



Contribution ID : 104

Type : Poster

## Evaluation of the Influence of the Beam Pipe on the Accuracy of Solving the Problem of Determining the Coordinates of Au-Au Interactions

Tuesday, 22 October 2024 17:05 (115)

The experimental setup for the MPD collider at NICA, currently under construction at JINR [1], is planned to study the fundamental properties of matter in heavy-ion collisions at energies up to 11 GeV/nucleon. This work focuses on the problem of determining the initial coordinates of Au-Au interactions at a system of center-of-mass energy of 7 GeV/nucleon and the impact of different beam pipe configurations on the accuracy of this determination. The approach used is based on the works [2], [3]. The UrQMD 3.4 event generator [4] was used for simulating interactions. The obtained results were then imported into a program implemented with Geant4 via the chromo interface [5]. These results were used to train a neural network model for solving the problem of determining the initial coordinates of ions. Four scenarios were considered: with beam pipe wall thicknesses of 1.2, 3, 5, and 8 mm, and materials of carbon or iron. The detection areas were located 4 meters from the interaction point and consisted of rings with a diameter of 600 mm. The accuracy of the coordinate determination was measured using the square root of the mean square error (MSE). We found that using an beam pipe with a thickness of 1 - 3 mm does not significantly affect the result and allowed us, for example, to achieve a precision for a carbon beam pipe with a thickness of 1.2 mm of  $\sqrt{\text{MSE}} \approx 3.82$  cm. Further increasing the thickness of the beam pipe decreases the accuracy of the solution. For an iron beam pipe with a thickness of 8 mm the inaccuracy increases to  $\sqrt{\text{MSE}} \approx 6.30$  cm. The work was supported by a grant from Saint Petersburg State University ID 95413904

### References

- [1] Abraamyan K. U. et al. «The MPD detector at the NICA heavy-ion collider at JINR» // Nuclear Instruments and Methods in Physics Research Section A: Accelerators, Spectrometers, Detectors and Associated Equipment, 2011, v. 628, No 1, p. 99-102.
- [2] V. S. Sandul , G. A. Feofilov F. F. Valiev. «Studying Capabilities of a Fast Monitor for Beam Collisions by Monte Carlo Simulations and Machine Learning Methods» // Phys. At. Nucl., v. 54 (2023), p. 712-716.
- [3] K.A. Galaktionov, V.A. Roudnev, F.F. Valiev. «Artificial Neural Networks Application in Estimating the Impact Parameter in Heavy Ion Collisions Using the Microchannel Plate Detector Data: Physics of Atomic Nuclei» // Phys. At. Nucl., v. 86, i. 6 (2023), p. 1426- 1432
- [4] Bleicher, M. and others. «Relativistic hadron hadron collisions in the ultrarelativistic quantum molecular dynamics model» // J.Phys. G 25 (1999), p. 1859-1896
- [5] GitHub Repository Url: <https://github.com/impj-project/chromo>

**Primary author(s)** : MONAKHOV, Vadim (SPbSU); VALIEV, Farkhat; ZHAROV, Mikhail (SPbSU)

**Presenter(s)** : ZHAROV, Mikhail (SPbSU)

**Session Classification** : Poster session

**Track Classification** : Facilities and advanced detector technologies