

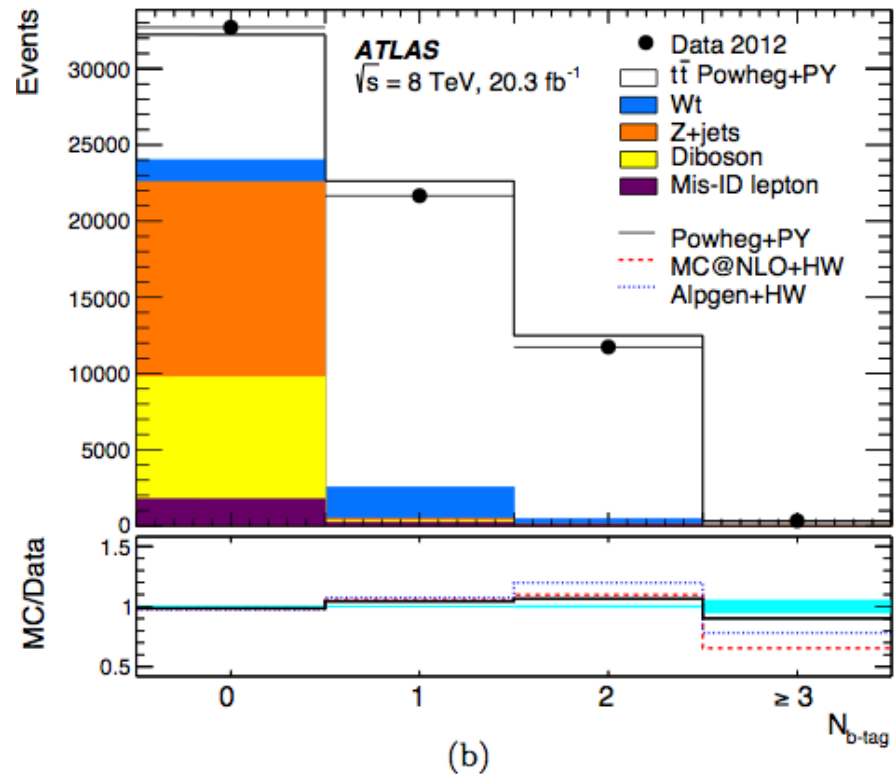
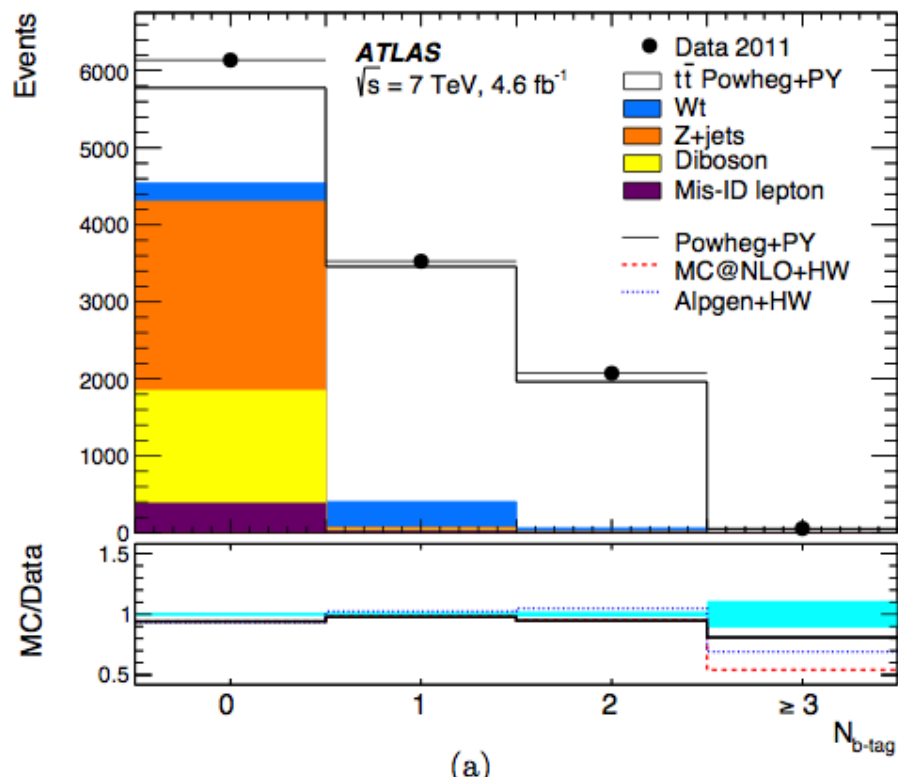
ATLAS $t\bar{t}b\bar{b}$ x-sec in $e\mu+b$ -tag-jets

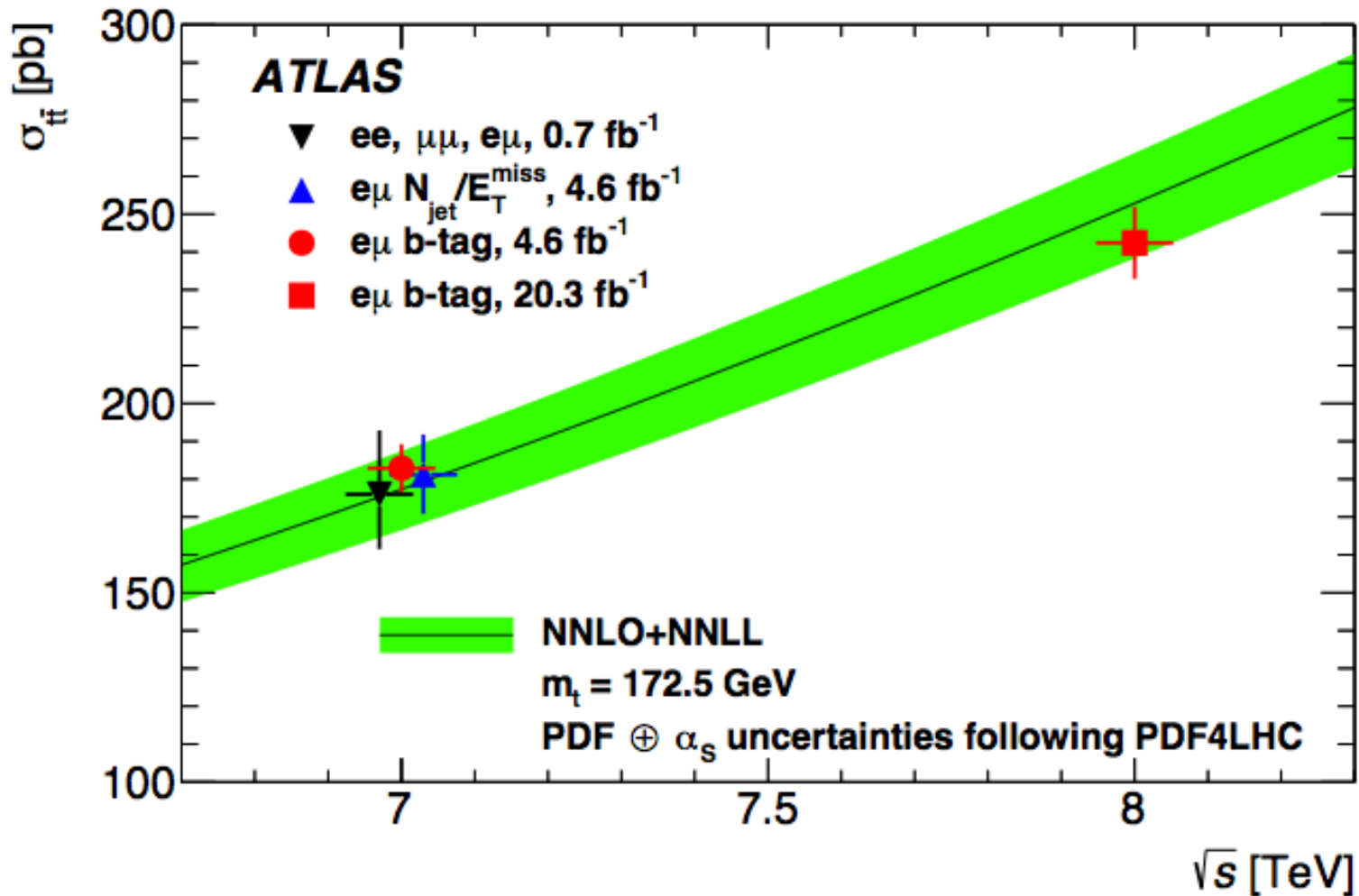
13 TeV: ATLAS-CONF-2015-033

7-8 TeV: arXiv:1406.5375,

EPJ C74 3109 (2014)

Event counts	$\sqrt{s} = 7 \text{ TeV}$		$\sqrt{s} = 8 \text{ TeV}$	
	N_1	N_2	N_1	N_2
Data	3527	2073	21666	11739
Wt single top	326 ± 36	53 ± 14	2050 ± 210	360 ± 120
Dibosons	19 ± 5	0.5 ± 0.1	120 ± 30	3 ± 1
$Z(\rightarrow \tau\tau \rightarrow e\mu)$ +jets	28 ± 2	1.8 ± 0.5	210 ± 5	7 ± 1
Misidentified leptons	27 ± 13	15 ± 8	210 ± 66	95 ± 29
Total background	400 ± 40	70 ± 16	2590 ± 230	460 ± 130





$\sigma_{t\bar{t}} = 182.9 \pm 3.1 \pm 4.2 \pm 3.6 \pm 3.3 \text{ pb}$ ($\sqrt{s} = 7 \text{ TeV}$) and

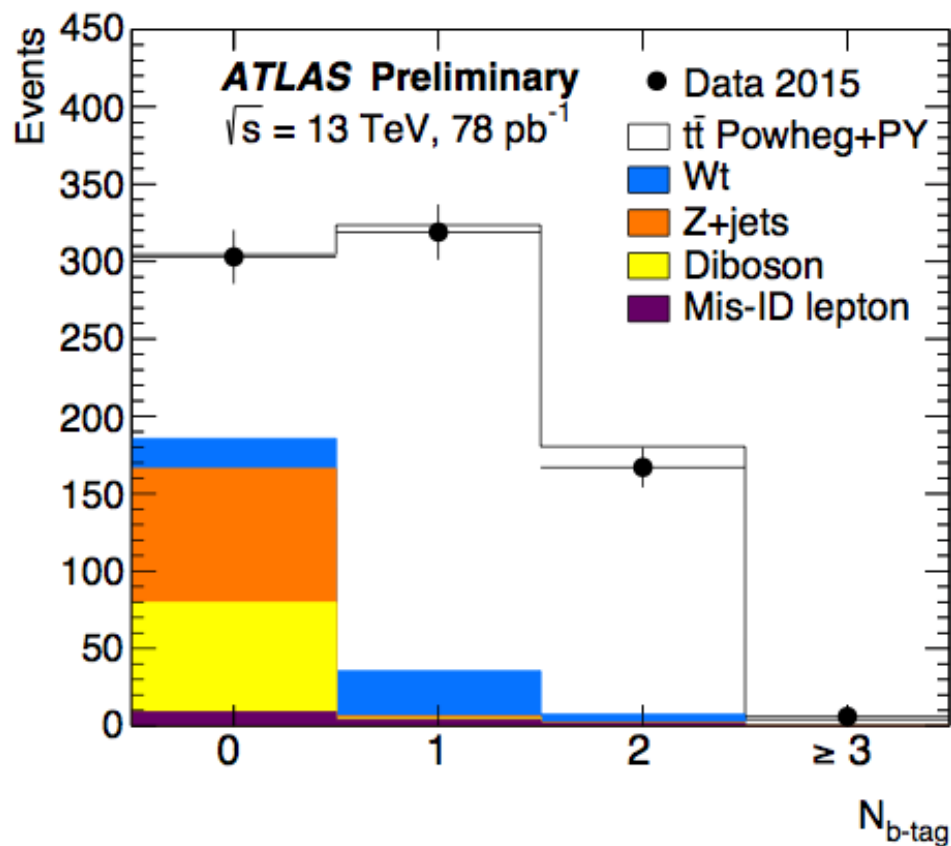
$\sigma_{t\bar{t}} = 242.4 \pm 1.7 \pm 5.5 \pm 7.5 \pm 4.2 \text{ pb}$ ($\sqrt{s} = 8 \text{ TeV}$),

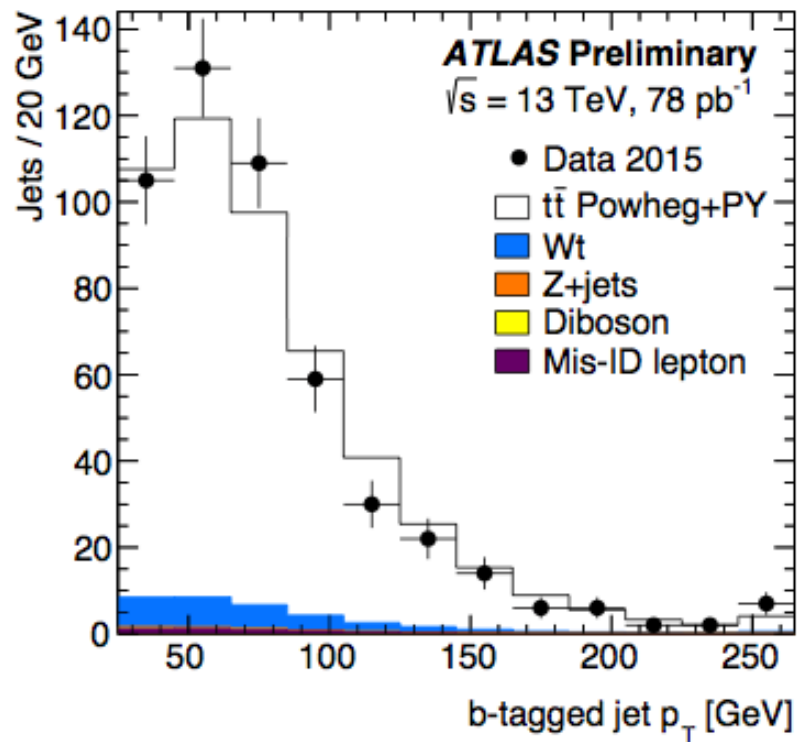
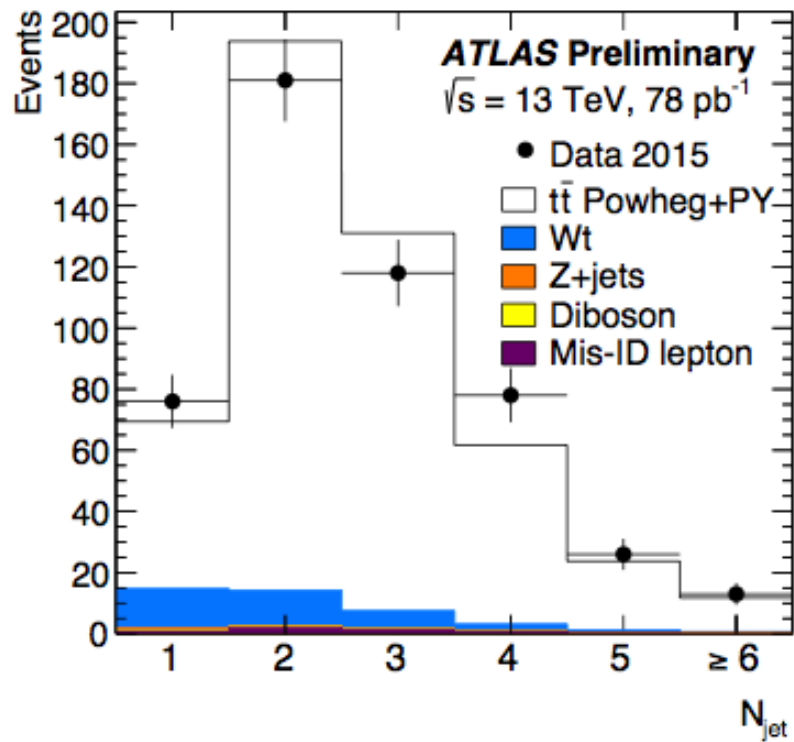
(uncertainties statistical, systematic, luminosity, beam energy)

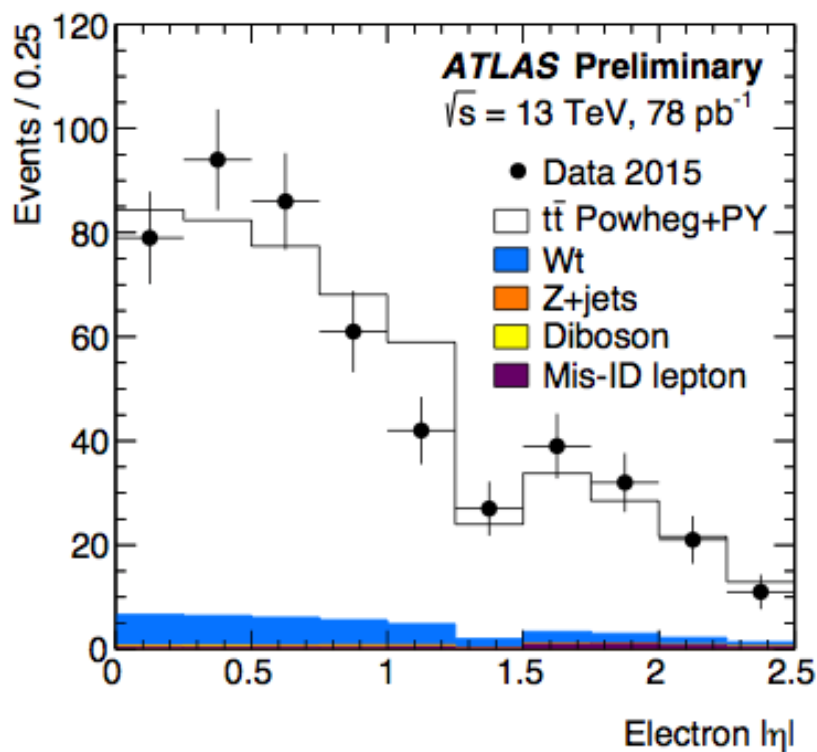
$R_{t\bar{t}} = 1.326 \pm 0.024 \pm 0.015 \pm 0.049 \pm 0.001$ (prediction 1.430 ± 0.013)

Uncertainty \sqrt{s}	$\Delta\sigma_{t\bar{t}}/\sigma_{t\bar{t}}$ (%)	
	7 TeV	8 TeV
Data statistics	1.69	0.71
$t\bar{t}$ modelling and QCD scale	1.46	1.26
Parton distribution functions	1.04	1.13
Background modelling	0.83	0.83
Lepton efficiencies	0.87	0.88
Jets and b -tagging	0.58	0.82
Misidentified leptons	0.41	0.34
Analysis systematics ($\sigma_{t\bar{t}}$)	2.27	2.26
Integrated luminosity	1.98	3.10
LHC beam energy	1.79	1.72
Total uncertainty	3.89	4.27

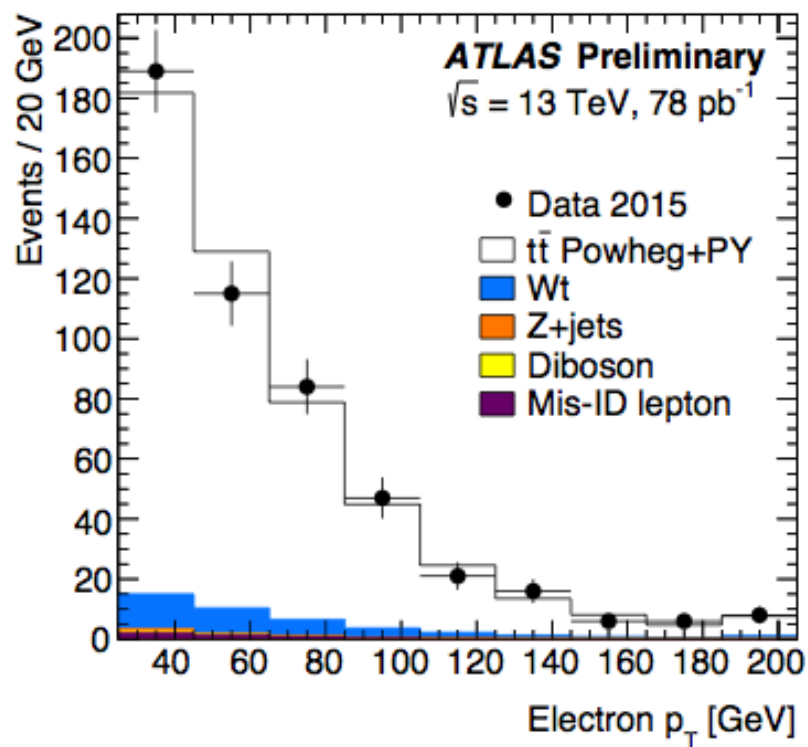
Event counts	N_1	N_2
Data	319	167
Wt single top	29.0 ± 3.8	5.6 ± 2.0
Dibosons	1.1 ± 0.2	0.0 ± 0.0
$Z(\rightarrow \tau\tau \rightarrow e\mu)+$ jets	1.3 ± 0.7	0.1 ± 0.1
Misidentified leptons	6.0 ± 3.9	2.8 ± 2.9
Total background	37.3 ± 5.5	8.5 ± 3.5



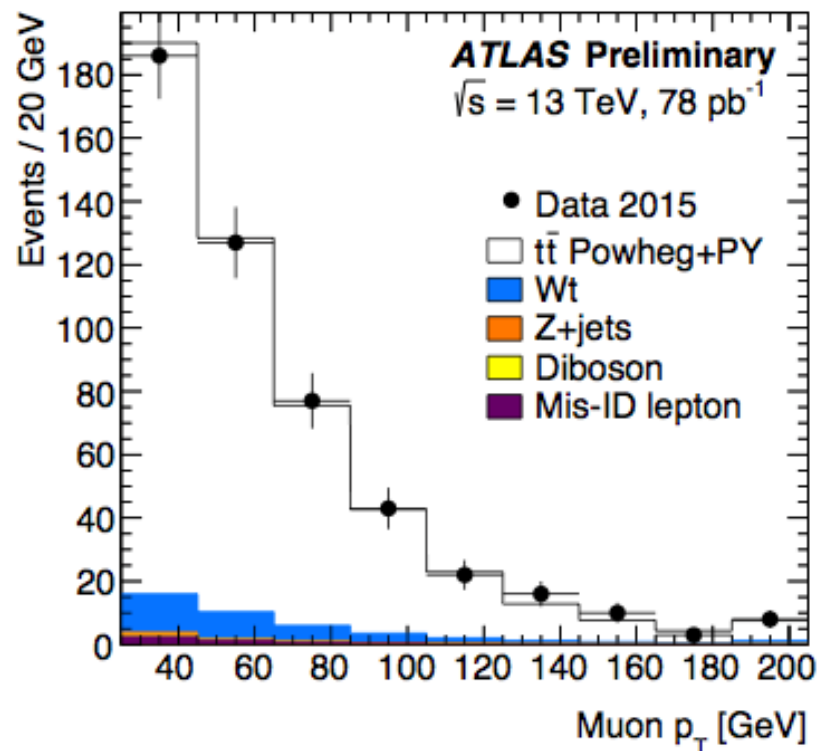
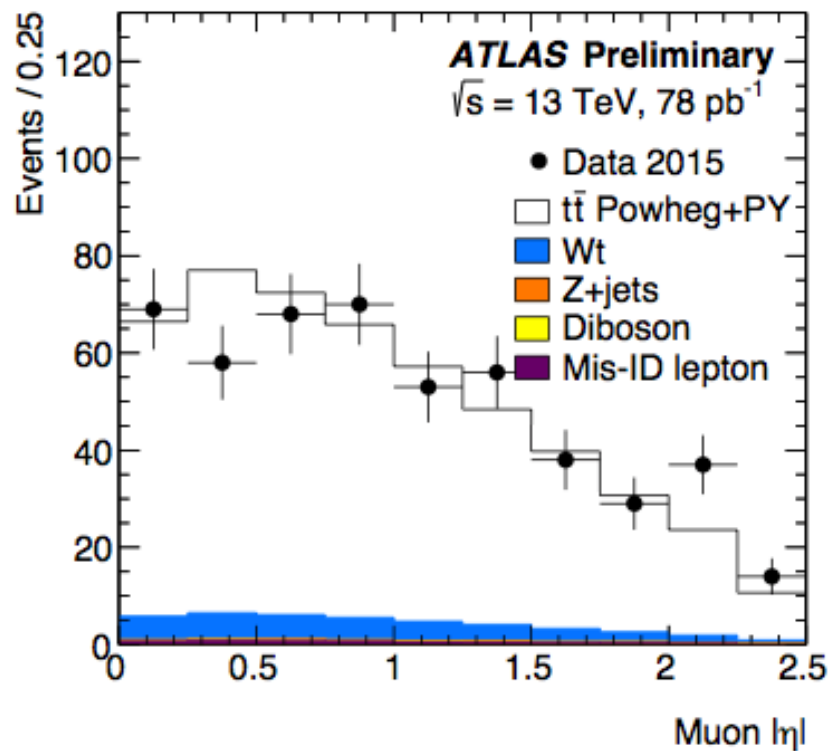




(c)



(d)

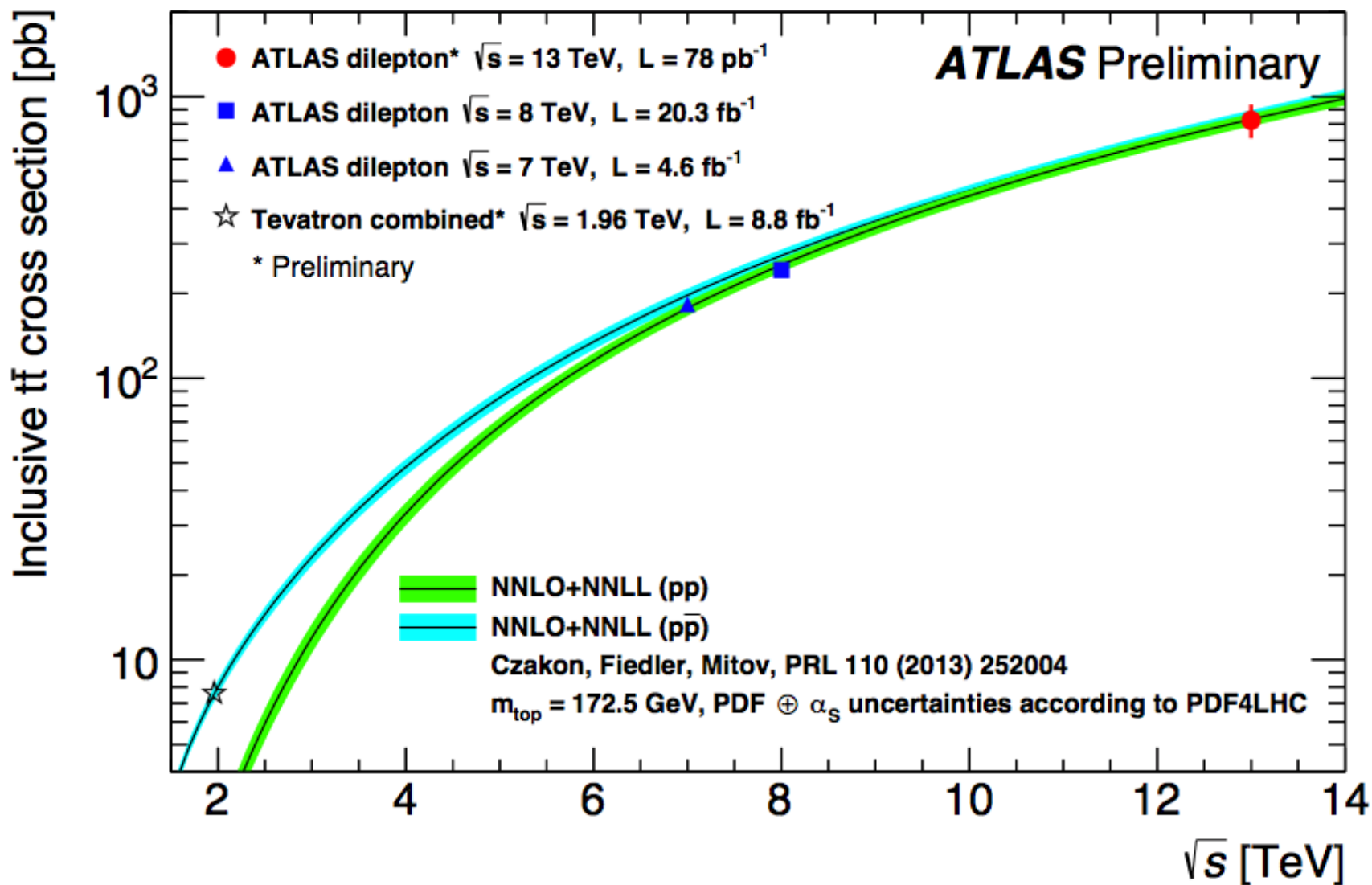


13 TeV

Component	OS $1b$	SS $1b$	(OS/SS) R_1	OS $2b$	SS $2b$	(OS/SS) R_2
Prompt	-	0.93 ± 0.06	-	-	0.44 ± 0.04	-
Misidentified	4.03 ± 0.11	2.75 ± 0.10	1.47 ± 0.04	1.75 ± 0.07	0.98 ± 0.05	1.79 ± 0.07
Total expectation	-	3.68 ± 0.11	-	-	1.42 ± 0.07	-
Data	-	5	-	-	2	-

$$\sigma_{t\bar{t}} = 825 \pm 49 \text{ (stat)} \pm 60 \text{ (syst)} \pm 83 \text{ (lumi) pb} \quad 13 \text{ TeV, prediction } 832+46-40 \text{ pb}$$

Uncertainty	$\Delta\epsilon_{e\mu}/\epsilon_{e\mu}$ (%)	$\Delta C_b/C_b$ (%)	$\Delta\sigma_{t\bar{t}}/\sigma_{t\bar{t}}$ (%)
Data statistics			6.0
$t\bar{t}$ NLO modelling	1.9	-0.3	2.2
$t\bar{t}$ hadronisation	-4.0	0.5	4.5
Initial/final state radiation	-1.1	0.1	1.2
Parton distribution functions	1.3	-	1.4
Single-top generator*	-	-	0.5
Single-top/ $t\bar{t}$ interference*	-	-	0.1
Single-top Wt cross-section	-	-	0.5
Diboson modelling*	-	-	0.1
Diboson cross-sections	-	-	0.0
Z+jets extrapolation	-	-	0.2
Electron energy scale/resolution	0.2	0.0	0.2
Electron identification	3.6	0.0	4.0
Electron isolation	1.0	-	1.1
Muon momentum scale/resolution	0.0	0.0	0.1
Muon identification	1.1	0.0	1.2
Muon isolation	1.0	-	1.1
Lepton trigger	1.3	0.0	1.3
Jet energy scale	-0.3	0.0	0.3
Jet energy resolution	-0.1	0.0	0.1
b -tagging	-	0.1	0.3
Misidentified leptons	-	-	1.3
Analysis systematics	6.4	0.6	7.3
Integrated luminosity	-	-	10.0
Total uncertainty	6.4	0.6	13.7



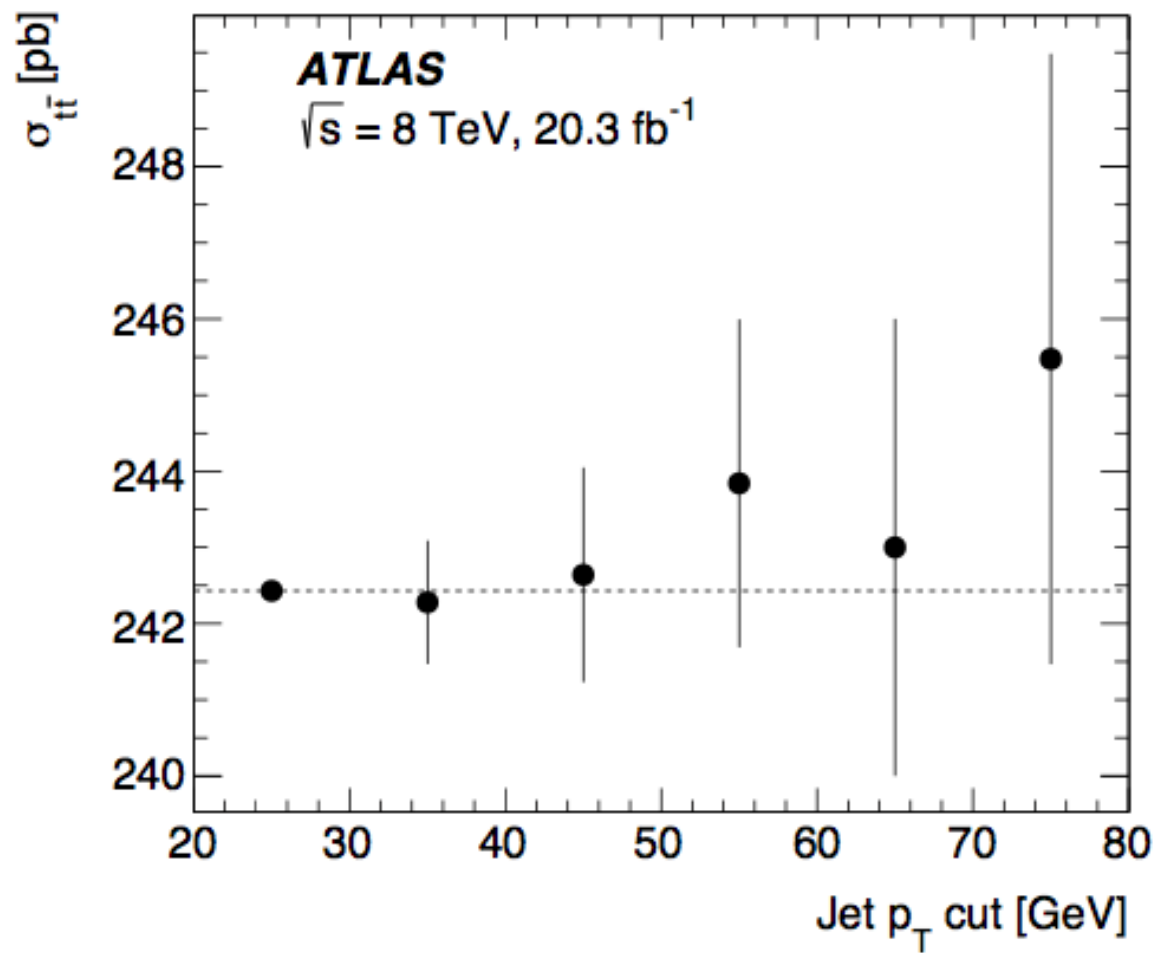
ATLAS 13 TeV **$e\mu + 1,2$ b-tagged jets****CMS 13 TeV** **$e\mu + \geq 2$ jets**

$$\sigma_{t\bar{t}} = 825 \pm 49 \text{ (stat)} \pm 60 \text{ (syst)} \pm 83 \text{ (lumi) pb}$$

Uncertainty	$\Delta\epsilon_{e\mu}/\epsilon_{e\mu}$ (%)	$\Delta C_b/C_b$ (%)	$\Delta\sigma_{t\bar{t}}/\sigma_{t\bar{t}}$ (%)
Data statistics			6.0
$t\bar{t}$ NLO modelling	1.9	-0.3	2.2
$t\bar{t}$ hadronisation	-4.0	0.5	4.5
Initial/final state radiation	-1.1	0.1	1.2
Parton distribution functions	1.3	-	1.4
Single-top generator*	-	-	0.5
Single-top/ $t\bar{t}$ interference*	-	-	0.1
Single-top Wt cross-section	-	-	0.5
Diboson modelling*	-	-	0.1
Diboson cross-sections	-	-	0.0
Z+jets extrapolation	-	-	0.2
Electron energy scale/resolution	0.2	0.0	0.2
Electron identification	3.6	0.0	4.0
Electron isolation	1.0	-	1.1
Muon momentum scale/resolution	0.0	0.0	0.1
Muon identification	1.1	0.0	1.2
Muon isolation	1.0	-	1.1
Lepton trigger	1.3	0.0	1.3
Jet energy scale	-0.3	0.0	0.3
Jet energy resolution	-0.1	0.0	0.1
b -tagging	-	0.1	0.3
Misidentified leptons	-	-	1.3
Analysis systematics	6.4	0.6	7.3
Integrated luminosity	-	-	10.0
Total uncertainty	6.4	0.6	13.7

$$\sigma_{t\bar{t}} = 772 \pm 60 \text{ (stat)} \pm 62 \text{ (syst)} \pm 93 \text{ (lumi) pb}$$

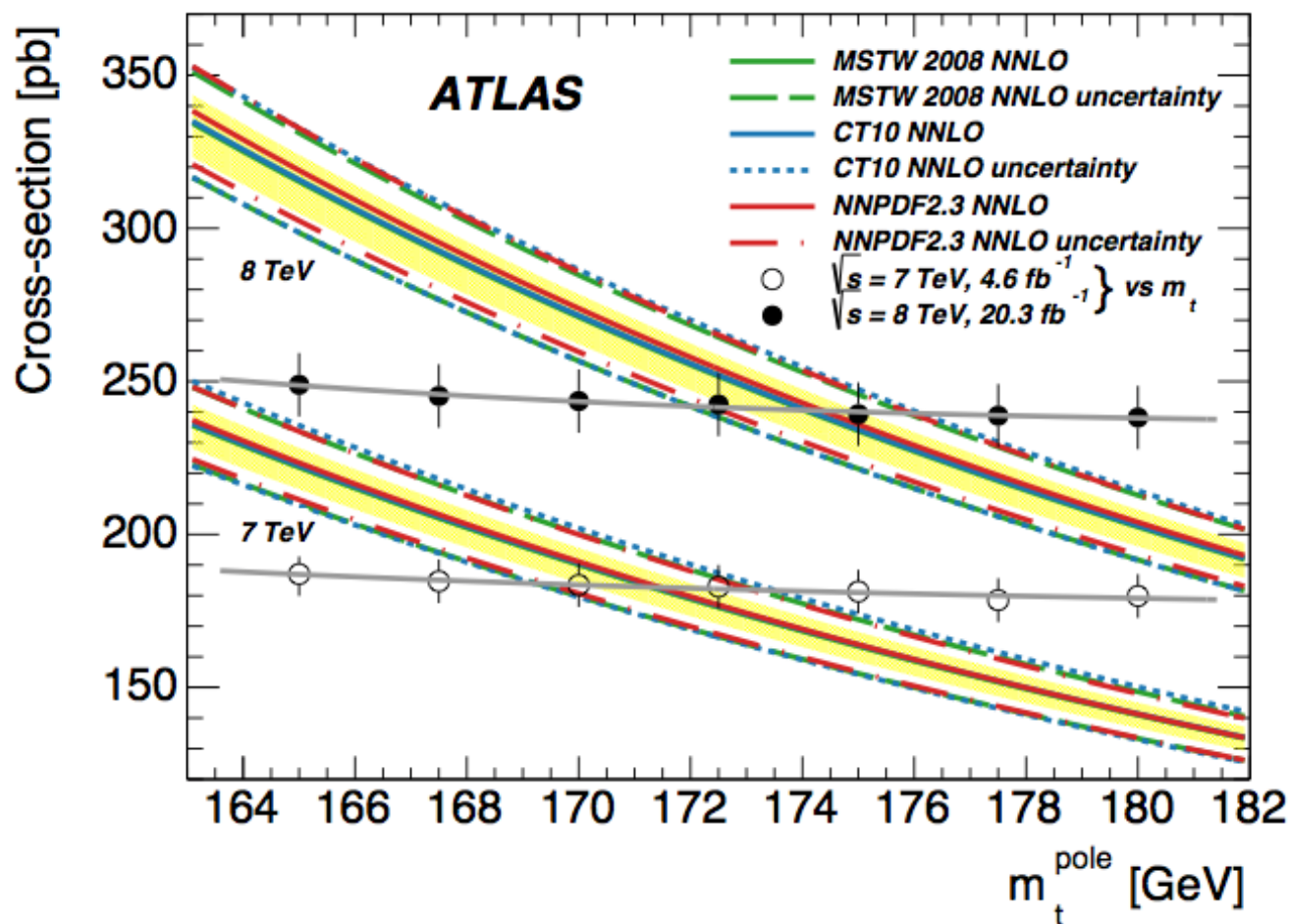
Source	$\Delta\sigma_{t\bar{t}}$ (pb)	$\Delta\sigma_{t\bar{t}}/\sigma_{t\bar{t}}$ (%)
Data statistics	60	7.7
Trigger efficiencies	39	5.0
Lepton efficiencies	33	4.3
Lepton energy scale	< 1	≤ 0.1
Jet energy scale	20	2.6
Jet energy resolution	< 1	≤ 0.1
Pileup	2.8	0.4
Scale (μ_F and μ_R)	1.5	0.2
$t\bar{t}$ NLO generator	15	1.9
$t\bar{t}$ hadronization	14	1.8
PDF	12	1.5
Single top quark	14	1.8
VV	3.5	0.5
Drell-Yan	3.9	0.5
Non-W/Z leptons	8	1.0
Total systematic (no integrated luminosity)	62	8.0
Integrated luminosity	93	12
Total	126	16.4

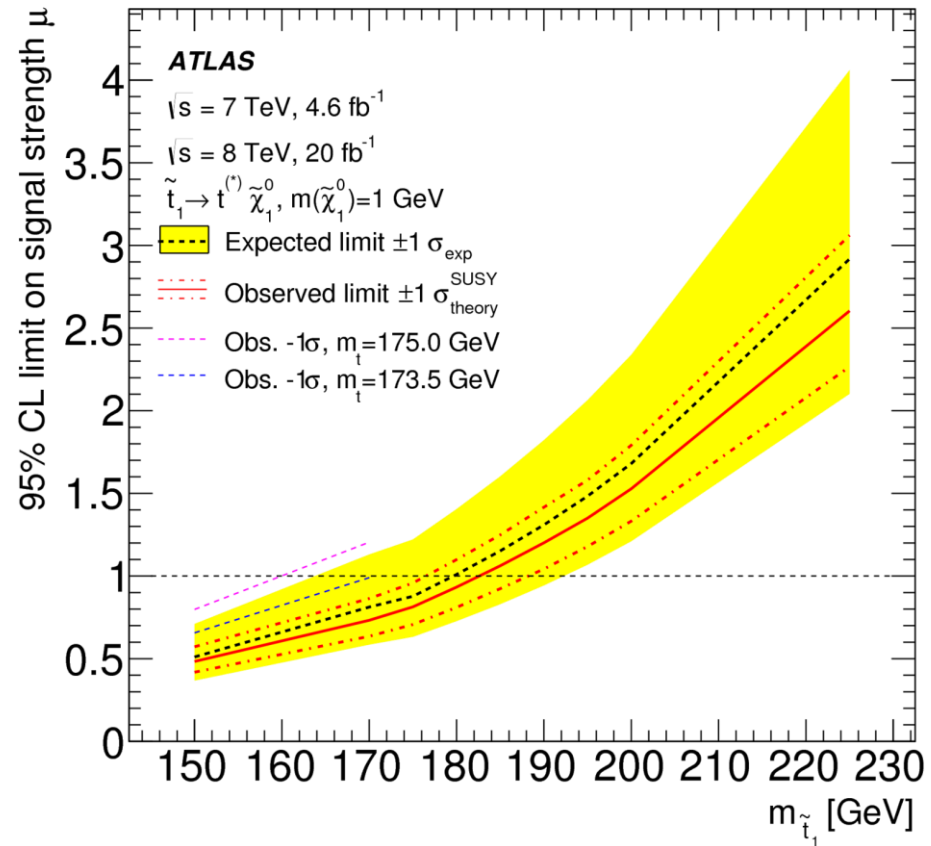
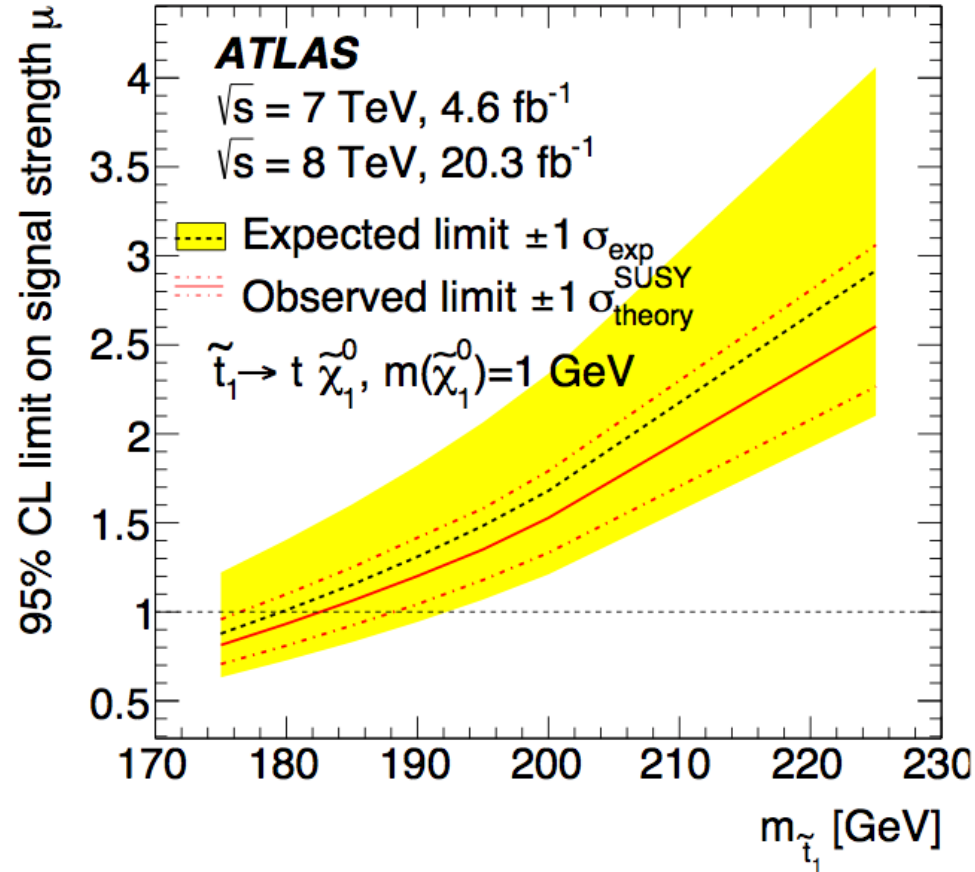


\sqrt{s} Uncertainty (inclusive $\sigma_{t\bar{t}}$)	$\Delta\epsilon_{e\mu}/\epsilon_{e\mu}$ (%)	7 TeV $\Delta C_b/C_b$ (%)	$\Delta\sigma_{t\bar{t}}/\sigma_{t\bar{t}}$ (%)	$\Delta\epsilon_{e\mu}/\epsilon_{e\mu}$ (%)	8 TeV $\Delta C_b/C_b$ (%)	$\Delta\sigma_{t\bar{t}}/\sigma_{t\bar{t}}$ (%)
Data statistics			1.69			0.71
$t\bar{t}$ modelling	0.71	-0.72	1.43	0.65	-0.57	1.22
Parton distribution functions	1.03	-	1.04	1.12	-	1.13
QCD scale choice	0.30	-	0.30	0.30	-	0.30
Single-top modelling	-	-	0.34	-	-	0.42
Single-top/ $t\bar{t}$ interference	-	-	0.22	-	-	0.15
Single-top Wt cross-section	-	-	0.72	-	-	0.69
Diboson modelling	-	-	0.12	-	-	0.13
Diboson cross-sections	-	-	0.03	-	-	0.03
Z+jets extrapolation	-	-	0.05	-	-	0.02
Electron energy scale/resolution	0.19	-0.00	0.22	0.46	0.02	0.51
Electron identification	0.12	0.00	0.13	0.36	0.00	0.41
Muon momentum scale/resolution	0.12	0.00	0.14	0.01	0.01	0.02
Muon identification	0.27	0.00	0.30	0.38	0.00	0.42
Lepton isolation	0.74	-	0.74	0.37	-	0.37
Lepton trigger	0.15	-0.02	0.19	0.15	0.00	0.16
Jet energy scale	0.22	0.06	0.27	0.47	0.07	0.52
Jet energy resolution	-0.16	0.08	0.30	-0.36	0.05	0.51
Jet reconstruction/vertex fraction	0.00	0.00	0.06	0.01	0.01	0.03
b -tagging	-	0.18	0.41	-	0.14	0.40
Misidentified leptons	-	-	0.41	-	-	0.34
Analysis systematics ($\sigma_{t\bar{t}}$)	1.56	0.75	2.27	1.66	0.59	2.26
Integrated luminosity	-	-	1.98	-	-	3.10
LHC beam energy	-	-	1.79	-	-	1.72
Total uncertainty ($\sigma_{t\bar{t}}$)	1.56	0.75	3.89	1.66	0.59	4.27
Uncertainty (fiducial $\sigma_{t\bar{t}}^{\text{fid}}$)	$\Delta\epsilon_{e\mu}/\epsilon_{e\mu}$ (%)	$\Delta C_b/C_b$ (%)	$\Delta\sigma_{t\bar{t}}^{\text{fid}}/\sigma_{t\bar{t}}^{\text{fid}}$ (%)	$\Delta\epsilon_{e\mu}/\epsilon_{e\mu}$ (%)	$\Delta C_b/C_b$ (%)	$\Delta\sigma_{t\bar{t}}/\sigma_{t\bar{t}}$ (%)
$t\bar{t}$ modelling	0.84	-0.72	1.56	0.74	-0.57	1.31
Parton distribution functions	0.35	-	0.38	0.23	-	0.28
QCD scale choice	0.00	-	0.00	0.00	-	0.00
Other uncertainties (as above)	0.88	0.21	1.40	1.00	0.17	1.50
Analysis systematics ($\sigma_{t\bar{t}}^{\text{fid}}$)	1.27	0.75	2.13	1.27	0.59	2.01
Total uncertainty ($\sigma_{t\bar{t}}^{\text{fid}}$)	1.27	0.75	3.81	1.27	0.59	4.14

Δm_t^{pole} (GeV)	$\sqrt{s} = 7 \text{ TeV}$	$\sqrt{s} = 8 \text{ TeV}$
Data statistics	0.6	0.3
Analysis systematics	0.8	0.9
Integrated luminosity	0.7	1.2
LHC beam energy	0.7	0.6
PDF+ α_s	1.8	1.7
QCD scale choice	+0.9 -1.2	+0.9 -1.3

$m_t^{\text{pole}} = 171.4 \pm 2.6 \text{ GeV}$ ($\sqrt{s} = 7 \text{ TeV}$) and
 $m_t^{\text{pole}} = 174.1 \pm 2.6 \text{ GeV}$ ($\sqrt{s} = 8 \text{ TeV}$).





		$\sigma(\text{pb})$		Stat (%)	Syst (%)	Lumi (%)
		NNLO	Meas.			
7 TeV	CMS	177.3	174.5	1.2	2.5	2.2
	ATLAS¹		182.9	1.7	2.3	2.0
8 TeV	CMS	252.9	245.6	0.5	2.4	2.6
	ATLAS¹		242.4	0.7	2.3	3.1
13 TeV	CMS	831.7	772	7.7	8.0	12
	ATLAS²		825	5.9	7.2	10

(taken from Enrique Palencia's CERN seminar, 25/8/15)