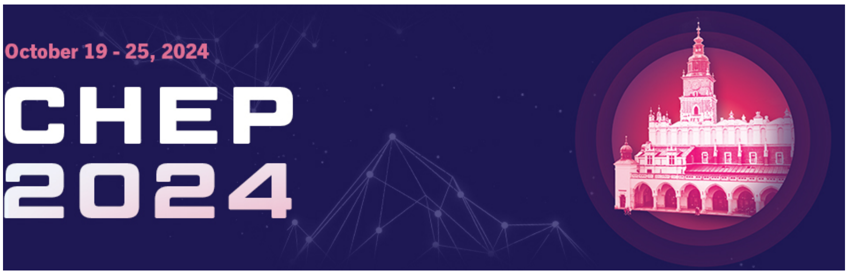

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ML-based classification of photons and neutral mesons for direct photon measurement in ALICE

Tuesday 22 October 2024 14:24 (18 minutes)

Direct photons are unique probes to study and characterize the quark-gluon plasma (QGP) as they leave the collision medium mostly unscathed. Measurements at top Large Hadron Collider (LHC) energies at low pT reveal a very small thermal photon signal accompanied by considerable systematic uncertainties. Reduction of such uncertainties, which arise from the π⁰ and η measurements, as well as the photon identification, is crucial for the comparison of the results with the theoretical calculations that are available.

To address these challenges, a novel approach employing machine learning (ML) techniques has been implemented for the classification of photons and neutral mesons. An open-source set of frameworks comprising hipe4ml, scikit-learn, and ONNX packages is chosen for training, validation,and testing the model on a part of Run2 Pb–Pb data at √s_{NN} = 5.02 TeV collision energy.

In this talk, the performance of the novel approach in comparison to the standard cut-based analysis is presented. Initial findings employing gradient-boosted decision trees demonstrate a substantial enhancement in photon purity while preserving efficiency levels comparable to those of the standard cut-based method. Strategies for addressing highly imbalanced data sets, including techniques like feature reduction during training and the implementation of scaled penalty factors to enhance discrimination between signal and background are also addressed. Finally, the feasibility of incorporating such ML methods into the main workflow of direct photon analysis is also presented.

Primary author: NATH, Abhishek (Heidelberg University (DE))

Presenter: NATH, Abhishek (Heidelberg University (DE))

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