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Parton Distributions with Theory Uncertainties

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We formulate a general approach to the inclusion of theoretical uncertainties, specifically those related to the missing higher order uncertainty (MHOU), in the determination of parton distribution functions (PDFs). We demonstrate how, under quite generic assumptions, theory uncertainties can be included as an extra contribution to the covariance matrix when determining PDFs from data. We define a set of prescriptions for constructing a theory covariance matrix using scale variations, which can be used in global fits of data from a wide range of different processes, based on choosing a set of independent scale variations suitably correlated within and across processes. We peform a NLO PDF determination which includes the MHOU, assess the impact of the inclusion of MHOUs on the PDF central values and uncertainties, and validate the results by comparison to the known shift between NLO and NNLO PDFs. We finally study the impact of the inclusion of MHOUs in a global PDF determination on LHC cross-sections.

Primary author: ROJO, Juan (VU Amsterdam)

Presenter: NOCERA, Emanuele Roberto (Nikhef)

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