

Charm production in the Parton-Hadron-String-Dynamics (PHSD) model *

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Heavy flavor is one of the important probes to investigate the properties of the hot dense nuclear matter created in relativistic heavy-ion collisions.

Since charm quark production requires high energy-momentum transfer, the number of produced charm quark pairs in relativistic heavy-ion collisions is proportional to the number of binary nucleon-nucleon collisions. Whether two nucleons collide or not in heavy-ion collisions is decided by the nucleon-nucleon inelastic cross section in geometrical method. From the binary collisions, we choose events which produce a charm quark pair by using Monte Carlo method, based on the cross section for charm quark-pair production. Furthermore, we employ Pythia event generator to generate the energy-momentum of charm quark pairs as shown in figure 1.

The produced charm quarks interact with partons in the quark-gluon plasma. We use the cross sections for the scattering of a heavy quark on the off-shell quarks and gluons (of the QGP) whose masses and widths are given by the Dynamical Quasi-Particle Model (DQPM) which reproduces the lattice QCD equation-of-state [1]. Once the local energy density is lower than a critical value ($\approx 0.5 \text{ GeV/fm}^3$), the charm quark is hadronized into a D meson either through fragmentation or through coalescence. The former process is favored by high- p_T charm quarks and the latter one by low- p_T charm quarks. We assume that the probability for coalescence is suppressed in Gaussian form, if the p_T of charm quark is larger than charm quark mass. Hadronized D mesons interact with other hadrons by using the scattering cross sections calculated in a chiral effective lagrangian model where the parameters are fitted to D meson and charmed baryon resonances.

Finally the nuclear modification factor, R_{AA} , is calculated as the number of D mesons produced in heavy-ion collisions divided by that in p+p collisions times the number of binary collisions in heavy-ion collisions as shown in figure 2 for different centralities.

References

- [1] H. Berrehrah, E. Bratkovskaya, W. Cassing, P. B. Gossiaux, J. Aichelin, and M. Bleicher, Phys. Rev. *C 89* (2014) 054901
 [2] T. Song, E. Bratkovskaya, H. Berrehrah, W. Cassing, in preparation

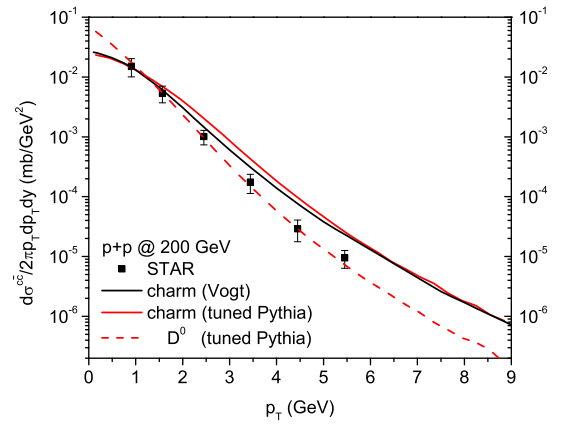


Figure 1: p_T spectra of charm quarks and D mesons from the tuned Pythia simulations compared with FONLL results by Vogt and that of D mesons from the STAR Collaboration.

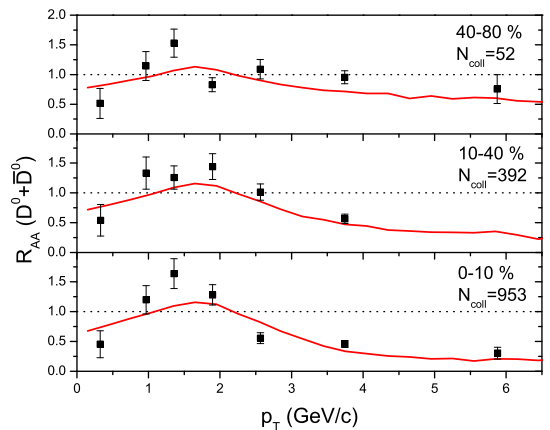


Figure 2: R_{AA} of D mesons from the PHSD simulations in comparison with the experimental data from the STAR Collaboration for Au+Au collisions at $\sqrt{s_{NN}} = 200 \text{ GeV}$.

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