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New results on event-by-event ratio fluctuations in PbPb collisions at CERN SPS energies

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Event-by-event fluctuations of hadron ratios characterize the hadro-chemical composition of the hot and dense medium created in heavy-ion collisions. This makes the fluctuation signal sensitive to changes in the underlying structure of matter, and phase transition effects in particular. In the SPS energy range, inclusive hadronic observables indicate the onset of the deconfinement phase transition [1], making ratio fluctuations a promising observable to further characterize the transition and possibly reveal signatures of the conjectured critical point as suggested by lattice calculations of quark number susceptibilities at finite mu_B [2]. Kaons and protons carry large parts of the conserved quantities strangeness and baryon number. Their correlation, reflected in the kaon-to-proton ratio fluctuations, is expected to undergo a significant change at the anticipated parton-hadron phase boundary [3].
Results on (K+ + K–)/(p + pbar) and K+/p fluctuations in heavy-ion collisions will be presented for the first time. At 5 energies between sqrt(s_NN) = 6.3 and 17.3 GeV, sigma_dyn has been evaluated in central Pb+Pb collisions. For both ratios, a fast transition from positive sigma_dyn at low SPS energies to negative values at the higher energies is observed, an energy dependence that is not reproduced by hadronic models. While hadronic transport models predict almost constant fluctuations in the SPS energy range, a multiplicity scaling as suggested in [4] is also incompatible with the data. This study is complemented by new results on the centrality dependence of ratio fluctuations at sqrt(s_NN) = 17.3 GeV, which confirm the systematics recently reported at RHIC energies [5].

References

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