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First simultaneous global QCD analysis of transverse momentum dependent and collinear distributions in the proton

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In this work, we for the first time extract collinear and transverse momentum dependent (TMD) parton distribution functions (PDFs) in the proton simultaneously from precise high energy Drell-Yan and Z-boson production q_T-dependent data. We make use of TMD factorization, which is conveniently formulated in b_T-space, the Fourier conjugate to intrinsic transverse momentum k_T. At collider facilities, the low-q_T data are especially sensitive to the perturbative contributions in small b_T because of the wide availability of phase space and gluon radiations. The perturbative contributions to the cross sections are described by the operator product expansion (OPE) through collinear PDFs. In this way, we are able to study the impacts on the collinear PDFs from transverse-momentum dependent as well as purely collinear data.

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