# Validphys Report
# NNPDF revision 528M

The NNPDF Collaboration

February 5, 2013

## Contents



| VALIDPHYS 528M | **Current Fit** | **Reference** | **CTEQ** | **MSTW** |
|---|---|---|---|---|
| **PDF set name** | NNPDF23 nlo FFN NF5 as 0120 mc | NNPDF23 nlo FFN NF5 as 0120 | CT10nlo | MSTW2008nlo90c |

Table 1: Configuration file

## 1 Fit summary

- This is the description block, please update these lines before run.

| **Parameter** | **Current Fit** | **Reference Fit** |
|---|---|---|
| $\chi^2_{\rm tot}$ (exp) | 1.15 | 1.09 |
| $\langle E\rangle \pm \sigma_E$ | 2.21±0.06 | 2.21±0.06 |
| $\langle E_{\rm tr}\rangle \pm \sigma_{E_{\rm tr}}$ | 2.17±0.09 | 2.17±0.09 |
| $\langle E_{\rm val}\rangle \pm \sigma_{E_{\rm val}}$ | 2.25±0.08 | 2.25±0.08 |
| $\langle {\rm TL}\rangle \pm \sigma_{\rm TL}$ | 18539±6918 | 18539±6918 |
| $\langle \chi^{2(k)}\rangle \pm \sigma_{\chi^{2(k)}}$ | 1.17±0.07 | 1.16±0.08 |
| $\langle \sigma^{(\rm exp)}\rangle_{\rm dat}$ | 14.89% | 14.89% |
| $\langle \sigma^{(\rm net)}\rangle_{\rm dat}$ | 2.89% | 3.09% |
| $\langle \rho^{(\rm exp)}\rangle_{\rm dat}$ | 3.81e-01 | 3.81e-01 |
| $\langle \rho^{(\rm net)}\rangle_{\rm dat}$ | 6.10e-01 | 5.87e-01 |
| $\langle {\rm cov}^{(\rm exp)}\rangle_{\rm dat}$ | 1.87e+08 | 1.87e+08 |
| $\langle {\rm cov}^{(\rm net)}\rangle_{\rm dat}$ | 1.09e+06 | 8.89e+05 |
| $x\Sigma + xg$ | 1.00600e+00±3.17845e-03 | 9.99715e-01±7.70332e-04 |
| $u_v$ | 2.00133e+00±1.30948e-02 | 2.00192e+00±1.45620e-02 |
| $d_v$ | 1.00130e+00±1.32110e-02 | 1.00240e+00±1.47082e-02 |
| $s_v$ | -1.10087e-03±3.49152e-03 | 4.66451e-06±1.07592e-05 |
| $xs_v$ | 2.34501e-03±1.64846e-03 | 3.58400e-03±2.08038e-03 |
| $K_s$ | 3.34251e-01±6.90586e-02 | 2.84304e-01±7.70546e-02 |
| $\Delta_s$ | 1.39619e-01±3.50720e-02 | 1.39031e-01±3.53393e-02 |

Table 2: Summary.

# 2 Comparing PDFs

## 2.1 Distances

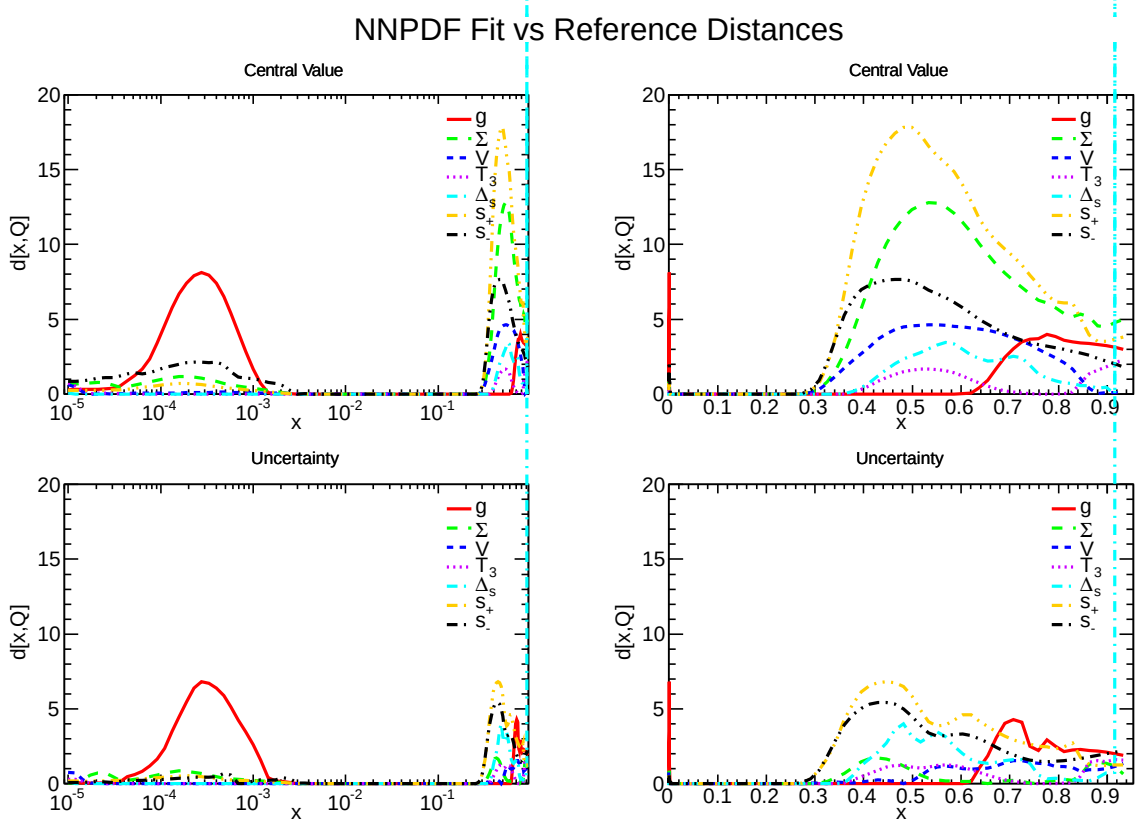


Figure 1: Distances in the fitting basis.

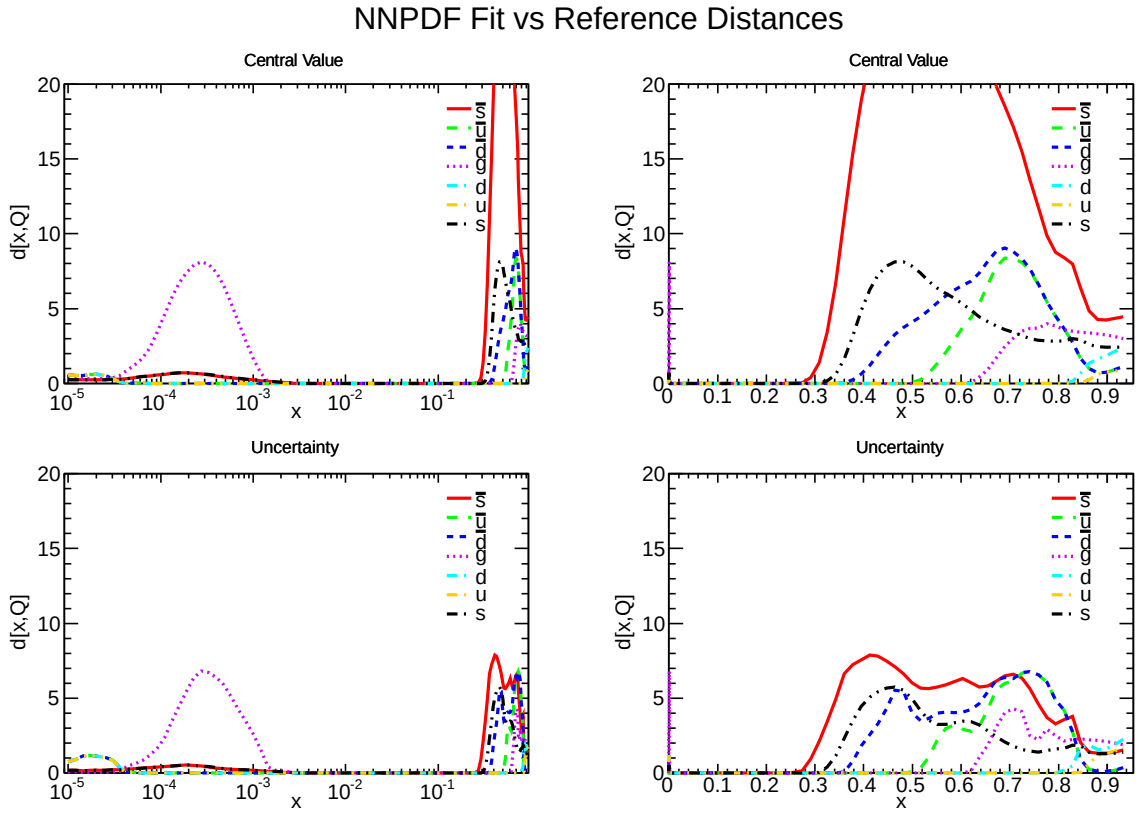


Figure 2: Distances in the flavour basis.

## 2.2 Comparing PDFs in evolution basis

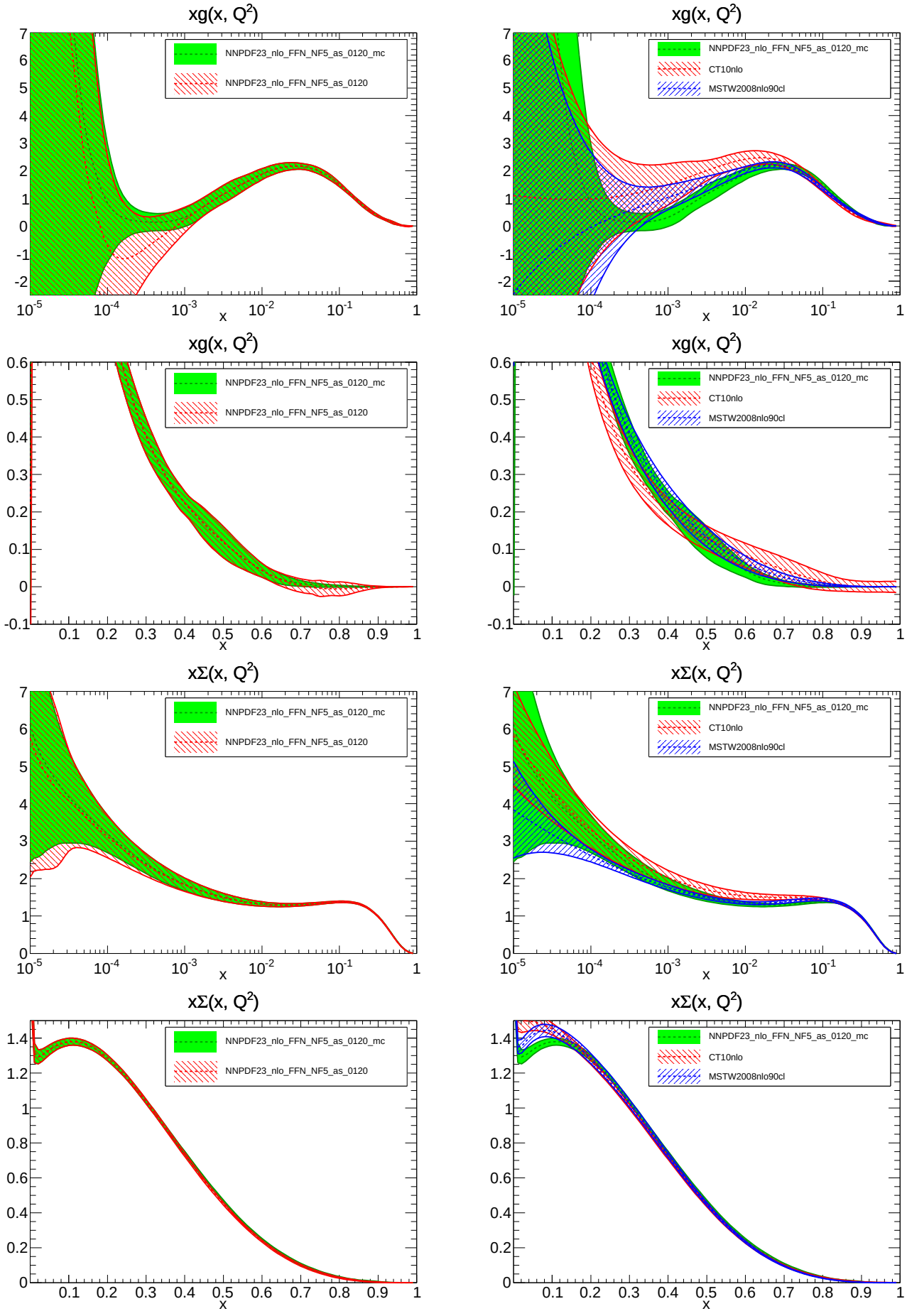


Figure 3: Comparison between PDFs at $Q^2 = 2.0e+00\,\mathrm{GeV}^2$.

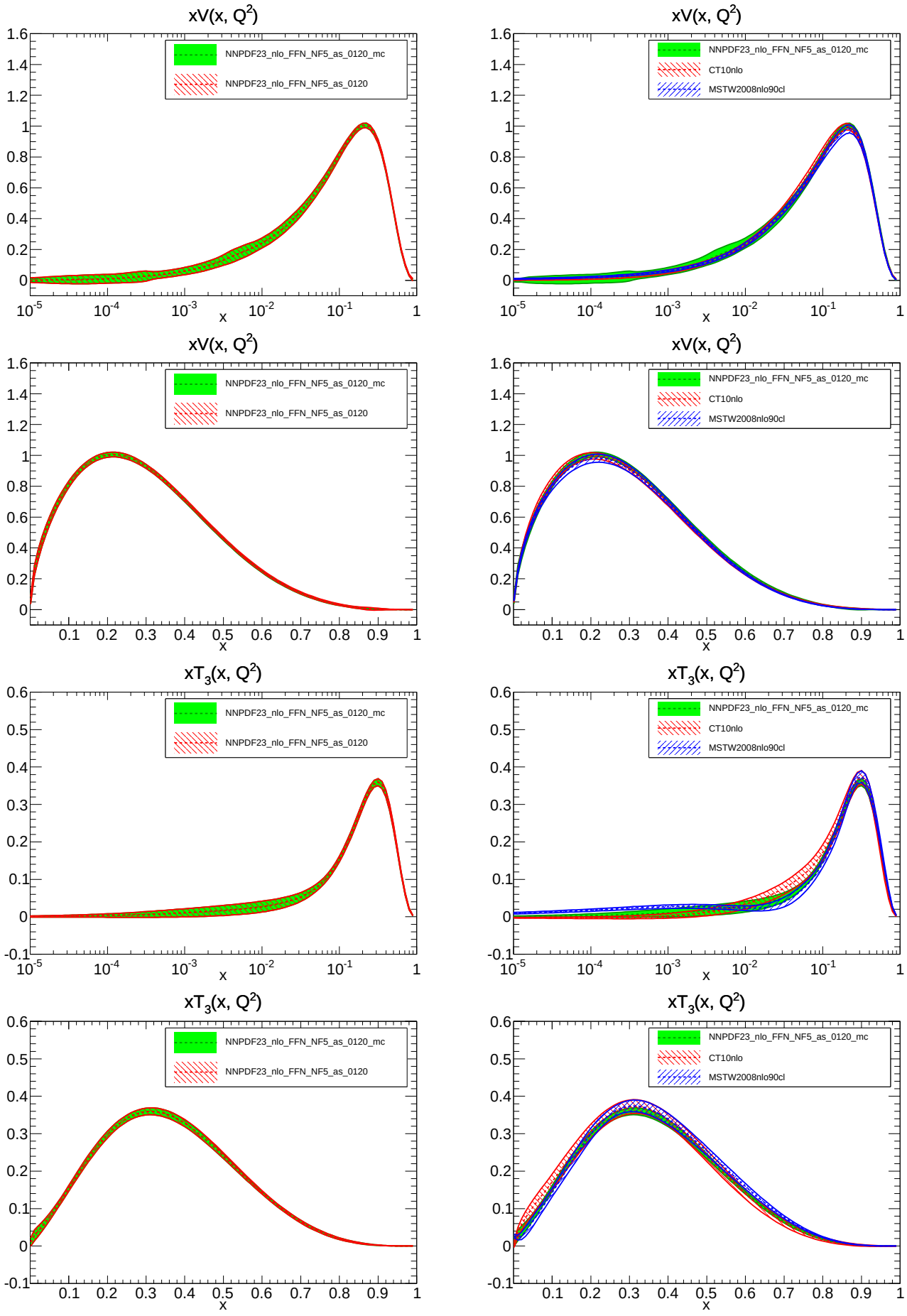


Figure 4: Comparison between PDFs at $Q^2 = 2.0e + 00\,\mathrm{GeV}^2$.

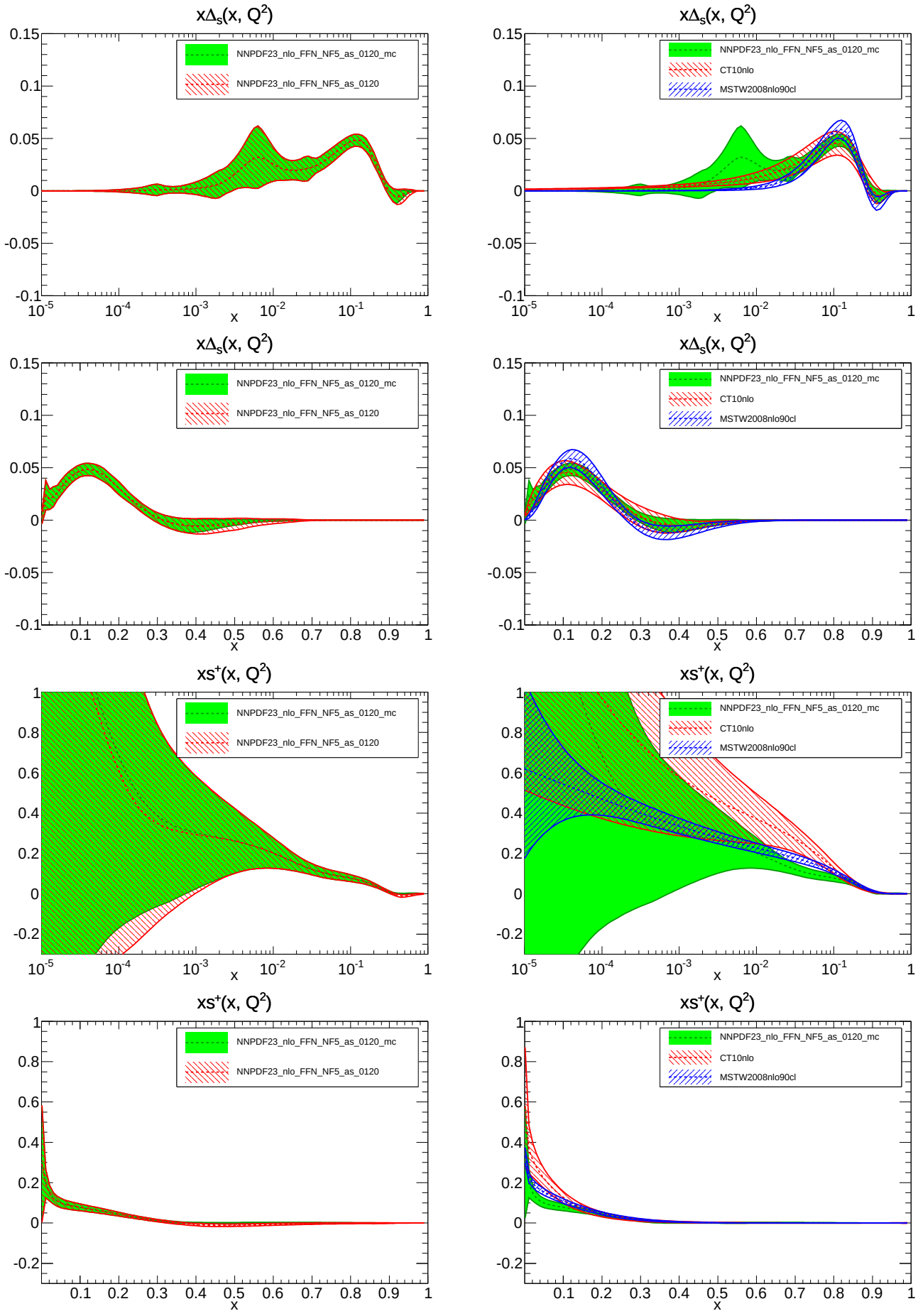


Figure 5: Comparison between PDFs at $Q^2 = 2.0e + 00\,\mathrm{GeV}^2$.

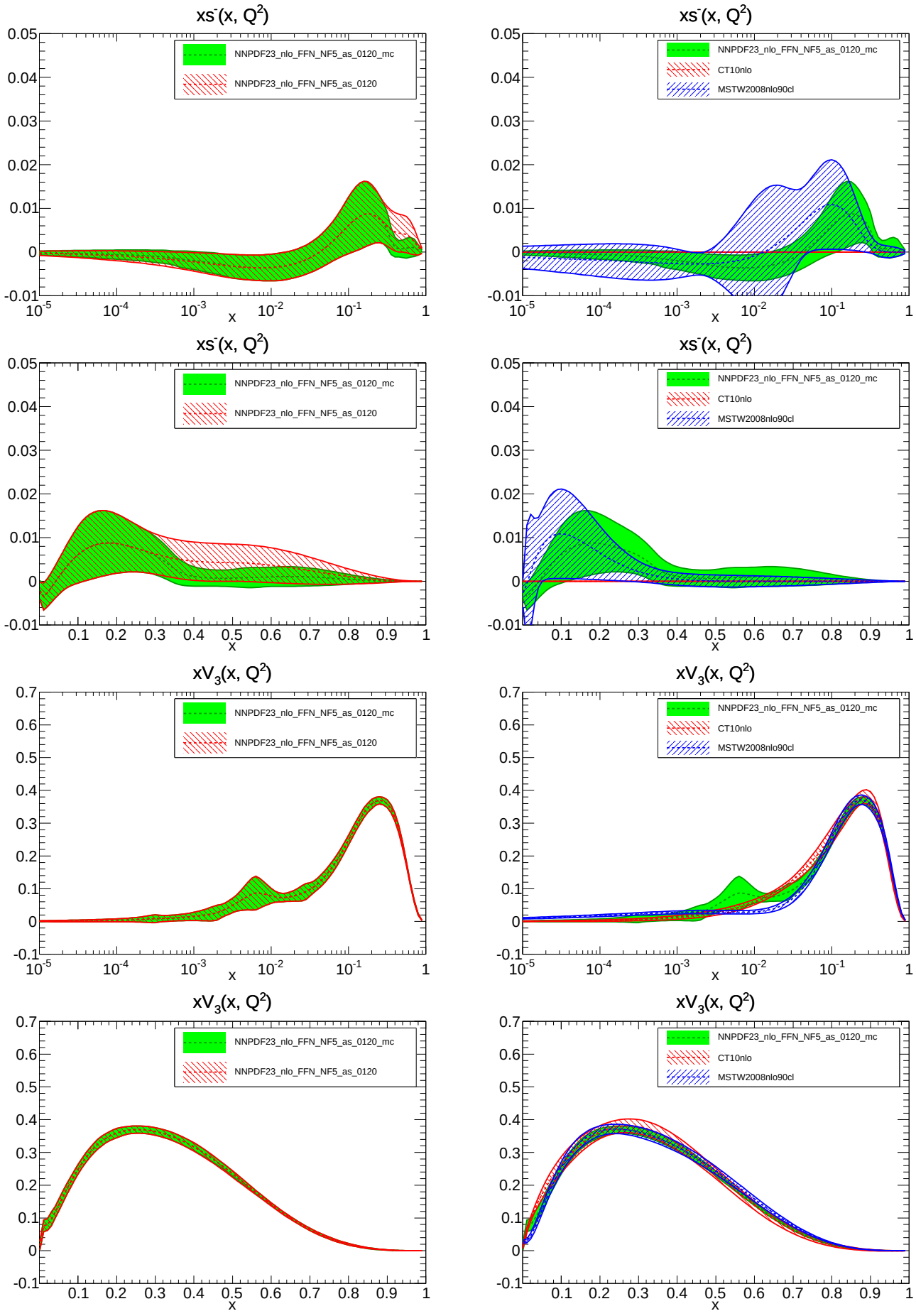


Figure 6: Comparison between PDFs at $Q^2 = 2.0e + 00\,\mathrm{GeV}^2$.

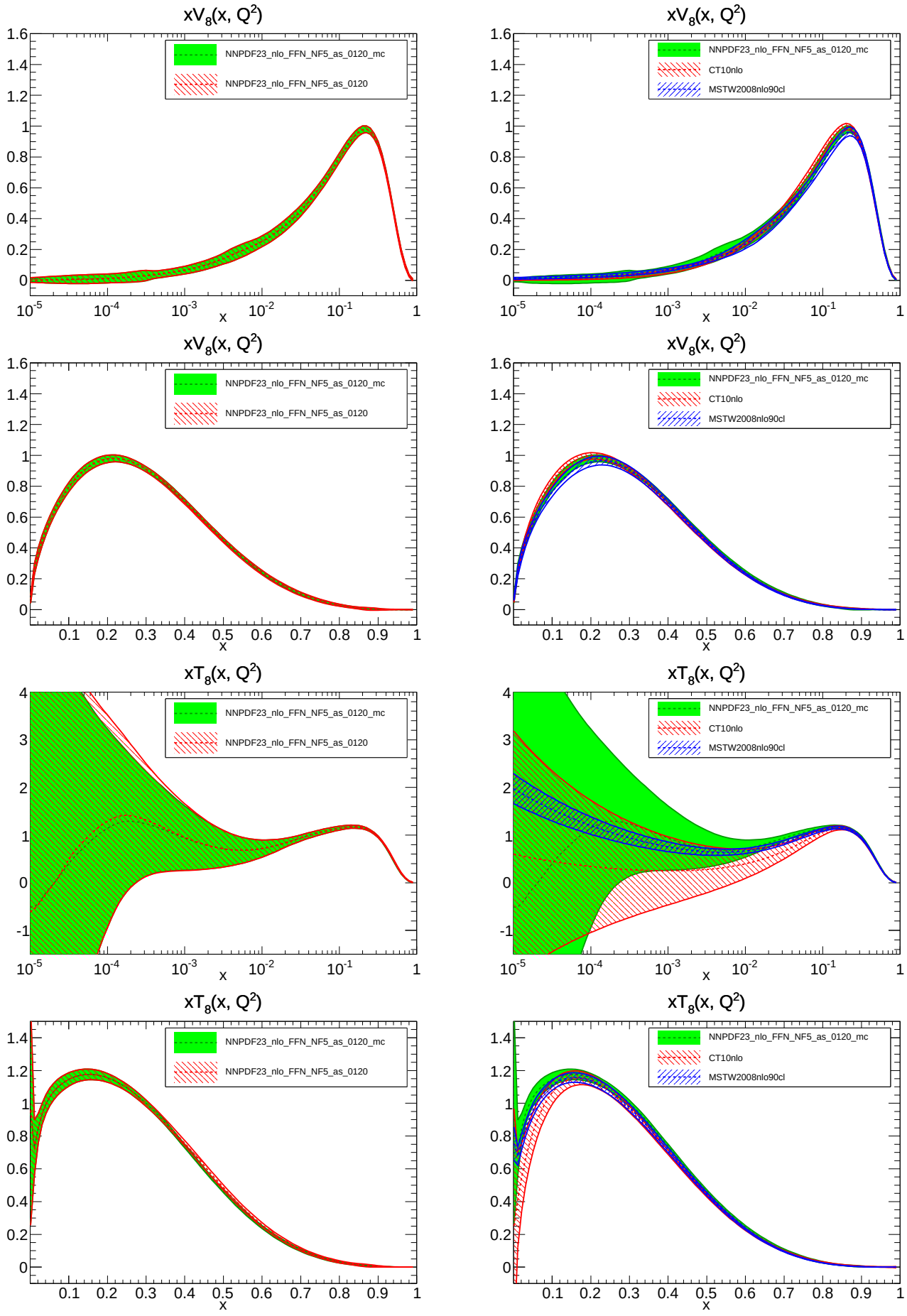


Figure 7: Comparison between PDFs at $Q^2 = 2.0e + 00\,\mathrm{GeV}^2$.

## 2.3 Comparing PDFs in LHA basis

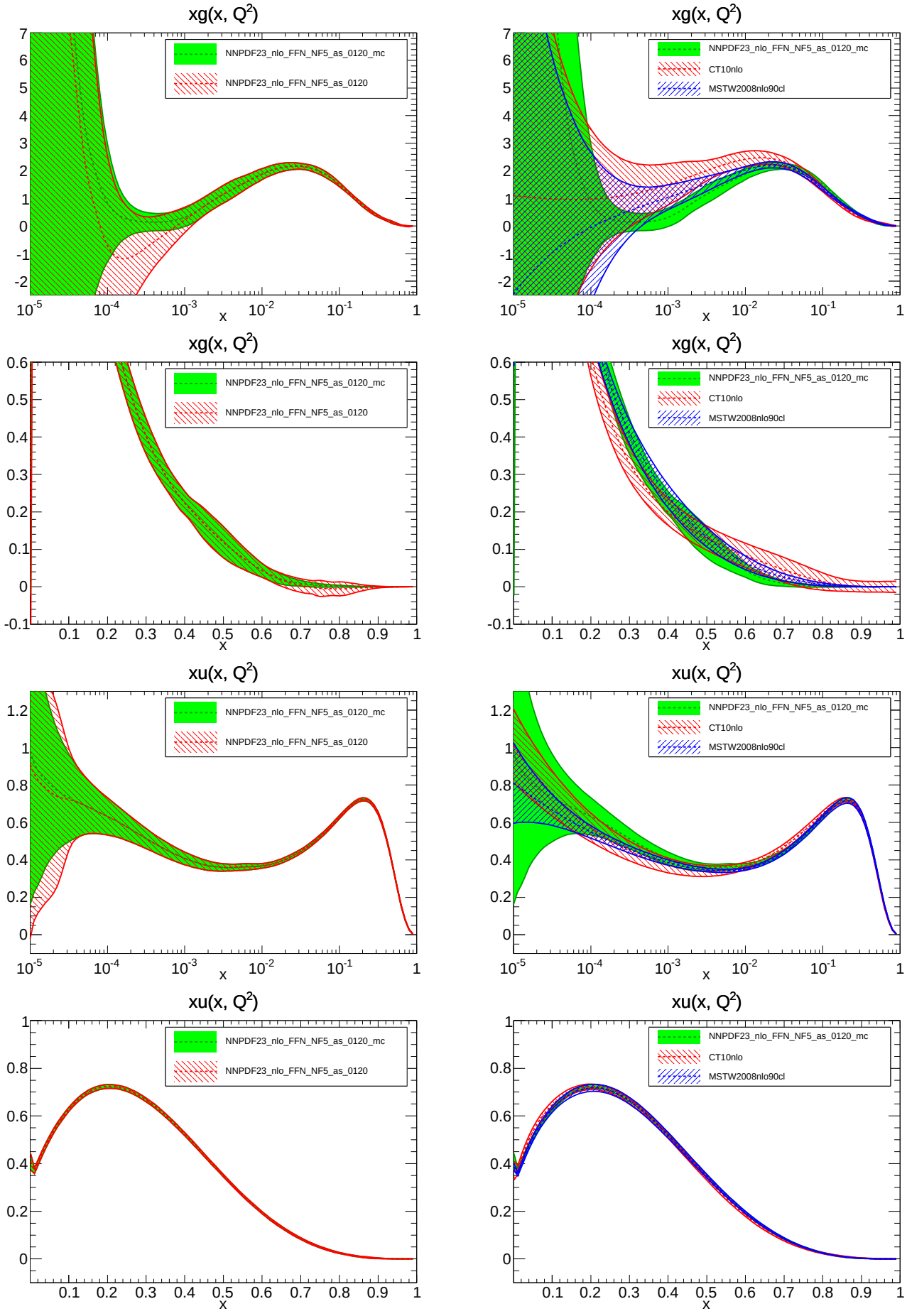


Figure 8: Comparison between PDFs at $Q^2 = 2.0e + 00\,\mathrm{GeV}^2$.

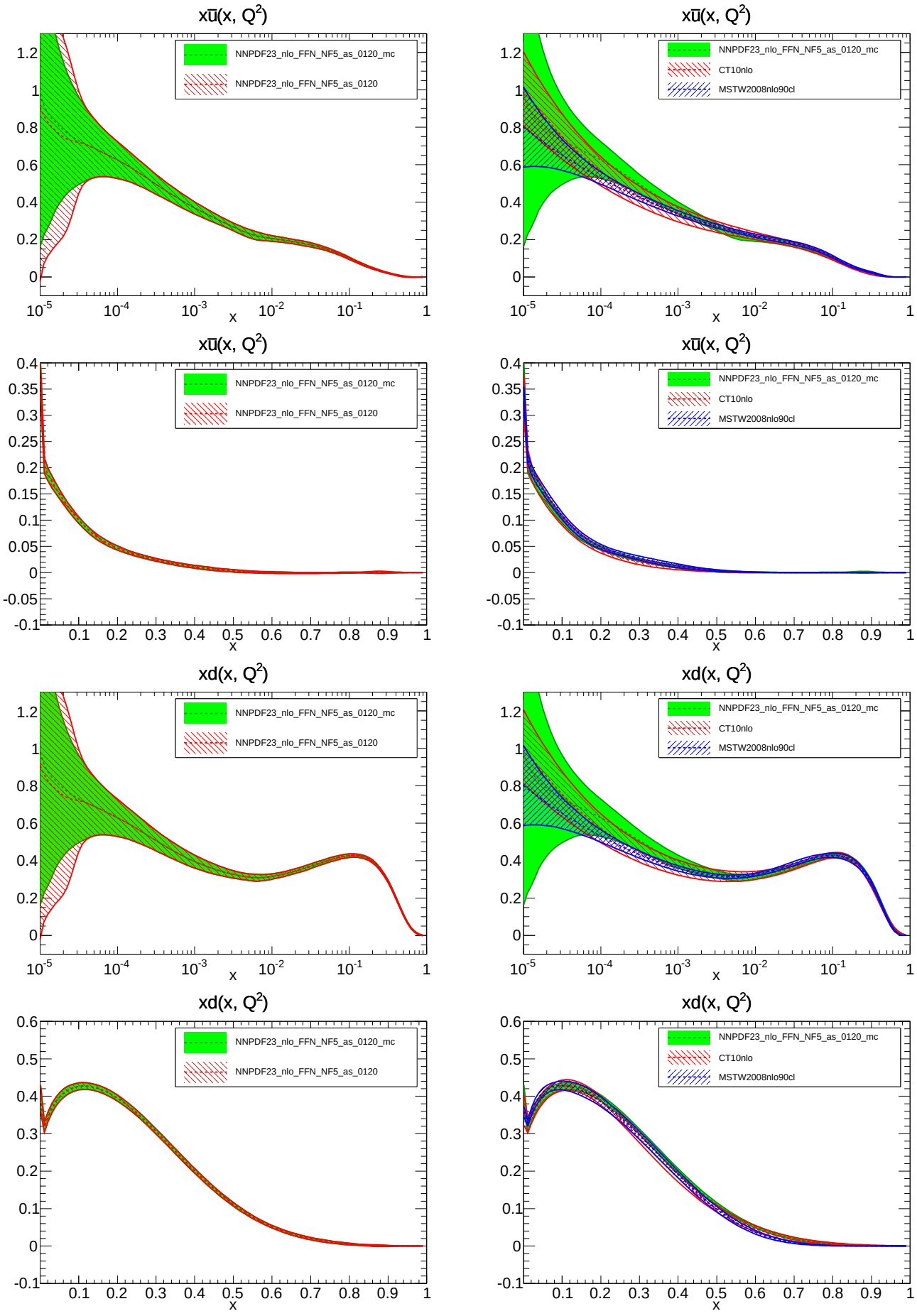


Figure 9: Comparison between PDFs at $Q^2 = 2.0e + 00\,\mathrm{GeV}^2$.

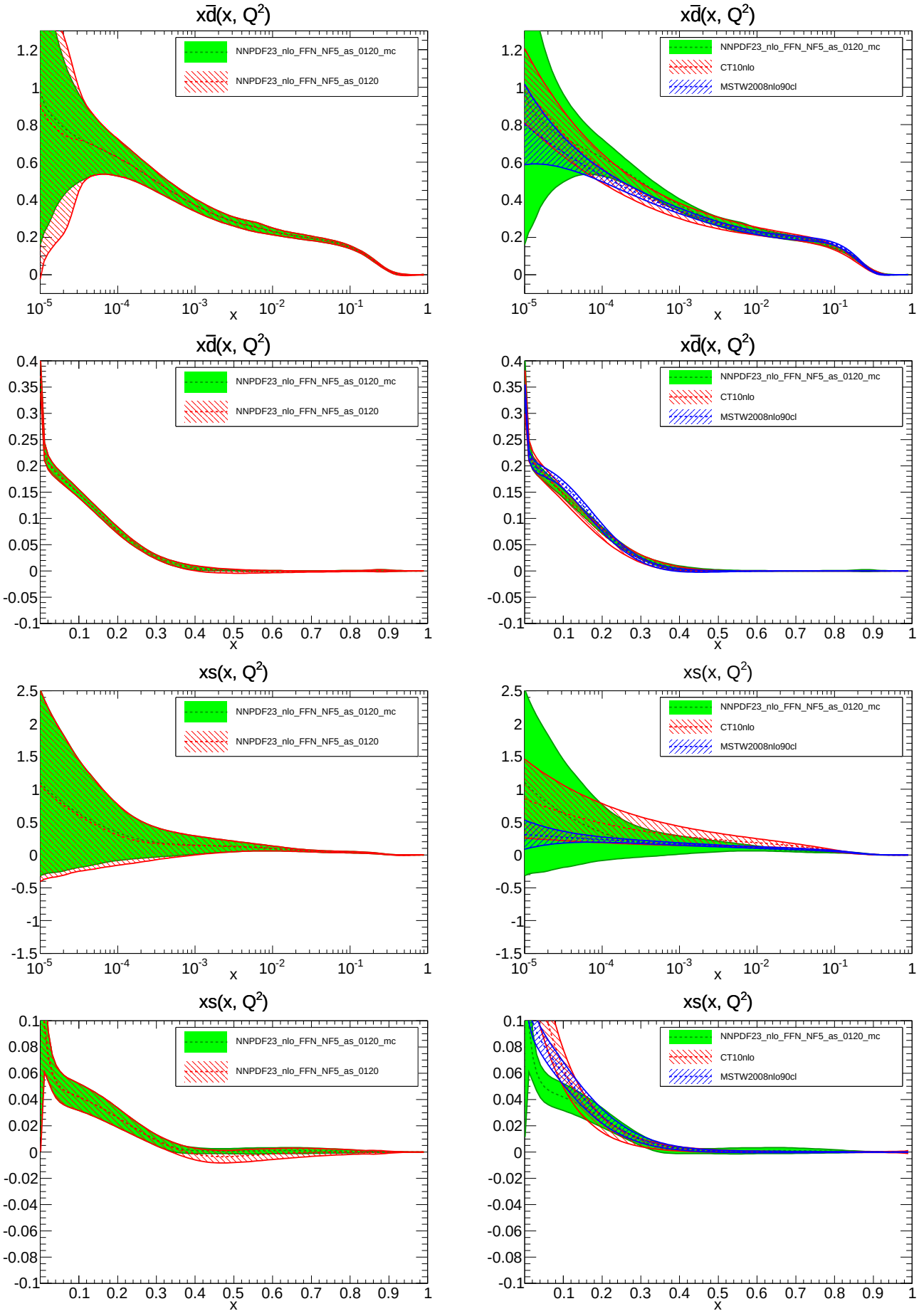


Figure 10: Comparison between PDFs at $Q^2 = 2.0e + 00\,\mathrm{GeV}^2$.

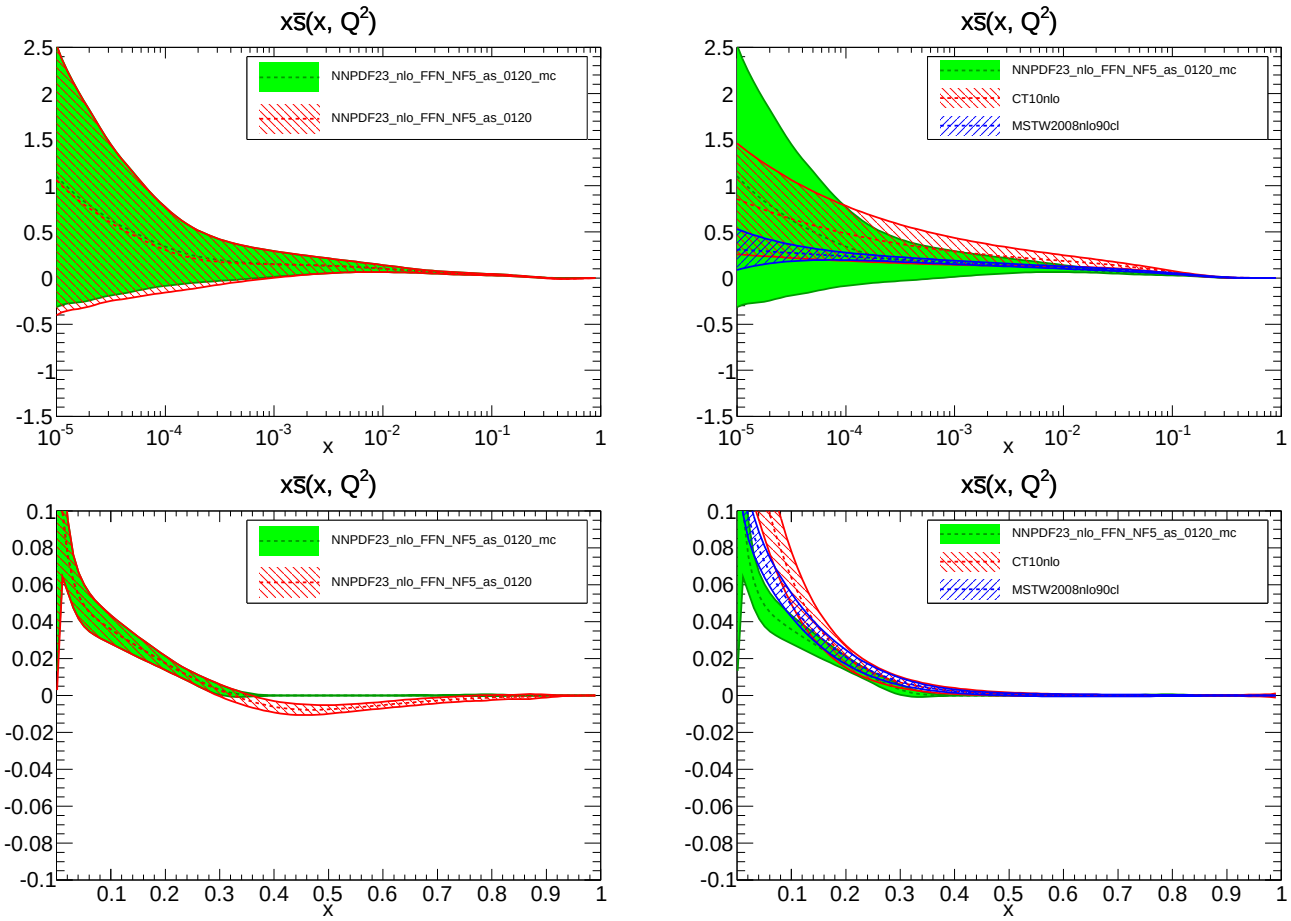


Figure 11: Comparison between PDFs at $Q^2 = 2.0e + 00\,\mathrm{GeV}^2$.

## 2.4 Replicas in the evolution basis

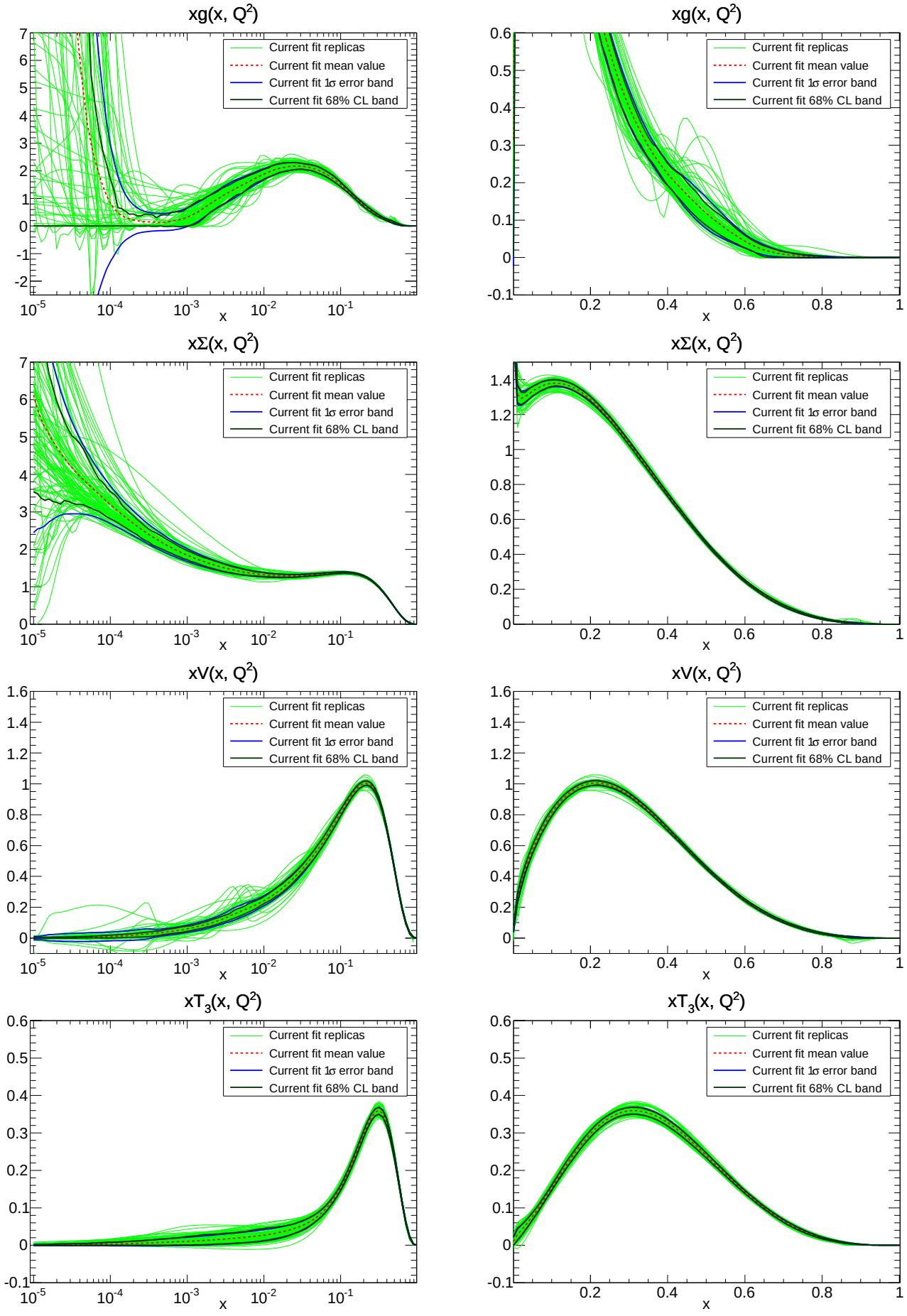


Figure 12: Current fit PDFs in the evolution basis at $Q^2 = 2.0e+00\,\mathrm{GeV}^2$.

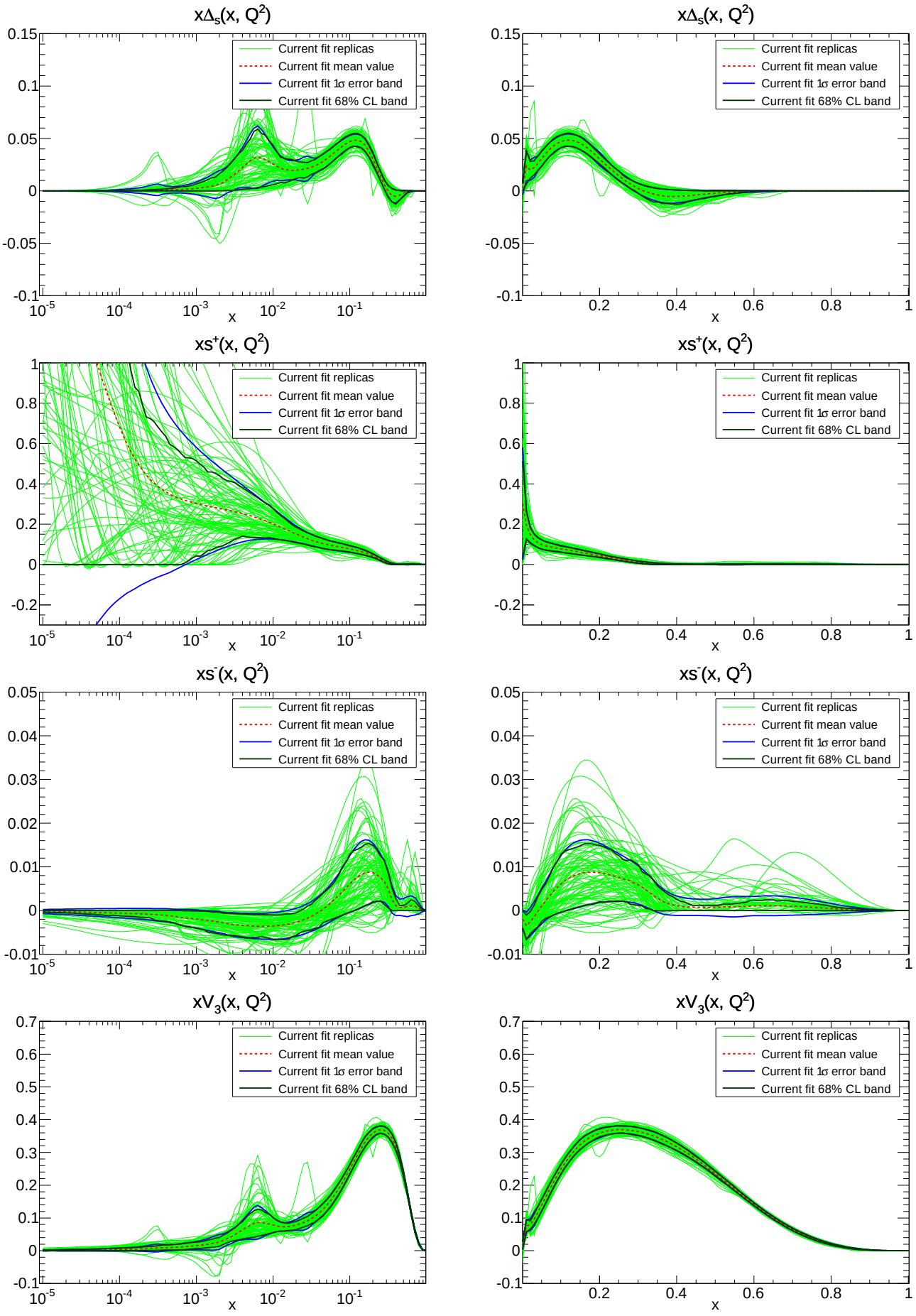


Figure 13: Current fit PDFs in the evolution basis at $Q^2 = 2.0e+00\,\mathrm{GeV}^2$.

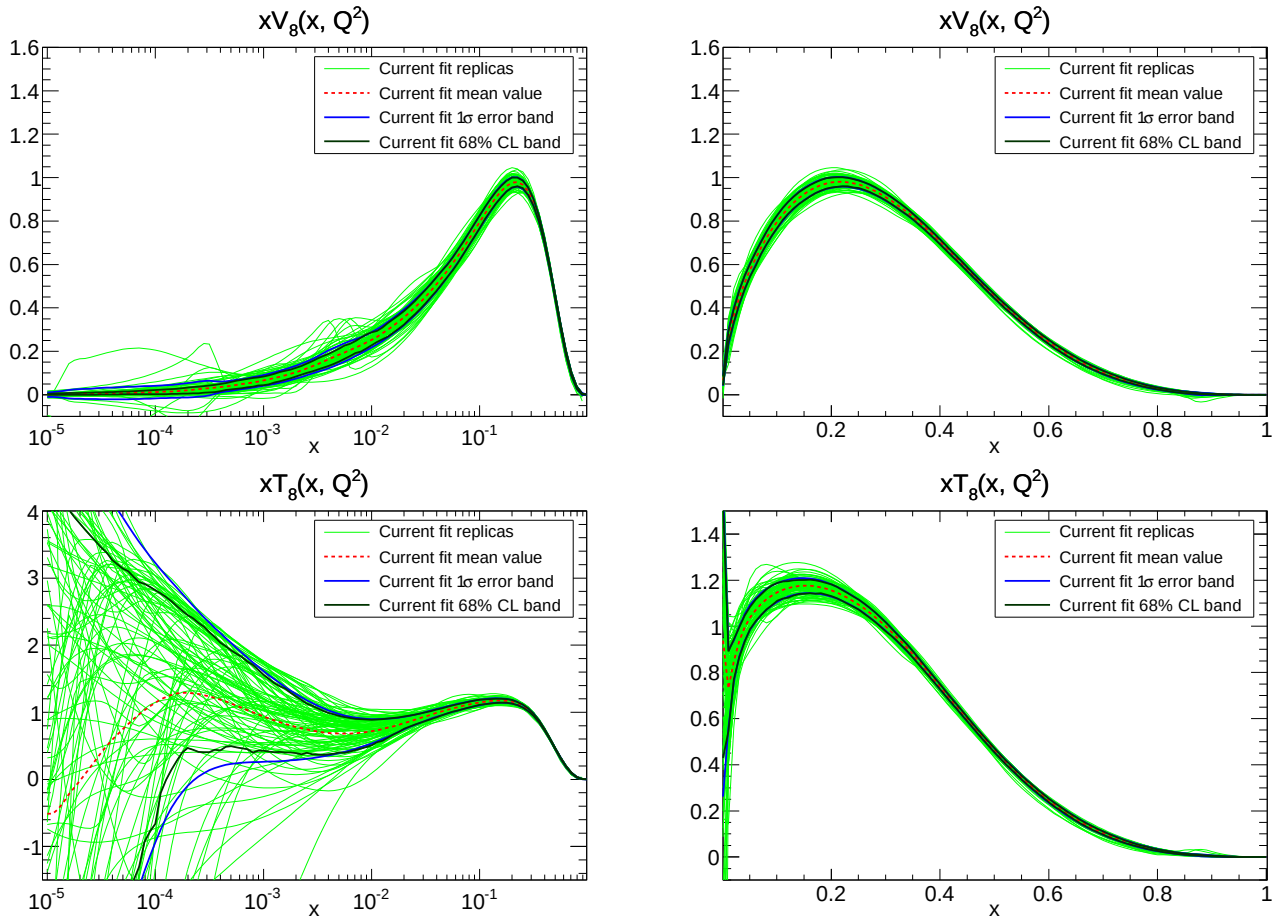


Figure 14: Current fit PDFs in the evolution basis at $Q^2 = 2.0e+00\,\mathrm{GeV}^2$.

## 2.5 Replicas in the LH basis

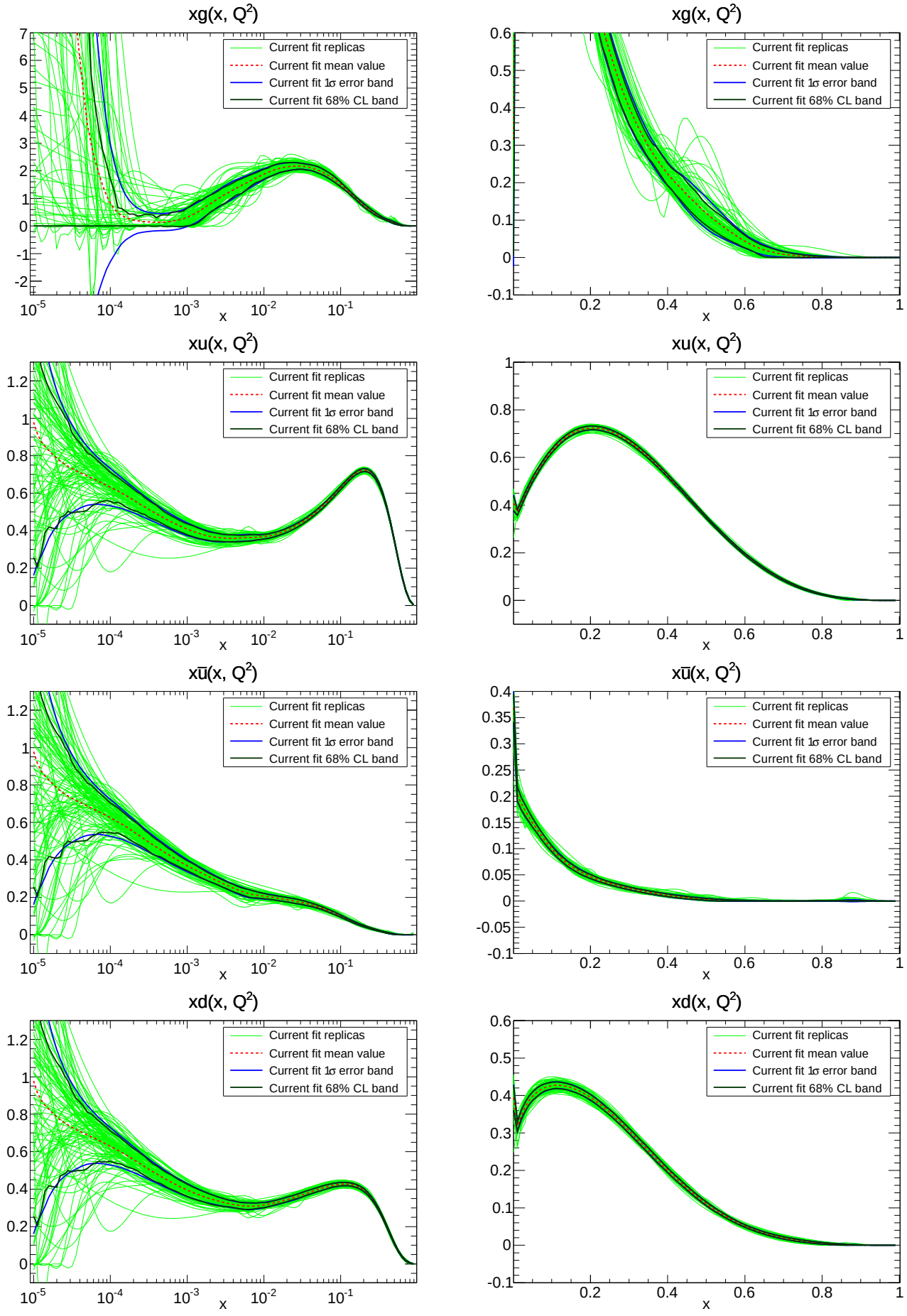


Figure 15: Current fit PDFs in the LH basis at $Q^2 = 2.0e+00\,\mathrm{GeV}^2$.

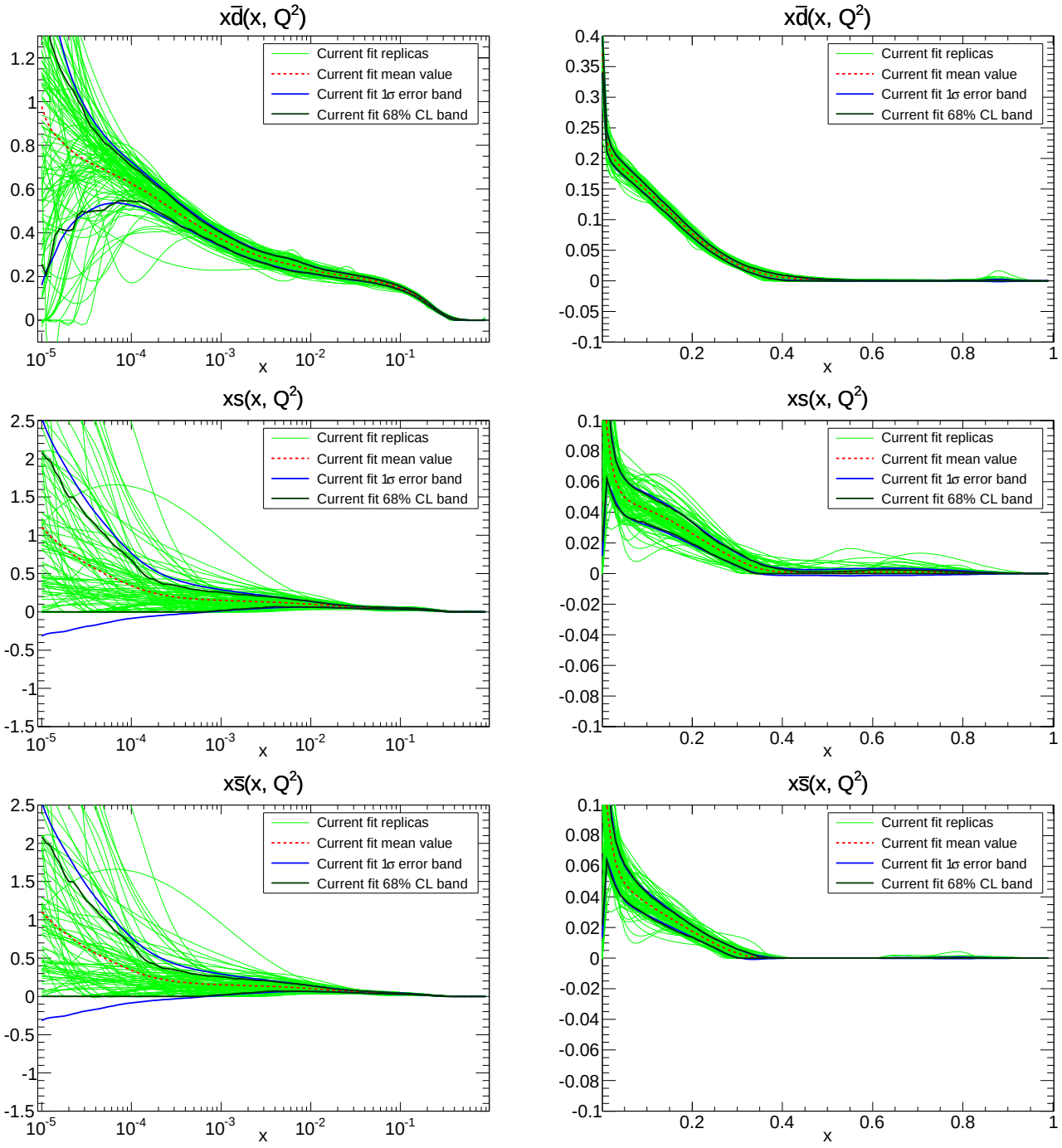


Figure 16: Current fit PDFs in the LH basis at $Q^2 = 2.0e + 00\,\mathrm{GeV}^2$.

# 3 Fit properties

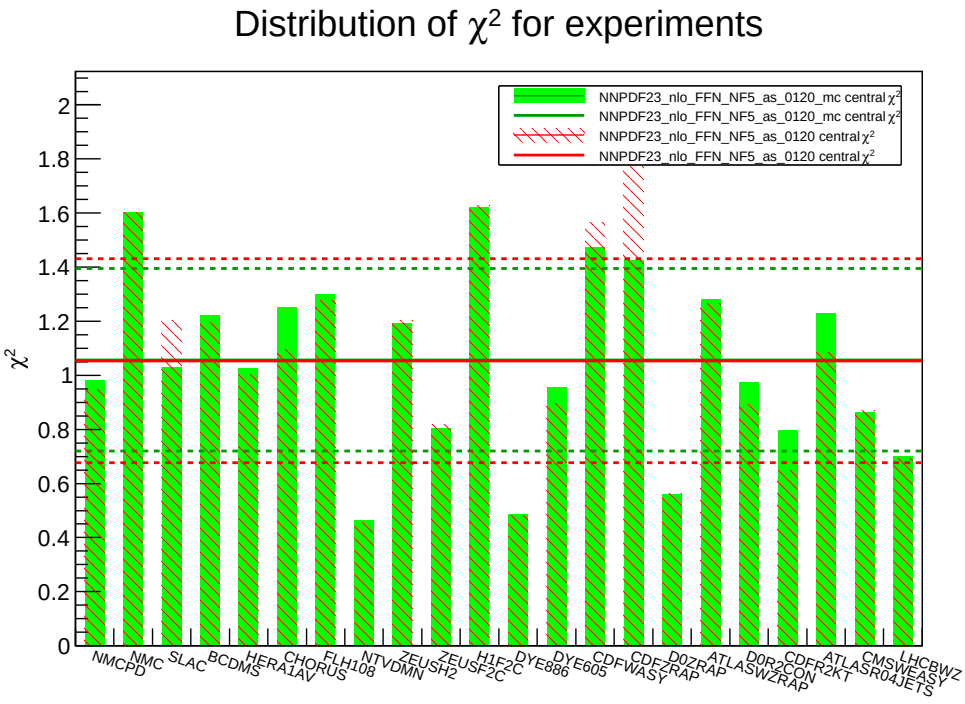


Figure 17: Total $\chi^2$ for each experiment.

## 3.1 $\chi^2$ details - experimental covariance matrix

| Experiment | Dataset | DOF | Current $\chi^2$ | Reference $\chi^2$ | CTEQ $\chi^2$ | MSTW $\chi^2$ |
|---|---|---|---|---|---|---|
| NMCPD | NMCPD | 132 | 0.98179 | 0.94794 | 0.97558 | 0.97705 |
| NMC | NMC | 224 | 1.60215 | 1.60227 | 1.69484 | 1.43420 |
| SLAC | | 74 | 1.02897 | 1.20123 | 1.76784 | 1.43447 |
| | SLACP | 37 | 1.13112 | 1.26249 | 1.74580 | 1.35034 |
| | SLACD | 37 | 0.88815 | 1.09222 | 1.57004 | 1.36595 |
| BCDMS | | 581 | 1.22392 | 1.19510 | 1.78538 | 1.55223 |
| | BCDMSP | 333 | 1.21570 | 1.21116 | 1.98186 | 1.53741 |
| | BCDMSD | 248 | 1.18341 | 1.14239 | 1.51868 | 1.44713 |
| HERA1AV | | 592 | 1.02529 | 1.00262 | 1.55123 | 1.23561 |
| | HERA1NCEP | 379 | 1.18472 | 1.15146 | 1.92013 | 1.49490 |
| | HERA1NCEM | 145 | 0.77982 | 0.77269 | 0.84975 | 0.80762 |
| | HERA1CCEP | 34 | 0.86488 | 0.88301 | 1.11770 | 0.94891 |
| | HERA1CCEM | 34 | 0.56522 | 0.57173 | 0.59330 | 0.56560 |
| CHORUS | | 862 | 1.25398 | 1.09382 | 1.34272 | 1.23278 |
| | CHORUSNU | 431 | 1.16901 | 1.13062 | 1.30847 | 1.16117 |
| | CHORUSNB | 431 | 1.20884 | 0.99009 | 1.28055 | 1.21985 |
| FLH108 | FLH108 | 8 | 1.29771 | 1.27778 | 1.47340 | 1.36120 |
| NTVDMN | | 79 | 0.46423 | 0.45539 | 4.11773 | 1.02519 |
| | NTVNUDMN | 41 | 0.29806 | 0.29124 | 2.64295 | 0.63867 |
| | NTVNBDMN | 38 | 0.63672 | 0.62865 | 6.33561 | 1.67843 |
| ZEUSH2 | | 127 | 1.19289 | 1.20394 | 1.53947 | 1.19210 |
| | Z06NC | 90 | 1.14517 | 1.14956 | 1.56788 | 1.13676 |
| | Z06CC | 37 | 1.18215 | 1.20909 | 1.33275 | 1.18208 |
| ZEUSF2C | | 50 | 0.80278 | 0.81847 | 0.70113 | 0.70633 |
| | ZEUSF2C99 | 14 | 0.76084 | 0.77409 | 0.58874 | 0.63459 |
| | ZEUSF2C03 | 21 | 1.33252 | 1.36159 | 1.11898 | 1.16675 |
| | ZEUSF2C08 | 7 | 0.19116 | 0.19070 | 0.37462 | 0.21906 |
| | ZEUSF2C09 | 8 | 0.12139 | 0.12095 | 0.23483 | 0.13932 |
| H1F2C | | 38 | 1.62354 | 1.62943 | 1.48635 | 1.46443 |
| | H1F2C01 | 6 | 0.97426 | 0.98750 | 0.49406 | 0.82622 |
| | H1F2C09 | 6 | 2.99262 | 2.96351 | 2.94472 | 2.68817 |
| | H1F2C10 | 26 | 1.36898 | 1.38162 | 1.30056 | 1.25629 |
| DYE886 | DYE886R | 15 | 0.48645 | 0.47953 | 0.50136 | 0.76020 |
| DYE605 | DYE605 | 119 | 0.95552 | 0.89363 | 0.72467 | 0.93410 |
| CDFWASY | CDFWASYM | 13 | 1.47349 | 1.56456 | 3.46828 | 9.25681 |
| CDFZRAP | CDFZRAP | 29 | 1.42380 | 1.79634 | 2.00430 | 2.52211 |
| D0ZRAP | D0ZRAP | 28 | 0.56214 | 0.56326 | 0.56482 | 0.60921 |
| ATLASWZRAP | ATLASWZRAP36PB | 30 | 1.28265 | 1.26747 | 1.21188 | 1.98839 |
| D0R2CON | D0R2CON | 110 | 0.97493 | 0.89218 | 0.91490 | 0.90350 |
| CDFR2KT | CDFR2KT | 76 | 0.79660 | 0.64898 | 0.92848 | 0.66190 |
| ATLASR04JETS | ATLASR04JETS36PB | 90 | 1.23184 | 1.08535 | 1.19851 | 1.03684 |
| CMSWEASY | CMSWEASY840PB | 11 | 0.86454 | 0.86941 | 1.38111 | 4.52985 |
| LHCBWZ | LHCBWZ36PB | 10 | 0.70298 | 0.69223 | 1.17855 | 0.92755 |
| **Total (sets)** | | **3298** | **1.13** | **1.08** | **1.48** | **1.00** |
| **Total (exps)** | | **3298** | **1.15** | **1.09** | **1.50** | **1.30** |

Table 3: Fit quality for datasets.

# 4 Configuration file of the training

```
#
# Configuration file for NNPDF++,
# comments start with # or ; or [
#

[Description]
This is the description block, please update these lines before run.
[/Description]

############################################################
[Experiments & Datasets]
EXPERIMENT: NMCPD
        DATASET = NMCPD 0.5
EXPERIMENT: NMC
        DATASET = NMC 0.5
EXPERIMENT: SLAC
        DATASET = SLACP 0.5
        DATASET = SLACD 0.5
EXPERIMENT: BCDMS
        DATASET = BCDMSP 0.5
        DATASET = BCDMSD 0.5
EXPERIMENT: HERA1AV
        DATASET = HERA1NCEP 0.5
        DATASET = HERA1NCEM 0.5
        DATASET = HERA1CCEP 0.5
        DATASET = HERA1CCEM 0.5
EXPERIMENT: CHORUS
        DATASET = CHORUSNU 0.5
        DATASET = CHORUSNB 0.5
EXPERIMENT: FLH108
        DATASET = FLH108 1
EXPERIMENT: NTVDMN
        DATASET = NTVNUDMN 0.5
        DATASET = NTVNBDMN 0.5
EXPERIMENT: ZEUSH2
        DATASET = Z06NC 0.5
        DATASET = Z06CC 0.5
EXPERIMENT: ZEUSF2C
        DATASET = ZEUSF2C99 0.5
        DATASET = ZEUSF2C03 0.5
        DATASET = ZEUSF2C08 0.5
        DATASET = ZEUSF2C09 0.5
EXPERIMENT: H1F2C
        DATASET = H1F2C01 0.5
        DATASET = H1F2C09 0.5
        DATASET = H1F2C10 0.5
EXPERIMENT: DYE886
        DATASET = DYE886R 1
EXPERIMENT: DYE605
        DATASET = DYE605 0.5
EXPERIMENT: CDFWASY
        DATASET = CDFWASYM 1
EXPERIMENT: CDFZRAP
        DATASET = CDFZRAP 1
EXPERIMENT: D0ZRAP
        DATASET = D0ZRAP 1
EXPERIMENT: ATLASWZRAP
        DATASET = ATLASWZRAP36PB 1
EXPERIMENT: DOR2CON
        DATASET = DOR2CON 0.5
EXPERIMENT: CDFR2KT
        DATASET = CDFR2KT 0.5
EXPERIMENT: ATLASR04JETS
        DATASET = ATLASR04JETS36PB 0.5
EXPERIMENT: CMSWEASY
        DATASET = CMSWEASY840PB 1
EXPERIMENT: LHCBWZ
        DATASET = LHCBWZ36PB 1
[/Experiments & Datasets]

############################################################
[Theory]
NFL      = 7
PTORD    = 1
ALPHAS   = 120
Q20      = 2
VFNS     = GMVN
VFNSTYPE = 1
[/Theory]

############################################################
[Experimental Data]
TOPDFSET = NNPDF-t0-set-nlo
IQ2CUT   = 0
NPARSAT  = 2
PARSAT   = 1.5  0.333333
IREG     = 1
Q2MINCUT = 3
Q2MIN    = 3
W2MIN    = 12.5
[/Experimental Data]

############################################################
[Replica Properties]
SEED         = 0
GENREP       = 1
RNGALGORITHM = 0
[/Replica Properties]

############################################################
[Fit Properties]
NGEN       = 50000
DYNSTOP    = 0
POSITIVITY = 0
MINCHI2    = 6
NSMEAR     = 200
DELTASM    = 200
RV         = 1.0003
RT         = 0.9999
[/Fit Properties]

############################################################
[Positivity]
POSDATASET = FCPOS
POSDATASET = FLPOS
POSDATASET = DMPOS
[/Positivity]

############################################################
[NN Properties]
NMUTANTS = 80
```

```
NLAYERS   = 4
NNODES    = 2 5 3 1
SMALLXSNG = 1.05 1.35
LARGEXSNG = 2.55 3.45
SMALLXGLU = 1.05 1.35
LARGEXGLU = 3.55 4.45
SMALLXT3  = 0 0.5
LARGEXT3  = 2.55 3.45
SMALLXV   = 0 0.5
LARGEXV   = 2.55 3.45
SMALLXDS  = -0.95 -0.65
LARGEXDS  = 12 14
SMALLXSP  = 1.05 1.35
LARGEXSP  = 2.55 3.45
SMALLXSM  = 0 0.5
LARGEXSM  = 2.55 3.45
[/NN Properties]

#################################################################
[Output Folder]
RESULTSDIR = results
[/Output Folder]
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