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Disentangling Long and Short Distances in Momentum-Space TMDs

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The extraction of nonperturbative TMD physics is made challenging by prescriptions that shield the Landau pole, which entangle long- and short-distance contributions in momentum space. The use of different prescriptions then makes the comparison of fit results for underlying nonperturbative contributions meaningless on their own. We propose a model-independent method to restrict momentum-space observables to the perturbative domain. This method is based on a set of integral functionals that act linearly on terms in the conventional position-space operator product expansion (OPE). Artifacts from the truncation of the integral can be systematically pushed to higher powers in $\Lambda_{\mathrm{QCD}}/k_T$. We demonstrate that this method can be used to compute the cumulative integral of TMDPDFs over k_T in terms of collinear PDFs, accounting for both radiative corrections and evolution effects. This gives a systematic way of correcting the naive picture where the TMDPDF integrates to a collinear PDF, and we find that for the unpolarized distribution the corrections are a percent-level effect. We also show that, when supplemented with experimental data and improved perturbative inputs, these functionals will enable model-independent limits to be put on the nonperturbative OPE contributions in the Collins-Soper kernel and intrinsic TMD distributions.

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