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Strongly intense observables as a tool for studying clusters of quark-gluon strings in relativistic hadronic interactions

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The using of strongly intensive observables are considered as a way to suppress the contribution of trivial " volume"fluctuations in experimental studies of the correlation and fluctuation phenomena [1]. In this regard, we study the properties of the strongly intensive variable characterizing correlations between the number of particles produced in two observation windows separated by a rapidity interval in pp interactions at LHC energies in the model with quark-gluon strings (color flux tubes) as sources [2,3].
It is shown that in the version of model with independent identical strings this variable really depends only on the individual characteristics of a string and is independent of both the mean number of strings and its fluctuation, which reflects its strongly intensive character.
In the version of the model when the string fusion processes are taken into account, and a formation of string clusters of a few different types takes place, it was found that the observable is proved to be equal to a weighted average of its values for different string clusters, with weight factors, depending on details of the collision - its energy and centrality [4].
The analytical calculations are supplemented by the MC simulations permitting to take into account the experimental conditions of pp collisions at LHC energies. We perform the MC simulations of string distributions in the impact parameter plane and take into account the string fusion processes, leading to the formation of string clusters, using a finite lattice (a grid) in the impact parameter plane [4,5].
As a result, the dependences of this variable both on the width of the observation windows and on the value of the gap between them were calculated for several initial energies. Analyzing these dependencies we see that in pp collisions at LHC energies the string fusion effects have a significant impact on the behavior of this observable and their role is increasing with the initial energy and centrality of collisions. In particular, we found that the increase of this variable with initial energy and collision centrality takes place due to the growth of the portion of the dense string clusters in string configurations arising in pp interactions.
We show that the comparison of our model results with the preliminary experimental values of the strongly intensive variable obtained by the analysis of the ALICE data on pp collisions enables to extract information on the parameters characterizing clusters with different numbers of merged strings, in particular, to find their two-particle correlation functions and the average multiplicity of charged particles from cluster decays [5].
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