Contribution ID: **248** Type: **not specified**

Bose–Einstein condensation in strong interaction processes

Tuesday 30 May 2017 17:26 (2 minutes)

A multiparticle Bose–Einstein symmetrization can enhance the emission of pions and as consequence can lead to the pion condensation in strong interactions at high energies. Onset of the Bose–Einstein condensation is driven by the critical space density of charged secondary bosons which are mostly pions. The energy dependence of space pion density at freeze-out and its critical value, calculated from estimations for volume of emission region and for total multiplicity, is investigated for both the proton-proton and the nucleus-nucleus collisions. The space-time extent of emission region is derived with help of the Bose–Einstein correlations of pion pairs produced in various collisions within the framework of the Gaussian model for particle source. It is shown that the space density of charged particles is smaller than its critical value and Bose–Einstein condensation cannot be expected for secondary pions in proton-proton collisions at energies up to about 100 TeV or even higher. A marked enhancement is observed for charged pion density in heavy ion collisions with respect to the proton-proton ones at similar collision energies. Relation between the charged particle density and its critical value allow the possibility of Bose–Einstein condensation for secondary pions in nucleus-nucleus collisions in multi-TeV energy domain. Therefore the experimental manifestations can be expected for qualitatively new effects in multiparticle production processes in energy domain of the Future Circular Collider project.

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Session Classification: Poster session