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Searches for direct pair production of third generation squarks with the ATLAS detector

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presented on behalf of the ATLAS Collaboration at
SUSY13, ICTP, Trieste, Italy

SUperSYmmetry

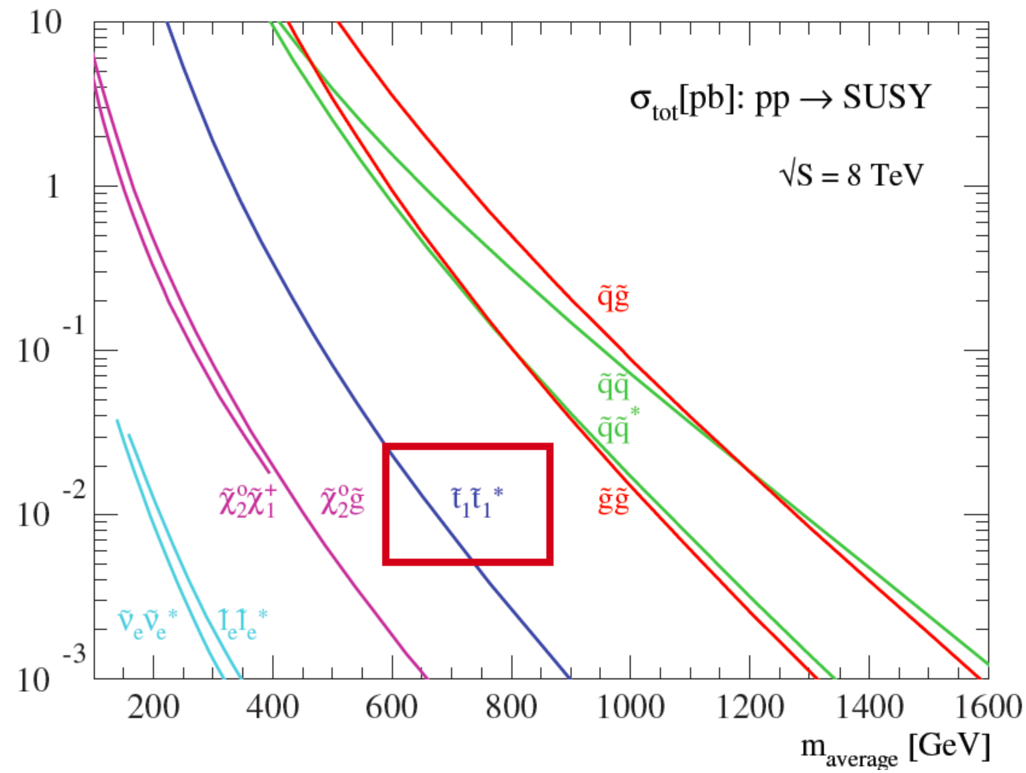
SUSY (more than) duplicates spectrum of particle states wrt. Standard Model

Sparticle decays produce SM objects:
(**b**/**c**-)jets, leptons, τ, γ, invisible (MET), …

Cancellation of the top loop correction to the Higgs mass **requires light third generation squarks**

Direct production cross section is relatively small compared to light squark and gluino

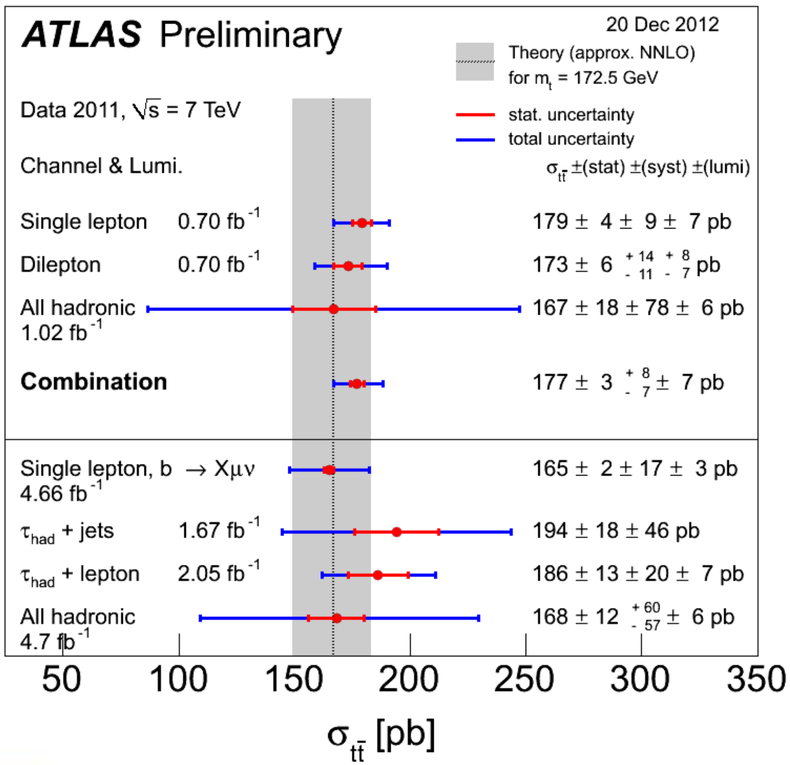
Dedicated searches required

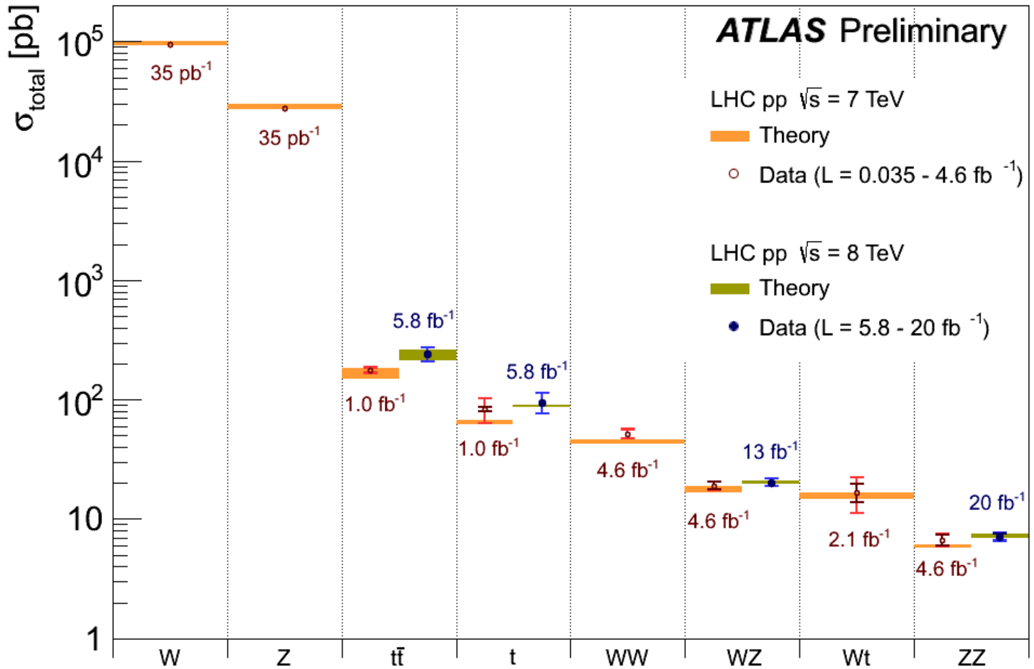


This presentation covers preliminary results from dedicated searches by ATLAS, all using the full 2012 dataset

Understanding the Standard Model Backgrounds

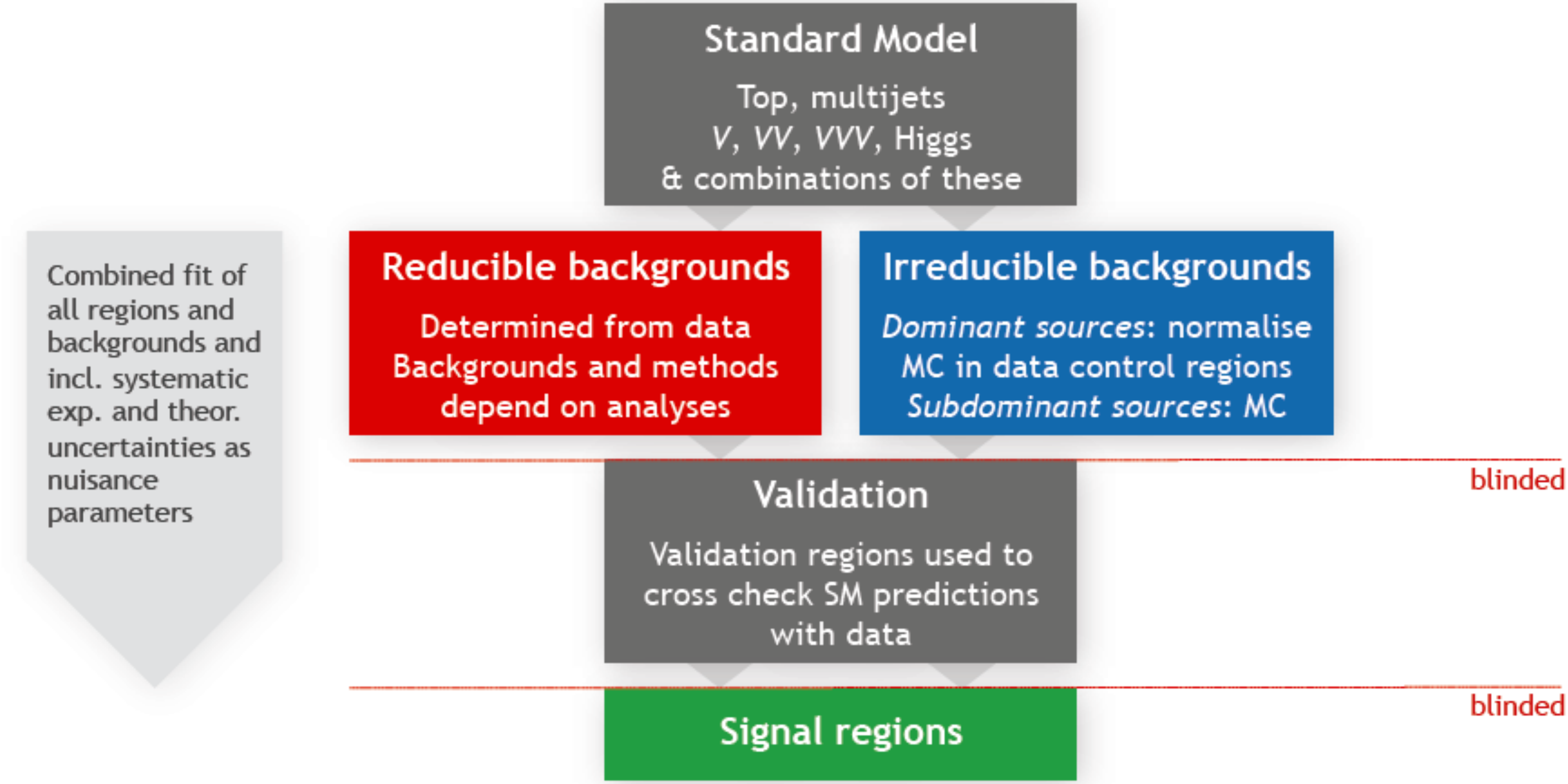
Precision measurements of boson, ttbar, single top and di-boson cross sections



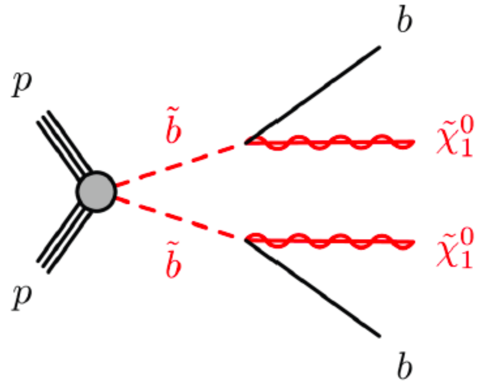


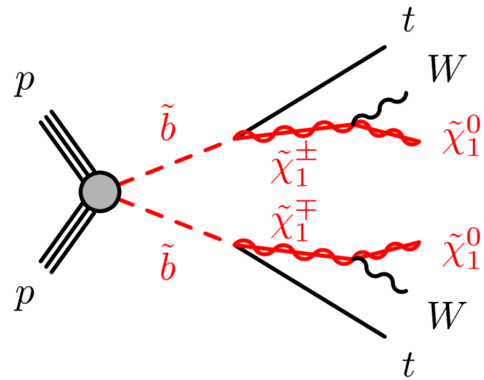
Crucial to demonstrate detector performance and measure Standard Model to great accuracy

SUSY searches rely primarily on the understanding of the SM backgrounds

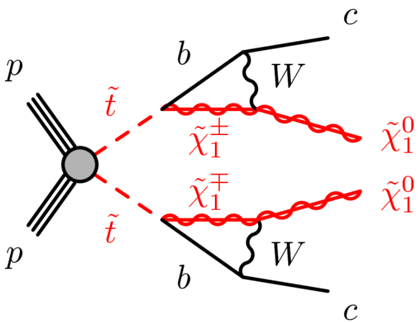


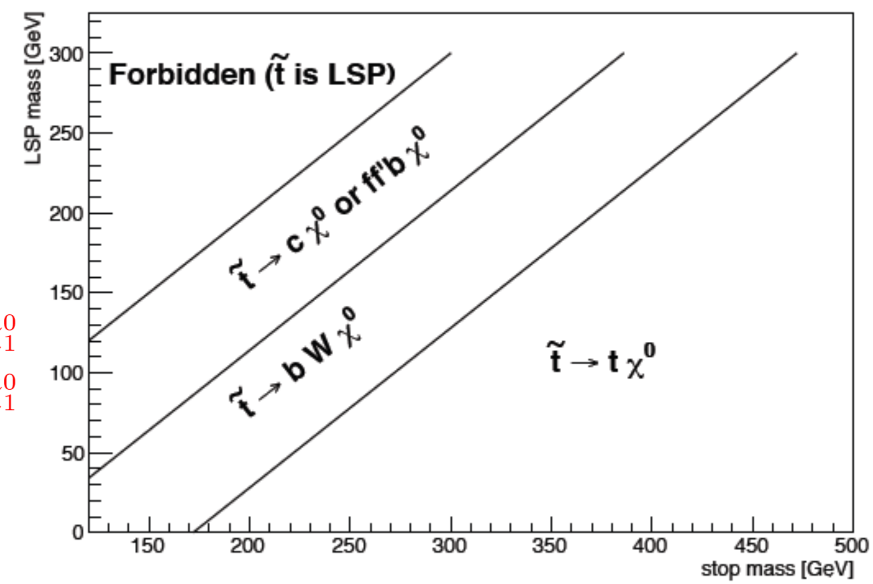
scalar bottom searches

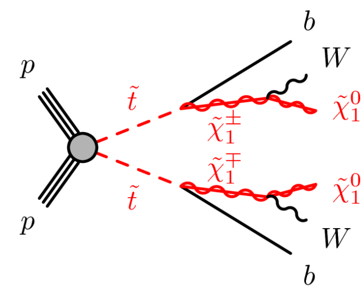


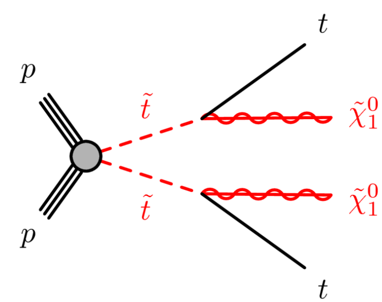


scalar top searches









Decays to b chargino or heavy neutralinos also possible

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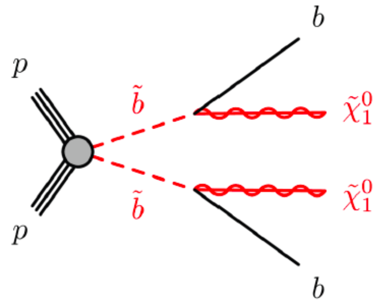
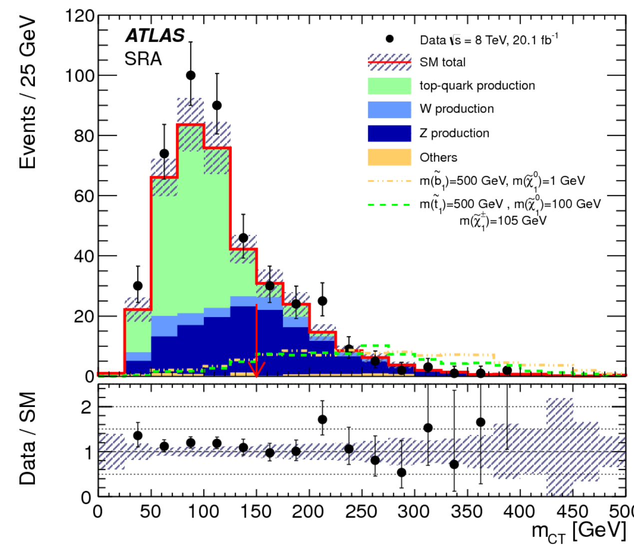
Scalar bottom searches



$$m_{CT}^2(v_1, v_2) = [E_T(v_1) + E_T(v_2)]^2 - [p_T(v_1) - p_T(v_2)]^2$$

$$H_{T,3} = \sum_{i=4}^{n} (p_T^{\text{jet}})_i$$

0 lepton + 2 b-jets + MET
Primary signature for direct sbottom production
Direct Stop sensitivity for small $\mathbf{\Delta m}(\tilde{\chi}^{\pm}, \tilde{\chi}^{\mathbf{0}})$ in $\tilde{t}_1 \to b\tilde{\chi}^{\pm}$



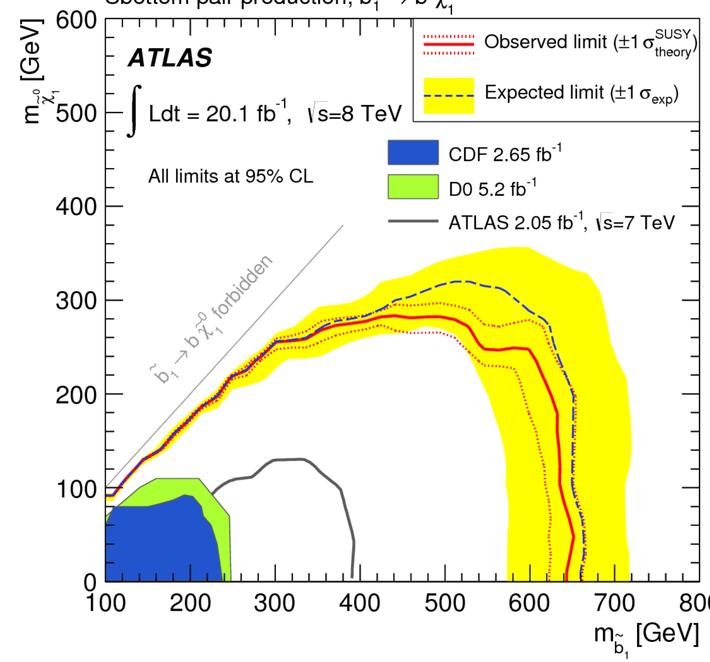
Analysis method:

- Trigger: E_T^{miss}
- Selection: E_T^{miss}, 2-b-jets, lepton veto
- Large $\Delta m(b_1,\chi^0_1)$: large m_{CT}, m_{bb} > 200GeV, 3rd jet veto
- Small $\Delta m(b_1,\chi^0_1)$: require an anti- b-tagged ISR jet, large $H_{T,3}$ and E_T^{miss}
- Main backgrounds: Z(νν)+bjets, W+bjets, tt

from Z(ll)+bjets control region

from single lep or e/μ control region

Sbottom pair production, $\tilde{b}_1 \to b\,\tilde{\chi}_1^0$



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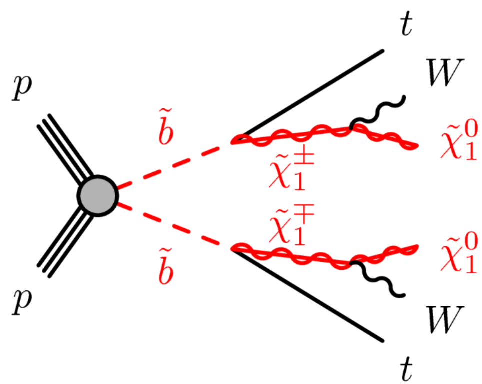
Scalar bottom searches: $t_1\tilde{\chi}^{\pm}$ and $b\tilde{\chi}^0_2$



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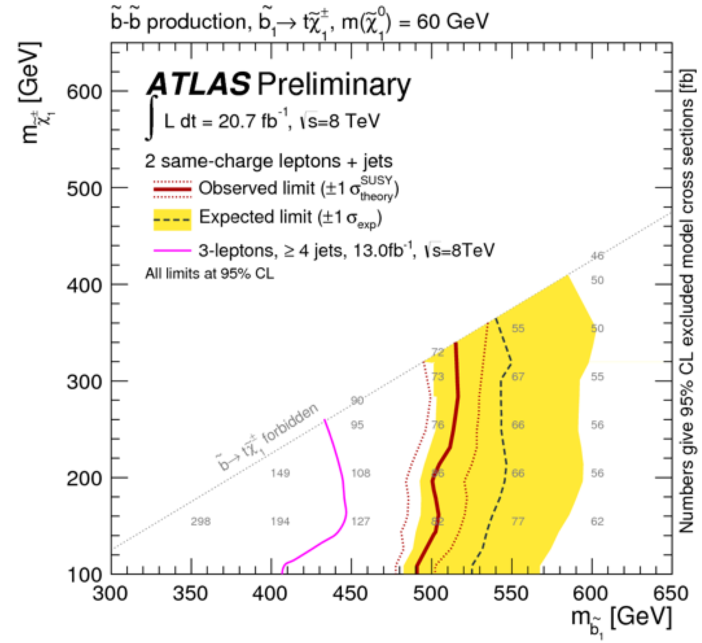
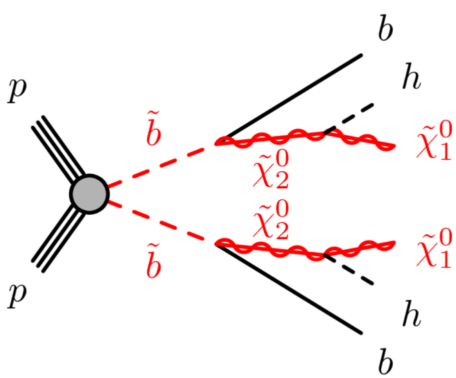


Signature:

E_T^{miss}, jets, 0-3 b-jets, **2 same-sign leptons**



Signature:

E_T^{miss}, 4-7 jets, ≥3 b-jets, **0 or 1 leptons**

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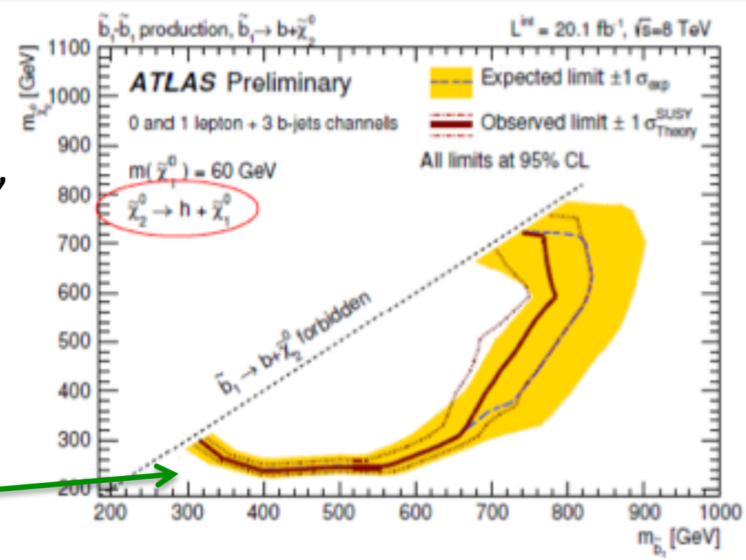
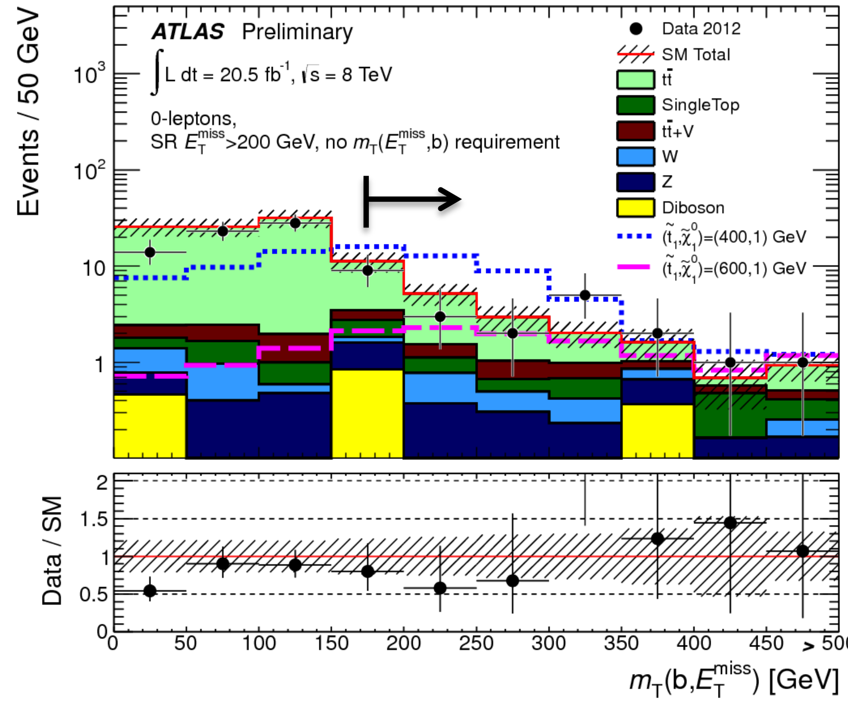


loss of sensitivity due to softer b-jets

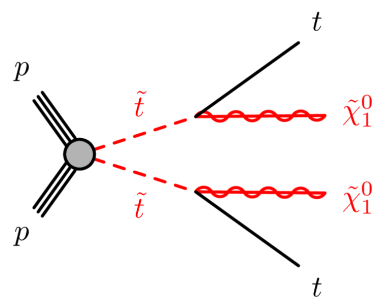
0lepton + 6 jets (2 b-jets) +E_T^{miss} analyses

	Signal
Trigger	E_T^{miss}
N_{lep}	0
p_T^{ℓ}	< 10 (10)
$p_T^{\ell_2}$	—
$m_{\ell\ell}$	—
N_{jet}	≥ 6
p_T^{jet}	$> 80,80,35,\ldots 35$
$N_{b\text{-jet}}$	≥ 2
m_{jjj}	80 to 270
E_T^{miss}	$> 200, 300, 350$
$E_T^{miss,track}$	> 30
$\Delta\phi(E_T^{miss}, E_T^{miss,track})$	$< \pi/3$
$m_T(\ell, E_T^{miss})$	—
$\Delta\phi(\text{jet}, E_T^{miss})$	$> \pi/5$
$m_T(b\text{-jet}, E_T^{miss})$	> 175
Tau veto	yes

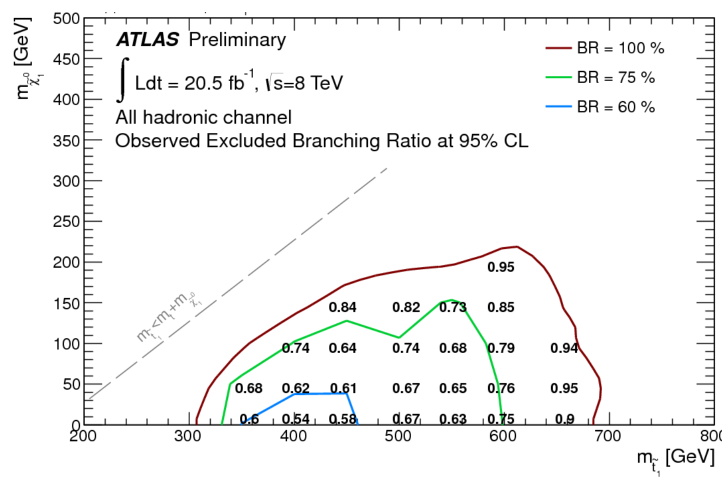


Main Backgrounds

- Semileptonic tt with one missing (or hadronic tau) lepton: normalise with 1-lepton control region (CR) in data
- Z(νν)+jets normalise with Z(ll) CR
- tt + W/Z taken from MC



Challenging fully hadronic search exploiting large MET regime, sensitive to t+LSP decays



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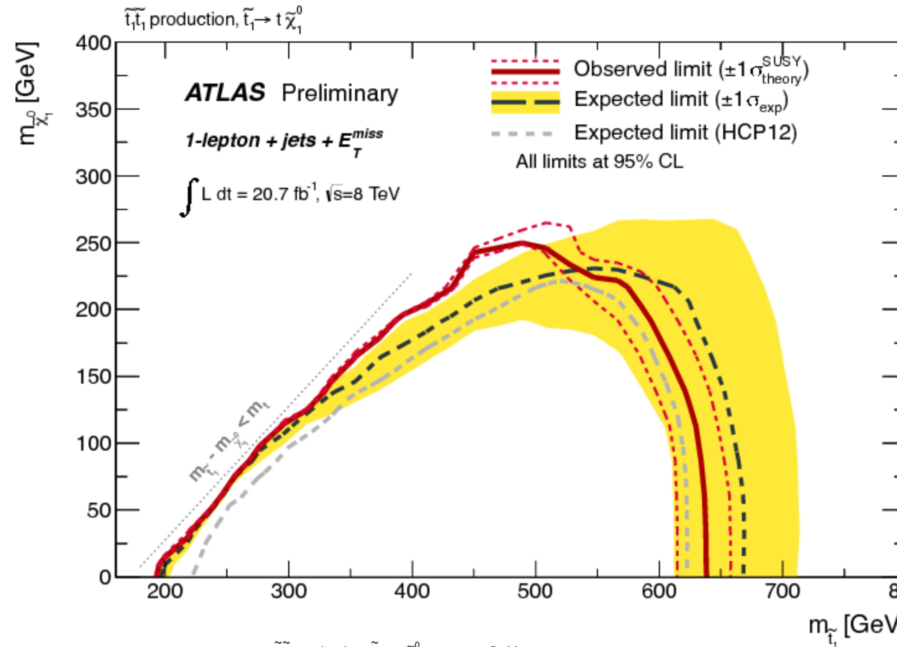
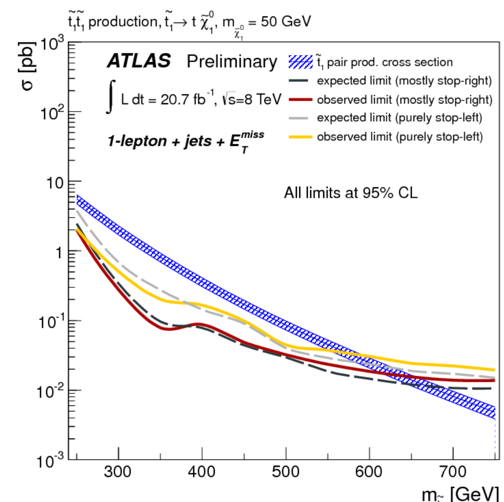
1lepton + 4 jets (1 b-jet) + E_T^{miss} analyses

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



- Trigger: single lepton OR E_T^{miss} based
- Main background from tt and W+jets
- Six signal regions for $t\chi^0_1$ and $b\chi^+_1$
- SRtN1: shape fit of m_T and E_T^{miss}, yielding tt, W+jets and signal normalisation
- Other SR are cut-and-count with background normalized to data at low m_T



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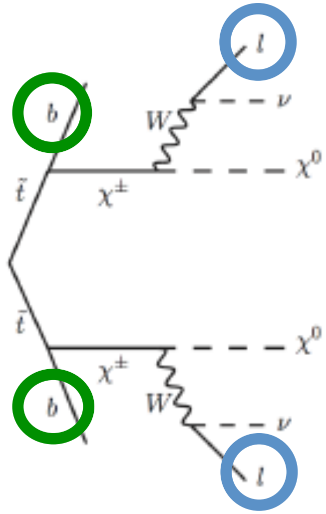
2lepton (+jets) $+E_T^{miss}$ analyses



- For pair-produced particles with identical decay chains the variable

$$m_{T2}^2(p_T^\alpha, p_T^\beta, p_T^{miss}) = \min_{\mathbf{q}_T'^{(1)}+\mathbf{q}_T'^{(2)}=p_T^{miss}} \left[\max\left(M_T^2(\mathbf{p}_T^\alpha, \mathbf{q}_T'^{(1)}; m_\alpha, m_\chi), M_T^2(\mathbf{p}_T^\beta, \mathbf{q}_T'^{(2)}; m_\beta, m_\chi)\right)\right]$$

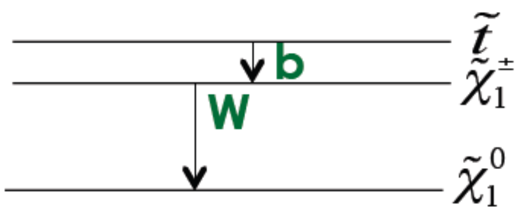
is bounded from above by the parent mass.

$m_{T2}(l_1, l_2, E_T^{Miss})$ bounded by W mass for WW, Wt, $t\bar{t}$

$m_{T2}(b_1, b_2, l_1 + l_2 + E_T^{Miss})$ bounded by top mass for $t\bar{t}$

ATLAS-CONF-2013-048

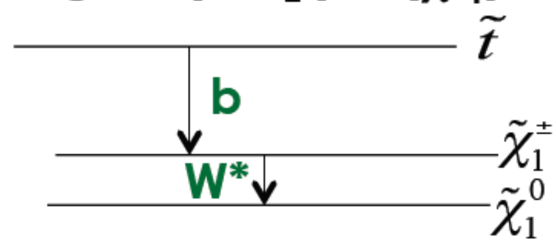
Search for $b\tilde{\chi}^\pm_1$ with large $m(\tilde{\chi}^\pm_1)$-$m(\tilde{\chi}^0_1)$



- Asks for large $m_{T2}(l_1, l_2, E_T^{Miss})$
- Four signal regions, one without jets: sensitive also to small $m(\tilde{t}) - m(\tilde{\chi}_1^\pm)$

ATLAS-CONF-2013-065

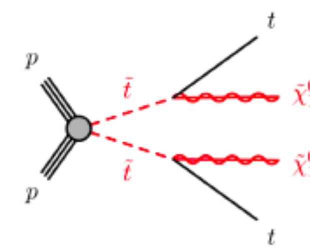
Search for $b\tilde{\chi}^\pm_1$ with large m(stop)-$m(\tilde{\chi}^\pm_1)$



Asks for 2 b-jets and large $m_{T2}(b_1, b_2, l_1 + l_2 + E_T^{Miss})$

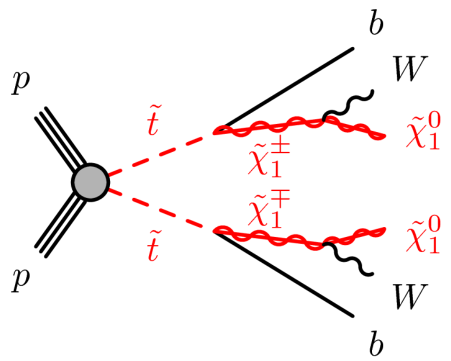
ATLAS-CONF-2013-065

Search for $t\tilde{\chi}^0_1$



Multivariate analysis using 7 variables (one of them $m_{T2}(l, l, E_T^{Miss})$) to discriminate signal and SM background

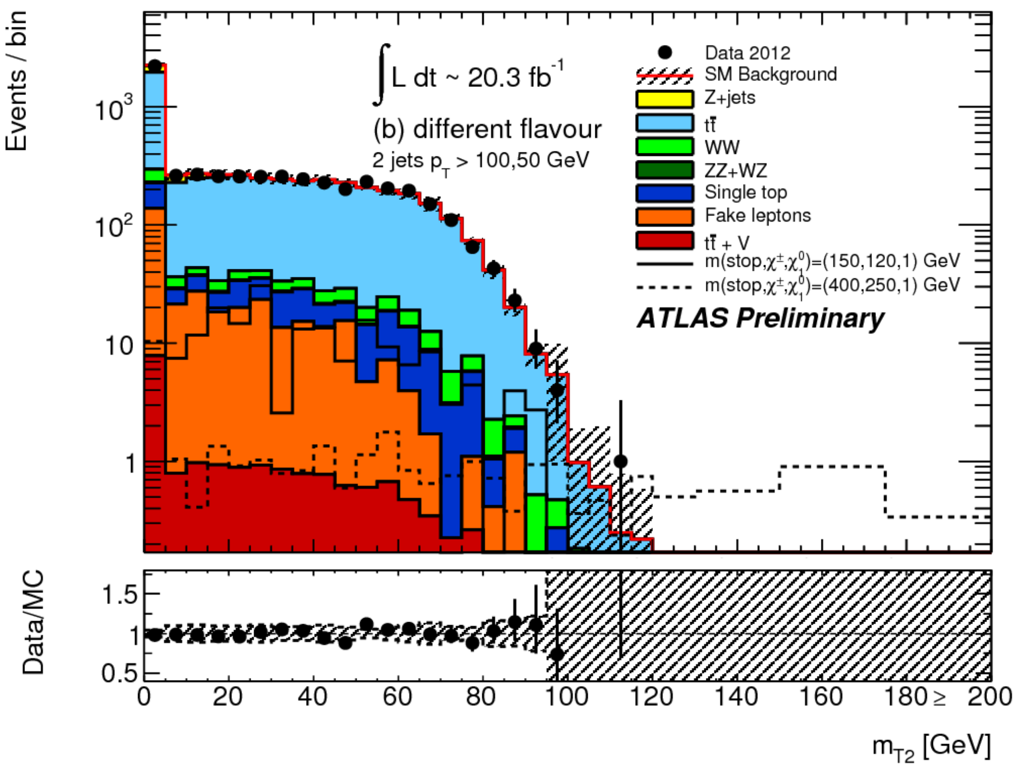
2lepton + (b) jets + E_T^{miss} analyses

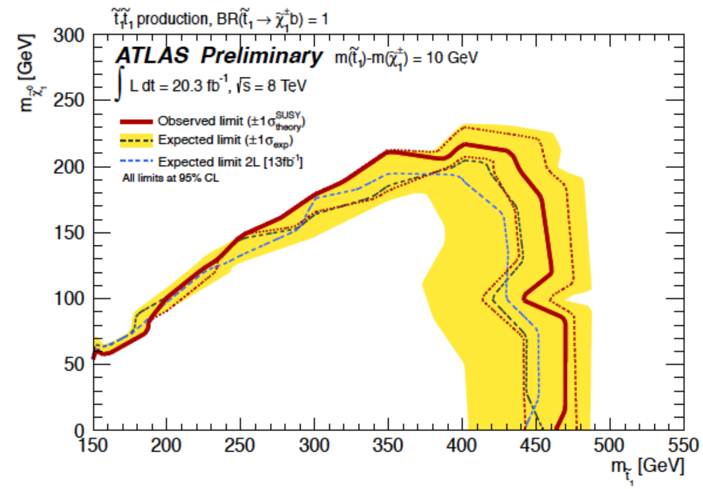


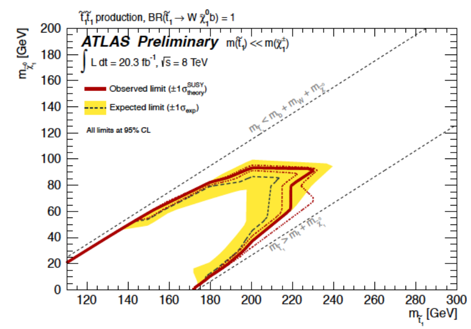
2 leptons (+jets) + MET

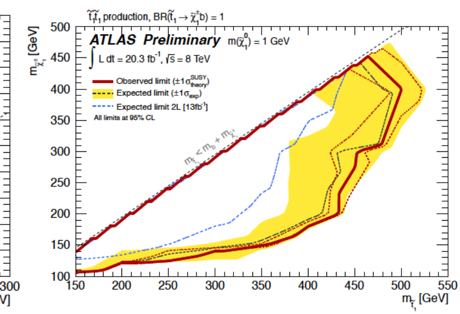
Analysis mainly targets $\tilde{t}_1 \rightarrow b\tilde{\chi}^{\pm}$

Complements bb + E_T^{miss} analysis for large $\mathbf{\Delta m}(\tilde{\chi}^{\pm}, \tilde{\chi}^{\mathbf{0}})$







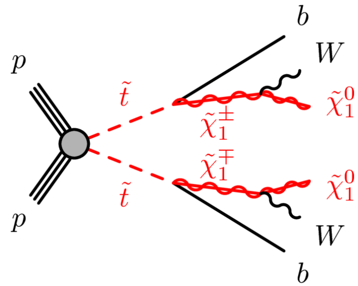


Limits placed in various kinematic scenarios

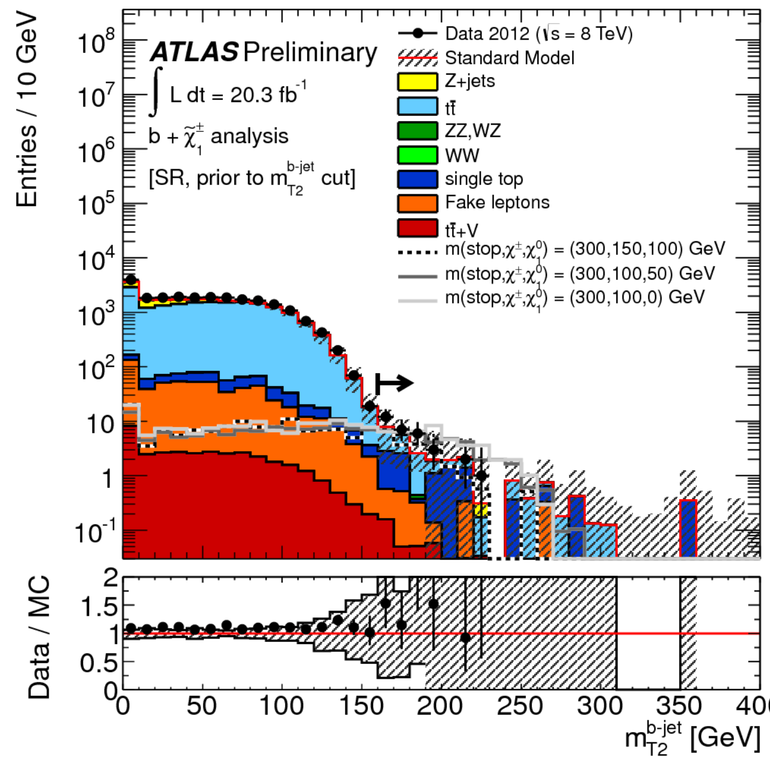
2lepton + (b) jets + E_T^{miss} analyses

Selections:

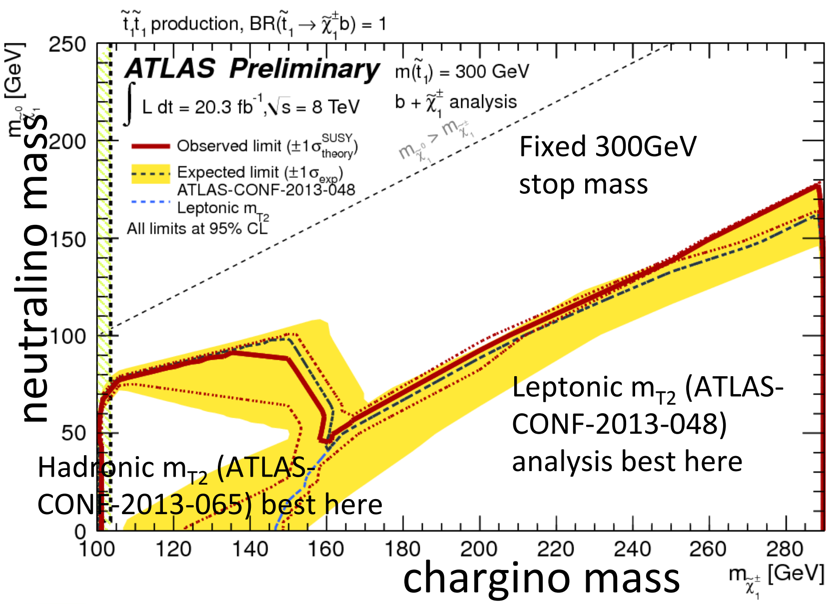
- 2leptons and 2 b-jets
- Leading lepton p_T < 60 GeV
- $m_{T2}(ll, E_T^{miss})$ < 90 GeV
- $m_{T2}(bb, l_1+l_2+E_T^{miss})$ > 160 GeV



- Main backgrounds (single top and top pairs) normalized in dedicated 1b control region

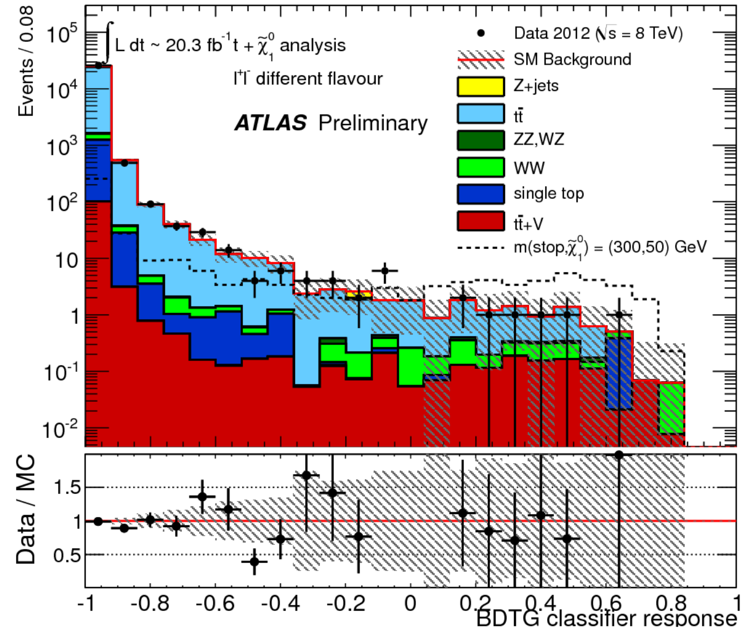


channel	SR
Observed events	31
Total (constrained to CRT, CRZ) expected background events	26 ± 6
Fitted $t\bar{t}$ events	14 ± 4
Fitted $Z\gamma^* \to ee, \mu\mu$+jets events	$0.23^{+0.30}_{-0.23}$
Expected $Z\gamma^* \to \tau\tau$+jets events	0.80 ± 0.21
Expected Wt events	9 ± 4
Expected WW events	$0.01^{+0.34}_{-0.01}$
Expected $t\bar{t} + V$ events	0.46 ± 0.16
Expected WZ, ZZ events	$0.08^{+0.09}_{-0.08}$
Expected events with fake leptons	1.8 ± 0.9
Fit input, expectation $t\bar{t}$	12 ± 5
Fit input, expectation $Z\gamma^* \to ee, \mu\mu$+jets	0.15 ± 0.15

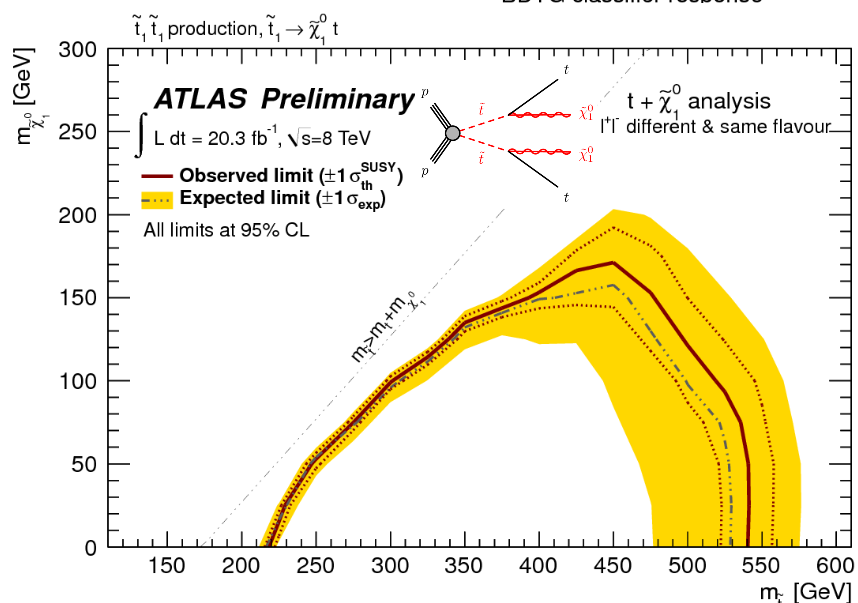


2lepton + (b) jets + E_T^{miss} analyses: MultiVariate Analysis

- Preselection: 2jets with p_T > 50GeV, M_{eff}>300GeV, E_T^{miss} and leading lepton p_T cuts
- Train a BDT algorithm using
  - E_T^{miss} , m(ll), $m_{T2}(l_1, l_2, E_T^{miss})$
  - Azimuthal and polar angle differences between the leptons
  - $\Delta\varphi$ (E_T^{miss}, jet1) and $\Delta\varphi$ (lep1, jet1)
- Separate trainings for different signal masses and for same flavour (SF) and different flavour (DF) leptons: 7 DF and 4 SF signal regions defined



- **Limits combining the best expected DF and SF SR for each mass point**



Backgrounds:

- Top pair normalized to control regions with low BDT values
- Fake leptons evaluated directly from data
- Other backgrounds from MC

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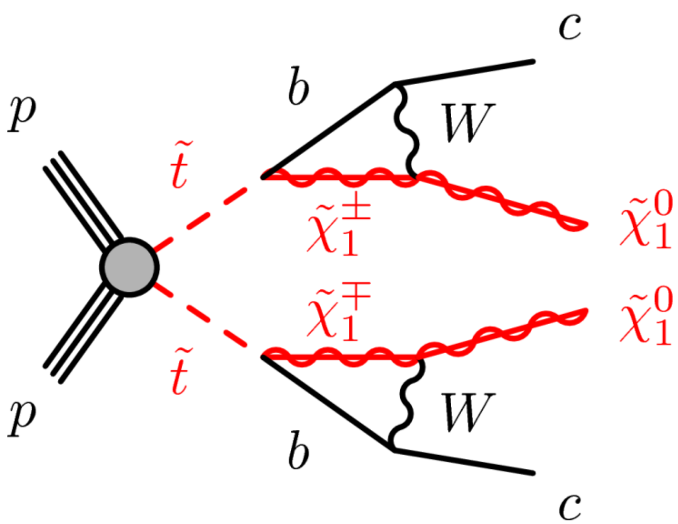

If $\boldsymbol{\Delta} m(t-\boldsymbol{\chi}^0_1) < m_W$ and $m(t) < m(\boldsymbol{\chi}^{\pm}_1)$:

$$\tilde{t} \to c\tilde{\chi}^0$$ ← **Target of this analysis**

$$\tilde{t} \to bff'\tilde{\chi}^0$$

- Need one hard ISR/FSR jet to boost the stop in order to trigger and separate signal from background.
  - If $\Delta m(t-\chi^0_1)$ is moderate (20-80 GeV) the charm can be detected and tagged.
    - Ask for ≥4 jets, some charm tagged, large E_T^{miss}, high pT untagged leading jet
  - If $\Delta m(t-\chi^0_1)$ is very low, the charm jets are too soft to be efficiently detected
    - Ask for 1-3 jets, high pT leading jet, large E_T^{miss}
- E_T^{miss} trigger used for both selections

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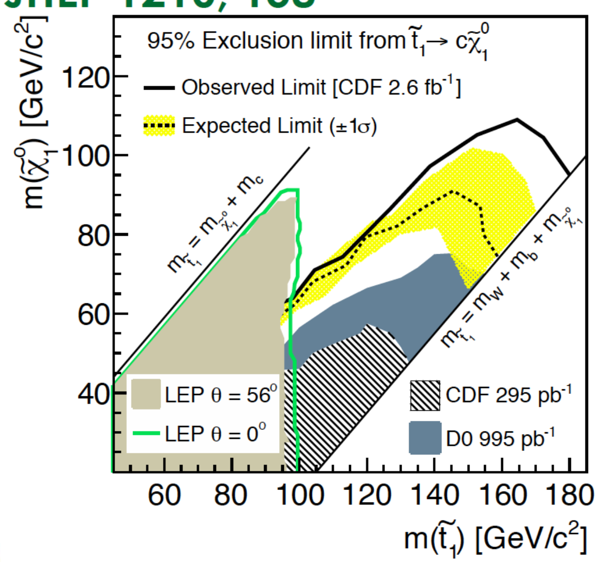

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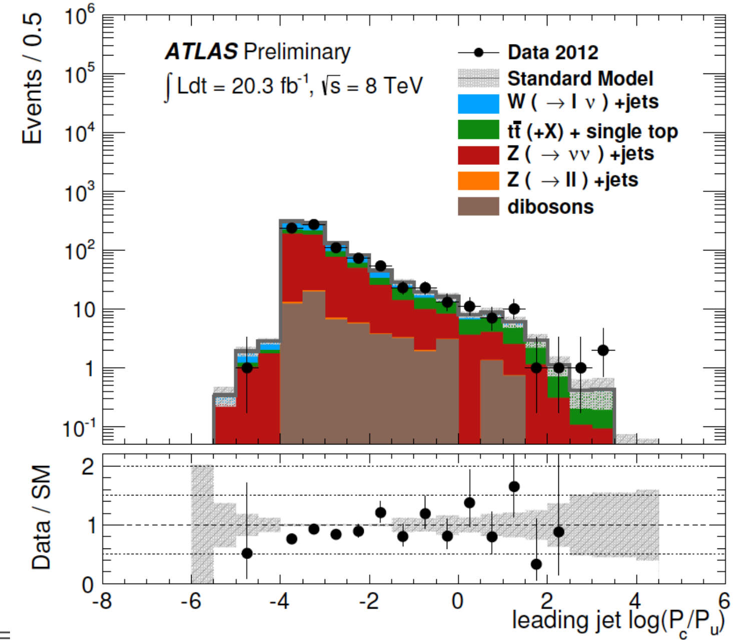
$\tilde{t}_1 \rightarrow c\,\tilde{\chi}^0_1$: selections

Charm Tagging: a multivariate algorithm provides light/gluon, charm and b jet weights
- Form anti-u and anti-b discriminators
- Cut on $\log(P_c/P_u)$ and $\log(P_c/P_b)$ to separate charm jets from light quark/gluon and b-jets

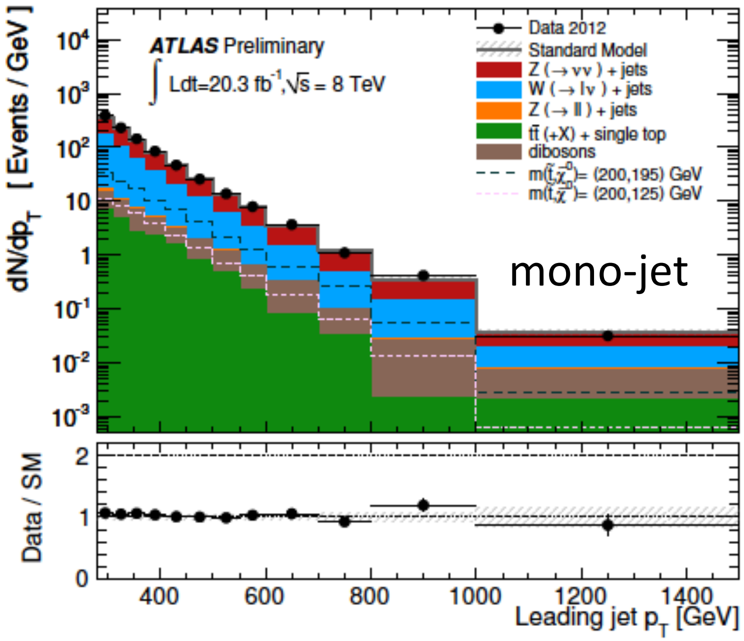
Medium cuts: 20% efficiency, factor 140(5) rejection against light(b)-jets

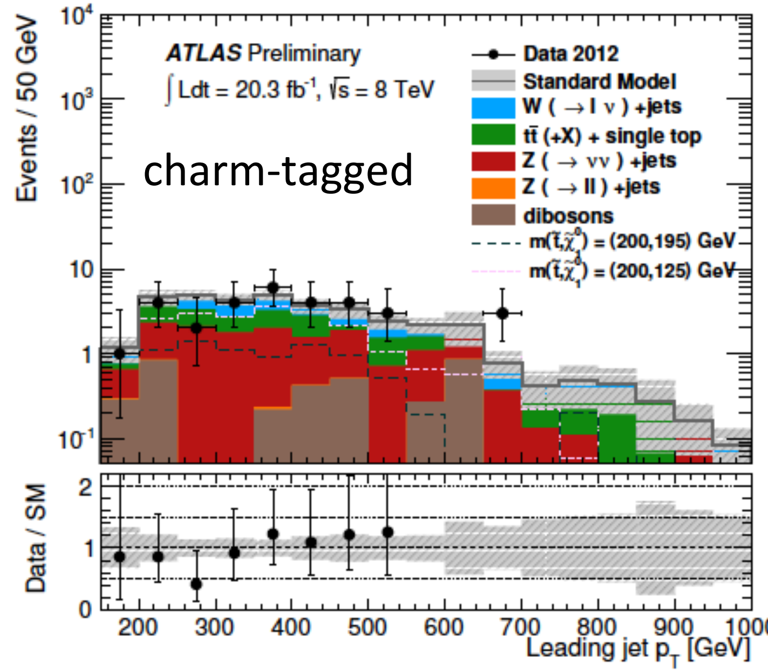
Loose cuts: 95% efficiency, factor 2 rejection of b-jets



Selection criteria		
Preselection		
Primary vertex $E_T^{miss} > 120$ GeV Jet quality requirements At least one jet with $p_T > 120$ GeV and $\lvert\eta\rvert < 2.8$ Lepton vetoes: no isolated electrons (muons) with $p_T > 20$ GeV ($p_T > 10$ GeV)		
Monojet-like selection M1		Charm-tagged selection C1
At most three jets with $p_T > 30$ GeV and $\lvert\eta\rvert < 2.8$ $\Delta\phi(\text{jet}, \mathbf{p}_T^{miss}) > 0.4$		At least three jets with $p_T > 30$ GeVand $\lvert\eta\rvert < 2.5$ (in addition to the leading jet) *b*-veto for second and third jet *medium* *c*-tag for fourth jet $\Delta\phi(\text{jet}, \mathbf{p}_T^{miss}) > 0.4$
minimum leading jet p_T (GeV)	280	270
minimum E_T^{miss} (GeV)	220	410

$\tilde{t}_1$ -> c $\tilde{\chi}^0_1$: results





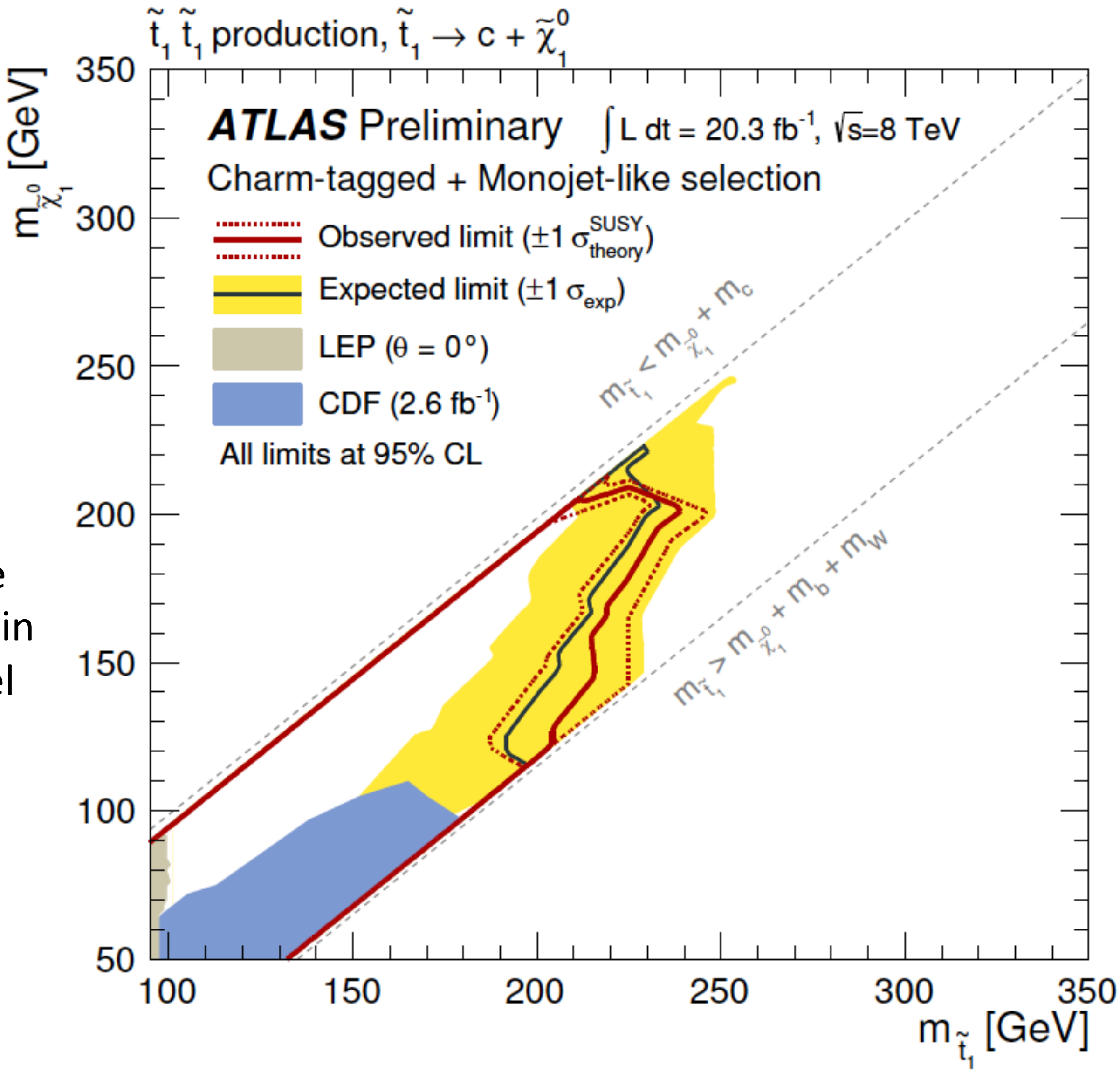
Signal Region	M1	C1
Observed events (20.3 fb^{-1})	30793	25
SM prediction	29800 ± 900	29 ± 7
$W(\to e\nu)$	2700 ± 420	0.5 ± 0.3
$W(\to \mu\nu)$	2900 ± 330	0.8 ± 0.4
$W(\to \tau\nu)$	6600 ± 300	7 ± 4
$Z(\to \nu\bar{\nu})$	15600 ± 900	10 ± 5
$Z/\gamma^* (\to e^+ e^-)$	–	–
$Z/\gamma^* (\to \mu^+ \mu^-)$	50 ± 28	0.01 ± 0.01
$Z/\gamma^* (\to \tau^+\tau^-)$	80 ± 24	0.09 ± 0.04
top	700 ± 86	7 ± 3
dibosons	900 ± 420	2 ± 2
multijets	340 ± 340	–

Good agreement in the signal regions for the two types of topologies

Set limits

$\tilde{t}_1 \to c\,\tilde{\chi}^0_1$: exclusions

monojet-like selection helps extend reach along the diagonal where the charm-jets in the $c\chi^0_1$ channel are too soft



Charm-tagged search extends reach where other decay modes are excluded

Most recent ATLAS references (using complete 8TeV dataset):

0leptons + 6 (2 b-) jets + E_T^{miss} (ATLAS-CONF-2013-024)

1lepton + 4 (1 b-) jets + E_T^{miss} (ATLAS-CONF-2013-037)

2leptons (+ jets) + E_T^{miss} (ATLAS-CONF-2013-048)

2lepton + b-jets + E_T^{miss} (ATLAS-CONF-2013-065)

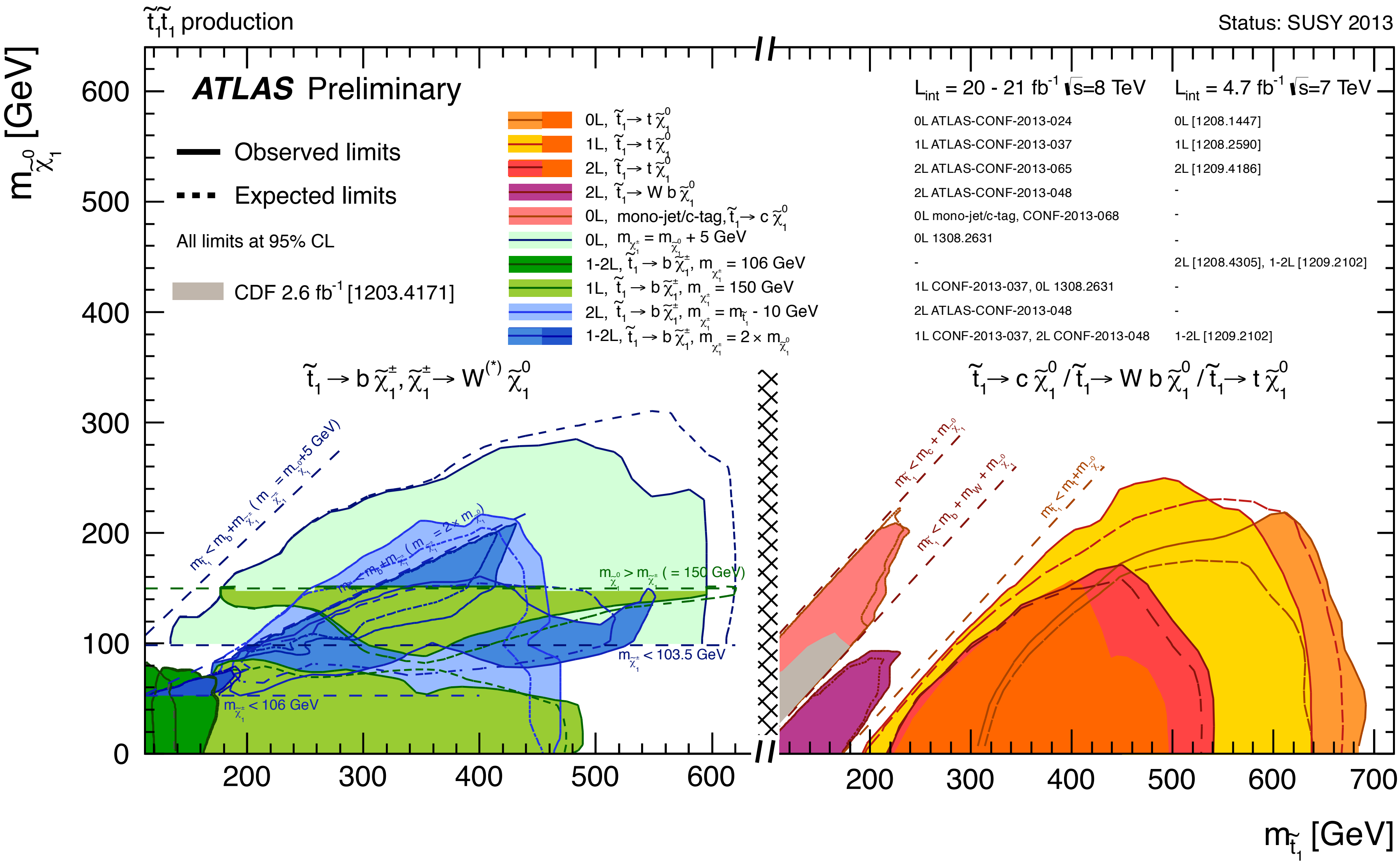
0leptons + 2b-jets + E_T^{miss} (ATLAS-CONF-2013-053)

Z + b-jet + jets + E_T^{miss} (ATLAS-CONF-2013-025)

2 charm-jets + E_T^{miss} (ATLAS-CONF-2013-068)

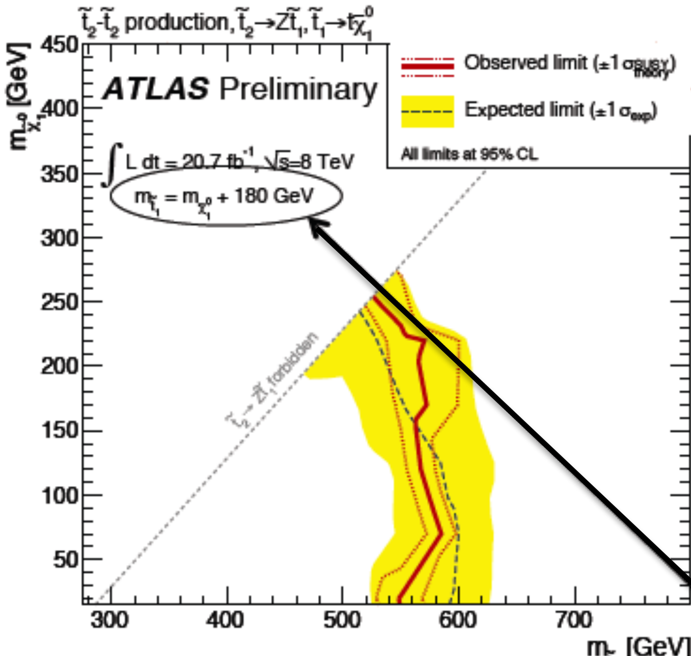
Stop searches - summary

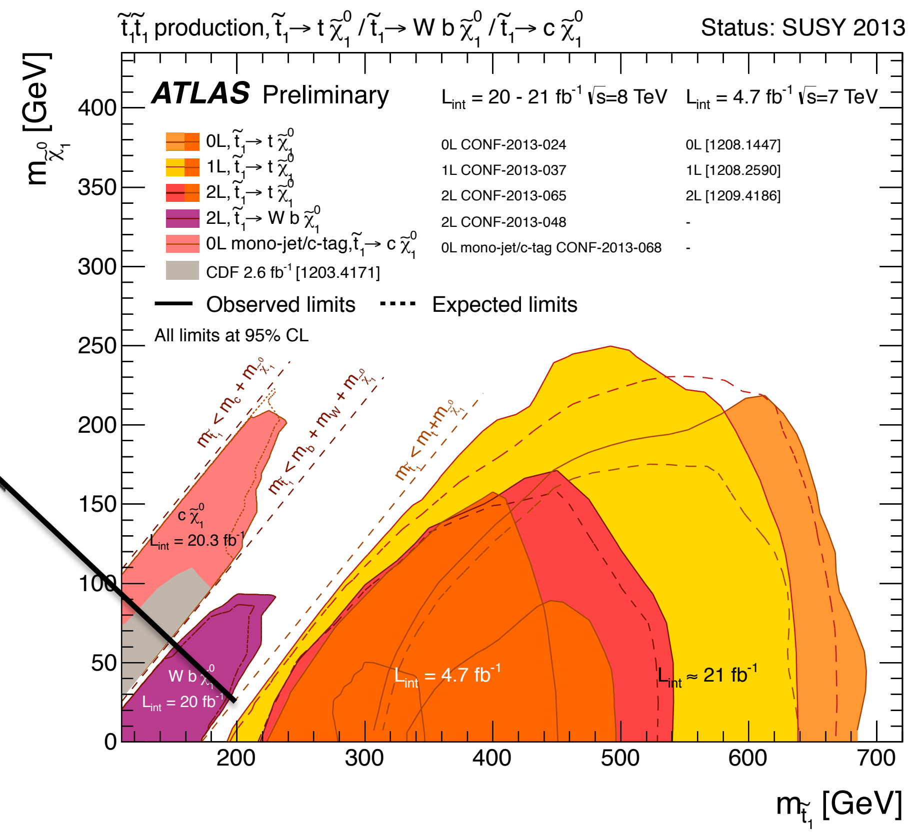
Most recent ATLAS references (using full 8TeV dataset):
ATLAS-CONF-2013-024, ATLAS-CONF-2013-037, ATLAS-CONF-2013-048, ATLAS-CONF-2013-053, ATLAS-CONF-2013-065, ATLAS-CONF-2013-068



Stop searches - summary

Most recent ATLAS references (using full 8TeV dataset):
ATLAS-CONF-2013-024, ATLAS-CONF-2013-037, ATLAS-CONF-2013-048, ATLAS-CONF-2013-053, ATLAS-CONF-2013-065, ATLAS-CONF-2013-068





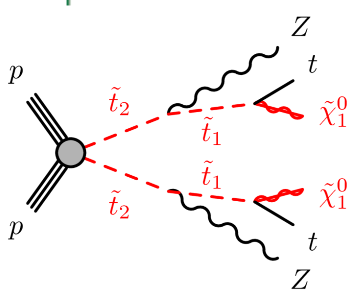
ATLAS-CONF-2013-025

Also, a search in Z(ll)+bjets+E_T^{Miss} and Z(ll)+l+bjets+E_T^{Miss} final states places limits on

$$\tilde{t}_2 \to \tilde{t}_1 Z \to \chi_1^0 t Z$$

$$\tilde{t}_1 \to \chi_1^0 t \to \tilde{G} Z t$$

[GMSB]



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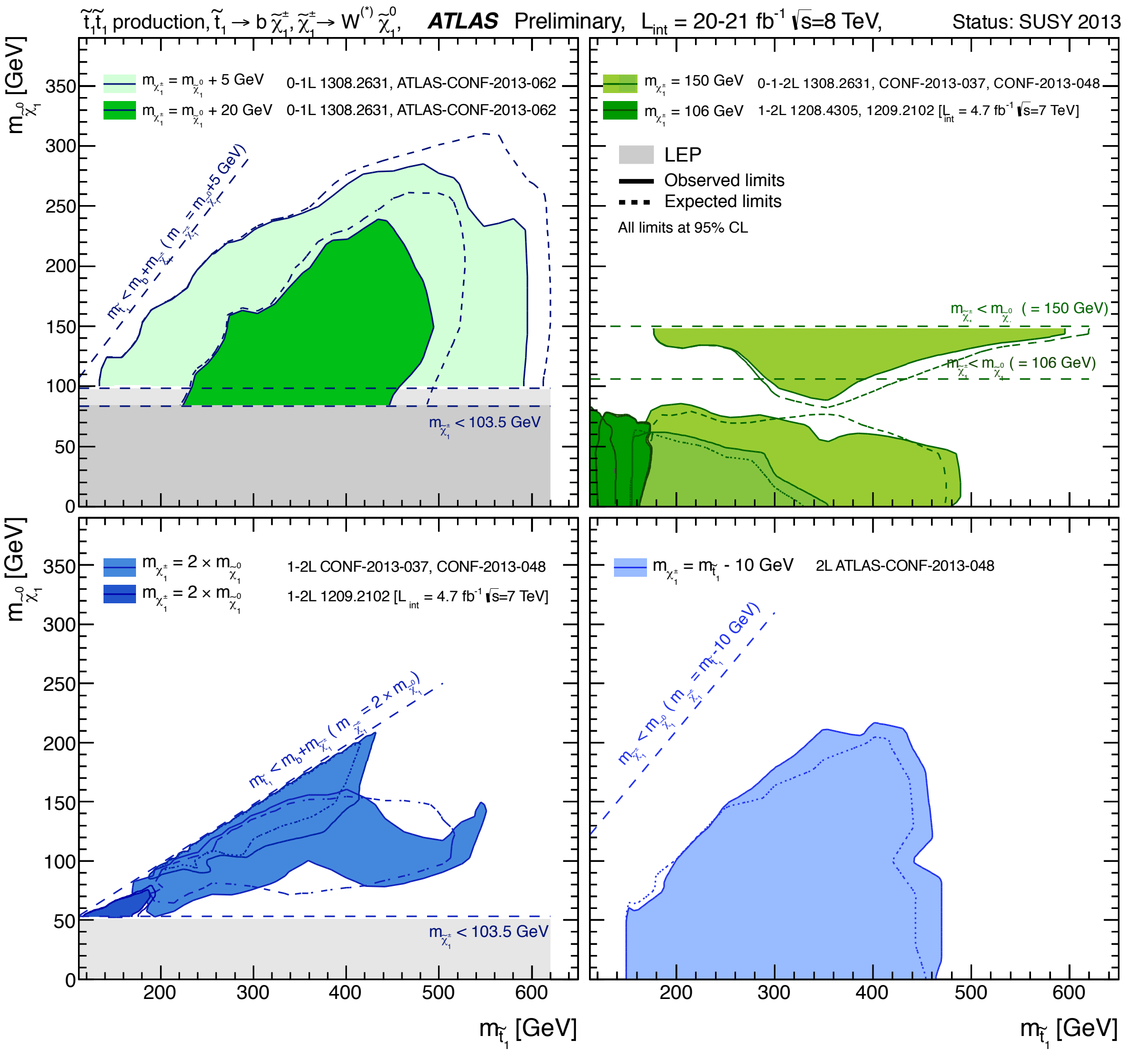
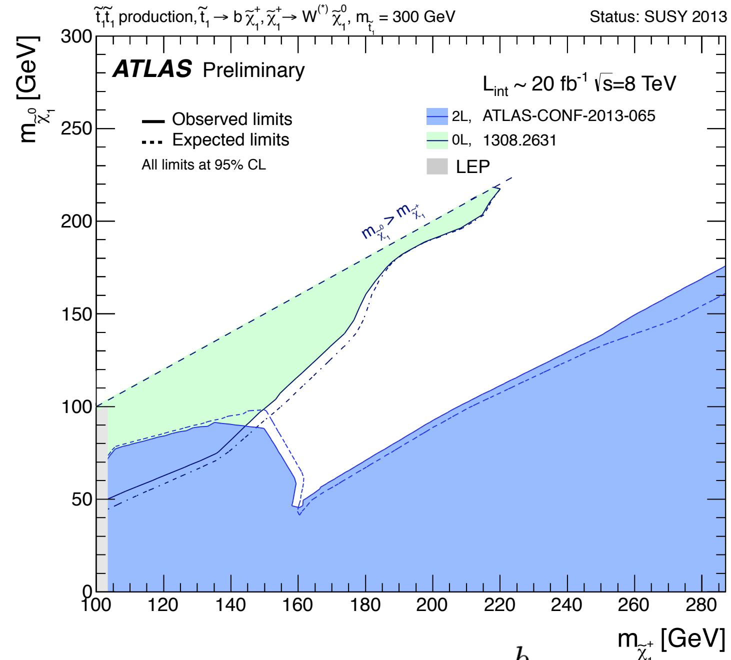
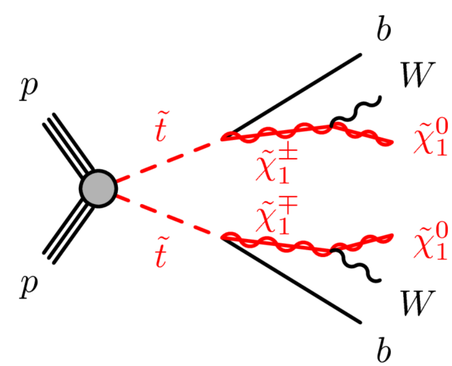
Stop searches - summary

Most recent ATLAS references (using full 8TeV dataset):
ATLAS-CONF-2013-024, ATLAS-CONF-2013-037, ATLAS-CONF-2013-048, ATLAS-CONF-2013-053, ATLAS-CONF-2013-065, ATLAS-CONF-2013-068







Summary

- No stop or sbottom discovered as yet
  - Limits on their masses placed for a variety of decays
- First LHC search for stop decaying to charm neutralino has been performed
  - stop mass limit of 230GeV for $m(\chi^0_1)$=200GeV

ATLAS SUSY Searches* - 95% CL Lower Limits

Status: SUSY 2013

ATLAS Preliminary

$\int \mathcal{L}\, dt = (4.6 - 22.9)\ \mathrm{fb}^{-1}$ $\sqrt{s} = 7, 8$ TeV

	Model	e, μ, τ, γ	Jets	E_T^{miss}	$\int \mathcal{L}\, dt[\mathrm{fb}^{-1}]$	Mass limit			Reference
3rd gen. squarks direct production	$\tilde{b}_1\tilde{b}_1,\ \tilde{b}_1 \to b\tilde{\chi}^0_1$	0	2 b	Yes	20.1	$\tilde{b}_1$	100-630 GeV	$m(\tilde{\chi}^0_1)$<100 GeV	ATLAS-CONF-2013-053
	$\tilde{b}_1\tilde{b}_1,\ \tilde{b}_1 \to t\tilde{\chi}^\pm_1$	2 e,μ (SS)	0-3 b	Yes	20.7	$\tilde{b}_1$	430 GeV	$m(\tilde{\chi}^\pm_1)$=2 $m(\tilde{\chi}^0_1)$	ATLAS-CONF-2013-007
	$\tilde{t}_1\tilde{t}_1$(light), $\tilde{t}_1 \to b\tilde{\chi}^\pm_1$	1-2 e,μ	1-2 b	Yes	4.7	$\tilde{t}_1$	167 GeV	$m(\tilde{\chi}^0_1)$=55 GeV	1208.4305, 1209.2102
	$\tilde{t}_1\tilde{t}_1$(light), $\tilde{t}_1 \to Wb\tilde{\chi}^0_1$	2 e,μ	0-2 jets	Yes	20.3	$\tilde{t}_1$	220 GeV	$m(\tilde{\chi}^0_1)$ =$m(\tilde{t}_1)$-$m(W)$-50 GeV, $m(\tilde{t}_1)$<<$m(\tilde{\chi}^\pm_1)$	ATLAS-CONF-2013-048
	$\tilde{t}_1\tilde{t}_1$(medium), $\tilde{t}_1 \to t\tilde{\chi}^0_1$	2 e,μ	2 jets	Yes	20.3	$\tilde{t}_1$	225-525 GeV	$m(\tilde{\chi}^0_1)$=0 GeV	ATLAS-CONF-2013-065
	$\tilde{t}_1\tilde{t}_1$(medium), $\tilde{t}_1 \to b\tilde{\chi}^\pm_1$	0	2 b	Yes	20.1	$\tilde{t}_1$	150-580 GeV	$m(\tilde{\chi}^0_1)$<200 GeV, $m(\tilde{\chi}^\pm_1)$-$m(\tilde{\chi}^0_1)$=5 GeV	ATLAS-CONF-2013-053
	$\tilde{t}_1\tilde{t}_1$(heavy), $\tilde{t}_1 \to t\tilde{\chi}^0_1$	1 e,μ	1 b	Yes	20.7	$\tilde{t}_1$	200-610 GeV	$m(\tilde{\chi}^0_1)$=0 GeV	ATLAS-CONF-2013-037
	$\tilde{t}_1\tilde{t}_1$(heavy), $\tilde{t}_1 \to t\tilde{\chi}^0_1$	0	2 b	Yes	20.5	$\tilde{t}_1$	320-660 GeV	$m(\tilde{\chi}^0_1)$=0 GeV	ATLAS-CONF-2013-024
	$\tilde{t}_1\tilde{t}_1,\ \tilde{t}_1 \to c\tilde{\chi}^0_1$	0	mono-jet/c-tag	Yes	20.3	$\tilde{t}_1$	200 GeV	$m(\tilde{t}_1)$-$m(\tilde{\chi}^0_1)$<85 GeV	ATLAS-CONF-2013-068
	$\tilde{t}_1\tilde{t}_1$(natural GMSB)	2 e,μ (Z)	1 b	Yes	20.7	$\tilde{t}_1$	500 GeV	$m(\tilde{\chi}^0_1)$>150 GeV	ATLAS-CONF-2013-025
	$\tilde{t}_2\tilde{t}_2,\ \tilde{t}_2 \to \tilde{t}_1 + Z$	3 e,μ (Z)	1 b	Yes	20.7	$\tilde{t}_2$	520 GeV	$m(\tilde{t}_1)$=$m(\tilde{\chi}^0_1)$+180 GeV	ATLAS-CONF-2013-025

Thank you for your attention!

p.jackson@adelaide.edu.au

ATLAS SUSY Searches

ATLAS SUSY Searches* - 95% CL Lower Limits

Status: SUSY 2013

ATLAS Preliminary

$\int \mathcal{L}\,dt = (4.6 - 22.9)\ \mathrm{fb}^{-1}$ $\sqrt{s} = 7, 8$ TeV

	Model	e, μ, τ, γ	Jets	E_T^{miss}	$\int \mathcal{L}\,dt[\mathrm{fb}^{-1}]$	Mass limit		Reference
Inclusive Searches	MSUGRA/CMSSM	0	2-6 jets	Yes	20.3	$\tilde{q}, \tilde{g}$ 1.7 TeV	$m(\tilde{q})=m(\tilde{g})$	ATLAS-CONF-2013-047
	MSUGRA/CMSSM	1 e, μ	3-6 jets	Yes	20.3	$\tilde{g}$ 1.2 TeV	any $m(\tilde{q})$	ATLAS-CONF-2013-062
	MSUGRA/CMSSM	0	7-10 jets	Yes	20.3	$\tilde{g}$ 1.1 TeV	any $m(\tilde{q})$	1308.1841
	$\tilde{q}\tilde{q}$, $\tilde{q}\to q\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{q}$ 740 GeV	$m(\tilde{\chi}_1^0)$=0 GeV	ATLAS-CONF-2013-047
	$\tilde{g}\tilde{g}$, $\tilde{g}\to q\bar{q}\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{g}$ 1.3 TeV	$m(\tilde{\chi}_1^0)$=0 GeV	ATLAS-CONF-2013-047
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qq\tilde{\chi}_1^{\pm}\to qqW^{\pm}\tilde{\chi}_1^0$	1 e, μ	3-6 jets	Yes	20.3	$\tilde{g}$ 1.18 TeV	$m(\tilde{\chi}_1^0)$<200 GeV, $m(\tilde{\chi}^{\pm})=0.5(m(\tilde{\chi}_1^0)+m(\tilde{g}))$	ATLAS-CONF-2013-062
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qq(\ell\ell/\ell\nu/\nu\nu)\tilde{\chi}_1^0$	2 e, μ	0-3 jets	-	20.3	$\tilde{g}$ 1.12 TeV	$m(\tilde{\chi}_1^0)$=0 GeV	ATLAS-CONF-2013-089
	GMSB ($\tilde{\ell}$ NLSP)	2 e, μ	2-4 jets	Yes	4.7	$\tilde{g}$ 1.24 TeV	$\tan\beta$<15	1208.4688
	GMSB ($\tilde{\ell}$ NLSP)	1-2 τ	0-2 jets	Yes	20.7	$\tilde{g}$ 1.4 TeV	$\tan\beta$ >18	ATLAS-CONF-2013-026
	GGM (bino NLSP)	2 γ	-	Yes	4.8	$\tilde{g}$ 1.07 TeV	$m(\tilde{\chi}_1^0)$>50 GeV	1209.0753
	GGM (wino NLSP)	1 $e, \mu + \gamma$	-	Yes	4.8	$\tilde{g}$ 619 GeV	$m(\tilde{\chi}_1^0)$>50 GeV	ATLAS-CONF-2012-144
	GGM (higgsino-bino NLSP)	γ	1 b	Yes	4.8	$\tilde{g}$ 900 GeV	$m(\tilde{\chi}_1^0)$>220 GeV	1211.1167
	GGM (higgsino NLSP)	2 e, μ (Z)	0-3 jets	Yes	5.8	$\tilde{g}$ 690 GeV	$m(\tilde{H})$>200 GeV	ATLAS-CONF-2012-152
	Gravitino LSP	0	mono-jet	Yes	10.5	$F^{1/2}$ scale 645 GeV	$m(\tilde{g})>10^{-4}$ eV	ATLAS-CONF-2012-147
3rd gen. $\tilde{g}$ med.	$\tilde{g}\to b\bar{b}\tilde{\chi}_1^0$	0	3 b	Yes	20.1	$\tilde{g}$ 1.2 TeV	$m(\tilde{\chi}_1^0)$<600 GeV	ATLAS-CONF-2013-061
	$\tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0	7-10 jets	Yes	20.3	$\tilde{g}$ 1.1 TeV	$m(\tilde{\chi}_1^0)$ <350 GeV	1308.1841
	$\tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0-1 e, μ	3 b	Yes	20.1	$\tilde{g}$ 1.34 TeV	$m(\tilde{\chi}_1^0)$<400 GeV	ATLAS-CONF-2013-061
	$\tilde{g}\to b\bar{t}\tilde{\chi}_1^+$	0-1 e, μ	3 b	Yes	20.1	$\tilde{g}$ 1.3 TeV	$m(\tilde{\chi}_1^0)$<300 GeV	ATLAS-CONF-2013-061
3rd gen. squarks direct production	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to b\tilde{\chi}_1^0$	0	2 b	Yes	20.1	$\tilde{b}_1$ 100-620 GeV	$m(\tilde{\chi}_1^0)$<90 GeV	1308.2631
	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to t\tilde{\chi}_1^{\pm}$	2 e, μ (SS)	0-3 b	Yes	20.7	$\tilde{b}_1$ 275-430 GeV	$m(\tilde{\chi}_1^{\pm})=2\ m(\tilde{\chi}_1^0)$	ATLAS-CONF-2013-007
	$\tilde{t}_1\tilde{t}_1$(light), $\tilde{t}_1\to b\tilde{\chi}_1^{\pm}$	1-2 e, μ	1-2 b	Yes	4.7	$\tilde{t}_1$ 110-167 GeV	$m(\tilde{\chi}_1^0)$=55 GeV	1208.4305, 1209.2102
	$\tilde{t}_1\tilde{t}_1$(light), $\tilde{t}_1\to Wb\tilde{\chi}_1^0$	2 e, μ	0-2 jets	Yes	20.3	$\tilde{t}_1$ 130-220 GeV	$m(\tilde{\chi}_1^0)=m(\tilde{t}_1)-m(W)$-50 GeV, $m(\tilde{t}_1)<<m(\tilde{\chi}_1^{\pm})$	ATLAS-CONF-2013-048
	$\tilde{t}_1\tilde{t}_1$(medium), $\tilde{t}_1\to t\tilde{\chi}_1^0$	2 e, μ	2 jets	Yes	20.3	$\tilde{t}_1$ 225-525 GeV	$m(\tilde{\chi}_1^0)$=0 GeV	ATLAS-CONF-2013-065
	$\tilde{t}_1\tilde{t}_1$(medium), $\tilde{t}_1\to b\tilde{\chi}_1^{\pm}$	0	2 b	Yes	20.1	$\tilde{t}_1$ 150-580 GeV	$m(\tilde{\chi}_1^0)$<200 GeV, $m(\tilde{\chi}_1^{\pm})-m(\tilde{\chi}_1^0)$=5 GeV	1308.2631
	$\tilde{t}_1\tilde{t}_1$(heavy), $\tilde{t}_1\to t\tilde{\chi}_1^0$	1 e, μ	1 b	Yes	20.7	$\tilde{t}_1$ 200-610 GeV	$m(\tilde{\chi}_1^0)$=0 GeV	ATLAS-CONF-2013-037
	$\tilde{t}_1\tilde{t}_1$(heavy), $\tilde{t}_1\to t\tilde{\chi}_1^0$	0	2 b	Yes	20.5	$\tilde{t}_1$ 320-660 GeV	$m(\tilde{\chi}_1^0)$=0 GeV	ATLAS-CONF-2013-024
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to c\tilde{\chi}_1^0$	0	mono-jet/c-tag	Yes	20.3	$\tilde{t}_1$ 90-200 GeV	$m(\tilde{t}_1)-m(\tilde{\chi}_1^0)$<85 GeV	ATLAS-CONF-2013-068
	$\tilde{t}_1\tilde{t}_1$(natural GMSB)	2 e, μ (Z)	1 b	Yes	20.7	$\tilde{t}_1$ 500 GeV	$m(\tilde{\chi}_1^0)$>150 GeV	ATLAS-CONF-2013-025
	$\tilde{t}_2\tilde{t}_2$, $\tilde{t}_2\to\tilde{t}_1+Z$	3 e, μ (Z)	1 b	Yes	20.7	$\tilde{t}_2$ 271-520 GeV	$m(\tilde{t}_1)=m(\tilde{\chi}_1^0)$+180 GeV	ATLAS-CONF-2013-025
EW direct	$\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}$, $\tilde{\ell}\to\ell\tilde{\chi}_1^0$	2 e, μ	0	Yes	20.3	$\tilde{\ell}$ 85-315 GeV	$m(\tilde{\chi}_1^0)$=0 GeV	ATLAS-CONF-2013-049
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to\tilde{\ell}\nu(\ell\tilde{\nu})$	2 e, μ	0	Yes	20.3	$\tilde{\chi}_1^{\pm}$ 125-450 GeV	$m(\tilde{\chi}_1^0)$=0 GeV, $m(\tilde{\ell},\tilde{\nu})=0.5(m(\tilde{\chi}_1^{\pm})+m(\tilde{\chi}_1^0))$	ATLAS-CONF-2013-049
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to\tilde{\tau}\nu(\tau\tilde{\nu})$	2 τ	-	Yes	20.7	$\tilde{\chi}_1^{\pm}$ 180-330 GeV	$m(\tilde{\chi}_1^0)$=0 GeV, $m(\tilde{\tau},\tilde{\nu})=0.5(m(\tilde{\chi}_1^{\pm})+m(\tilde{\chi}_1^0))$	ATLAS-CONF-2013-028
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to\tilde{\ell}_L\nu\tilde{\ell}_L\ell(\tilde{\nu}\nu)$, $\ell\tilde{\nu}\tilde{\ell}_L\ell(\tilde{\nu}\nu)$	3 e, μ	0	Yes	20.7	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$ 600 GeV	$m(\tilde{\chi}_1^{\pm})=m(\tilde{\chi}_2^0)$, $m(\tilde{\chi}_1^0)$=0, $m(\tilde{\ell},\tilde{\nu})=0.5(m(\tilde{\chi}_1^{\pm})+m(\tilde{\chi}_1^0))$	ATLAS-CONF-2013-035
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to W\tilde{\chi}_1^0Z\tilde{\chi}_1^0$	3 e, μ	0	Yes	20.7	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$ 315 GeV	$m(\tilde{\chi}_1^{\pm})=m(\tilde{\chi}_2^0)$, $m(\tilde{\chi}_1^0)$=0, sleptons decoupled	ATLAS-CONF-2013-035
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to W\tilde{\chi}_1^0h\tilde{\chi}_1^0$	1 e, μ	2 b	Yes	20.3	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$ 285 GeV	$m(\tilde{\chi}_1^{\pm})=m(\tilde{\chi}_2^0)$, $m(\tilde{\chi}_1^0)$=0, sleptons decoupled	ATLAS-CONF-2013-093
Long-lived particles	Direct $\tilde{\chi}_1^+\tilde{\chi}_1^-$ prod., long-lived $\tilde{\chi}_1^{\pm}$	Disapp. trk	1 jet	Yes	20.3	$\tilde{\chi}_1^{\pm}$ 270 GeV	$m(\tilde{\chi}_1^{\pm})-m(\tilde{\chi}_1^0)$=160 MeV, $\tau(\tilde{\chi}_1^{\pm})$=0.2 ns	ATLAS-CONF-2013-069
	Stable, stopped $\tilde{g}$ R-hadron	0	1-5 jets	Yes	22.9	$\tilde{g}$ 832 GeV	$m(\tilde{\chi}_1^0)$=100 GeV, 10 μs<$\tau(\tilde{g})$<1000 s	ATLAS-CONF-2013-057
	GMSB, stable $\tilde{\tau}$, $\tilde{\chi}_1^0\to\tilde{\tau}(\tilde{e},\tilde{\mu})+\tau(e,\mu)$	1-2 μ	-	-	15.9	$\tilde{\chi}_1^0$ 475 GeV	10<$\tan\beta$<50	ATLAS-CONF-2013-058
	GMSB, $\tilde{\chi}_1^0\to\gamma\tilde{G}$, long-lived $\tilde{\chi}_1^0$	2 γ	-	Yes	4.7	$\tilde{\chi}_1^0$ 230 GeV	0.4<$\tau(\tilde{\chi}_1^0)$<2 ns	1304.6310
	$\tilde{q}\tilde{q}$, $\tilde{\chi}_1^0\to qq\mu$ (RPV)	1 μ, displ. vtx	-	-	20.3	$\tilde{q}$ 1.0 TeV	1.5 <$c\tau$<156 mm, BR(μ)=1, $m(\tilde{\chi}_1^0)$=108 GeV	ATLAS-CONF-2013-092
RPV	LFV $pp\to\tilde{\nu}_\tau+X$, $\tilde{\nu}_\tau\to e+\mu$	2 e, μ	-	-	4.6	$\tilde{\nu}_\tau$ 1.61 TeV	λ'_{311}=0.10, λ_{132}=0.05	1212.1272
	LFV $pp\to\tilde{\nu}_\tau+X$, $\tilde{\nu}_\tau\to e(\mu)+\tau$	1 $e, \mu + \tau$	-	-	4.6	$\tilde{\nu}_\tau$ 1.1 TeV	λ'_{311}=0.10, $\lambda_{1(2)33}$=0.05	1212.1272
	Bilinear RPV CMSSM	1 e, μ	7 jets	Yes	4.7	$\tilde{q}, \tilde{g}$ 1.2 TeV	$m(\tilde{q})=m(\tilde{g})$, $c\tau_{LSP}$<1 mm	ATLAS-CONF-2012-140
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to W\tilde{\chi}_1^0$, $\tilde{\chi}_1^0\to ee\tilde{\nu}_\mu, e\mu\tilde{\nu}_e$	4 e, μ	-	Yes	20.7	$\tilde{\chi}_1^{\pm}$ 760 GeV	$m(\tilde{\chi}_1^0)$>300 GeV, λ_{121}>0	ATLAS-CONF-2013-036
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to W\tilde{\chi}_1^0$, $\tilde{\chi}_1^0\to\tau\tau\tilde{\nu}_e, e\tau\tilde{\nu}_\tau$	3 $e, \mu + \tau$	-	Yes	20.7	$\tilde{\chi}_1^{\pm}$ 350 GeV	$m(\tilde{\chi}_1^0)$>80 GeV, λ_{133}>0	ATLAS-CONF-2013-036
	$\tilde{g}\to qqq$	0	6-7 jets	-	20.3	$\tilde{g}$ 916 GeV	BR(t)=BR(b)=BR(c)=0%	ATLAS-CONF-2013-091
	$\tilde{g}\to\tilde{t}_1t$, $\tilde{t}_1\to bs$	2 e, μ (SS)	0-3 b	Yes	20.7	$\tilde{g}$ 880 GeV		ATLAS-CONF-2013-007
Other	Scalar gluon pair, sgluon$\to q\bar{q}$	0	4 jets	-	4.6	sgluon 100-287 GeV	incl. limit from 1110.2693	1210.4826
	Scalar gluon pair, sgluon$\to t\bar{t}$	2 e, μ (SS)	1 b	Yes	14.3	sgluon 800 GeV		ATLAS-CONF-2013-051
	WIMP interaction (D5, Dirac χ)	0	mono-jet	Yes	10.5	M* scale 704 GeV	$m(\chi)$<80 GeV, limit of<687 GeV for D8	ATLAS-CONF-2012-147

Mass scale [TeV] (10^{-1} … 1)

$\sqrt{s}$ = 7 TeV full data | $\sqrt{s}$ = 8 TeV partial data | $\sqrt{s}$ = 8 TeV full data

*Only a selection of the available mass limits on new states or phenomena is shown. All limits quoted are observed minus 1σ theoretical signal cross section uncertainty.

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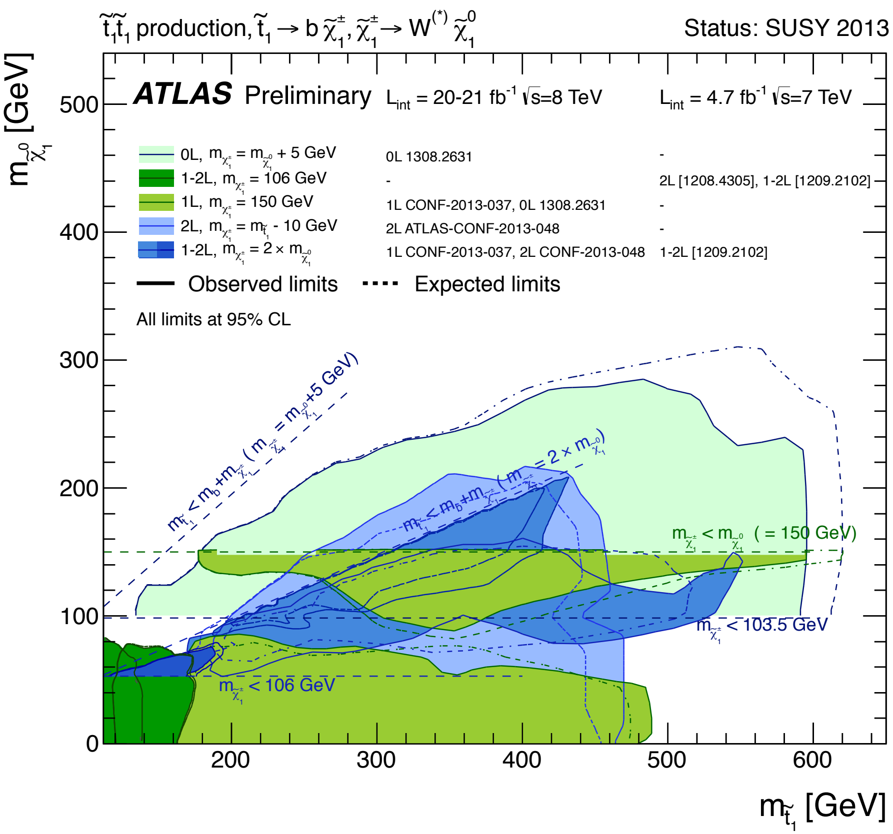
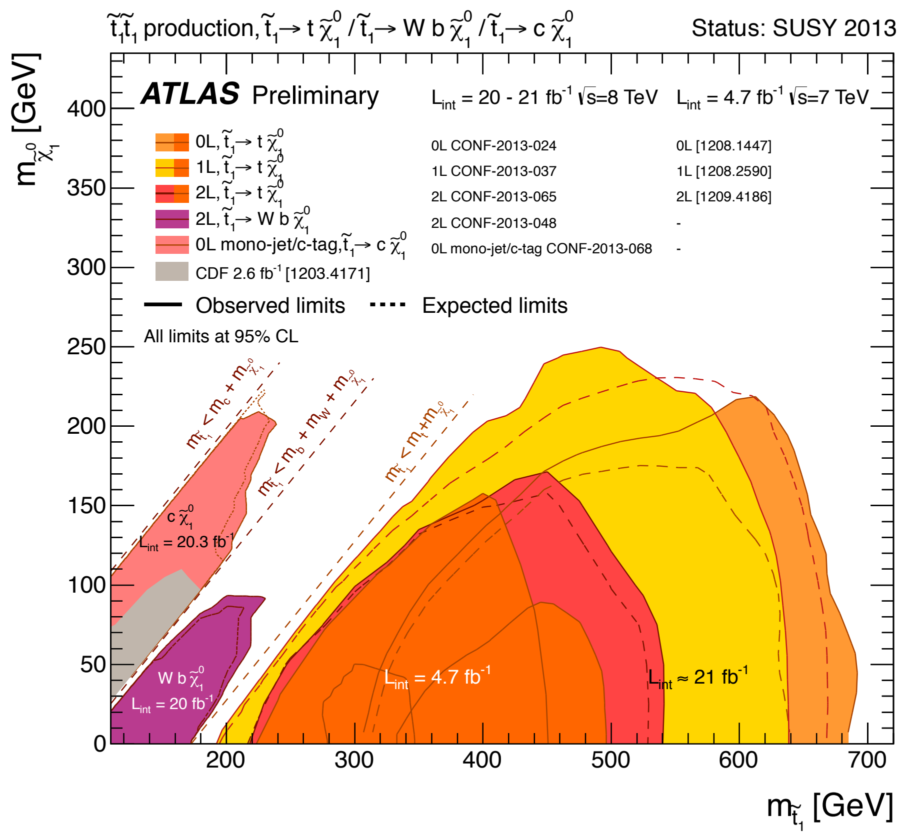
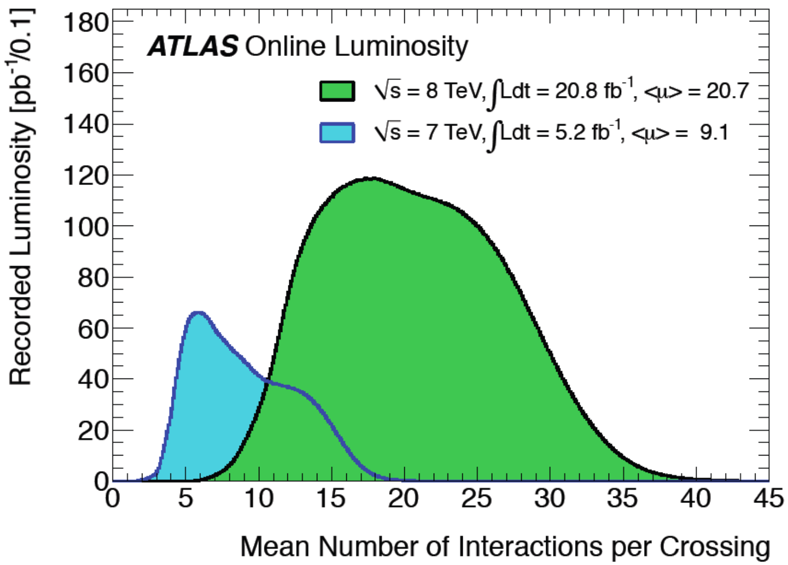
SUSY - 3rd Generation

Most recent ATLAS references (using full 8TeV dataset):
ATLAS-CONF-2013-024, ATLAS-CONF-2013-037, ATLAS-CONF-2013-048, ATLAS-CONF-2013-053, ATLAS-CONF-2013-065, ATLAS-CONF-2013-068

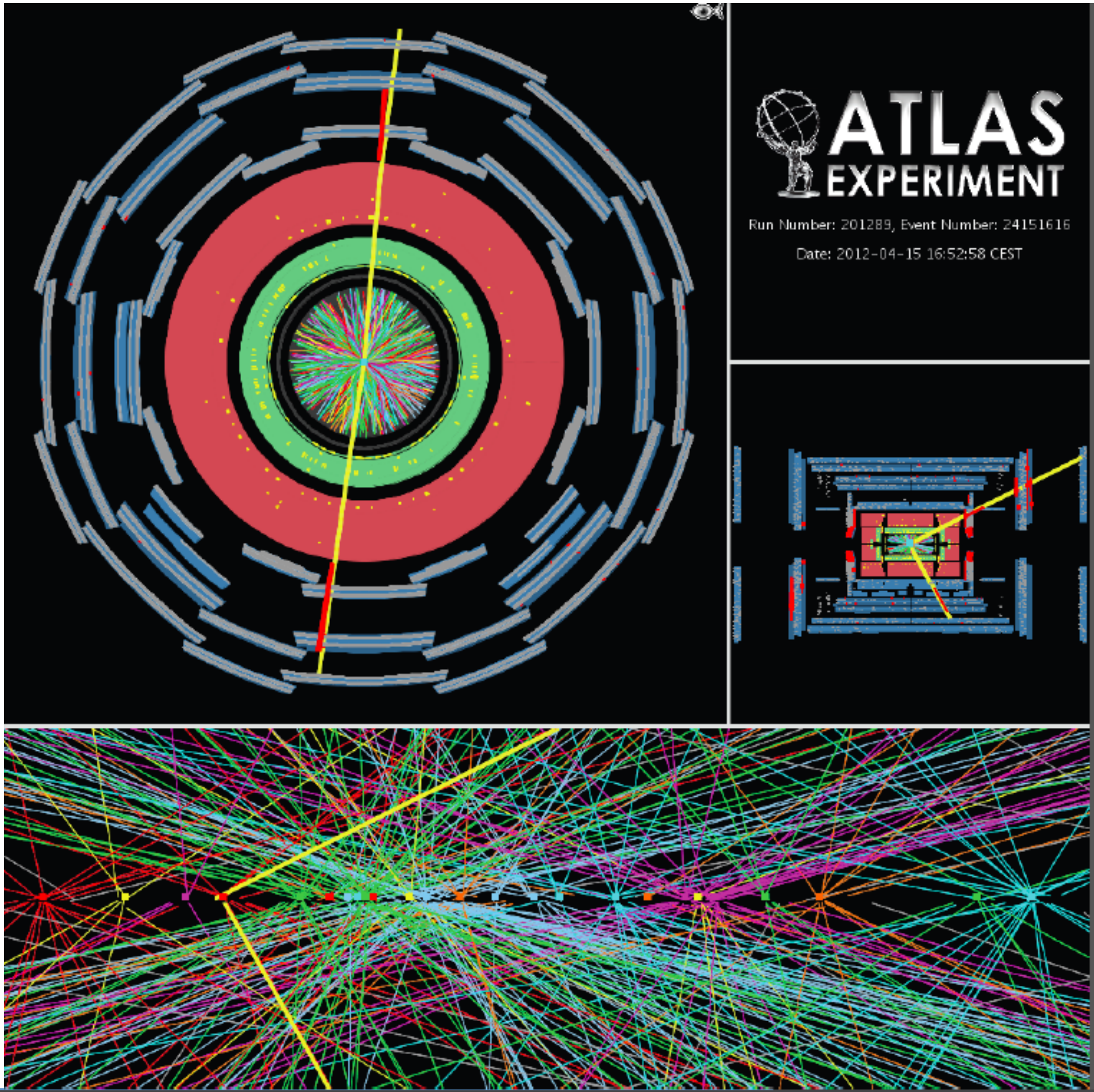




Pile-up in 2012



Z → μμ event in ATLAS with 25 reconstructed vertices



Mostly affects analyses with jets, b-jets, taus and missing transverse momentum. Along with triggering and computing.

Tracking, electrons, muons and photons less sensitive