



Comparison of methods for elliptic flow measurements at NICA energy range

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Outline

- Elliptic flow v_2 at NICA energies
- Description of methods for flow measurements and their sensitivity to flow fluctuations
- Performance of v_2 of identified charged hadrons in MPD
- Summary

Elliptic flow at NICA energies



v₂ is sensitive to the properties of the strongly interacting matter produced in relativistic heavy-ion collisions

Methods for v_2 measurements and their sensitivity to fluctuations σ_{v_2}

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MPD Experiment at NICA



- 20M at $\sqrt{s_{_{\rm NN}}} = 7.7 \text{ GeV}$
- 10M at $\sqrt{s_{_{\rm NN}}} = 11.5 \text{ GeV}$
- Centrality determination:
 - b based on MC-Glauber method (see Idrisov's talk)
- Event plane determination: TPC
- Track selection:
 - Primary tracks
 - $N_{\text{TPC hits}} \ge 16$
 - ▶ 0.2 < p_T < 3.0 GeV/c</p>
 - ► |η| < 1.5
 - PID based on PDG





Multi-Purpose Detector (MPD) Stage 1

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Performance of v_2 of pions and protons in MPD



Reconstructed and generated v_2 of pions and protons have a good agreement for all methods

Summary

- v₂ is sensitive to properties of the strongly interacting matter at NICA energy range
 - At $\sqrt{s_{NN}} = 4.5$ GeV, v_2 from UrQMD, SMASH are in a good agreement with the experimental data
 - ► At $\sqrt{s_{NN}} \ge 7.7$ GeV, UrQMD & SMASH underestimate v_2 need hybrid models with QGP phase, such as vHLLE+UrQMD
- Comparison of methods for v₂ measurements:
 - The differences between methods are well understood and could be attributed to nonflow and fluctuations
- Feasibility study for elliptic flow in MPD:
 - v₂ of identified charged hadrons: results from reconstructed and generated data are in a good agreement for all methods

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Backup slides

Phase Diagram of the Strongly-Interacting Matter



• Top RHIC/LHC:

- Validation of the cross-over transition leading to the sQGP
- Access to high T, small μ_B
- Beam-energy scan programs: RHIC/SPS/NICA/FAIR:
- Broad domain of the (T, μ_B) -plane
- Access to different systems, search for first-order phase transition and critical end point

Anisotropic Collective Flow at top RHIC/LHC



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- Initial eccentricity (and its attendant fluctuations) $\epsilon_{\rm n}$ drives momentum anisotropy $v_{\rm n}$ with specific viscous modulation
- v_1 directed flow, v_2 elliptic flow, v_3 triangular flow
- ν_n (p_T, centrality):
 - sensitive to the early stages of collision
 - important constraint for transport properties: EoS, η/s, ζ/s, etc.