H1prelim-03-011

Measurement of the Inclusive Diffractive Cross Section $\sigma_{\mathrm{r}}^{\mathrm{D(3)}}$ at high Q^2

H1 Collaboration

Abstract

A new measurement of the diffractive reduced cross section $\sigma_r^{D(3)}(x, Q^2, x_{I\!P})$ at high Q^2, describing the deep-inelastic scattering process $ep \rightarrow eXY$ in which the system Y is a proton or a low-mass proton excitation carrying a fraction $1 - x_{I\!P}$ of the beam longitudinal momentum, is presented in the kinematic range $Q^2 > 130\ \mathrm{GeV}^2$, $0.1 < \beta = x/x_{I\!P} < 0.9$ and $0.005 < x_{I\!P} < 0.05$. The measurement is based on e^+p data taken in the years 1999 and 2000 with the H1 detector, corresponding to an integrated luminosity of $65\ \mathrm{pb}^{-1}$. The data are used together with other recent measurements at small and intermediate Q^2 values to test various factorisation properties and models of diffractive DIS. In particular, good agreement is found at high Q^2 with the extrapolated NLO QCD fit to lower Q^2 σ_r^D data.

Prepared for DIS 2003, St. Petersburg

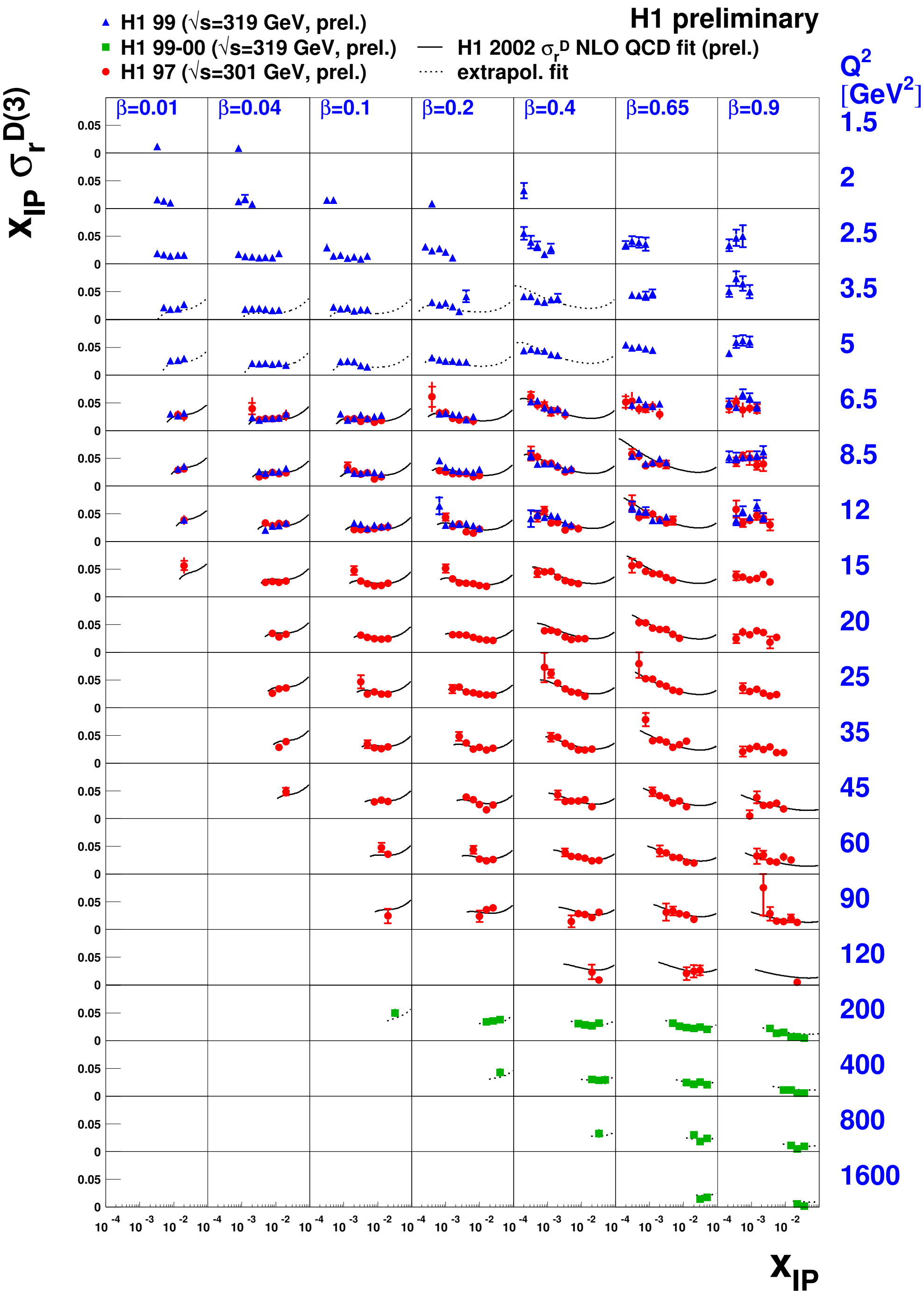

Figure 1: Reduced cross section $\sigma_r^{D(3)}$ from this measurement at high Q^2 (green boxes) as well as from recent H1 measurements at low [1] (blue triangles) and medium [2] (red points) Q^2. $x_{I\!P}\sigma_r^{D(3)}(x_{I\!P}, \beta, Q^2)$ is shown as a function of $x_{I\!P}$ for fixed β and Q^2. Here and elsewhere, inner error bars represent statistical errors, outer error bars correspond to the total error, given by the quadratic sum of statistical and systematic errors. Normalization uncertainties, which are of the order of $6-8\%$ for each data set, are not shown. Also shown is the prediction for $x_{I\!P}\sigma_r^{D(3)}$ for $\sqrt{s} = 319$ GeV from the NLO QCD fit [2] (solid curves) performed to the medium Q^2 data. The fit is shown for $Q^2 > Q_0^2 = 3$ GeV^2 and $M_X > 2$ GeV. The fit extrapolation to low ($Q^2 < 6.5$ GeV^2) and high ($Q^2 > 120$ GeV^2) values of Q^2 is shown as dotted curves.

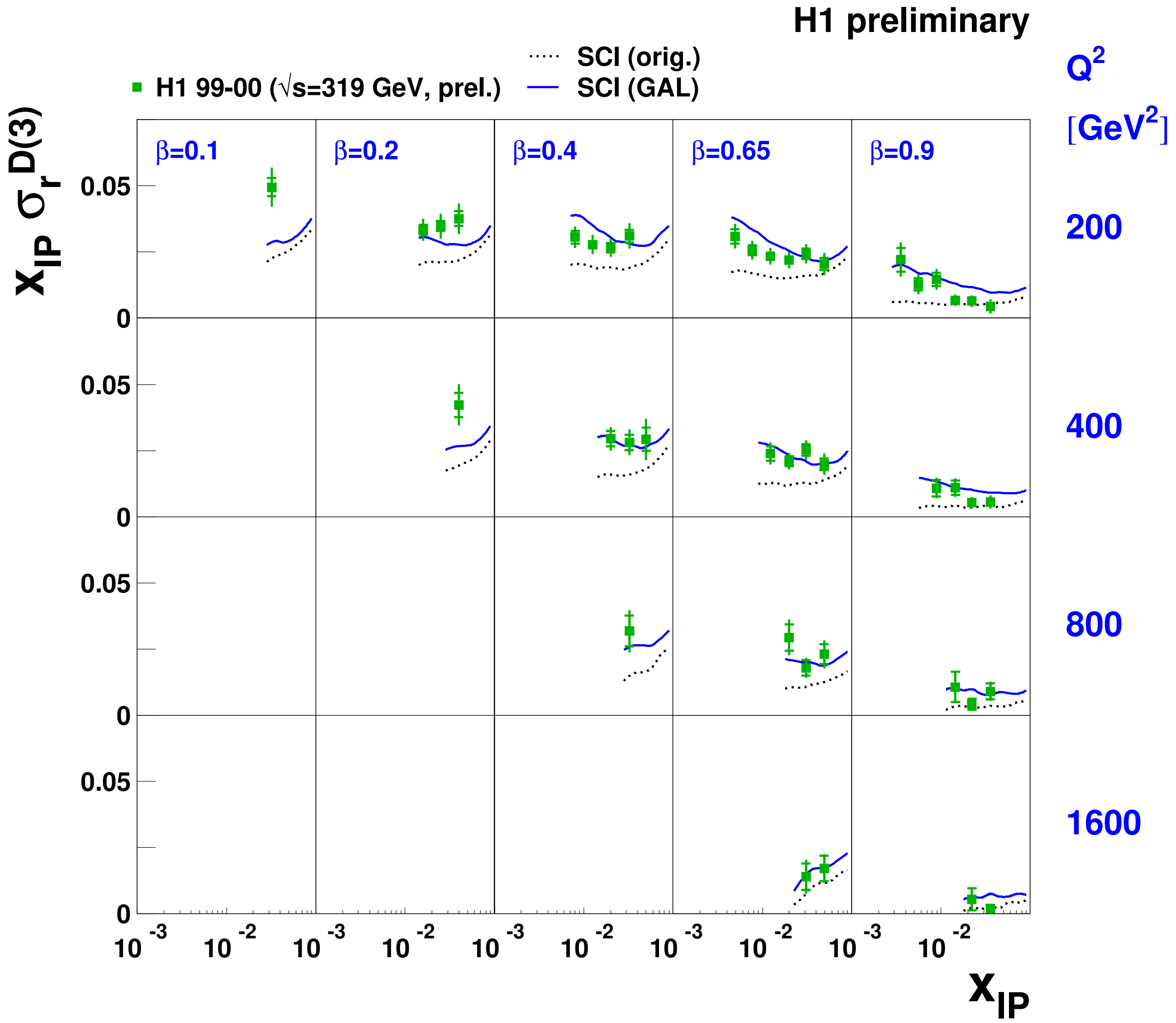

Figure 2: The measured reduced cross section $x_{I\!P}\sigma_r^{D(3)}$, plotted as a function of $x_{I\!P}$ at fixed (β, Q^2) (green data points). The data are compared with the predictions of the original Soft Colour Interactions (SCI) model [3] (dashed curves) and its refinement based on a generalized area law (solid curves) [4], both obtained with the LEPTO 6.5 MC generator and using CTEQ5L proton pdf's.

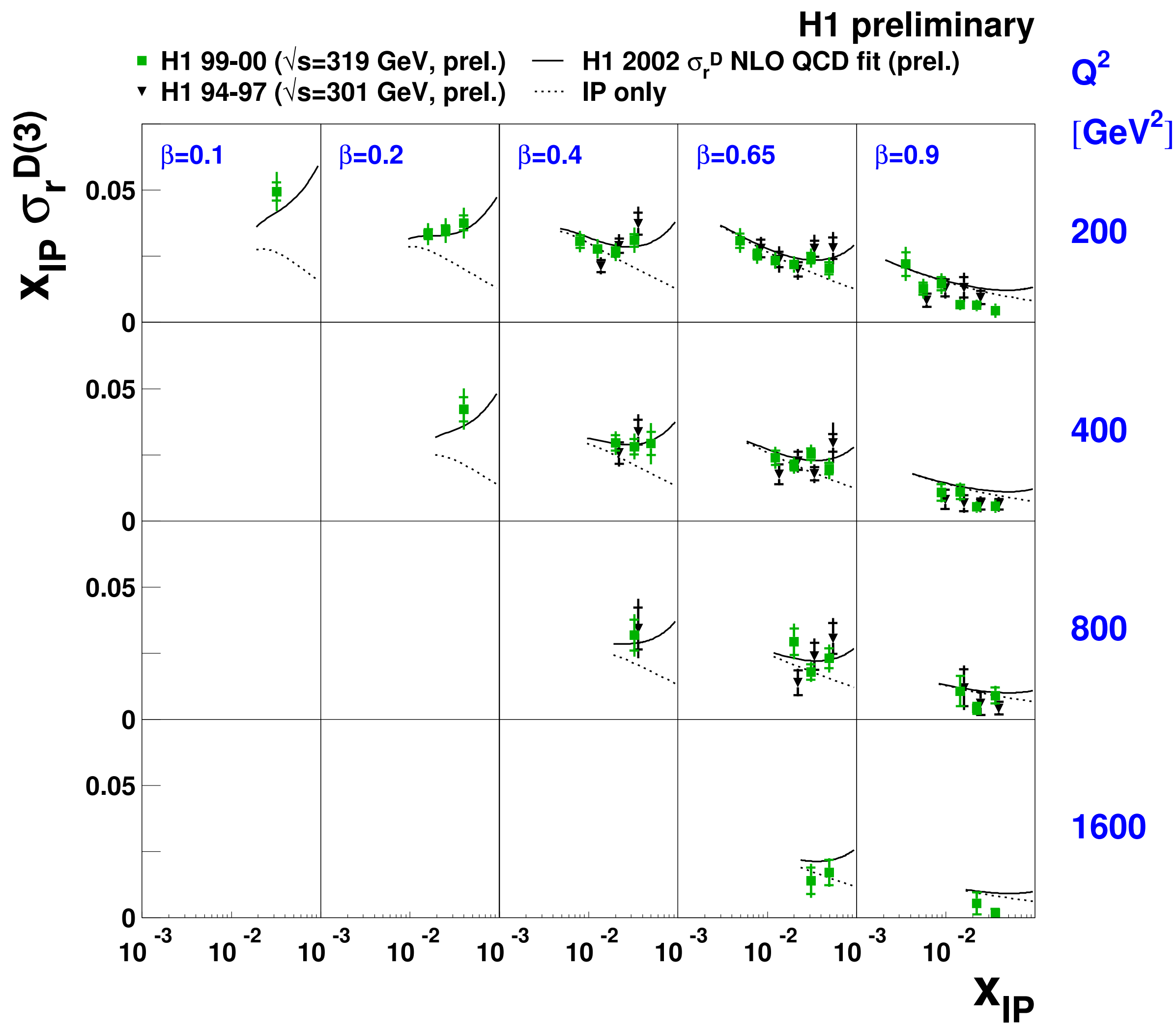

Figure 3: The measured reduced cross section $x_{I\!P}\sigma_r^{D(3)}$, plotted as a function of $x_{I\!P}$ at fixed (β, Q^2) from the present measurement (green data points), compared with the previous H1 preliminary measurement based on 1994-1997 data [5] (released for ICHEP Vancouver 1998, black triangles, scaled horizontally by a factor 1.1 for better visibility). Also shown is the prediction for $x_{I\!P}\sigma_r^{D(3)}$ for $\sqrt{s} = 319$ GeV from the NLO QCD fit [2] performed to the medium Q^2 data. The solid curves correspond to the sum of "Pomeron" and "Reggeon" exchange contributions in the fit, whereas the dotted curves represent the contribution from "Pomeron" exchange alone.

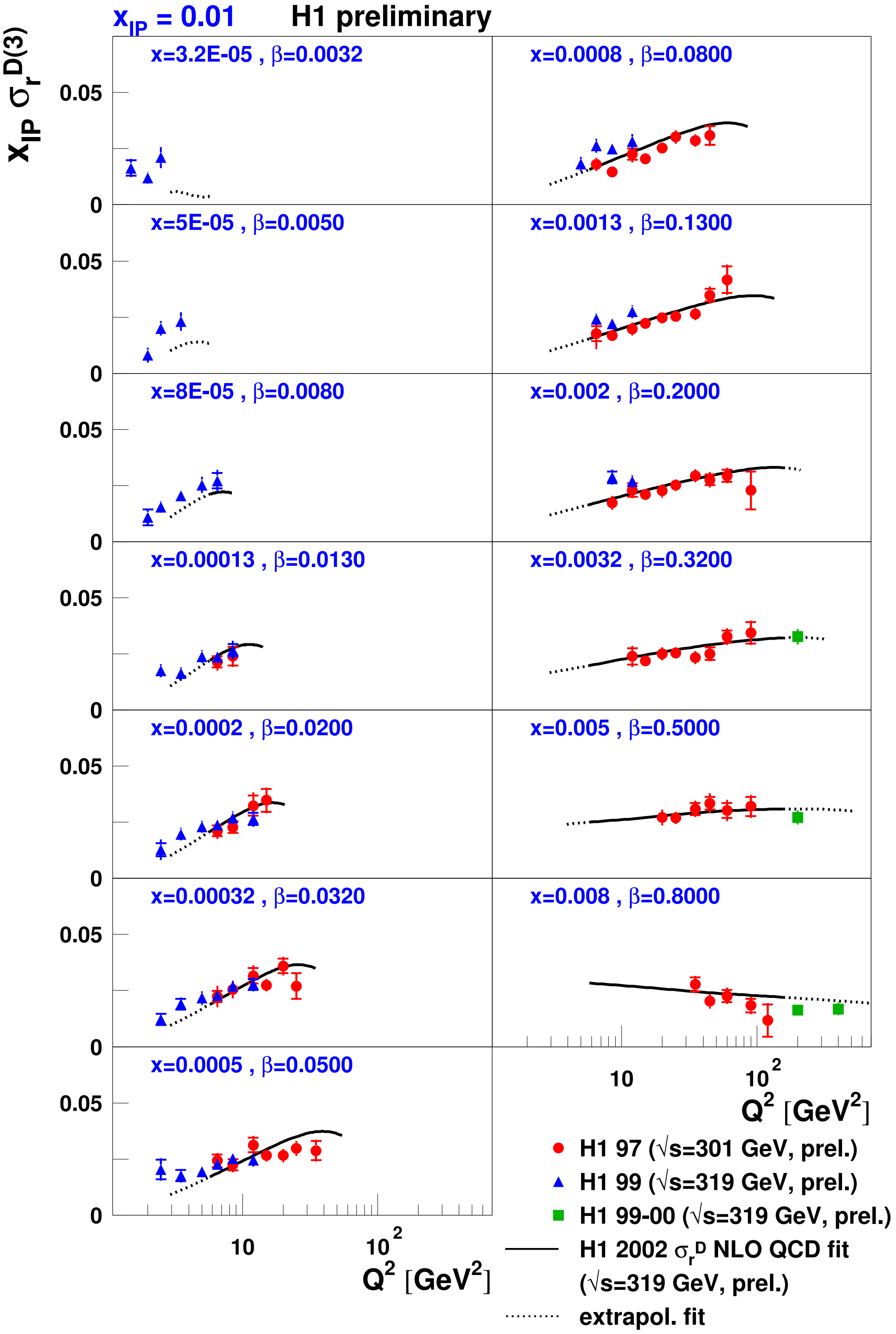

Figure 4: Reduced cross section $\sigma_r^{D(3)}$ from this measurement (green boxes) shown together with recent H1 measurements at lower Q^2 (blue triangles and red points). $x_{I\!P}\sigma_r^{D(3)}(x_{I\!P}, \beta, Q^2)$ is shown as a function of Q^2 at fixed x or β and $x_{I\!P} = 0.01$. Also shown is the prediction for $x_{I\!P}\sigma_r^{D(3)}$ for $\sqrt{s} = 319$ GeV from the NLO QCD fit performed to the medium Q^2 data.

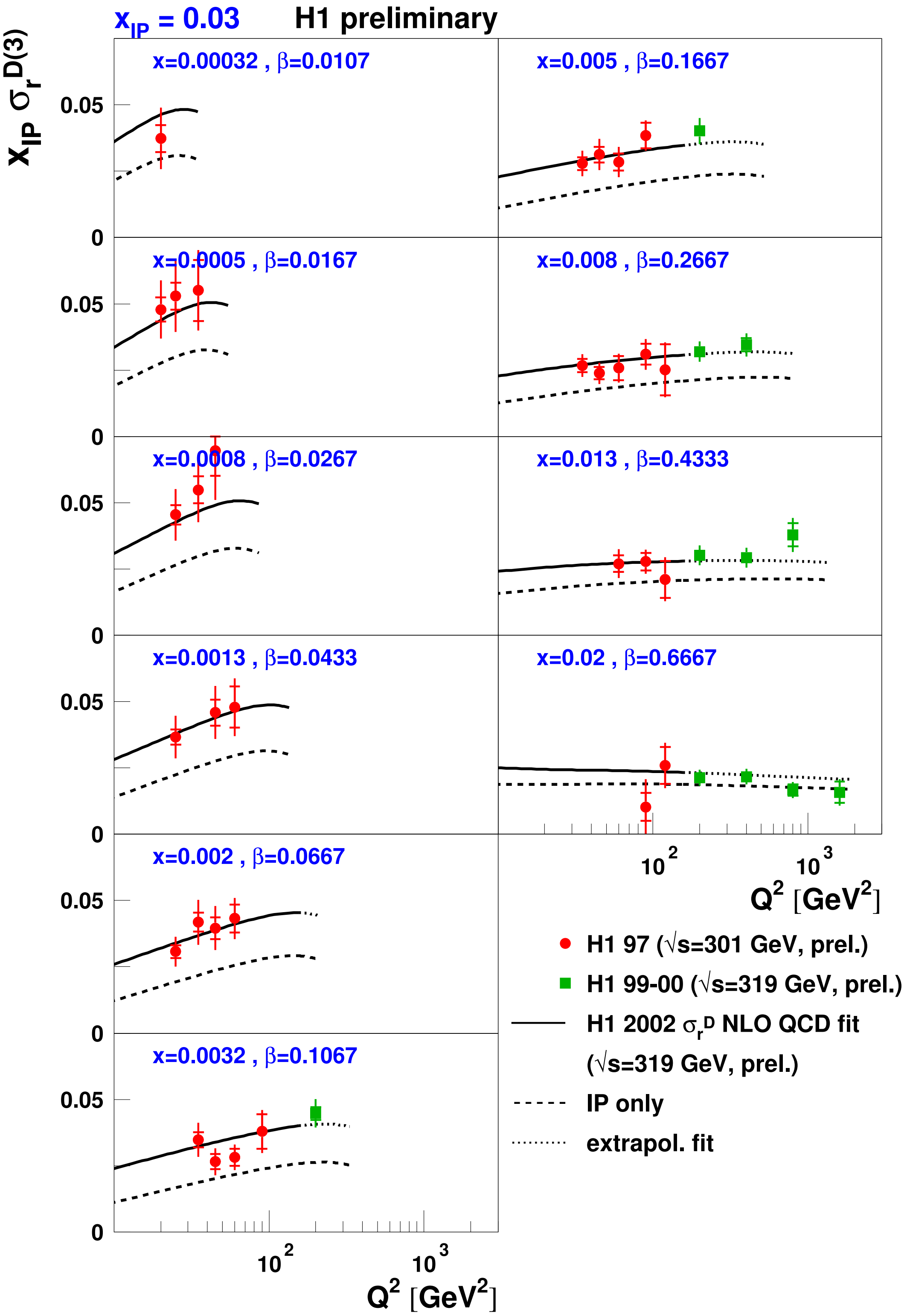

Figure 5: Reduced cross section $\sigma_r^{D(3)}$ from this measurement (green boxes) shown together with recent H1 measurements at lower Q^2 (red points). $x_{I\!P}\sigma_r^{D(3)}(x_{I\!P}, \beta, Q^2)$ is shown as a function of Q^2 at fixed x or β and $x_{I\!P} = 0.03$. Also shown is the prediction for $x_{I\!P}\sigma_r^{D(3)}$ for $\sqrt{s} = 319$ GeV from the NLO QCD fit performed to the medium Q^2 data.

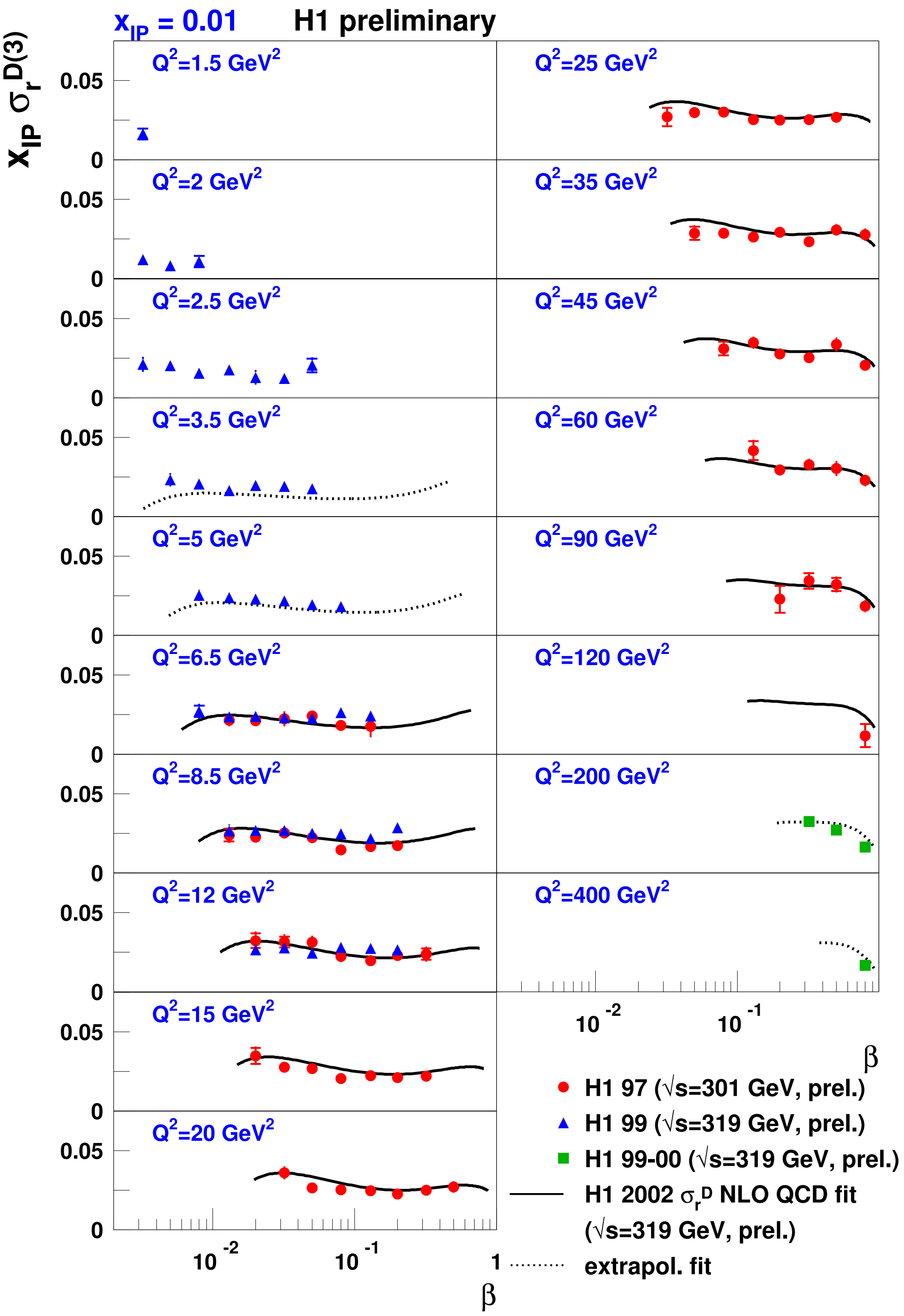

Figure 6: Reduced cross section $\sigma_r^{D(3)}$ from this measurement (green boxes) shown together with recent H1 measurements at lower Q^2 (blue triangles and red points). $x_{I\!P}\sigma_r^{D(3)}(x_{I\!P}, \beta, Q^2)$ is shown as a function of β at fixed Q^2 and $x_{I\!P} = 0.01$. Also shown is the prediction for $x_{I\!P}\sigma_r^{D(3)}$ for $\sqrt{s} = 319$ GeV from the NLO QCD fit performed to the medium Q^2 data.

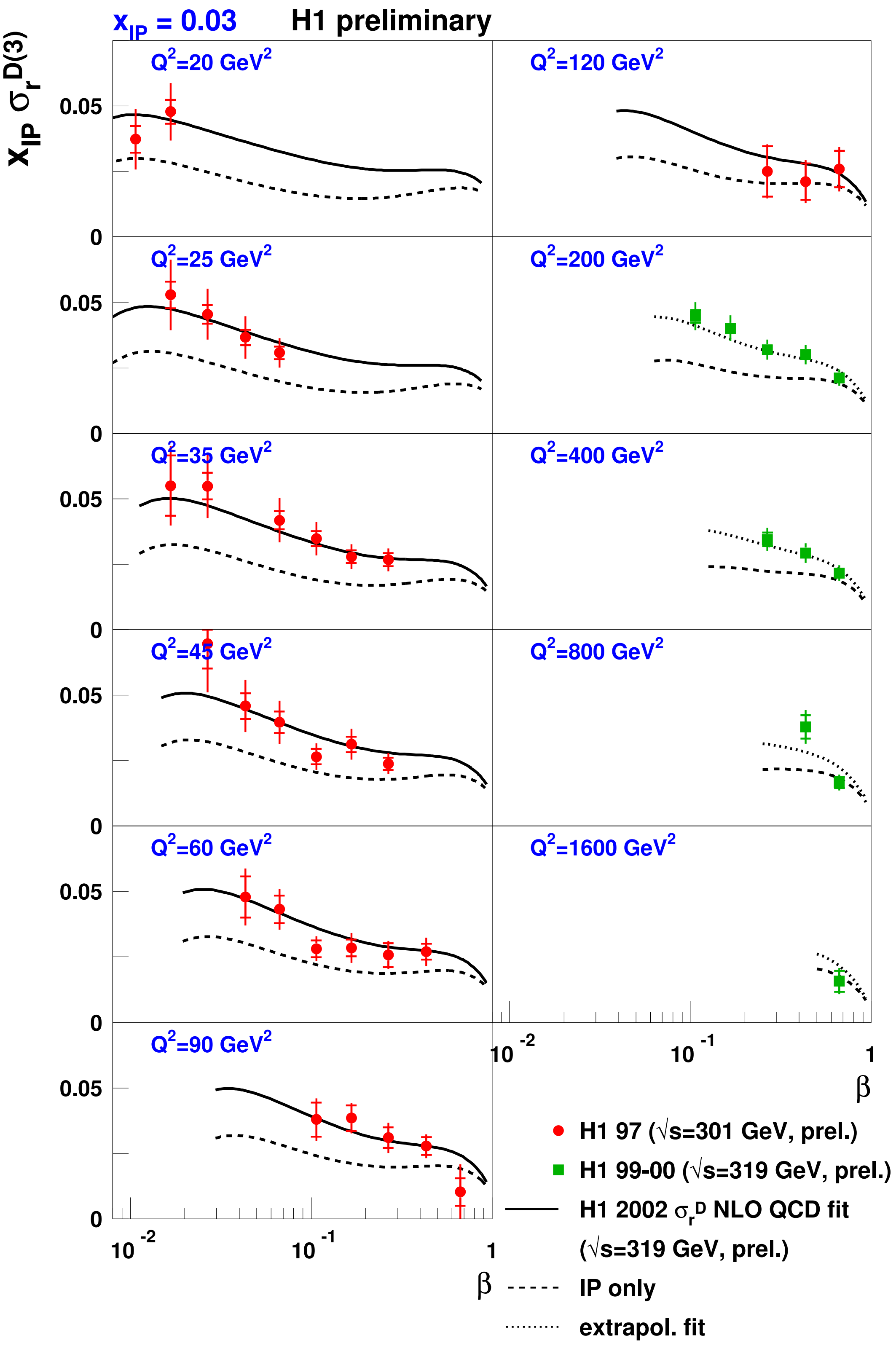

Figure 7: Reduced cross section $\sigma_r^{D(3)}$ from this measurement (green boxes) shown together with recent H1 measurements at lower Q^2 (red points). $x_{I\!P}\sigma_r^{D(3)}(x_{I\!P}, \beta, Q^2)$ is shown as a function of β at fixed Q^2 and $x_{I\!P} = 0.03$. Also shown is the prediction for $x_{I\!P}\sigma_r^{D(3)}$ for $\sqrt{s} =$ 319 GeV from the NLO QCD fit performed to the medium Q^2 data.

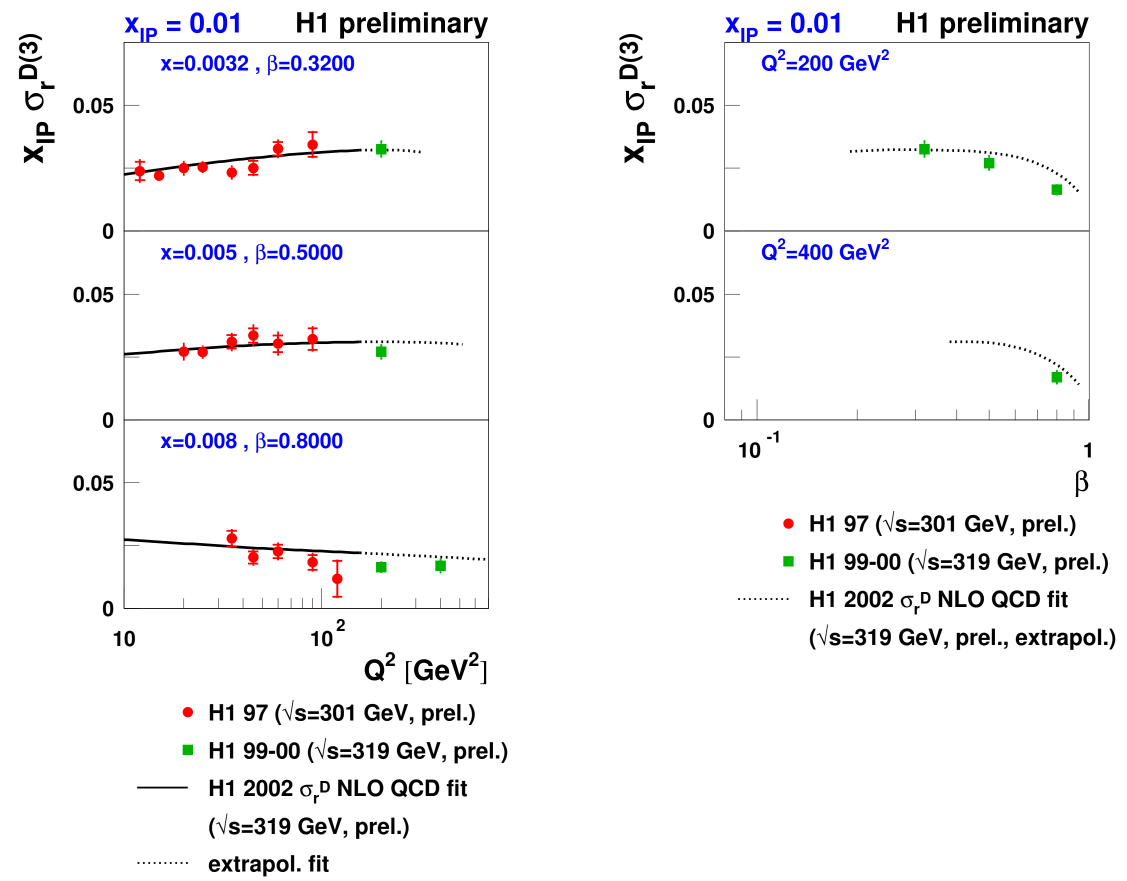

Figure 8: Reduced cross section $\sigma_r^{D(3)}$ at fixed $x_{I\!P} = 0.01$ from this measurement (green boxes) shown together with recent H1 measurements at lower Q^2 (red points). $x_{I\!P}\sigma_r^{D(3)}(x_{I\!P}, \beta, Q^2)$ is shown as a function of Q^2 at fixed x or β (left) and as a function of β at fixed Q^2 (right). Also shown is the prediction for $x_{I\!P}\sigma_r^{D(3)}$ for $\sqrt{s} = 319$ GeV from the NLO QCD fit performed to the medium Q^2 data.

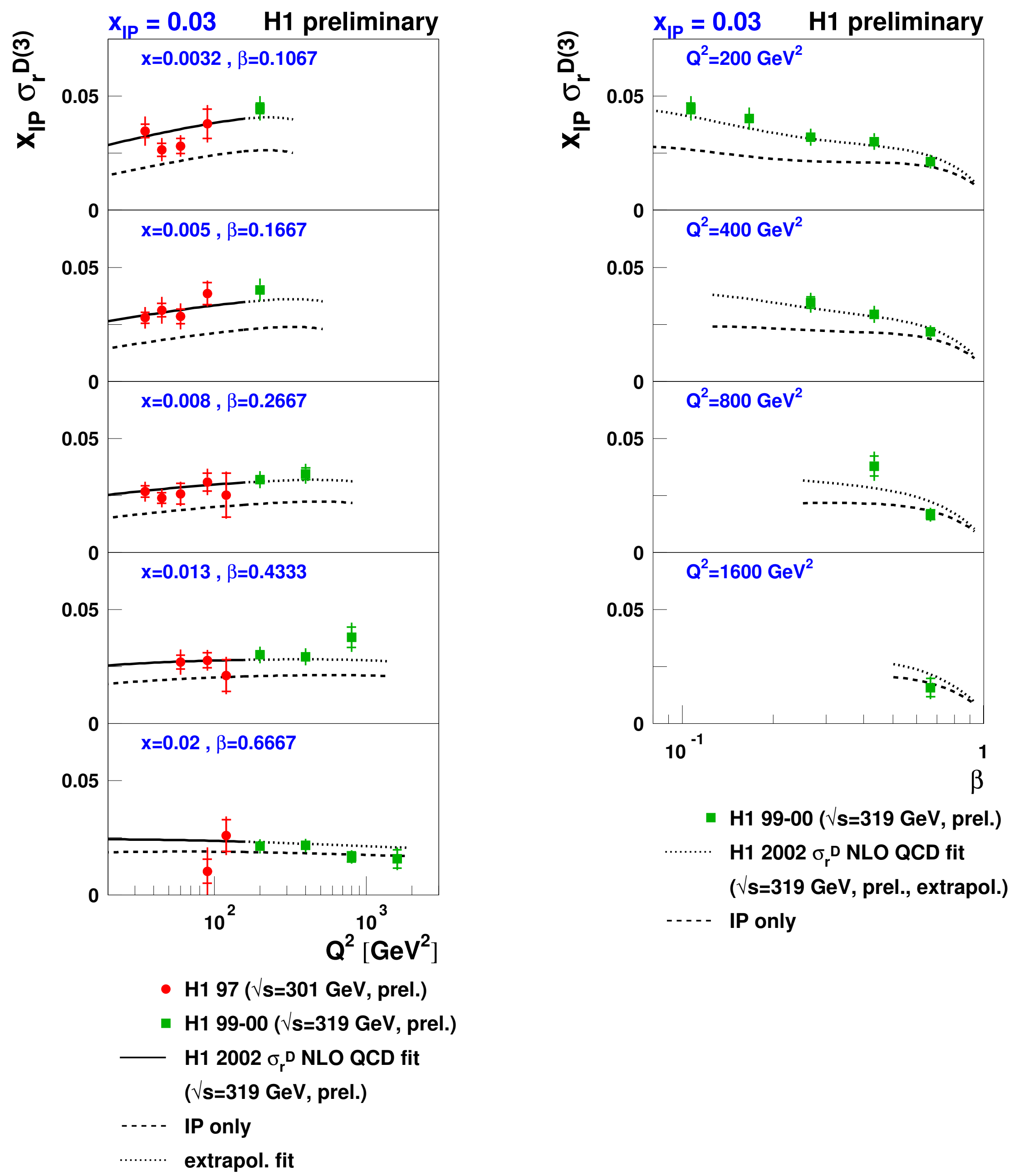

Figure 9: Reduced cross section $\sigma_r^{D(3)}$ at fixed $x_{I\!P} = 0.03$ from this measurement (green boxes) shown together with recent H1 measurements at lower Q^2 (red points). $x_{I\!P}\sigma_r^{D(3)}(x_{I\!P}, \beta, Q^2)$ is shown as a function of Q^2 at fixed x or β (left) and as a function of β at fixed Q^2 (right). Also shown is the prediction for $x_{I\!P}\sigma_r^{D(3)}$ for $\sqrt{s} = 319$ GeV from the NLO QCD fit performed to the medium Q^2 data.

References

[1] H1 Collaboration, ”Measurement of the Diffractive DIS Cross Section at low Q2”, paper **981** subm. to ICHEP 2002 (Amsterdam). [H1prelim-02-112]

[2] H1 Collaboration, ”Measurement and NLO DGLAP QCD Interpretation of Diffractive Deep-Inelastic Scattering at HERA”, paper **980** subm. to ICHEP 2002 (Amsterdam). [H1prelim-02-012]

[3] A. Edin, G. Ingelman, J. Rathsman, *Phys. Lett.* **B 366** (1996) 371;
A. Edin, G. Ingelman, J. Rathsman, *Z. Phys.* **C 75** (1997) 57.

[4] J. Rathsman, *Phys. Lett.* **B 452** (1999) 364.

[5] H1 Collaboration ”Measurements of the diffractive structure function $F_2^{D(3)}$ at low and high Q^2 at HERA, paper no. **571** subm. to ICHEP 1998 (Vancouver). [H1prelim-98-571]