Validation of atlas_1605_04285, paper:arxiv:1605.04285v1

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I reproduce the signal distributions (dashed blue lines) in the figures 5d and 5f.
Furthermore the cutflows are checked.
The events are produced according to a simpified model (see figure 1)

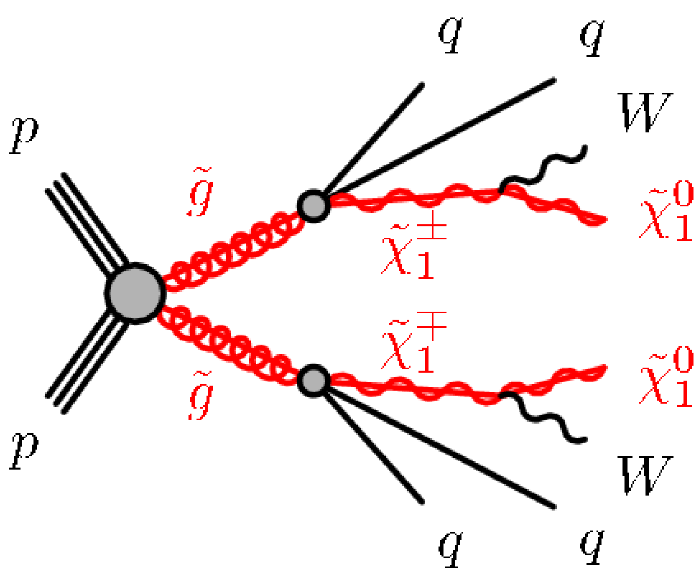

Figure 1: Simplified model for event generation

1 Validation using cutflows

1.1 hard SR, using $(m_{\tilde{g}}, m_{\tilde{\chi}_1^{\pm}}, m_{\tilde{\chi}_1^0}) = (1105, 865, 625) GeV$ simplified model

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	509	496
$E_T^{miss} > 250$	56.2, 0.11	51.1733±4.5694,0.1032(0.0864,0.1232)
$N_{jets} >= 5$	47.3, 0.84	45.3578±4.059,0.8864(0.7409,1.0604)
$p_T^{j_1} > 225$ GeV	26.3, 0.556	28.2204±2.5549,0.6222(0.5194,0.7452)
$p_T^{j_5} > 50$ GeV	17.4, 0.661	19.9327±1.8272,0.7063(0.5883,0.8478)
Jet Aplanarity > 0.04	10.4, 0.598	12.263±1.1533,0.6152(0.5106,0.741)
$m_T > 275$ GeV	4.6, 0.44	5.5345±0.56,0.4513(0.3708,0.5486)
$\frac{E_T^{miss}}{m_{eff}} > 0.1$	4.6, 1	5.5205±0.5587,0.9975(0.8141,1.2221)
$m_{eff} > 1800$ GeV	1.1, 0.239	1.6435±0.2095,0.2977(0.2359,0.3735)

Table 1: Cutflow for hard 5j SR

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	509	496.0
$E_T^{miss} > 250$	56.2, 0.1104	51.1733±4.5694,0.1032(0.0864,0.1232)
$N_{jets} >= 6$	34, 0.60	36.3537±3.2688,0.7104(0.5935,0.8502)
$p_T^{j_1} > 125$ GeV	33.4, 0.982	35.2159±3.1689,0.9687(0.8088,1.0)
$p_T^{j_6} > 30$ GeV	33.4, 1	30.8613±2.7867,0.8763(0.7314,1.0)
Jet Aplanarity > 0.04	22.1, 0.661	20.607±1.8864,0.6677(0.5564,0.8012)
$m_T > 225$ GeV	14.8, 0.67	13.2042±1.236,0.6408(0.5321,0.7714)
$\frac{E_T^{miss}}{m_{eff}} > 0.2$	13.7, 0.93	11.5466±1.0902,0.8745(0.7241,1.0)
$m_{eff} > 1000$ GeV	12.9, 0.94	11.0129±1.0433,0.9538(0.7889,1.153)

Table 2: Cutflow for hard 6j SR

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis
start	509	496
Filter	442	-
Primary vertex>= 2	442	-
Pass bad jet veto	439	-
Exactly one base lepton	160, 0.314	154.3767±13.6251,0.3112(0.2608,0.3
Exactly one signal lepton	120	-
3 or more jets	119	-
$E_T^{miss} > 100$	105	-
E_T^{miss} Trigger	100	-
$p_T^{l1} > 35$ GeV	93, 0.58	98.8348±8.7516,0.6402(0.5362,0.76
$E_T^{miss} > 200$	70, 0.75	67.9594±6.0424,0.6876(0.5755,0.82
$N_{jets} >= 4$	66, 0.94	66.2738±5.8945,0.9752(0.8159,1.0
$p_T^{j_1} > 325$ GeV	15.8, 0.23	18.6966±1.7187,0.2821(0.2353,0.33
$p_T^{j_4} > 150$ GeV	1.4, 0.088	3.1465±0.347,0.1683(0.1371,0.205
Jet Aplanarity > 0.04	0.18, 0.12	2.2475±0.2654,0.7143(0.5674,0.89
$m_T > 125$ GeV	0.045, 0.25	1.7137±0.2161,0.7625(0.596,0.973
$m_{eff} > 2000$ GeV	0.038, 0.84	1.0114±0.1486,0.5902(0.4471,0.77

Table 3: Cutflow for hard 4j low x

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	509	496
$E_T^{miss} > 200$	70, 0.137	68.1702±6.0609,0.1374(0.1151,0.1641)
$N_{jets} >= 4$	66, 0.94	66.2738±5.8945,0.9722(0.8134,1.162)
$p_T^{j_1} > 325$ GeV	15.8, 0.23	18.6966±1.7187,0.2821(0.2353,0.3381)
$p_T^{j_4} > 30$ GeV	15.8, 1.0	18.3314±1.6866,0.9805(0.8153,1.1791)
$m_T > 425$ GeV	-	-
$\frac{E_T^{miss}}{m_{eff}} > 0.3$ GeV	1.2, 0.0759	0.899±0.1373,0.049(0.0381,0.0623)
$m_{eff} > 1800$ GeV	1.0, 0.83	0.4495±0.0887,0.5(0.3482,0.7066)

Table 4: Cutflow for hard 4j high x

Comment: The last two cutflows in 4 do not agree perfectly, but this is due to the low number of events in the cutflows (30 events). The statistical error is highly underestimated and running the event generation again shows that too.

1.2 hard SR, using $(m_{\tilde{g}}, m_{\tilde{\chi}_1^{\pm}}, m_{\tilde{\chi}_1^0}) = (1385, 705, 25) GeV$ simplified model

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	88.7	86.4
$E_T^{miss} > 250$	17.0, 0.19	17.2048±1.5422,0.1991(0.1665,0.2382)
$N_{jets} >= 5$	16.1, 0.95	16.4361±1.4739,0.9553(0.7981,1.1435)
$p_T^{j_1} > 225$ GeV	16.1, 1.0	16.2607±1.4583,0.9893(0.8265,1.1843)
$p_T^{j_5} > 50$ GeV	14.2, 0.88	14.5712±1.3081,0.8961(0.7485,1.0728)
Jet Aplanarity > 0.04	11.3, 0.80	11.3583±1.0225,0.7795(0.6509,0.9335)
$m_T > 275$ GeV	7.5, 0.66	7.0652±0.6409,0.622(0.5189,0.7456)
$\frac{E_T^{miss}}{m_{eff}} > 0.1$	7.4, 0.99	6.9567±0.6312,0.9846(0.8208,1.1811)
$m_{eff} > 1800$ GeV	6.7, 0.91	6.2435±0.5678,0.8975(0.748,1.0768)

Table 5: Cutflow for hard 5j SR

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	88.7	86.4
$E_T^{miss} > 250$	17.0, 0.19	17.2048±1.5422,0.1991(0.1665,0.2382)
$N_{jets} >= 6$	13.4, 0.79	14.3196±1.2858,0.8323(0.6952,0.9964)
$p_T^{j_1} > 125$ GeV	13.4, 1.0	14.3196±1.2858,1.0(0.8352,1.1973)
$p_T^{j_6} > 30$ GeV	13.4, 1.0	13.5533±1.2177,0.9465(0.7905,1.1333)
Jet Aplanarity > 0.04	10.6, 0.80	10.5666±0.9521,0.7796(0.6509,0.9338)
$m_T > 225$ GeV	8.0, 0.75	7.4068±0.6712,0.701(0.5847,0.8402)
$\frac{E_T^{miss}}{m_{eff}} > 0.2$	4.7, 0.59	4.3185±0.3966,0.583(0.4855,0.7)
$m_{eff} > 1000$ GeV	4.7, 1.0	4.3208±0.3968,1.0005(0.8322,1.2029)

Table 6: Cutflow for hard 6j SR

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	88.7	86.4
$E_T^{miss} > 200$	19.2, 0.22	19.0651±1.7076,0.2207(0.1845,0.2639)
$N_{jets} >= 4$	19.0, 0.99	18.9797±1.7,0.9955(0.8318,1.1914)
$p_T^{j_1} > 325$ GeV	17.2, 0.91	16.9624±1.5207,0.8937(0.7467,1.0696)
$p_T^{j_4} > 150$ GeV	9.3, 0.54	10.0149±0.9031,0.5904(0.493,0.707)
Jet Aplanarity > 0.04	7.9, 0.85	8.1408±0.7365,0.8129(0.6782,0.9743)
$m_T > 125$ GeV	6.8, 0.86	6.7697±0.6146,0.8316(0.6934,0.9973)
$m_{eff} > 2000$ GeV	5.6, 0.82	5.6872±0.5184,0.8401(0.7,1.0082)

Table 7: Cutflow for hard 4j low x

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	88.7	86.4
$E_T^{miss} > 200$	19.2, 0.22	19.0651±1.7076,0.2207(0.1845,0.2639)
$N_{jets} >= 4$	19.0, 0.99	18.9797±1.7,0.9955(0.8318,1.1914)
$p_T^{j_1} > 325$ GeV	17.2, 0.91	16.9624±1.5207,0.8937(0.7467,1.0696)
$p_T^{j_4} > 30$ GeV	17.2, 1.0	16.9209±1.517,0.9976(0.8334,1.194)
$m_T > 425$ GeV	-	-
$\frac{E_T^{miss}}{m_{eff}} > 0.3$ GeV	1.33, 0.077	1.0687±0.1072,0.0632(0.0521,0.0763)
$m_{eff} > 1800$ GeV	1.24, 0.93	0.9371±0.0954,0.8769(0.7158,1.0739)

Table 8: Cutflow for hard 4j high x

1.3 hard SR, using $(m_{\tilde{g}}, m_{\tilde{\chi}_1^\pm}, m_{\tilde{\chi}_1^0}) = (1200, 160, 60) GeV$ simplified model

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	275	263.6
$E_T^{miss} > 250$	34.9, 0.13	35.0323±3.272,0.1329(0.1103,0.1601)
$N_{jets} >= 5$	33.2, 0.95	33.9745±3.1744,0.9698(0.8041,1.1697)
$p_T^{j_1} > 225$ GeV	33.1, 0.997	33.8432±3.1623,0.9961(0.8259,1.2015)
$p_T^{j_5} > 50$ GeV	30.5, 0.92	30.8958±2.8903,0.9129(0.7568,1.1012)
Jet Aplanarity > 0.04	23.2, 0.76	23.491±2.2069,0.7603(0.63,0.9176)
$m_T > 275$ GeV	2.1, 0.09	2.3929±0.2573,0.1019(0.0831,0.1245)
$\frac{E_T^{miss}}{m_{eff}} > 0.1$	2.07, 0.98	2.3053±0.2491,0.9634(0.7759,1.1962)
$m_{eff} > 1800$ GeV	1.89, 0.91	2.1011±0.23,0.9114(0.7324,1.1337)

Table 9: Cutflow for hard 5j SR

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	275	263.6
$E_T^{miss} > 250$	34.9, 0.13	35.0323±3.272,0.1329(0.1103,0.1601)
$N_{jets} >= 6$	29.3, 0.84	30.5821±2.8613,0.873(0.7237,1.053)
$p_T^{j_1} > 125$ GeV	29.3, 1.0	30.5821±2.8613,1.0(0.8289,1.2064)
$p_T^{j_6} > 30$ GeV	29.3, 1.0	29.0501±2.7199,0.9499(0.7873,1.1461)
Jet Aplanarity > 0.04	22.2, 0.76	22.28±2.0951,0.767(0.6353,0.9257)
$m_T > 225$ GeV	2.5, 0.11	3.582±0.368,0.1608(0.1319,0.1957)
$\frac{E_T^{miss}}{m_{eff}} > 0.2$	0.72, 0.29	0.9265±0.1186,0.2587(0.2045,0.3252)
$m_{eff} > 1000$ GeV	0.72, 1.0	0.9265±0.1186,1.0(0.773,1.2936)

Table 10: Cutflow for hard 6j SR

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	275	263.6
$E_T^{miss} > 200$	42.7, 0.16	42.065±3.921,0.1596(0.1325,0.1923)
$N_{jets} >= 4$	42.4, 0.99	41.9629±3.9116,0.9976(0.8275,1.2027)
$p_T^{j_1} > 325$ GeV	40.8, 0.96	39.8545±3.717,0.9498(0.7877,1.1451)
$p_T^{j_4} > 150$ GeV	26.2, 0.64	25.1398±2.359,0.6308(0.5228,0.7609)
Jet Aplanarity > 0.04	21.6, 0.82	20.5875±1.9389,0.8189(0.6782,0.9888)
$m_T > 125$ GeV	8.3, 0.38	8.5575±0.8282,0.4157(0.3431,0.5033)
$m_{eff} > 2000$ GeV	6.8, 0.82	7.0984±0.6934,0.8295(0.6824,1.0081)

Table 11: Cutflow for hard 4j low x

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	275	263.6
$E_T^{miss} > 200$	42.7, 0.16	42.065±3.921,0.1596(0.1325,0.1923)
$N_{jets} >= 4$	42.4, 0.99	41.9629±3.9116,0.9976(0.8275,1.2027)
$p_T^{j_1} > 325$ GeV	40.8, 0.96	39.8545±3.717,0.9498(0.7877,1.1451)
$p_T^{j_4} > 30$ GeV	40.8, 1.0	39.7962±3.7116,0.9985(0.8282,1.204)
$m_T > 425$ GeV	-	-
$\frac{E_T^{miss}}{m_{eff}} > 0.3$ GeV	0.0, 0.0	0.1094±0.03,0.0027(0.0018,0.0039)
$m_{eff} > 1800$ GeV	0.0, -	0.0948±0.0277,0.8667(0.4814,1.5431)

Table 12: Cutflow for hard 4j high x

Comment: In the last two signal regions we have 15 and 13 events. Therefore the given error which relies on the poisson error is not reliable anymore. The statistical error is much larger. Therefore the last two cutflows from Checkmate agree with the given cutflow.

1.4 soft SR, using $(m_{\tilde{g}}, m_{\tilde{\chi}_1^{\pm}}, m_{\tilde{\chi}_1^0}) = (1000, 110, 60) GeV$ simplified model

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	1059	1024
$E_T^{miss} > 530$	8.6, 0.00812	7.7475±0.8107,0.0076(0.0062,0.0091)
$N_{jets} >= 2$	8.6, 1.0	7.7475±0.8107,1.0(0.8105,1.2338)
$p_T^{j_1} > 180$ GeV	8.6, 1.0	7.7475±0.8107,1.0(0.8105,1.2338)
$m_T > 100$ GeV	2.2, 0.255	1.8701±0.2836,0.2414(0.1854,0.3105)
$\frac{E_T^{miss}}{m_{eff}} > 0.38$ GeV	0.3, 0.12	0.0297±0.0298,0.0159(-0.0,0.0375)

Table 13: Cutflow for soft 2j SR

Comment: In table 13 the ETmiss/meff cut does not look fine, But(!) the number of events which have been normalized is 1. If I run the event generation another time I get there 5 events which leads to $N_{Norm} = 0.12 \pm 0.06$.

cut	$N_{weighted}$, fraction (from paper)	N_{Norm},fraction(from CM analysis)
start	1059	1024
$E_T^{miss} > 375$	26.5, 0.025	26.8044±2.4312,0.0262(0.0219,0.0312)
$N_{jets} >= 5$	24.7, 0.93	25.0828±2.2855,0.9358(0.7798,1.0)
$p_T^{j_1} > 200$ GeV	24.4, 0.987	25.0531±2.283,0.9988(0.832,1.0)
$p_T^{j_2} > 200$ GeV	22.1, 0.91	22.9455±2.1046,0.9159(0.7624,1.0)
$p_T^{j_3} > 200$ GeV	14.6, 0.66	15.4059±1.4653,0.6714(0.5565,0.8095)
Jet Aplanarity > 0.02	13.4, 0.91	13.6842±1.3188,0.8882(0.7329,1.0)
$H_T > 1100$ GeV	12.9, 0.96	13.3577±1.291,0.9761(0.8043,1.0)

Table 14: Cutflow for soft 5j SR

2 Reproducing Figure 5d (Hard lepton 6 jets SR)

m_T range in GeV	N_{Norm} (from paper)	N_{Norm} (from CM analysis)
$65 < m_T \leq 145$	2.5	1.8683±0.2305
$145 < m_T \leq 225$	2.7	2.3318±0.2732
$225 < m_T \leq 305$	4.05	3.3572±0.366
$305 < m_T \leq 385$	4.15	2.7251±0.309
$385 < m_T \leq 465$	1.9	2.1492±0.2564
$465 < m_T$	3.15	2.2756±0.268

Table 15: Comparing values of figure 5d (paper) with the values from CM simulation

Comment: We used the first dataset:

$$(m_{\tilde{g}}, m_{\tilde{\chi}_1^\pm}, m_{\tilde{\chi}_1^0}) = (1105, 865, 625)GeV, \tag{1}$$

3 Reproducing Figure 5f (Soft-lepton 5-jets SR)

E_T^{miss} range in GeV	N_{Norm} (from paper)	N_{Norm} (from CM analysis)
$315 < E_T^{miss} \leq 375$	6.0	5.7883±0.6406
$375 < E_T^{miss} \leq 435$	4.7	4.9275±0.5649
$435 < E_T^{miss} \leq 495$	3.2	3.4433±0.432
$495 < E_T^{miss} \leq 555$	2.1	1.8998±0.2865
$555 < E_T^{miss}$	2.4	3.0871±0.3994

Table 16: Comparing values of figure 5f (paper) with the values from CM simulation

Comment: I used the second dataset

$$(m_{\tilde{g}}, m_{\tilde{\chi}_1^\pm}, m_{\tilde{\chi}_1^0}) = (1000, 110, 60)GeV, \tag{2}$$