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Concept of measuring (Multi-)Strange Hadron Yields in the CBM Experiment using Machine Learning Techniques

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The Compressed Baryonic Matter (CBM) experiment at FAIR will investigate the QCD phase diagram at high net-baryon density (μB > 500 MeV) with heavy-ion collisions in the energy range of √sNN = 2.7−4.9 GeV. Precise determination of dense baryonic matter properties requires multi-differential measurements of strange hadron yields, both for the most copiously produced K0s and Λ as well as for rare (multi-)strange hyperons and their antiparticles.

The strange hadrons are reconstructed via their weak decay topology using PFSimple, a Kalman Filter Mathematics-based package that has been developed for the reconstruction of particles via their weak decay topology. The large combinatorial background needs to be removed by applying certain selection criteria to the topological features.

In this poster, selection criteria optimization for strange hadrons using the boosted decision tree-based library XGBoost will be discussed and the performance of this non-linear multi-parameter selection method is evaluated. To gain insights into the importance of the different features, the trained model is analyzed by looking at the SHAP values, which give an overview of the impact of a given feature value on the prediction and can help to improve the accuracy of the model. As the CBM experiment is under construction and therefore no real data is available yet, signal and background data for the machine learning model are both taken from simulated data of two different event generators: DCM-QGSM-SMM generates the signal candidates and UrQMD data is treated as real data.

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