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Can the LHCb fixed-target charmed meson data be an evidence of intrinsic charm in a nucleon?

We discuss the impact of the new LHCb fixed-target $p+^4He$ data for $D^0/\bar{D}^0$ production on the intrinsic $c\bar{c}$ component in the nucleon wave function. Within the scenario presented here neither the traditional gluon-gluon fusion or quark-antiquark annihilation mechanisms calculated in the k_T-factorization approach nor their counterparts from the collinear next-to-leading order collinear framework are sufficient to describe the transverse momentum and rapidity distributions of $D^0/\bar{D}^0$ mesons. First the $c\bar{c}$-pair production within the standard frameworks is considered. Here a crucial role of the $c \to D$ hadronization effects at low energies and low transverse momenta is found and discussed, which was not analyzed in previous studies. A contribution related to intrinsic $c\bar{c}$ component in the nucleon wave function is included in addition. Two models of the symmetric ($c(x) = \bar{c}(x)$) intrinsic charm (IC) component are considered. The intrinsic charm $g^*c \to gc$ (or $g^*\bar{c} \to g\bar{c}$) contribution needs to be regularized in order to obtain a suppression of the minijet p_T spectrum present in the phenomenological minijet model, commonly used in Monte Carlo generators. We show that in our model the regularization parameter can be obtained from the fit to the LHCb fixed-target data under consideration here. We discuss uncertainties of our calculations (scale, charm quark mass, fragmentation function) as well as set limits on the IC probability. According to our model the intrinsic charm probability $P_{IC} = 1.65\%$ allows to significantly improve description of the LHCb data but the number is rather uncertain. More details of the studies can be found in Ref.[1].

[1] R. Maciuła and A. Szczurek, Impact of the LHCb $p+^4He$ fixed-target $D^0/\bar{D}^0$ data on the intrinsic $c\bar{c}$ component in the nucleon, Phys. Rev. D 105, no.1, 014001 (2022).

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