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Jet Tagging Algorithm for Long-Lived Particles at the CMS Level-1 Trigger

Monday 10 July 2023 19:00 (2 hours)

This poster presents an exploration into the realm of Beyond the Standard Model (BSM) Long-Lived Particles (LLPs) with a focus on the integration and development of a jet-tagging algorithm for the Compact Muon Solenoid (CMS) experiment's Level 1 (L1) Trigger system, in the context of the forthcoming upgrade to the High Luminosity Large Hadron Collider (HL-LHC). In spite of the challenges posed by traditional particle collision data analyses at the LHC, involving variable thresholds such as pT, HT, and displaced vertices, which have proven insufficiently sensitive to LLP signatures, we propose a pathway beyond these limitations. The conventional L1 triggers, currently designed to select tracks from events decaying near the collision vertex, face difficulties arising from pileup interactions, hence impeding discovery of novel BSM signals. The solution we present involves a Deep-Neural Network (DNN) based jet-tagging algorithm specifically designed to amplify the tagging efficiency of LLP signatures and considerably attenuate pileup effects. As we progress into an era characterized by increased collision rates and voluminous data due to the HL-LHC upgrade, the need for faster and more efficient real-time event selection algorithms becomes imperative. Drawing lessons from prior studies on b-tagging and tau-tagging neural networks, we endeavor to optimize this jet-tagging algorithm using tools such as the hls4ml Python library. Our work also includes application of optimization techniques to fulfill stringent timing requisites and the validation of the jet-tagging algorithm's performance using simulated collision data.

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