

Complete NLO Calculation of Forward Single-Inclusive Hadron Production in Proton-Nucleus Collisions

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We study the single-inclusive particle production from proton-nucleus collisions in the dilute-dense framework of the color glass condensate (CGC) at next-to-leading order (NLO) accuracy. In this regime, the cross section factorizes into hard impact factors and dipole-target scattering amplitude describing the eikonal interaction of the partons in the target color field. For the first time, we combine the NLO impact factors with the dipole amplitude evolved consistently using the NLO Balitsky-Kovchegov (BK) equation with the initial conditions fitted to HERA structure function data.

The resulting neutral pion cross section with all parton channels included are qualitatively consistent with the recent LHCb measurement. In particular, the NLO evolution coupled to the leading order impact factor is shown to produce a large Cronin peak that is not visible in the data, demonstrating the importance of consistently including NLO corrections to all the ingredients. Furthermore, the transverse momentum spectrum is found to be sensitive to the resummation scheme and the running coupling prescription in the BK evolution. This demonstrates how additional constraints for the initial condition of the BK evolution can be obtained from global analyses including both the HERA and LHC data. In light of the upcoming upgrades to the LHC, the dependence of our results on rapidity will also be discussed.

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