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Full NLO corrections for DIS structure functions in the dipole factorization formalism

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Deep Inelastic Scattering (DIS) is the cleanest tool available to probe the content of a fast proton or nucleus. In the regime of low Bjorken x, one enters in the nonlinear regime of gluon saturation, where the gluons are better described as a strong coherent semi-classical field than as a collection of quasi on-shell partons. Hence, that regime lies outside the validity range of the collinear factorization, and is better described within the dipole factorization of DIS observables which allows to resum coherent multiple scattering on the target, and also to resum the high-energy leading logarithms (LL).
One of the motivations to study in detail the regime of gluon saturation in proton and nuclei is that it drives the physics of the earliest stages of heavy collisions, up to the formation of the Quark-Gluon Plasma.

So far, phenomenological studies have been performed successfully at LO in the dipole factorization, with LL resummation, using HERA data for proton DIS. However, in order to reach precision, NLO corrections should be included, as well as high-energy NLL resummations. This is important not only to extract as much knowledge as possible out of the HERA data, but also in prevision of future electron-proton and/or electron-nucleus colliders.

In this talk, I will present an update on the calculation of the (fixed order) NLO corrections to DIS structure functions on a dense target in the dipole factorization picture. In earlier studies, only one part of the NLO corrections has been calculated, the one corresponding to a quark-antiquark-gluon Fock state interacting with the target. By contrast, I will present the first direct calculation of the other part of NLO corrections, for which a quark-antiquark Fock state interacts with the target. I will also discuss issues related with the combination of the two pieces, which is complicated by the presence of UV divergences. Along the way, various techniques have been developped, which will simplify the calculation of NLO corrections to most other observables relevant for gluon saturation.

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