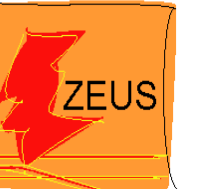
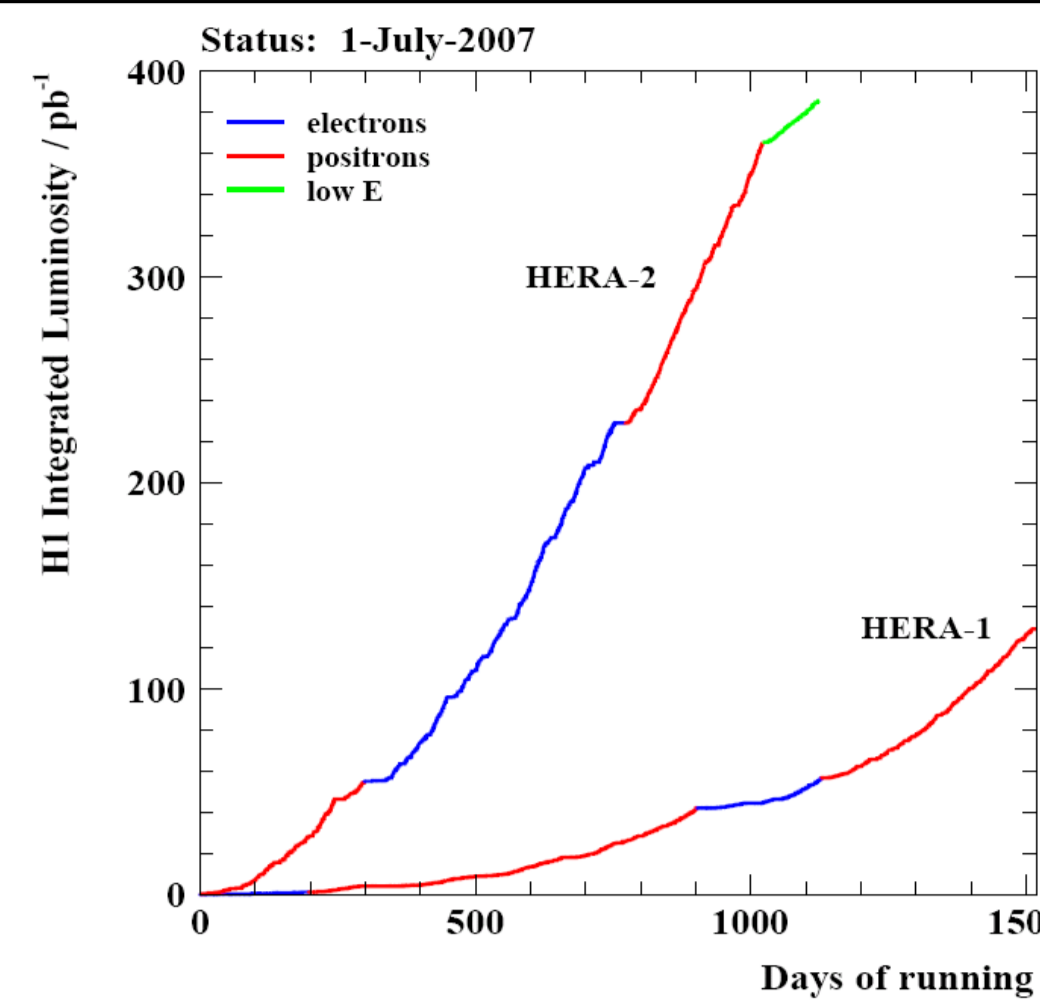
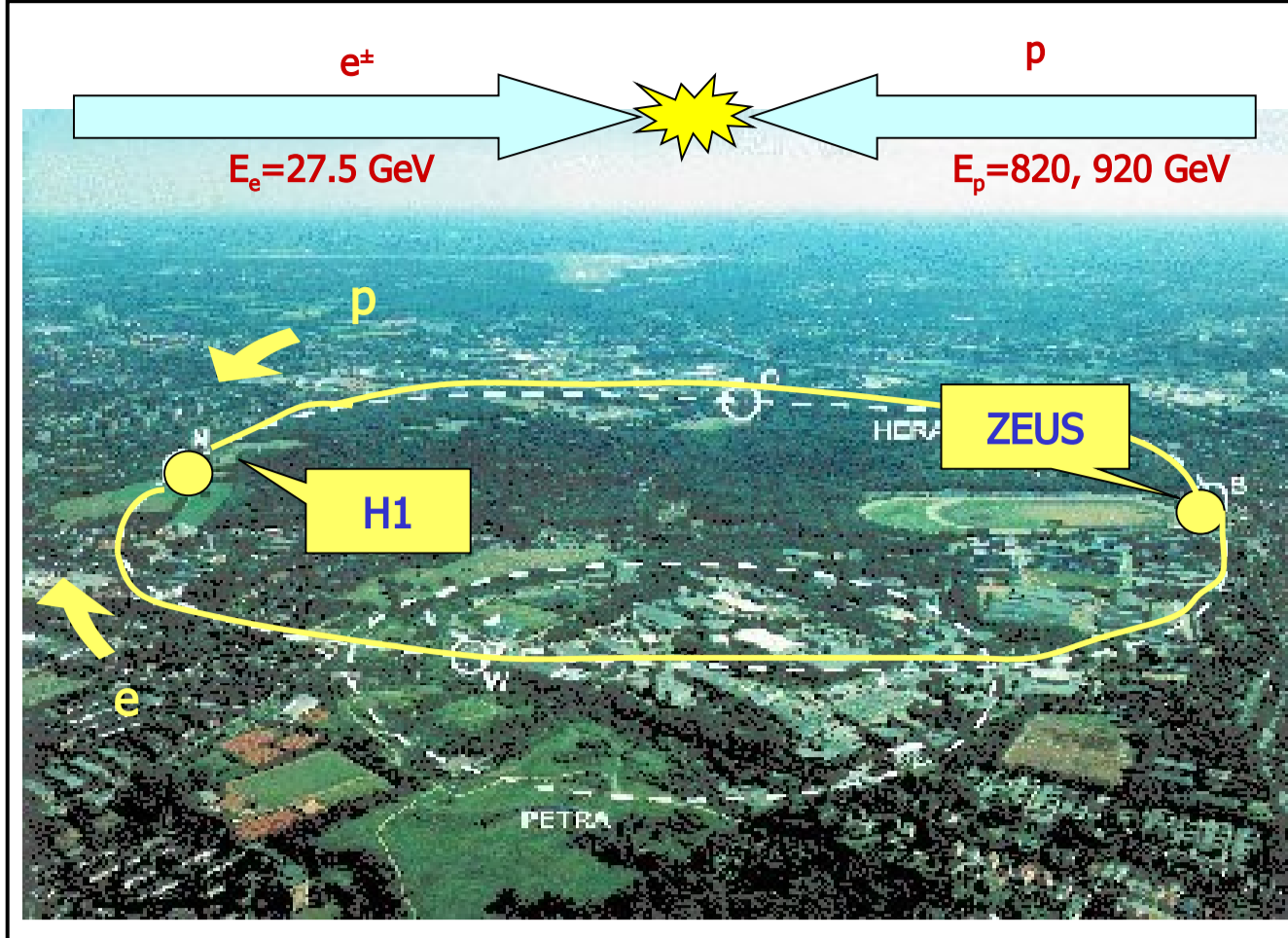




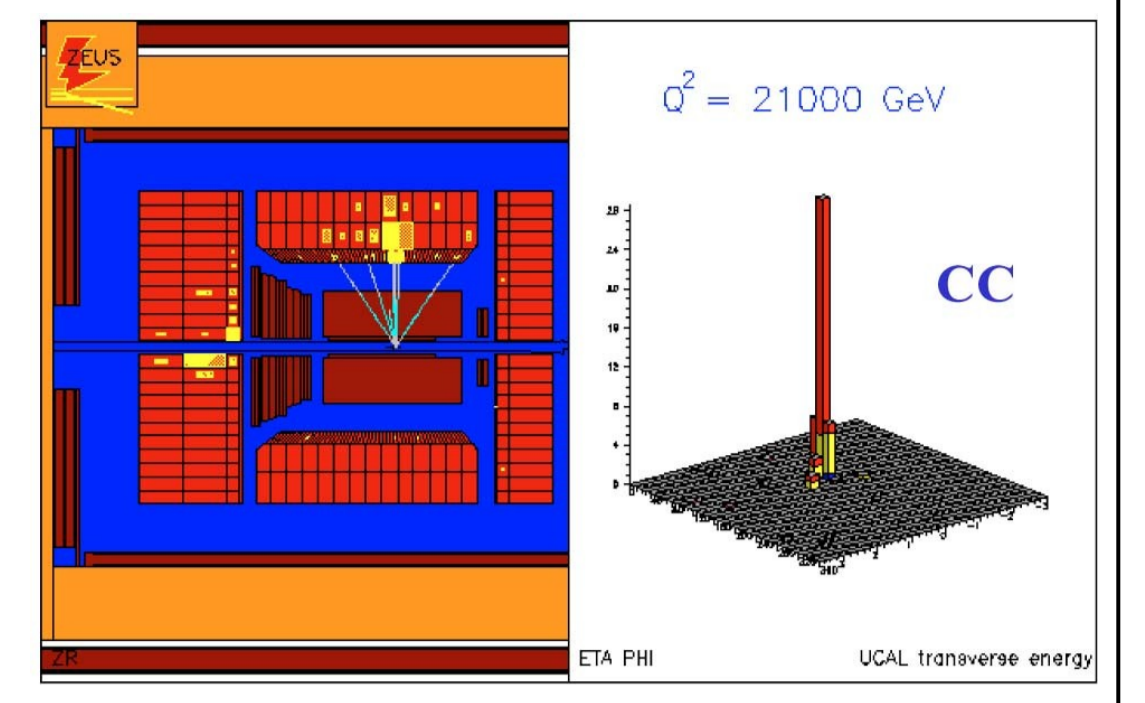
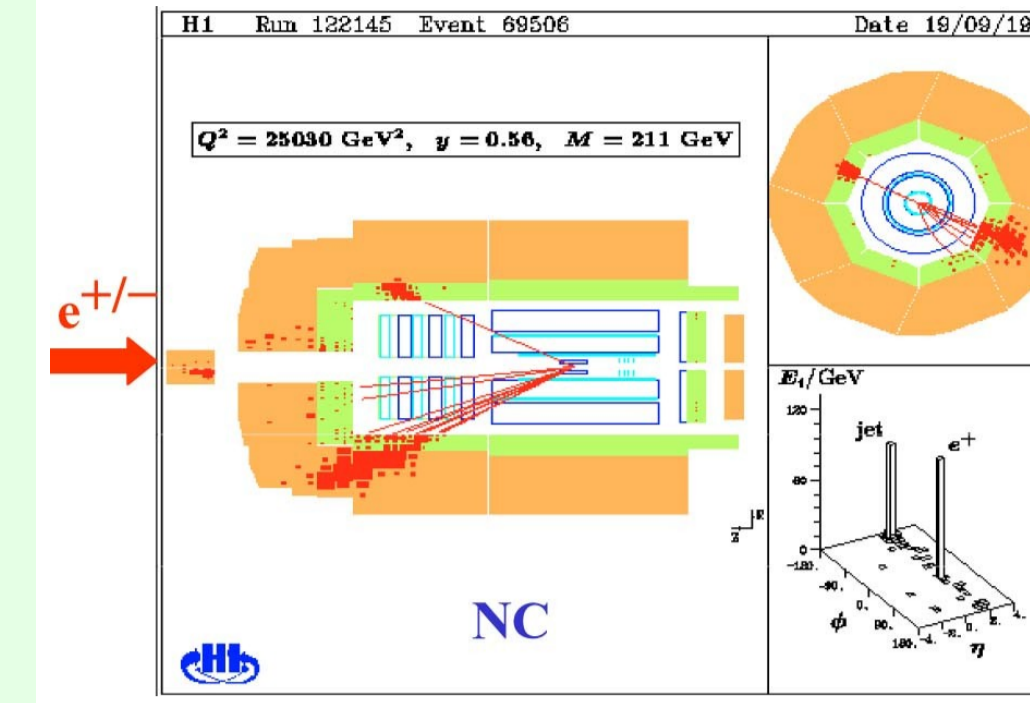
# Structure Functions Measurements at HERA



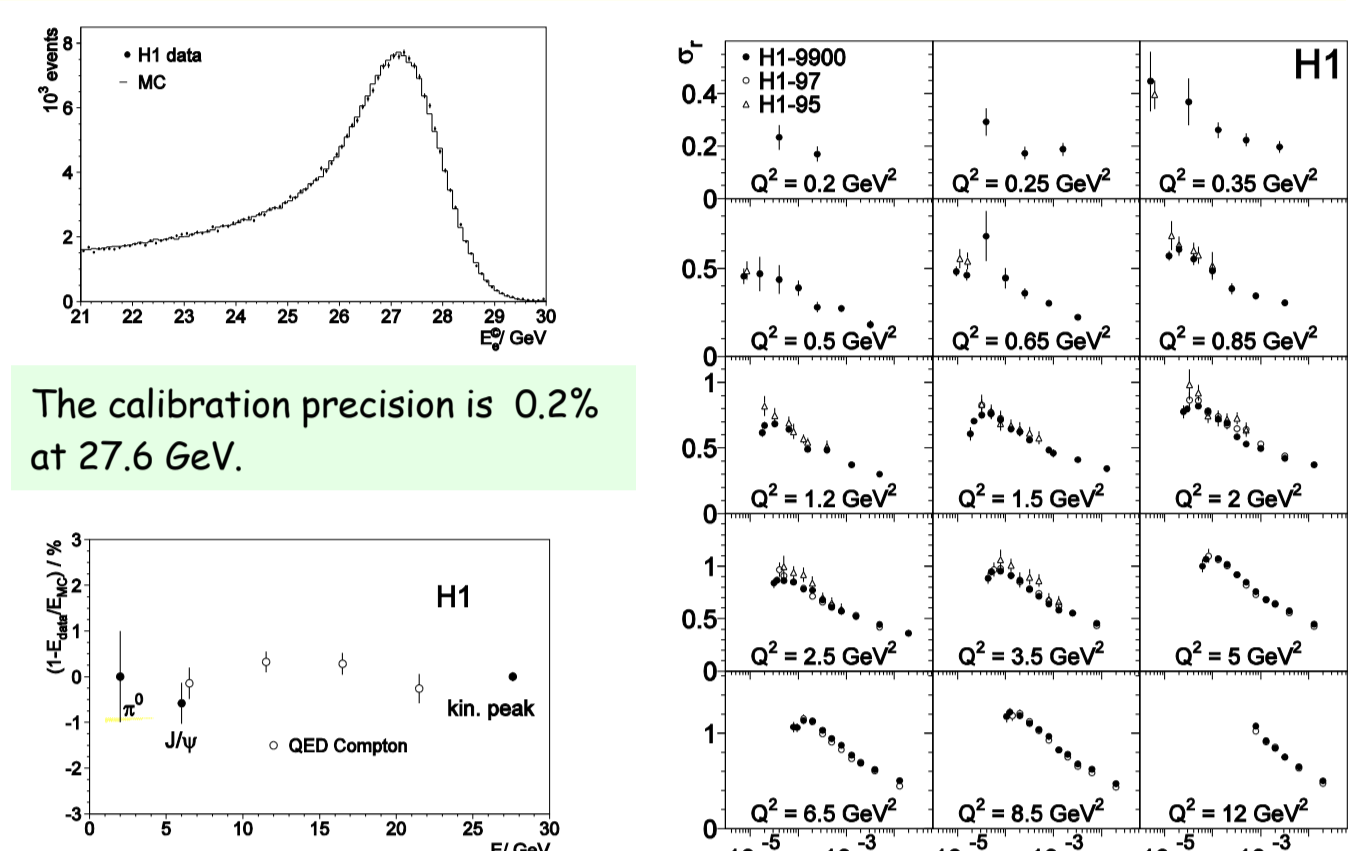
(Alexey Petrukhin on behalf of the H1 & ZEUS collaborations)



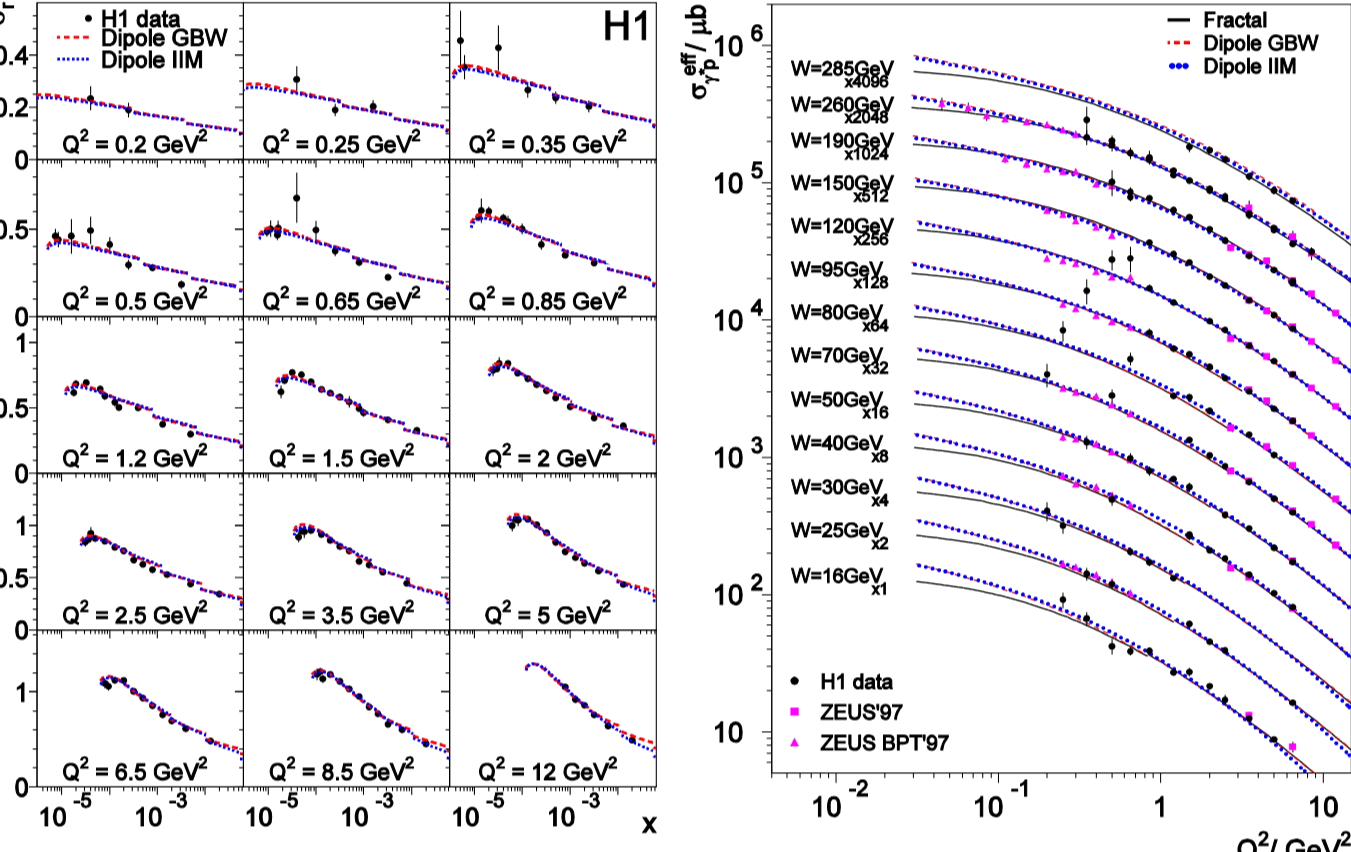
1993-2000: HERA I  
integrated luminosity ~120 pb<sup>-1</sup>  
2003-2007: HERA II  
integrated luminosity ~380 pb<sup>-1</sup>  
March 2007: Low energy run E<sub>p</sub>=460 & 575 GeV  
integrated luminosity ~ 20 pb<sup>-1</sup>  
June 30, 2007: HERA Shutdown



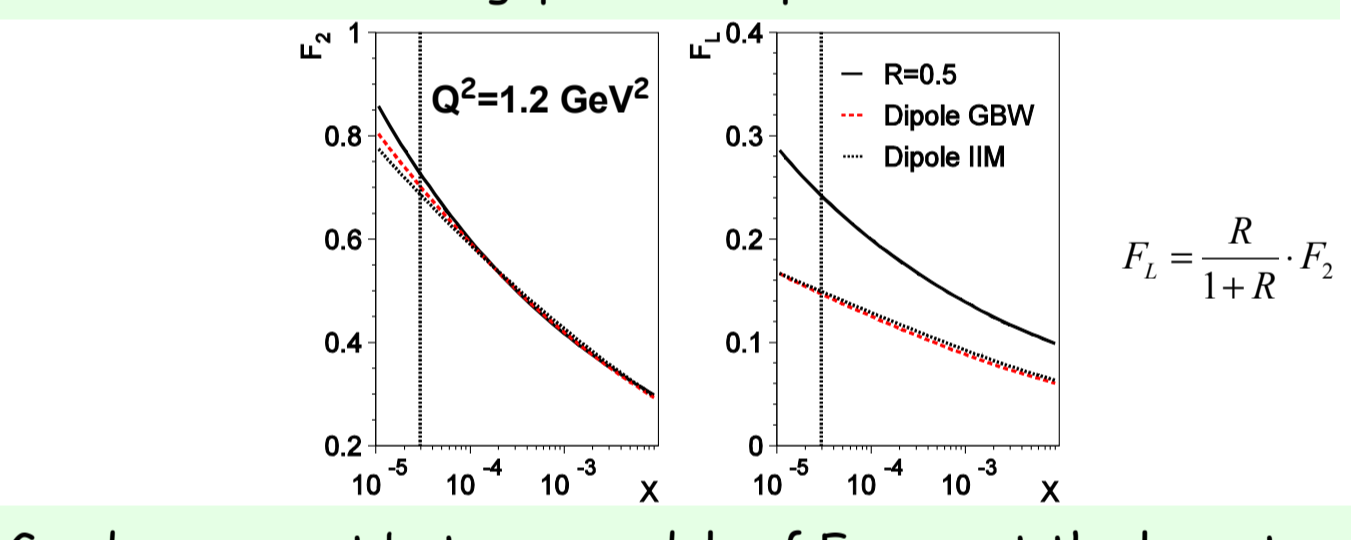
## Low Q<sup>2</sup>: 0.2-12 GeV<sup>2</sup>



New H1-9900 results extend H1 measurements to low Q<sup>2</sup> and high x. They agree well with H1-97 and H1-95 taking into account the H1-95 normalisation uncertainty.

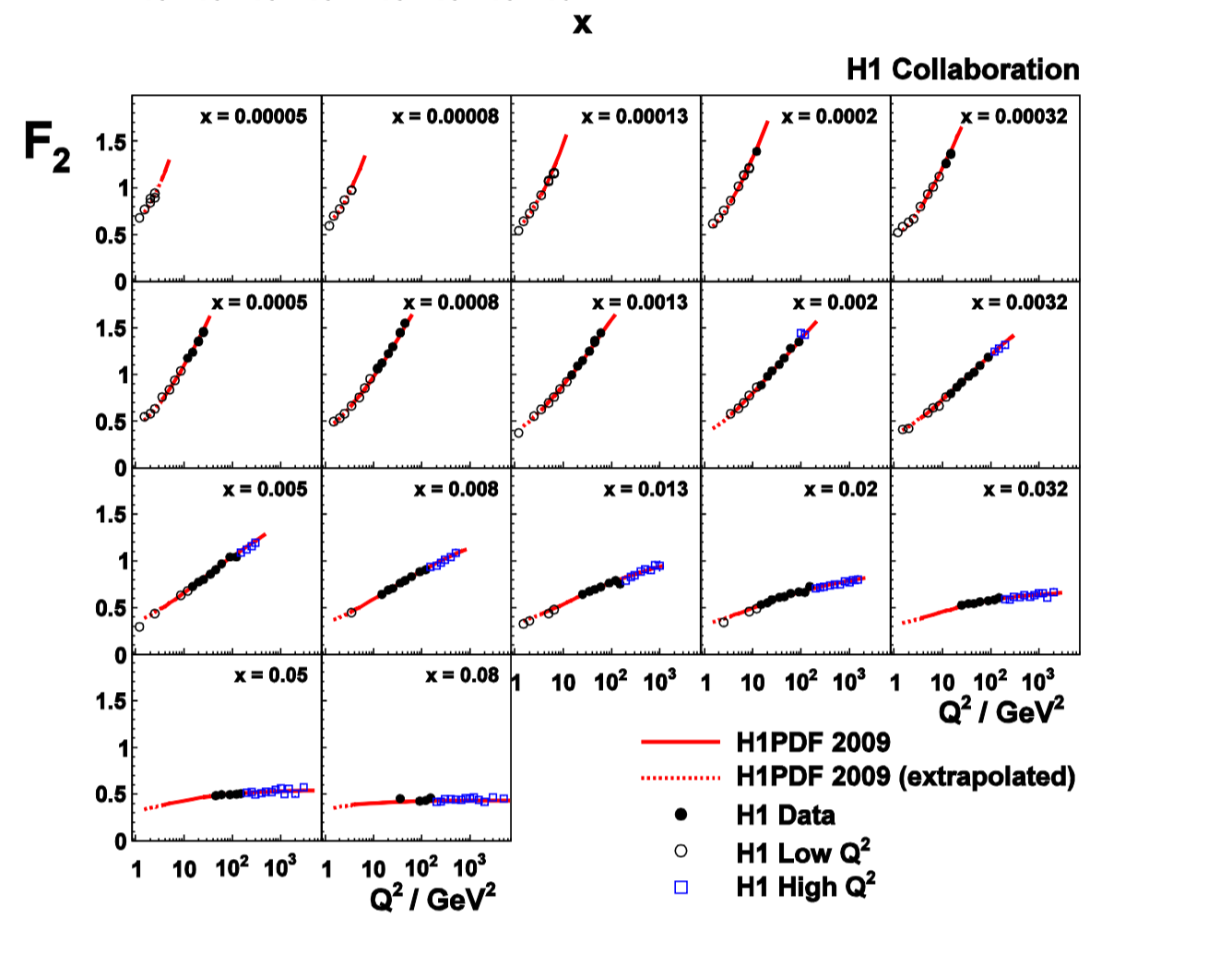
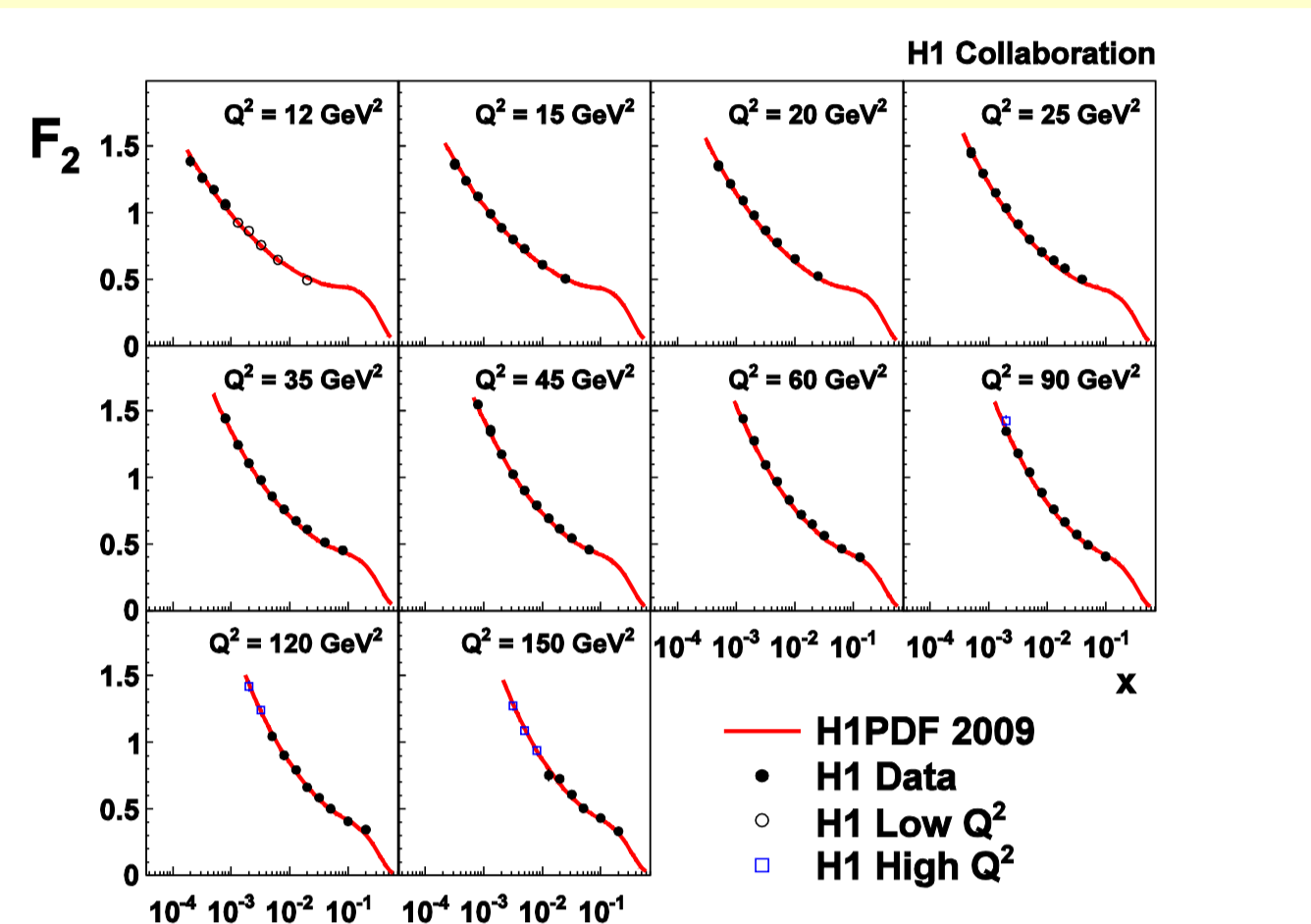


The combined H1 data are very precise (1.5-2% total error). They are well described by the Fractal & Dipole models and cover the gap between previous results.

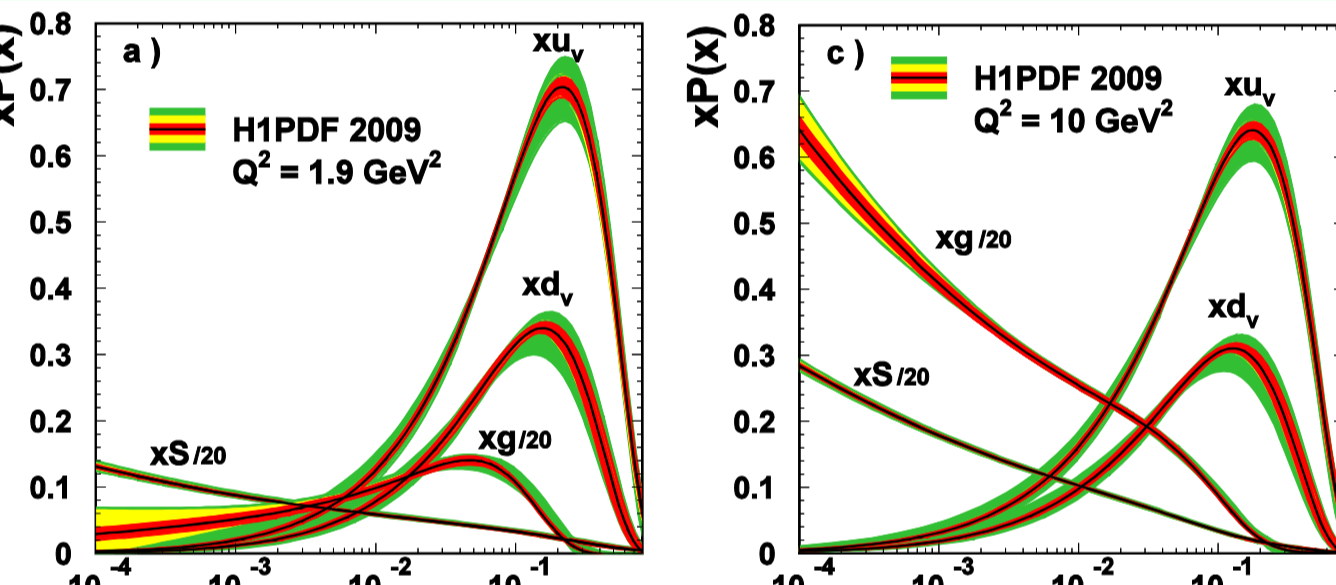


Good agreement between models of F<sub>2</sub> except the lowest x region. F<sub>1</sub> predictions of Dipole models are nearly half of the Fractal fit result. Softer F<sub>2</sub> of IIM allows a description of the data with smaller F<sub>1</sub> compared to GBW and Fractal models.

## Medium Q<sup>2</sup>: 12-150 GeV<sup>2</sup>



New combined HERA I data in the region of inelasticity 0.005 < x < 0.6 with a precision of 1.3-2%.

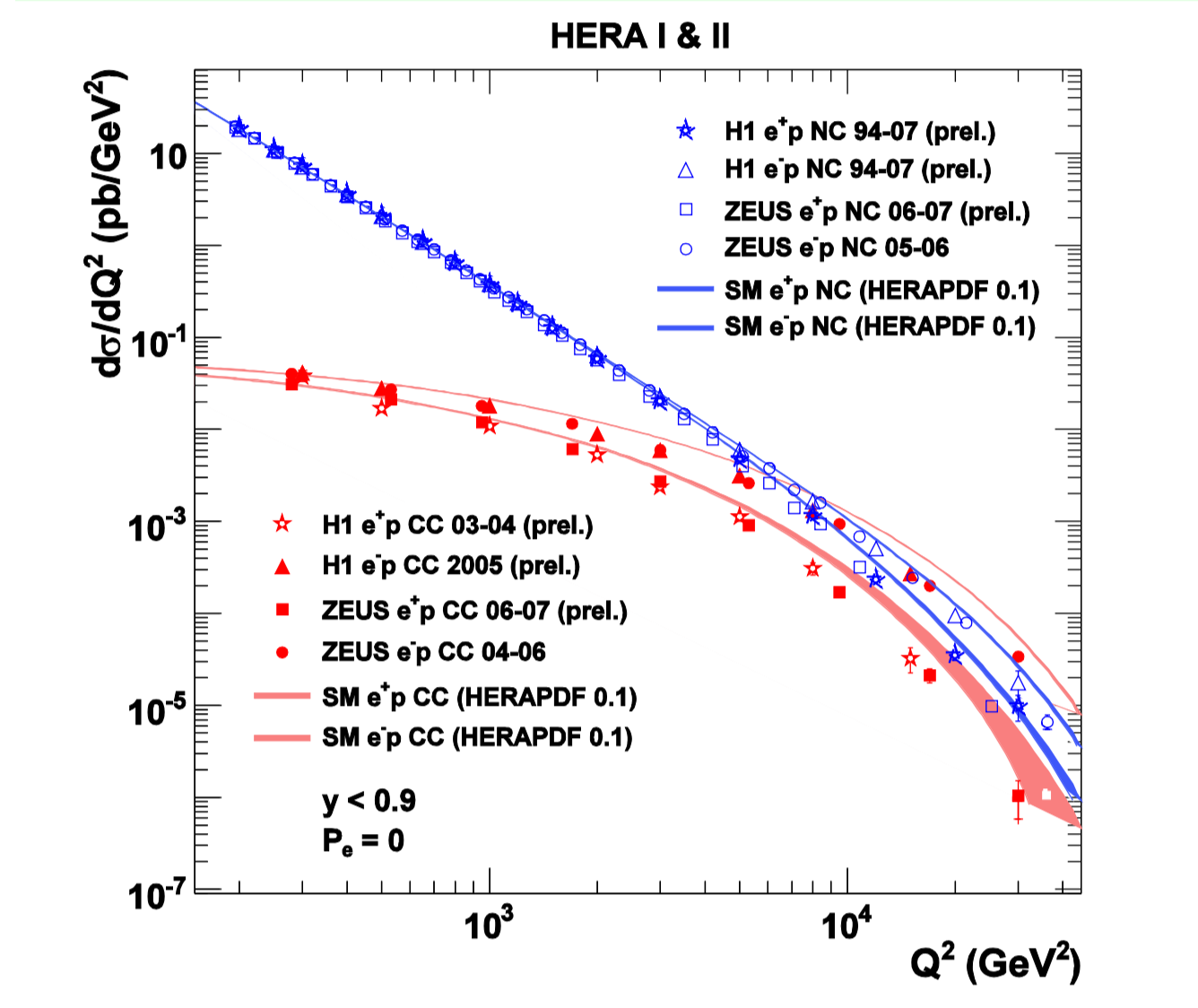


An NLO QCD fit to the H1 data alone - H1PDF 2009 - provides a new determination of the gluon & parton densities of the proton including experimental and theoretical uncertainties.

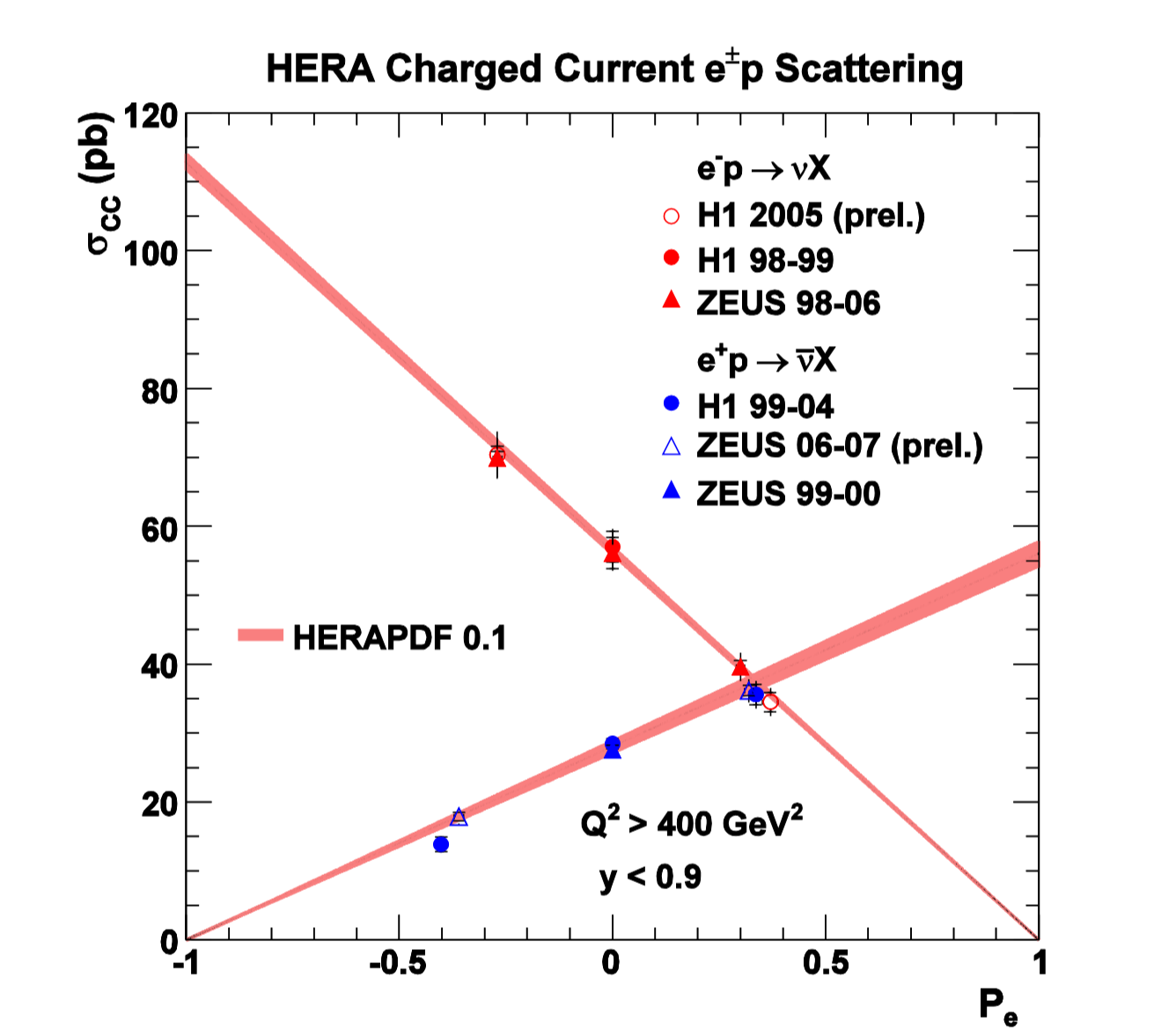
## High Q<sup>2</sup>: 150 - 30000 GeV<sup>2</sup>

### H1 & ZEUS results

The combined collected luminosity of 1fb<sup>-1</sup> by the H1 and ZEUS experiments provides a good test of the SM.

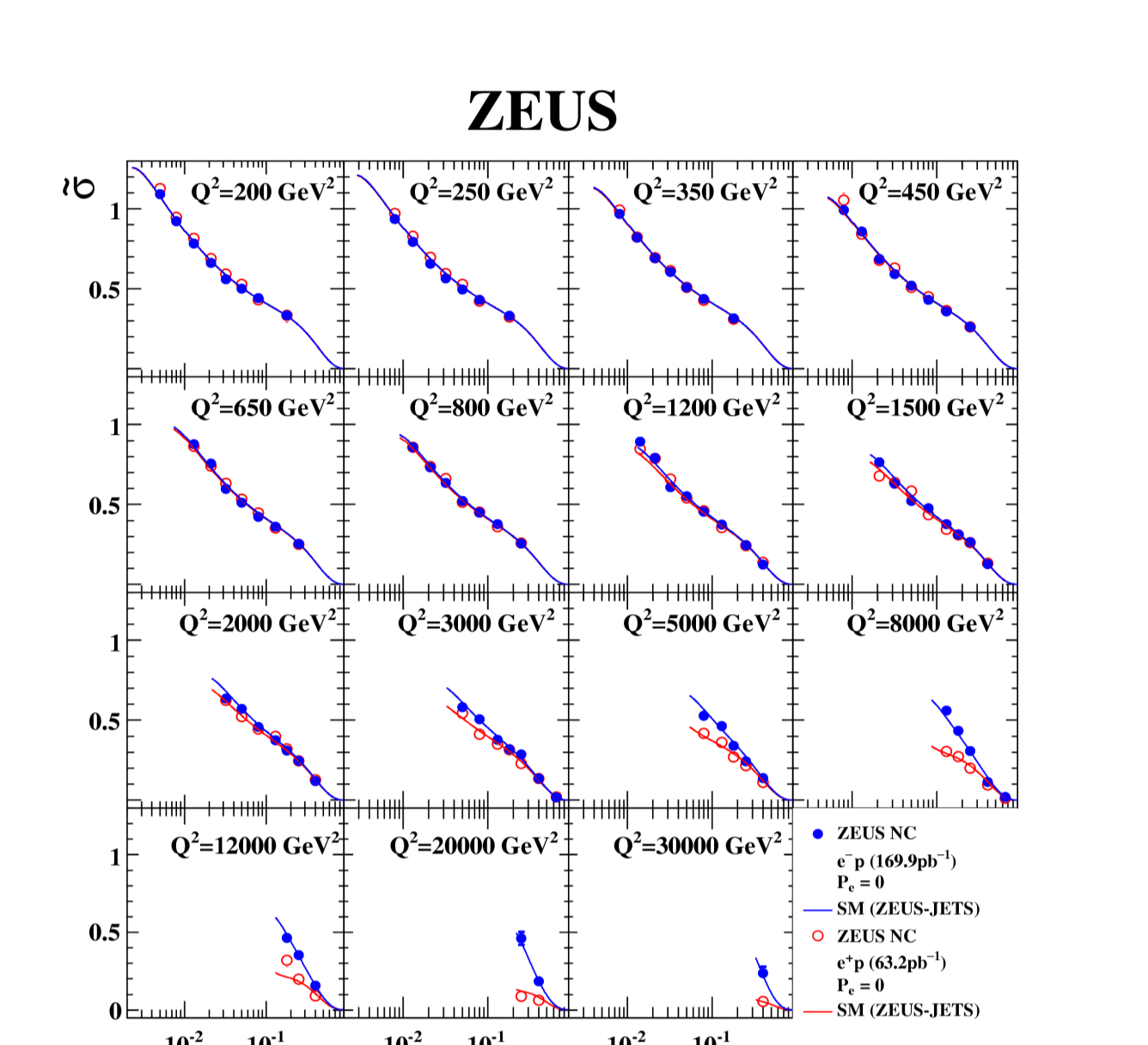


Neutral (γ/Z) and Charged (W<sup>-</sup>) current cross sections at Q<sup>2</sup> ≥ M<sup>2</sup>(Z/W) scale get similar: EW unification.

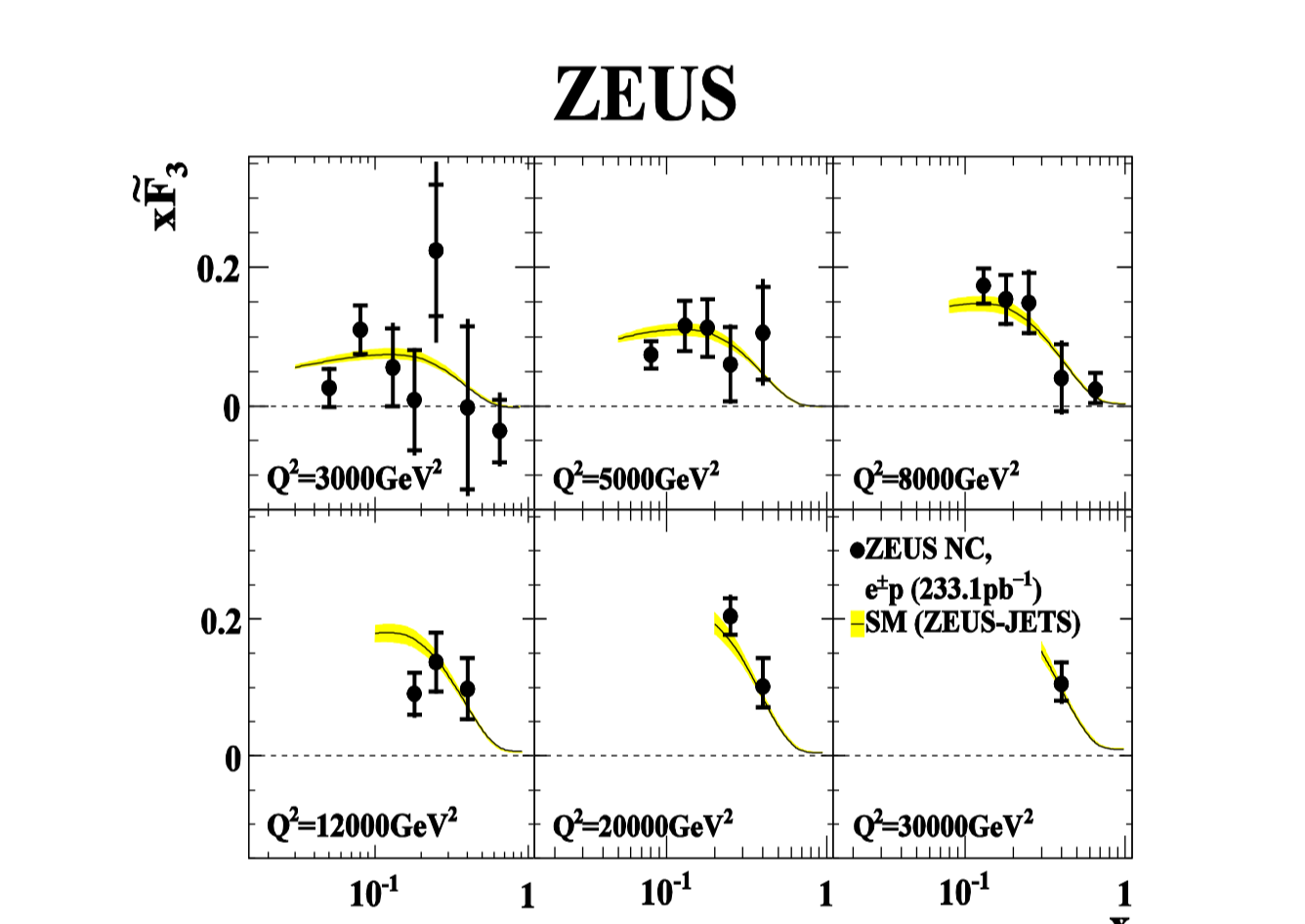


Data are compatible with vanishing cross sections for left(right)-handed positrons(electrons).

### ZEUS results



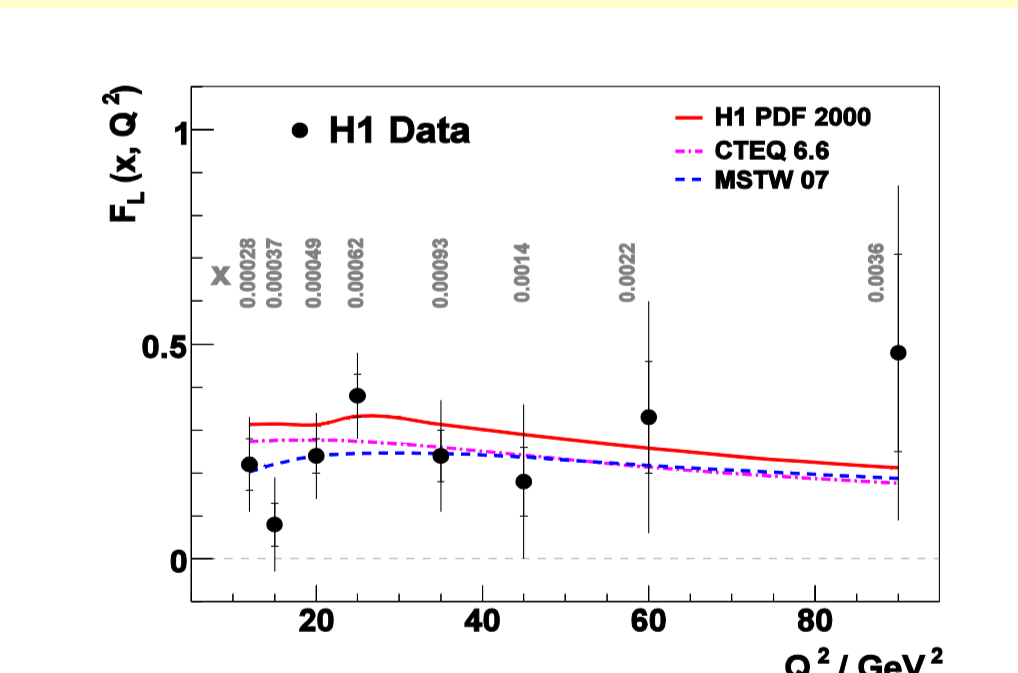
Compare new NC 170 pb<sup>-1</sup> e<sup>-</sup> with HERA I e<sup>+</sup> data and use these two data sets to extract xF<sub>3</sub> ~ 1 / (2(1-γ^2)) [σ<sub>NC</sub> - σ<sub>NC</sub><sup>-</sup>].



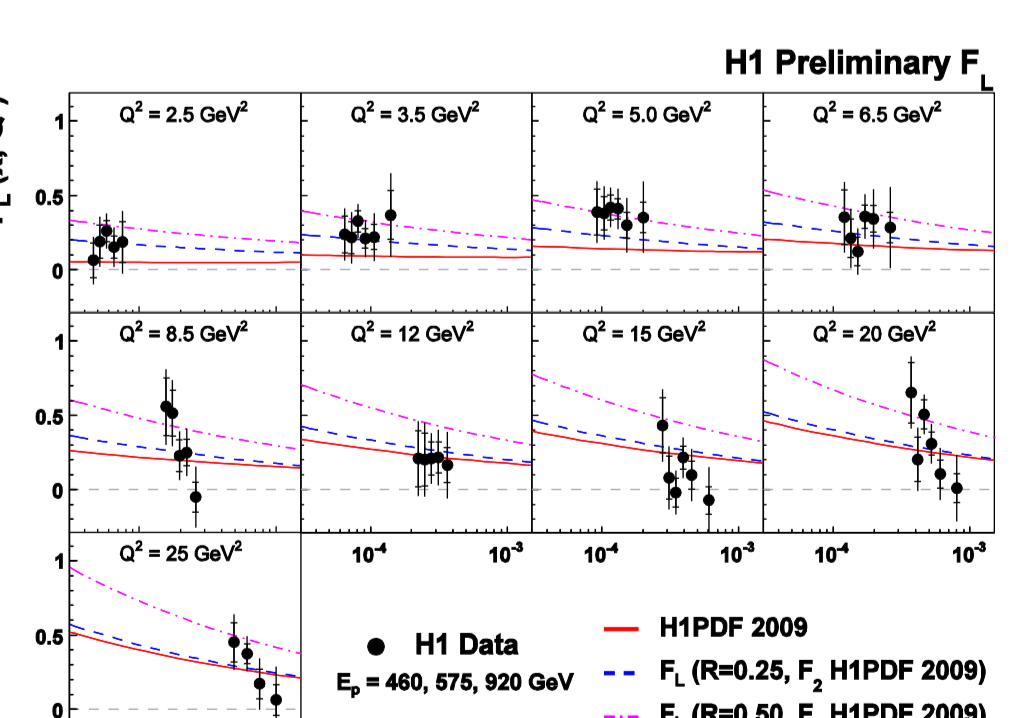
The results of measured cross sections and structure function xF<sub>3</sub> are comparable with SM expectations.

## Measurements of F<sub>L</sub>

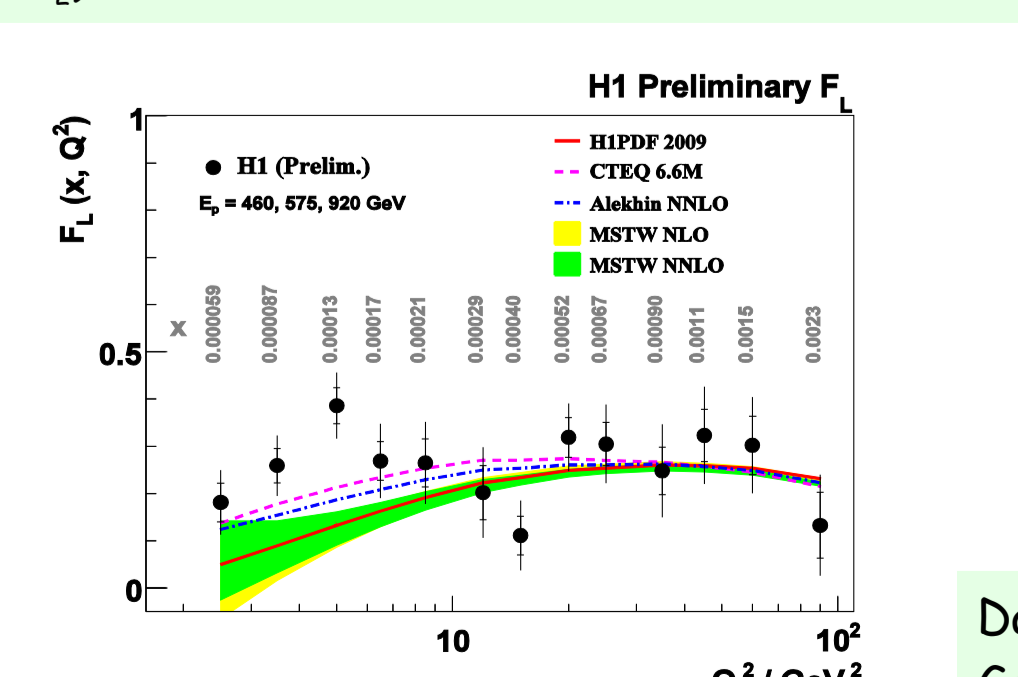
### H1 results



This is the first direct measurement of the structure function F<sub>L</sub> at HERA.

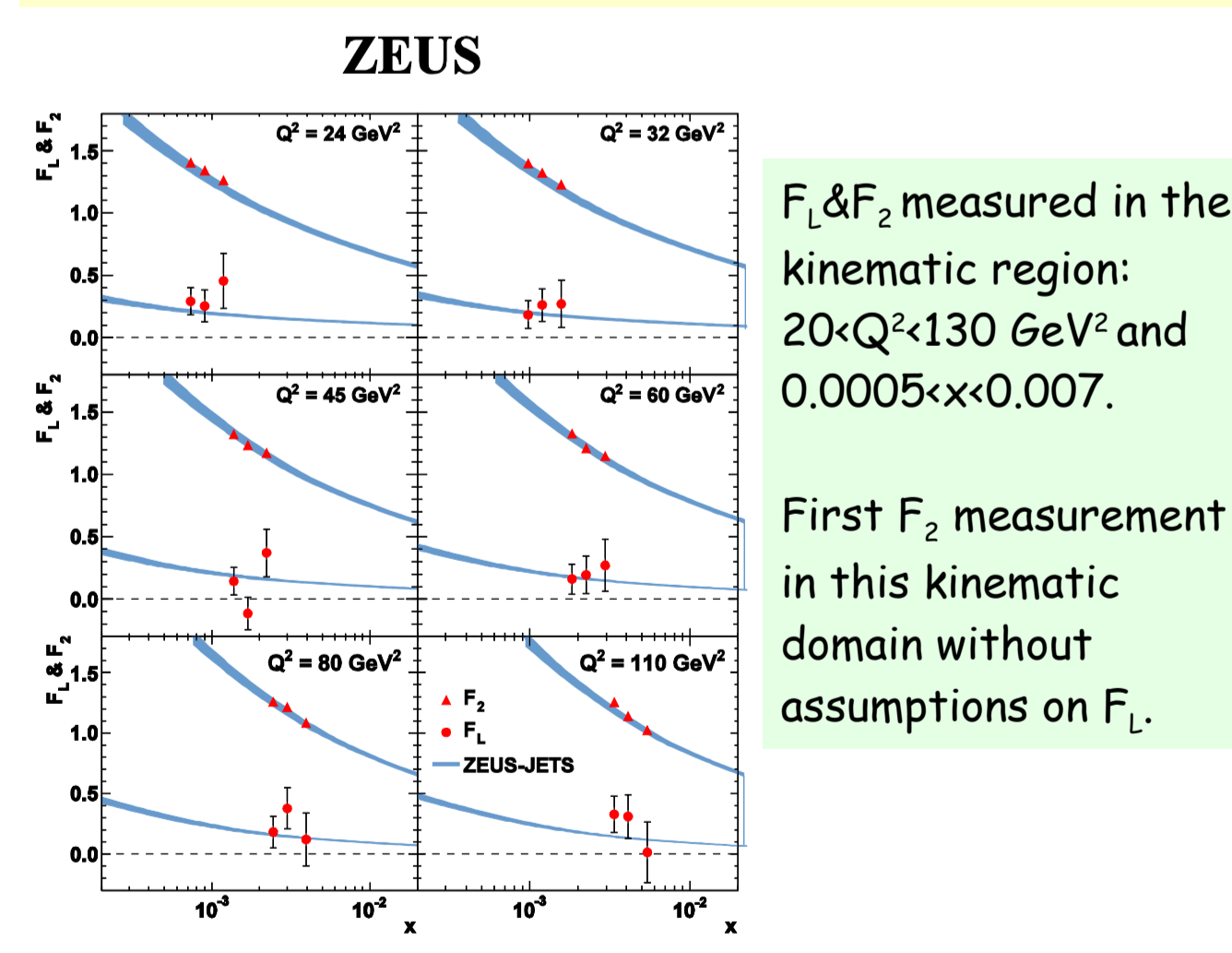


The new preliminary measurements of F<sub>L</sub> extend the results to low Q<sup>2</sup>. Data are consistent with R~0.25 (F<sub>L</sub>=0.2·F<sub>2</sub>).

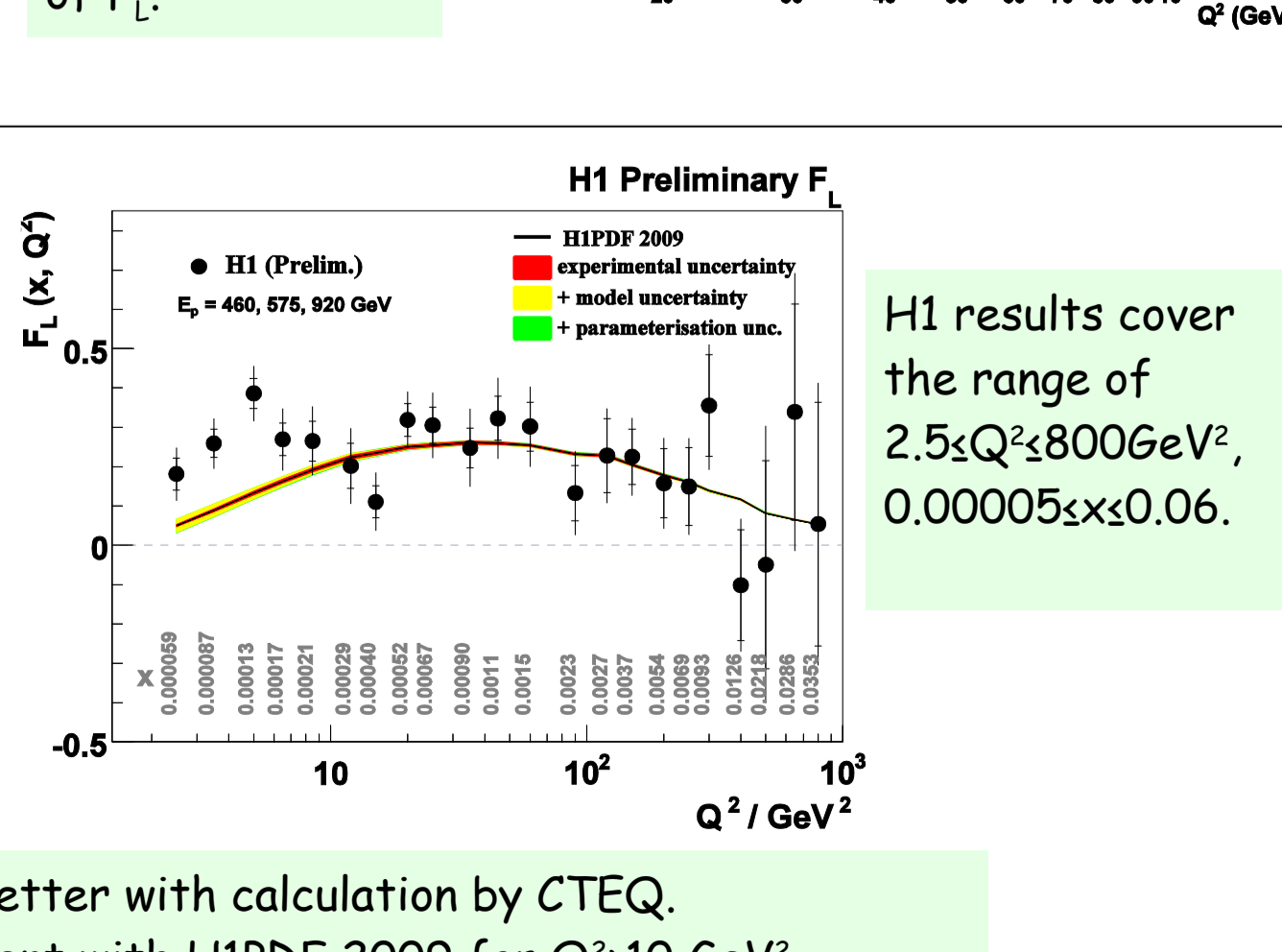


Data agree better with calculation by CTEQ. Good agreement with H1PDF 2009 for Q<sup>2</sup>>10 GeV<sup>2</sup>.

### ZEUS results

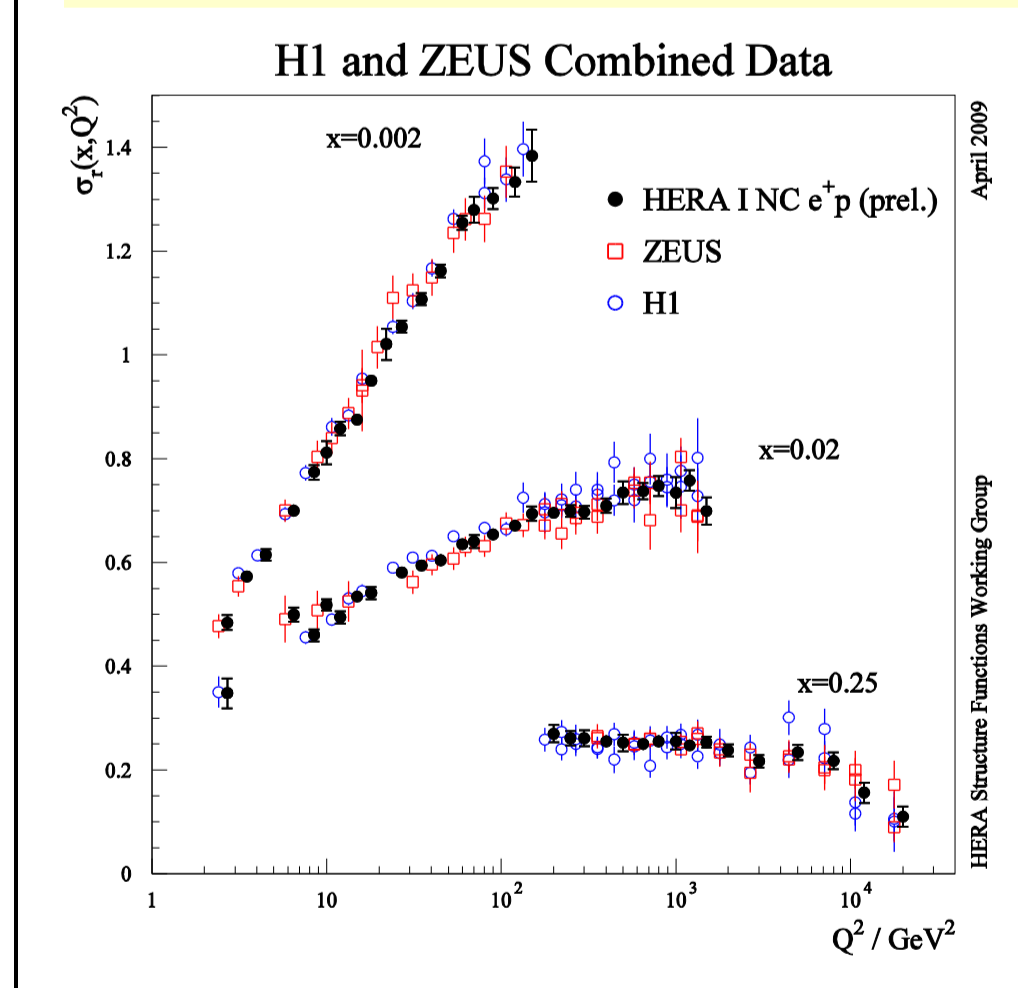


F<sub>1</sub> & F<sub>2</sub> measured in the kinematic region: 20 < Q<sup>2</sup> < 130 GeV<sup>2</sup> and 0.0005 < x < 0.007. First F<sub>2</sub> measurement in this kinematic domain without assumptions on F<sub>L</sub>.



A non-zero F<sub>L</sub> is observed. A wide range of QCD predictions agree with the measured values of F<sub>L</sub>.

## Combined H1 - ZEUS results

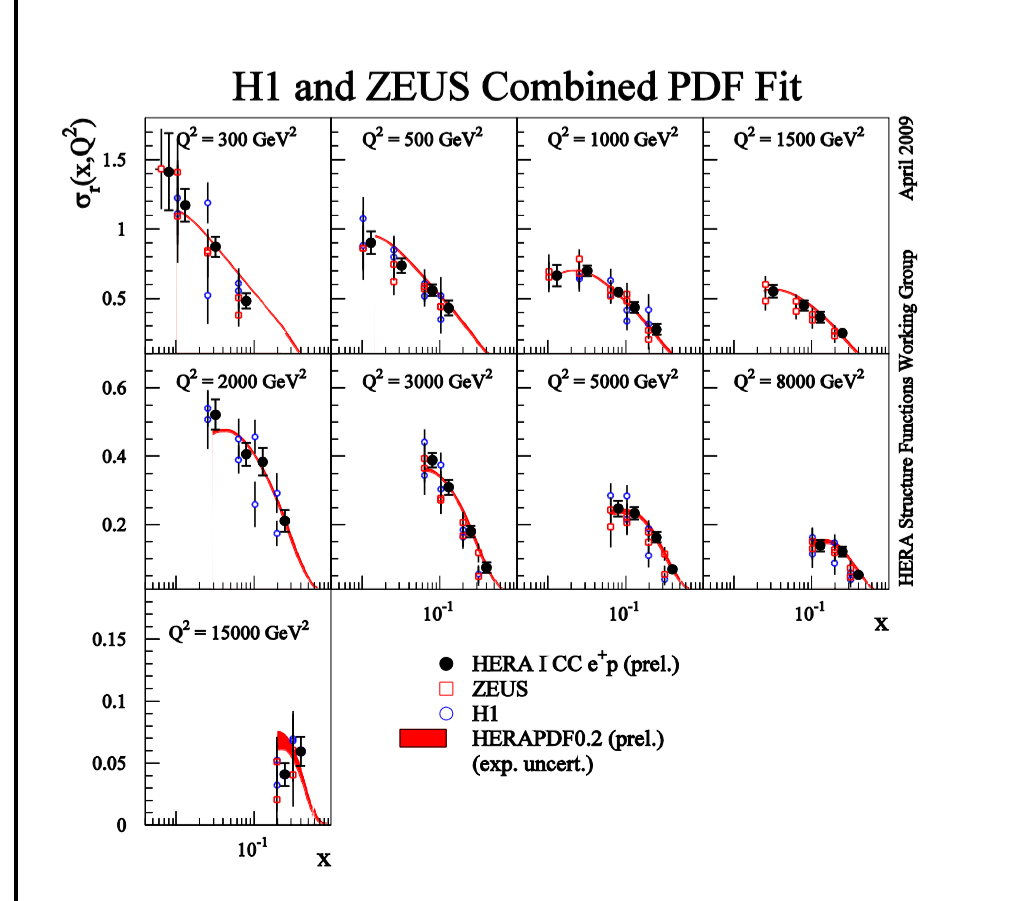
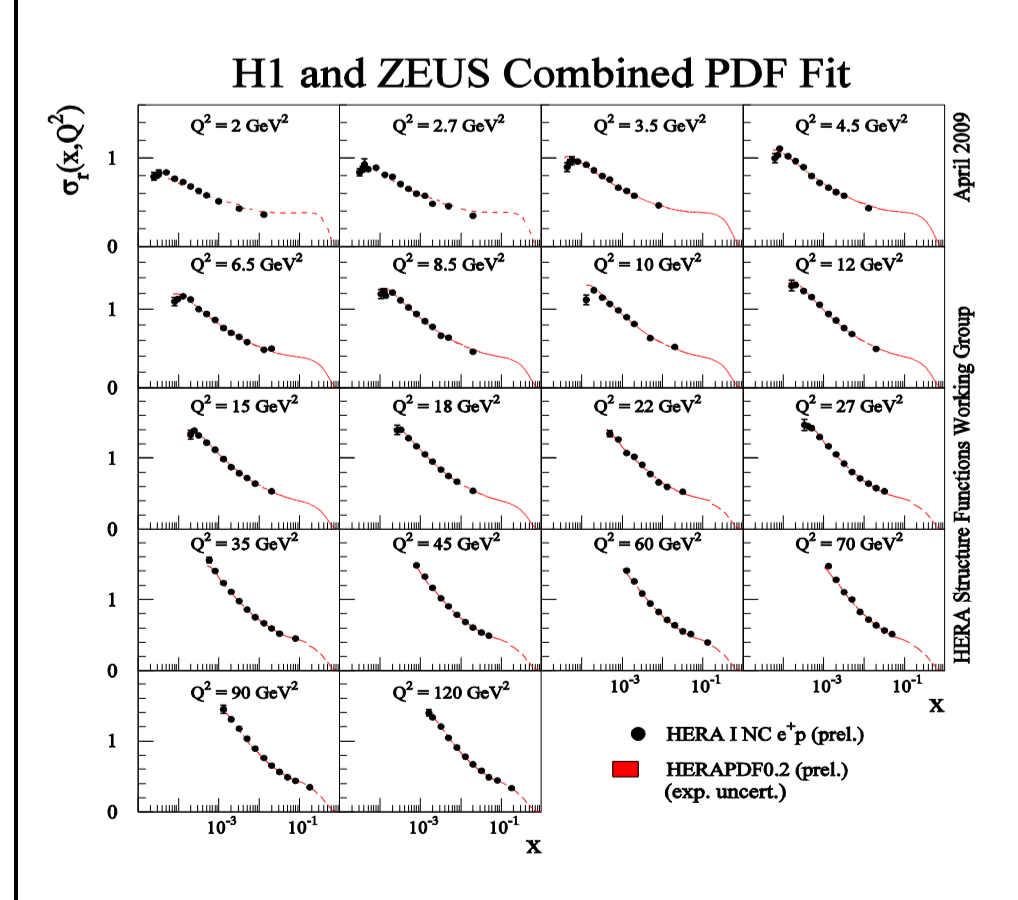


Combination of H1 & ZEUS HERA I data provides a model independent tool to study consistency of the data and to reduce systematic errors.

New average based on the complete HERA I inclusive NC and CC DIS data set with a total luminosity of L=240 pb<sup>-1</sup>.

HERAPDF0.2 is a new fit to the complete inclusive HERA I data.

The error reductions after the averaging procedure and the scaling violations predicted by the theory of QCD are clearly observed.



The combined HERA I cross sections are used as single input to a new QCD analysis to extract new proton's PDFs: HERAPDF0.2.

