JETS IN DIFFRACTIVE *ep* INTERACTIONS

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Measurements of differential *ep* cross sections for 2 jet events in diffractive deep inelastic scattering and photoproduction with the H1 detector at HERA are presented. They are compared with predictions based on a partonic interpretation of the pomeron.

1 Introduction

The large rapidity gap events in *ep* collisions at HERA are attributed mostly to diffractive processes. The presence of jets in the final state indicates a hard pQCD subprocess. Therefore an analysis of 2 jet events can give insight into any partonic component of diffractive dynamics.

2 Data selection

The following study is based on e^+p data taken by H1 in 1994, corresponding to an integrated luminosity of $\mathcal{L}_{\mathrm{int}} = (2.25 \pm 0.045)\mathrm{pb}^{-1}$. To select deep inelastic scattering (DIS) events the scattered positron must be identified in the backward electromagnetic calorimeter with an energy of $E'_{e^+} > 10\,\mathrm{GeV}$. The kinematical domain is further restricted to $0.05 < y < 0.6$ and $7.5\,\mathrm{GeV}^2 < Q^2 < 80\,\mathrm{GeV}^2$. Photoproduction events are selected using the H1 small angle electron tagger, which restricts the kinematical region to $0.25 < y < 0.7$ and $10^{-8}\,\mathrm{GeV}^2 < Q^2 < 0.01\,\mathrm{GeV}^2$. Subsamples of diffractive events are selected by demanding no signal above noise in the H1 forward detectors sensitive to particle production in the region $3.0 < \eta < 7.5$. The use of the forward detectors gives good acceptance in the kinematical region of high E_{t} jet production while keeping the background at an acceptable level (Fig. 1).

3 Cross sections for 2 jet production

The Monte Carlo generators RAPGAP (for DIS) and POMPYT (for photoproduction) were used to model diffractive hard scattering events for acceptance corrections. These models assume factorisation of the diffractive cross section into a pomeron flux and a photon pomeron cross section parameterised in terms

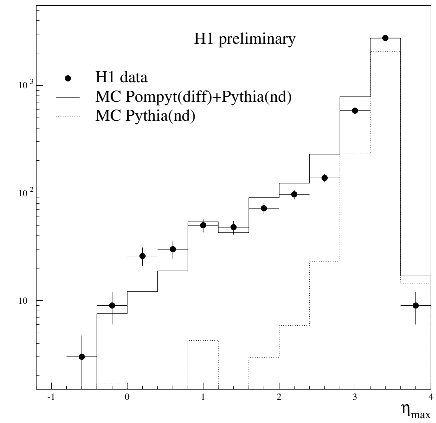

Figure 1: Distribution of $\eta_{\max}$, the maximum pseudorapidity of a calorimeter cluster with $E > 400$MeV, for 2 jet events in photoproduction. The solid line shows a combination of POMPYT and (non-diffractive) PYTHIA distributions normalised to the data. The dotted line shows the non-diffractive PYTHIA contribution.

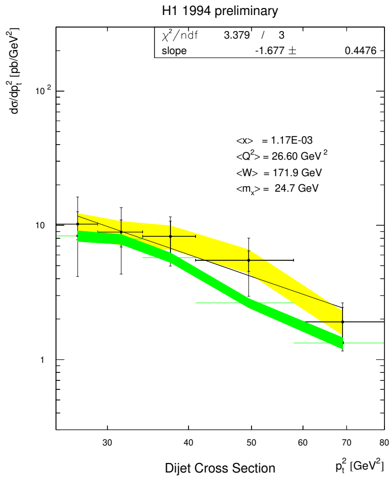

Figure 2: Differential ep cross section $d\sigma/dp^2_{\rm t,jet}$ for 2 jet events in diffractive DIS. The upper band indicates the common error due to the uncertainty of the energy scale in the main calorimeter. The lower band shows the RAPGAP prediction with its statistical error. The line represents a fit of the form $d\sigma/dp^2_{\rm t,jet} \propto p^{2n}_{\rm t,jet}$ with $n = -1.7$.

of parton densities in the pomeron. For RAPGAP these were obtained from a QCD fit assuming DGLAP evolution in the $F_2^{D(3)}$ diffractive structure function (P. Newman, these proceedings). For POMPYT three different parton densities were used: a hard gluon or hard quark density $\propto z(1-z)$ and a soft gluon density $\propto (1-z)^5$. The jet analysis in DIS and photoproduction was done with a CONE type algorithm using a combination of clusters and tracks as input. The DIS jet analysis uses a $25 \times 25 (\eta, \phi)$ grid in the photon-pomeron rest frame with $-2.5 < \eta < 2.5$, a cone radius of $\Delta R = 1$ and $E_{\rm t,jet} \geq 5$ GeV. In total 95 events with 2 jets were found. The differential cross section $d\sigma/dp^2_{\rm t,jet}$ for inclusive 2 jet production corrected to the hadron level for $x_{\rm IP} < 0.1$ is shown in figure 2. The photoproduction jet analysis uses a 24×24 (η, ϕ) grid in the lab frame with $-2.5 < \eta < 3.5$, a cone radius of $\Delta R = 1$ and $E_{\rm t,jet} \geq 5$ GeV. After a final jet cut of $-1.5 < \eta_{\rm jet} < 2.5$, a total of 441 events with 2 jets remained. The differential cross sections for inclusive 2 jet production corrected to the hadron level for $x_{\rm IP} < 0.05$ are shown in figure 3 ($d\sigma/dE_{\rm t,jet}$) and figure 4 ($d\sigma/d\eta_{\rm jet}$). In all plots the inner and outer error bars represent respectively the statistical error and the statistical and systematic error added in quadrature.

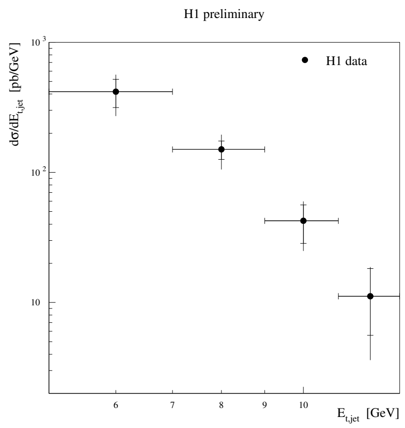

Figure 3: Differential ep cross section $d\sigma/dE_{\mathrm{t,jet}}$ for 2 jet events in diffractive photoproduction.

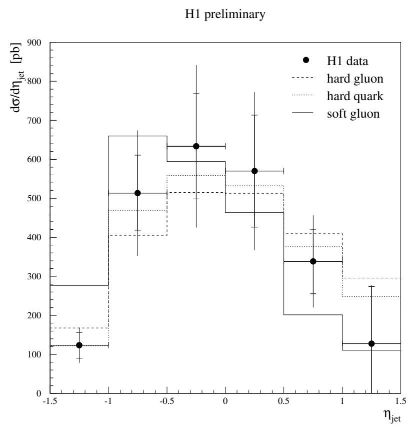

Figure 4: Differential ep cross section $d\sigma/d\eta_{jet}$ for 2 jet events in diffractive photoproduction. For comparison POMPYT predictions normalised to the data are also shown.

The main contribution to the systematic errors comes from a 5% uncertainty in the energy scale of the main calorimeter. Other sources of systematic error considered are the uncertainty in the background subtraction, the acceptance correction, the luminosity measurement and the trigger efficiency.

4 Conclusions

Using the H1 forward detectors, samples of 2 jet events with a large rapidity gap were collected in DIS and photoproduction, which is strong evidence for hard subprocesses. The measured cross sections were corrected to the hadron level. In photoproduction there is no discrimination in the η_{jet} spectrum in shape to different POMPYT inputs. A prediction for the 2 jet cross section in DIS with the Monte Carlo generator RAPGAP using parton densities obtained from a QCD fit of $F_2^{D(3)}$ is close to the data.

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