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Forward electroweak gauge boson production in the color dipole S-matrix framework

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The particle production at forward rapidities in hadronic collisions is one of the most promising processes to probe the QCD dynamics at small - x as well as to observe the breakdown of the collinear and kT factorization theorems, predicted to occur to high partonic densities. In this process, one has the interaction between projectile partons with large cone momentum fractions and target partons carrying a very small momentum fraction. Thus, the projectile parton scatter off a dense gluonic system in the target. In this contribution, we investigate the case where one of the particles in the final state is an electroweak gauge boson ($G = W^{\pm}, Z^0, \gamma$) and present the differential cross-section for the isolated gauge boson production in pp collisions at forward rapidities as a function of the dipole - proton cross-section or the unintegrated gluon distribution as presented in our paper (BANDEIRA; GONCALVES; SCHÄFER, 2024). Moreover, we also present the associated electroweak gauge boson production. These new formalism can be used to estimate the impact of the saturation effects in the gauge boson production at the LHC and future colliders. Moreover, we demonstrate that our general parton-level cross-section reduces to expressions previously used in the literature for the description of the real photon production and Drell - Yan process at forward rapidities in some particular limits.

BANDEIRA, Y. B.; GONCALVES, V. P.; SCHÄFER, W. Production of electroweak gauge bosons at forward rapidities in the color-dipole S-matrix framework. JHEP, v. 07, p. 171, 2024.

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