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Heavy-flavour production in the SACOT-mT scheme

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The hadroproduction of heavy-flavoured mesons has recently attracted a growing interest e.g. within the groups involved in global analysis of proton/nuclear parton distribution functions (PDFs), saturation physics, and physics of cosmic rays. In particular, the D- and B-meson measurements of LHCb at forward direction are sensitive to gluon dynamics at small x and are one of the few perturbative small-x probes before the next generation deep-inelastic-scattering experiments.

In this talk, we will concentrate on the collinear-factorization approach to inclusive D-meson production and describe a novel implementation (called SACOT-$m_{\rm T}$) of the general-mass variable flavour number scheme (GM-VFNS). In the GM-VFNS framework the cross sections retain the full heavy-quark mass dependence at $p_{\rm T} = 0$, but gradually reduce to the ordinary zero-mass results towards asymptotically high $p_{\rm T}$. However, the region of small (but non-zero) $p_{\rm T}$ has been somewhat problematic in the previous implementations of GM-VFNS, leading to divergent cross sections towards $p_{\rm T} \to 0$, unless the QCD scales are set in a particular way. Here, we provide a solution to this problem. In essence, the idea is to consistently account for the underlying energy-momentum conservation in the presence of a final-state heavy quark-antiquark pair. This automatically leads to a well-behaved GM-VFNS descrpition of the cross sections across all $p_{\rm T}$ without a need to fine tune the QCD scales. The results are compared with the LHCb, ALICE and CMS data and a very good agreement is found. We also compare to fixed-order calculations and explain why they lead to approximately a factor of two lower D-meson production cross sections than the GM-VFNS approach.

Summary

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