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Multiplicity, transverse momentum and pseudorapidity dependence of freeze-out parameters for open-charm hadrons in hadronic collisions at LHC energy

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Heavy quarks (charm and beauty) act as better probes in understanding the formation and evolution of the QCD medium in the ultra-relativistic heavy-ion collisions because of their heavy mass and large relaxation time compared to QGP (quark-gluon plasma) lifetime. Possible thermalization of charm quarks is observed in small systems like proton+proton (pp) collisions by studying charm-hadrons, namely D^0 and ^+_c . With this enthusiasm, we have studied the freeze-out scenarios of D^0 and ^+_c in a pp collisions at $\sqrt{s}$ =13 TeV using a pQCD-based framework called PYTHIA8. In this work, the production dynamics of open-charm hadrons are studied as a function of event multiplicity ($dN_{ch}/d\eta$), transverse momentum spectra (p_T) and pseudorapidity (η). The p_T -spectra are analyzed with thermodynamically consistent non-extensive Tsallis distribution function. The effective temperature (T) and non-extensive parameter (q) have been studied as a function of charged-particle multiplicity, transverse momentum, and pseudorapidity. We observed that T increases with $dN_{ch}/d\eta$ and decreases with η while the non-extensive parameter increases for both the cases, when we consider heavy-flavors. Further, it is observed that the behaviour of T and q with transverse momentum depends explicitly on the final state charged-particle multiplicity. Along with these two parameters T and q, a correlation between these initial state effects and final state effects is observed through the number of multi-partonic interactions (nMPI) and Knudsen number. Possible thermalization in small collision systems and applicability of hydrodynamics are explored.

Session

Heavy Ions and QCD

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