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Parametrization of perturbative QCD in hadronic tau decays

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The determination of the strong coupling, α_s, from the theoretical description of inclusive hadronic tau decays in Quantum Chromodynamics (QCD), is one of the most precise extractions from experimental data. The theoretical description is dominated by perturbation theory but receives non-perturbative contributions from the Operator Product Expansion and duality violations, which cannot be neglected. The standard approach is to build sum rules where the QCD contribution is evaluated as closed-contour integrals in the complex plane. However, this method introduces complications related to the renormalization scale, notably in the perturbative series. Therefore, with its inherent complexity, the state-of-the-art five-loop QCD description is non-trivial. Although these complications are unavoidable in a realistic, high-precision analysis, it would be desirable to have a much simpler but reliable parametrization of the QCD result, including all correlations, to provide a simple interface with precision Electroweak Fits and Monte Carlo simulations for future accelerators, such as the FCC-ee. Furthermore, this parametrization could be applied in various fits where constraints from hadronic tau decays are of significant interest. In this work, we perform a parametrization for the perturbative QCD part, aiming to simplify the integration of theoretical predictions and check if this new version maintains the precision required.

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