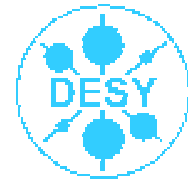


DIJET (and inclusive-jet) CROSS SECTIONS IN DIS AT HERA

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DIS 06, 19-24 April 2006
Tsukuba, Japan

(for the ZEUS collaboration)

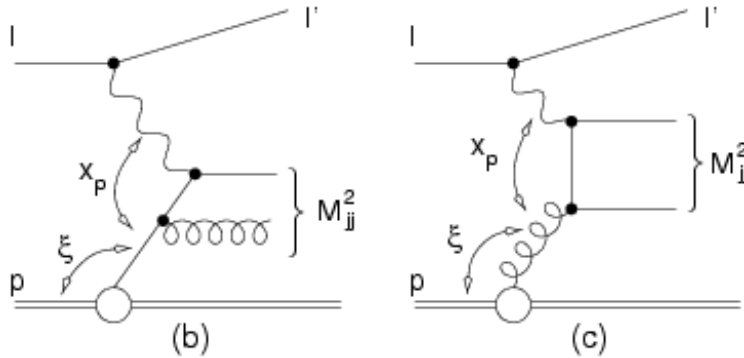


- ¶ Motivation
- ¶ Event and jet selection
- ¶ Data treatment, NLO theory, uncertainties
- ¶ Results
- ¶ Summary

INTRODUCTION, MOTIVATION

Jets at high values of Q^2 in the Breit frame

- provide clean tests of pQCD (parton universality, factorisation),
- allow access to the strong coupling and to the PDFs.



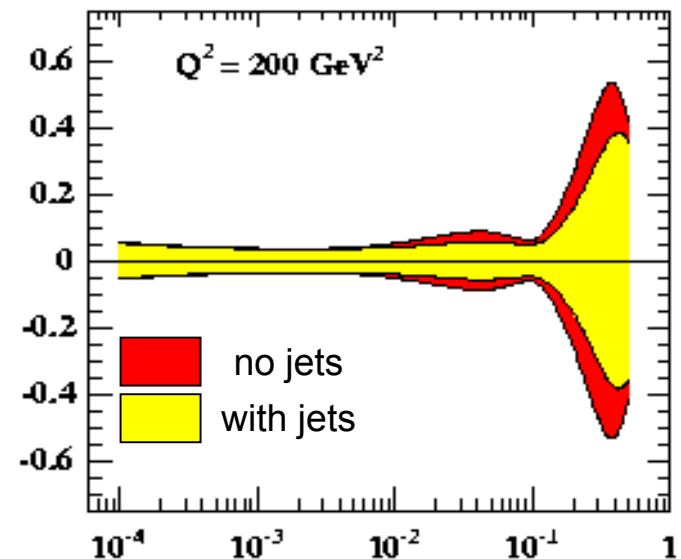
- ¶ Especially double-differential cross sections in Q^2 and E_T (inclusive jets) or Q^2 and ξ may help to pin down further the PDFs (gluon at high ξ !).

$$\xi = x_{Bj} \left(1 + M_{jj}^2 / Q^2 \right)$$

- ¶ The use of inclusive jets from high- Q^2 DIS was successful in recent ZEUS QCD fits!

Compared to previous (dijet) analysis

- almost three times the statistics (82pb^{-1}),
- new kinematic regime ($E_p = 920\text{ GeV}$).
- better analysis technique (Breit frame)
- data constrained to theoretically safer regime (high Q^2 , higher E_T)
→ reduced uncertainties)



EVENT AND JET SELECTION

data treatment, uncertainties, theory

¶ **Data:** ZEUS 98-00, 81.73pb⁻¹,

¶ **Phase-space selection:**

- $125 < Q^2 (< 5000 \text{ GeV}^2)$
- $|\cos\gamma_{\text{had}}| < 0.65$

¶ **Jet reconstruction:**

- longitudinally invariant k_T cluster algorithm in Breit frame.
- linear jet energy corrections

¶ **Jet phase-space:**

- $-2 < \eta_{\text{Breit}} < 1.5$
- $E_{T,1(2)} > 12 (8) \text{ GeV} / 8 \text{ GeV}$

¶ **Data corrections:**

- acceptance/efficiency:
ARIADNE/LEPTO MC: $\sim 10\%$.
- for QED effects: about 5%.
- for dijets Z^0 effect negligible
- for inclusive jets Z^0 small ($< 5\%$)

¶ **Systematic checks:**

- alternative acceptance correction (LEPTO/ARIADNE) $\rightarrow \pm 7(8)\%$
- correlated exp. uncertainty:
jet energy scale $\pm 1(3)\% \rightarrow \pm 5-10\%$
- total uncorrelated uncertainty (mainly acceptance correction): $\sim 10\%$

¶ **NLO theory:** DISENT with CTEQ6

¶ **Hadronisation:** ARIADNE MC;
typically 10%.

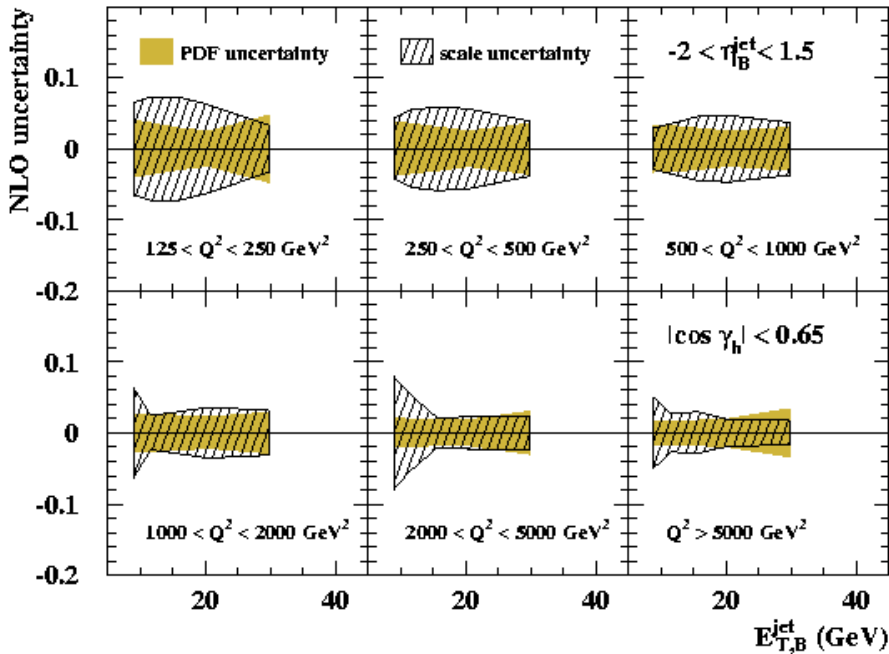
¶ **Theoretical uncertainties:**

- scale: $0.5, 2\mu_R \rightarrow \pm 5-10(20)\%$
- PDF: 40 CTEQ6 sets $\rightarrow \pm 2-5\%$
- α_S : CTEQ6AB \rightarrow less than $\pm 4\%$

THEORETICAL UNCERTAINTIES

Summary

NLO QCD, CTEQ6



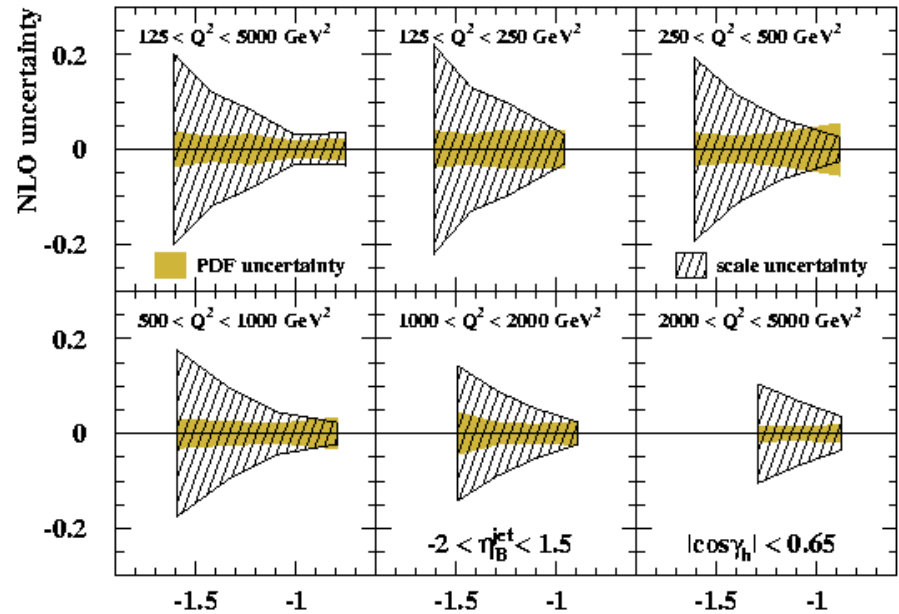
¶ Double-diff. dijet analysis:

- ξ distributions in Q^2 bins
- scale uncertainty 5-20%, large at small ξ .
- PDF uncertainty $\leq 4\%$, significant at high ξ .

¶ Double-diff. inclusive-jet analysis:

- E_T distributions in Q^2 bins
- scale uncertainty $\leq 8\%$, decreasing with increasing Q^2 .
- PDF uncertainty $\leq 4\%$, significant at high E_T .

NLO QC, CTEQ6

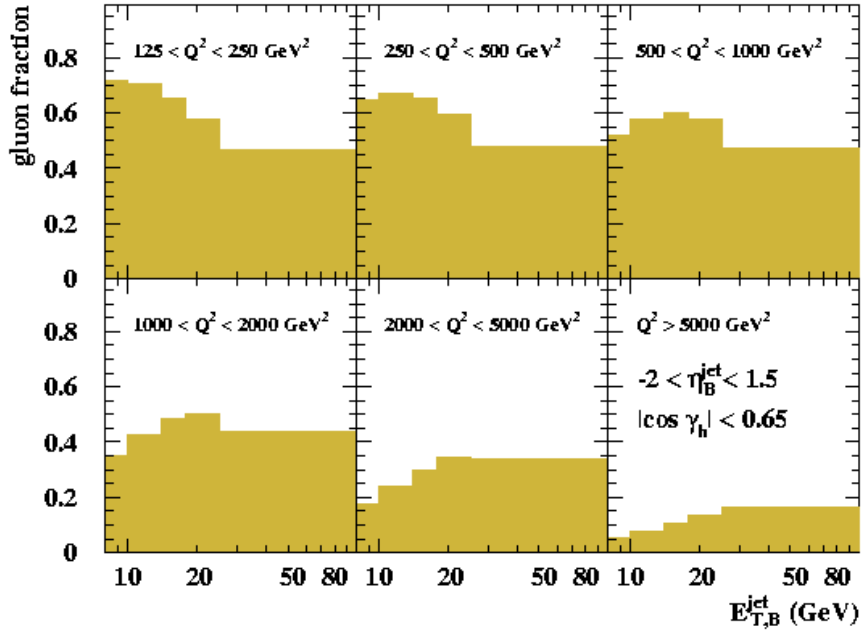


$\log_{10} \xi$

GLUON-INDUCED EVENT FRACTION

For double-differential cross sections

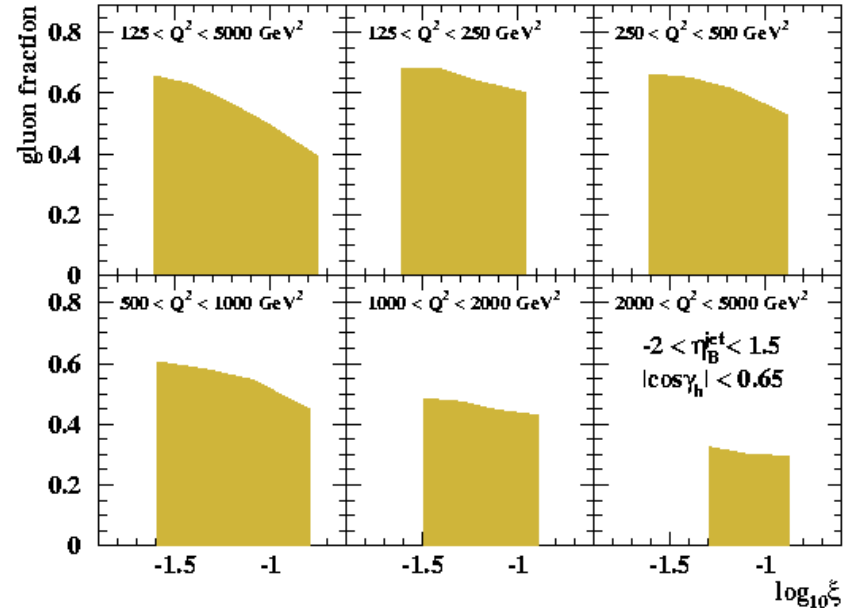
NLO QC, CTEQ6



- ¶ Double-diff. dijet analysis:
- ξ distributions in Q^2 bins
 - gluon fraction decreases with increasing ξ and Q^2 .

- ¶ Double-diff. inclusive-jet analysis:
- E_T distributions in Q^2 bins
 - gluon fraction decreases with increasing E_T and with increasing Q^2 .

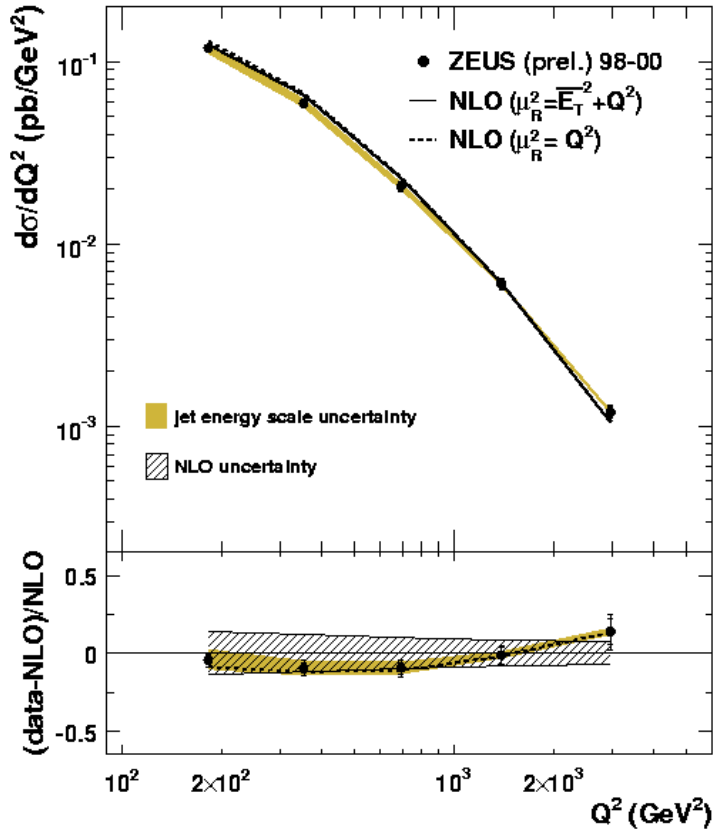
NLO QC, CTEQ6



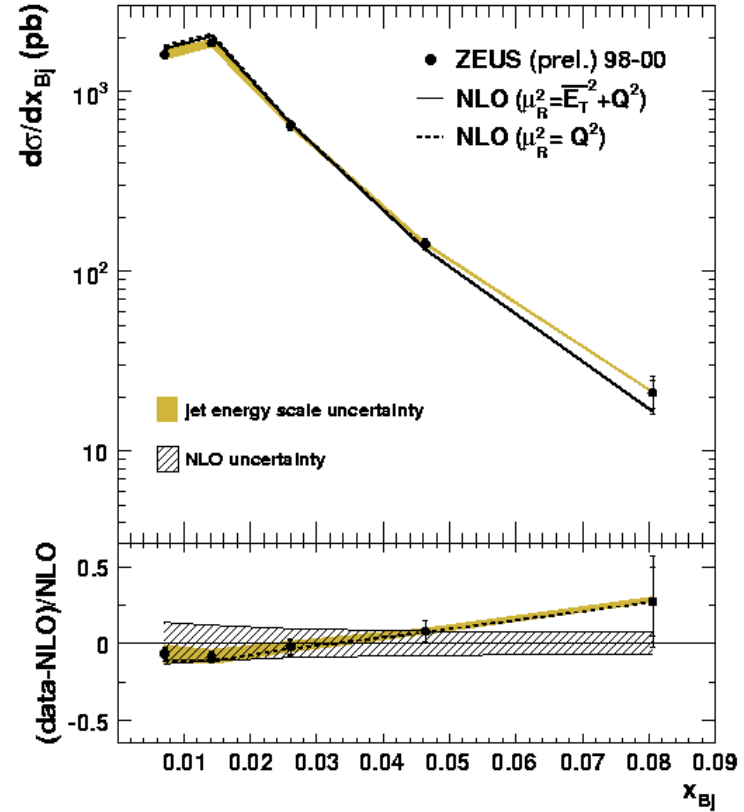
RESULTS 1

first set of single-diff. dijet variables: Q^2 and x_{Bj} .

ZEUS



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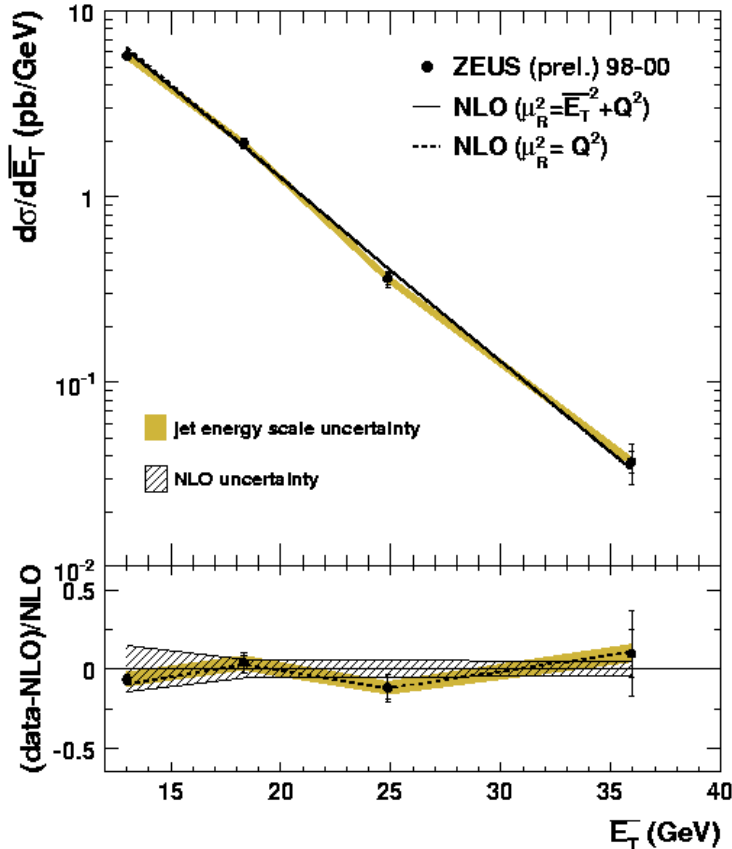


Data nicely described by the NLO theory.
Errors dominated by theory (scale).

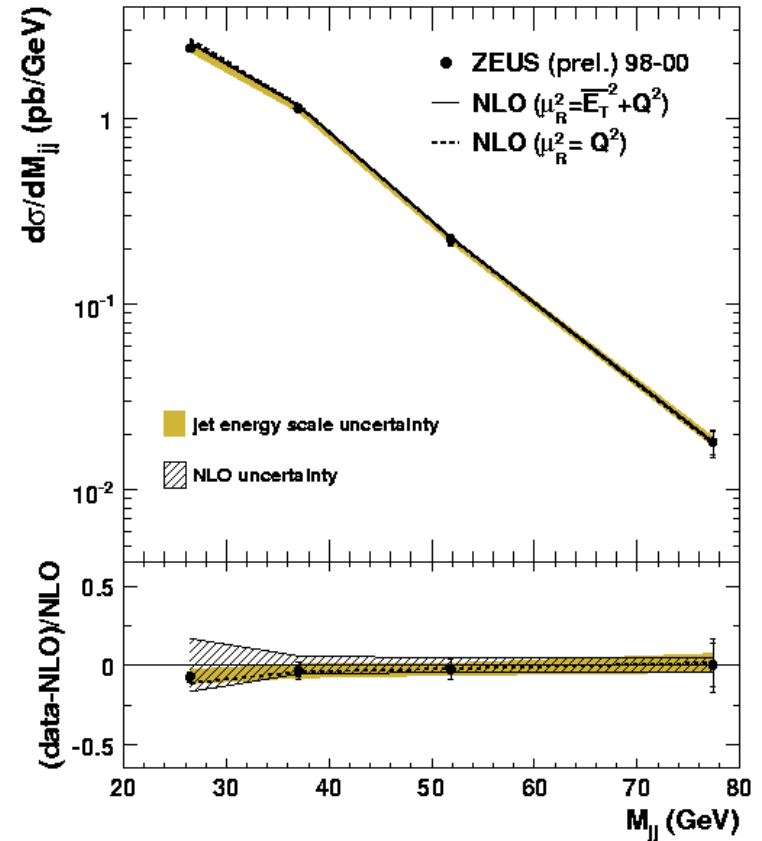
RESULTS 2

second set of single-diff. dijet variables: \overline{E}_T and M_{jj} .

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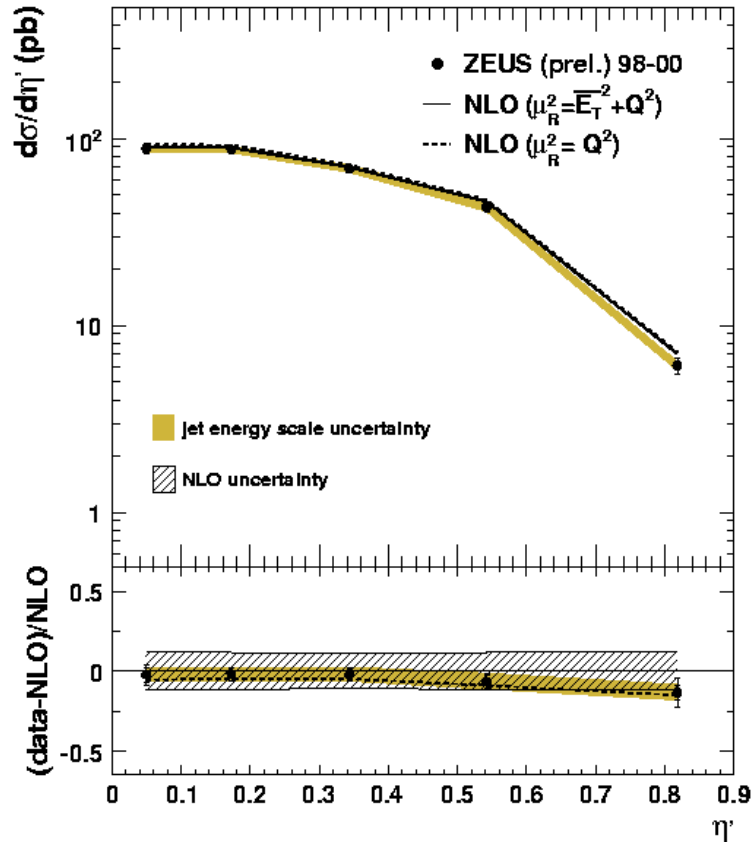


Data nicely described by the NLO theory. Errors dominated by theory (scale); sometimes energy scale uncertainty comparable.

RESULTS 3

last set of single-diff. dijet variables: $\eta' = 0.5 * |\eta_1 - \eta_2|$

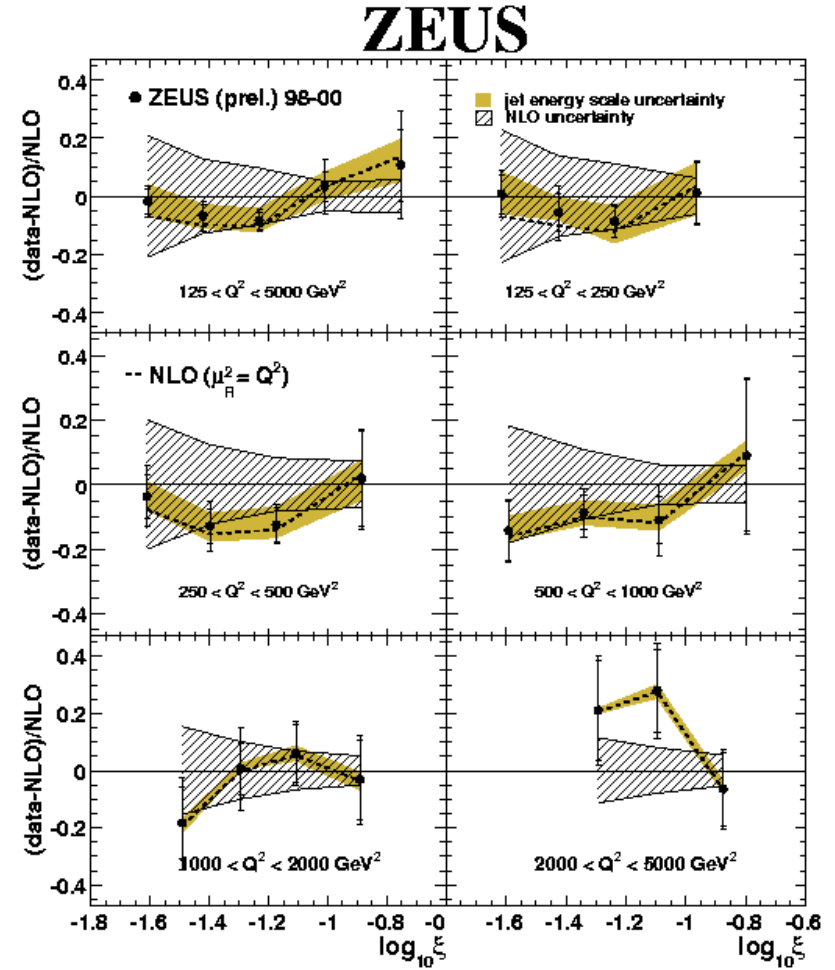
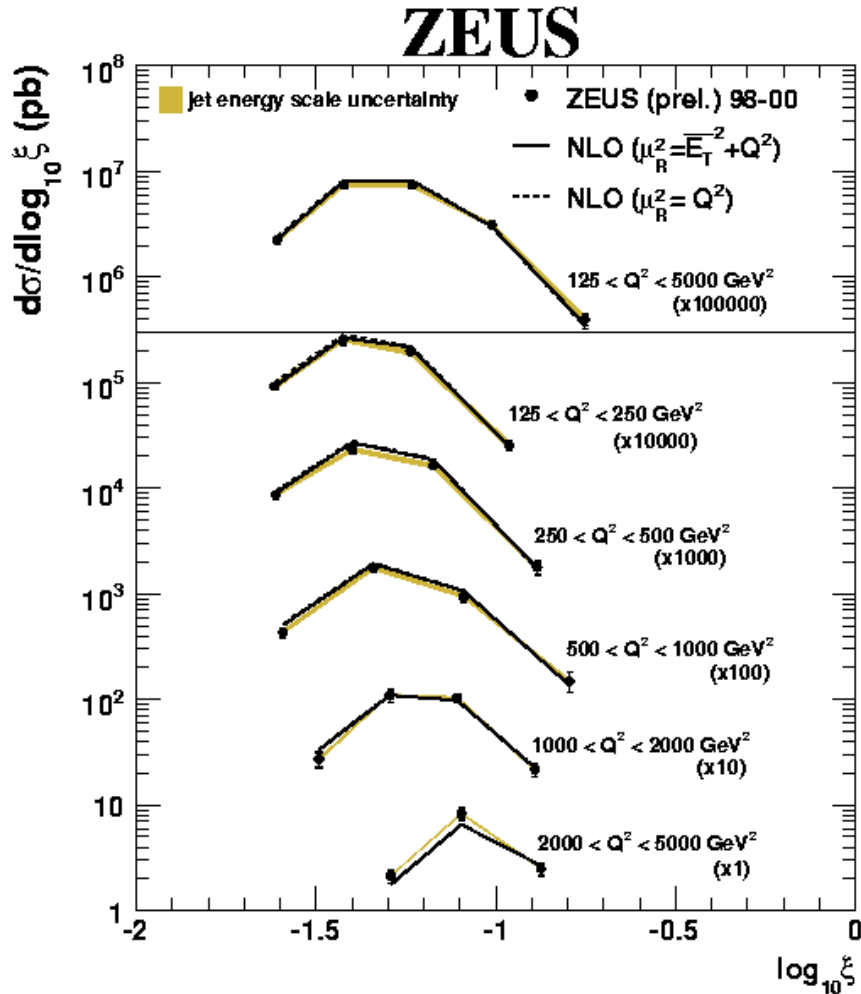
ZEUS



Data nicely described by the NLO theory. Errors dominated by theory.

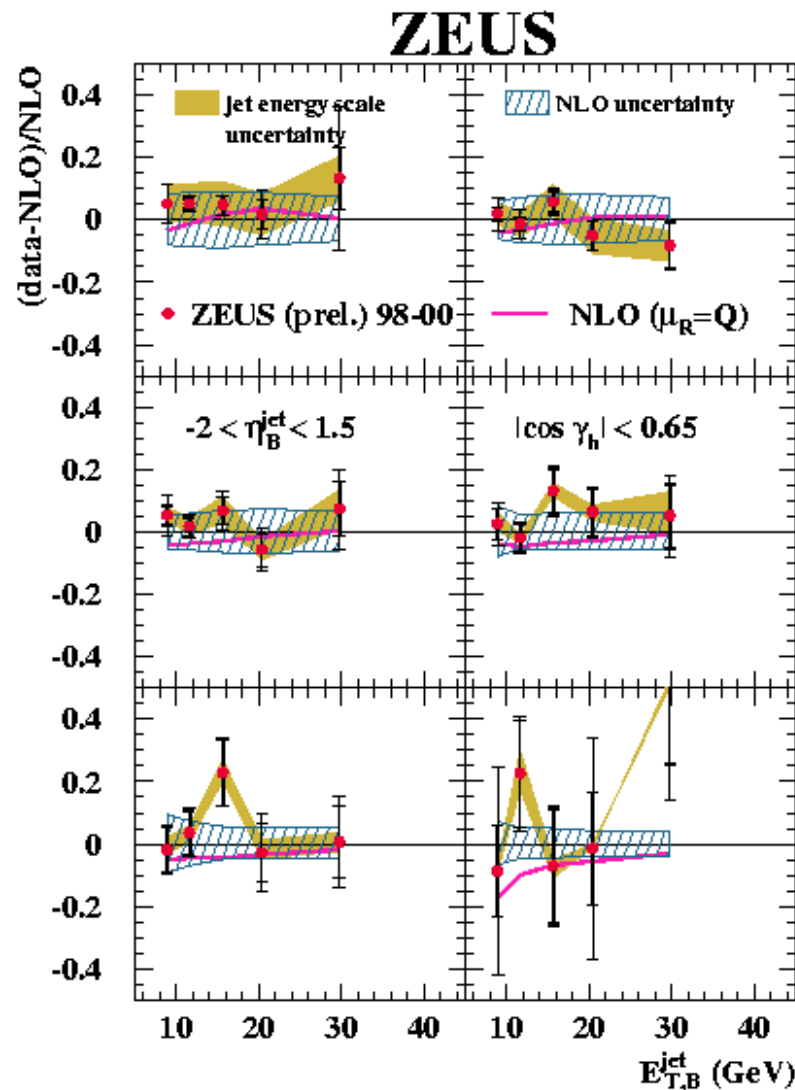
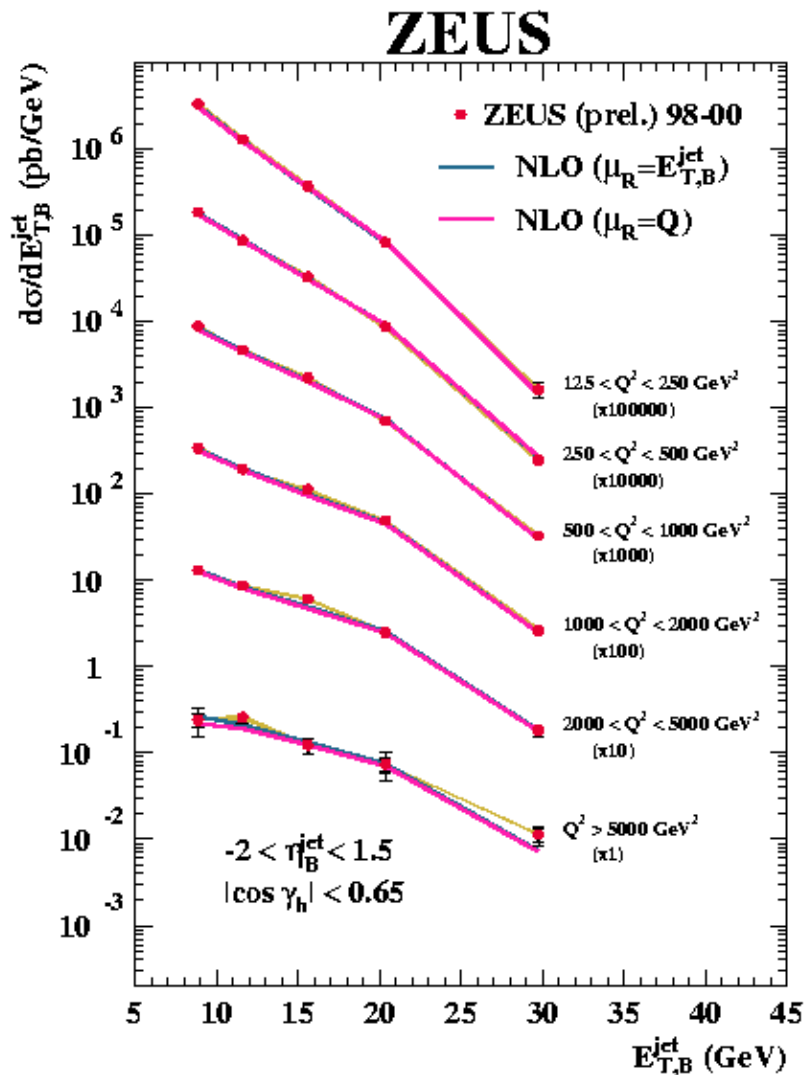
RESULTS 4

double-differential dijet analysis



RESULTS 5

double-differential inclusive-jet analysis



SUMMARY

- ¶ Single- and double-differential dijet (and inclusive-jet) cross sections have been measured in high- Q^2 DIS in 98-00 data from the ZEUS experiment (82pb^{-1}).
- ¶ The dijet data improve previous analyses:
 - larger statistics (almost factor 3 with respect to 96-97 data)
 - higher center-of-mass energy (920 versus 820 GeV)
 - improved selection (Breit frame) and tighter cuts (smaller uncertainties).
- ¶ The inclusive-jet data complement a measurement of single-differentiell inclusive-jet cross sections presented earlier.
- ¶ The data are well described by NLO QCD calculations.
- ¶ The double-differential distributions are sensitive to the gluon density in the proton and should thus serve as input to global QCD fits of the PDFs.