

How the parton shower cutoff affects the heavy quark mass parameter

Monday, 16 July 2018 17:25 (25 minutes)

We show that using an infrared cutoff in the parton shower evolution for massive quarks implies that one employs a short-distance mass scheme, i.e. a mass scheme that does not have the $O(\Lambda_{\text{QCD}})$ renormalon contained in the pole mass. Our analysis considers an angular ordered shower based on coherent branching and is based on jet masses. In this context we determine explicitly the relation of this short-distance mass to the pole mass. The basis of our analysis is (a) an analytic solution of the parton shower evolution and (b) that the infrared cut of the angular ordered shower can be implemented into analytic calculations in the framework of SCET. Numerical comparison to the Herwig event generator confirms our analytic results. The outcome of our analysis proves that the top quark mass parameter contained in multi-purpose event generators is in general not the pole mass.

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Session Classification: Calculations