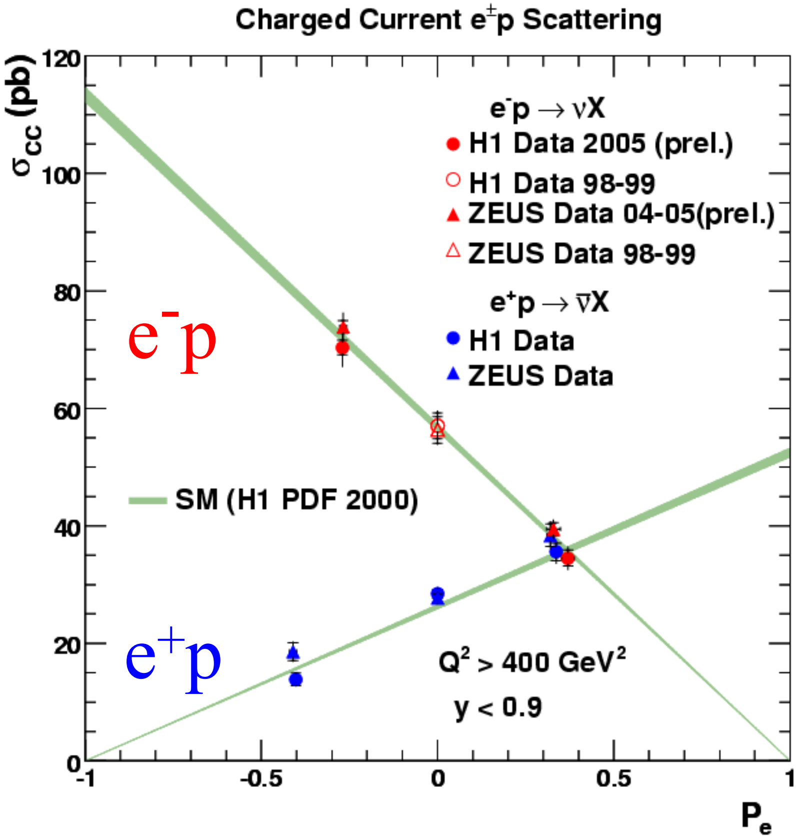
The Structure Functions and low x working group summary

Vladimir Chekelian, Claire Gwenlan, Robert Thorne

- HERA Results (VC)
- FNAL, RHIC, JLAB (CG)
  & new techniques for data analysis
- Theory (RT)

Total CC cross sections
with longitudinally polarised e^+ and e^-

B. Antunovic H. Kaji



e+p: the first HERA II publications
Phys. Lett. B 634 (2006) 173 (H1), hep-ex 0602026 (ZEUS)

$$\sigma_{CC}^{e^{\pm}p}(P_e) = (1 \pm P_e)\sigma_{CC}^{e^{\pm}p}(P_e = 0)$$

$P_e = (N_R - N_L)/(N_R + N_L)$

- linear dependence is firmly established for e^+ & e^-
- extrapolations to $P_e = \pm 1$: 95% CL

	95% CL $M(W_R)$>
H1:	
σ(P=-1)= -3.9±2.3(sta)±0.7(sys)±0.8(pol) pb	208GeV
σ(P=1) = -0.9±2.9(sta)±1.9(sys)±2.9(pol) pb	186GeV
ZEUS:	
σ(P=-1)= 7.4 ± 3.9(sta) ± 1.2(sys) pb	
σ(P=1) = 0.8 ± 3.1(sta) ± 5.0(sys) pb	180 GeV

→ consistent with the absence of the right-handed weak currents

Total CC cross sections
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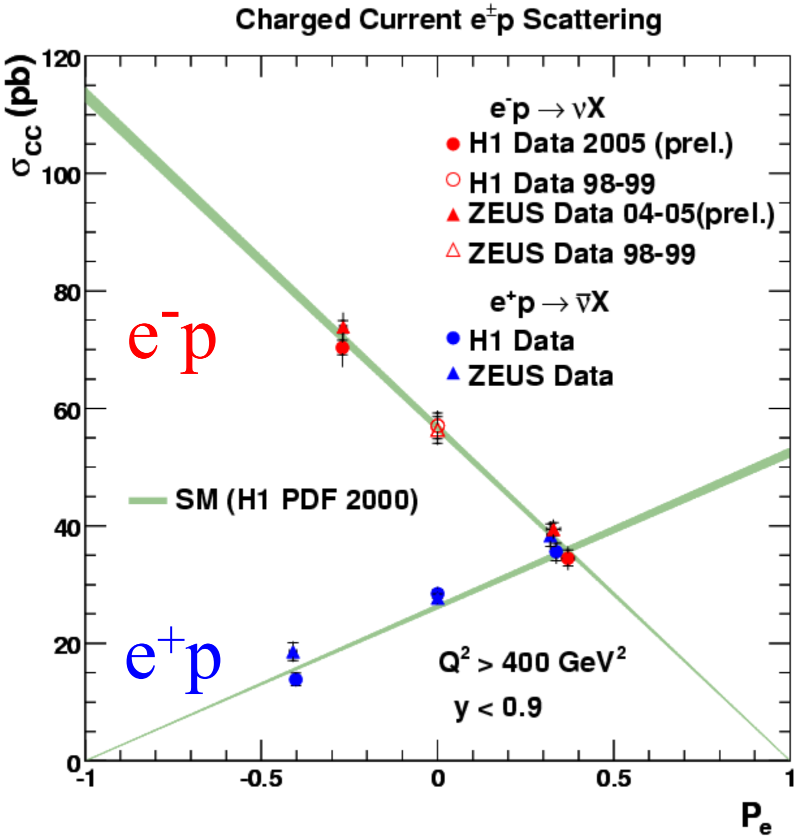
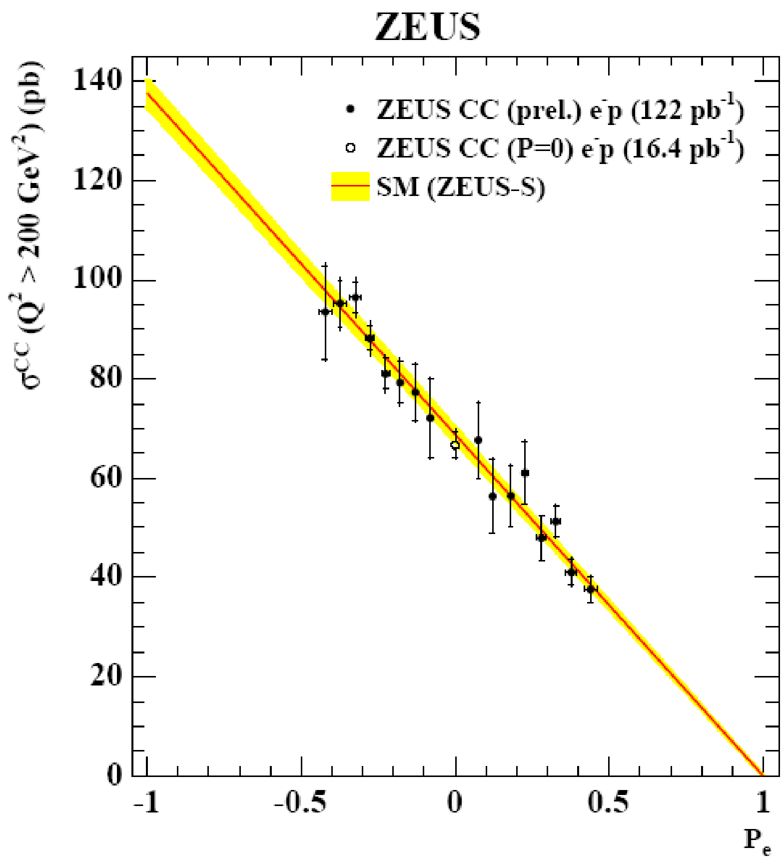
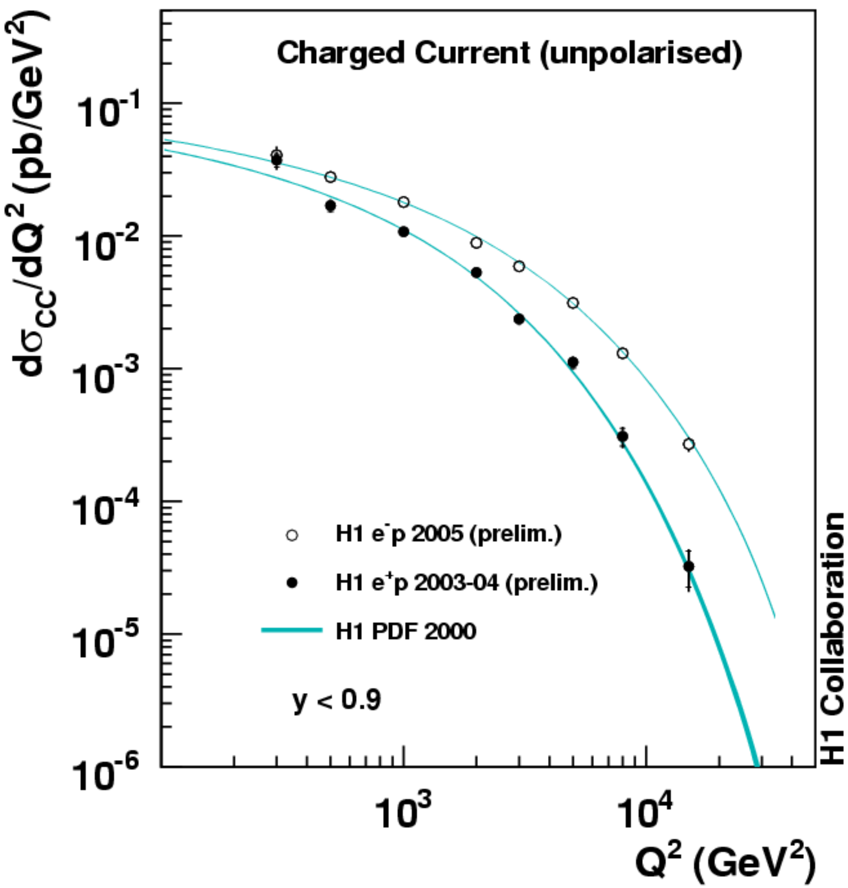




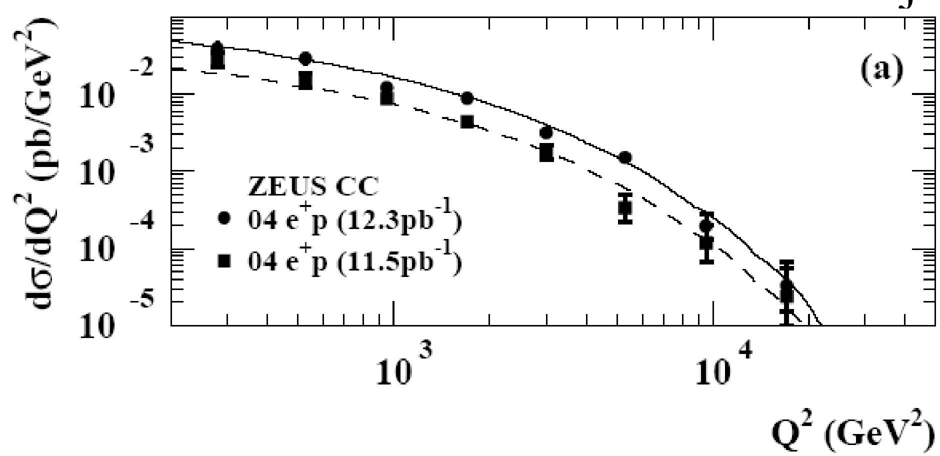
→ consistent with the absence of the right-handed weak currents

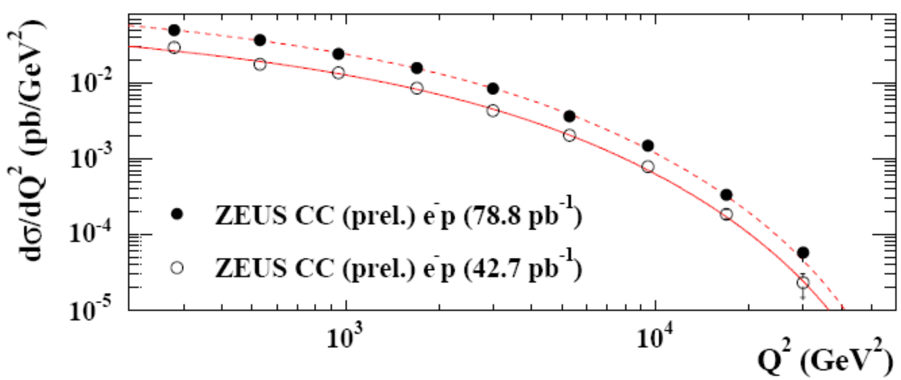
HERA II: CC cross sections $d\sigma/dQ^2$

B. Antunovic



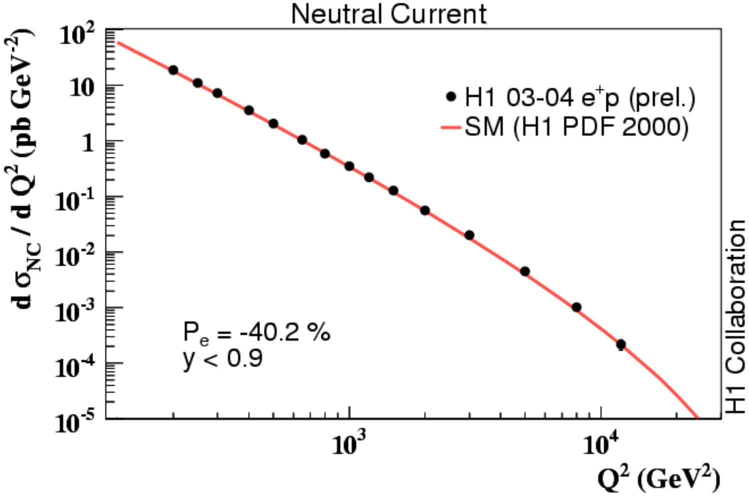
H. Kaji



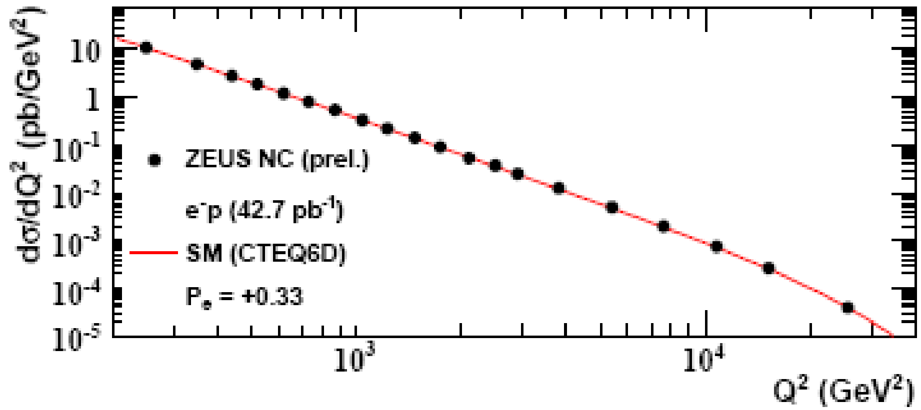


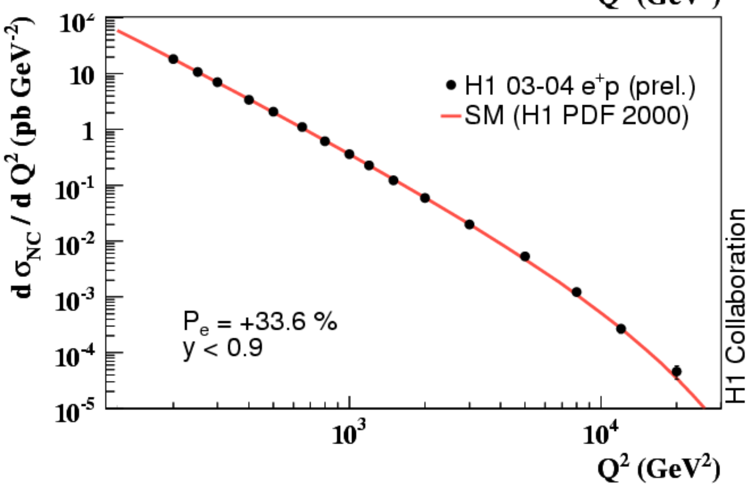
HERA II: NC cross sections $d\sigma/dQ^2$

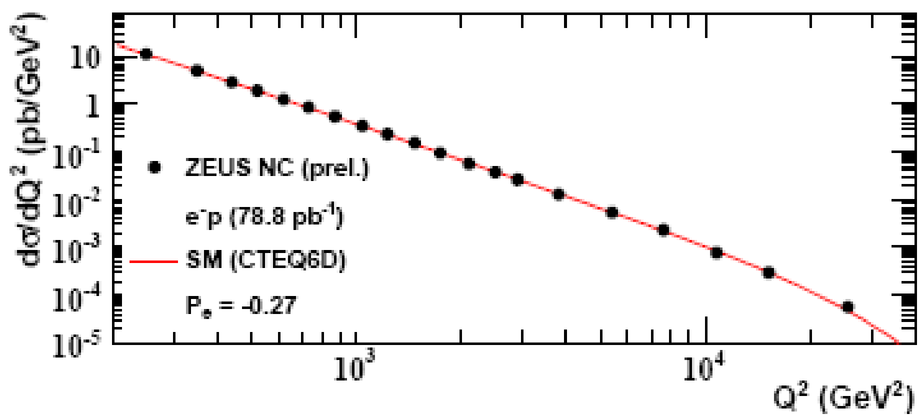
A. Nikiforov



ZEUS U. Noor





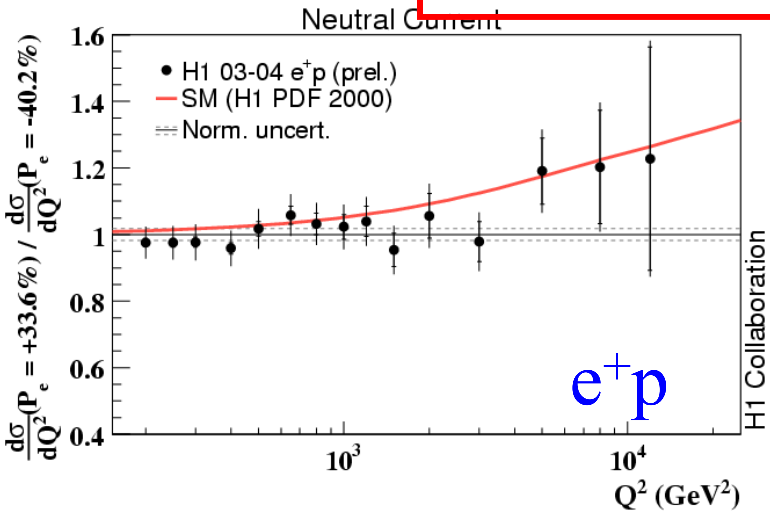


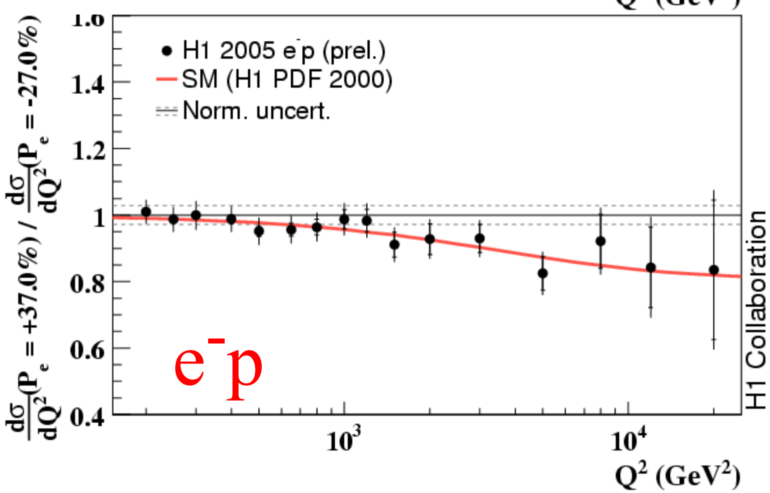
Each experiment: 2 lepton beam polarities and 2 polarisation periods

NC: polarisation ratios σ(RH)/σ(LH)

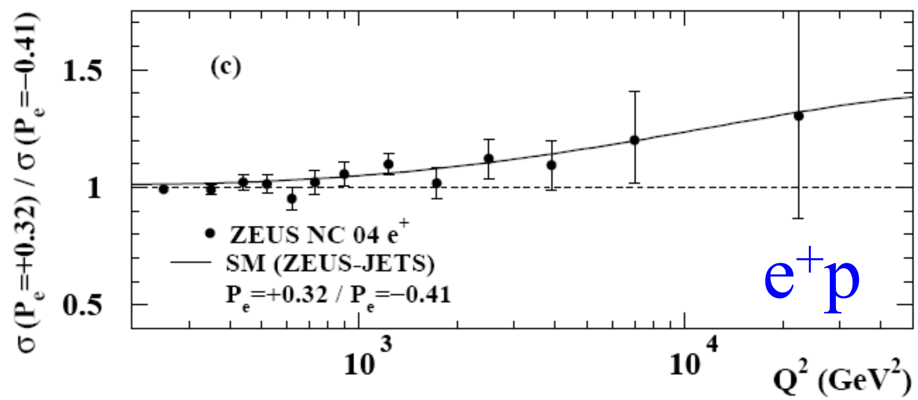
$$\sigma_{NC}^{e^{\pm}p} \sim F_2 \mp P_e a_e K_Z \cdot F_2^{\gamma Z} \mp a_e K_Z \cdot xF_3^{\gamma Z}$$

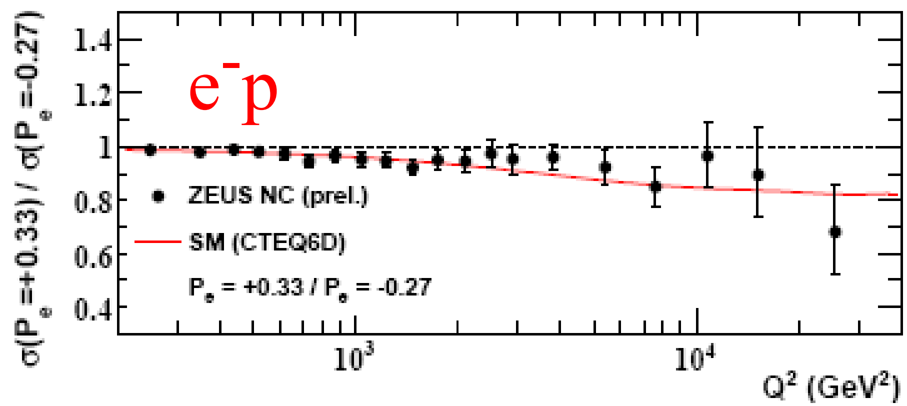
A. Nikiforov





U. Noor





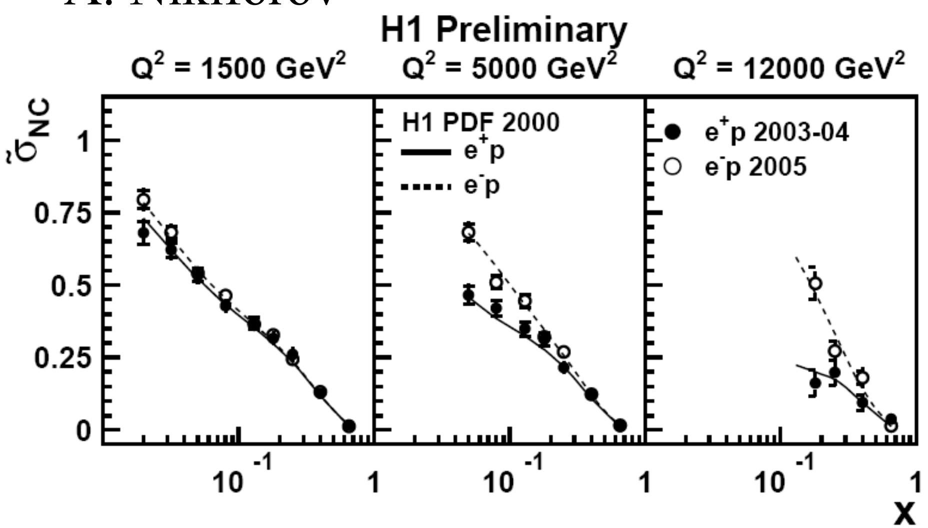
Polarisation effects in NC are established

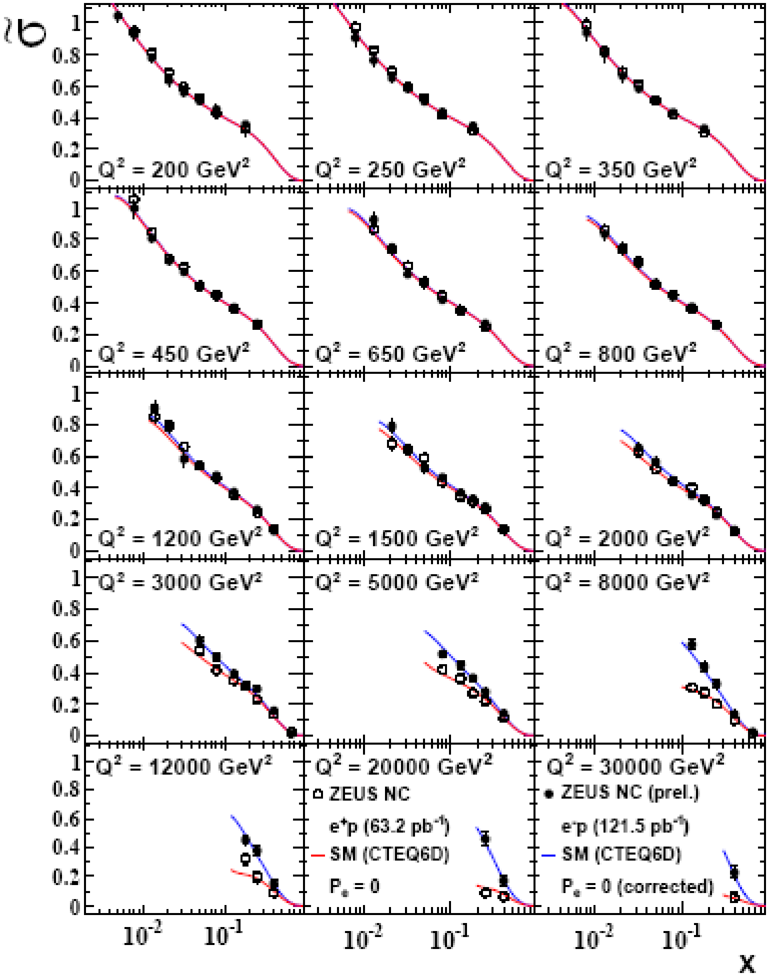
HERA II: Unpolarised NC

ZEUS U. Noor

$$\tilde{\sigma}^{\pm}_{NC} = F_2 - \frac{y^2}{Y_+} F_L \mp \frac{Y_-}{Y_+} xF_3$$

A. Nikiforov



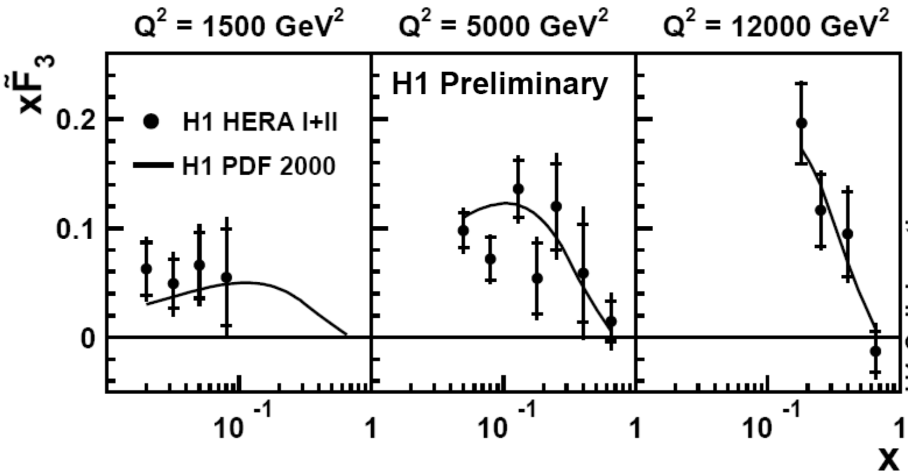


e^-p lumi at HERA II: ~ 6 fold of HERA I

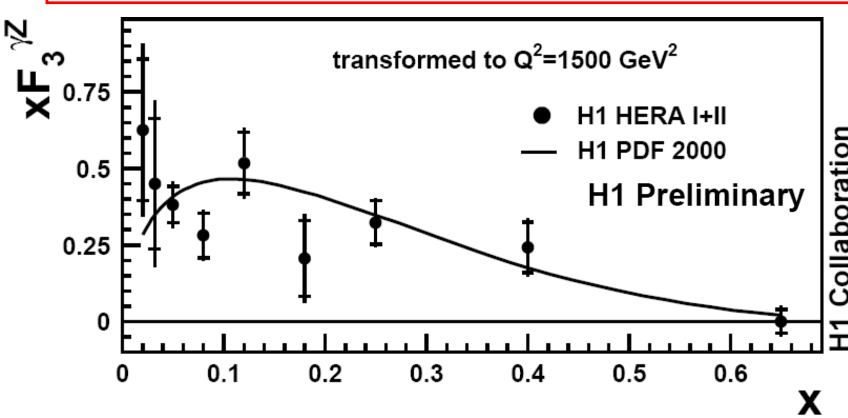
→ determine xF_3

Structure Function xF_3

A. Nikiforov

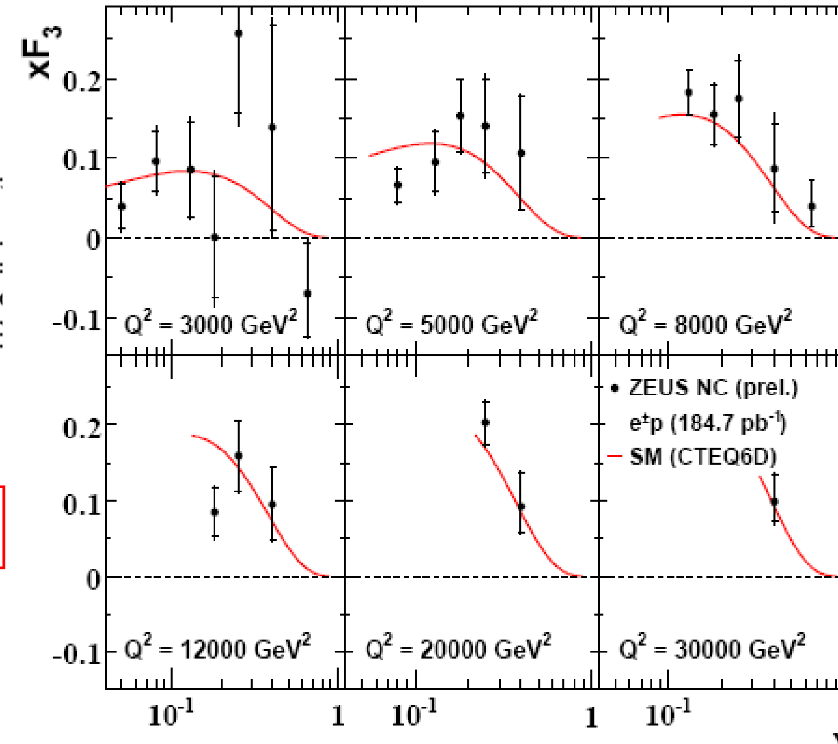


$$xF_3^{\gamma Z} = xF_3 / [-a_e k_w / (Q^2 + M_Z^2)] \sim (2u_v + d_v)$$



ZEUS

U. Noor

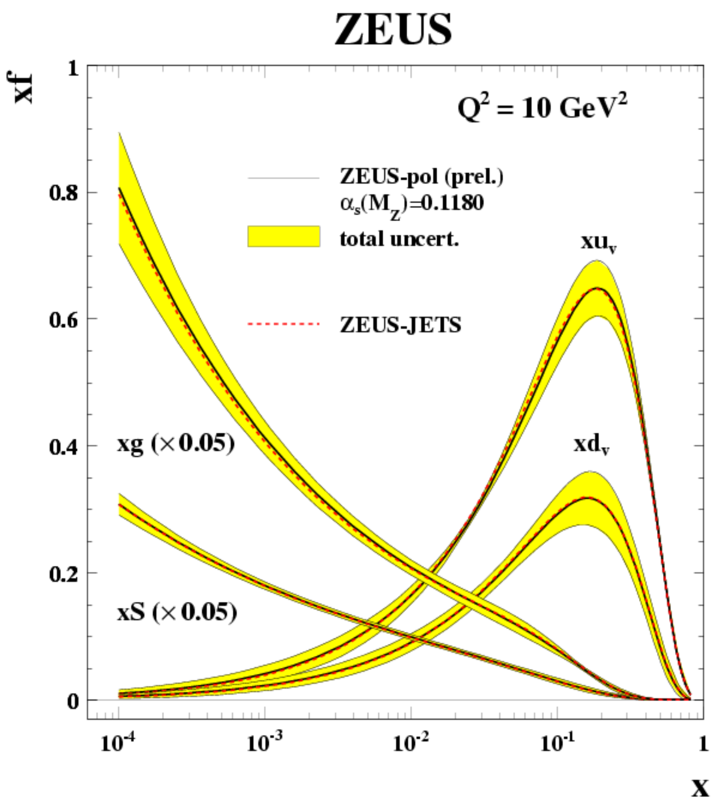


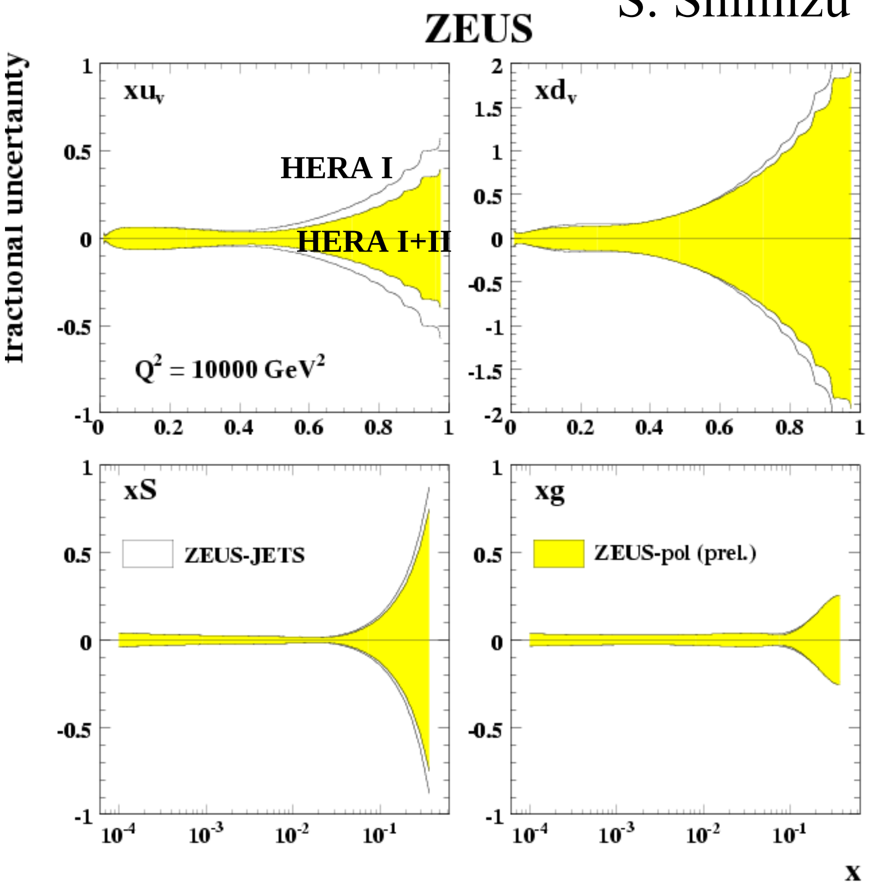
Precision of xF_3 is improved by ~ 20%
due to larger e-p statisatics at HERA II

PDFs in the ZEUS EW&QCD fit

Coherent EW+PDF analysis based on ZEUS-JETS fit
- include also polarised NC&CC double diff. cross sections

S. Shimizu

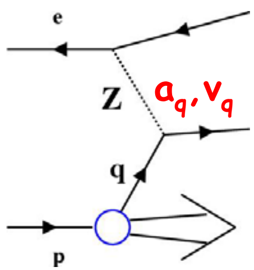




→ PDFs are almost unchanged
→ uncertainty on xu_v is reduced

Light quark couplings to Z

S. Shimizu

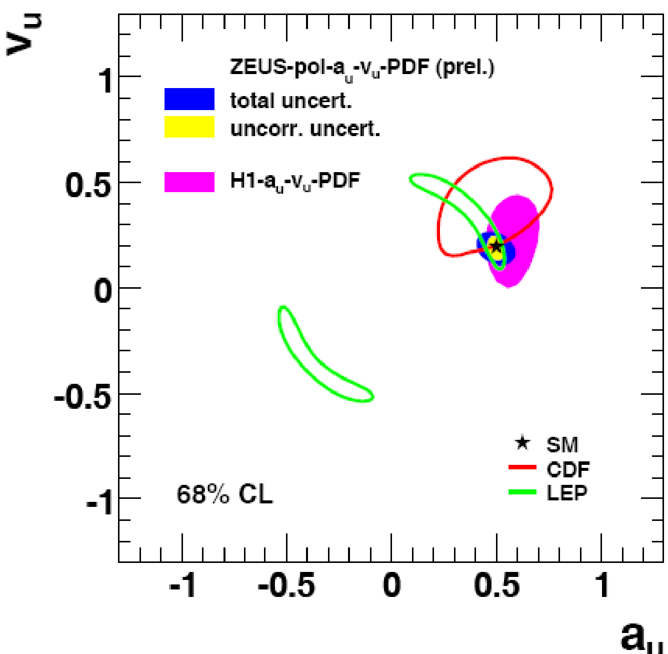


$$a_q = I_q^3 \rightarrow (a_u = +1/2; a_d = -1/2); \quad v_q = I_q^3 - 2e_q \sin^2\theta_W$$

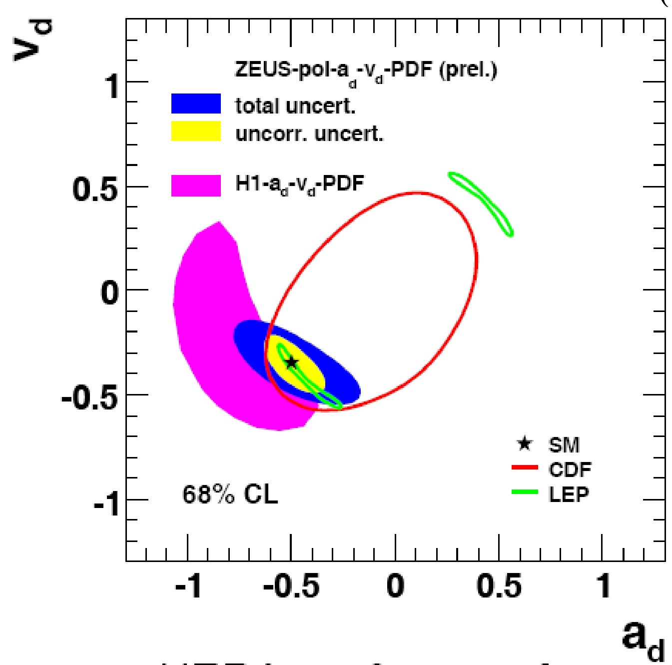
$$F_2^{\pm} \approx F_2^{em} \mp \lambda a_e K_Z \cdot 2x \sum e_q v_q (q+\bar{q}) + a_e^2 K_Z^2 \cdot x \sum (v_q^2 + a_q^2)(q+\bar{q})$$

$$xF_3^{NC} \approx -a_e K_Z \cdot 2x \sum e_q a_q (q-\bar{q})$$

$$K_Z = \frac{Q^2}{(Q^2+M_Z^2)^2}\,\frac{1}{4\sin^2\theta_W \cos^2\theta_W}$$



HERA: a_u & v_u are free



HERA: a_d & v_d are free

- polarised data
  → improve Vu,Vd
- more precise for U

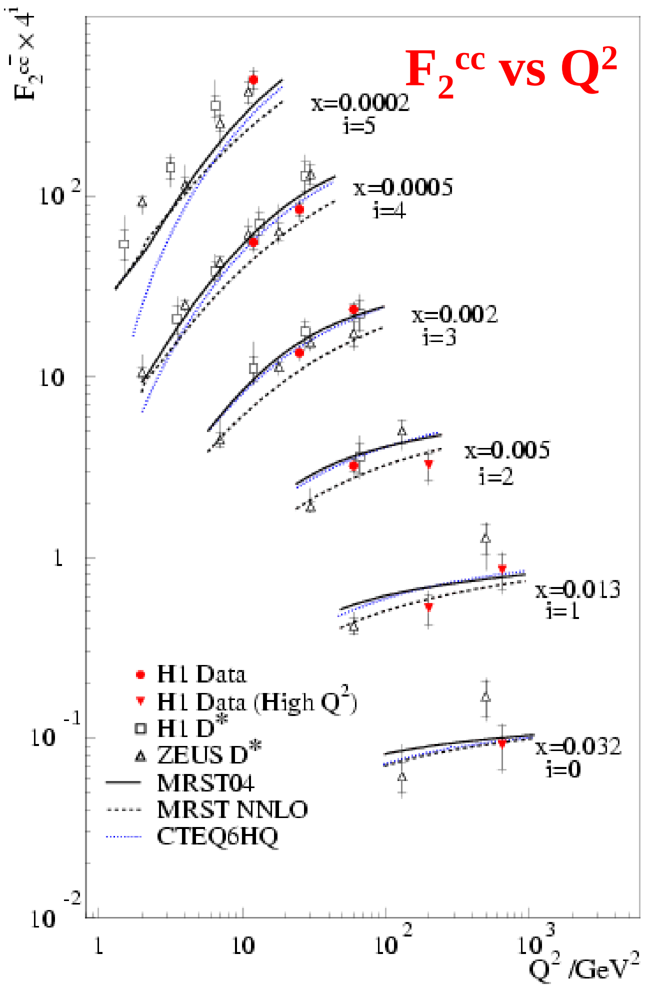
- comparable precision
- help to resolve LEP ambiguities

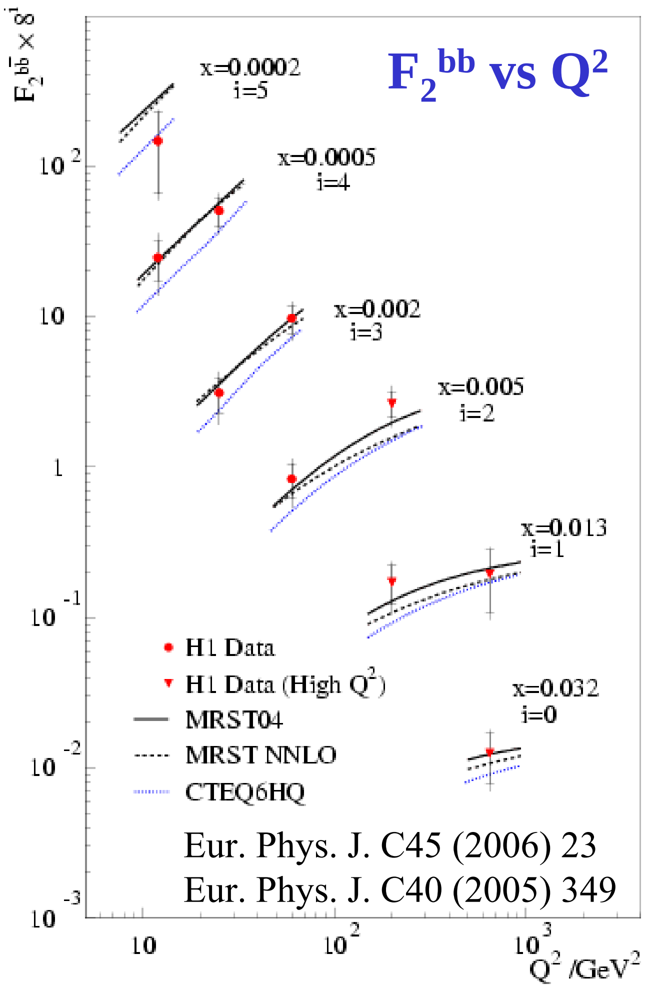
Joint SF & HF session

Discussion on mass effects / heavy flavour PDF's

P. Laycock

→ will be summarised by HF group



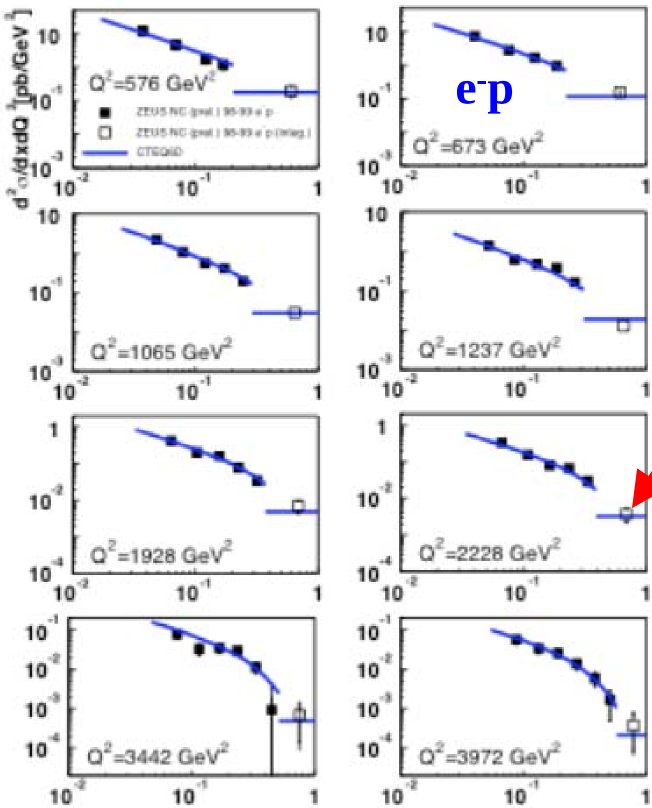


→ F2cc, F2bb are included into latest global fits

ZEUS NC at highest x

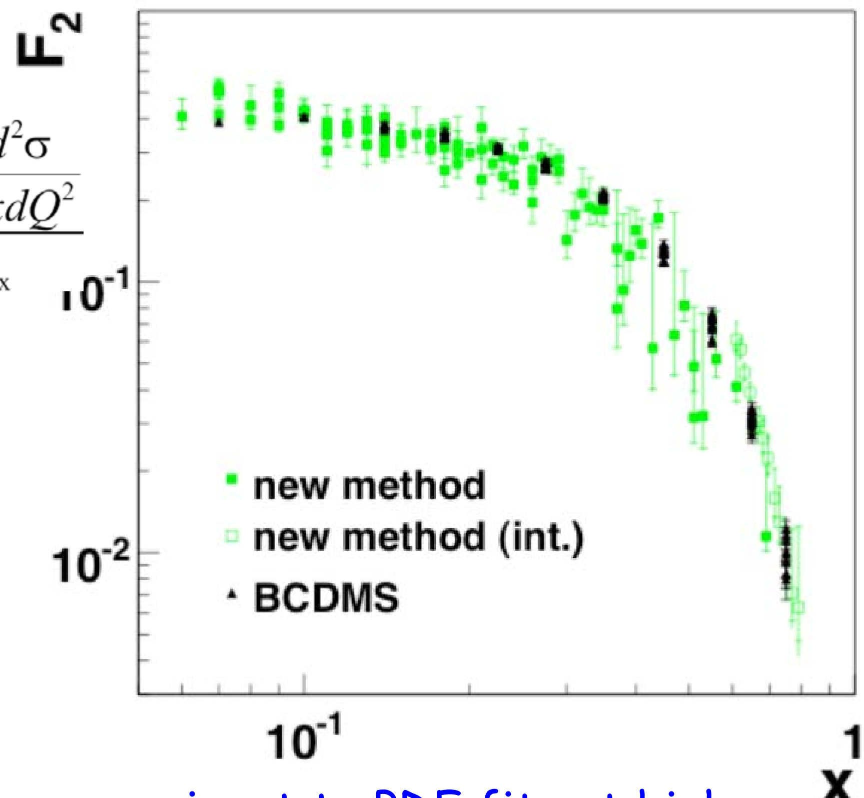
- make use of E_{jet}, ϑ_{jet} and events without jets (lost in the beam pipe) to access high x

-> highest x point is an integrated cross section up to x=1



$$\frac{\int_{x_{max}}^{1} dx \frac{d^2\sigma}{dxdQ^2}}{1-x_{max}}$$

A. Caldwell



measured for e^+p 99-00, e^-p 98-99, e^+p 96-97

- intergated points: tendency to lie above CTEQ6D

- input to PDF fits at high x

Prospects for direct F_L measur. at HERA

Both H1 and ZEUS expressed interest in the low proton beam energy running to measure longitudinal structure function $F_L(x,Q^2)$

→ SF WG: D.Kollar (ZEUS), M. Klein (H1)

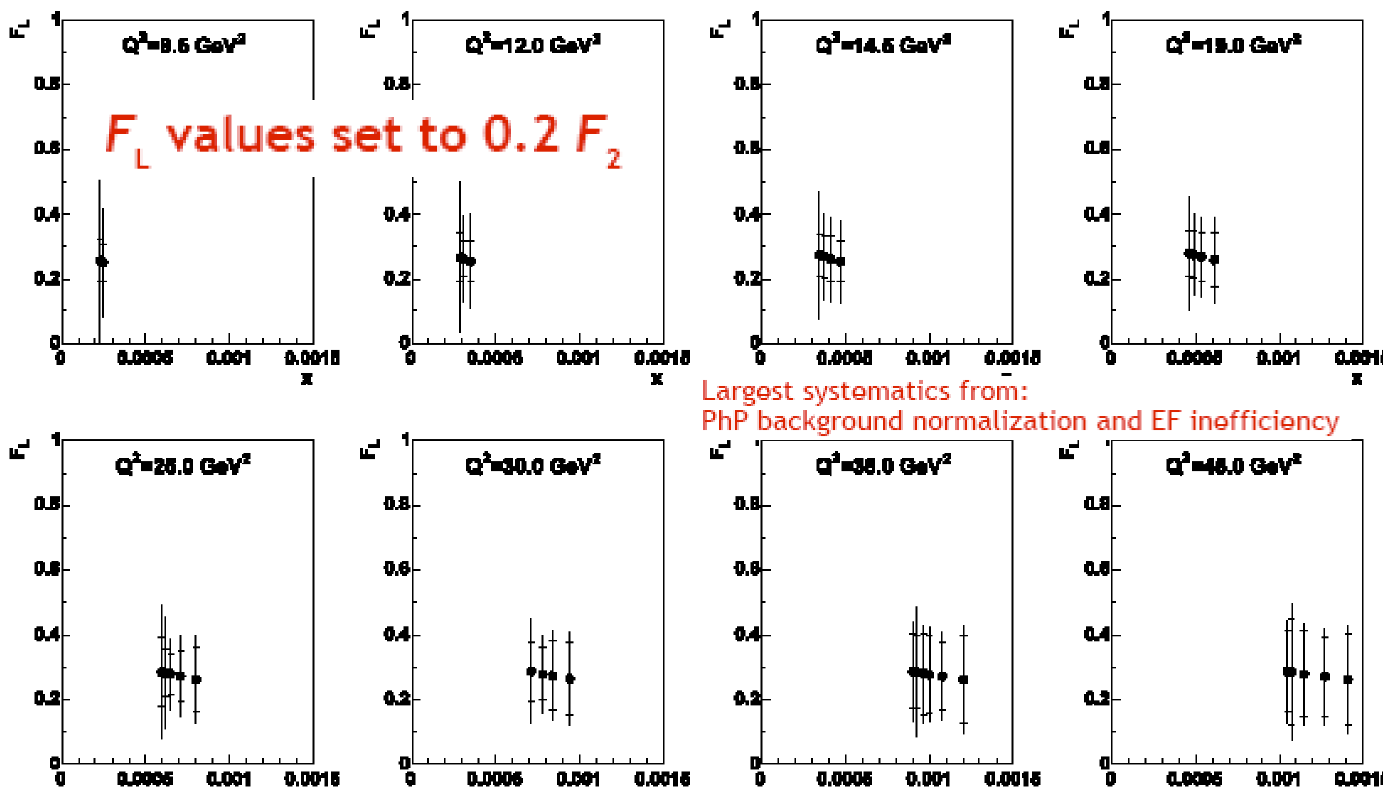
→ Plenary: A. Caldwell

ZEUS

D. Kollar

Duration:
~ 3 months
Proton energy:
460 GeV
Lumi:
10 pb-1

plus usual running at Ep = 920 GeV

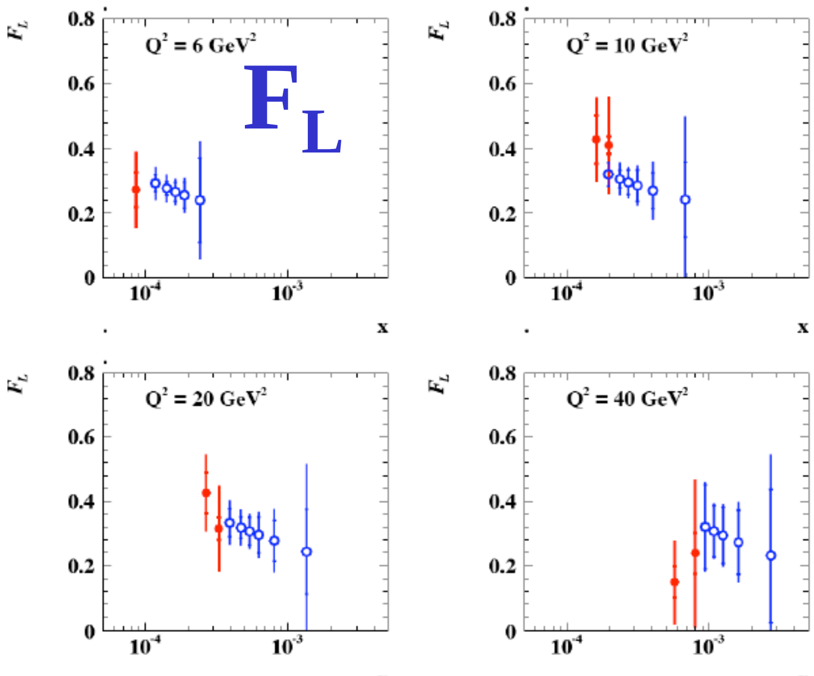


Prospects for direct F_L measur. at HERA

The H1 Collaboration has submitted an expression of interest for this measurement to the DESY Physics Research Committee. A recommendation of the PRC is expected in May 2006.

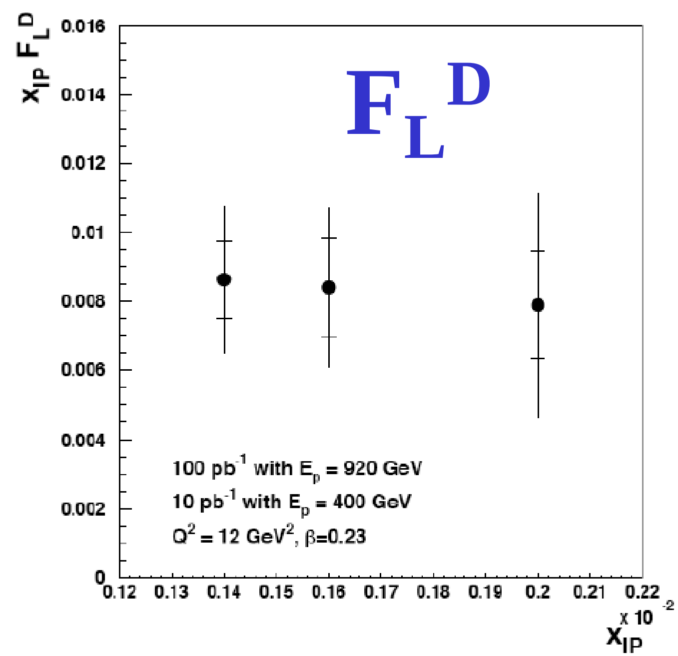
M. Klein

F_L - simulation for 3 energies and the published points



F_L may be measured by H1 in the range of 5-40 GeV^2 and low x, 10^{-4} - 4 10^{-3} , with an absolute accuracy of up to 0.05 which corresponds to about 5 sigma depending on F_L

Simulation of diffractive F_L^D Measurement with H1



F_L^D may be measured at about 3 sigma, depending on F_L^D.