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Erratum

Erratum to: Measurements of top-quark pair differential and double-differential cross-sections in the ℓ+jets channel with pp collisions at $\sqrt{s} = 13$ TeV using the ATLAS detector [Eur. Phys. J. C 79 (2019) 1028]

ATLAS Collaboration★

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Erratum to: Eur. Phys. J. C (2019) 79:1028
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Corrections for five figures and six tables are noted for the paper, which do not affect the conclusions reported:

- in the double-differential cross-sections at particle level in the resolved topology as a function of $\left|\Delta\phi\left(t\bar{t}\right)\right|$, $|y^{t,\mathrm{had}}|$ and $|y^{t\bar{t}}|$ as a function of the number of additional jets, in certain cases the values of $|y^{t,\mathrm{had}}|$ and $|y^{t\bar{t}}|$ were shifted by 0.5 and the values of $\left|\Delta\phi\left(t\bar{t}\right)\right|$ were shifted by $0.14 \cdot i$, where i is the number of additional jets. This issue affects Fig. 34 and Tables 11 and 12;
- the differential cross-section at particle level in the boosted topology as a function of the number of small-R jets clustered inside a top-quark candidate was actually evaluated as a function of the number of small-R jets clustered inside the large-R jet with higher transverse momentum. As a consequence, the definition of the multiplicity of additional small-R jets referred to the large-R jet with higher transfer momentum rather than to the top-quark candidate. This issue affects the single-differential cross-section as a function of N^{subjets} and $N^{\mathrm{extrajets}}$ and the double-differential cross-sections as a function of $p_{\mathrm{T}}^{t,\mathrm{had}}$, $m^{t\bar{t}}$ and $p_{\mathrm{T}}^{t\bar{t}}$ in bins of $N^{\mathrm{extrajets}}$. This issue affects Figs. 42, 50, 51 and 52 and Tables 13, 14, 15 and 16.

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The original article can be found online at https://doi.org/10.1140/epjc/s10052-019-7525-6.

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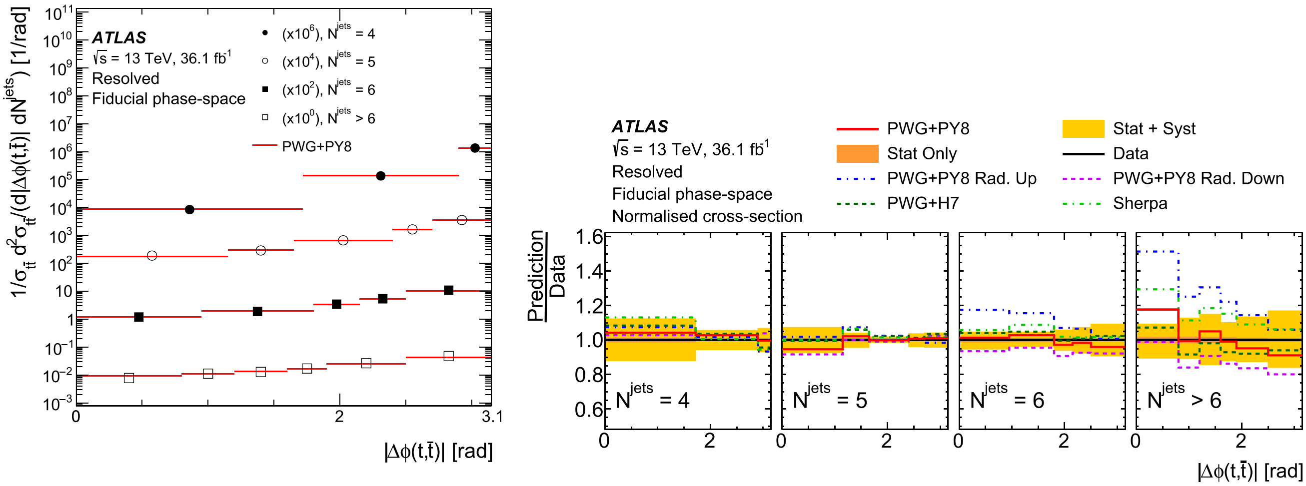


(a) **(b)**

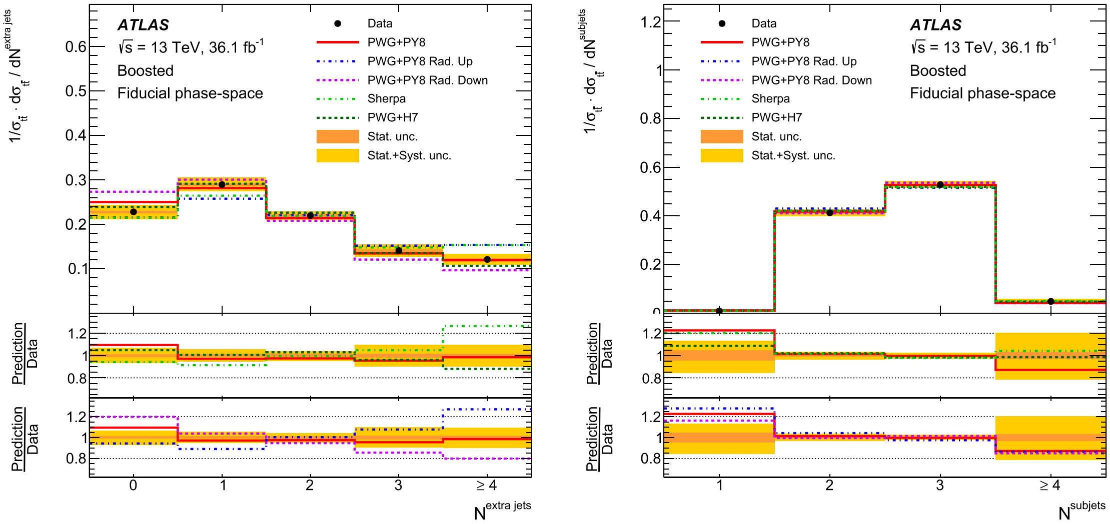
Fig. 34 **a** Particle-level normalised differential cross-section as a function of $|\Delta\phi(t, \bar{t})|$ in bins of the jet multiplicity in the resolved topology compared with the prediction obtained with the POWHEG+ PYTHIA8 MC generator. Data points are placed at the centre of each bin. **b** The ratio of the measured cross-section to different Monte Carlo predictions. The bands represent the statistical and total uncertainty in the data

Table 11 Comparison of the measured particle-level normalised double-differential cross-sections in the resolved topology with the predictions from several MC generators. For each prediction a χ^2 and a p value are calculated using the covariance matrix of the measured spectrum. The NDF is equal to the number of bins in the distribution minus one

Observable	PWG + PY8		PWG + PY8 Rad. Up		PWG + PY8 Rad. Down		PWG + H7		SHERPA 2.2.1	
	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value
$H_{\mathrm{T}}^{t\bar{t}}$ vs $N^{\mathrm{extrajets}}$	9.7/19	0.96	57.9/19	< 0.01	19.4/19	0.43	48.7/19	< 0.01	27.4/19	0.10
$\lvert p_{\mathrm{out}}^{t,\mathrm{had}}\rvert$ vs $N^{\mathrm{extrajets}}$	10.8/9	0.29	89.2/9	< 0.01	31.9/9	< 0.01	32.6/9	< 0.01	19.2/9	0.02
$\chi^{t\bar{t}}$ vs $N^{\mathrm{extrajets}}$	37.6/19	< 0.01	31.6/19	0.03	88.9/19	< 0.01	84.8/19	< 0.01	23.7/19	0.21
$\lvert\Delta\phi(t,\bar{t})\rvert$ vs $N^{\mathrm{extrajets}}$	41.4/18	< 0.01	214.0/18	< 0.01	41.3/18	< 0.01	65.5/18	< 0.01	54.0/18	< 0.01
$\lvert y^{t,\mathrm{had}}\rvert$ vs $N^{\mathrm{extrajets}}$	16.1/12	0.19	14.9/12	0.25	39.4/12	< 0.01	67.5/12	< 0.01	9.8/12	0.63
$\lvert y^{t,\mathrm{had}}\rvert$ vs $p_{\mathrm{T}}^{t,\mathrm{had}}$	14.9/12	0.25	11.9/12	0.45	18.1/12	0.11	8.4/12	0.75	9.4/12	0.67
$p_{\mathrm{T}}^{t,\mathrm{had}}$ vs $\lvert p_{\mathrm{out}}^{t,\mathrm{had}}\rvert$	10.5/12	0.57	74.5/12	< 0.01	25.3/12	0.01	13.4/12	0.34	22.4/12	0.03
$p_{\mathrm{T}}^{t,\mathrm{had}}$ vs $N^{\mathrm{extrajets}}$	14.2/16	0.58	45.7/16	< 0.01	37.3/16	< 0.01	67.5/16	< 0.01	13.9/16	0.60
$\lvert y^{t\bar{t}}\rvert$ vs $N^{\mathrm{extrajets}}$	8.2/12	0.77	11.8/12	0.47	28.0/12	< 0.01	63.0/12	< 0.01	12.6/12	0.40
$\lvert y^{t\bar{t}}\rvert$ vs $m^{t\bar{t}}$	18.0/14	0.21	12.0/14	0.60	23.1/14	0.06	13.2/14	0.51	14.8/14	0.40
$\lvert y^{t\bar{t}}\rvert$ vs $p_{\mathrm{T}}^{t\bar{t}}$	28.5/12	< 0.01	149.0/12	< 0.01	23.2/12	0.03	31.8/12	< 0.01	70.7/12	< 0.01
$m^{t\bar{t}}$ vs $N^{\mathrm{extrajets}}$	29.1/16	0.02	25.5/16	0.06	49.6/16	< 0.01	24.6/16	0.08	11.5/16	0.78
$m^{t\bar{t}}$ vs $p_{\mathrm{T}}^{t,\mathrm{had}}$	58.9/31	< 0.01	51.4/31	0.01	92.3/31	< 0.01	35.6/31	0.26	44.8/31	0.05
$m^{t\bar{t}}$ vs $p_{\mathrm{T}}^{t\bar{t}}$	43.6/21	< 0.01	260.0/21	< 0.01	47.0/21	< 0.01	44.7/21	< 0.01	149.0/21	< 0.01
$p_{\mathrm{T}}^{t\bar{t}}$ vs $N^{\mathrm{extrajets}}$	69.1/19	< 0.01	283.0/19	< 0.01	58.5/19	< 0.01	82.8/19	< 0.01	102.0/19	< 0.01
$p_{\mathrm{T}}^{t\bar{t}}$ vs $p_{\mathrm{T}}^{t,\mathrm{had}}$	39.2/19	< 0.01	282.0/19	< 0.01	51.5/19	< 0.01	55.8/19	< 0.01	137.0/19	< 0.01

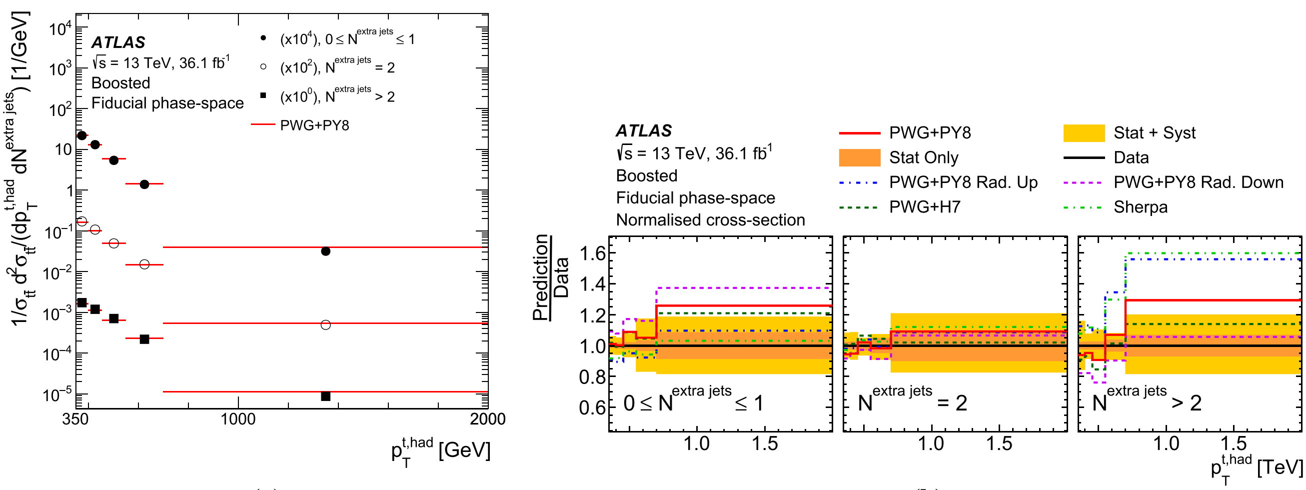
Table 12 Comparison of the measured particle-level absolute double-differential cross-sections in the resolved topology with the predictions from several MC generators. For each prediction a χ^2 and a p value are calculated using the covariance matrix of the measured spectrum. The NDF is equal to the number of bins in the distribution

Observable	PWG + PY8		PWG + PY8 Rad. Up		PWG + PY8 Rad. Down		PWG + H7		SHERPA 2.2.1	
	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value
$H_{\mathrm{T}}^{t\bar{t}}$ vs $N^{\mathrm{extrajets}}$	13.8/20	0.84	72.9/20	< 0.01	31.3/20	0.05	56.6/20	< 0.01	40.5/20	< 0.01
$\lvert p_{\mathrm{out}}^{t,\mathrm{had}}\rvert$ vs $N^{\mathrm{extrajets}}$	16.3/10	0.09	165.0/10	< 0.01	15.7/10	0.11	35.6/10	< 0.01	50.9/10	< 0.01
$\chi^{t\bar{t}}$ vs $N^{\mathrm{extrajets}}$	44.4/20	< 0.01	60.3/20	< 0.01	88.3/20	< 0.01	62.2/20	< 0.01	24.6/20	0.21
$\lvert\Delta\phi(t,\bar{t})\rvert$ vs $N^{\mathrm{extrajets}}$	47.5/19	< 0.01	221.0/19	< 0.01	48.0/19	< 0.01	57.8/19	< 0.01	62.7/19	< 0.01
$\lvert y^{t,\mathrm{had}}\rvert$ vs $N^{\mathrm{extrajets}}$	15.8/13	0.26	37.3/13	< 0.01	33.3/13	< 0.01	52.1/13	< 0.01	15.2/13	0.29
$\lvert y^{t,\mathrm{had}}\rvert$ vs $p_{\mathrm{T}}^{t,\mathrm{had}}$	13.3/13	0.42	12.9/13	0.45	15.6/13	0.27	8.7/13	0.80	9.8/13	0.71
$p_{\mathrm{T}}^{t,\mathrm{had}}$ vs $\lvert p_{\mathrm{out}}^{t,\mathrm{had}}\rvert$	8.6/13	0.80	79.6/13	< 0.01	28.8/13	< 0.01	9.7/13	0.72	16.0/13	0.25
$p_{\mathrm{T}}^{t,\mathrm{had}}$ vs $N^{\mathrm{extrajets}}$	19.3/17	0.31	59.5/17	< 0.01	43.3/17	< 0.01	65.3/17	< 0.01	24.7/17	0.10
$\lvert y^{t\bar{t}}\rvert$ vs $N^{\mathrm{extrajets}}$	7.4/13	0.88	19.1/13	0.12	21.1/13	0.07	47.9/13	< 0.01	17.8/13	0.16
$\lvert y^{t\bar{t}}\rvert$ vs $m^{t\bar{t}}$	22.3/15	0.10	15.0/15	0.45	29.8/15	0.01	15.8/15	0.40	19.1/15	0.21
$\lvert y^{t\bar{t}}\rvert$ vs $p_{\mathrm{T}}^{t\bar{t}}$	32.7/13	< 0.01	143.0/13	< 0.01	21.2/13	0.07	36.8/13	< 0.01	81.4/13	< 0.01
$m^{t\bar{t}}$ vs $N^{\mathrm{extrajets}}$	28.0/17	0.04	29.0/17	0.03	49.2/17	< 0.01	36.3/17	< 0.01	14.0/17	0.67
$m^{t\bar{t}}$ vs $p_{\mathrm{T}}^{t,\mathrm{had}}$	56.2/32	< 0.01	59.9/32	< 0.01	79.9/32	< 0.01	31.9/32	0.47	48.5/32	0.03
$m^{t\bar{t}}$ vs $p_{\mathrm{T}}^{t\bar{t}}$	49.0/22	< 0.01	310.0/22	< 0.01	53.3/22	< 0.01	55.1/22	< 0.01	175.0/22	< 0.01
$p_{\mathrm{T}}^{t\bar{t}}$ vs $N^{\mathrm{extrajets}}$	93.2/20	< 0.01	412.0/20	< 0.01	51.9/20	< 0.01	91.8/20	< 0.01	163.0/20	< 0.01
$p_{\mathrm{T}}^{t\bar{t}}$ vs $p_{\mathrm{T}}^{t,\mathrm{had}}$	38.6/20	< 0.01	294.0/20	< 0.01	66.5/20	< 0.01	46.1/20	< 0.01	128.0/20	< 0.01



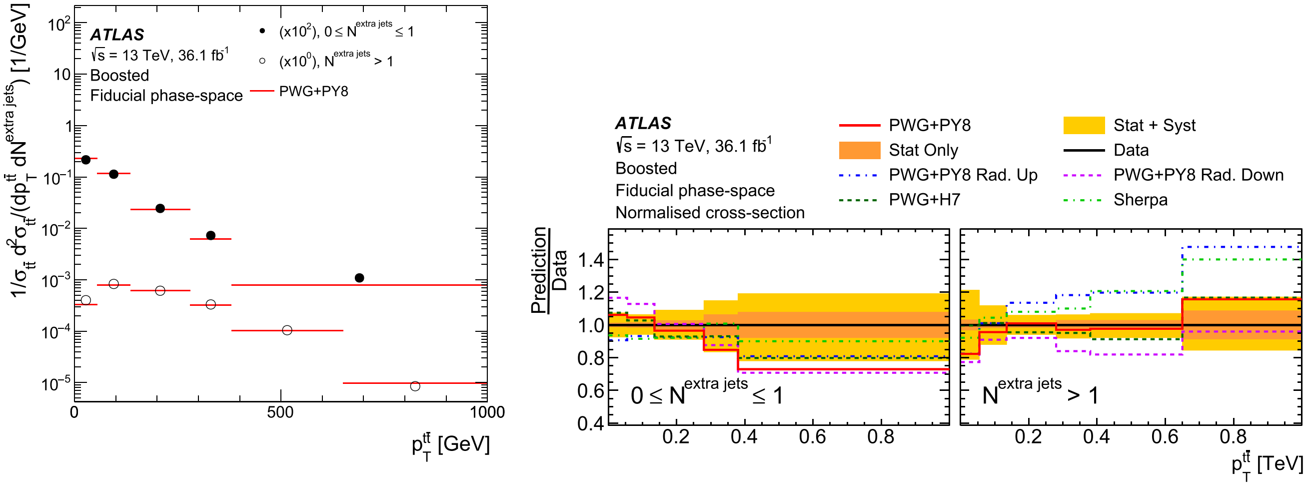
(a) (b)

Fig. 42 Particle-level normalised differential cross-sections as a function of **a** the number of additional jets and **b** the number of small-R jets composing the hadronically decaying top quark in the boosted topology, compared with different Monte Carlo predictions. The bands represent the statistical and total uncertainty in the data. Data points are placed at the centre of each bin. The lower panel shows the ratios of the simulations to data



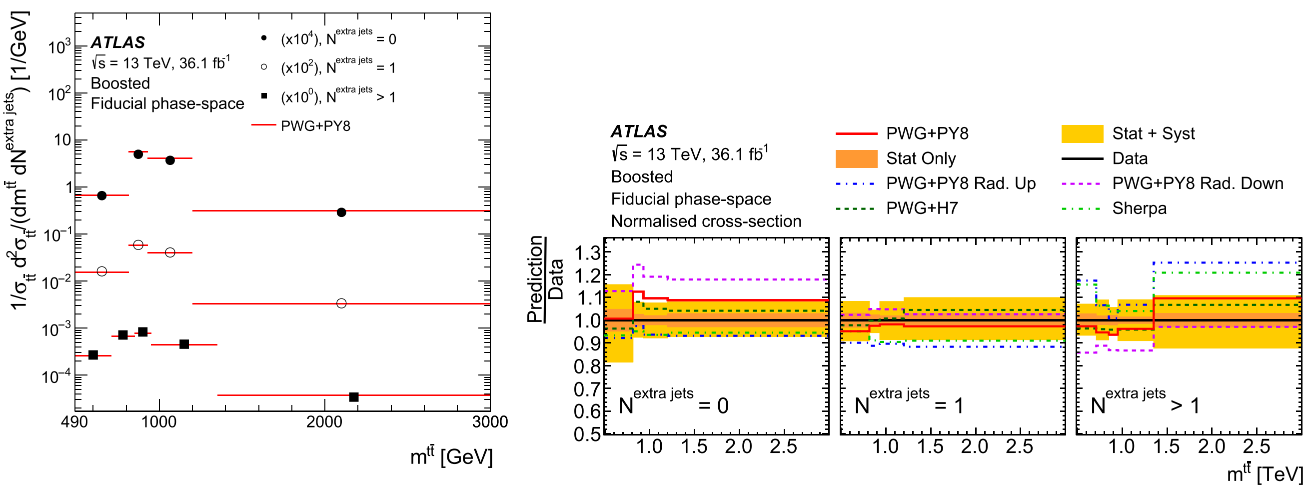
(a) (b)

Fig. 50 **a** Particle-level normalised differential cross-section as a function of the p_{T} of the hadronically decaying top quark in bins of the number of additional jets in the boosted topology compared with the prediction obtained with the POWHEG+ PYTHIA8 MC generator. Data points are placed at the centre of each bin. **b** The ratio of the measured cross-section to different Monte Carlo predictions. The bands represent the statistical and total uncertainty in the data



(a) (b)

Fig. 51 **a** Particle-level normalised differential cross-section as a function of the p_{T} of the $t\bar{t}$ system in bins of the number of additional jets in the boosted topology compared with the prediction obtained with the POWHEG+ PYTHIA8 MC generator. Data points are placed at the centre of each bin. **b** The ratio of the measured cross-section to different Monte Carlo predictions. The bands represent the statistical and total uncertainty in the data



(a) (b)

Fig. 52 **a** Particle-level normalised differential cross-section as a function of the mass of the $t\bar{t}$ system in bins of the number of additional jets in the boosted topology compared with the prediction obtained with the POWHEG+ PYTHIA8 MC generator. Data points are placed at the centre of each bin. **b** The ratio of the measured cross-section to different Monte Carlo predictions

Table 13 Comparison of the measured particle-level normalised single-differential cross-sections in the boosted topology with the predictions from several MC generators. For each prediction a χ^2 and a p value are calculated using the covariance matrix of the measured spectrum. The NDF is equal to the number of bins in the distribution minus one

Observable	PWG + PY8		PWG + PY8 Rad. Up		PWG + PY8 Rad. Down		PWG + H7		SHERPA 2.2.1	
	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value
$p_{\mathrm{T}}^{t,1}$	6.2/7	0.51	10.3/7	0.17	2.8/7	0.90	2.4/7	0.93	11.1/7	0.14
$p_{\mathrm{T}}^{t,2}$	4.0/6	0.68	3.9/6	0.69	4.1/6	0.66	3.2/6	0.78	4.4/6	0.62
$H_{\mathrm{T}}^{t\bar{t}}$	9.0/9	0.44	7.1/9	0.62	24.1/9	< 0.01	10.4/9	0.32	7.8/9	0.56
$\left\|p_{\mathrm{out}}^{t,\mathrm{lep}}\right\|$	7.1/6	0.31	17.2/6	< 0.01	43.3/6	< 0.01	25.4/6	< 0.01	2.9/6	0.82
$\chi^{t\bar{t}}$	3.5/6	0.74	1.0/6	0.98	18.4/6	< 0.01	3.2/6	0.79	8.9/6	0.18
$N^{\mathrm{extrajets}}$	6.8/4	0.15	16.7/4	< 0.01	16.5/4	< 0.01	3.4/4	0.49	8.6/4	0.07
$p_{\mathrm{T}}^{t,\mathrm{had}}$	6.2/7	0.52	11.0/7	0.14	3.2/7	0.86	3.5/7	0.83	10.6/7	0.16
N^{subjets}	2.6/3	0.45	4.1/3	0.25	1.9/3	0.60	0.7/3	0.88	3.6/3	0.31
$\|y^{t,\mathrm{had}}\|$	0.6/3	0.90	0.5/3	0.93	1.5/3	0.68	0.6/3	0.90	1.2/3	0.75
$\|y^{t\bar{t}}\|$	3.2/3	0.36	1.9/3	0.60	4.5/3	0.21	5.2/3	0.16	4.2/3	0.24
$m^{t\bar{t}}$	7.5/9	0.59	11.8/9	0.23	16.2/9	0.06	8.1/9	0.52	8.3/9	0.50
$p_{\mathrm{T}}^{t\bar{t}}$	3.5/5	0.63	25.6/5	< 0.01	35.7/5	< 0.01	9.8/5	0.08	19.7/5	< 0.01

Table 14 Comparison of the measured particle-level absolute single-differential cross-sections in the boosted topology with the predictions from several MC generators. For each prediction a χ^2 and a p value are calculated using the covariance matrix of the measured spectrum. The NDF is equal to the number of bins in the distribution

Observable	PWG + PY8		PWG + PY8 Rad. Up		PWG + PY8 Rad. Down		PWG + H7		SHERPA 2.2.1	
	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value
$p_{\mathrm{T}}^{t,1}$	7.8/8	0.46	14.1/8	0.08	3.9/8	0.86	2.8/8	0.95	12.9/8	0.11
$p_{\mathrm{T}}^{t,2}$	5.3/7	0.62	6.6/7	0.47	5.7/7	0.58	5.6/7	0.59	4.8/7	0.68
$H_{\mathrm{T}}^{t\bar{t}}$	10.9/10	0.37	10.5/10	0.40	15.5/10	0.12	7.0/10	0.72	11.4/10	0.33
$\left\|p_{\mathrm{out}}^{t,\mathrm{lep}}\right\|$	24.2/7	< 0.01	21.7/7	< 0.01	72.0/7	< 0.01	31.9/7	< 0.01	9.9/7	0.19
$\chi^{t\bar{t}}$	12.9/7	0.07	9.2/7	0.24	32.0/7	< 0.01	4.5/7	0.72	17.2/7	0.02
$N^{\mathrm{extrajets}}$	34.6/5	< 0.01	40.4/5	< 0.01	51.7/5	< 0.01	5.7/5	0.34	34.6/5	< 0.01
$p_{\mathrm{T}}^{t,\mathrm{had}}$	9.2/8	0.33	16.0/8	0.04	5.9/8	0.66	4.5/8	0.81	12.0/8	0.15
N^{subjets}	12.5/4	0.01	15.2/4	< 0.01	12.0/4	0.02	0.6/4	0.97	6.0/4	0.20
$\|y^{t,\mathrm{had}}\|$	4.0/4	0.41	5.8/4	0.21	3.9/4	0.42	2.3/4	0.68	10.6/4	0.03
$\|y^{t\bar{t}}\|$	8.8/4	0.07	10.3/4	0.04	8.1/4	0.09	6.7/4	0.15	10.5/4	0.03
$m^{t\bar{t}}$	16.5/10	0.09	28.5/10	< 0.01	24.3/10	< 0.01	11.2/10	0.34	25.5/10	< 0.01
$p_{\mathrm{T}}^{t\bar{t}}$	21.0/6	< 0.01	59.3/6	< 0.01	107.0/6	< 0.01	27.8/6	< 0.01	38.4/6	< 0.01

Table 15 Comparison of the measured particle-level normalised double-differential cross-sections in the boosted topology with the predictions from several MC generators. For each prediction a χ^2 and a p value are calculated using the covariance matrix of the measured spectrum. The NDF is equal to the number of bins in the distribution minus one

Observable	PWG + PY8		PWG + PY8 Rad. Up		PWG + PY8 Rad. Down		PWG + H7		SHERPA 2.2.1	
	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value
$m^{t\bar{t}}$ vs $N^{\text{extrajets}}$	16.9/12	0.15	34.1/12	< 0.01	31.4/12	< 0.01	6.3/12	0.90	21.0/12	0.05
$p_{\text{T}}^{t\bar{t}}$ vs $N^{\text{extrajets}}$	14.8/10	0.14	52.2/10	< 0.01	48.3/10	< 0.01	14.1/10	0.17	32.2/10	< 0.01
$m^{t\bar{t}}$ vs $H_{\text{T}}^{t\bar{t}}$	7.3/8	0.51	16.5/8	0.04	15.7/8	0.05	7.1/8	0.53	20.8/8	< 0.01
$m^{t\bar{t}}$ vs $\|y^{t\bar{t}}\|$	4.8/13	0.98	11.5/13	0.57	15.9/13	0.26	5.8/13	0.95	16.4/13	0.23
$m^{t\bar{t}}$ vs $p_{\text{T}}^{t\bar{t}}$	7.8/12	0.80	34.6/12	< 0.01	40.6/12	< 0.01	18.6/12	0.10	18.0/12	0.12
$p_{\text{T}}^{t,\text{had}}$ vs $\|y^{t}\|$	8.6/9	0.47	12.7/9	0.17	6.5/9	0.69	5.7/9	0.77	12.5/9	0.18
$p_{\text{T}}^{t,\text{had}}$ vs $\|y^{t\bar{t}}\|$	10.0/9	0.35	11.6/9	0.24	8.5/9	0.48	8.9/9	0.45	13.5/9	0.14
$p_{\text{T}}^{t,\text{had}}$ vs $N^{\text{extrajets}}$	16.9/14	0.26	40.1/14	< 0.01	30.8/14	< 0.01	20.6/14	0.11	31.5/14	< 0.01
$p_{\text{T}}^{t,\text{had}}$ vs $m^{t\bar{t}}$	6.9/7	0.44	18.7/7	< 0.01	8.9/7	0.26	4.4/7	0.73	25.6/7	< 0.01
$p_{\text{T}}^{t,\text{had}}$ vs $p_{\text{T}}^{t\bar{t}}$	16.1/13	0.24	50.4/13	< 0.01	63.2/13	< 0.01	26.0/13	0.02	33.9/13	< 0.01

Table 16 Comparison of the measured particle-level absolute double-differential cross-sections in the boosted topology with the predictions from several MC generators. For each prediction a χ^2 and a p value are calculated using the covariance matrix of the measured spectrum. The NDF is equal to the number of bins in the distribution

Observable	PWG + PY8		PWG + PY8 Rad. Up		PWG + PY8 Rad. Down		PWG + H7		SHERPA 2.2.1	
	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value	χ^2/NDF	p value
$m^{t\bar{t}}$ vs $N^{\text{extrajets}}$	40.5/13	< 0.01	56.0/13	< 0.01	73.8/13	< 0.01	9.6/13	0.73	38.2/13	< 0.01
$p_{\mathrm{T}}^{t\bar{t}}$ vs $N^{\text{extrajets}}$	44.5/11	< 0.01	103.0/11	< 0.01	119.0/11	< 0.01	27.3/11	< 0.01	59.1/11	< 0.01
$m^{t\bar{t}}$ vs $H_{\mathrm{T}}^{t\bar{t}}$	12.7/9	0.17	17.8/9	0.04	25.3/9	< 0.01	11.8/9	0.22	24.4/9	< 0.01
$m^{t\bar{t}}$ vs $\|y^{t\bar{t}}\|$	18.4/14	0.19	17.3/14	0.24	36.5/14	< 0.01	14.2/14	0.43	22.1/14	0.08
$m^{t\bar{t}}$ vs $p_{\mathrm{T}}^{t\bar{t}}$	15.5/13	0.28	70.1/13	< 0.01	86.4/13	< 0.01	27.8/13	< 0.01	28.8/13	< 0.01
$p_{\mathrm{T}}^{t,\text{had}}$ vs $\|y^{t}\|$	11.2/10	0.34	15.9/10	0.10	7.3/10	0.70	6.7/10	0.75	15.3/10	0.12
$p_{\mathrm{T}}^{t,\text{had}}$ vs $\|y^{t\bar{t}}\|$	9.7/10	0.47	10.6/10	0.39	8.1/10	0.62	8.5/10	0.58	13.4/10	0.20
$p_{\mathrm{T}}^{t,\text{had}}$ vs $N^{\text{extrajets}}$	31.3/15	< 0.01	61.1/15	< 0.01	55.1/15	< 0.01	26.2/15	0.04	52.2/15	< 0.01
$p_{\mathrm{T}}^{t,\text{had}}$ vs $m^{t\bar{t}}$	14.8/8	0.06	29.8/8	< 0.01	16.4/8	0.04	4.4/8	0.82	32.6/8	< 0.01
$p_{\mathrm{T}}^{t,\text{had}}$ vs $p_{\mathrm{T}}^{t\bar{t}}$	24.6/14	0.04	70.1/14	< 0.01	94.3/14	< 0.01	30.0/14	< 0.01	48.7/14	< 0.01

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