Three-loop jet function for boosted heavy quarks

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Previous studies have shown that certain observables at massless e^+e^- colliders producing primary top quarks can be used to measure the top quark mass with an uncertainty smaller than Λ_{QCD}. The maximal sensitivity to the top mass is attained in the peak of the distribution, where Effective Field Theories (EFTs) enable the factorization of the differential cross section across different physical scales. The jet function —previously known at two loops—appears as a common ingredient in many factorization theorems, motivating the computation of this matrix element at higher perturbative orders.

In this talk, we will review the basic EFT concepts and the factorization theorem necessary to introduce the jet function. We will outline the workflow of a fixed-order calculation and present our analytic result for the three-loop jet function for boosted heavy quarks. Our result can be used to improve the calibration of the top quark mass parameter in parton-shower Monte Carlo generators and enhances the perturbative accuracy of the jet invariant mass distribution for reconstructed top quarks.

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