

Towards High-Precision Nucleon Parton Distributions via Distillation

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We apply the Distillation spatial smearing program to the extraction of the unpolarized isovector valence PDF of the nucleon using the pseudo-distribution formalism. The improved volume sampling and control of excited-states afforded by distillation leads to a dramatically improved determination of the requisite Ioffe-time Pseudo-distribution (pITD).

The valence PDF is extracted by analyzing both the matched Ioffe-time Distribution (ITD), as well as a direct matching of the pITD to the PDF. The latter method of extraction is facilitated by a novel expansion of the pITD in a set of Jacobi polynomials using the NLO coordinate space matching kernel. Generalizing this expansion, we are able to introduce nuisance parameters to quantify and remove higher-twist and discretization effects present in the pITD signal - the most notable among these being a short-distance tension of the pITD with the expected DGLAP evolution of the unpolarized pseudo-PDF. Observance and correction of this discrepancy underscores the utility of distillation in such structure studies. Prospects for other collinear distributions is also discussed.

Authors: EGERER, Colin (Jefferson Lab); EDWARDS, Robert; KALLIDONIS, Christos (Thomas Jefferson National Accelerator Facility); ORGINOS, Kostas (William and Mary - Jlab); RADYUSHKIN, Anatoly; RICHARDS, David (Jefferson Lab); ROMERO, Eloy (Jefferson Lab); ZAFEIROPOULOS, Savvas (Aix Marseille Univ. & CNRS)

Presenter: EGERER, Colin (Jefferson Lab)

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