LHeC
PDFs and QCD

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LHeC in the context of LHC
-> motivation
Improve power of precision of SM/QCD parameters to sharpen signs of new physics

->high x vs low x region

Simulated LHeC Data updated scenario

- The scenarios described in CDR need to be updated:

Scenario B: (Lumi $e^{+/-}p$ = 50 fb^{-1}) Ep=7 TeV, Ee=50 GeV, Pol=±0.4

- Kinematic region: $2 < Q^2 < 500\,000$ GeV^2 and $0.000002 < x < 0.8$

Scenario H: (Lumi $e^{-}p$ = 1 fb^{-1}) Ep=1TeV, Ee=50 GeV, Pol=0

- Kinematic region: $2 < Q^2 < 100\,000$ GeV^2 and $0.000002 < x < 0.8$

Typical uncertainties:

Full simulation of NC and CC inclusive cross section measurements including statistics, uncorrelated and correlated uncertainties – based on typical best values achieved by H1

- Statistical it ranges from 0.1% (low Q^2) to ~10% for x=0.7 in CC
- Uncorrelated systematic: 0.7 %
- Correlated systematic: typically 1-3% (for CC high x up to 9%)

source of uncertainty	error on the source or cross section
scattered electron energy scale $\Delta E'_e/E'_e$	0.1 %
scattered electron polar angle	0.1 mrad
hadronic energy scale $\Delta E_h/E_h$	0.5 %
calorimeter noise (only $y < 0.01$)	1-3 %
radiative corrections	0.5%
photoproduction background (only $y > 0.5$)	1 %
global efficiency error	0.7 %

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all for ep: Ee=60 GeV, Ep=7000GeV,  MSTWLO

  acronym   charge  polarisation  luminosity (fb-1)

  mimi        -        -0.8         500

  mipl        -        +0.8          50

  plnu        +         0             5
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 86  LHEC CC ele neg pol cross section
122  LHEC NC ele neg pol cross section
 83  LHEC CC ele pos pol cross section
120  LHEC NC ele pos pol cross section
 77  LHEC CC pos unpol cross section
117  LHEC NC pos unpol cross section
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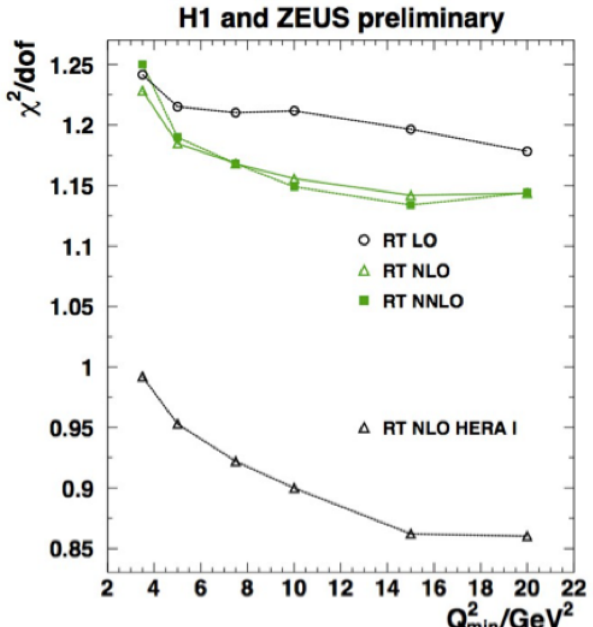
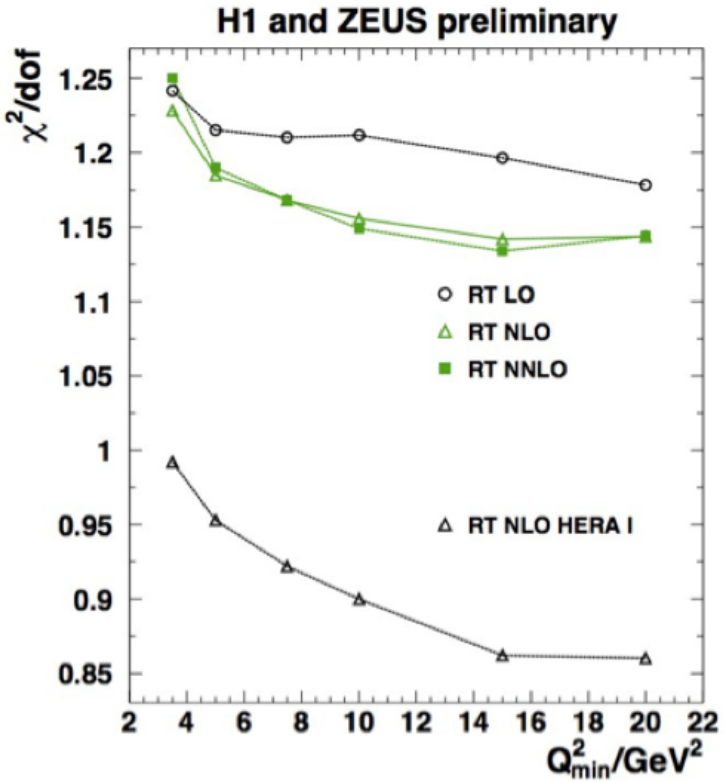
- Methodology:
  - fits to inclusive simulated data -> PDFs, alphas
  - Low Q2 region?
  - addition of F2b, F2c simulated data -> mc, mb scans
  - Further possibility of flavour decomposition: strange data
  - Release of assumptions



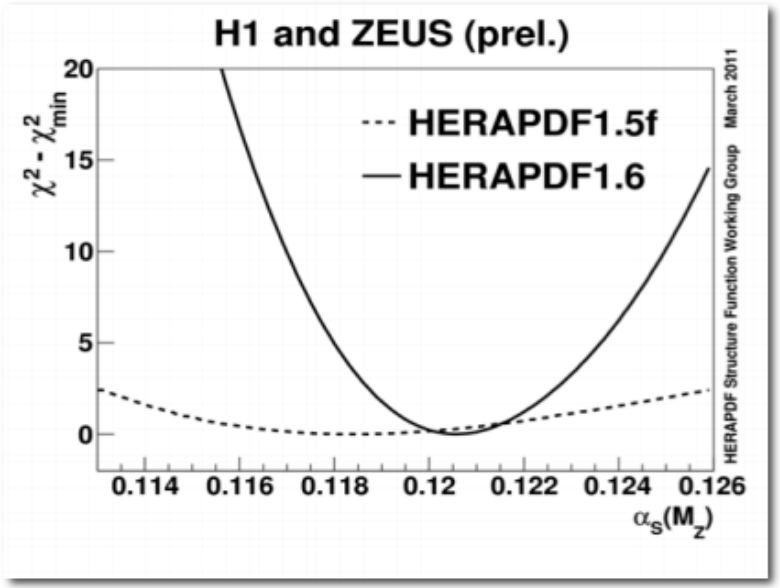
Update of New Studies

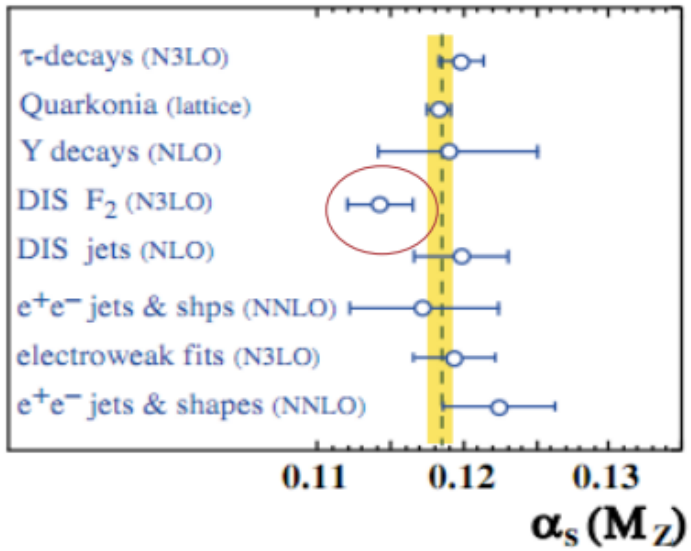
- Methodology:
  - fits to inclusive simulated data -> PDFs, alphas
  - Low Q2 region?
  - addition of F2b, F2c simulated data -> mc, mb scans
  - Further possibility of flavour decomposition: strange data
  - Release of assumptions
  - QED effects?



Alphas from DIS at the LHeC

- Results from HERA show that even with precise HERA data one has to rely on jet measurements to extract alphas from DIS
- Strong coupling from DIS processes still seem to prefer smaller values





- LHEC CDR study promises per mile precision for alphas from scaling violations.
  - full exploitation requires theory advances to NNNLO precision
- LHeC can provide a new level of predicting grand unification

After CDR:

- CDR: