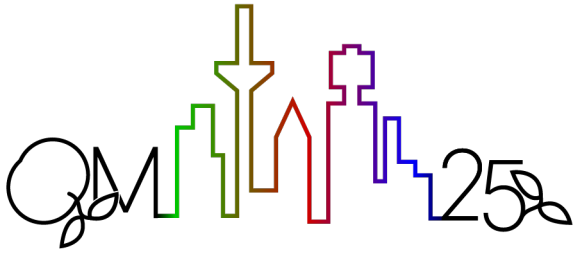

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Improving Charge Ratio's Sensitivity to Hadronization via Jet Substructure

Unravelling the hadronization mechanism in Quantum Chromodynamics (QCD) remains challenging due to its non-perturbative nature, often modelled in Monte Carlo event generators (such as PYTHIA and HERWIG) with parameters tuned to experimental data. While jets were originally proposed to circumvent non-perturbative effects and probe QCD at perturbative scales, we show that their substructure can be a powerful tool to investigate hadronization. In this study, we employ the charge correlation ratio, which evaluates the probability of jet production with same-sign or opposite-sign leading charged particles charges, already shown to be sensitive to hadronization effects. We find that this sensitivity can be enhanced by selections on jet substructure, particularly by analysing the relative placement of splittings that resolve the leading charged particles within the clustering tree. Our findings reveal remarkable differences between widely used hadronization models (Lund string and cluster fragmentation), contributing to a better understanding of the hadronization process and opening new avenues for exploring non-perturbative QCD.

Category

Theory

Collaboration (if applicable)

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