

Dijet production at HERA and tests of QCD factorisation

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1 Exclusive dijet production in diffractive DIS

The exclusive production of dijets in diffractive deep inelastic lepton-proton scattering has been measured by the ZEUS Collaboration for the first time at HERA [1]. Jets have been reconstructed in the virtual photon-Pomeron centre-of-mass system frame using the exclusive k_T algorithm. The cross section for the exclusive production of dijets is given as a function of the azimuthal angle ϕ between the plane defined by exchanged photon and dijet system and the plane defined by the incoming and scattered lepton momenta in the γ^* -Pomeron rest frame. The shape of the ϕ distribution is sensitive to the production mechanism of diffractive exclusive dijets. The data favour fully perturbative calculations of the two-gluon exchange model over boson-gluon fusion mechanism, in which a partonic structure of the Pomeron is assumed.

2 Tests of QCD factorisation

In the framework of QCD collinear factorisation the cross section for the diffractive DIS process factorises into universal diffractive parton distribution functions (DPDFs) and hard subprocess cross sections calculable within the perturbative approach. The universality of these DPDFs was successfully tested for hard diffractive DIS production. However, the factorisation breaking was observed for hard processes in diffractive hadron-hadron scattering where the predictions based on HERA DPDFs overestimate the data, at Tevatron by about one order of magnitude. The factorisation breaking is usually explained in terms of multiple scattering effects, which occur in the presence of beam remnants and lead to the destruction of the rapidity gap associated with the diffractive process. Rapidity gap survival effects can be investigated at HERA in hard diffractive dijet photoproduction.

Diffractive dijet cross sections in photoproduction and in DIS with a leading proton detected in the very forward proton spectrometer (VFPS) have been measured by H1 [2]. DIS measurements are complemented by measurements of dijet production with an associated large rapidity gap (LRG) [3]. The cross sections for the dijet production in diffractive DIS with VFPS and with LRG are found to be well described by the NLO QCD predictions using the H12006 Fit-B DPDF set. These results confirm the validity of QCD factorisation in hard diffractive DIS.

Using the VFPS data the double ratio of measured to predicted cross sections in photoproduction to the corresponding ratio in DIS has been determined and its value is equal to $0.55 \pm 0.10(\text{data}) + 0.02(\text{theor.})$, with no significant kinematic dependence. This result is consistent with previous H1 measurements based on the LRG method and indicates that QCD factorisation may be broken in diffractive dijet photoproduction. However, ZEUS does not observe factorisation breaking in diffractive photoproduced jets.

References

- [1] M. Guzik, Proceedings PoS (DIS2014) 070.
- [2] R. Zlebcik, Proceedings PoS (DIS2014) 072.
- [3] V. Andreev et al. [H1 Collaboration], DESY 14-200.