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Quark-Gluon Constituent-Based Jet Taggers for the HL-LHC

Jet constituents provide a more detailed description of the radiation pattern within a jet compared to observables summarizing global jet properties. In Run 2 analyses at the LHC using the ATLAS detector, transformer-based taggers leveraging low-level variables outperformed traditional approaches based on high-level variables and conventional neural networks in distinguishing quark- and gluon-initiated jets. With the upcoming High-Luminosity LHC (HL-LHC) era, characterized by higher luminosity and increased center-of-mass energy, the ATLAS detector has undergone significant upgrades. These include a new inner detector with extended coverage into the most forward region, previously inaccessible to tracking, as well as the addition of the High Granularity Timing Detector (HGTD) to mitigate the effects of pile-up. This study assesses how these advancements enhance jet tagger accuracy and robustness. These improvements are crucial for processes such as vector boson fusion, vector boson scattering, and supersymmetry, where precise jet identification in the most forward region enhances background discrimination.

Secondary track

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