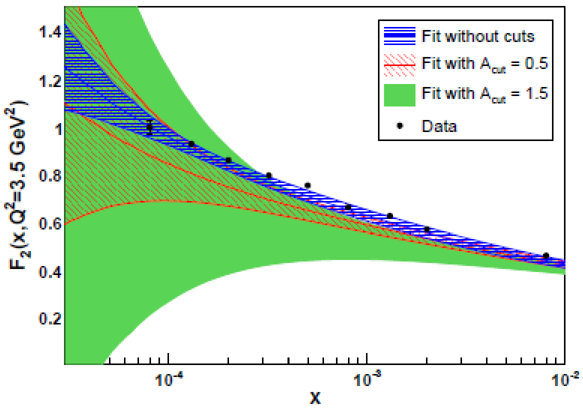
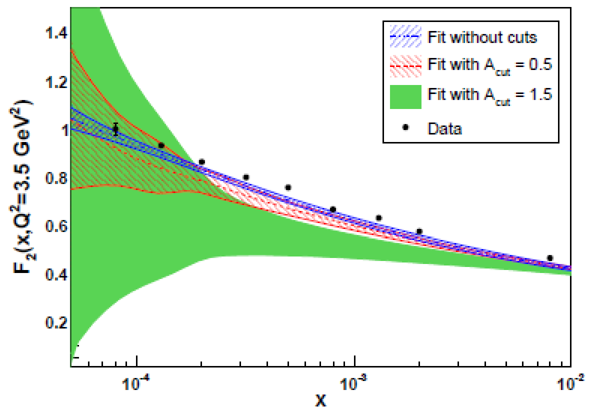
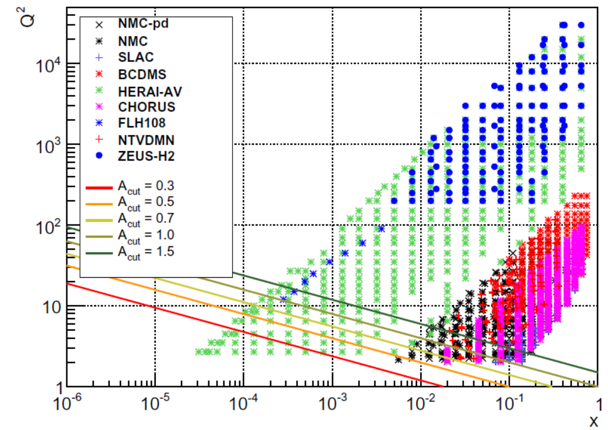
IS NLO DGLAP applicable for the low-x,Q^2 part of the kinematic plane?



Before combined HERA-I



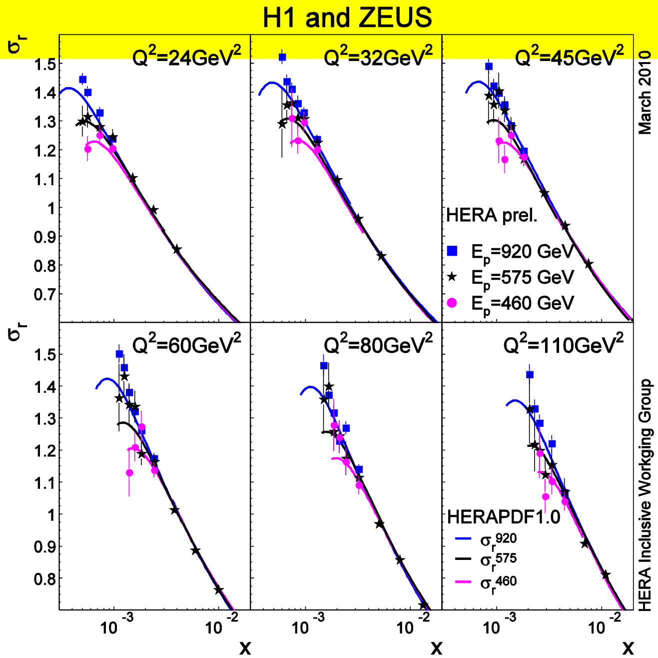
With combined HERA-I

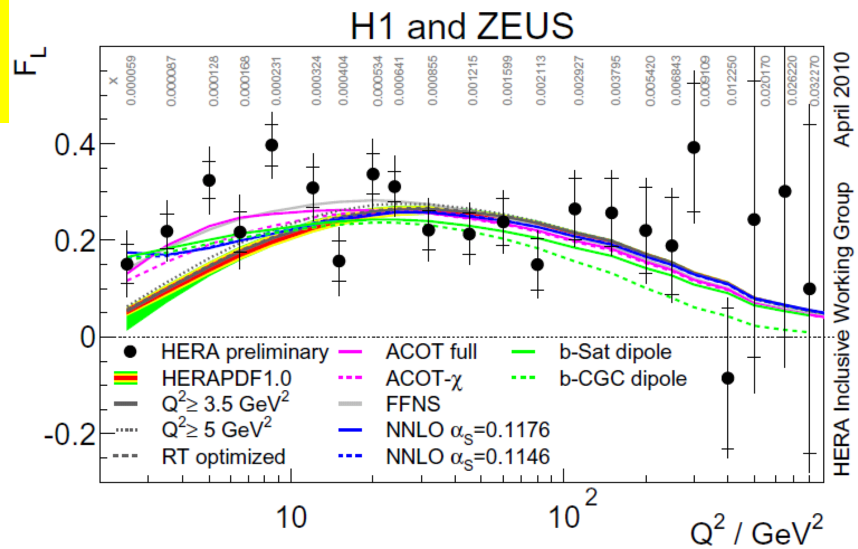


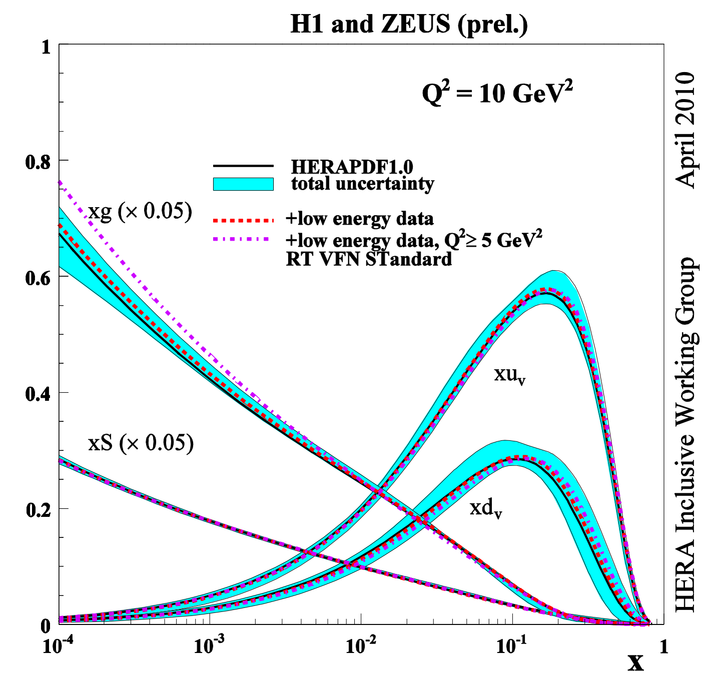
NNPDF Caola et al observe that the new combined HERA data shows tension as cuts are made to cut out low-x,Q2 data

Wen HERA combine their low energy run data the low x,Q^2 part of the data is not so well fit and the **gluon** which results from imposing harder Q^2 cuts or $Q^2 > 0.5x^{-0.3}$ cut **is steeper-** this seems NOT to be solved by NNLO....

H1 and ZEUS have also combined the e+p NC inclusive data from the lower proton beam energy runs (P_P = 460 and 575) and produced a common FL measurement (ZEUS prel 10-001 , H1prelim 10-043)







In HERAPDF1.0,1.5 we also present a model uncertainty from the variation of the minimum Q^2 cut on the data The low energy data are more sensitive to this cut.

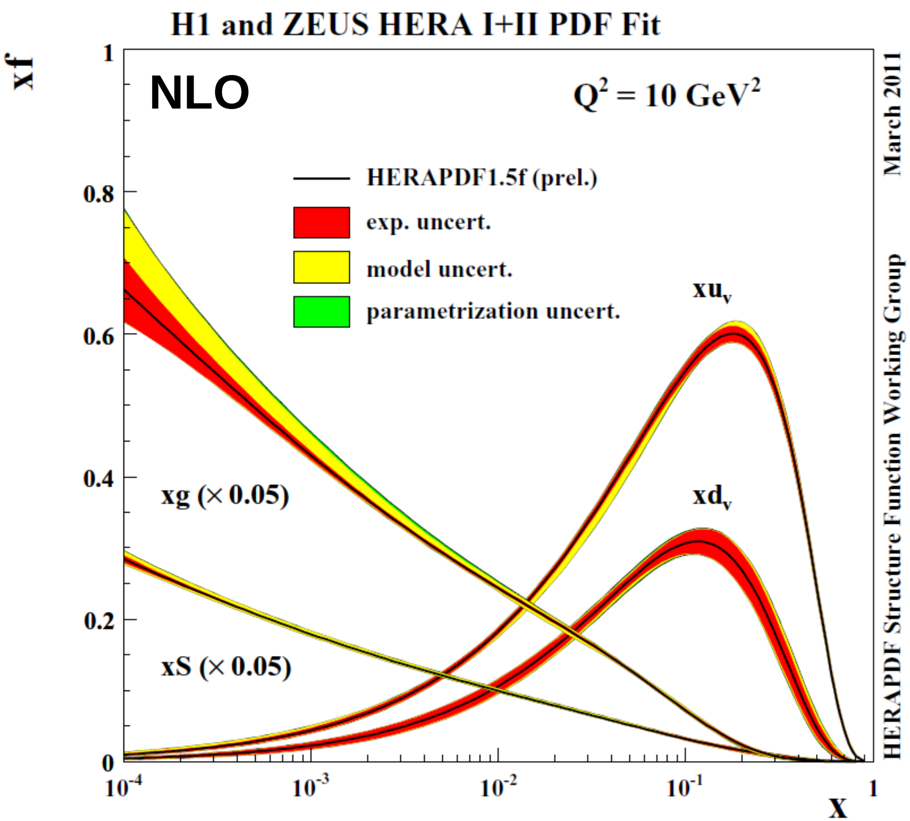
If low Q^2 -and hence low x - data are cut -the resulting gluon is somewhat steeper.
This level of uncertainty is now covered by the extended parametrization

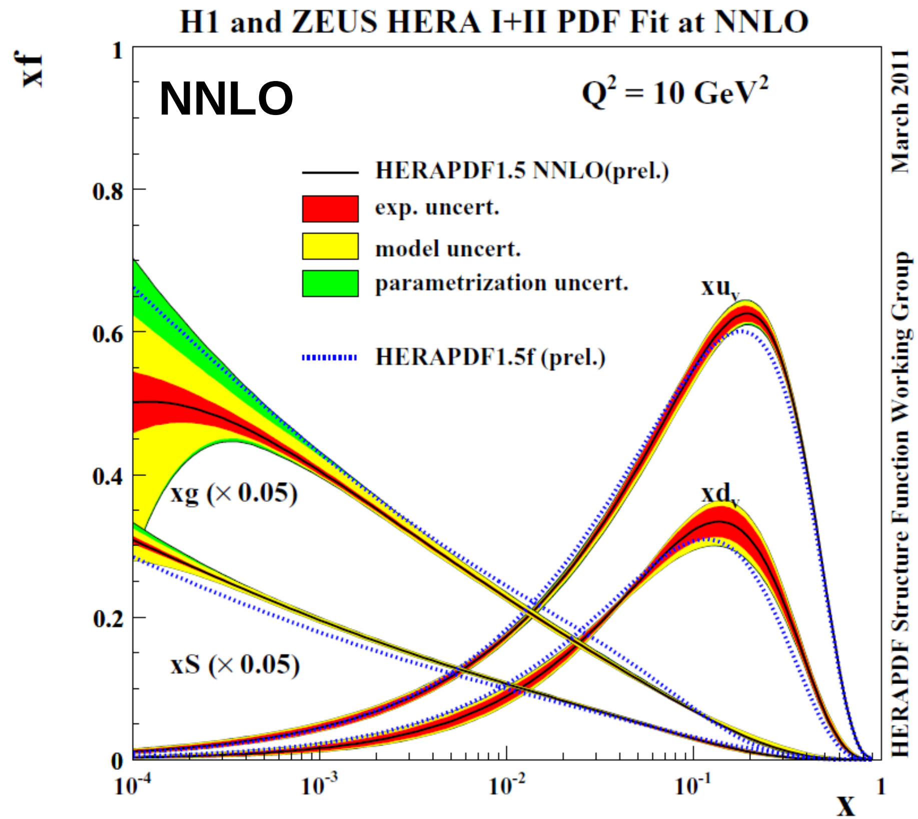
BUT fits using different HQ VFN schemes like ACOT fit low x,Q2 at NLO better..
ACOt uses only O(αs) for FL at NLO
Thorne uses O(αs^2) for FL at NLO

Does this tell us anything?

And so to NNLO: ZEUS-prel-11-002/H1prelim-11-042. For these fits only HERA I+II high energy inclusive data are used

First compare HERAPDF1.5 NLO and NNLO both with extended parametrization





What are the differences?

- Valence not much
- Sea a little steeper
- Gluon more valence like

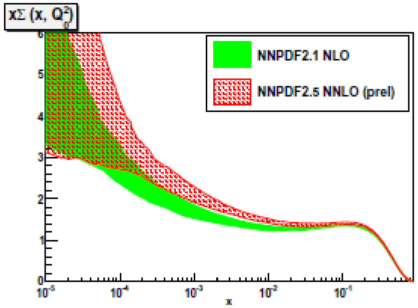
On these plots both NLO and NNLO have $\alpha_S(M_Z)$ =0.1176

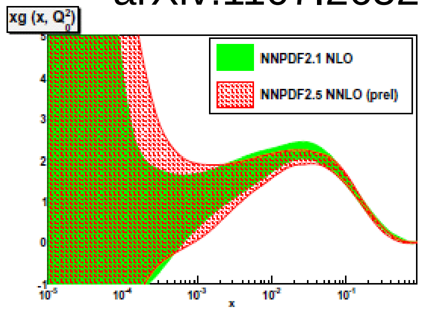
The low-x gluon has greater uncertainty NNLO DGLAP is NOT a better fit than NLO to low-x,Q^2 data

VERY sensitive to low x,Q2 cuts

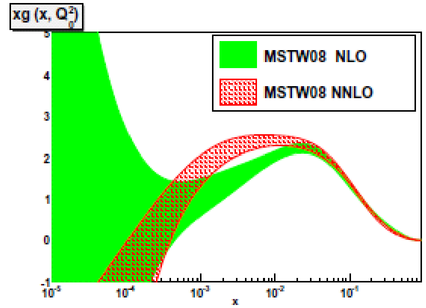
NNLO -- NNPDF2.1

arXiv:1107.2652

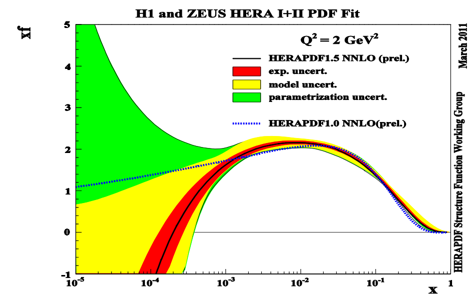




Compare MSTW



Compare HERAPDF1.5



NNPDF at NNLO has larger uncertainties than MSTW a NNLO.

HERAPDF at NNLO has central PDF similar to MTSW but uncertainties similar to NNPDF

1.
Does geometrical scaling really imply saturation?

The contribution of heavy quarks should be considered

2.
ATLAS, CMS LHCb data at $Q^2 \sim M_Z^2$ can be described by DGLAP evolution from lower Q2...
For ATLAS and CMS the x values go down to $x \sim 10^{-3}$
For LHCb the x values extend down to $x \sim 10^{-5}$
Amazingly LHCB Drell-Yan also looks good... Even lower x

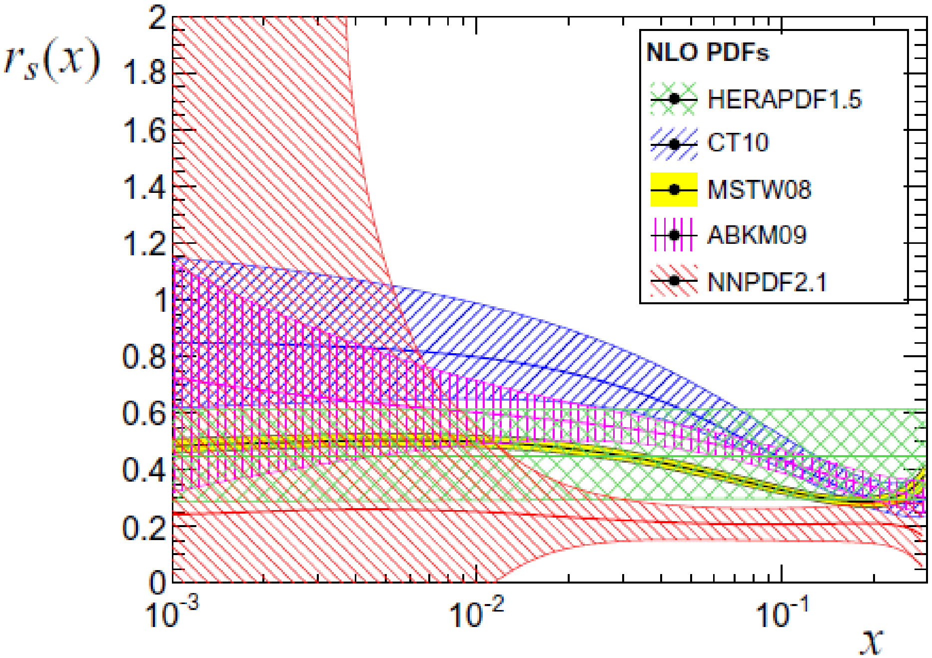
So DGLAP is working down to such low x

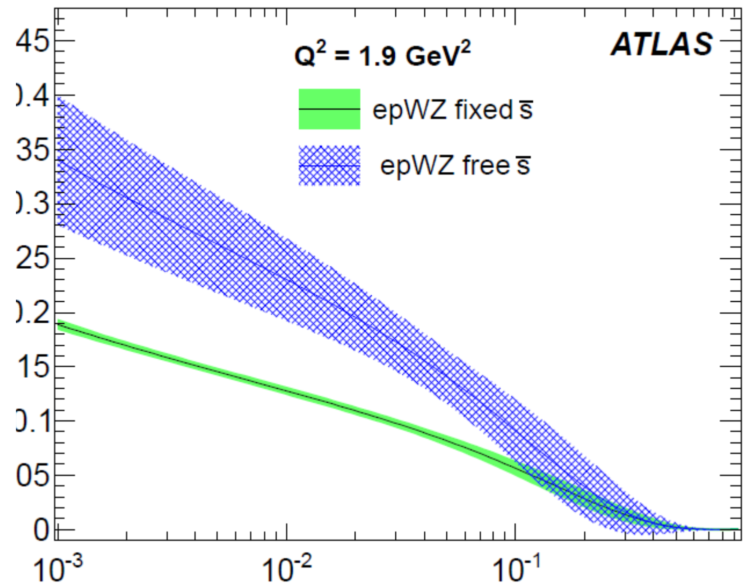
No need for ln(1/x) resummation or non-linear effects?

3.
Many presentations on fits using BFKL (Salas) and/or saturation (kutak) show successful fits BUT is tihis definitve evidence?

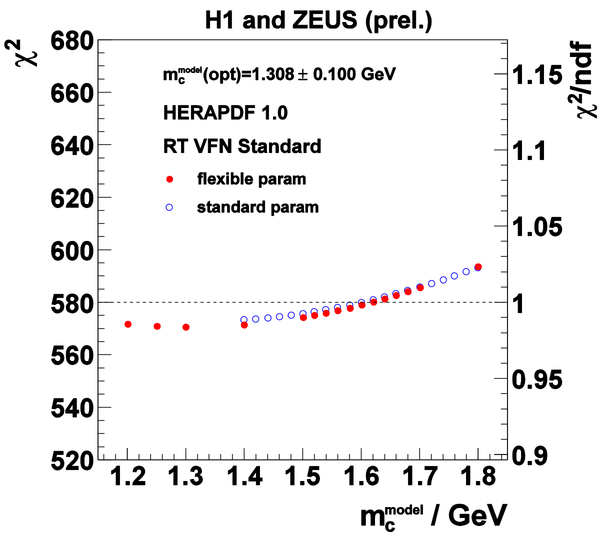
Where should be look for the ‘smoking gun’? CMS jforward ets? What observables?

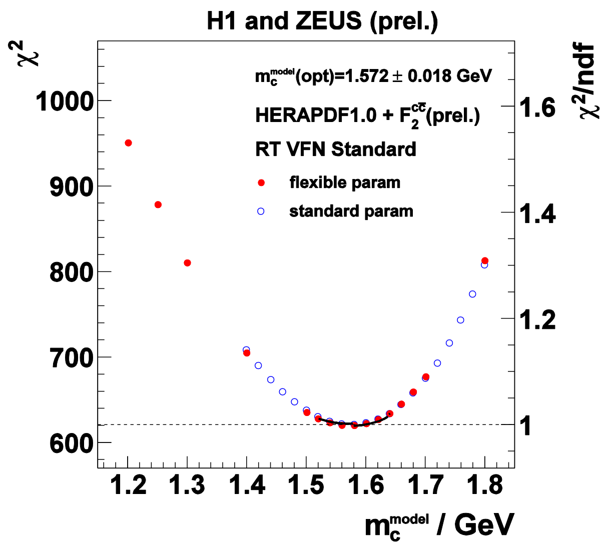
ATLAS strange is in tension with strange from di-muons?

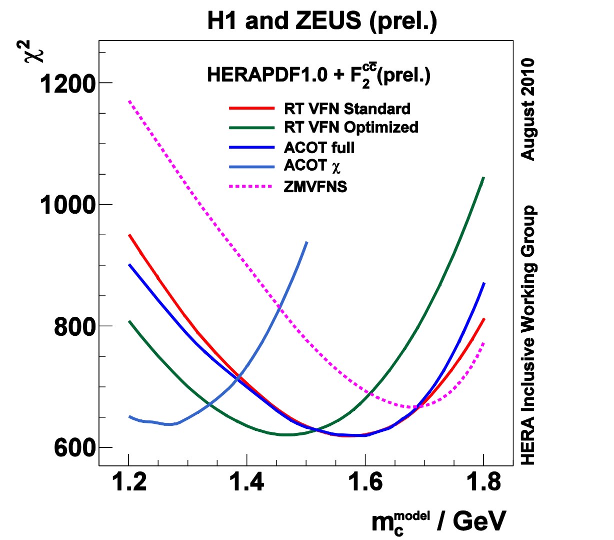




We have also made specific studies of the addition of the HERA combined F2charm data (ZEUS prel 10- 009,H1prelim 10 -045)

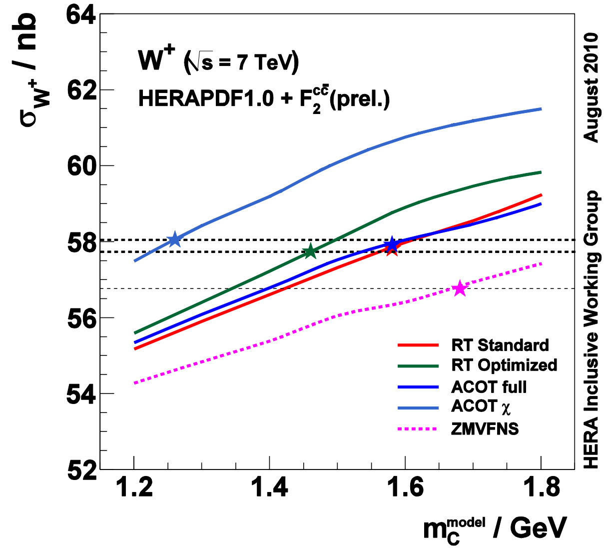






In HERAPDF1.0,1.5 we present a model uncertainty of mc 1.35 to 1.65 GeV on the charm mass . The inclusive data have no sensitivity to mc (left). The combined charm data do (middle). However the value depends on the scheme chosen to calculate the heavy quark contributions (right). All schemes bar the Zero Mass Variable Flavour Number have equally acceptable χ2

The use of the optimal charm mass for the chosen scheme has consequences for the predictions of LHC W, Z cross sections.



The charm data will help to reduce uncertainties