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CALCULATING AZIMUTHAL FLOWS IN PB–PB AND XE–XE COLLISIONS WITH THE HYDJET++ MONTE CARLO GENERATOR AT THE LHC ENERGIES

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Nowadays, research in the field of extreme states of matter is actively developing, e.g. study of quark-gluon plasma. In this regard, the comprehensive application of various models that describe the phenomena occurring with matter, for example, in relativistic collisions of heavy ions at the accelerators, is also developing. New methods of studying extreme conditions are being built, and methods of working with them are being improved. One of these methods is the investigated study of nuclear collision using Monte Carlo generators.

In reality, accelerators and detector complexes serve as a platform for such research. In our work, we will focus mainly on the results obtained by the CMS [1] collaboration working at the Large Hadron Collider. Conducting research since 2010, the CMS collaboration has already published more than two hundreds scientific articles [2] on heavy ion physics. These articles discuss in detail various methods for calculating azimuthal fluxes of charged particles: the method of the true reaction plane, the second and fourth order cumulants, two-particle correlations, etc [3,4]. This work will be devoted to the study of these methods and their implementation in the Monte Carlo generator HYDJET++ [5].

HYDJET++ is a Monte Carlo model for generating relativistic collisions of heavy ions. It includes a combination of two independent components: a soft hydrodynamic part for low-energy particles and a hard part for jets and hadrons, taking into account the effect of their quenching due to energy losses in a dense matter. Initially, the azimuthal flows of charged particles in the HYDJET++ generator are calculated using the true reaction plane method [6]. In the current work, we will demonstrate the results of integrating another methods into the HYDJET++ model.

The work considers methods for calculating azimuthal flows – elliptical v2 and triangular v3 – in collisions of lead and xenon ions. The reaction plane method involves finding the angle of the reaction plane and calculating harmonics relative to this angle. The cumulant method, accordingly, implies the calculation of cumulants that take into account correlations between particles. With the help of these methods, the calculation of flows is carried out, and the results are compared with those similar in the work of the CMS collaboration [3,4].

As a result of the work, the generation of relativistic collisions of lead ions at an energy of $\sqrt{s_{NN}}$ = 5.36 TeV per nucleon pair in c.m.s. and xenon with an energy of $\sqrt{s_{NN}}$ = 5.44 TeV per nucleon pair in c.m.s. Elliptical v2 and triangular v3 flows were calculated using various methods. The methods were analyzed and the obtained results were compared with the results of the CMS experiment [3,4]. This work will allow us to adjust the generator model in the future and identify areas in which the model does not perform well enough and future developing.

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Primary author(s) : MYAGKOV, Danila (MSU Faculty of Physics); PETRUSHANKO, Sergey (M.V.Lomonosov Moscow State University, Skobeltsyn Institute of Nuclear Physics)

Presenter(s) : MYAGKOV, Danila (MSU Faculty of Physics)

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