

**mW combination ATLAS-Tevatron
*Update***

N. Andari, CEA Saclay

LHC-Tevatron working meetings
09/11/2018

Reminder

Use Powheg to simulate 1.96 TeV pp-bar and 7 TeV pp with a baseline PDF: CT10
Compute PDF weights for CTEQ6.6, CT14, MMHT, NNPDF3.1

Mimic recoil and lepton resolution effects through a **smearing approach** of the truth level distributions to the one published in the measurements (done by eye)

Update from last meeting: selection cuts

CDF	ATLAS
$30 < p_t^{l,\nu} < 55$ GeV, $60 < m_T < 100$ GeV, $u_T < 15$ GeV, $ \eta < 1$	$p_t^{l,\nu} > 30$ GeV, $m_T > 60$ GeV, $u_T < 30$ GeV, $ \eta < 2.4$

pTl observable

Correlations

CT10	1.	2.	3.	4.
1. W ⁺ 2 TeV	1	0.99	0.26	0.51
2. W ⁻ 2 TeV	0.99	1	0.31	0.52
3. W ⁺ 7 TeV	0.26	0.31	1	-0.23
4. W ⁻ 7 TeV	0.51	0.52	-0.23	1

CTEQ6.6	1.	2.	3.	4.
1. W ⁺ 2 TeV	1	1	0.37	0.45
2. W ⁻ 2 TeV	1	1	0.36	0.46
3. W ⁺ 7 TeV	0.37	0.36	1	-0.42
4. W ⁻ 7 TeV	0.45	0.46	-0.42	1

mT observable

Correlations

CT10	1.	2.	3.	4.
1. W ⁺ 2 TeV	1	0.99	0.19	0.55
2. W ⁻ 2 TeV	0.99	1	0.22	0.56
3. W ⁺ 7 TeV	0.19	0.22	1	-0.30
4. W ⁻ 7 TeV	0.55	0.56	-0.30	1

CTEQ6.6	1.	2.	3.	4.
1. W ⁺ 2 TeV	1	1	0.32	0.50
2. W ⁻ 2 TeV	1	1	0.31	0.52
3. W ⁺ 7 TeV	0.32	0.31	1	-0.42
4. W ⁻ 7 TeV	0.50	0.52	-0.42	1

Shifts (MeV)

CTEQ6.6-CT10	p_{τ^+}	p_{τ^-}	m_{τ^+}	m_{τ^-}
2 TeV	-8.4	-8.4	-7.3	-6.8
7 TeV eta 1	-4.0	-6.3	-7.7	-3.8
7 TeV eta 2	-12.6	-1.5	-16.8	-1.8
7 TeV eta 3	-17.7	+8.6	-15.5	+9.9
7 TeV eta 4	-11.1	+16.4	-11	+12.6

Stat uncertainties and m_W values

Assume: $m_W = 80387$ for Tevatron and $m_W = 80370$ for ATLAS

CDF

Distribution	W-boson mass (MeV)	χ^2/dof
$m_T(e, \nu)$	$80\,408 \pm 19_{\text{stat}} \pm 18_{\text{syst}}$	52/48
$p_T^\ell(e)$	$80\,393 \pm 21_{\text{stat}} \pm 19_{\text{syst}}$	60/62
$p_T^\nu(e)$	$80\,431 \pm 25_{\text{stat}} \pm 22_{\text{syst}}$	71/62
$m_T(\mu, \nu)$	$80\,379 \pm 16_{\text{stat}} \pm 16_{\text{syst}}$	58/48
$p_T^\ell(\mu)$	$80\,348 \pm 18_{\text{stat}} \pm 18_{\text{syst}}$	54/62
$p_T^\nu(\mu)$	$80\,406 \pm 22_{\text{stat}} \pm 20_{\text{syst}}$	79/62

Combine e/mu \rightarrow 13.67 (pTI) and 12.24 (mT)
 pTI+: 19.33 , pTI-: 19.33, mT+: 17.31, mT-: 17.31

ATLAS

Different categories for electrons and muons but similar stat uncertainties.

For now assume muons uncertainties and divide by sqrt(2)

Channel	m_W [MeV]	Stat. Unc.	Muon Unc.	Elec. Unc.	Recoil Unc.	Bckg. Unc.	QCD Unc.	EW Unc.	PDF Unc.	Total Unc.
m_T-Fit										
$W^+ \rightarrow \mu\nu, \eta < 0.8$	80371.3	29.2	12.4	0.0	15.2	8.1	9.9	3.4	28.4	47.1
$W^+ \rightarrow \mu\nu, 0.8 < \eta < 1.4$	80354.1	32.1	19.3	0.0	13.0	6.8	9.6	3.4	23.3	47.6
$W^+ \rightarrow \mu\nu, 1.4 < \eta < 2.0$	80426.3	30.2	35.1	0.0	14.3	7.2	9.3	3.4	27.2	56.9
$W^+ \rightarrow \mu\nu, 2.0 < \eta < 2.4$	80334.6	40.9	112.4	0.0	14.4	9.0	8.4	3.4	32.8	125.5
$W^- \rightarrow \mu\nu, \eta < 0.8$	80375.5	30.6	11.6	0.0	13.1	8.5	9.5	3.4	30.6	48.5
$W^- \rightarrow \mu\nu, 0.8 < \eta < 1.4$	80417.5	36.4	18.5	0.0	12.2	7.7	9.7	3.4	22.2	49.7
$W^- \rightarrow \mu\nu, 1.4 < \eta < 2.0$	80379.4	35.6	33.9	0.0	10.5	8.1	9.7	3.4	23.1	56.9
$W^- \rightarrow \mu\nu, 2.0 < \eta < 2.4$	80334.2	52.4	123.7	0.0	11.6	10.2	9.9	3.4	34.1	139.9
$W^+ \rightarrow e\nu, \eta < 0.6$	80352.9	29.4	0.0	19.5	13.1	15.3	9.9	3.4	28.5	50.8
$W^+ \rightarrow e\nu, 0.6 < \eta < 1.2$	80381.5	30.4	0.0	21.4	15.1	13.2	9.6	3.4	23.5	49.4
$W^+ \rightarrow e\nu, 1.8 < \eta < 2.4$	80352.4	32.4	0.0	26.6	16.4	32.8	8.4	3.4	27.3	62.6
$W^- \rightarrow e\nu, \eta < 0.6$	80415.8	31.3	0.0	16.4	11.8	15.5	9.5	3.4	31.3	52.1
$W^- \rightarrow e\nu, 0.6 < \eta < 1.2$	80297.5	33.0	0.0	18.7	11.2	12.8	9.7	3.4	23.9	49.0
$W^- \rightarrow e\nu, 1.8 < \eta < 2.4$	80423.8	42.8	0.0	33.2	12.8	35.1	9.9	3.4	28.1	72.3
p_T-Fit										
$W^+ \rightarrow \mu\nu, \eta < 0.8$	80327.7	22.1	12.2	0.0	2.6	5.1	9.0	6.0	24.7	37.3
$W^+ \rightarrow \mu\nu, 0.8 < \eta < 1.4$	80357.3	25.1	19.1	0.0	2.5	4.7	8.9	6.0	20.6	39.5
$W^+ \rightarrow \mu\nu, 1.4 < \eta < 2.0$	80446.9	23.9	33.1	0.0	2.5	4.9	8.2	6.0	25.2	49.3
$W^+ \rightarrow \mu\nu, 2.0 < \eta < 2.4$	80334.1	34.5	110.1	0.0	2.5	6.4	6.7	6.0	31.8	120.2
$W^- \rightarrow \mu\nu, \eta < 0.8$	80427.8	23.3	11.6	0.0	2.6	5.8	8.1	6.0	26.4	39.0
$W^- \rightarrow \mu\nu, 0.8 < \eta < 1.4$	80395.6	27.9	18.3	0.0	2.5	5.6	8.0	6.0	19.8	40.5
$W^- \rightarrow \mu\nu, 1.4 < \eta < 2.0$	80380.6	28.1	35.2	0.0	2.6	5.6	8.0	6.0	20.6	50.9
$W^- \rightarrow \mu\nu, 2.0 < \eta < 2.4$	80315.2	45.5	116.1	0.0	2.6	7.6	8.3	6.0	32.7	129.6
$W^+ \rightarrow e\nu, \eta < 0.6$	80336.5	22.2	0.0	20.1	2.5	6.4	9.0	5.3	24.5	40.7
$W^+ \rightarrow e\nu, 0.6 < \eta < 1.2$	80345.8	22.8	0.0	21.4	2.6	6.7	8.9	5.3	20.5	39.4
$W^+ \rightarrow e\nu, 1.8 < \eta < 2.4$	80344.7	24.0	0.0	30.8	2.6	11.9	6.7	5.3	24.1	48.2
$W^- \rightarrow e\nu, \eta < 0.6$	80351.0	23.1	0.0	19.8	2.6	7.2	8.1	5.3	26.6	42.2
$W^- \rightarrow e\nu, 0.6 < \eta < 1.2$	80309.8	24.9	0.0	19.7	2.7	7.3	8.0	5.3	20.9	39.9
$W^- \rightarrow e\nu, 1.8 < \eta < 2.4$	80413.4	30.1	0.0	30.7	2.7	11.5	8.3	5.3	22.7	51.0

mW uncertainties (MeV)

2 TeV CTEQ6.6	$p_{T^{l+}}$	$p_{T^{l-}}$	m_{T^+}	m_{T^-}	pT&mT
Stat	19.7	19.3	17.3	17.3	9.4
PDF	14.8	15.9	11.9	11.9	12.9
Total	24.3	25.0	21.0	21.0	16.0

2 TeV CT10	$p_{T^{l+}}$	$p_{T^{l-}}$	m_{T^+}	m_{T^-}	pT&mT
Stat	19.3	19.3	17.3	17.3	9.7
PDF	16.6	18.1	13.2	13.4	14.3
Total	25.5	26.5	21.8	21.9	17.3

mW uncertainties (MeV)

7 TeV CTEQ 6.6	$p_{\tau^{l+}}$ Eta 1	$p_{\tau^{l-}}$ Eta 1	$p_{\tau^{l+}}$ Eta 2	$p_{\tau^{l-}}$ Eta 2	$p_{\tau^{l+}}$ Eta 3	$p_{\tau^{l-}}$ Eta 3	$p_{\tau^{l+}}$ Eta 4	$p_{\tau^{l-}}$ Eta 4	m_{τ^+} Eta 1	m_{τ^-} Eta 1	m_{τ^+} Eta 2	m_{τ^-} Eta 2	m_{τ^+} Eta 3	m_{τ^-} Eta 3	m_{τ^+} Eta 4	m_{τ^-} Eta 4	pT& mT
Stat	15.6	16.5	17.8	19.7	23.9	28.1	24.4	32.2	20.6	21.6	22.7	25.8	30.2	35.6	28.9	37.0	6.8
PDF	23.4	22.9	27.1	20.4	25.6	23.1	18.4	24.8	27.4	24.5	25.4	20.2	21.2	24.3	20.0	30.9	8.4
Total	28.2	28.2	32.4	28.4	35.0	36.4	30.5	40.6	34.3	32.7	34.0	32.8	36.9	43.1	35.2	48.3	10.8

7 TeV CT10	$p_{\tau^{l+}}$ Eta 1	$p_{\tau^{l-}}$ Eta 1	$p_{\tau^{l+}}$ Eta 2	$p_{\tau^{l-}}$ Eta 2	$p_{\tau^{l+}}$ Eta 3	$p_{\tau^{l-}}$ Eta 3	$p_{\tau^{l+}}$ Eta 4	$p_{\tau^{l-}}$ Eta 4	m_{τ^+} Eta 1	m_{τ^-} Eta 1	m_{τ^+} Eta 2	m_{τ^-} Eta 2	m_{τ^+} Eta 3	m_{τ^-} Eta 3	m_{τ^+} Eta 4	m_{τ^-} Eta 4	pT& mT
Stat	15.6	16.5	17.8	19.7	23.9	28.1	24.4	32.2	20.6	21.6	22.7	25.8	30.2	35.6	28.9	37.0	7.4
PDF	32.9	29.8	31.3	24.6	28.8	25.2	25.9	26.2	37.1	30.4	26.3	25.3	25.1	27.2	29.8	35.1	10.0
Total	36.4	34.0	36.0	31.5	37.4	37.8	35.6	41.5	42.4	37.3	34.8	36.1	39.3	44.8	41.5	51.0	12.5

mW combined uncertainties (MeV)
Very preliminary

2 TeV + 7 TeV eta	CT10	CTEQ6.6
mw	80376.3	80371
Stat	6.49	6.06
PDF	9.71	8.30
Stat+PDF	11.68	10.28