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## New single- and double-parton scattering mechanisms for double charmed meson production

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Some time ago two of us predicted that at large energies relevant for the LHC the production of double charm should be dominated by the double-parton scattering (DPS) mechanism [1]. Those studies of double  $c\bar{c}$  production was extended next to the  $k_t$ -factorization approach which includes effectively higher-order QCD effects [2,3]. A relatively good description of the LHCb experimental data [4] was achieved for both the total yield and the dimeson correlation observables. The single-parton scattering (SPS)  $gg \rightarrow c\bar{c}c\bar{c}$  contribution was discussed carefully in both collinear [3] and  $k_t$ -factorization [5] approaches. Their contribution to the  $c\bar{c}c\bar{c}$  cross section was found to be rather small and was not able to describe details of the LHCb data.

Here we discuss production of  $D^0 D^0$  (and  $\bar{D}^0 \bar{D}^0$ ) pairs within an alternative approach where  $g \rightarrow D$  fragmentation is included [6]. We consider double-parton scattering (DPS) mechanisms of double  $c\bar{c}$  production and subsequent  $cc \rightarrow D^0 D^0$  hadronization as well as double  $g$  and mixed  $gc\bar{c}$  production with  $gg \rightarrow D^0 D^0$  and  $gc \rightarrow D^0 D^0$  hadronization calculated with the help of the scale dependent hadronization functions of Kniehl et al. Single-parton scattering (SPS) mechanism of digluon production is also taken into account. We compare our results with several correlation observables in azimuthal angle  $\varphi_{D^0 D^0}$  between  $D^0$  mesons or in dimeson invariant mass  $M_{D^0 D^0}$ . The inclusion of new mechanisms with  $g \rightarrow D^0$  fragmentation leads to larger cross sections, than when including only DPS mechanism with standard scale independent  $cc \rightarrow D^0 D^0$  fragmentation functions. Some consequences of the presence of the new mechanisms are discussed. In particular a larger  $\sigma_{eff}$  is needed to describe the LHCb data. There is a signature that  $\sigma_{eff}$  may depend on transverse momentum of  $c$  quarks and/or  $\bar{c}$  antiquarks.

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