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STRUCTURE FUNCTIONS AT LOW X AND Q^2 AT ZEUS

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Abstract

Using 3.9 pb^{-1} of data from ep $\rightarrow$ eX interactions recorded using the ZEUS detector in 1997, the proton structure function, F_2, has been measured in the range 0.015 GeV^2 $< Q^2 <$ 0.65 GeV^2 and $6 \times 10^{-7} < x < 1 \times 10^{-3}$. The analysis is based on data taken incorporating new detector components. Compared with the previous analysis, these components allow improved background suppression and better control of systematic uncertainties, extending the accessible kinematic region towards lower Q^2.

1 Introduction

The measurement of the proton struture function F_2 at low Q^2 has been used recently by ZEUS [1] to study the transition between photoproduction and deep inelastic scattering. The first measurement by ZEUS [2] using 1995 data has now been followed by a higher precision measurement using dedicated detector components.

A measurement of F_2 has been made in the range $0.015\ \mathrm{GeV}^2 < Q^2 < 0.65\ \mathrm{GeV}^2$ and $6\times10^{-7} < x < 1\times10^{-}3$, where Q^2 is the four-momentum transfer squared and x is the Bjorken scaling variable. The measurement was made using 3.9 pb^{-}1 of data taken using special triggers in 1997 and, compared to the previous result, covers a larger kinematic region with improved accuracy.

2 Analysis

Reconstruction of the scattered positron is performed using dedicated detector compontents: the Beam Pipe Calorimeter (BPC) and the Beam Pipe Tracker (BPT) of the ZEUS detector.

The BPC is a small Tungsten-scintillator sampling calorimeter that detects positrons scattered at angles of 18-32mrad with respect to the positron beam direction. It has an energy resolution of $\sigma_E = 0.17/\sqrt{E[GeV]}$.

The BPT consisted of two silicon microstrip detectors. A track is reconstructed as the straight line between a hit on each detector and provides information on the positron scattering angle and impact point on the BPC. This helps eliminate background and reduce the systematic uncertainties.

3 Results

Figure 1 shows F_2 as a function of x in bins of Q^2. Down to $Q^2\approx1$ the data is well described by NLO QCD fits. The steep rise in F_2 at low x observed at higher Q^2 persists down to the low Q^2 region. This rise though, becomes shallower as Q^2 decreases into the new region of measuremement. At low values of Q^2 the data are well described by Regge theory.

4 Conclusions

The ZEUS collaboration has measured F_2 in the region $0.015\ \mathrm{GeV}^2 < Q^2 < 0.65\ \mathrm{GeV}^2$ and $6 \times 10^{-7} < x < 1 \times 10^{-3}$ with high precision. The data can be used to examine the transition between perturbative and non-perturbative QCD.

References

References

[1] ZEUS Coll., *Eur. Phys.* C **7**, 609 (1999)

[2] ZEUS Coll., *Phys. Lett.* B **407**, 432 (1997).

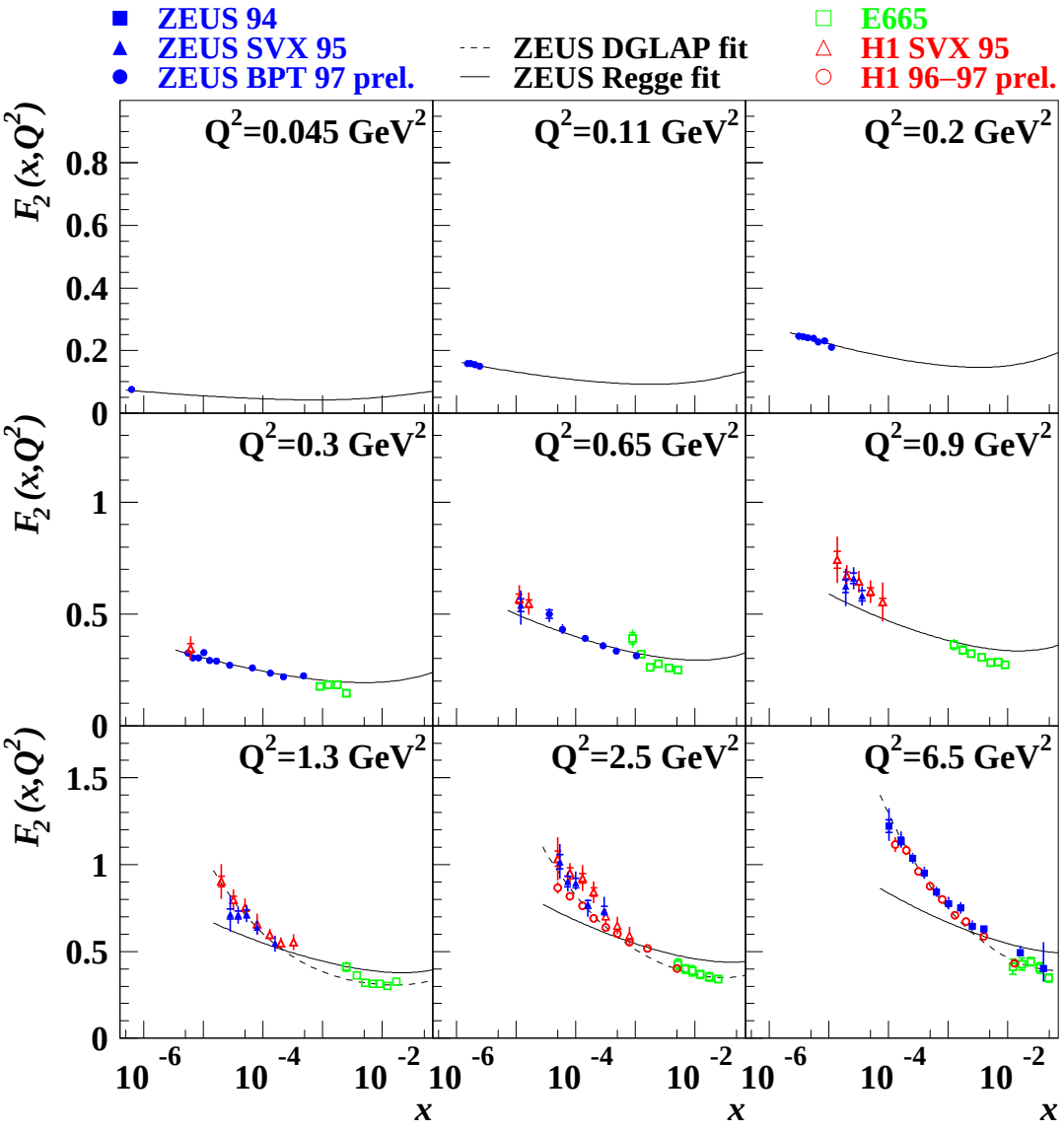

Figure 1: F_2 versus x in bins of Q^2, compared to other measurements from ZEUS, H1 and fixed target experiments.