Diffractive Final States and Test of QCD Factorisation

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for the H1 Collaboration

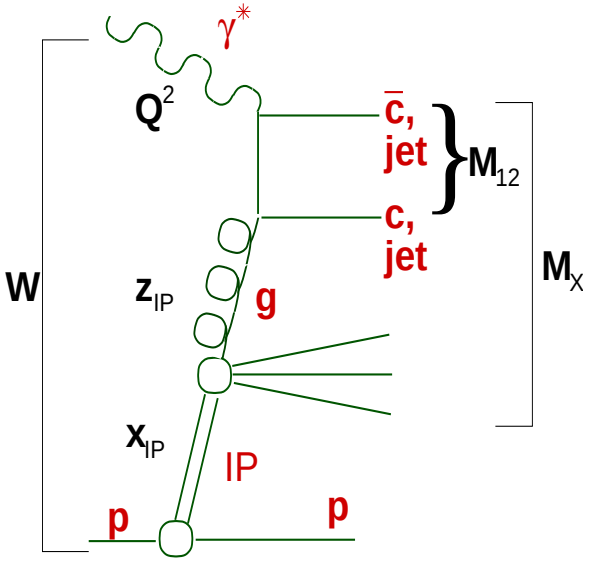
Workshop on Deep Inelastic Scattering
St. Petersburg, 25 April 2003

- Diffractive D* Production in DIS
- Dijets in diffractive DIS

New!

- Diffractive Photoproduction of Dijets

Testing QCD Factorisation in Diffraction



D* and Dijet Measurements

- Sensitive to diffractive gluon via boson−gluon fusion

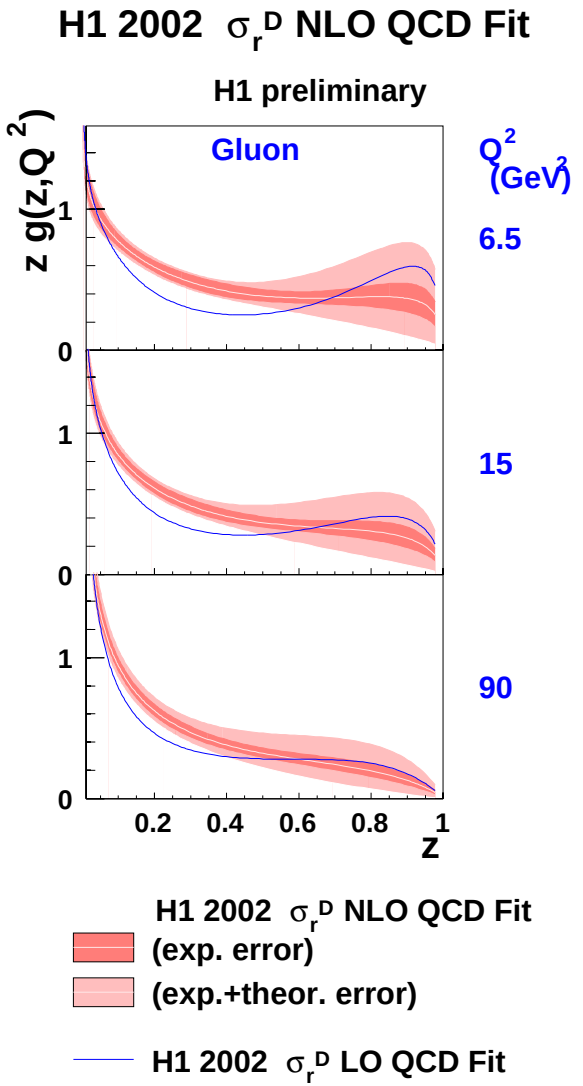
Predictions

- leading order diffractive PDFs
- leading order matrix elements+parton showers

fractional momenta:

$$x_{IP} \approx \frac{Q^2 + M_X^2}{Q^2 + W^2}$$

$$z_{IP} \approx \frac{Q^2 + M_{12}^2}{Q^2 + M_X^2}$$

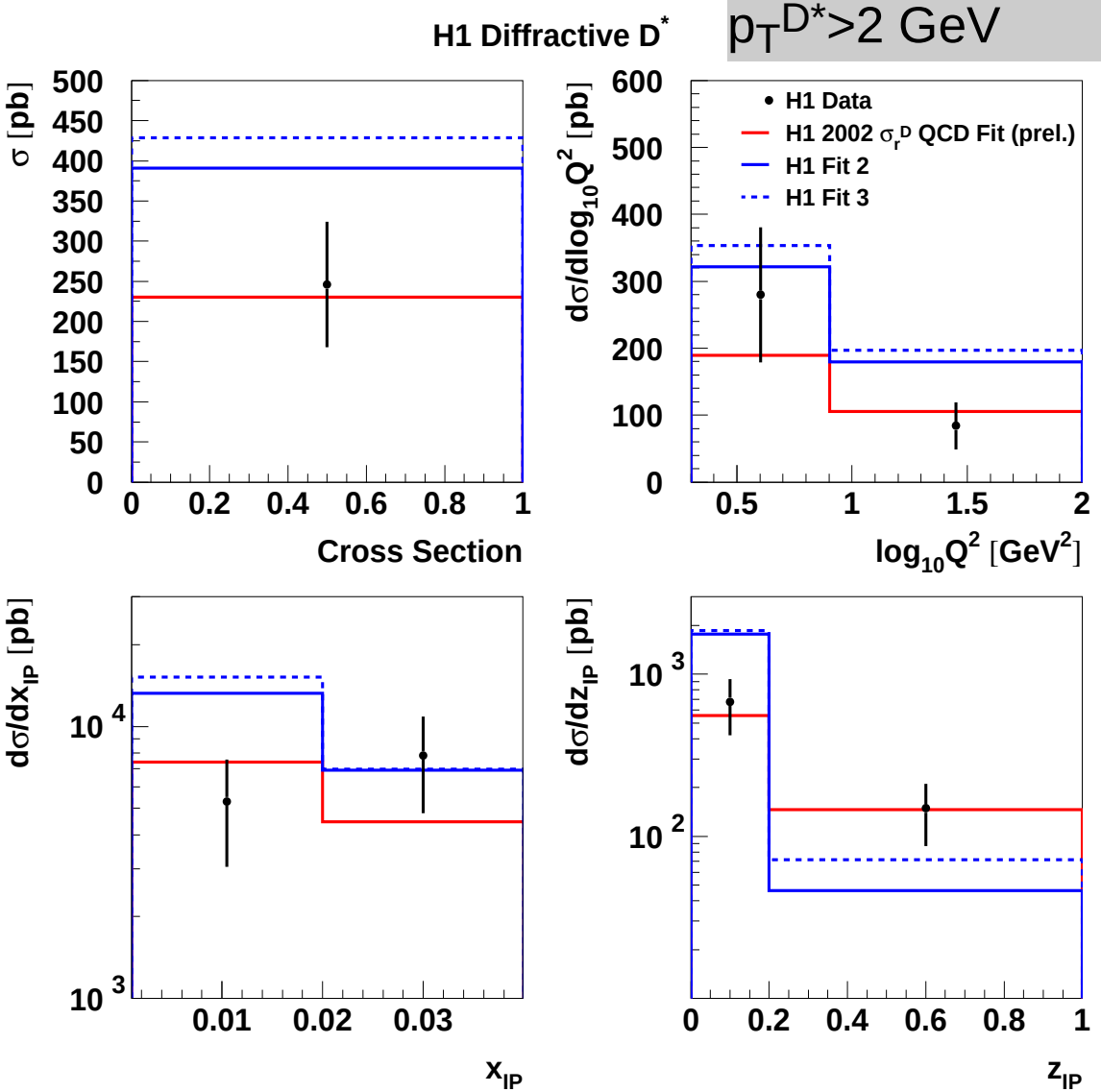


D* Measurements in DIS

L=19/pb
$2<Q^2<100\ \mathrm{GeV}^2$
$x_{IP}<0.04$
$p_T^{D^*}>2$ GeV

- H1 Fit 2 (LO): published fit
- H1 2002 (LO): new fit
  - gluon density 30% lower
  - gluon density uncertainty 25%
- additional uncertainties from scale dependences (LO comparison)

both fits consistent with data within PDF and scale uncertainties

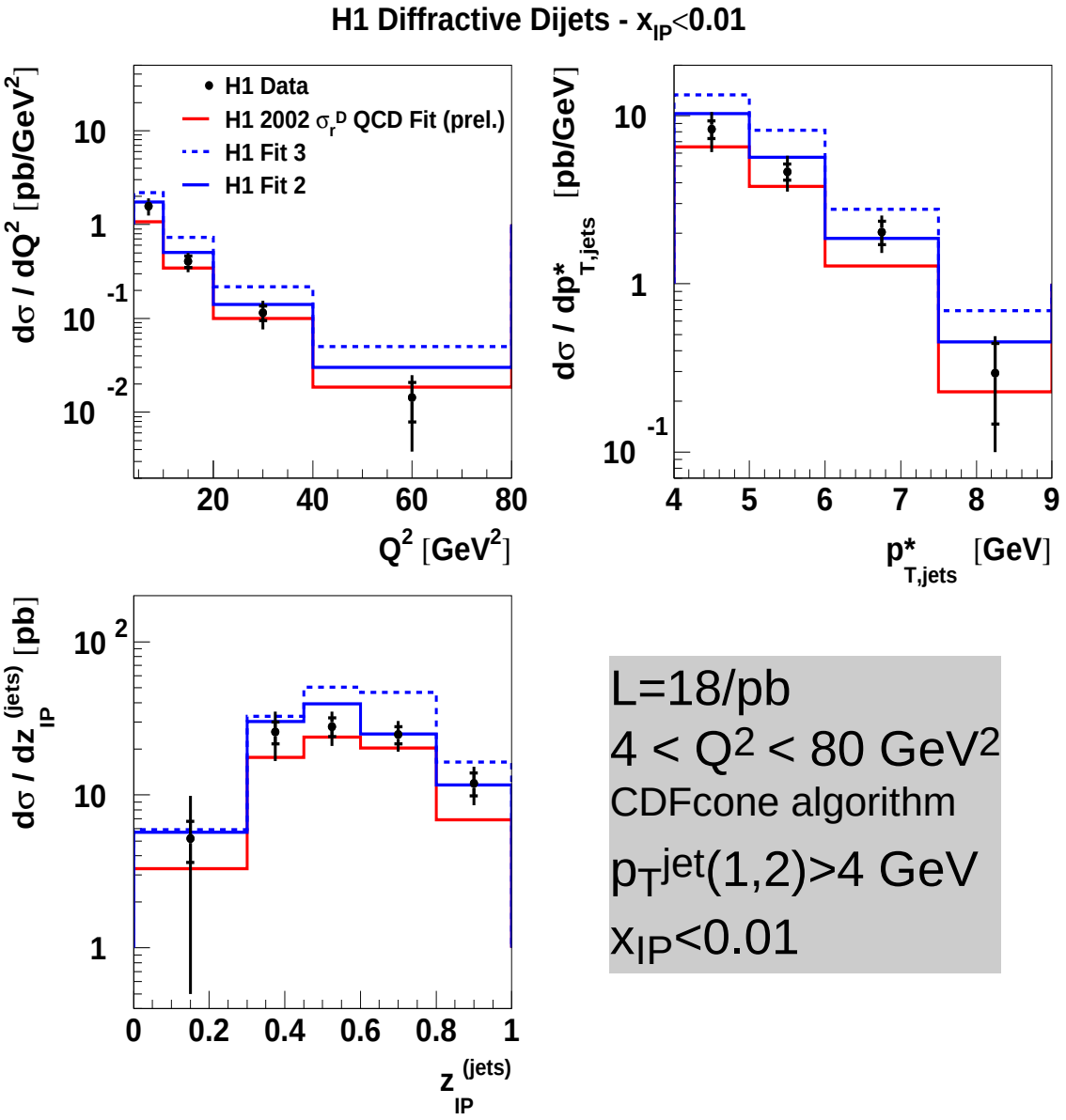


H1 Data: Phys. Lett. B520 (2001) 191

Dijets in Diffractive DIS

- H1 2002 fit (LO):
  - shapes ok
  - normalisation consistent within uncertainties
- H1 fit 2 (LO):
  - good description of shapes and normalisation!

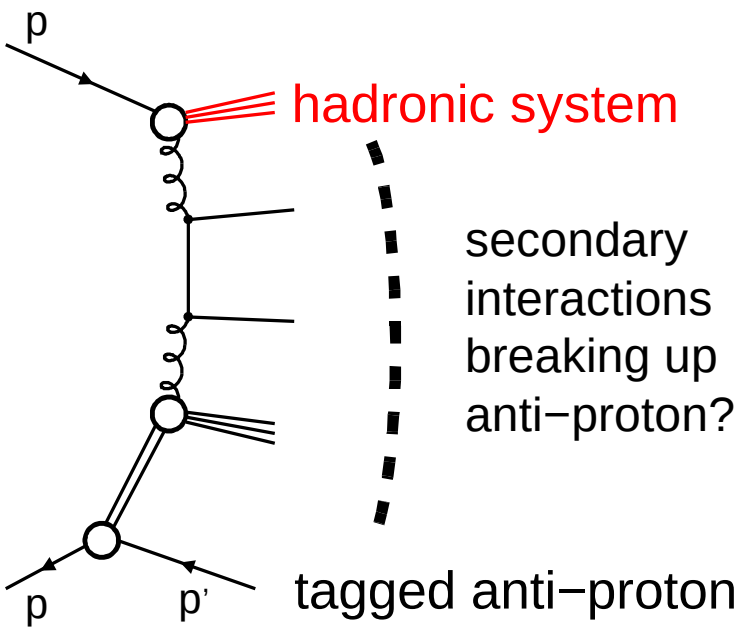
Factorisation works in diffractive DIS!



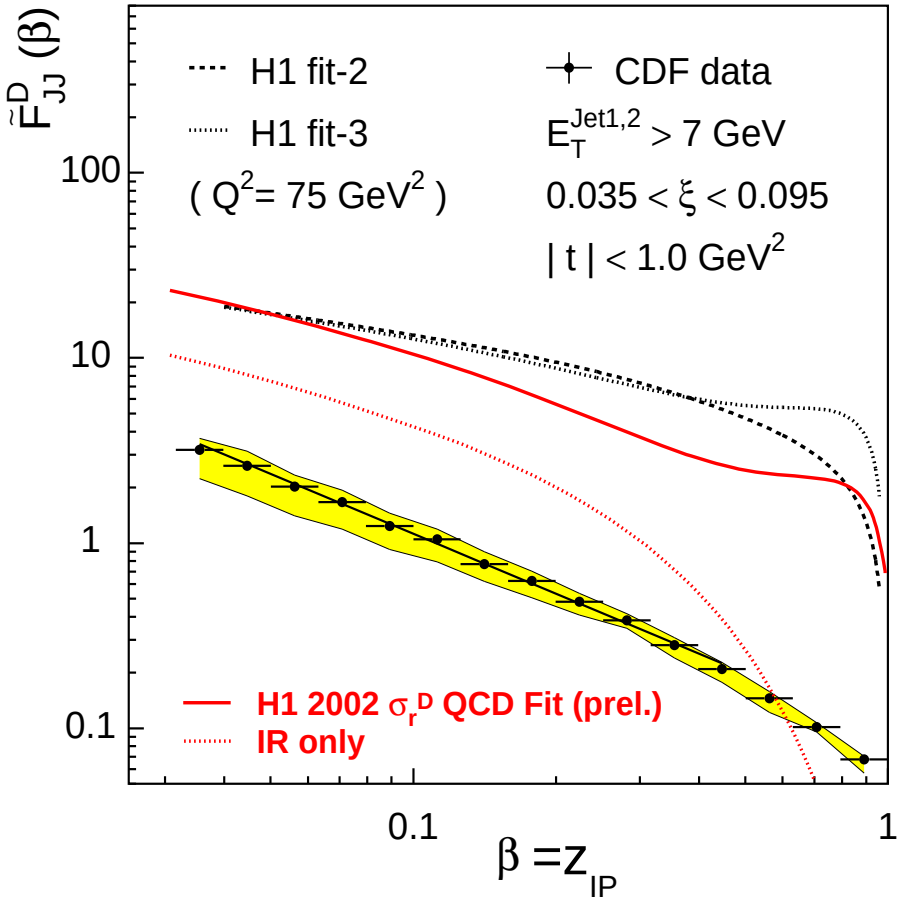
L=18/pb
$4 < Q^2 < 80$ GeV^2
CDFcone algorithm
$p_T^{jet}(1,2)>4$ GeV
$x_{IP}<0.01$

H1 Data: Eur. Phys. J. C20 (2001) 29

Single−Diffractive Dijets at the Tevatron



Diffractive Structure Function of Antiproton



Comparison to diffr. Parton Densities from HERA:

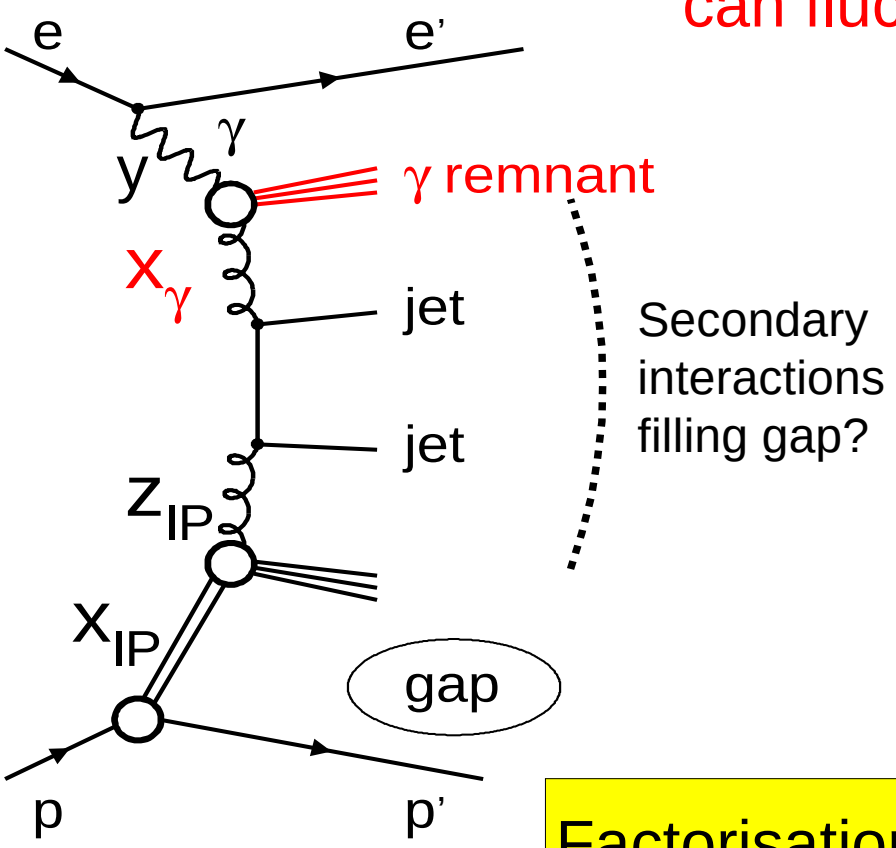
- Overestimation by factor ≈ 10

→ Breakdown of Factorisation!

- secondary interactions due to hadronic system?

Photoproduction — Transition from DIS to $p\bar{p}$

quasi−real photon $(Q^2 \approx 0)$
can fluctuate into hadronic system



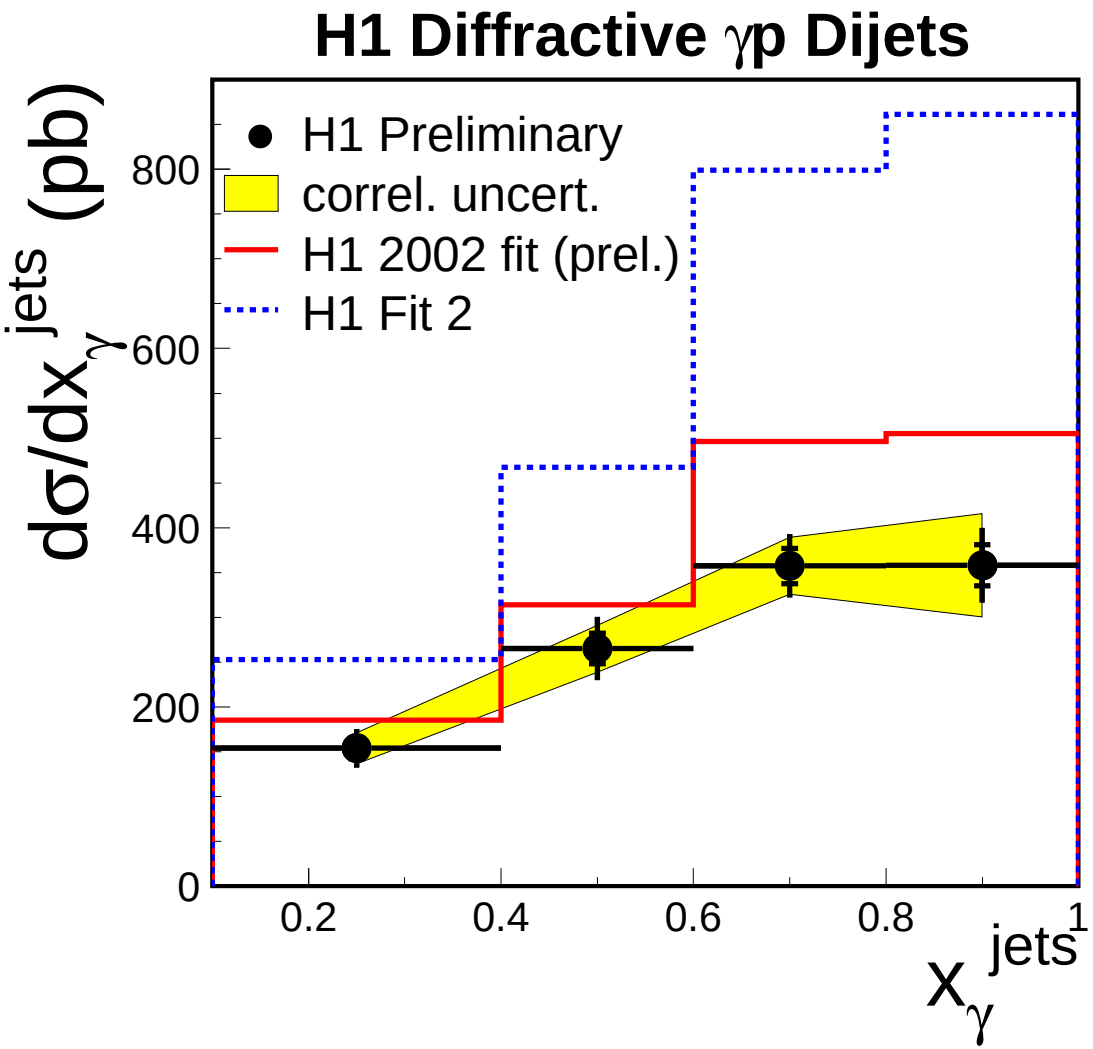
- x_γ =1: direct photon coupling, DIS−like
- x_γ <1: resolved photon, hadron−like
- photon remnant energy $\propto 1-x_\gamma$

Factorisation breaking in diffr. photoproduction
Suppression dependent on photon remnant ?

Diffractive Dijets in Photoproduction

- New Measurement:

L=18/pb
Q^2<0.01 GeV^2
165<W<240 GeV
incl. k_T algorithm
$p_T^{jet}(1,2)$>5,4 GeV
x_{IP}<0.03



- both fits overestimate cross−section
- large PDF and scale uncertainties
- new fit gives better description

Comparison of Diffractive Dijet Cross−Sections in DIS and Photoproduction

$$\frac{\left(\frac{\text{model}}{\text{data}}\right)_{\gamma p}}{\left(\frac{\text{model}}{\text{data}}\right)_{\text{DIS}}} = 1.8 \pm 0.45\ (\text{exp.})$$

experimental errors of both measurements (mainly calorimeter scale)

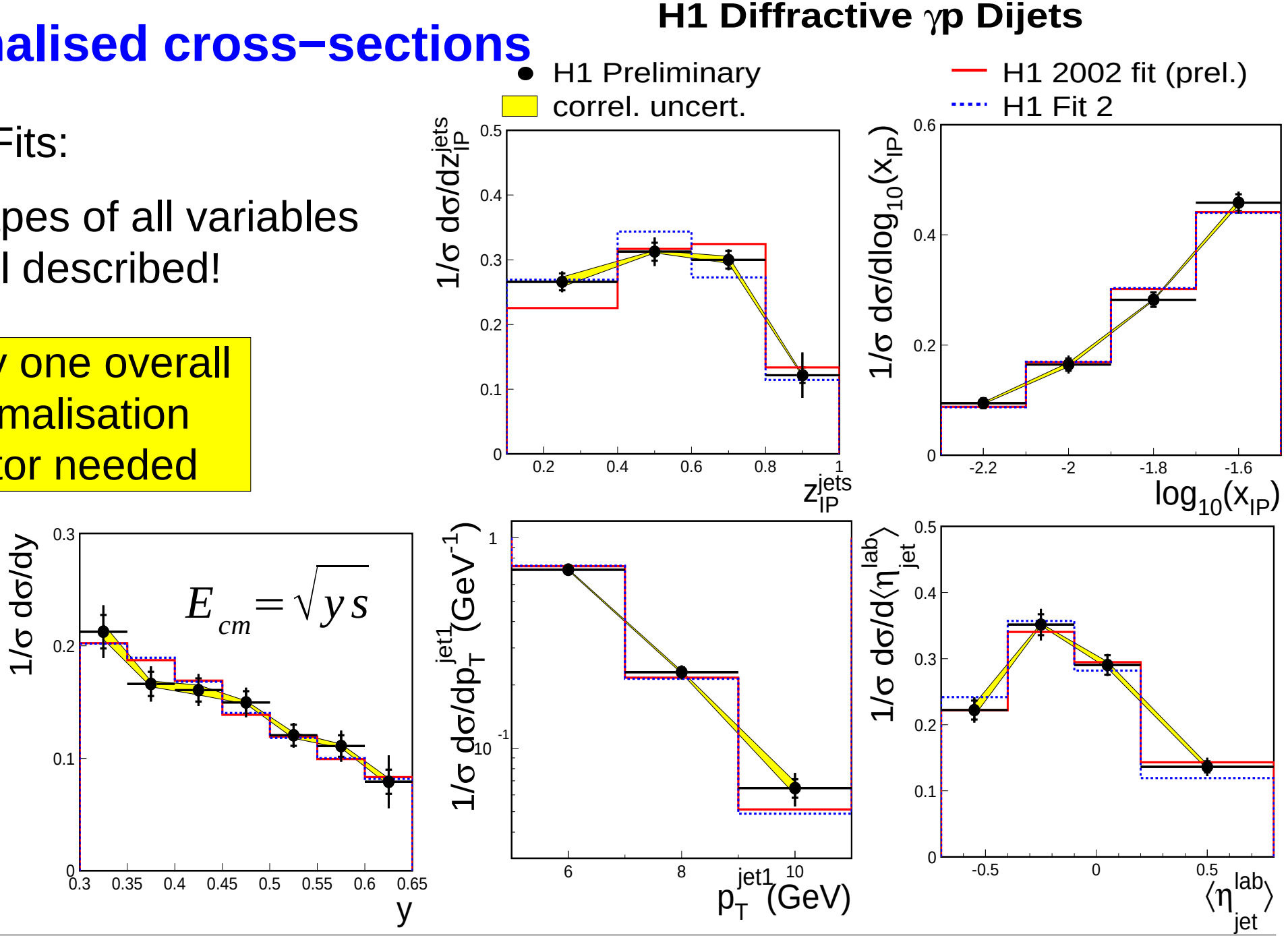
Within IP Model at LO: diffractive γp Dijet Cross−Section suppressed with respect to diffractive DIS by 1.8±0.45 (exp.)

- Independent of fit
- Reduction of uncertainties:
  - Preparing DIS measurement with same jet algorithm as in γp measurement
  - Preparation of NLO comparisons

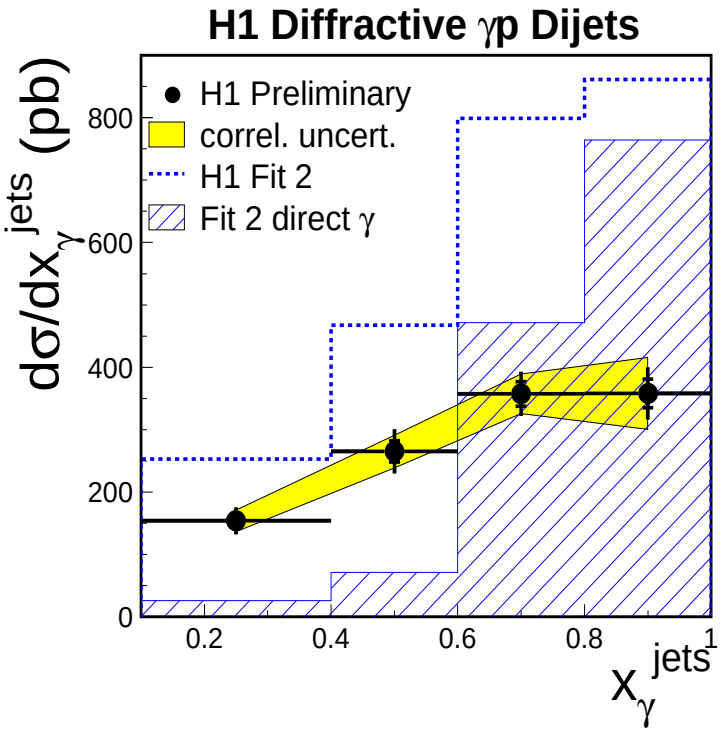
Normalised cross−sections

Both Fits:

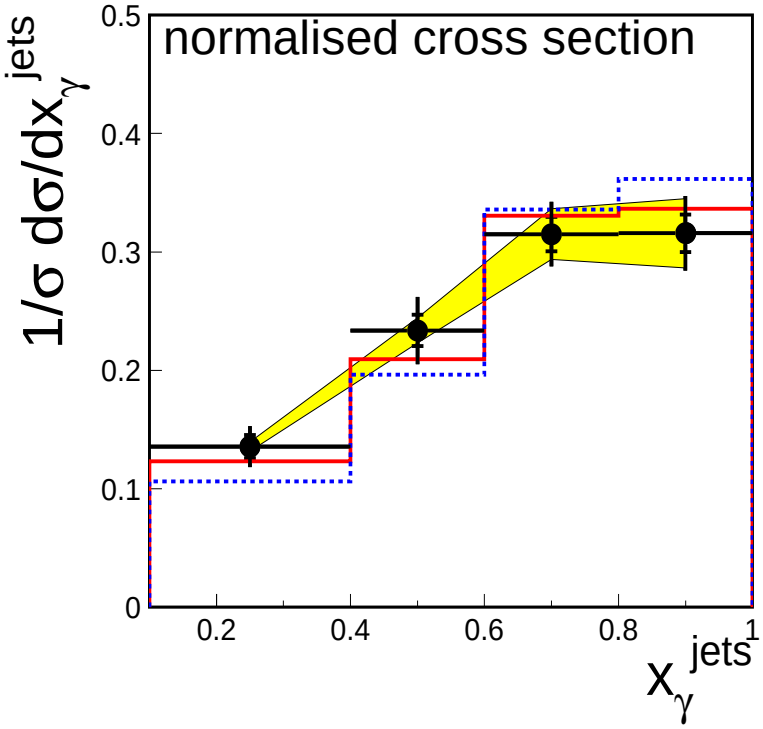
- shapes of all variables well described!
- only one overall normalisation factor needed



Direct and Resolved Photon Processes



- Sensitivity to both direct and resolved photon processes



- Same suppression factor for direct and resolved photon processes

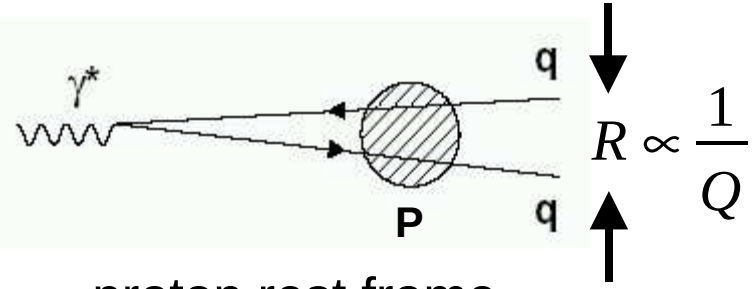
suppression does not depend on energy in photon remnant
→ contrary to expectations from spectator interactions

γp Suppression Mechanism

Possible explanation of suppression within Dipole Picture?

- photon fluctuates into colour dipole of transverse size $R \propto 1/Q$

  → photon dipole small in DIS, large in Photoproduction



proton rest frame

- Secondary interactions depend on overlap of dipole and proton colour fields

Summary

New Measurement:

- Dijet cross−sections in diffractive Photoproduction

Factorisation in Diffraction:

- Factorisation holds in DIS
- ep vs. $p\bar{p}$ factorisation breaking
- Factorisation seemingly broken in Photoproduction

	E_{cm} (GeV)	Suppression
DIS	90..260	1
γp	165..240	$\approx 1.8 \pm 0.45$ (exp.)
$p\bar{p}$	1800	≈ 10

Suppression in diffractive Photoproduction:

- does not depend on energy in photon remnant
  → not in line with spectator interaction scenarios