Exclusive production of $\pi^+\pi^-$ pairs in proton-proton and proton-antiproton collisions

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We evaluate differential distributions for the four-body $pp \to pp\pi^+\pi^-$ (and $p\bar{p} \to p\bar{p}\pi^+\pi^-$) reaction which constitutes an irreducible background to three-body processes $pp \to ppM$, where M is a broad resonance in the $\pi^+\pi^-$ channel, e.g. $M = \sigma, \rho_0, f_0(980), f_2(1275), f_0(1500)$. We include both double-diffractive contribution (both pomeron and reggeon exchanges) as well as the pion-pion rescattering contribution. The first process dominates at higher energies and small pion-pion invariant masses while the second becomes important at lower energies and higher pion-pion invariant masses. The amplitude(s) is(are) calculated in the Regge approach. We compare our results with the close-to-threshold experimental data. We also compare our results with measured cross sections for ISR and FNAL experiments. We make predictions for future experiments at PANDA, RHIC, Tevatron and LHC energies. Differential distributions in momentum transfers, invariant two-pion mass, pion rapidities and transverse momenta of pions are presented. The two-dimensional distribution in (y_{π^+}, y_{π^-}) is particularly interesting. The higher the incident energy, the higher preference for the same-hemisphere emission of pions. The processes considered constitute a sizeable contribution to the total nucleon-nucleon cross section as well as to pion inclusive cross section.

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[2] P. Lebiedowicz, A. Szczurek, Phys. Rev. **D81** (2010) 036003.

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