Simulation of p-p and Xe-W collisions in EPOS4, UrQMD and PhQMD event generators: conservation laws and particle distributions.

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Proton-Proton 7 TeV collisions

- EPOS4, UrQMD and PhQMD event generators were adapted for these events.
- The most simple event we can check in experiment.
- Checking the interaction of nuclons directly (No spectator-particles etc.).

Q, B and L charges conservation



Total Energy conservation

- EPOS wide distributions. In spike only 13% events.
- UrQMD in spike 75% events.
- PhQMD in spike 98% events, have distribution shift (*), because of start conditions.





pp 7 TEv ALICE (CERN) data comparison



Too many events for UrQMD & PhQMD with Nch = 0



Xe-W 2.5 GeV beam energy collisions

- Checking PhQMD event generator.
- Need to check conservation laws in bigger events.

(B, Q, L – Ok, Energy – No)

- Pseudorapidity (and angular) producted particles distributions can be used for detectors' position optimizing.
- Working with target and beam in Lab. system.
- 2.5 GeV Xenon beam energy
- Impact parameter from 0 to approx. nucleus radius.
- Xe-W will be used for tests at NICA

Total Energy conservation

* L system where W is target and Xe is beam particle



Angular distribution of production particles (Xe-W)



Proton & Antiproton production in Xe-W



Charged pion production in Xe-W



Results

- EPOS4 showed significant violations of the conservation laws of energy, B, L and Q charges.
- For UrQMD and PhQMD, these conservation laws are implemented much better, but a worse agreement with the experimental ALICE data is observed.
- An idea of filtering generator's "bad" events that violate conservation laws is proposed. It is shown that for UrQMD and PhQMD it is useful (for p-p collisions), but for EPOS4 it significantly worsens the multiplicity distribution.
- Using examples of Xe-W collision simulations, it is shown that when generating events in PhQMD, the implementation of the energy conservation law for small systems (p-p) does not guarantee its implementation in systems with heavy ions.
- Angular distributions of reaction products for Xe-W are obtained, which can be used in the process of calibration and selection of detector positions in the MPD and SPD experiments at the NICA collider.
- Need to check ion-ion in UrQMD, Pythia ant etc.

Thank you for attention