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Integrated determination of proton and nuclear PDFs

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The precision-level reached at collider experiments offer us the unique opportunity to probe the inner structure of the protons and heavy nuclei, described in the language of parton density functions (PDFs), at an unprecedented accuracy. Despite that current determination of the proton PDFs account for nuclear effects and reciprocally the determination of the nuclear PDFs (nPDFs) depend on the proton PDFs, so far a concurrent extraction of both is not available. For the first time, we present a unified framework in which we simultaneously determine the PDFs of the proton, deuterium, and heavier nuclei up to lead. Our approach is based on the integration of the fitting framework underlying the nNNPDF3.0 determination of nuclear PDFs into that adopted for the NNPDF4.0 global analysis of proton PDFs. We benchmark in detail the performance of this integrated (n)PDF fitting framework and explore some of its phenomenological implications. Our framework represent a stepping stone towards a full integrated global analysis of non-perturbative QCD, a key ingredient for the exploitation of the scientific potential of future facilities such as the Electron-Ion Collider (EIC).

Submitted on behalf of a Collaboration?

Yes

Participate in poster competition?

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