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Extending Precision Perturbative QCD with Track Functions (remote)

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Track functions describe the collective effect of the fragmentation of quarks and gluons into charged hadrons, making them a key ingredient for jet substructure measurements at hadron colliders, where track-based measurements offer superior angular resolution. Measurements of higher-point correlations of energy flow necessitate a characterization of fluctuations in the hadronization process, described theoretically by higher moments of track functions. We have analytically derived the NLO renormalization group evolution equations for track function moments up to the six moment, which allow for the study of up to six-point correlations in energy flow using tracks at order-α_s^2 level. Energy conservation gives rise to a shift symmetry that fixes the form of the evolution equations for track function moments at all-loop orders and allows the equations to be written in terms of cumulants or central moments. We find that the evolution for the first three cumulants is approximately DGLAP, while for the fourth moment and beyond, non-linearities in the evolution result in genuinely new behavior beyond DGLAP; and we studied the RG flows of the fourth and the fifth cumulants in pure Yang-Mills theory. Finally, we have initiated a study of track function evolution in momentum-fraction space, and have derived the full NLO evolution equation in $\mathcal{N} = 4$ SYM and preliminary results in QCD, paving the way for precision jet substructure at LHC.

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