Parameter extractions for RHIC BES using Bayesian statistics

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We present the latest results on the collision energy dependence of eta/s, obtained from a Bayesian model-to-data analysis of UrQMD + viscous hydrodynamics hybrid model [1] to RHIC beam energy scan data for Au+Au collisions at 19.6, 39 and 62.4 GeV. A change in eta/s over beam energy scan range would suggest that, in addition to temperature, eta/s depends also on baryon chemical potential mu_B.

Analyzing the dependence of the multiple interconnected parameters of the model on a large set of experimental data necessitates a novel Bayesian statistics approach, including Markov chain Monte Carlo methods and model emulation using Gaussian processes. The end result is a multidimensional conditional probability distribution, where the peak position indicates the most likely combination for the model parameters given the experimental data, and the width of the distribution provides a measure of uncertainty on the choice of the best-fit parameter values.

This approach has been successfully utilized in constraining the temperature dependence of eta/s in Pb+Pb collisions at the LHC [2], and some tentative results, albeit with large uncertainties, have already been obtained also for the mu_B dependence of eta/s in the RHIC beam energy scan [3-5]. For this latest analysis, we have revised the uncertainty estimations in the likelihood calculations, which has led to stronger constraints on the model parameters.

[1] Iu. Karpenko et al., PRC 91 6, 064901 (2015).
[2] Bernhard et al., PRC 94 2, 024907 (2016).
[3] Bass et al., CPOD 2016 proceedings, arXiv:1610.00590.
[4] Auvinen et al., SQM 2016 proceedings, J.Phys.Conf.Ser. 779, 012045 (2017).
[5] Auvinen et al., QM 2017 proceedings, arXiv:1704.04643.

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