

Inclusive-jet photoproduction at HERA and determination of α_s

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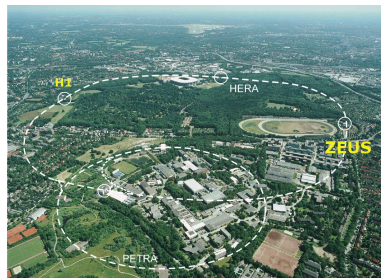
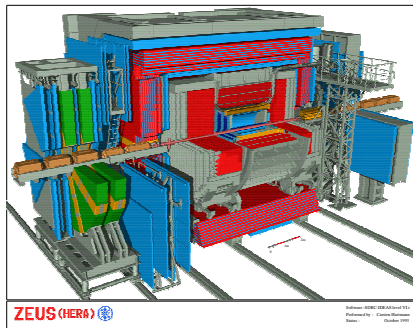
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Overview

- The experiment
- Data and data selection
- NLO-QCD predictions
- Cross sections in comparison to NLO-QCD predictions
- Dependence on model assumptions
- Dependence on PDFs
- Determination of α_s at the Z mass and α_s energy scaling
- Summary

The experiment



der

- ZEUS experiment at the electron-proton collider HERA
- HERA: protons of 920 GeV and electrons/positrons of 27.5 GeV
centre-of-mass energy $\sqrt{s} = 318\text{GeV}$

Data and data selection

Data

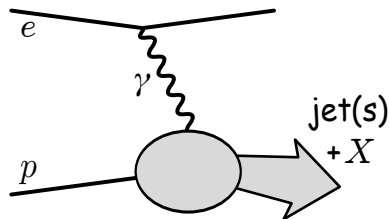
- data from 2005 - 2007
- luminosity: 300pb^{-1}

Data selection

- no electron in detector:
 $Q^2 < 1\text{GeV}^2$
- $142 < W_{\gamma p} < 293\text{GeV}$
- $E_T^{\text{jet}} > 17\text{GeV}$
- $-1 < \eta^{\text{jet}} < 2.5$

jet search

- using k_T algorithm with radius set to unity

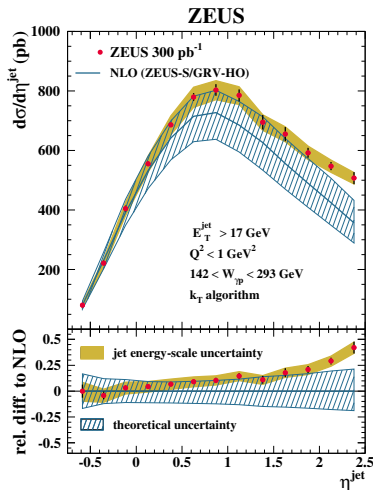
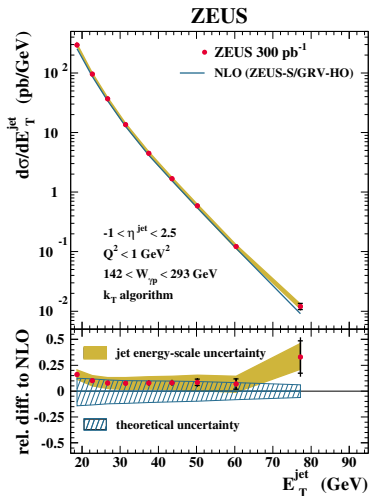


- calculations with program of Klasen, Kleinwort and Kramer
ref: EPJ Direct C1 (1998) 1

Features

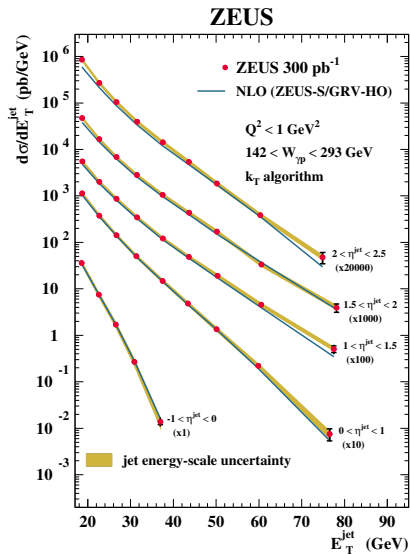
- $\mu_R = \mu_F = \mu = E_T^{jet}$
- ZEUS-S for the proton PDFs
- GRV-HO for the photon PDFs
- Predictions refer to a jet of partons
- MC simulations (PYTHIA and HERWIG) were used to correct predictions to hadron level
- MC simulations including multi-parton scatterings (PYTHIA-MI) were used for comparisons

Cross sections in comparison to NLO-QCD predictions(I)



- Experimental errors: bars + yellow band for error of jet-energy scale
- Theoretical errors: mainly due to terms beyond NLO and photon PDFs

Cross sections in comparison to NLO-QCD predictions(II)



Observations

- Reasonable description for most of the data points
- data above prediction for $\eta^{\text{jet}} > 2$ and low E_T^{jet}

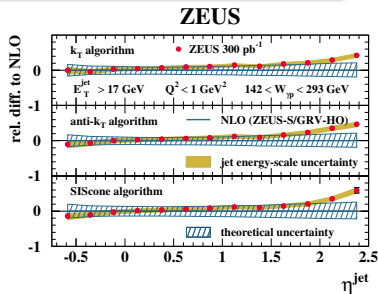
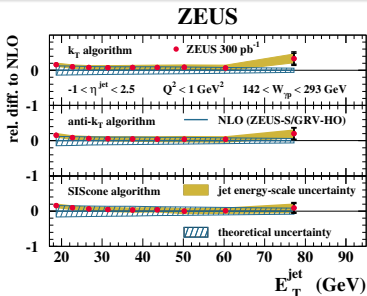
Studies

- Comparison of jet algorithms
- Effect of multi-parton interactions

Comparison of jet algorithms

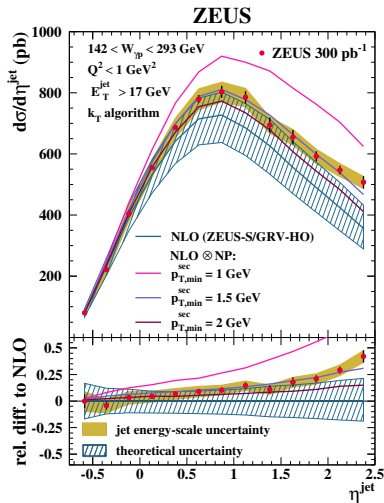
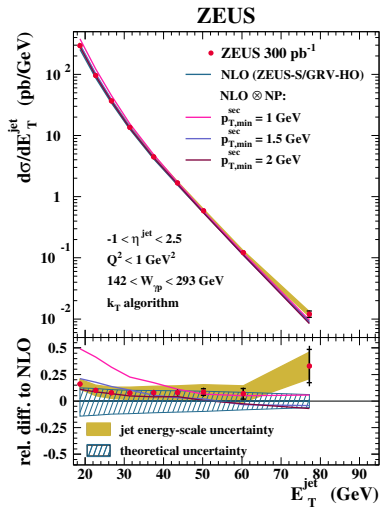
Comparison

- Cross sections and NLO were calculated, in addition to k_T , with *anti* - k_T and *SIScone* algorithms (ZEUS, PL B691 (2010) 127)
- Plots show the relative difference between data to NLO



- small differences

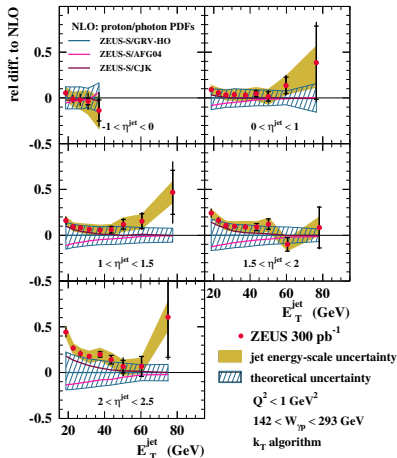
Studies of multi-parton interactions



- Larger jet rates at low E_T^{jet} and large η^{jet}
- Best prediction for $p_{T,min}^{sec} = 1.5 \text{ GeV}$ (blue line)

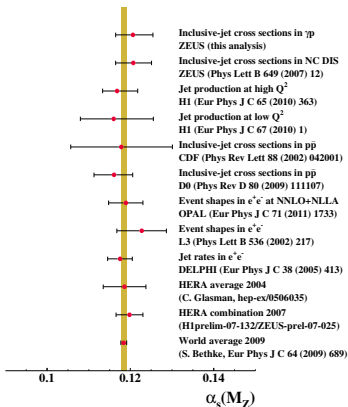
Studies of different sets of photon PDFs

ZEUS



- Two sets of photon PDFs were tested relative to GRV-HO(default)
- Differences seen at high η^{jet} and low E_T^{jet}
- Some dependence also on proton PDFs (not shown)
- This data has some potential to improve PDFs when included in global fits

Determination of $\alpha_s(M_Z)$

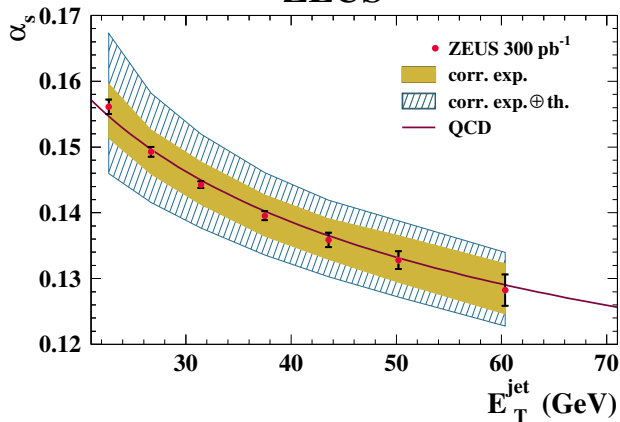


Result (based on k_T):

- Fit of NLO-QCD to $d\sigma/dE_T^{jet}$ (ZEUS, PL B 547 (2002) 164)
- Result (based on k_T):
 $\alpha_s(M_Z) = 0.1206^{+0.0023}_{-0.0022} (exp.)^{+0.0042}_{-0.0035} (th.)$
consistent with world average
- Consistent values obtained with the other jet algorithms

Dependence of α_s on E_T^{jet} as scaling variable

ZEUS



- The measurement confirms running of α_s over a wide range of E_T^{jet}
- The observed running is in good agreement with NLO-QCD

- Inclusive-jet photoproduction was measured with the ZEUS detector at the ep collider HERA
- Cross sections were calculated in the region of $E_T^{jet} > 17\text{GeV}$ and $-1 < \eta^{jet} < 2.5$
- They are in general well described by NLO-QCD predictions
- Three jet algorithms were studied and showed only small differences
- The dependence on multi-parton interactions was studied and contributions were seen at large η^{jet} and low E_T^{jet}
- Different sets of photon PDFs give NLO-QCD predictions which also differ at large η^{jet} and low E_T^{jet} so that this measurement has the potential to constrain PDFs in a global fit.
- α_s was determined at the mass of Z and over a wide range of E_T^{jet}