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System size dependence of light-flavor hadron production: from the smallest to the largest collision system at the LHC with ALICE

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Recent measurements in pp and p-Pb collisions at the LHC showed that the production of light-flavour hadrons relative to pions increases with the charged particle multiplicity of the event already in small systems. This smooth evolution connects different collision systems almost independently of the collision energy. This extends to the strangeness sector, where the enhanced production of strange hadrons in high-multiplicity pp events is reminiscent of heavy-ion phenomenology in the case of quark-gluon plasma formation. With the wealth of data collected in Run 2 and Run 3 with the ALICE experiment, it is possible to bridge the gap in multiplicity between small and large systems, exploring for the first time the systems size dependence of light-flavour particle production at the same multiplicity values for pp and AA. This contribution presents new results on the production of light flavour hadrons in pp collisions up to a centre-of-mass energy of 13.6 TeV and in Pb-Pb collisions up to an energy of 5.36 TeV. A dedicated high multiplicity trigger is used in pp collisions to reach values up to those of peripheral Pb–Pb collisions. The light flavour particle production is also investigated versus multiplicity and as a function of the event shape, with the transverse spherocity and flattenicity estimators. Moreover, for the first time at the LHC, the system size dependence is explored down to values smaller than in pp collisions using ultra-peripheral γ–Pb reactions. The system size dependence in light-flavour production is probed from the smallest system (γ–Pb) to the largest one (Pb–Pb) at the LHC, enabling testing the statistical hadronization picture at its limits. This contribution will present new light-flavour hadron measurements covering three orders of magnitude in multiplicity. These results are discussed within the context of state-of-the-art QCD and statistical hadronization models.

Secondary track

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