Validation of the MadAnalysis 5 implementation of ATLAS-SUSY-2013-11

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This note contains detailed validation material for the MadAnalysis 5 implementation [1] of the ATLAS search [2] for electroweak-inos and sleptons in the di-lepton channel at the 8 TeV run of the LHC. Event samples used for the validation were generated with Herwig++ 2.5.2, using as input the SLHA files provided on HepData [3]. 100000 events were generated for each of the nine benchmark points we consider below. Simulation of detector effects was done within `MadAnalysis 1.1.11`, using `delphesMA5tune` with a dedicated detector card [4]. In the case of chargino pair production ($pp \to \tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\mp}$), non-leptonic decays of the intermediate W boson were filtered to increase statistics. Similarly, for chargino-neutralino production ($pp \to \tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$), non-leptonic decays of the intermediate Z boson were filtered. The cross sections for the benchmark points were taken from the HepData entry [3].

Pages 2–27 contain the cut flows of 9 benchmark points for chargino pair, chargino–neutralino and slepton pair production for the various signal regions considered in ATLAS-SUSY-2013-11 and given in [2] (Figs. 46 to 49). Moreover, on pages 28–29, we compare some kinematic distributions to the official ATLAS ones. Finally, the limit-setting procedure will be validated on page 30. Throughout, the notation for the benchmark points is $(m_i, m_{\tilde{\chi}_1^0})$, where m_i is either the chargino or the slepton mass, depending on the process considered. The $\tilde{\chi}_2^0$ and $\tilde{\chi}_1^{\pm}$ are assumed to be degenerate. In case of intermediate sleptons, $m_{\tilde{\ell}_R} = m_{\tilde{\ell}_L} = (m_{\tilde{\chi}_1^{\pm}} + m_{\tilde{\chi}_1^0})$ is assumed as in the experimental publication.

References

[1] `http://inspirehep.net/record/1304590/`

[2] `https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/SUSY-2013-11/`

[3] `http://hepdata.cedar.ac.uk/view/ins1286761`

[4] `http://madanalysis.irmp.ucl.ac.be/attachment/wiki/PhysicsAnalysisDatabase/delphesMA5tune_card_ATLAS_dileptonSUSY.tcl`

1 Cutflows

1.1 $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (100/0)

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (100/0) cutflow for SR WWaee				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	12301.5	12301.5		
2 OS leptons	1520.8	-87.6%		
$m_{\ell\ell} > 20$ GeV	1497.8	-1.5%		
τ veto	1497.8	-0.0%		
ee leptons	392.9	-73.8%	402.1	402.1
jet veto	257.3	-34.5%	198.6	-50.6%
Z veto	216.0	-16.1%	165.0	-16.9%
$p_{T,\ell\ell} > 80$ GeV	35.3	-83.7%	28.0	-83.0%
$E_T^{\text{miss,rel}} > 80$ GeV	18.9	-46.5%	14.7	-47.5%
$m_{\ell\ell} < 120$ GeV	10.1	-46.6%	9.2	-37.4%

Table 1: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (100/0) in the Signal Region WWaee.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ (100/0) cutflow for SR $WW\text{a}e\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	12301.5	12301.5		
2 OS leptons	1520.8	−87.6%		
$m_{\ell\ell} > 20$ GeV	1497.8	−1.5%		
τ veto	1497.8	−0.0%		
$e\mu$ leptons	589.7	−60.6%	741.3	741.3
jet veto	383.5	−35.0%	370.1	−50.1%
$p_{T,\ell\ell} > 80$ GeV	59.5	−84.5%	57.0	−84.6%
$E_T^{\text{miss,rel}} > 80$ GeV	34.3	−42.4%	35.7	−37.4%
$m_{\ell\ell} < 120$ GeV	19.9	−42.0%	24.4	−31.7%

Table 2: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ (100/0) in the Signal Region $WW\text{a}e\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ (100/0) cutflow for SR $WW\text{a}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	12301.5	12301.5		
2 OS leptons	1520.8	−87.6%		
$m_{\ell\ell} > 20$ GeV	1497.8	−1.5%		
τ veto	1497.8	−0.0%		
$\mu\mu$ leptons	515.1	−65.6%	521.6	521.6
jet veto	338.7	−34.2%	258.6	−50.4%
Z veto	282.0	−16.7%	212.0	−18.0%
$p_{T,\ell\ell} > 80$ GeV	47.0	−83.3%	35.3	−83.3%
$E_T^{\text{miss,rel}} > 80$ GeV	26.7	−43.2%	22.8	−35.4%
$m_{\ell\ell} < 120$ GeV	15.8	−40.8%	16.4	−28.1%

Table 3: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ (100/0) in the Signal Region $WW\text{a}\mu\mu$.

1.2 $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (140/20)

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (140/20) cutflow for SR WWbee				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	3375.0	3375.0		
2 OS leptons	503.5	−85.1%		
$m_{\ell\ell} > 20$ GeV	497.2	−1.3%		
τ veto	497.2	−0.0%		
ee leptons	132.4	−73.4%	139.6	139.6
jet veto	79.6	−39.9%	65.7	−52.9%
Z veto	67.6	−15.1%	55.5	−15.5%
$m_{T2} > 90$ GeV	5.4	−92.0%	4.5	−91.9%
$m_{\ell\ell} < 170$ GeV	4.3	−20.4%	3.9	−13.3%

Table 4: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (140/20) in the Signal Region WWbee.

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (140/20) cutflow for SR WWb$e\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	3375.0	3375.0		
2 OS leptons	503.5	−85.1%		
$m_{\ell\ell} > 20$ GeV	497.2	−1.3%		
τ veto	497.2	−0.0%		
$e\mu$ leptons	199.3	−59.9%	253.8	253.8
jet veto	118.9	−40.3%	118.6	−53.3%
$m_{T2} > 90$ GeV	9.4	−92.1%	8.0	−93.3%
$m_{\ell\ell} < 170$ GeV	8.2	−12.8%	7.2	−10.0%

Table 5: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (140/20) in the Signal Region WWb$e\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ (140/20) cutflow for SR $WW\mathrm{b}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	3375.0	3375.0		
2 OS leptons	503.5	−85.1%		
$m_{\ell\ell} > 20$ GeV	497.2	−1.3%		
τ veto	497.2	−0.0%		
$\mu\mu$ leptons	165.5	−66.7%	168.7	168.7
jet veto	101.0	−39.0%	78.2	−53.6%
Z veto	84.4	−16.4%	65.5	−16.2%
$m_{T2} > 90$ GeV	6.8	−91.9%	5.2	−92.1%
$m_{\ell\ell} < 170$ GeV	6.2	−8.8%	4.5	−13.5%

Table 6: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ (140/20) in the Signal Region $WW\mathrm{b}\mu\mu$.

1.3 $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (200/0)

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (200/0) cutflow for SR $WWcee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	835.5	835.5		
2 OS leptons	145.6	-82.6%		
$m_{\ell\ell} > 20$ GeV	143.9	-1.2%		
τ veto	143.9	-0.0%		
ee leptons	39.0	-72.9%	40.9	40.9
jet veto	22.8	-41.5%	17.5	-57.2%
Z veto	19.9	-12.7%	15.5	-11.4%
$m_{T2} > 100$ GeV	3.1	-84.4%	2.4	-84.5%

Table 7: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (200/0) in the Signal Region $WWcee$.

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (200/0) cutflow for SR $WWce\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	835.5	835.5		
2 OS leptons	145.6	-82.6%		
$m_{\ell\ell} > 20$ GeV	143.9	-1.2%		
τ veto	143.9	-0.0%		
$e\mu$ leptons	58.2	-59.6%	71.1	71.1
jet veto	34.0	-41.6%	30.8	-56.7%
$m_{T2} > 100$ GeV	6.4	-81.2%	4.6	-85.1%

Table 8: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$ (200/0) in the Signal Region $WWce\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ (200/0) cutflow for SR $WW\mathrm{c}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	835.5	835.5		
2 OS leptons	145.6	-82.6%		
$m_{\ell\ell} > 20$ GeV	143.9	-1.2%		
τ veto	143.9	-0.0%		
$\mu\mu$ leptons	46.7	-67.5%	46.3	46.3
jet veto	26.9	-42.4%	20.7	-55.3%
Z veto	23.4	-13.0%	18.0	-13.0%
$m_{T2} > 100$ GeV	3.7	-84.2%	2.8	-84.4%

Table 9: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$ (200/0) in the Signal Region $WW\mathrm{c}\mu\mu$.

1.4 $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (350/0)

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (350/0) cutflow for SR $m_{\mathrm{T2}}^{120}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	713.1	713.1		
2 OS leptons	183.8	−74.2%		
$m_{\ell\ell} > 20$ GeV	183.0	−0.4%		
τ veto	183.0	−0.0%		
ee leptons	49.5	−73.0%	52.0	52.0
jet veto	26.1	−47.3%	22.4	−56.9%
Z veto	24.7	−5.4%	21.2	−5.4%
$m_{T2} > 120$ GeV	11.5	−53.4%	9.4	−55.7%

Table 10: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (350/0) in the Signal Region $m_{\mathrm{T2}}^{120}ee$.

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (350/0) cutflow for SR $m_{\mathrm{T2}}^{120}e\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	713.1	713.1		
2 OS leptons	183.8	−74.2%		
$m_{\ell\ell} > 20$ GeV	183.0	−0.4%		
τ veto	183.0	−0.0%		
$e\mu$ leptons	80.5	−56.0%	77.7	77.7
jet veto	42.1	−47.7%	32.4	−58.3%
$m_{T2} > 120$ GeV	20.1	−52.3%	14.7	−54.6%

Table 11: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (350/0) in the Signal Region $m_{\mathrm{T2}}^{120}e\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) cutflow for SR $m_{\mathrm{T2}}^{120}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	713.1	713.1		
2 OS leptons	183.8	-74.2%		
$m_{\ell\ell} > 20$ GeV	183.0	-0.4%		
τ veto	183.0	-0.0%		
$\mu\mu$ leptons	53.0	-71.0%	47.8	47.8
jet veto	28.2	-46.8%	20.7	-56.7%
Z veto	26.8	-5.0%	19.3	-6.8%
$m_{T2} > 120$ GeV	12.2	-54.5%	8.7	-54.9%

Table 12: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) in the Signal Region $m_{\mathrm{T2}}^{120}\mu\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) cutflow for SR $m_{\mathrm{T2}}^{150}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	713.1	713.1		
2 OS leptons	183.8	-74.2%		
$m_{\ell\ell} > 20$ GeV	183.0	-0.4%		
τ veto	183.0	-0.0%		
ee leptons	49.5	-73.0%	52.0	52.0
jet veto	26.1	-47.3%	22.4	-56.9%
Z veto	24.7	-5.4%	21.2	-5.4%
$m_{T2} > 150$ GeV	8.0	-67.6%	6.2	-70.8%

Table 13: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) in the Signal Region $m_{\mathrm{T2}}^{150}ee$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) cutflow for SR $m_{\mathrm{T2}}^{150}e\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	713.1	713.1		
2 OS leptons	183.8	-74.2%		
$m_{\ell\ell} > 20$ GeV	183.0	-0.4%		
τ veto	183.0	-0.0%		
$e\mu$ leptons	80.5	-56.0%	77.7	77.7
jet veto	42.1	-47.7%	32.4	-58.3%
$m_{T2} > 150$ GeV	13.9	-67.0%	10.1	-68.8%

Table 14: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) in the Signal Region $m_{\mathrm{T2}}^{150}e\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) cutflow for SR $m_{\mathrm{T2}}^{150}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	713.1	713.1		
2 OS leptons	183.8	-74.2%		
$m_{\ell\ell} > 20$ GeV	183.0	-0.4%		
τ veto	183.0	-0.0%		
$\mu\mu$ leptons	53.0	-71.0%	47.8	47.8
jet veto	28.2	-46.8%	20.7	-56.7%
Z veto	26.8	-5.0%	19.3	-6.8%
$m_{T2} > 150$ GeV	8.3	-69.0%	5.7	-70.5%

Table 15: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) in the Signal Region $m_{\mathrm{T2}}^{150}\mu\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) cutflow for SR $m_{\mathrm{T2}}^{90}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	713.1	713.1		
2 OS leptons	183.8	−74.2%		
$m_{\ell\ell} > 20$ GeV	183.0	−0.4%		
τ veto	183.0	−0.0%		
ee leptons	49.5	−73.0%	52.0	52.0
jet veto	26.1	−47.3%	22.4	−56.9%
Z veto	24.7	−5.4%	21.2	−5.4%
$m_{T2} > 90$ GeV	14.7	−40.5%	12.7	−40.1%

Table 16: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) in the Signal Region $m_{\mathrm{T2}}^{90}ee$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) cutflow for SR $m_{\mathrm{T2}}^{90}e\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	713.1	713.1		
2 OS leptons	183.8	−74.2%		
$m_{\ell\ell} > 20$ GeV	183.0	−0.4%		
τ veto	183.0	−0.0%		
$e\mu$ leptons	80.5	−56.0%	77.7	77.7
jet veto	42.1	−47.7%	32.4	−58.3%
$m_{T2} > 90$ GeV	26.0	−38.2%	19.1	−41.0%

Table 17: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) in the Signal Region $m_{\mathrm{T2}}^{90}e\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) cutflow for SR $m_{\mathrm{T2}}^{90}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	713.1	713.1		
2 OS leptons	183.8	-74.2%		
$m_{\ell\ell} > 20$ GeV	183.0	-0.4%		
τ veto	183.0	-0.0%		
$\mu\mu$ leptons	53.0	-71.0%	47.8	47.8
jet veto	28.2	-46.8%	20.7	-56.7%
Z veto	26.8	-5.0%	19.3	-6.8%
$m_{T2} > 90$ GeV	16.2	-39.6%	11.5	-40.4%

Table 18: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (350/0) in the Signal Region $m_{\mathrm{T2}}^{90}\mu\mu$.

1.5 $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (425/75)

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (425/75) cutflow for SR $m_{\mathrm{T2}}^{120}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	282.5	282.5		
2 OS leptons	76.7	-72.8%		
$m_{\ell\ell} > 20$ GeV	76.5	-0.3%		
τ veto	76.5	-0.0%		
ee leptons	21.4	-72.0%	20.5	20.5
jet veto	10.7	-50.0%	8.3	-59.5%
Z veto	10.4	-2.8%	7.8	-6.0%
$m_{T2} > 120$ GeV	5.4	-48.1%	3.8	-51.3%

Table 19: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (425/75) in the Signal Region $m_{\mathrm{T2}}^{120}ee$.

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (425/75) cutflow for SR $m_{\mathrm{T2}}^{120}e\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	282.5	282.5		
2 OS leptons	76.7	-72.8%		
$m_{\ell\ell} > 20$ GeV	76.5	-0.3%		
τ veto	76.5	-0.0%		
$e\mu$ leptons	33.3	-56.5%	31.3	31.3
jet veto	17.0	-48.9%	12.3	-60.7%
$m_{T2} > 120$ GeV	9.3	-45.3%	6.3	-48.8%

Table 20: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (425/75) in the Signal Region $m_{\mathrm{T2}}^{120}e\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) cutflow for SR $m_{\mathrm{T2}}^{120}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	282.5	282.5		
2 OS leptons	76.7	-72.8%		
$m_{\ell\ell} > 20$ GeV	76.5	-0.3%		
τ veto	76.5	-0.0%		
$\mu\mu$ leptons	21.8	-71.5%	19.9	19.9
jet veto	11.4	-47.7%	8.0	-59.8%
Z veto	10.9	-4.4%	7.7	-3.7%
$m_{T2} > 120$ GeV	5.7	-47.7%	3.9	-49.4%

Table 21: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) in the Signal Region $m_{\mathrm{T2}}^{120}\mu\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) cutflow for SR $m_{\mathrm{T2}}^{150}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	282.5	282.5		
2 OS leptons	76.7	-72.8%		
$m_{\ell\ell} > 20$ GeV	76.5	-0.3%		
τ veto	76.5	-0.0%		
ee leptons	21.4	-72.0%	20.5	20.5
jet veto	10.7	-50.0%	8.3	-59.5%
Z veto	10.4	-2.8%	7.8	-6.0%
$m_{T2} > 150$ GeV	4.0	-61.5%	2.7	-65.4%

Table 22: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) in the Signal Region $m_{\mathrm{T2}}^{150}ee$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) cutflow for SR $m_{\mathrm{T2}}^{150}e\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	282.5	282.5		
2 OS leptons	76.7	-72.8%		
$m_{\ell\ell} > 20$ GeV	76.5	-0.3%		
τ veto	76.5	-0.0%		
$e\mu$ leptons	33.3	-56.5%	31.3	31.3
jet veto	17.0	-48.9%	12.3	-60.7%
$m_{T2} > 150$ GeV	7.1	-58.2%	4.6	-62.6%

Table 23: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) in the Signal Region $m_{\mathrm{T2}}^{150}e\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) cutflow for SR $m_{\mathrm{T2}}^{150}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	282.5	282.5		
2 OS leptons	76.7	-72.8%		
$m_{\ell\ell} > 20$ GeV	76.5	-0.3%		
τ veto	76.5	-0.0%		
$\mu\mu$ leptons	21.8	-71.5%	19.9	19.9
jet veto	11.4	-47.7%	8.0	-59.8%
Z veto	10.9	-4.4%	7.7	-3.7%
$m_{T2} > 150$ GeV	4.2	-61.5%	3.0	-61.0%

Table 24: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) in the Signal Region $m_{\mathrm{T2}}^{150}\mu\mu$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) cutflow for SR $m_{\mathrm{T2}}^{90}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	282.5	282.5		
2 OS leptons	76.7	-72.8%		
$m_{\ell\ell} > 20$ GeV	76.5	-0.3%		
τ veto	76.5	-0.0%		
ee leptons	21.4	-72.0%	20.5	20.5
jet veto	10.7	-50.0%	8.3	-59.5%
Z veto	10.4	-2.8%	7.8	-6.0%
$m_{T2} > 90$ GeV	6.7	-35.6%	4.8	-38.5%

Table 25: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) in the Signal Region $m_{\mathrm{T2}}^{90}ee$.

$\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) cutflow for SR $m_{\mathrm{T2}}^{90}e\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	282.5	282.5		
2 OS leptons	76.7	-72.8%		
$m_{\ell\ell} > 20$ GeV	76.5	-0.3%		
τ veto	76.5	-0.0%		
$e\mu$ leptons	33.3	-56.5%	31.3	31.3
jet veto	17.0	-48.9%	12.3	-60.7%
$m_{T2} > 90$ GeV	11.5	-32.4%	7.9	-35.8%

Table 26: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_1^\pm$(slep) (425/75) in the Signal Region $m_{\mathrm{T2}}^{90}e\mu$.

$\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (425/75) cutflow for SR $m_{\mathrm{T2}}^{90}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	282.5	282.5		
2 OS leptons	76.7	-72.8%		
$m_{\ell\ell} > 20$ GeV	76.5	-0.3%		
τ veto	76.5	-0.0%		
$\mu\mu$ leptons	21.8	-71.5%	19.9	19.9
jet veto	11.4	-47.7%	8.0	-59.8%
Z veto	10.9	-4.4%	7.7	-3.7%
$m_{T2} > 90$ GeV	7.1	-34.9%	4.9	-36.4%

Table 27: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_1^{\pm}$(slep) (425/75) in the Signal Region $m_{\mathrm{T2}}^{90}\mu\mu$.

1.6 $\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ (250/0)

$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ (250/0) cutflow for SR Zjetsee				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	661.4	661.4		
2 OS leptons	184.0	-72.2%		
$m_{\ell\ell} > 20$ GeV	183.9	-0.1%		
τ veto	183.9	-0.0%		
ee leptons	83.4	-54.6%	63.2	63.2
≥ 2 central light jets	48.9	-41.4%	48.7	-22.9%
b and forward jet veto	40.1	-18.0%	36.8	-24.4%
Z window	36.0	-10.2%	35.5	-3.5%
$p_{T,\ell\ell} > 80$ GeV	28.0	-22.2%	27.4	-22.8%
$E_T^{\text{miss,rel}} > 80$ GeV	15.2	-45.7%	12.5	-54.4%
$0.3 < \Delta R_{\ell\ell} < 1.5$	11.1	-27.0%	9.6	-23.2%
$50 < m_{jj} < 100$ GeV	6.8	-38.7%	6.1	-36.5%
$p_T(j_1, j_2) > 45$ GeV	2.4	-64.7%	2.9	-52.5%

Table 28: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ (250/0) in the Signal Region Zjetsee.

$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ (250/0) cutflow for SR Zjets$\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	661.4	661.4		
2 OS leptons	184.0	-72.2%		
$m_{\ell\ell} > 20$ GeV	183.9	-0.1%		
τ veto	183.9	-0.0%		
$\mu\mu$ leptons	97.0	-47.3%	71.0	71.0
≥ 2 central light jets	57.0	-41.2%	54.6	-23.1%
b and forward jet veto	46.6	-18.2%	40.9	-25.1%
Z window	43.7	-6.2%	39.2	-4.2%
$p_{T,\ell\ell} > 80$ GeV	33.2	-24.0%	29.2	-25.5%
$E_T^{\text{miss,rel}} > 80$ GeV	17.6	-47.0%	14.7	-49.7%
$0.3 < \Delta R_{\ell\ell} < 1.5$	12.7	-27.8%	10.2	-30.6%
$50 < m_{jj} < 100$ GeV	7.9	-37.8%	6.6	-35.3%
$p_T(j_1, j_2) > 45$ GeV	2.7	-65.8%	3.5	-47.0%

Table 29: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ (250/0) in the Signal Region Zjets$\mu\mu$.

1.7 $\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ (350/50)

$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ (350/50) cutflow for SR Zjetsee				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	152.2	152.2		
2 OS leptons	46.9	-69.2%		
$m_{\ell\ell} > 20$ GeV	46.9	-0.0%		
τ veto	46.9	-0.0%		
ee leptons	21.9	-53.3%	16.3	16.3
≥ 2 central light jets	13.8	-37.0%	13.1	-19.6%
b and forward jet veto	11.1	-19.6%	9.8	-25.2%
Z window	9.9	-10.8%	9.4	-4.1%
$p_{T,\ell\ell} > 80$ GeV	8.9	-10.1%	8.2	-12.8%
$E_T^{\text{miss,rel}} > 80$ GeV	6.1	-31.5%	5.4	-34.1%
$0.3 < \Delta R_{\ell\ell} < 1.5$	5.2	-14.8%	4.6	-14.8%
$50 < m_{jj} < 100$ GeV	3.1	-40.4%	3.1	-32.6%
$p_T(j_1, j_2) > 45$ GeV	1.4	-54.8%	1.9	-38.7%

Table 30: Cutflow for the benchmark point $\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ (350/50) in the Signal Region Zjetsee.

$\tilde{\chi}_1^\pm\tilde{\chi}_2^0$ (350/50) cutflow for SR Zjets$\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	152.2	152.2		
2 OS leptons	46.9	−69.2%		
$m_{\ell\ell} > 20$ GeV	46.9	−0.0%		
τ veto	46.9	−0.0%		
$\mu\mu$ leptons	24.2	−48.4%	16.4	16.4
≥ 2 central light jets	15.4	−36.4%	13.2	−19.5%
b and forward jet veto	12.4	−19.5%	9.5	−28.0%
Z window	11.6	−6.5%	9.1	−4.2%
$p_{T,\ell\ell} > 80$ GeV	10.1	−12.9%	8.0	−12.1%
$E_T^{\text{miss,rel}} > 80$ GeV	7.0	−30.7%	5.1	−36.3%
$0.3 < \Delta R_{\ell\ell} < 1.5$	5.9	−15.7%	4.2	−17.6%
$50 < m_{jj} < 100$ GeV	3.6	−39.0%	2.7	−35.7%
$p_T(j_1, j_2) > 45$ GeV	1.6	−55.6%	1.8	−33.3%

Table 31: Cutflow for the benchmark point $\tilde{\chi}_1^\pm\tilde{\chi}_2^0$ (350/50) in the Signal Region Zjets$\mu\mu$.

1.8 $\tilde{\ell}\tilde{\ell}$ (191/90)

$\tilde{\ell}\tilde{\ell}$ (191/90) cutflow for SR $m_{\mathrm{T2}}^{120}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	301.5	301.5		
2 OS leptons	178.9	−40.7%		
$m_{\ell\ell} > 20$ GeV	177.9	−0.6%		
τ veto	177.9	−0.0%		
ee leptons	84.1	−52.7%	135.4	135.4
jet veto	47.7	−43.3%	60.5	−55.3%
Z veto	44.5	−6.7%	55.7	−7.9%
$m_{T2} > 120$ GeV	5.5	−87.6%	8.0	−85.6%

Table 32: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (191/90) in the Signal Region $m_{\mathrm{T2}}^{120}ee$.

$\tilde{\ell}\tilde{\ell}$ (191/90) cutflow for SR $m_{\mathrm{T2}}^{120}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	301.5	301.5		
2 OS leptons	178.9	−40.7%		
$m_{\ell\ell} > 20$ GeV	177.9	−0.6%		
τ veto	177.9	−0.0%		
$\mu\mu$ leptons	93.8	−47.3%	147.8	147.8
jet veto	53.7	−42.8%	64.7	−56.2%
Z veto	50.1	−6.7%	60.0	−7.3%
$m_{T2} > 120$ GeV	6.6	−86.8%	8.5	−85.8%

Table 33: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (191/90) in the Signal Region $m_{\mathrm{T2}}^{120}\mu\mu$.

$\tilde{\ell}\tilde{\ell}$ (191/90) cutflow for SR $m_{\mathrm{T2}}^{150}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	301.5	301.5		
2 OS leptons	178.9	-40.7%		
$m_{\ell\ell} > 20$ GeV	177.9	-0.6%		
τ veto	177.9	-0.0%		
ee leptons	84.1	-52.7%	135.4	135.4
jet veto	47.7	-43.3%	60.5	-55.3%
Z veto	44.5	-6.7%	55.7	-7.9%
$m_{T2} > 150$ GeV	0.0	-100.0%	0.6	-98.9%

Table 34: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (191/90) in the Signal Region $m_{\mathrm{T2}}^{150}ee$.

$\tilde{\ell}\tilde{\ell}$ (191/90) cutflow for SR $m_{\mathrm{T2}}^{150}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	301.5	301.5		
2 OS leptons	178.9	-40.7%		
$m_{\ell\ell} > 20$ GeV	177.9	-0.6%		
τ veto	177.9	-0.0%		
$\mu\mu$ leptons	93.8	-47.3%	147.8	147.8
jet veto	53.7	-42.8%	64.7	-56.2%
Z veto	50.1	-6.7%	60.0	-7.3%
$m_{T2} > 150$ GeV	0.2	-99.6%	1.1	-98.2%

Table 35: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (191/90) in the Signal Region $m_{\mathrm{T2}}^{150}\mu\mu$.

$\tilde{\ell}\tilde{\ell}$ (191/90) cutflow for SR $m_{\mathrm{T2}}^{90}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	301.5	301.5		
2 OS leptons	178.9	-40.7%		
$m_{\ell\ell} > 20$ GeV	177.9	-0.6%		
τ veto	177.9	-0.0%		
ee leptons	84.1	-52.7%	135.4	135.4
jet veto	47.7	-43.3%	60.5	-55.3%
Z veto	44.5	-6.7%	55.7	-7.9%
$m_{T2} > 90$ GeV	14.9	-66.5%	21.8	-60.9%

Table 36: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (191/90) in the Signal Region $m_{\mathrm{T2}}^{90}ee$.

$\tilde{\ell}\tilde{\ell}$ (191/90) cutflow for SR $m_{\mathrm{T2}}^{90}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	301.5	301.5		
2 OS leptons	178.9	-40.7%		
$m_{\ell\ell} > 20$ GeV	177.9	-0.6%		
τ veto	177.9	-0.0%		
$\mu\mu$ leptons	93.8	-47.3%	147.8	147.8
jet veto	53.7	-42.8%	64.7	-56.2%
Z veto	50.1	-6.7%	60.0	-7.3%
$m_{T2} > 90$ GeV	17.3	-65.5%	21.7	-63.8%

Table 37: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (191/90) in the Signal Region $m_{\mathrm{T2}}^{90}\mu\mu$.

1.9 $\tilde{\ell}\tilde{\ell}$ (250/10)

$\tilde{\ell}\tilde{\ell}$ (250/10) cutflow for SR $m_{\mathrm{T2}}^{120}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	96.8	96.8		
2 OS leptons	65.0	−32.9%		
$m_{\ell\ell} > 20$ GeV	64.8	−0.3%		
τ veto	64.8	−0.0%		
ee leptons	32.1	−50.5%	51.2	51.2
jet veto	17.4	−45.8%	19.4	−62.1%
Z veto	16.9	−2.9%	18.7	−3.6%
$m_{T2} > 120$ GeV	8.2	−51.5%	9.1	−51.3%

Table 38: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (250/10) in the Signal Region $m_{\mathrm{T2}}^{120}ee$.

$\tilde{\ell}\tilde{\ell}$ (250/10) cutflow for SR $m_{\mathrm{T2}}^{120}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	96.8	96.8		
2 OS leptons	65.0	−32.9%		
$m_{\ell\ell} > 20$ GeV	64.8	−0.3%		
τ veto	64.8	−0.0%		
$\mu\mu$ leptons	32.7	−49.5%	47.0	47.0
jet veto	17.7	−45.9%	19.8	−57.9%
Z veto	17.1	−3.4%	19.3	−2.5%
$m_{T2} > 120$ GeV	8.3	−51.5%	10.0	−48.2%

Table 39: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (250/10) in the Signal Region $m_{\mathrm{T2}}^{120}\mu\mu$.

$\tilde{\ell}\tilde{\ell}$ (250/10) cutflow for SR $m_{\mathrm{T2}}^{150}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	96.8	96.8		
2 OS leptons	65.0	-32.9%		
$m_{\ell\ell} > 20$ GeV	64.8	-0.3%		
τ veto	64.8	-0.0%		
ee leptons	32.1	-50.5%	51.2	51.2
jet veto	17.4	-45.8%	19.4	-62.1%
Z veto	16.9	-2.9%	18.7	-3.6%
$m_{T2} > 150$ GeV	5.9	-65.1%	7.0	-62.6%

Table 40: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (250/10) in the Signal Region $m_{\mathrm{T2}}^{150}ee$.

$\tilde{\ell}\tilde{\ell}$ (250/10) cutflow for SR $m_{\mathrm{T2}}^{150}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	96.8	96.8		
2 OS leptons	65.0	-32.9%		
$m_{\ell\ell} > 20$ GeV	64.8	-0.3%		
τ veto	64.8	-0.0%		
$\mu\mu$ leptons	32.7	-49.5%	47.0	47.0
jet veto	17.7	-45.9%	19.8	-57.9%
Z veto	17.1	-3.4%	19.3	-2.5%
$m_{T2} > 150$ GeV	6.0	-64.9%	7.4	-61.7%

Table 41: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (250/10) in the Signal Region $m_{\mathrm{T2}}^{150}\mu\mu$.

$\tilde{\ell}\tilde{\ell}$ (250/10) cutflow for SR $m_{\mathrm{T2}}^{90}ee$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	96.8	96.8		
2 OS leptons	65.0	-32.9%		
$m_{\ell\ell} > 20$ GeV	64.8	-0.3%		
τ veto	64.8	-0.0%		
ee leptons	32.1	-50.5%	51.2	51.2
jet veto	17.4	-45.8%	19.4	-62.1%
Z veto	16.9	-2.9%	18.7	-3.6%
$m_{T2} > 90$ GeV	10.4	-38.5%	11.7	-37.4%

Table 42: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (250/10) in the Signal Region $m_{\mathrm{T2}}^{90}ee$.

$\tilde{\ell}\tilde{\ell}$ (250/10) cutflow for SR $m_{\mathrm{T2}}^{90}\mu\mu$				
cut	# events (scaled to σ and $\mathcal{L}$)	relative change	# events (official)	relative change (official)
Initial number of events	96.8	96.8		
2 OS leptons	65.0	-32.9%		
$m_{\ell\ell} > 20$ GeV	64.8	-0.3%		
τ veto	64.8	-0.0%		
$\mu\mu$ leptons	32.7	-49.5%	47.0	47.0
jet veto	17.7	-45.9%	19.8	-57.9%
Z veto	17.1	-3.4%	19.3	-2.5%
$m_{T2} > 90$ GeV	10.6	-38.0%	12.3	-36.3%

Table 43: Cutflow for the benchmark point $\tilde{\ell}\tilde{\ell}$ (250/10) in the Signal Region $m_{\mathrm{T2}}^{90}\mu\mu$.

2 Histograms

In the histograms below, the solid lines correspond to the results from the MadAnalysis 5 implementation, while the dashed lines are the official ATLAS results. They correspond to Figs. 3, 4 and 35 from ATLAS-SUSY-2013-11.

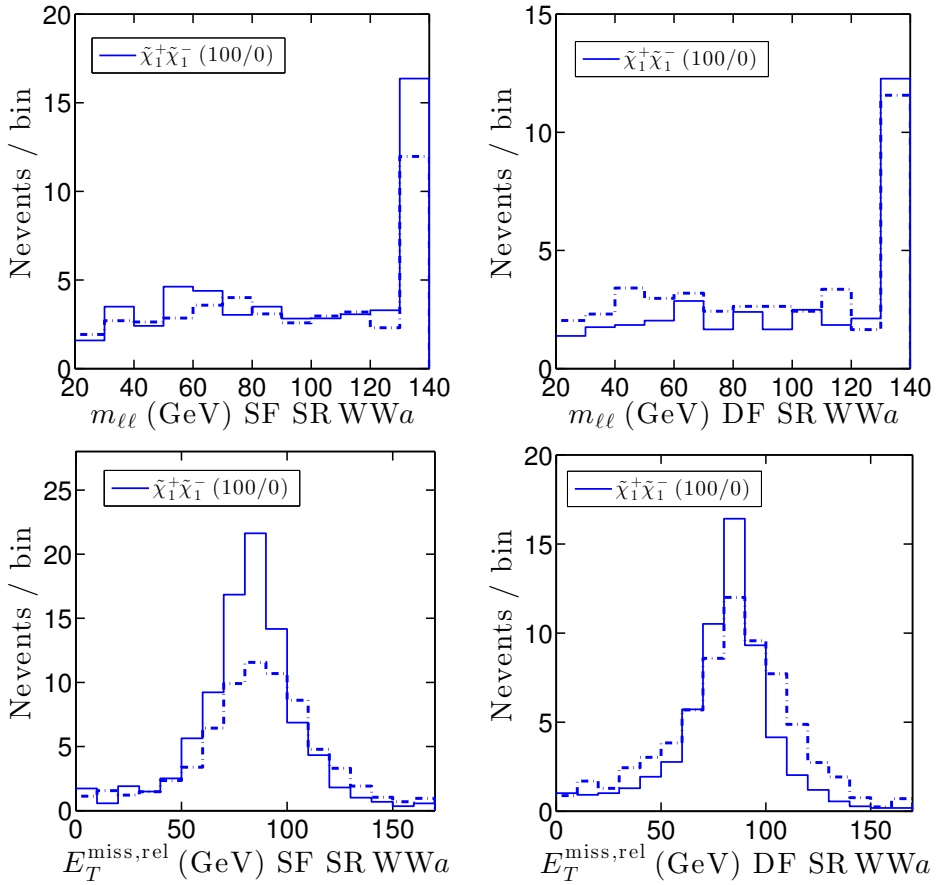

Figure 1: SF and DF samples that satisfy all cuts of the WWa signal region except the ones on $m_{\ell\ell}$ (for the first row), and the ones on $m_{\ell\ell}$ and on $E_T^{\mathrm{miss,rel}}$ (for the bottom row). Corresponds to Fig. 3 of ATLAS-SUSY-2013-11.

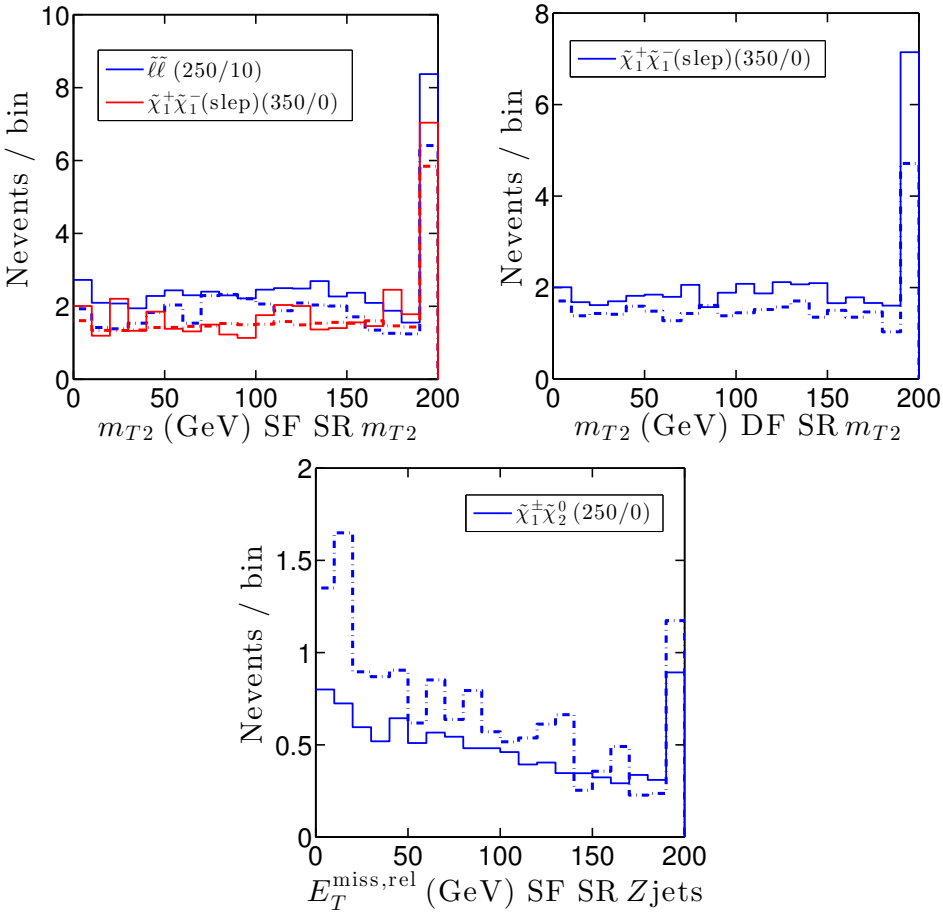

Figure 2: SF and DF samples that satisfy all cuts of the m_{T2} signal regions except the ones on m_{T2} (for the first row), and satisfy all cuts of the Zjets signal regions except the ones on $E_T^{\mathrm{miss,rel}}$ (for the bottom row). Corresponds to Fig. 4 of ATLAS-SUSY-2013-11.

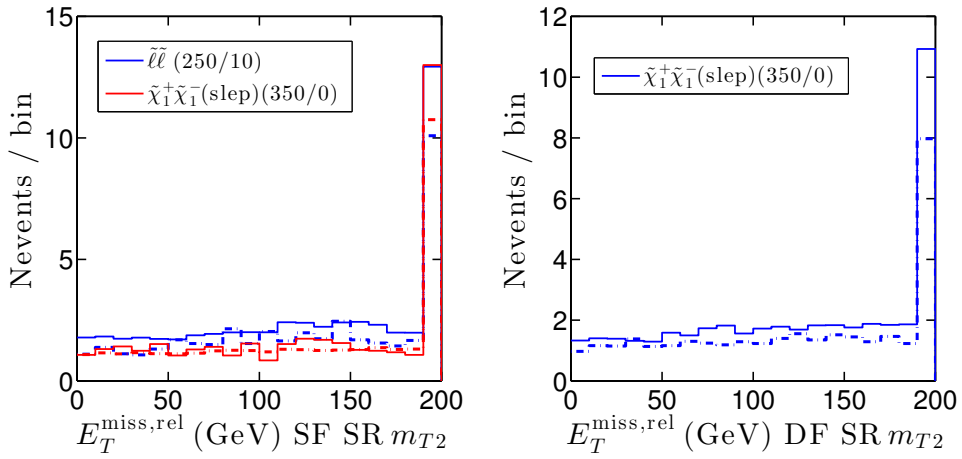

Figure 3: SF and DF samples that satisfy all cuts of the m_{T2} signal regions except the ones on m_{T2}. Corresponds to the auxiliary Fig. 35 of ATLAS-SUSY-2013-11.

3 Limit-setting procedure

Limits are derived using `exclusion_CLs.py`. The 95% CL upper limits on the model cross section obtained from the code are compared to the ATLAS value [3] for the nine benchmark points considered above, as well as the best expected signal region and the (1-CL_s)% value for each benchmark point. "C1C1" and "C1N2" correspond to chargino pair production and chargino-neutralino production, respectively, with possible intermediate sleptons ("slep") or not ("noslep"). For direct slepton production, the name of the benchmark point starts with "slep".

benchmark point	xs95 MA5	xs95 ATLAS	bestSR MA5	bestSR ATLAS
C1C1_noslep_100_0	3.69 pb	4.61 pb	SR-WWa	SR-WWa
C1C1_noslep_140_20	1.59 pb	1.58 pb	SR-WWb	SR-WWb
C1C1_noslep_200_0	0.66 pb	0.46 pb	SR-WWc	SR-WWc
C1C1_slep_350_0	0.0133 pb	0.0104 pb	SR-mT2,120	SR-mT2,120
C1C1_slep_425_75	0.0138 pb	0.0100 pb	SR-mT2,120	SR-mT2,150
C1N2_250_0	0.26 pb	0.18 pb	SR-Zjets	SR-Zjets
C1N2_350_50	0.099 pb	0.069 pb	SR-Zjets	SR-Zjets
slep_191_90	3.69 fb	~4.3 fb	SR-WWc	SR-mT2,90/120
slep_250_10	2.18 fb	~1.26 fb	SR-mT2,150	SR-mT2,120/150

benchmark point	(1-CLs)% MA5	(1-CLs)% ATLAS
C1C1_noslep_100_0	99.5%	98%
C1C1_noslep_140_20	93.4%	95%
C1C1_noslep_200_0	74.1%	91%
C1C1_slep_350_0	100.0%	99.997%
C1C1_slep_425_75	98.2%	97%
C1N2_250_0	97.9%	100%
C1N2_350_50	88.6%	96%
slep_191_90	100.0%	~99.9995%
slep_250_10	100.0%	~99.999%