Diffractive Charm Production with H1

Dis 06, Tsukuba, 21.04.2006

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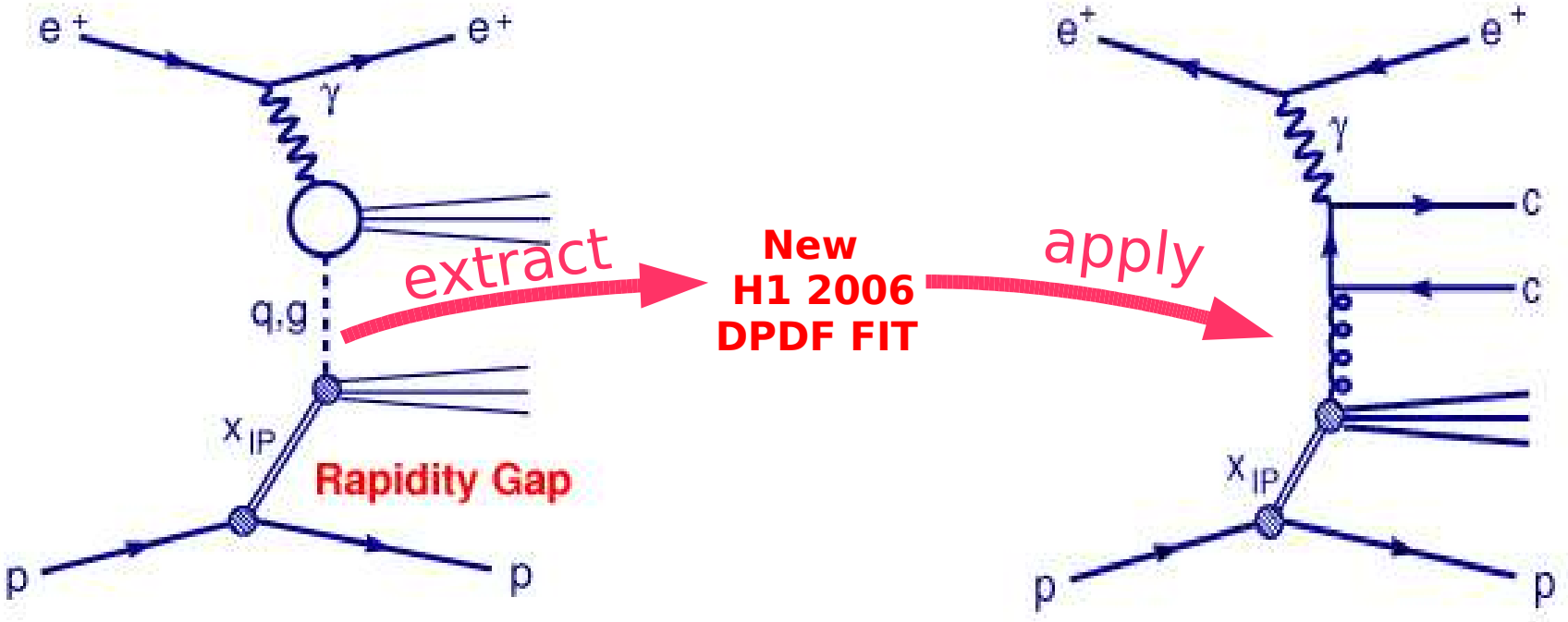
A Test of Factorisation in Diffraction

σ = **universal** diffractive PDF $\otimes$ hard **ME**



Inclusive diffraction

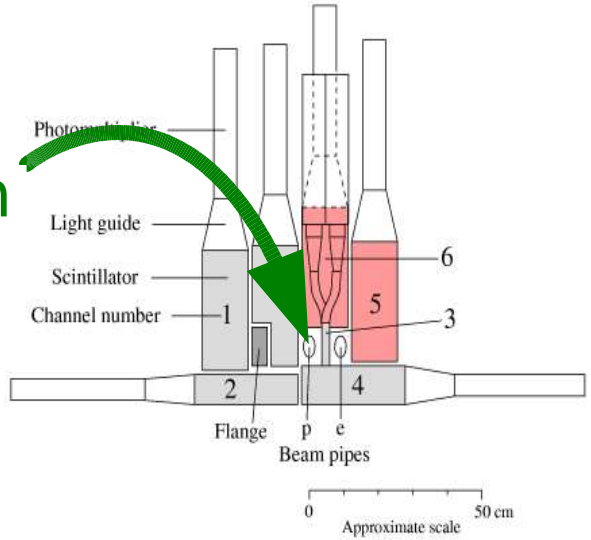
Diffractive charm:

- γp : D*

- DIS : Charm contribution to σ

Inclusive lifetime tag, D*

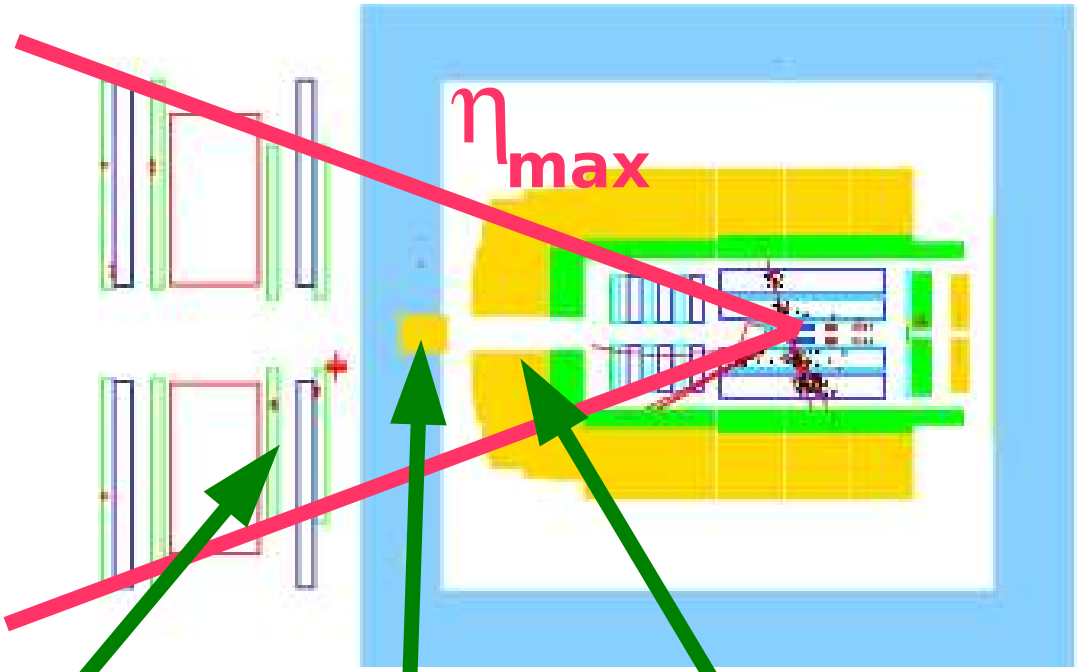
Diffractive Selection via Rapidity Gap



beam pipes

z=+26m

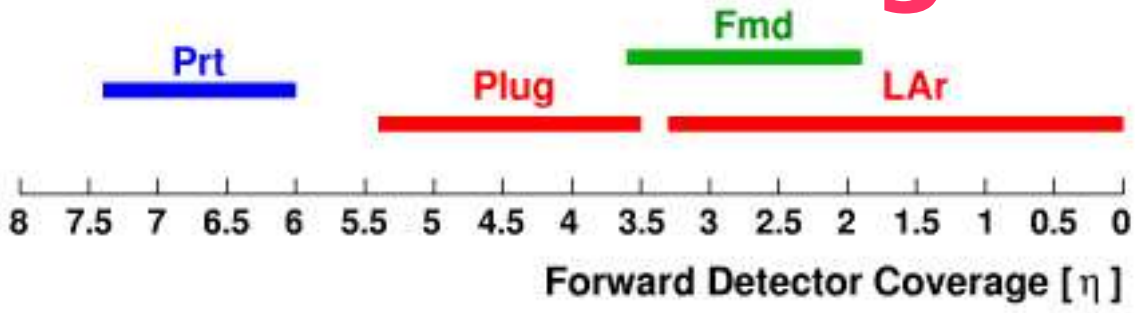
Prt



Fmd

Plug

LAr



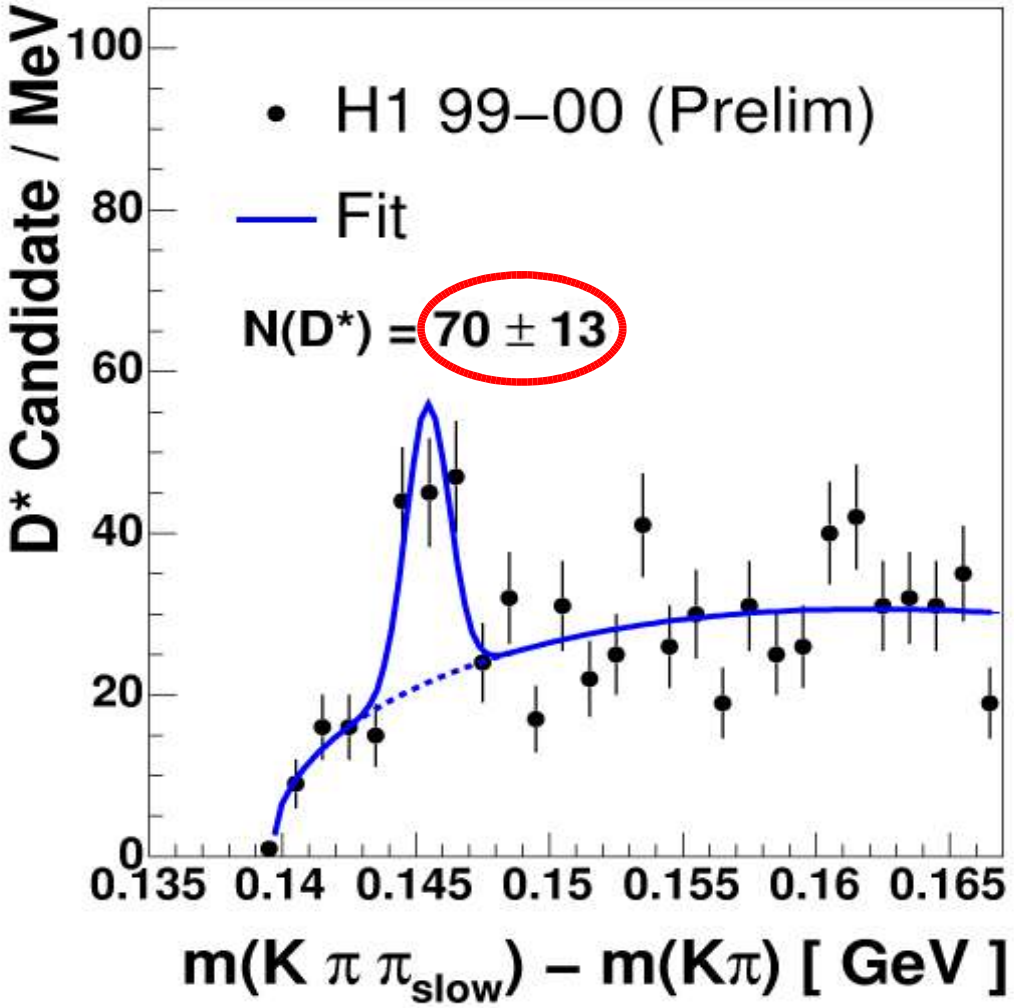
Apply H1 'Standard' Selection: No Signal in Forward det. above noise thresholds

D* in γp: Specific Selections

- **99/00 data**
- **47.0 pb^{-1}**

- **Tagged γp:**
  - **Measure scattered positron in tagger at z=-33 m**
  - **Q^2<0.01 GeV^2**
  - **$Y \in$ [0.3,0.65]**

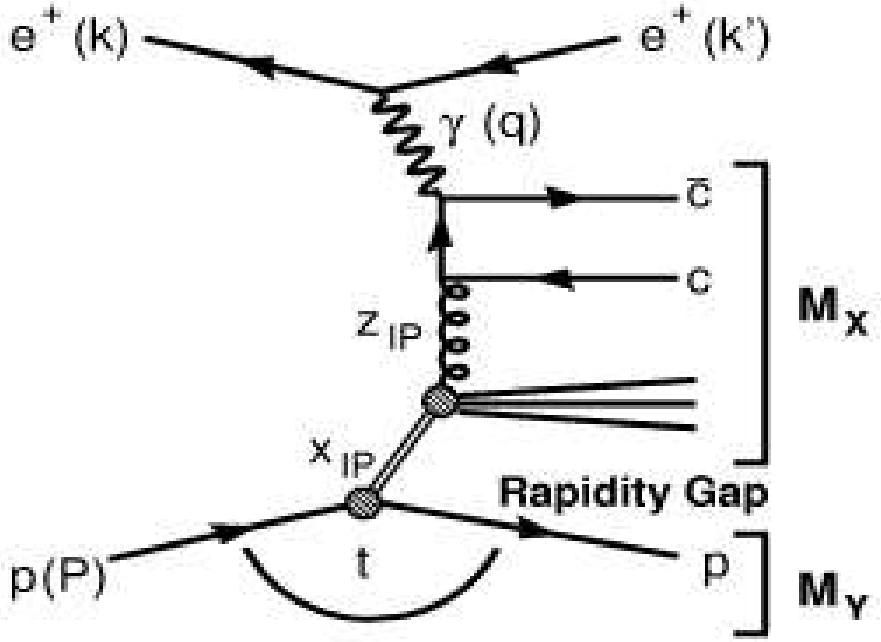
- **D* Selection:**
  - **$D^* \rightarrow D^0 \pi_s \rightarrow K \pi \pi_s$**
  - **$p_t(D^*) > 2$ GeV**
  - **$|\eta(D^*)| < 1.5$**



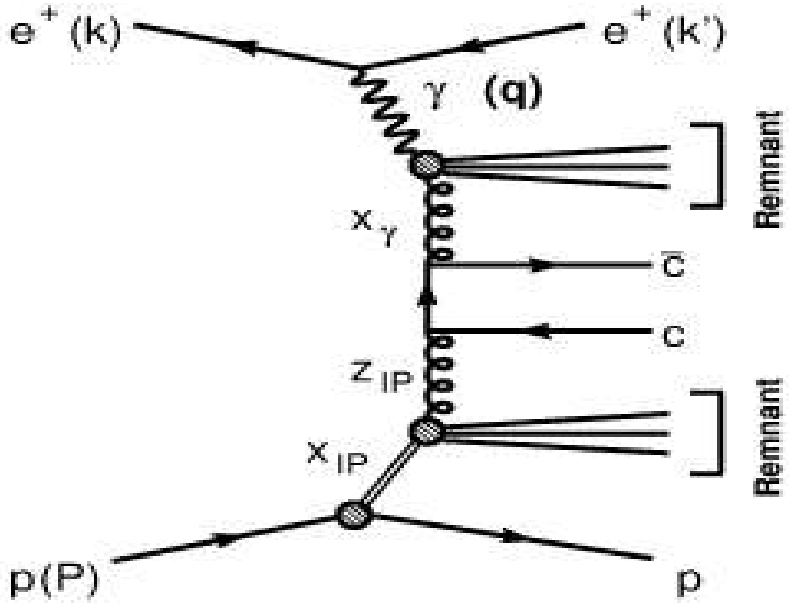
D* in γp: 'Massive' NLO Calculation FMNR

Leading Order Processes:

Direct γ



Resolved γ:

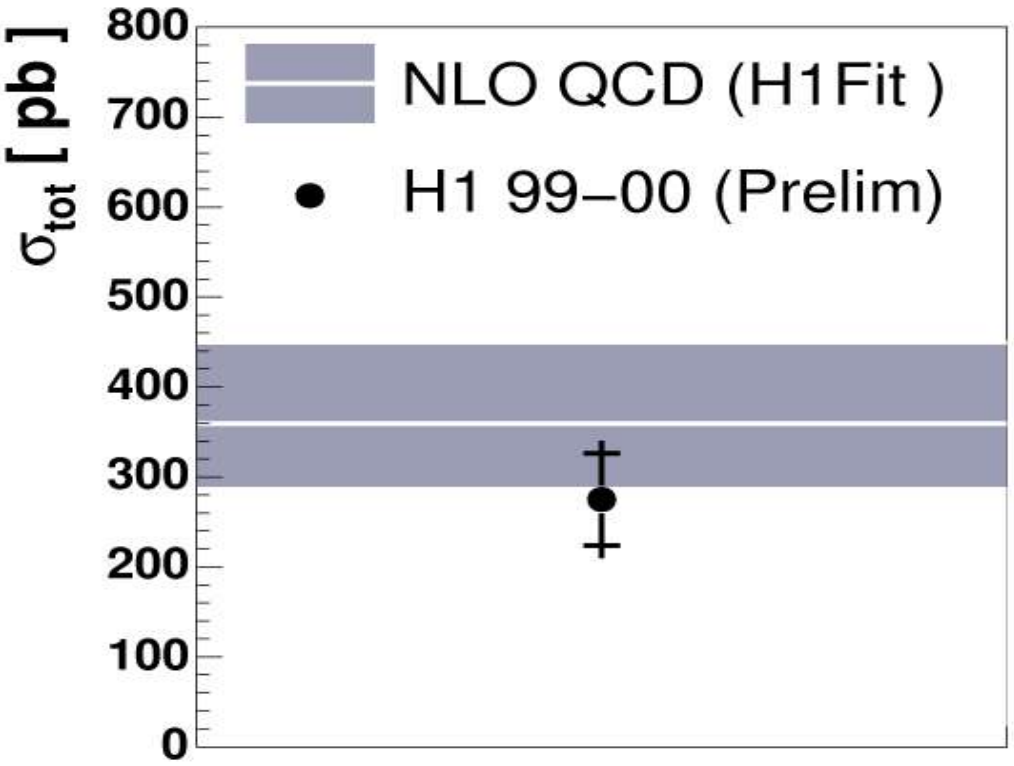


Expected resolved γ contributions: ~ 10%

Charm probes mainly direct γ component (in contrast to dijets)

D* in γp: Total Cross Section

Visible Range:
Q^2<0.01 GeV^2, 0.3<y<0.65
x_p<0.04, M_Y<1.6 GeV, |t|< 1 GeV^2,
p_t(D*) > 2 GeV, |η(D*)| < 1.5

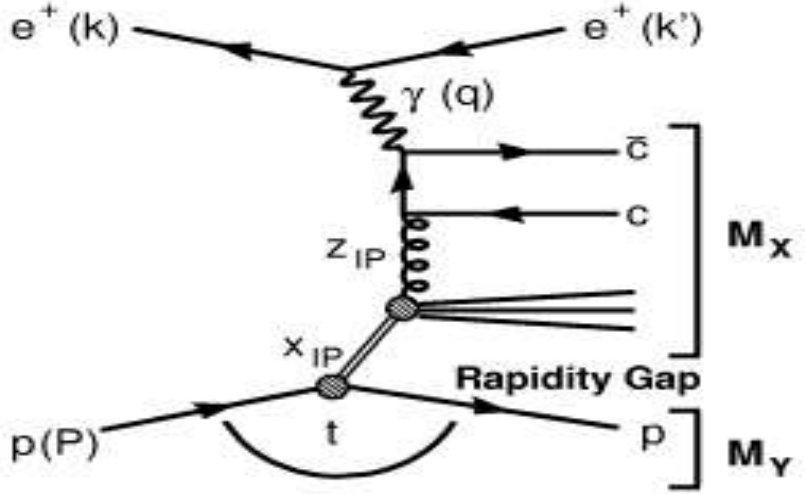


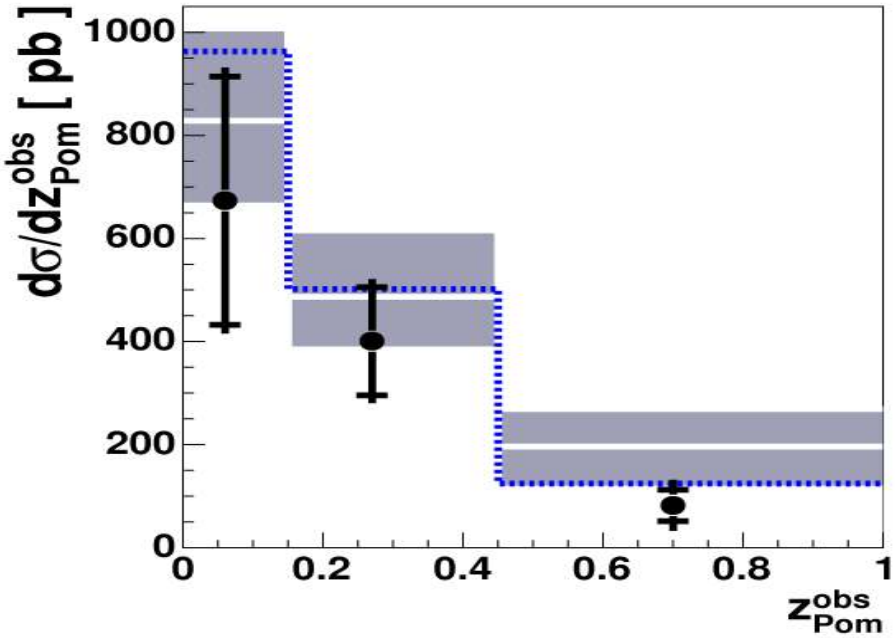
NLO Settings (FMNR):
- **m_c = 1.5 GeV**
- **$\mu_f^2 = \mu_r^2 = (p_t^2 + 4m_c^2)$**
- **H1 2006 DPDF FIT**
- **Peterson (ε_p=0.035)**

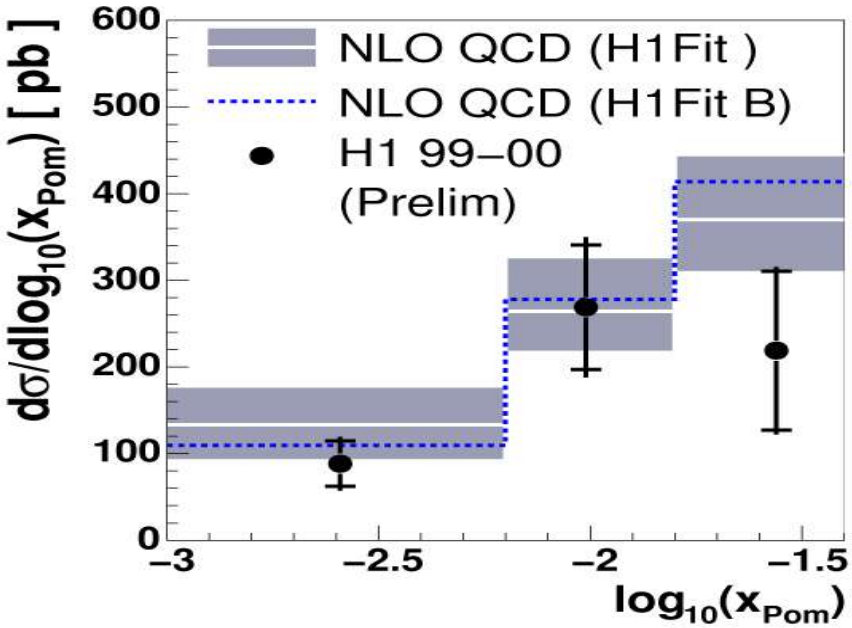
NLO Variations:
m_c = 1.3 … 1.7 GeV
$\mu_f^2 = \mu_r^2$ = ¼ … 4
Peterson (ε_p=±0.025)

- **Factorisation ok (within large errors)**
- **No evidence for diffr. γp suppression as observed for dijets**

D* in γp vs Diffractive Variables

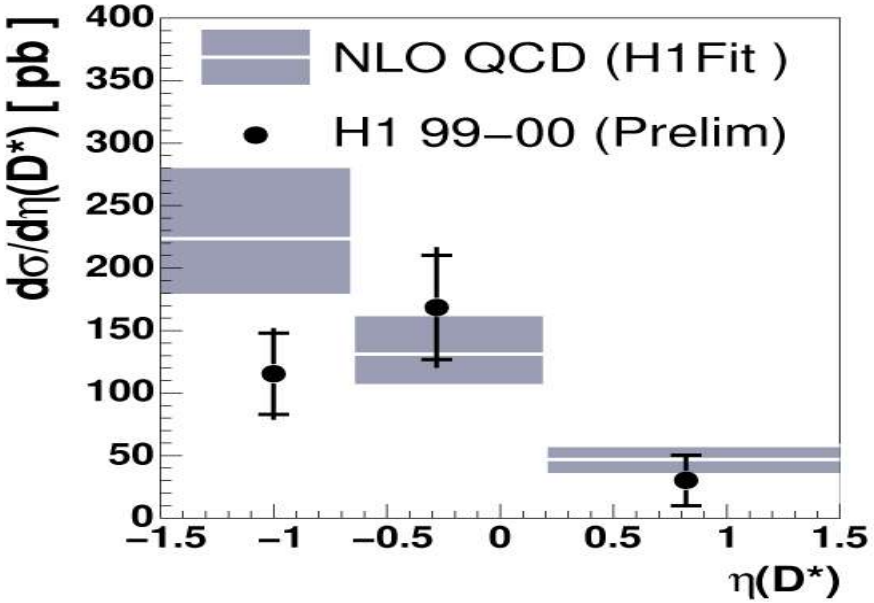


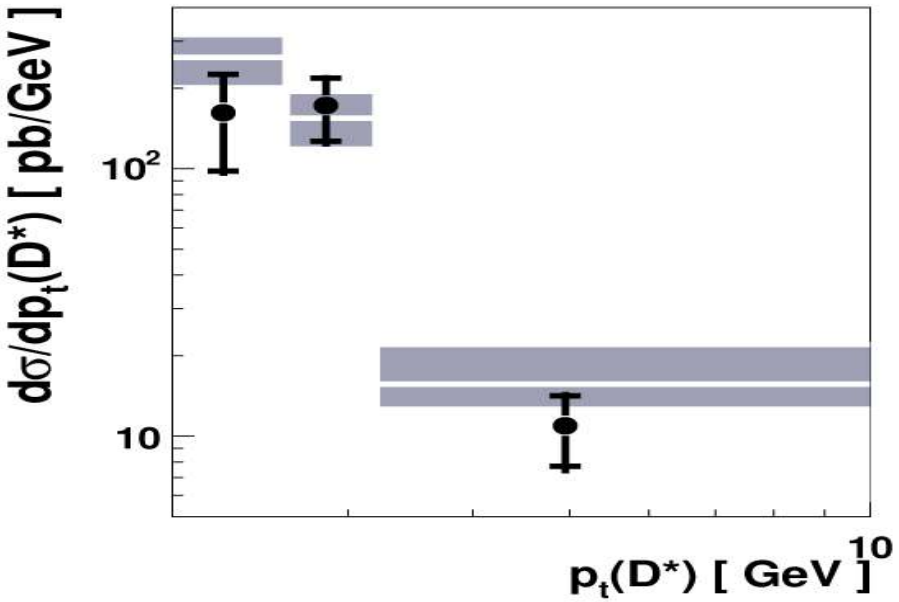


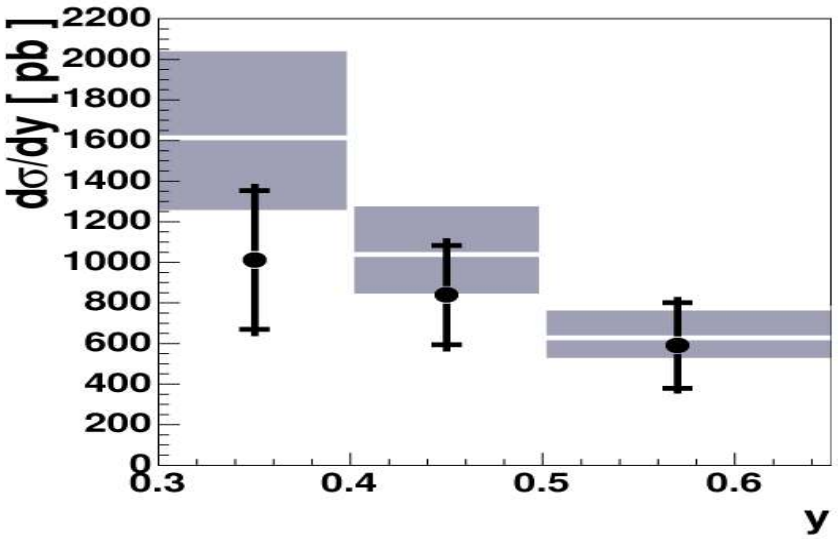


Well described by NLO

D* in γp vs D* and Event Kinematics

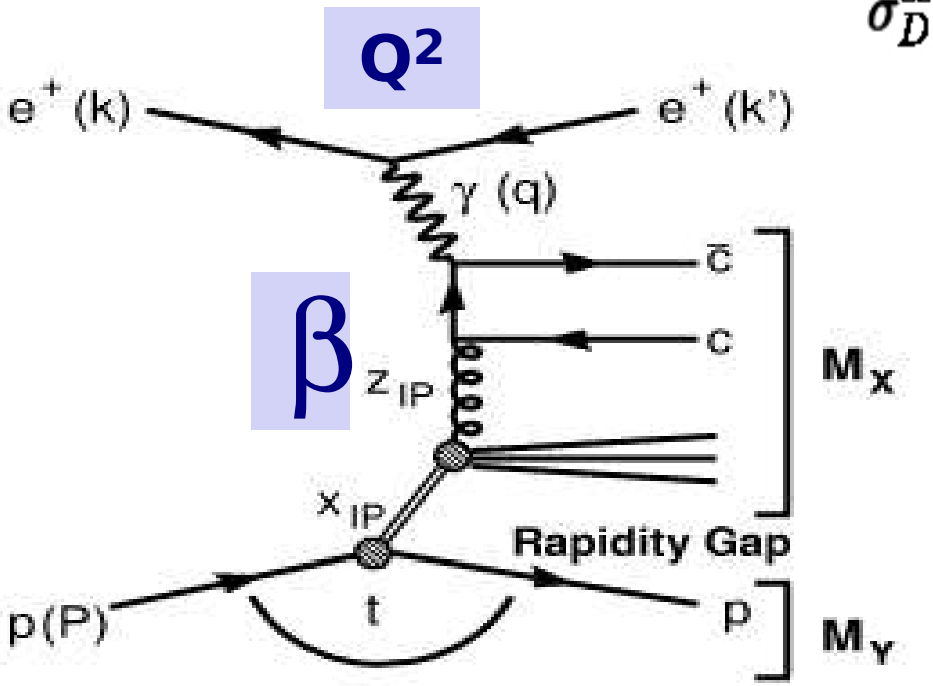






Reasonable description by NLO

Charm in DIS: Reduced Cross Section



$$\tilde{\sigma}_D^{c\bar{c}}(x_{IP},\beta,Q^2) = \frac{d^3\sigma_D^{c\bar{c}}}{dx_{IP}d\beta dQ^2}\frac{xQ^4}{2\pi\alpha^2(1+(1-y)^2)}$$

Two Measurements:
99/00 Data, ~50 pb^{-1}
x_p<0.04, M_Y<1.6 GeV, |t|< 1 GeV^2

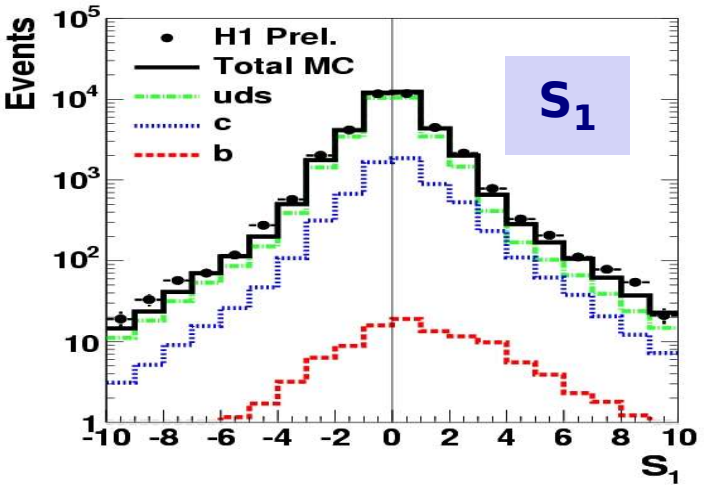
1. D* analysis
2<Q^2<100 GeV^2, 0.05<y<0.7
p_t(D*) > 2 GeV, |η(D*)| < 1.5
Large extrapol. factors ~2.5 from D* visible range to total charm σ

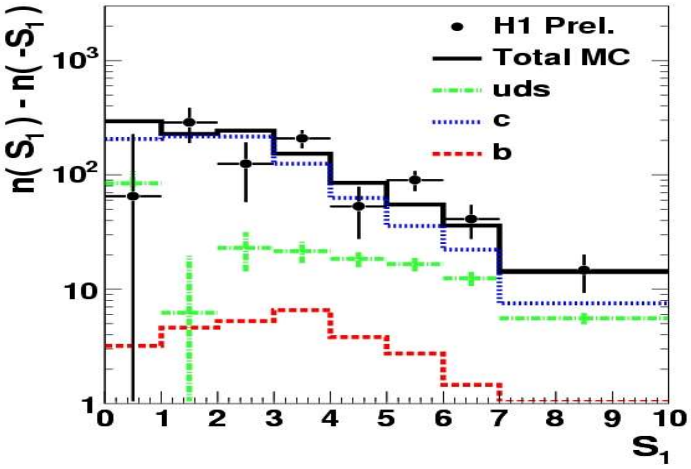
2. First inclusive lifetime tag measurement in diffractive DIS
15.8<Q^2<100 GeV^2, 0.07<y<0.7

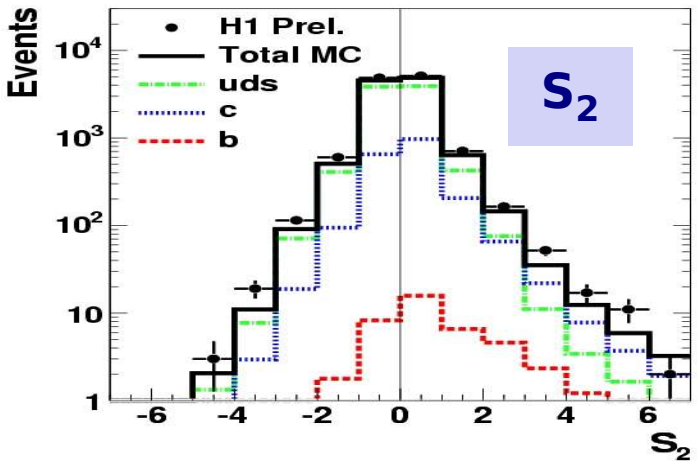
Incl. Lifetime Tag for Diffractive Charm in DIS

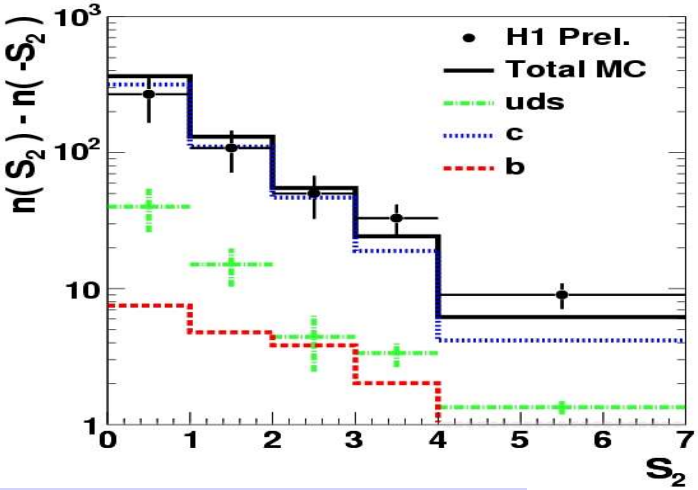
- **Method as pioneered in H1 measurement hep-ex/050781**
- **Select tracks with p_t>500 MeV**
- **Use tracks with the two largest impact par. significances S_1, S_2**

Negative subtracted







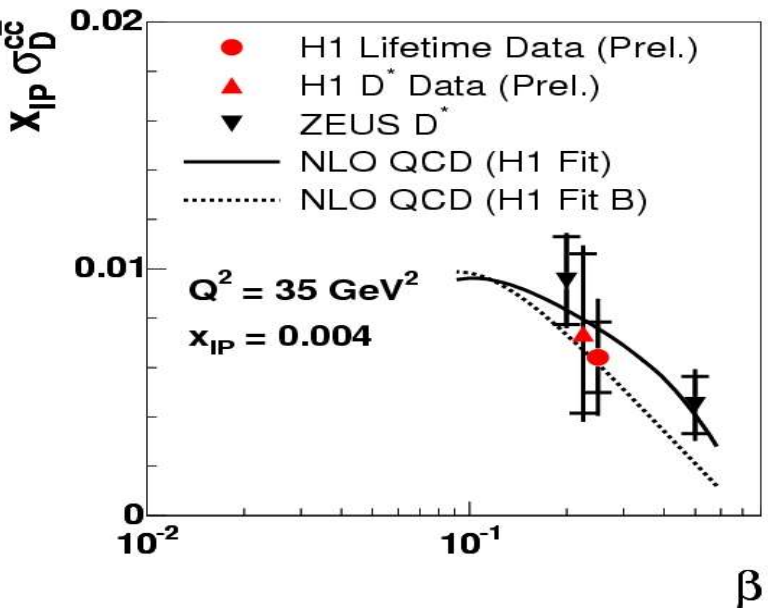


Apply simultaneous fit to negative subtracted S_1, S_2 and total number of diffractive events -> determine diffractive charm cross section

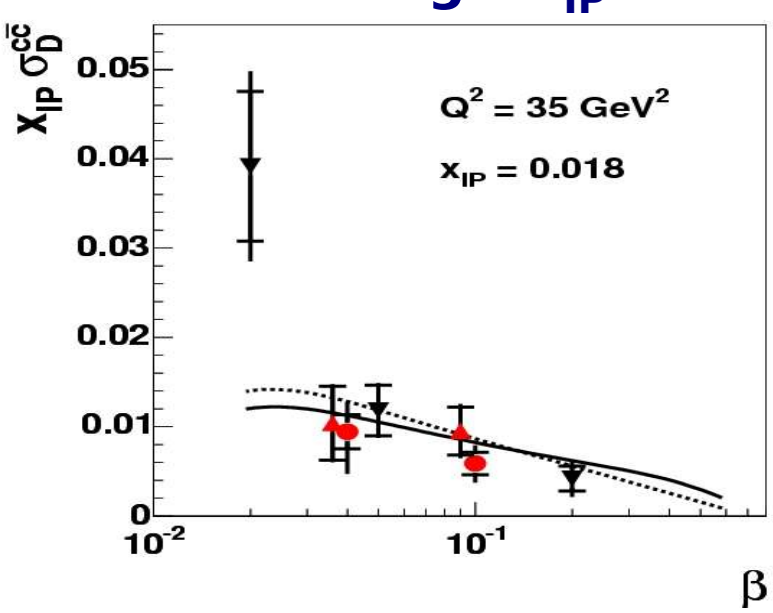
Note: Beauty contribution is fixed in fit to Rapgap MC prediction and varied by -100% to +400% -> large syst. errors at medium and low β

Results: Reduced Cross Sections

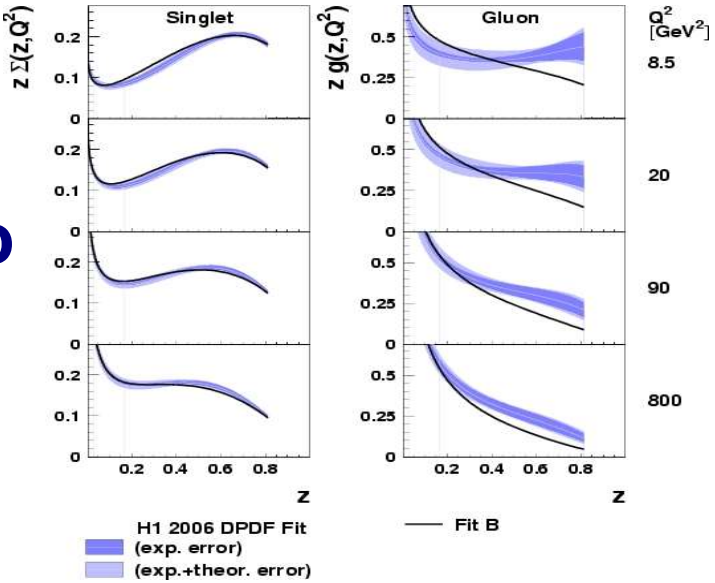
Low X_{IP}



High X_{IP}



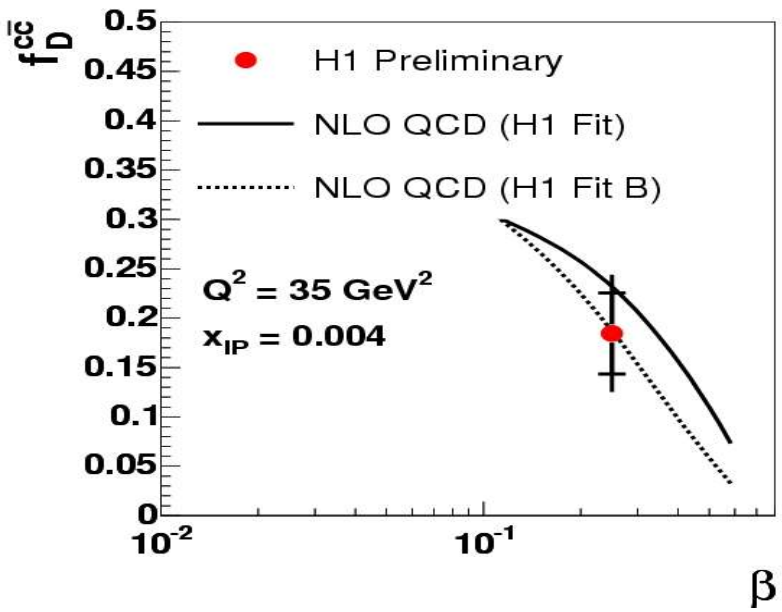
Input DPFS for NLO



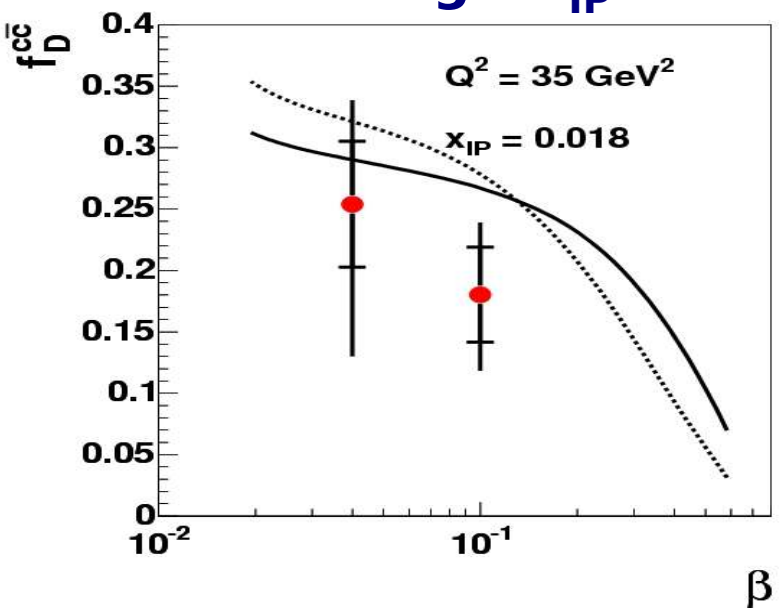
Well described by NLO for both gluon densities:
- H1 2006 DPDF FIT
- H1 FIT B

Charm fractional contribution to diffr. DIS

Low X_{IP}



High X_{IP}



~20%, similar as for inclusive DIS, Charm gives a large contribution!

Conclusions

Brand-new H1 measurements of diffractive charm production at HERA compared to NLO predictions using the H1 2006 DPDF:

D* in γp:

- Well described by NLO
- No evidence for suppression of diffr. γp as observed for dijets

Diffractive Charm Cross Section in DIS
(incl Lifetime Tag & D*)

- Consistent results with two different methods
- Charm contributes ~20% to inclusive diffraction (in given Q^2 range)
- Adequate description by NLO