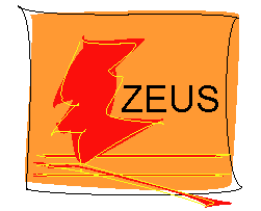
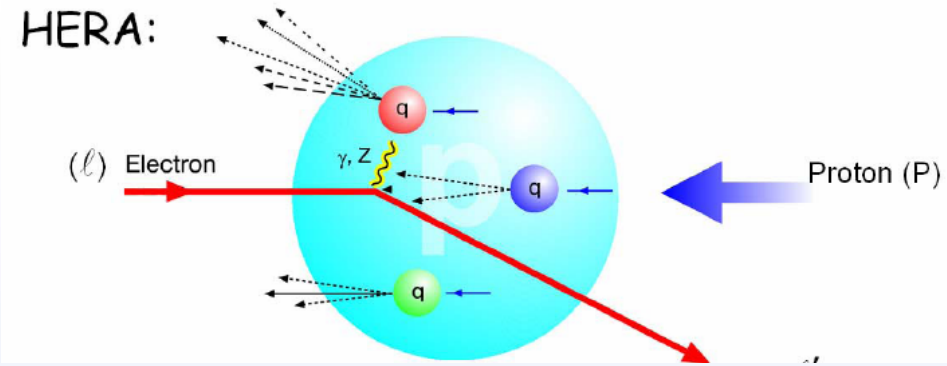


ZEUS: young and immersed in work
(status report)

V. Aushev

(on behalf of the ZEUS Collaboration)

71. PRC meeting – open session,
DESY Hamburg, April 28th, 2011



Outline

- ZEUS between past and future of *e-p* physics;
- Analysis activity and physics highlights;
- Physics objectives for ZEUS: publications, the *e-p* physics book (with H1) and ZEUS data preservation;
- Conclusions.

"Today many of the insights gained with HERA belong to our fundamental knowledge of how the world is put together. For many years to come, the evaluation of the HERA data will continue to provide unique insights into the inner structure of the proton and the fundamental forces of nature."

Prof. Dr. Joachim Mnich

http://www.desy.de/research/research_areas/particle_physics/insight/introduction/index_eng.html

ZEUS between past and future of *e-p* physics

Past (1950^s – …)	Era of HERA (mid-1990^s - …)	Future (> 2020)
Elastic → Deep Inelastic Scattering (DIS)	Precision measurements in Photoproduction & DIS	EIC@JLAB eRHIC@BNL LHeC@CERN

ZEUS structure

- ***ZEUS management:***

  Spokesperson: Aharon Levy (Tel Aviv)

  Physics Chairs: Achim Geiser (DESY) and Burkard Reisert (MPI Munich)

  H1/ZEUS coordinator: Olaf Behnke (DESY)

- ***Analysis groups: Heavy Flavour Physics, QCD and Hadronic Final States, Structure function and Exotics***

  The evaluation of the recorded data will continue to provide exciting insights into the inner structure of the proton and the fundamental forces of nature.

- The present structure continues till end of 2013. We have started to develop the future structure of ZEUS beyond 2013.

ZEUS collaboration: lively and attractive

- ***About 50 young people (under 30 years) participating in ZEUS.*** They can turn the remaining active ZEUS analyses into papers as well !

- Number of students in ZEUS - indicator of expected level of activity during the next years also point to a healthy physics program during these years;

- Excellent opportunities for high-profile research and conference talks for junior collaborators !

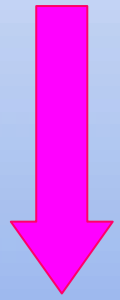
- Many new students since last PRC (Oct. 2010) ,
  *(e.g., ~**15** new bachelor/master students and **2** new PhD);*

ZEUS physics output and activities

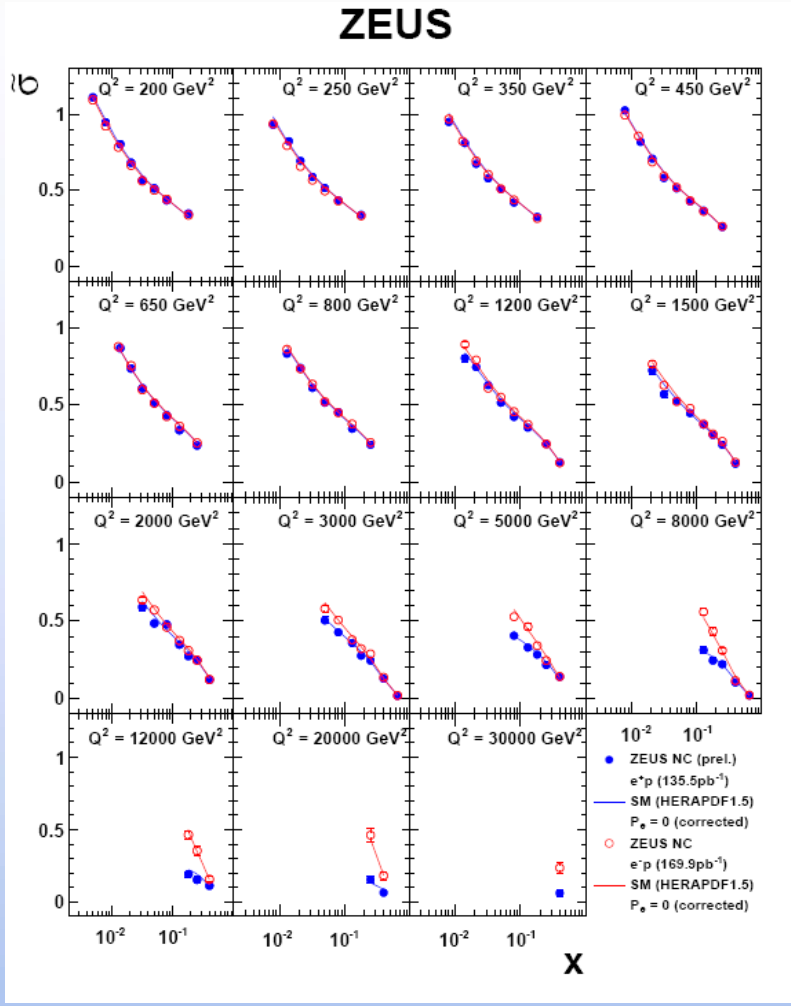
- Since last PRC (Oct. 2010):
  - **Monte Carlo simulations: ~ 900 M events (Grid > 85%);**
  - **5 papers;**
  - **18 ZEUS talks at DIS2011 +4 combined with H1;**
- **65** ongoing analyses:
  - **28** - Editorial board or preliminary;
  - **37** - in progress;

New ZEUS paper and preliminary results since last PRC (Oct. 2010), next slides - **Physics highlights**

(Combined ZEUS/H1→ talk of J. Sztuk-Dambietz)



New preliminary: NC *e*+*p* measurement

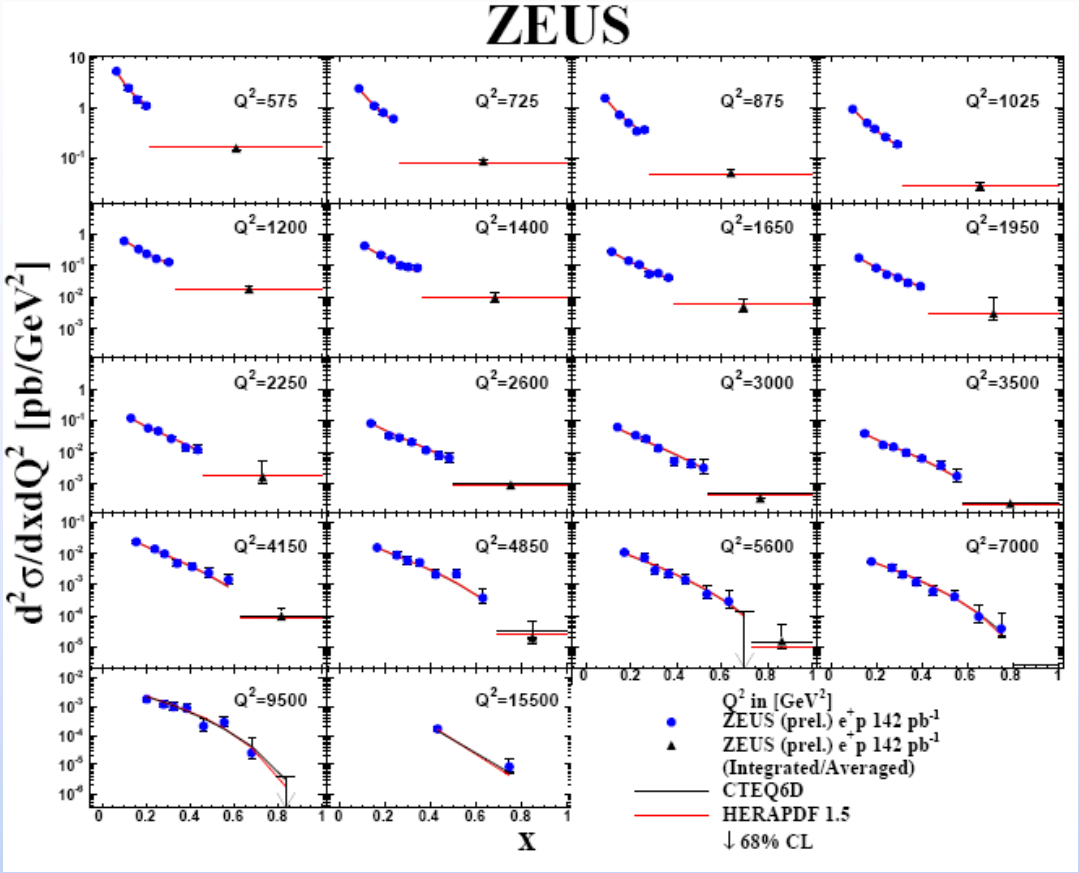


- Last missing part of the ZEUS inclusive NC measurements.
- Data are compared to predictions based on HERAPDF1.5 fit.
- Difference between *e*–*p* and *e*+*p* cross sections can be used to measure xF_3 and constrain valence quarks.

- *- blue – new results;*

New preliminary: extension to high x and Q^2

e^+p – complements e^-p results

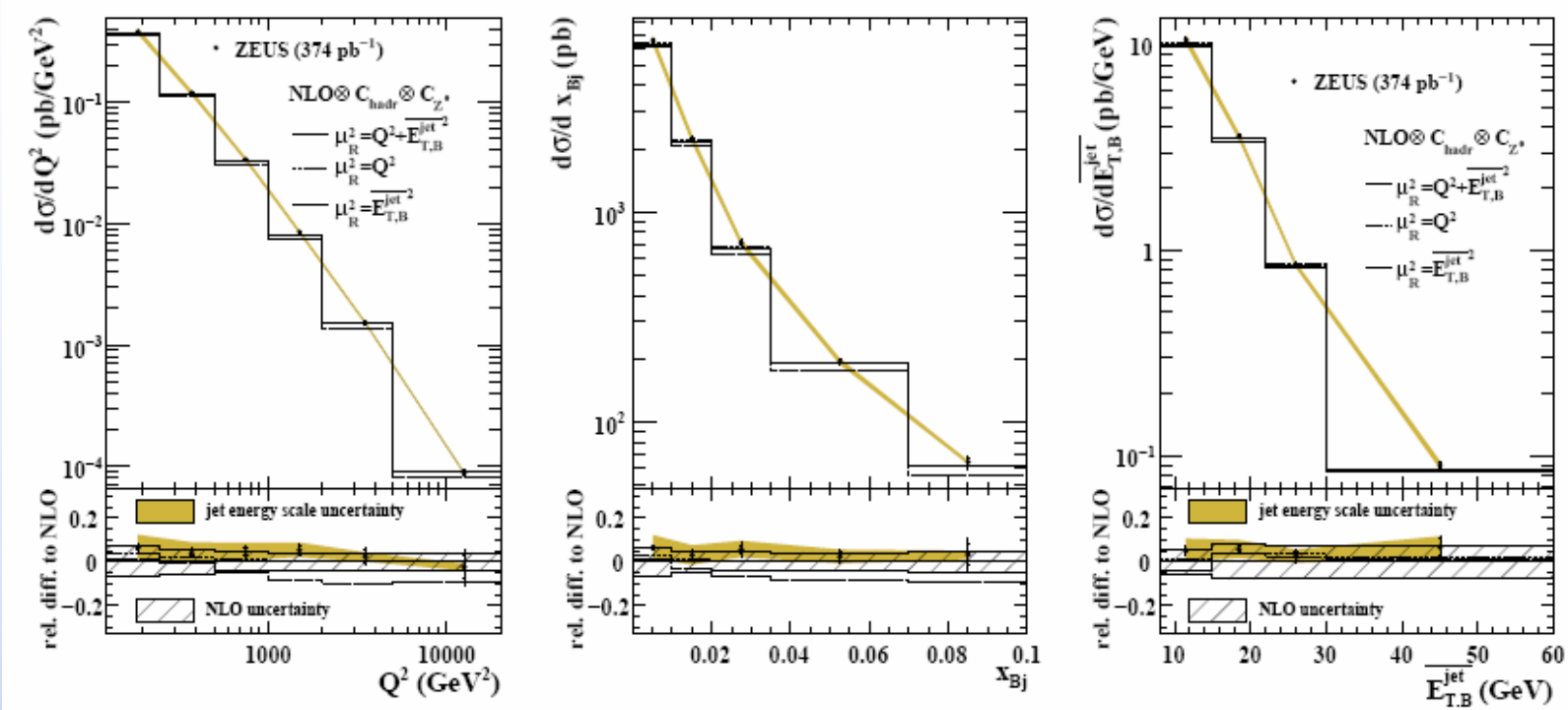


HERA-II data improve precision at high x,

up to now not so many accurate constraints on PDF at high x and Q^2.

New paper: dijets in DIS

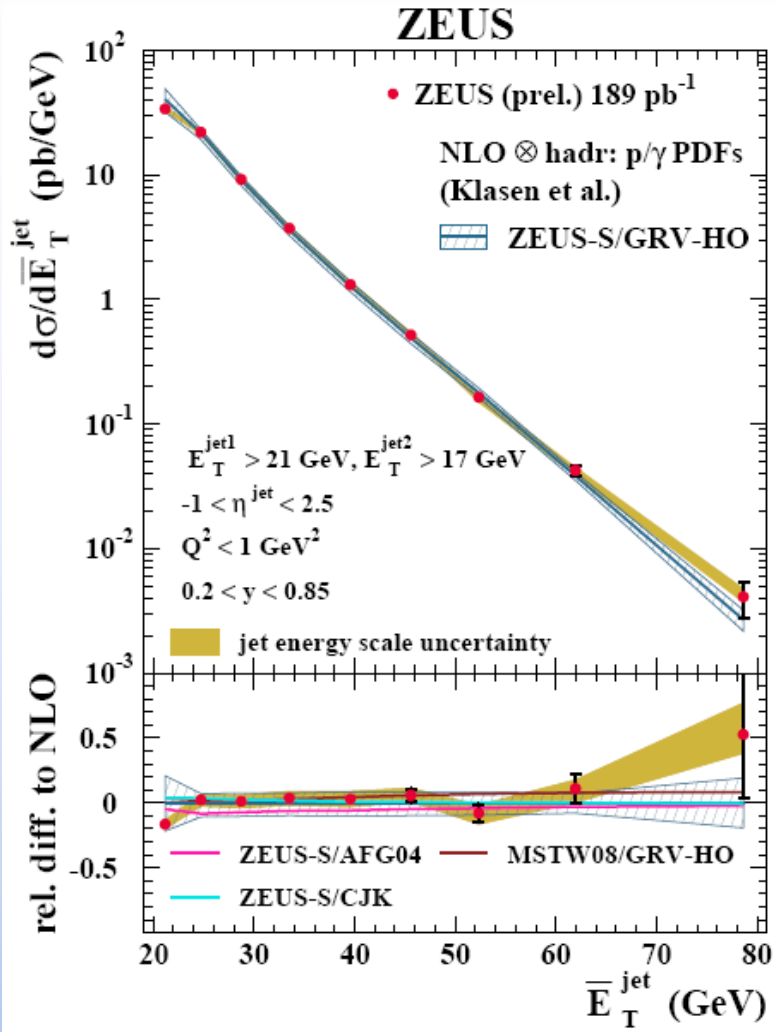
Eur.Phys.J.C70:965-982,2010

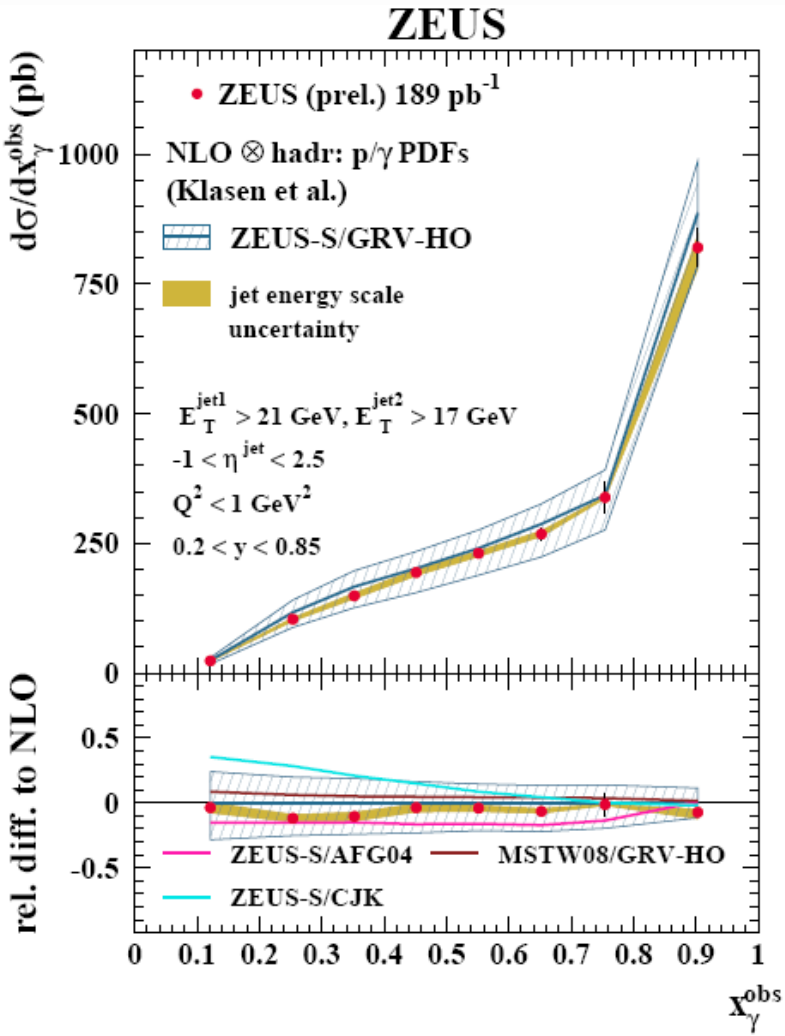


- Kinematic region: - $125 < Q^2 < 20\,000\,\mathrm{GeV}^2$, $0.2 < y < 0.6$
  $-1 < \eta^{jet}_{LAB} < 2.5$, $E^{jet}_{T,B(1,2)} > 8$ GeV, $M_{jj} > 20$ GeV
- Good description of data by NLO QCD in the whole measured range

Very small statistical and systematic uncertainties!

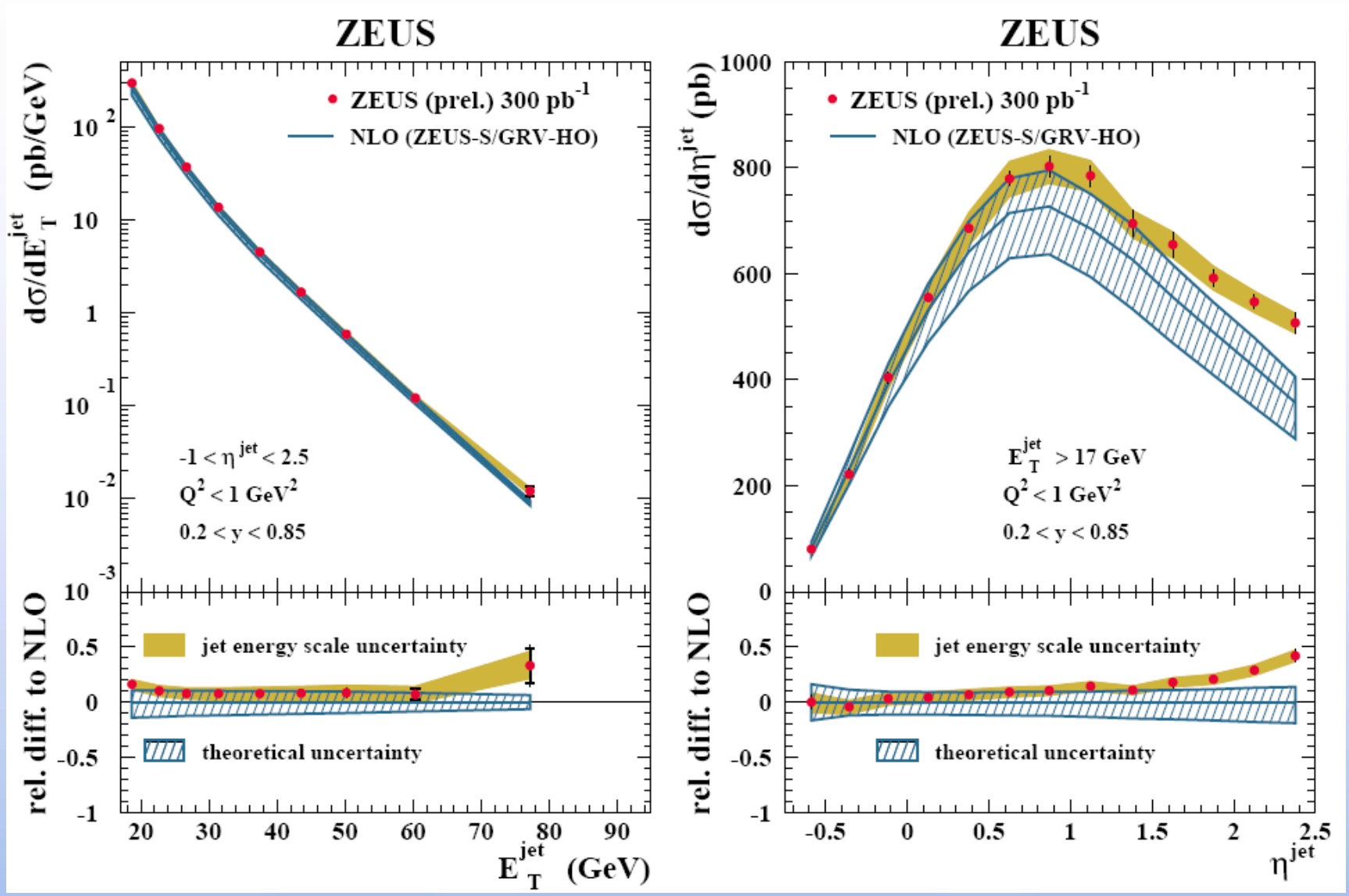
New preliminary: dijets in photoproduction



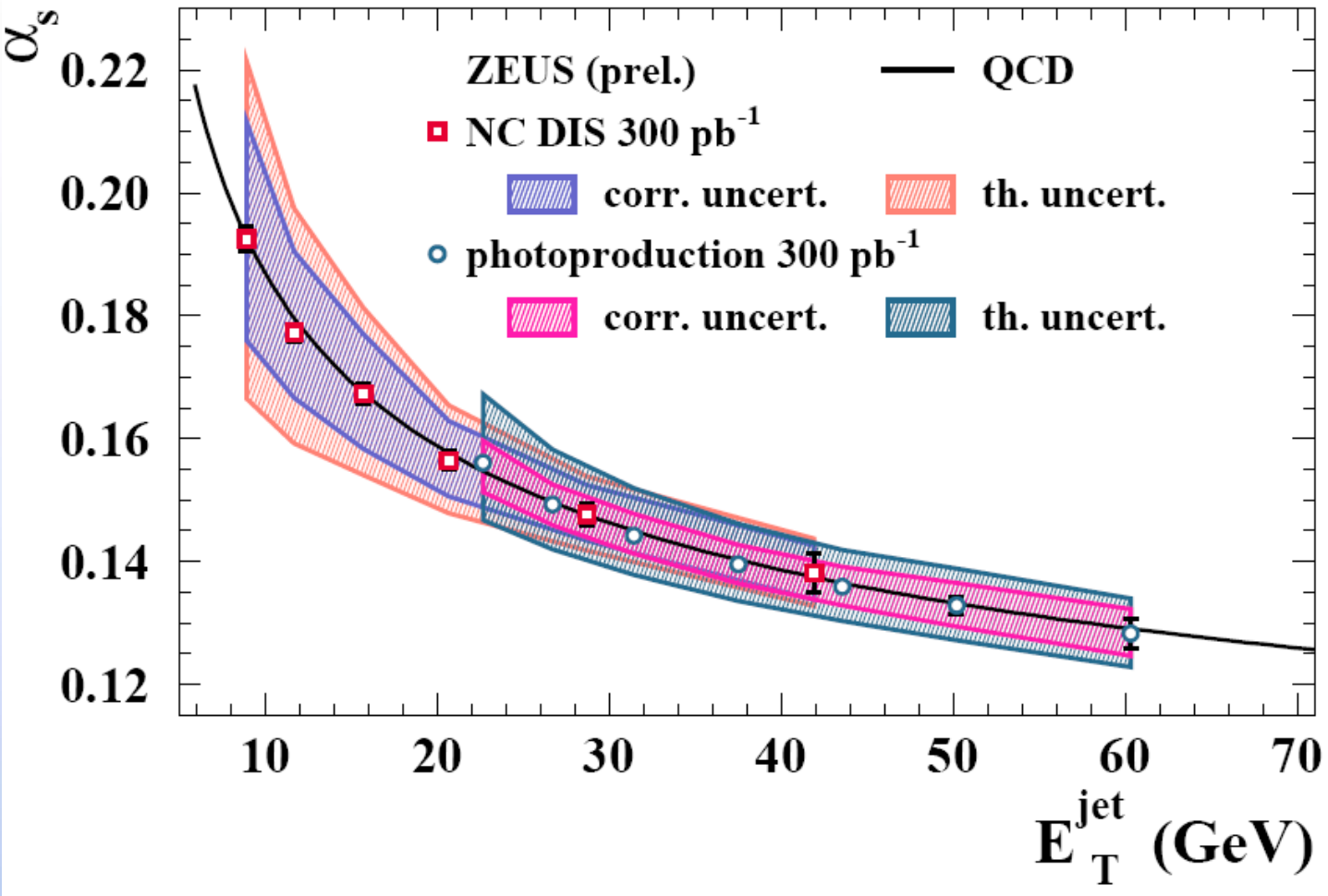


Good description in shape and normalization.

New preliminary: inclusive jets in photoproduction



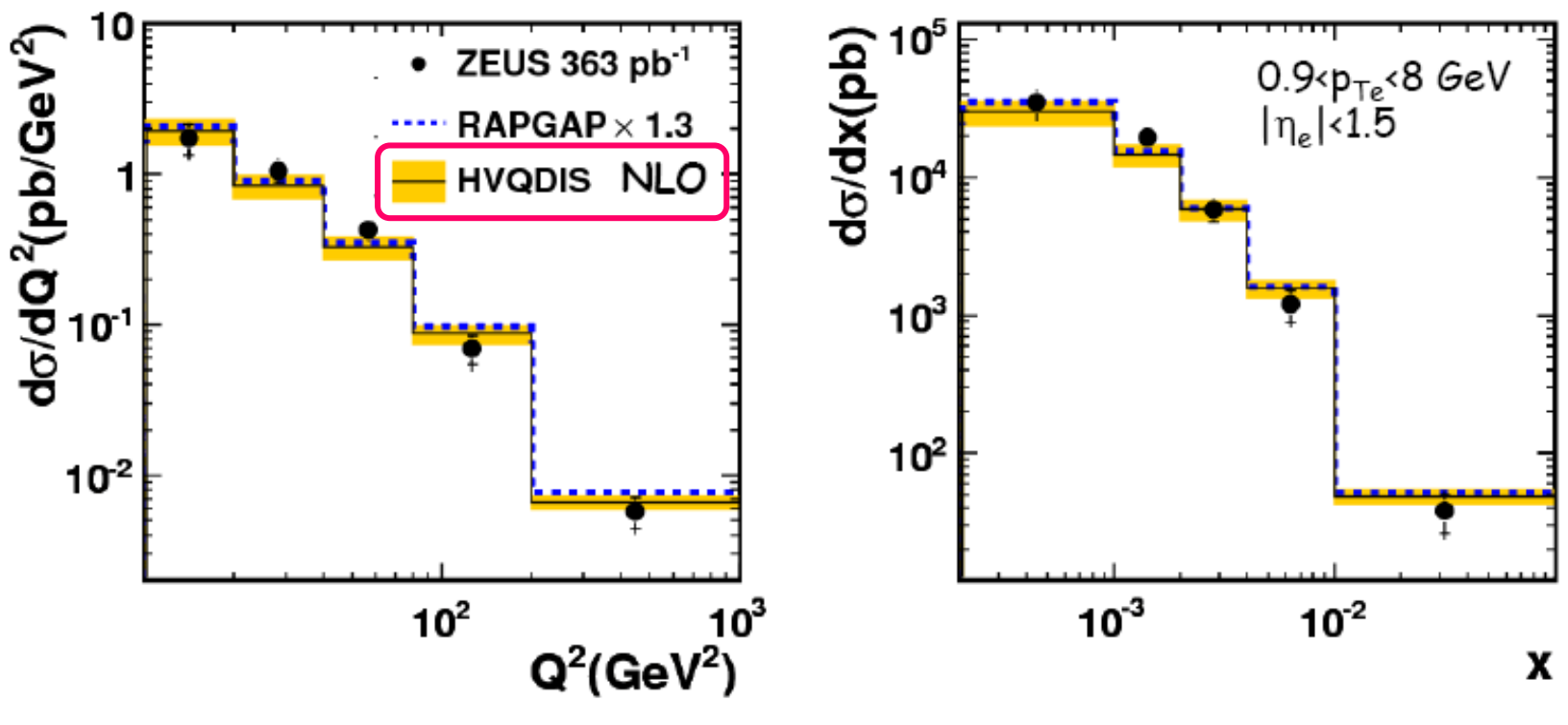
ZEUS α_s measurements with full HERAII statistics



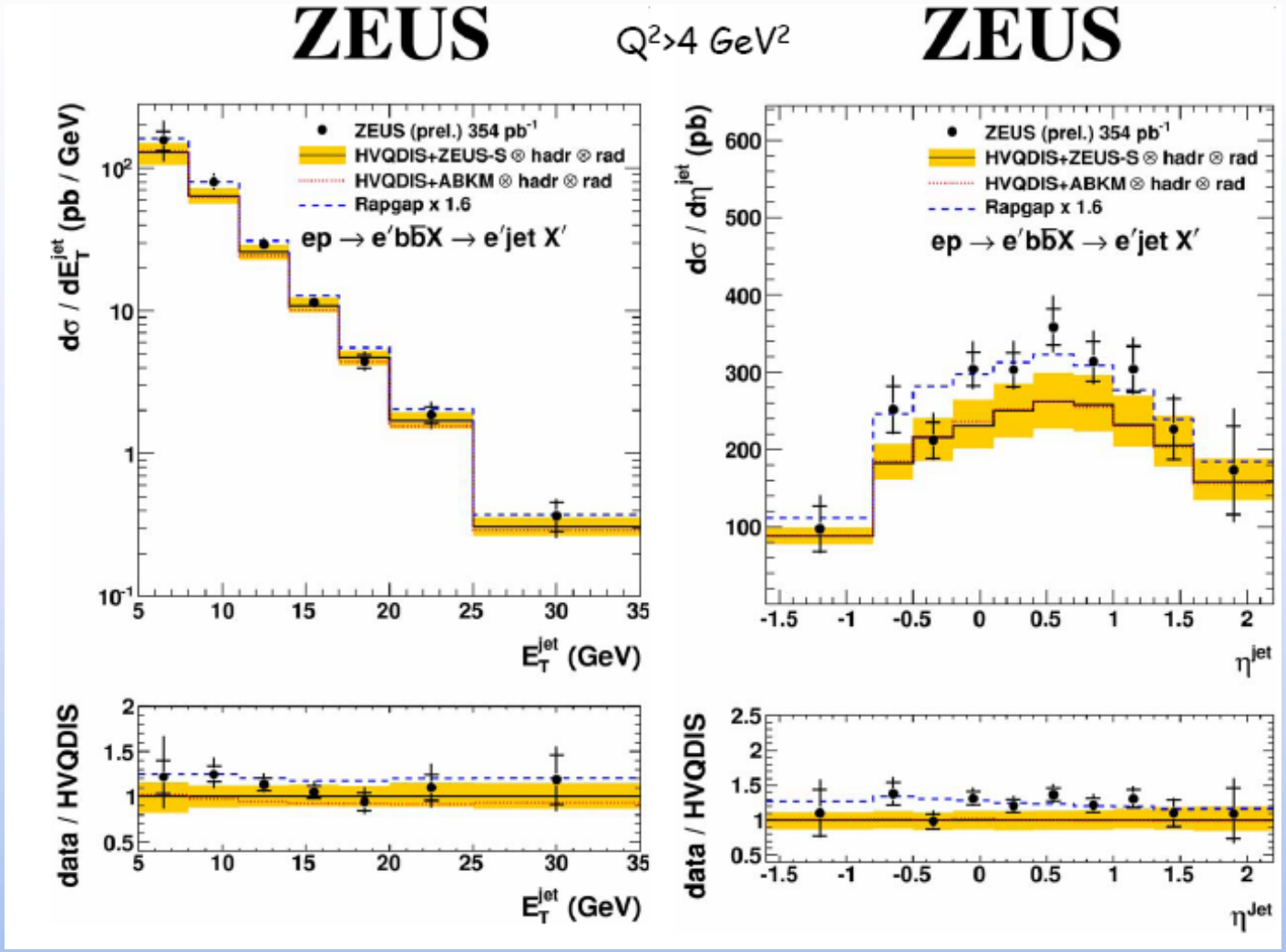
The results (from PHP and DIS) are in good agreement with the predicted running of α_s over a large range in E_T^{jet}

New paper: beauty in DIS from b→e decays

DESY-11-005, to be published in EPJ C

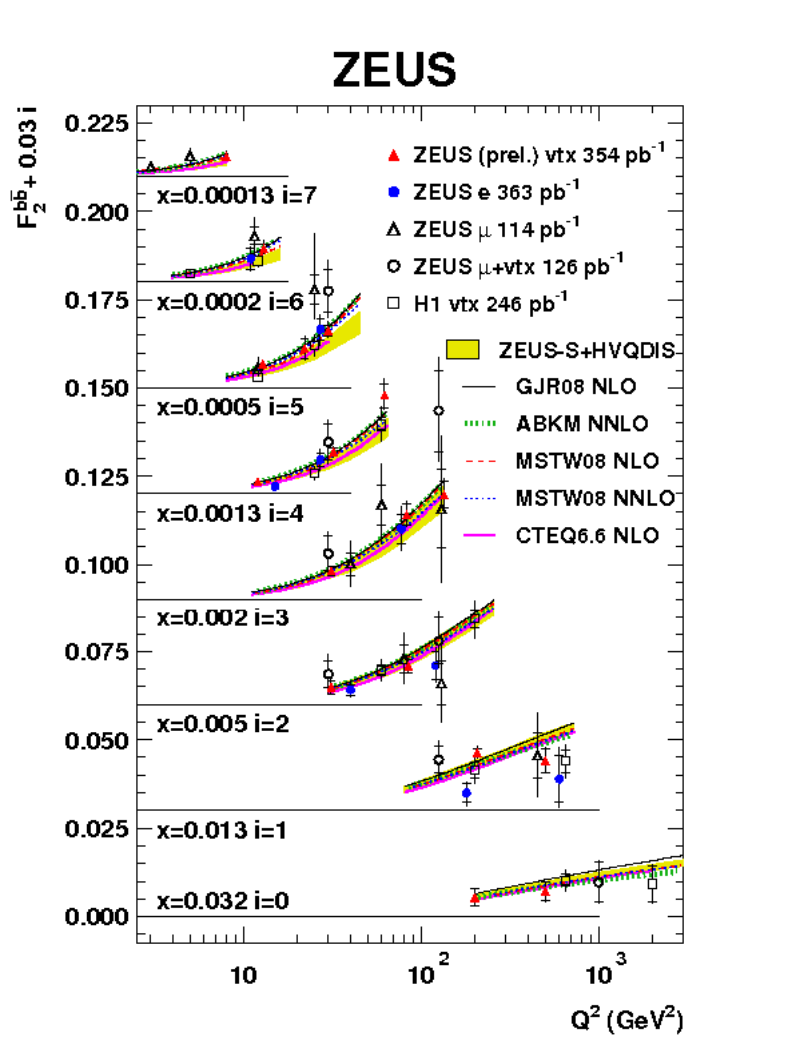


Beauty jets in DIS



Most precise measurement so far!
Almost full phase space coverage.

Beauty contribution to F_2

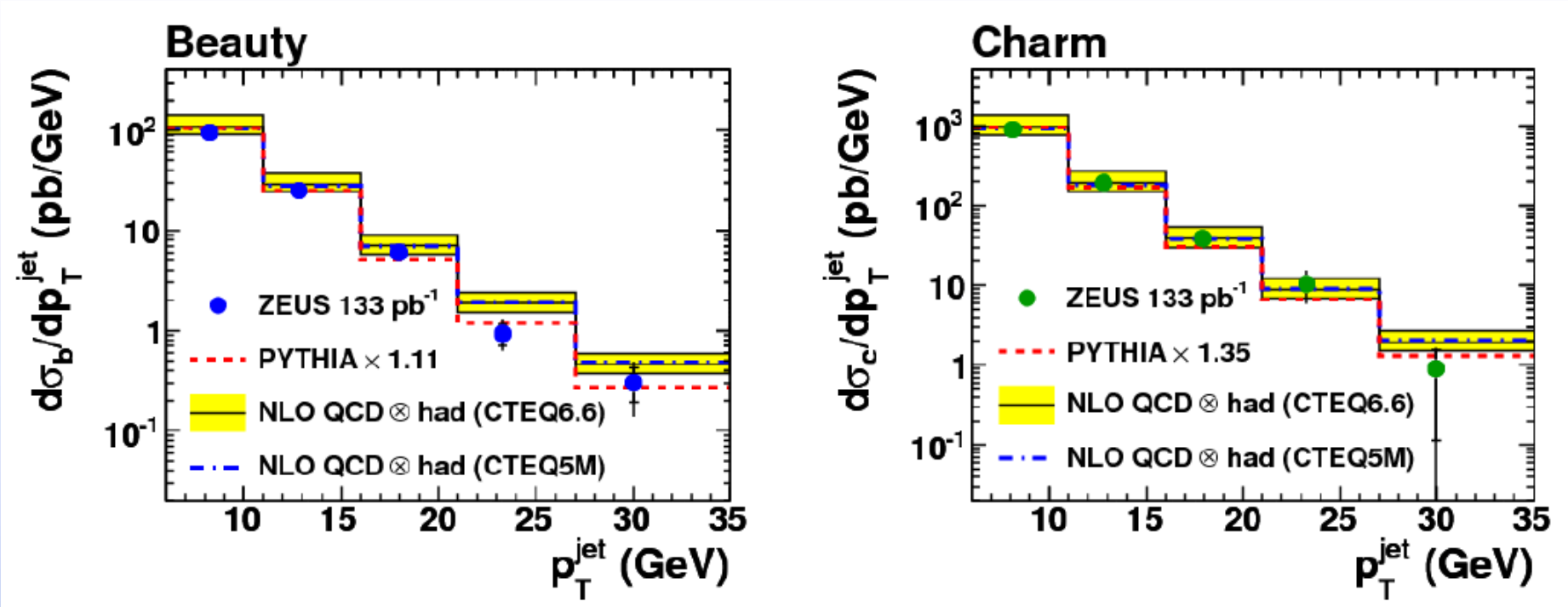


NLO and partial NNLO QCD in agreement with data.

Check b-PDF for LHC

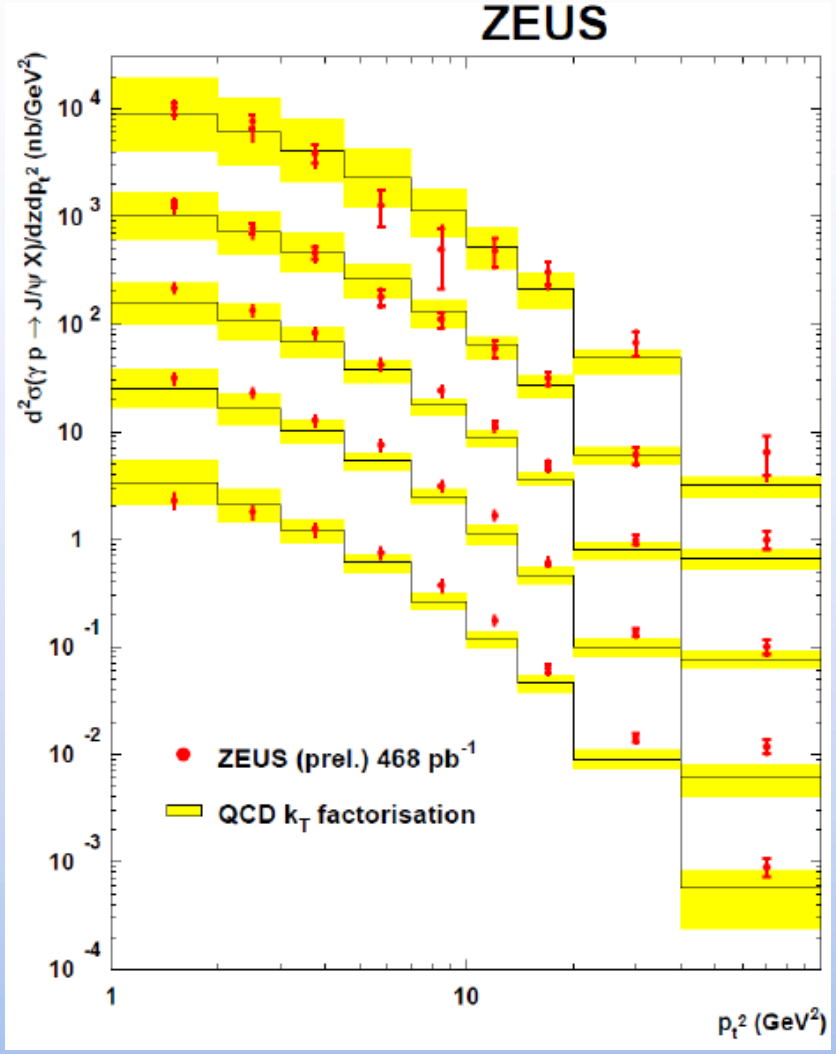
New paper: beauty and charm jets in photoproduction

ZEUS-pub-11-002 - to be submitted to EPJ C



Measured from secondary vertex distributions. Reasonable agreement with NLO QCD up to high p_T.

New preliminary: Inelastic J/ψ photoproduction



0.1<z<0.3

0.3<z<0.45

0.45<z<6.0

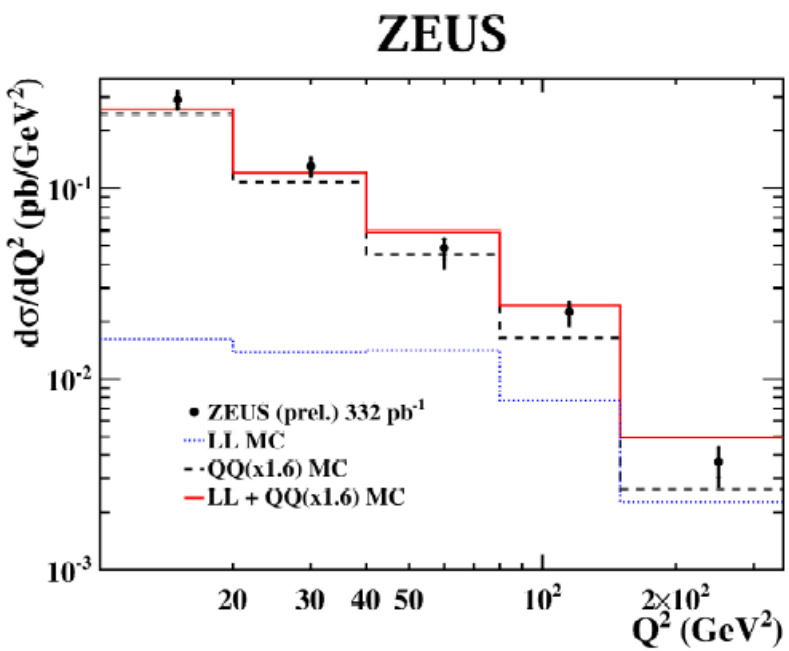
0.6<z<0.75

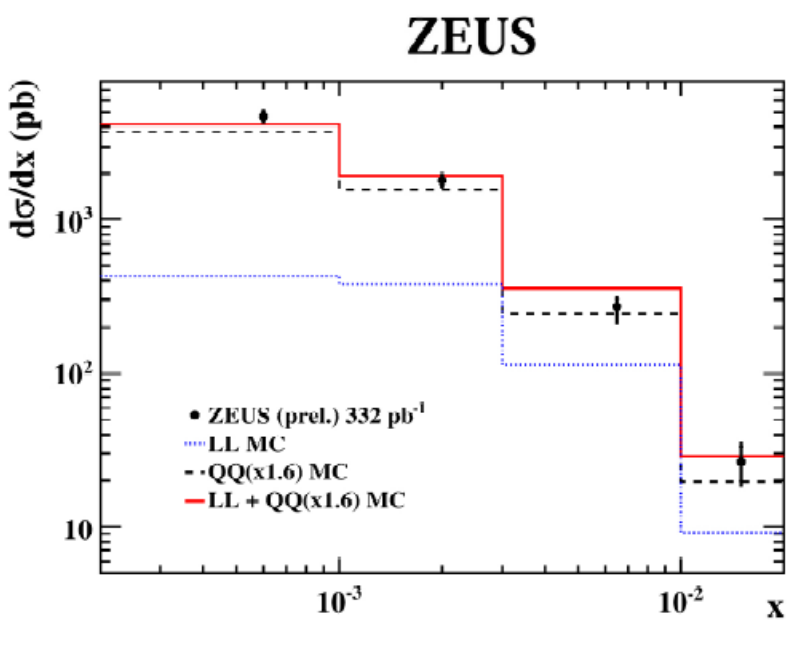
0.75<z<0.9

Precise measurement compared to a QCD prediction: within uncertainties an encouraging agreement.

z - inelasticity

New preliminary: prompt photons + jets differential cross sections in DIS vs. Q^2 and E_T^{jet}





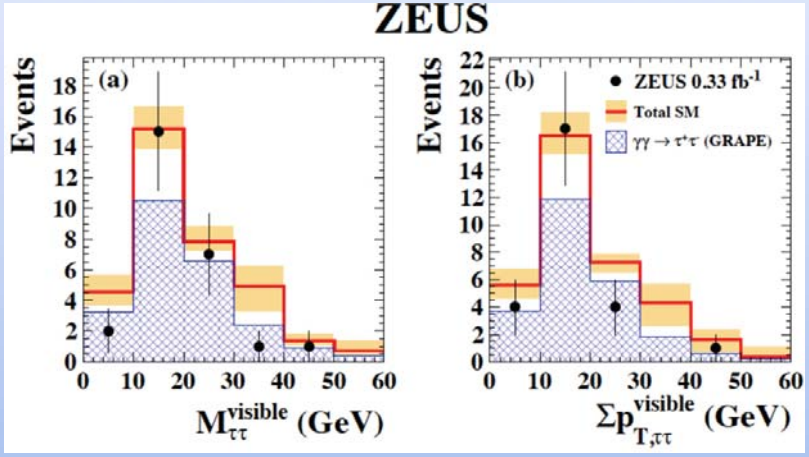
MC vs. Data: reasonable agreement;
theory predictions hopefully soon.

New paper: ditau production at ZEUS

DESY-10-250, submitted to JHEP

ZEUS ditau events HERA II data (L=0.33 fb^{-1})

Topology	$(e\text{-})e\text{-}\mu$	$(e\text{-})e$-jet	$(e\text{-})\mu$-jet	$(e\text{-})$jet-jet	Total
Data	4	7	4	10	25
Total MC	$3.6^{+1.3}_{-0.3}$	$8.8^{+1.8}_{-0.8}$	$8.0^{+2.2}_{-1.2}$	$14.4^{+2.2}_{-3.5}$	$34.8^{+3.9}_{-3.8}$
$\tau^+\tau^-$ MC	$3.0^{+0.3}_{-0.2}$	$5.3^{+0.3}_{-0.2}$	$5.9^{+0.5}_{-0.5}$	$9.0^{+0.4}_{-0.3}$	$23.2^{+0.7}_{-0.7}$



The cross section is measured in the kinematic region $p_t(\tau) > 5$ GeV, $17^o < \theta(\tau) < 160^o$ for both τ.

$\sigma = 3.3 \pm 1.3\ (stat.)\ ^{+1.0}_{-0.7}(syst.)$ pb

(SM $\sigma = 5.67 \pm 0.16$ (theor.))

No excess w.r.t. SM prediction

ZEUS Data Preservation

- **Virtual environment for simulation, reconstruction and analysis software;**
- **Standalone simulation package;**
- **Common Nutple (CN): means for future analyses and preservation the ZEUS data for posterity, the only ZEUS data format beyond 2012;**
  - **group:** *Robin Devenish (convenor), Halina Abramowicz, Achim Geiser, Julia Grebenyuk, Jola Sztuk-Dambietz, Janusz Szuba;*
  - **beyond the summer 2011 conferences, all results for which preliminary status is requested should have at least one of the analyses using the common ntuple.**
  - **must ensure that information necessary for a new or revised analysis remains accessible;**

Conclusions

- **Recorded a gigantic amount of data; many physics results have been obtained with full HERA statistics but still many more to come.**
- **Active physics analyses: many published papers, new preliminary results, fully committed to combinations .**
- **ZEUS is attractive for young scientists: many new diploma and PhD students;**
- **ZEUS - one of the best QCD laboratories, good basis for physics at LHC and future QCD initiatives (EIC, eRHIC and LHeC);**

Longer term goals

- Data analysis/publications will carry on until ≥ 2014. Expect significant further improvements over next few years. Journey of discovery is far from over. Substantial part of analyses should be completed until ~2014;
- Can be important publication target: the *e-p* physics book (Proton Structure and QCD at HERA);
- Preserve the ZEUS data for posterity: well documented for the long term ZEUS data analysis beyond 2014. We need long-term technical support.

We have still a lot of very exciting and interesting physics and lots of hard work ahead of us!