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Single and double charmed meson production at the LHC

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Collaboration

Abstract content

We discuss production of charmed mesons in proton-proton collisions at the LHC. The cross section for inclusive production of $c\bar{c}$ pairs is calculated in the framework of the $k_\perp$-factorization approach, i.e. effectively includes next-to-leading order corrections. Taking wide range of x values necessary for the calculation we use and test several unintegrated gluon distributions from the literature. Some of them include effect of small-x saturation and fullfil Balitsky-Kovchegov evolution equation. Theoretical uncertainties of the model related to the choice of renormalization and factorization scales as well as due to the quark mass are also discussed. Results of the $k_\perp$-factorization approach are compared to NLO parton model and FONLL predictions. The hadronization of charm quarks is included with the help of different fragmentation functions found for the production of charm in e^+e^- collisions. Sensitivity of our predictions to the choice of the model of fragmentation is also shown. Inclusive differential distributions in transverse momentum and (pseudo)rapidity of several charmed mesons (D^0, $D^\pm$, $D^{*\pm}$, $D^{\pm}_s$) will be presented and compared to recent results of the ALICE, ATLAS and LHCb collaborations. Furthermore, u
anti-meson pairs (D^0 {\overline D^0}, D^0 D^-, D^+ D^{-} etc.) in unique kinematics of forward rapidities of the LHCbexpe
D}, invariant mass M_{D \overline D} and rapidity difference Y_{D \overline D} distributions are represented and compared to I
\bar c within a simple formalism of double-parton scattering (DPS). Surprisingly large cross sections, comparable to single-
parton scattering (SPS) contribution, are predicted for LHC energies. We compare results of exact calculations of single-
parton scattering (SPS) and double-parton scattering (DPS) for production of c \bar c c \bar c and for D-
D meson-meson correlations [2, 3]. Each step of DPS is also calculated within k_t-factorization approach. The SPS calculation
g \to c \bar c c \bar c subprocesses as well as with approximate matrix elements in high-energy approximation. We compare our pr
meson pairs) with recent results of the LHCb collaboration for azimuthal angle \varphi_{DD}, dimeson invariant mass M_{DD
The predicted shapes are similar to the measured ones, however, some strength seems to be still lacking. Possible missing contribution within the framework of DPS mechanism is suggested. Our new calculations clearly confirm the dominance of DPS in the production of events with double charm. Finally, we emphasize possible significant contribution of DPS mechanism to inclusive charmed meson spectra measured recently by ALICE, ATLAS and LHCb.

[1] R. Maciuła, and A. Szczurek, Phys. Rev. D87, 094022 (2013); arXiv:1301.3033 [hep-ph]. [2] R. Maciuła, and A. Szczurek, Phys. Rev. D87, 074039 (2013); arXiv:1301.4469 [hep-ph]. [3] A. van Hameren, R. Maciuła and A. Szczurek, arXiv:1402.6972 [hep-ph].

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