HERA Diffractive Structure Function Data and Parton Distributions

Paul Laycock*, Paul Newman† and Frank-Peter Schilling**

*FH1 Liverpool 10b, DESY, Notkestrasse 85, 22603 Hamburg, Germany
email: laycock@mail.desy.de
†School of Physics and Astronomy, University of Birmingham, B15 2TT, UK
email: newmanpr@mail.desy.de
**CERN/PH-CMT (CMS Collaboration) Office 40-1-B06, mail E27710, CH-1211 Geneva 23
email:fpschill@mail.cern.ch

Abstract. The high precision diffractive DIS data from the H1 and ZEUS collaborations discussed elsewhere in these proceedings are compared. NLO DGLAP QCD fits are performed separately to the H1 and ZEUS data samples and the resulting diffractive PDFs are compared.

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INTRODUCTION

The H1 collaboration has extracted diffractive PDFs from neutral current data as discussed in [1, 2]. Further to the proof of Collins [3] that the process $\gamma^* p \to X p$ is factorisable an additional assumption is required. This assumption, which is supported by the data, is that the x_{IP} dependence of the data can be modelled using a Regge-motivated parameterisation [2]. Following this assumption the diffractive PDFs shown in figure 1 can be extracted. Also shown in figure 1 is the diffractive dijet cross-section compared with the predictions of a leading order Monte Carlo using the H1 diffractive PDFs. The prediction does rather well.

COMPARISON OF DIFFRACTIVE DIS DATA

The different experimental techniques for selecting diffractive DIS events imply different kinematic ranges for the various datasets considered here, in particular the range of M_Y varies. In order to compare the various datasets they have all been corrected to the same phase space as the H1 large rapidity gap measurements [2, 4, 5], i.e. $M_Y < 1.6$ GeV. The H1 [6] and ZEUS [7] leading proton data are scaled up by a global factor of 1.1 [8]. A factor of 0.7 [9] is used to correct the ZEUS M_X data [9] from the measured $M_Y < 2.3$ GeV to an elastic proton. The same factor of 1.1 is then used to correct from an elastic proton to $M_Y < 1.6$ GeV, resulting in an overall global scale factor of 0.77 being applied to the ZEUS M_X data.

Shown in figure 2 is a comparison of the H1 large rapidity gap data and the ZEUS M_X data. There is in general good agreement but differences are observed at low M_X (high

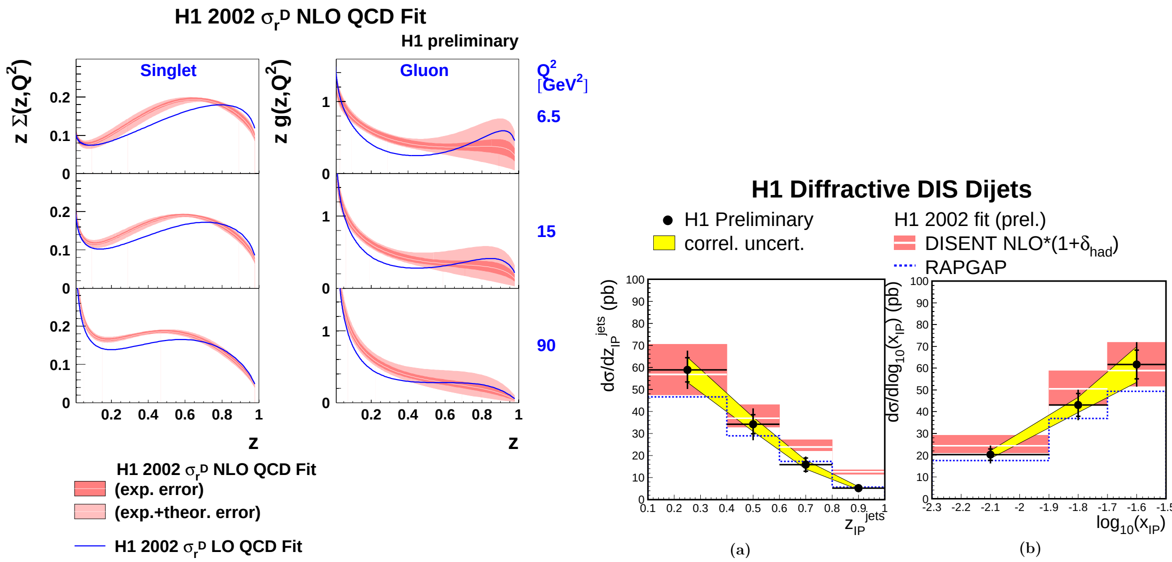

FIGURE 1. Diffractive PDFs extracted by H1 from their inclusive cross-section measurements (left) and (right) the diffractive dijet cross-section compared with the predictions using the H1 PDFs.

β) and in the Q^2 dependence of the data. Figure 3 is a comparison of the H1 rapidity gap measurements and the two leading proton measurements. The two leading proton measurements agree well with each other. There is also good agreement between the leading proton analyses and the H1 large rapidity gap measurement.

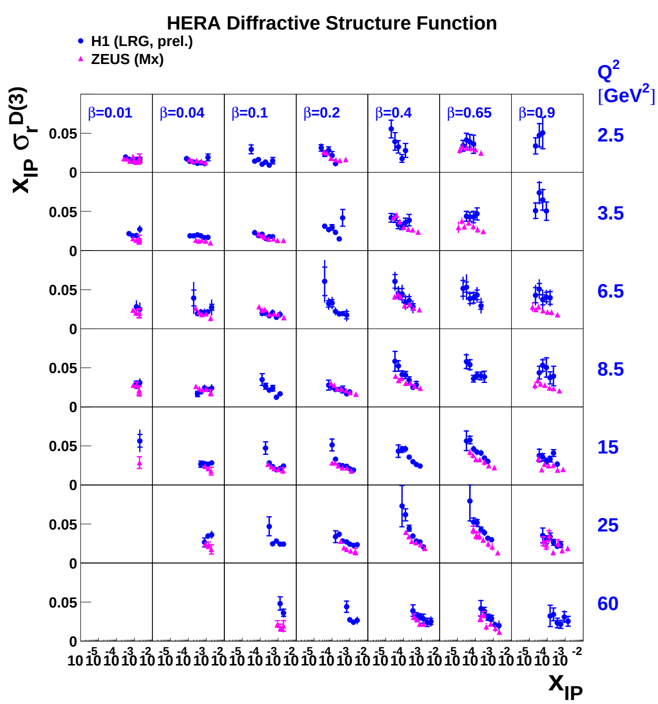

FIGURE 2. A comparison of the H1 large rapidity gap measurement and the ZEUS M_X data.

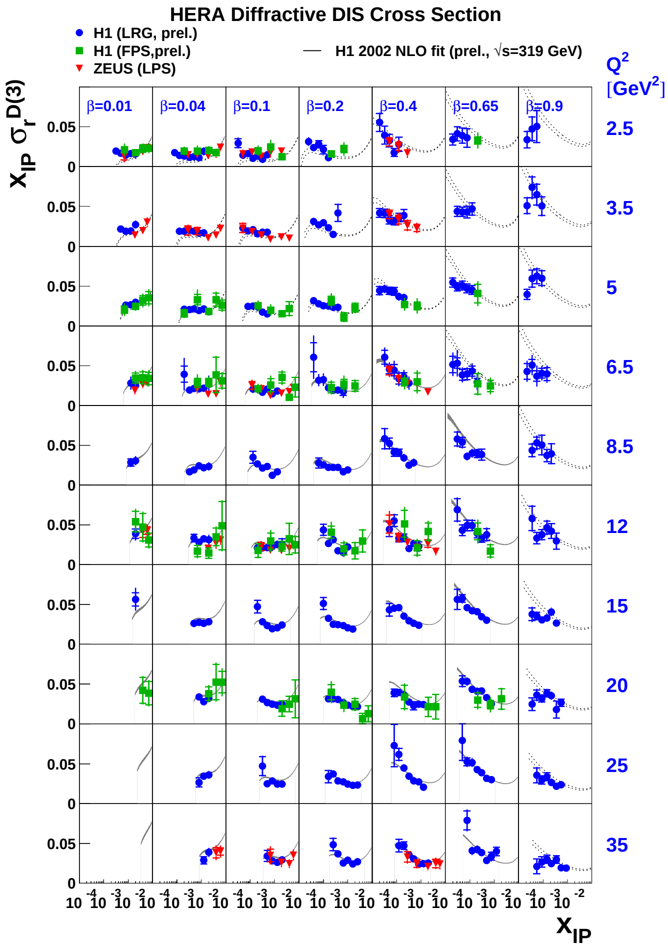

FIGURE 3. A comparison of the H1 large rapidity gap measurement and the leading proton analyses of H1 and ZEUS.

NLO DGLAP QCD FIT COMPARISONS

The same NLO DGLAP QCD fit procedure as described in [2] was used to fit the ZEUS M_X data, with only a few minor modifications. The modifications were:

- All M_x data for $Q^2 > 4$ GeV^2 were included in the fit (H1: $Q^2 > 6.5$ GeV^2)
- Only the total error of the data was considered
- No meson component was included in the fit
- The Pomeron intercept was fitted at the same time as the PDFs

and otherwise the fit was the same as for the H1 large rapidity gap data. The resulting fit gives a good desciption of the data.

Figure 4 shows a comparison of the two sets of diffractive PDFs extracted from the H1 and ZEUS fits. The two singlet distributions are similar at low Q^2, evolving differently to higher Q^2. As a result the ZEUS gluon is a factor of ≈ 2 smaller than the H1 gluon.

The different Q^2 evolution of the H1 and ZEUS datasets results in the differences in the extracted PDFs. Note that the fits remain largely unaffected by the differences seen at low M_X between the two datasets because of a cut of $M_X > 2$ GeV.

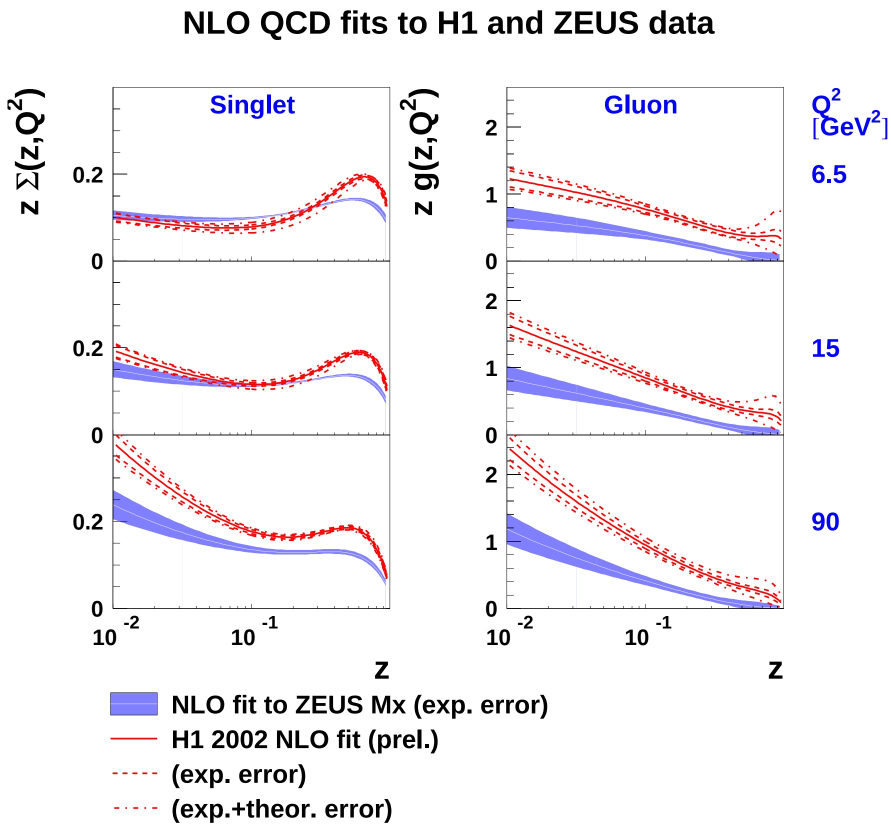

FIGURE 4. A comparison of the diffractive PDFs extracted from the NLO DGLAP QCD fits to H1 and ZEUS data.

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