Searches for 3rd generation SUSY-partners

"Particle Physics at the LHC"

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Outline

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Section 1

Motivation

Motivation

In several models, the partners of the top and the bottom quarks, the stops and the sbottoms, are predicted to be the lightest squarks for several reasons:

- diagonalizing the mass matrices in the basis of chiral eigenstates $\{\tilde{t}_L, \tilde{t}_R\}/\{\tilde{b}_L, \tilde{b}_R\}$ leads to 2 mass eigenstates $\tilde{t}_1$ and $\tilde{t}_2$

$$M^2_{\tilde{t}} = \begin{pmatrix} m_t^2 + m^2_{\tilde{t}_L,\tilde{b}_L} + \left(\frac{1}{2} - \frac{2}{3}s_W^2\right) M_Z^2 c_{2\beta} & m_t\left(A_t - \mu \cot\beta\right) \\ m_t\left(A_t - \mu \cot\beta\right) & m_t^2 + m^2_{\tilde{t}_R} + \frac{2}{3}s_W^2 M_Z^2 c_{2\beta} \end{pmatrix} \quad (1)$$

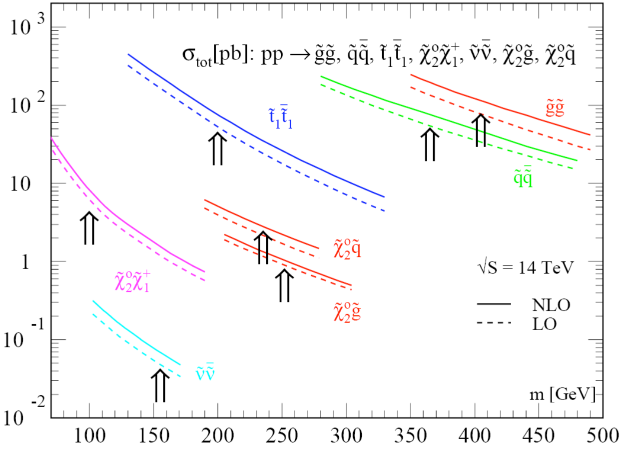
$$M^2_{\tilde{b}} = \begin{pmatrix} m_b^2 + m^2_{\tilde{t}_L,\tilde{b}_L} - \left(\frac{1}{2} - \frac{1}{3}s_W^2\right) M_Z^2 c_{2\beta} & m_b\left(A_b - \mu \tan\beta\right) \\ m_b\left(A_b - \mu \tan\beta\right) & m_b^2 + m^2_{\tilde{b}_R} + \frac{1}{3}s_W^2 M_Z^2 c_{2\beta} \end{pmatrix} \quad (2)$$

$$c_{2\beta} \equiv \cos 2\beta \quad \& \quad s_W^2 \equiv \sin^2\theta_W$$

- by demanding a natural solution of hierarchy problem
  (natural SUSY models)

Trying to find squarks since using a pp-collider

Cross sections for SUSY production processes



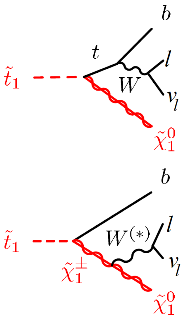
Cross-sections for SUSY production processes

Considered processes

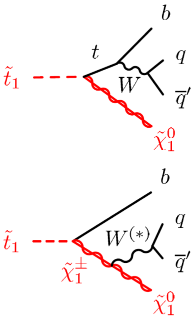
- We only consider stop pair production
- We assume there are only two simplified $\tilde{t}_1$ decay modes:
  - $\tilde{t}_1 \to t\ \tilde{\chi}_1^0$
  - $\tilde{t}_1 \to b\ \tilde{\chi}_1^{\pm} \to b\ \tilde{\chi}_1^0\ W^{(*)}$
- Assuming different BR for our analysis

Final states

- Combining two final states of the $\tilde{t}_1$ decay to get the final states of direct stop pair production
- Final states of the $\tilde{t}_1$ decay:



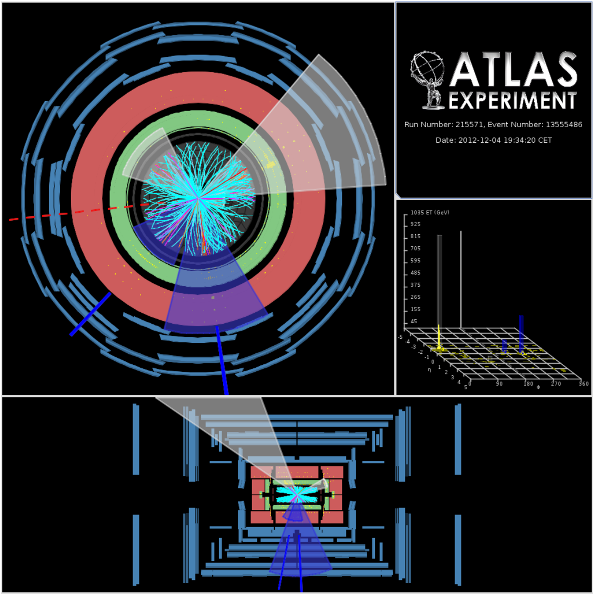
One lepton



Zero lepton

- Detector signature: 4+jets (2b-tagged) & large E_T^{miss}

Considered processes: Detector signature



- $E_T^{\text{miss}} = 896\,\text{GeV}$
- 5 jets
- 2 b-tagged jets (blue)
- 2 reclustered top candidates

Section 2

Final states with zero leptons

Final states with zero leptons

- Search for direct stop pair production
- $20.1\,\text{fb}^{-1}$ of Atlas data used in this analysis
- data was taken at $\sqrt{s} = 8\,\text{TeV}$ with the ATLAS detector at the LHC
- Using all-hadronic final states only

Zero leptons: Signal regions

Defining 9 signal regions (SR)

SR	main label criteria	sensitive for:
SRA1-4	E_T^{miss}	$\tilde{t}_1 \to t\,\tilde{\chi}_1^0$ & $\tilde{t}_1 \to b\,\tilde{\chi}_1^\pm$
SRB1-2	$\mathcal{A}_{m_t}$	$\tilde{t}_1 \to b\,\tilde{\chi}_1^\pm$
SRC1-3	$m_T^{b,\text{min}}$	$\tilde{t}_1 \to t\,\tilde{\chi}_1^0$

with: $\mathcal{A}_{m_t}$ = top mass assymetry

$m_T^{b,\text{min}}$ = transverse mass from E_T^{miss} and closest b-tagged jet

Zero leptons: Event selection requirement

SRA the fully resolved topology needs at least 6 jets.

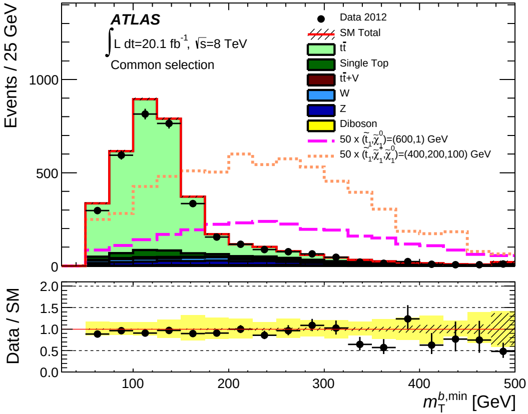
Trigger	$E_{\mathrm{T}}^{\mathrm{miss}}$
N_{lep}	0
b-tagged jets	≥ 2
$E_{\mathrm{T}}^{\mathrm{miss}}$	> 150 GeV
$\left\|\Delta\phi\left(\mathrm{jet}, \mathbf{p}_{\mathrm{T}}^{\mathrm{miss}}\right)\right\|$	$> \pi/5$
$\left\|\Delta\phi\left(\mathbf{p}_{\mathrm{T}}^{\mathrm{miss}}, \mathbf{p}_{\mathrm{T}}^{\mathrm{miss,track}}\right)\right\|$	$< \pi/3$
$m_{\mathrm{T}}^{b,\mathrm{min}}$	> 175 GeV

Selection criteria for all SR

	SRA1	SRA2	SRA3	SRA4
anti-k_t $R = 0.4$ jets	$\geq 6,\ p_{\mathrm{T}} > 80, 80, 35, 35, 35, 35$ GeV			
m_{bjj}^{0}	< 225 GeV		[50,250] GeV	
m_{bjj}^{1}	< 250 GeV		[50,400] GeV	
$\min[m_{\mathrm{T}}(\mathrm{jet}^i, \mathbf{p}_{\mathrm{T}}^{\mathrm{miss}})]$	–		> 50 GeV	
τ veto	yes			
$E_{\mathrm{T}}^{\mathrm{miss}}$	> 150 GeV	> 250 GeV	> 300 GeV	> 350 GeV

Selection criteria for SRA

Zero leptons: $m_T^{b,min}$ distribution



$m_T^{b,min}$ distribution for events with at least 4 jets and all selection criteria applied except $m_T^{b,min}$

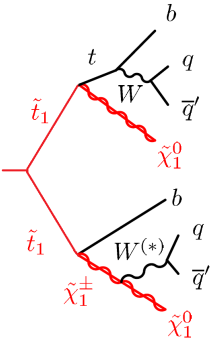
Zero leptons: Event selection requirement

SRB and SRC are only partially resolved, SRB needing 4-5 jets and SRC exactly 5 jets.

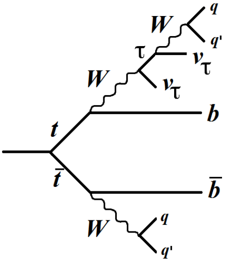
	SRB1	SRB2
anti-k_t $R = 0.4$ jets	4 or 5, $p_T > 80, 80, 35, 35, (35)$ GeV	5, $p_T > 100, 100, 35, 35, 35$ GeV
$\mathscr{A}_{m_t}$	< 0.5	> 0.5
$p^0_{\mathrm{T,jet},R=1.2}$	–	> 350 GeV
$m^0_{\mathrm{jet},R=1.2}$	> 80 GeV	$[140, 500]$ GeV
$m^1_{\mathrm{jet},R=1.2}$	$[60, 200]$ GeV	–
$m^0_{\mathrm{jet},R=0.8}$	> 50 GeV	$[70, 300]$ GeV
$m_{\mathrm{T}}^{\mathrm{min}}$	> 175 GeV	> 125 GeV
$m_{\mathrm{T}}\left(\mathrm{jet}^3, \mathbf{p}_{\mathrm{T}}^{\mathrm{miss}}\right)$	> 280 GeV for 4-jet case	–
$E_{\mathrm{T}}^{\mathrm{miss}}/\sqrt{H_{\mathrm{T}}}$	–	$> 17\sqrt{\mathrm{GeV}}$
$E_{\mathrm{T}}^{\mathrm{miss}}$	> 325 GeV	> 400 GeV

	SRC1	SRC2	SRC3
anti-k_t $R = 0.4$ jets	5, $p_T > 80, 80, 35, 35, 35$ GeV		
$\lvert\Delta\phi(b, b)\rvert$	$> 0.2\pi$		
$m_{\mathrm{T}}^{b,\mathrm{min}}$	> 185 GeV	> 200 GeV	> 200 GeV
$m_{\mathrm{T}}^{b,\mathrm{max}}$	> 205 GeV	> 290 GeV	> 325 GeV
τ veto	yes		
$E_{\mathrm{T}}^{\mathrm{miss}}$	> 160 GeV	> 160 GeV	> 215 GeV

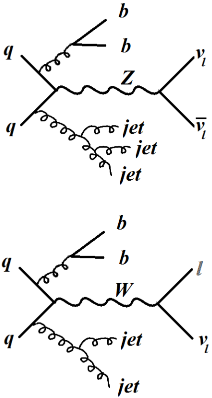
Zero leptons: Background estimation



Example of final state we want to detect



Main BG from $t\bar{t}$ production



BG from Z+jet (top) and W+jet (bottom) production

Zero leptons: Background estimation

- All possible SM processes are background processes
- BG simulated with Monte-Carlo (MC) simulations except for all-hadronic $t\bar{t}$-production and multijet events, those were computed from data in control regions (CR) alone
- CR used to adjust normalization to SR
- Validation regions (VR) used to verify the normalization
- CR and VR again chosen to be orthogonal to SR

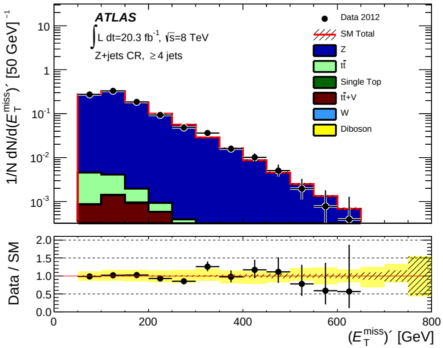
Zero leptons: Selection criteria for the CR corresponding to SRA

	$t\bar{t}$ **CR**	$Z+$ jets **CR**	**Multijet CR**
Trigger	electron (muon)	electron (muon)	same
$N_{\rm lep}$	1	2	same
$p_{\rm T}^{\ell}$	$> 35(35)$ GeV	$> 25(25)$ GeV	–
$p_{\rm T}^{\ell_2}$	same	$> 10(10)$ GeV	same
$m_{\ell\ell}$	–	$[86, 96]$ GeV	–
$E_{\rm T}^{\rm miss,track}$	–	–	same
$\left\lvert\Delta\phi\left(\mathbf{p}_{\rm T}^{\rm miss}, \mathbf{p}_{\rm T}^{\rm miss,track}\right)\right\rvert$	–	–	–
$\left\lvert\Delta\phi\left(\text{jet}, \mathbf{p}_{\rm T}^{\rm miss}\right)\right\rvert$	$> \pi/10$	–	< 0.1
$m_{\rm T}^{b,\rm min}$	> 125 GeV	–	–
$m_{\rm T}\left(\ell, \mathbf{p}_{\rm T}^{\rm miss}\right)$	$[40, 120]$ GeV	–	–
$\min[m_{\rm T}\left(\text{jet}^i, \mathbf{p}_{\rm T}^{\rm miss}\right)]$	–	–	–
m_{bjj}^{0} or m_{bjj}^{1}	< 600 GeV	–	–
$E_{\rm T}^{\rm miss}$	> 150 GeV	< 50 GeV	> 150 GeV
$\left(E_{\rm T}^{\rm miss}\right)'$	–	> 70 GeV	–

Selection criteria for the CR of the SRA signal region

For the VR of SRA the same event selection criteria are applied except the τ-veto is inverted and requirements on the top mass and $m_T^{\rm b,min}$ are changed

Zero leptons: Normalized MC predictions and data in Z+jets CR



E_T^{miss}-distribution in the Z+jets CR

Zero leptons: BG compared to data

Observed data and normalized BG in all CR

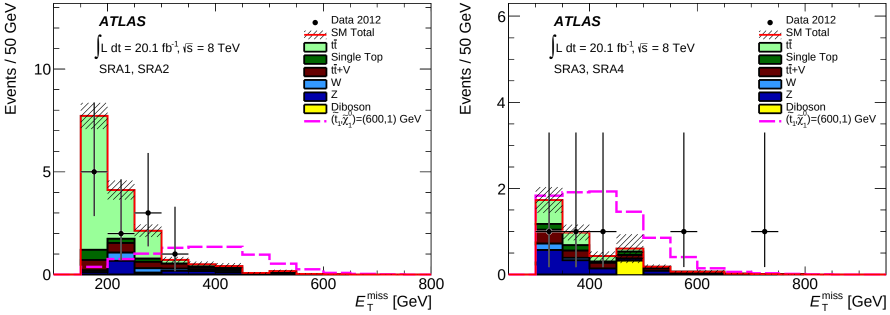
	CRs for SRA			CRs for SRB				CRs for SRC		
	$t\bar{t}$	$Z+$jets	Multijets	$t\bar{t}$	$W+$jets	$Z+$jets	Multijets	$t\bar{t}$	$Z+$jets	Multijets
Observed events										
	247	101	592	950	440	499	2082	313	499	1017
Fitted background events										
Total SM	247 ± 16	101 ± 10	593 ± 27	950 ± 40	440 ± 27	499 ± 22	2082 ± 48	313 ± 18	499 ± 22	1018 ± 34
$t\bar{t}$	197 ± 21	12.6 ± 3.0	109 ± 23	800 ± 50	189 ± 25	46 ± 7	140 ± 14	239 ± 24	49 ± 12	115 ± 23
$Z+$jets	0.28 ± 0.19	73 ± 11	2.5 ± 0.6	0.59 ± 0.16	1.40 ± 0.25	423 ± 25	11.7 ± 1.6	0.18 ± 0.07	420 ± 26	6.7 ± 0.9
$W+$jets	20 ± 9	–	4.5 ± 2.2	54 ± 20	190 ± 40	–	18 ± 7	28 ± 12	–	9 ± 4
Multijets	–	–	460 ± 40	–	–	–	1890 ± 50	–	–	870 ± 40
Others	29 ± 4	15 ± 4	11.8 ± 1.6	93 ± 13	61 ± 8	30 ± 10	22.7 ± 3.0	45 ± 7	30 ± 7	12.6 ± 1.6
Expected events (before fit)										
$t\bar{t}$	159	10.2	88	800	190	46	140	224	46	108
$Z+$jets	0.31	78	2.7	0.55	1.30	394	10.9	0.17	394	6.3
$W+$jets	20	–	4.5	52	180	–	17	28	–	9
Multijets	–	–	460	–	–	–	2090	–	–	870
Others	29	15	11.7	93	61	30	22.7	45	30	12.6

Zero leptons: Compare simulated and normalized BG to data in VR

Simulated and normalized BG in the VR

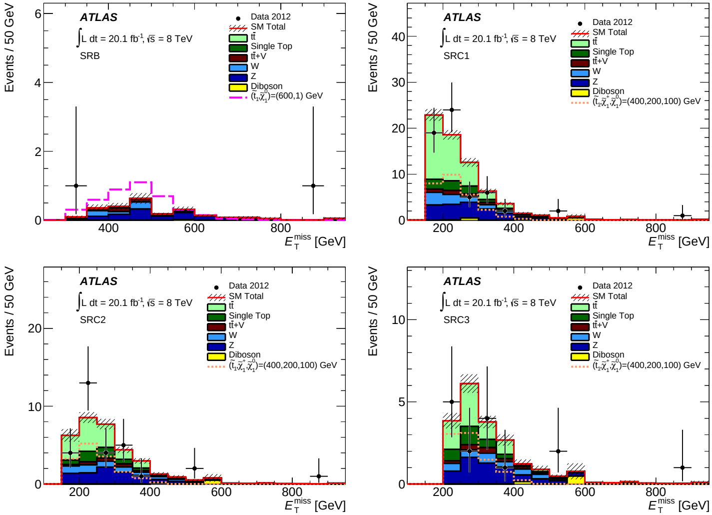
	VRA1	VRA2	VRB	VRC1	VRC2
Observed events					
	158	51	69	103	24
Fitted background events					
Total SM	189 ± 26	50 ± 6	70 ± 19	110 ± 12	21.1 ± 2.9
$t\bar{t}$	170 ± 27	34 ± 7	60 ± 19	93 ± 12	17.3 ± 2.8
Z + jets	4.0 ± 1.1	1.5 ± 0.4	1.5 ± 0.5	6.9 ± 1.5	0.24 ± 0.20
W + jets	2.8 ± 1.2	4.8 ± 2.2	2.1 ± 1.4	3.9 ± 1.8	1.1 ± 0.5
Others	11.8 ± 3.1	9.1 ± 2.2	7.2 ± 2.5	6.7 ± 2.0	2.4 ± 0.7

Zero leptons: E_T^{miss} distributions for SRA



E_T^{miss}-distributions for the signal regions SRA

Zero leptons: E_T^{miss} distributions for different SR



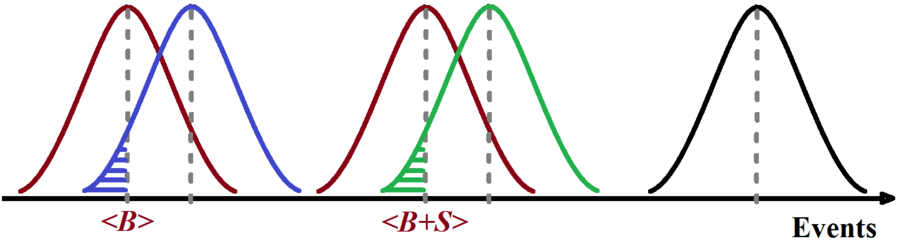
E_T^{miss}-distributions for the signal regions SRB & SRC

Zero leptons: Observed events in SR

Observed data in the SR

	SRA1	SRA2	SRA3	SRA4	SRB	SRC1	SRC2	SRC3
Observed events	11	4	5	4	2	59	30	15
Total SM	15.8 ± 1.9	4.1 ± 0.8	4.1 ± 0.9	2.4 ± 0.7	2.4 ± 0.7	68 ± 7	34 ± 5	20.3 ± 3.0
$t\bar{t}$	10.6 ± 1.9	1.8 ± 0.5	1.1 ± 0.6	0.49 ± 0.34	$0.10^{+0.14}_{-0.10}$	32 ± 4	12.9 ± 2.0	6.7 ± 1.2
$t\bar{t} + W/Z$	1.8 ± 0.6	0.85 ± 0.29	0.82 ± 0.29	0.50 ± 0.17	0.47 ± 0.17	3.2 ± 0.8	1.9 ± 0.5	1.3 ± 0.4
Z + jets	1.4 ± 0.5	0.63 ± 0.22	1.2 ± 0.4	0.68 ± 0.27	1.23 ± 0.31	15.7 ± 3.5	9.0 ± 1.9	6.1 ± 1.3
W + jets	1.0 ± 0.5	0.46 ± 0.21	0.21 ± 0.19	$0.06^{+0.10}_{-0.06}$	0.49 ± 0.33	8 ± 4	4.8 ± 2.2	2.8 ± 1.2
Single top	1.0 ± 0.4	0.30 ± 0.17	0.44 ± 0.14	0.31 ± 0.16	0.08 ± 0.06	7.2 ± 2.9	4.5 ± 1.8	2.9 ± 1.4
Diboson	< 0.4	< 0.13	0.32 ± 0.17	0.32 ± 0.18	0.02 ± 0.01	1.1 ± 0.8	$0.6^{+0.7}_{-0.6}$	$0.6^{+0.7}_{-0.6}$
Multijets	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.24 ± 0.24	0.06 ± 0.06	0.01 ± 0.01
σ_{vis} (obs) [fb]	0.33	0.29	0.33	0.32	0.21	0.78	0.62	0.40
σ_{vis} (exp) [fb]	$0.48^{+0.21}_{-0.14}$	$0.29^{+0.13}_{-0.09}$	$0.29^{+0.14}_{-0.09}$	$0.25^{+0.13}_{-0.07}$	$0.24^{+0.13}_{-0.06}$	$1.03^{+0.42}_{-0.29}$	$0.73^{+0.31}_{-0.21}$	$0.55^{+0.24}_{-0.15}$
N^{95}_{obs}	6.6	5.7	6.7	6.5	4.2	15.7	12.4	8.0
N^{95}_{exp}	$9.7^{+4.3}_{-3.0}$	$5.8^{+2.6}_{-1.8}$	$5.9^{+2.8}_{-1.9}$	$5.0^{+2.6}_{-1.4}$	$4.7^{+2.6}_{-1.2}$	$20.7^{+8.4}_{-5.8}$	$14.7^{+6.2}_{-4.2}$	$11.0^{+4.9}_{-3.1}$

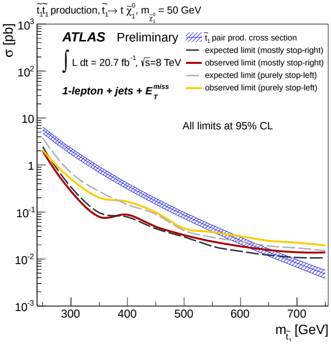
Zero leptons: Extracting cross sections



Simplified schematic illustration of obtaining the expected and the visible cross section

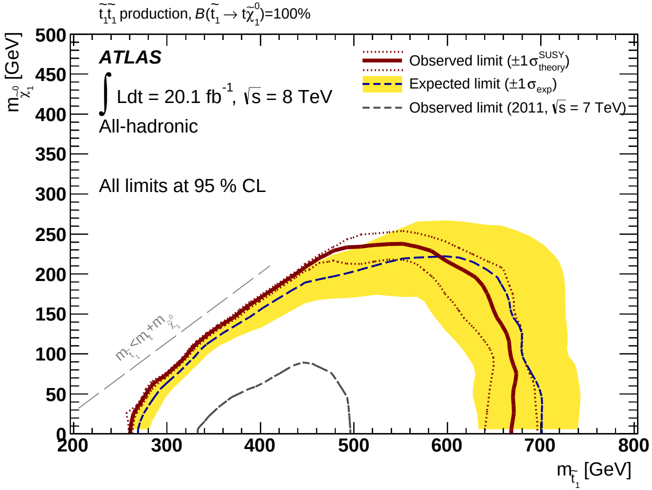
Zero leptons: Results

- No significant deviation from data to simulated BG
- Expected and observed cross-sections are equal within 2 σ
- Applying models to redefine exclusion regions for the mass of the observed(?) sparticles



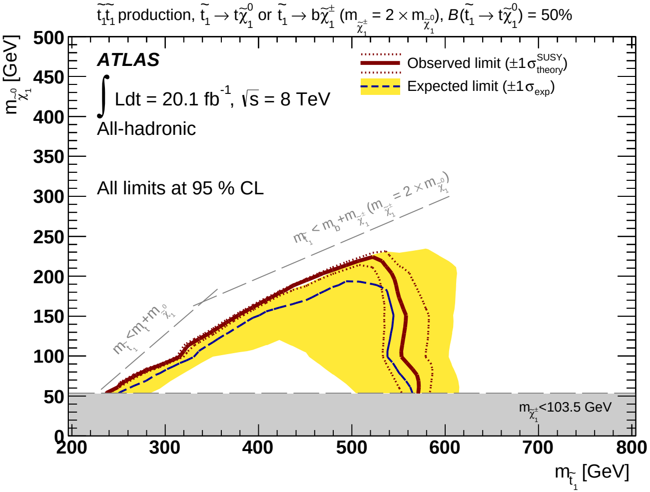
(Only for illustration purpose)

Zero leptons: Exclusion contoures



Assumptions: $\tilde{t}_1\tilde{t}_1$ production, $\mathcal{B}\left(\tilde{t}_1 \to t\,\tilde{\chi}_1^0\right) = 100\%$

Zero leptons: Exclusion contoures



Assumptions: $\tilde{t}_1\tilde{t}_1$ production, $\mathcal{B}\left(\tilde{t}_1 \to t\,\tilde{\chi}_1^0\right) = 50\%$

Section 3

Final states with one lepton

Final states with one lepton

- Search for direct stop pair production
- $20.7\,\text{fb}^{-1}$ of data used in this analysis
- Data was taken with $\sqrt{s} = 8\,\text{TeV}$ with the ATLAS detector at the LHC
- Only using events with exactly one isolated lepton

One lepton: Signal regions

Defining 6 signal regions (SR), labeled SRbC for $\tilde{t}_1 \to b\,\tilde{\chi}_1^\pm$ and SRtN for $\tilde{t}_1 \to t\,\tilde{\chi}_1^0$ decay modes.

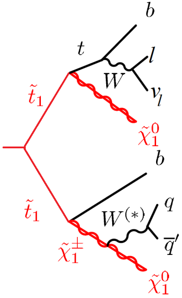
SR	sensitive for:
SRbC1	$m_{\tilde{\chi}_1^\pm} = 100 - 300\,\text{GeV}$ & $m_{\tilde{t}_1} = 200 - 400\,\text{GeV}$
SRbC2	$m_{\tilde{t}_1} = 310 - 500\,\text{GeV}$
SRbC3	$\left(m_{\tilde{t}_1} - m_{\tilde{\chi}_1^\pm}\right) \gtrsim 150\,\text{GeV}$
SRtN1	$m_{\tilde{t}_1} \gtrsim m_t + m_{\tilde{\chi}_1^0}$
SRtN2	large $m_{\tilde{\chi}_1^0}$
SRtN3	large $m_{\tilde{t}_1}$

One lepton: Event selection requirements

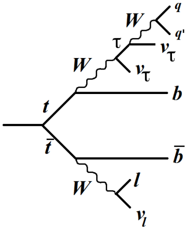
Requirement	SRtN1_shape	SRtN2	SRtN3	SRbC1	SRbC2	SRbC3
$\Delta\varphi(\text{jet}_1, \vec{p}_T^{\text{miss}}) >$	0.8	-	0.8	0.8	0.8	0.8
$\Delta\varphi(\text{jet}_2, \vec{p}_T^{\text{miss}}) >$	0.8	0.8	0.8	0.8	0.8	0.8
E_T^{miss} [GeV] >	$100^{(\star)}$	200	275	150	160	160
$E_T^{\text{miss}} / \sqrt{H_T}$ [GeV$^{1/2}$] >	5	13	11	7	8	8
m_T [GeV] >	$60^{(\star)}$	140	200	120	120	120
m_{eff} [GeV] >	-	-	-	-	550	700
am_{T2} [GeV] >	-	170	175	-	175	200
m_{T2}^{τ} [GeV] >	-	-	80	-	-	-
m_{jjj}	Yes	Yes	Yes	-	-	-
$N^{\text{iso-trk}} = 0$	-	-	-	Yes	Yes	Yes
Number of b-jets ≥	1	1	1	1	2	2
p_T (leading b-jet) [GeV] >	25	25	25	25	100	120
p_T (second b-jet) [GeV] >	-	-	-	-	50	90

Selection criteria defining the six SR

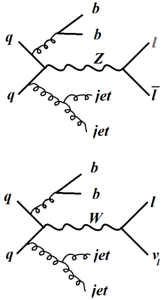
One lepton: Background estimation



Final states we want to detect



Main BG from $t\bar{t}$ production

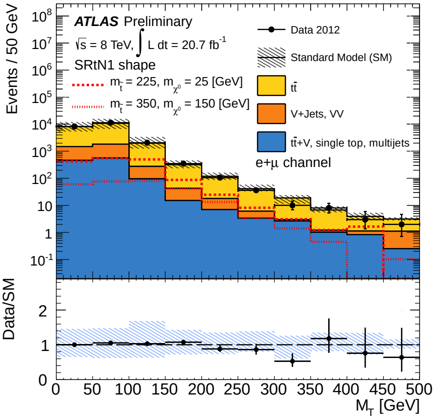


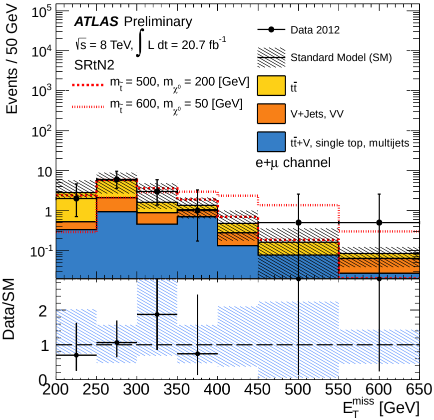
BG from Z+jet (top) and W+jet (bottom) production

One lepton: Background estimation

- Again all possible SM processes are background
- Background simulated with MC Simulations
- Using CR to normalize background to SR
- Using VR to check normalization for $t\bar{t}$-BG
- CR and VR defined non overlapping with SR

One lepton: Characteristic distributions for different SRtN





One lepton: Observed events in SRbC

Regions	WCR-SRbC1	TCR-SRbC1	TVR-SRbC1	SRbC1
Observed events	2358	2944	785	456
Total background (fit)	2358 ± 151	2944 ± 119	806 ± 123	482 ± 76
$t\bar{t}$	440 ± 180 (440)	2160 ± 210 (2170)	630 ± 100 (630)	400 ± 90 (400)
$t\bar{t}+V$	2.8 ± 1.6	14 ± 8	5.9 ± 3.4	14 ± 7
W+jets	1780 ± 240 (2080)	540 ± 170 (630)	120 ± 40 (140)	45 ± 17 (52)
Z+jets, VV, multijet	100 ± 80	37 ± 28	5 ± 5	5 ± 4
Single top	39 ± 25	190 ± 90	46 ± 31	19 ± 10

Regions	WCR-SRbC2	TCR-SRbC2	TVR-SRbC2	SRbC2
Observed events	1139	264	76	25
Total background (fit)	1139 ± 45	264 ± 19	75 ± 26	18 ± 5
$t\bar{t}$	130 ± 80 (150)	204 ± 29 (240)	61 ± 25 (71)	9 ± 5 (11)
$t\bar{t}+V$	1.3 ± 0.9	2.5 ± 1.5	1.0 ± 0.7	2.4 ± 1.3
W+jets	940 ± 100 (1000)	26 ± 12 (28)	5.8 ± 2.7 (6.2)	3.3 ± 2.0 (3.4)
Z+jets, VV, multijet	50 ± 40	1.3 ± 1.2	0 ± 0	0 ± 0
Single top	16 ± 13	30 ± 14	7 ± 5	3.4 ± 1.5

Regions	WCR-SRbC3	TCR-SRbC3	TVR-SRbC3	SRbC3
Observed events	665	144	39	6
Total background	665 ± 33	144 ± 17	42 ± 9	7 ± 3
$t\bar{t}$	60 ± 40 (80)	106 ± 23 (141)	31 ± 8 (42)	2.4 ± 1.5 (3.1)
$t\bar{t}+V$	0.8 ± 0.6	1.8 ± 1.1	0.6 ± 0.5	0.8 ± 0.6
W+jets	560 ± 60 (610)	17 ± 8 (19)	4.7 ± 2.0 (5.2)	1.7 ± 1.7 (1.9)
Z+jets, VV, multijet	33 ± 26	$0.5^{+1.2}_{-0.5}$	0 ± 0	0 ± 0
Single top	10 ± 7	18 ± 9	6 ± 4	2.0 ± 1.0

Table of events measured in the CR,VR and SR (for SRbC)

One lepton: Observed events in SRtN

Regions	WCR-SRtN2	TCR-SRtN2	TVR-SRtN2	SRtN2
Observed events	165	204	23	14
Total background (fit)	165 ± 15	204 ± 16	29 ± 10	13 ± 3
$t\bar{t}$	31 ± 18 (30)	139 ± 26 (138)	22 ± 8 (22)	7.5 ± 2.9 (7.5)
$t\bar{t}+V$	0.4 ± 0.3	1.4 ± 0.8	0.4 ± 0.3	2.2 ± 1.2
W+jets	122 ± 28 (157)	44 ± 19 (57)	4.6 ± 2.6 (5.9)	1.5 ± 0.8 (1.9)
Z+jets, VV, multijet	11 ± 9	5 ± 4	$0.1^{+0.3}_{-0.1}$	0.4 ± 0.3
Single top	$1.3^{+2.4}_{-1.3}$	14 ± 10	2.1 ± 1.9	1.1 ± 0.5

Regions	WCR-SRtN3	TCR-SRtN3	TVR-SRtN3	SRtN3
Observed events	149	175	22	7
Total background (fit)	149 ± 25	175 ± 19	28 ± 14	5 ± 2
$t\bar{t}$	20 ± 15 (24)	96 ± 33 (118)	19 ± 12 (24)	1.8 ± 1.0 (2.2)
$t\bar{t}+V$	0.3 ± 0.3	1.5 ± 0.9	0.48 ± 0.35	1.0 ± 0.7
W+jets	117 ± 29 (131)	55 ± 25 (61)	5.3 ± 2.6 (5.9)	1.5 ± 1.3 (1.6)
Z+jets, VV, multijet	10 ± 8	3.8 ± 3.5	$0.1^{+0.6}_{-0.1}$	$0.14^{+0.19}_{-0.14}$
Single top	$1.6^{+1.8}_{-1.6}$	19 ± 11	2.6 ± 1.9	0.53 ± 0.24

Table of events measured in the CR,VR and SR (for SRtN2-3)

One lepton: Observed events in SRtN1_shape

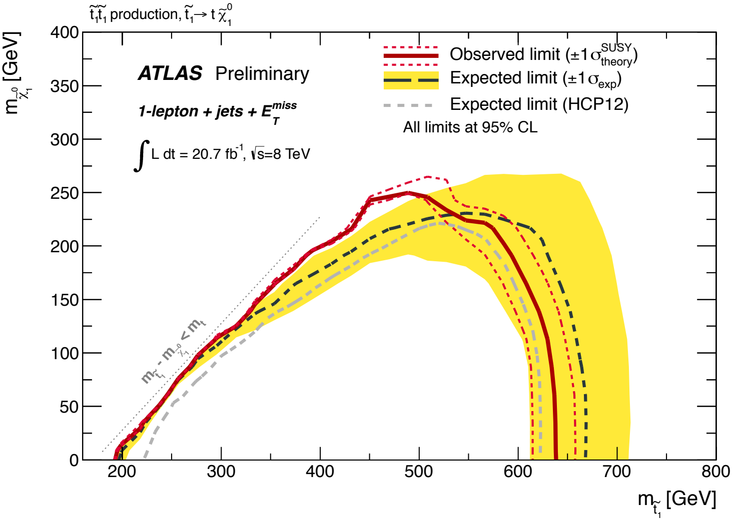
	$= 0b$-jet	$\geq 1b$-jet			
$100 < E_T^{miss} < 125$ GeV	$60 < m_T < 90$ GeV	$60 < m_T < 90$ GeV	$90 < m_T < 120$ GeV	$120 < m_T < 140$ GeV	$m_T > 140$ GeV
Observed events	1289	3122	1521	268	253
Total background (fit)	1289 ± 85	3122 ± 116	1535 ± 260	291 ± 61	250 ± 57
$t\bar{t}$	480 ± 140 (430)	2720 ± 170 (2410)	1350 ± 249 (1200)	260 ± 60 (230)	230 ± 50 (200)
$t\bar{t} + V$	2.0 ± 1.0	9 ± 4	5.6 ± 2.8	1.9 ± 0.9	2.8 ± 1.3
W+jets	730 ± 170 (880)	230 ± 120 (270)	110 ± 50 (130)	22 ± 11 (26)	12 ± 10 (14)
Z+jets, VV, multijet	39 ± 35	35 ± 35	7 ± 6	$1.4^{+2.3}_{-1.4}$	$0.6^{+0.9}_{-0.6}$
Single top	31 ± 18	130 ± 70	60 ± 40	8 ± 6	6 ± 4
$125 < E_T^{miss} < 150$ GeV	$60 < m_T < 90$ GeV	$60 < m_T < 90$ GeV	$90 < m_T < 120$ GeV	$120 < m_T < 140$ GeV	$m_T > 140$ GeV
Observed events	825	1962	721	119	165
Total background (fit)	825 ± 56	1962 ± 60	755 ± 119	145 ± 23	174 ± 28
$t\bar{t}$	330 ± 120 (290)	1740 ± 100 (1510)	670 ± 110 (590)	135 ± 21 (118)	162 ± 27 (141)
$t\bar{t} + V$	1.4 ± 0.9	7.0 ± 3.5	3.9 ± 2.2	1.3 ± 0.7	2.9 ± 1.3
W+jets	450 ± 130 (640)	130 ± 60 (180)	47 ± 25 (68)	5 ± 5 (7)	3^{+5}_{-3} (5)
Z+jets, VV, multijet	30 ± 24	16^{+27}_{-16}	3.4 ± 3.4	0.4 ± 0.4	$0.8^{+1.0}_{-0.8}$
Single top	19 ± 12	78 ± 35	27 ± 19	$3.4^{+3.5}_{-3.4}$	5.7 ± 1.9
$E_T^{miss} > 150$ GeV	$60 < m_T < 90$ GeV	$60 < m_T < 90$ GeV	$90 < m_T < 120$ GeV	$120 < m_T < 140$ GeV	$m_T > 140$ GeV
Observed events	1441	2591	663	113	235
Total background (fit)	1441 ± 103	2591 ± 104	695 ± 151	101 ± 26	262 ± 34
$t\bar{t}$	430 ± 180 (420)	2100 ± 180 (2030)	590 ± 120 (570)	88 ± 23 (85)	220 ± 40 (210)
$t\bar{t} + V$	2.7 ± 1.7	14 ± 8	5.7 ± 3.5	2.2 ± 1.2	10 ± 5
W+jets	920 ± 210 (1110)	310 ± 120 (380)	59 ± 28 (72)	6.0 ± 3.5 (7.3)	24 ± 14 (29)
Z+jets, VV, multijet	60 ± 60	24 ± 22	2^{+5}_{-2}	$0.4^{+0.6}_{-0.4}$	2.1 ± 1.8
Single top	27 ± 20	140 ± 80	37 ± 26	4 ± 4	7 ± 5

Table of events measured in the CR,VR and SR (for SRtN1)

One lepton: Results

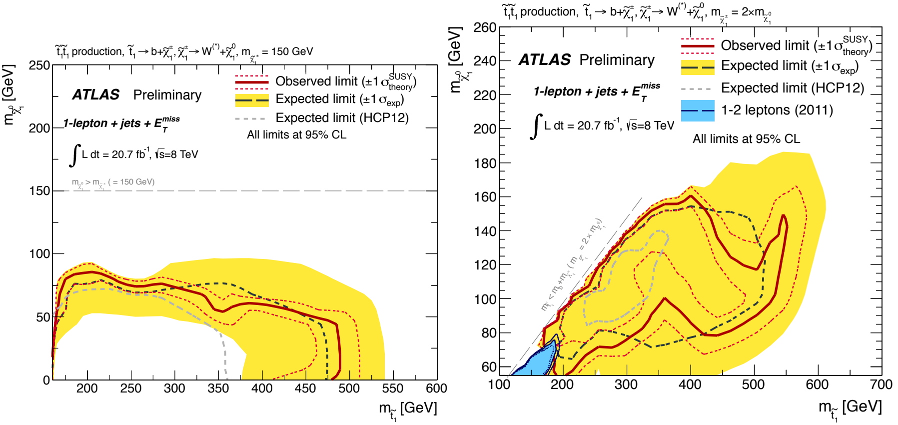
- No significant deviation of simulated BG to data
  $\Rightarrow$ No evidence to physics beyond SM
- Calculating expected and observed visible cross-sections
- Applying certain models, one can calculate exclusion limits for the considered sparticle masses

One lepton: Excluded regions



Assumptions: $\tilde{t}_1\tilde{t}_1$ production, $\mathcal{B}\left(\tilde{t}_1 \rightarrow t\,\tilde{\chi}^0_1\right) = 100\%$

One lepton: Excluded regions

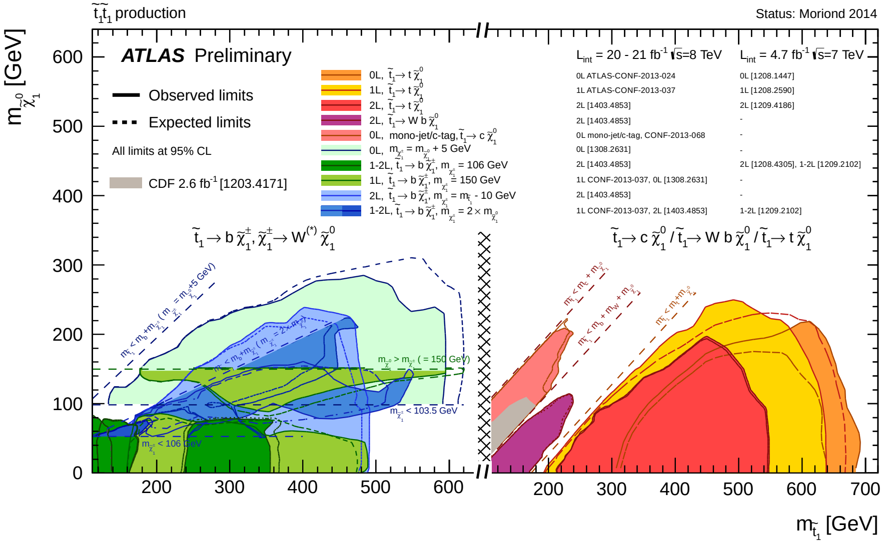


Assumptions: $\tilde{t}_1\tilde{t}_1$ production, $\mathcal{B}\left(\tilde{t}_1 \rightarrow b\,\tilde{\chi}_1^{\pm}\right) = 100\%$,
left: $m_{\tilde{\chi}_1^{\pm}} = 150\,\text{GeV}$, right: $m_{\tilde{\chi}_1^{\pm}} = 2 \cdot m_{\tilde{\chi}_1^0}$

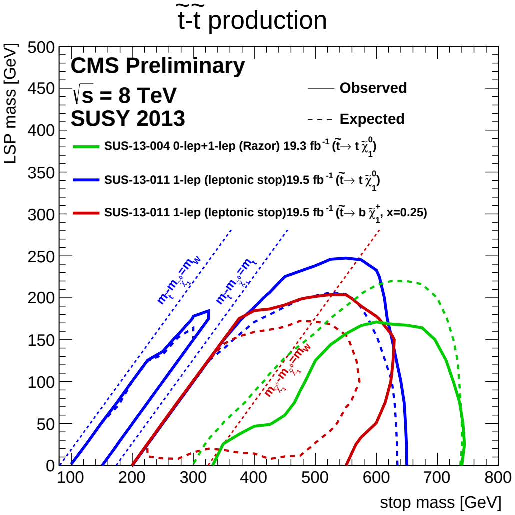
Section 4

State of the art

State of the art of the ATLAS Experiment



Comparing Achievements with results from CMS



Exclusion limits observed by CMS are similar to those measured by ATLAS

Summarization

- Observed events agree with SM predictions
- No evidence for physics beyond the SM
- Mass exclusion regions could be extended