D* Production in Diffractive Processes

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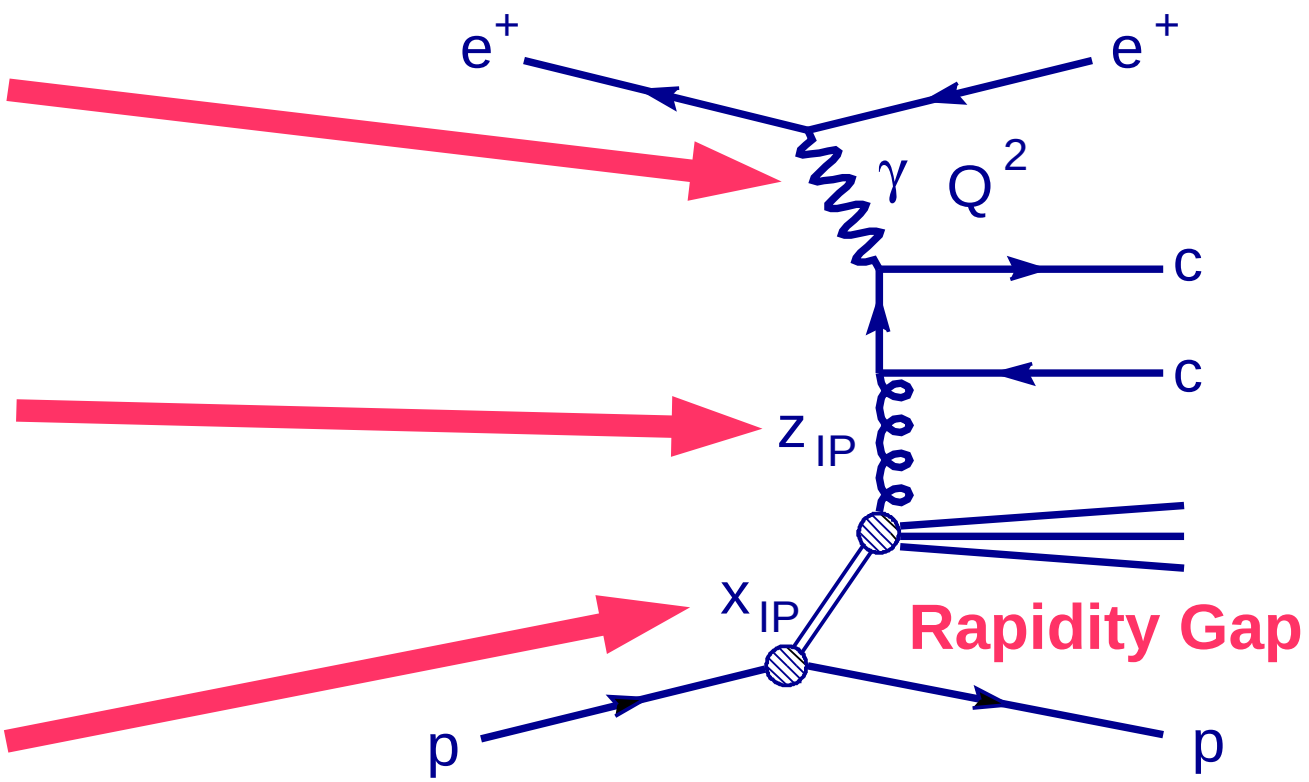
Reminder of variables:

Q^2: Momentum transfer at the e^- vertex

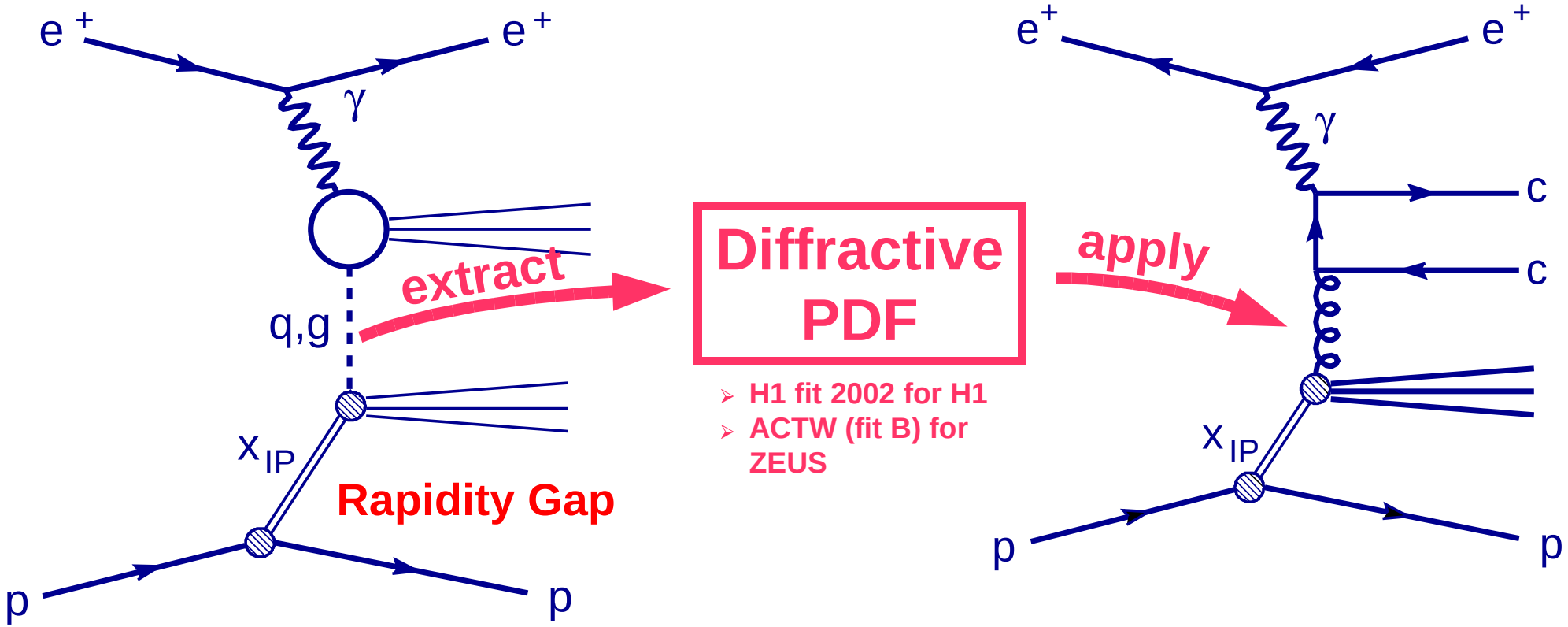
z_{IP}: Momentum fraction of the color neutral object carried by the gluon

x_{IP}: Momentum fraction of proton carried by color neutral object



QCD Factorization:

$\sigma_{measure}$ = universal diffractive PDF $\otimes$ hard ME



Measure diffractive Structure Function from inclusive diffractive scattering

For diffractive Dijets

DIS	γ p
... fulfilled	... broken

Datasets:

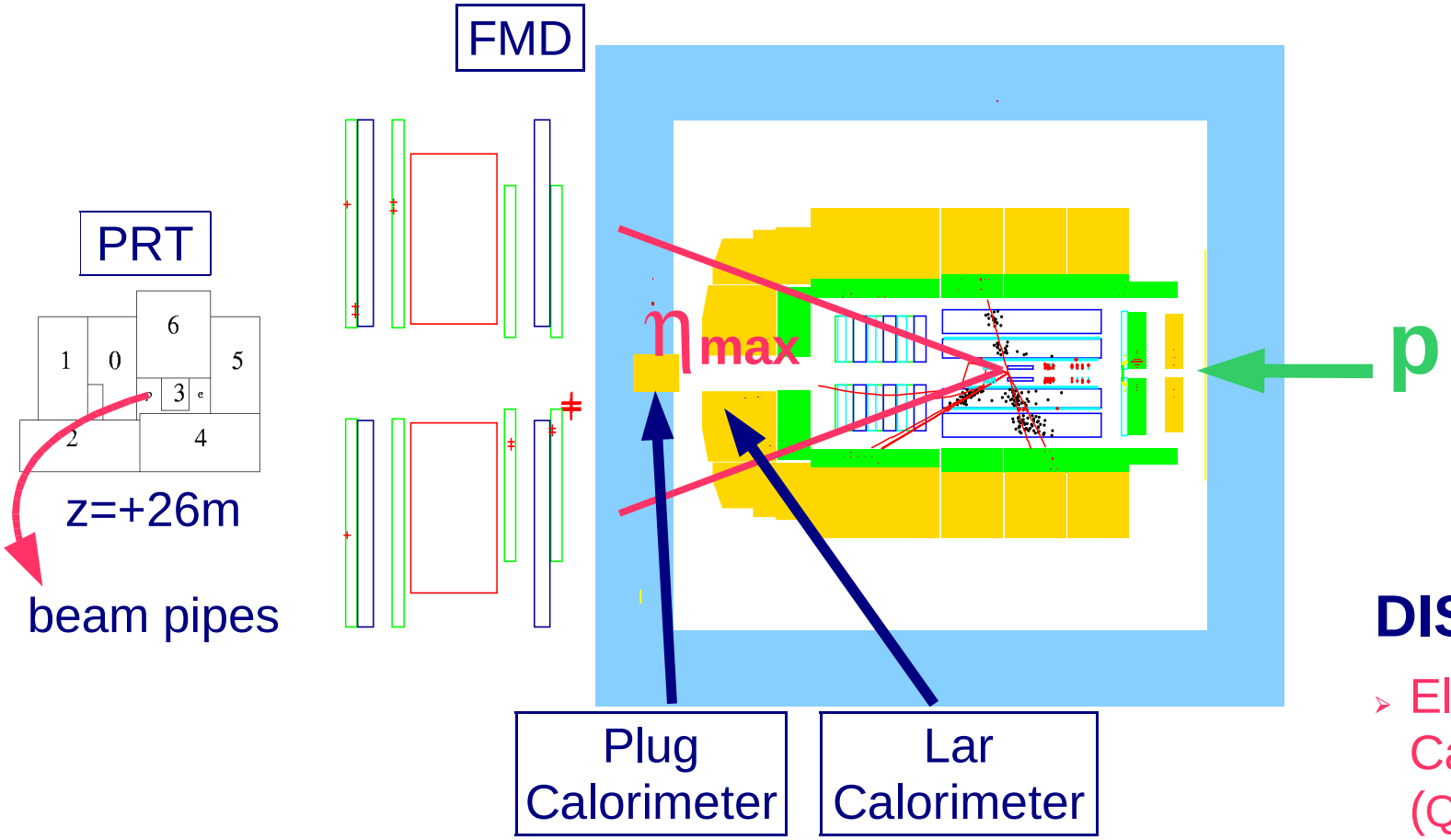
Data Taking Period: HERA I: 98/00

	DIS	γ p
H1	**42.6 pb^{-1}** $Q^2 \in [2 – 100]$ GeV^2	
ZEUS	**82 pb^{-1}** $Q^2 \in [1.5 – 200]$ GeV^2	**78.6 pb^{-1}** $Q^2 < 1$ GeV^2

Diffractive Event Selection in DIS (@ H1):

Diffractive Selection:

- no activity in the forward region of the H1 detector above *noise level* (η_{max}<3.2).



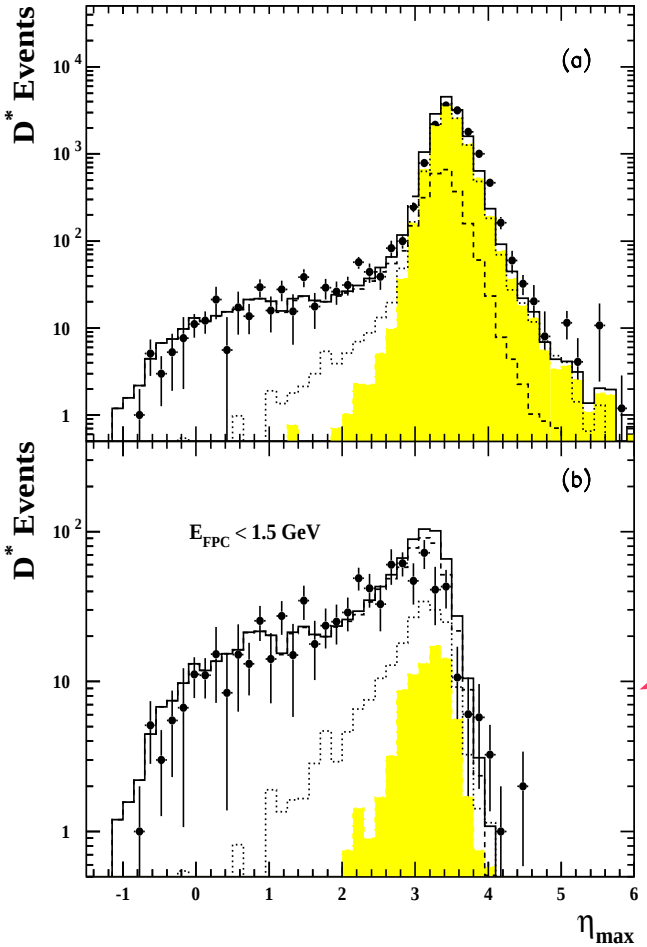
DIS Selection:

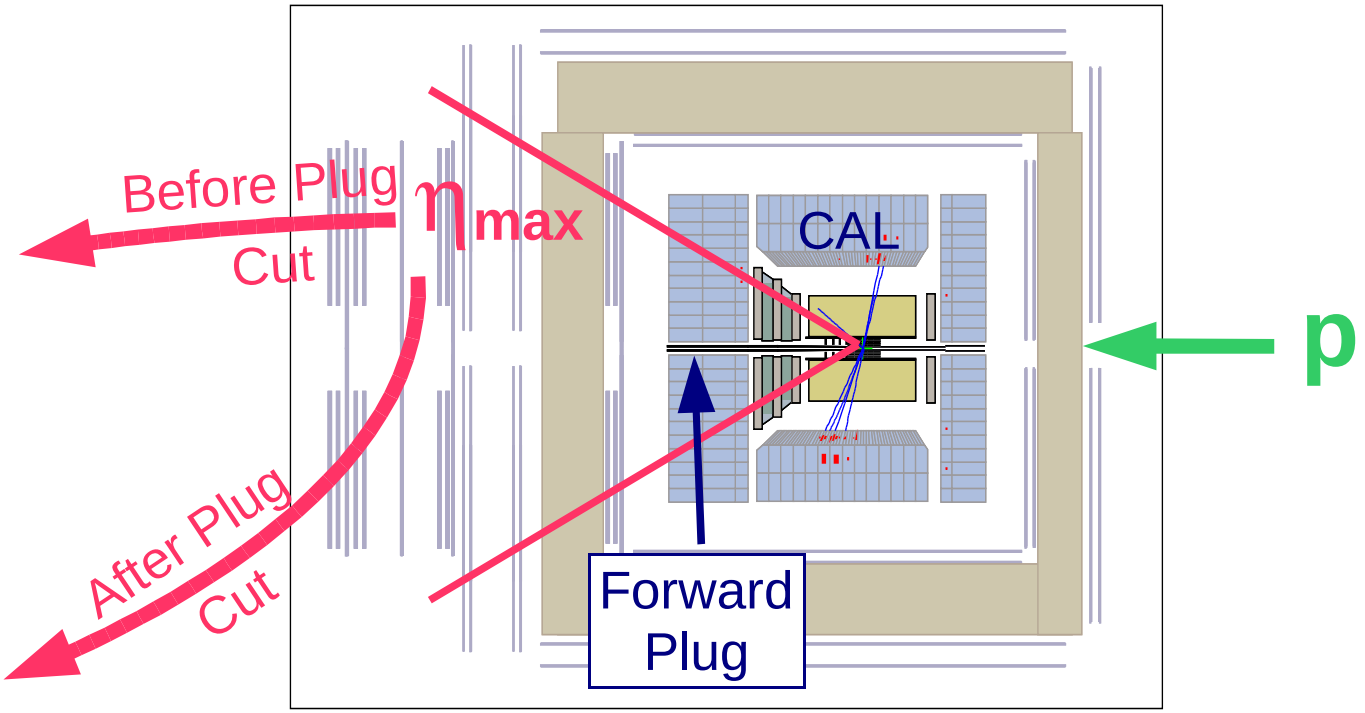
- Electron in Spacal Calorimeter (Q^2 (2, 100) GeV^2).

Diffractive Event Selection in γp (@ ZEUS):

Diffractive Selection:

- no activity in the forward region of ZEUS above *noise level* (η_{max}<3 & E_{FPC}<1.5 GeV).





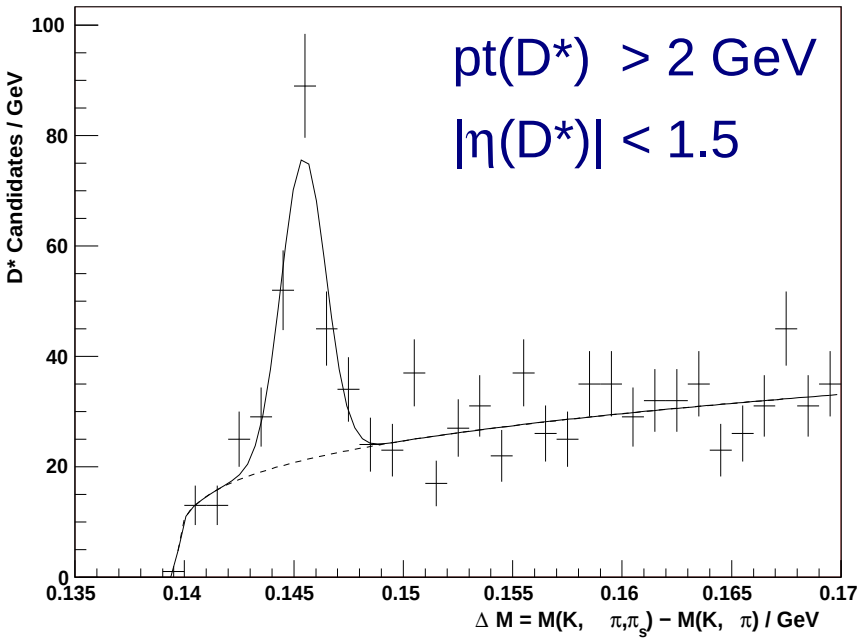
γp Selection:

- No Electron identified in the CAL (Q^2<1GeV^2).

Charm Selection & Signal Yield

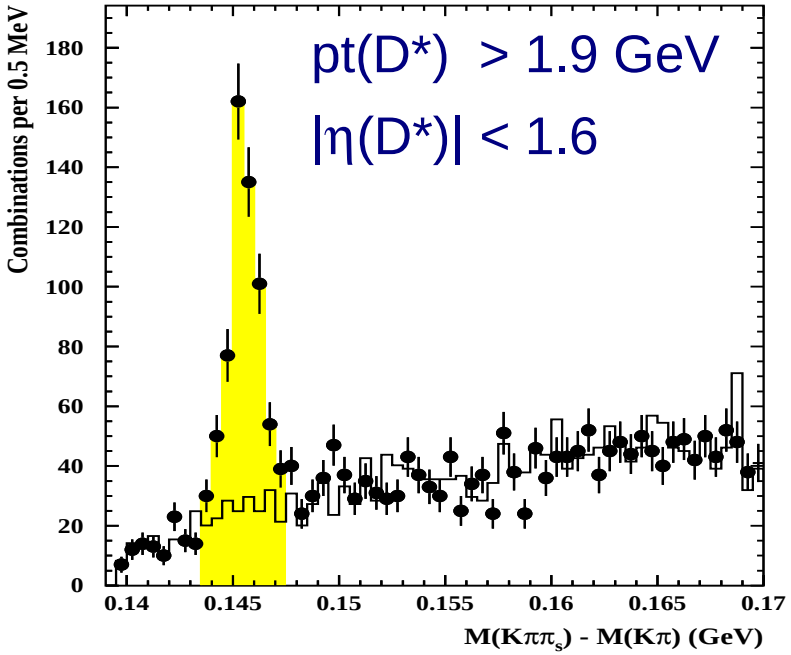
$$D^{*+} \xrightarrow{2.57\%} K^{-}\pi^{+}\pi^{+}_{Slow}$$

H1: Dis



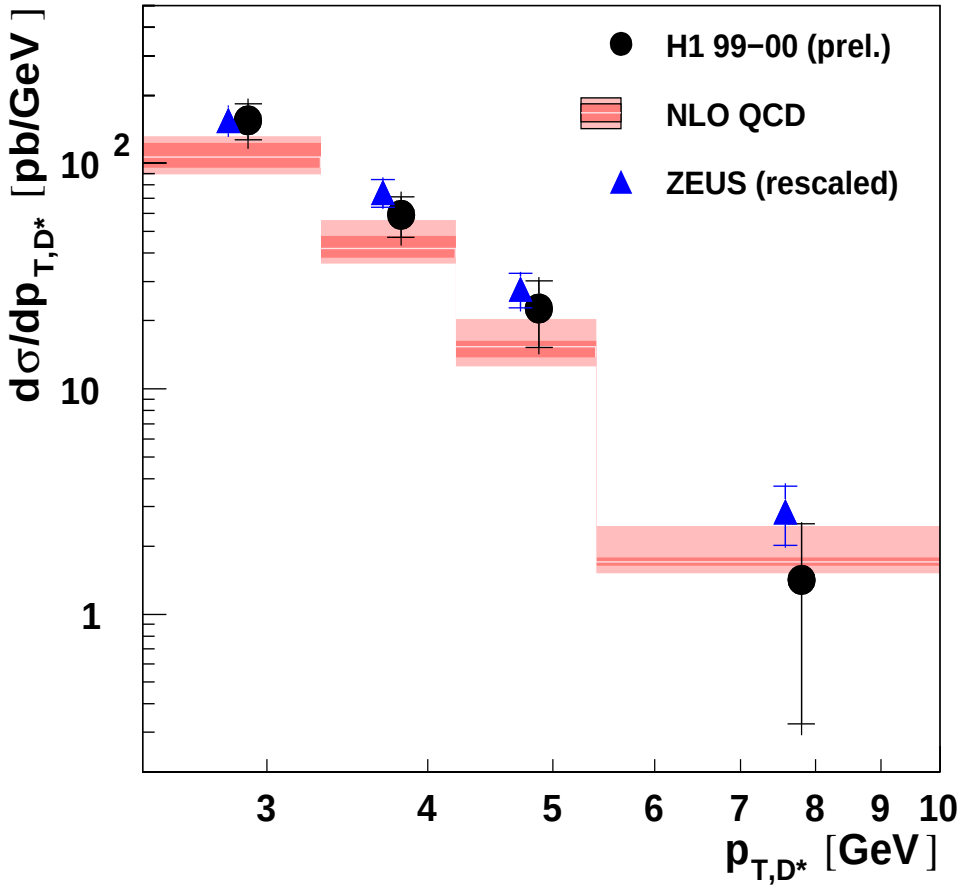
N(D*) = 140 ± 16

ZEUS: γp



N(D*) = 454 ± 30

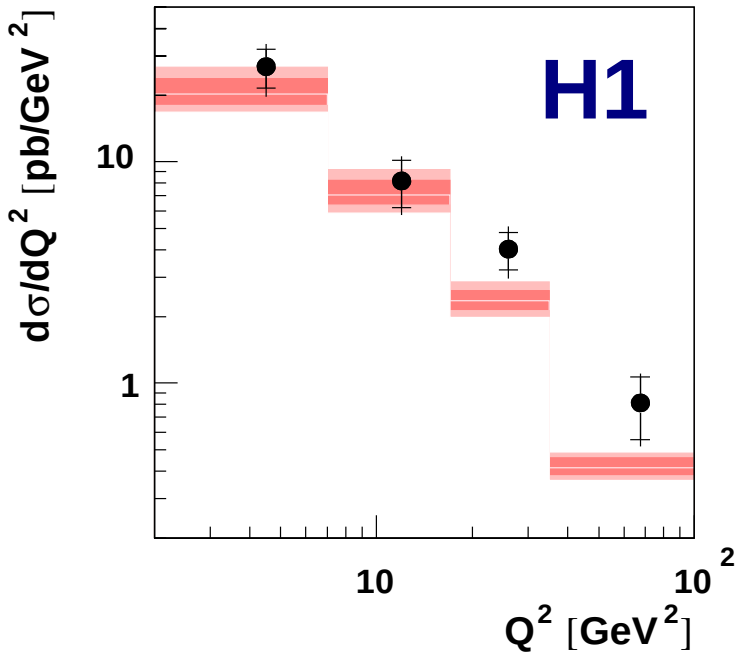
Comparison between Experiments in DIS

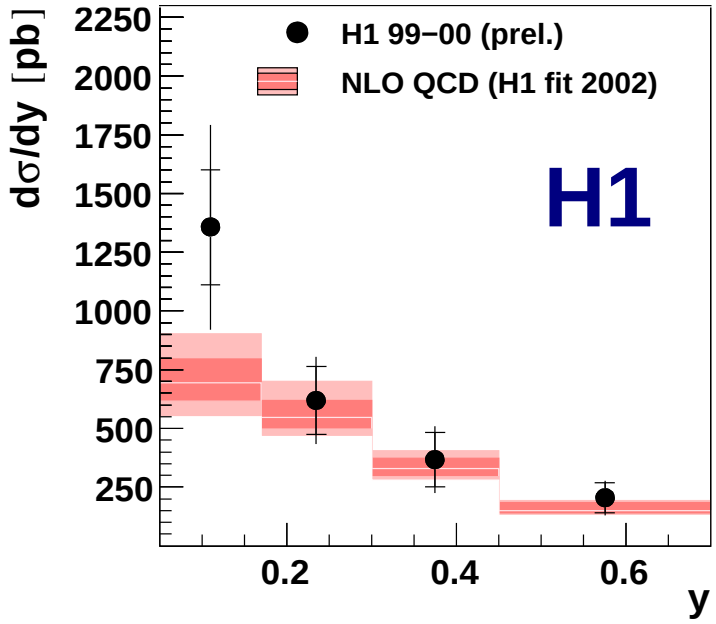


- **H1 (Preliminary) Data**
- **ZEUS Data (extrapolated to H1 phase space)**

Good agreement between experiments

Test of QCD Factorization in DIS



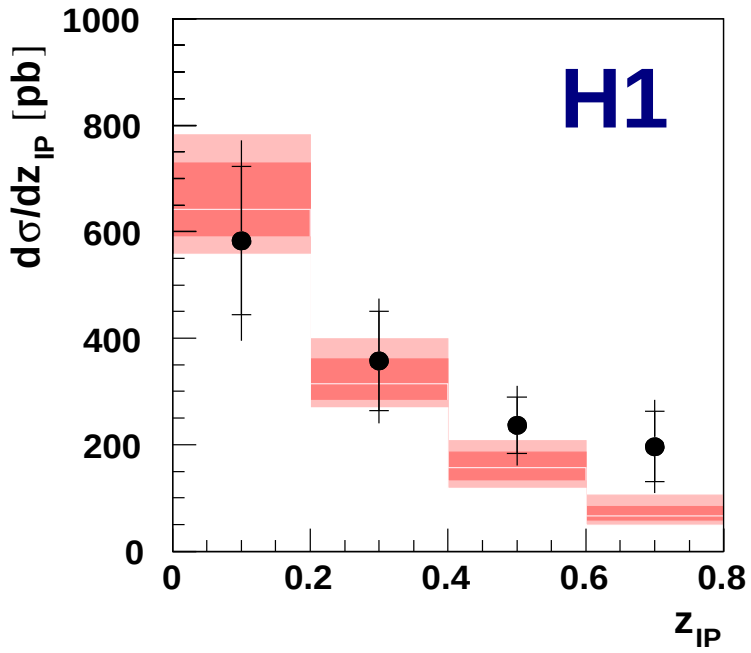


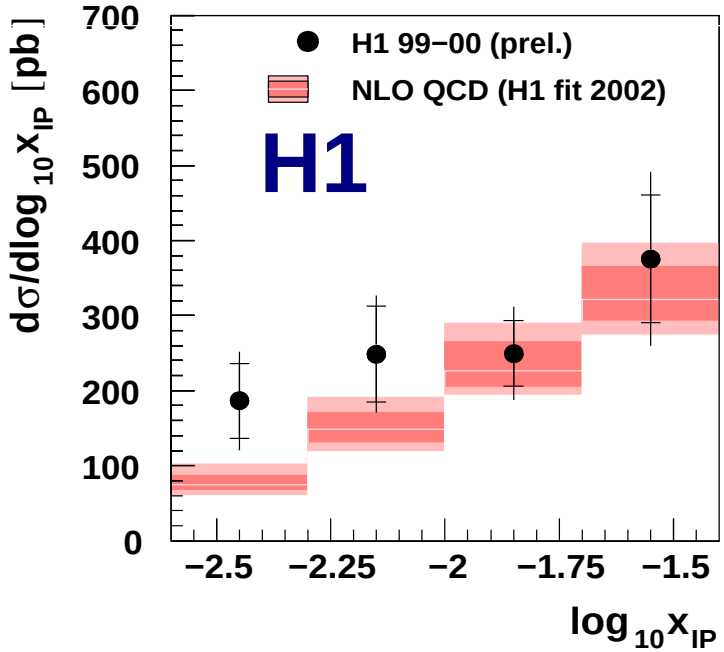
NLO QCD Prediction:

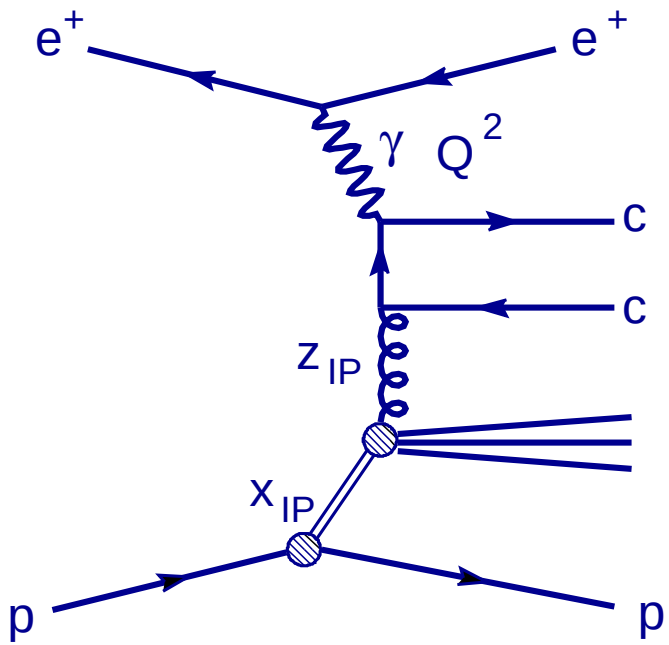
- HVQDIS program (massive)
- diff PDF: H1 fit 2002
- Uncertainties: variation of scales (μ_f /μ_r)
  variation of m_c
  variation of fragmentation function

Good agreement

Test of QCD Factorization in DIS

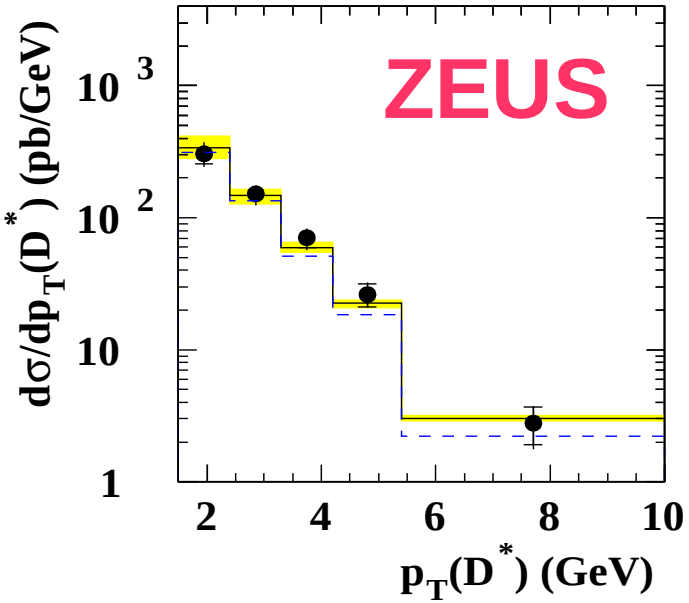


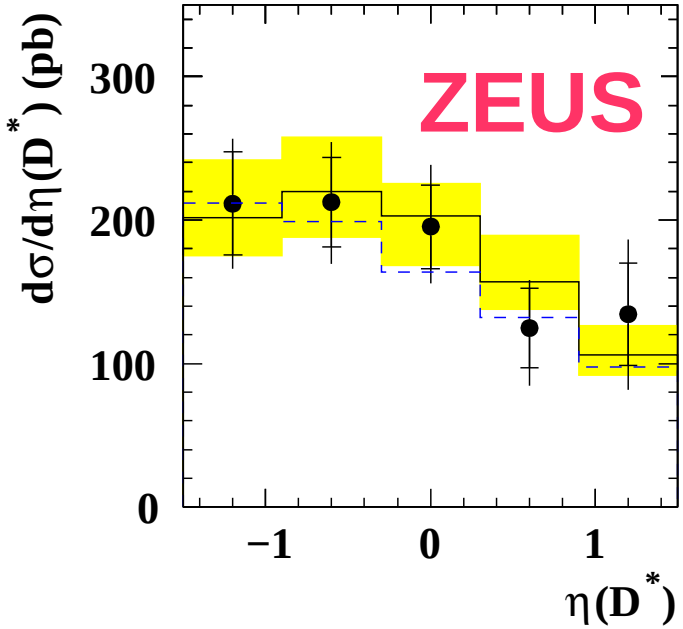




Good agreement

Test of QCD Factorization in DIS

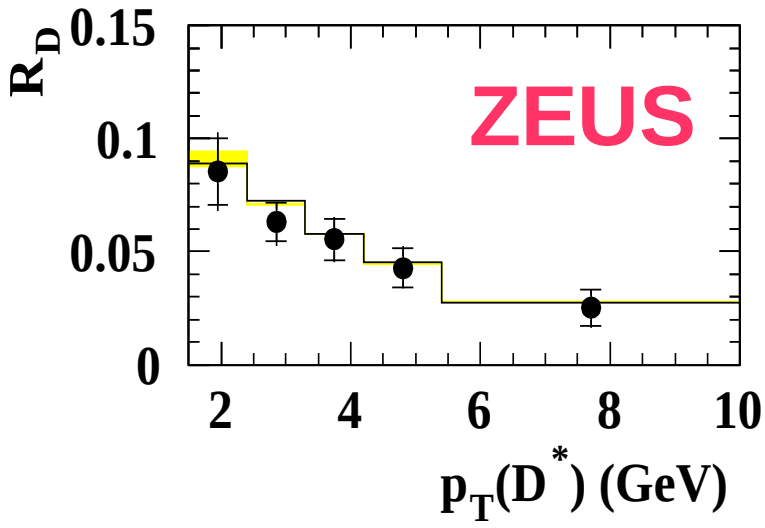




NLO QCD Prediction:

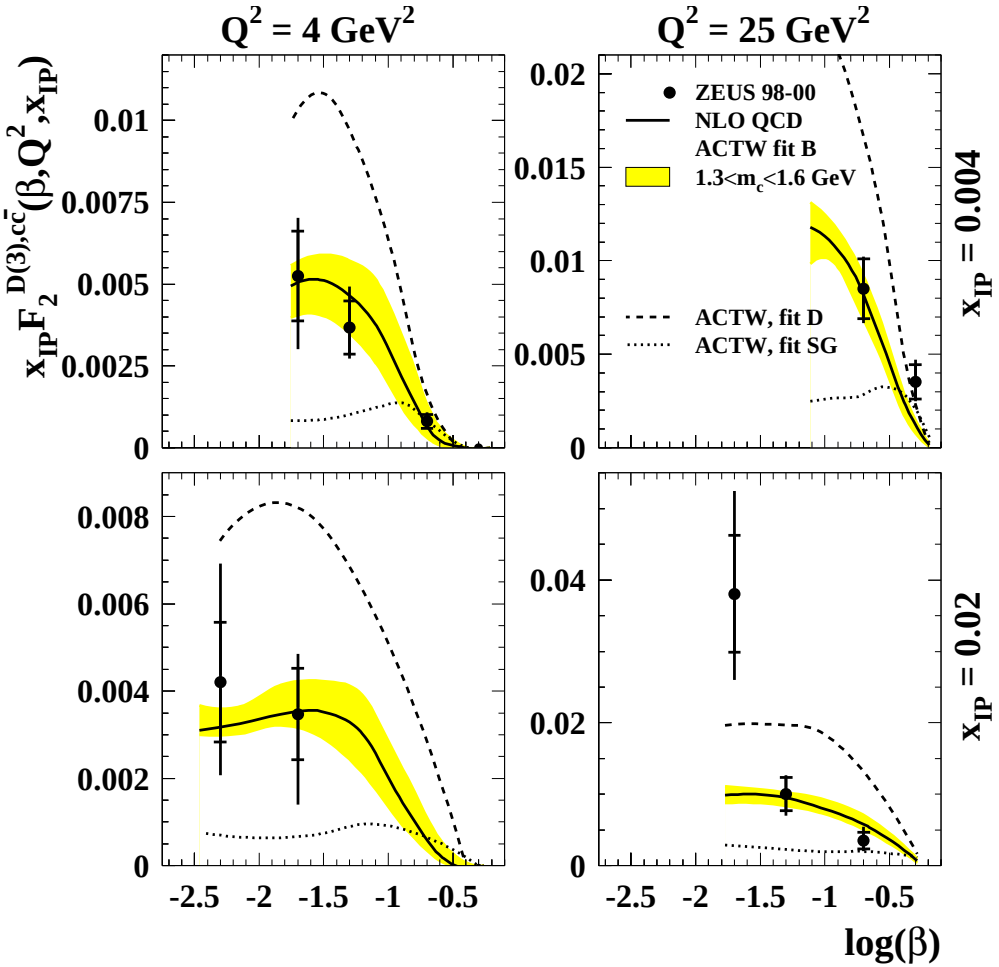
- HVQDIS program (massive)
- PDFs: ACTW(fit B) (*diff*)
  CTEQ5F3 (*incl*)
- Uncertainties: variation of m_c

$$R_D = \frac{\sigma_{diff}\left(x_{IP}<0.035, \beta<0.8\right)}{\sigma_{incl}\left(x<0.028\right)}$$



Test of QCD Factorization in DIS

charm contribution to diffractive proton structure:

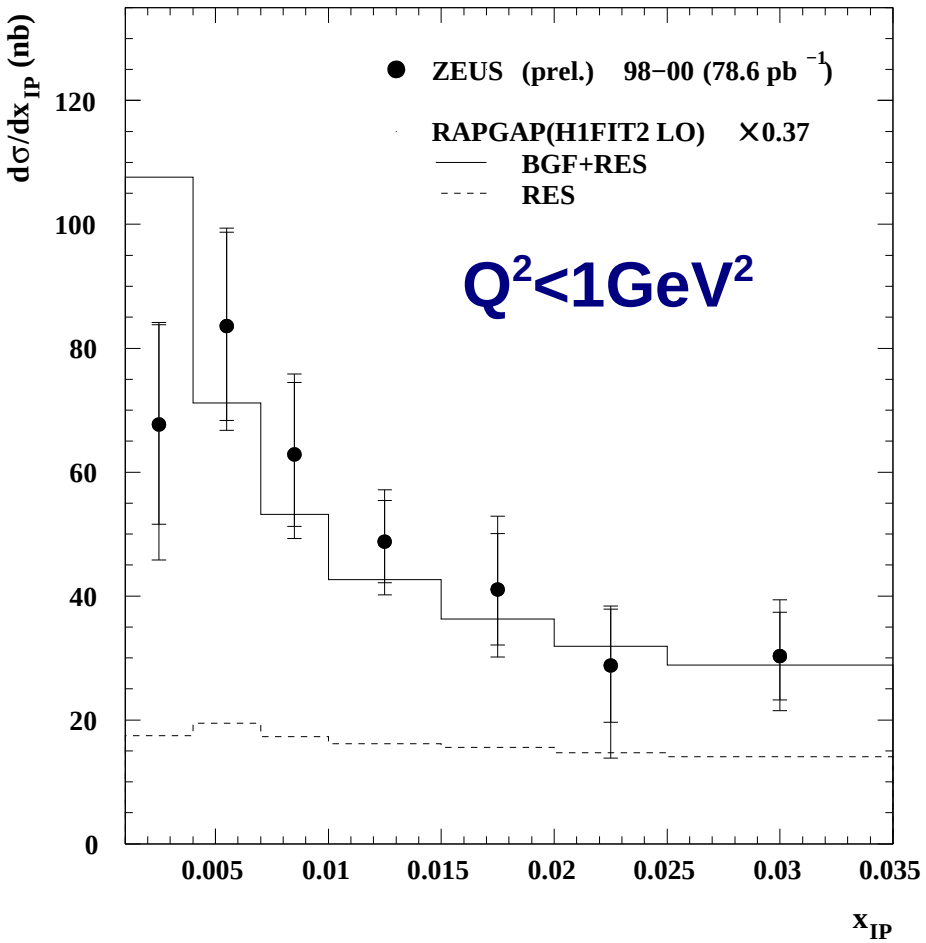


High sensitivity to choice of Structure Function

Measured structure function is well described by NLO

QCD Factorization works for *charm* production in Dis (for both choices of diffractive PDFs)

First Results in γp from ZEUS

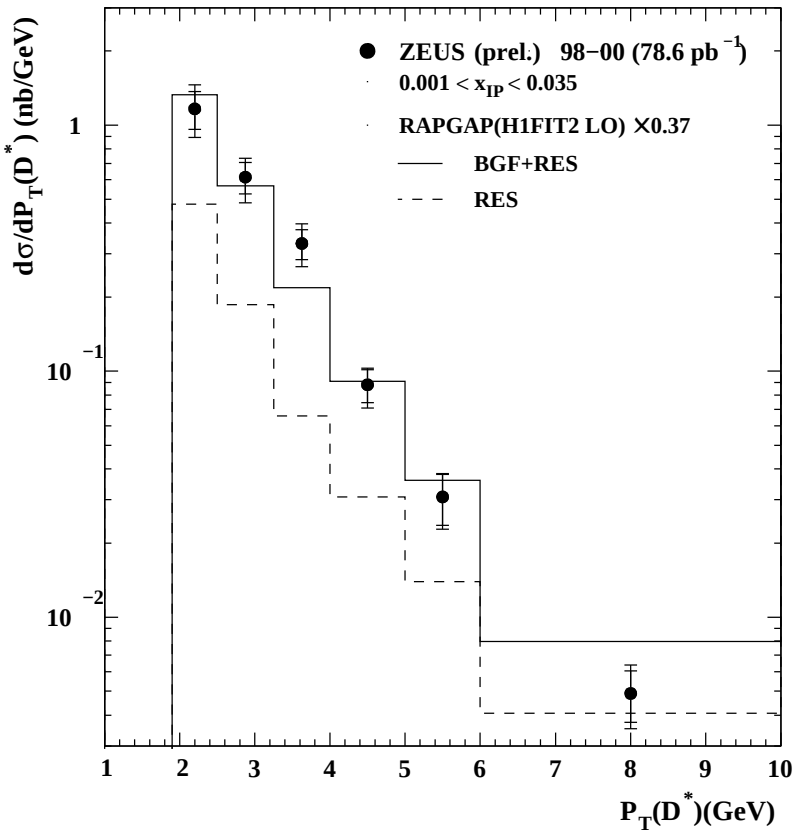


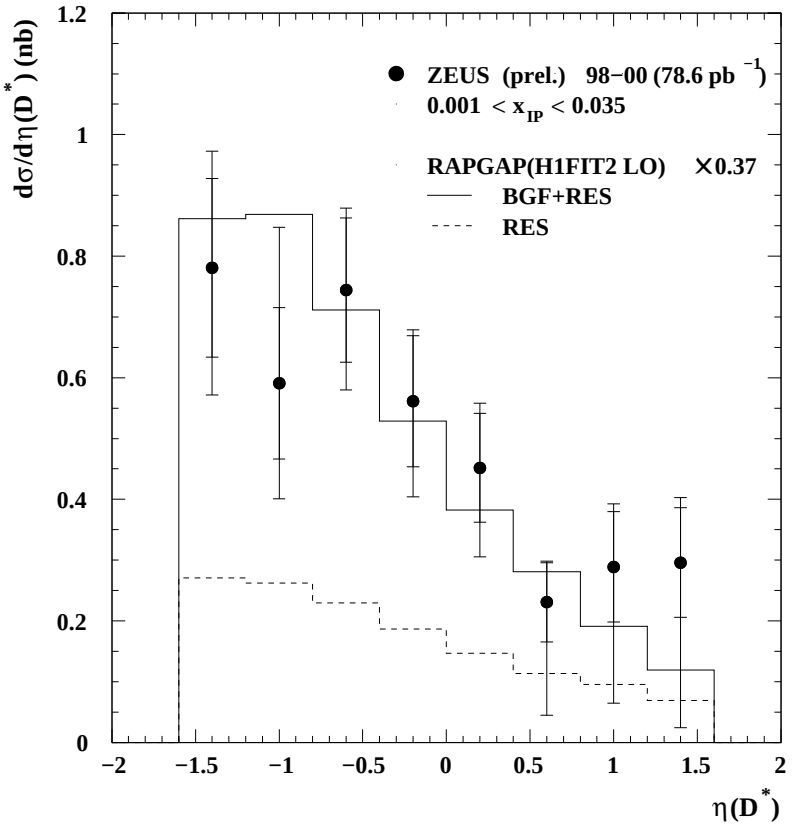
LO Monte Carlo:

- Rapgap (with parton showers)
- diff PDF: H1Fit2 (1994) LO
- Three contributions: direct
  resolved & excitation

- **Factor ~3 in normalization**
- **shapes ok**

First Results in γp from ZEUS





- Factor ~3 in normalization
- shapes ok

Need NLO predictions in γp to see if Factorization does or does not hold in NLO

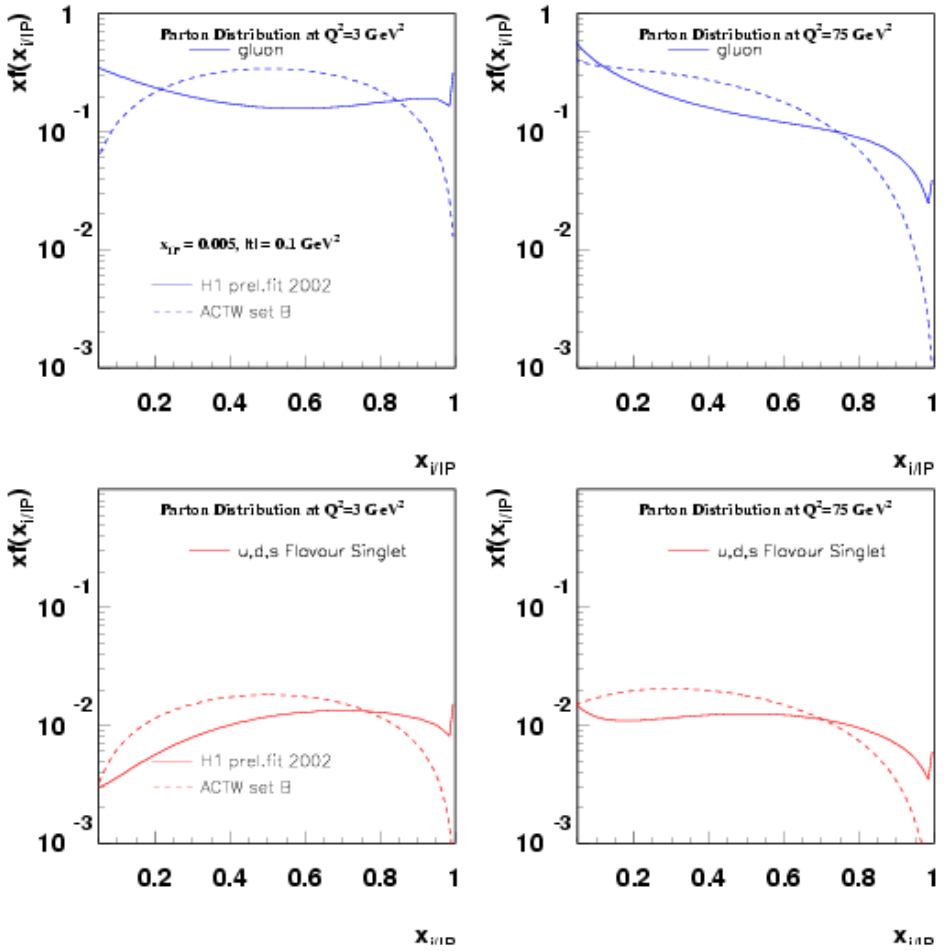
Conclusions

- **Factorization works for *charm* Production in DIS for the chosen diffractive PDFs (H1 fit 2002 & ACTW (fit B))**

- **First Data in γp exist from Zeus**

- **If Factorization holds for γp in NLO will turn out as soon as the NLO predictions in γp are available!**

Backup: H1 fit 2002 versus ACTW (fit B)



→ **Gluon PDF**

→ **Quark PDF**