

Validation of the MadAnalysis 5 implementation of CMS-SUS-14-001

Atmasiddha, Prachi (IISER); Bein, Samuel (Florida State U.)

emails: prachi.atmariddha@students.iiserpune.ac.in, samuel.bein@gmail.com

November 5, 2015

1 T2tt simplified model

We present the results of the synchronization of the MA5 implementation of the SUS-14-001 “top tagging” SUSY search for top squarks. The performance of the implementation is evaluated by comparing the MA5-derived results with a set of cut flow tables and kinematic distributions provided by CMS for this purpose. The simplified model T2tt (Fig. 1) is used as a common benchmark, with values of the masses of the stop and neutralino taking on a range of values. Two types of comparisons are given in Figs. 1-9: cut flow tables and normalized kinematic distributions. In some cases the cut flow tables give the number of events normalized to 100%; in other cases the tables are normalized to the cross section times the integrated luminosity. The normalization convention used by CMS was followed. Question marks hold the place of values that were not provided in the CMS cut flow tables.

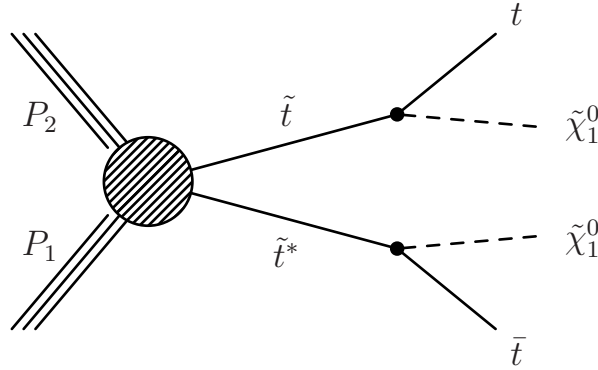


Figure 1: Diagram for the T2tt SMS topology. Several mass combinations of the stop and LSP are used in the tables below as benchmark comparison scenarios.

Cut Name	CMS Count(Eff)	MA5 Count(Eff)
Event Cleaning	98.13 (xxx)	98.13 (xxx)
No Mu	72.16 (73%)	72.21 (73%)
No Ele	55.41 (76%)	55.50 (76%)
Njet70>1	49.55 (89%)	50.07 (90%)
Njet50>3	31.16 (62%)	32.14 (64%)
Njet30>4	26.25 (84%)	27.10 (84%)
Min $\Delta(\phi)$	22.46 (85%)	23.15 (85%)
Nbjets>0	19.63 (87%)	19.69 (85%)
MET>200	12.21 (62%)	12.95 (65%)
Top Reco	? (?)	5.79 (44%)
MTsum>500	4.87 (39%)	4.95 (85%)

Table 1: The acceptance cut flow for the baseline selection in CMS SUS-14-001 for model point T2tt-500-125 and the MA5 results are given in column 3. .

Signal Region Name	CMS	MA5
MET200-350, Nbjets=1	1.19	1.25
MET>350, Nbjets=1	0.93	1.12
MET200-350, Nbjets>1	1.64	1.38
MET>350, Nbjets>1	1.11	1.19

Table 2: The signal region (SR) counts in CMS CMS-SUS-14-001 for the working point T2tt-500-125 after all selection has been applied. Column 2 is the CMS account, and our own results displayed in column 3. These counts were determined by applying the SR selection to the end of the cut flow featured in table ??.

Cut Name	CMS Count(Eff)	MA5 Count(Eff)
Event Cleaning	97.44 (xxx)	97.44 (xxx)
No Mu	72.5 (74%)	71.81 (73%)
No Ele	55.55 (76%)	54.98 (76%)
Njet70>1	52.72 (94%)	51.86 (94%)
Njet50>3	34.55 (65%)	34.66 (66%)
Njet30>4	28.49 (82%)	28.86 (83%)
Min $\Delta(\phi)$	24.98 (87%)	25.22 (87%)
Nbjets>0	21.81 (87%)	21.67 (85%)
MET>200	17.6 (80%)	17.73 (81%)
Top Reco	? (?)	9.10 (51%)
MTsum>500	8.37 (47%)	8.52 (93%)

Table 3: The acceptance cut flow for the baseline selection in CMS SUS-14-001 for model point T2tt-650-25 and the MA5 results are given in column 3. .

Signal Region Name	CMS	MA5
MET200-350, Nbjets=1	1.06	0.91
MET>350, Nbjets=1	2.49	2.93
MET200-350, Nbjets>1	1.34	1.24
MET>350, Nbjets>1	3.48	3.43

Table 4: The signal region (SR) counts in CMS CMS-SUS-14-001 for the working point T2tt-650-25 after all selection has been applied. Column 2 is the CMS account, and our own results displayed in column 3. These counts were determined by applying the SR selection to the end of the cut flow featured in table ??.

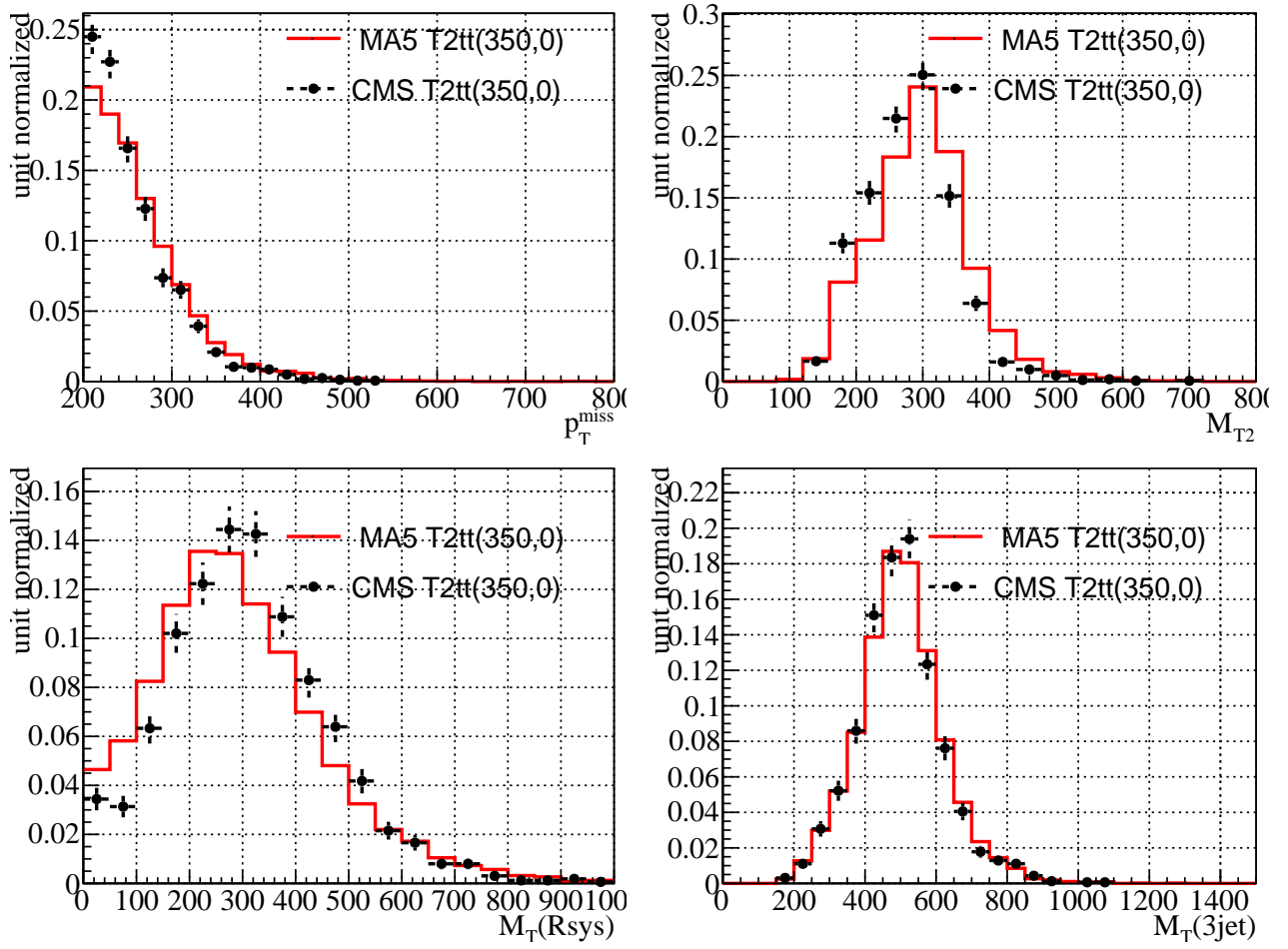
Cut Name	CMS Count(Eff)	MA5 Count(Eff)
Event Cleaning	15662.0 (xxx)	15662.0 (xxx)
No Mu	? (?)	11568.97 (73%)
No Ele	8802.0 (56%)	8927.82 (77%)
Njet70>1	? (?)	7380.74 (82%)
Njet50>3	? (?)	4350.13 (58%)
Njet30>4	3113.0 (35%)	3653.80 (83%)
Min $\Delta(\phi)$	2205.0 (70%)	2972.08 (81%)
Nbjets>0	2200.0 (99%)	2539.64 (85%)
MET>200	? (?)	1010.90 (39%)
Top Reco	? (?)	314.46 (31%)
MTsum>500	182.9 (8%)	213.18 (67%)

Table 5: The acceptance cut flow for the baseline selection in CMS SUS-14-001 for model point T2tt-350-0 and the MA5 results are given in column 3. .

Signal Region Name	CMS	MA5
MET200-350, Nbjets=1	?	95.08
MET>350, Nbjets=1	?	13.66
MET200-350, Nbjets>1	?	90.88
MET>350, Nbjets>1	7.5	13.55

Table 6: The signal region (SR) counts in CMS CMS-SUS-14-001 for the working point T2tt-350-0 after all selection has been applied. Column 2 is the CMS account, and our own results displayed in column 3. These counts were determined by applying the SR selection to the end of the cut flow featured in table ??.

Figure 2: MA5 and CMS unit-normalized kinematic distributions after the baseline selection for the T2tt working point (350,0).



Cut Name	CMS Count(Eff)	MA5 Count(Eff)
Event Cleaning	1660.0 (xxx)	1660.0 (xxx)
No Mu	? (?)	1229.14 (74%)
No Ele	927.0 (55%)	942.80 (76%)
Njet70>1	? (?)	856.80 (90%)
Njet50>3	? (?)	551.71 (64%)
Njet30>4	419.0 (45%)	468.27 (84%)
Min $\Delta(\phi)$	360.0 (85%)	400.29 (85%)
Nbjets>0	314.0 (87%)	341.67 (85%)
MET>200	? (?)	229.78 (67%)
Top Reco	? (?)	105.02 (45%)
MTsum>500	85.9 (27%)	90.82 (86%)

Table 7: The acceptance cut flow for the baseline selection in CMS SUS-14-001 for model point T2tt-500-100 and the MA5 results are given in column 3. .

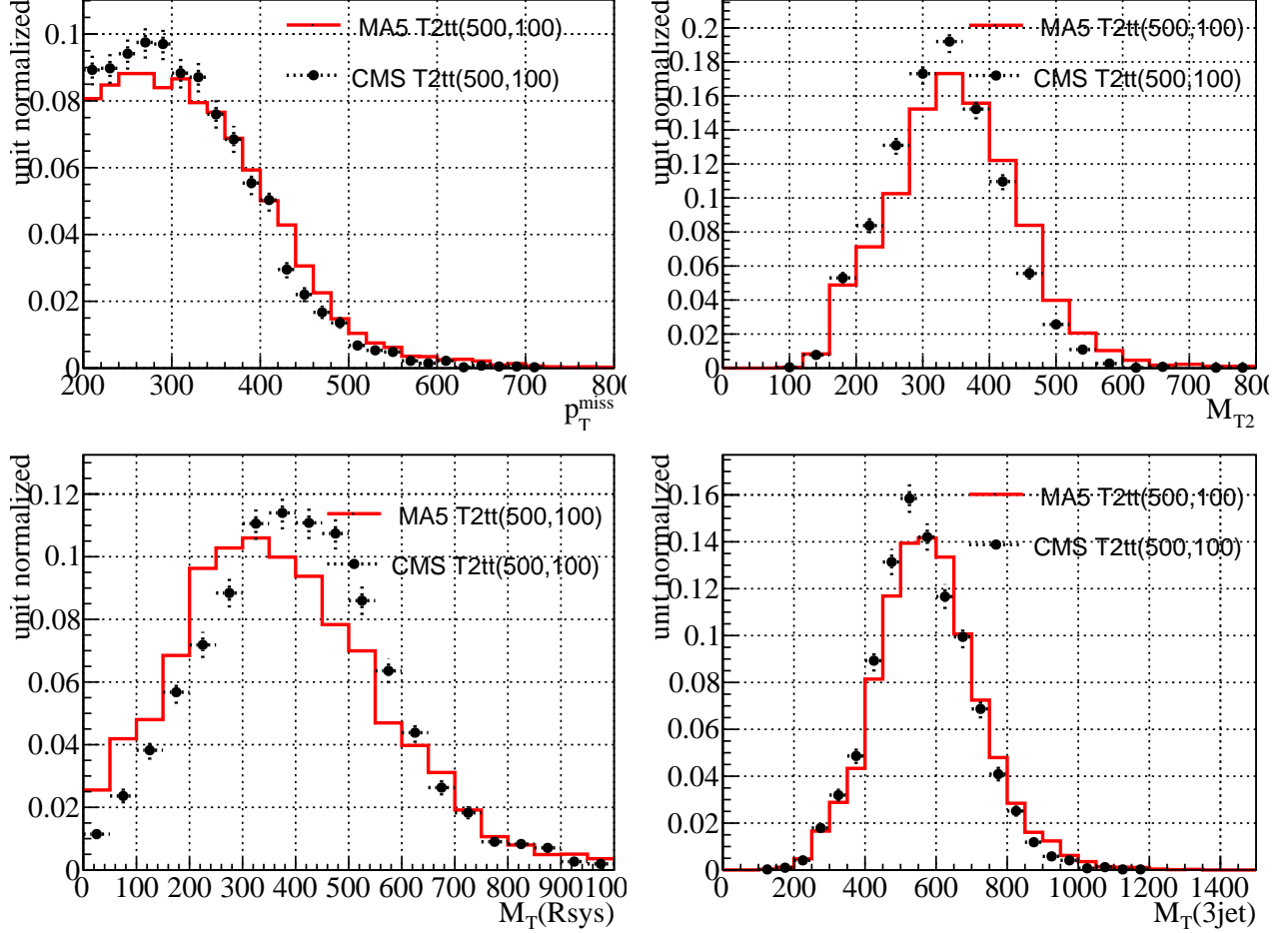
Signal Region Name	CMS	MA5
MET200-350, Nbjets=1	?	21.48
MET>350, Nbjets=1	?	20.52
MET200-350, Nbjets>1	?	25.31
MET>350, Nbjets>1	19.8	23.50

Table 8: The signal region (SR) counts in CMS CMS-SUS-14-001 for the working point T2tt-500-100 after all selection has been applied. Column 2 is the CMS account, and our own results displayed in column 3. These counts were determined by applying the SR selection to the end of the cut flow featured in table ??.

Cut Name	CMS Count(Eff)	MA5 Count(Eff)
Event Cleaning	270.8 (xxx)	270.8 (xxx)
No Mu	? (?)	199.25 (73%)
No Ele	152.0 (56%)	152.26 (76%)
Njet70>1	? (?)	143.65 (94%)
Njet50>3	? (?)	95.87 (66%)
Njet30>4	75.0 (49%)	79.95 (83%)
Min $\Delta(\phi)$	66.0 (88%)	69.84 (87%)
Nbjets>0	58.0 (87%)	59.99 (85%)
MET>200	? (?)	48.58 (80%)
Top Reco	? (?)	25.36 (52%)
MTsum>500	22.7 (39%)	23.71 (93%)

Table 9: The acceptance cut flow for the baseline selection in CMS SUS-14-001 for model point T2tt-650-50 and the MA5 results are given in column 3. .

Figure 3: MA5 and CMS unit-normalized kinematic distributions after the baseline selection for the T2tt working point (500,100).



Signal Region Name	CMS	MA5
MET200-350, Nbjets=1	?	2.77
MET>350, Nbjets=1	?	8.08
MET200-350, Nbjets>1	?	3.35
MET>350, Nbjets>1	9.3	9.49

Table 10: The signal region (SR) counts in CMS CMS-SUS-14-001 for the working point T2tt-650-50 after all selection has been applied. Column 2 is the CMS account, and our own results displayed in column 3. These counts were determined by applying the SR selection to the end of the cut flow featured in table ??.

Figure 4: MA5 and CMS unit-normalized kinematic distributions after the baseline selection for the T2tt working point (650,50).

