Experimental and theoretical issues

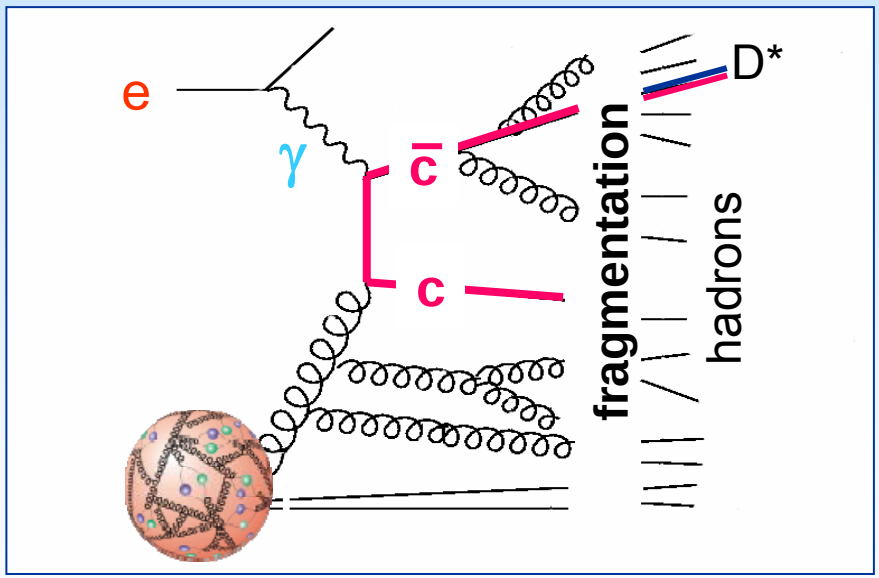
of open charm production at HERA.

Meeting 08 August 2008

Motivation

Katerina Lipka, H1

Motivation: direct access to the gluon



Methods:

- HERA most precise measurement of D* production cross sections yet

H1, $\mathcal{L}$ = 350 pb^{-1}, 5< Q^2 < 1000 GeV^2

- H1 measurement of F^c_2 via lifetime tag
- ZEUS analysis ongoing (300 pb^{-1})
- Combination of the above results: expected precision

$F_2^{c\bar{c}}$ extraction from D* cross sections

$$F_2^{c\bar{c}}(\exp) = \frac{\sigma_{vis}(\exp)}{\sigma_{vis}(theory)} F_2^{c\bar{c}}(theory)$$

Problem: detector sees only 30% of the phase space for c→D*

Extrapolation needed → strong model dependence

Models:

- NLO: Riemersma et al: integrated form; HVQDIS: differential form, fixed order massive calculation, Nf=3, FFNS, evolution: DGLAP
- CASCADE: massive LO ME + Parton showers, proton structure: gluons only, evolution: CCFM

More problems: input to the model: charm mass, scales, fragmentation

Model parameters/variations: NLO

PDFs: MRST04F3, CTEQ5F3

Central charm mass: 1.43 GeV (charm mass of MRST04F3)

Central Scales: $\mu_r=\mu_f=\sqrt{Q^2+4m_c^2}$

Unknown model parameters → Workaround: variations

Charm mass variation: $1.3<m_c<1.6$ GeV

Scale Variation 1: $\mu_r=\mu_f=\mu$; $0.5\mu<\mu<2\mu$ (used up to now)

Scale Variation 2: $0.5\mu<\mu_r<2\mu$, $0.5\mu<\mu_f<2\mu$, $0.5<\mu_r/\mu_f<2$ *(HERA-LHC05)*

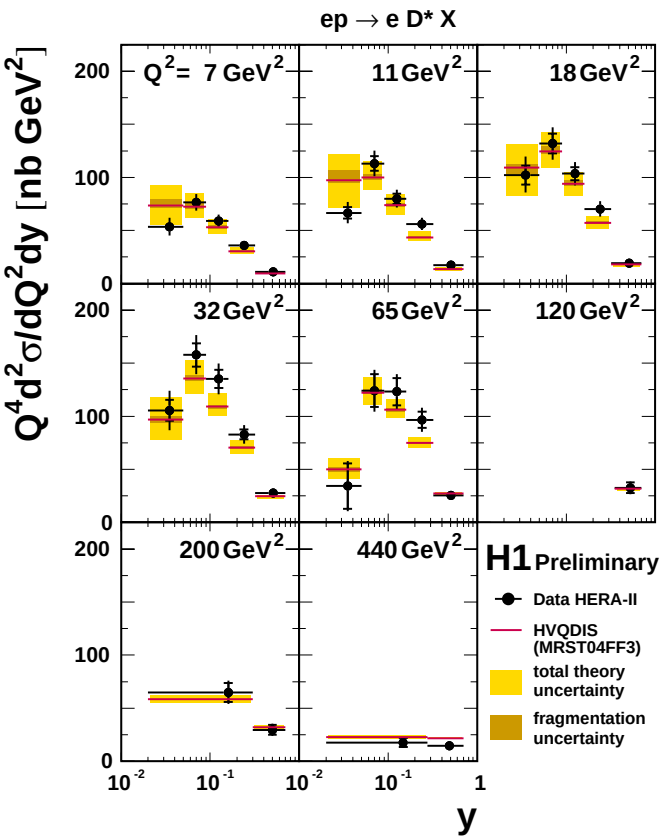
Word of caution: Inconsistencies in the PDF and calculation

Charm mass: differences in PDF due to charm mass not accounted for

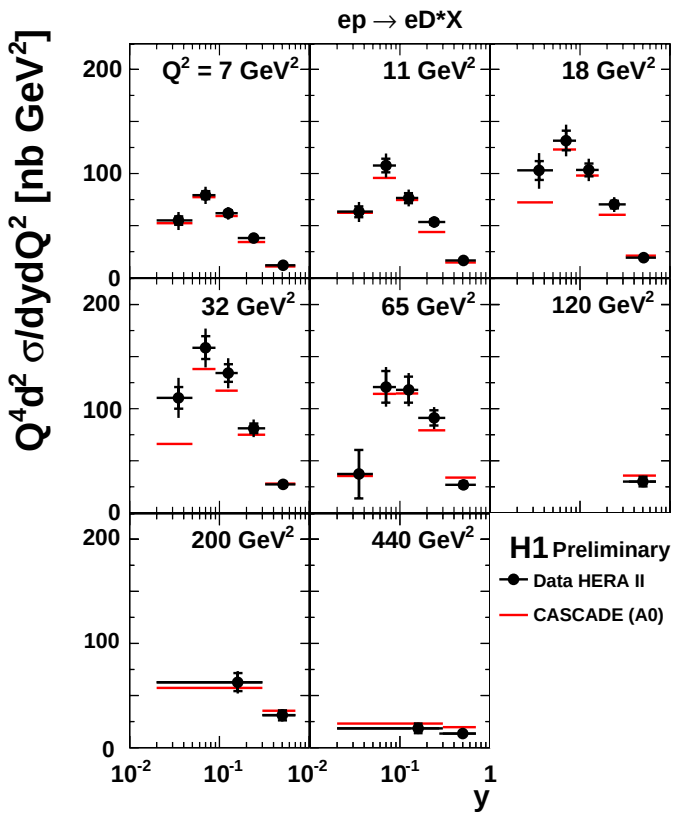
Scale: is independent variation of the scale treated technically correct?

Cross sections vs NLO and CASCADE

HVQDIS

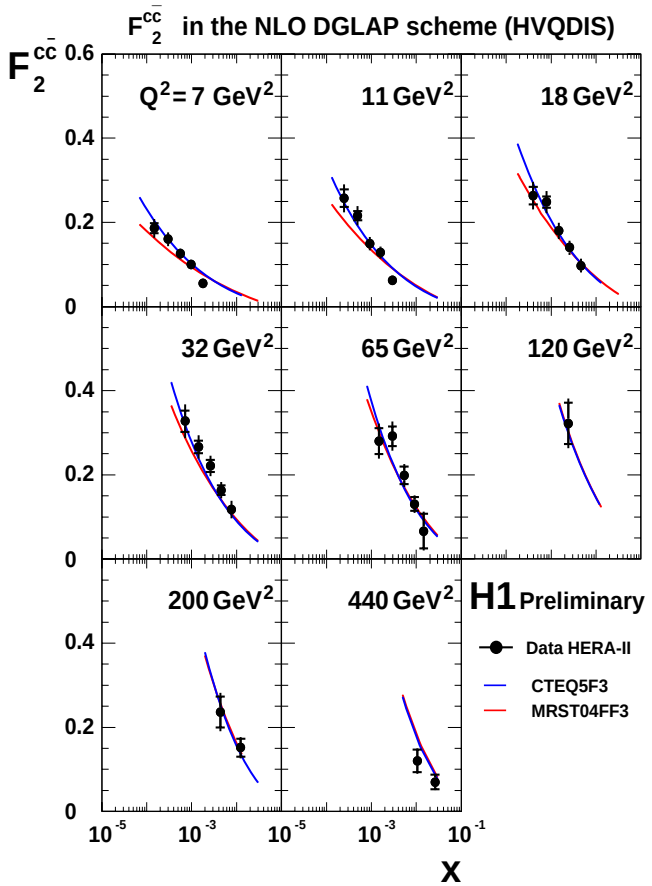


CASCADE

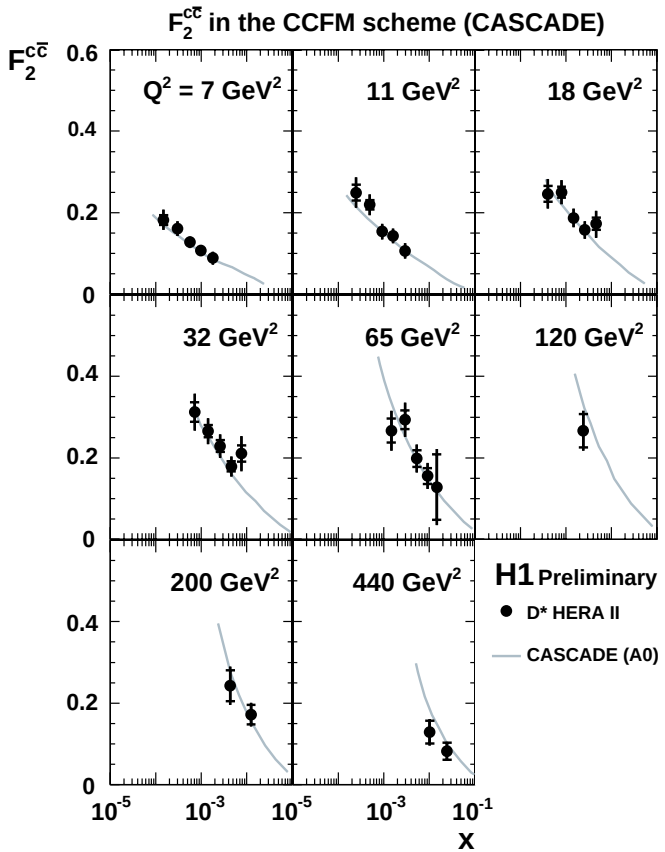


H1 results on F_2^c

HVQDIS



CASCADE



Open issues to be discussed

- Fragmentation
- Extrapolation model
- Parameters of the extrapolation model
- Treatment of the differences by using different models
- Study of the origin of those differences

Workshop on open charm physics

DESY, November 2008