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Three-dimensional source function from a hydro + cascade model

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Femtoscopic analyses have a long history towards comprehensive understanding of the space-time structure of dynamically evolving matter created in high-energy nuclear collisions. Among them, the source imaging technique enables us to extract the source function, namely distribution of the relative distance between two emission points for observed particles, directly from two particle correlation functions. Since the source function looks no longer a Gaussian in general, it contains richer information about the space-time distribution of emission source than HBT radii and is an ideal quantity to compare experimental data with theoretical results. In this study, we discuss one- and three-dimensional source functions for pions and kaons from a hydro + hadronic cascade hybrid model simulations [1]. Our model consists of event-by-event Glauber-type initial conditions, (3+1)-dimensional ideal hydrodynamics for the quark gluon plasma and a hadronic cascade for the hadron resonance gas. We first confirm the p_T spectra for pions and kaons are reproduced well. We next calculate one-dimensional source function of pions and kaons in Au + Au collisions at the top RHIC energy and find that hadronic rescatterings play a significant role to describe non-Gaussian tail which was observed by the PHENIX Collaboration. We also analyze three-dimensional source functions at the RHIC energy, where a special attention is paid to obtain the source function by decomposing them into coefficients of Cartesian spherical harmonics as the PHENIX Collaboration employed the same technique. Finally we also predict the source functions of pions and kaons from hybrid model simulations of Pb+Pb collisions at the LHC energy and compare them with the ones at the RHIC energy.

[1] T.Hirano et al., Prog. Part. Nucl. Phys. 70, 108 (2013).

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