‘MMHT’19 updates + next steps

Lucian Harland-Lang, University of Oxford

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MMHT19: datasets

- MMHT14 datasets listed in 1412.3989 (see Simone's slides):

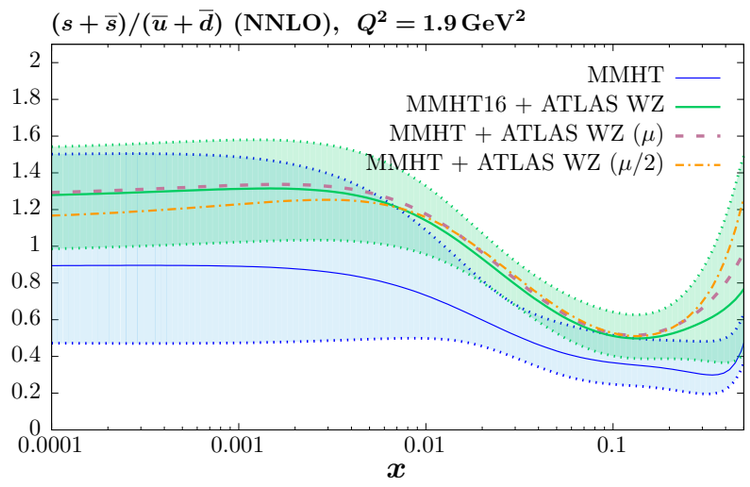
Data set	LO	NLO	NNLO
BCDMS μp F_2 [125]	162 / 153	176 / 163	173 / 163
BCDMS μd F_2 [19]	140 / 142	143 / 151	143 / 151
NMC μp F_2 [20]	141 / 115	132 / 123	123 / 123
NMC μd F_2 [20]	134 / 115	115 / 123	108 / 123
NMC $\mu n/\mu p$ [21]	122 / 137	131 / 148	127 / 148
E665 μp F_2 [22]	59 / 53	60 / 53	65 / 53
E665 μd F_2 [22]	52 / 53	52 / 53	60 / 53
SLAC ep F_2 [23, 24]	21 / 18	31 / 37	31 / 37
SLAC ed F_2 [23, 24]	13 / 18	30 / 38	26 / 38
NMC/BCDMS/SLAC/HERA F_L [20, 125, 24, 63, 64, 65]	113 / 53	68 / 57	63 / 57
E866/NuSea pp DY [88]	229 / 184	221 / 184	227 / 184
E866/NuSea pd/pp DY [89]	29 / 15	11 / 15	11 / 15
NuTeV νN F_2 [29]	35 / 49	39 / 53	38 / 53
CHORUS νN F_2 [30]	25 / 37	26 / 42	28 / 42
NuTeV νN xF_3 [29]	49 / 42	37 / 42	31 / 42
CHORUS νN xF_3 [30]	35 / 28	22 / 28	19 / 28
CCFR $\nu N \to \mu\mu X$ [31]	65 / 86	71 / 86	76 / 86
NuTeV $\nu N \to \mu\mu X$ [31]	53 / 40	38 / 40	43 / 40
HERA e^+p NC 820 GeV[61]	125 / 78	93 / 78	89 / 78
HERA e^+p NC 920 GeV[61]	479 /330	402 /330	373/ 330
HERA e^-p NC 920 GeV [61]	158/ 145	129/ 145	125 /145
HERA e^+p CC [61]	41 / 34	34 / 34	32 / 34
HERA e^-p CC [61]	29 / 34	23 / 34	21 / 34
HERA ep $F_2^{\rm charm}$ [62]	105 /52	72 / 52	82 / 52
H1 99–00 e^+p incl. jets [126]	77 / 24	14 / 24	—
ZEUS incl. jets [127, 128]	140/60	45 / 60	—
DØ II $p\bar{p}$ incl. jets [119]	125 / 110	116 / 110	119 / 110
CDF II $p\bar{p}$ incl. jets [118]	78 / 76	63 / 76	59 / 76
CDF II W asym. [66]	55 / 13	32 / 13	30 / 13
DØ II $W \to \nu e$ asym. [67]	47 / 12	28 / 12	27 / 12
DØ II $W \to \nu\mu$ asym. [68]	16 / 10	19 / 10	21 / 10
DØ II Z rap. [90]	34 / 28	16 / 28	16 / 28
CDF II Z rap. [70]	95 / 28	36 / 28	40 / 28
ATLAS W^+, W^-, Z [10]	94/30	38/30	39/30
CMS W asymm $p_T > 35$ GeV [9]	10/11	7/11	9/11
CMS asymm $p_T > 25$ GeV, 30 GeV[77]	7/24	8/24	10/24
LHCb $Z \to e^+e^-$[79]	76/9	13/9	20/9
LHCb W asymm $p_T > 20$ GeV[78]	27/10	12/10	16/10
CMS $Z \to e^+e^-$ [84]	46/35	19/35	22/35
ATLAS high-mass Drell-Yan [83]	42/13	21/13	17/13
CMS double diff. Drell-Yan [86]	—	372/132	149/132
Tevatron, ATLAS, CMS $\sigma_{t\bar{t}}$ [91]–[97]	53/13	7/13	8/13
ATLAS jets (2.76 TeV+7 TeV)[108, 107]	162/116	106/116	—
CMS jets (7 TeV) [106]	150/133	138/133	—
All data sets	**3706 / 2763**	**3267 / 2996**	**2717 / 2663**

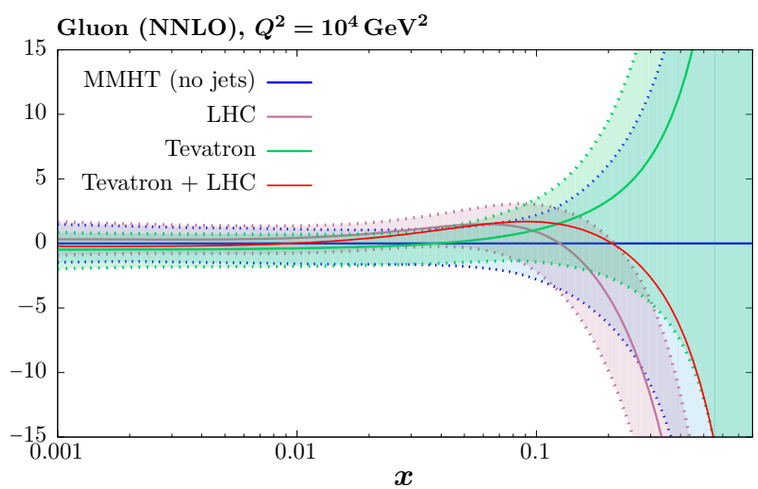
MMHT19: datasets

- Since MMHT14, addition of HERA combined described in 1601.03413, and new LHC data in e.g. **1708.00047**:

	Points	NLO χ^2	NNLO χ^2
$\sigma_{t\bar{t}}$	18	19.6 (20.5)	14.7 (15.3)
LHCb 7 TeV $W+Z$	33	50.1 (45.4)	46.5 (42.9)
LHCb 8 TeV $W+Z$	34	77.0 (58.9)	62.6 (59.0)
LHCb 8 TeV $Z \to ee$	17	37.4 (33.4)	30.3 (28.9)
CMS 8 TeV W	22	32.6 (18.6)	34.9 (20.5)
CMS 7 TeV $W+c$	10	8.5 (10.0)	8.7 (7.8)
D0 e asymmetry	13	22.2 (21.5)	27.3 (25.8)
Total	3405 (3738)	4375.9 (4336.1)	3741.5 (3723.7)

- In addition, ATLAS precision W,Z included (**1708.00047**) and ATLAS, CMS 7 TeV jet data (**1711.05757**)





MMHT19: datasets

- Further new data added/being added:

  ★ ATLAS and CMS 8 TeV Z pt.

  ★ CMS 8 TeV jets (ATLAS - no NNLO K-factors available yet).

  ★ D0 W asymmetry (replace lepton asymmetry).

  ★ HERA combined heavy flavour .

  ★ ATLAS, CMS 8 TeV differential top (lepton + jet, dilepton).

- Currently work in progress - work actively ongoing to include these, but no complete version yet. Time scale: O(months) for official release, less for unofficial set.

Next steps: few technical comments

- From procedural/time point of view actual running of multiple toy fits not a huge issue (no need for additional manpower), within reason.

- (Probably) most time consuming part: 'just' making sure toy datasets are in the appropriate format (here help producing conversion script etc so that we are provided with everything in our format, would be useful).

- Suspect it will only be for older data that above issue could be relevant (more recent = more unified?).

- My view: first step should be to start with variation of (e.g.) HERA inclusive data alone. Straightforward to do, but still rather constraining (also recalling CT18 and MMHT19 not yet available).