Understanding the structure of the proton: from HERA and Tevatron to LHC

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Today landscape for proton PDFs

Note: PDFs uncertainties does not reflect the hypothesis done when running the global fits (in particular in the anti-quark sector)
We discuss possible improvements possible at LHC in EW physics...

& The role of PDFs error versus The observation of new phenomena
Possible improvements

Drell-Yan at LHC: prospects

Idea:
Differentiate between up & down quarks

Comparing DY at large & low mass
=> Reduce the error on $d(x)$
Drell-Yan (high mass) at LHC
Expectations and error

\[ \sim 6\% \text{ uncertainty} \]

Pt distribution for these events
Drell-Yan

Observation of new phenomena

\[ m = M_Z \exp(-|y|) \, & \, M = M_Z \exp(+|y|) \]

Interest for xs ratio to reduce the effect of PDFs uncertainties

Simulation with SM + 2TeV Z’

Sensitivity

>650 GeV for \( \sigma \) &

\( \sim 300 \text{ GeV for } R \)
Another example of xs ratio @ LHC: W asymmetry

Fit DIS + pseudo data on $W$ asym @ LHC
=> Error reduced by factor 2

Fit DIS only

Same fit with $W_{sym}$ LHC Pseudo-data

Fit DIS data without
The assumption
ubar=dbar at low x
Rel error ~10%
Main message

With Z and W measurements at LHC, there will be a strong input in the PDF landscape...

& subsequently on the possibility to observe new phenomena as deviations in standard spectra
Diffraction at the LHC and more…
(towards a unified understanding of processes)

Double Pomeron Exchange and Higgs

See dedicated talks in this conference
Detectors at LHC for diffraction
Proton tagging in Roman Pots
What has been done @ Tevatron

Measurement of the Dijet Mass Fraction @ TeV

Can we observe exclusive events? (Rjj ~ 1)
Diffraction at Tevatron & DPE

predictions with exclusive DPE production
Summary

Only few items selected from:

General idea:

LHC data (even @ 8 TeV) would help to bring constraints on SM physics (continuation of HERA+TeV)

** Example with QED and WW coupling (see C.R. talk)

** Examples with PDFs and DY + W asymmetry

** Exclusive processes @ LHC open also a potential for diffraction and DPE…

** Important note: HERA data at large x/Q^2 will have a strong impact on the PDFs landscape (work on going)