Study of high p_T pion emission in central Au+Au collisions at CBM

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The suppression of particle emission at high transverse momenta p_T in central heavy ion collisions is interpreted as a sign of parton energy loss in strongly interacting matter at RHIC and top SPS energies [1, 2]. Therefore it seems to be worthwhile to study high p_T pions at the energy domain of SIS100/300 [3]. Fig. 1 displays the transverse momentum
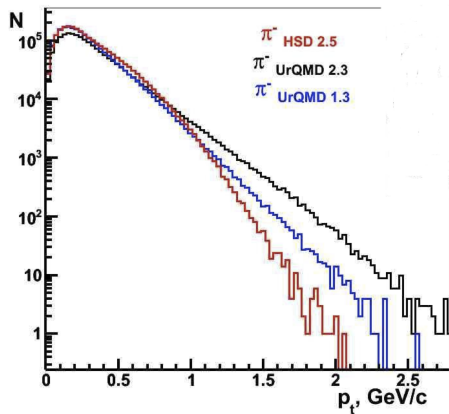

Figure 1: Negatively charged pions transverse momentum spectra from Au+Au central collisions at 10 A·GeV for UrQMD 2.3 (black), UrQMD 1.3 (blue) and HSD 2.5 (red)

spectra of negatively charged pions from central $Au + Au$ collisions at 10 A·GeV for UrQMD 2.3, UrQMD 1.3 [4] and HSD 2.5 [5] generators given by the black, blue and red lines, respectively. One can observe significantly different behavior of the pion spectra at $p_T > 1 \ GeV/c$ for different models [4, 5].

The simulation has been performed for 10000 $Au + Au$ UrQMD 2.3 central events at 10 A·GeV using the standard STS geometry and the magnetic field map for the electron version of CBM, release JUN10. The pions have been selected using $m^2 - p$ correlation, where momentum and time-of-flight were reconstructed from STS and RPCs information, respectively. This method unavoidably leads to the contamination of misidentified kaons and protons, especially at high momenta [3]. To improve the purity of the particle identification procedure the $m^2 - p$ plot was divided into several momentum slices. In each slice the contamination of pions, kaons and protons were estimated by a multi-Gaussian fit of the m^2 - axis projection (see Fig. 2). The graphical cut was modified in the way that the pion border next to kaon was shifted to the left getting equivalent numbers of pions and kaons in a certain bin. This procedure improves the purity for the π^+ identification.

The π^-/π^+ ratio for $Au + Au$ collisions at 10 AGeV as a function of transverse momentum p_T for symmetrical [3]

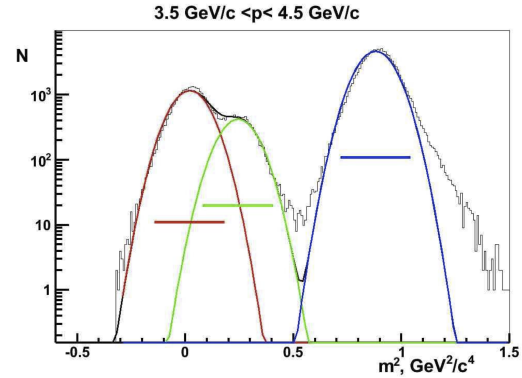Figure 2: Result of the minimization procedure for reconstructed momentum slice for three Gaussian function. The horizontal lines show the 2σ intervals (95% events).
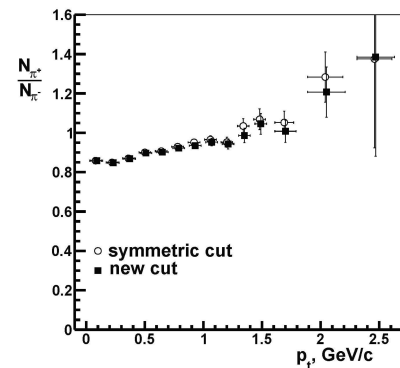

Figure 3: The π^-/π^+ ratio for $Au + Au$ collisions at 10 AGeV as a function of p_T for different graphical cuts

and new graphycal cuts is shown in Fig. 3 by the open and closed symbols, respectively. The ratio at large p_T obtained with the new cut is closer to the expected value of ~ 0.8 [4, 5]. However, additional criteria (for instance, the use of RICH information) is required to improve the purity of the π^+ identification.

References

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