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DD-pair production in the Parton Reggeization Approach within SPS and DPS scenarios

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Open-charm production constitutes a stringent test of next-to-leading-order (NLO) perturbative QCD, because at the scale of charm quark $\mu \simeq m_c$ the strong coupling constant is already moderately small $\alpha_S \ll 1$. Single Parton Scattering (SPS) calculations alone fail to reproduce the measured DD-pair production. A realistic description may also include either gluon to charm-quark fragmentation or Double Parton Scattering (DPS) contribution [1,2]. The usage of gluon-to-charm fragmentation, however, includes double-counting issues and the limited range of validity of the gluon fragmentation function [3]. The detailed study in Ref. [1] investigated gluon fragmentation in both SPS and DPS, but charm quark mass effects were omitted. The first combined SPS and DPS predictions within k_T -factorization using Kimber-Martin-Ryskin (KMR) uPDFs were presented in Ref. [4].

In this work, we study DD-pair production in the Parton Reggeization Approach (PRA) [5]. PRA is based on the Lipatov high-energy effective field theory [6] and the modified KMR unPDFs [7, 8]. The charm-quark mass effects in the $c \rightarrow D$ fragmentation are taken into account. We predict various differential cross sections for the SPS and DPS contributions to the DD-pair production in the central and forward rapidity regions at the LHC energies.

- [1] R. Maciula, V. A. Saleev, A. V. Shipilova and A. Szczurek, New mechanisms for double charmed meson production at the LHCb, Phys. Lett. B 758, 458-464 (2016) doi:10.1016/j.physletb.2016.05.052.
- [2] R. Maciula and A. Szczurek, Double open charm meson production at the LHC: new single- and double-parton scattering mechanisms, EPJ Web Conf. 130, 05013 (2016) doi:10.1051/epjconf/201613005013
- [3] A. V. Karpishkov, M. A. Nefedov, V. A. Saleev and A. V. Shipilova, DbarD and DD pair production at the LHCb in the parton Reggeization approach, PoS DIS2016, 125 (2016) doi:10.22323/1.265.0125.
- [4] A. van Hameren, R. Maciula and A. Szczurek, Production of two charm quark-antiquark pairs in single-parton scattering within the k_t -factorization approach, Phys. Lett. B 748, 167-172 (2015) doi:10.1016/j.physletb.2015.06.061.
- [5] M.A. Nefedov, V.A. Saleev, and A.V. Shipilova. Dijet azimuthal decorrelations at the LHC in the parton Reggeization approach. Physical Review D, 87(9):094030, 2013.
- [6] L.N. Lipatov. Gauge invariant effective action for high energy processes in QCD. Nuclear Physics B, 452(1-2):369–397, 1995.
- [7] M.A. Kimber, A.D. Martin, and M.G. Ryskin. Unintegrated parton distributions. Physical Review D, 63(11):114027, 2001.
- [8] M.A. Nefedov and V.A. Saleev. High-energy factorization for the Drell-Yan process in pp and $p\bar{p}$ collisions with new unintegrated PDFs. Physical Review D, 102(11):114018, 2020.

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