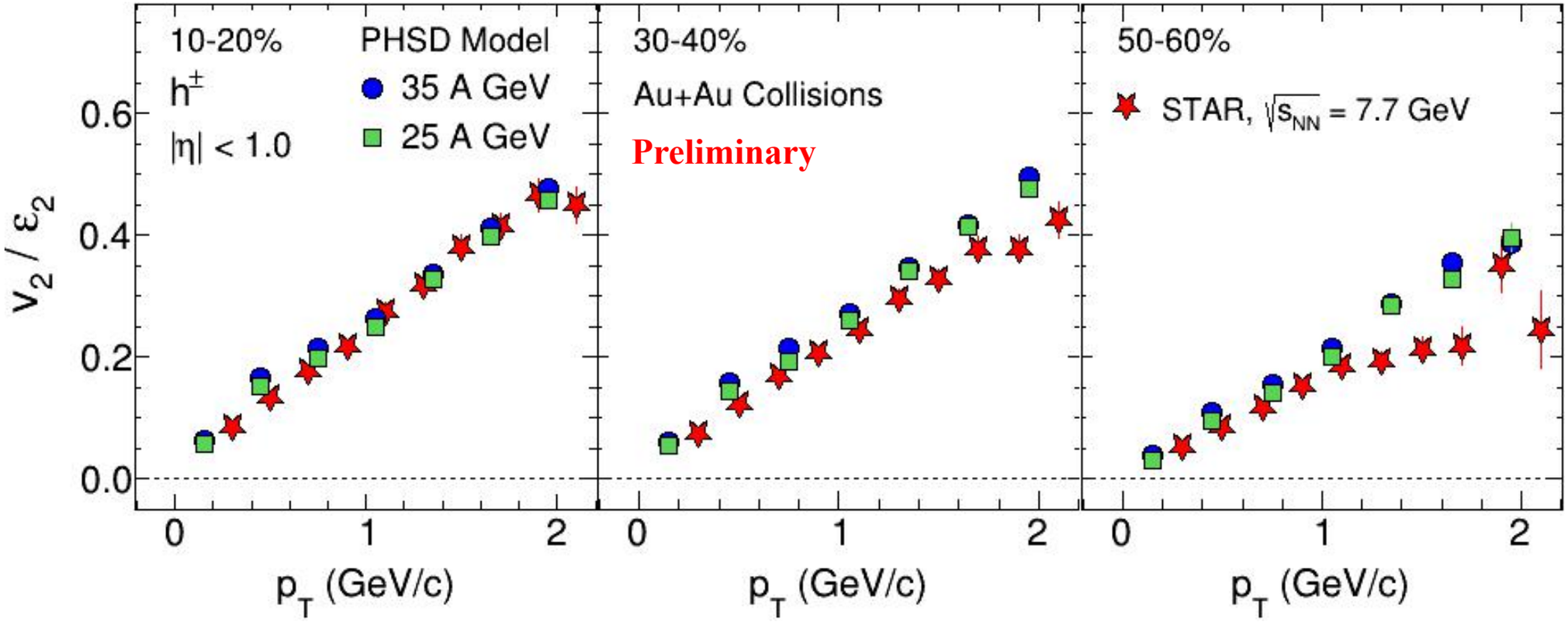
Differential $v_2(p_T)$



- Elliptic flow $v_2(p_T)$ increases monotonically with transverse momentum (p_T) till 2.0 GeV/c.
- $v_2(p_T)$ in Au+Au collisions from the PHSD model shows similar trend as in the Au+Au collisions at $\sqrt{s_{NN}}$ = 7.7 GeV from the STAR experiment.
- The difference between $v_2(p_T)$ at E_{lab} = 35 and 25 A GeV from the PHSD model is ~10% at lower p_T.

- *L. Adamczyk et al. (STAR Collaboration), Phys. Rev. C 86, 054908 (2012)*

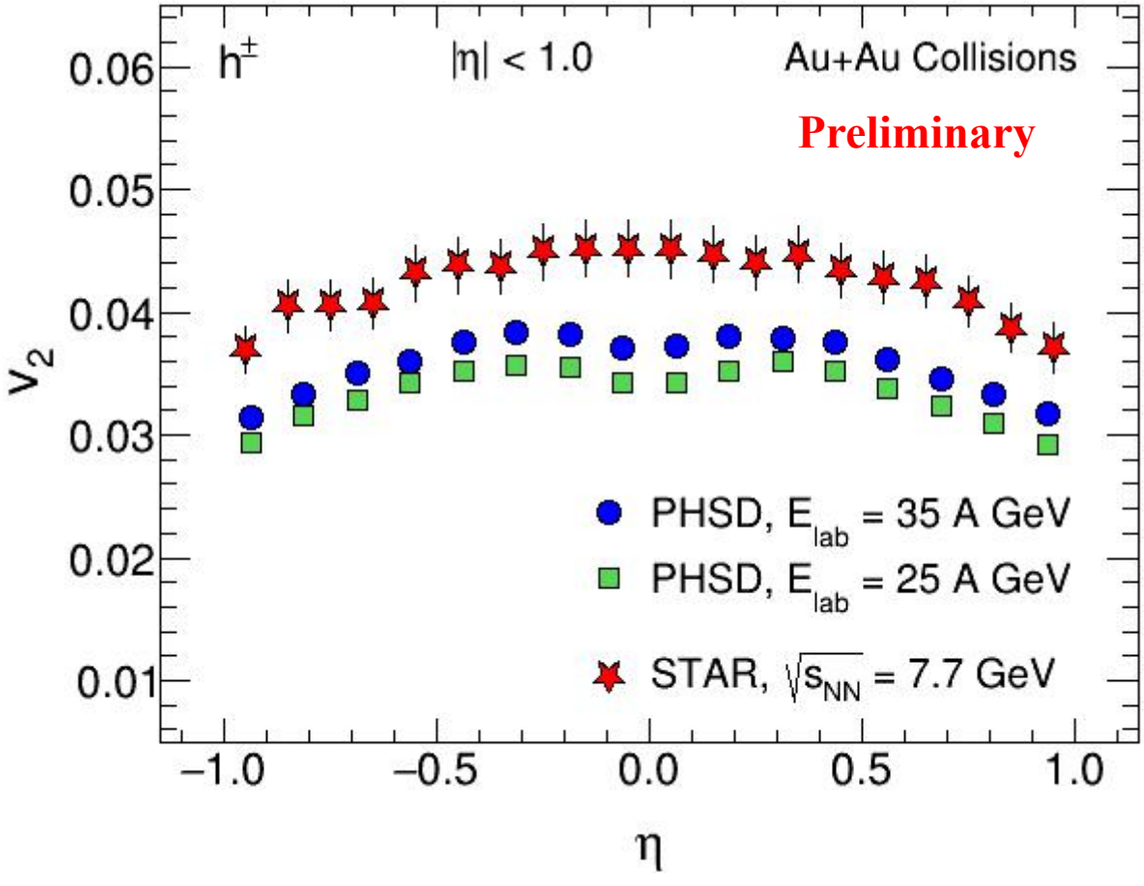
Eccentricity Scaling



- Elliptic flow $v_2(p_T)$ scaled by participant eccentricity ε_2 increases from pheripheral to central collisions indicating more collectivity in central Au+Au collisions at E_{lab} = 35 and 25 A GeV from the PHSD model
- A similar trend as in the Au+Au collisions at $\sqrt{s_{NN}}$ = 7.7 GeV from the STAR experiment.

- *L. Adamczyk et al. (STAR Collaboration), Phys. Rev. C 86, 054908 (2012)*

Pseudorapidity dependence



- Elliptic flow $v_2(\eta)$ in Au+Au collisions at E_{lab} = 35 and 25 A GeV from the PHSD model shows similar trend as in the Au+Au collisions at $\sqrt{s_{NN}}$ = 7.7 GeV from the STAR experiment.

- *L. Adamczyk et al. (STAR Collaboration), Phys. Rev. C 86, 054908 (2012)*

Summary

- Inclusive hadron elliptic flow v_2 at mid-rapidity measured using eta-sub event plane method is presented for Au+Au collisions at E_{lab} = 35 and 25 A GeV from the PHSD model.

- Elliptic flow $v_2(p_T)$ results from the PHSD model are consistent with Au+Au collisions at $\sqrt{s_{NN}}$ = 7.7 GeV from the STAR experiment.

Sensitive to initial conditions

- Integrated v_2 increases from central to pheripheral collisions showing strong centrality dependence and indicates senstivity towards the initial conditions.

Medium Collectivity

- Eccentricity-scaled v_2 increases from peripheral to central collisions indicating increase in collectivity towards most central collisions at Au+Au collisions at E_{lab} = 35 and 25 A GeV from the PHSD model.

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Thank you!

Backup

centrality selection

- Centrality Selection is based on reference multiplicity (N_{ch} in |eta| < 0.5) in the PHSD model same as in case of the experimental measurements.