LATEST ATLAS SUSY RESULTS

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Outline

A biased selection of ATLAS SUSY searches

new since last GDR

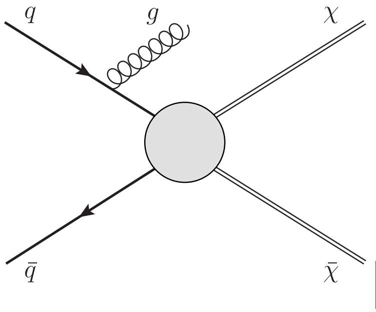
ATLASSUSYPublicResults

1 energetic jet + E_T^{miss}	February 2015
2 leptons + jets + E_T^{miss}	March 2015
Analyses combination	March 2015
Run-2 expected sensitivity	March 2015
Conclusion	

1 energetic jet + E_T^{miss}

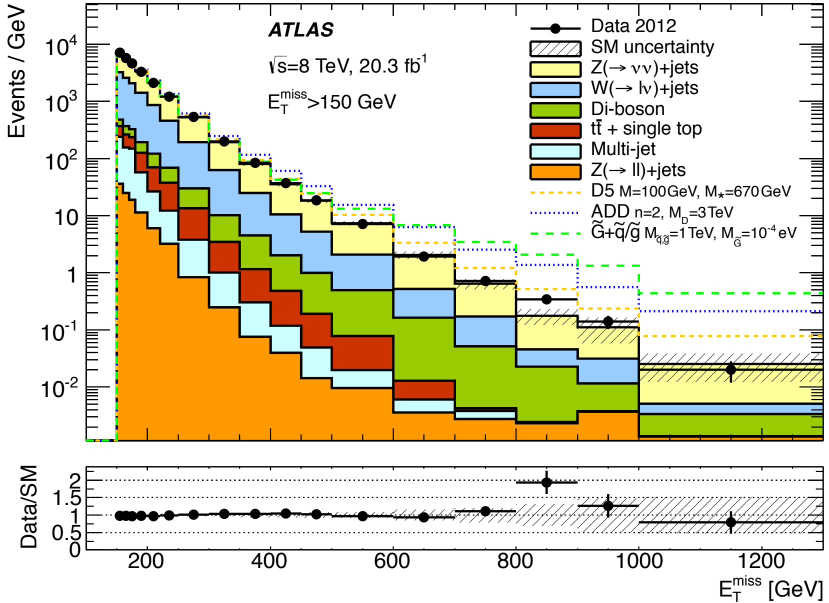
Search for new phenomena in final states with an energetic jet and large E_T^{miss} with ATLAS

1 energetic jet + E_T^{miss}
Target of the search

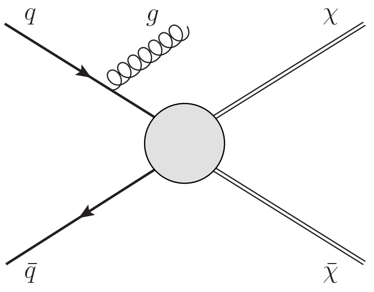


arxiv:1502.01518

- Multiple interpretations:
  - large extra spatial dimensions (LED)
  - pair production of weakly interacting dark matter candidates (WIMP)
  - production of very light gravitinos in a GMSB SUSY model
- WIMPs are assumed to be produced in pairs, and the events are identified via the presence of an energetic jet from initial-state radiation (ISR) yielding large E_T^{miss}
- Event selection:
  - at least one jet with $p_T > 120$ GeV, $|\eta|<2$
  - no leptons
  - leading jet $p_T/E_T^{miss} > 0.5$
  - $d\phi(\text{jet}, E_T^{miss}) > 1.0$
  - 9 SRs with increasing E_T^{miss} requirements (> 150 GeV - > 700 GeV)

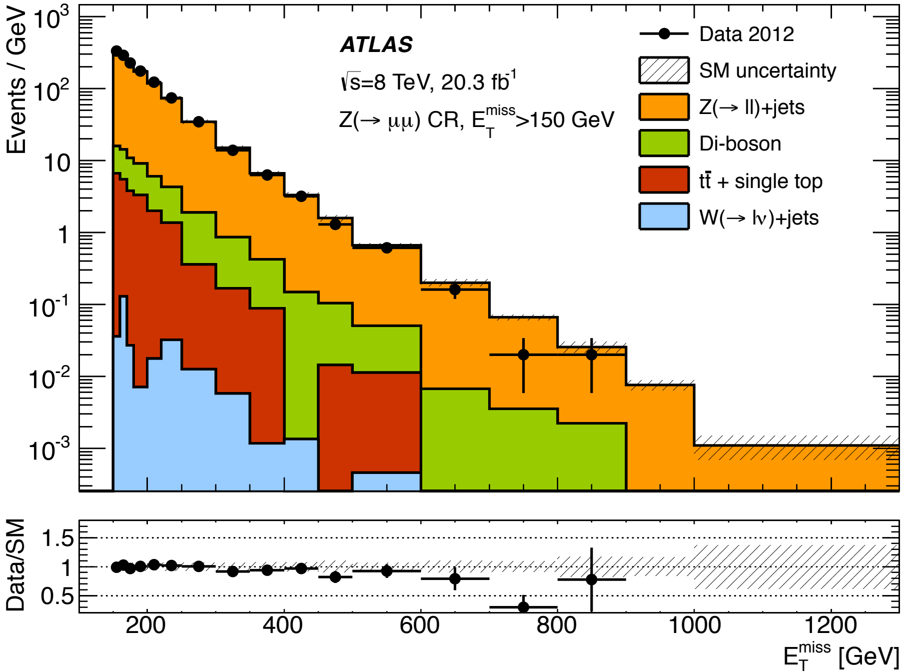


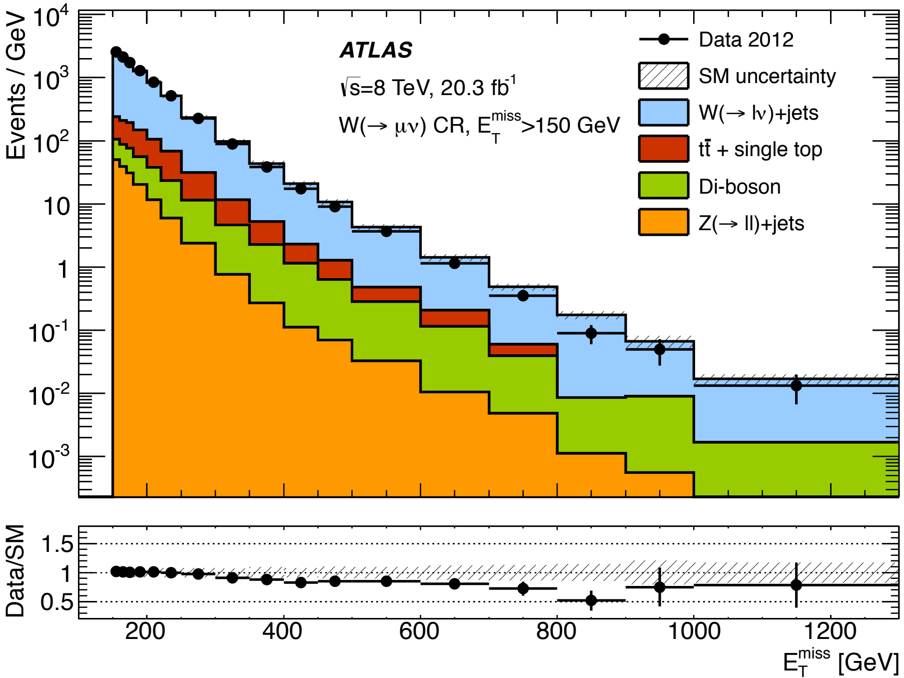
1 energetic jet + E_T^{miss}
Background estimation



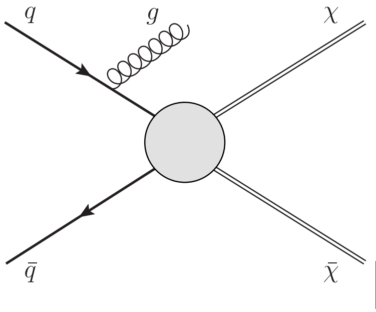
arxiv:1502.01518

- W+jets and $Z(\rightarrow \nu\bar{\nu})$+jets backgrounds are estimated using MC normalized using data in CRs
- $Z/\gamma^*(\rightarrow \ell^+\ell^-)$+jets, $t\bar{t}$, single top, and dibosons are determined using MC
- Multijet background contribution extracted from data
- MC expectations provide a fair description of the shapes in data



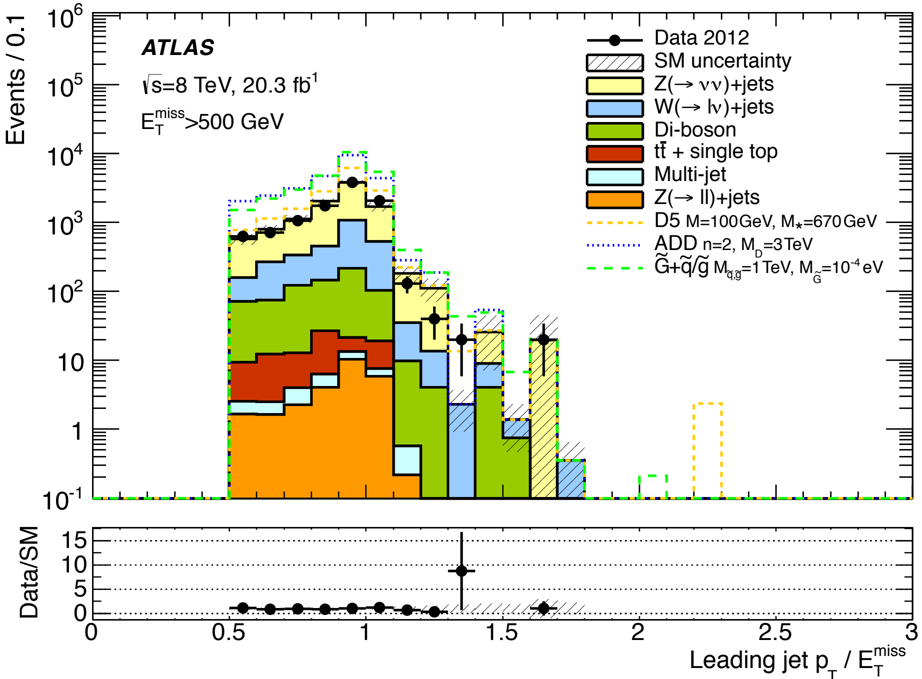


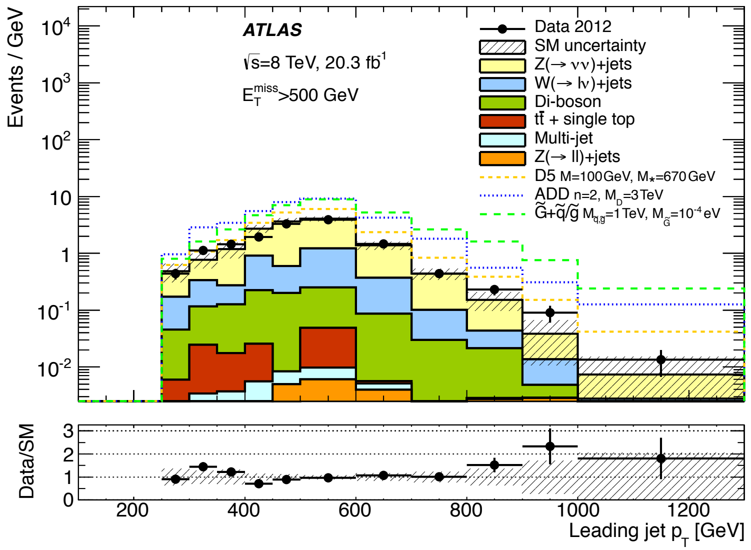
1 energetic jet + E_T^{miss}
Signal regions definition

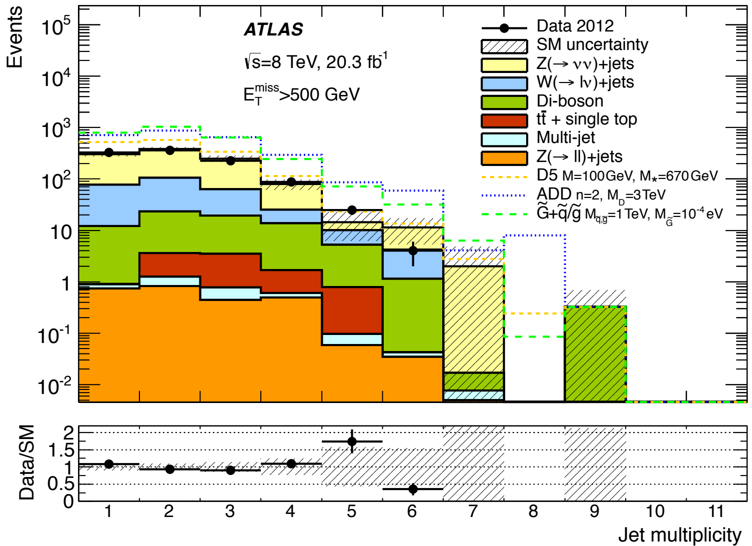


arxiv:1502.01518

- Signal region 7:
  - at least one jet with $p_T > 120$ GeV
  - no leptons
  - leading jet $p_T/E_T^{miss} > 0.5$
  - $\Delta\phi$(jet, E_T^{miss}) > 1.0
  - $E_T^{miss} > 500$ GeV



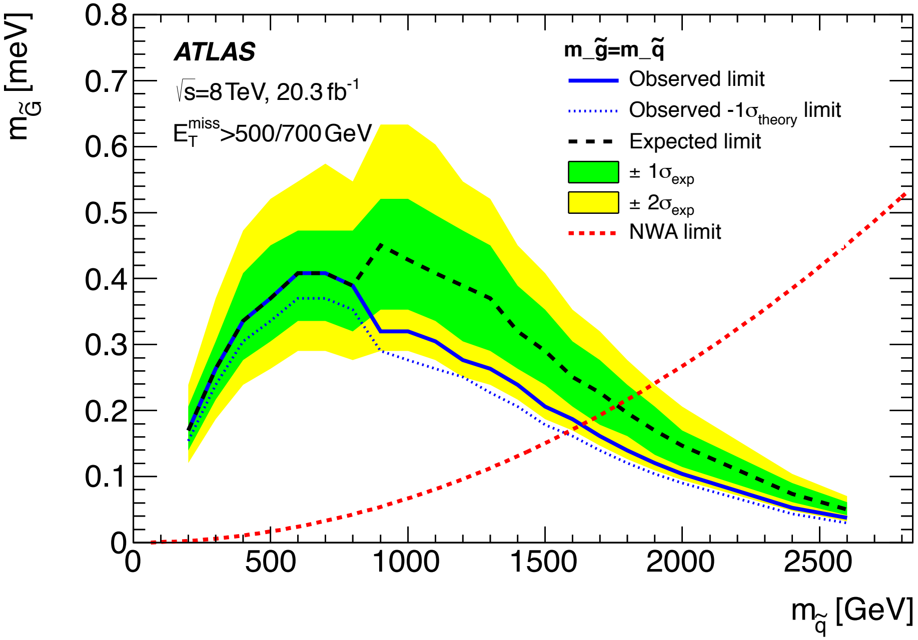


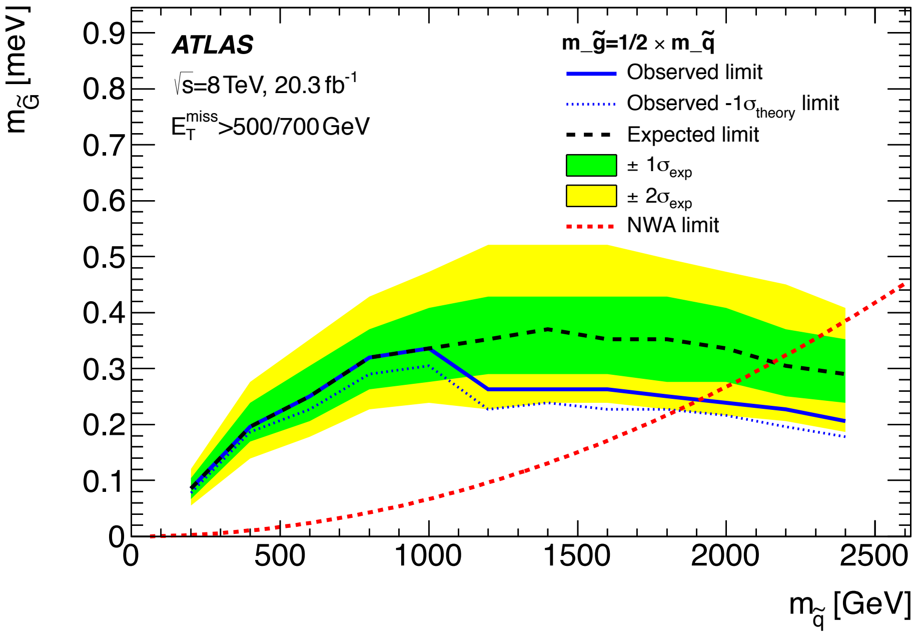


1 energetic jet + E_T^{miss} SUSY interpretations

arxiv:1502.01518

- Good agreement between data and SM expectations
- Results interpretation in GMSB scenarios
  - the gravitino $\tilde{G}$ (spin-3/2 superpartner of the graviton) is the LSP
- The gravitino mass as a function of squark mass for degenerate and non degenerate squark and gluino masses ($m(\tilde{g})=1/2m(\tilde{q})$)





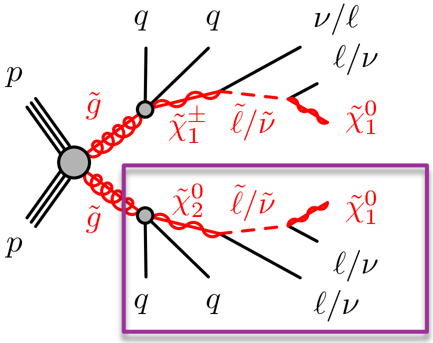
2 leptons + jets + E_T^{miss}

Search for SUSY in events containing a same-flavour opposite-sign dilepton pair, jets, and large E_T^{miss} with the ATLAS detector

2 SFOS leptons + jets + E_T^{miss}
Target of the search

arxiv:1503.03290

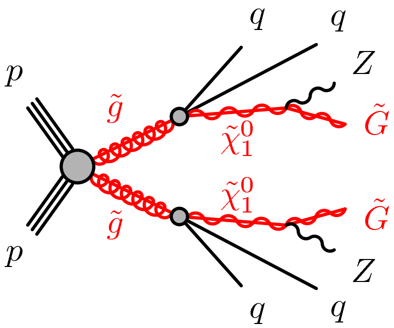
Off-Z



- Search outside Z window for a kinematic edge in dilepton invariant mass $m_{\ell\ell}$
- ≥2 or 4 jets, with or without b-tags
- CMS found ~2.4σ excess

arxiv:1502.06031

On-Z



- Decays of squarks and gluinos (cascades) with Z bosons in the final state
- Peak in the $m_{\ell\ell}$ distribution around the Z-boson mass
- large E_T^{miss}, large H_T, ≥ 2 jets

2-leptons + jets + E_T^{miss} Background estimation

"Flavour-symmetric" processes dominant

- Same-flavour (SF) contributions can be estimated using information from the different-flavour (DF) contribution
  - Data driven technique
- Dominated by ttbar, and also includes WW, single top (Wt) and Z→ττ production
- 60 % in on-Z SRs
- 90 % in off-Z SRs

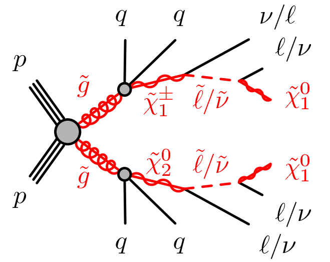
Z/γ^* + jets background

- Consequence of artificial E_T^{miss} from jet mismeasurements
- Important in on-Z search:
  - Data-driven technique is used - jet smearing

Diboson background

- Real Z boson production
- While small in the off-Z regions, contribute up to 25% of the total background in the on-Z regions

Off-Z + jets + E_T^{miss}
Signal and control regions definition

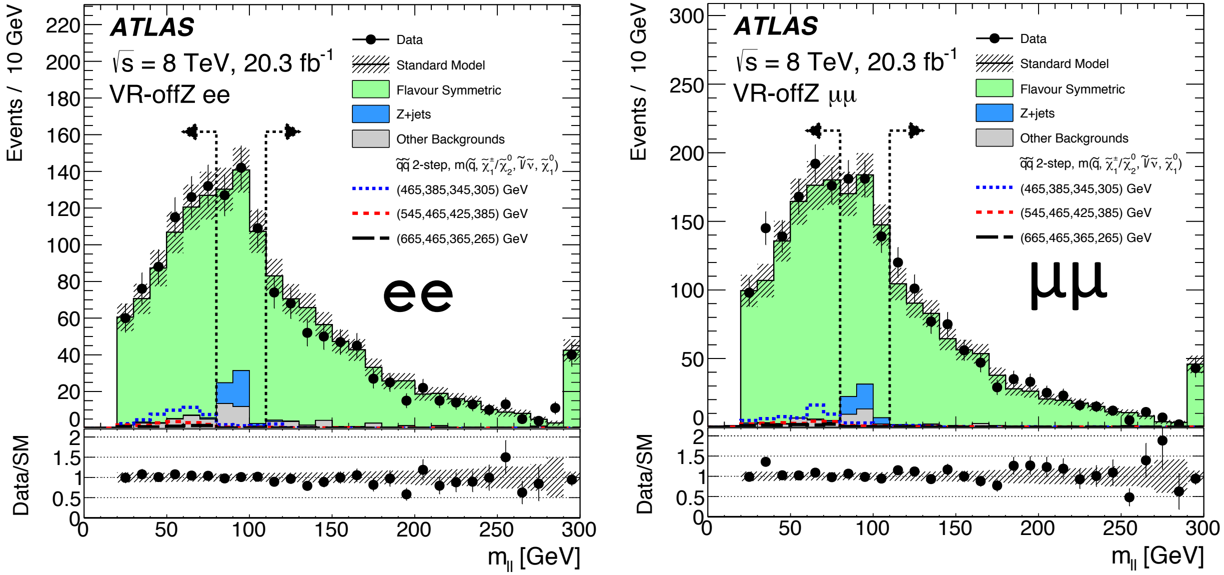


arxiv:1503.03290

- Control regions (CR) designed to constrain the dominant backgrounds
- Validation regions (VR) to check the modeling
- CMS-like region
  - SR-loose

Off-Z region	**E_T^{miss} [GeV]**	**nJet**	**Mll [GeV]**	**SF/DF**
SR-loose	>(150,100)	(2,≥3)	$m_{\ell\ell} \notin [80, 110]$	SF
CRZ-loose	>(150,100)	(2,≥3)	$80 < m_{\ell\ell} < 110$	SF
CRT-loose	>(150,100)	(2,≥3)	$m_{\ell\ell} \notin [80, 110]$	DF
VR-offZ	100-150	=2	$m_{\ell\ell} \notin [80, 110]$	SF

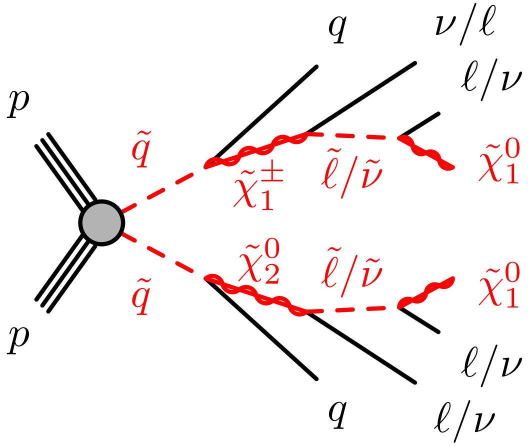
- ● Data
- ▨ Standard Model
- 🟩 Flavour Symmetric
- 🟦 Z+jets
- ⬜ Other Backgrounds

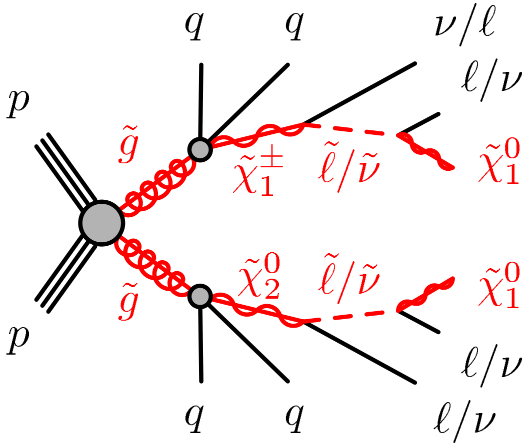


Off-Z + jets + E_T^{miss}
Signal region definition

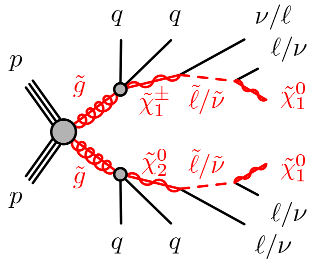
arxiv:1503.03290

- Z-boson mass window is vetoed, 2 regions defined:
  - $20 < m_{\ell\ell} < 80$ GeV
  - $m_{\ell\ell} > 110$ GeV
- At least 2 jets + b-jet veto
  - targeting squark pair production
- At least 4 jets + b-jet veto
  - targeting gluino pair production
- At least one b-tagged jet
  - models where sbottom is the lightest squark
- $E_T^{miss} > 200$ GeV





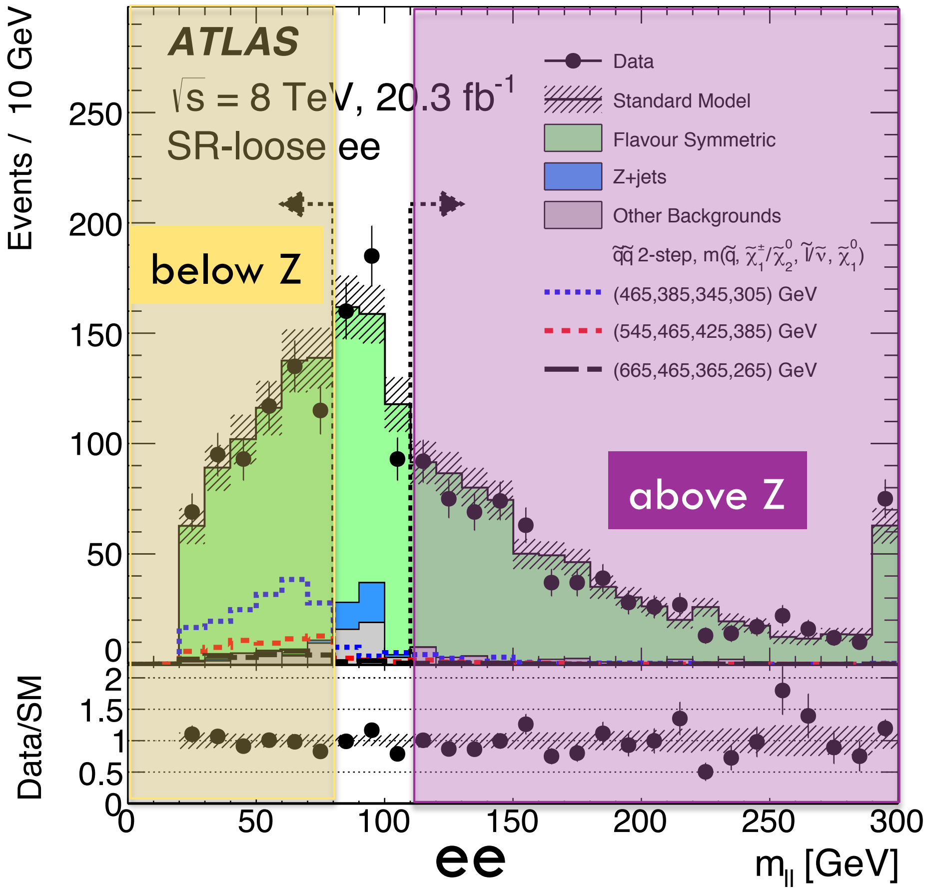
Off-Z + jets + E_T^{miss}
SR-loose

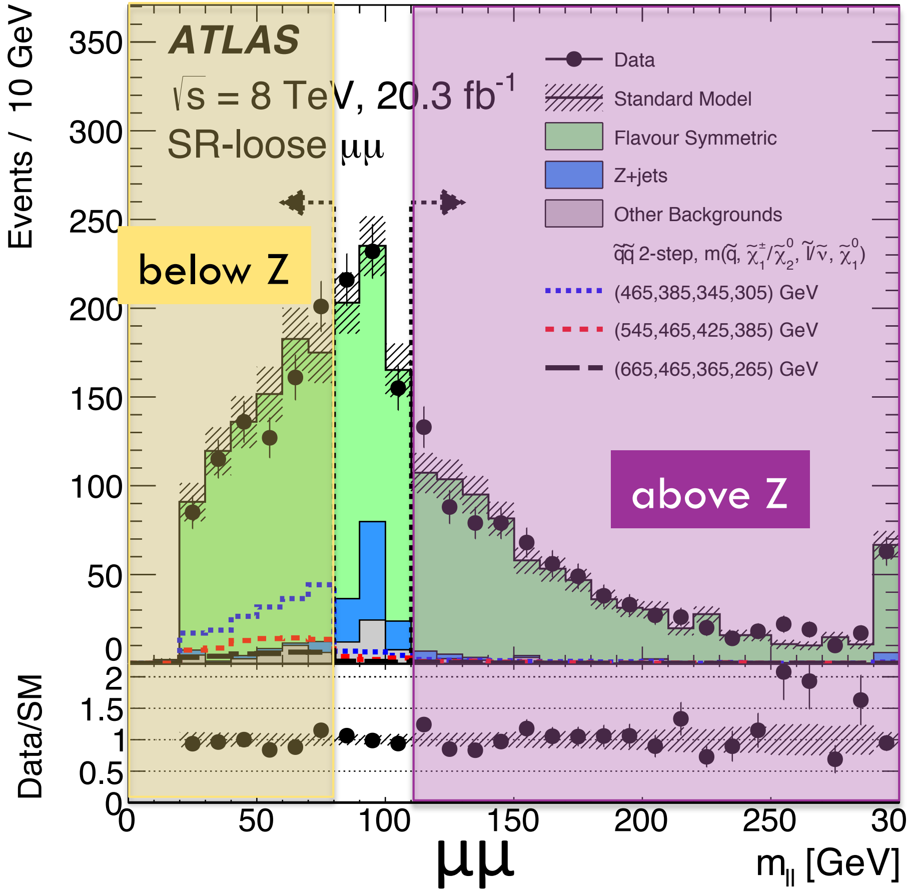


arxiv:1503.03290

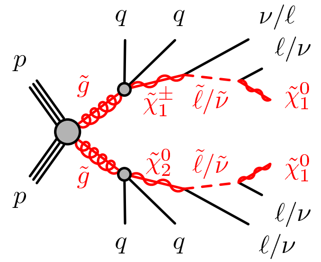
Off-Z region	E_T^{miss} [GeV]	nJet	Mll [GeV]	SF/DF
SR-loose	>(150,100)	(2,≥3)	$m_{\ell\ell} \notin [80, 110]$	SF

No excess!!





Off-Z + jets + E_T^{miss} SR-loose



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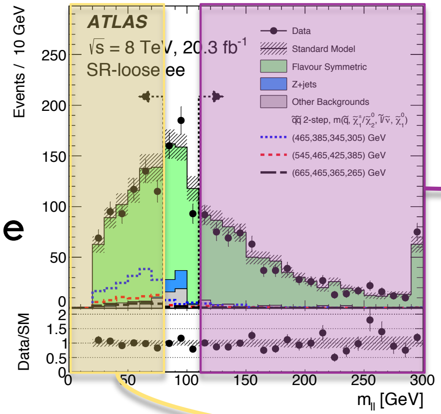
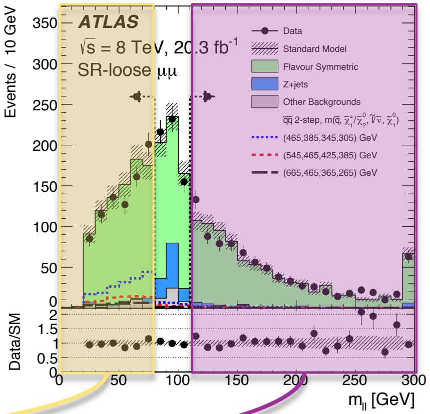


ee

No excess found in the region with the same cuts as the one CMS found excess



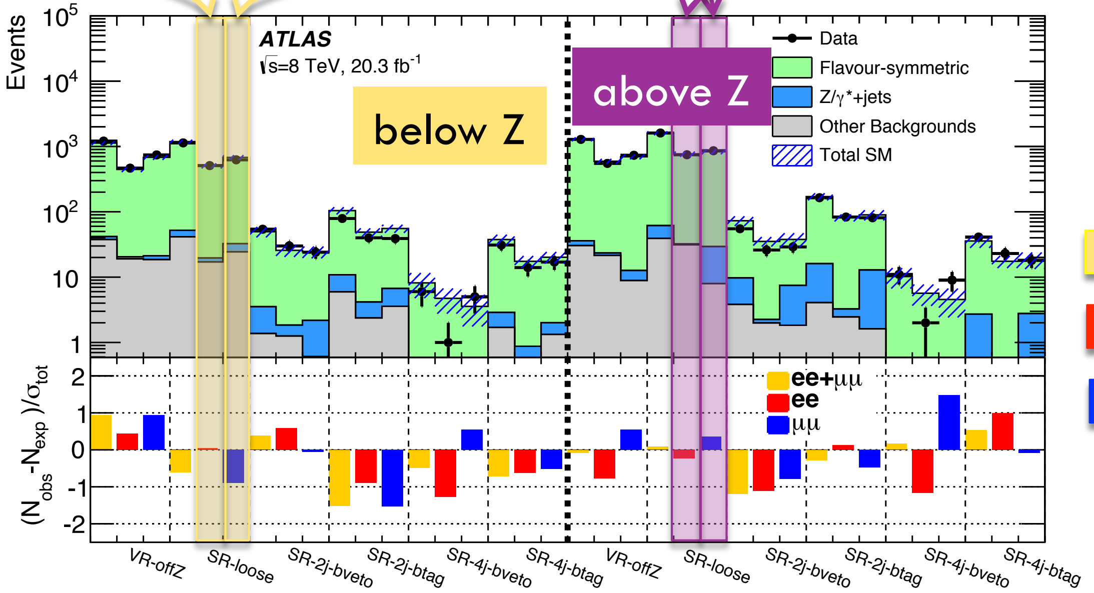
Two channels:

- ☐ ee, μμ

Two regions:

- ☐ Below and above Z

μμ



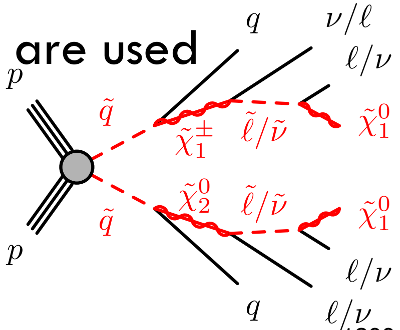
- ●— Data
- ▨ Standard Model
- 🟩 Flavour Symmetric
- 🟦 Z+jets
- ⬜ Other Backgrounds

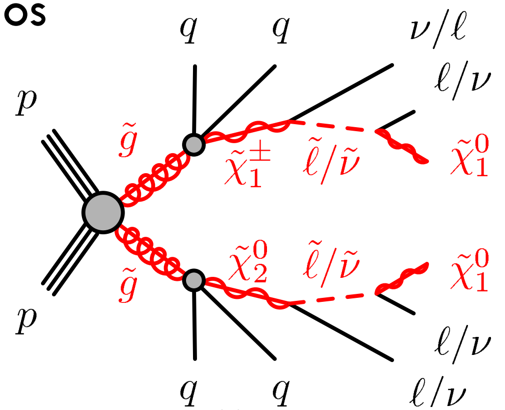
- 🟨 ee+μμ
- 🟥 ee
- 🟦 μμ

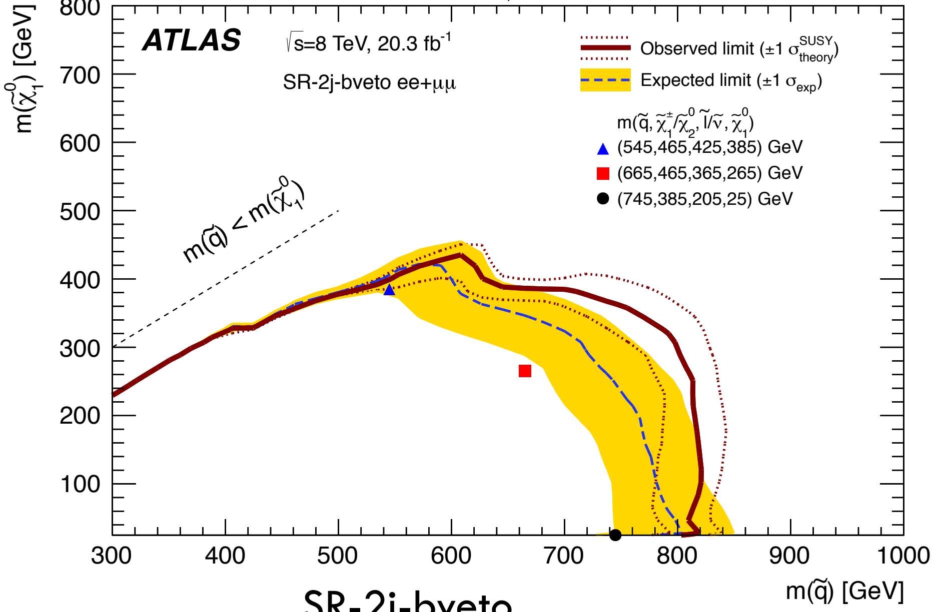
Off-Z + jets + E_T^{miss} Interpretations

arxiv:1503.03290

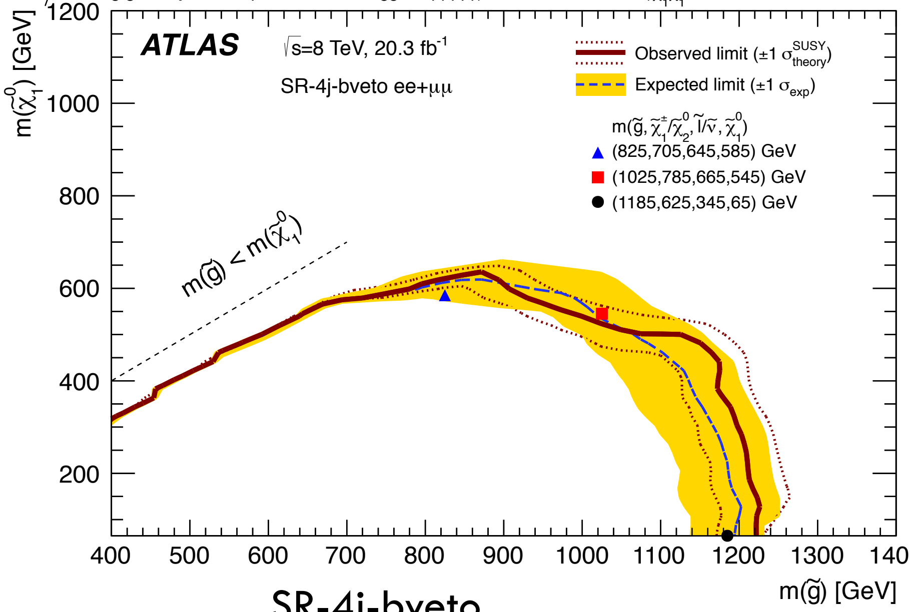
- May be produced in the cascade decays of squarks and gluinos via several mechanisms
- Combined ee+μμ channels are used







SR-2j-bveto



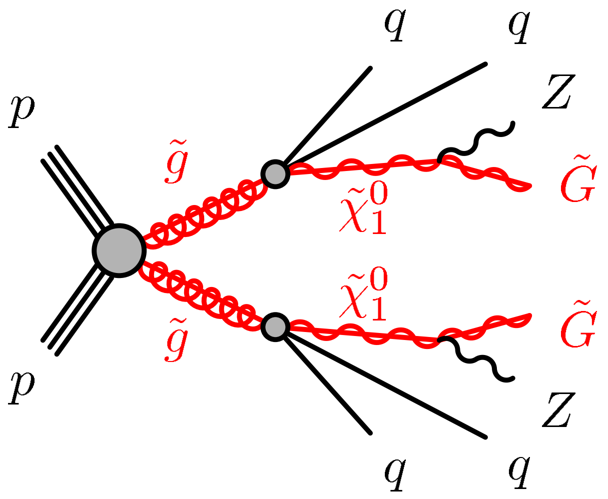
SR-4j-bveto

On-Z + jets + E_T^{miss}
Event selection

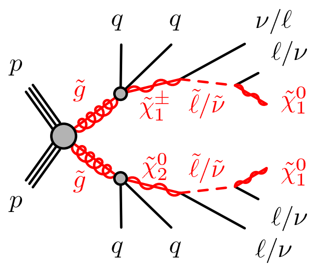
arxiv:1503.03290

- At least two leptons (electrons or muons) oppositely charged
- At least 2 jets
- Z boson mass window 81 < $m_{\ell\ell}$ < 101 GeV
- E_T^{miss} > 225 GeV
- H_T > 600 GeV
- dϕ (jet, E_T^{miss}) > 0.4
  - reject events with jet mismeasurements

$$H_{\mathrm{T}} = \sum_i p_{\mathrm{T}}^{\mathrm{jet},i} + p_{\mathrm{T}}^{\mathrm{lepton},1} + p_{\mathrm{T}}^{\mathrm{lepton},2}$$



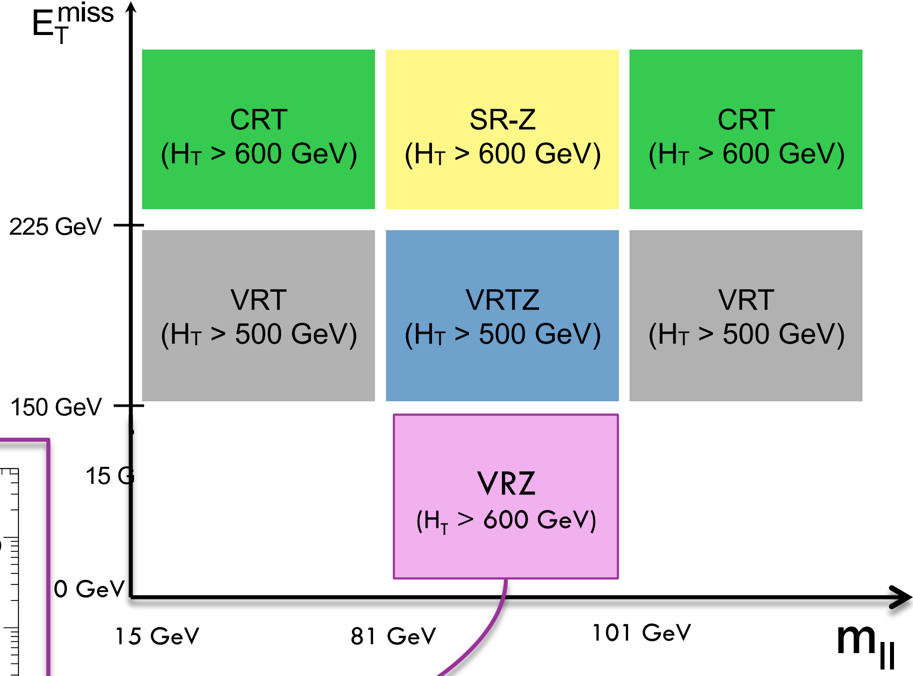
On-Z + jets + E_T^{miss}
Control and validation regions

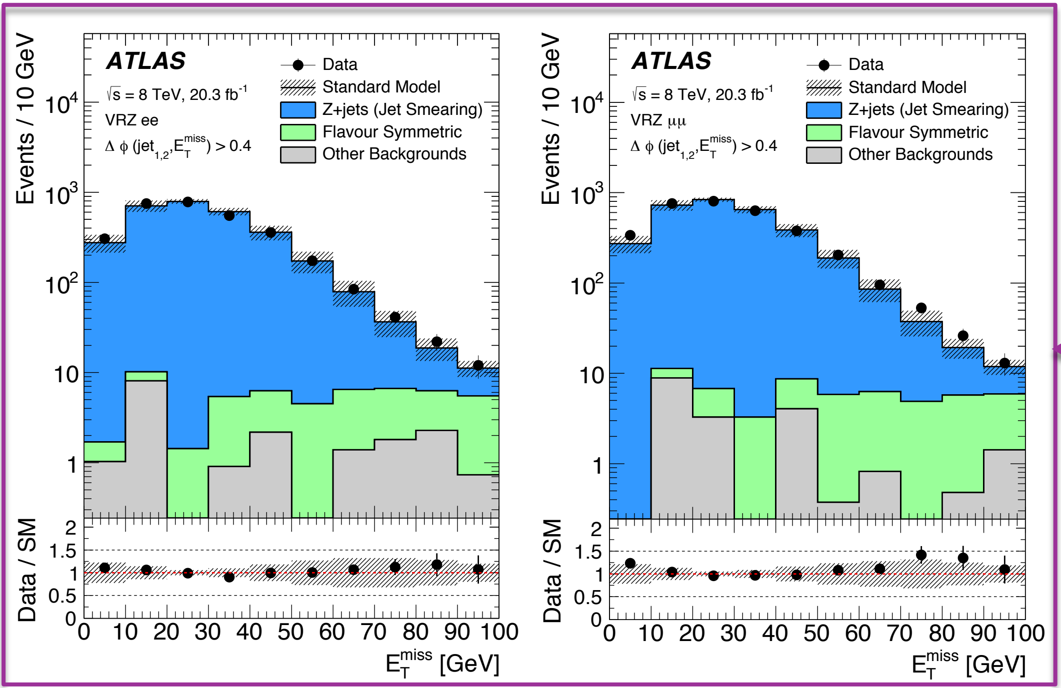


arxiv:1503.03290

Z/ γ *+jets background

- data-driven technique is used
  - Jet smearing
- Validated in VRZ





- ● Data
- ▨ Standard Model
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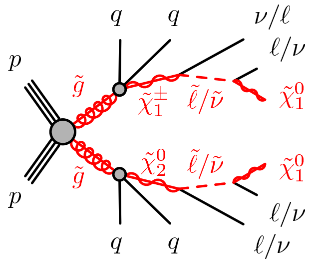
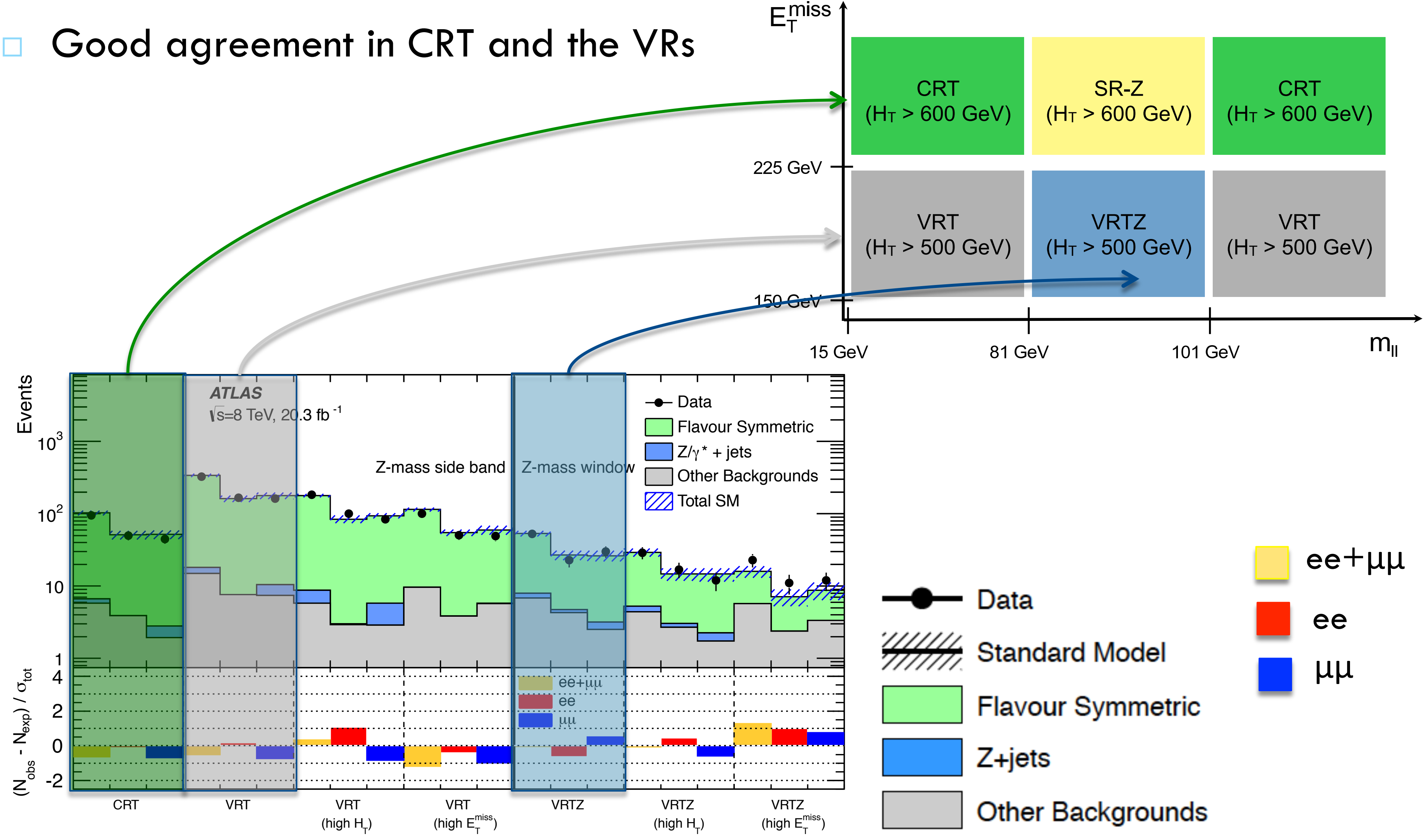
On-Z + jets + E_T^{miss}

Control and validation regions

arxiv:1503.03290



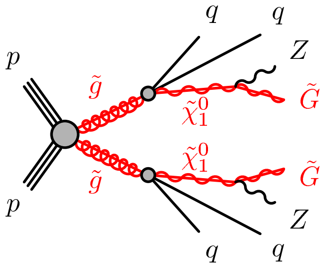
- Good agreement in CRT and the VRs

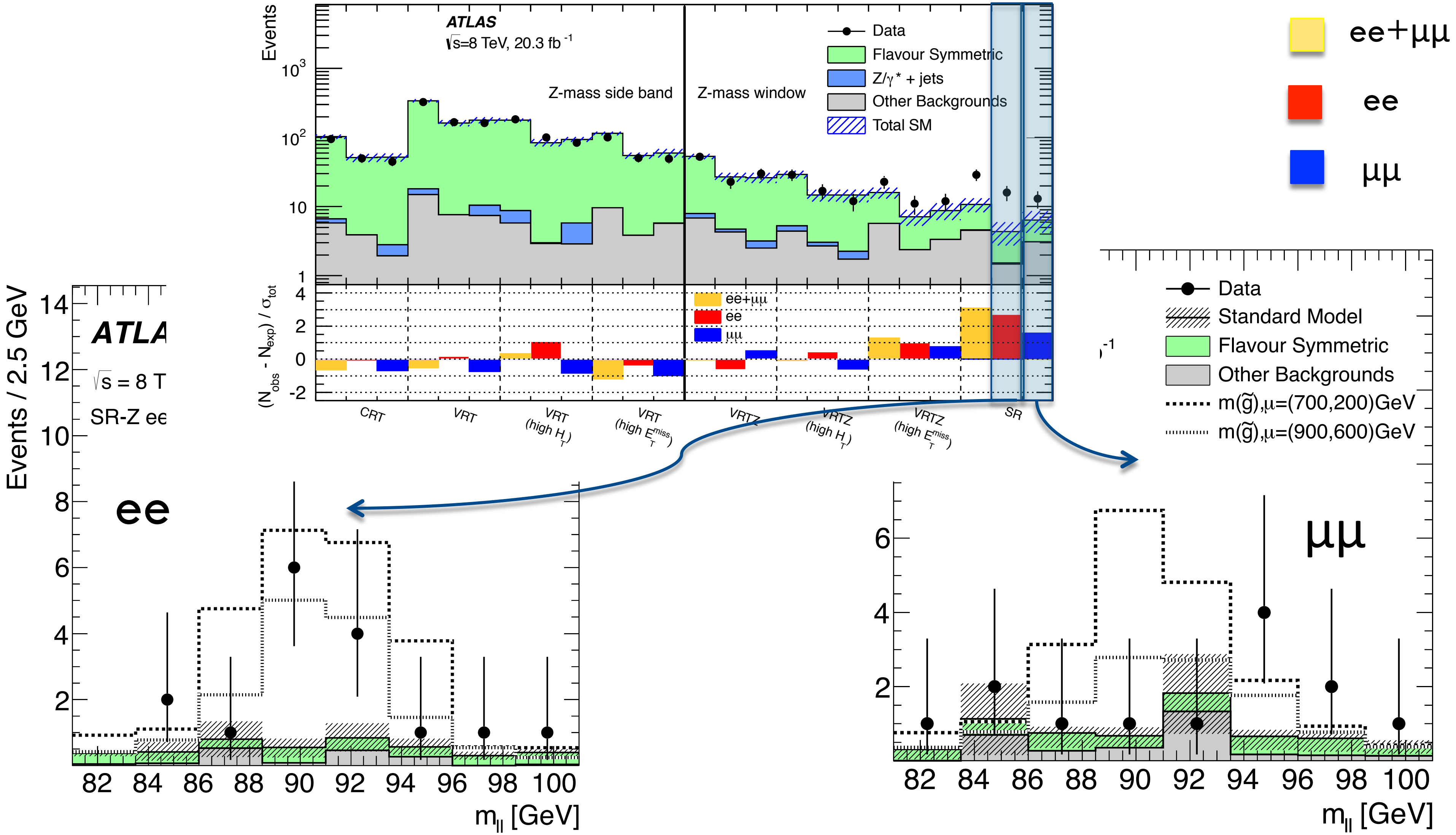


CRT (H_T > 600 GeV)	SR-Z (H_T > 600 GeV)	CRT (H_T > 600 GeV)
VRT (H_T > 500 GeV)	VRTZ (H_T > 500 GeV)	VRT (H_T > 500 GeV)

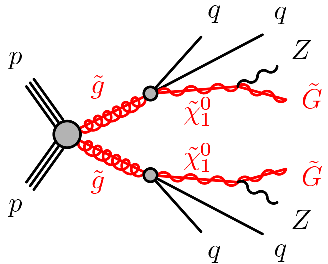
On-Z + jets + E_t^{miss}
Signal region

arxiv:1503.03290





On-Z + jets + E_T^{miss} Signal region

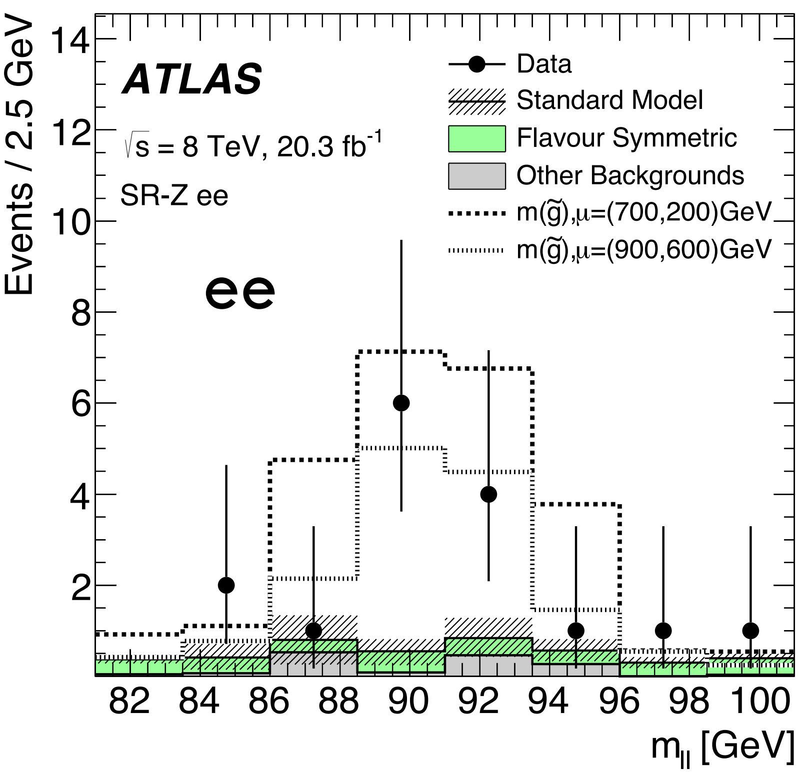


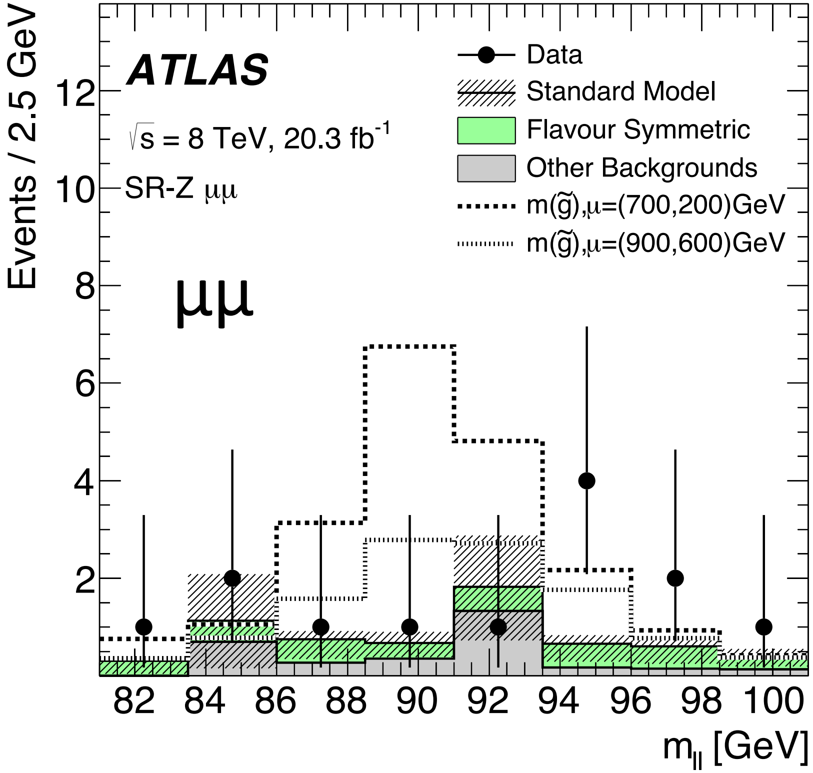
arxiv:1503.03290

3 σ excess

- Dominated by ee channel

channel	nObs	nExp	p-value	significance
ee+μμ	16	4.2±1.6	0.0013	3.0
ee	13	6.4±2.2	0.0013	3.0
μμ	29	10.6±3.2	0.0430	1.7

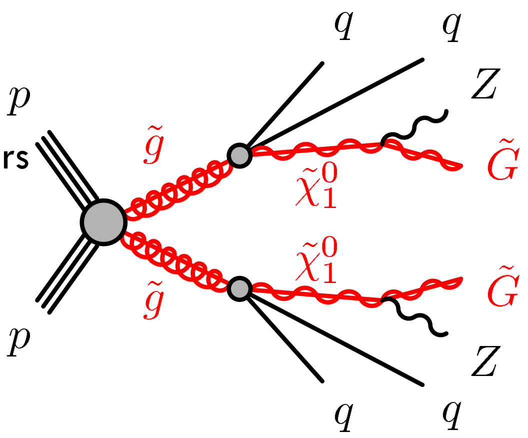




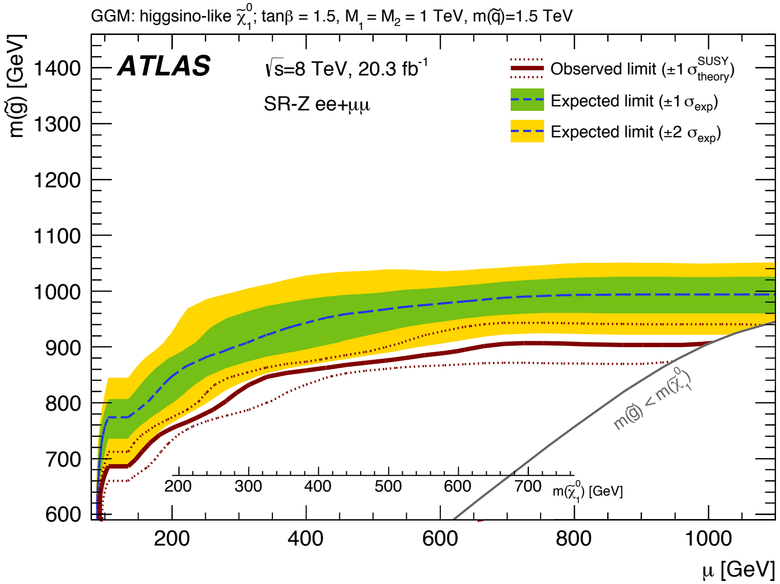
On-Z + jets + E_T^{miss} Interpretations

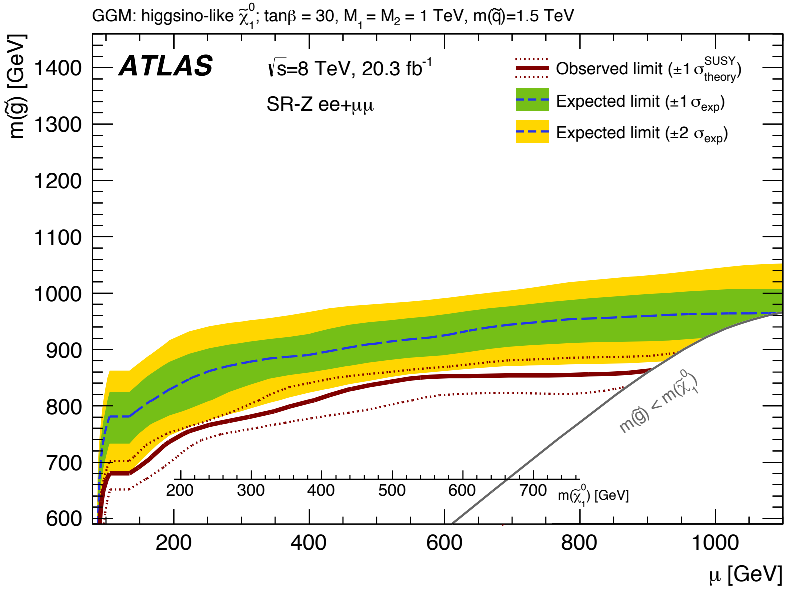
arxiv:1503.03290

- GGM model:
  - the gravitino is the LSP and the NLSP is a higgsino-like neutralino
  - The higgsino mass parameter, μ , and the gluino mass are free parameters
  - Gaugino mass parameters, M_1 and M_2, are fixed to be 1 TeV
  - All other sparticles are set at 1.5 TeV
  - μ is set to be positive to make the dominant NLSP decay
  - $\tan\beta = 1.5$ (left) and $\tan\beta = 30$ (right)



- Results in SR-Z ee and SR-Z μμ are considered simultaneously





Combination 0/1-lepton + jets + E_T^{miss}

Combination of searches for strongly-produced SUSY particles with the ATLAS detector

Statistical combination of all-hadronic and one-lepton analyses targeting scalar top pair production with the ATLAS detector

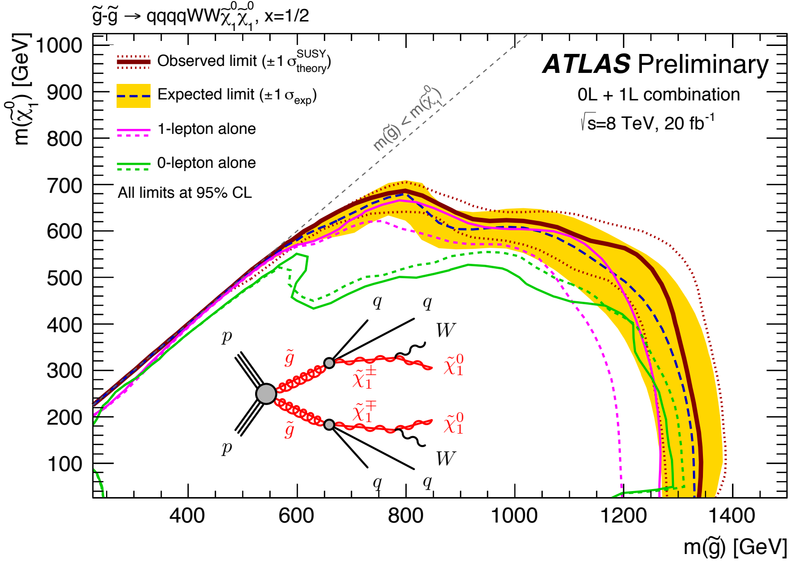
Combination 0/1-lepton + jets + E_T^{miss} sq/gl searches

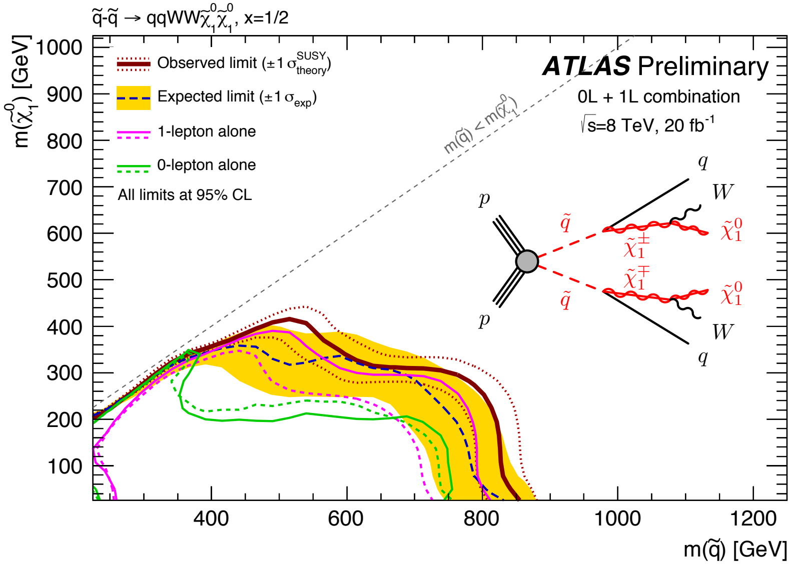
ATLAS-CONF-2015-011

- Statistical combination of analyses targeting strong production:
  - 0-lepton + jets + E_T^{miss} arxiv:1405.7875
  - 1-lepton + jets + E_T^{miss} arxiv:1501.03555
- Analyses have similar sensitivities in some of the considered simplified models
  - Pair production of gluinos or squarks with a decay through intermediate chargino
- Some modification in CRs to ensure a complete statistical independence

Increase in sensitivity:

- ~50 GeV in comparison to individual analyses for light LSP

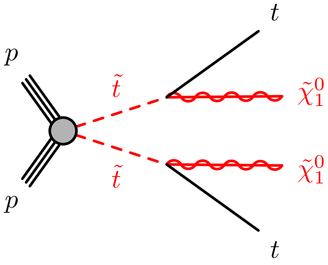


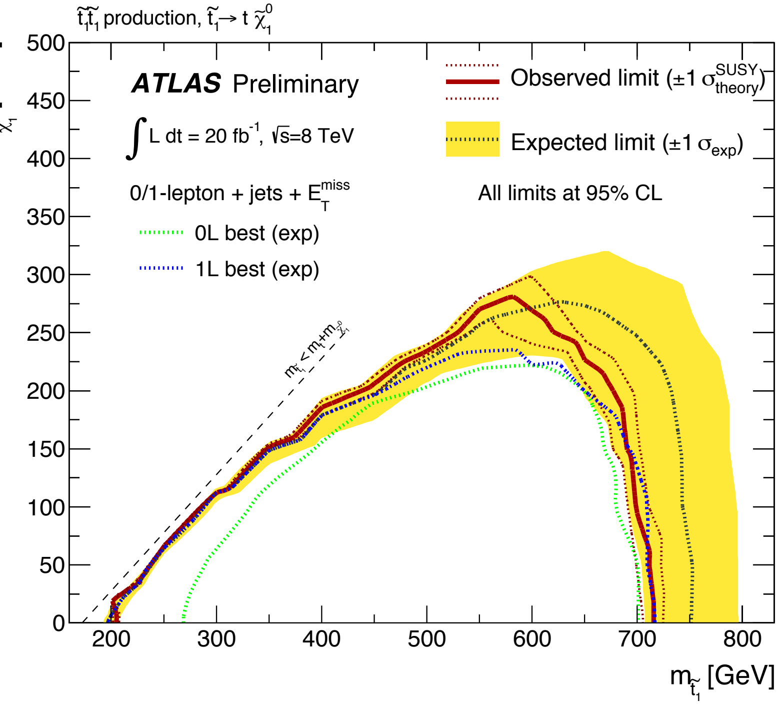


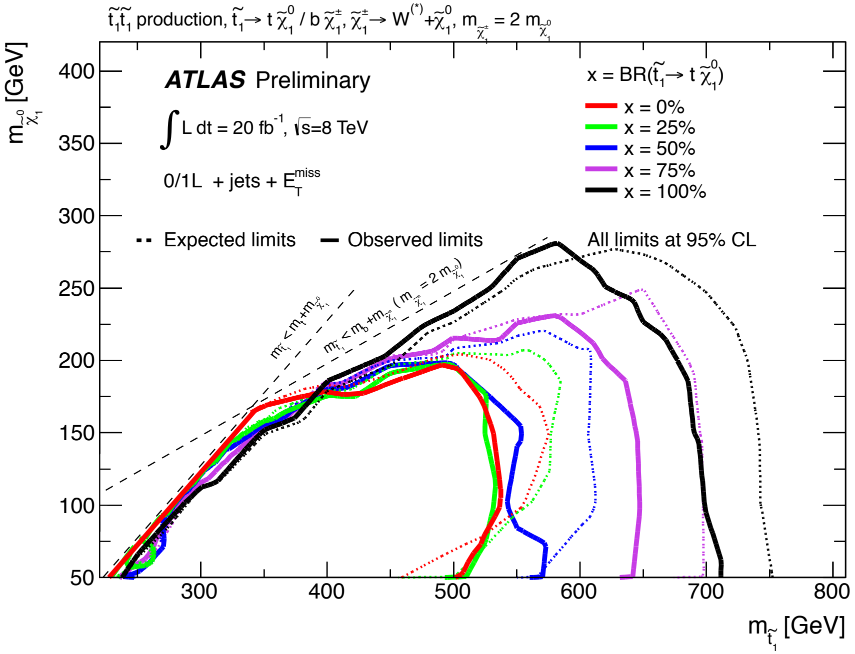
Combination 0/1-lepton + jets + E_T^{miss} stop searches

ATLAS-CONF-2015-010

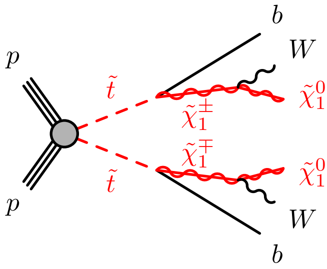
- Statistical combination of analyses targeting stop pair production:
  - Stop 0-lepton arxiv:1406.1122
  - Stop 1-lepton arxiv:1407.0583







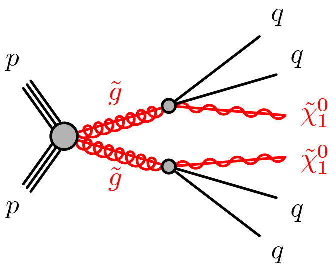
- A similar combination is performed that targets a scenario where the stop can decay into top with branching ratio *x* and into b+chargino with branching ratio *1-x*



Run-2 expected sensitivity

Expected sensitivity studies for gluino and squark searches using the early LHC 13 TeV Run-2 dataset with the ATLAS experiment

Run-2 expected sensitivity
0-lepton + jets + E_T^{miss}

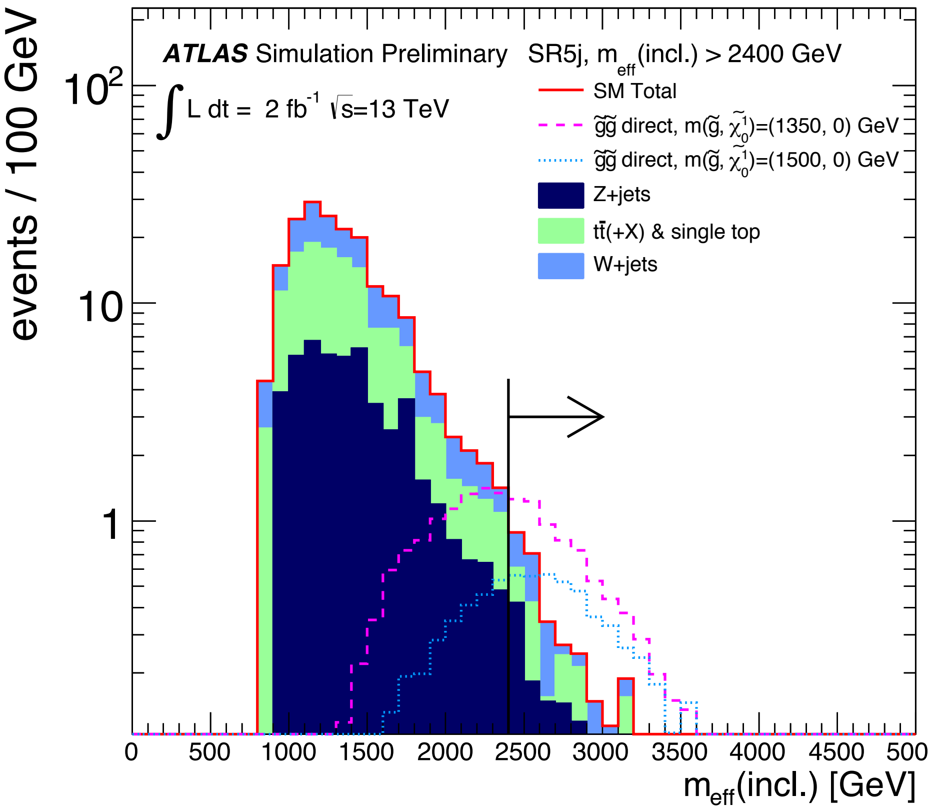


ATL-PHYS-PUB-2015-005

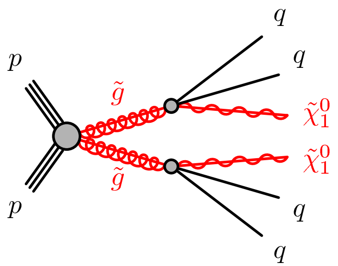
- Discovery reach in Run-2 is expected to be greatly enhanced due to LHC going from 8 TeV to 13 TeV
- Understanding when our 13TeV discovery potential will surpass our 8TeV limits for several analyses
- Analyses similar to Run-1
  - Same discriminating variables: m_{eff}, E_T^{miss}, dϕ(jet, E_T^{miss}), $E_T^{\text{miss}}/m_{\text{eff}}$…

$$m_{\text{eff}} \equiv \sum_{i=1}^{n} |\mathbf{p}_{\mathrm{T}}^{(i)}| + E_{\mathrm{T}}^{\text{miss}}$$

- Signal region 5jet selection:
  - p_T(jet1) and p_T(jet2) > 200 GeV
  - At least 5 jets with p_T > 60 GeV
  - Electron and muon veto
  - $E_T^{\text{miss}}/m_{\text{eff}}$ > 0.2
  - m_{eff} > 2200 GeV



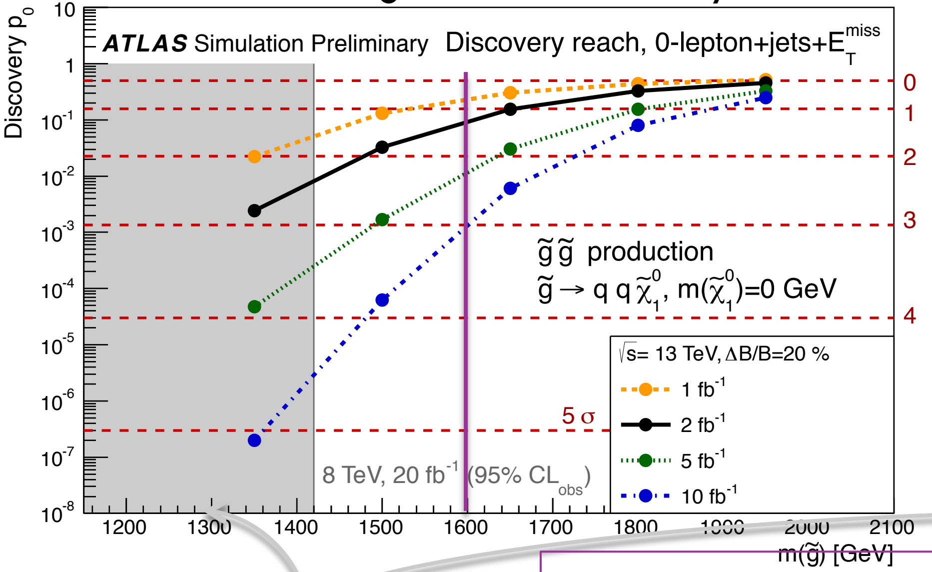
Run-2 expected sensitivity
0-lepton + jets + E_T^{miss}



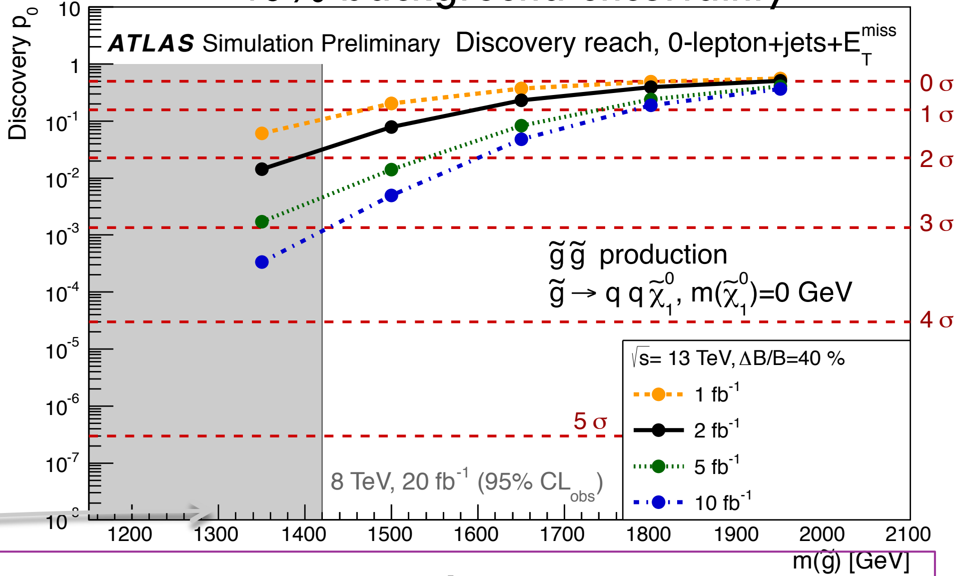
ATL-PHYS-PUB-2015-005

- Various assumptions on the integrated luminosity (1, 2, 5, or 10 fb^{-1})
  - LHC is expected to deliver 2 fb^{-1} by the summer of 2015, 10 fb^{-1} in the first year of Run-2
- Uncertainty on the total background prediction is assumed to be 20% as in Run-1
  - Also consider a conservative scenario with the total background uncertainty of 40%
- Several signal regions defined

20% background uncertainty



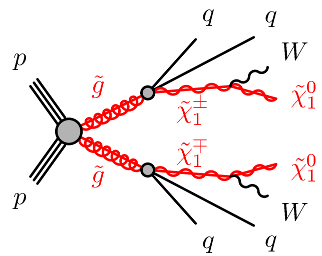
40% background uncertainty



Excluded with Run-1

With an integrated luminosity of 10 fb^{-1}, 3 σ evidence can be obtained for a gluino with a mass of 1600 GeV

Run-2 expected sensitivity
1-lepton + jets + E_T^{miss}

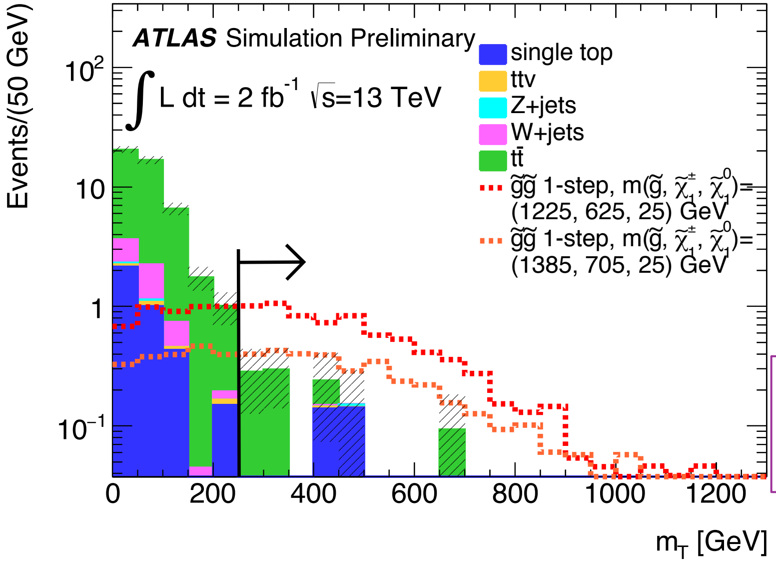


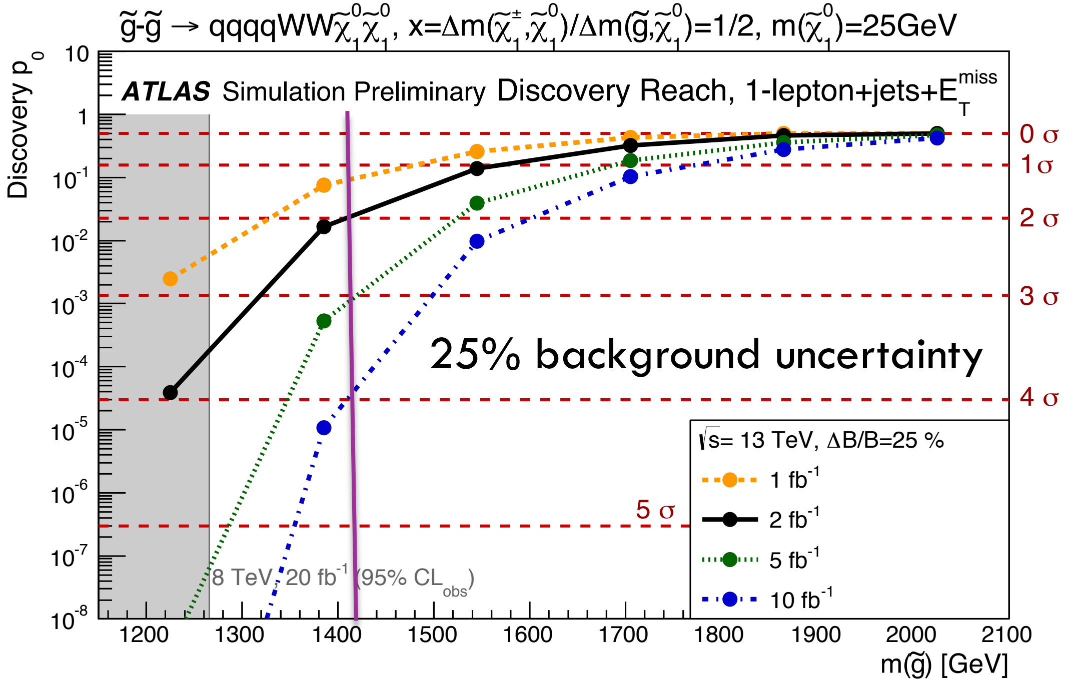
ATL-PHYS-PUB-2015-005

- Analysis similar to Run-1
  - Same discriminating variables: m_{eff}, E_T^{miss}, m_T…
- Signal region selection:
  - 1 lepton with p_T > 25 geV
  - 5 jets with p_T > 100 GeV
  - p_T(leading jet) > 150 GeV
  - E_T^{miss} > 200 GeV
  - m_T > 250 GeV
  - m_{eff} > 1400 GeV

$$m_T = \sqrt{2p_T^\ell E_T^{miss}(1-\cos[\Delta\phi(\vec{\ell},\vec{p}_T^{miss})])}$$

$$m_{eff}^{lepton} = p_T^\ell + \sum p_T^{jet} + E_T^{miss}$$





With an integrated luminosity of 5 fb^{-1}, 3 σ evidence can be obtained for a gluino with a mass of 1400 GeV

Conclusion

- Still new interesting papers from ATLAS with Run-1 data!
  - Filling gaps, finishing complex searches
  - Excess in on-Z + jets + E_T^{miss} search!!
    - Need to follow it up in Run-2!
- In parallel getting ready for 13 TeV data

Back up

1 energetic jet + E_T^{miss}
Control regions

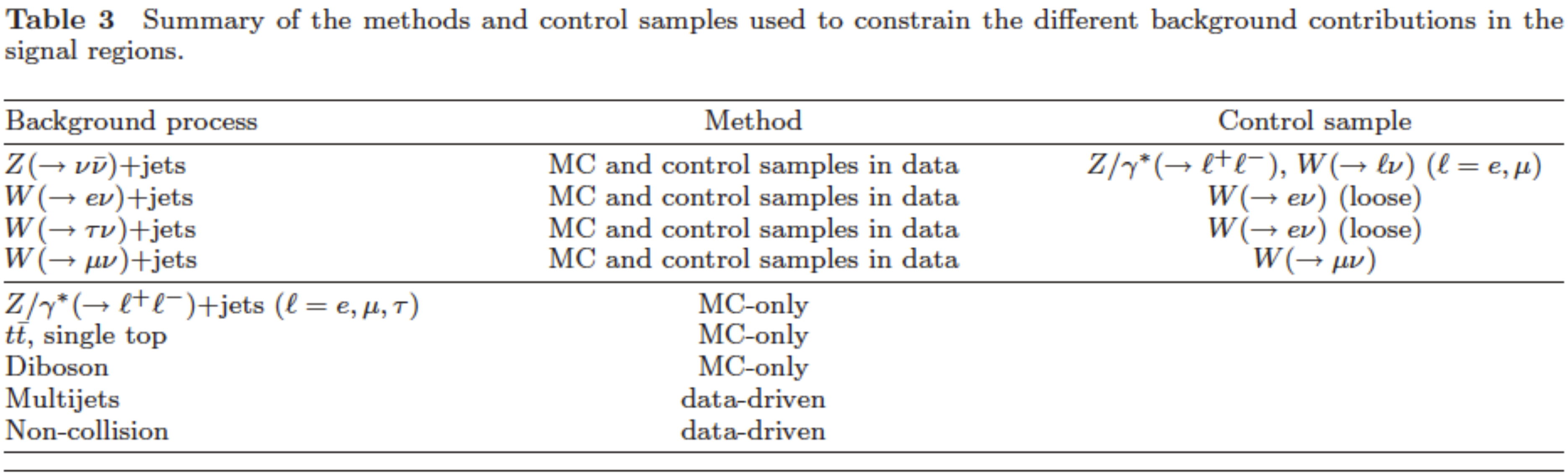


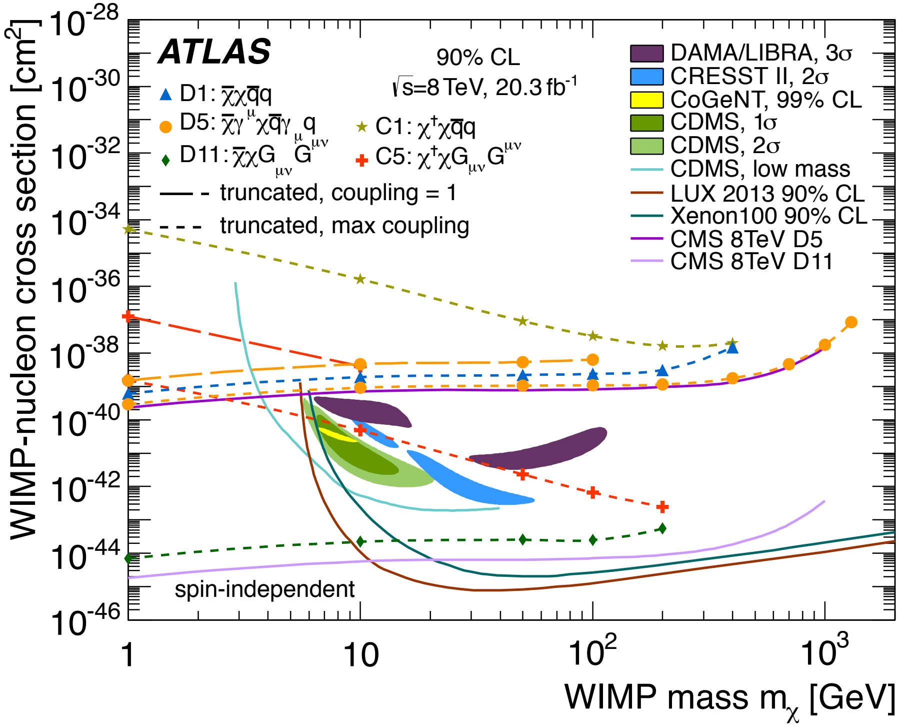
Table 3 Summary of the methods and control samples used to constrain the different background contributions in the signal regions.

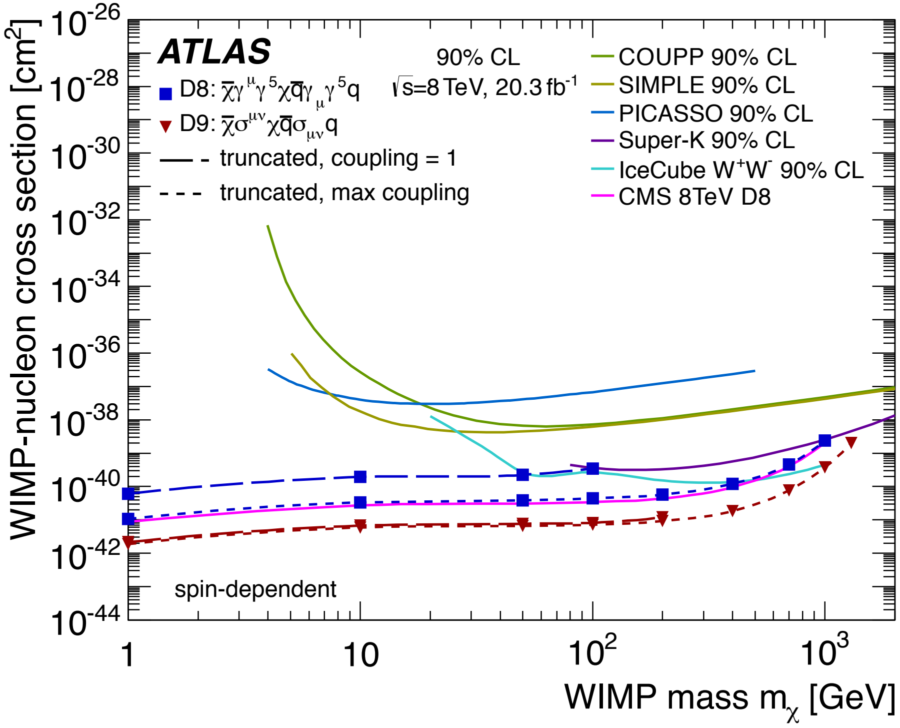
Background process	Method	Control sample
$Z(\rightarrow \nu\bar{\nu})$+jets	MC and control samples in data	$Z/\gamma^*(\rightarrow \ell^+\ell^-)$, $W(\rightarrow \ell\nu)$ $(\ell = e, \mu)$
$W(\rightarrow e\nu)$+jets	MC and control samples in data	$W(\rightarrow e\nu)$ (loose)
$W(\rightarrow \tau\nu)$+jets	MC and control samples in data	$W(\rightarrow e\nu)$ (loose)
$W(\rightarrow \mu\nu)$+jets	MC and control samples in data	$W(\rightarrow \mu\nu)$
$Z/\gamma^*(\rightarrow \ell^+\ell^-)$+jets $(\ell = e, \mu, \tau)$	MC-only	
$t\bar{t}$, single top	MC-only	
Diboson	MC-only	
Multijets	data-driven	
Non-collision	data-driven	

1 energetic jet + E_T^{miss} WIMP

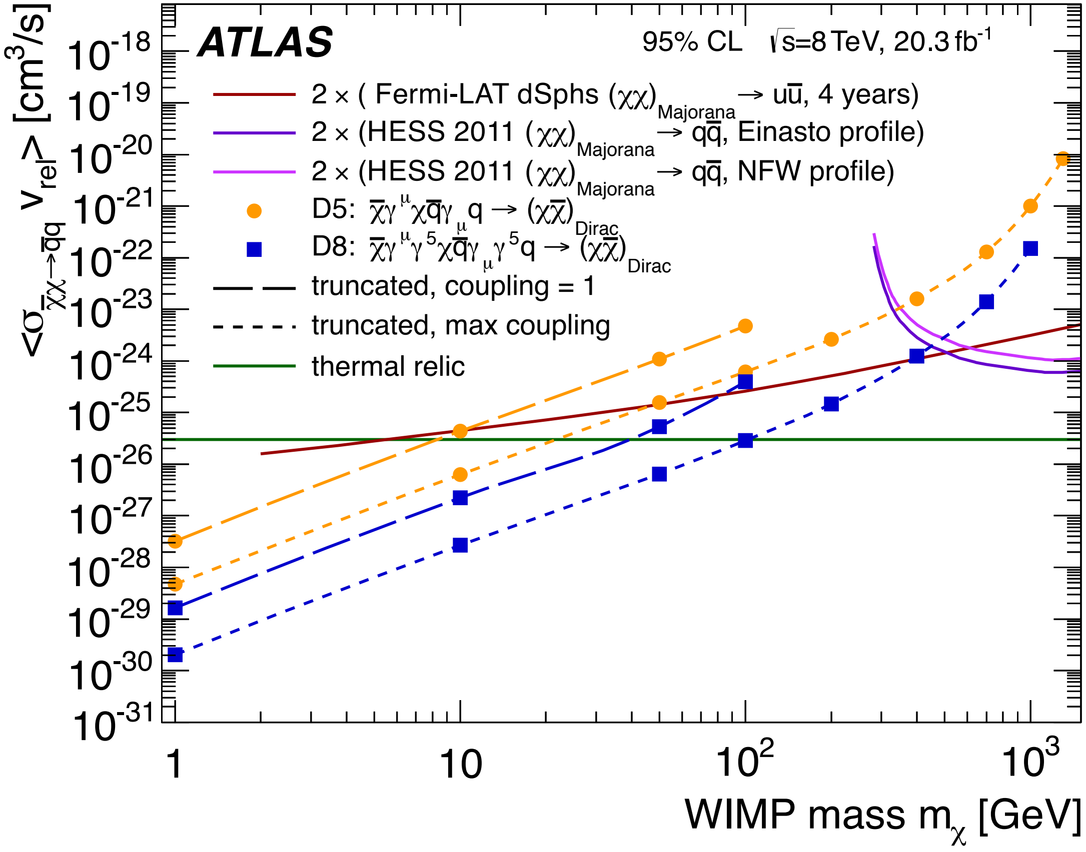
Name	Initial state	Type	Operator
C1	qq	scalar	$\frac{m_q}{M_\star^2}\chi^\dagger\chi\bar{q}q$
C5	gg	scalar	$\frac{1}{4M_\star^2}\chi^\dagger\chi\alpha_s(G_{\mu\nu}^a)^2$
D1	qq	scalar	$\frac{m_q}{M_\star^3}\bar{\chi}\chi\bar{q}q$
D5	qq	vector	$\frac{1}{M_\star^2}\bar{\chi}\gamma^\mu\chi\bar{q}\gamma_\mu q$
D8	qq	axial-vector	$\frac{1}{M_\star^2}\bar{\chi}\gamma^\mu\gamma^5\chi\bar{q}\gamma_\mu\gamma^5 q$
D9	qq	tensor	$\frac{1}{M_\star^2}\bar{\chi}\sigma^{\mu\nu}\chi\bar{q}\sigma_{\mu\nu}q$
D11	gg	scalar	$\frac{1}{4M_\star^3}\bar{\chi}\chi\alpha_s(G_{\mu\nu}^a)^2$

1 energetic jet + E_T^{miss} WIMP

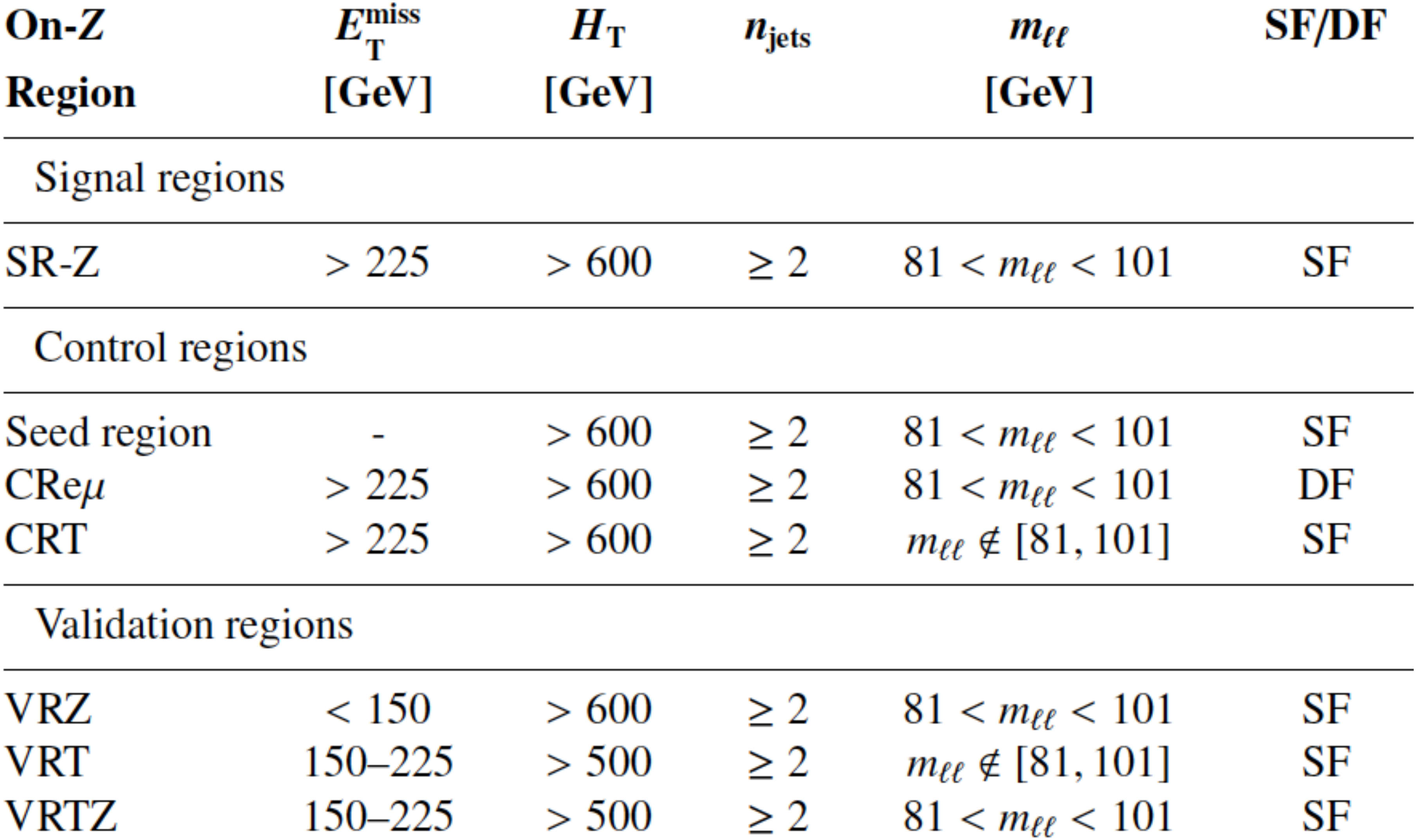




1 energetic jet + E_T^{miss}
WIMP

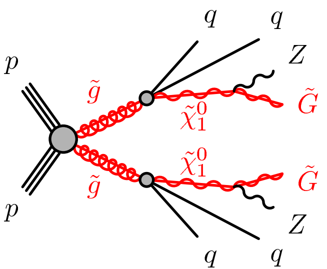


On-Z + jets + E_T^{miss}
Control regions

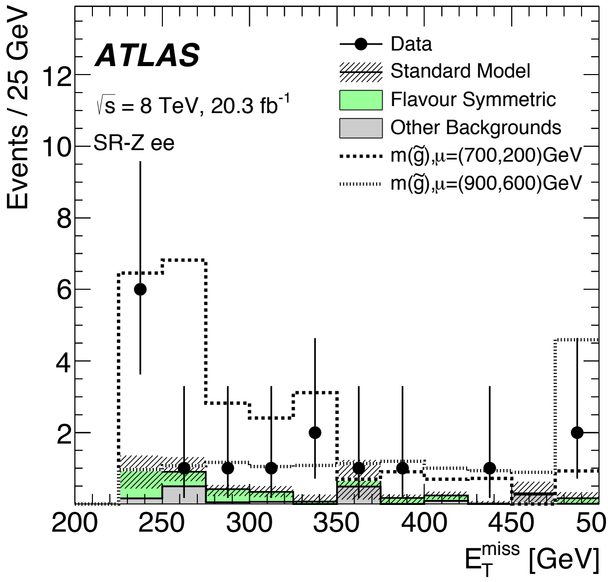


On-Z **Region**	E_T^{miss} **[GeV]**	H_T **[GeV]**	n_{jets}	$m_{\ell\ell}$ **[GeV]**	**SF/DF**
Signal regions					
SR-Z	> 225	> 600	≥ 2	$81 < m_{\ell\ell} < 101$	SF
Control regions					
Seed region	-	> 600	≥ 2	$81 < m_{\ell\ell} < 101$	SF
CReμ	> 225	> 600	≥ 2	$81 < m_{\ell\ell} < 101$	DF
CRT	> 225	> 600	≥ 2	$m_{\ell\ell} \notin [81, 101]$	SF
Validation regions					
VRZ	< 150	> 600	≥ 2	$81 < m_{\ell\ell} < 101$	SF
VRT	150–225	> 500	≥ 2	$m_{\ell\ell} \notin [81, 101]$	SF
VRTZ	150–225	> 500	≥ 2	$81 < m_{\ell\ell} < 101$	SF

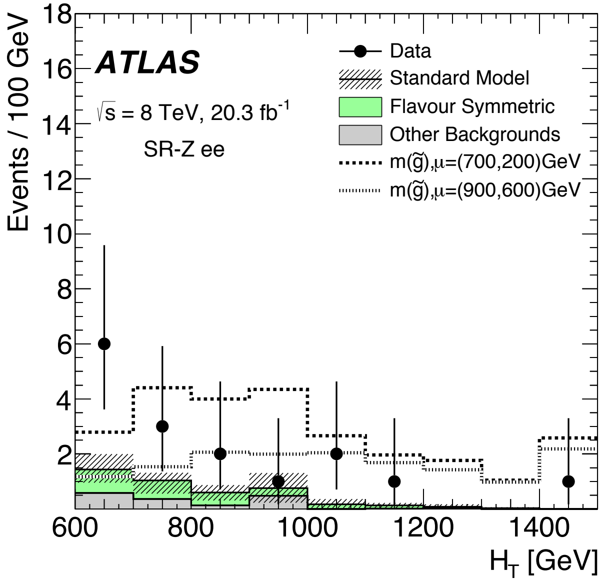
on Z + jets + met



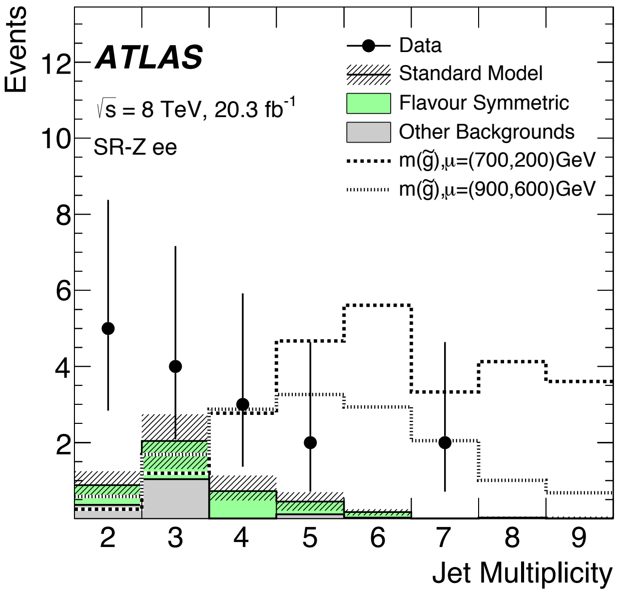
p
p
$\tilde{g}$
$\tilde{g}$
$\tilde{\chi}_1^0$
$\tilde{\chi}_1^0$
q
q
Z
$\tilde{G}$
$\tilde{G}$
Z
q
q



ATLAS
$\sqrt{s}$ = 8 TeV, 20.3 fb^{-1}
SR-Z ee
Data
Standard Model
Flavour Symmetric
Other Backgrounds
m(g̃),μ=(700,200)GeV
m(g̃),μ=(900,600)GeV
Events / 25 GeV
2
4
6
8
10
12
200
250
300
350
400
450
500
E_T^{miss} [GeV]

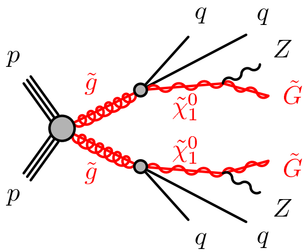


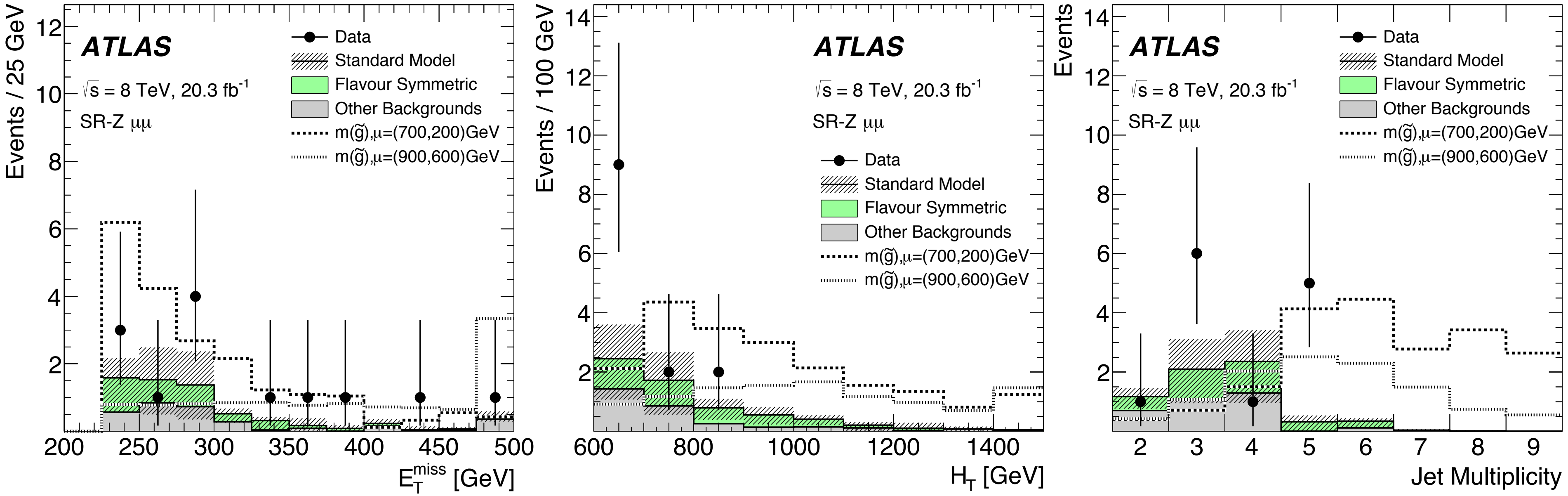
ATLAS
$\sqrt{s}$ = 8 TeV, 20.3 fb^{-1}
SR-Z ee
Data
Standard Model
Flavour Symmetric
Other Backgrounds
m(g̃),μ=(700,200)GeV
m(g̃),μ=(900,600)GeV
Events / 100 GeV
2
4
6
8
10
12
14
16
18
600
800
1000
1200
1400
H_T [GeV]



ATLAS
$\sqrt{s}$ = 8 TeV, 20.3 fb^{-1}
SR-Z ee
Data
Standard Model
Flavour Symmetric
Other Backgrounds
m(g̃),μ=(700,200)GeV
m(g̃),μ=(900,600)GeV
Events
2
4
6
8
10
12
2
3
4
5
6
7
8
9
Jet Multiplicity

on Z + jets + met


p
p
$\tilde{g}$
$\tilde{g}$
q
q
q
q
Z
Z
$\tilde{\chi}_1^0$
$\tilde{\chi}_1^0$
$\tilde{G}$
$\tilde{G}$

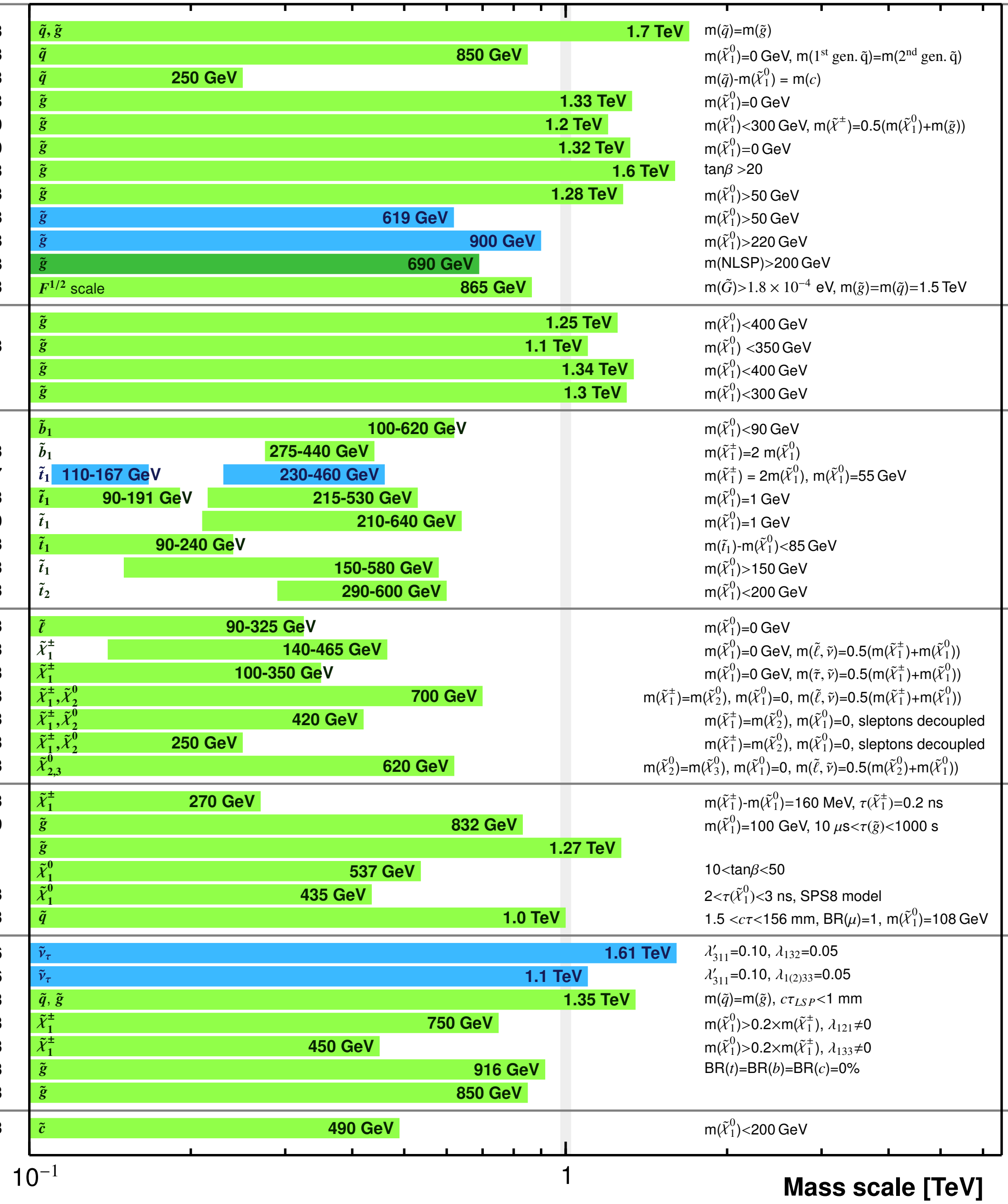

ATLAS
$\sqrt{s}$ = 8 TeV, 20.3 fb^{-1}
SR-Z μμ
Data
Standard Model
Flavour Symmetric
Other Backgrounds
m($\tilde{g}$),μ=(700,200)GeV
m($\tilde{g}$),μ=(900,600)GeV
Events / 25 GeV
E_T^{miss} [GeV]
Events / 100 GeV
H_T [GeV]
Events
Jet Multiplicity
200
250
300
350
400
450
500
600
800
1000
1200
1400
2
3
4
5
6
7
8
9
10
12
14

ATLAS SUSY Searches* - 95% CL Lower Limits

Status: Feb 2015

ATLAS Preliminary

$\sqrt{s}$ = 7, 8 TeV

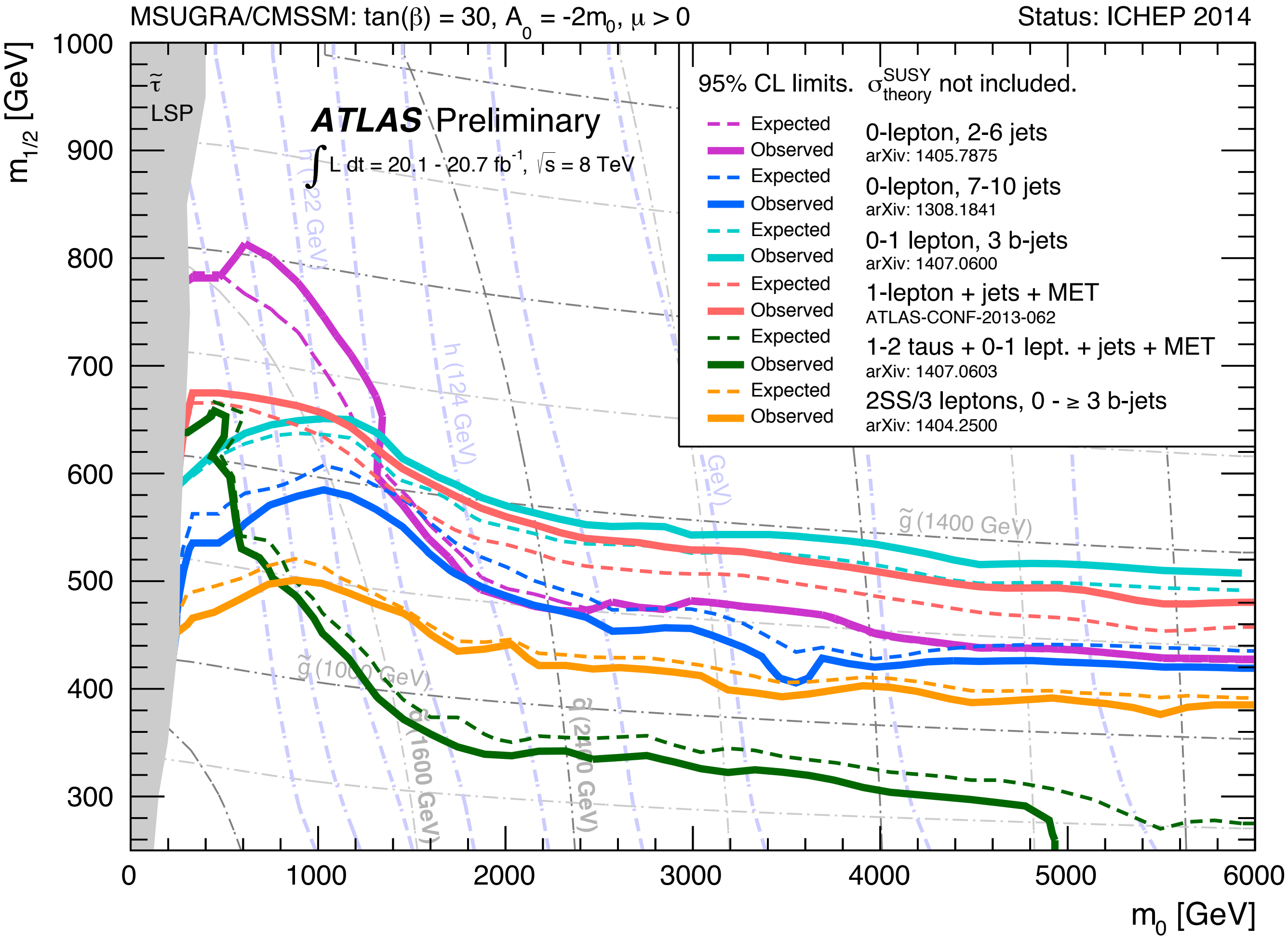


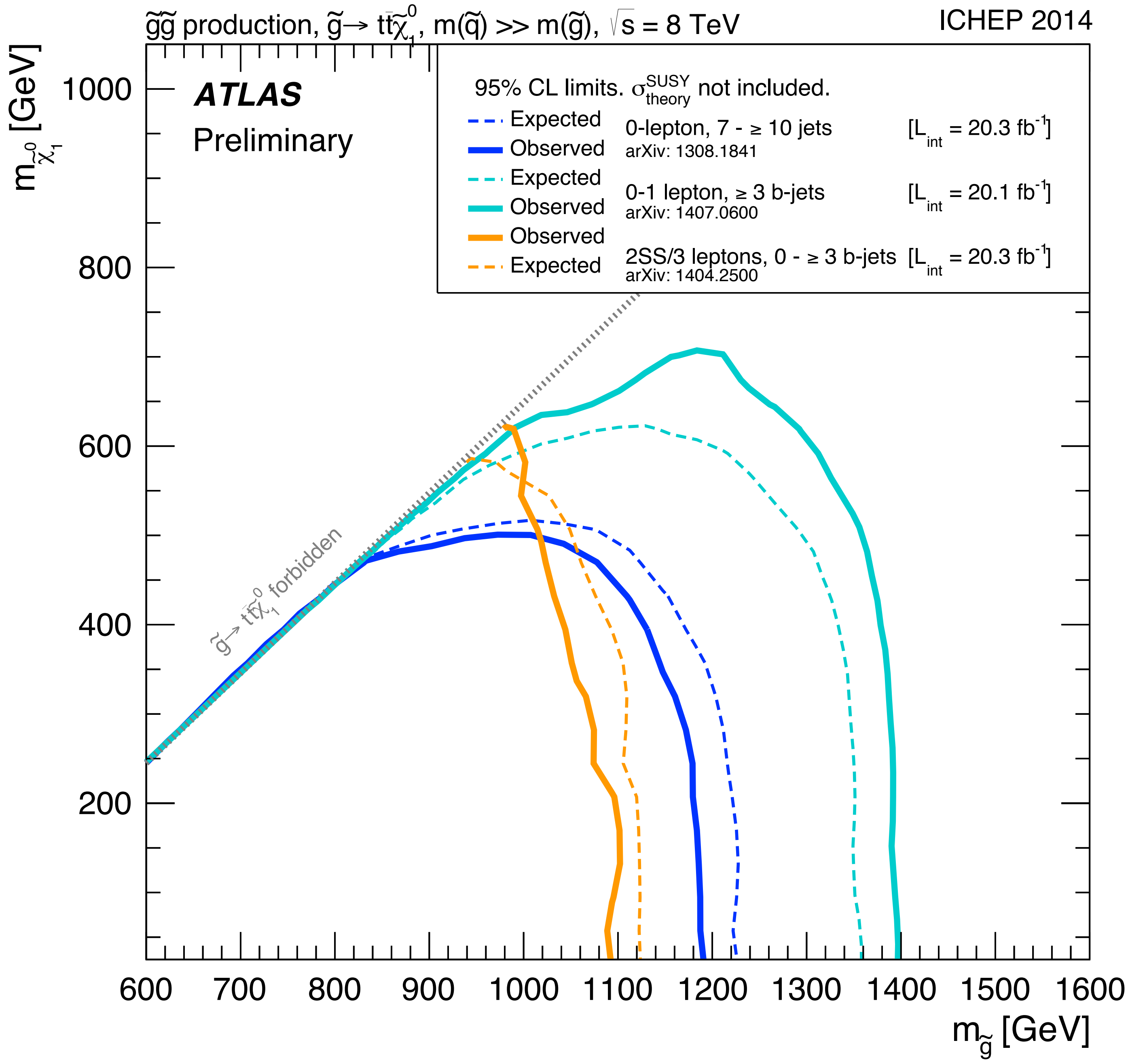
	Model	e,μ,τ,γ	Jets	E_T^{miss}	$\int\mathcal{L}\,dt[\text{fb}^{-1}]$	Mass limit		Reference
Inclusive Searches	MSUGRA/CMSSM	0	2-6 jets	Yes	20.3	$\tilde{q},\tilde{g}$ 1.7 TeV	m($\tilde{q}$)=m($\tilde{g}$)	1405.7875
	$\tilde{q}\tilde{q}$, $\tilde{q}\to q\tilde{\chi}^0_1$	0	2-6 jets	Yes	20.3	$\tilde{q}$ 850 GeV	m($\tilde{\chi}^0_1$)=0 GeV, m(1^{st} gen. $\tilde{q}$)=m(2^{nd} gen. $\tilde{q}$)	1405.7875
	$\tilde{q}\tilde{q}\gamma$, $\tilde{q}\to q\tilde{\chi}^0_1$ (compressed)	1 γ	0-1 jet	Yes	20.3	$\tilde{q}$ 250 GeV	m($\tilde{q}$)-m($\tilde{\chi}^0_1$) = m(c)	1411.1559
	$\tilde{g}\tilde{g}$, $\tilde{g}\to q\bar{q}\tilde{\chi}^0_1$	0	2-6 jets	Yes	20.3	$\tilde{g}$ 1.33 TeV	m($\tilde{\chi}^0_1$)=0 GeV	1405.7875
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qq\tilde{\chi}^\pm_1\to qqW^\pm\tilde{\chi}^0_1$	1 e,μ	3-6 jets	Yes	20	$\tilde{g}$ 1.2 TeV	m($\tilde{\chi}^0_1$)<300 GeV, m($\tilde{\chi}^\pm$)=0.5(m($\tilde{\chi}^0_1$)+m($\tilde{g}$))	1501.03555
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qq(\ell\ell/\ell\nu/\nu\nu)\tilde{\chi}^0_1$	2 e,μ	0-3 jets	-	20	$\tilde{g}$ 1.32 TeV	m($\tilde{\chi}^0_1$)=0 GeV	1501.03555
	GMSB ($\tilde{\ell}$ NLSP)	1-2 τ + 0-1 ℓ	0-2 jets	Yes	20.3	$\tilde{g}$ 1.6 TeV	tanβ >20	1407.0603
	GGM (bino NLSP)	2 γ	-	Yes	20.3	$\tilde{g}$ 1.28 TeV	m($\tilde{\chi}^0_1$)>50 GeV	ATLAS-CONF-2014-001
	GGM (wino NLSP)	1 $e,\mu+\gamma$	-	Yes	4.8	$\tilde{g}$ 619 GeV	m($\tilde{\chi}^0_1$)>50 GeV	ATLAS-CONF-2012-144
	GGM (higgsino-bino NLSP)	γ	1 b	Yes	4.8	$\tilde{g}$ 900 GeV	m($\tilde{\chi}^0_1$)>220 GeV	1211.1167
	GGM (higgsino NLSP)	2 e,μ (Z)	0-3 jets	Yes	5.8	$\tilde{g}$ 690 GeV	m(NLSP)>200 GeV	ATLAS-CONF-2012-152
	Gravitino LSP	0	mono-jet	Yes	20.3	$F^{1/2}$ scale 865 GeV	m($\tilde{G}$)>1.8×10^{-4} eV, m($\tilde{g}$)=m($\tilde{q}$)=1.5 TeV	1502.01518
3^{rd} gen. $\tilde{g}$ med.	$\tilde{g}\to b\bar{b}\tilde{\chi}^0_1$	0	3 b	Yes	20.1	$\tilde{g}$ 1.25 TeV	m($\tilde{\chi}^0_1$)<400 GeV	1407.0600
	$\tilde{g}\to t\bar{t}\tilde{\chi}^0_1$	0	7-10 jets	Yes	20.3	$\tilde{g}$ 1.1 TeV	m($\tilde{\chi}^0_1$) <350 GeV	1308.1841
	$\tilde{g}\to t\bar{t}\tilde{\chi}^0_1$	0-1 e,μ	3 b	Yes	20.1	$\tilde{g}$ 1.34 TeV	m($\tilde{\chi}^0_1$)<400 GeV	1407.0600
	$\tilde{g}\to b\bar{t}\tilde{\chi}^+_1$	0-1 e,μ	3 b	Yes	20.1	$\tilde{g}$ 1.3 TeV	m($\tilde{\chi}^0_1$)<300 GeV	1407.0600
3^{rd} 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	$\tilde{b}_1$ 100-620 GeV	m($\tilde{\chi}^0_1$)<90 GeV	1308.2631
	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to t\tilde{\chi}^\pm_1$	2 e,μ (SS)	0-3 b	Yes	20.3	$\tilde{b}_1$ 275-440 GeV	m($\tilde{\chi}^\pm_1$)=2 m($\tilde{\chi}^0_1$)	1404.2500
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to b\tilde{\chi}^\pm_1$	1-2 e,μ	1-2 b	Yes	4.7	$\tilde{t}_1$ 110-167 GeV 230-460 GeV	m($\tilde{\chi}^\pm_1$) = 2m($\tilde{\chi}^0_1$), m($\tilde{\chi}^0_1$)=55 GeV	1209.2102, 1407.0583
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to Wb\tilde{\chi}^0_1$ or $t\tilde{\chi}^0_1$	2 e,μ	0-2 jets	Yes	20.3	$\tilde{t}_1$ 90-191 GeV 215-530 GeV	m($\tilde{\chi}^0_1$)=1 GeV	1403.4853, 1412.4742
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to t\tilde{\chi}^0_1$	0-1 e,μ	1-2 b	Yes	20	$\tilde{t}_1$ 210-640 GeV	m($\tilde{\chi}^0_1$)=1 GeV	1407.0583,1406.1122
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to c\tilde{\chi}^0_1$	0	mono-jet/c-tag	Yes	20.3	$\tilde{t}_1$ 90-240 GeV	m($\tilde{t}_1$)-m($\tilde{\chi}^0_1$)<85 GeV	1407.0608
	$\tilde{t}_1\tilde{t}_1$(natural GMSB)	2 e,μ (Z)	1 b	Yes	20.3	$\tilde{t}_1$ 150-580 GeV	m($\tilde{\chi}^0_1$)>150 GeV	1403.5222
	$\tilde{t}_2\tilde{t}_2$, $\tilde{t}_2\to\tilde{t}_1+Z$	3 e,μ (Z)	1 b	Yes	20.3	$\tilde{t}_2$ 290-600 GeV	m($\tilde{\chi}^0_1$)<200 GeV	1403.5222
EW direct	$\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}$, $\tilde{\ell}\to\ell\tilde{\chi}^0_1$	2 e,μ	0	Yes	20.3	$\tilde{\ell}$ 90-325 GeV	m($\tilde{\chi}^0_1$)=0 GeV	1403.5294
	$\tilde{\chi}^+_1\tilde{\chi}^-_1$, $\tilde{\chi}^+_1\to\tilde{\ell}\nu(\ell\tilde{\nu})$	2 e,μ	0	Yes	20.3	$\tilde{\chi}^\pm_1$ 140-465 GeV	m($\tilde{\chi}^0_1$)=0 GeV, m($\tilde{\ell},\tilde{\nu}$)=0.5(m($\tilde{\chi}^\pm_1$)+m($\tilde{\chi}^0_1$))	1403.5294
	$\tilde{\chi}^+_1\tilde{\chi}^-_1$, $\tilde{\chi}^+_1\to\tilde{\tau}\nu(\tau\tilde{\nu})$	2 τ	-	Yes	20.3	$\tilde{\chi}^\pm_1$ 100-350 GeV	m($\tilde{\chi}^0_1$)=0 GeV, m($\tilde{\tau},\tilde{\nu}$)=0.5(m($\tilde{\chi}^\pm_1$)+m($\tilde{\chi}^0_1$))	1407.0350
	$\tilde{\chi}^\pm_1\tilde{\chi}^0_2\to\tilde{\ell}_L\nu\tilde{\ell}_L\ell(\tilde{\nu}\nu), \ell\tilde{\nu}\tilde{\ell}_L\ell(\tilde{\nu}\nu)$	3 e,μ	0	Yes	20.3	$\tilde{\chi}^\pm_1,\tilde{\chi}^0_2$ 700 GeV	m($\tilde{\chi}^\pm_1$)=m($\tilde{\chi}^0_2$), m($\tilde{\chi}^0_1$)=0, m($\tilde{\ell},\tilde{\nu}$)=0.5(m($\tilde{\chi}^\pm_1$)+m($\tilde{\chi}^0_1$))	1402.7029
	$\tilde{\chi}^\pm_1\tilde{\chi}^0_2\to W\tilde{\chi}^0_1Z\tilde{\chi}^0_1$	2-3 e,μ	0-2 jets	Yes	20.3	$\tilde{\chi}^\pm_1,\tilde{\chi}^0_2$ 420 GeV	m($\tilde{\chi}^\pm_1$)=m($\tilde{\chi}^0_2$), m($\tilde{\chi}^0_1$)=0, sleptons decoupled	1403.5294, 1402.7029
	$\tilde{\chi}^\pm_1\tilde{\chi}^0_2\to W\tilde{\chi}^0_1h\tilde{\chi}^0_1$, $h\to b\bar{b}/WW/\tau\tau/\gamma\gamma$	e,μ,γ	0-2 b	Yes	20.3	$\tilde{\chi}^\pm_1,\tilde{\chi}^0_2$ 250 GeV	m($\tilde{\chi}^\pm_1$)=m($\tilde{\chi}^0_2$), m($\tilde{\chi}^0_1$)=0, sleptons decoupled	1501.07110
	$\tilde{\chi}^0_2\tilde{\chi}^0_3$, $\tilde{\chi}^0_{2,3}\to\tilde{\ell}_R\ell$	4 e,μ	0	Yes	20.3	$\tilde{\chi}^0_{2,3}$ 620 GeV	m($\tilde{\chi}^0_2$)=m($\tilde{\chi}^0_3$), m($\tilde{\chi}^0_1$)=0, m($\tilde{\ell},\tilde{\nu}$)=0.5(m($\tilde{\chi}^0_2$)+m($\tilde{\chi}^0_1$))	1405.5086
Long-lived particles	Direct $\tilde{\chi}^+_1\tilde{\chi}^-_1$ prod., long-lived $\tilde{\chi}^\pm_1$	Disapp. trk	1 jet	Yes	20.3	$\tilde{\chi}^\pm_1$ 270 GeV	m($\tilde{\chi}^\pm_1$)-m($\tilde{\chi}^0_1$)=160 MeV, τ($\tilde{\chi}^\pm_1$)=0.2 ns	1310.3675
	Stable, stopped $\tilde{g}$ R-hadron	0	1-5 jets	Yes	27.9	$\tilde{g}$ 832 GeV	m($\tilde{\chi}^0_1$)=100 GeV, 10 μs<τ($\tilde{g}$)<1000 s	1310.6584
	Stable $\tilde{g}$ R-hadron	trk	-	-	19.1	$\tilde{g}$ 1.27 TeV		1411.6795
	GMSB, stable $\tilde{\tau}$, $\tilde{\chi}^0_1\to\tilde{\tau}(\tilde{e},\tilde{\mu})+\tau(e,\mu)$	1-2 μ	-	-	19.1	$\tilde{\chi}^0_1$ 537 GeV	10<tanβ<50	1411.6795
	GMSB, $\tilde{\chi}^0_1\to\gamma\tilde{G}$, long-lived $\tilde{\chi}^0_1$	2 γ	-	Yes	20.3	$\tilde{\chi}^0_1$ 435 GeV	2<τ($\tilde{\chi}^0_1$)<3 ns, SPS8 model	1409.5542
	$\tilde{q}\tilde{q}$, $\tilde{\chi}^0_1\to qq\mu$ (RPV)	1 μ, displ. vtx	-	-	20.3	$\tilde{q}$ 1.0 TeV	1.5 <$c\tau$<156 mm, BR(μ)=1, m($\tilde{\chi}^0_1$)=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	2 e,μ (SS)	0-3 b	Yes	20.3	$\tilde{q},\tilde{g}$ 1.35 TeV	m($\tilde{q}$)=m($\tilde{g}$), $c\tau_{LSP}$<1 mm	1404.2500
	$\tilde{\chi}^+_1\tilde{\chi}^-_1$, $\tilde{\chi}^+_1\to W\tilde{\chi}^0_1, \tilde{\chi}^0_1\to ee\tilde{\nu}_\mu, e\mu\tilde{\nu}_e$	4 e,μ	-	Yes	20.3	$\tilde{\chi}^\pm_1$ 750 GeV	m($\tilde{\chi}^0_1$)>0.2×m($\tilde{\chi}^\pm_1$), $\lambda_{121}\neq0$	1405.5086
	$\tilde{\chi}^+_1\tilde{\chi}^-_1$, $\tilde{\chi}^+_1\to W\tilde{\chi}^0_1, \tilde{\chi}^0_1\to\tau\tau\tilde{\nu}_e, e\tau\tilde{\nu}_\tau$	3 $e,\mu+\tau$	-	Yes	20.3	$\tilde{\chi}^\pm_1$ 450 GeV	m($\tilde{\chi}^0_1$)>0.2×m($\tilde{\chi}^\pm_1$), $\lambda_{133}\neq0$	1405.5086
	$\tilde{g}\to qqq$	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	20.3	$\tilde{g}$ 850 GeV		1404.250
Other	Scalar charm, $\tilde{c}\to c\tilde{\chi}^0_1$	0	2 c	Yes	20.3	$\tilde{c}$ 490 GeV	m($\tilde{\chi}^0_1$)<200 GeV	1501.01325

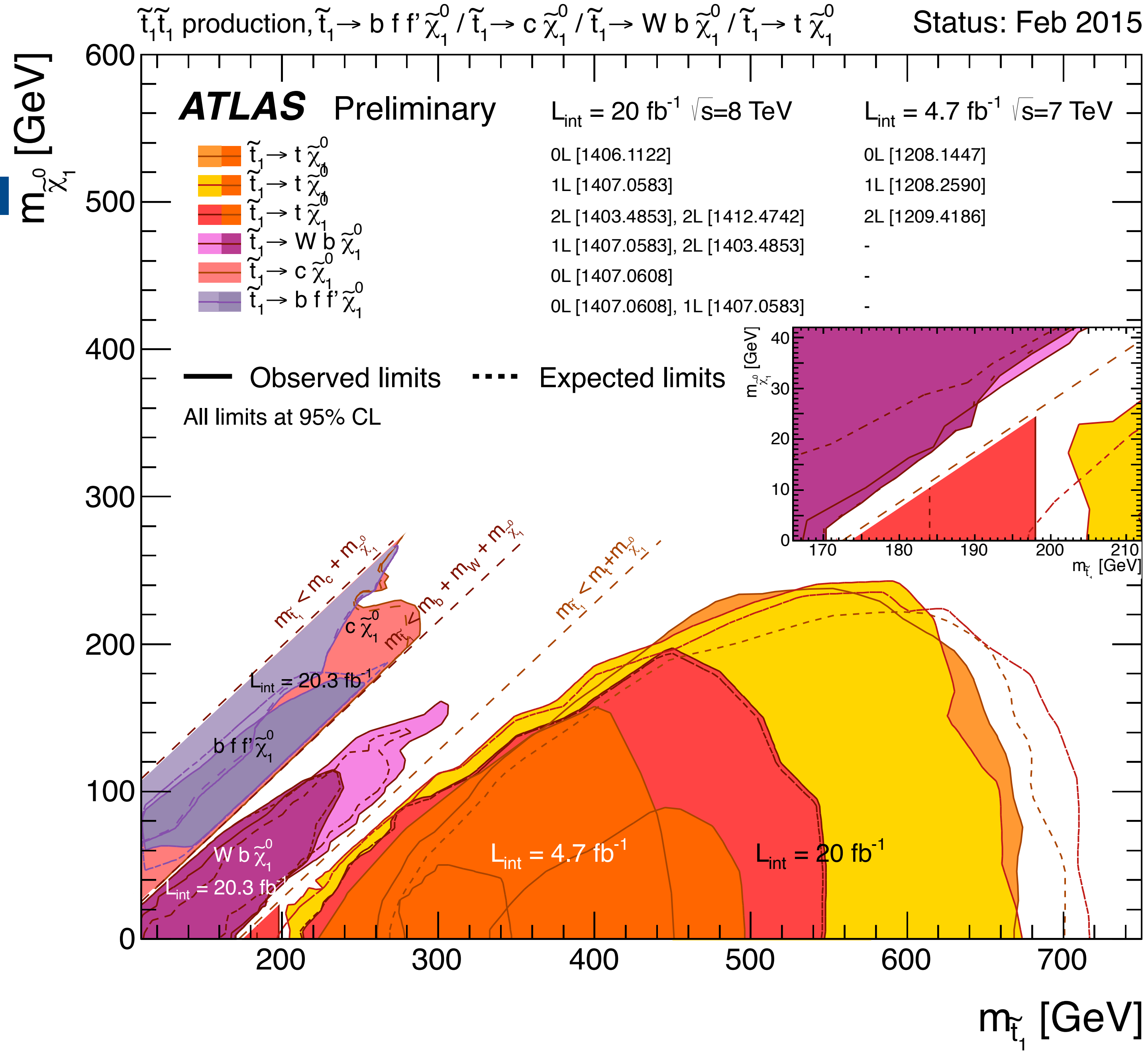
- 🟦 $\sqrt{s}$ = 7 TeV full data
- 🟩 $\sqrt{s}$ = 8 TeV partial data
- 🟩 $\sqrt{s}$ = 8 TeV full data

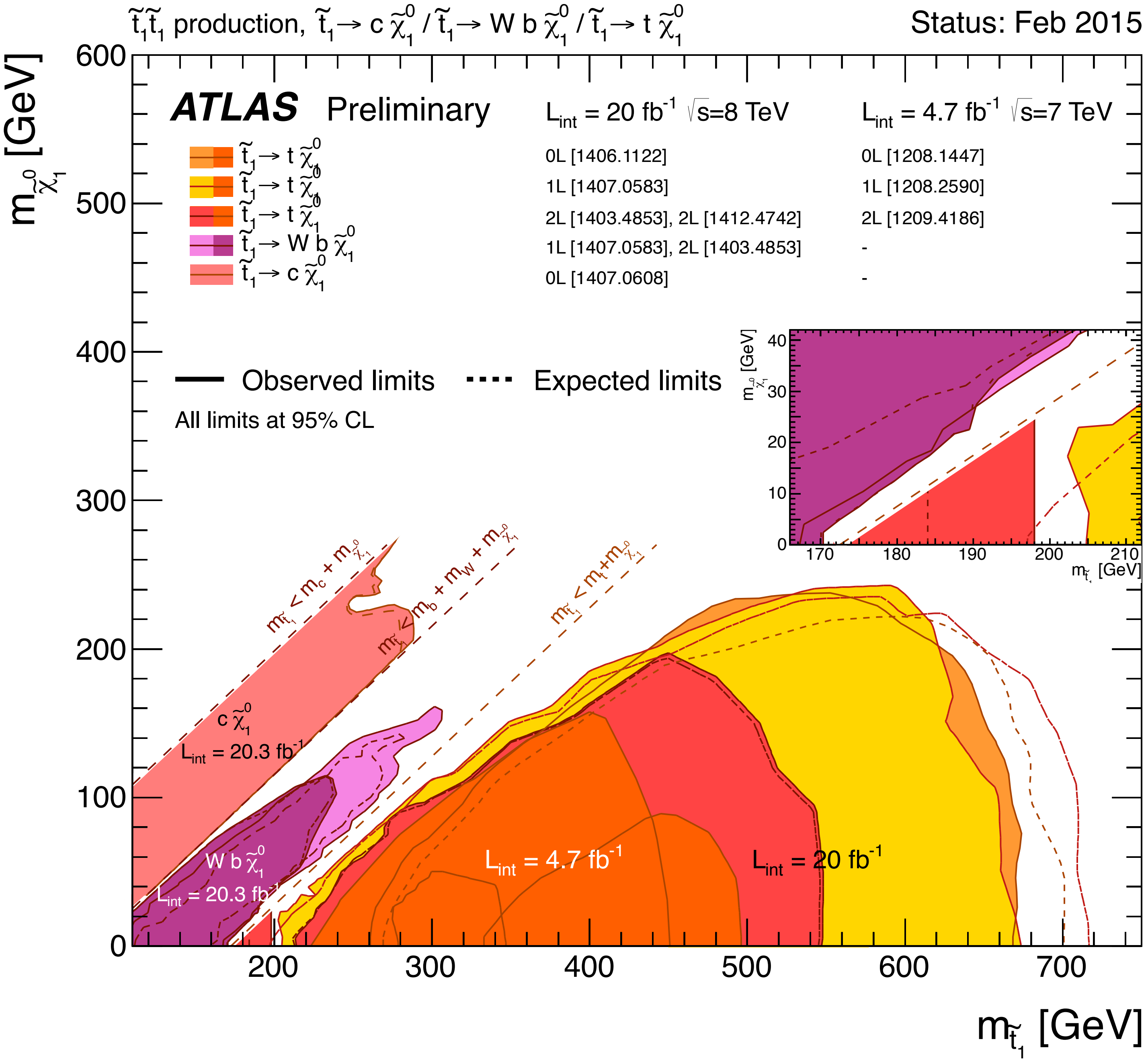
*Only a selection of the available mass limits on new states or phenomena is shown. All limits quoted are observed minus 1σ theoretical signal cross section uncertainty.

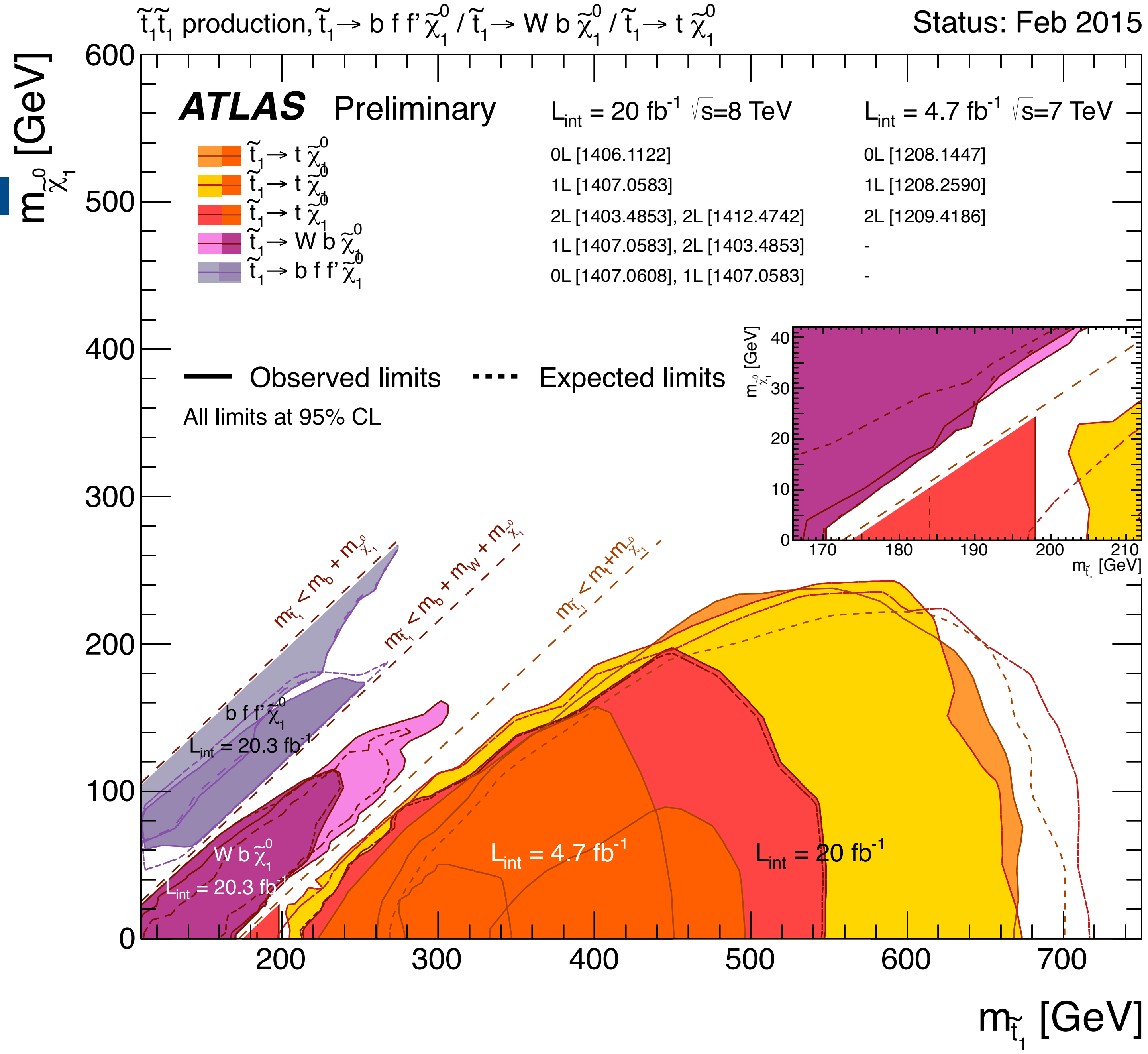
mSUGRA summary

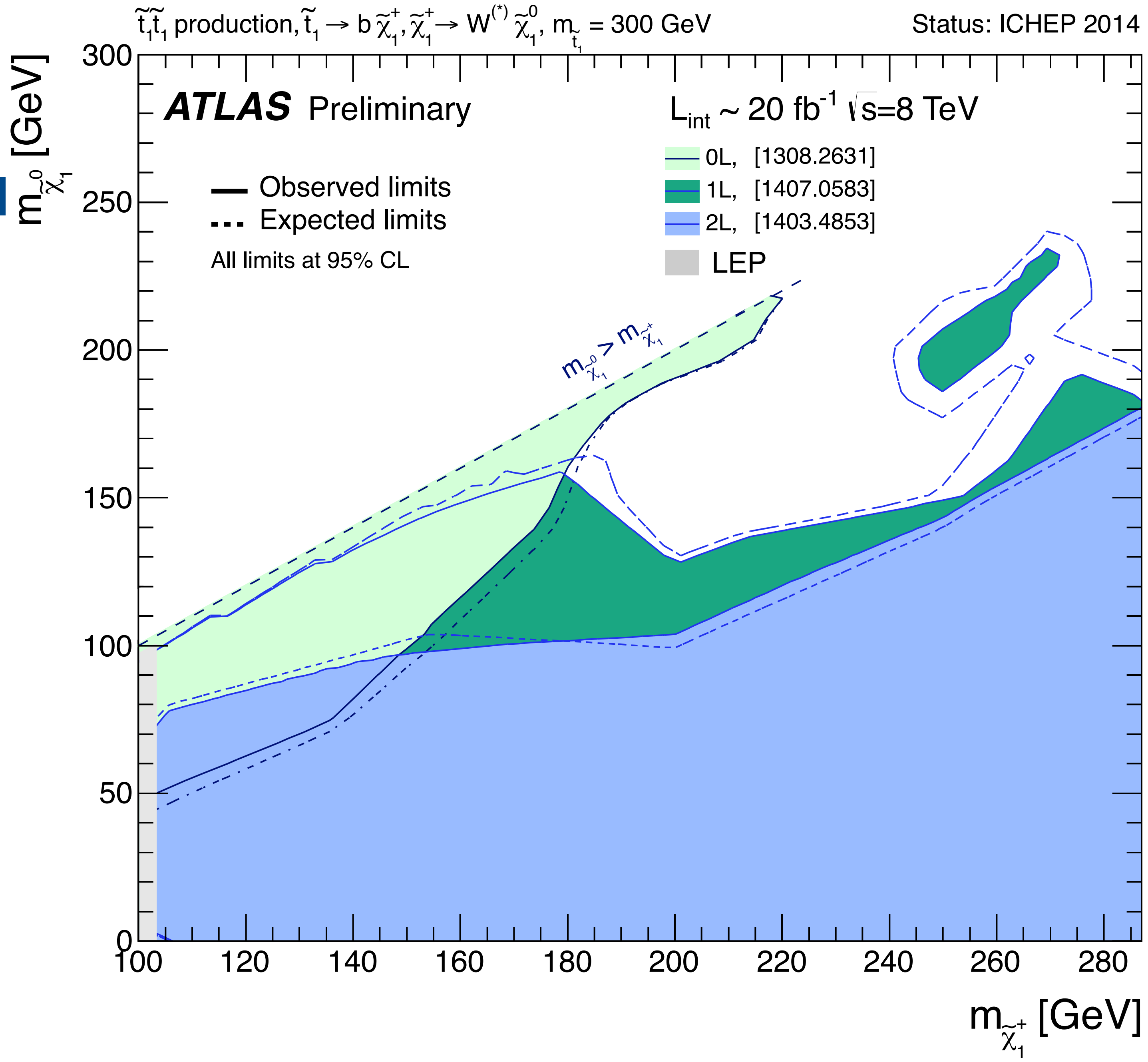


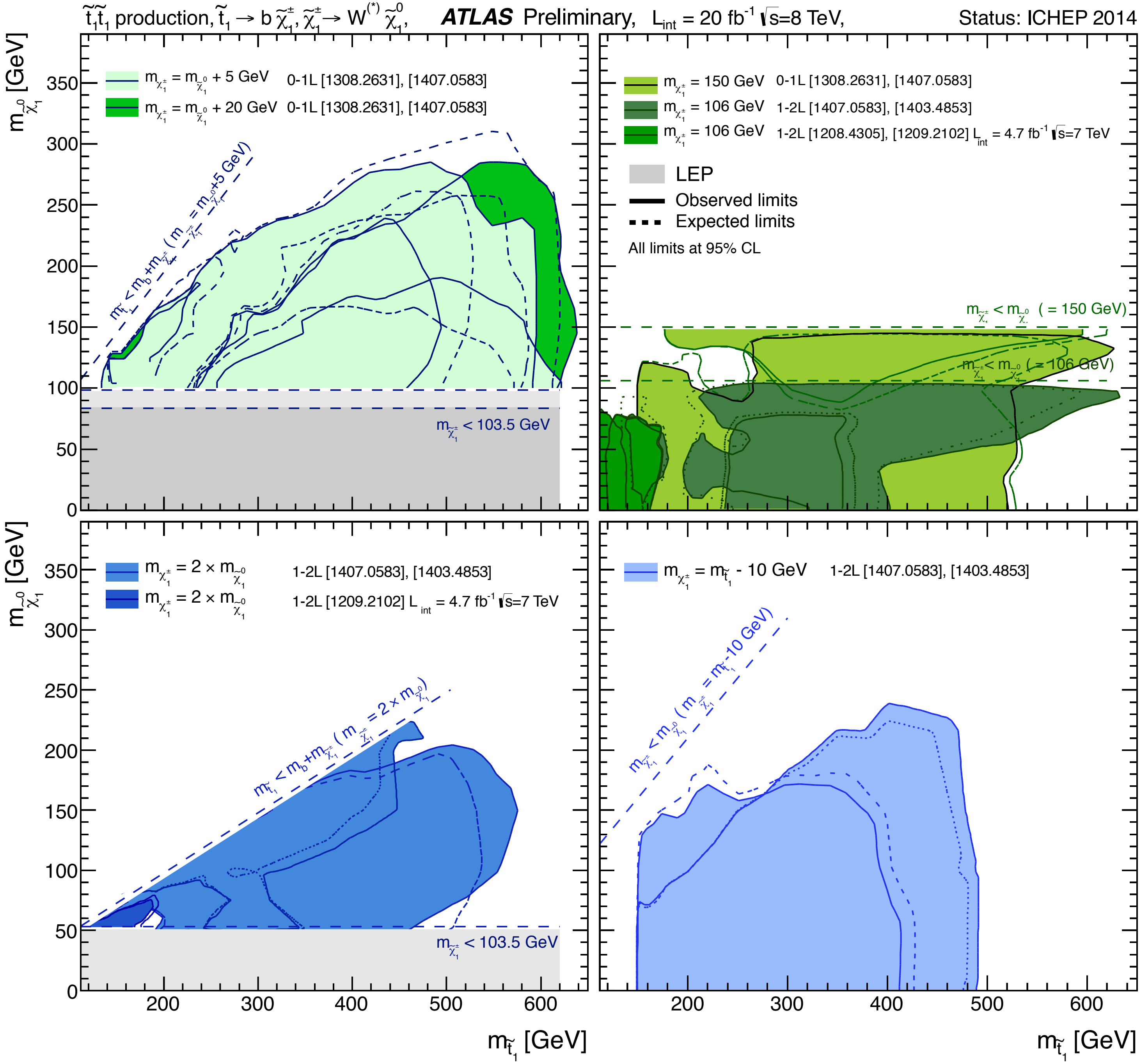

$\tilde{g}\tilde{g}$ production, $\tilde{g}\rightarrow t\bar{t}\tilde{\chi}_1^0$, $m(\tilde{q}) >> m(\tilde{g})$, $\sqrt{s}$ = 8 TeV
ICHEP 2014
ATLAS
Preliminary
95% CL limits. σ^{SUSY}_{theory} not included.
Expected
Observed
0-lepton, 7 - ≥ 10 jets
arXiv: 1308.1841
[L_{int} = 20.3 fb^{-1}]
Expected
Observed
0-1 lepton, ≥ 3 b-jets
arXiv: 1407.0600
[L_{int} = 20.1 fb^{-1}]
Observed
Expected
2SS/3 leptons, 0 - ≥ 3 b-jets
arXiv: 1404.2500
[L_{int} = 20.3 fb^{-1}]
$\tilde{g}\rightarrow t\bar{t}\tilde{\chi}_1^0$ forbidden
$m_{\tilde{\chi}_1^0}$ [GeV]
1000
800
600
400
200
600
700
800
900
1000
1100
1200
1300
1400
1500
1600
$m_{\tilde{g}}$ [GeV]

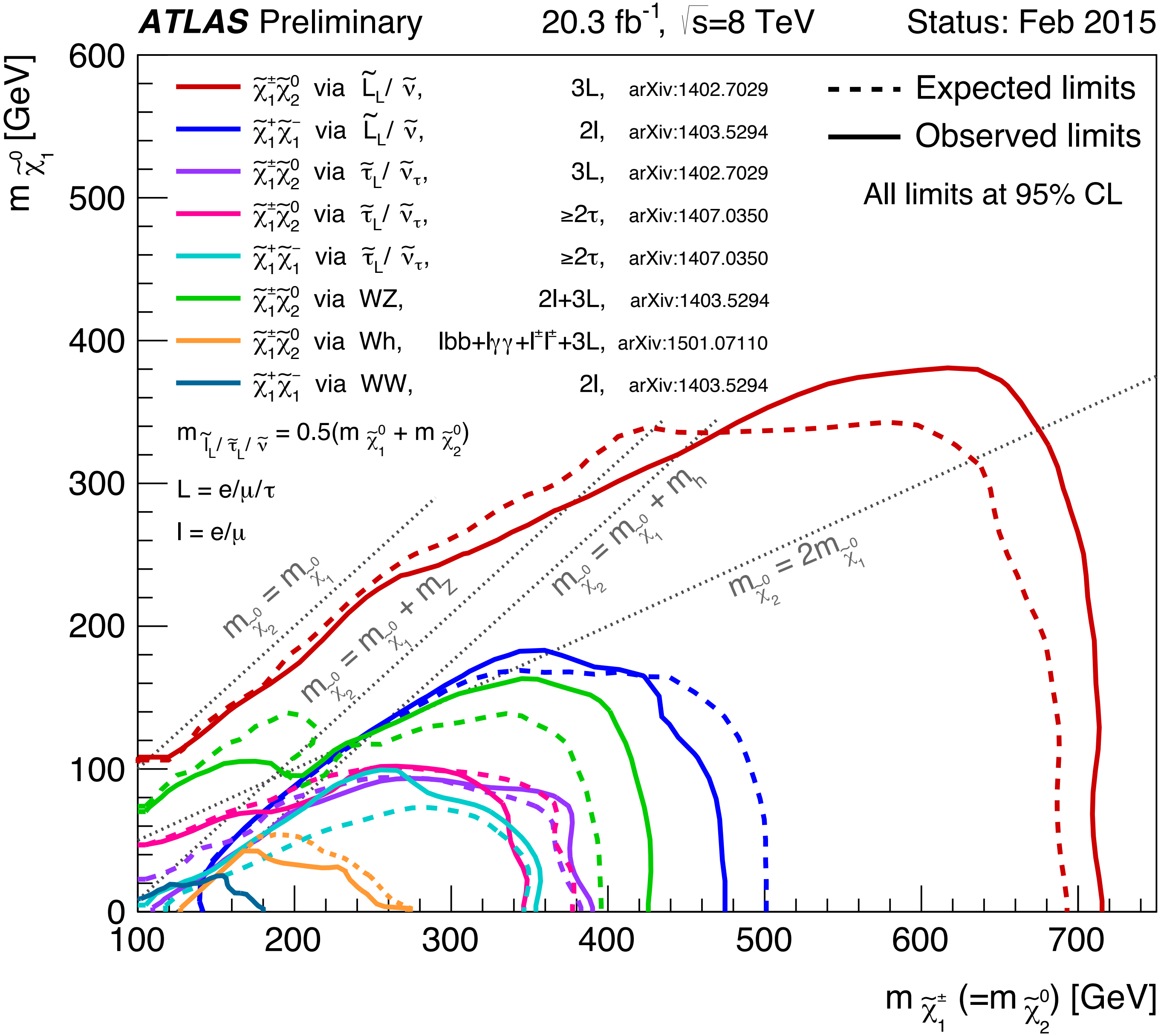

$\tilde{t}_1\tilde{t}_1$ production, $\tilde{t}_1 \to b f f' \tilde{\chi}_1^0$ / $\tilde{t}_1 \to c \tilde{\chi}_1^0$ / $\tilde{t}_1 \to W b \tilde{\chi}_1^0$ / $\tilde{t}_1 \to t \tilde{\chi}_1^0$
Status: Feb 2015
ATLAS Preliminary
L_{int} = 20 fb^{-1} $\sqrt{s}$=8 TeV
L_{int} = 4.7 fb^{-1} $\sqrt{s}$=7 TeV
$\tilde{t}_1 \to t \tilde{\chi}_1^0$ 0L [1406.1122] 0L [1208.1447]
$\tilde{t}_1 \to t \tilde{\chi}_1^0$ 1L [1407.0583] 1L [1208.2590]
$\tilde{t}_1 \to t \tilde{\chi}_1^0$ 2L [1403.4853], 2L [1412.4742] 2L [1209.4186]
$\tilde{t}_1 \to W b \tilde{\chi}_1^0$ 1L [1407.0583], 2L [1403.4853] -
$\tilde{t}_1 \to c \tilde{\chi}_1^0$ 0L [1407.0608] -
$\tilde{t}_1 \to b f f' \tilde{\chi}_1^0$ 0L [1407.0608], 1L [1407.0583] -
Observed limits
Expected limits
All limits at 95% CL
$m_{\tilde{\chi}_1^0}$ [GeV]
$m_{\tilde{t}_1}$ [GeV]
$m_{\tilde{t}_1} < m_c + m_{\tilde{\chi}_1^0}$
$m_{\tilde{t}_1} < m_b + m_W + m_{\tilde{\chi}_1^0}$
$m_{\tilde{t}_1} < m_t + m_{\tilde{\chi}_1^0}$
$c \tilde{\chi}_1^0$
L_{int} = 20.3 fb^{-1}
$b f f' \tilde{\chi}_1^0$
$W b \tilde{\chi}_1^0$
L_{int} = 20.3 fb^{-1}
L_{int} = 4.7 fb^{-1}
L_{int} = 20 fb^{-1}
0
100
200
300
400
500
600
200
300
400
500
600
700
170
180
190
200
210
0
10
20
30
40


$\tilde{t}_1\tilde{t}_1$ production, $\tilde{t}_1 \to c\,\tilde{\chi}_1^0$ / $\tilde{t}_1 \to W\,b\,\tilde{\chi}_1^0$ / $\tilde{t}_1 \to t\,\tilde{\chi}_1^0$
Status: Feb 2015
ATLAS Preliminary
L_{int} = 20 fb^{-1} $\sqrt{s}$=8 TeV
L_{int} = 4.7 fb^{-1} $\sqrt{s}$=7 TeV
$\tilde{t}_1 \to t\,\tilde{\chi}_1^0$ 0L [1406.1122] 0L [1208.1447]
$\tilde{t}_1 \to t\,\tilde{\chi}_1^0$ 1L [1407.0583] 1L [1208.2590]
$\tilde{t}_1 \to t\,\tilde{\chi}_1^0$ 2L [1403.4853], 2L [1412.4742] 2L [1209.4186]
$\tilde{t}_1 \to W\,b\,\tilde{\chi}_1^0$ 1L [1407.0583], 2L [1403.4853] -
$\tilde{t}_1 \to c\,\tilde{\chi}_1^0$ 0L [1407.0608] -
Observed limits
Expected limits
All limits at 95% CL
$m_{\tilde{t}_1} < m_c + m_{\tilde{\chi}_1^0}$
$m_{\tilde{t}_1} < m_b + m_W + m_{\tilde{\chi}_1^0}$
$m_{\tilde{t}_1} < m_t + m_{\tilde{\chi}_1^0}$
$c\,\tilde{\chi}_1^0$
L_{int} = 20.3 fb^{-1}
$W\,b\,\tilde{\chi}_1^0$
L_{int} = 20.3 fb^{-1}
L_{int} = 4.7 fb^{-1}
L_{int} = 20 fb^{-1}
$m_{\tilde{\chi}_1^0}$ [GeV]
0
100
200
300
400
500
600
$m_{\tilde{t}_1}$ [GeV]
200
300
400
500
600
700
$m_{\tilde{\chi}_1^0}$ [GeV]
0
10
20
30
40
170
180
190
200
210
$m_{\tilde{t}_1}$ [GeV]


$\tilde{t}_1\tilde{t}_1$ production, $\tilde{t}_1 \to b f f' \tilde{\chi}^0_1$ / $\tilde{t}_1 \to W b \tilde{\chi}^0_1$ / $\tilde{t}_1 \to t \tilde{\chi}^0_1$
Status: Feb 2015
ATLAS Preliminary
L_{int} = 20 fb^{-1} $\sqrt{s}$=8 TeV
L_{int} = 4.7 fb^{-1} $\sqrt{s}$=7 TeV
$\tilde{t}_1 \to t \tilde{\chi}^0_1$ 0L [1406.1122] 0L [1208.1447]
$\tilde{t}_1 \to t \tilde{\chi}^0_1$ 1L [1407.0583] 1L [1208.2590]
$\tilde{t}_1 \to t \tilde{\chi}^0_1$ 2L [1403.4853], 2L [1412.4742] 2L [1209.4186]
$\tilde{t}_1 \to W b \tilde{\chi}^0_1$ 1L [1407.0583], 2L [1403.4853] -
$\tilde{t}_1 \to b f f' \tilde{\chi}^0_1$ 0L [1407.0608], 1L [1407.0583] -
Observed limits
Expected limits
All limits at 95% CL
$m_{\tilde{t}_1} < m_b + m_{\tilde{\chi}^0_1}$
$m_{\tilde{t}_1} < m_b + m_W + m_{\tilde{\chi}^0_1}$
$m_{\tilde{t}_1} < m_t + m_{\tilde{\chi}^0_1}$
$b f f' \tilde{\chi}^0_1$
L_{int} = 20.3 fb^{-1}
$W b \tilde{\chi}^0_1$
L_{int} = 20.3 fb^{-1}
L_{int} = 4.7 fb^{-1}
L_{int} = 20 fb^{-1}
$m_{\tilde{\chi}^0_1}$ [GeV]
0
100
200
300
400
500
600
200
300
400
500
600
700
$m_{\tilde{t}_1}$ [GeV]
$m_{\tilde{\chi}^0_1}$ [GeV]
0
10
20
30
40
170
180
190
200
210
$m_{\tilde{t}_1}$ [GeV]


$\tilde{t}_1\tilde{t}_1$ production, $\tilde{t}_1 \rightarrow b\,\tilde{\chi}_1^+, \tilde{\chi}_1^+ \rightarrow W^{(*)}\,\tilde{\chi}_1^0$, $m_{\tilde{t}_1}$ = 300 GeV
Status: ICHEP 2014
ATLAS Preliminary
L_{int} ~ 20 fb^{-1} $\sqrt{s}$=8 TeV
Observed limits
Expected limits
All limits at 95% CL
0L, [1308.2631]
1L, [1407.0583]
2L, [1403.4853]
LEP
$m_{\tilde{\chi}_1^0} > m_{\tilde{\chi}_1^+}$
$m_{\tilde{\chi}_1^0}$ [GeV]
$m_{\tilde{\chi}_1^+}$ [GeV]
300
250
200
150
100
50
0
100
120
140
160
180
200
220
240
260
280


$\tilde{t}_1\tilde{t}_1$ production, $\tilde{t}_1 \rightarrow b\,\tilde{\chi}_1^\pm$, $\tilde{\chi}_1^\pm \rightarrow W^{(*)}\,\tilde{\chi}_1^0$,
ATLAS Preliminary, L_{int} = 20 fb^{-1} $\sqrt{s}$=8 TeV,
Status: ICHEP 2014
$m_{\tilde{\chi}_1^0}$ [GeV]
$m_{\tilde{t}_1}$ [GeV]
$m_{\chi_1^\pm} = m_{\tilde{\chi}_1^0}$ + 5 GeV 0-1L [1308.2631], [1407.0583]
$m_{\chi_1^\pm} = m_{\tilde{\chi}_1^0}$ + 20 GeV 0-1L [1308.2631], [1407.0583]
$m_{\tilde{t}_1} < m_b + m_{\tilde{\chi}_1^\pm}$ ($m_{\tilde{\chi}_1^\pm} = m_{\tilde{\chi}_1^0}$+5 GeV)
$m_{\tilde{\chi}_1^\pm}$ < 103.5 GeV
$m_{\chi_1^\pm}$ = 150 GeV 0-1L [1308.2631], [1407.0583]
$m_{\chi_1^\pm}$ = 106 GeV 1-2L [1407.0583], [1403.4853]
$m_{\chi_1^\pm}$ = 106 GeV 1-2L [1208.4305], [1209.2102] L_{int} = 4.7 fb^{-1} $\sqrt{s}$=7 TeV
LEP
Observed limits
Expected limits
All limits at 95% CL
$m_{\tilde{\chi}_1^\pm} < m_{\tilde{\chi}_1^0}$ (= 150 GeV)
$m_{\tilde{\chi}_1^\pm} < m_{\tilde{\chi}_1^0}$ (= 106 GeV)
$m_{\chi_1^\pm} = 2 \times m_{\tilde{\chi}_1^0}$ 1-2L [1407.0583], [1403.4853]
$m_{\chi_1^\pm} = 2 \times m_{\tilde{\chi}_1^0}$ 1-2L [1209.2102] L_{int} = 4.7 fb^{-1} $\sqrt{s}$=7 TeV
$m_{\tilde{t}_1} < m_b + m_{\tilde{\chi}_1^\pm}$ ($m_{\tilde{\chi}_1^\pm} = 2 \times m_{\tilde{\chi}_1^0}$)
$m_{\tilde{\chi}_1^\pm}$ < 103.5 GeV
$m_{\chi_1^\pm} = m_{\tilde{t}_1}$ - 10 GeV 1-2L [1407.0583], [1403.4853]
$m_{\tilde{\chi}_1^\pm} < m_{\tilde{\chi}_1^0}$ ($m_{\tilde{\chi}_1^\pm} = m_{\tilde{t}_1}$-10 GeV)
0
50
100
150
200
250
300
350
200
300
400
500
600


ATLAS Preliminary
20.3 fb^{-1}, $\sqrt{s}$=8 TeV
Status: Feb 2015
$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ via $\tilde{L}_L / \tilde{\nu}$, 3L, arXiv:1402.7029
$\tilde{\chi}_1^{+}\tilde{\chi}_1^{-}$ via $\tilde{L}_L / \tilde{\nu}$, 2l, arXiv:1403.5294
$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ via $\tilde{\tau}_L / \tilde{\nu}_\tau$, 3L, arXiv:1402.7029
$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ via $\tilde{\tau}_L / \tilde{\nu}_\tau$, ≥2τ, arXiv:1407.0350
$\tilde{\chi}_1^{+}\tilde{\chi}_1^{-}$ via $\tilde{\tau}_L / \tilde{\nu}_\tau$, ≥2τ, arXiv:1407.0350
$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ via WZ, 2l+3L, arXiv:1403.5294
$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0$ via Wh, lbb+lγγ+l$^{\pm}$l$^{\pm}$+3L, arXiv:1501.07110
$\tilde{\chi}_1^{+}\tilde{\chi}_1^{-}$ via WW, 2l, arXiv:1403.5294
Expected limits
Observed limits
All limits at 95% CL
$m_{\tilde{l}_L / \tilde{\tau}_L / \tilde{\nu}} = 0.5(m_{\tilde{\chi}_1^0} + m_{\tilde{\chi}_2^0})$
L = e/μ/τ
l = e/μ
$m_{\tilde{\chi}_2^0} = m_{\tilde{\chi}_1^0}$
$m_{\tilde{\chi}_2^0} = m_{\tilde{\chi}_1^0} + m_Z$
$m_{\tilde{\chi}_2^0} = m_{\tilde{\chi}_1^0} + m_h$
$m_{\tilde{\chi}_2^0} = 2m_{\tilde{\chi}_1^0}$
$m_{\tilde{\chi}_1^0}$ [GeV]
0
100
200
300
400
500
600
100
200
300
400
500
600
700
$m_{\tilde{\chi}_1^{\pm}}$ (=$m_{\tilde{\chi}_2^0}$) [GeV]