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Results for α_s from the decoupling strategy

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We present analysis details and new results for the strong coupling $\alpha_s(m_Z)$, determined by the decoupling strategy detailed in the previous talk. Starting from a line of constant physics (LCP) from previous ALPHA Collaboration work, we simulate $N_f = 3$ massless quarks to measure a set of renormalization and improvement constants which allow us to determine the simulation parameters for the LCP at non-zero mass. Then massive simulations were performed at different z=LM and L/a in order to measure the gradient flow couplings and extrapolate them to the continuum. The massive couplings are matched to effective couplings in pure gauge. Using the running in the pure gauge theory and the perturbative relation of the Lambda parameters, the Lambda parameter of the three flavor theory is obtained by an extrapolation to infinite M. Our final result is compatible both with the FLAG average and with the previous ALPHA result, albeit with a slightly smaller, yet still statistics dominated, error. This constitutes a highly non-trivial check, as the decoupling strategy is conceptually very different from the 3-flavor QCD step-scaling method, and so are most of its systematic errors. These include the uncertainties of the decoupling and continuum limits, which we discuss in some detail. Furthermore, by relying on decoupling once again, we could estimate the small O(a) and O(1/M) contaminations to the massive GF coupling stemming from the SF boundaries by means of pure gauge simulations.

Primary authors: DALLABRIDA, Mattia (CERN); HÖLLWIESER, Roman (University of Wuppertal); KORZEC, Tomasz (University of Wuppertal); KNECHTLI, Francesco (University of Wuppertal); RAMOS MARTINEZ, Alberto (Univ. of Valencia and CSIC (ES)); SINT, Stefan (Trinity College Dublin); SOMMER, Rainer (DESY)

Presenter: HÖLLWIESER, Roman (University of Wuppertal)

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