

# Renormalization of non-singlet quark operator matrix elements for off-forward hard scattering

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We calculate non-singlet quark operator matrix elements of deep-inelastic scattering in the chiral limit including operators with total derivatives. This extends previous calculations with zero-momentum transfer through the operator vertex which provides the well-known anomalous dimensions for the evolution of parton distributions, as well as calculations in off-forward kinematics utilizing conformal symmetry. Non-vanishing momentum-flow through the operator vertex leads to mixing with total derivative operators under renormalization. In the limit of a large number of quark flavors  $n_f$  and for low moments in full QCD, we determine the anomalous dimension matrix to fifth order in the perturbative expansion in the strong coupling  $\alpha_s$  in the  $\overline{\text{MS}}$ -scheme. We exploit consistency relations for the anomalous dimension matrix which follow from the renormalization structure of the operators, combined with a direct calculation of the relevant diagrams up to fourth order.

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