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Threshold resummation in rapidity for colorless particle production at the LHC

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We present a formalism that resums threshold enhanced logarithms to all orders in perturbative Quantum Chromodynamics for the rapidity distribution of any colorless particle produced in hadron colliders. We achieve this by exploiting the factorization properties and K+G equations satisfied by the soft and virtual parts of the cross section. We compute for the first time, the resummed result in two dimensional Mellin space up to next-to-next-to-next-to-leading logarithmic (N3LL) accuracy. Using various state-of-the-art multi-loop and multi-leg results, we demonstrate the numerical impact of the resummed results up to next-to-next-to-leading order for the rapidity distribution of the Higgs boson and Drell-Yan production at the Large Hadron Collider. We find that these threshold logs in the resummed result stabilise the predictions against the renormalization and factorization scale choices as well as we achieve better perturbative convergence.

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