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## Production of $c\bar{c}c\bar{c}$ in single and double parton scattering in collinear and $k_t$ -factorization approaches

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We present first results for the  $2 \rightarrow 4$  single-parton scattering  $gg \rightarrow c\bar{c}c\bar{c}$  subprocess for the first time fully within the  $k_t$ -factorization approach. In this calculation we have used the Kimber-Martin-Ryskin unintegrated gluon distribution which effectively includes some class of higher-order gluon emissions, and an off-shell matrix element squared calculated using recently developed techniques. The results are compared with our earlier result obtained within the collinear approach.

Only slightly larger cross sections are obtained than in the case of the collinear approach.

Inclusion of transverse momenta of gluons entering the hard process leads to a much stronger azimuthal decorrelation between  $cc$  and  $\bar{c}\bar{c}$  than in the collinear-factorization approach.

A comparison to predictions of double parton scattering (DPS) results and the LHCb data strongly suggests that the assumption of two fully independent DPS ( $gg \rightarrow c\bar{c} \otimes gg \rightarrow c\bar{c}$ ) may be too approximate.

1) A. van Hameren, R. Maciula and A. Szczurek,  
"Single-parton scattering versus double-parton scattering  
in the production of two  $c\bar{c}$  pairs and charmed meson correlations  
at the LHC",  
Phys. Rev. D89 (2014) 094019.

2) 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,  
arXiv:1504.06491, submitted to Phys.Lett.B.

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