PROCEEDINGS OF SCIENCE

Diffractive Structure Functions with H1

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H1 has measured the diffractive DIS cross section $ep \to eXY$ using data from both of the HERA data-taking periods. Using new measurements of the diffractive cross section at different centre-of-mass energies, the diffractive longitudinal structure function F_L^D has been extracted. The results are in agreement with NLO QCD predictions based on fits to inclusive data. New high statistics measurements of the diffractive reduced cross section σ_r^D have been made using two experimental methods covering the accessible kinematic range. This precise dataset agrees well with QCD-based predictions.

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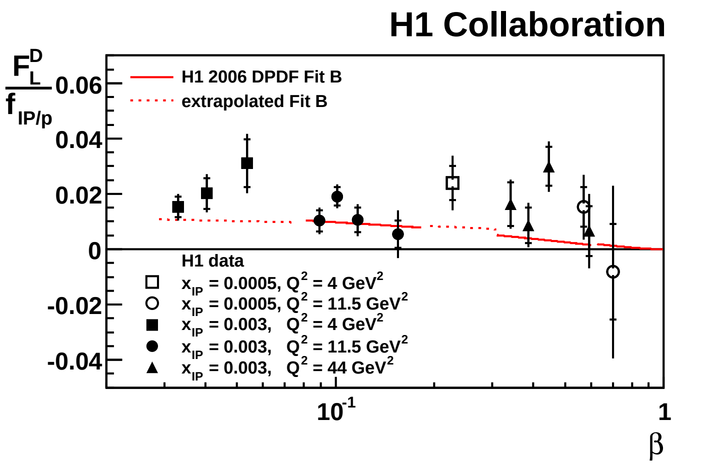

Figure 1: The measurements of F_L^D, as a function of β. The data are compared to the predictions of Fit B, the extrapolation of this fit is shown as a dashed line.

1. Introduction

The diffractive DIS process $ep \rightarrow eXY$ factorises in QCD. An additional assumption is often made whereby the proton vertex dynamics factorise from the vertex of the hard scatter - proton vertex factorisation. Although proton vertex factorisation must be broken in QCD, measurements show that it's a good enough approximation to the data such that meaningful next-to-leading order (NLO) QCD fits can be made [1].

In analogy with the inclusive case, the DDIS cross section can be expressed in terms of a linear combination of structure functions. In the HERA kinematic regime, this can be well approximated by F_2^D and a term related to scattering of longitudinally polarised photons F_L^D.

Diffractive events are selected either by detecting the final state proton, or on the basis of a Large Rapidity Gap (LRG) being present. In the latter case, the final state system Y escapes detection, the cross section is integrated over ranges in leading baryon mass M_Y and t.

2. Structure Function Measurements

Data from three proton beam energies, $E_p = 460, 575$ and 920 GeV, have been used to measure the diffractive reduced cross section at the same x and Q^2, but different y. Following a similar procedure to that used for the extraction of F_L by H1, these data have then been used, together with previously published data at 820 GeV [1], to extract the diffractive longitudinal structure function F_L^D.

In order to extract F_L^D optimally, the cross sections are normalised to the H1 2006 DPDF Fit B result. As the published data at 820 GeV were included in the analysis of the data used as input to H1 2006 DPDF Fit B, they are already consistently normalised. The resulting measurements of F_L^D [2] are shown in figure 1. The data agree well with the predictions of Fit B.

Data at the nominal proton beam energy of $E_p = 920$ GeV have been analysed to extract the diffractive reduced cross section σ_r^D in as wide a kinematic range as possible, using both the tagged

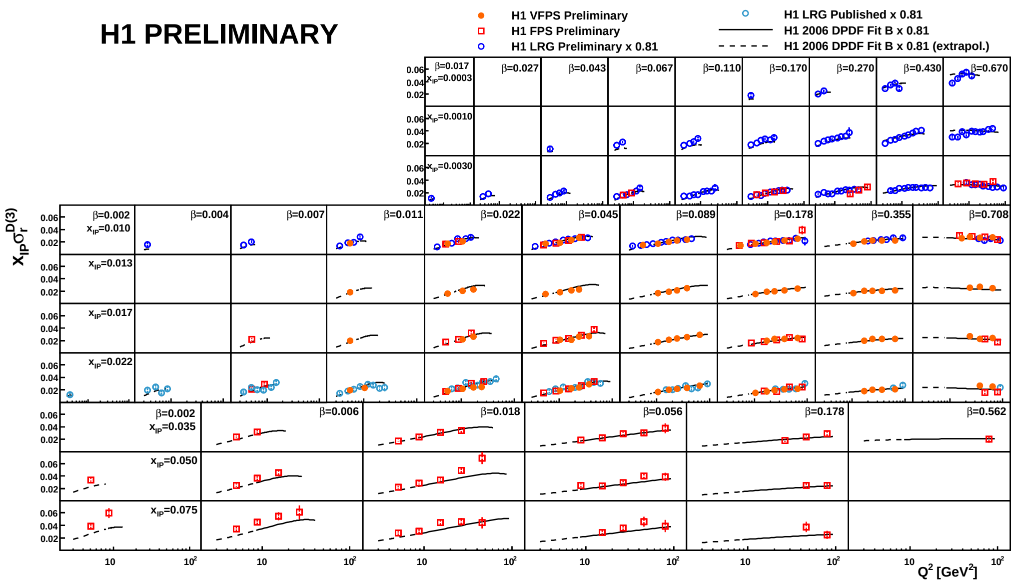

Figure 2: The measurements of σ_r^D using all experimental methods.

proton and the LRG methods. These new, precise data [3, 4, 5] agree well with the published H1 data [1] and cover almost the entire accessible kinematic range. The full set of measurements are shown in figure 2. The data are shown as a function of Q^2 in bins of β, both the LRG data and Fit B have been normalised to $M_Y = M_{proton}$. The data compare well with Fit B.

3. Conclusions

New measurements of the diffractive reduced cross section using data taken at three proton beam energies have been made. The measurements have been combined with existing H1 data at 820 GeV in order to extract F_L^D. The result agrees well with the predictions of Fit B. New measurements of σ_r^D using both the proton tagged and LRG methods have also been made, which cover nearly the whole accessible kinematic range. The data agree well with published data and with Fit B.

References

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