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Towards Ultimate Parton Distributions at the High-Luminosity LHC

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In this talk, we present results from a detailed assessment of the ultimate constraining power of LHC data on the PDFs that can be expected from the complete dataset, in particular after the High-Luminosity (HL) phase. To achieve this, HL-LHC pseudo-data for different projections of the experimental uncertainties are generated, and the resulting constraints on the PDF4LHC15 set are quantified by means of the Hessian profiling method. We find that HL-LHC measurements can reduce PDF uncertainties by up to a factor of 2 to 4 in comparison to state-of-the-art fits, leading to few-percent uncertainties for important observables such as the Higgs boson transverse momentum distribution via gluon-fusion. Our results illustrate the significant improvement in the precision of PDF fits achievable from hadron collider data alone. In addition, we apply the same methodology to the final anticipated data sample from the proposed LHeC, and compare these with the HL-LHC projections, demonstrating an encouraging complementarity between the projected HL-LHC and LHeC constraints.

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