

Measurements of F_2 and F_L

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Unpolarised DIS

- $$\frac{d^2\sigma^{1\gamma}}{dx dQ^2} = \frac{4\pi\alpha^2}{xQ^4} \left(F_2(x, Q^2) \left(1 - y - \frac{Q^2}{4E^2}\right) + y^2 x F_1(x, Q^2) \right)$$

- alternatively:

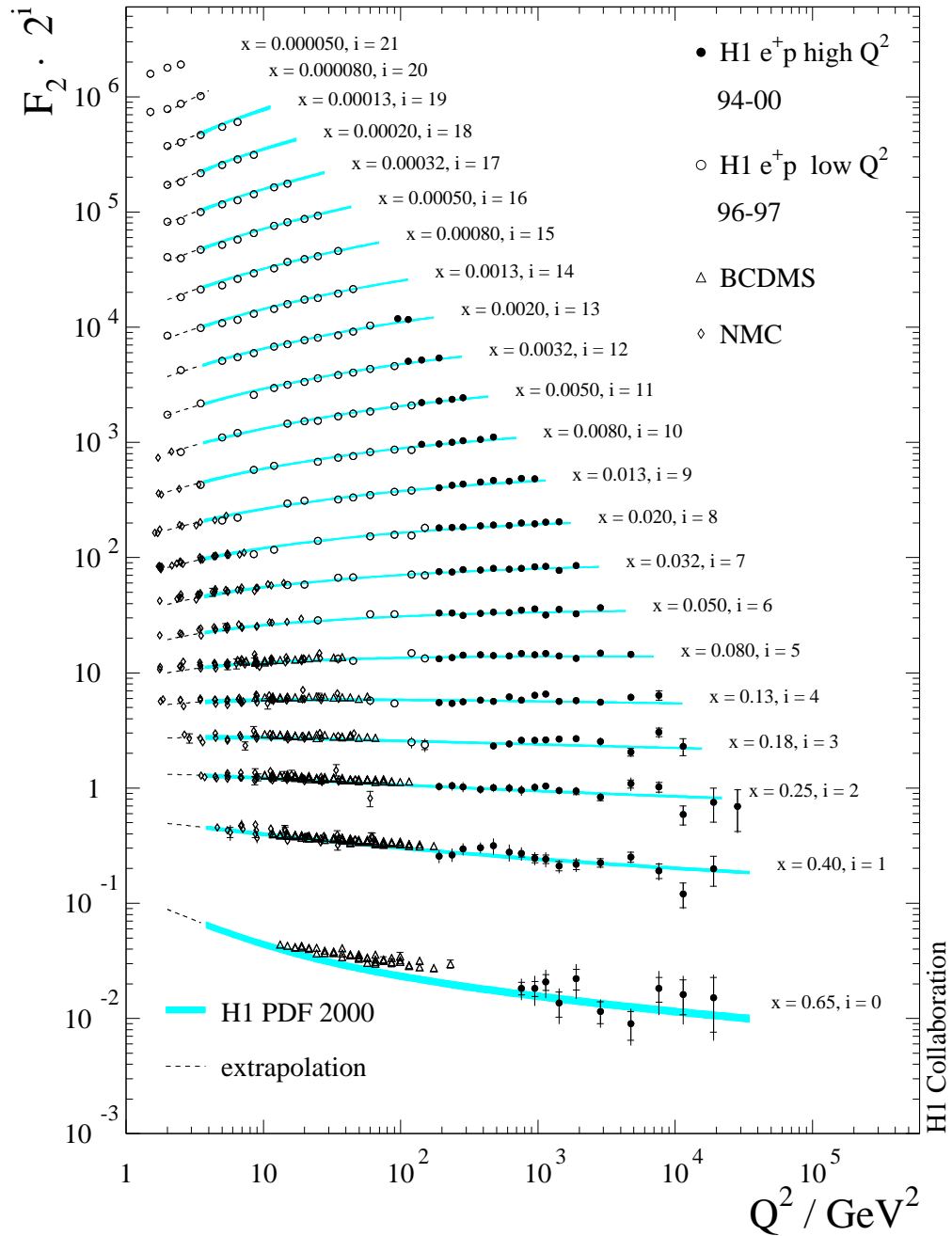
$$\frac{d^2\sigma}{dQ^2 dx} = \Gamma(\sigma_T(x, Q^2) + \varepsilon\sigma_L(x, Q^2))$$

- with $R = \sigma_L/\sigma_T$:

$$R(x, Q^2) = \frac{F_2(x, Q^2) \left(1 + \frac{\nu^2}{Q^2}\right) - 2xF_1(x, Q^2)}{2xF_1(x, Q^2)} = \frac{F_L(x, Q^2)}{2xF_1(x, Q^2)}$$

$$\frac{d^2\sigma^{1\gamma}}{dx dQ^2} = \frac{4\pi\alpha^2}{Q^4} \cdot \frac{F_2(x, Q^2)}{x} \cdot \left(1 - y - \frac{Q^2}{4E^2} + \frac{y^2 + Q^2/E^2}{2(1 + R(x, Q^2))} \right)$$

- $F_L(x, Q^2)$ longitudinal structure functions



- QCD analysis

use of HERA plus BCMDS (p and d) data

problems with BCDMS data due to systematics e.g. energy calibration

- α_s determination

high x BCDMS data are very important

systematic errors limit the precision of α_s

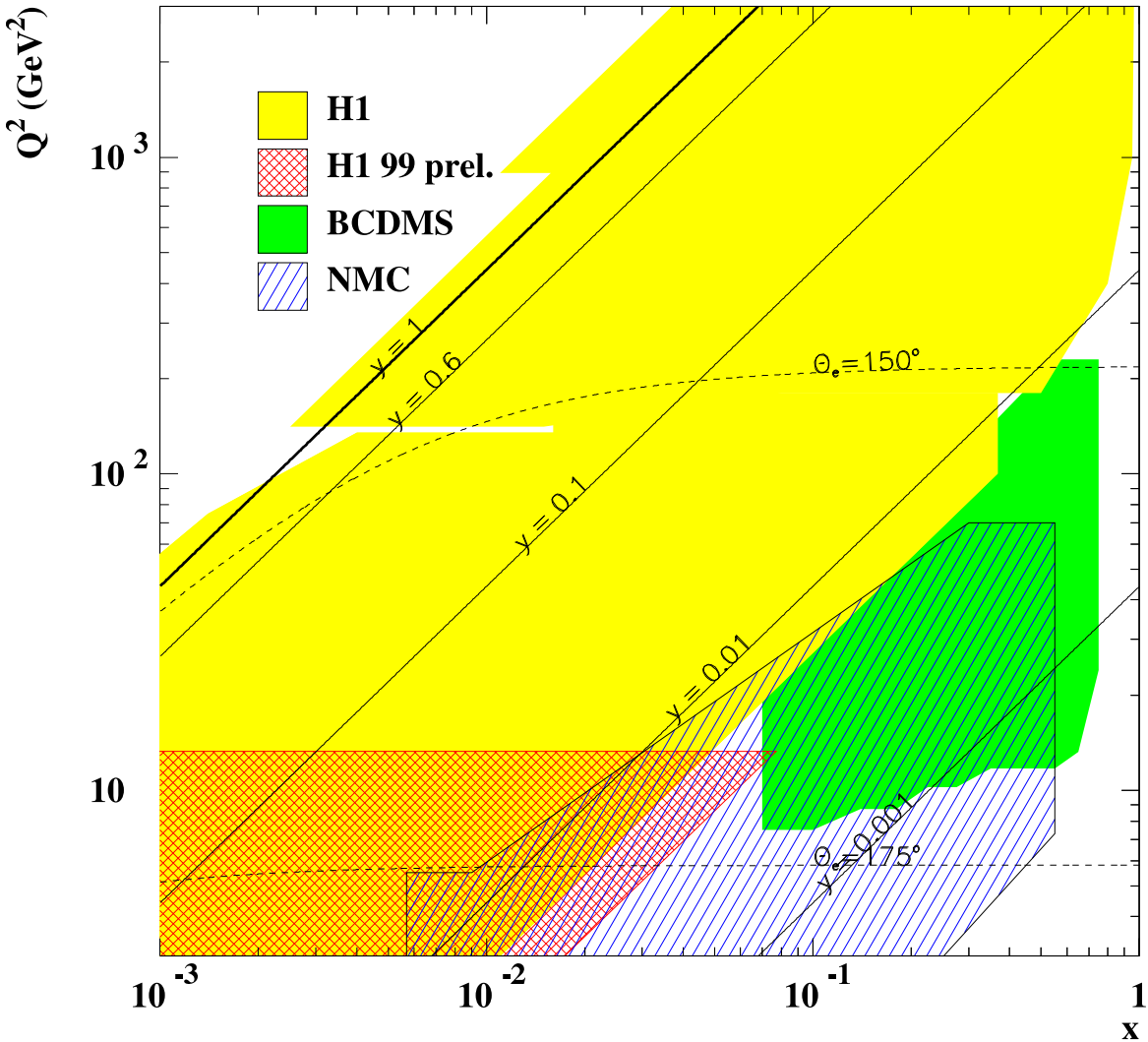
- improvement of BCDMS data?

high statistics, especially at high x

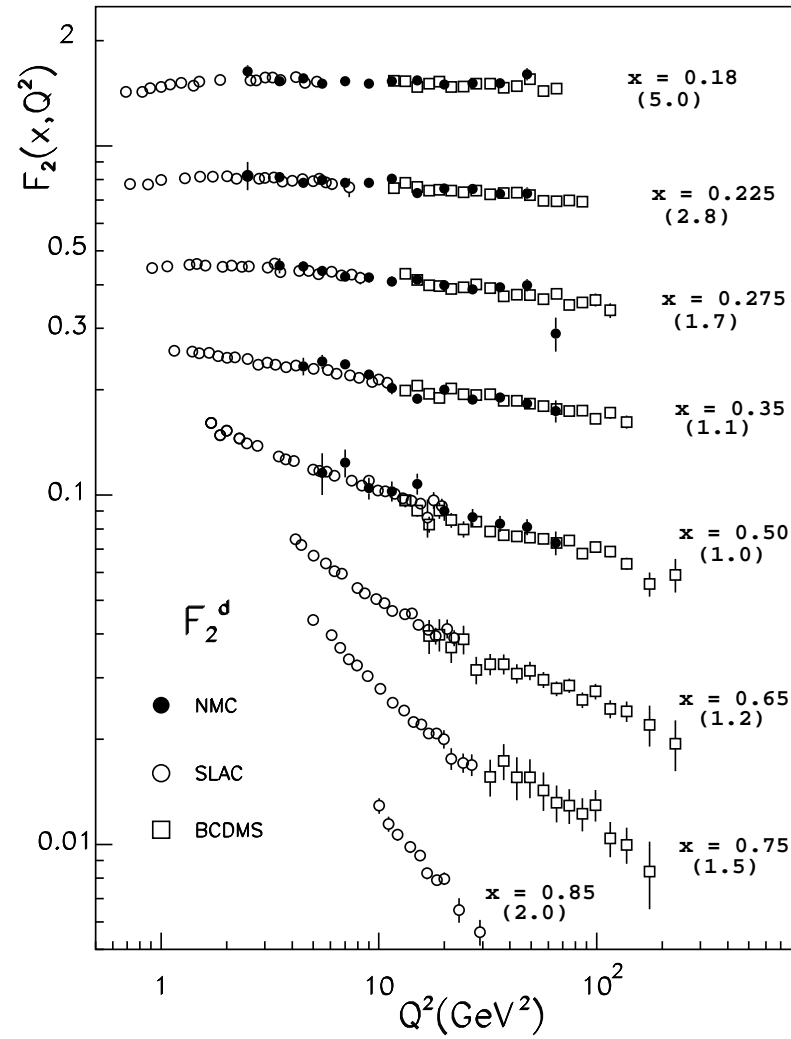
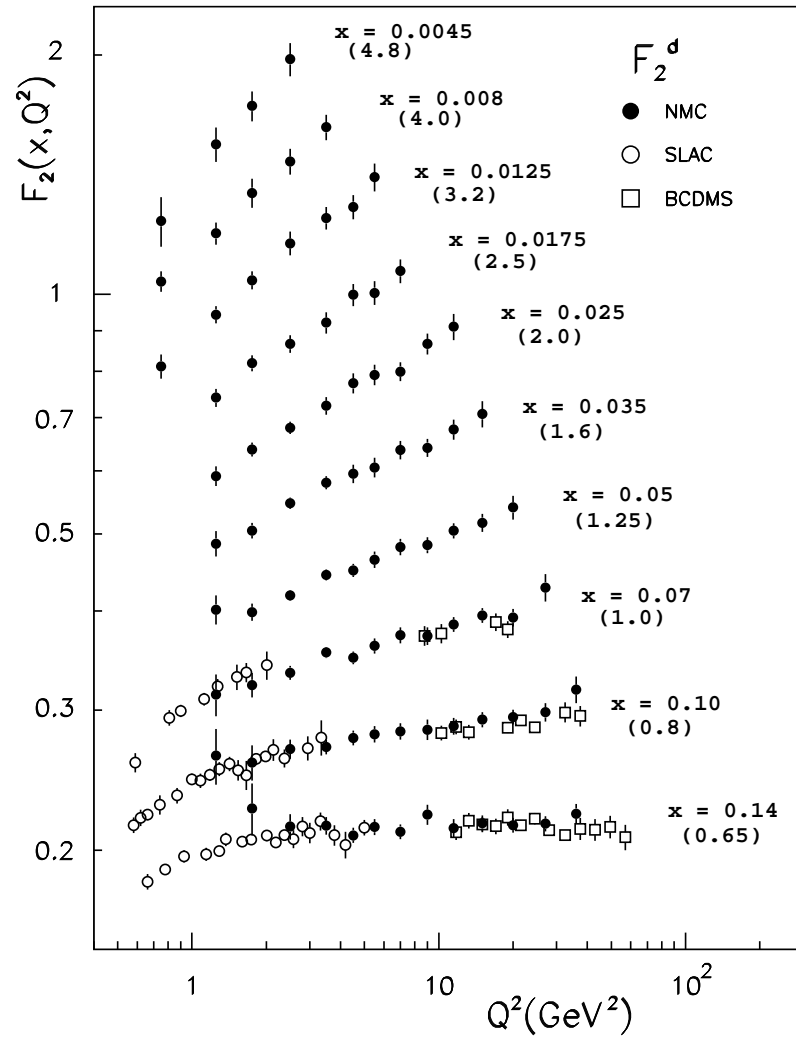
very important: low systematic error $< 1\%$

several beam energies needed for a large kinematic coverage

Kinematic coverage



Fixed target F_2 data



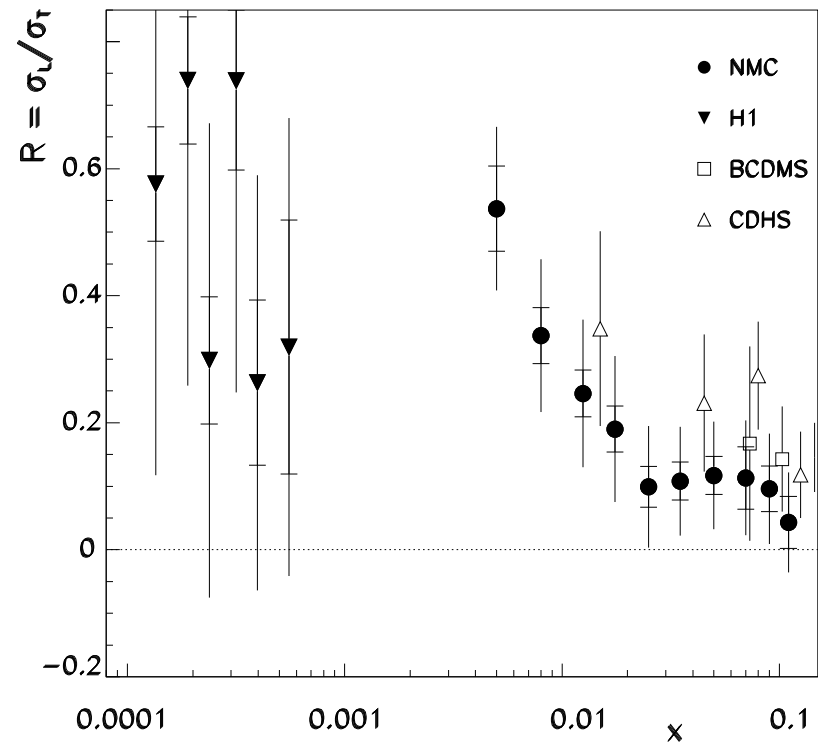
F_L and R

- current status:

last measurement for p,d in DIS region from NMC

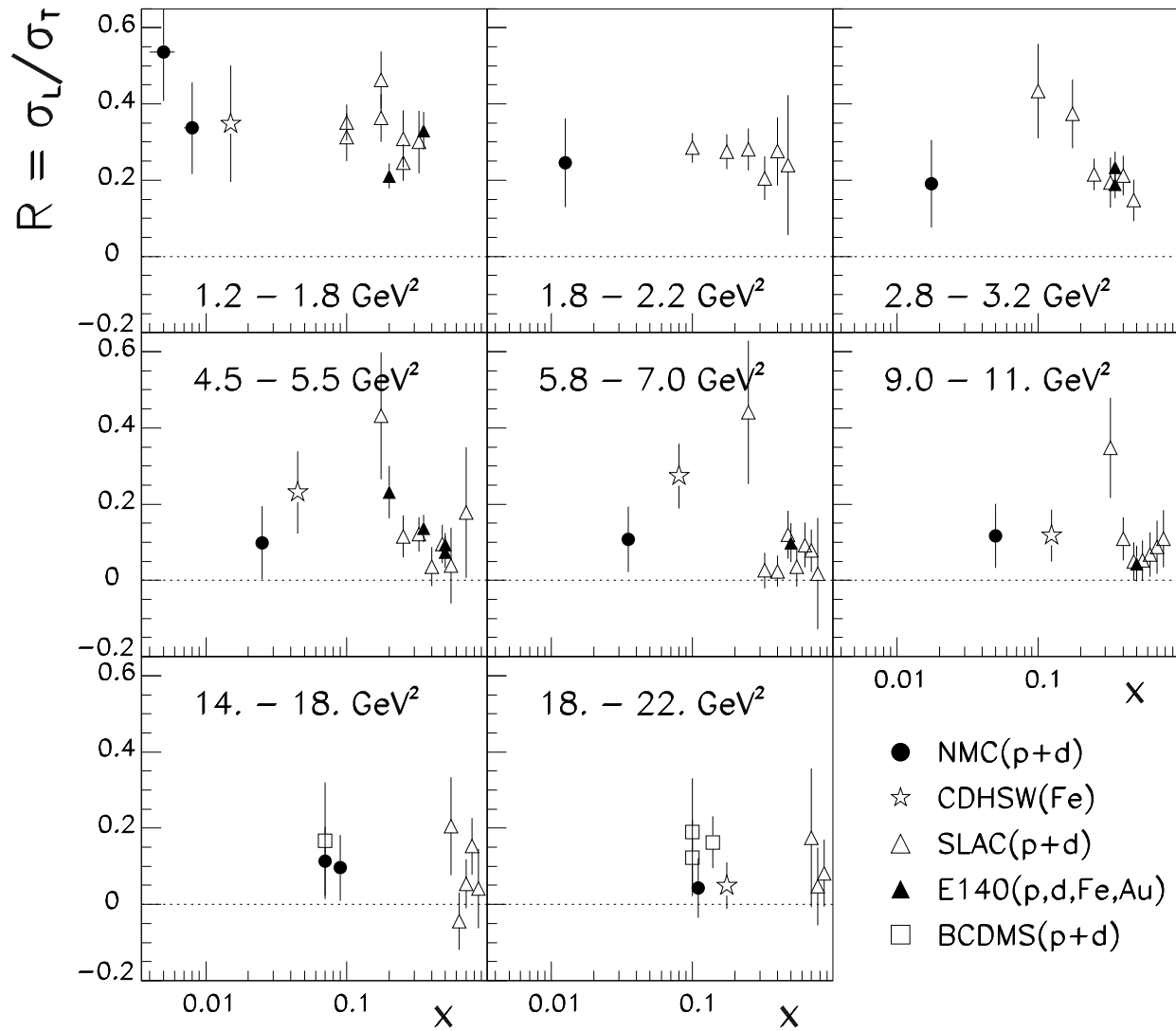
NMC measurement at low x and Q^2

H1 results from F_2 extrapolation at very low x



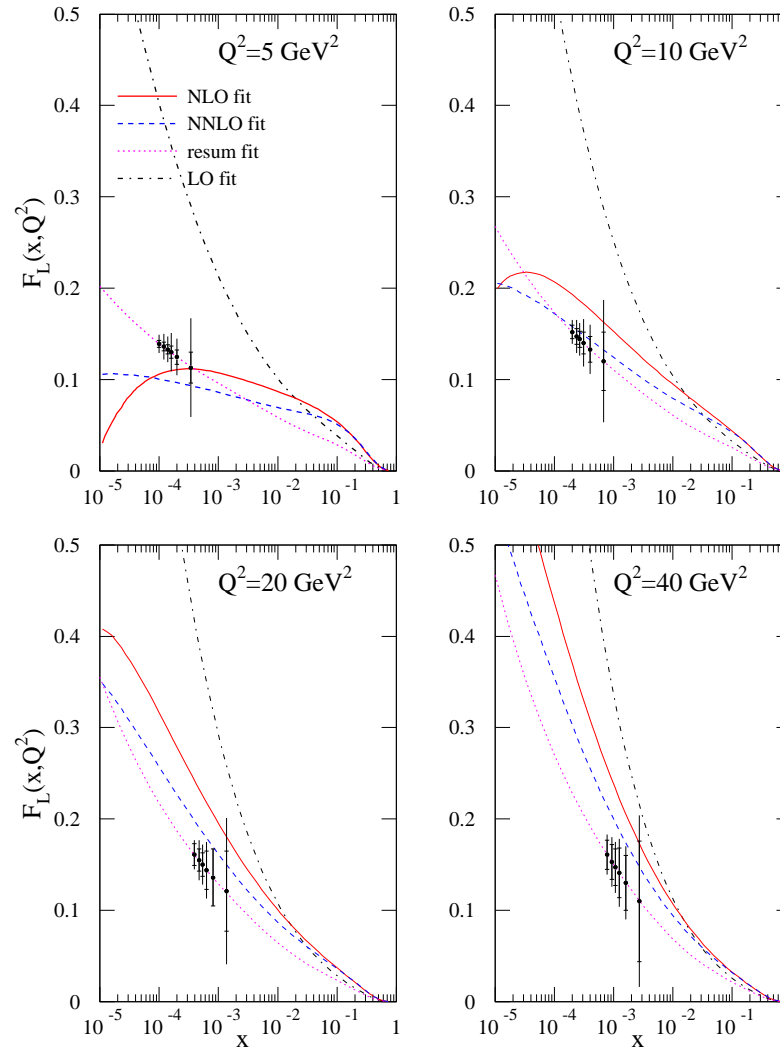
- planned measurements at HERA:
low x , $Q^2 \approx 10 \text{ GeV}^2$

R(x, Q²)



Possible HERA measurement

F_L LO, NLO, NNLO and resummed - Simulation of Low E_p H1 Data



Measurement of R ?

- improvement and extension at low x and Q^2
- measurements at several beam energies necessary with proton or deuteron
- excellent normalisation ($< 1\%$)
- low systematic errors and high statistics (compared to NMC)