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B-hadron identification in b-jets using novel deep learning technique in pp and PbPb collisions in CMS

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Advancements in geometric deep learning offer powerful tools to study the internal structure of jets initiated by heavy quarks, particularly in the context of dead-cone effect and jet quenching. The kinematics of b-hadron decays present a challenge for substructure measurements with inclusive b-jets, which are essential for quantum chromodynamics (QCD) studies. We propose an approach using graph-based deep learning that utilises charged decay products of the jets represented as point clouds to simultaneously identify tracks associated with b-hadron decay and perform b-jet tagging. The method is demonstrated in simulated p-p and Pb-Pb collisions passed through the CMS detector framework, in Run 2 conditions. We benchmark our method against traditional boosted decision tree classifiers, showcasing significant performance improvements in b-hadron identification of tracks.

Reference: CMS Collaboration, "A novel track finding algorithm to identify b hadron in b jets using FusionNet: a geometric deep learning model", CMS-DP-2025/035

Auteurs: GHOSH, Shamik ({CNRS}UMR7638); NGUYEN, Matthew

Orateur: GHOSH, Shamik ({CNRS}UMR7638)

Classification de Session: Graph and Geometric Deep Learning for Event and Particle Analysis

Classification de thématique: Object detection and reconstruction