Validation of CMS-PAS-SUS-16-025

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1 Eletroweakino-like Signal Region Validation

We have validated our codes according to Figure 5 in Page 15 in the CMS document CMS_PAS_SUS_16_025 because of no cutflow information given by the CMS group. Our simulation agrees with the corresponding CMS analysis within 20% uncertainty.

In the left plot of Figure 5, we choose five points on the observed exclusion contours shown in Table 1.

For the point P1, we generate 59537 events and the acceptation ratio is 0.0005 for the most significant signal region (SR) $10 < M(ll) < 20, E_T^{miss} = [125 - 200]$ of electroweakino-like SR.

For the point P2, we generated 57072 events and the acceptation ratio is 0.0009 for the most significant signal region (SR) $10 < M(ll) < 20, E_T^{miss} = [125 - 200]$ of electroweakino-like SR.

For the point P3, we generated 44623 events and the acceptation ratio is 0.002 for the most significant signal region (SR) $10 < M(ll) < 20, E_T^{miss} = [125 - 200]$ of electroweakino-like SR.

For the point P4, we generated 115775 events and the acceptation ratio is 0.0015 for the most significant signal region (SR) $4 < M(ll) < 10, E_T^{miss} = [125 - 200]$ of electroweakino-like SR.

For the point P5, we generated 30028 events and the acceptation ratio is 0.0025 for the most significant signal region (SR) $10 < M(ll) < 20, E_T^{miss} = [125 - 200]$ of electroweakino-like SR.

	$m_{\tilde{\chi}_2^0,\tilde{\chi}_1^\pm}$[GeV]	$\Delta m(\tilde{\chi}_2^0,\tilde{\chi}_1^0)$[GeV]	N_{SUSY}/S_{95}^{obs}		
			CMS	CheckMATE	DIFF
P1	120	32.5	1.0	0.95	-5%
P2	140	29	1.0	1.0	0
P3	170	24.5	1.0	1.1	10%
P4	170	10	1.0	1.05	5%
P5	195	20	1.0	0.92	-8%

Table 1: Electroweakino-like SR validation table for CMS_PAS_SUS_16_025.

2 $\tilde{t}$-like Signal Region Validation

For the stop signal region validation, we generated spectrum card using the package SUSY-HIT. Events of the process $pp \to \tilde{t}\tilde{t}$ are generated in association with two additional jets by MADGRAPH5 and Pythia6.4. ATLAS and CMS generate events with 4 additional jets for the process which is very time consuming so we generated events only with two additional jets according to the performance of our computer. The scale factor 0.6 in the following table maybe arise from the difference between our events and CMS events for simulation. Our simulation agrees with the corresponding CMS analysis within 30% uncertainty if we considered the scale factor.

In the right plot of Figure 5, we choose five points on the observed exclusion contours shown in Table 2.

For the point P1, we generated 274854 events and the acceptation ratio is 0.0006 for the most significant signal region (SR) $5 < P_T(l1) < 12, E_T^{miss} = [125 - 200]$ of $\tilde{t}$-like SR.

For the point P2, we generated 111893 events and the acceptation ratio is 0.0012 for the most significant signal region (SR) $5 < P_T(l1) < 12, E_T^{miss} = [125 - 200]$ of $\tilde{t}$-like SR.

For the point P3, we generated 164077 events and the acceptation ratio is 0.0030 for the most significant signal region (SR) $12 < P_T(l1) < 20, E_T^{miss} = [125 - 200]$ of $\tilde{t}$-like SR.

For the point P4, we generated 290030 events and the acceptation ratio is 0.0017 for the most significant signal region (SR) $12 < P_T(l1) < 20, E_T^{miss} = [125 - 200]$ of $\tilde{t}$-like SR.

	$m_{\tilde{t}_1}$[GeV]	$\Delta m(\tilde{t}_1, \tilde{\chi}_1^0)$[GeV]	N_{SUSY}/S_{95}^{obs}		
			CMS	CheckMATE	DIFF
P1	280.0	18.0	1.0	0.828 (=1.34*0.6)	-17.2%
P2	320.0	20.0	1.0	0.852	-14.8%
P3	320.0	54.0	1.0	1.14	14.0%
P4	280.0	72.0	1.0	0.732	-26.8%

Table 2: $\tilde{t}$-like SR validation table for CMS_PAS_SUS_16_025.