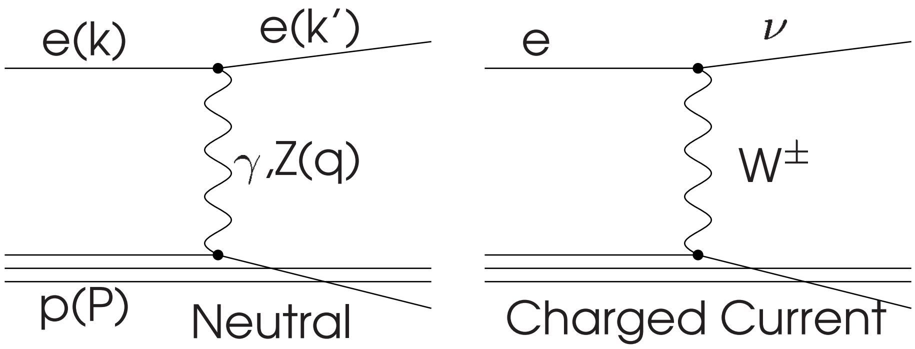
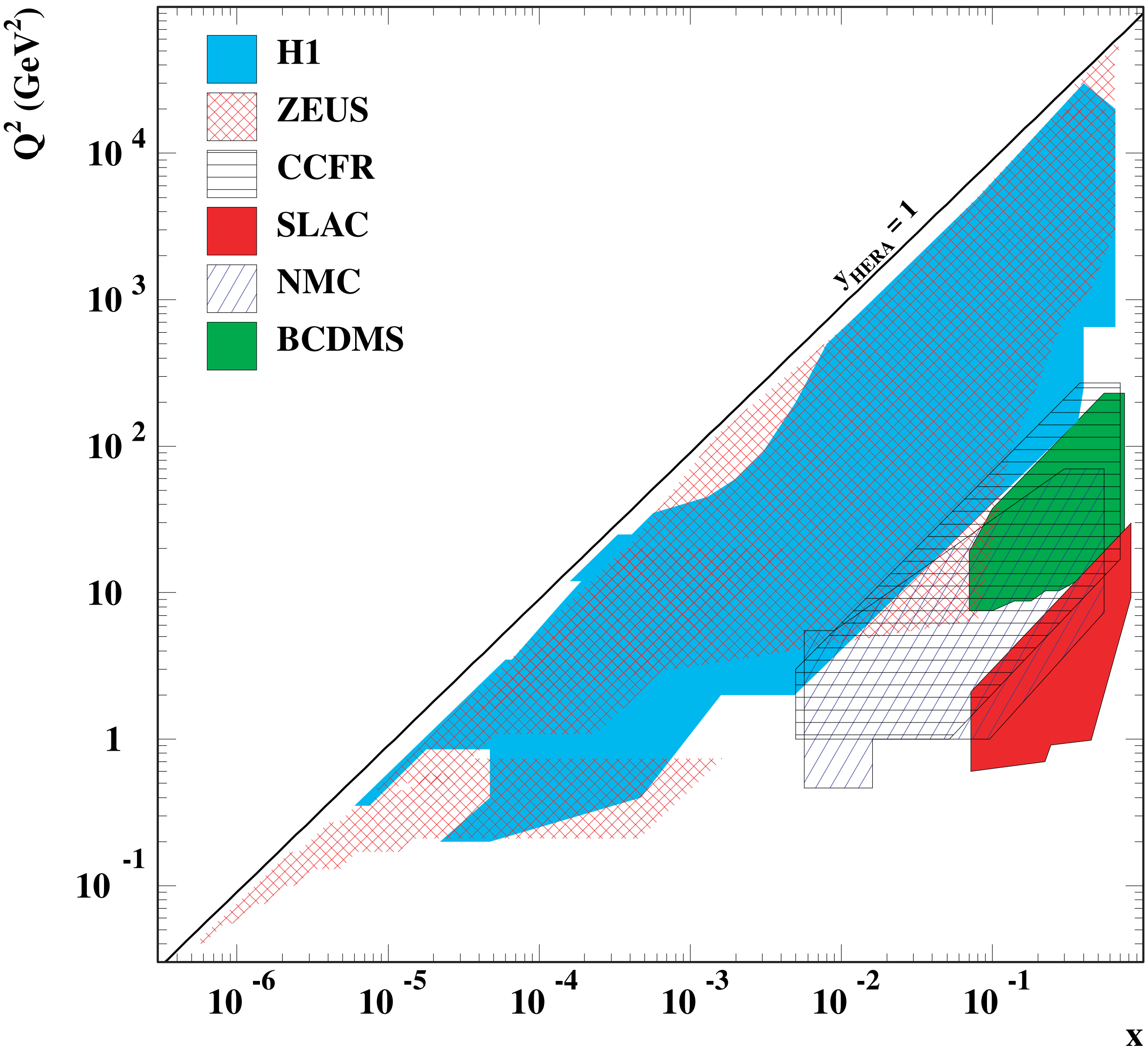
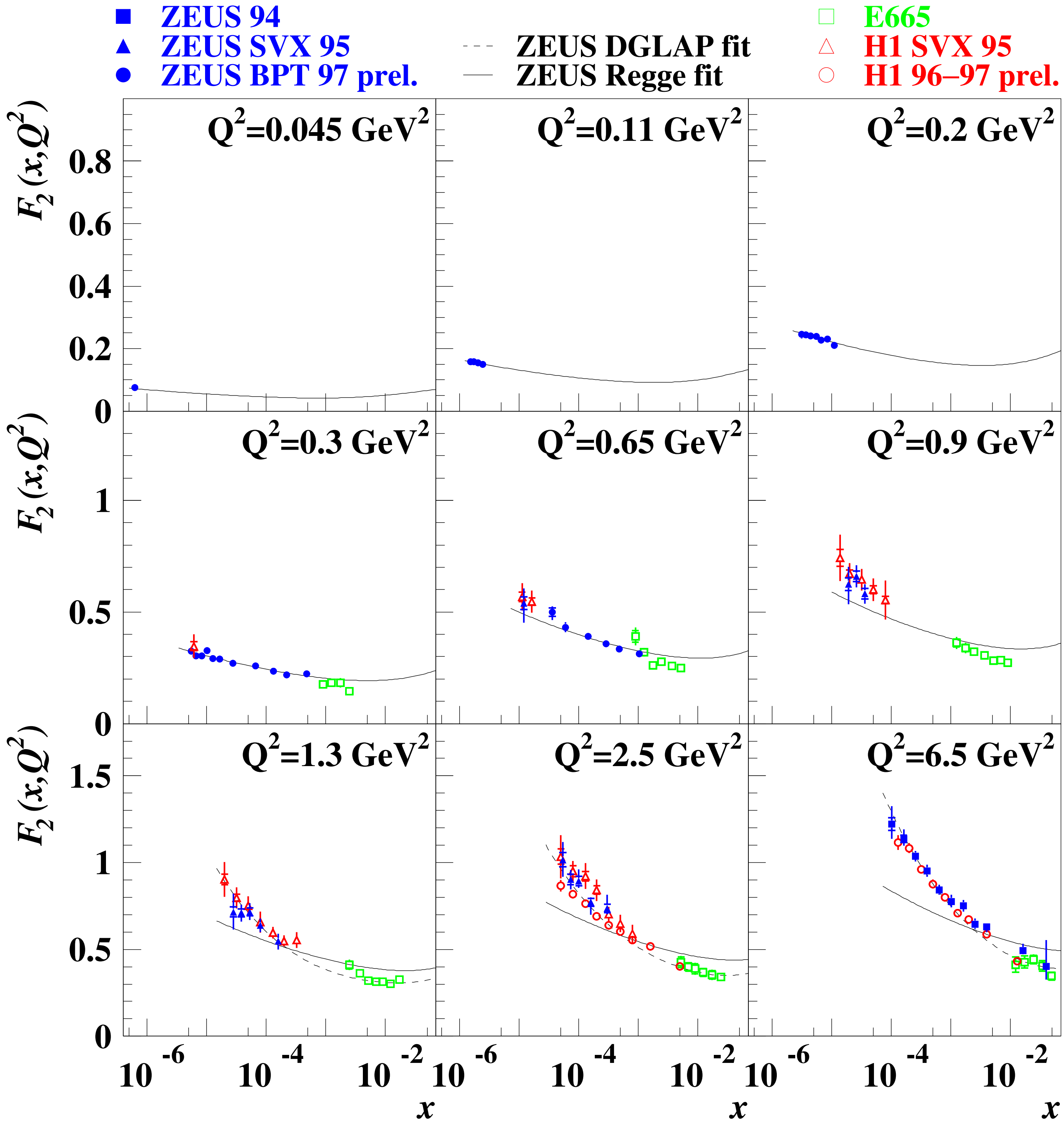
Deep Inelastic Scattering



$$s = (k+P)^2$$
$$Q^2 = -q^2$$
$$x = Q^2/(2Pq)$$
$$Q^2 = xys, W^2 = ys$$

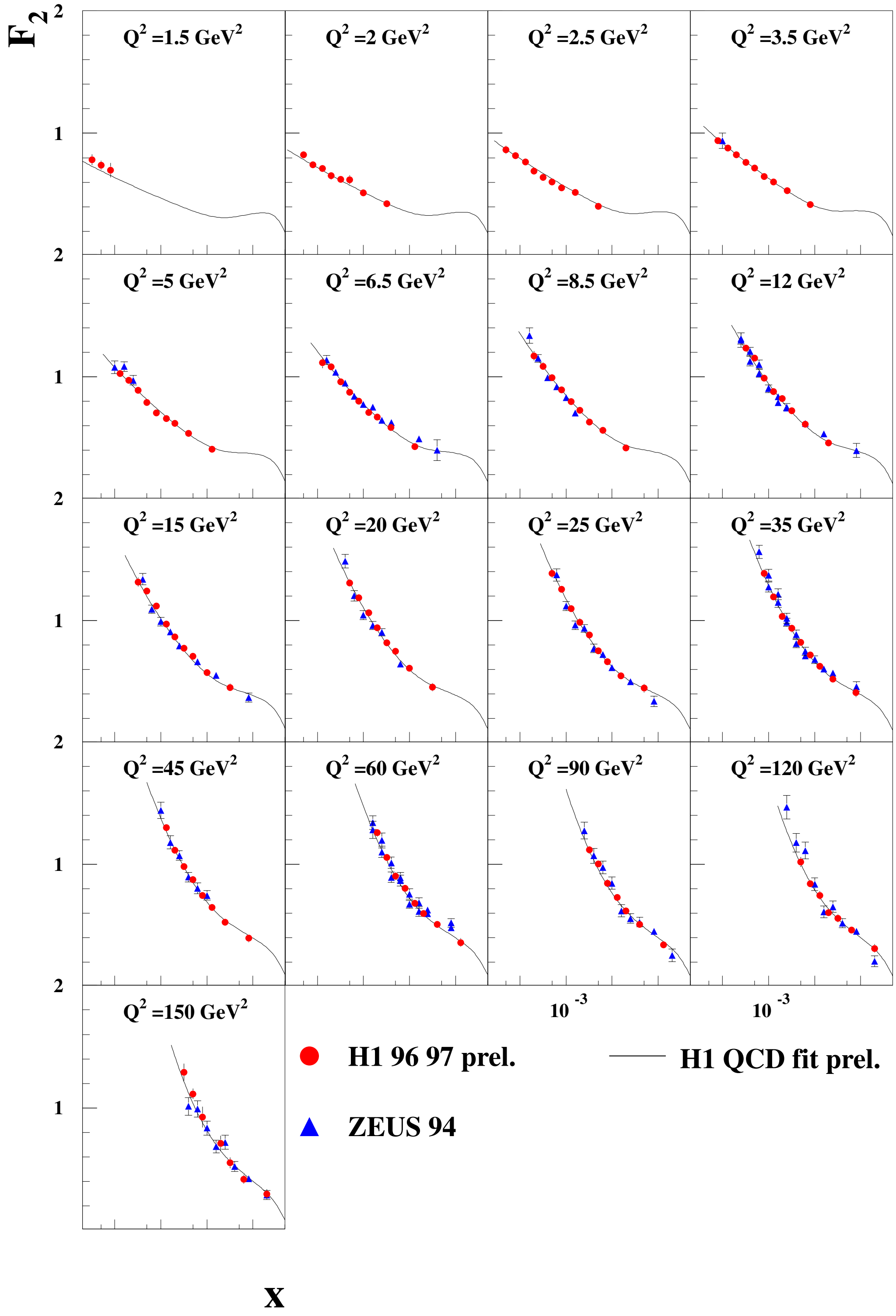


Proton Structure Function F_2 at small Q^2



Proton Structure Function F_2

$$\frac{d^2\sigma^{\rm NC}(e^+p)}{dx dQ^2} = \frac{2\pi\alpha^2}{xQ^4}\left[Y_+ F_2^{\rm NC}(x,Q^2) - Y_-\, xF_3^{\rm NC}(x,Q^2)\right]$$



Analysis of F_2: derivatives

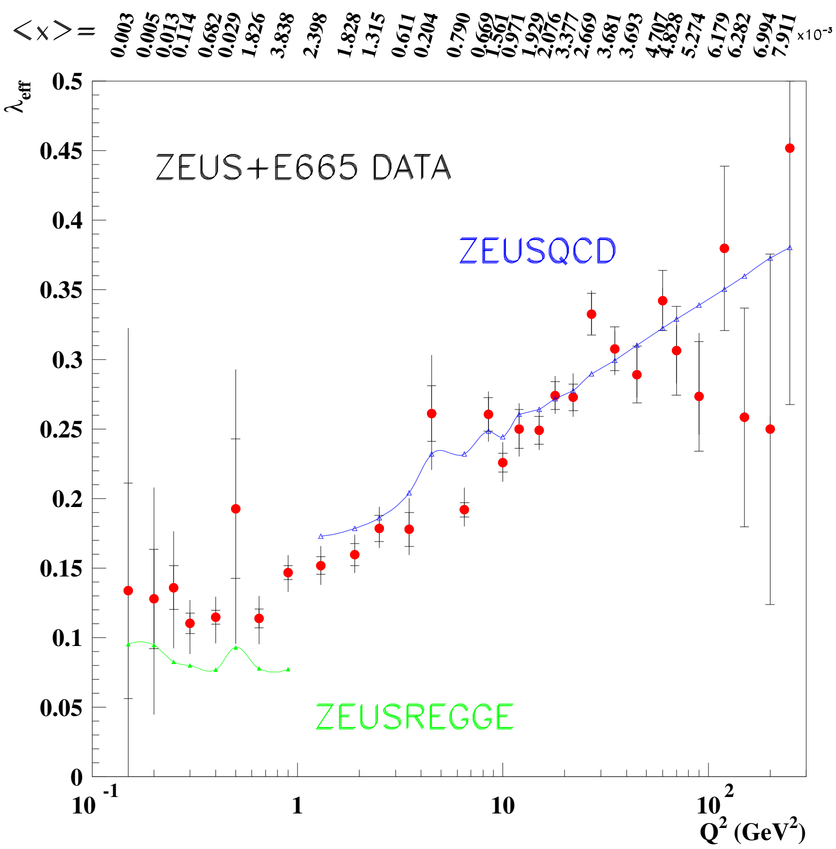
Slopes of F_2 contain a lot of information

$d \ln F_2 / d \ln(1/x)$

at small x,

at fixed Q^2

fit $F_2 \sim x^{-\lambda_{eff}}$

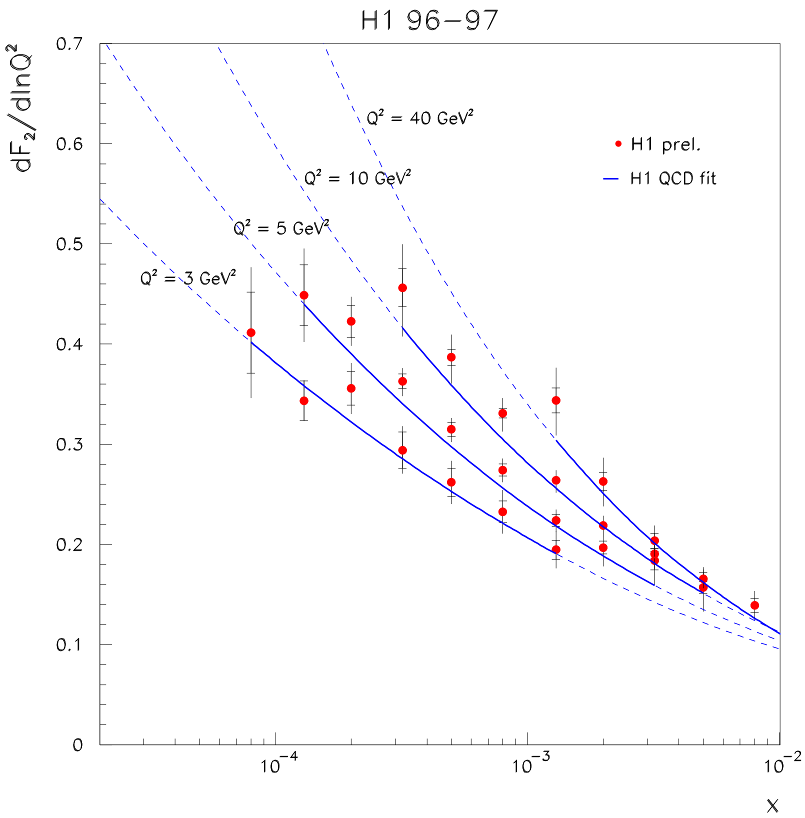


At fixed x fit

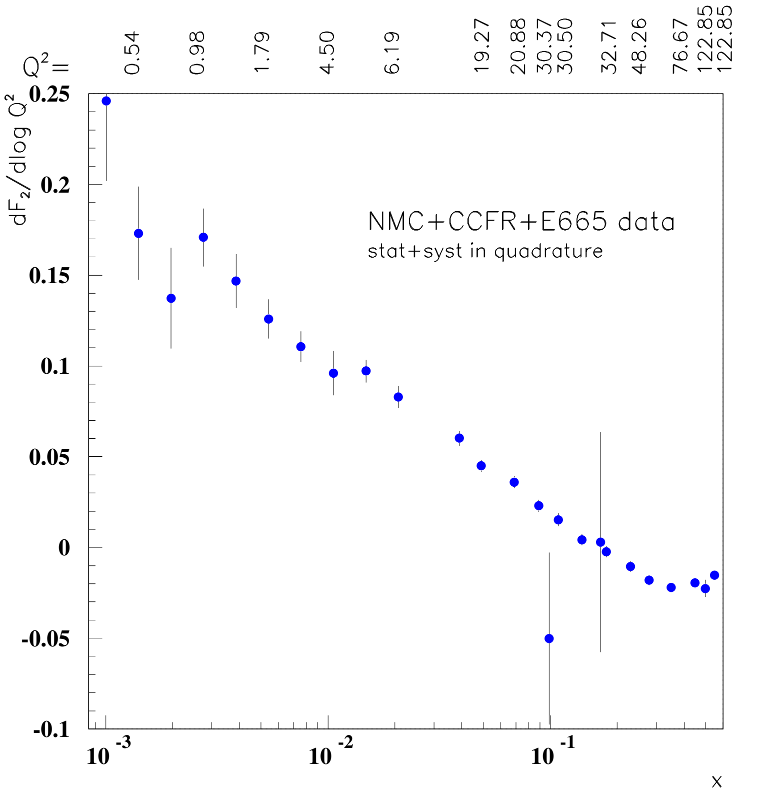
$F_2 = a + b \ln Q^2$

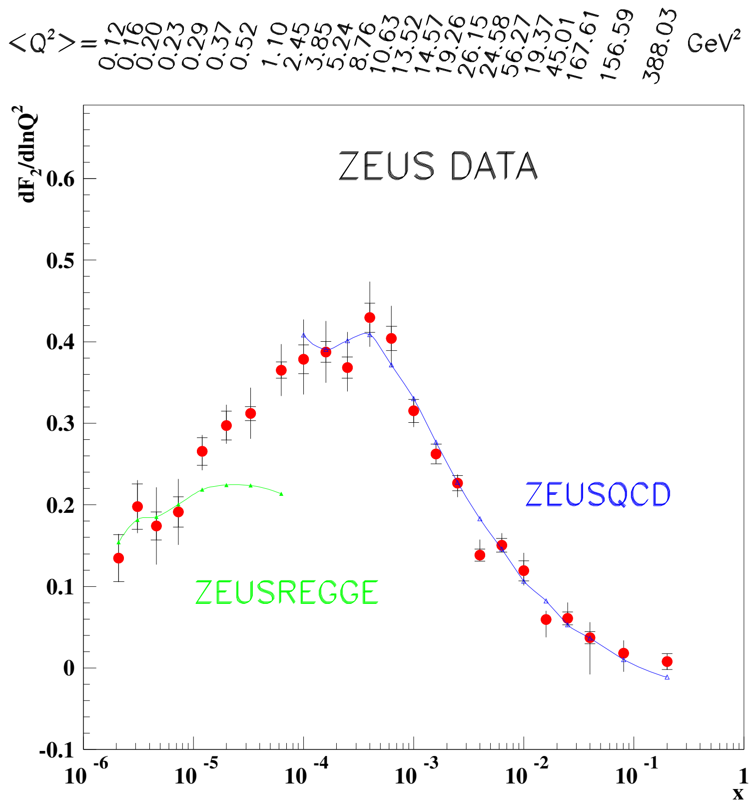
in Q^2 bins

$\hookrightarrow$ but



Analysis of F_2: derivatives cont'd



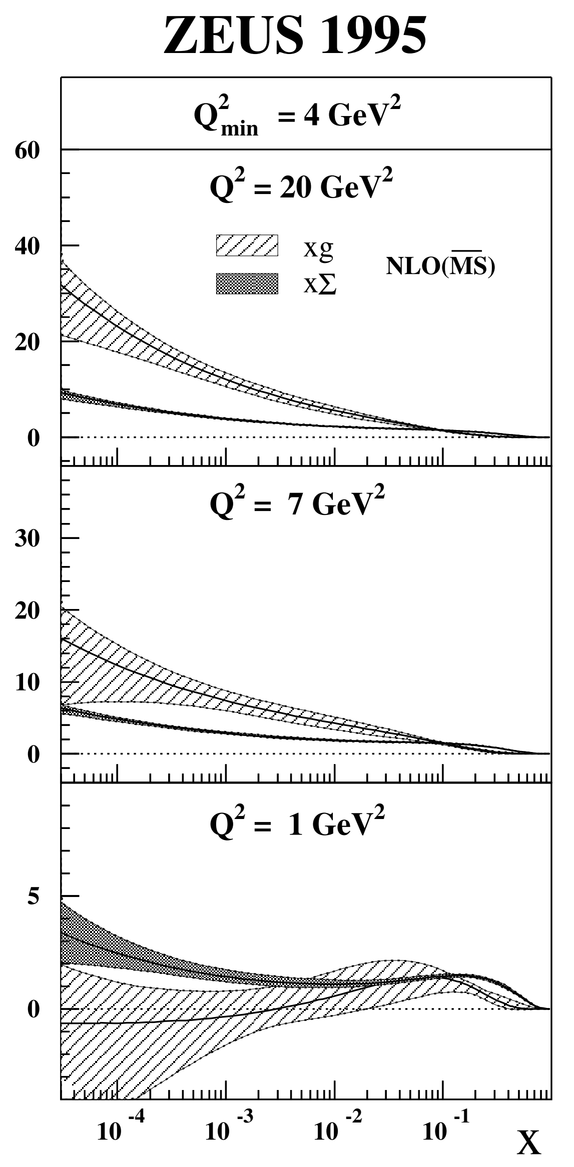


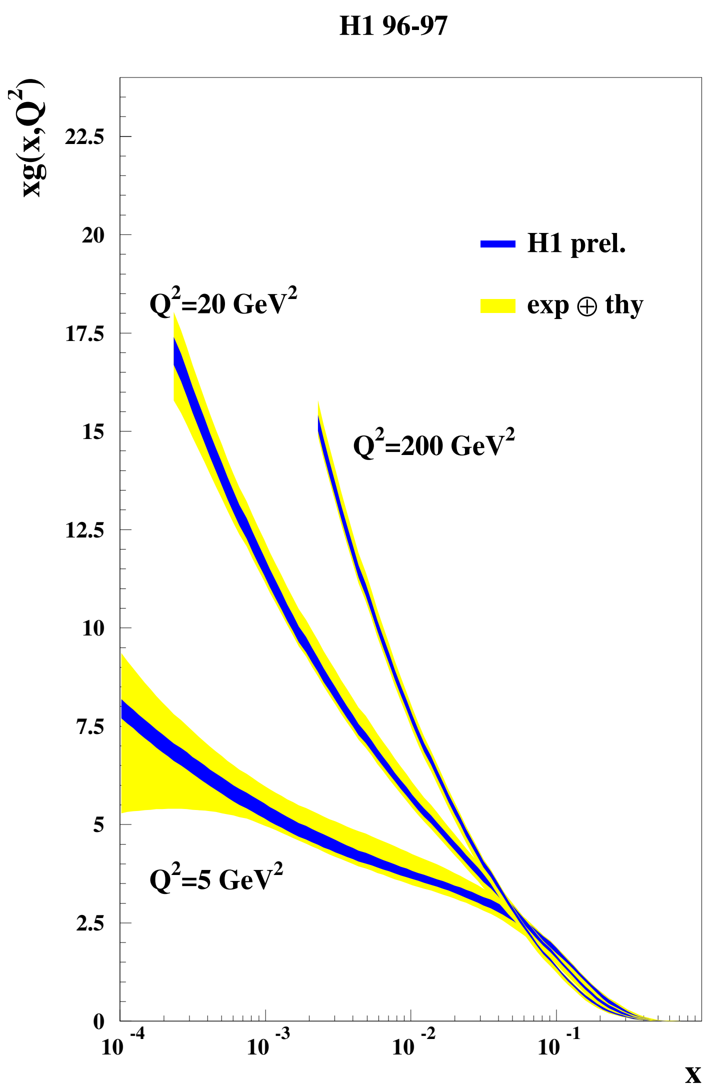
Analysis of F_2: xg(x) and xΣ(x)

Fit to F_2 with input scale Q_0^2 = 7 GeV^2

$$xg(x) = A_g x^{\delta_g}(1-x)^{\eta_g}(1+\gamma_g x)$$

with QCDNUM: NLO in $\overline{\mathrm{MS}}$ scheme

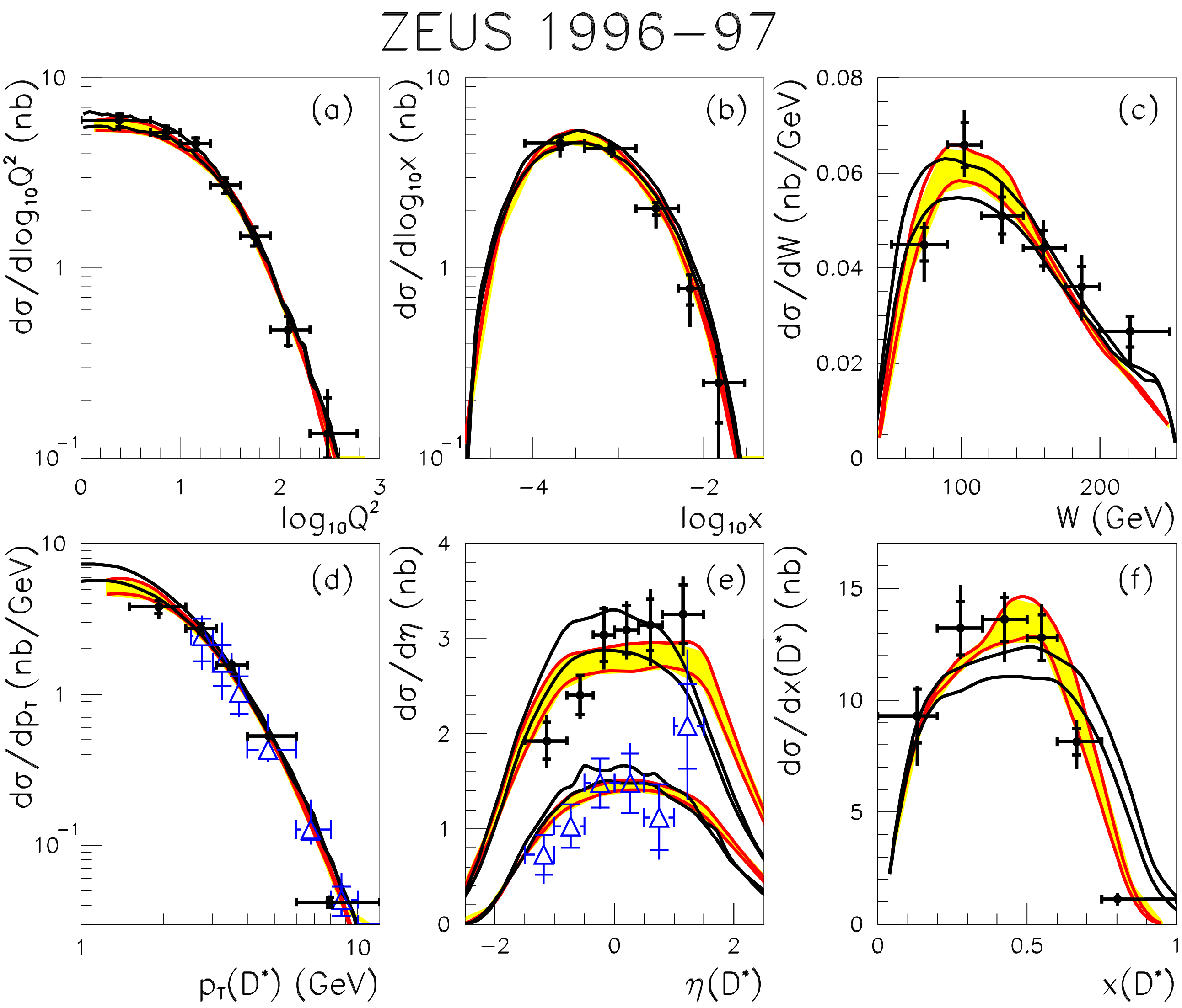




QCD is able to describe F_2 data to $Q^2 \geq$ 1 GeV^2

where $\alpha_s \simeq 0.46$

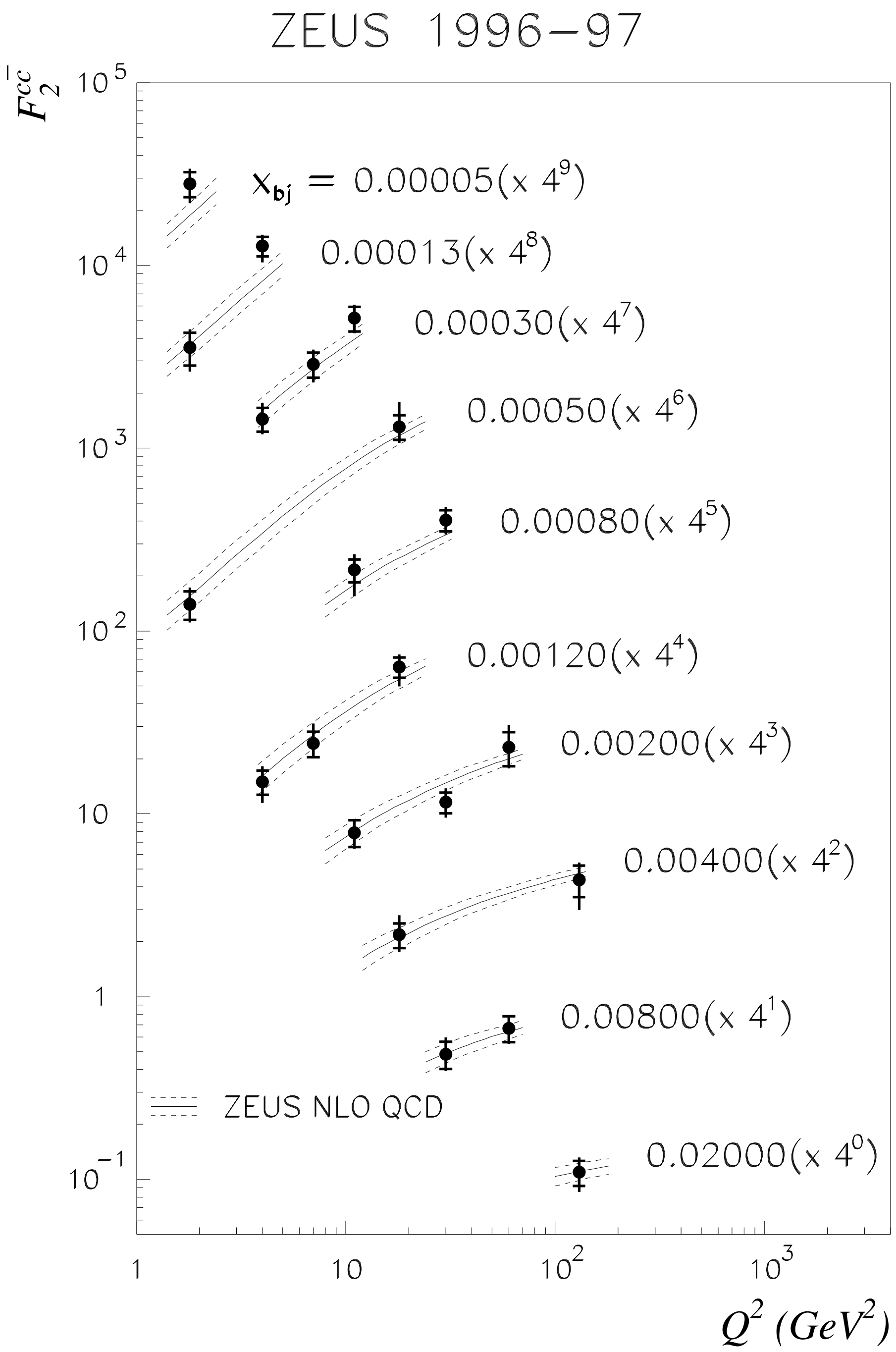
Charm contribution to F_2 from D^*



Fragmentation, "beam drag"

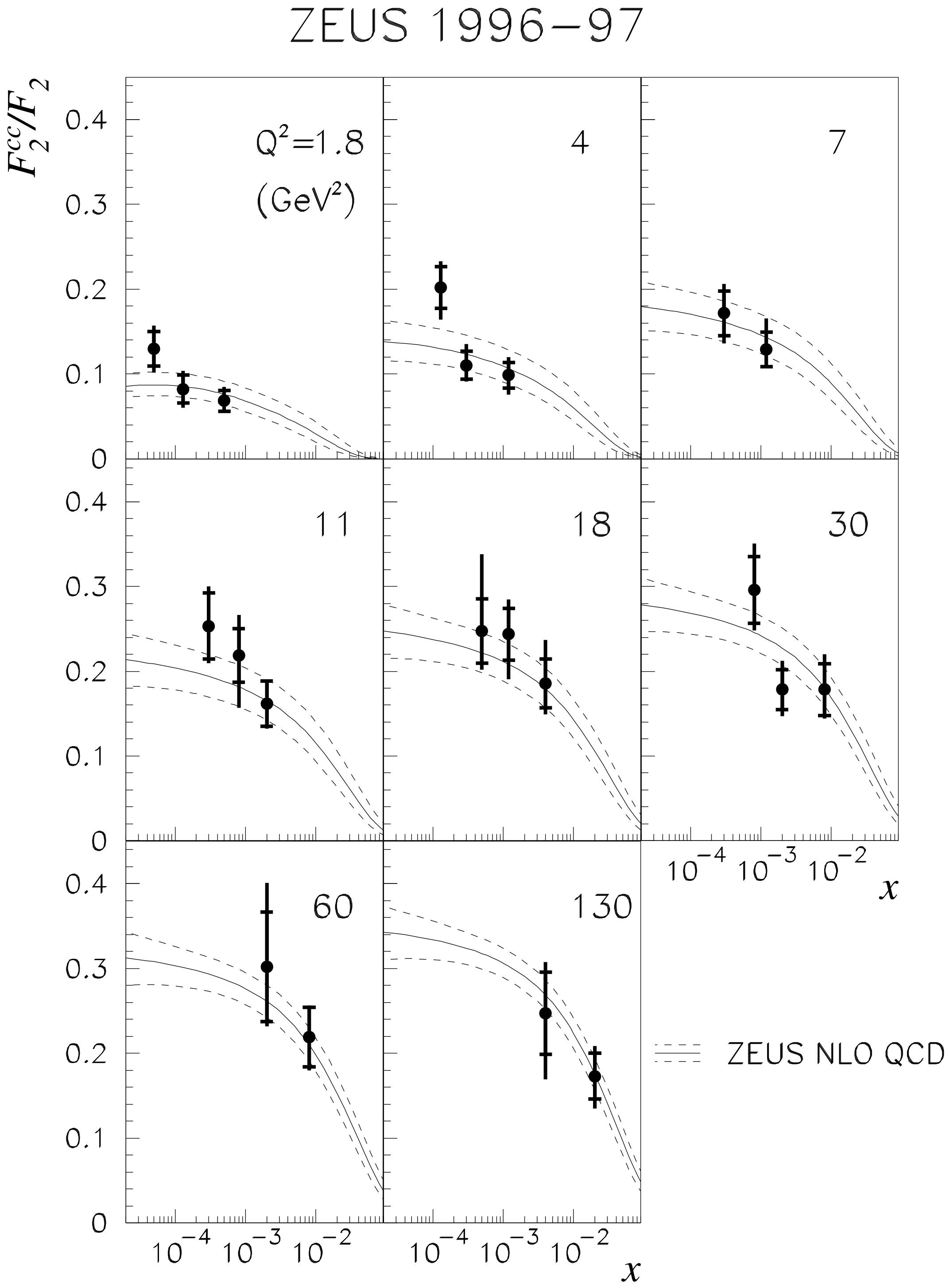
Charm contribution to F_2

Measure $D^{*\pm}$ in DIS (gluon dominated) in 2 decay modes
Determine the cross sections in DIS and D^* variables
Relate the extrapolated double differential cross section to $F_2^{c\bar{c}}$



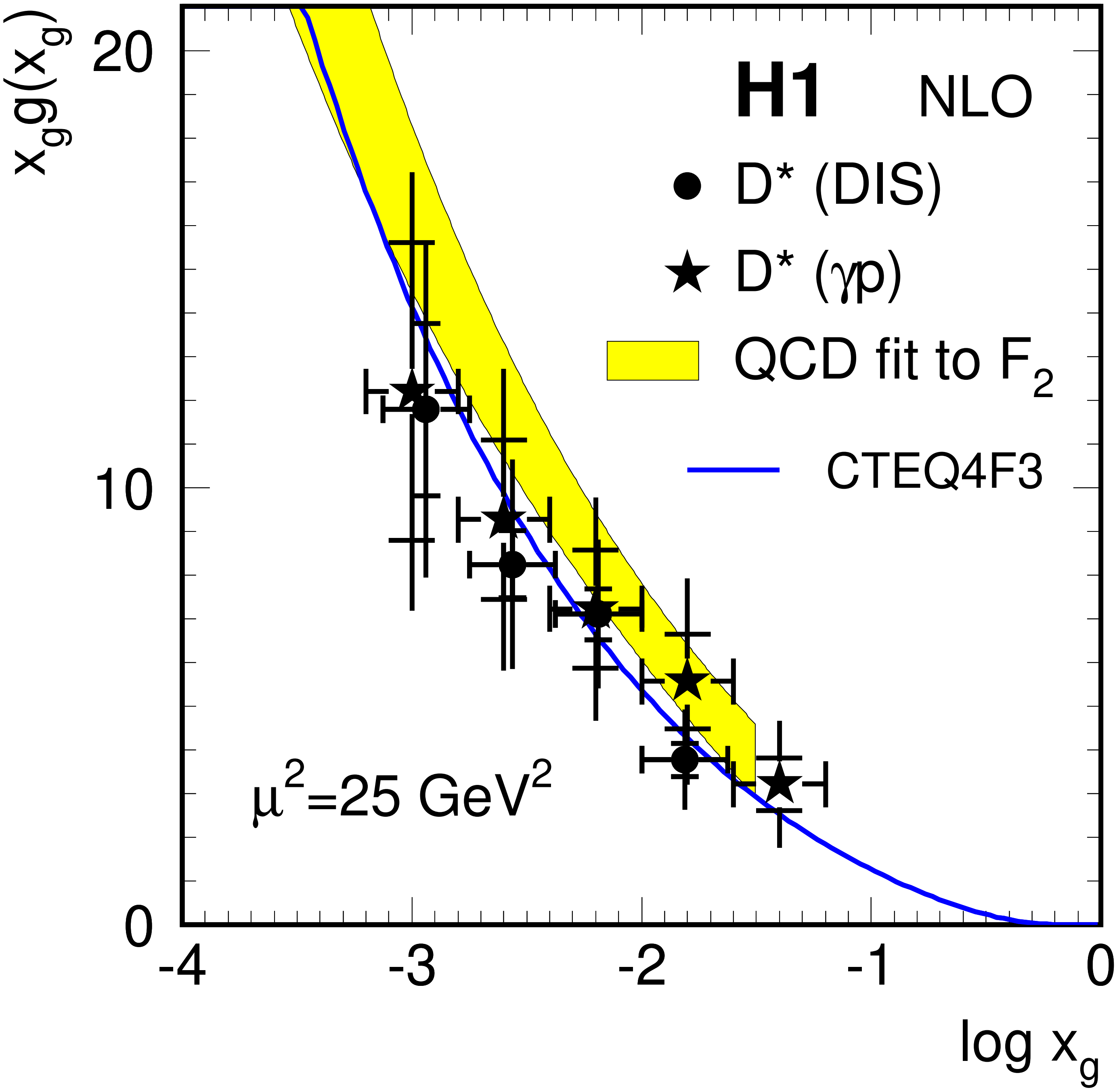
test of QCD: $F_2 \rightarrow x\,g(x), xg \otimes BGF \rightarrow F_2^{c\bar{c}}$
relate to "directly" measured $F_2^{c\bar{c}}$ from σ^{D^*}

Charm contribution to F_2 cont'd

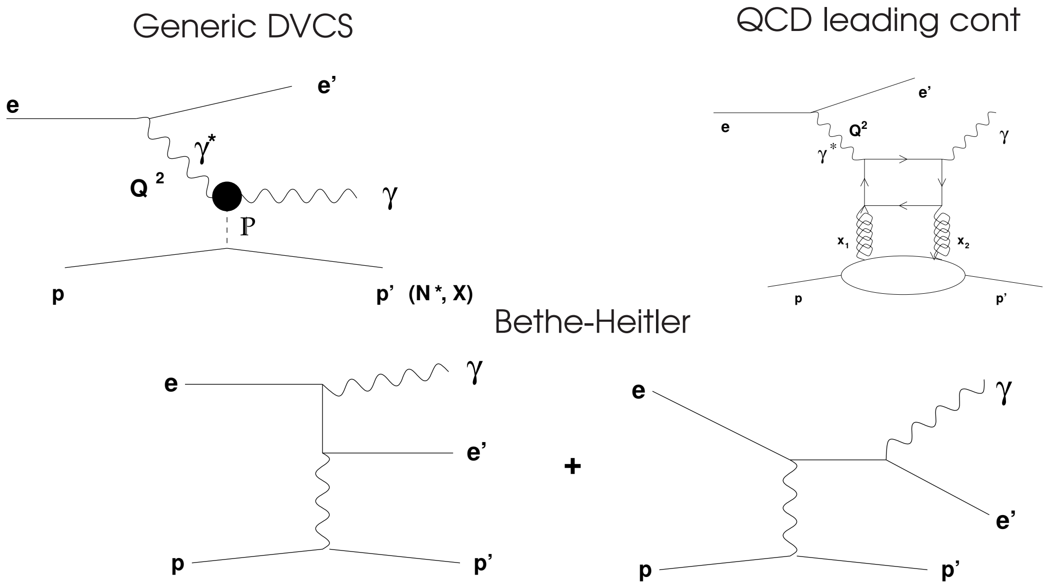


- $F_2^{c\bar{c}}$ rises faster than F_2 (glue dominated)
- $F_2^{c\bar{c}} \approx 25\%\ F_2$ at low x, high Q^2

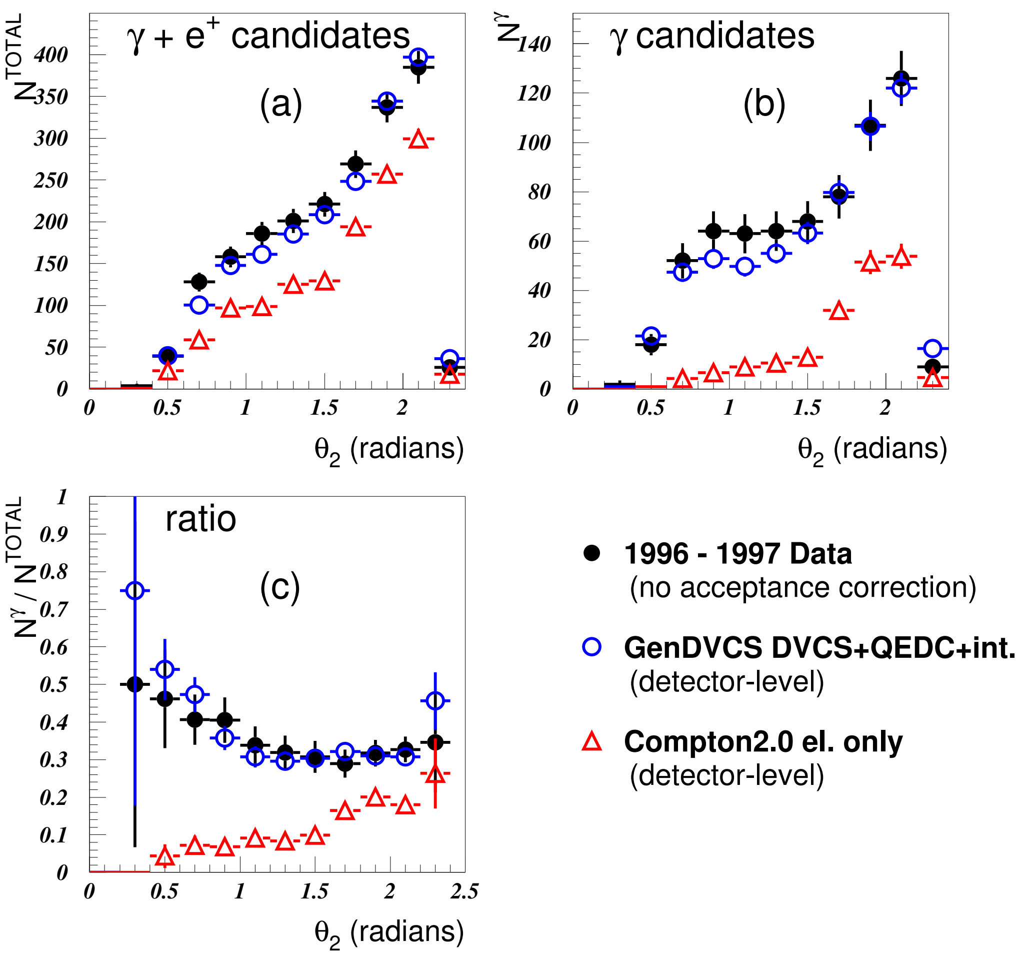
Charm contribution to F_2: extraxt x g(x)



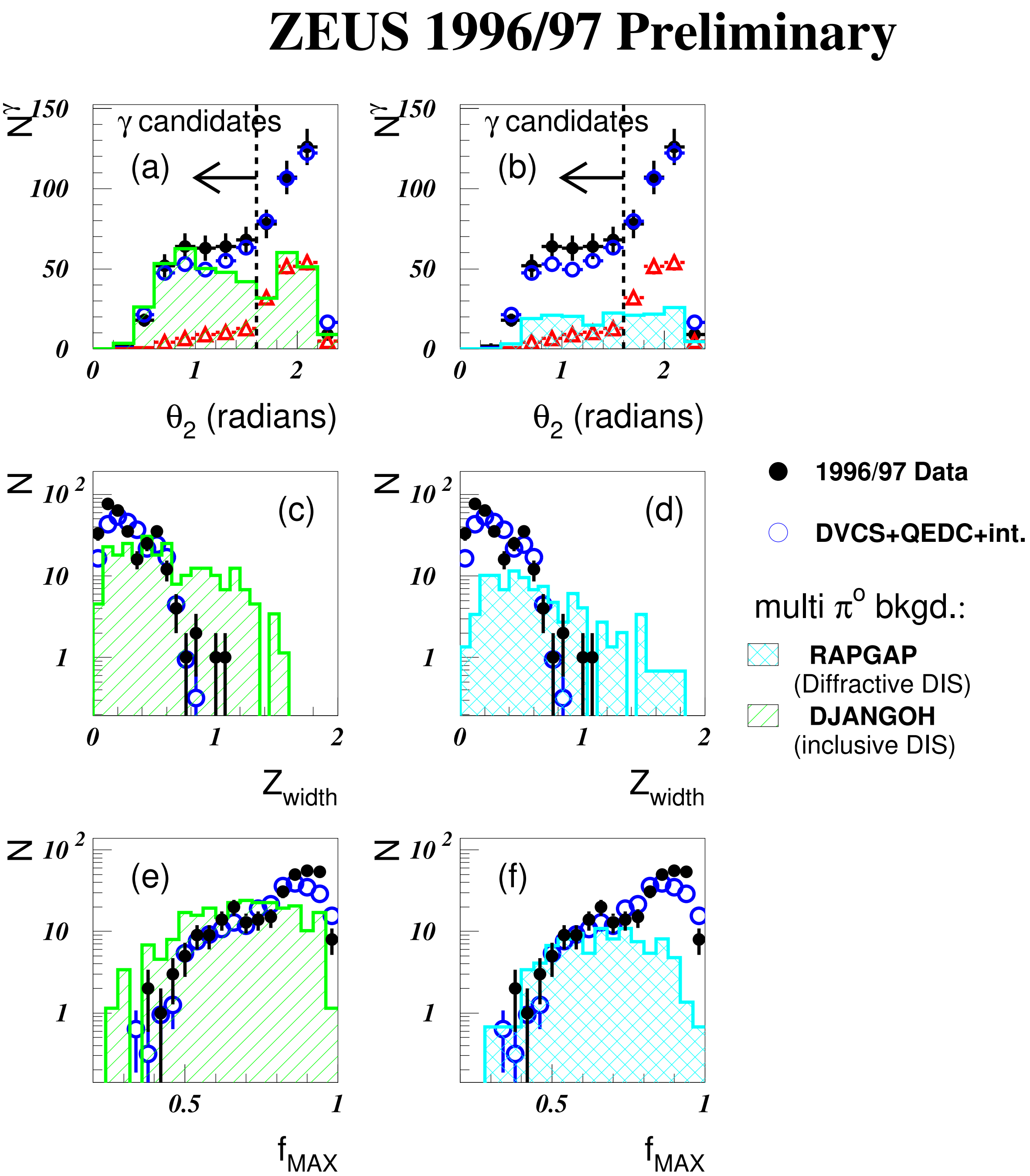
Deeply Virtual Compton Scattering



ZEUS 1996/97 Preliminary



DVCS cont'd



Establish for the first time a clear signal for DVCS

$\Rightarrow$ extract physics