Structure Function Session Summary 'a personal view'

Richard Nisius (CERN) 03/09/2001

- Introduction

1) What have we learnd recently?
2) What should we resolve or look at?
3) What will future bring us?

- Conclusion

Introduction

We had:

1) Three talks from LEP about F_2^γ and $F_{2,c}^\gamma$.
2) Three talks from HERA about jet production and photon structure.
3) One theory contribution.

Which means to me:

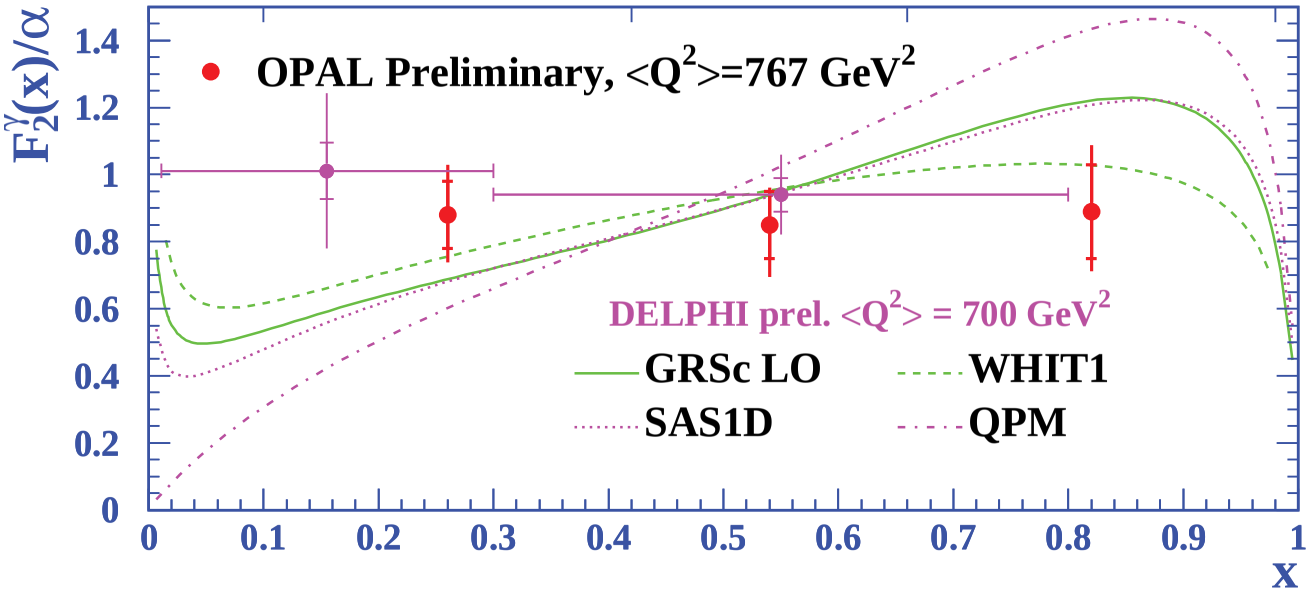
1) The investigation of the Photon Structure is an active field of research, both experimentally and theoretically.
2) In some areas we considerably improved on the precision.
3) Study of the photon structure is an almost democratic field wrt. experimental and theoretical investigations.

So let us see what we can conclude from this.

The high-Q^2 reach of F_2^γ

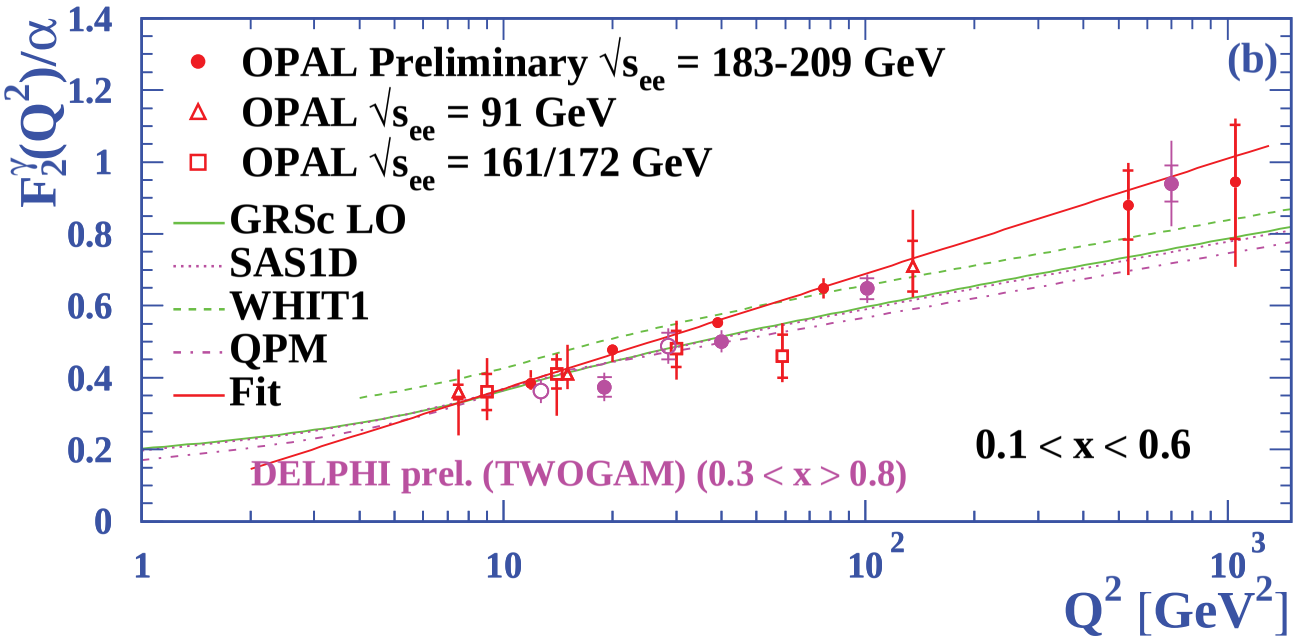
R.Taylor

I.Tiapkin



1) We start to look at factorisation scales of about 1000 GeV^2.
   This will be the 'final' word until the Linear Collider, so let us try to make the most out of it!
2) F_2^γ is measured with 15-20% precision at $Q^2 \approx 750\ \mathrm{GeV}^2$.
3) For $x > 0.1$ the precision of the measurement is mainly limited by the statistical error. Get ADOL together to improve on the statistical error.

The improvement on the Q^2 evolution of F_2^γ



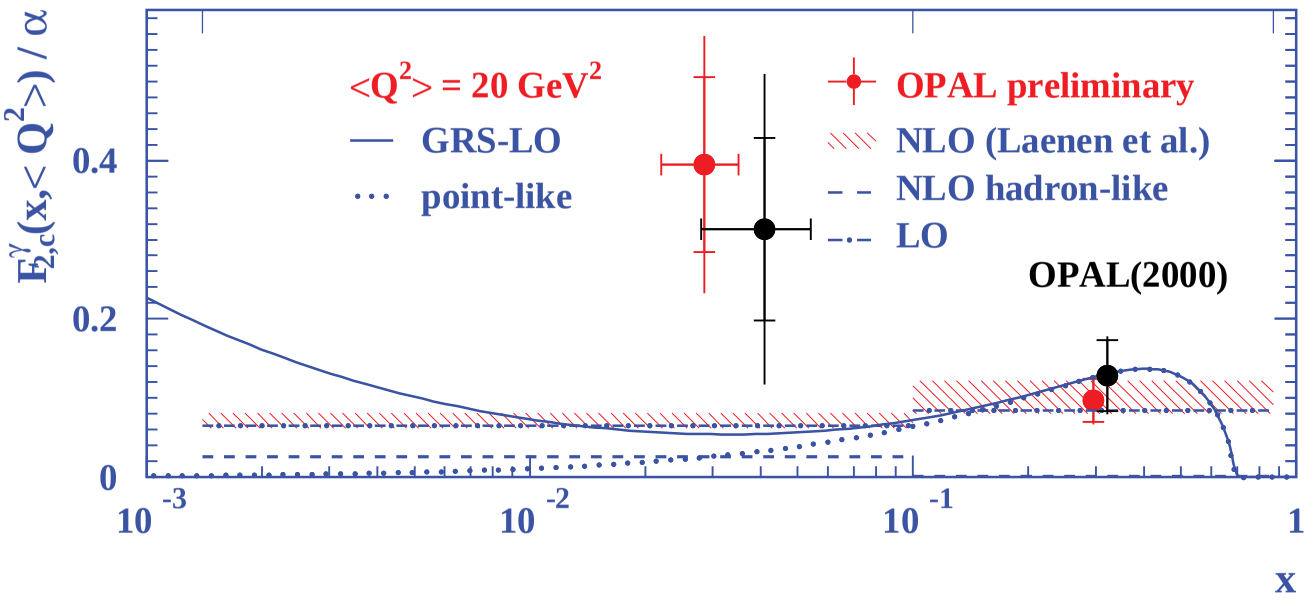
1) The errors have been reduced to about 5-10% at Q^2 around 10-100 GeV^2.
2) The measurements start to challenge theoretical predictions.
3) We need to worry more about the virtuality suppression of $F_2^\gamma(x, Q^2, P^2)$ and radiative corrections.

R.Taylor

I.Tiapkin

Á. Csilling

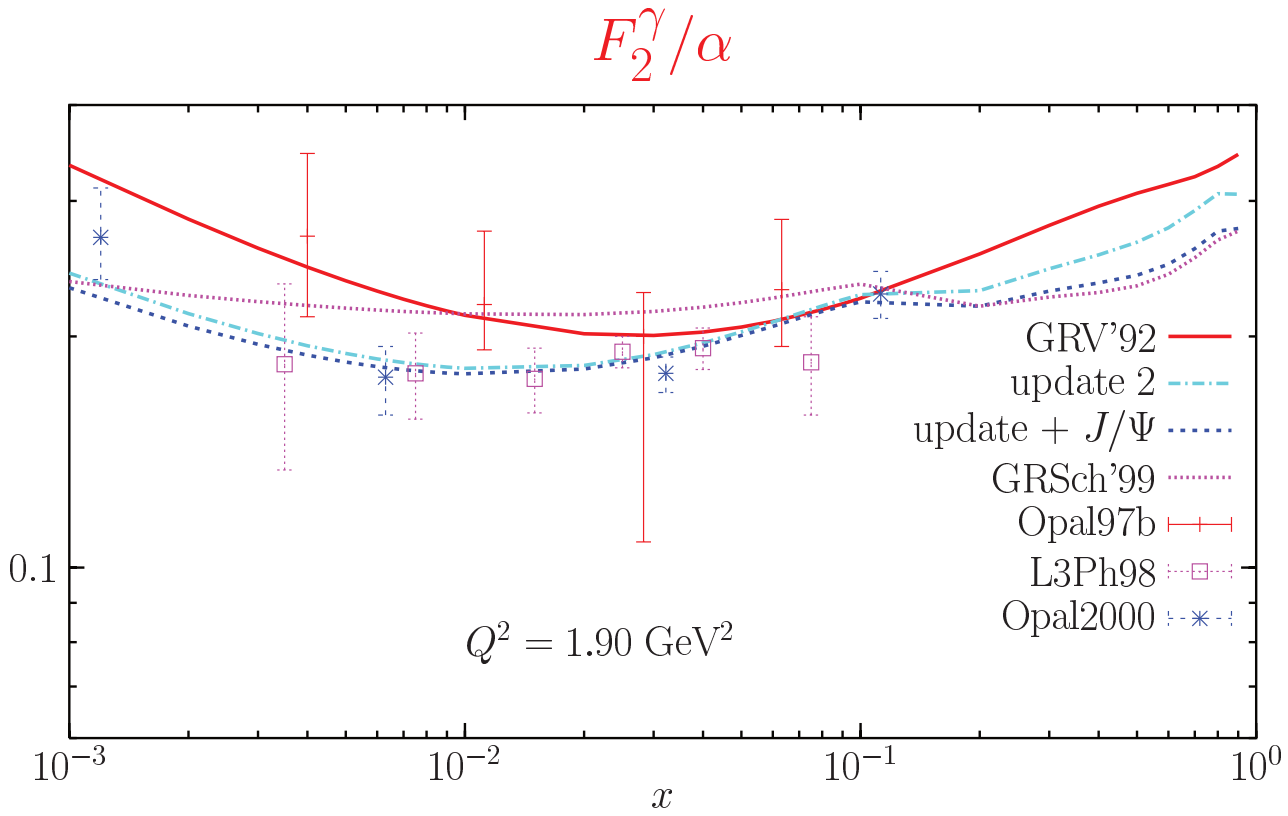
The improvement on $F_{2,c}^{\gamma}$



1) This is the first NLO analysis of a photon structure function!
1) The errors have been reduced somewhat, but more work is needed to get the systematic error even smaller.
2) At low x the precision of the measurement is limited by the statistical error, and it is not precise enough to constrain the gluon in the photon.
3) Get ADOL together to improve on the statistical error.

'Summary' of the theory contribution

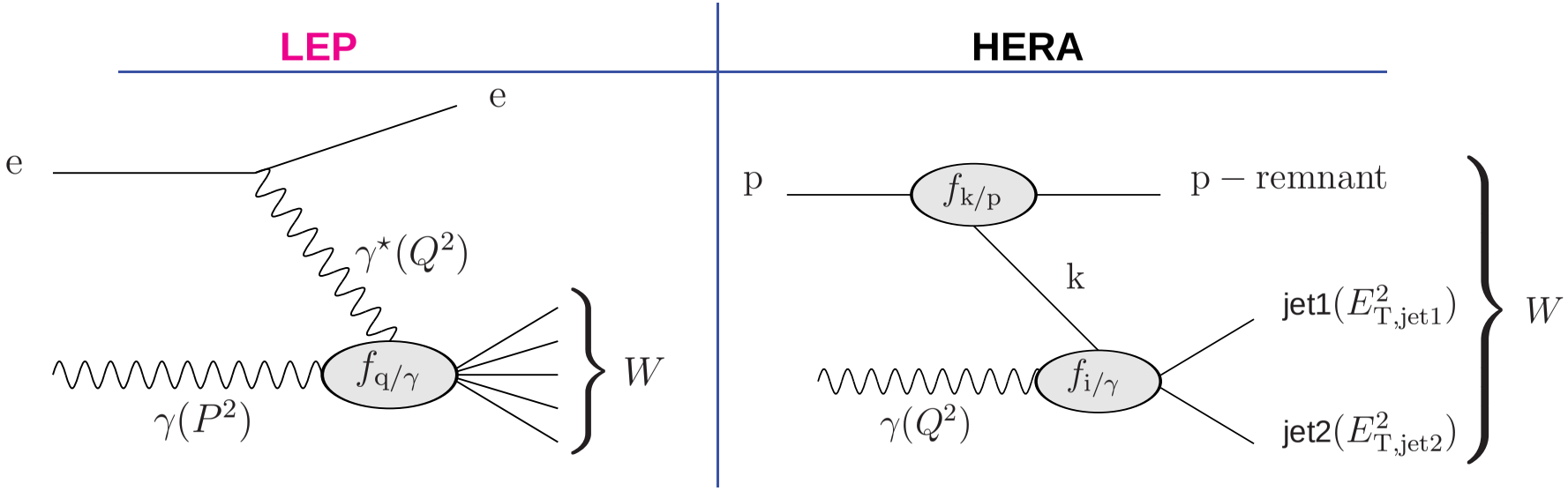
P. Jankowski



1) This is a good initiative, the last fits are quite old.

2) We need to include the jet data in the fits.

The LEP – HERA dictionary



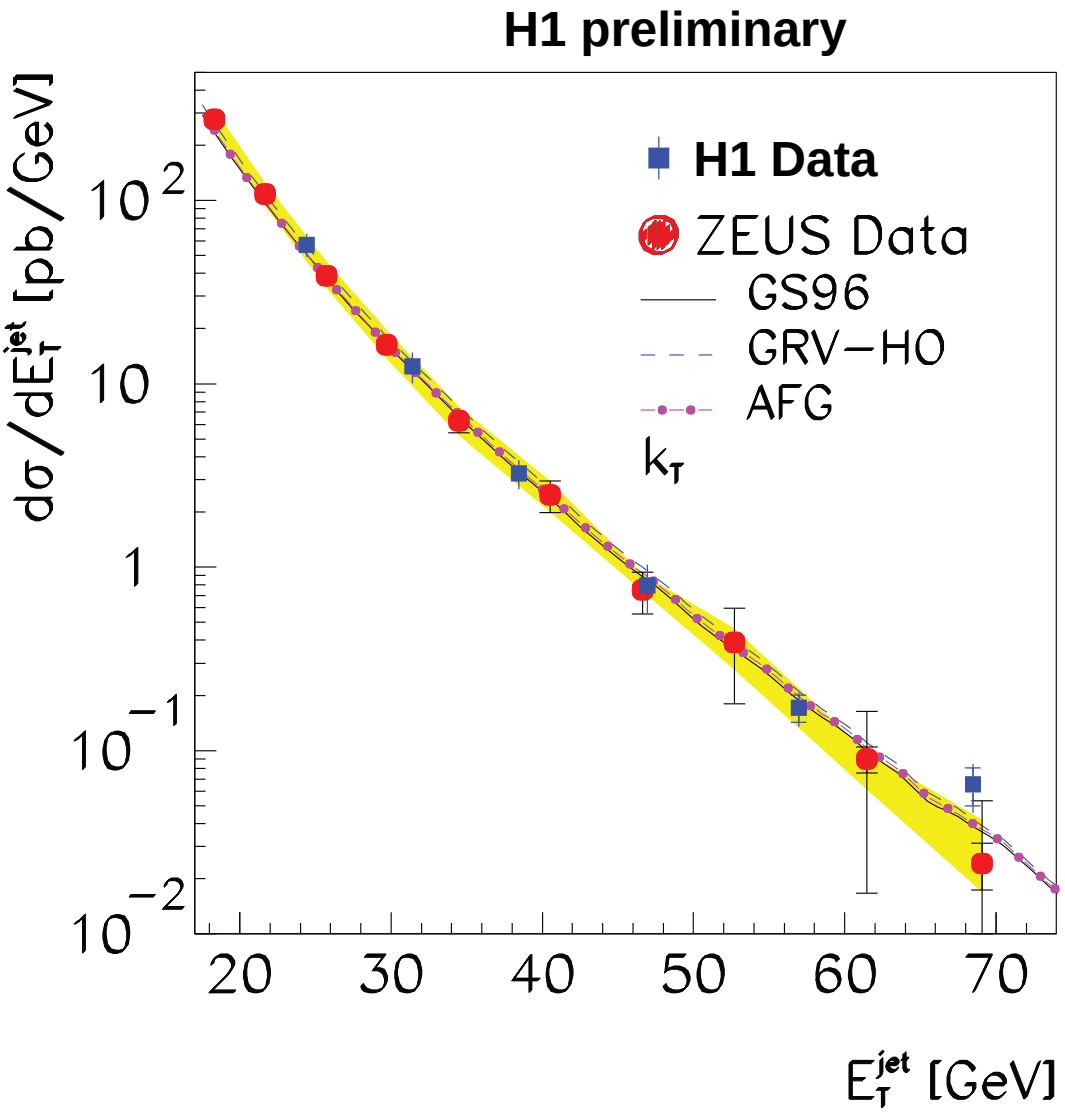
Factorisation scale: $Q^2 \rightarrow E^2_{\mathrm{T,jet}}$

Photon virtuality: $P^2 \rightarrow Q^2$

$\frac{E_\gamma}{E_\mathrm{b}}$: $z \rightarrow y$

momentum fraction: $x \rightarrow x_\gamma = \frac{\sum_{i=1}^{2} E_{\mathrm{T,jet_i}} \mathrm{e}^{-\eta^{jet_\mathrm{i}}}}{2yE}$

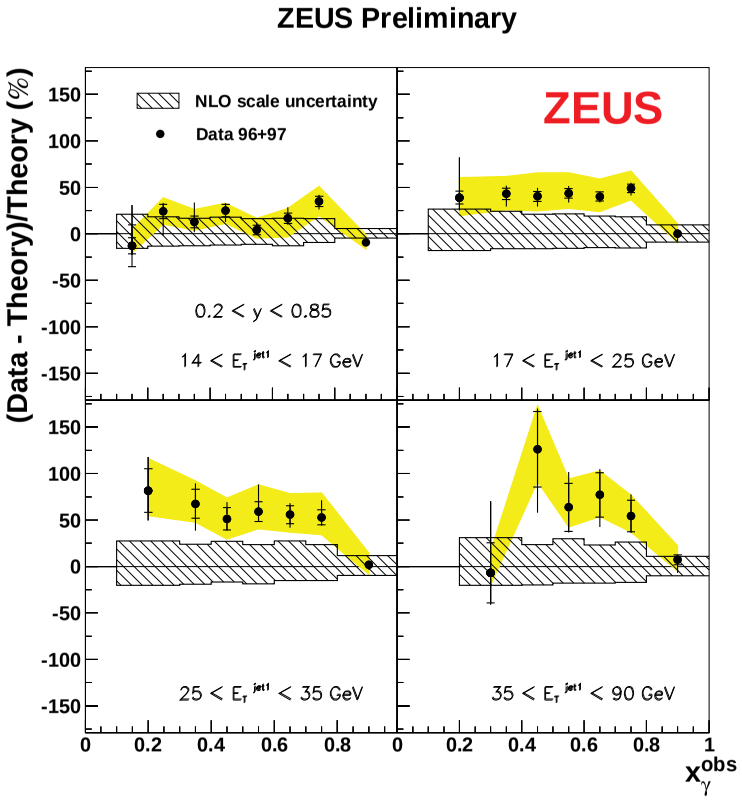
Inclusive jet-production at HERA

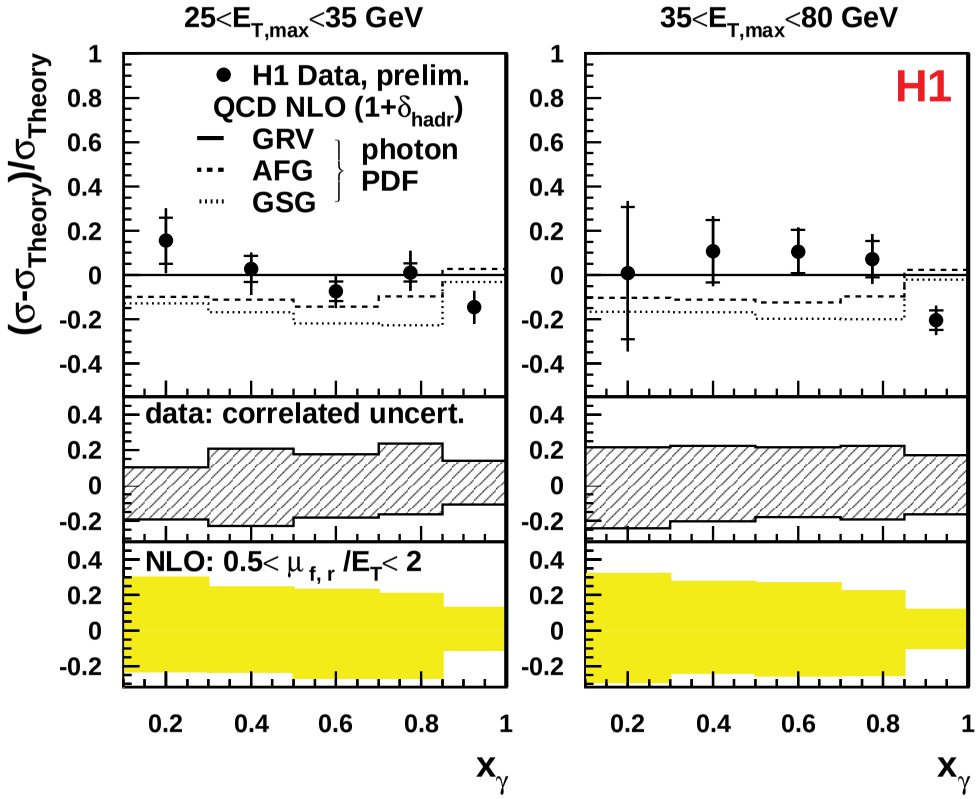


1) The cross-section falls for about four orders of magnitude.
2) There is good agreement between the H1 and ZEUS results and also with the theoretical predictions!

A. Valkarova

Di-jets in γp-scattering at HERA





1) The messages we get from the H1 and ZEUS experiments are different!

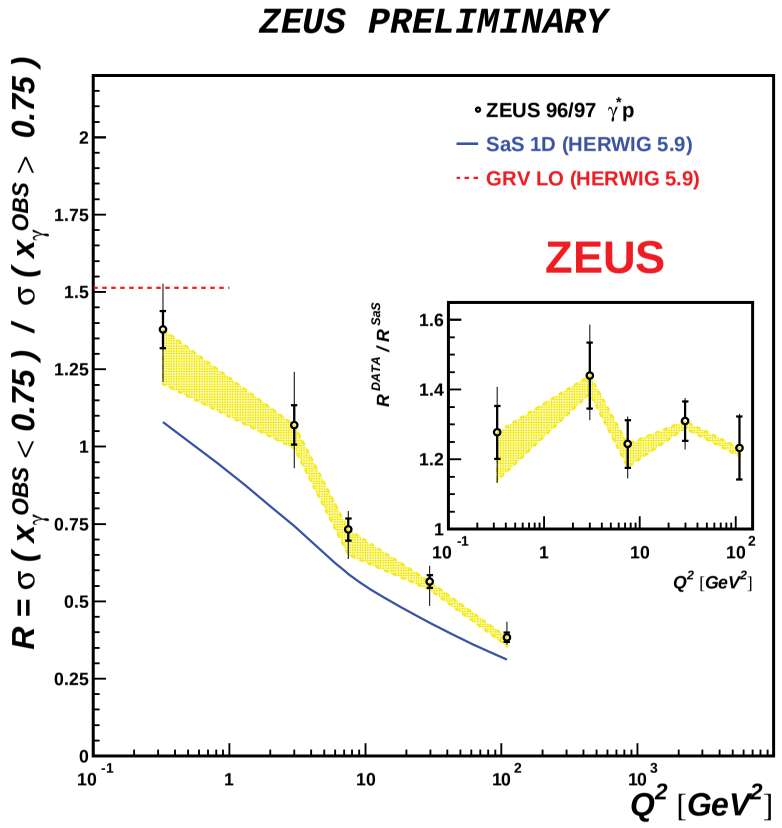
2) We need to find the source of the difference.

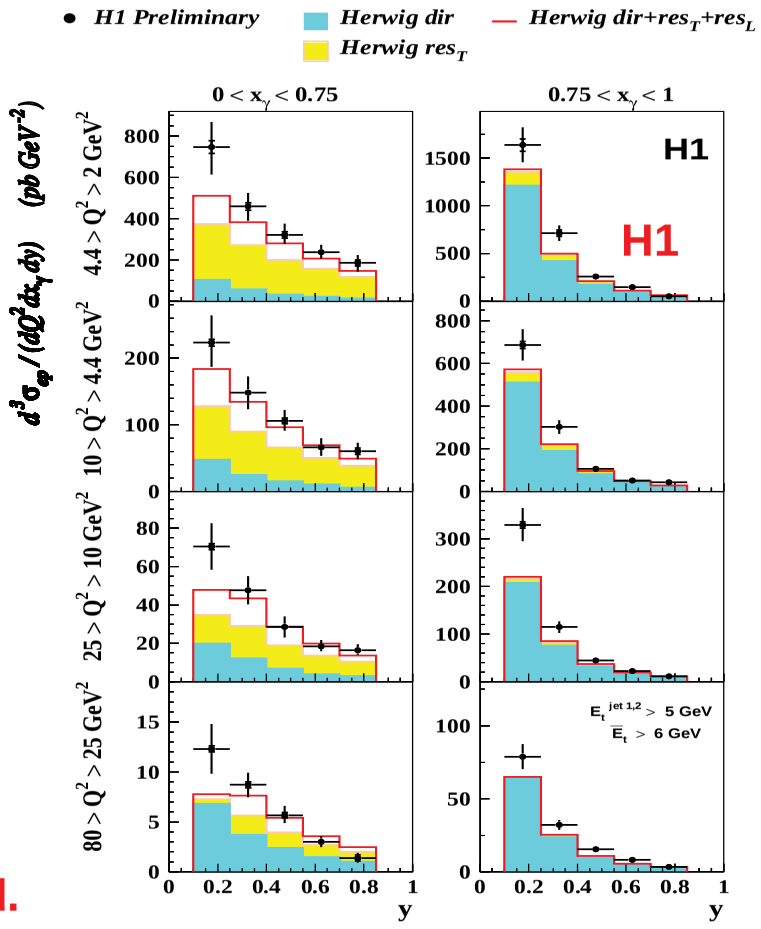
   There is only a 15-20% freedom in F_2^γ.

A. Valkarova

Jets in DIS ep-scattering at HERA

K. Sedlák

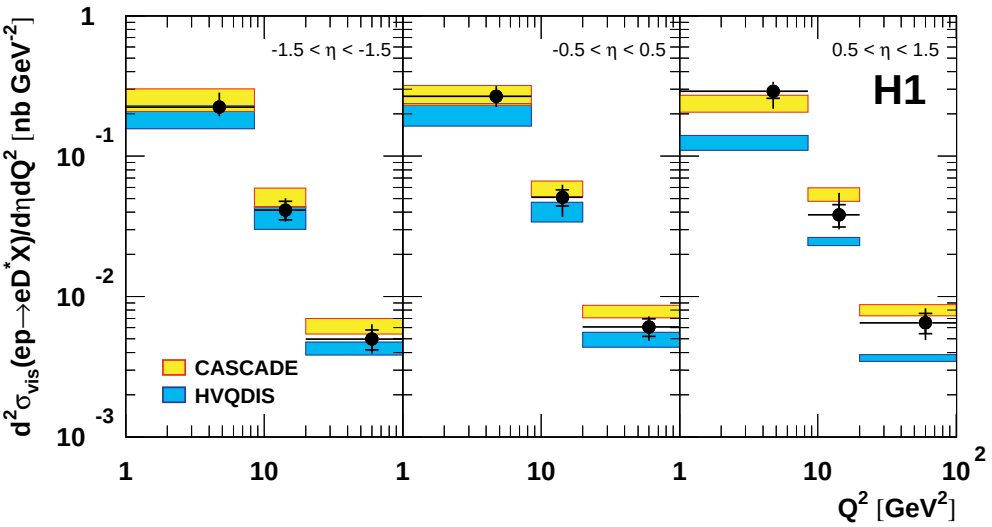




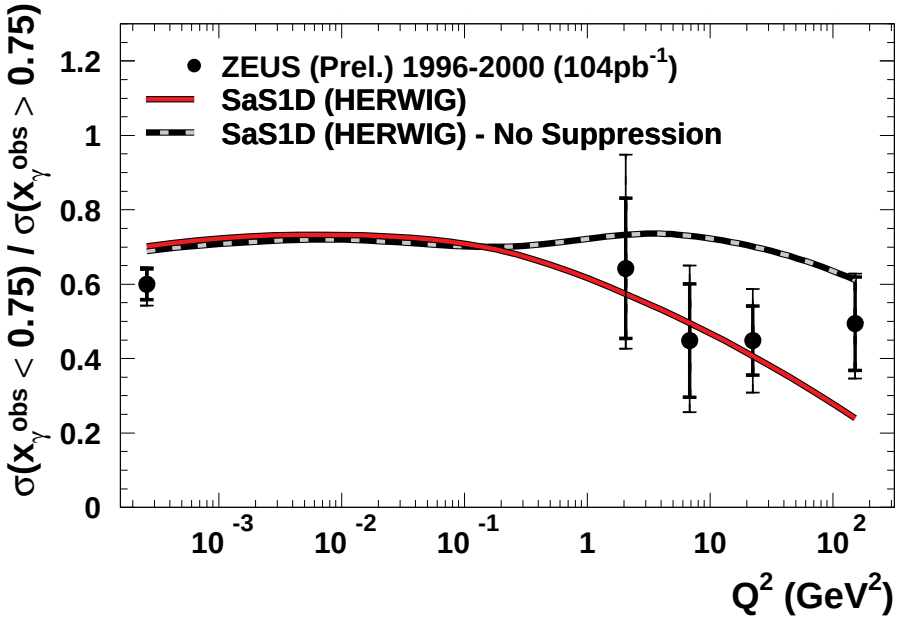
1) The low-x region is more suppressed.

2) The addition of longitudinal photons helps, but also the CASCADE model gets closer to the data.

Charming jets in γp-scattering at HERA



ZEUS



1) The LO CCFM prediction is somewhat closer than NLO DGLAP.

2) The supression with the photon virtuality is weaker in the presence of charm.

B. West

Things to do

What should we resolve?

1. The apparent difference of di-jet data at HERA should be resolved.

What should we look at?

1. It would be nice if we could extract more parton level quantities at HERA.
2. The inclusion of jet data into the fits to obtain photon PDFs is desirable.
3. The P^2 suppression of F_2^γ (GRS vs SaS) needs more study.
4. The radiative corrections for F_2^γ need clarification.
5. A combination of F_2^γ in the low-x and high-Q^2 regions is desirable. This work has already been started within the LEP WG on Two-Photon Physics.
6. More measurements of $F_{2,c}^\gamma$ are needed and eventually a combination should be performed.

Conclusion

- Many measurements concerning the structure of the photon have been improved in the last year(s).
- There are some areas which need clarification, like di-jet production at HERA.
- We should make the best use of LEP by combining results of the four experiments in several areas.

Outlook

- Using the complete luminosity of LEP and from the HERA upgrade, together with an improved understanding of the underlying physics, several measurements will certainly get even more precise.
- In the far future, the planned linear collider programme will allow for an extension of the measurements of the photon structure to much larger momentum transfers.

Stay tuned for PHOTON 20xx

Slides: http://home.cern.ch/nisius