Search for squarks and gluinos in final states with same-sign leptons and jets using 139 fb^{-1} of data collected with the ATLAS detector, arxiv:1909.08457

1 Validation

Processes:

- **Rpc2L0b**
  $pp \to \tilde{g}\tilde{g}$, $\tilde{g} \to q\bar{q}'WZ\tilde{\chi}_1^0$
  $m_g = 1200$ GeV, $m_{\tilde{\chi}_1^\pm} = 1200$ GeV, $m_{\tilde{\chi}_2^0} = 1000$ GeV, $m_{\tilde{\chi}_1^0} = 800$ GeV, squarks decoupled
  Events generated with `MG5_aMC 2.6.6` interfaced to `Pythia8` with up to two extra partons (CKKW-L).

	ATLAS	CM
MC events generated	12000	10000
Trigger	262.2 ± 3.6	818.9
≥ 2 SS leptons ($p_T > 20$ GeV)	50.0 ± 1.6	59.0 ± 2.7
0 b-jet ($p_T > 20$ GeV)	33.8 ± 1.3	36.2 ± 2.1
≥ 6 jets ($p_T > 40$ GeV)	22.4 ± 1.1	24.7 ± 1.8
$E_{\mathrm{T}}^{\mathrm{miss}} > 200$ GeV	16.0 ± 0.9	19.2 ± 1.6
$m_{\mathrm{eff}} \geq 1000$ GeV	16.0 ± 0.9	19.2 ± 1.6
$E_{\mathrm{T}}^{\mathrm{miss}}/m_{\mathrm{eff}} \geq 0.2$	9.35 ± 0.7	11.7 ± 1.2

- **Rpc2L1b**
  $pp \to \tilde{b}_1\tilde{b}_1^*$, $\tilde{b}_1 \to t\tilde{\chi}_1^\pm$, $\tilde{\chi}_1^\pm \to W^\pm\tilde{\chi}_1^0$
  $m_{\tilde{b}} = 850$ GeV, $m_{\tilde{\chi}_1^\pm} = 500$ GeV, $m_{\tilde{\chi}_1^0} = 400$ GeV, squarks decoupled
  Events generated with `MG5_aMC 2.6.6` interfaced to `Pythia8` with up to two extra partons (CKKW-L).

	ATLAS	CM
MC events generated	6000	50000
Trigger	243.8 ± 3.9	1471.9
≥ 2 SS leptons ($p_T > 20$ GeV)	116.4 ± 2.7	139.9 ± 2.8
≥ 1 b-jets ($p_T > 20$ GeV)	97.7 ± 2.4	117.2 ± 2.6
≥ 6 jets ($p_T > 40$ GeV)	17.4 ± 1.0	22.1 ± 1.2
$E_{\mathrm{T}}^{\mathrm{miss}}/m_{\mathrm{eff}} > 0.25$	5.5 ± 0.6	6.1 ± 0.6

- **Rpc2L2b**
  $pp \to \tilde{b}_1\tilde{b}_1^*$, $\tilde{b}_1 \to t\tilde{\chi}_1^\pm$, $\tilde{\chi}_1^\pm \to W^\pm\tilde{\chi}_1^0$
  $m_{\tilde{b}} = 850$ GeV, $m_{\tilde{\chi}_1^\pm} = 500$ GeV, $m_{\tilde{\chi}_1^0} = 400$ GeV, squarks decoupled
  Events generated with `MG5_aMC 2.6.6` interfaced to `Pythia8` with up to two extra partons (CKKW-L).

	ATLAS	CM
MC events generated	6000	50000
Trigger	243.8 ± 3.9	1471.9
≥ 2 SS leptons ($p_T > 20$ GeV)	116.4 ± 2.7	139.9 ± 2.8
≥ 2 b-jets ($p_T > 20$ GeV)	43.3 ± 1.6	53.6 ± 1.8
≥ 6 jets ($p_T > 25$ GeV)	20.0 ± 1.1	26.4 ± 1.3
$E_{\mathrm{T}}^{\mathrm{miss}} > 300$ GeV	6.6 ± 0.7	6.1 ± 0.6
$m_{\mathrm{eff}} > 1.4$ TeV	2.8 ± 0.4	2.1 ± 0.4
$E_{\mathrm{T}}^{\mathrm{miss}}/m_{\mathrm{eff}} > 0.14$	2.8 ± 0.4	2.1 ± 0.4

- **Rpv2L**
  $pp \to \tilde{g}\tilde{g}$, $\tilde{g} \to t\tilde{t}_1$, $\tilde{t}_1 \to \bar{b}\bar{d}$

$m_{\tilde{g}} = 1600$ GeV, $m_{\tilde{t}_1} = 800$ GeV, other squarks decoupled
Events generated with `MG5_aMC 2.6.1` interfaced to `Pythia8` with up to two extra partons (CKKW-L).

	ATLAS	CM
MC events generated	30000	15000
Trigger	320.6 ± 4.0	393
≥ 2 SS leptons ($p_T > 20$ GeV)	13.3 ± 0.8	15.8 ± 1.1
≥ 6 jets ($p_T > 40$ GeV)	11.6 ± 0.8	14.5 ± 1.1
$m_{\text{eff}} > 2.6$ TeV	8.04 ± 0.63	8.9 ± 0.8

- **Rpc3LSS1b**
Note: the agreement is poor. ATLAS errors are nonsense: the number of simulated events is only 3 times the total number of events, unless generator filters were applied.
$pp \to \tilde{t}_1\tilde{t}_1^*$, $\tilde{t}_1 \to t\tilde{\chi}_2^0$, $\tilde{\chi}_2^0 \to W^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^- \to \tilde{\chi}_1^0 + \text{soft}$
$m_{\tilde{t}_1} = 800$ GeV, $m_{\tilde{\chi}_2^0} = 625$ GeV, $m_{\tilde{\chi}_1^\pm} \approx m_{\tilde{\chi}_1^0} = 525$ GeV, other squarks decoupled
Events generated with `MG5_aMC 2.6.1` interfaced to `Pythia8` with up to two extra partons (CKKW-L).

	ATLAS	CM
MC events generated	12000	49000
Trigger	446 ± 4.9	1030 ± 10
≥ 2 SS leptons ($p_T > 20$ GeV)	164.7 ± 2.9	199 ± 5
≥ 1 b-jet	134.1 ± 2.6	164 ± 4
≥ 3 SS leptons	6.11 ± 0.54	8.9 ± 1
veto $81 < m_{e^\pm e^\pm} < 101$ GeV	5.21 ± 0.50	8.3 ± 0.9
$E_{\text{T}}^{\text{miss}}/m_{\text{eff}} > 0.14$	3.90 ± 0.44	7.3 ± 0.9