

Dissecting groomed soft radiation with factorization at the LHC

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Effects of hadronization and underlying event on jet substructure observables must be accurately quantified for precision QCD measurements such as the strong coupling constant and the top quark mass. While these effects have long been studied for ungroomed observables such as the jet mass and jet p_T , they are significantly more complicated in groomed observables. In this work we employ a model-independent, field theory-based formalism to systematically quantify hadronization corrections in terms of universal, flavor dependent $O(\Lambda_{\text{QCD}})$ constants and moments of groomed jet radius R_g . We further extend this framework to describe the impact of the underlying event (UE) by precisely computing the dynamical groomed catchment area as a function of groomed jet mass. We compute these moments of R_g using the soft drop double differential cross section at NLL + $O(\alpha_s)$ accuracy by consistently matching across 2×3 factorization regimes. We test our predictions and fit for hadronization and UE phenomenological parameters by performing detailed comparison with various event generators for quark and gluon initiated jets.

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