Validation of CheckMATE Implementation of ATLAS-SUSY-2013-11

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Abstract

This note details the validation of CheckMATE[1] analysis of the 8 TeV ATLAS search[2] for electroweak-inos and sleptons with dilepton final states. The events used for the validation were generated with CalcHEP[3], with 100000 events produced for each benchmark point, using the SLHA files provided from HepData[4]. Leptonic decays of Z in the $\chi^{\pm}\chi 2$ production and W in the $\chi^{+}\chi^{-}$, were also specified in CalcHEP to improve efficiency, which were then showered with CheckMATE's built-in Pythia 8[5] module. Detector effects are also applied via CheckMATE's Delphes[6] module.

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	12301.5		12301.5			
02 2 OS leptons	0.13944	1715.3	86%	1666.5	86%		
03 $m\ell\ell > 20$ GeV	0.13688	1683.9	2%	1637.5	2%		
04 tau veto	0.13688	1683.9	0%	1637.5	0%		
05 ee leptons	0.03070	377.7	78%	392.9	76%	402.1	
06 ee jet veto	0.01806	222.2	41%	257	35%	198.6	51%
07 ee Z veto	0.01498	184.2	17%	215.9	16%	165	17%
08 ee WWa $pT(\ell\ell) > 80$ GeV	0.00196	24.1	87%	35.3	84%	28	83%
09 ee WWa METrel¿80 GeV	0.00101	12.4	49%	18.9	46%	14.7	48%
10 ee WWa $m\ell\ell < 120$ GeV	0.00066	8.1	35%	10.1	47%	9.2	37%

Table 1: $\chi + \chi$ (100/0), Wwaee

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	12301.5		12301.5			
02 2 OS leptons	0.13944	1715.3	86%	1666.5	86%		
03 $m\ell\ell > 20$ GeV	0.13688	1683.9	2%	1637.5	2%		
04 tau veto	0.13688	1683.9	0%	1637.5	0%		
05 emu leptons	0.06020	740.5	56%	729.4	55%	741.3	
06 emu jet veto	0.03497	430.2	42%	474.9	35%	370.1	50%
08 emu WWa $pT(\ell\ell) > 80$ GeV	0.00478	58.8	86%	75.8	84%	57	85%
09 emu WWa METrel¿80 GeV	0.00266	32.8	44%	44.8	41%	35.7	37%
10 emu WWa $m\ell\ell < 120$ GeV	0.00182	22.3	32%	29	35%	24.4	32%

Table 2: $\chi + \chi$ (100/0), Wwaemu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	12301.5		12301.5			
02 2 OS leptons	0.13944	1715.3	86%	1666.5	86%		
03 $m\ell\ell > 20$ GeV	0.13688	1683.9	2%	1637.5	2%		
04 tau veto	0.13688	1683.9	0%	1637.5	0%		
05 mumu leptons	0.04600	565.7	66%	515.1	69%	521.6	
06 mumu jet veto	0.02667	328.1	42%	338.3	34%	258.6	50%
07 mumu Z veto	0.02178	267.9	18%	281.6	17%	212	18%
08 mumu WWa $pT(\ell\ell) > 80$ GeV	0.00316	38.9	85%	46.7	83%	35.3	83%
09 mumu WWa METrel¿80 GeV	0.00174	21.5	45%	26.7	43%	22.8	35%
10 mumu WWa $m\ell\ell$¡120 GeV	0.00119	14.7	32%	15.8	41%	16.4	28%

Table 3: $\chi + \chi-$ (100/0), Wwamumu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	3375.0		3375			
02 2 OS leptons	0.16405	553.7	84%	545.8	84%		
03 $m\ell\ell > 20$ GeV	0.16119	544.0	2%	537.8	1%		
04 tau veto	0.16100	544.0	0%	537.8	0%		
05 ee leptons	0.03680	124.2	77%	132.4	75%	139.6	
06 ee jet veto	0.02018	68.1	45%	79.2	40%	65.7	53%
07 ee Z veto	0.01690	57.0	16%	67.3	15%	55.5	16%
08 ee WWb mT2¿90 GeV	0.00136	4.6	92%	5.3	92%	4.5	92%
09 ee WWb $m\ell\ell < 170$ GeV	0.00115	3.9	15%	4.3	19%	3.9	13%

Table 4: $\chi + \chi-$ (140/20), Wwbee

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	3375.0		3375			
02 2 OS leptons	0.16405	553.7	84%	545.8	84%		
03 $m\ell\ell > 20$ GeV	0.16119	544.0	2%	537.8	1%		
04 tau veto	0.16100	544.0	0%	537.8	0%		
05 emu leptons	0.07158	241.6	56%	239.9	55%	253.8	
06 emu jet veto	0.03899	131.6	46%	142.6	41%	118.6	53%
08 emu WWb mT2¿90 GeV	0.00273	9.2	93%	10.5	93%	8	93%
09 emu WWb $m\ell\ell < 170$ GeV	0.00245	8.3	10%	9.3	11%	7.2	10%

Table 5: $\chi + \chi-$ (140/20), Wwbemu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	3375.0		3375			
02 2 OS leptons	0.16405	553.7	84%	545.8	84%		
03 $m\ell\ell > 20$ GeV	0.16119	544.0	2%	537.8	1%		
04 tau veto	0.16100	544.0	0%	537.8	0%		
05 mumu leptons	0.05281	178.2	67%	165.5	69%	168.7	
06 mumu jet veto	0.02877	97.1	46%	100.7	39%	78.2	54%
07 mumu Z veto	0.02408	81.3	16%	84.2	16%	65.5	16%
08 mumu WWb mT2¿90 GeV	0.00182	6.2	92%	6.8	92%	5.2	92%
09 mumu WWb $m\ell\ell < 170$ GeV	0.00169	5.7	7%	6.2	9%	4.5	13%

Table 6: $\chi + \chi-$ (140/20), Wwbmumu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	835.5		835.5			
02 2 OS leptons	0.19479	162.7	81%	155.4	81%		
03 $m\ell\ell > 20$ GeV	0.19232	160.7	1%	153.3	1%		
04 tau veto	0.19232	160.7	0%	153.3	0%		
05 ee leptons	0.04540	38.0	76%	39	75%	40.9	
06 ee jet veto	0.02291	19.1	50%	22.8	42%	17.5	57%
07 ee Z veto	0.02005	16.8	12%	19.9	13%	15.5	11%
08 ee WWc mT2¿100 GeV	0.00302	2.5	85%	3.1	84%	2.4	85%

Table 7: $\chi + \chi-$ (200/0), Wwcee

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	835.5		835.5			
02 2 OS leptons	0.19479	162.7	81%	155.4	81%		
03 $m\ell\ell > 20$	0.19232	160.7	1%	153.3	1%		
04 tau veto	0.19232	160.7	0%	153.3	0%		
05 emu leptons	0.08430	70.4	56%	67.6	56%	71.1	
06 emu jet veto	0.04308	36.0	49%	39.9	41%	30.8	57%
08 emu WWc mT2¿100 GeV	0.00612	5.1	86%	6.7	83%	4.6	85%

Table 8: $\chi + \chi-$ (200/0), Wwcemu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	835.5		835.5			
02 2 OS leptons	0.19479	162.7	81%	155.4	81%		
03 $m\ell\ell > 20$ GeV	0.19232	160.7	1%	153.3	1%		
04 tau veto	0.19232	160.7	0%	153.3	0%		
05 mumu leptons	0.06259	52.3	67%	46.7	70%	46.3	
06 mumu jet veto	0.03230	27.0	48%	26.9	42%	20.7	55%
07 mumu Z veto	0.02764	23.1	14%	23.4	13%	18	13%
08 mumu WWc mT2¿100 GeV	0.00416	3.5	85%	3.7	84%	2.8	84%

Table 9: $\chi + \chi-$ (200/0), Wwcmumu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	661.4		661.4			
02 2 OS leptons	0.39636	262.2	60%	184.5	72%		
03 $m\ell\ell > 20$ GeV	0.39585	261.8	0%	184.3	0%		
04 tau veto	0.39585	261.8	0%	184.3	0%		
05 ee leptons	0.15630	103.4	61%	83.4	55%	63.2	
07 ee Zjets ≥ 2 central light jets	0.09406	62.2	40%	49.2	41%	48.7	23%
08 ee Zjets b, forward jet veto	0.07539	49.9	20%	40.3	18%	36.8	24%
09 ee Zjets Z window	0.06384	42.2	15%	36.2	10%	35.5	4%
10 ee Zjets $pT\ell\ell > 80$ GeV	0.04977	32.9	22%	28.2	22%	27.4	23%
11 ee Zjets MET rel> 80 GeV	0.02487	16.4	50%	15.2	46%	12.5	54%
12 ee Zjets $0.3 < dR\ell\ell < 1.5$	0.01867	12.3	25%	11.2	26%	9.6	23%
13 ee Zjets $50 < mjj < 100$ GeV	0.01074	7.1	42%	6.9	38%	6.1	36%
14 ee Zjets $pTjj > 45$	0.00484	3.2	55%	2.4	65%	2.9	52%

Table 10: $\chi \pm \chi 2$ (250/0), Zjets ee

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	661.4		661.4			
02 2 OS leptons	0.39636	262.2	60%	184.5	72%		
03 $m\ell\ell > 20$ GeV	0.39585	261.8	0%	184.3	0%		
04 tau veto	0.39585	261.8	0%	184.3	0%		
05 mumu leptons	0.21870	144.6	45%	97	47%	71	
07 mumu Zjets ≥ 2 central light jets	0.13136	86.9	40%	57.5	41%	54.6	23%
08 mumu Zjets b, forward jet veto	0.10538	69.7	20%	46.9	18%	40.9	25%
09 mumu Zjets Z window	0.09224	61.0	12%	44	6%	39.2	4%
10 mumu Zjets $pT\ell\ell > 80$ GeV	0.06740	44.6	27%	33.5	24%	29.2	26%
11 mumu Zjets MET rel> 80 GeV	0.03335	22.1	51%	17.7	47%	14.7	50%
12 mumu Zjets $0.3 < dR\ell\ell < 1.5$	0.02323	15.4	30%	12.8	28%	10.2	31%
13 mumu Zjets $50 < mjj < 100$ GeV	0.01408	9.3	39%	8	38%	6.6	35%
14 mumu Zjets $pTjj > 45$	0.00614	4.1	56%	2.8	65%	3.5	47%

Table 11: $\chi \pm \chi 2$ (250/0), Zjets mumu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	152.2		152.2			
02 2 OS leptons	0.42586	64.8	57%	47	69%		
03 $m\ell\ell > 20$ GeV	0.42545	64.8	0%	46.9	0%		
04 tau veto	0.42545	64.8	0%	46.9	0%		
05 ee leptons	0.17811	27.1	58%	21.9	53%	16.3	
07 ee Zjets ≥ 2 central light jets	0.11192	17.0	37%	13.9	37%	13.1	20%
08 ee Zjets b, forward jet veto	0.08921	13.6	20%	11.2	19%	9.8	25%
09 ee Zjets Z window	0.07530	11.5	16%	10	11%	9.4	4%
10 ee Zjets $pT\ell\ell > 80$ GeV	0.06760	10.3	10%	9	10%	8.2	13%
11 ee Zjets MET rel> 80 GeV	0.04253	6.5	37%	6.1	32%	5.4	34%
12 ee Zjets $0.3 < dR\ell\ell < 1.5$	0.03611	5.5	15%	5.2	15%	4.6	15%
13 ee Zjets $50 < mjj < 100$ GeV	0.02127	3.2	41%	3.1	40%	3.1	33%
14 ee Zjets $pTjj > 45$	0.01186	1.8	44%	1.5	52%	1.9	39%

Table 12: $\chi \pm \chi 2$ (350/50), Zjets ee

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	152.2		152.2			
02 2 OS leptons	0.42586	64.8	57%	47	69%		
03 $m\ell\ell > 20$ GeV	0.42545	64.8	0%	46.9	0%		
04 tau veto	0.42545	64.8	0%	46.9	0%		
05 mumu leptons	0.22614	34.4	47%	24.2	48%	16.4	
07 mumu Zjets ≥ 2 central light jets	0.14378	21.9	36%	15.5	36%	13.2	20%
08 mumu Zjets b, forward jet veto	0.11363	17.3	21%	12.5	19%	9.5	28%
09 mumu Zjets Z window	0.09738	14.8	14%	11.7	6%	9.1	4%
10 mumu Zjets $pT\ell\ell > 80$ GeV	0.08441	12.8	13%	10.2	13%	8	12%
11 mumu Zjets MET rel> 80 GeV	0.05396	8.2	36%	7	31%	5.1	36%
12 mumu Zjets $0.3 < dR\ell\ell < 1.5$	0.04361	6.6	19%	5.9	16%	4.2	18%
13 mumu Zjets $50 < mjj < 100$ GeV	0.02609	4.0	40%	3.6	39%	2.7	36%
14 mumu Zjets $pTjj > 45$	0.01454	2.2	44%	1.7	53%	1.8	33%

Table 13: $\chi \pm \chi 2$ (350/50), Zjets mumu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	96.8		96.8			
02 2 OS leptons	0.61952	60.0	38%	65.3	33%		
03 mll¿20 GeV	0.61850	59.9	0%	65.1	0%		
04 tau veto	0.61850	59.9	0%	65.1	0%		
05 ee leptons	0.31231	30.2	50%	32.1	51%	51.2	
06 ee jet veto	0.13617	13.2	56%	17.5	45%	19.4	62%
07 ee Z veto	0.13245	12.8	3%	16.9	3%	18.7	4%
08 ee mT2¿120 GeV	0.07317	7.1	45%	8.2	51%	9.1	51%

Table 14: $\widetilde{\ell}^+\widetilde{\ell}^-$ (250/10), m120 T2 ee

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	96.8		96.8			
02 2 OS leptons	0.61952	60.0	38%	65.3	33%		
03 mll¿20 GeV	0.61850	59.9	0%	65.1	0%		
04 tau veto	0.61850	59.9	0%	65.1	0%		
05 mumu leptons	0.30613	29.6	51%	33	49%	47	
06 mumu jet veto	0.13472	13.0	56%	17.8	46%	19.8	58%
07 mumu Z veto	0.13110	12.7	3%	17.2	3%	19.3	3%
08 mumu mT2¿120 GeV	0.07394	7.2	44%	8.5	51%	10	48%

Table 15: $\widetilde{\ell}^+\widetilde{\ell}^-$ (250/10), m120 T2 mumu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	96.8		96.8			
02 2 OS leptons	0.61952	60.0	38%	65.3	33%		
03 mll¿20 GeV	0.61850	59.9	0%	65.1	0%		
04 tau veto	0.61850	59.9	0%	65.1	0%		
05 ee leptons	0.31231	30.2	50%	32.1	51%	51.2	
06 ee jet veto	0.13617	13.2	56%	17.5	45%	19.4	62%
07 ee Z veto	0.13245	12.8	3%	16.9	3%	18.7	4%
08 ee mT2¿150 GeV	0.05728	5.5	57%	5.9	65%	7	63%

Table 16: $\widetilde{\ell}^+\widetilde{\ell}^-$ (250/10), m150 T2 ee

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	96.8		96.8			
02 2 OS leptons	0.61952	60.0	38%	65.3	33%		
03 mll¿20 GeV	0.61850	59.9	0%	65.1	0%		
04 tau veto	0.61850	59.9	0%	65.1	0%		
05 mumu leptons	0.30613	29.6	51%	33	49%	47	
06 mumu jet veto	0.13472	13.0	56%	17.8	46%	19.8	58%
07 mumu Z veto	0.13110	12.7	3%	17.2	3%	19.3	3%
08 mumu mT2¿150 GeV	0.05837	5.6	55%	6.1	65%	7.4	62%

Table 17: $\widetilde{\ell}^{+}\widetilde{\ell}^{-}$ (250/10), m150 T2 mumu

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	96.8		96.8			
02 2 OS leptons	0.61952	60.0	38%	65.3	33%		
03 mll¿20 GeV	0.61850	59.9	0%	65.1	0%		
04 tau veto	0.61850	59.9	0%	65.1	0%		
05 ee leptons	0.31231	30.2	50%	32.1	51%	51.2	
06 ee jet veto	0.13617	13.2	56%	17.5	45%	19.4	62%
07 ee Z veto	0.13245	12.8	3%	16.9	3%	18.7	4%
08 ee mT2¿90 GeV	0.08902	8.6	33%	10.5	38%	11.7	37%

Table 18: $\widetilde{\ell}^{+}\widetilde{\ell}^{-}$ (250/10), m90 T2 ee

Cut	Acc	Weighted	Change	MadAnalysis	Change	Official	Change
01 Initial	1	96.8		96.8			
02 2 OS leptons	0.61952	60.0	38%	65.3	33%		
03 mll¿20 GeV	0.61850	59.9	0%	65.1	0%		
04 tau veto	0.61850	59.9	0%	65.1	0%		
05 mumu leptons	0.30613	29.6	51%	33	49%	47	
06 mumu jet veto	0.13472	13.0	56%	17.8	46%	19.8	58%
07 mumu Z veto	0.13110	12.7	3%	17.2	3%	19.3	3%
08 mumu mT2¿90 GeV	0.08881	8.6	32%	10.8	37%	12.3	36%

Table 19: $\widetilde{\ell}^{+}\widetilde{\ell}^{-}$ (250/10), m90 T2 mumu

References

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