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## Pre-hydrodynamical effects in large and small systems

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The pre-hydrodynamic evolution of a heavy-ion collision can have a considerable effect on final state observables, notably those related to the transverse momentum spectra of final particles [1]. In this work, we study two different collision systems, namely Pb-Pb and p-Pb, utilising a state-of-the-art hybrid model. We extend our previous results [1] on the effects of pre-hydrodynamical models on final state observables to small systems. We show that the artificial bulk pressure generated at the switch to hydrodynamics by the assumption of scaling invariance during the pre-hydrodynamical evolution is enhanced for smaller systems sizes. We also show that its magnitude is dependent on the duration of the pre-hydrodynamical phase, growing with longer evolution times. These results further reinforce the need for non-conformal pre-hydrodynamical models, particularly in light of concerns about the validity of hydrodynamics at early times and the resulting need for accurate pre-hydrodynamic evolution, and the growing interest in small systems. Finally, we investigate whether a free-streaming pre-hydrodynamical evolution with a velocity smaller than  $c$  [2], thus effectively breaking the assumption of scale invariance, can alleviate the effects of this artefact when performing the extraction of transport coefficients and initial state parameters from hybrid simulations.

[1] Tiago Nunes da Silva, David Chinellato, Mauricio Hippert, Willian Serenone, Jun Takahashi, Gabriel S. Denicol, Matthew Luzum, Jorge Noronha, *Phys. Rev. C* 103, 054906 (2021)

[2] Govert Nijs, Wilke van der Schee, Umut Gürsoy, Raimond Snellings, *Phys. Rev. C* 103, 054909 (2021)

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