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Correction to Bjorken energy density calculations for central A-A collisions

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Abstract:

We consider a correction to the Bjorken energy density [1] calculations [2-6] where the information is usually taken from the nucleus-nucleus collisions events selected in a certain centrality class. The last one is usually defined in terms of some observable (multiplicity of particles, number of participating nucleons, transverse energy) used as a proxy to the impact parameter b . However, due to the natural dominance of peripheral collisions in any class of centrality, the relevant mean values of the impact parameter will be always shifted towards some higher values. For example, it is possible to show that in case of 0-5% centrality class of A-A collisions, the value is considerably shifted from 0 (~ 2 fm), therefore in this case the corresponding value of ST - the transverse interaction area of two overlapping colliding disks, should not be taken to be that of a circle. It appears to be smaller, thus resulting in the higher values of energy density finally calculated for a given class.

We present our estimates of the Bjorken energy density in 0-5% centrality classes events in a broad range of heavy-ion collision energies (from SPS to the LHC) using the available experimental information on mean multiplicity of charged particles and mean transverse momenta. We make the analytical approximation of the updated Bjorken energy excitation function, obtained in our study for these very central A-A collisions, and we compare it to the previously obtained ones [7,8]. We present also and discuss the relevant energy dependences of pion, kaon and proton contributions to the Bjorken energy density that are also estimated in our study.

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