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Collider physics with no PDFs

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Measurements of Deep Inelastic Scattering (DIS) provide a powerful tool to probe fundamental structure of protons and other nuclei. The DIS cross sections can be expressed in terms of structure functions which are conventionally constructed via parton distribution functions (PDFs) that obey the DGLAP evolution equations. However, it is also possible to formulate the DGLAP evolution directly in terms of measurable DIS structure functions thereby entirely sidestepping the need for introducing PDFs. We call this as the physical-basis approach. In a global analysis one would thereby directly parametrize the (observable) structure functions – not the (unobservable) PDFs. Ideally, with data constraints at fixed Q^2, the initial condition for the evolution would be the same at each perturbative order (unlike for PDFs) and the approach thus provides a more clean test of the QCD dynamics.
In the initial work reported here we first study a physical basis consisting of the structure functions F_2 and $F_{\rm L}$ in the fixed-flavour number scheme to the leading non-zero order in α_s. We show how to express the quark singlet and gluon PDFs in terms of F_2 and $F_{\rm L}$ directly in momentum space which then leads to the DGLAP evolution of the structure functions F_2 and $F_{\rm L}$. In the second step we expand the physical basis to include six independent structure functions which allows for a consistent global analysis, and illustrate how to express e.g. the Drell-Yan cross sections at the LHC directly in terms of measurable DIS structure functions. The steps towards the NLO accuracy and variable-flavour-number scheme are outlined.

Submitted on behalf of a Collaboration?

No

Participate in poster competition?

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