Contribution ID: **135** Type: **Oral presentation**

A QGP Trigger for the CBM Experiment based on Artificial Neural Networks

Tuesday 23 April 2024 14:30 (20 minutes)

The field of heavy-ion experiments, such as the future Compressed Baryonic Matter (CBM) experiment at FAIR, necessitates algorithms that are high in performance and efficient in real-time data analysis. The increasing integration of machine learning techniques, particularly artificial neural networks, into physics experiments marks a significant advancement in this domain. The report introduces the application of a specialized neural network package, ANN4FLES, which has been optimized for high-performance computing clusters. The primary focus of this study is the utilization of ANN4FLES in the CBM experiment for the detection and classification of events indicative of Quark-Gluon Plasma (QGP) production.

Our research presents an advanced approach using ANN for developing a QGP trigger within the First Level Event Selection (FLES) package, integral to the CBM experiment. The investigation involves the use of both fully-connected and convolutional neural networks. These networks are trained and tested on simulated data of Au+Au collisions at 31.2A GeV, generated using the Parton-Hadron-String Dynamics (PHSD) off-shell transport model. Our research demonstrate that the convolutional neural network model notably surpasses the performance of fully-connected networks, achieving an impressive accuracy rate of over 95% on the testing dataset.

This report delves into the nuances of the neural network's superior selection efficiency, exploring the intricate physics that underlie this high rate of accuracy in identifying events featuring QGP. Additionally, we discuss various essential characteristics of neural networks, particularly in the context of their application to the selection process in heavy ion collisions where quark-gluon plasma production is a significant factor.

Minioral

Yes

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Session Classification: Oral presentations

Track Classification: AI, Machine Learning, Real Time Simulation, Intelligent Signal Processing