

Mixed NNLO QCD-electroweak radiative corrections to the Higgs-boson decay $H \rightarrow b\bar{b}$

Abstract:

We present numerical calculations of parts of the mixed QCD-electroweak corrections of $\mathcal{O}(\alpha\alpha_s)$ to the partial decay width of the Standard Model Higgs boson into a pair of bottom quarks. In particular, we calculate the corrections associated with weak one-loop graphs and a real radiated gluon with the full bottom mass dependence. Occurring infrared divergences are regulated by means of the dipole subtraction formalism for massive partons. In addition we calculate those parts of the $\mathcal{O}(\alpha\alpha_s)$ corrections that involve four-fermion final states. They arise from interference terms of electroweak and gluonic tree-level diagrams of the process $H \rightarrow 4b$.

We find residual logarithmic singularities in the subtracted NNLO contributions with one real-emission gluon, normalised on the leading-order decay width. These arise from bottom mass effects, which lead to a non-standard factorisation behaviour of the infrared singularities from the leading order matrix element. In diagrams with indirect Hbb -coupling these contributions are not mass-suppressed which leads to mass singularities in the final results for the subtracted relative real/virtual $\mathcal{O}(\alpha\alpha_s)$ corrections.