Past, present and future of open charm measurements at the CERN SPS energies

Anastasia Merzlaya
Jagiellonian University, Saint Petersburg State University

The study of heavy flavor production is a sensitive tool for new detailed investigations of the properties of hot and dense matter formed in AA collisions.

The (c¯c) pairs produced in the collisions are converted into open charm mesons and charmonia. It was suggested that color screening in the plasma would reduce and eventually prevent the binding of charm quarks and antiquarks to produce charmonia [1]. However, due to initial state effects in nucleon-nucleon reactions, the overall number of the (c¯c) pairs produced in nuclear collisions may be reduced [2].

Thus the effect of the medium on c-bridging may only be quantitatively determined by comparing the ratio of J/ψ to (c¯c) meson production to that in proton-proton reactions. In Pb+Pb collisions the onset of color screening should already be seen in the centrality dependence of the J/ψ to (c¯c) ratio.

The first pilot data for open charm measurements in Pb+Pb collisions at 150 GeV/c was conducted in 2017 and 2018. The NA49/50, NA60 and NA61/SHINE experiments measured precisely charmonium production at the top SPS energies (158 A GeV/c); via measurements of charmnucleon production [3]. The increased production of charmonium pairs was observed by NA50, which could be attributed to enhanced production of open charm. By this, an indirect estimate of open charm was provided.

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