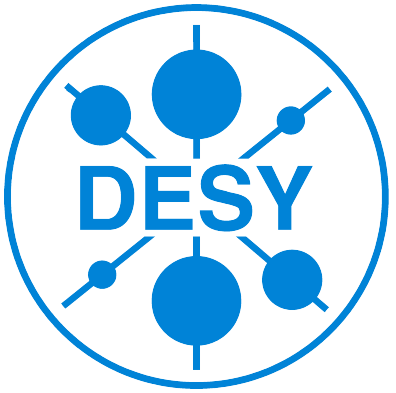
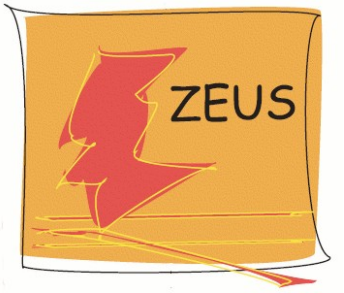




Update from HERAPDF

Shiraz Habib (DESY)

PDF4LHC Meeting • CERN • May 23, 2012

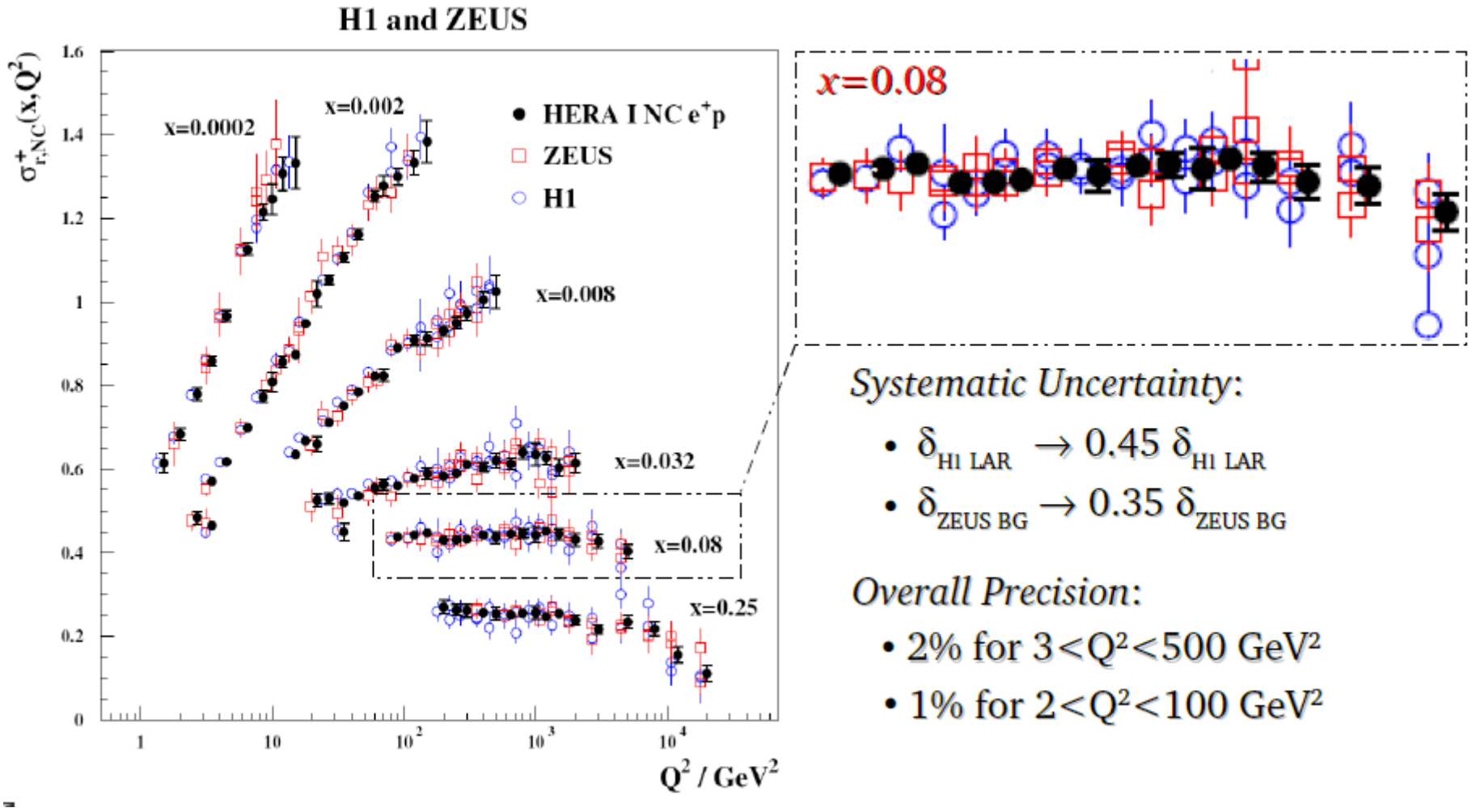
Solid QCD fits need solid data (central value, uncertainty and **correlations**).

Data set	$\delta^{\mathcal{L}}$		δ^{E}	δ^{θ}	δ^{h}	δ^{N}	δ^{B}	δ^{V}	δ^{S}	δ^{pol}
Combined low Q^2	$\mathcal{L}1$									
Combined low E_p	$\mathcal{L}1$									
e^+ NC 94-97	$\mathcal{L}1$	$\mathcal{L}2$	$E1$	$\theta1$	$h1$	$N1$	$B1$	–	–	–
e^+ CC 94-97	$\mathcal{L}1$	$\mathcal{L}2$	–	–	$h1$	$N1$	$B1$	$V1$	–	–
e^- NC 98-99	$\mathcal{L}1$	$\mathcal{L}3$	$E1$	$\theta2$	$h1$	$N1$	$B1$	–	–	–
e^- NC 98-99 *high y*	$\mathcal{L}1$	$\mathcal{L}3$	$E1$	$\theta2$	$h1$	$N1$	–	–	$S1$	–
e^- CC 98-99	$\mathcal{L}1$	$\mathcal{L}3$	–	–	$h1$	$N1$	$B1$	$V2$	–	–
e^+ NC 99-00 (incl. *high y*)	$\mathcal{L}1$	$\mathcal{L}4$	$E1$	$\theta2$	$h1$	$N1$	$B1$	–	$S1$	–
e^+ CC 99-00	$\mathcal{L}1$	$\mathcal{L}4$	–	–	$h1$	$N1$	$B1$	$V2$	–	–

Given Exp. : HERA-II Measurements are combined with HERA - I.

H1 and ZEUS also combine their measurements (inclusive/charm) giving precision better than that of a pure statistical nature.

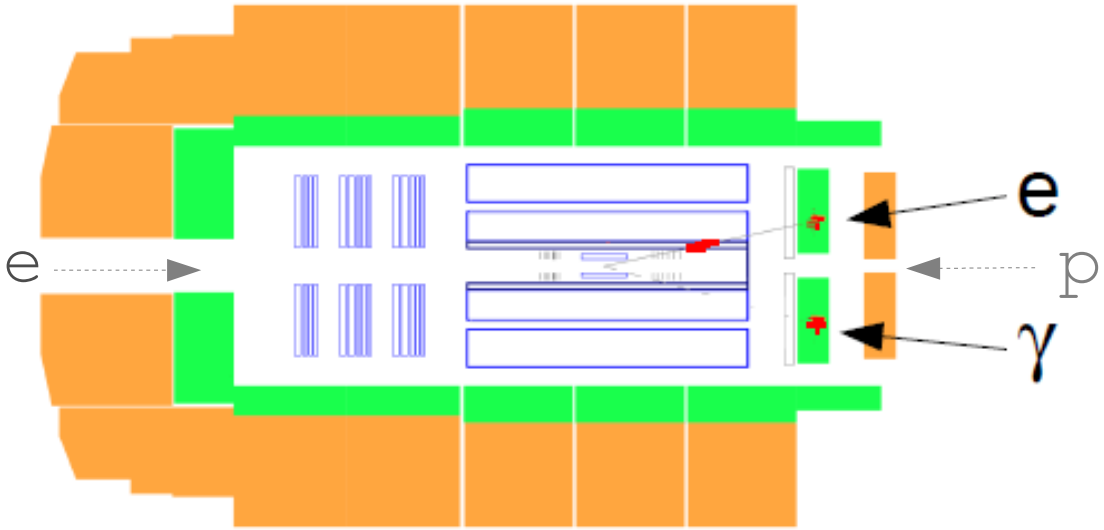
Gain in combining H1 and ZEUS inclusive data.



Combinations take place concurrently as the new measurements are produced.

Cross Section = Number of Events / **Luminosity**

Luminosity is obtained using Elastic QED Compton: $ep \rightarrow ep\gamma$

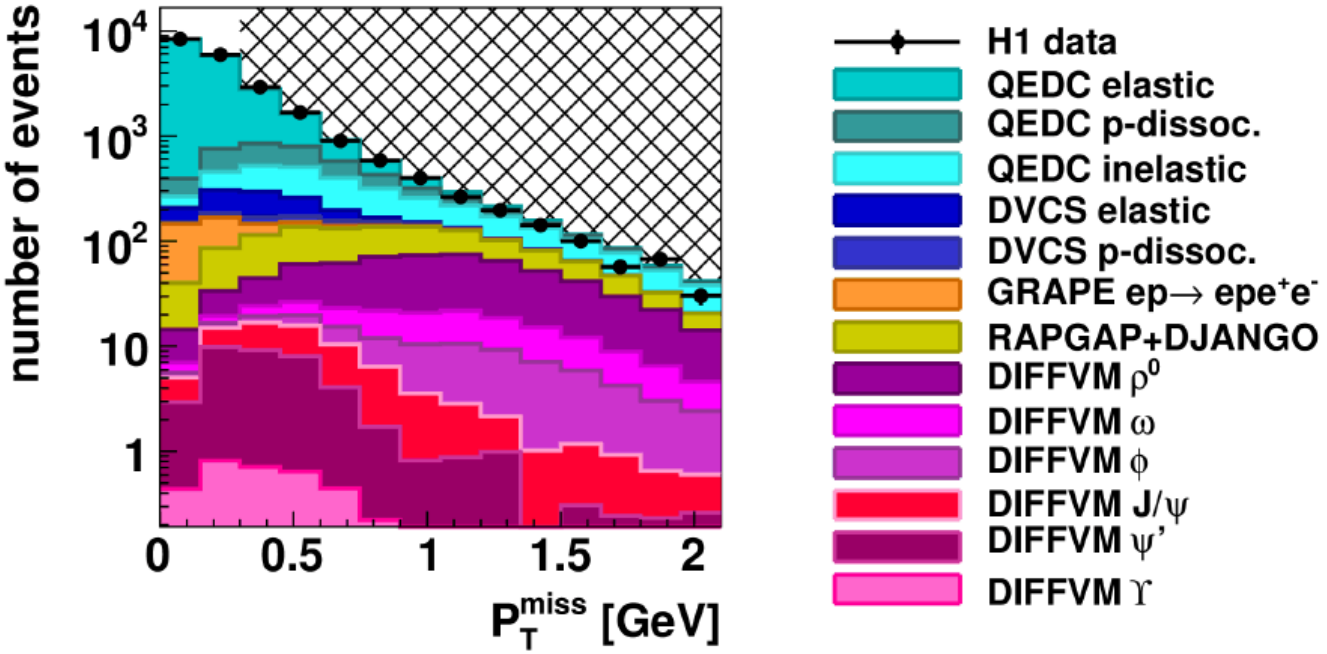


- clear signature
- e and γ with a sizable transverse momenta
- use main detector
- indep. of beam optics

Challenges :

› Small Cross Section (~ 50 pb)

› Bg Contributions (DIFFVM,L-Pair)



Uncertainty [%]:

Experimental	1.4
Background	1.2
QEDC Theory	1.1
Statistical	0.8
Total	2.3
Previous **HERAII**	3.4

This represents the final Luminosity precision and is propagated to all HERA-II measurements.

	R	L
e^-p	$\mathcal{L} = 47.1\ \text{pb}^{-1}$ $P_e = (+36.0 \pm 1.0)\%$	$\mathcal{L} = 104.1\ \text{pb}^{-1}$ $P_e = (-25.8 \pm 0.7)\%$
e^+p	$\mathcal{L} = 101.0\ \text{pb}^{-1}$ $P_e = (+32.5 \pm 0.7)\%$	$\mathcal{L} = 80.5\ \text{pb}^{-1}$ $P_e = (-37.0 \pm 0.7)\%$

Hera - II luminosity for one of the colliding beam experiments

Cross Section = **Number of Events** / Luminosity

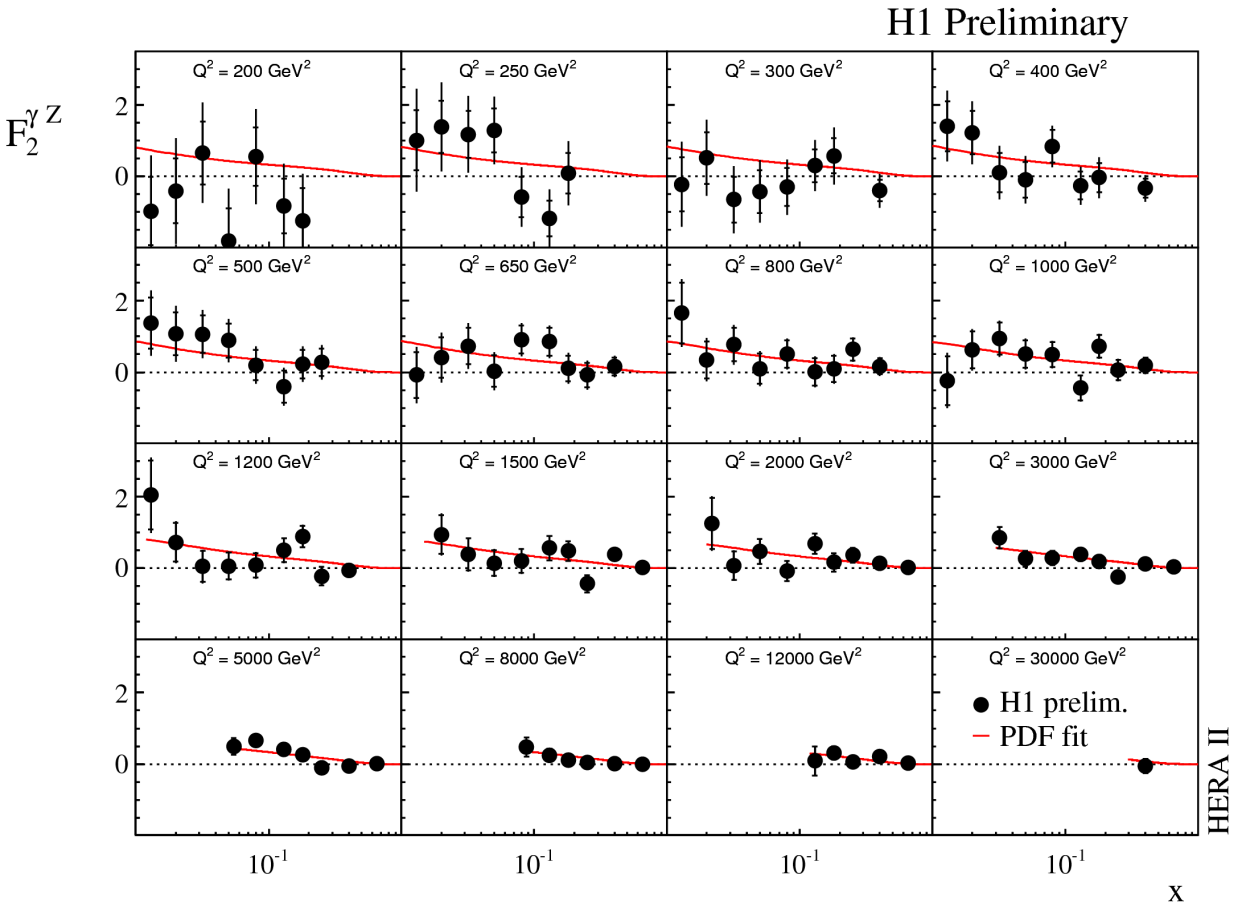
The $\mathbf{F_2^{GZ}}$ structure function

$$\left[F_2, F_2^{\gamma Z}, F_2^Z\right] = x \sum_q [e_q^2, 2e_q v_q, v_q^2 + a_q^2](q + \bar{q})$$

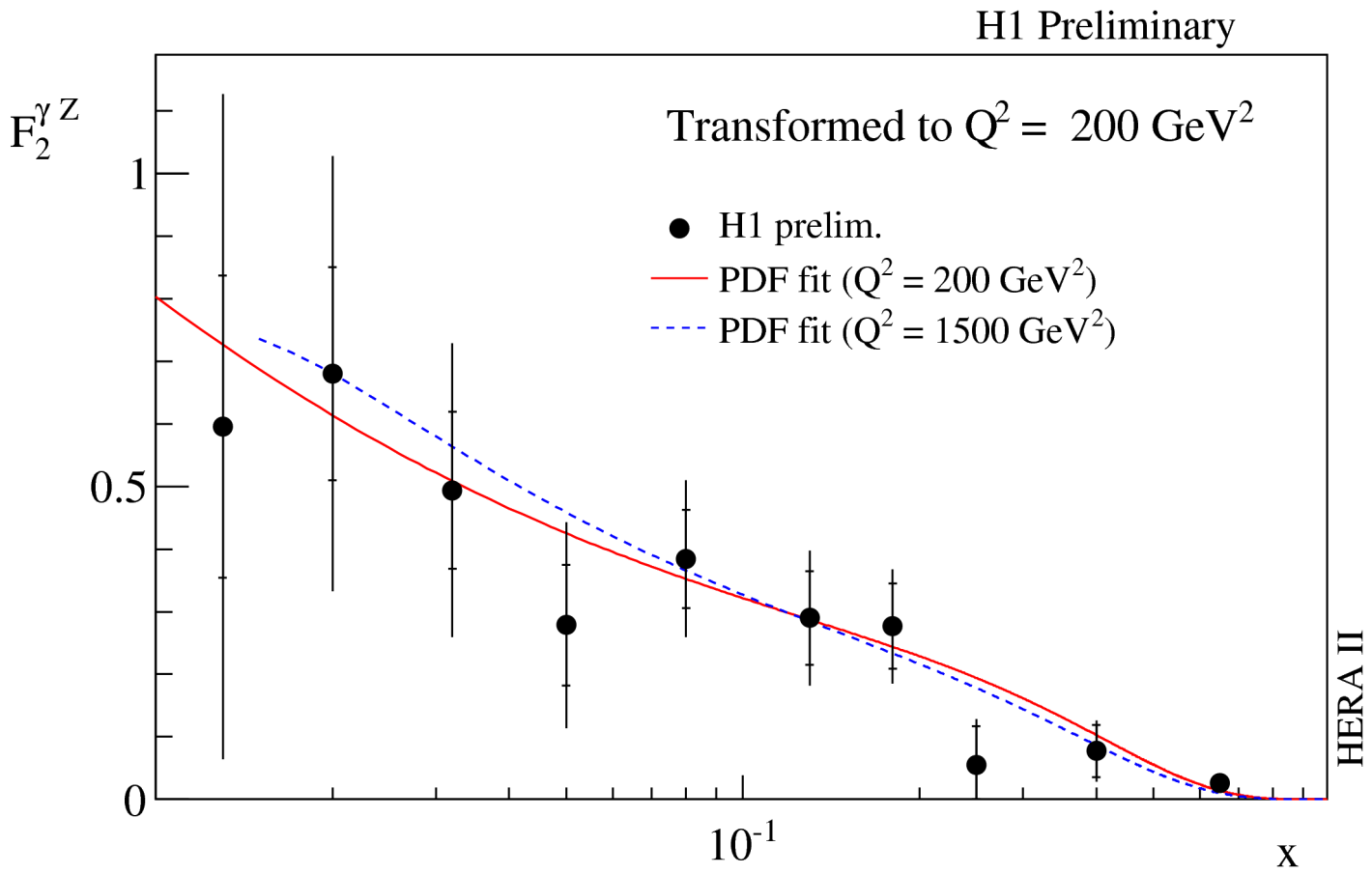
Using the polarization dependence of the NC cross sections for e+p and e-p interactions, F_2^{GZ} can be extracted.

$$\frac{\sigma^{\pm}(P_L) - \sigma^{\pm}(P_R)}{P_L - P_R} = \frac{\kappa Q^2}{Q^2 + M_Z^2}\left[\mp a_e F_2^{\gamma Z} + \frac{Y_-}{Y_+} v_e x F_3^{\gamma Z} - \frac{Y_-}{Y_+}\frac{\kappa Q^2}{Q^2 + M_Z^2}(v_e^2 + a_e^2) x F_3^Z\right]$$

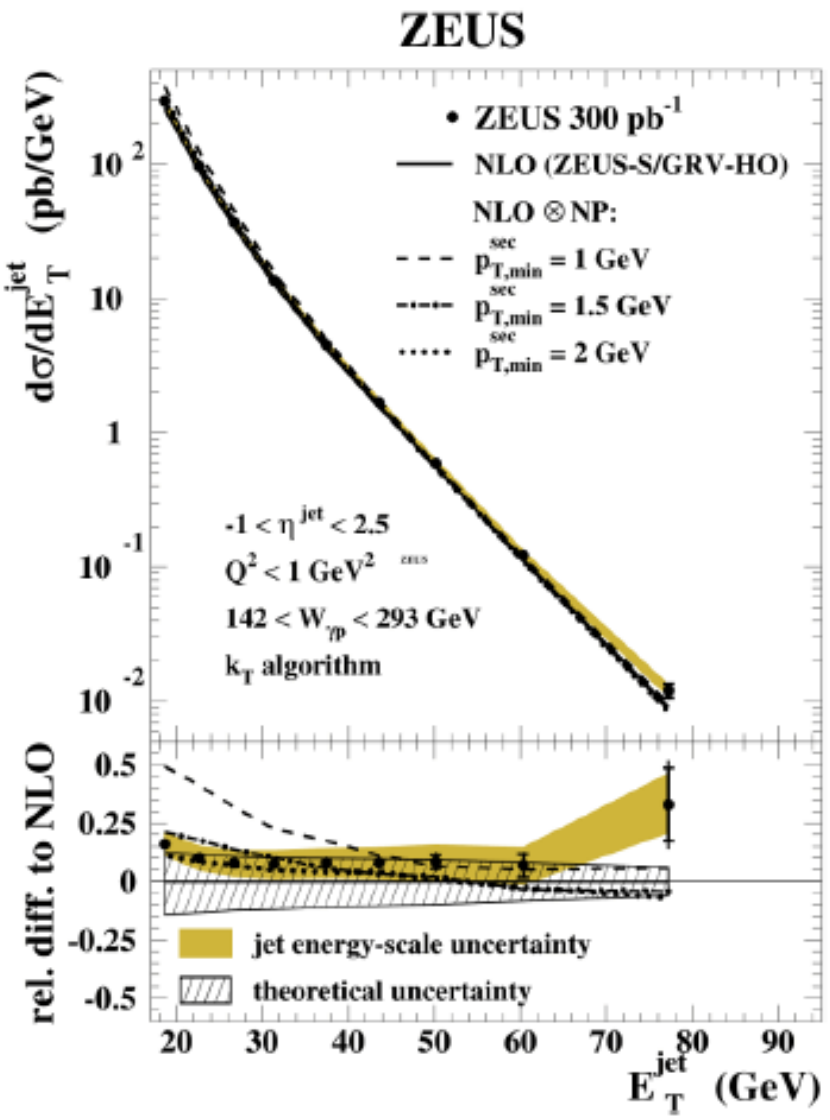
Weak Q^2 dep.

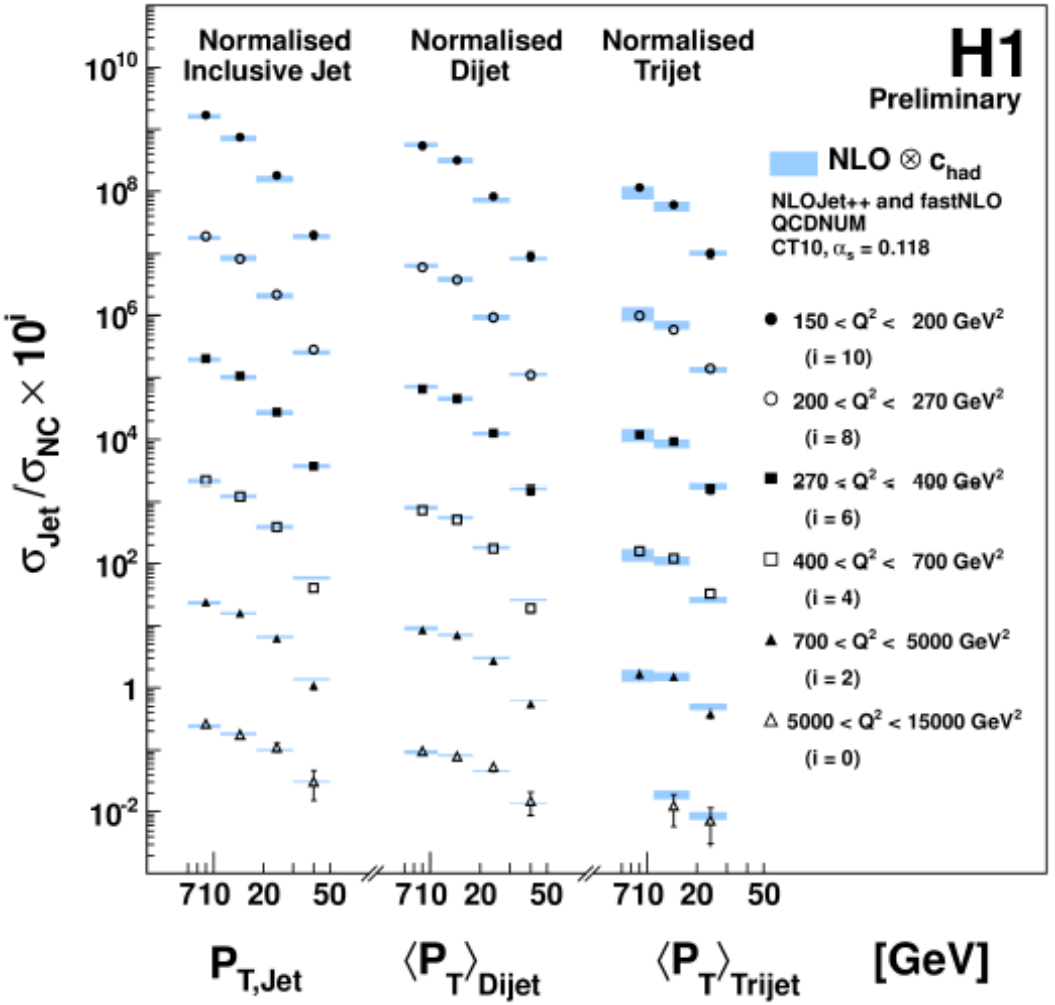


F_2^{GZ} transformed to $Q^2 = 200\ GeV^2$.



[2] Other HERA Measurements in progress : **Jet Data**



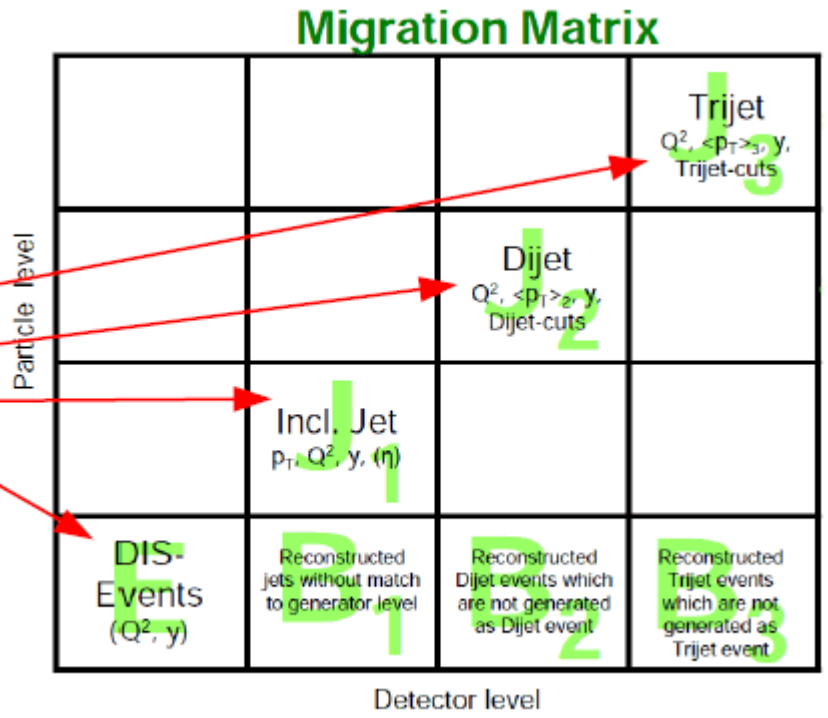


Unfolding method employed to extract multi-jet cross sections in order to reduce model uncertainty

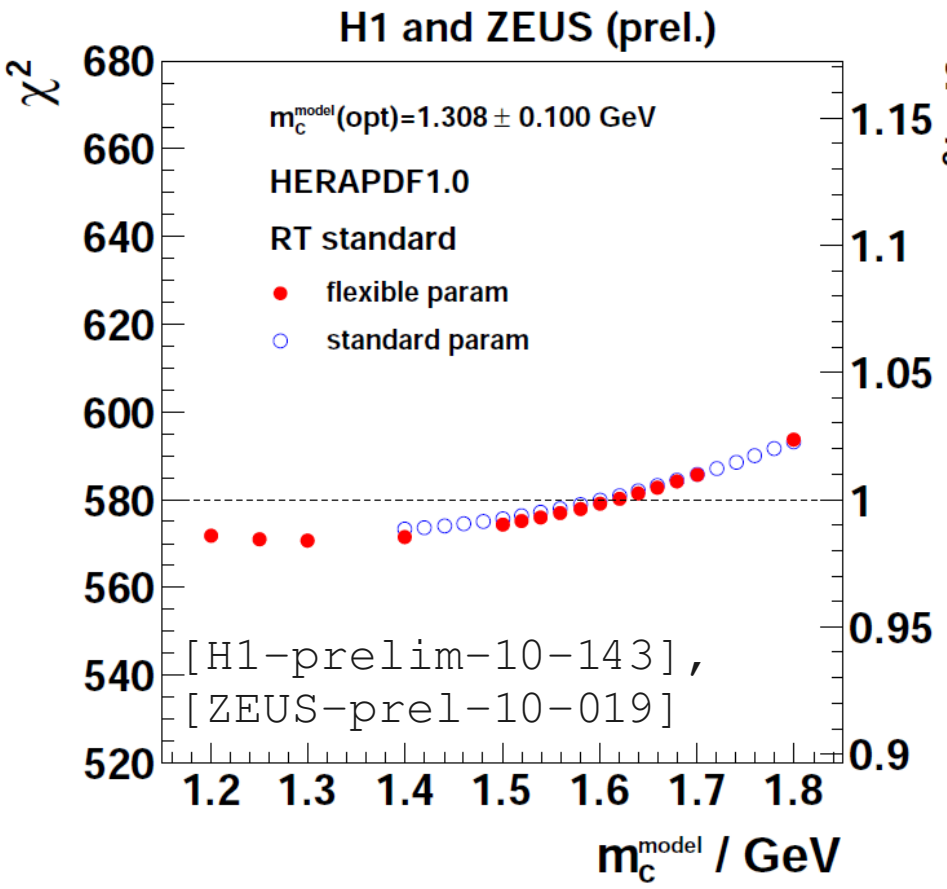
Simultaneous extraction of:

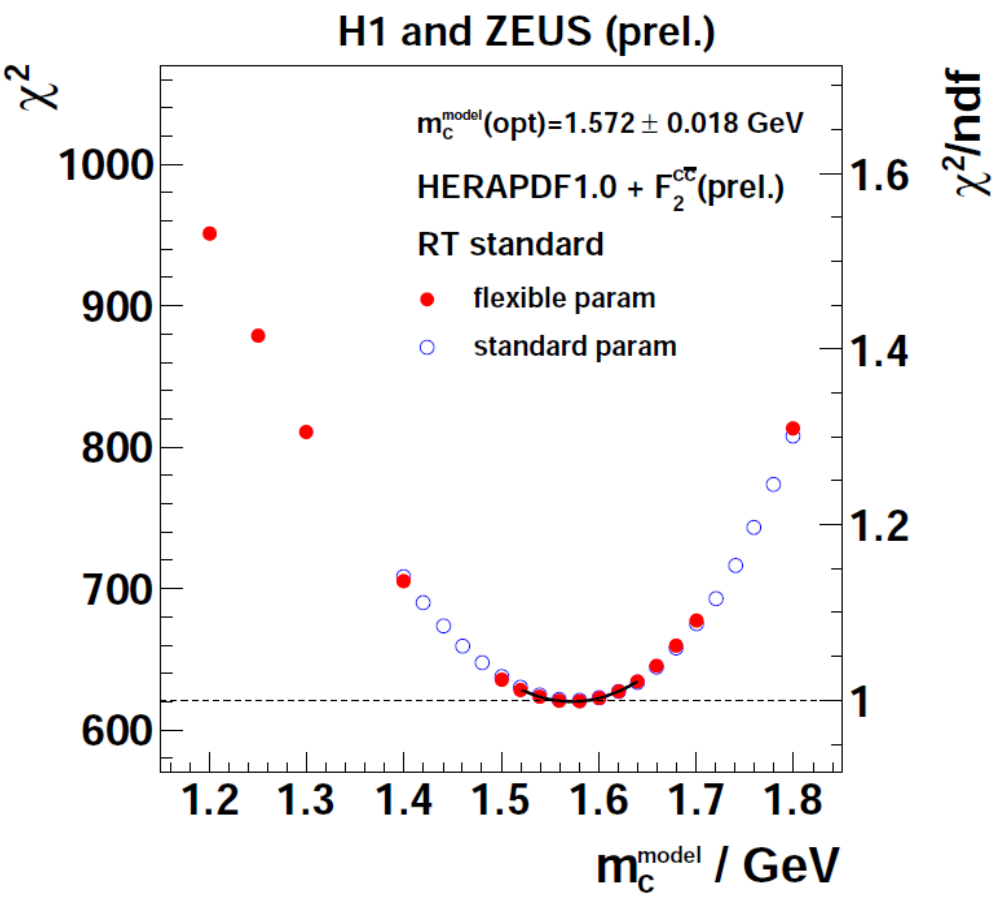
Trijet cross sections
Dijet cross sections
Inclusive jet cross sections
Inclusive DIS cross sections

Full correlation matrix calculated (important for fits)



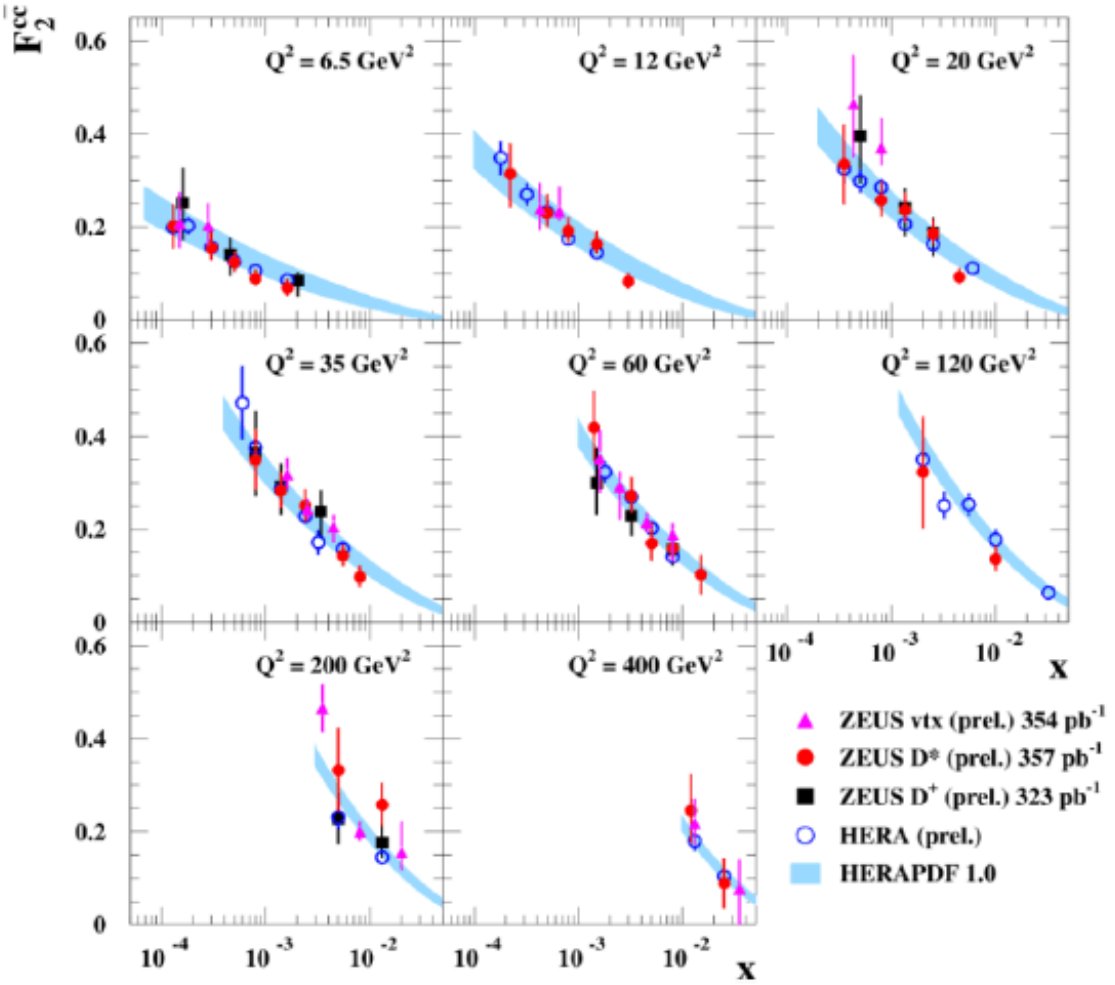
HERA Charm data provides a tool to test pQCD
and different heavy flavor schemes.





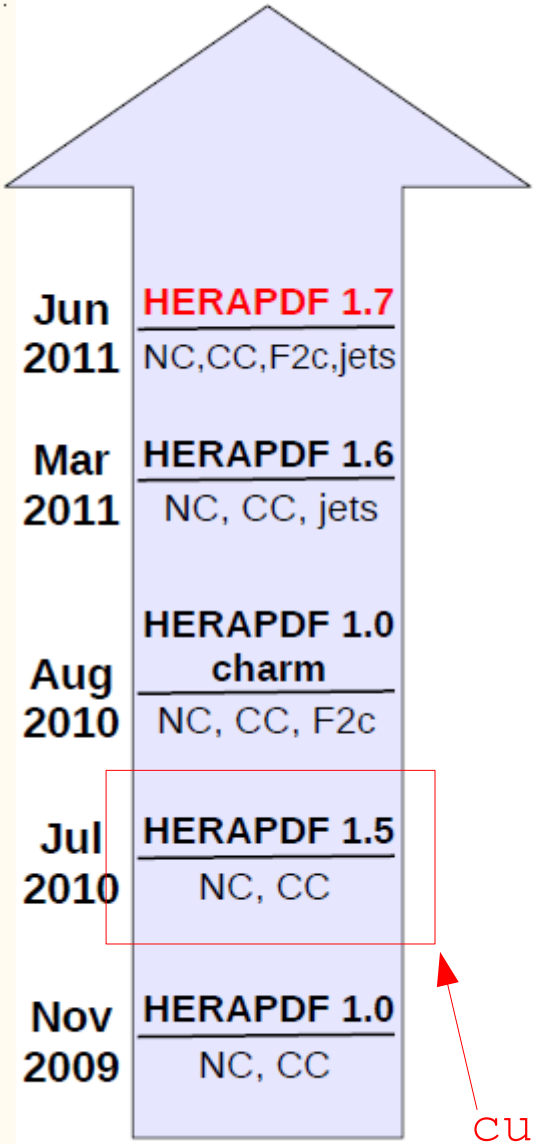
Combined H1-ZEUS charm data is close to publication.

[ZEUS Prel.]



- NLO QCD calculations were used to extrapolate from the visible to the full phase space to extract $F_2^{c\bar{c}}$.
- **Consistent with previous measurements.**
- **High precision**, significant improvement of combination expected.

HERAPDF 2.0 [Inclusive/Heavy/Jet Data/NLO/NNLO]



Final Inclusive Data including Combination of H1 & ZEUS as well as Jet and heavy flavor is converging.

We are excited about what these precision measurements will bring to our understanding of proton structure and to LHC predictions.