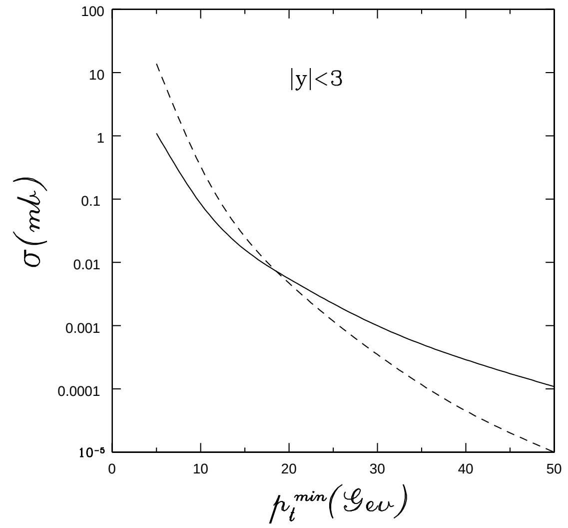

Fig. 41: Integrated cross section for production of four jets with $|y| < 3$ as a function of the lowest transverse momentum of the jets p_T^{min}. The continuous curve is the expected cross section as from the leading QCD production mechanism $2 \to 4$, the dashed curve is the expected cross section due to the contribution of double parton collisions $(2 \to 2)^2$.

factor, with dimensions of a cross section. It is the result of the integration on the transverse distance b, actually $1/\sigma_{eff} = \int d^2bF^2(b)$. All the information on the parton correlation in transverse space is summarized in σ_{eff} [518]. The geometrical origin of σ_{eff} justifies the expectation that its value is both a energy and cutoff independent quantity.

The double parton scattering process has been measured at Fermilab by CDF by looking at final states with three mini-jets and one photon [175, 176]. The measured value of the scale factor is:

$$\sigma_{eff} = 14.5 \pm 1.7^{+1.7}_{-2.3} \text{ mb.} \tag{106}$$

In the limited range of x experimentally accessible, σ_{eff} does not show evidence of dependence on the fractional momenta, which indicates that the simplest hypotheses above are not in contradiction with the experiment.

The qualitative features of the double parton scattering process are easily read in the factorized expression in Eq. (105). As a consequence of the proportionality of σ_D with σ_S^2, the double parton scattering cross section is characterized by a rapid decrease for $p_T \to \infty$ and by a rapid growth for $p_T \to 0$. As for the energy behavior, σ_D increases faster with s as compared to the single scattering cross section (it goes as σ_S^2). Multiple parton collisions are therefore enhanced at the LHC.

8.3 Four jet production

The most obvious case where multiple parton collisions play a role at high energy is in the production of jets, since the integrated cross section can easily exceed the unitarity limit at large energies and with a fixed value of p_T^{cut}. One has in fact that, for any value of p_T^{cut}, when s is sufficiently large $\sigma_S > \sigma_{inel}$. The simplest case to consider is the production of four large p_T jets, where one can compare the leading $(2 \to 4)$ process with the power suppressed $(2 \to 2)^2$ double parton collision.

In fig. (41) we show the expected rates of production of four large p_T jets in the central rapidity region ($|y| < 3$) with the two different production mechanisms, as a function of the lowest value of the transverse momenta of the produced jets p_T^{min}. The continuous curve is the expected cross section as from the leading QCD production mechanism $(2 \to 4)$ [122, 519]. The dashed curve is the double parton