

#### Motivation

Currently ATLAS and CMS are using different nominal  $t\bar{t}$  samples

A  $t \bar t$  sample using common settings would make combinations and comparisons easier

- Helps to understand correlations of systematic uncertainties
- Understanding of trends in similar analyses with slightly different selections or binnings

Remove differences in top quark mass measurements

- Differences in color reconnection models
- Differences in parton shower / soft physics settings

First step towards sharing resources, for this and future generators

Dominic Hirschbühl

Plots and tables are documented in: ATL-PHYS-PUB-2021-xxx CMS-Note XYZ

#### Current status

#### Main $t\bar{t}$ sample: POWHEG-BOX (hvq) + Pythia8

- That's almost the only point which is common
- Many parameters are different:

Powheg revision & settings, Pythia8 version & settings, usage of EvtGen etc.

#### **Main Powheg and Pythia8 parameters**

Setting name	Setting description	CMS default	ATLAS default
Роwнес-Вох			
qmass	top-quark mass [GeV]	172.5	172.5
twidth	top-quark width [GeV]	1.31	1.32
hdamp	first emission damping parameter [GeV]	237.8775	258.75
wmass	W <sup>±</sup> mass [GeV]	80.4	80.3999
wwidth	W <sup>±</sup> width [GeV]	2.141	2.085
bmass	b-quark mass [GeV]	4.8	4.95
Рутніа 8			
	Pythia 8 version	v240	v230
	Tune	CP5	A14
PDF:pSet	LHAPDF6 parton densities to be used for proton beams	NNPDF31_nnlo	NNPDF23_lo
		_as_0118	_as_0130_qed
TimeShower:alphaSvalue	Value of $\alpha_s$ at Z mass scale for Final State Radiation	0.118	0.127
SpaceShower:alphaSvalue	Value of $\alpha_s$ at Z mass scale for Initial State Radiation	0.118	0.127
MPI:alphaSvalue	Value of $\alpha_s$ at Z mass scale for Multi-Parton Interaction	0.118	0.126
MPI:pT0ref	Reference $p_T$ scale for regularizing soft QCD emissions	1.41	2.09
ColourReconnection:range	Parameter controlling colour reconnection probability	5.176	1.71

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### Common settings

#### First step towards a $t\bar{t}$ sample with common settings (v0.1)

- To avoid lengthy discussion we used a "democratic" setup:
  - Tune: Monash (basis of both ATLAS and CMS tunes)
  - Averaged all physical parameters (which don't come from the tune)
  - Technical parameters are mainly chosen from ATLAS

Setting name	Setting description	CMS default	ATLAS default	Common Proposal
Powheg-Box				
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 <sup>±</sup> mass [GeV]	80.4	80.3999	80.4
wwidth	W <sup>±</sup> width [GeV]	2.141	2.085	2.11
bmass	b-quark mass [GeV]	4.8	4.95	4.875
Рутніа 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	NNPDF23_lo	NNPDF23_lo
		_as_0118	_as_0130_qed	_as_0130_qed
TimeShower:alphaSvalue	Value of $\alpha_s$ at Z mass scale for Final State Radiation	0.118	0.127	0.1365
SpaceShower:alphaSvalue	Value of $\alpha_s$ at Z mass scale for Initial State Radiation	0.118	0.127	0.1365
MPI:alphaSvalue	Value of $\alpha_s$ 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

### Common sample

#### **Technical setup of the production**

- Samples are produced separately in the respective frameworks
- Used agreed settings exchange through simple text files
  - → converted them to corresponding config files.
- Since not all Pythia versions are available in the respective frameworks different versions are used
  - → Checked before, that all Pythia versions 8.230, 8.24x leading to identical results
- Produced 10M inclusive events each

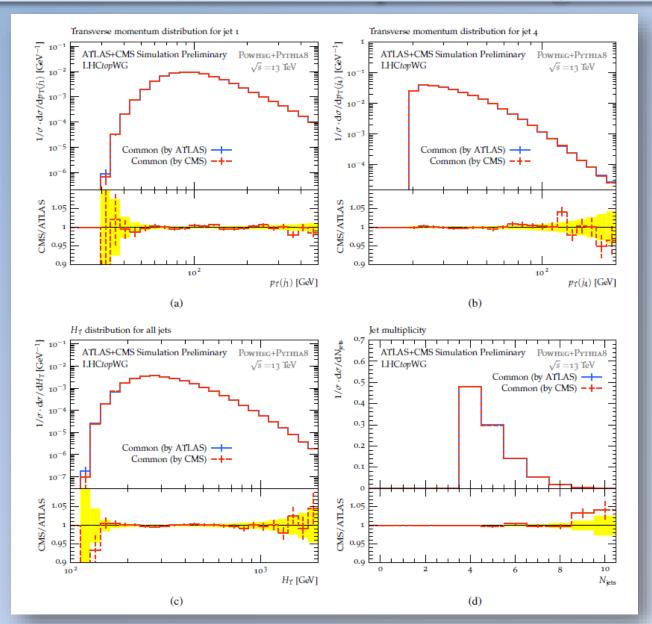
18.05.2021

Plots are produced with Rivet v3.1.2 and the MC\_TTBAR routine (onelep mode)

Note: We don't expect identical events, but the overall sample should agree

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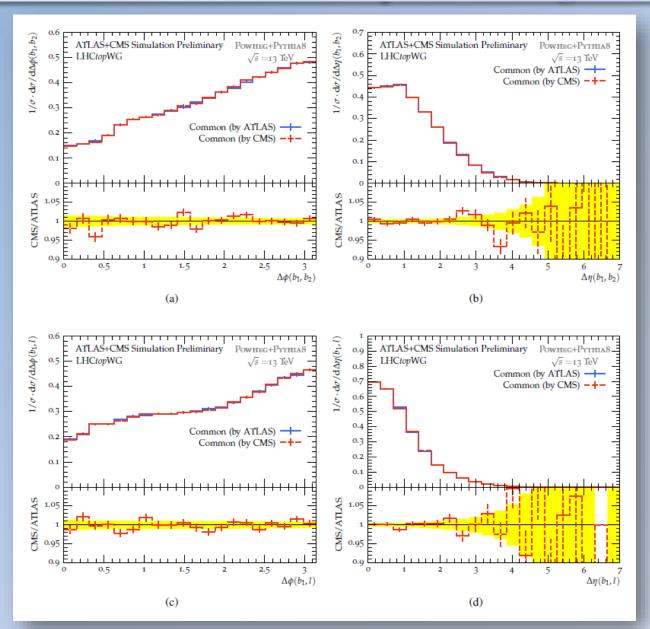
### Validation of samples using common settings



Perfect agreement within produced statistics



### Validation of samples using common settings

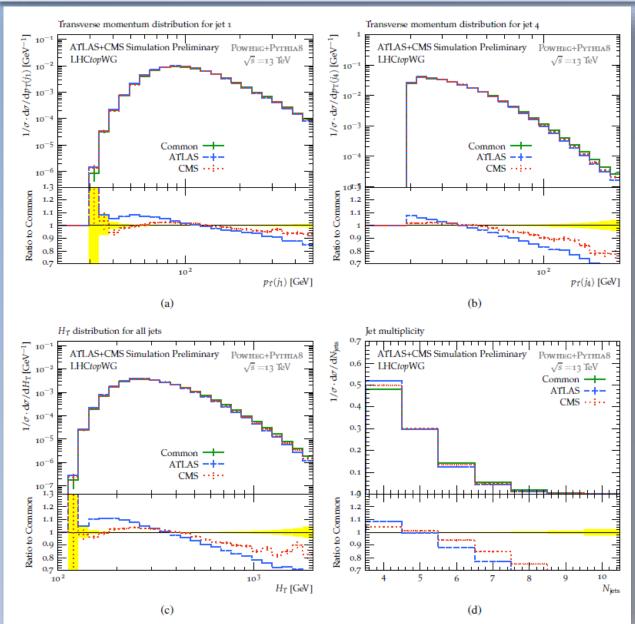


Perfect agreement within produced statistics



### ATLAS/CMS vs Common settings

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Difference between Common sample and ATLAS/CMS mainly due to different  $\alpha_s$  of the tune

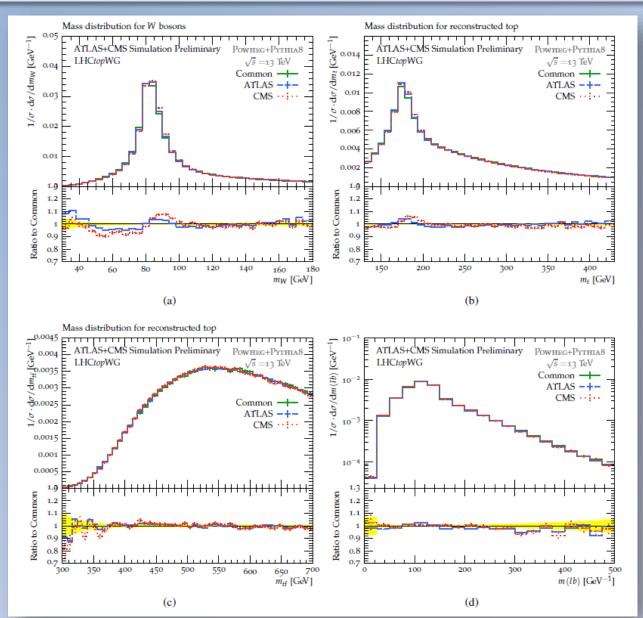
ATLAS and CMS are tuned to their experimental results

#### Note:

These common settings are not optimized/tuned, but mainly aimed at providing input for technical validation

### ATLAS/CMS vs Common settings

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Note the difference in the reconstructed W boson and top quark masses!

Using a simple Gaussian fit around the peak:

Common vs. ATLAS:  $0.2 \pm 0.1 \, \text{GeV}$ 

Common vs. CMS:  $0.4 \pm 0.1 \, \text{GeV}$ 

#### Conclusion / Outlook

#### First successfully produced MC sample with common settings (v0.1)

- Key point: Exchanged the full list of Powheg and Pythia8 parameters between the experiments
- Produced separate samples in separate frameworks
  - → Distributions are in perfect agreement within statistical uncertainties

#### Next steps

- Agree on a more tuned set of parameters resulting in closer distributions to tuned ones
- Prepare a common LHE sample
- Establish common sample to be added to all published differential distributions

#### **Ultimate** goal

- Real common sample using identical events
- Common Pythia8 tuning using ATLAS and CMS data
- Sharing of resources and of prescriptions, for nominal and systematic uncertainties

18.05.2021



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### POWHEG-BOX settings

Setting name	Setting description	CMS default	ATLAS default	Common Proposal
	Powheg-Box V2 svn revision	3728	3026	3728 (CMS)
				3026 (ATLAS)
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 <sup>±</sup> 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	$\mu$ 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-Box settings used in the ATLAS and CMS default Monte Carlo event generation setups for  $t\bar{t}$  production and proposal for Common Settings.

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## POWHEG-BOX settings

Setting name	Setting description	CMS default	ATLAS default	Common Proposa
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	I
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-Box 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-Box value is being used are indicated in parentheses.

## PYTHIA8 settings

POWHEG         Interface parameters in PYTHIA for matching to POWHEG           pTdef         Flag for hardness criterion (POWHEG vs PYTHIA)         1         2         1           pTem         Flag for defining emissions         0         0         0         0           pTem         Flag for which partons are used to define POWHEG hardness criteria         0         0         0         0           pThard         Flag for which partons are used to define POWHEG hardness criteria         0         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         2           veto         Flag for vetoed or unveloed showers         1         1         1         1         1           MPIveto         Flag for applying veto to Multi Parton Interactions         0         0         0         0           TimeShower         Final State Radiation Parameters           Maximum invariant mass for $\gamma \rightarrow ff$ 1.0         (10         10           alphaSorder         Order of running for $\alpha_s$ 2         (1)         1 <th>Setting name</th> <th>Setting description</th> <th>CMS default</th> <th>ATLAS default</th> <th>Common proposal</th>	Setting name	Setting description	CMS default	ATLAS default	Common proposal
POWHEG         Interface parameters in PYTHIA for matching to POWHEG           pTdef         Flag for bardness criterion (Powited vs PYTHIA)         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           pTemt         Flag for bow to calculate POWHEG hardness criteria         0         0         0           pThard         Flag for bow 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         2           veto         Flag for vetoed or unvetoed showers         1         1         1         1           MPIveto         Flag for vetoed or unvetoed showers         1         1         1         1           Image: Page of vetoed or unvetoed showers         1         1         1         1         1           Image: Page of vetoed or unvetoed showers         1         1         1         1         1         1         <		Pythia 8 version	v240	v230	v240 (CMS)
pTdef         Flag for hardness criterion (PowHeG vs PYTHIA )         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           veto         How many emissions vetoed showers for born level process         2         2         2         2           veto         Flag for vetoed or unvetoed showers         1         1         1         1           MPIveto         Flag for applying veto to Multi Parton Interactions         (0)         0         0           TimeShower         Final State Radiation Parameters					v244 (ATLAS)
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pThard	emitted	Flag for defining emissions	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         2           veto         Flag for vetoed or unvetoed showers         1         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 $y \rightarrow f\bar{f}$ 1.0         (10)         10           alphaSorder         Order of running for $\alpha_s$ 2         2         (1)         1           alphaSvalue         Value of $\alpha_s$ at Z mass scale         0.118         0.127         0.13650           PTmaxMatch         Flag for setting maximum shower scale algorithm         2         2         2         1           alphaSorder         Order of running for $\alpha_s$ 2         1         1         1         1           alphaSorder         Initial State Radiation Parameters         2         2         (1)         1         1         1         1         1         1         1         1         1         1	pTemt	Flag for which partons are used to define POWHEG hardness criteria	0	0	0
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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         TimeShower         Final State Radiation Parameters $-$ MAXGamma         Maximum invariant mass for $γ → ff$ 1.0         (10)         10           alphaSorder         Order of running for $α_s$ 2         (11)         1           alphaSovalue         Value of $α_s$ at Z mass scale         0.118         0.127         0.13650           SpaceShower         Initial State Radiation Parameters         2         (1)         1           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	vetoCount	How many emissions vetoed showers checks after first allowed emission	100	3	50
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TimeShower         Final State Radiation Parameters           mMaxGamma         Maximum invariant mass for $γ → ff$ 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         3         (1)         1           alphaSorder         Order of running for $α_s$ 2         (1)         1           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 to be ordered in rapidity         on         on         on           pTORef         Reference $p_T$ scale for regularizing soft QCD emissions         (2)         (1)	veto	Flag for vetoed or unvetoed showers	1	1	1
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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           pTORef         Reference $p_T$ scale for regularizing soft QCD emissions         (2)         1.56         2           MPI         Multi-Parton Interaction Parameters         3         2         (1)         1           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 pTO         0.03344         (0.215)         0.215           bprofile         impact parameter profile choice flag for hadron beams         2         (3)         3           coreRadius         Inner radius of cor	alphaSvalue	Value of $\alpha_s$ at Z mass scale	0.118	0.127	0.13650
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rapidityOrderMPI Force emissions in secondary scatterings to be ordered in rapidity (on) on pTORef Reference $p_T$ scale for regularizing soft QCD emissions (2) 1.56 2  MPI Multi-Parton Interaction Parameters  alphaSorder Order of running for $\alpha_s$ 2 (1) 1 alphaSvalue Value of $\alpha_s$ at $Z$ mass scale 0.118 0.126 0.130 ecmPow Exponent control kinematic dependence of pTO 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 pTOref Reference $p_T$ scale for regularizing soft QCD emissions 1.41 2.09 2.28  BeamRemnants Parameters for all partons extracted from a beam primordial KThard 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	pTmaxMatch	Flag for setting maximum shower scale algorithm	2	2	2
pTORefReference $p_T$ scale for regularizing soft QCD emissions(2)1.562MPIMulti-Parton Interaction ParametersalphaSorderOrder of running for $\alpha_S$ 2(1)1alphaSvalueValue of $\alpha_S$ at Z mass scale0.1180.1260.130ccmPowExponent control kinematic dependence of pT00.03344(0.215)0.215bprofileimpact parameter profile choice flag for hadron beams2(3)3coreRadiusInner radius of core when using bprofile = 20.7634(0.4)0.4coreFractionMatter content fraction of core when using bprofile = 20.63(0.5)0.5pTOrefReference $p_T$ scale for regularizing soft QCD emissions1.412.092.28BeamRemnantsParameters for all partons extracted from a beamprimordialKThardParameter controlling $k_T$ of beam remnant initiators in hard-interations(1.8)1.881.8ColourReconnectionColour Reconnection ParametersrangeParameter controlling colour reconnection probability5.1761.711.80	rapidityOrder	Force emissions to be ordered in rapidity	on	on	on
MPIMulti-Parton Interaction ParametersalphaSorderOrder of running for $\alpha_s$ 2(1)1alphaSvalueValue of $\alpha_s$ at Z mass scale0.1180.1260.130ccmPowExponent control kinematic dependence of pT00.03344(0.215)0.215bprofileimpact parameter profile choice flag for hadron beams2(3)3coreRadiusInner radius of core when using bprofile = 20.7634(0.4)0.4coreFractionMatter content fraction of core when using bprofile = 20.63(0.5)0.5pT0refReference $p_T$ scale for regularizing soft QCD emissions1.412.092.28BeamRemnantsParameters for all partons extracted from a beamprimordialKThardParameter controlling $k_T$ of beam remnant initiators in hard-interations(1.8)1.881.8ColourReconnectionColour Reconnection ParametersrangeParameter controlling colour reconnection probability5.1761.711.80	rapidityOrderMPI		(on)	on	on
alphaSorder alphaSvalueOrder of running for $\alpha_s$ 2(1)1alphaSvalueValue of $\alpha_s$ at Z mass scale0.1180.1260.130ccmPowExponent control kinematic dependence of pT00.03344(0.215)0.215bprofileimpact parameter profile choice flag for hadron beams2(3)3coreRadiusInner radius of core when using bprofile = 20.7634(0.4)0.4coreFractionMatter content fraction of core when using bprofile = 20.63(0.5)0.5pT0refReference $p_T$ scale for regularizing soft QCD emissions1.412.092.28BeamRemnantsParameters for all partons extracted from a beamprimordialKThardParameter controlling $k_T$ of beam remnant initiators in hard-interations(1.8)1.881.8ColourReconnectionColour Reconnection ParametersrangeParameter controlling colour reconnection probability5.1761.711.80	pT0Ref	Reference $p_T$ scale for regularizing soft QCD emissions	(2)	1.56	2
alphaSvalueValue of $\alpha_s$ at Z mass scale0.1180.1260.130ccmPowExponent control kinematic dependence of pT00.03344(0.215)0.215bprofileimpact parameter profile choice flag for hadron beams2(3)3coreRadiusInner radius of core when using bprofile = 20.7634(0.4)0.4coreFractionMatter content fraction of core when using bprofile = 20.63(0.5)0.5pTOrefReference $p_T$ scale for regularizing soft QCD emissions1.412.092.28BeamRemnantsParameters for all partons extracted from a beamprimordialKThardParameter controlling $k_T$ of beam remnant initiators in hard-interations(1.8)1.881.8ColourReconnectionColour Reconnection ParametersrangeParameter controlling colour reconnection probability5.1761.711.80	MPI	Multi-Parton Interaction Parameters			
ecmPowExponent control kinematic dependence of pT0 $0.03344$ $(0.215)$ $0.215$ bprofileimpact parameter profile choice flag for hadron beams $2$ $(3)$ $3$ coreRadiusInner radius of core when using bprofile = $2$ $0.7634$ $(0.4)$ $0.4$ coreFractionMatter content fraction of core when using bprofile = $2$ $0.63$ $(0.5)$ $0.5$ pT0refReference $p_T$ scale for regularizing soft QCD emissions $1.41$ $2.09$ $2.28$ BeamRemnantsParameters for all partons extracted from a beamprimordialKThardParameter controlling $k_T$ of beam remnant initiators in hard-interations $(1.8)$ $1.88$ $1.8$ ColourReconnectionColour Reconnection ParametersrangeParameter controlling colour reconnection probability $5.176$ $1.71$ $1.80$	alphaSorder	Order of running for $\alpha_s$	2	(1)	1
bprofileimpact parameter profile choice flag for hadron beams2(3)3coreRadiusInner radius of core when using bprofile = 20.7634(0.4)0.4coreFractionMatter content fraction of core when using bprofile = 20.63(0.5)0.5pTOrefReference $p_T$ scale for regularizing soft QCD emissions1.412.092.28BeamRemnantsParameters for all partons extracted from a beamprimordialKThardParameter controlling $k_T$ of beam remnant initiators in hard-interations(1.8)1.881.8ColourReconnectionColour Reconnection ParametersrangeParameter controlling colour reconnection probability5.1761.711.80	alphaSvalue	Value of $\alpha_s$ at Z mass scale	0.118	0.126	0.130
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       1.88       1.8         primordialKThard       Parameter controlling $k_T$ of beam remnant initiators in hard-interations       (1.8)       1.88       1.8         ColourReconnection       Colour Reconnection Parameters       5.176       1.71       1.80	ecmPow	Exponent control kinematic dependence of pT0	0.03344	(0.215)	0.215
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       Parameter controlling $k_T$ of beam remnant initiators in hard-interations       (1.8)       1.88       1.8         ColourReconnection       Colour Reconnection Parameters       5.176       1.71       1.80         range       Parameter controlling colour reconnection probability       5.176       1.71       1.80	bprofile	impact parameter profile choice flag for hadron beams	2	(3)	3
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	coreRadius	Inner radius of core when using bprofile = 2	0.7634	(0.4)	0.4
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         5.176         1.71         1.80	coreFraction	Matter content fraction of core when using bprofile = 2	0.63	(0.5)	0.5
primordialKThard     Parameter controlling $k_T$ of beam remnant initiators in hard-interations     (1.8)     1.88       ColourReconnection     Colour Reconnection Parameters       range     Parameter controlling colour reconnection probability     5.176     1.71     1.80	pT0ref	Reference $p_T$ scale for regularizing soft QCD emissions	1.41	2.09	2.28
ColourReconnection         Colour Reconnection Parameters           range         Parameter controlling colour reconnection probability         5.176         1.71         1.80	BeamRemnants				
range Parameter controlling colour reconnection probability 5.176 1.71 1.80	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	ParticleDecays	Particle Decay Settings			
allowPhotonRadiation Allow photon radiation in decays to lepton pairs on (off) off	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.

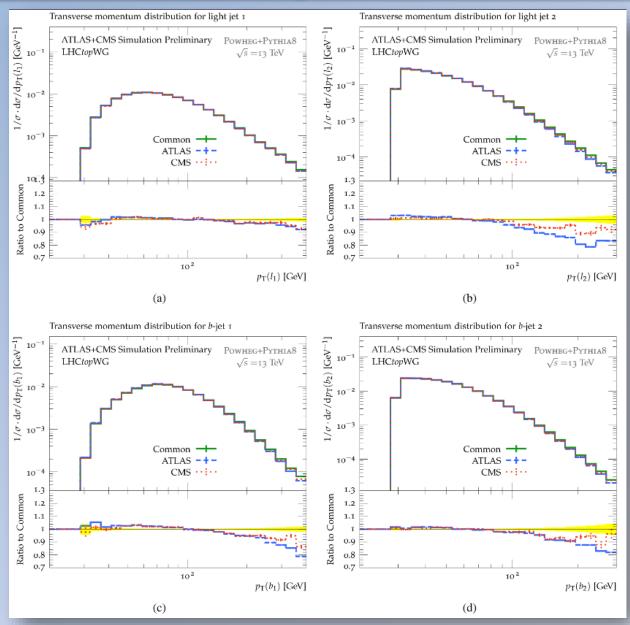
Dominic Hirschbühl

# PYTHIA8 settings

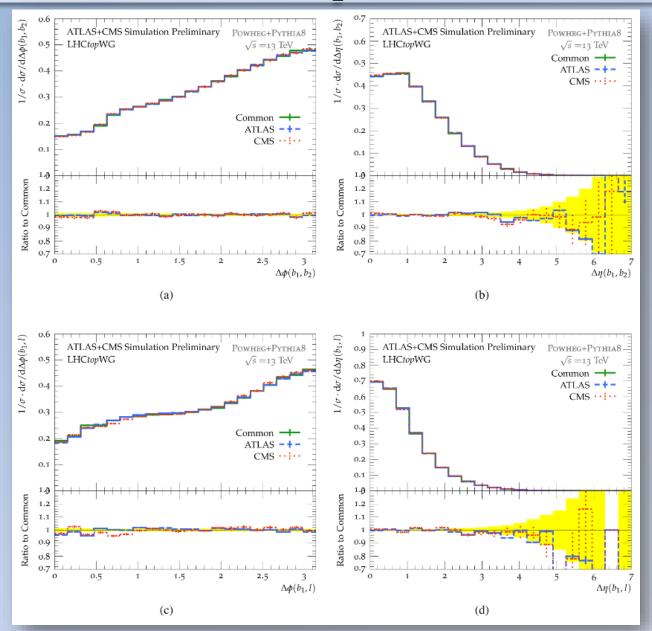
Setting name	Setting description	CMS default	ATLAS default	Common proposal
Check	Parameters for Error Checking			
epTolErr	Maximum allowed summed deviation of different values	0.01	0.0001	0.0001
Tune	Tune Settings			
	Tune	CP5	A14	Monash
preferLHAPDF	LHAPDF package to obtain PDF values	2	1	1
pp	Choice of tune to $pp/p\bar{p}$ data	14	14	14
ee	Choice of 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	LHAPDF6:NNPDF23	LHAPDF6:NNPDF23
		_nnlo_as_0118	_lo_as_0130_qed	_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

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### More comparisions



### More comparisions



18.05.2021