

NEWS ON STRANGENESS

FROM **NPDF**

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MILAN UNIVERSITY & INFN
(FOR THE NNPDF COLLABORATION)



LES HOUCHES, JUNE 15, 2009

QUESTION: (F. OLNESS)

HOW “STRANGE” IS THE STRANGE PDF?

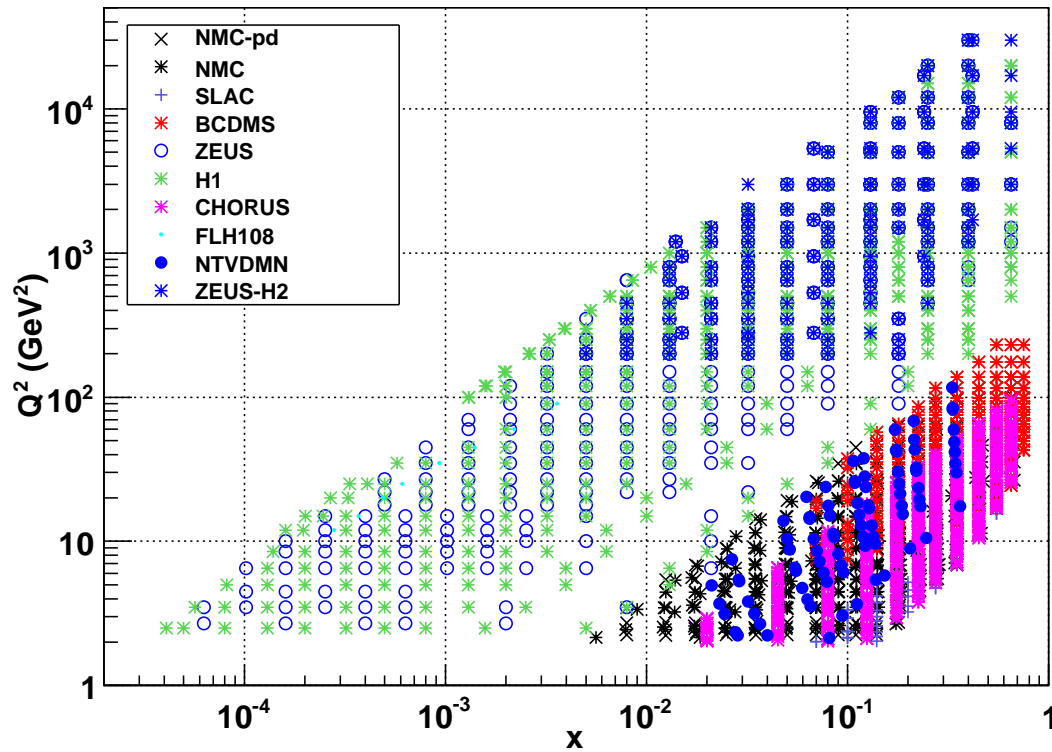
QUESTION: (F. OLNESS)

HOW "STRANGE" IS THE STRANGE PDF?

ANSWER: THE NNPDF1.2 SET

THE DATA SET

- SEVEN PDFS INDEP. PARAMETRIZED
- 74 EXTRA FREE PARMS (s^{\pm}) IN COMPARISON TO NNPDF1.0
- NUTEV DIMUON DATA USED TO CONSTRAIN STRANGENESS

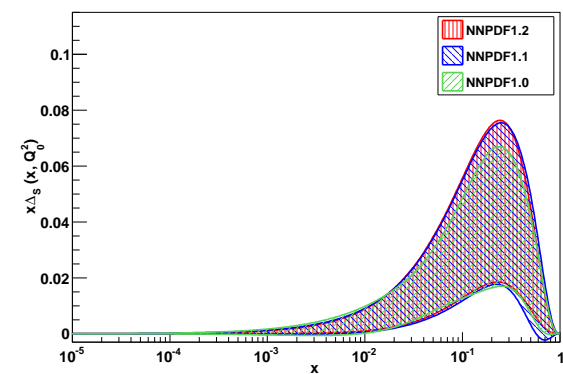
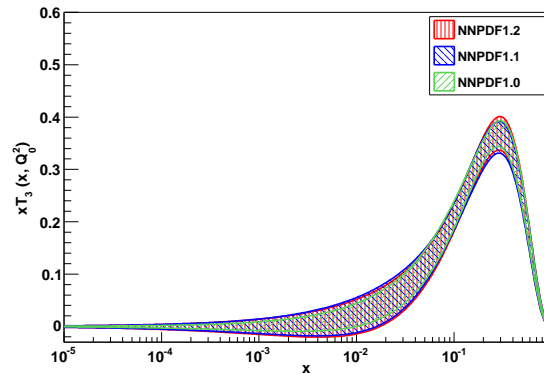
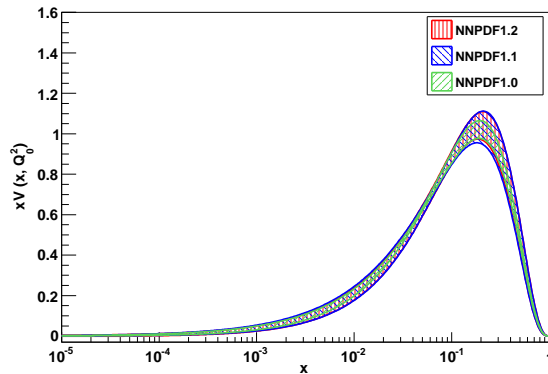
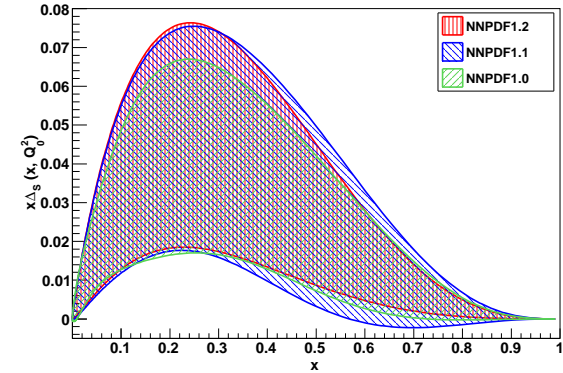
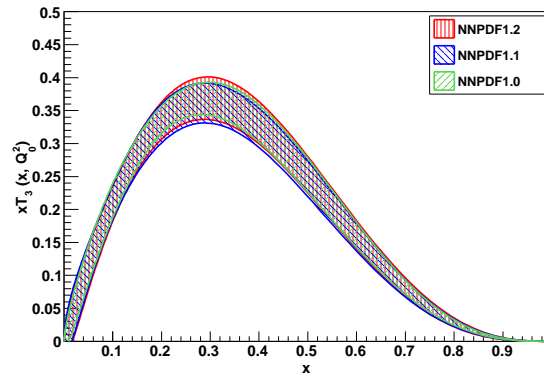
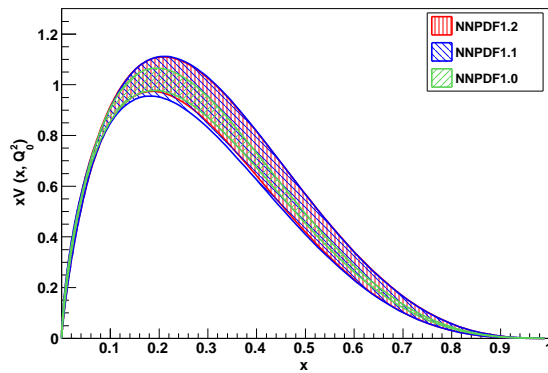


STABILITY

COMPARISON TO PREVIOUS NNPDF SETS

- NNPDF1.0: $s(x, Q_0^2) = \bar{s}(x, Q_0^2)$, $s + \bar{s} = \frac{1}{2}(\bar{u} + \bar{d})$
- NNPDF1.1: s, \bar{s} (ACTUALLY s^\pm) INDEP. PARAMETRIZED, NO DIMUON DATA
- NNPDF1.2: s, \bar{s} INDEP. PARAMETRIZED, DIMUON DATA

NONSTRANGE PDFS

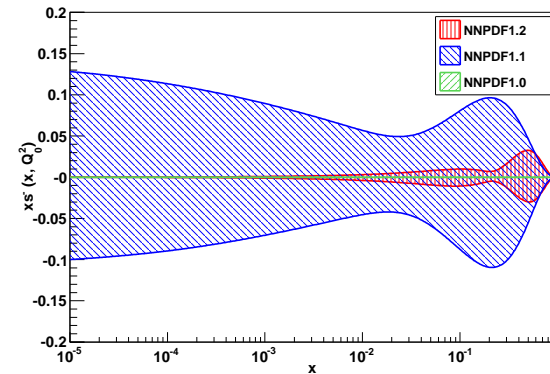
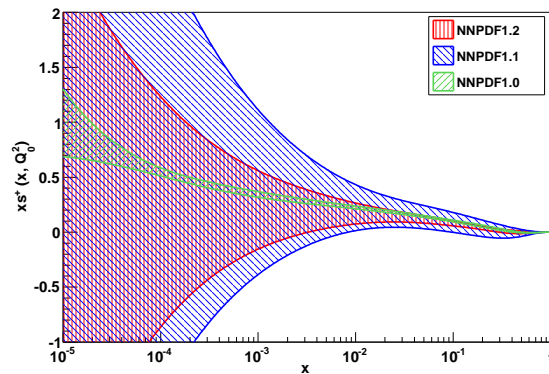
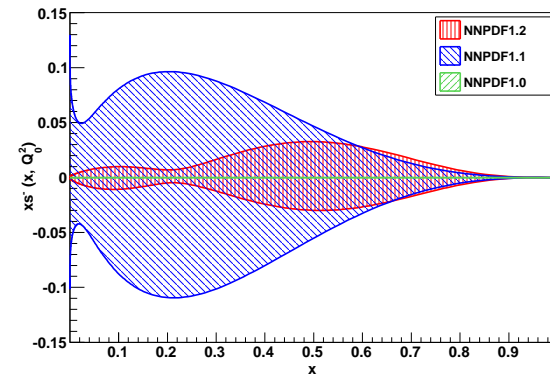
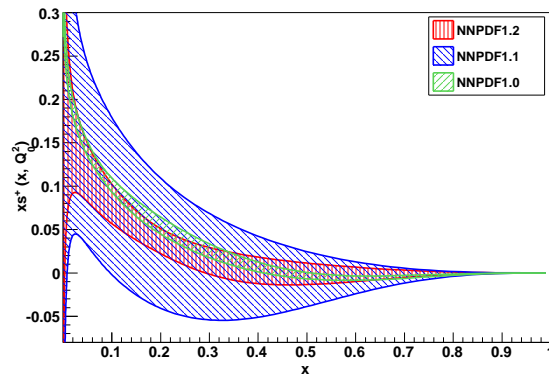


DETERMINING STRANGENESS

COMPARISON TO PREVIOUS NNPDF SETS

- NNPDF1.0: STRANGENESS UNCERTAINTY UNDERESTIMATED
- NNPDF1.1: STRANGENESS UNCERTAINTY HUGE
- NNPDF1.2: STRANGENESS UNCERTAINTY UNDER CONTROL

STRANGE PDFS

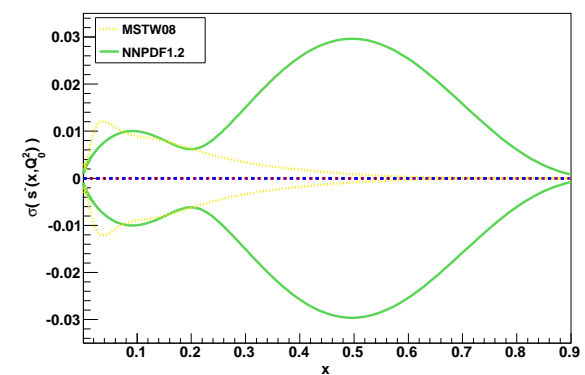
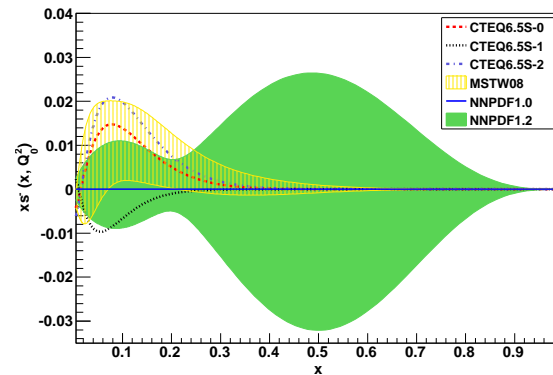
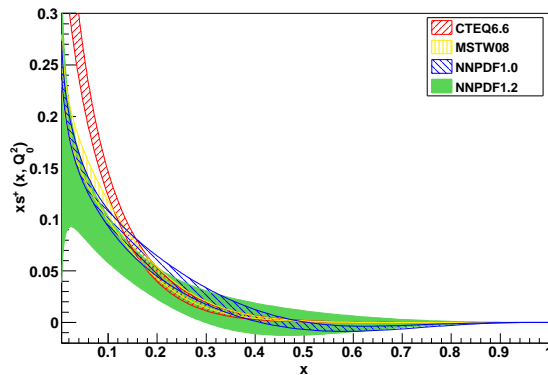
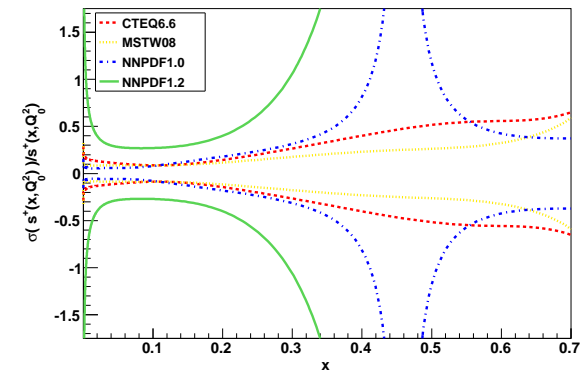
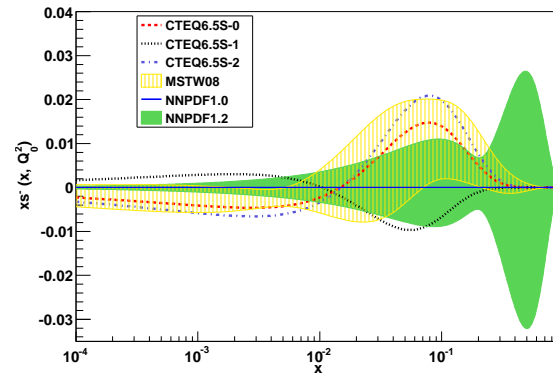
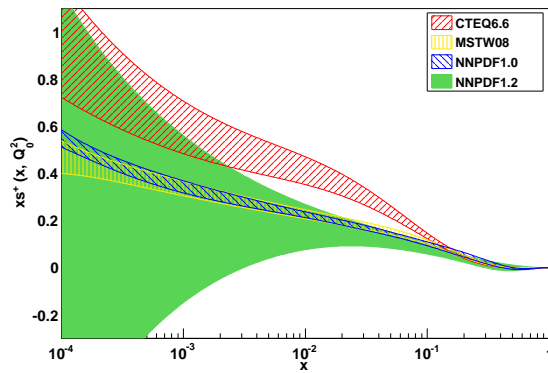


DETERMINING STRANGENESS

COMPARISON TO OTHER NNPDF SETS

- CTEQ6.6: $s = \bar{s}$, s^+ PARM W. TWO FREE PARAMETERS
- MSTW08: s^+ & s^- PARM W. TWO FREE PARAMETERS EACH
- EVERYBODY ENFORCES STRANGENESS SUM RULE

STRANGE PDFS



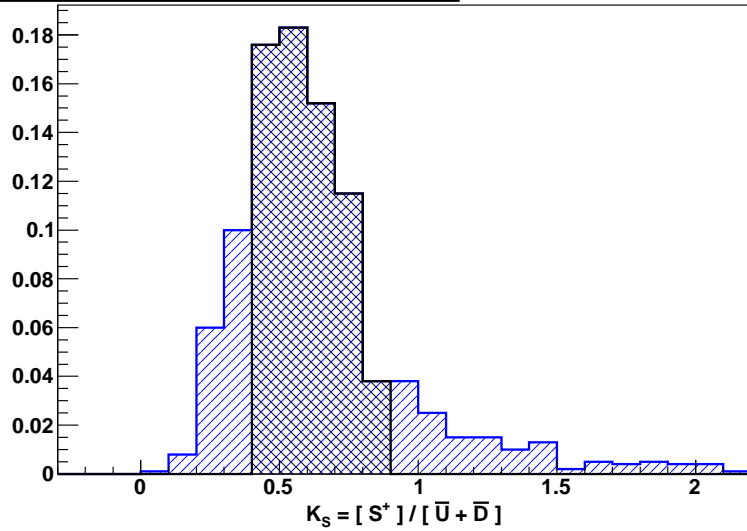
STRANGE MOMENTUM FRACTIONS

INCREASED UNCERTAINTY DUE TO GREATER FLEXIBILITY

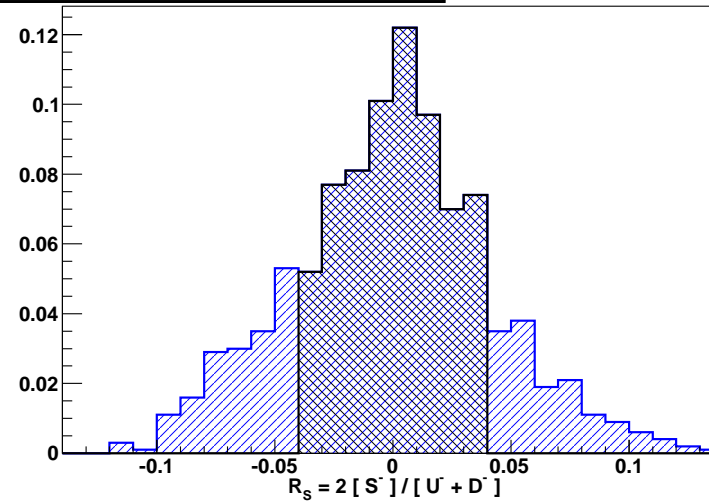
ANALYSIS	$K_S (Q^2 = 20 \text{ GeV}^2)$
NNPDF1.2	$0.71^{+0.19}_{-0.31}$
MSTW08	0.56 ± 0.03
CTEQ66	0.72 ± 0.05
AKP08	0.59 ± 0.08

ANALYSIS	$[S^-] (Q^2) \cdot 10^3$	$Q^2 \text{ GeV}^2$	$[S^-] (20 \text{ GeV}^2) \cdot 10^3$
NNPDF1.2	0.5 ± 8.6	20	0.5 ± 8.6
MSTW08	2.4 ± 2.0	1	1.4 ± 1.2
CTEQ6.5s	2.0 ± 1.8	1.69	1.2 ± 1.1
CTEQ6.1s	1.5 ± 1.5	1.69	1.2 ± 1.2
AKP08	1.0 ± 1.3	20	1.0 ± 1.3
NuTeV07	2.2 ± 1.3	16	1.3 ± 0.8
BPPZ03	1.8 ± 3.8	20	1.8 ± 3.8

NNPDF1.2, $Q^2 = 20 \text{ GeV}^2$, $N_{\text{rep}} = 1000$

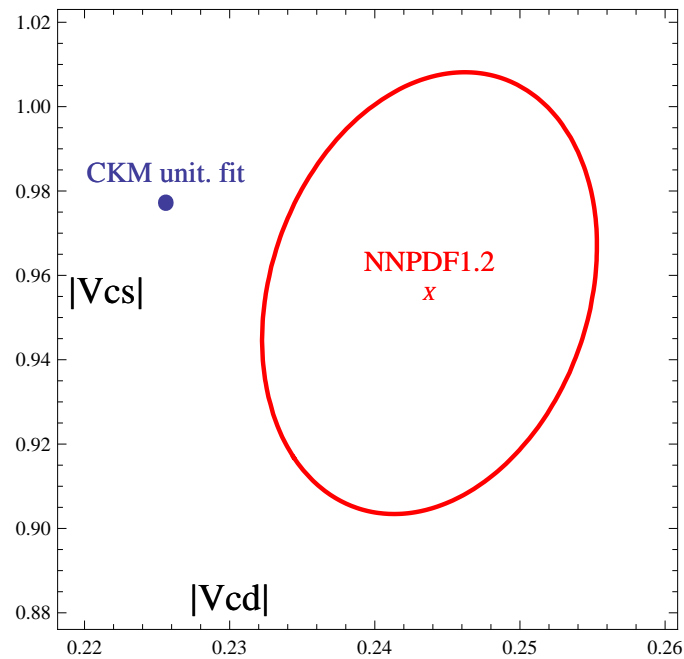


NNPDF1.2, $Q^2 = 20 \text{ GeV}^2$, $N_{\text{rep}} = 1000$



CKM MATRIX ELEMENT

CAN BE DETERMINED WITH SURPRIZING ACCURACY



ANALYSIS	DETERMINATION	$ V_{cs} $
NNPDF1.2	DIRECT FROM GLOBAL PDF ANALYSIS	$0.96 \pm 0.07^{\text{tot}}$
CDHS	LO FROM $\nu N \rightarrow \mu^+ \mu^- X$	≥ 0.59 (90% C.L.)
CCFR	NLO FROM $\nu N \rightarrow \mu^+ \mu^- X$	≥ 0.74 (90% C.L.)
PDG08	AVERAGE FROM D DECAYS	1.04 ± 0.06
HOCKER	AVERAGE FROM $\nu N \rightarrow \mu^+ \mu^- X$	1.04 ± 0.16
DELPHI	DIRECT FROM $W^+ \rightarrow c\bar{s}$ DECAYS	$0.94^{+0.32}_{-0.26} \pm 0.13$
PDG08	CKM UNITARITY FIT	0.97334 ± 0.00023

ANALYSIS	DETERMINATION	$ V_{cd} $
NNPDF1.2	DIRECT FROM GLOBAL PDF ANALYSIS	$0.244 \pm 0.019^{\text{tot}}$
CDHS	LO FROM $\nu N \rightarrow \mu^+ \mu^- X$	0.24 ± 0.03
CCFR	NLO FROM $\nu N \rightarrow \mu^+ \mu^- X$	$0.232^{+0.017}_{-0.019}$
PDG08	AVERAGE FROM $\nu N \rightarrow \mu^+ \mu^- X$	0.230 ± 0.011
PDG08	AVERAGE FROM $D \rightarrow K/\pi l\nu$ DECAYS	0.218 ± 0.023
PDG08	CKM UNITARITY FIT	0.2256 ± 0.0010

THE NUTEV ANOMALY

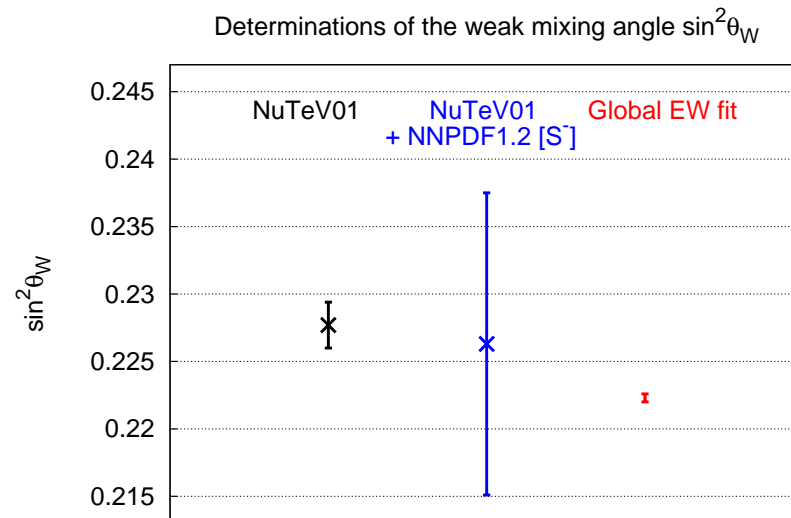
THE NUTEV ANOMALY

IS GONE

$$R_{\text{PW}} \equiv \frac{\sigma(\nu\mathcal{N} \rightarrow \nu X) - \sigma(\bar{\nu}\mathcal{N} \rightarrow \bar{\nu} X)}{\sigma(\nu\mathcal{N} \rightarrow \ell X) - \sigma(\bar{\nu}\mathcal{N} \rightarrow \bar{\ell} X)}$$

$$= \frac{1}{2} - \sin^2 \theta_W + \left(\frac{(U^- - D^-) + (C^- - S^-)}{Q^-} \frac{1}{6} (3 - 7 \sin^2 \theta_W) \right),$$

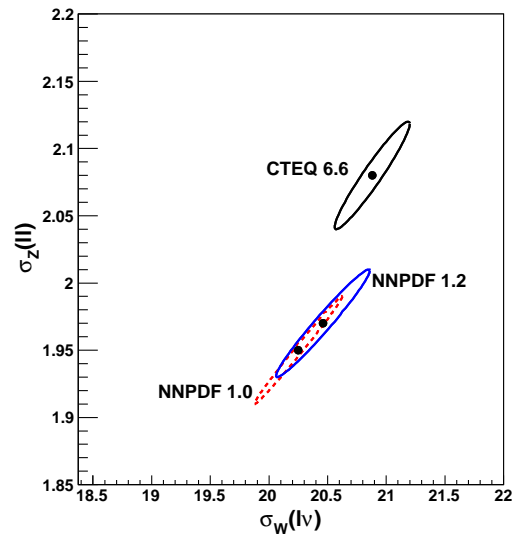
- STRANGENESS VALENCE MOMENTUM ASSUMED BY NUTEV TO VANISH
- UNCERTAINTY ON IT DOMINATES UNCERTAINTY ON THE PW RATIO



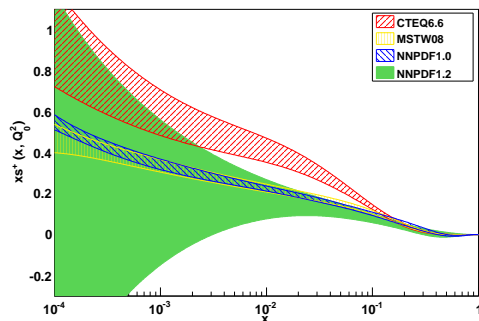
IMPACT ON SOME LHC STANDARD CANDLES: IT COULD BE WORSE

- TOTAL W/Z XSCT DOMINATED BY CENTRAL RAPIDITY REGION
⇒ UNCERTAINTY ON STRANGENESS UNDER CONTROL
- AWAY FROM CENTRAL REGION UNCERTAINTY MUCH LARGER

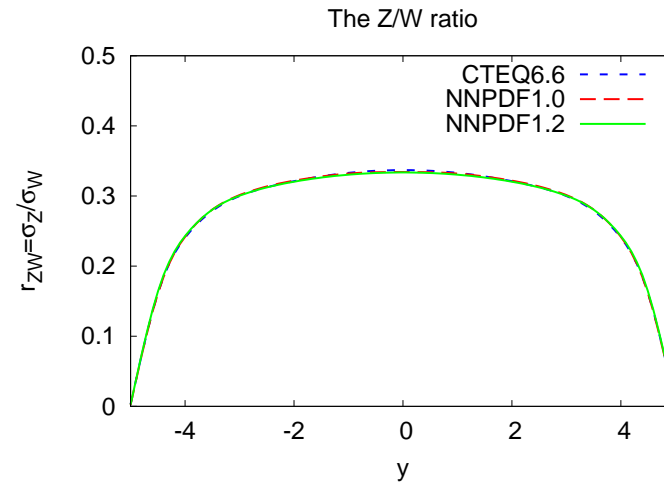
TOTAL XSECTNS



STRANGENESS (REMINDER)



RAPIDITY DISTRIBUTION



PERC. UNCERTAINTY

