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Jet momentum reconstruction in the QGP background with machine learning

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We apply a Dense Neural Network (DNN) approach to reconstruct jet momentum within a quark-gluon plasma (QGP) background, using simulated data from PYTHIA and Linear Boltzmann Transport (LBT) Models for comparative analysis. We find that medium response particles from the LBT simulation, scattered out of the QGP background but belonging to medium-modified jets, can inevitably lead to oversubtraction of the background if the DNN model is trained on vacuum jets from PYTHIA simulation. By training the DNN model on quenched jets generated using the LBT model, we significantly reduce this prediction bias and achieve more accurate background subtraction compared to conventional Area-based and Constituent Subtraction methods widely adopted in experimental measurements. Additionally, we develop a matching procedure to pair reconstructed jets inside a background to their counterparts reconstructed without the background, further improving the reliability of ML models in background subtraction, and therefore enabling an accurate capture of the jet quenching effect and a precise estimation of the nuclear modification factor of jets in high-energy nuclear collisions.

[1] Ran Li, Yi-Lun Du, Shanshan Cao, arXiv:2412.06466

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