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

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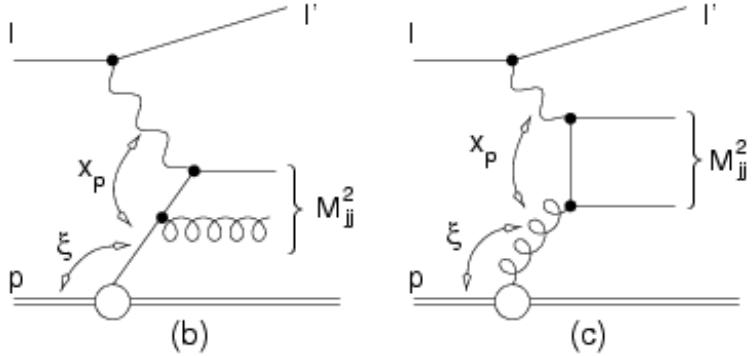
- Motivation
- Event and jet selection
- Data treatment, NLO theory, uncertainties
- Results
- Summary

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.

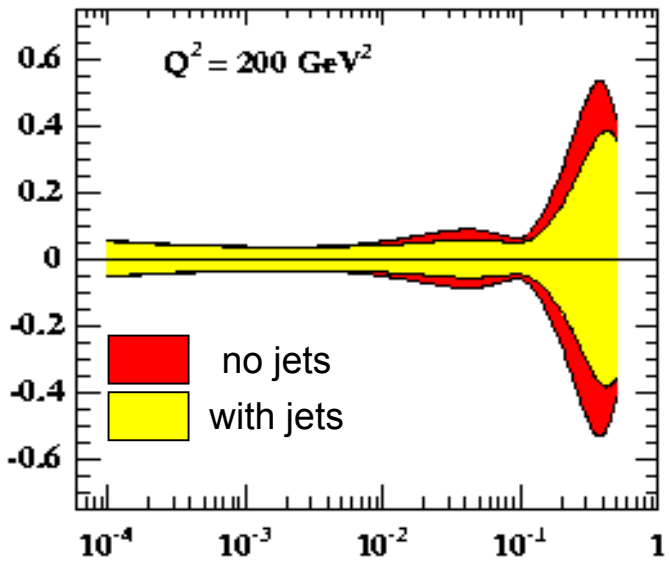


¶ Especially double-differential cross sections in Q^2 and E_T (inclusive jets) or Q^2 and ξ may help to pin down further the PDFs (gluon at high ξ!).

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

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

¶ Jet reconstruction:
- longitudinally invariant k_T cluster algorithm in Breit frame.
- linear jet energy corrections

¶ Jet phase-space:
- $-2 < \eta_{Breit} < 1.5$
- $E_{T,1(2)} > 12\ (8)$ GeV / 8 GeV

¶ Data corrections:
- acceptance/efficiency: ARIADNE/LEPTO MC: ~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) → ±7(8)%
- correlated exp. uncertainty: jet energy scale ±1(3)% → ±5-10%
- total uncorrelated uncertainty (mainly acceptance correction): ~10%

¶ NLO theory: DISENT with CTEQ6

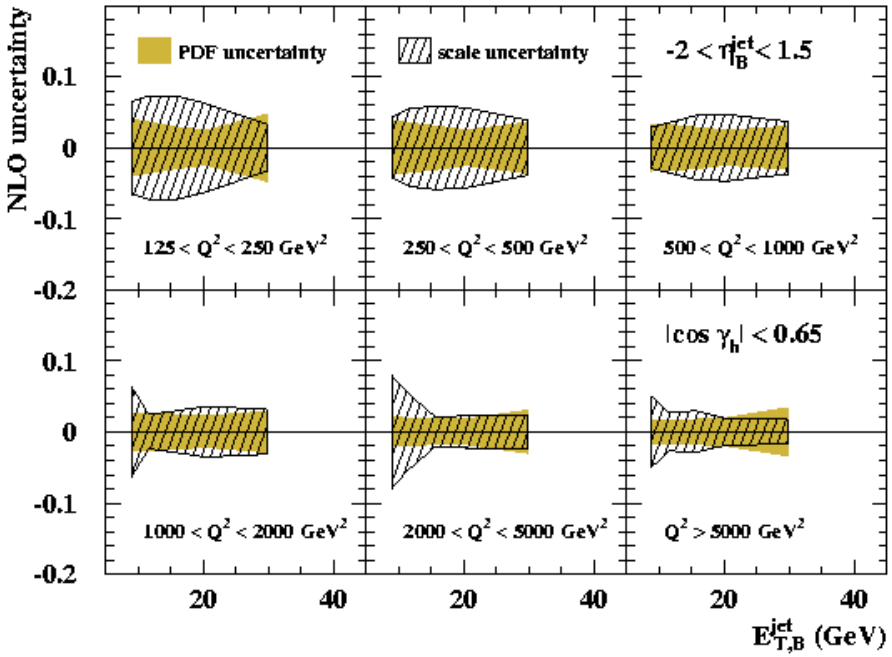
¶ Hadronisation: ARIADNE MC; typically 10%.

¶ Theoretical uncertainties:
- scale: $0.5,2\mu_R$ → ±5-10(20)%
- PDF: 40 CTEQ6 sets → ±2-5%
- α_S: CTEQ6AB → less than ±4%

THEORETICAL UNCERTAINTIES

Summary

NLO QCD, CTEQ6



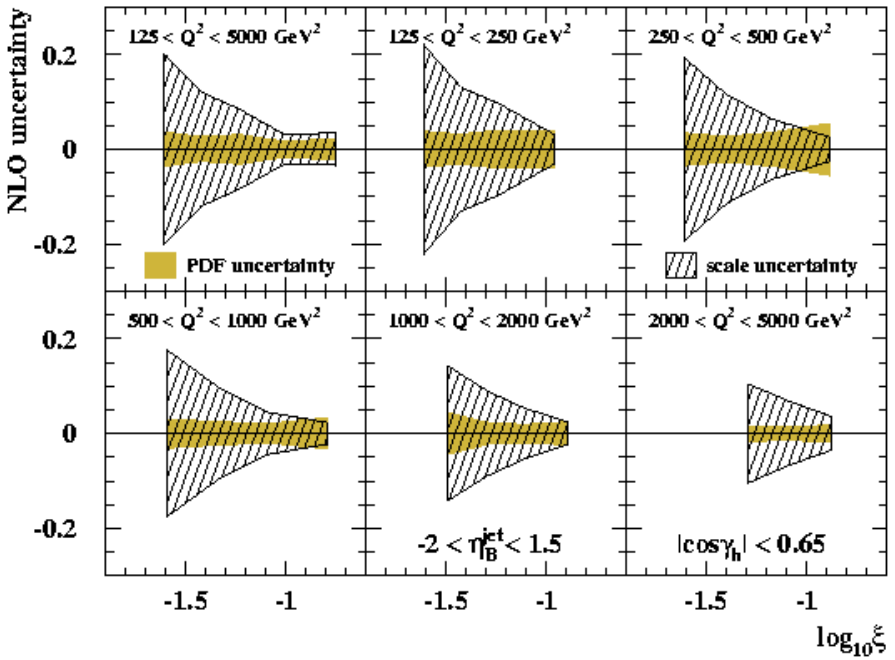
¶ Double-diff. inclusive-jet analysis:

– E_T distributions in Q^2 bins

– scale uncertainty ≤8%, decreasing with increasing Q^2.

– PDF uncertainty ≤4%, significant at high E_T.

NLO QC, CTEQ6



¶ Double-diff. dijet analysis:

– ξ distributions in Q^2 bins

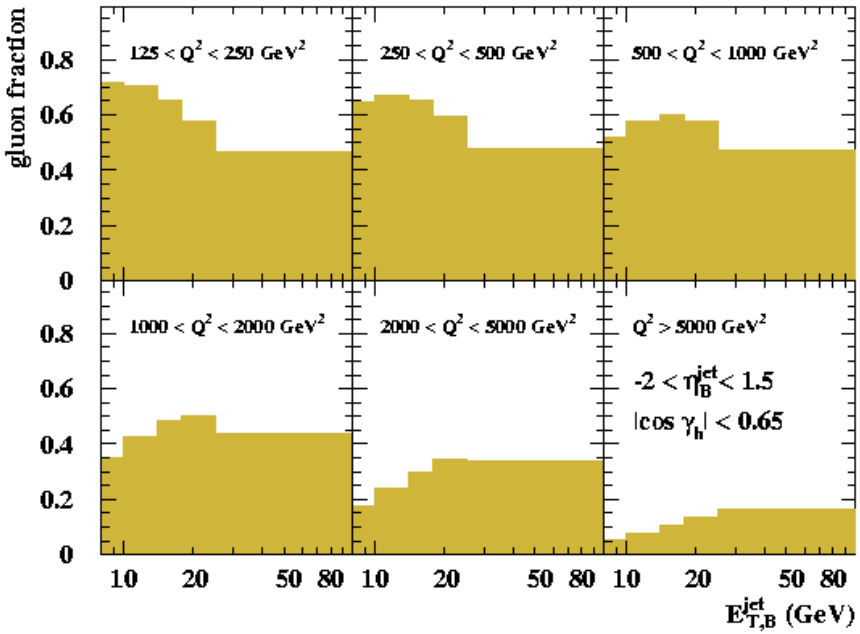
– scale uncertainty 5-20%, large at small ξ.

– PDF uncertainty ≤4%, significant at high ξ.

GLUON-INDUCED EVENT FRACTION

For double-differential cross sections

NLO QC, CTEQ6

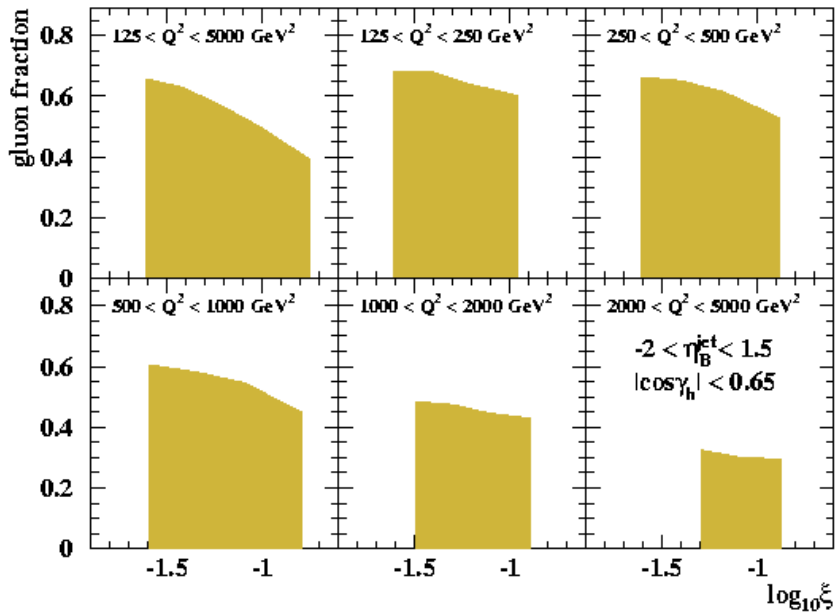


¶ Double-diff. inclusive-jet analysis:

– E_T distributions in Q2 bins

– gluon fraction decreases with increasing E_T and with increasing Q^2.

NLO QC, CTEQ6



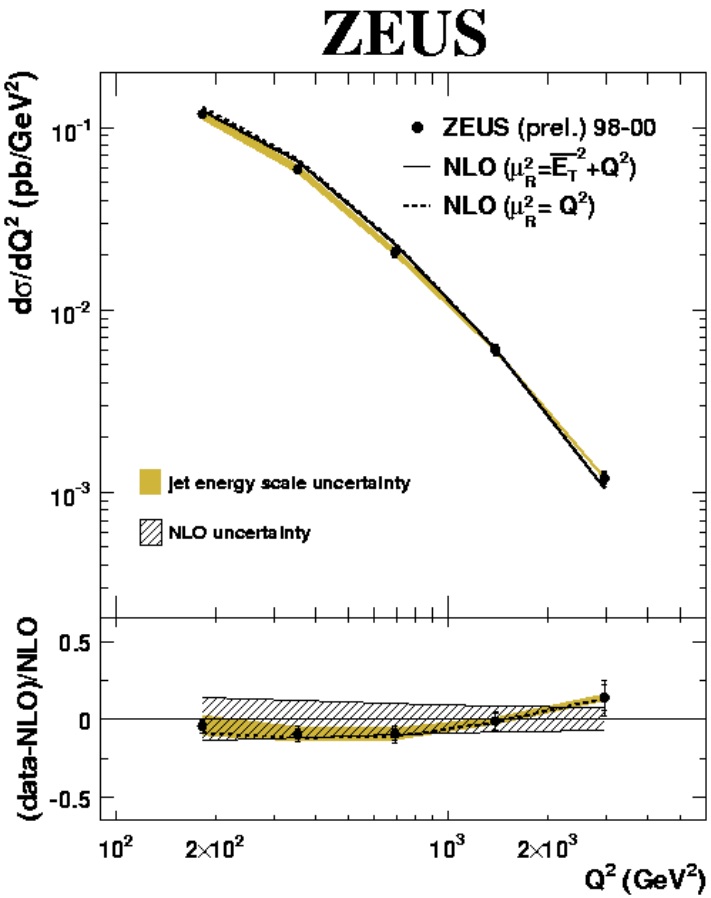
¶ Double-diff. dijet analysis:

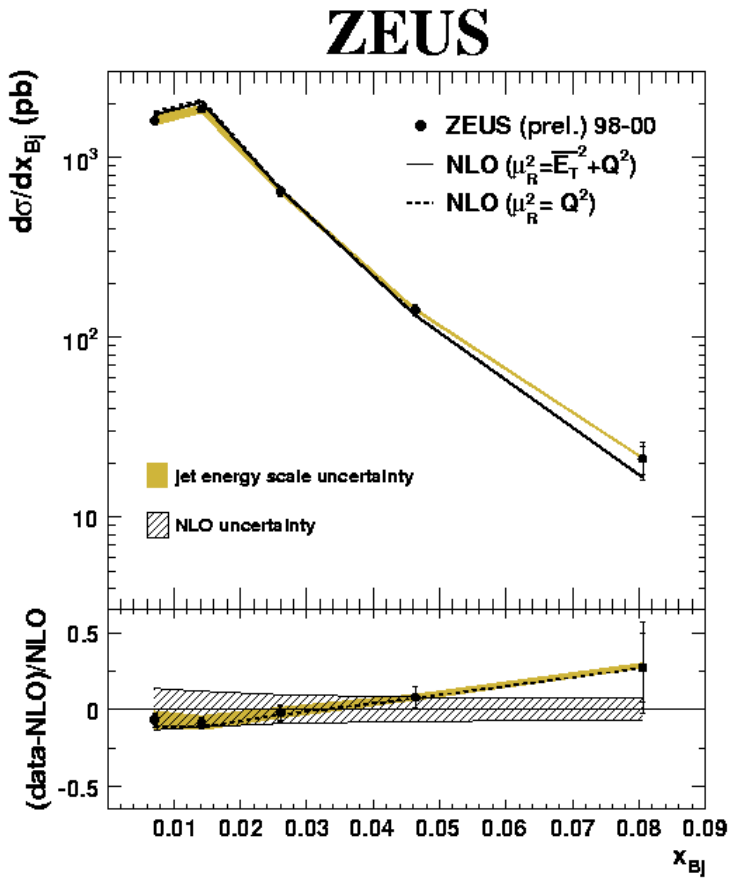
– ξ distributions in Q^2 bins

– gluon fraction decreases with increasing ξ and Q^2.

RESULTS 1

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

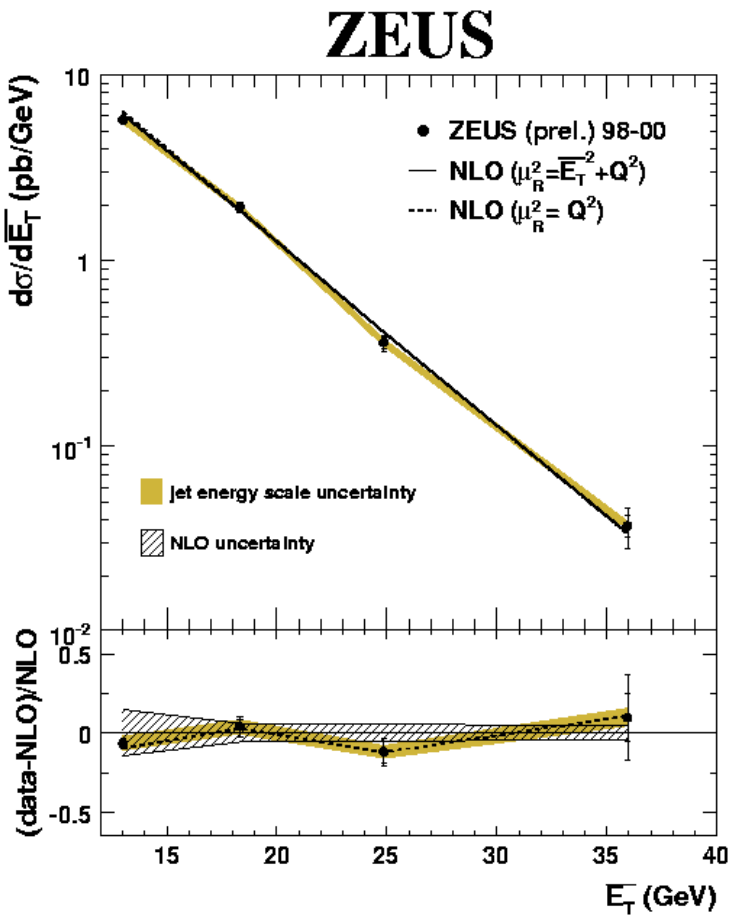


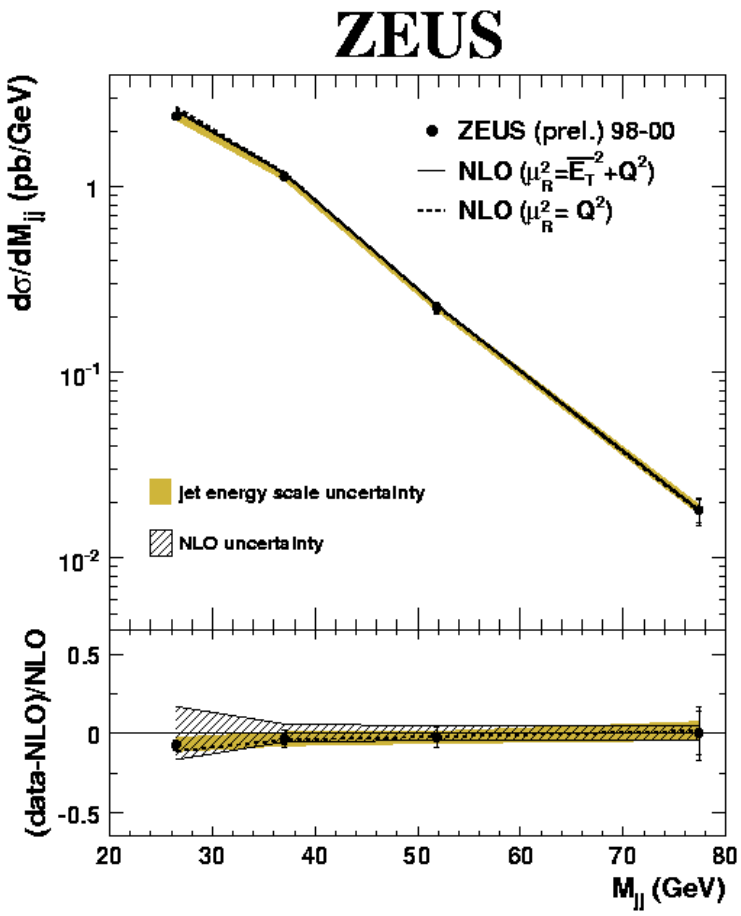


Data nicely described by the NLO theory.
Errors dominated by theory (scale).

RESULTS 2

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

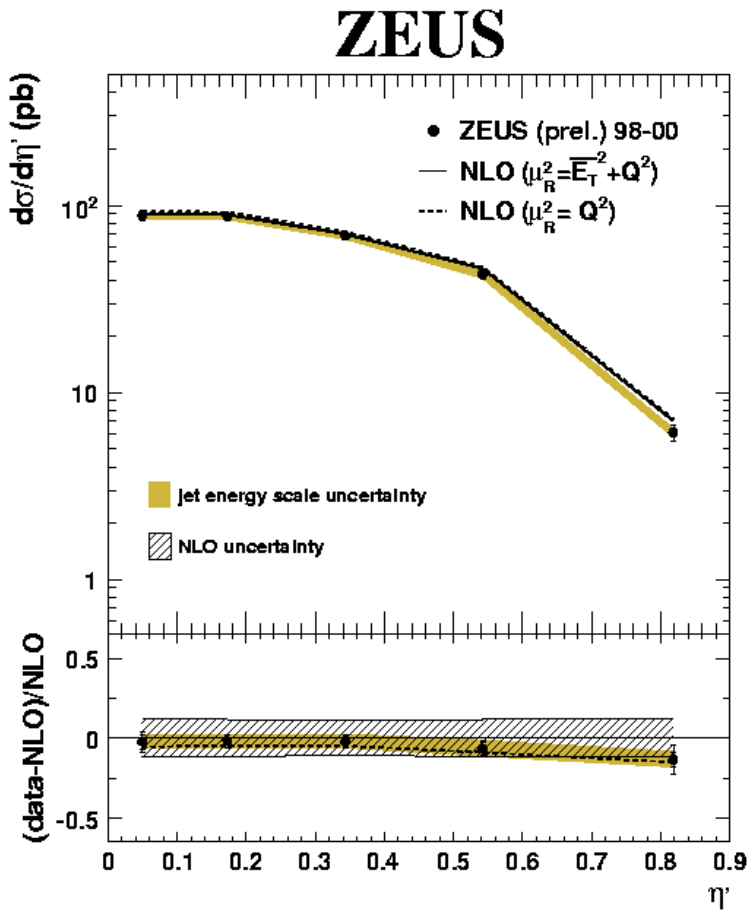




Data nicely described by the NLO theory. Errors dominated by theory (scale); sometimes energy scale uncertainty comparable.

RESULTS 3

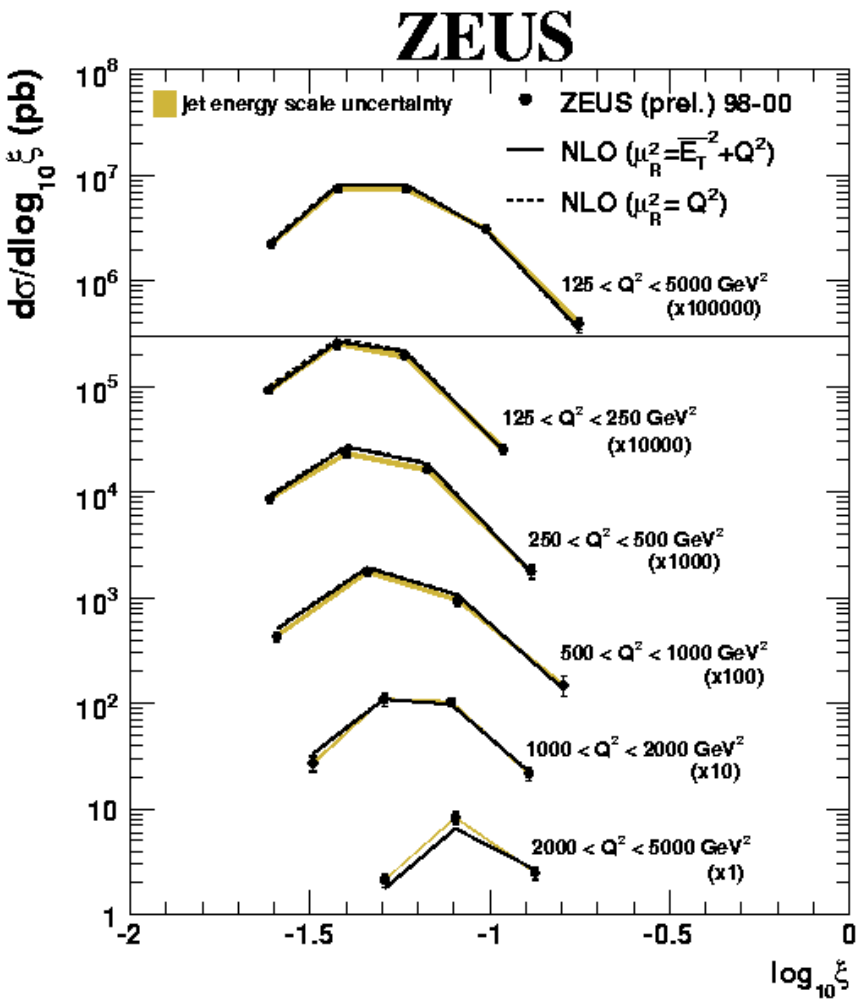
last set of single-diff. dijet variables: $\eta' = 0.5 * |\eta_1 - \eta_2|$

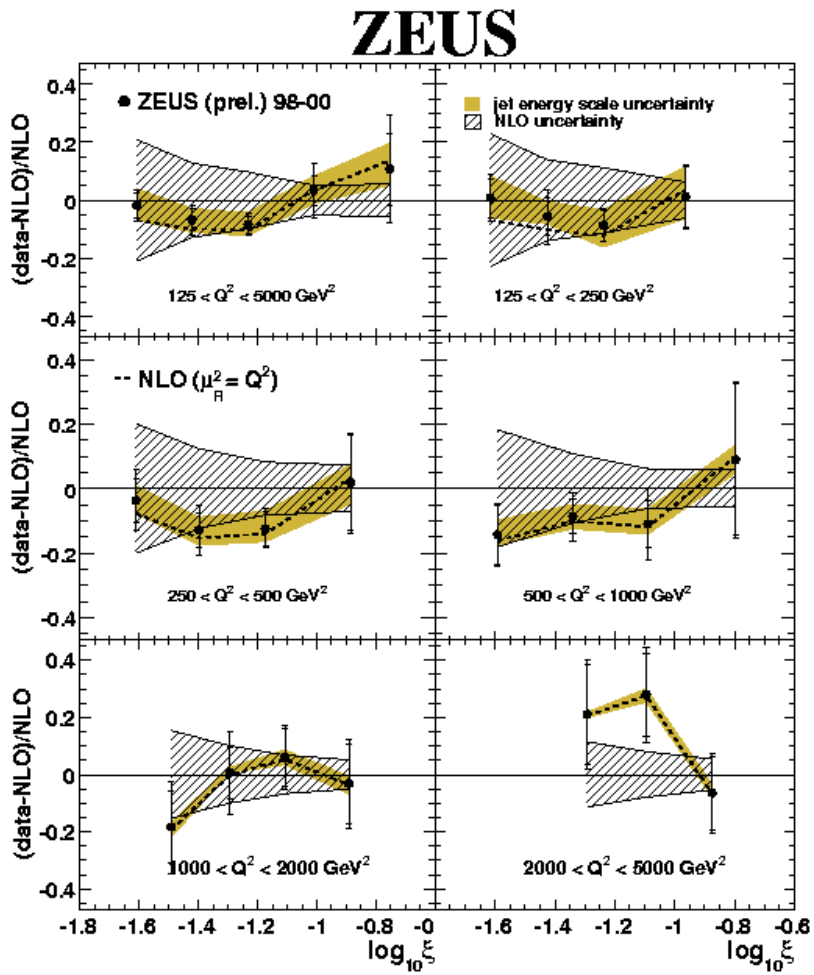


Data nicely described by the NLO theory. Errors dominated by theory.

RESULTS 4

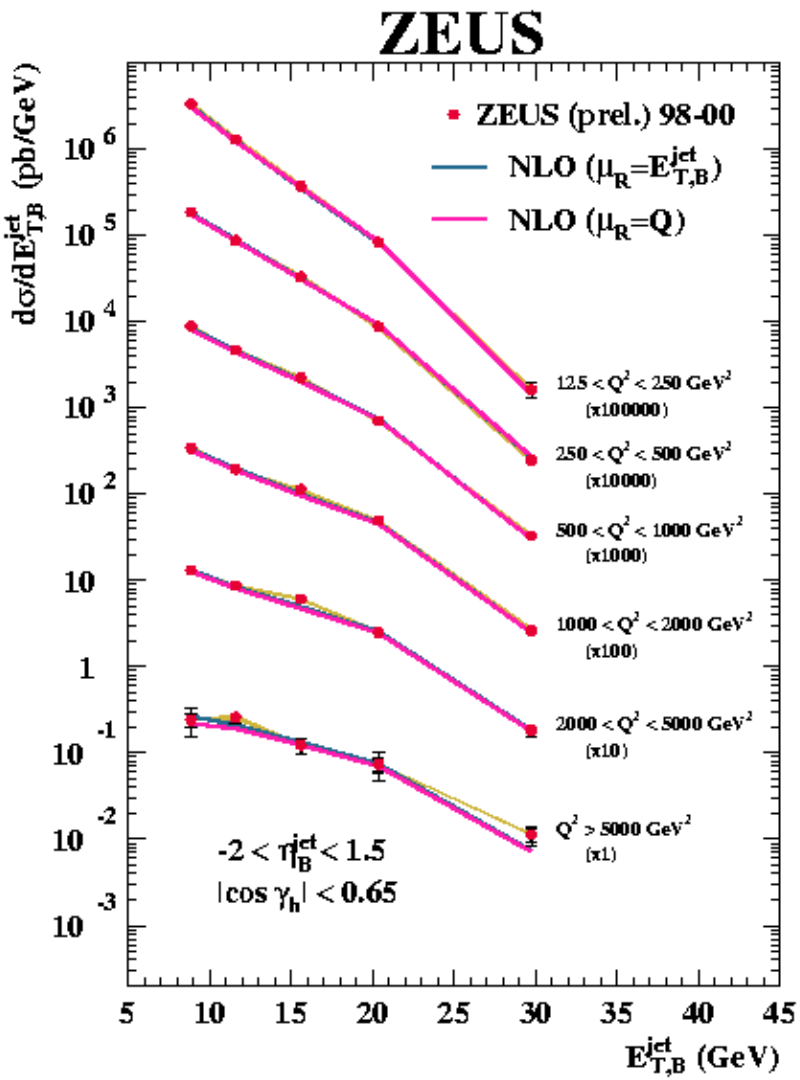
double-differential dijet analysis

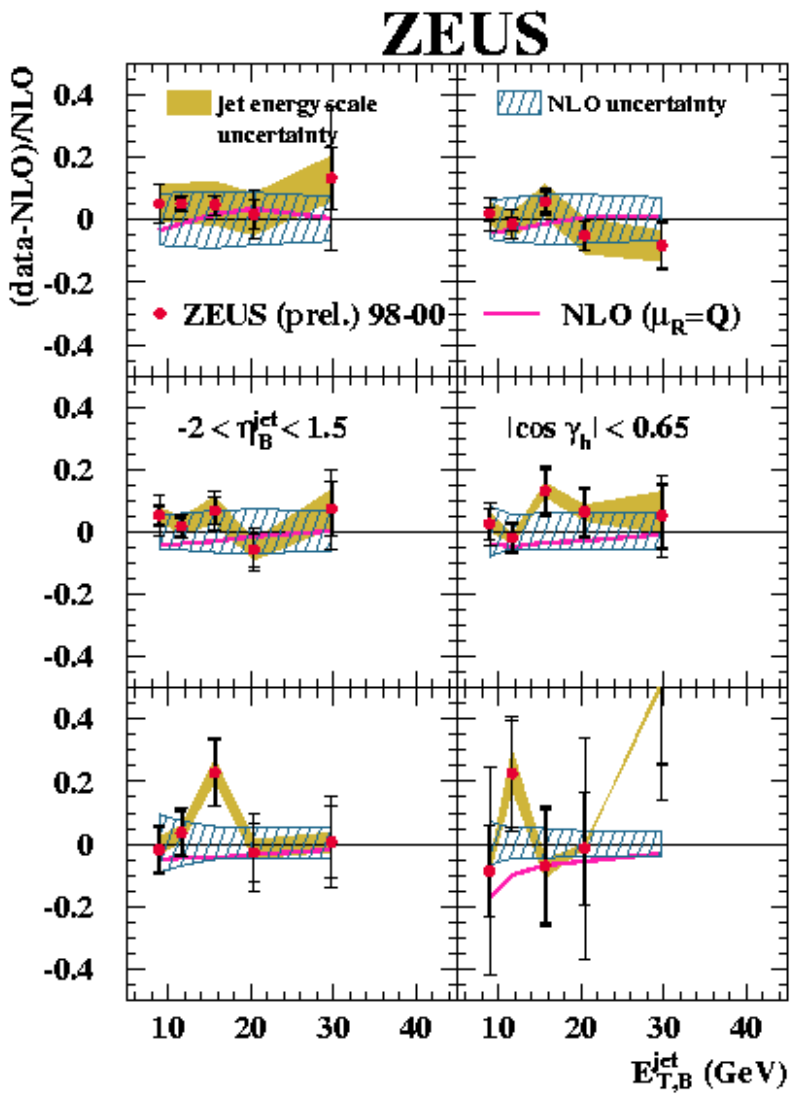




RESULTS 5

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.