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Thrust distribution at N^3LL with power corrections and precision determination of alpha_s

A traditional method for determining the strong coupling constant (QCD) with high precision is the analysis of jet cross sections at e+ e- colliders. Event-shape distributions play a special role as they have been extensively measured with small experimental uncertainties and are theoretically clean and accessible to high-order perturbative computations. The strong coupling constant alpha_s plays a crucial role in all leptonic (LEP) and hadronic (LHC) collider experiments. Many interesting quantities also depend on its value (quark masses, mixing angles, new-physics searches…). The current world average is largely dominated by the lattice uncertainties. Our determination has similar precision as the lattice one (~1%) although the central value is much lower. Our value has been recently confirmed by DIS analyses. We give a factorization formula for the thrust distribution based on soft-collinear effective theory. The result is applicable for all tau, i.e. in the peak region, in the tail region, and in the far-tail region. The formula includes O(\alpha_s^3) fixed-order QCD results, resummation of singular partonic \alpha_s^j ln^k(\tau)/tau terms with N3LL accuracy, hadronization effects from fitting a universal nonperturbative soft function defined in factorization, bottom mass effects, QED corrections, and the dominant top-mass dependent terms from the axial-anomaly. We do not rely on a Monte Carlo generator to determine nonperturbative effects, since hadronization corrections obtained from MCs are not compatible with perturbative higher order analyses. Instead our treatment of hadronization corrections is based on fitting nonperturbative matrix elements in field theory, which are moments of the nonperturbative soft function. Our result is alpha_s(mZ)=0.1135 \pm (0.0002)_expt \pm (0.0005)_hadr \pm (0.0009)_pert, with chi2/dof=0.91.

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