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Comparison of different centrality determination methods at the BM@N experiment

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The centrality determination procedure provides an estimate of the initial geometry in heavy ion collisions through a connection between the observable and the impact parameter. The multiplicity of produced charged particles and the two-parameter Glauber model is usually used to determine the centrality. However, there are difficulties in using this approach at NICA collider energies due to the large uncertainty of the impact parameter at small multiplicity, autocorrelation effect, etc. New approach to determine the centrality based on Bayes' theorem and two-dimensional Gamma distribution is proposed. This method allows to obtain information about the impact parameter by using only the measured two-dimensional energy distribution of spectator nucleons and the multiplicity of produced charged particles. A new method to account for the efficiency of the detector system and the pileup is also proposed. The performance of the proposed approach has been tested on simulation data from the DCM-QGSM-SMM model for Xe+CsI collisions at a beam energy of 3.8A GeV. The GEANT4 software package was used for a realistic response of the BM@N detector system.

Primary author(s) : IDRISOV, Dim; GUBER, Fedor (INR)

Presenter(s) : IDRISOV, Dim

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