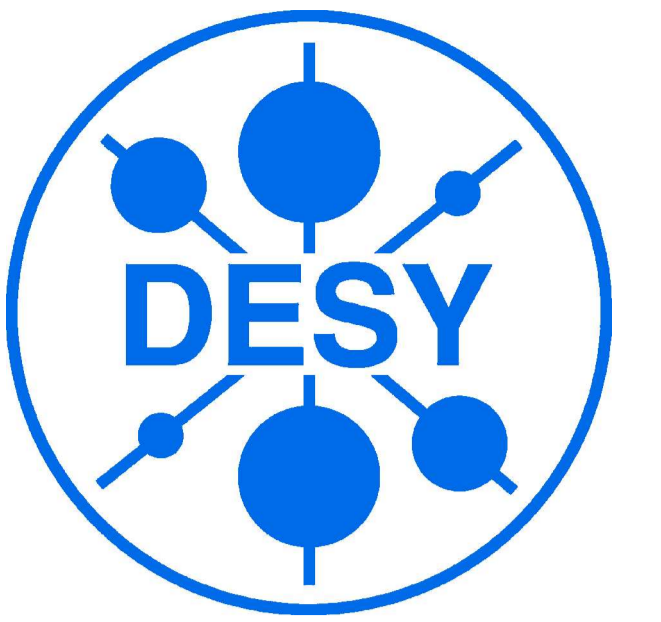




Recent Results from the Heavy Flavour Working Group of the H1 Experiment

Michael Steder, DESY

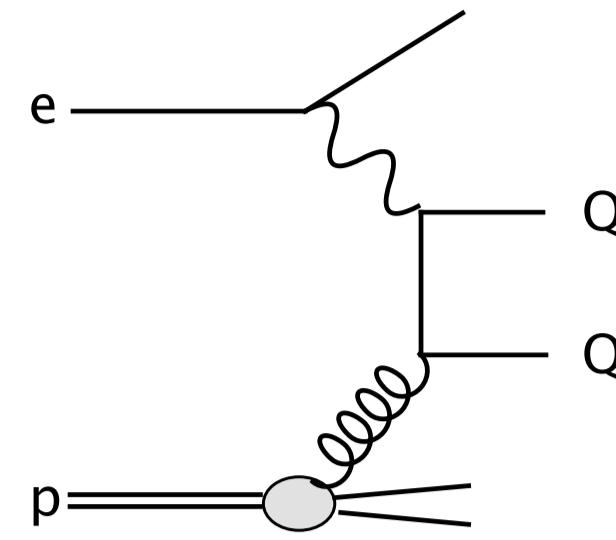


Heavy Quark Production at HERA

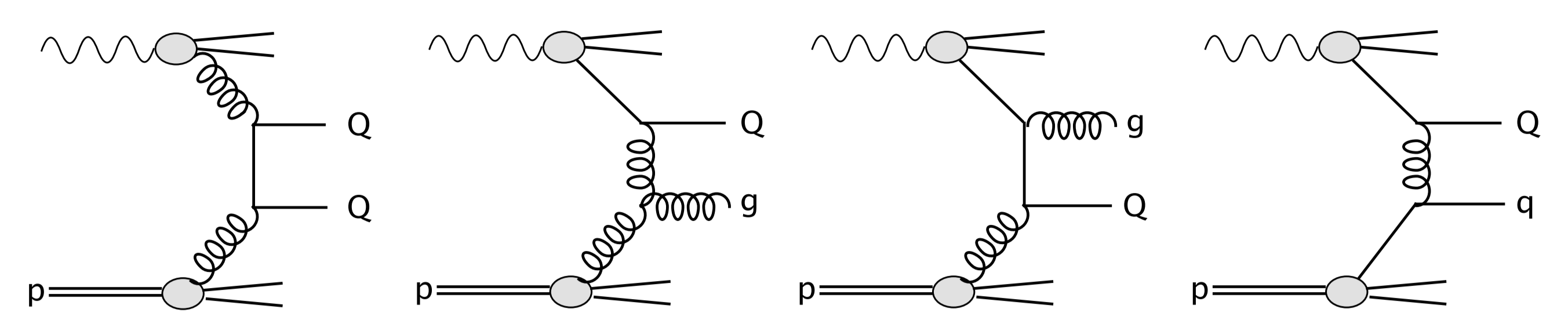
The predominant process for heavy quark production at HERA is **boson gluon fusion (BGF)**, where a gluon from the proton interacts via a quark pair with a gauge boson emitted by the beam lepton. (Neutral Current: γ, Z^0 – Charged Current: W^\pm)

x_γ denotes the energy fraction of the photon that enters the hard interaction. In the case of **direct processes**, the photon couples directly to a quark with its full energy ($x_\gamma \approx 1$), while in **resolved processes** the photon fluctuates into a hadronic system prior to the hard interaction ($x_\gamma < 1$).

direct



resolved



D* Meson Production in DIS

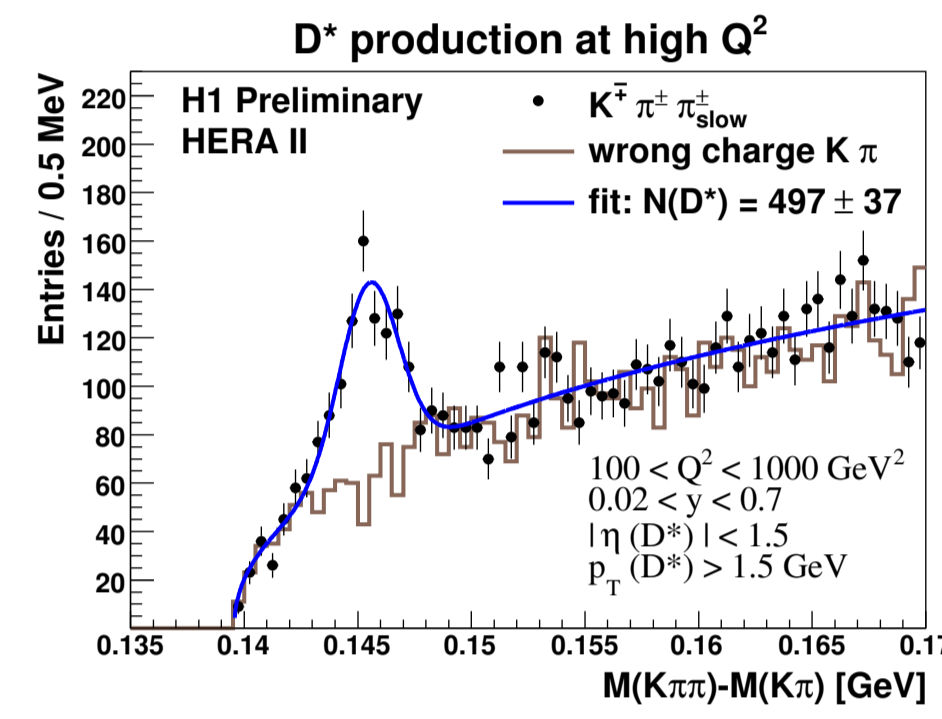
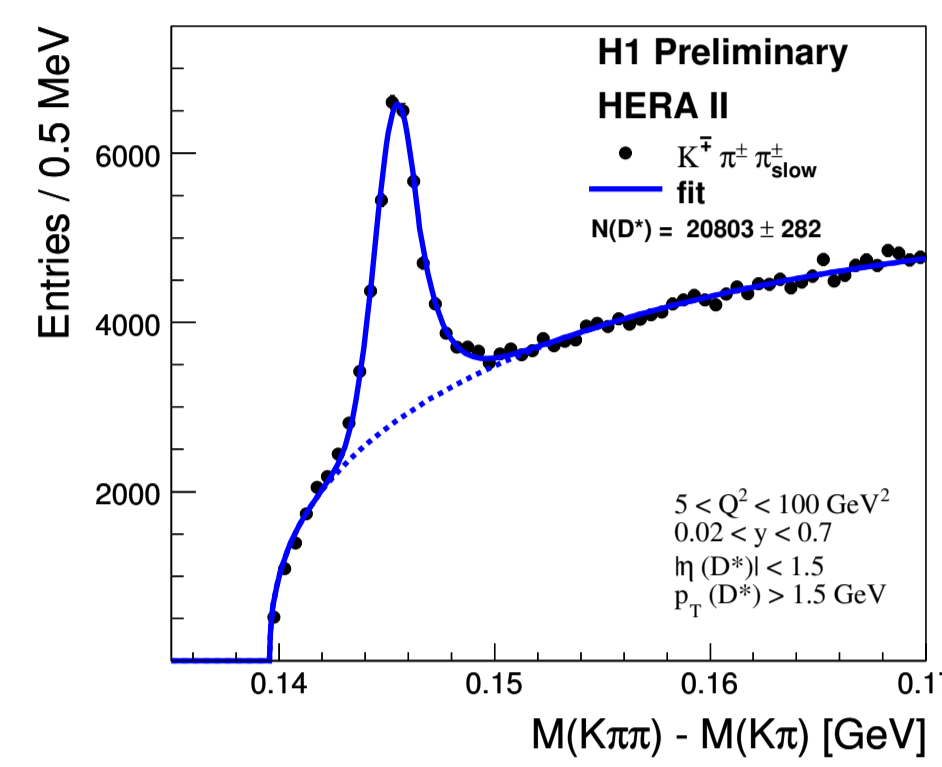
H1prelim-08-072, H1prelim-08-074

Inclusive production of D* mesons is studied up to very high photon virtualities using the full HERA-II data sample corresponding to an integrated luminosity of $\mathcal{L} \approx 350 \text{ pb}^{-1}$.

The visible range of the measured cross sections is $5 < Q^2 < 1000 \text{ GeV}^2$, $0.02 < y < 0.7$, $P_T(D^*) > 1.5 \text{ GeV}$, $|\eta(D^*)| < 1.5$

Data are compared to LO MC predictions (as implemented in the MC generators Rapgap and Cascade) and NLO calculations (HVQDIS).

The best description of the measurement is provided by a NLO calculation using HVQDIS. Rapgap using CTEQ6ll parton density functions describes the shape of the data quite well at low and medium Q^2 , but fails at very large Q^2 . While RAPGAP predictions using the NLO PDF CTEQ65m fail to model the data.



Inelastic Photoproduction of J/ψ Mesons

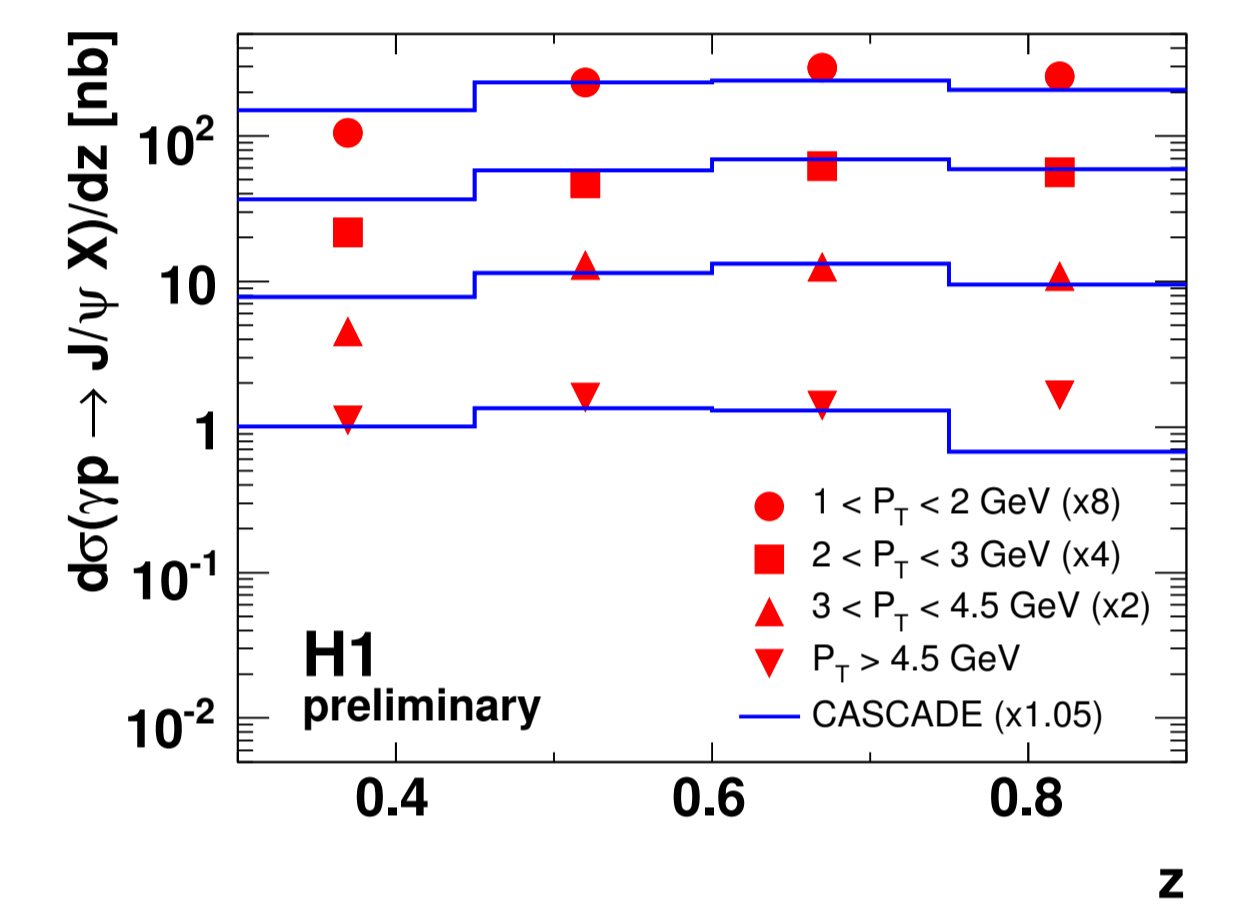
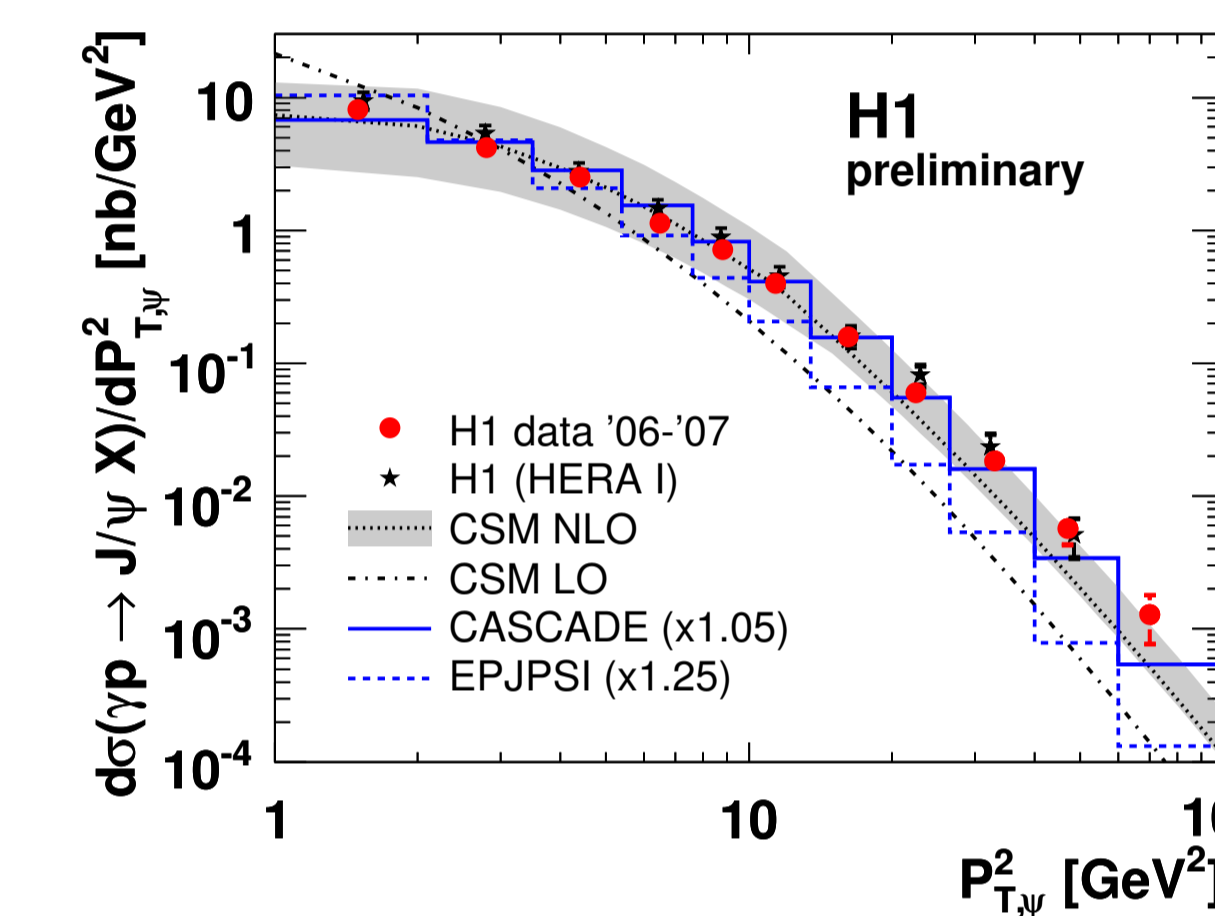
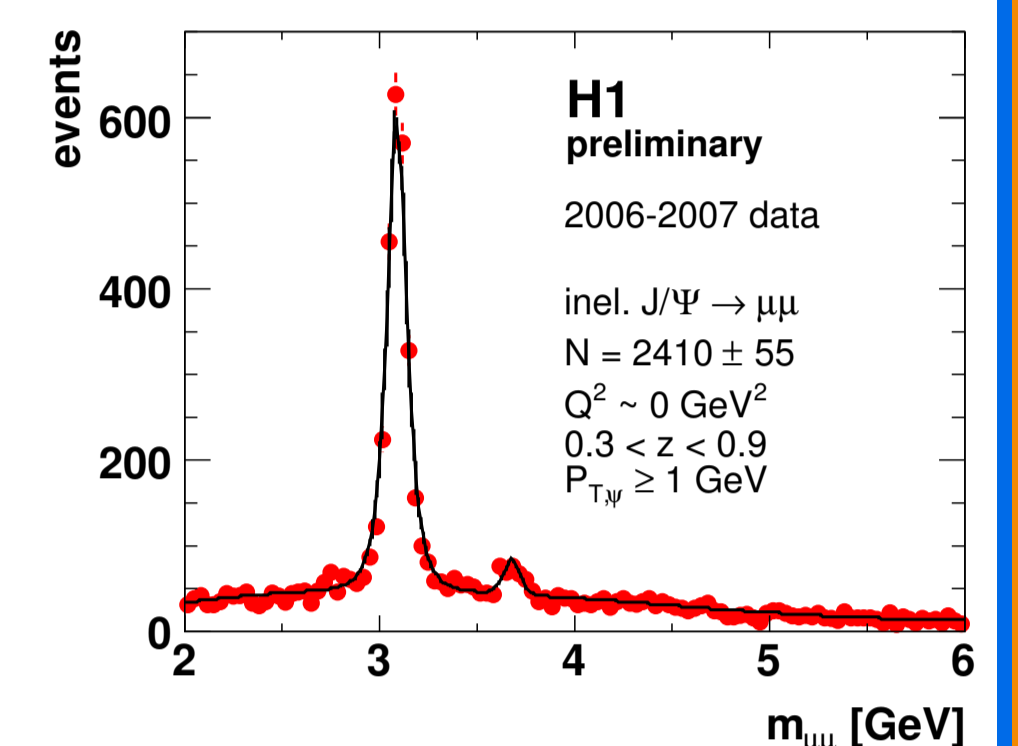
H1prelim-07-172

Inelastic photoproduction of J/ψ mesons has been analysed using data collected with the H1 detector in the years 2006 through 2007 corresponding to an integrated luminosity of $\mathcal{L} \approx 165 \text{ pb}^{-1}$.

The kinematic range of this analysis is $Q^2 < 2 \text{ GeV}^2$, $P_{T,W} > 1 \text{ GeV}$, $60 < W < 240 \text{ GeV}$, $0.3 < z < 0.9$

The data are compared to theoretical predictions in the Color Singlet Model (CSM) at leading and at next-to-leading order. CSM predictions are able to describe the measured cross sections quite well – provided that they are performed at NLO level or use a k_T factorisation ansatz (Cascade).

No indication for large contributions from color octet states are found in the data.



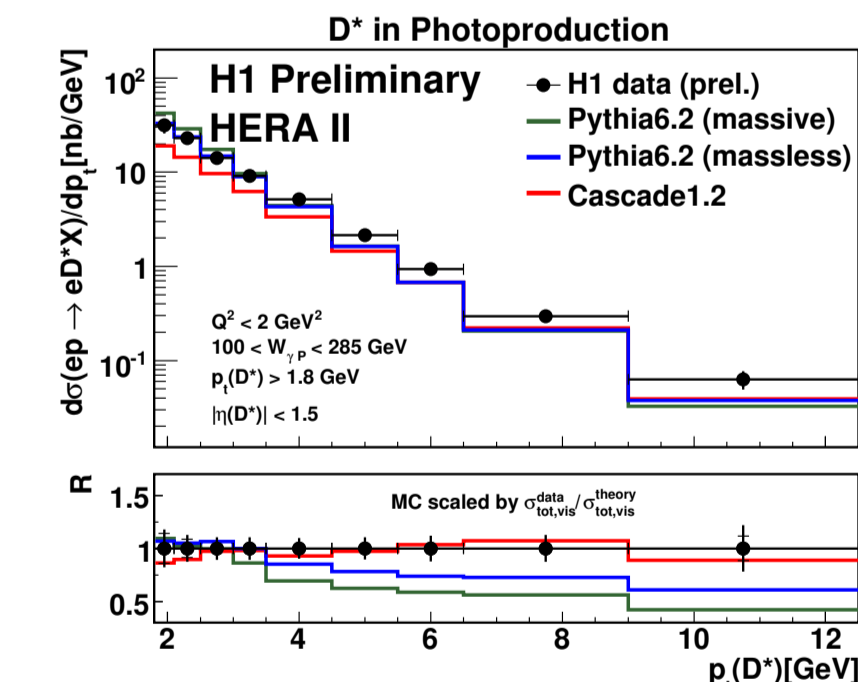
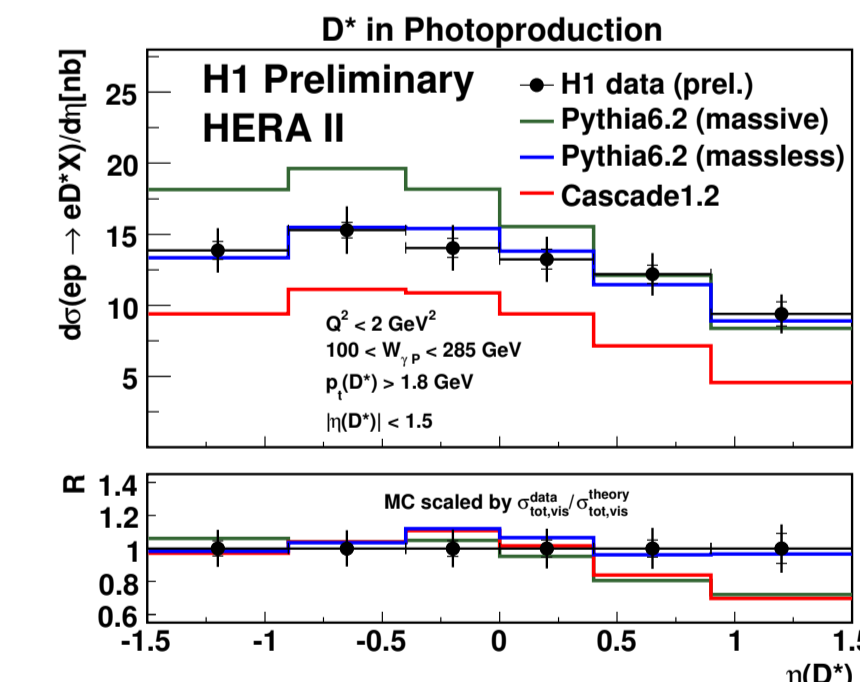
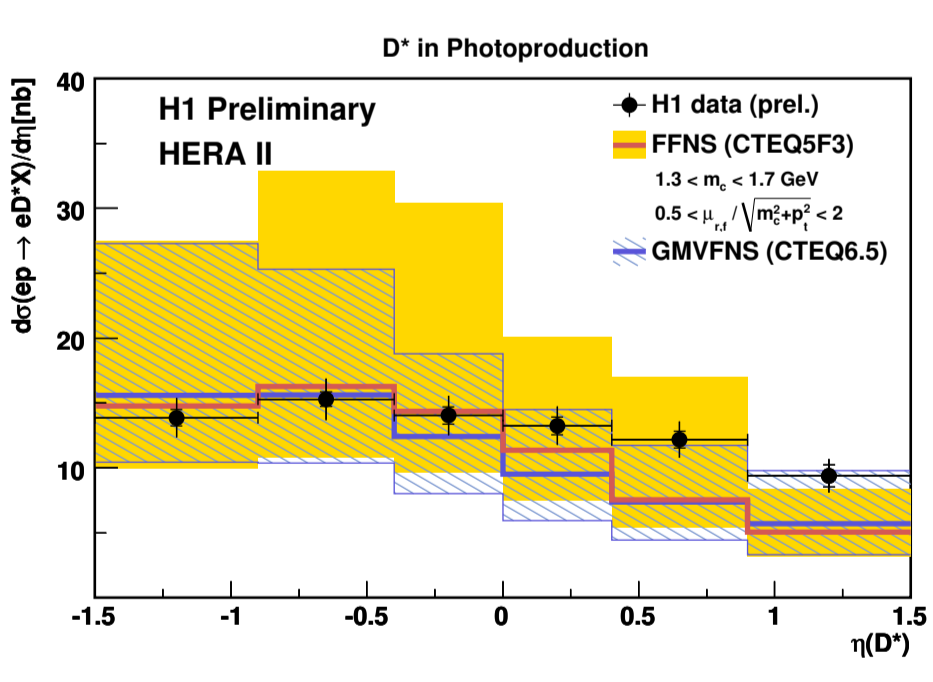
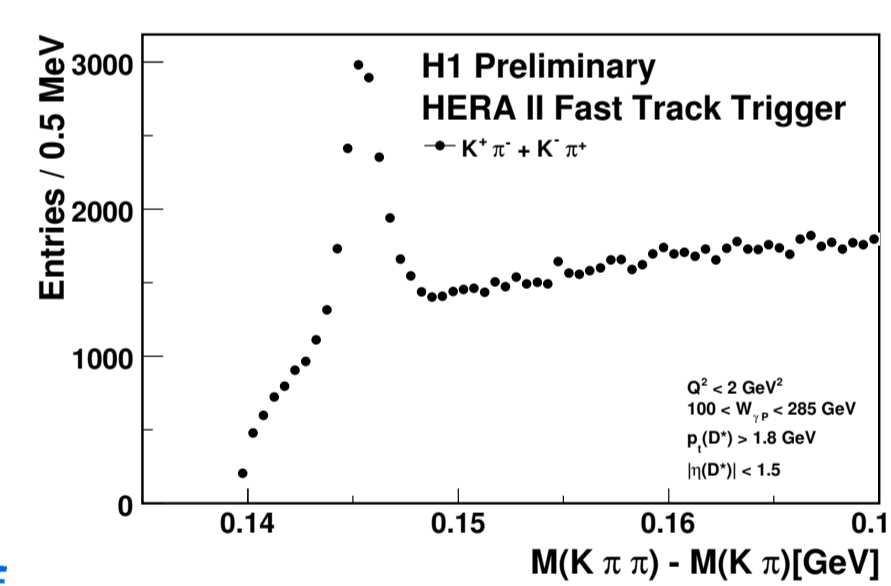
D* Meson Production in Photoproduction

H1prelim-08-073

Inclusive production of D* mesons in untagged Photoproduction at HERA has been measured. The data were collected in the end of the year 2006 and in 2007 and correspond to an integrated luminosity of $\mathcal{L} \approx 93 \text{ pb}^{-1}$.

The analysis covers a kinematic range of $Q^2 < 2 \text{ GeV}^2$, $100 < W < 285 \text{ GeV}$, $P_T(D^*) > 1.8 \text{ GeV}$, $|\eta(D^*)| < 1.5$

No model is capable of describing all aspects of the data. Cascade (CCFM) is able to model the measured P_T slope, but is too low in normalisation. In contrast a massless calculation (Pythia) is able to describe shape and normalisation of $\eta(D^*)$. NLO calculations in FFNS (FMNR) and GMVFNS (combination of massless and massive approach) show reasonable agreement with the data, but are slightly below the data in the forward region.



Heavy Quarks inside the Proton: F_2^c and F_2^b

Measuring the charm and beauty contribution to the proton structure function F_2 is an important test of QCD within the Standard Model. Two methods are used in H1 in order to measure these heavy quark contributions: either exclusive final states with charmed D mesons are reconstructed or events containing heavy quarks are separated from events with only light quarks using variables that are sensitive to the lifetime of heavy flavour hadrons (e.g. the transverse displacement of tracks from the primary vertex).

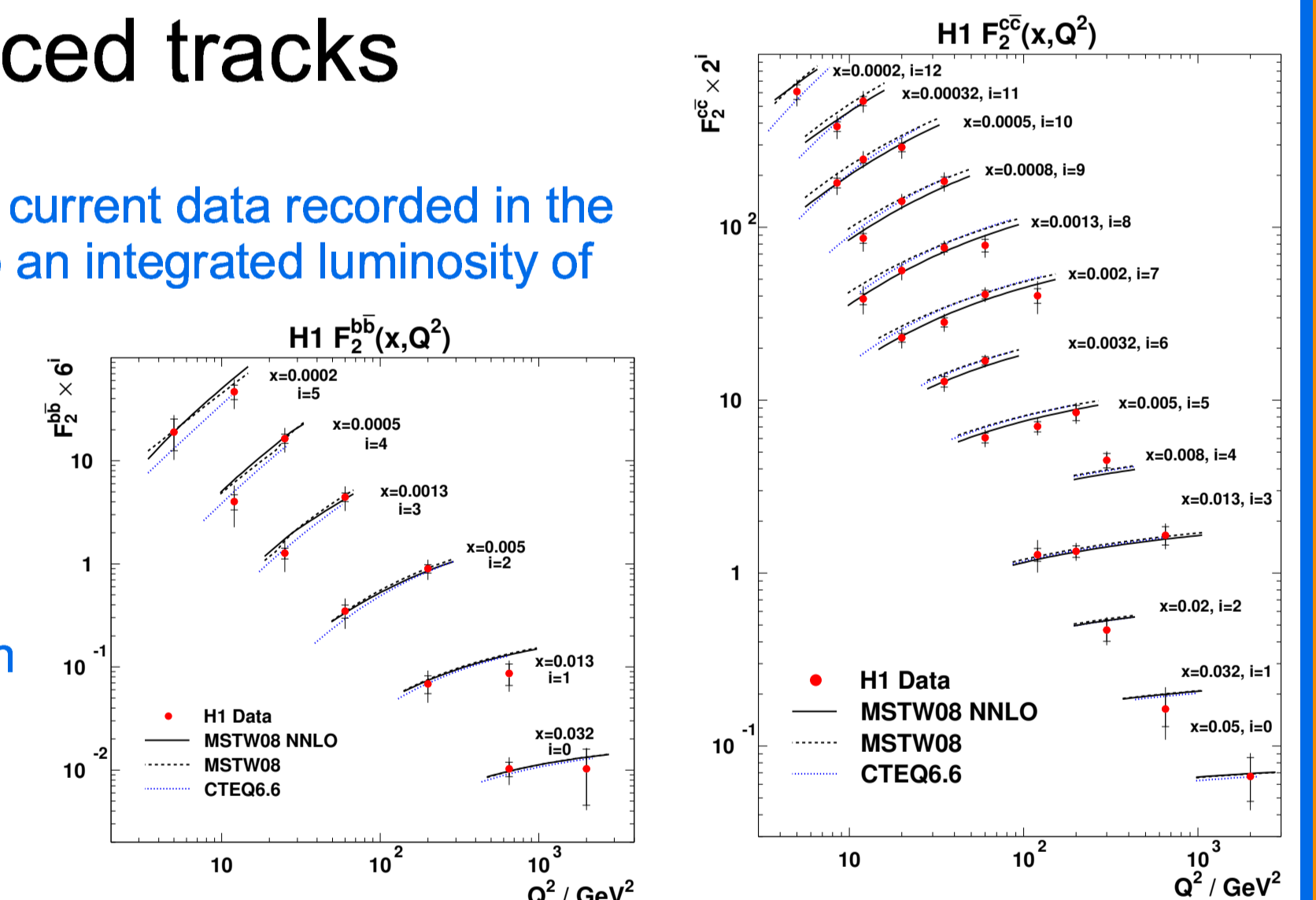
F_2^b and F_2^c using displaced tracks

DESY-09-096 (submitted to EPJC)

This measurement is based on neutral current data recorded in the years 2006 and 2007 corresponding to an integrated luminosity of $\mathcal{L} \approx 189 \text{ pb}^{-1}$.

The visible range of the analysis is $5 \leq Q^2 \leq 2000 \text{ GeV}^2$, $0.0002 \leq x \leq 0.05$

The HERA-II results are combined with HERA-I ($\mathcal{L} \approx 57.4 \text{ pb}^{-1}$) measurements to produce a complete HERA dataset.



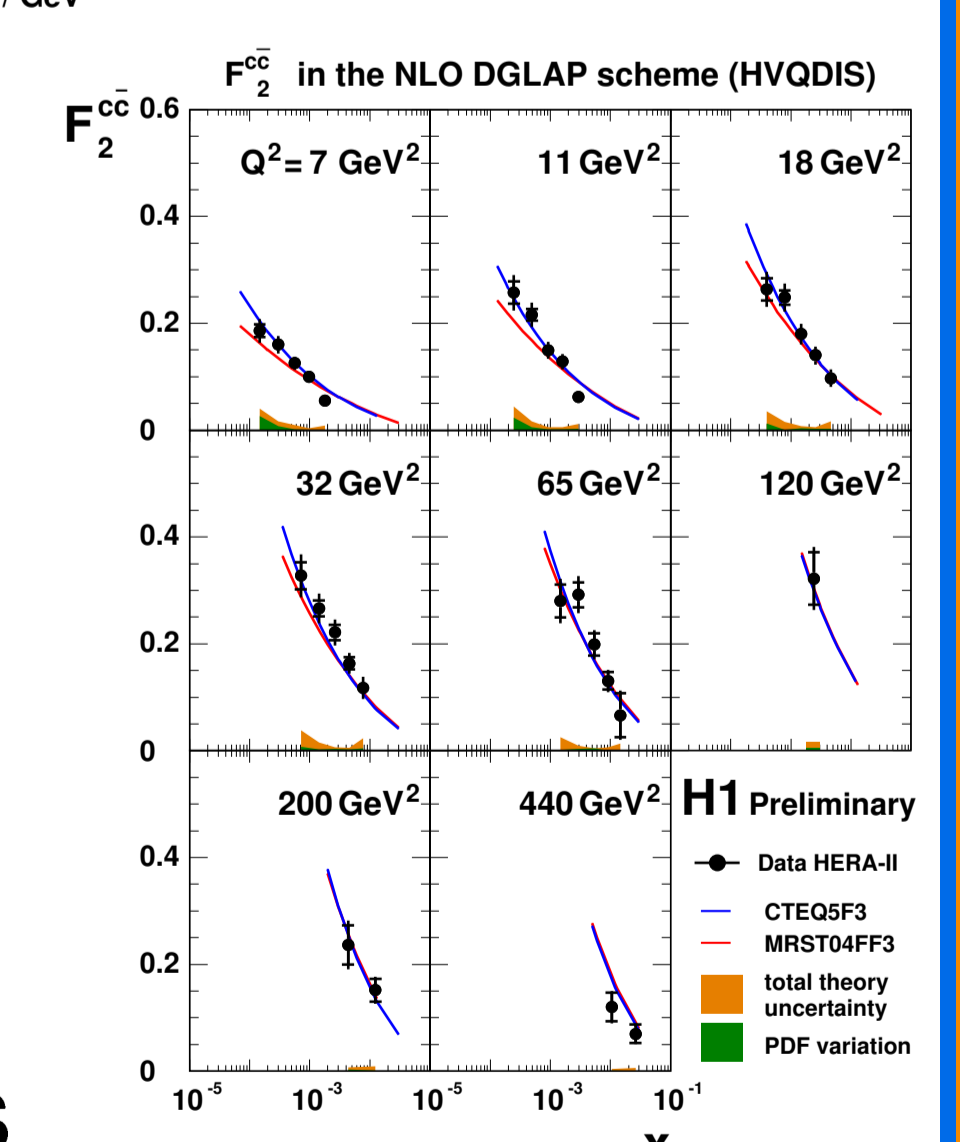
F_2^c from D*

H1prelim-08-172

The most precise single F_2^c measurement at low and medium Q^2 is determined based on the latest H1 results of D* meson production in DIS (cf. top left box of this poster).

F_2^c is determined for the kinematic region $7 < Q^2 < 440 \text{ GeV}^2$, $10^{-4} < x < 3 \cdot 10^{-2}$

by extrapolating the visible D* meson cross section to the full phase space using NLO QCD calculations based on DGLAP (HVQDIS) evolution and a LO+PS MC simulation using CCFM evolution equations.



Beauty Photoproduction in Semi-Leptonic Decays

H1prelim-08-071

Photoproduction of beauty quarks is studied with data collected in the years 2006 and 2007 ($\mathcal{L} \approx 170 \text{ pb}^{-1}$) using events with two jets and one muon in the final state. Events including heavy quarks are identified by a lifetime tag with the help of the H1 silicon vertex detector (CST).

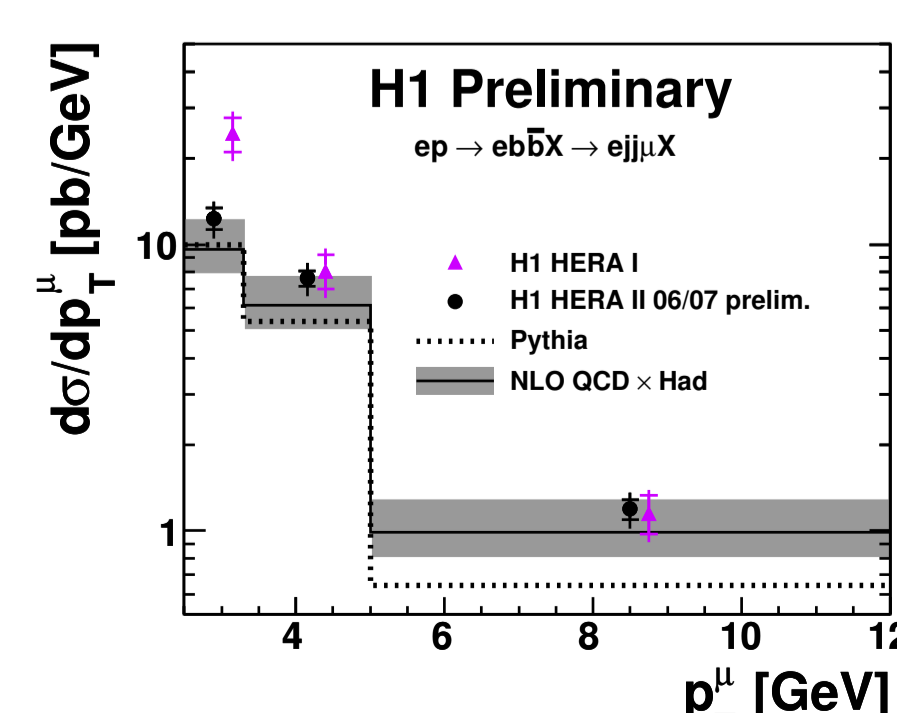
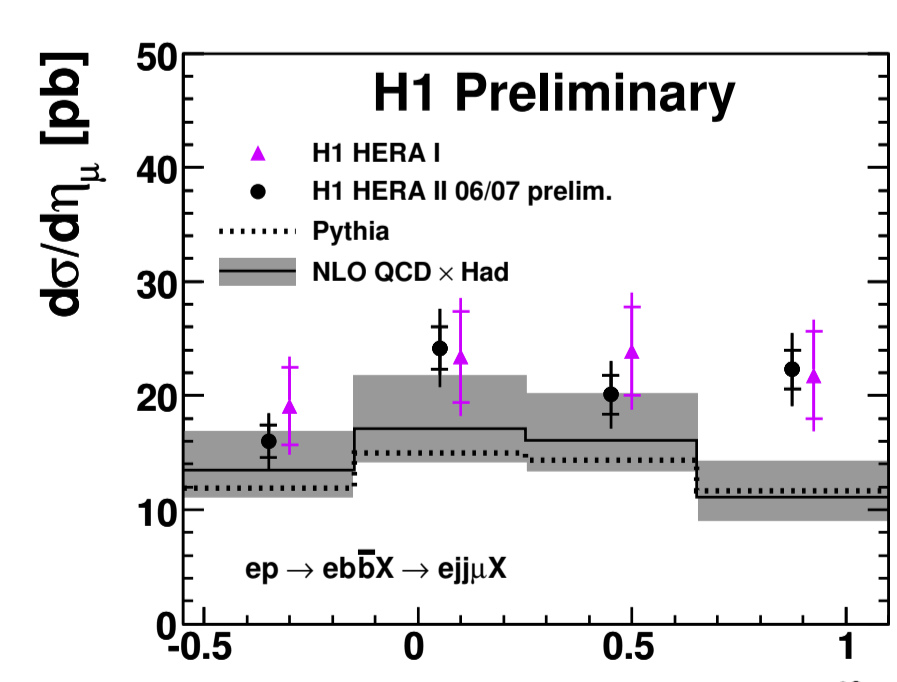
The cross section in the visible range $Q^2 < 1 \text{ GeV}^2$, $0.2 < y < 0.8$, $P_{T,jet1(2)} > 7(6) \text{ GeV}$, $|\eta(jets)| < 2.5$, $P_{T,\mu} > 2.5 \text{ GeV}$, $-0.5 < \eta(\mu) < 1.1$

has been measured to be

$$\sigma_{vis}(ep \rightarrow ebbX \rightarrow e\mu\mu X) = 31.4 \pm 1.3(\text{stat.}) \pm 3.8(\text{syst.}) \text{ pb}$$

The measured cross section is in good agreement with NLO predictions obtained using FMNR. The FMNR predictions are also able to describe the shape of the measured cross sections.

As in the HERA-I publication the LO MC simulation as well as the NLO prediction, undershoot the measured cross sections in the forward region of the detector ($\eta(\mu) > 0.75$).



Combination of D* and lifetime results

H1prelim-08-174

Results from the measurements of D* meson production in DIS and the measurement based on a lifetime tag method are interpolated to the common x, Q^2 grid using a massive NLO calculation in the fixed flavour number scheme.

The results are combined using the averaging procedure developed at H1 for the inclusive F_2 taking into account the bin-to-bin correlations between the systematic uncertainties of the single measurements and the cross correlations of the systematics between both measurement methods.

A massive FFNS NLO calculation using CTEQ5F3 describes the data best, the NNLO prediction models the data best at medium Q^2 , while the prediction using the matched FFNS-VFNS NLO approach is significantly above the data.

