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Towards Common $t\bar{t}$ Monte-Carlo Settings for ATLAS and CMS

The ATLAS and CMS Collaborations

Both ATLAS and CMS use Powheg+Pythia8 Monte-Carlo simulations to model the $t\bar{t}$ process. A commonly agreed upon set of Powheg and Pythia8 parameters is presented and compared to the nominal ATLAS and CMS settings. Samples generated with the different settings are compared using a publicly available Rivet routine. Comparisons are presented to demonstrate that samples produced with the Common Settings by both collaborations are in agreement with each other. Samples generated with the Common Settings can be used to compare ATLAS and CMS analyses.

Contents

1 Introduction

In order to achieve the ultimate precision in top quark physics during the LHC era, it is necessary to combine the results of the ATLAS and CMS collaborations. Monte-Carlo (MC) modelling is a crucial ingredient in almost all top quark analyses, and understanding how to combine the differing strategies of ATLAS and CMS in this area is critical. Currently, ATLAS and CMS use the same generators, but different settings and uncertainty prescriptions, making combinations challenging. To simplify such combinations, it is useful to have Common Settings that can be used by both collaborations to produce a MC sample. Comparisons of this sample with the various MC samples in use by each collaboration provide insight into differences in shapes and normalisations of distributions, which can then be used to help understand the correlations of systematic uncertainties due to MC modelling. In addition, all future experimental results that compare to multiple MC setups can include a sample produced with these Common Settings, making it easier to understand the trends in similar analyses with slightly different selections or binnings. Common Settings that are tuned to ATLAS and CMS data could also become the default for $t\bar{t}$ samples, making it possible to share the computing resources to produce them, for current and future generators.

Since both experiments use Powheg+Pythia8 at NLO in QCD for the nominal $t\bar{t}$ modelling, the new settings proposed in this document are also based on this generator setup. The hard process is generated using the HVQ program [1] in the Powheg-Box V2 [2] package, which is then interfaced to Pythia8 [3, 4] for parton showering and hadronisation. No detector simulation is applied because this is highly experiment-specific [5]. No tuning to data is attempted here, instead the focus is on the technical implementation of Common Settings, which are then used to produce a common sample. Comparisons are performed at the stable particle level (mean lifetime $> 0.3 \times 10^{-10}$ s) using the publicly available “MC_TTBAR" event selection routine packaged with Rivet [6] v3.1.2.

This document is organised as follows. In Section 2, the nominal settings of both experiments are summarised, and the proposed Common Settings are introduced. Section 3 presents validation plots which demonstrate that the two experiments are both able to produce consistent samples with the Common Settings. Comparisons between a sample generated with the Common Settings and the nominal samples of both ATLAS and CMS are presented in Section 4, and conclusions are drawn in Section 5.

2 Comparison of Settings

Both the ATLAS and CMS experiments use Powheg+Pythia8 setups to generate their nominal $t\bar{t}$ MC samples, generating the hard process with the HVQ program [1] in the Powheg-Box V2 [2] package, which is then interfaced to Pythia8 [3] for parton showering and hadronisation. Many settings are similar if not identical; for example, both experiments use the Powheg default choice for both the renormalisation and factorisation scale, which is the transverse mass of the top quark in the $t\bar{t}$ rest frame, *i.e.* $\mu_R = \mu_F = \sqrt{m_t^2 + p_\perp^2}$. Similarly, both experiments use the same value for the top-quark mass $m_t = 172.5$ GeV.

Perhaps the biggest difference between the Powheg settings used in each experiment is in the choice of the h_{damp} parameter, which controls the scale of the first emission from the hard process. ATLAS uses $h_{\mathrm{damp}} = 1.5 \times m_t = 258.75$ GeV, a value optimised on $t\bar{t}$ data from the studies of [7]. In contrast, CMS includes h_{damp} in the tuning, finding a value of $h_{\mathrm{damp}} = 237.8775$ [8]. ATLAS and CMS also use different svn revisions of Powheg (3026 and 3728, respectively), but the HVQ program is unchanged in these.

For the parton showering and hadronisation, while both experiments use Pythia8, there is a small difference in version, with ATLAS using v230 and CMS using v240. Further, both experiments have independently tuned (optimised parameters related to the parton shower and multiple-parton interactions) Pythia8 to their respective datasets. ATLAS has developed the A14 tune [9], used in conjunction with the NNPDF2.3 LO PDF set [10], while CMS uses the CP5 tune [8] and NNPDF3.1 NNLO set [11]. Another difference between the two experiments is in the treatment of heavy flavor (HF) hadron decays. For this, ATLAS uses EvtGen v1.2.0 [12], while CMS allows Pythia8 to handle these decays. There are many other Pythia8 settings which differ between the two experiments, and these are summarised in Table 3.

The new settings for Powheg+Pythia8 have been developed by both collaborations in order to aid in combination efforts and allow easy comparisons to identical Powheg+Pythia8 settings in future experimental results. Referred to as the "Common Settings", these settings have not been optimised for agreement with data. This is the first attempt to create such settings (version 0.1) by taking approximate averages for non-binary settings. The binary settings are mostly taken from the ATLAS setup. Both experiments use Pythia8 with a slightly different version, v244 in ATLAS and v240 in CMS, but with the same Monash tune [13] and the NNPDF2.3 LO PDF set. A list of Powheg settings for the Common Settings, as well as the default CMS and ATLAS settings, are shown in Table 1. This list includes all of the relevant physics parameters that vary from Powheg defaults. Additional parameters, mostly relevant to the integration settings, are shown in Table 2.

Similarly, a list of the relevant Pythia8 settings in each of the three setups is given in Table 3, while Table 4 shows additional Pythia8 settings, including those related to the tune. The value for the tune setting is the same for all three setups, but the actual tune is different because many of the tune-related parameters change. The name of the setting in Pythia8 is the combination of the section heading and the name, so for example "TimeShower:alphaSvalue". For simplicity, the Common Settings do not use EvtGen for HF decays, and the decays of the top quarks in Powheg are inclusive in all Standard Model decays[1].

A summary of the most significant Powheg and Pythia8 settings is shown in Table 5.

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[1] It should be noted that the ATLAS and CMS samples discussed here are both filtered to require at least one lepton (electron or muon) in the final state.

Setting name	Setting description	CMS default	ATLAS default	Common Proposal
	POWHEG-Box V2 svn revision	3728	3026	3728 (CMS) 3026 (ATLAS)
topdecaymode	Allowed decays of the top quark	22222	22222	22222
qmass	top-quark mass [GeV]	172.5	172.5	172.5
twidth	top-quark width [GeV]	1.31	1.32	1.315
hdamp	first emission damping parameter [GeV]	237.8775	258.75	250
wmass	$W^{\pm}$ mass [GeV]	80.4	80.3999	80.4
wwidth	$W^{\pm}$ width [GeV]	2.141	2.085	2.11
bmass	b-quark mass [GeV]	4.8	4.95	4.875
cmass	c-quark mass [GeV]	1.5	1.55	1.525
smass	s-quark mass [GeV]	0.2	0.5	0.35
dmass	d-quark mass [GeV]	0.1	0.32	0.21
umass	u-quark mass [GeV]	0.1	0.32	0.21
taumass	τ mass [GeV]	1.777	1.777	1.777
mumass	μ mass [GeV]	0.1057	0.1057	0.1057
emass	e mass [GeV]	0.00051	0.00051	0.00051
elbranching	W-boson electronic branching fraction	0.108	0.1082	0.1081
sin2cabibbo	quark mixing angle	0.051	0.051	0.051

Table 1: POWHEG settings for the HVQ program used in the ATLAS and CMS default Monte Carlo event generation setups for $t\bar{t}$ production and proposal for Common Settings.

Setting name	Setting description	CMS default	ATLAS default	Common Proposal
bmass_lhe	b-quark mass in GeV (for momentum reshuffling)	(5.0)	4.95	4.875
cmass_lhe	c-quark mass in GeV (for momentum reshuffling)	(1.5)	1.55	1.525
fastbtlbound	use fast btilde bound	(1)	1	1
ptsqmin	minimum pT in GeV for generating gluon emission off light quarks	(0.8)	0.8	0.8
ubexcess_correct	whether to correct for upper bound violations in btilde/remnant generation	(1)	1	1
withnegweights	allow negative weights	(1)	1	1
lhans1/lhans2	LHA pdfs	306000	260000	260000
ncall1	number of calls for initializing the integration grid	10000	500	500
itmx1	number of iterations for initializing the integration grid	5	1	1
ncall2	number of calls for computing the integral and finding upper bound	100000	50000	50000
itmx2	number of iterations for computing the integral and finding upper bound	5	8	8
nubound	number of calls to setup upper bounds for radiation	100000	800000	800000
xupbound	increase upper bound for radiation generation	2	10	10

Table 2: Additional POWHEG settings used in the ATLAS and CMS default Monte Carlo event generation setups for $t\bar{t}$ production and proposal for Common Settings. Entries where the default POWHEG value is being used are indicated in parentheses.

Setting name	Setting description	CMS default	ATLAS default	Common proposal
	Pythia 8 version	v240	v230	v240 (CMS) v244 (ATLAS)
Powheg	Interface parameters in Pythia8 for matching to POWHEG			
pTdef	Flag for hardness criterion (Powheg vs Pythia8)	1	2	1
emitted	Flag for defining emissions	0	0	0
pTemt	Flag for which partons are used to define Powheg hardness criteria	0	0	0
pThard	Flag for how to calculate Powheg hardness criteria	0	0	0
vetoCount	How many emissions vetoed showers checks after first allowed emission	100	3	50
nFinal	Number of outgoing particles for born level process	2	2	2
veto	Flag for vetoed or unvetoed showers	1	1	1
MPIveto	Flag for applying veto to Multi Parton Interactions	(0)	0	0
TimeShower	Final State Radiation Parameters			
mMaxGamma	Maximum invariant mass for $\gamma \to f\bar{f}$	1.0	(10)	10
alphaSorder	Order of running for α_s	2	(1)	1
alphaSvalue	Value of α_s at Z mass scale	0.118	0.127	0.13650
pTmaxMatch	Flag for setting maximum shower scale algorithm	2	2	2
SpaceShower	Initial State Radiation Parameters			
alphaSorder	Order of running for α_s	2	(1)	1
alphaSvalue	Value of α_s at Z mass scale	0.118	0.127	0.1365
pTmaxMatch	Flag for setting maximum shower scale algorithm	2	2	2
rapidityOrder	Force emissions to be ordered in rapidity	on	on	on
rapidityOrderMPI	Force emissions in secondary scatterings to be ordered in rapidity	(on)	on	on
pT0Ref	Reference p_T scale for regularizing soft QCD emissions	(2)	1.56	2
MPI	Multi-Parton Interaction Parameters			
alphaSorder	Order of running for α_s	2	(1)	1
alphaSvalue	Value of α_s at Z mass scale	0.118	0.126	0.130
ecmPow	Exponent control kinematic dependence of pT0	0.03344	(0.215)	0.215
bprofile	impact parameter profile choice flag for hadron beams	2	(3)	3
coreRadius	Inner radius of core when using bprofile = 2	0.7634	(0.4)	0.4
coreFraction	Matter content fraction of core when using bprofile = 2	0.63	(0.5)	0.5
pT0ref	Reference p_T scale for regularizing soft QCD emissions	1.41	2.09	2.28
BeamRemnants	Parameters for all partons extracted from a beam			
primordialKThard	Parameter controlling k_T of beam remnant initiators in hard-interations	(1.8)	1.88	1.8
ColourReconnection	Colour Reconnection Parameters			
range	Parameter controlling colour reconnection probability	5.176	1.71	1.80
ParticleDecays	Particle Decay Settings			
allowPhotonRadiation	Allow photon radiation in decays to lepton pairs	on	(off)	off

Table 3: Pythia8 settings used in the ATLAS and CMS default Monte Carlo event generation setups for $t\bar{t}$ production and proposal for Common Settings. Entries where the default Pythia8 value (from v240 in CMS and from v230 in ATLAS) is being used are indicated in parentheses.

Setting name	Setting description	CMS default	ATLAS default	Common proposal
Check	Parameters for Error Checking			
epTolErr	Maximum allowed summed deviation of different values	0.01	0.0001	0.0001
Tune	Tune Settings			
	Tune	CP5	A14	Monash
preferLHAPDF	LHAPDF package to obtain PDF values	2	1	1
pp	Choice of baseline tune to $pp/p\bar{p}$ data	14	14	14
ee	Choice of baseline tune to e^+e^- data	7	7	7
SigmaTotal	Parameters for Total Cross Sections			
zeroAXB	Flag to switch off central diffraction	off	on	on
mode	Mode	0	1	1
sigmaEl	Elastic cross section (in mb)	21.89	25.00	25.00
sigmaTot	Total cross section (in mb)	100.309	100.000	100.000
PDF	Parameters for PDF selection			
pSet	Parton densities to be used for proton beams	LHAPDF6:NNPDF31_nnlo_as_0118	LHAPDF6:NNPDF23_lo_as_0130_qed	LHAPDF6:NNPDF23_lo_as_0130_qed
StandardModel	Standard Model Parameters			
sin2thetaW	Weak mixing angle	(0.23120)	(0.23113)	0.23113
sin2thetaWbar	Weak mixing angle for fermions vector couplings to Z^0	(0.23150)	(0.23146)	0.23146

Table 4: Additional Pythia8 settings used in the ATLAS and CMS default Monte Carlo event generation setups for $t\bar{t}$ production and proposal for Common Settings. Entries where the default Pythia8 value (from v240 in CMS and from v230 in ATLAS) is being used are indicated in parentheses.

Setting name	Setting description	CMS default	ATLAS default	Common Proposal
Powheg				
qmass	top-quark mass [GeV]	172.5	172.5	172.5
twidth	top-quark width [GeV]	1.31	1.32	1.315
hdamp	first emission damping parameter [GeV]	237.8775	258.75	250
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wwidth	$W^{\pm}$ width [GeV]	2.141	2.085	2.11
bmass	b-quark mass [GeV]	4.8	4.95	4.875
Pythia 8				
	Pythia 8 version	v240	v230	v240 (CMS) v244 (ATLAS)
	Tune	CP5	A14	Monash
PDF:pSet	LHAPDF6 parton densities to be used for proton beams	NNPDF31_nnlo_as_0118	NNPDF23_lo_as_0130_qed	NNPDF23_lo_as_0130_qed
TimeShower:alphaSvalue	Value of α_s at Z mass scale for Final State Radiation	0.118	0.127	0.1365
SpaceShower:alphaSvalue	Value of α_s at Z mass scale for Initial State Radiation	0.118	0.127	0.1365
MPI:alphaSvalue	Value of α_s at Z mass scale for Multi-Parton Interaction	0.118	0.126	0.130
MPI:pT0ref	Reference p_T scale for regularizing soft QCD emissions	1.41	2.09	2.28
ColourReconnection:range	Parameter controlling colour reconnection probability	5.176	1.71	1.80

Table 5: Highlights of Powheg and Pythia8 settings used in the ATLAS and CMS default Monte Carlo event generation setups for $t\bar{t}$ production and proposal for Common Settings.

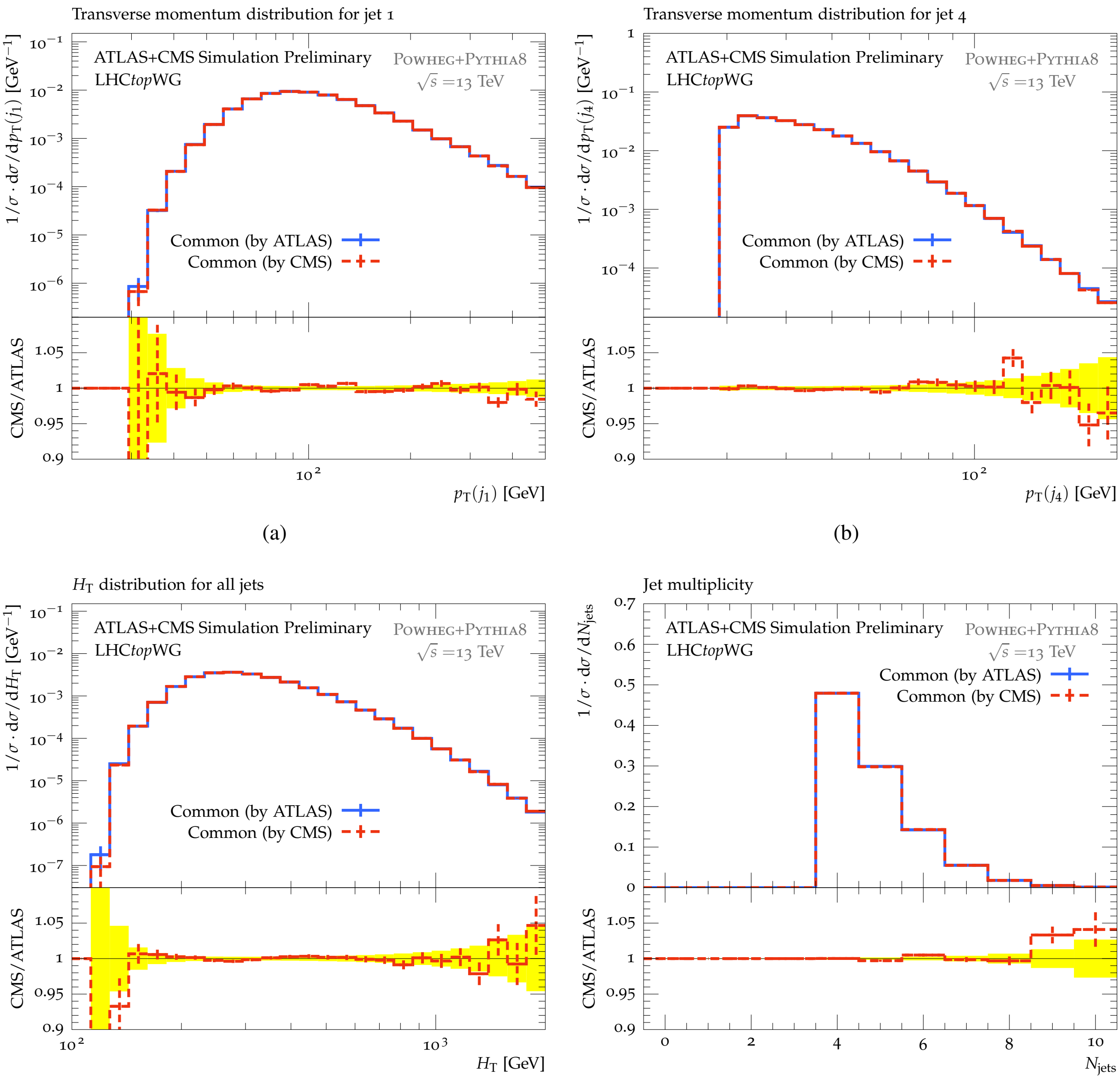
3 Validation

The first step is to validate that samples generated in each experiment's software stack with the Common Settings are consistent with each other. To do this, both ATLAS and CMS produced samples of 10M events inclusive in all top decay modes. The production is done independently by each experiment, using the settings listed in Section 2. The LHE files are produced and showered independently by each collaboration. It was found not to be possible to have the random number generator sequence identical, even when starting from the same seed. The generator setups are sufficiently different that producing identical events is not possible.

The ONELEP mode of the MC_TTBAR Rivet routine is used for the comparison of the two samples. This mode has an event selection requiring exactly one lepton (electron or muon) with $p_{\mathrm{T}} > 30$ GeV and $|\eta| < 4.2$, missing transverse energy $E_{\mathrm{T}}^{\mathrm{miss}} > 30$ GeV, and at least 4 jets, reconstructed with the anti-k_T algorithm [14, 15] and a radius parameter of 0.6, with $p_{\mathrm{T}} > 30$ GeV and $|\eta| < 4.2$. Any jet within a $\Delta R = \sqrt{\Delta\eta^2 + \Delta\phi^2} < 0.3$ of the lepton is removed to prevent double counting of energy deposits. The p_{T} of the leading and fourth jet as well as the jet multiplicity and H_{T} (scalar sum of jet momenta) distributions are shown in Figure 1. The histograms are filled with all events passing these requirements.

Finally, exactly two of the jets must be ghost-matched to a b-hadron, and these are referred to as b-tagged jets. The leading two light jets (not b-tagged) and the leading two b-tagged jets are shown in Figure 2. The angular correlations between different jets are shown in Figure 3.

The mass of the hadronically decaying W-boson, shown in Figure 4(a), is then reconstructed by taking the vector sum of the non-b-tagged jet pair which is closest to $m_W = 80.4$ GeV. The top quark mass plot shown in Figure 4(b) is filled twice per event by combining each b-tagged jet with the W-boson candidate. The mass of the top-quark-pair system is shown in Figure 4(c), and the mass of the system of b-quark and lepton is shown in Figure 4(d). All of the distributions demonstrate good closure between the two experiments, confirming that both ATLAS and CMS are able to produce consistent samples with the Common Settings. The invariant mass distributions of the W boson and the top quark are particularly sensitive to different settings for α_{S} and color reconnection, see Figure 8 and its discussion. The samples generated with the Common Settings by ATLAS and CMS agree with each other within uncertainties, no shift in mass is observed, showing that the Common Settings are successfully implemented by both collaborations.



(a)

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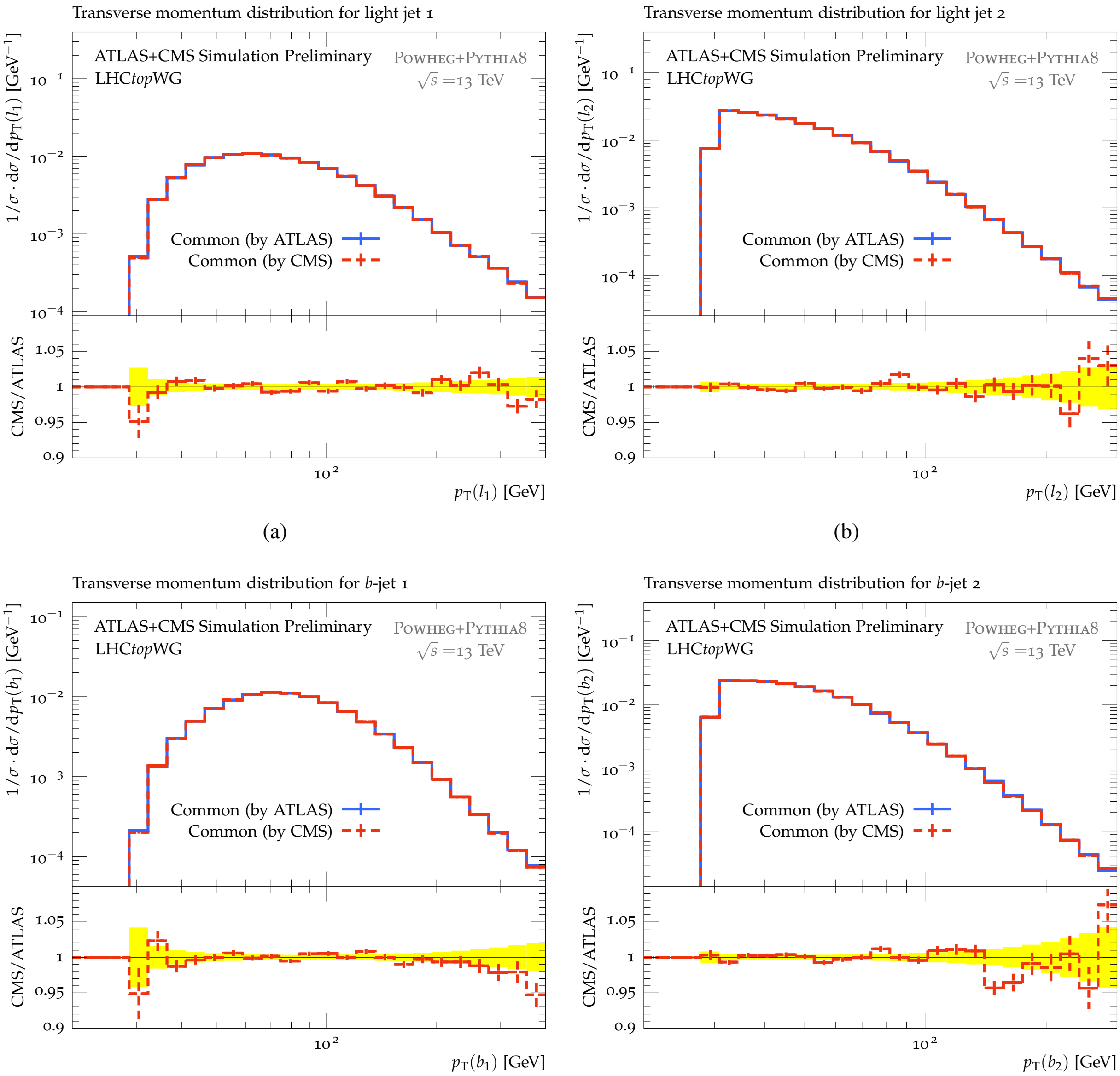
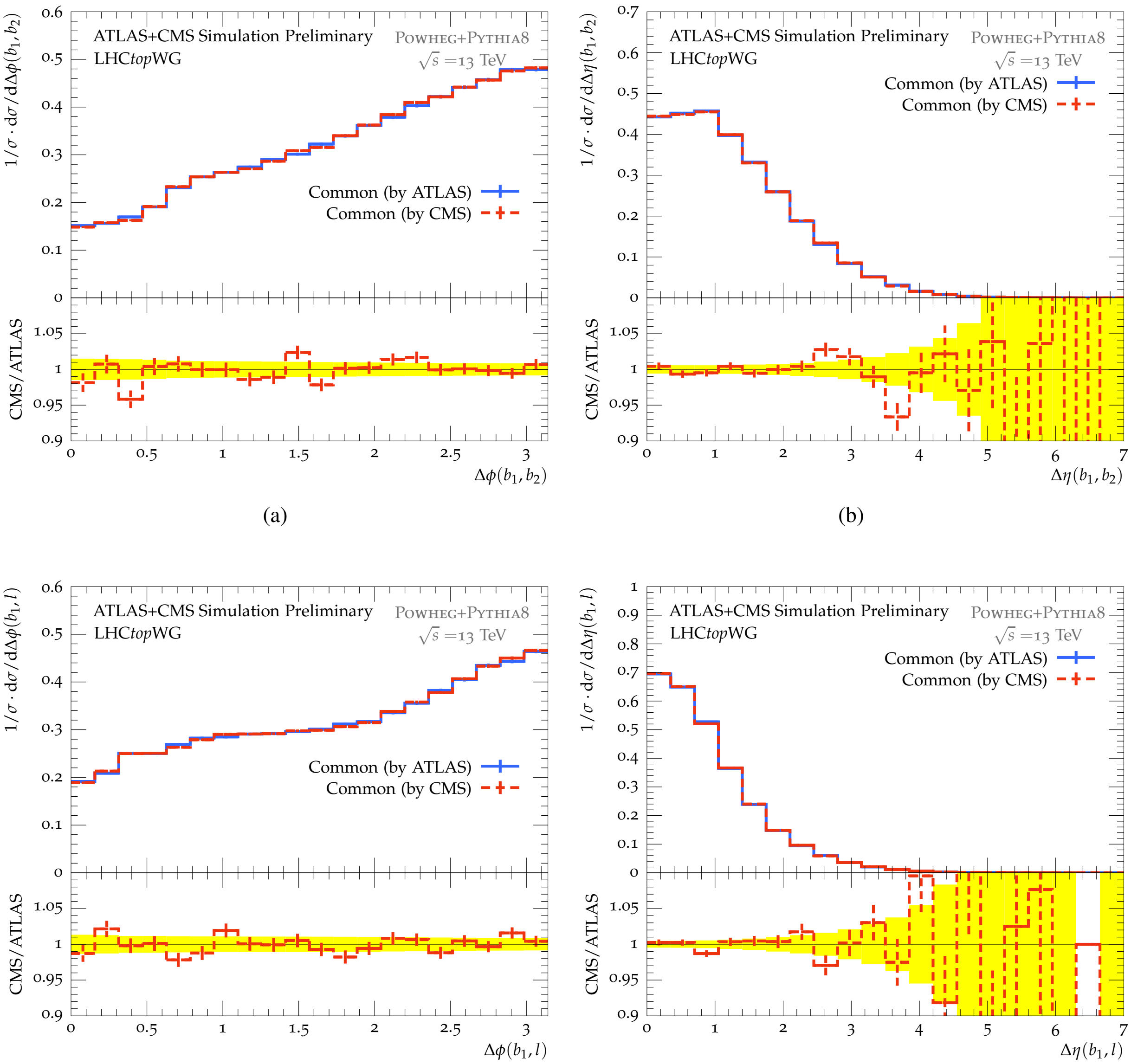
Figure 1: Comparison of samples produced by ATLAS (in blue) and CMS (in red) with Common Settings for NLO Monte Carlo simulation of $t\bar{t}$ events using Powheg matched with Pythia8. Shown are the kinematic distributions of jets prior to the b-tagging requirements, (a) the leading jet transverse momentum, (b) the fourth-leading jet transverse momentum, (c) the scalar sum of jet momenta, and (d) the jet multiplicity. Only statistical uncertainties due to the limited number of simulation events are shown. The yellow band in the ratio panel gives the statistical uncertainty on the sample produced by ATLAS.



(a) (b)

(c) (d)

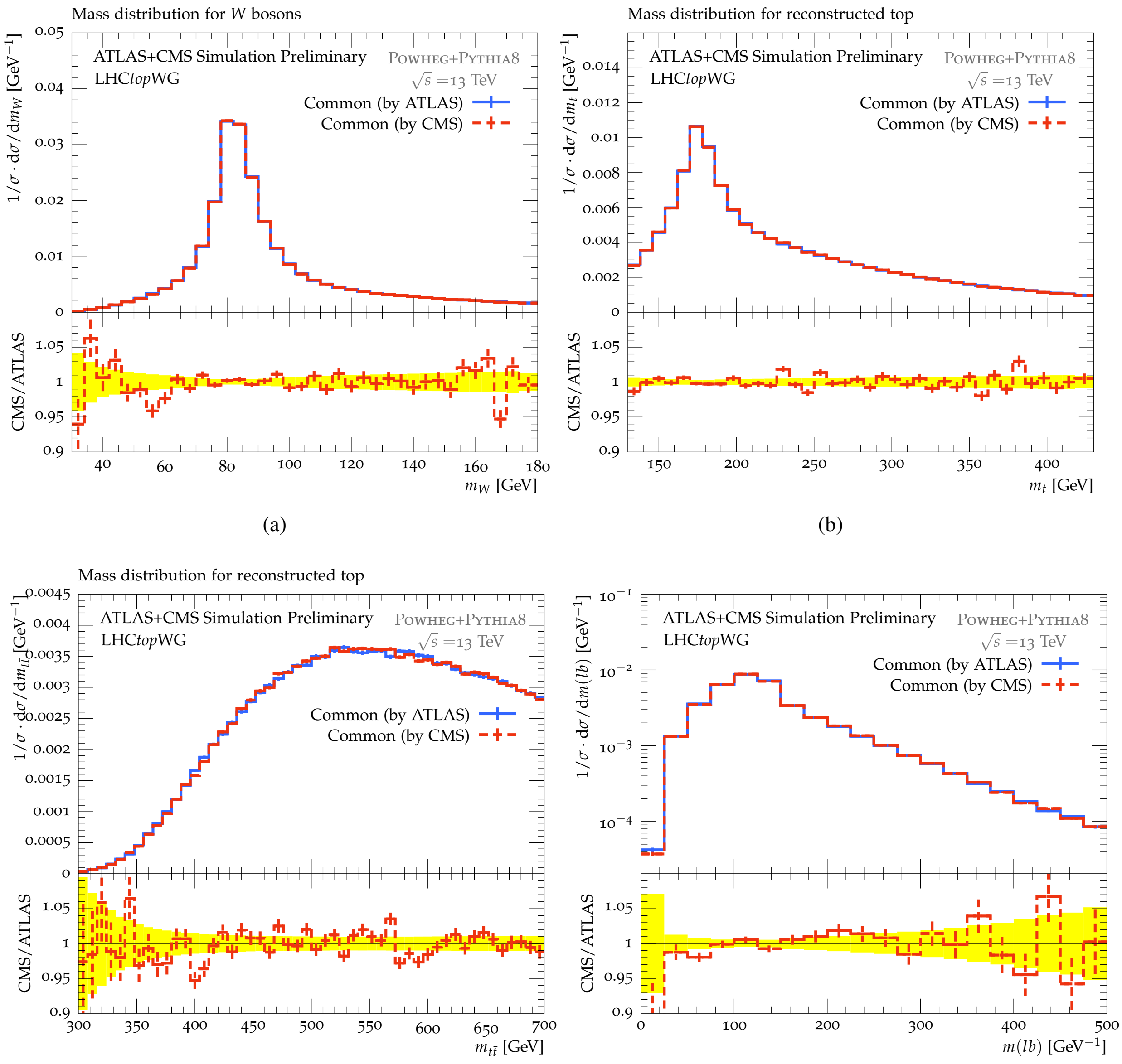
Figure 2: Comparison of samples produced by ATLAS (in blue) and CMS (in red) with Common Settings for NLO Monte Carlo simulation of $t\bar{t}$ events using POWHEG matched with PYTHIA8. Shown are the p_T distributions for the leading two light jets and the two b-tagged jets after the b-tagging requirements have been applied, showing the (a) leading light jet transverse momentum, (b) second-leading light jet transverse momentum, (c) leading b-tagged jet transverse momentum, and (d) second-leading b-tagged jet transverse momentum. Only statistical uncertainties due to the limited number of simulation events are shown. The yellow band in the ratio panel gives the statistical uncertainty on the sample produced by ATLAS.



(a) (b)

(c) (d)

Figure 3: Comparison of samples produced by ATLAS (in blue) and CMS (in red) with Common Settings for NLO Monte Carlo simulation of $t\bar{t}$ events using Powheg matched with Pythia8. Shown are angular distributions sensitive to spin and spin correlation effects: (a) $\Delta\phi$ and (b) $\Delta\eta$ between the two b-tagged jets, and (c) $\Delta\phi$ and (d) $\Delta\eta$ between the leading b-tagged jet and the lepton. Only statistical uncertainties due to the limited number of simulation events are shown. The yellow band in the ratio panel gives the statistical uncertainty on the sample produced by ATLAS.



(a) (b)

(c) (d)

Figure 4: Comparison of samples produced by ATLAS (in blue) and CMS (in red) with Common Settings for NLO Monte Carlo simulation of $t\bar{t}$ events using Powheg matched with Pythia8. Shown are reconstructed invariant mass distributions of: (a) the hadronically-decaying W-boson candidates, (b) hadronically decaying top-quark candidates, (c) $t\bar{t}$ system, and (d) lepton + leading b-jet system. Only statistical uncertainties due to the limited number of simulation events are shown. The yellow band in the ratio panel gives the statistical uncertainty on the sample produced by ATLAS.

4 Comparison with nominal ATLAS and CMS samples

With the validation complete, a common sample is generated with the Common Settings and then compared to the nominal $t\bar{t}$ samples of both experiments. For this, the same MC_TTBAR routine described in Section 3 is used and 10 M events are generated for each sample.

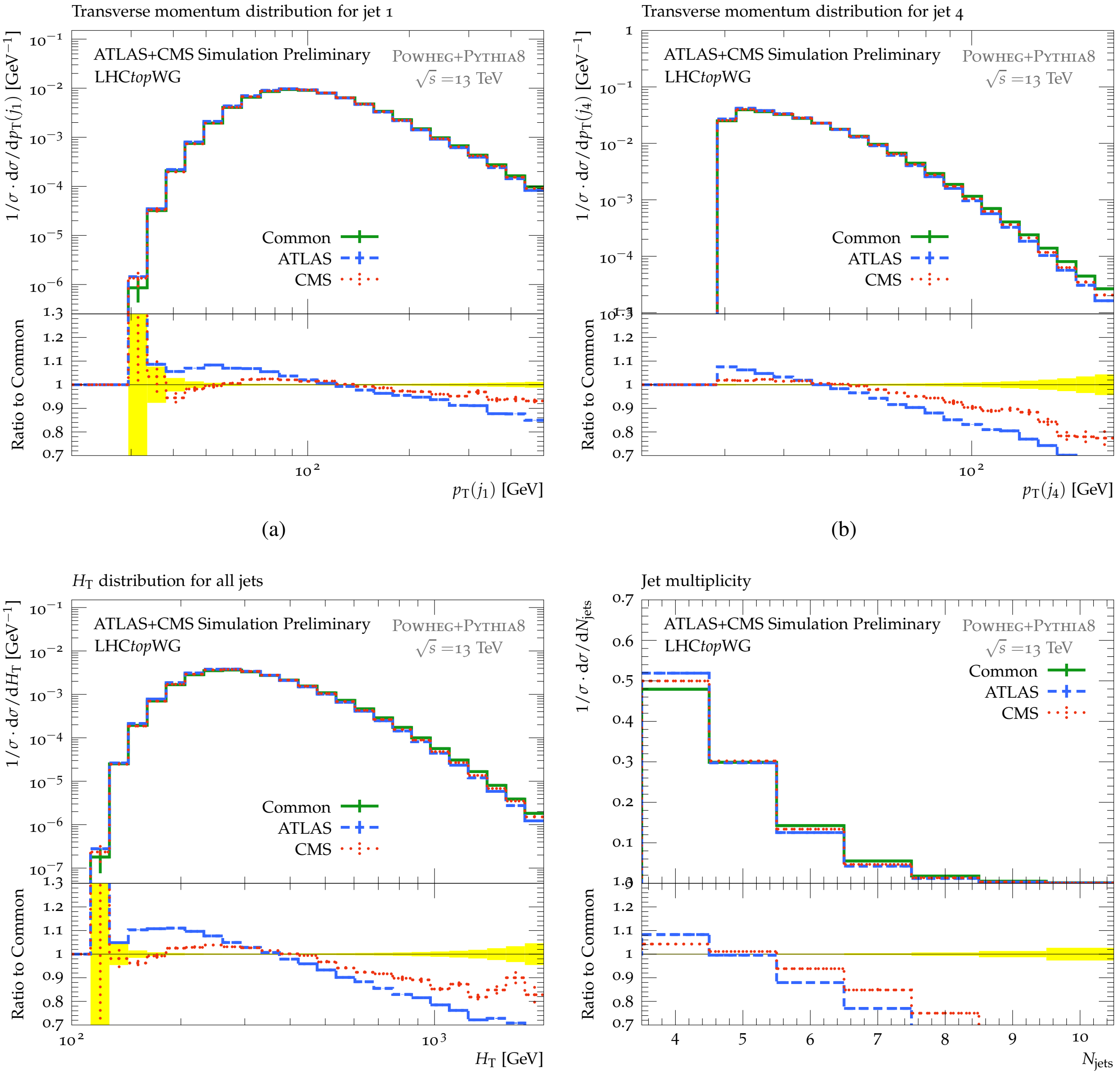
Figure 5 shows distributions for jet related quantities, inclusive of both light jets and b-tagged jets, and plotted prior to the b-tagging requirements. The ratios with the common sample show a significant slope in each distribution, tending to produce more and higher p_{T}-jets than either of the nominal samples. The CMS settings, are slightly closer to the Common Settings, though both show large disagreement. This is due to the use of the Monash tune for the Common Settings and in particular to the larger α_{S} value, which leads to a harder p_{T} spectrum and more energy in the event, see Table 5. The ATLAS and CMS settings are tuned to the data collected by each experiment and those distributions agree with the experimental results [16, 17].

Figure 6 shows the p_{T} distributions for the leading two light jets and the two b-tagged jets, after the b-tagging requirements have been applied. These distributions show slightly better agreement than the more inclusive plots in Figure 5. In particular, the leading light jet distribution in Figure 6(a) shows good agreement between the ATLAS and CMS samples, with only a small slope to the common sample.

In Figure 7, four angular distributions sensitive to spin correlation effects are shown: the $\Delta\phi$ (left) and $\Delta\eta$ (right) between the two b-tagged jets (top) and the leading b-tagged jet and the lepton (bottom). Good agreement is observed between all three samples in all of these distributions.

Finally, Figure 8 shows the mass distributions of the hadronically decaying W boson, hadronically decaying top quark, $t\bar{t}$ system, and the lepton + leading b-jet m_{lb}. Both the W mass and the top mass are shifted slightly in the peak of the distribution for the common sample compared to the other samples, even though the input masses are the same. The top-quark mass peak shifts by 0.2 GeV from the Common Settings to the ATLAS settings, and by 0.4 GeV to the CMS settings, with an uncertainty in the peak position of 0.1 GeV. This can be attributed to differences in parton shower model, the α_{S} value (which affects out-of-cone radiation) and the colour reconnection modelling, see Table 5.

The $t\bar{t}$ mass is constructed by solving for the neutrino mass via a W mass constraint, and then summing the 4-vectors of the W, lepton, both b-tagged jets, and the leading two light jets. Both the $m_{t\bar{t}}$ and m_{lb} distributions show overall good agreement between all samples, with some slight disagreement between the common sample and the nominal samples at low $m_{t\bar{t}}$ values.



(a)

(b)

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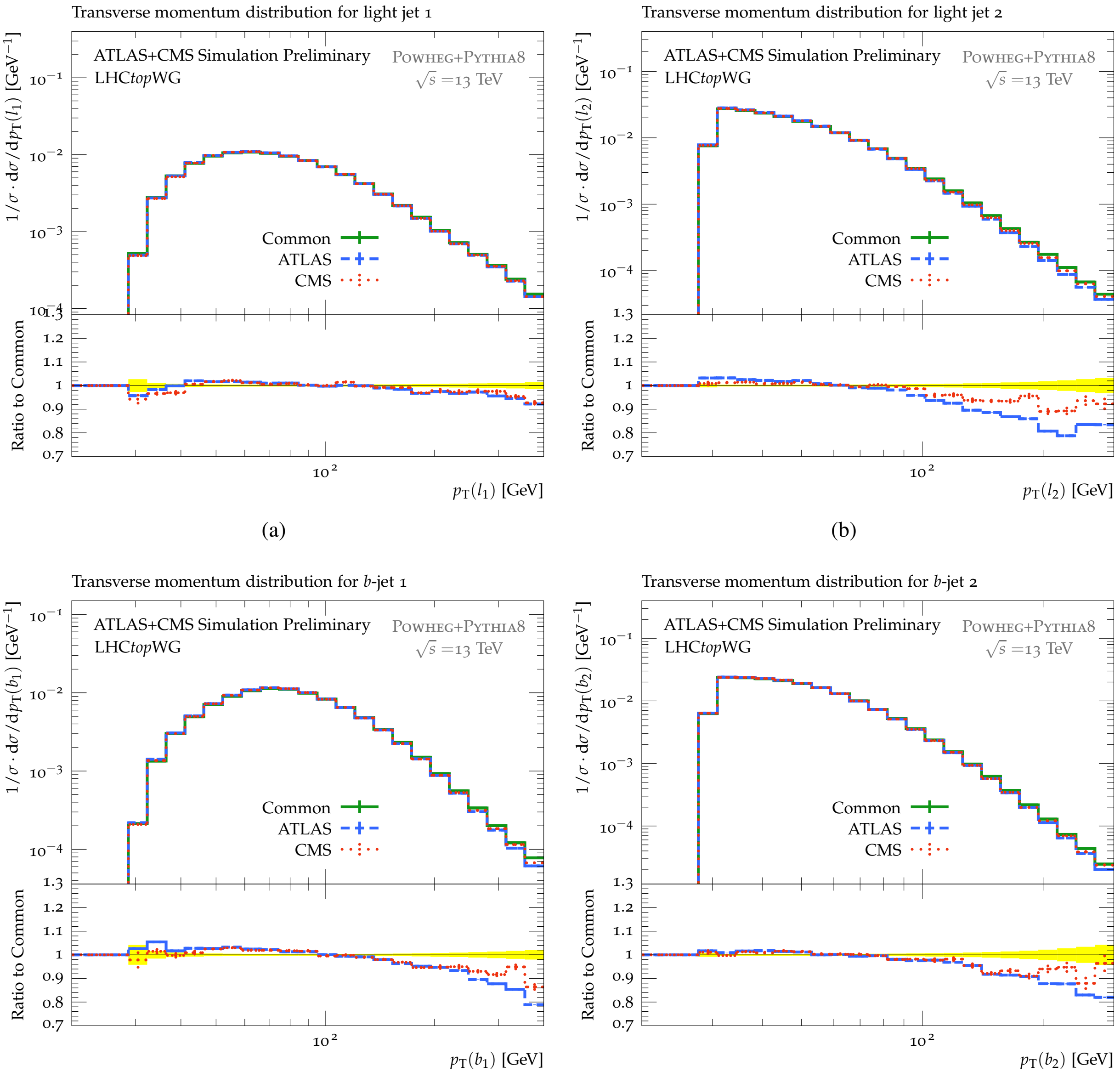
(d)

Figure 5: Comparison of Common Settings (in green), nominal ATLAS (in blue), and CMS (in red) settings for kinematic distributions of jets prior to the b-tagging requirements, showing the (a) leading jet transverse momentum, (b) fourth-leading jet transverse momentum, (c) scalar sum of jet momenta, and (d) jet multiplicity. Only statistical uncertainties due to the limited number of simulation events are shown. The yellow band in the ratio panel gives the statistical uncertainty on the sample generated with the Common Settings.



(a)

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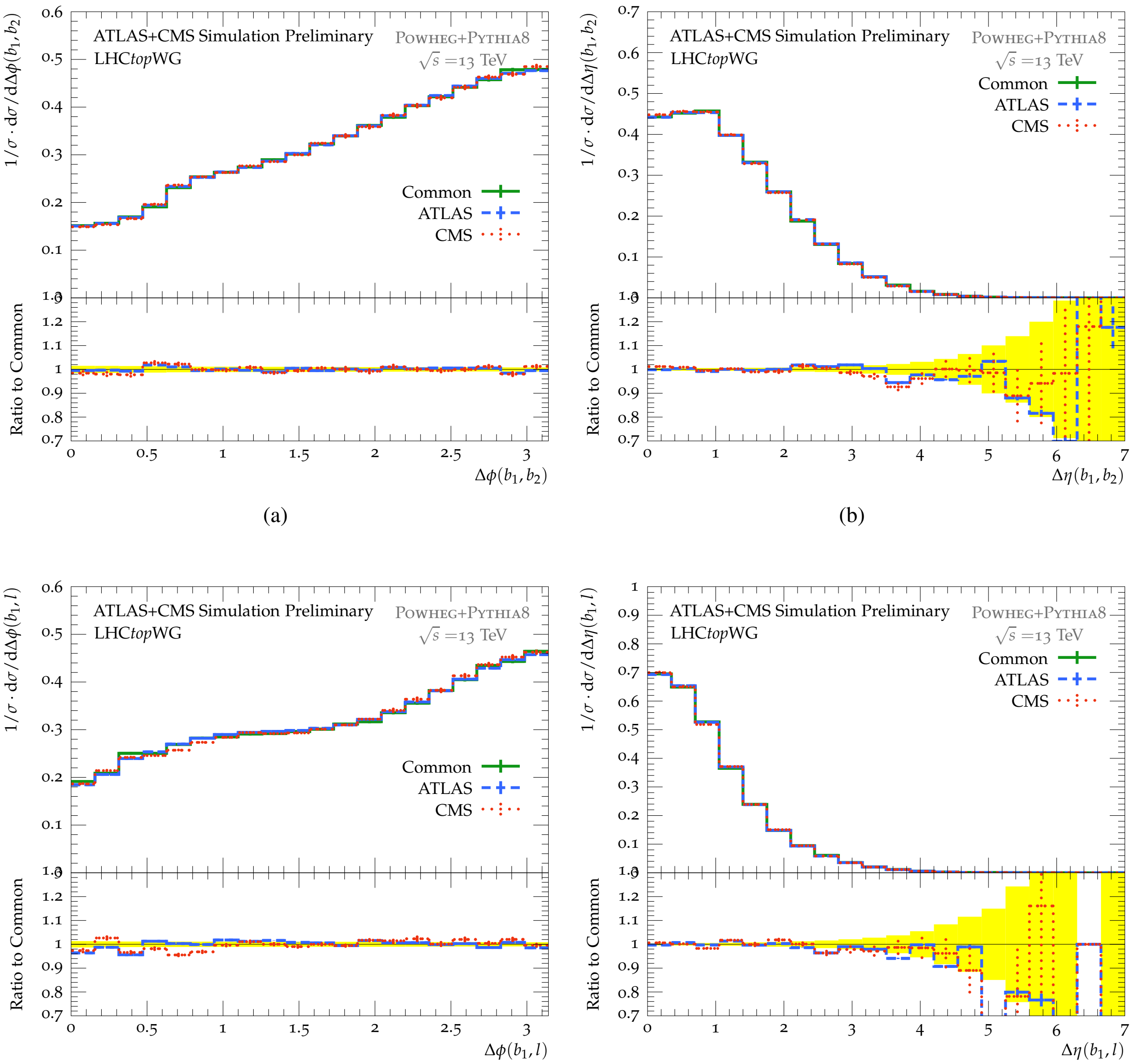
Figure 6: Comparison of Common Settings (in green), nominal ATLAS (in blue), and CMS (in red) settings for p_T distributions for the leading two light jets and the two b-tagged jets after the b-tagging requirements have been applied, showing the (a) leading light jet transverse momentum, (b) second-leading light jet transverse momentum, (c) leading b-tagged jet transverse momentum, and (d) second-leading b-tagged jet transverse momentum. Only statistical uncertainties due to the limited number of simulation events are shown. The yellow band in the ratio panel gives the statistical uncertainty on the sample generated with the Common Settings.



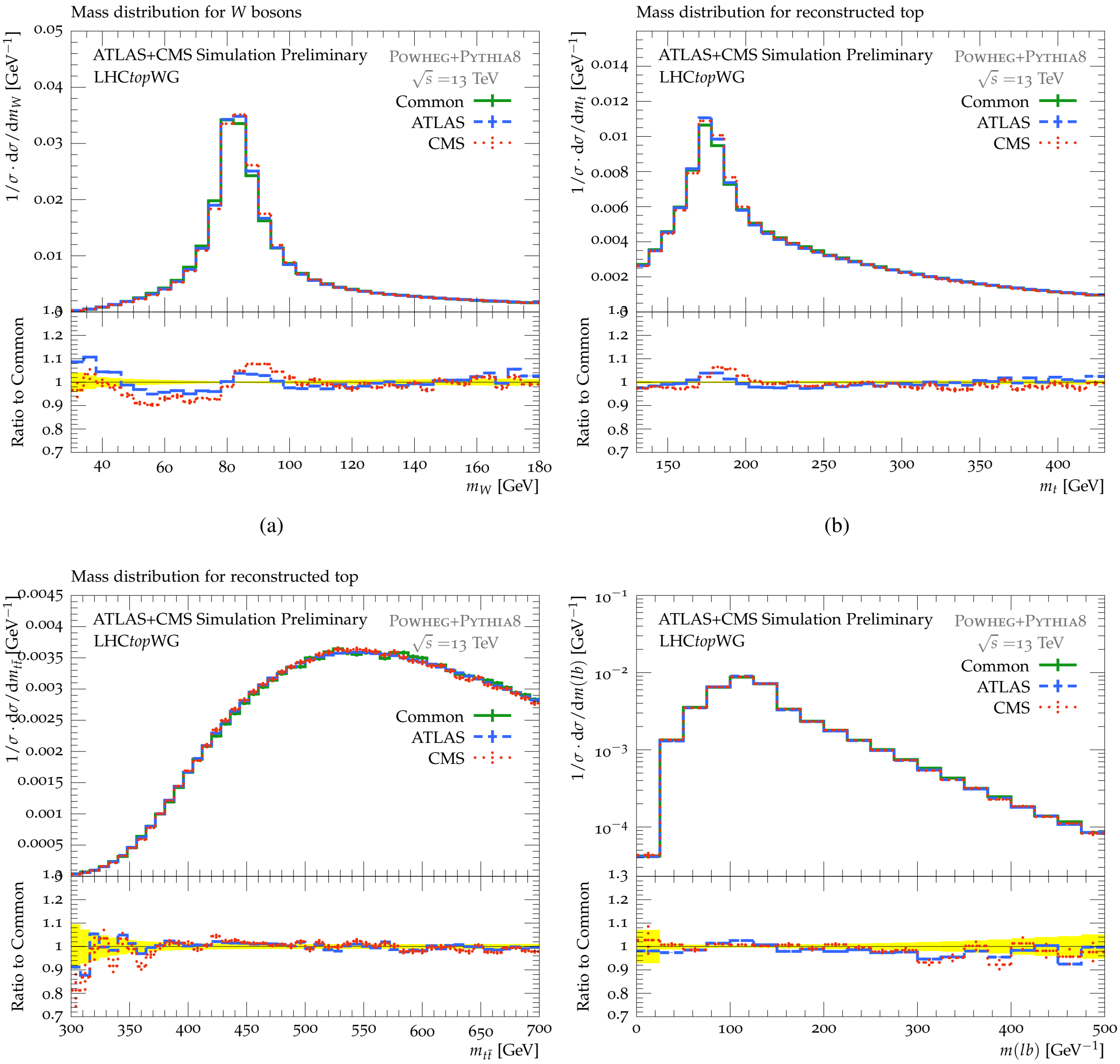
(a)

(b)

(c)

(d)

Figure 7: Comparison of Common Settings (in green), nominal ATLAS (in blue), and CMS (in red) settings for angular distributions sensitive to spin correlation effects, showing the (a) $\Delta\phi$ and (b) $\Delta\eta$ between the two b-tagged jets, and the (c) $\Delta\phi$ and (d) $\Delta\eta$ between the leading b-tagged jet and the lepton. Only statistical uncertainties due to the limited number of simulation events are shown. The yellow band in the ratio panel gives the statistical uncertainty on the sample generated with the Common Settings.



(a)

(b)

(c)

(d)

Figure 8: Comparison of Common Settings (in green), nominal ATLAS (in blue), and CMS (in red) settings for mass distributions, showing the reconstructed masses of (a) hadronically-decaying W-boson candidates, (b) hadronically decaying top-quark candidates, (c) $t\bar{t}$ system, and (d) lepton + leading b-jet system. Only statistical uncertainties due to the limited number of simulation events are shown. The yellow band in the ratio panel gives the statistical uncertainty on the sample generated with the Common Settings.

5 Summary

The first technical step towards Common Settings for $t\bar{t}$ MC has been completed. A first set of parameters, agreed upon by ATLAS and CMS, have been proposed, validated and compared to the nominal settings of each experiment. These Common Settings (version 0.1) are for a setup of Powheg+Pythia8, the Monash Pythia8 tune, NNPDF2.3 LO PDF set, and approximately average values for the various physical and technical settings that are different between experiments.

It has been shown that both experiments produce consistent samples with the Common Settings. A sample generated with the Common Settings shows disagreement with the two nominal samples in many distributions, particularly those related to jet kinematics and resonance masses. Nonetheless, the Common Settings are not optimised for agreement with data, instead primarily representing a technical step forwards. Future work will include comparisons to data and variations of some settings to obtain a set of tuned parameter settings closer to the current setups used by ATLAS and CMS. The goal of the optimisation is that the Common Settings can facilitate ATLAS + CMS combinations. While they cannot be used for measurements, the Common Settings proposed here may already be used in comparisons with ATLAS and CMS results in order to help understand qualitatively the trends between the two experiments.

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