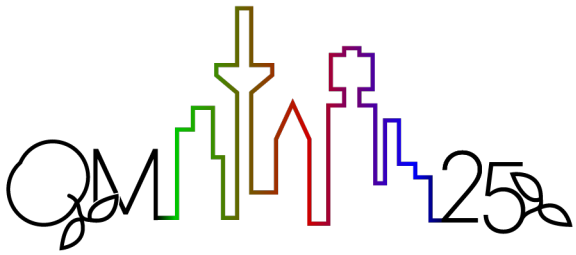

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# Neural network enhanced Bayesian analysis of heavy-ion observables using EbyE-EKRT model with dynamical freeze-out

Bayesian statistical analysis is nowadays a well-established method for performing global fits of QCD matter properties and initial conditions to experimental data from ultrarelativistic heavy ion collisions. However, even when surrogate models such as Gaussian process emulators are used to reduce the number of simulations, the computational costs can still remain prohibitively large for producing sufficient training data for observables, such as rare flow correlators, which require a very large sample of events. These costs can be reduced by orders of magnitude by using neural networks to predict simulated event-by-event observables, whose event averages are then used in the training of the Gaussian process emulators. Here, we present results [1] of a Bayesian global analysis of four collision systems using EbyE-EKRT initial conditions and (2+1)D viscous fluid dynamical model with dynamical freeze-out [2]. The investigated systems are 200 GeV Au+Au collisions at RHIC and 2.76 TeV Pb+Pb, 5.02 TeV Pb+Pb, and 5.44 TeV Xe+Xe collisions at the LHC. The statistical analysis is enhanced with deep convolutional neural networks, which are trained to predict the model output event-by-event for a given initial state profile [3], QCD matter properties and freeze-out conditions [4]. This combination of neural networks and Gaussian process emulators allows us to account for the statistics-expensive flow observables that provide further constraints for the temperature dependencies of shear and bulk viscosity, and for Knudsen number and system size -based freeze-out conditions.

References:

[1] J. Auvinen, K. J. Eskola, H. Hirvonen and H. Niemi, work in progress
[2] H. Hirvonen, K. J. Eskola and H. Niemi, Phys. Rev. C 106, 044913 (2022).
[3] H. Hirvonen, K. J. Eskola and H. Niemi, Phys. Rev. C 108, 034905 (2023).
[4] H. Hirvonen, K. J. Eskola and H. Niemi, EPJ Web Conf. 296, 02002 (2024).

## Category

Theory

## Collaboration (if applicable)

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