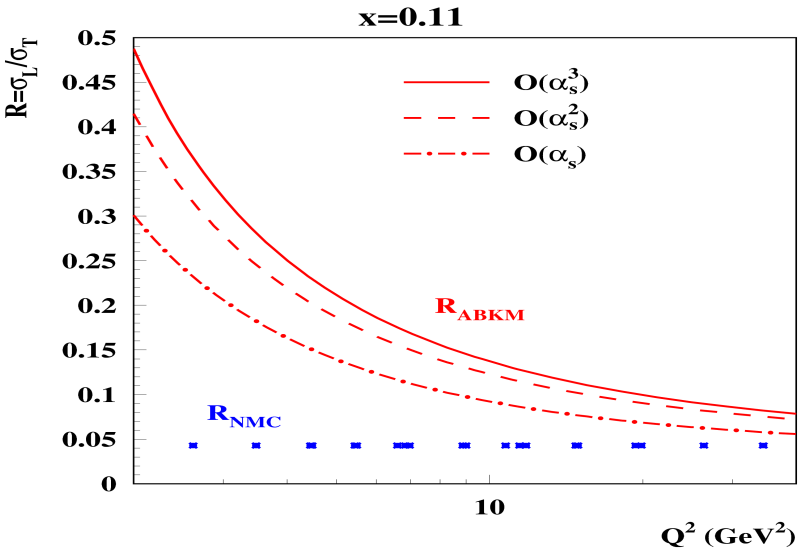
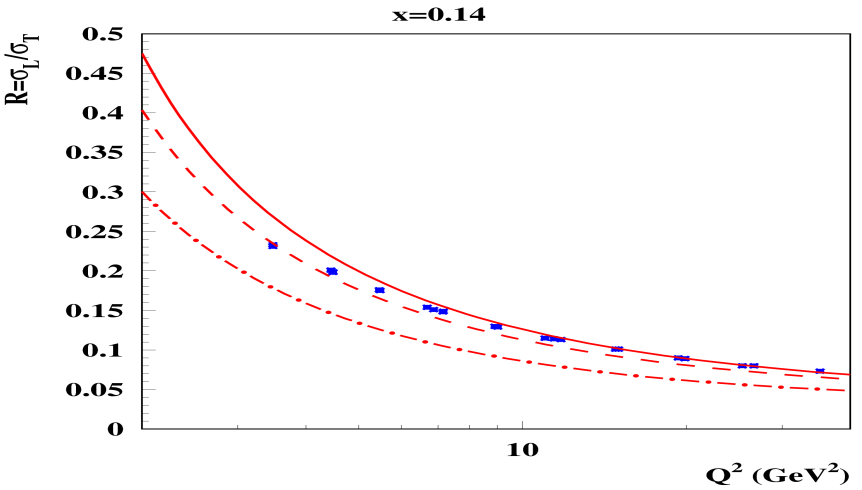
Value of R and α_s





sa, Blümlein, Moch [hep-ph 1007.3657]

$\alpha_s(M_Z)$	$\alpha_s(M_Z)$ with $\sigma_{\rm NMC}$	$\alpha_s(M_Z)$ with $F_2^{\rm NMC}$	difference
NLO	0.1179(16)	0.1195(17)	$+0.0016 \simeq 1\sigma$
NNLO	**0.1135(14)**	0.1170(15)	$+0.0035 \simeq 2.3\sigma$
NNLO $+F_L$ at $O(\alpha_s^3)$	0.1122(14)	0.1171(14)	$+0.0050 \simeq 3.6\sigma$

- With a smooth model of R the value of α_s is smaller
- Effect rises from NLO to NNLO

M_H=165 GeV Tevatron

$\sigma(H)$	$\sigma(H)$ with $\sigma_{\rm NMC}$	$\sigma(H)$ with $F_2^{\rm NMC}$	difference
NLO	0.206(17) pb	0.225(18) pb	0.019 pb $\simeq 1.1\sigma$
NNLO	**0.253(22) pb**	0.309(24) pb	0.056 pb $\simeq 2.3\sigma$
NNLO $+F_L$ at $O(\alpha_s^3)$	0.242(22) pb	0.310(24) pb	0.068 pb $\simeq 2.8\sigma$

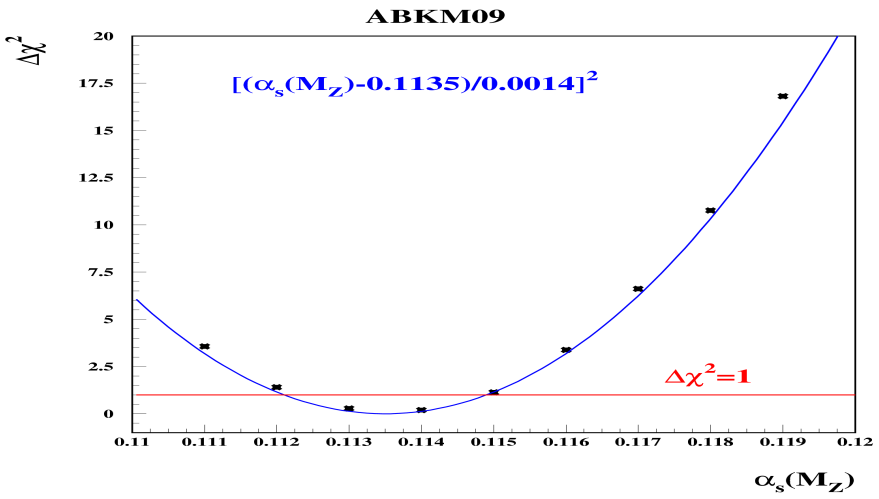
MSTW reanalysis

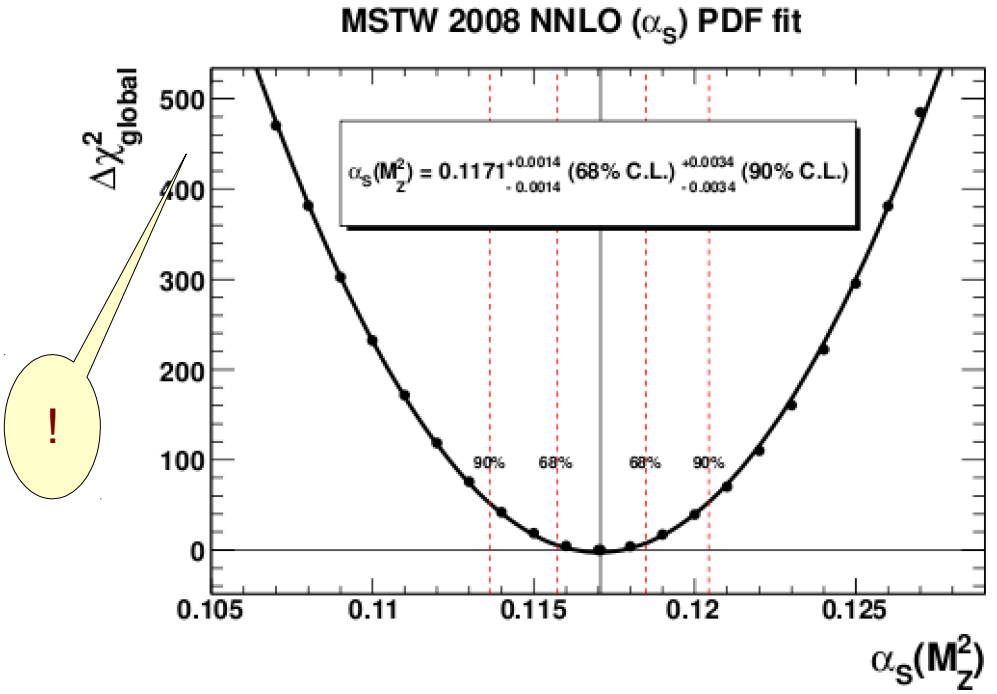
Thorne, Watt hep-ph/1106.5789

The shift in $\alpha_s(M_z)$ is small: 0.1171 → 0.1167

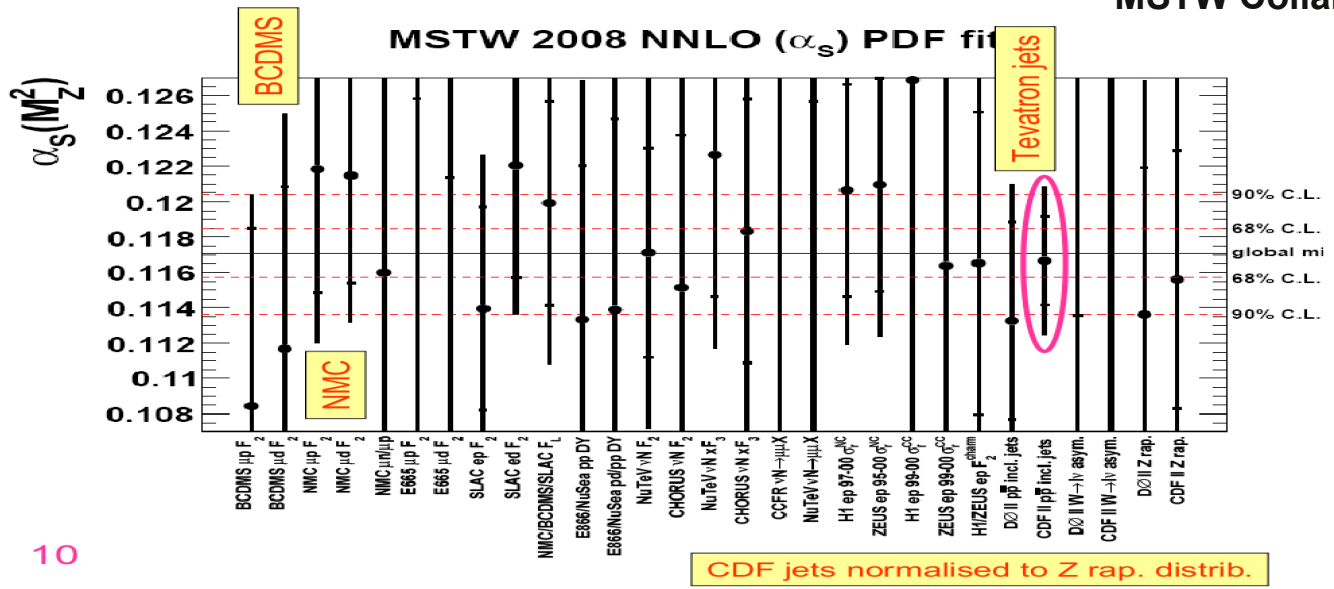
In the MSTW fit α_s is more constrained:

- the high-twist terms set to 0
- impact of the jet data





MSTW Collaboration EPJC 64, 653 (2009)

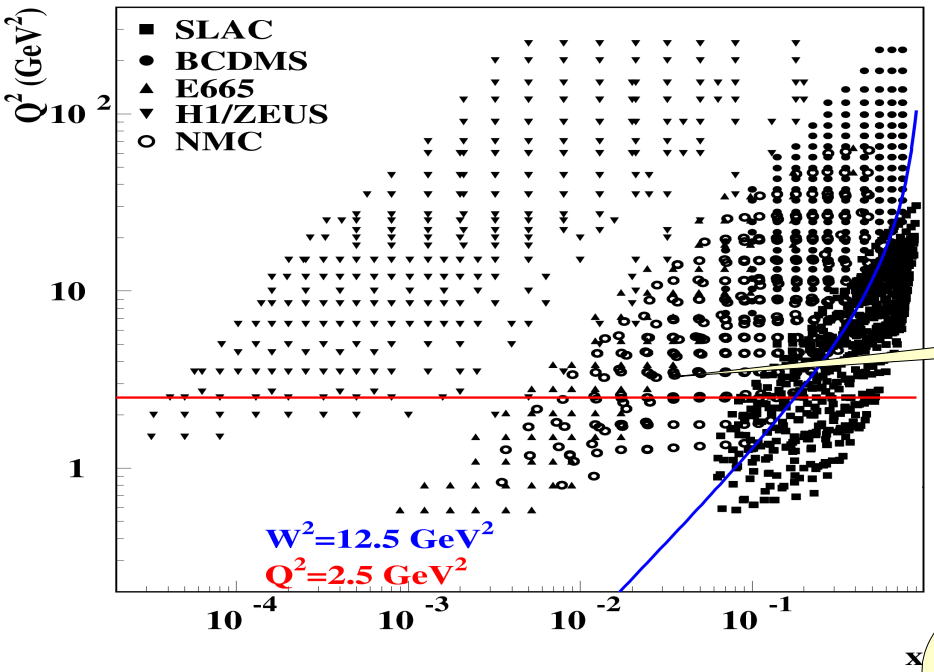


CDF jets normalised to Z rap. distrib.

Some features of AB(K)M fit

- The cross sections are used for all DIS data sets : HERA, NMC, SLAC, BCDMS
- The leading-twist and high-twist terms are separated both for F_2 and F_T
- The error correlations are taken into account if available

High-twist terms in DIS

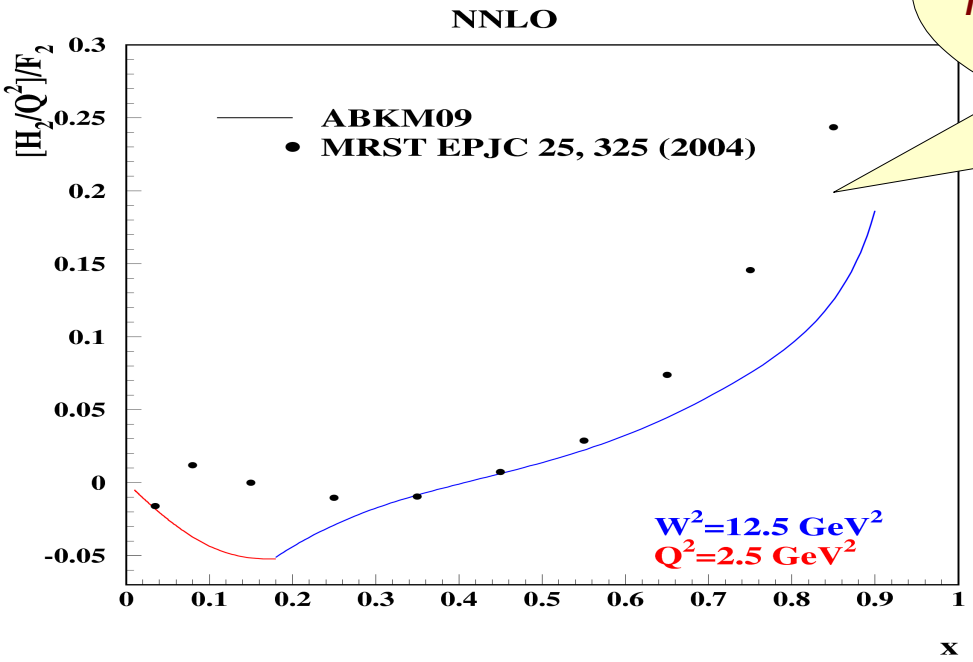


At small Q and /or W the high-twist (HT) terms give substantial contribution. One can try to get rid of them with a “safe” cut on W:

Is not removed with the “safe” cut on W

The selection of W_{at} is unclear due to fluctuations

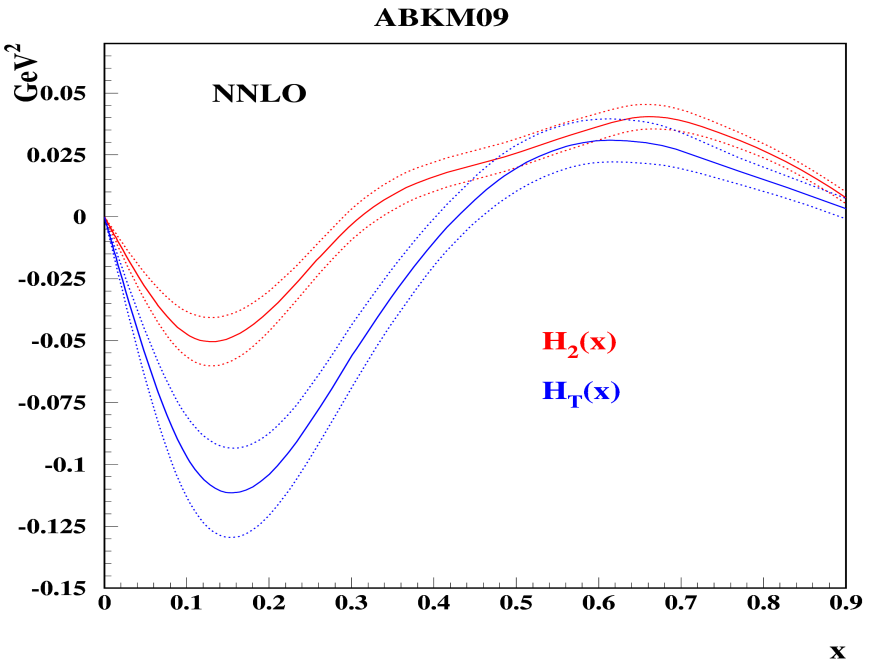
In the data → the HT terms are essential at the border of kinematics left after the cut

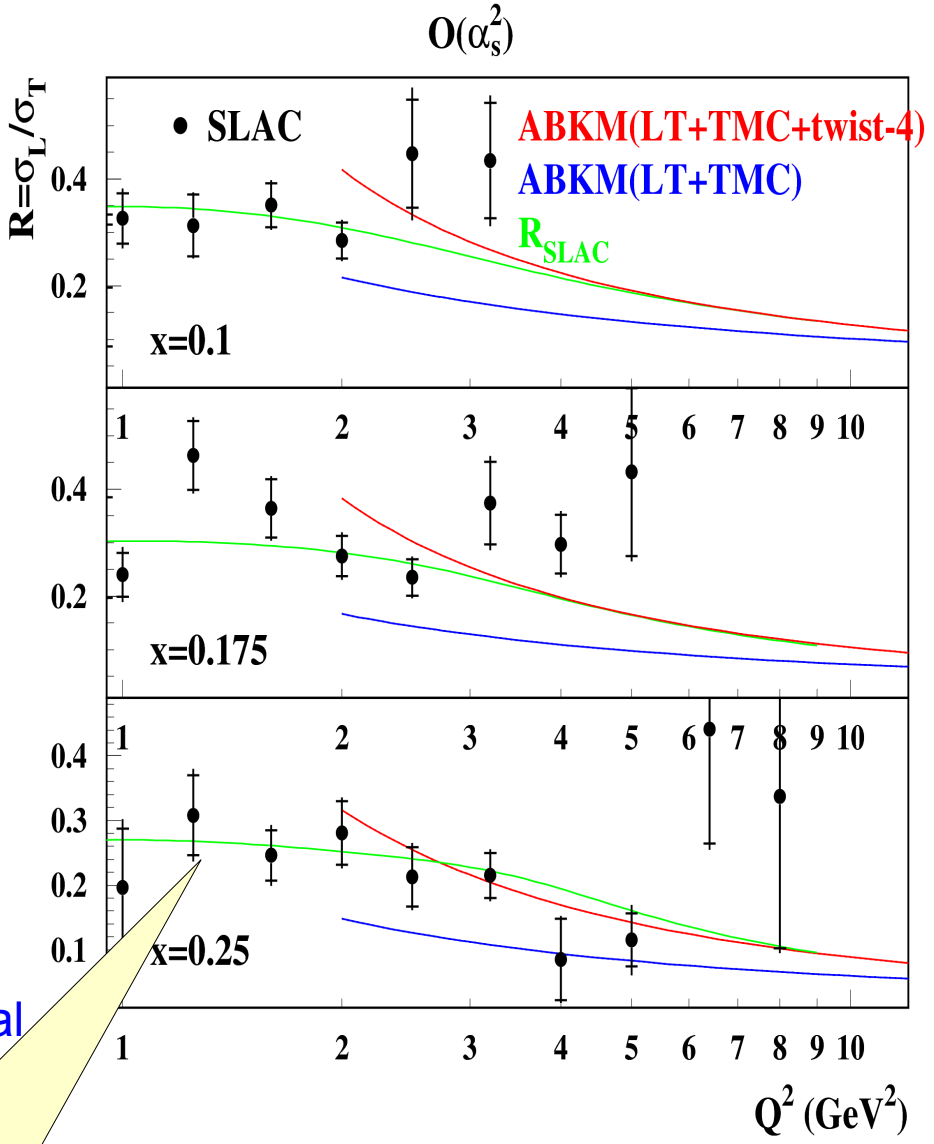


In the ABKM fit the twist-4 terms are fitted simultaneosly with the leading-twist PDFs → consistent separation:

$$F_{2T} = F_{2T}(LT) + H_{2T}(x)/Q^2$$

High-twist terms in ABKM fit





At x~0.1 the twist-4 terms in F_T are important:

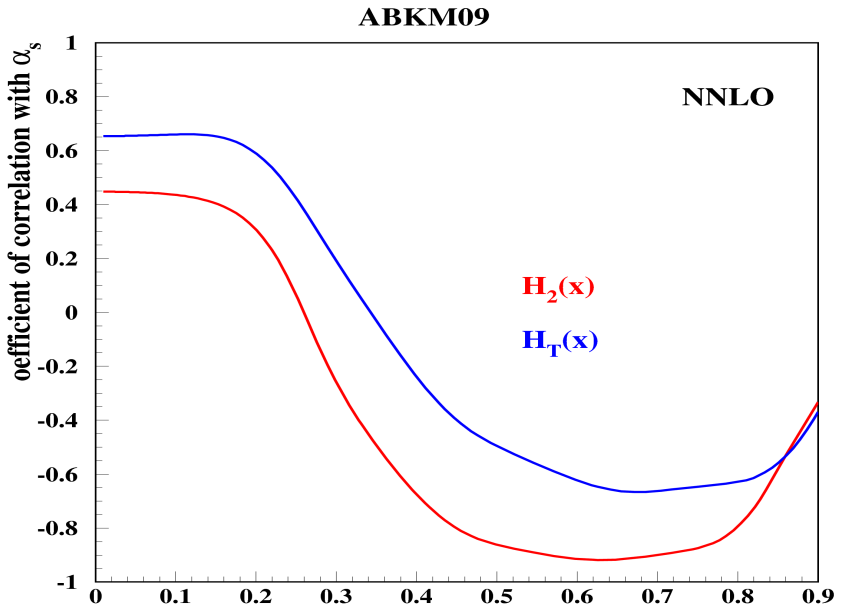
- In the ABKM fit they give about half of the total value of R at the SLAC kinematics

Twist-6 terms are necessary?

sa, Kulagin, Petti [hep-ph 0710.0124]

A verification of the SLAC data is highly desirable

Correlation of α_s with twist-4 terms



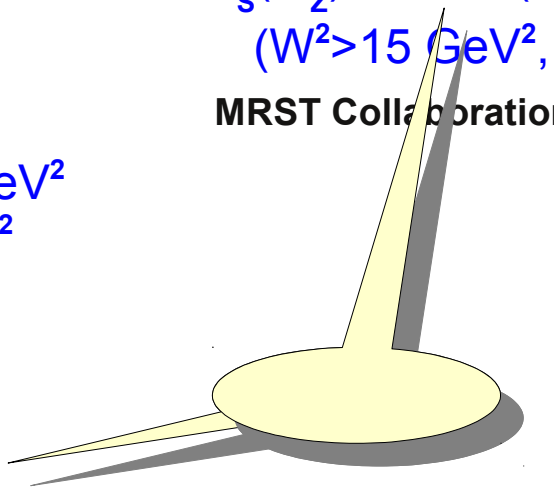
The value of α_s and twist-4 terms are strongly correlated

- With HT=0 the errors are reduced → no uncertainty due to HTs
- With account of the HT terms the value of α_s is stable with respect to the cuts
- With the HT terms fitted the fit is sensitive to the ansatz details

ABM: $\alpha_s(M_z)=0.1134(11)$ (NNLO)
($W>1.8$ GeV, $Q^2>2.5$ GeV^2, fitted twist-4 terms in F_{2T})

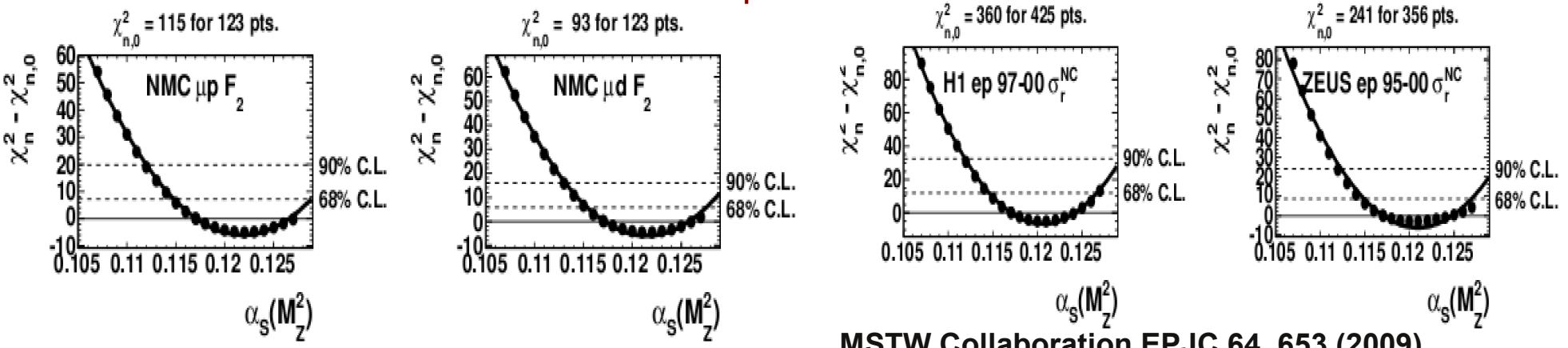
MRST: $\alpha_s(M_z)=0.1153(20)$ (NNLO)
($W^2>15$ GeV^2, $Q^2>10$ GeV^2)
MRST Collaboration EPJC 35, 325 (2004)

	$W^2>12.5$ GeV^2 $Q^2>2.5$ GeV^2	$W^2>12.5$ GeV^2 $Q^2>10$ GeV^2
HT fixed	0.1125(7)	0.1125(10)
HT=0	0.1168(7)	0.1143(10)



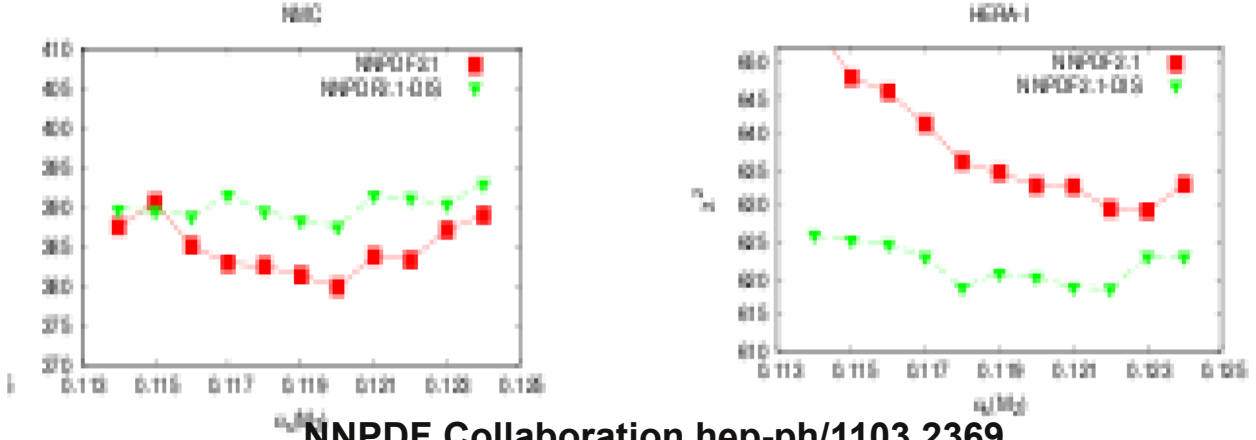
Very stringent cut is necessary for the fit with HT=0, otherwise α_s is pushed up

The HERA and NMC errors are combined in quadrature



MSTW Collaboration EPJC 64, 653 (2009)

The error correlations are taken into account



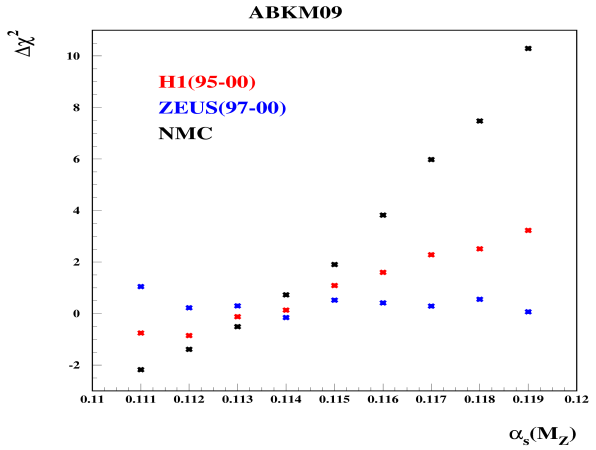
NNPDF:

$\alpha_s(M_z) = 0.1177(9)$ DIS / NLO

ABKM09: 0.1179(16) NLO

NNPDF Collaboration hep-ph/1103.2369

The error correlations are taken into account



With the errors combined in quadrature the HERA and NMC data prefer bigger value of α_s:

ABKM: $\alpha_s(M_z)$ 0.1135 → 0.1163 NNLO

The MSTW value of α_s is pushed up by the DIS data?

Modeling the MSTW ansatz

Shift in $\alpha_s(M_z)$ due to NMC data treatment:

ABKM09	+errors combined	+HT=0, W^2>12.5 GeV^2
+0.0035 :	+0014	**+0.0006**
		(compare with +0.0004 for MSTW)

The value of α_s is pushed up → reduced sensitivity to the ansatz?

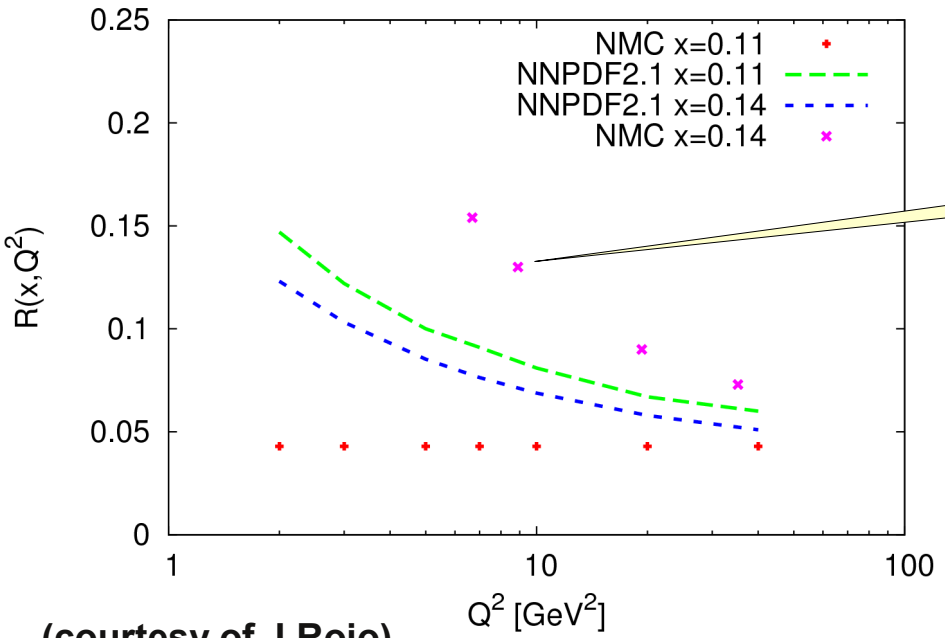
Further cross-checks desirable from MSTW:

- Take into account the error correlations
- Try the DIS cross sections instead of structure functions

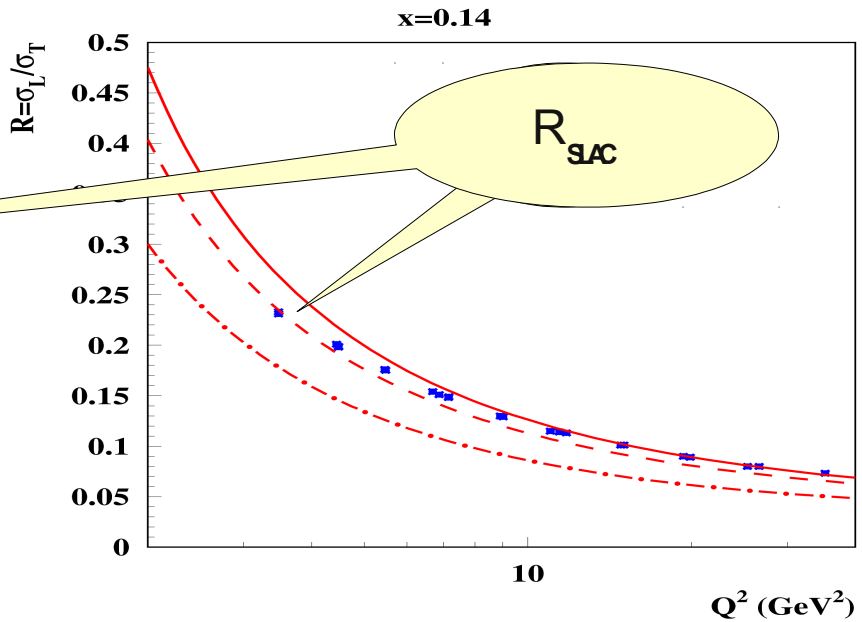
From our side we want to check sensitivity of the of our fit to the value of α_s with the MSTW shape of PDFs → check of the PDF flexibility

NNPDF reanalysis

NNPDF Collaboration hep-ph 1102.3182



(courtesy of J.Rojo)



sa, Blümlein, Moch [hep-ph 1101.5261]

- The NNPDF model of R doesn't match with the SLAC parameterization – *the high-twist terms are essential*

$$R^{\rm fit} = \frac{b_1}{\ln(Q^2/\Lambda^2)}\Theta(x,Q^2) + \frac{b_2}{Q^2} + \frac{b_3}{Q^4+0.3^2}$$

Whitlow et al. PLB 250, 193 (1990)

- The published NNPDF analysis is performed in the NLO
- The correlation between α_s and gluons is not considered by NNPDF

Further cross check desirable from NNPDF: the values of R for full SLAC kinematics