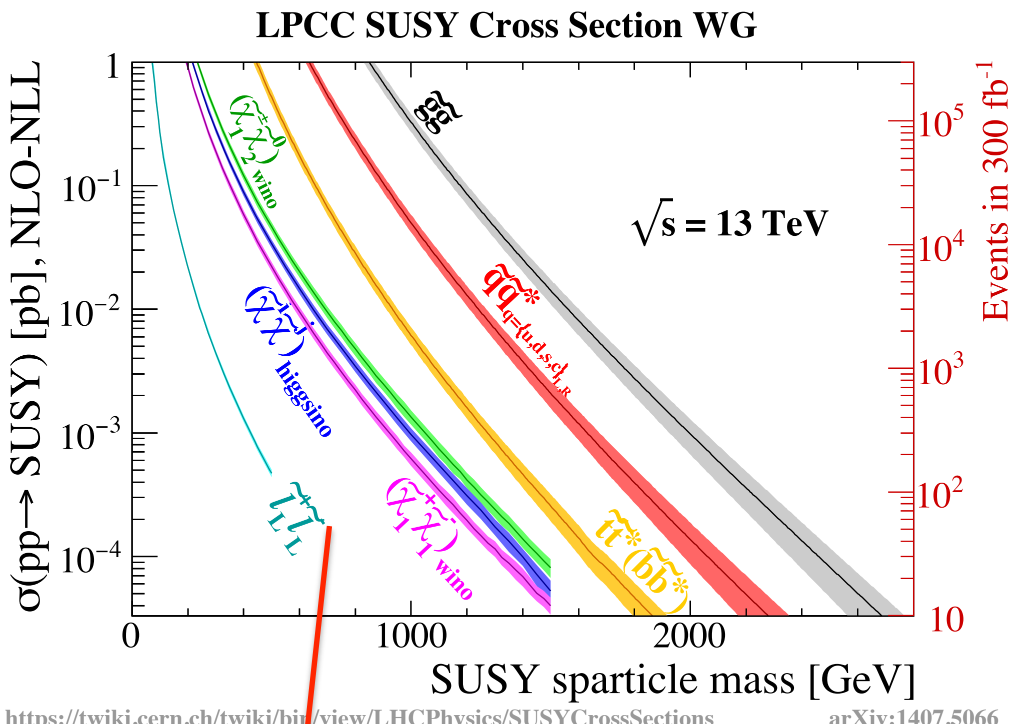
Searches for electroweak SUSY with the ATLAS and CMS detectors

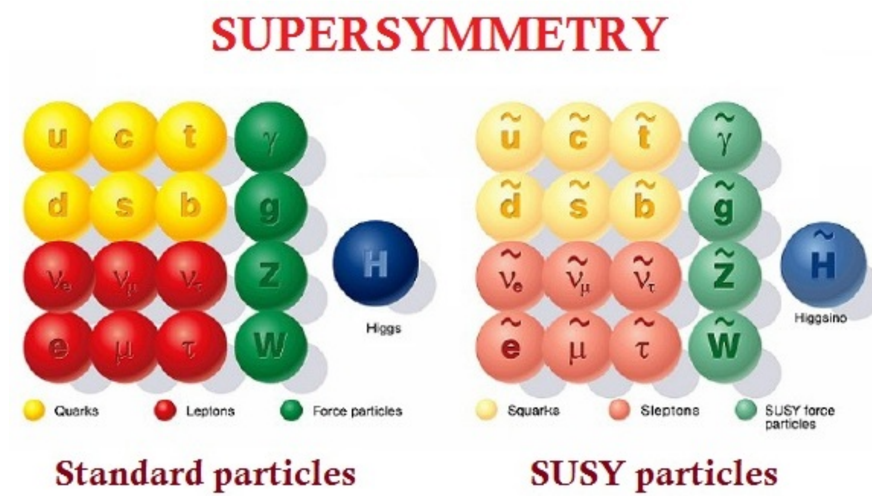
Matthew Gignac
on behalf of the ATLAS and CMS Collaborations

Moriond Electroweak, La Thuile, Italy
March 16-23rd 2019

Electroweak supersymmetry (SUSY)

- ⇨ **SUSY predicts partner particles for all SM particles**
- ⇨ **Addresses the Higgs hierarchy problem, Dark Matter,..**



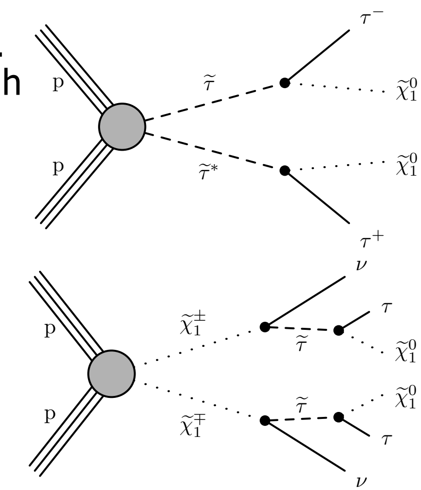


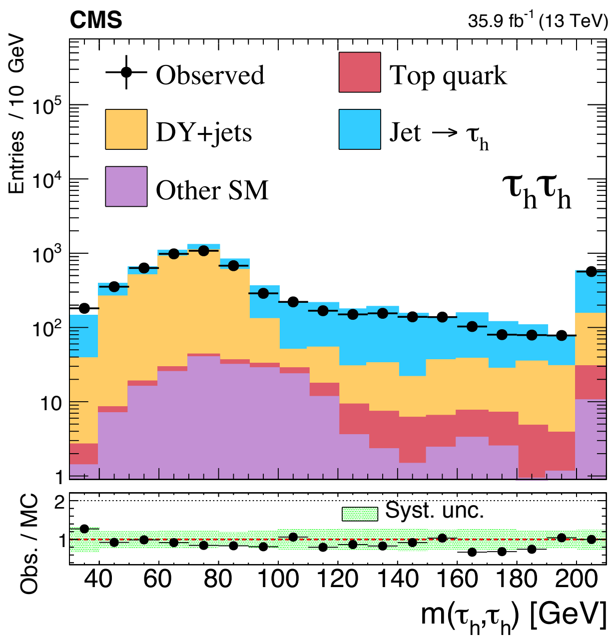
$$-\frac{1}{2}m_Z^2 = |\mu|^2 + m_{H_u}^2,$$

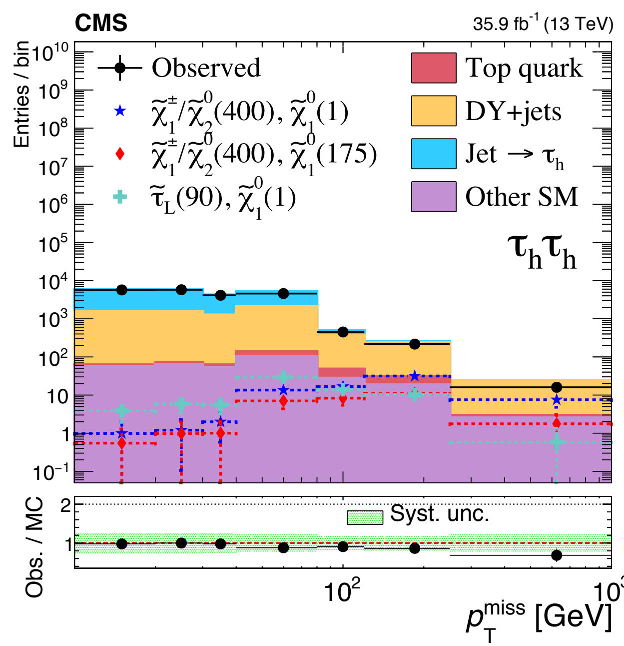
- Naturalness motivates weak scale masses
- Small cross section, but typically a distinct leptonic signature

Searches for staus

- ⇨ Searches for staus with final states: eμ, $e\tau_h$, $\mu\tau_h$, and $\tau_h\tau_h$
- ⇨ Experimentally challenging → large backgrounds
  - – DY Z → ττ : Use Z → μμ CR to correct modeling in m(Z) vs p_T(Z)
  - – QCD and W+jets → fake rate from data with loosened isolation
  - – Top quarks and other SM→ from MC, dominant for eμ final state
- ⇨ Signal region binned number of jets, p_T^{miss}, m_{T2} and D_ζ



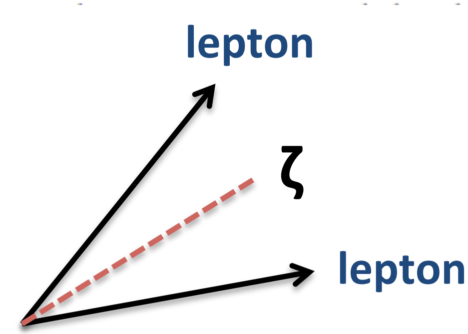




$$D_\zeta = P_{\zeta,\text{miss}} - 0.85 P_{\zeta,\text{vis}}$$

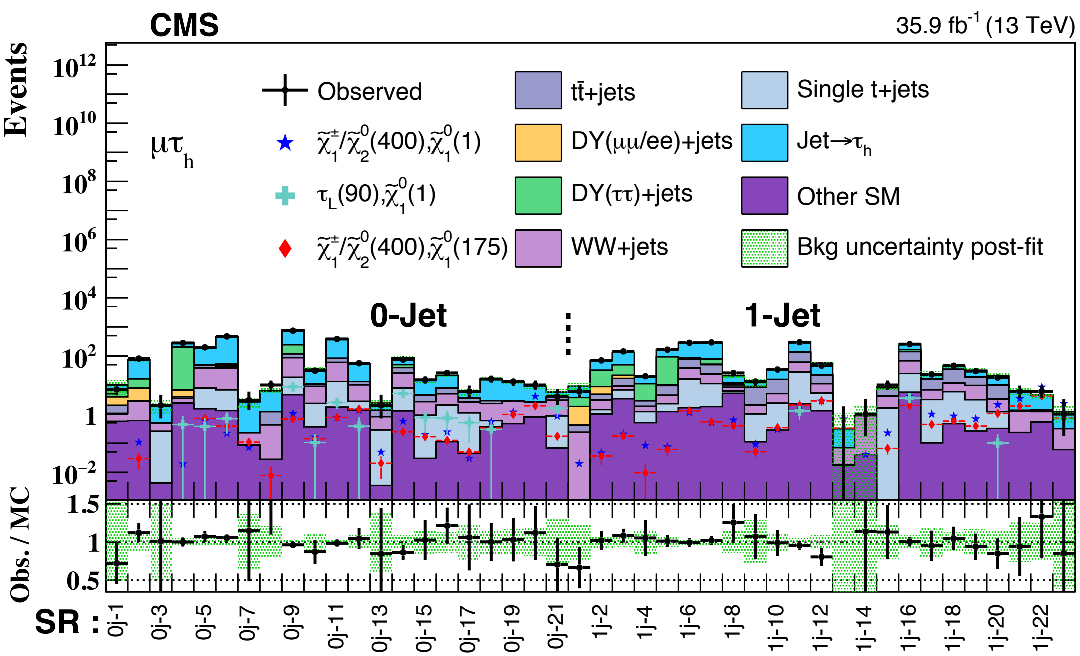
$$P_{\zeta,\text{miss}} = \vec{p}_T^{\,\text{miss}} \cdot \vec{\zeta}$$

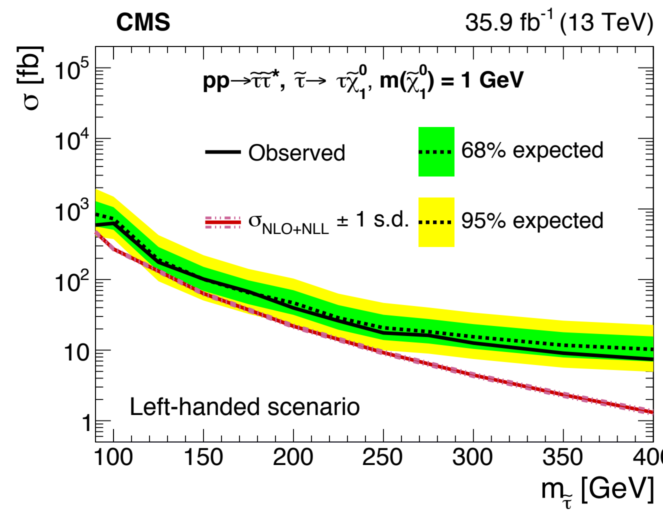
$$P_{\zeta,\text{vis}} = (\vec{p}_T^{\,\ell_1} + \vec{p}_T^{\,\ell_2}) \cdot \vec{\zeta},$$



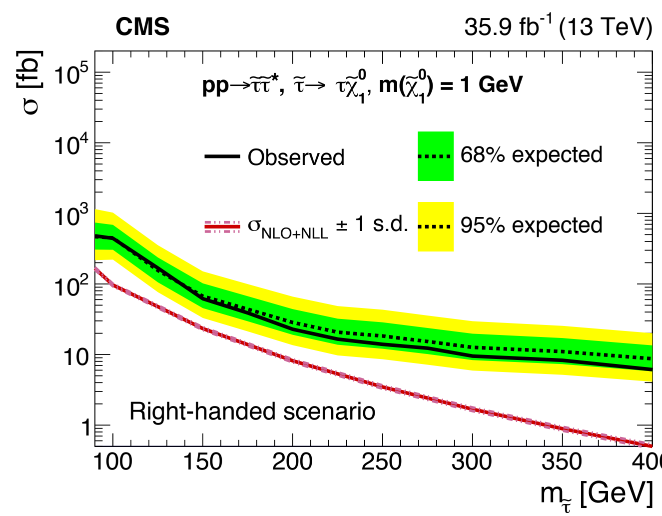
Results: staus

- ⇨ No significant excesses above predictions in any of the categories
- ⇨ Direct stau production very difficult to excluded due to low cross section
- ⇨ Interpretations for left and right handed staus, and maximal mixing





Left-handed

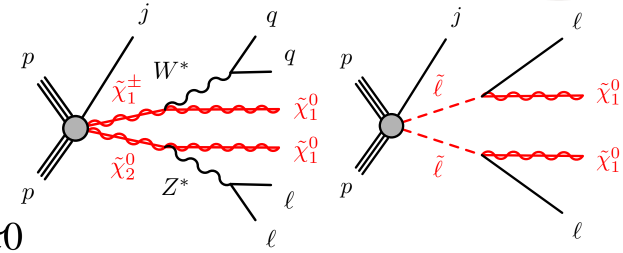


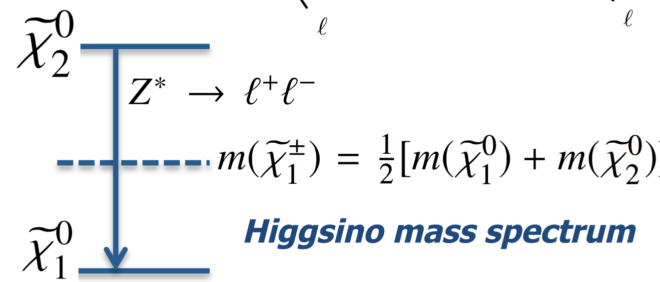
Right-handed

Compressed analysis

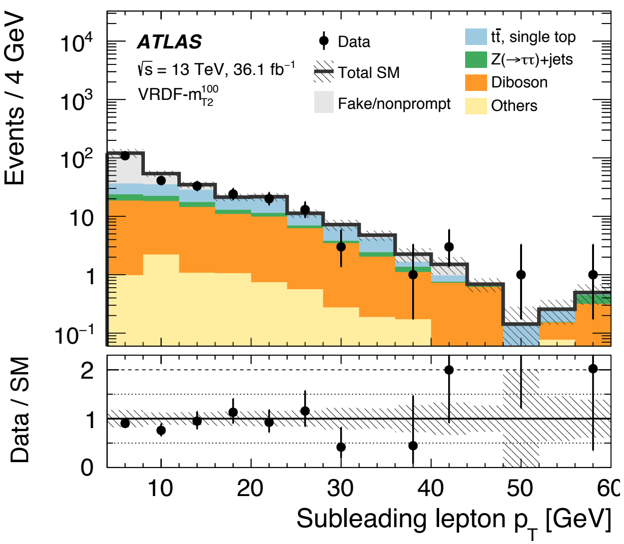
- ⇨ Search for a <u>compressed</u> electroweak spectrum
- ⇨ Electron (muon) reconstruction to 4 (4.5) GeV !
- ⇨ Dominant backgrounds:
  - Top backgrounds (tt and tW)
  - Diboson WZ and WW
  - Low mass DY Z → ττ
  - Fake/non prompt leptons → data driven

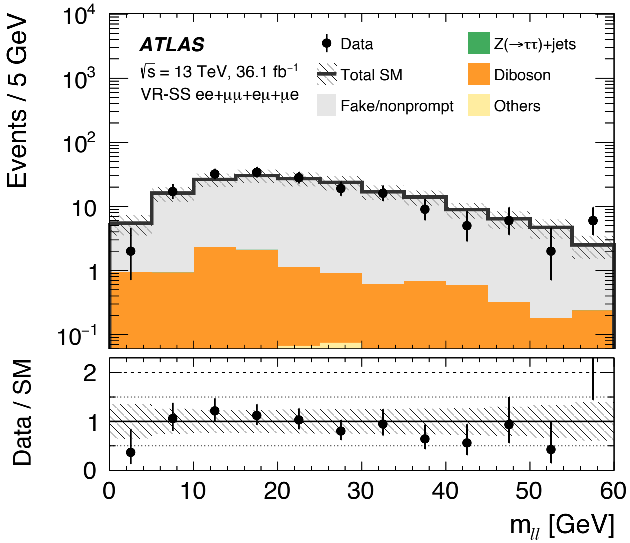
Normalized using data control regions (Top, Diboson, Low mass DY)

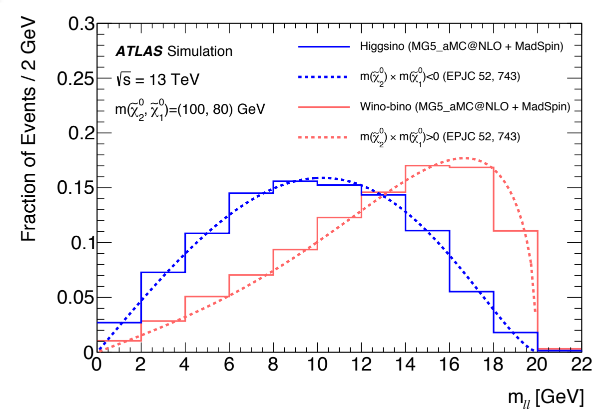




Higgsino mass spectrum



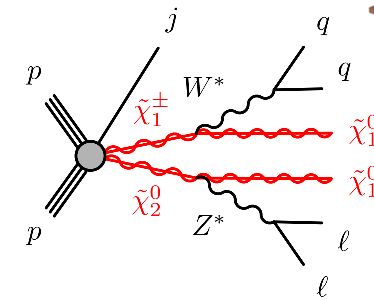




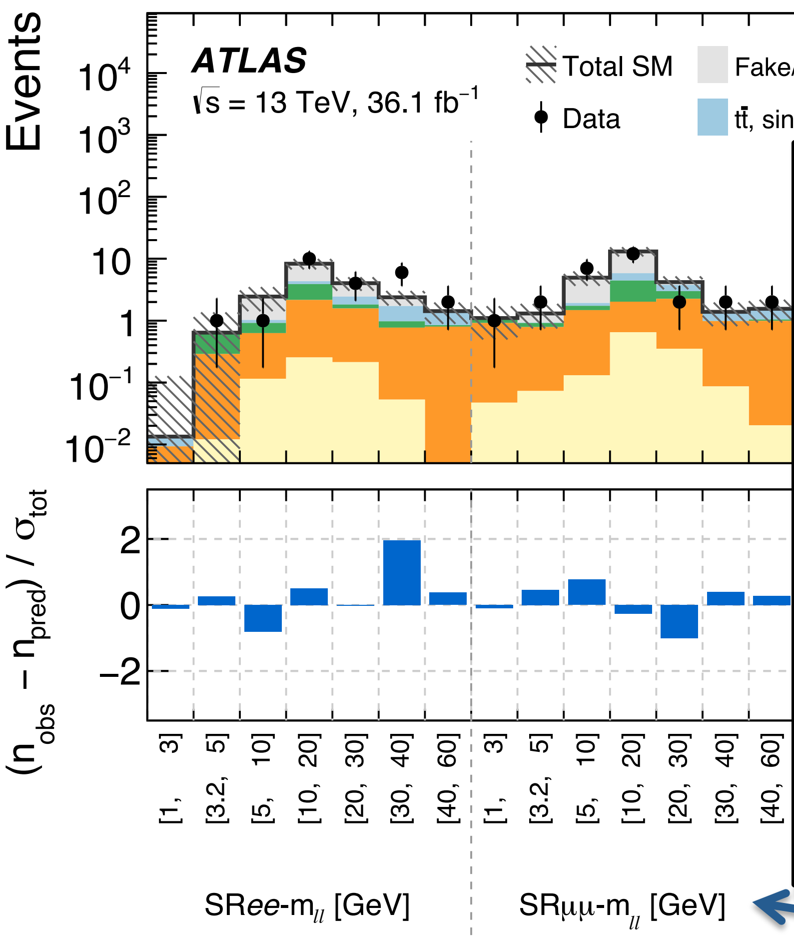
Good modeling down to low lepton p_T and low m_{ll} !

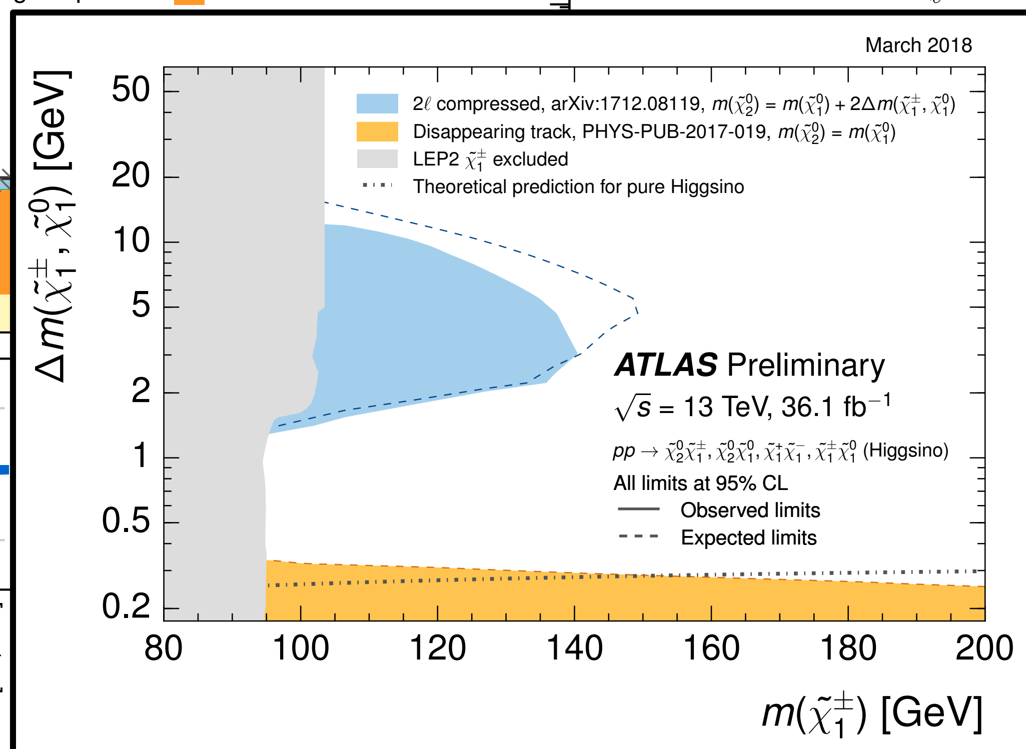
Phys. Rev. D 97 (2018) 052010

Compressed results: WZ



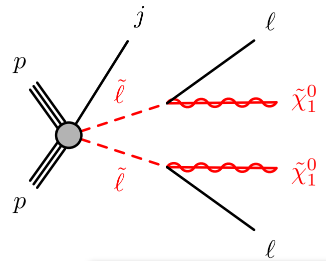
Observations in agreement with predictions



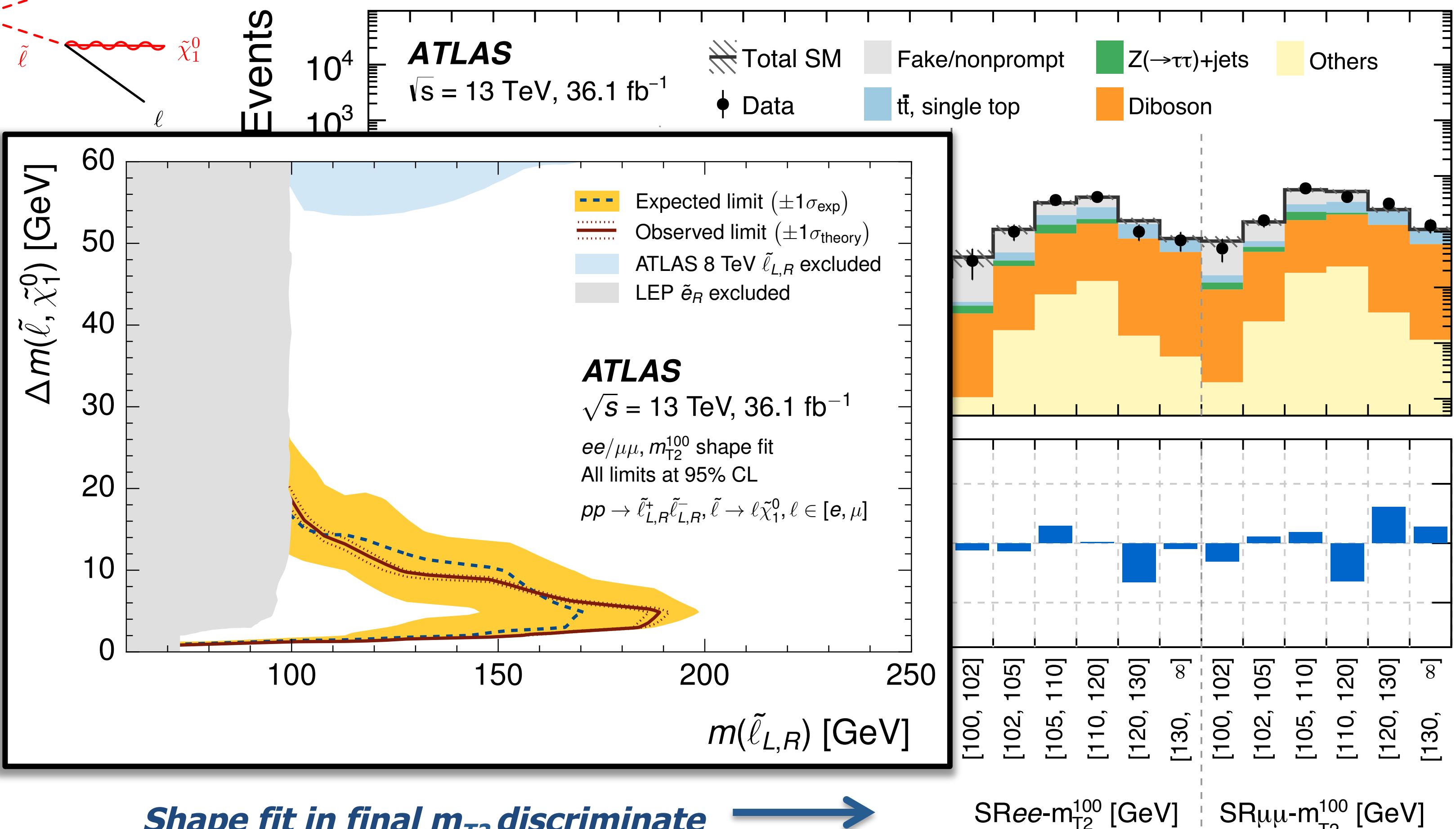


Shape fit in final m_{ll} discriminate

Compressed results: sleptons



Observations in agreement with predictions



Shape fit in final m_{T2} discriminate →

$$m_{\mathrm{T2}}^{m_\chi}\left(\mathbf{p}_{\mathrm{T}}^{\ell_1}, \mathbf{p}_{\mathrm{T}}^{\ell_2}, \mathbf{p}_{\mathrm{T}}^{\mathrm{miss}}\right) = \min_{\mathbf{q}_{\mathrm{T}}}\left(\max\left[m_{\mathrm{T}}\left(\mathbf{p}_{\mathrm{T}}^{\ell_1}, \mathbf{q}_{\mathrm{T}}, m_\chi\right), m_{\mathrm{T}}\left(\mathbf{p}_{\mathrm{T}}^{\ell_2}, \mathbf{p}_{\mathrm{T}}^{\mathrm{miss}} - \mathbf{q}_{\mathrm{T}}, m_\chi\right)\right]\right)$$

Two lepton + MET

⇨ Search for charginos and sleptons with well separated mass states

– **Irreducible backgrounds**: diboson and top → MC simulation

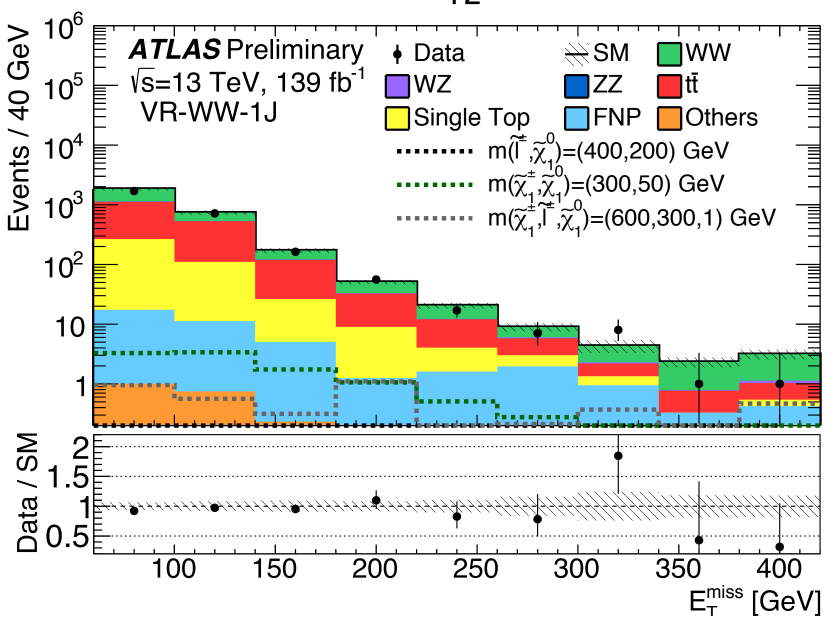
– **Reducible backgrounds**: fake non prompt leptons → data driven

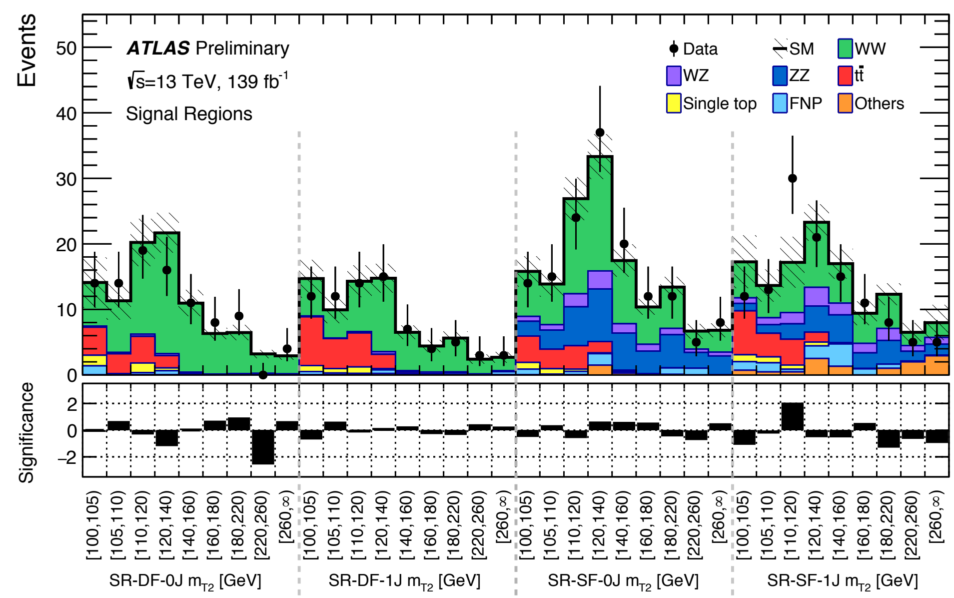
⇨ Signal region selection

– Same/opposite flavor lepton selections

– Binned in m_{T2} for exclusion

Signal region (SR)	SR-DF-0J	SR-DF-1J	SR-SF-0J	SR-SF-1J
$n_{\text{non-}b\text{-tagged jets}}$	= 0	= 1	= 0	= 1
$m_{\ell\ell}$ [GeV]	>100		>121.2	
$E_{\mathrm{T}}^{\mathrm{miss}}$ [GeV]	>110			
$E_{\mathrm{T}}^{\mathrm{miss}}$ significance	>10			



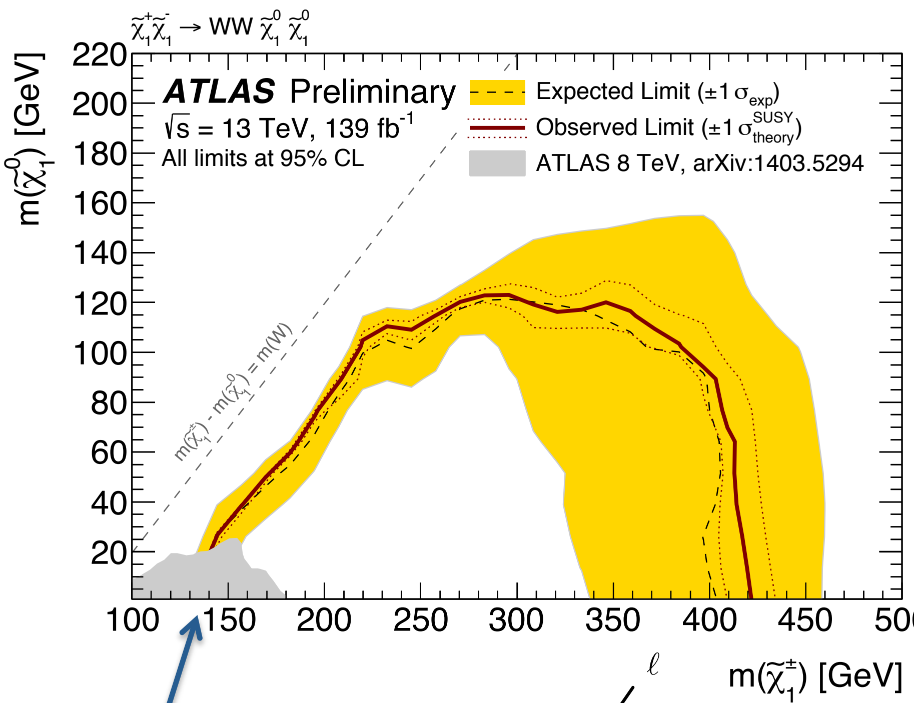


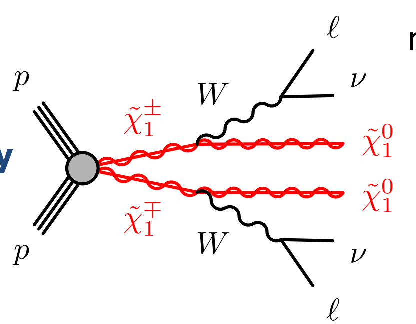
Good modeling in VRs!

ATLAS-CONF-2019-008

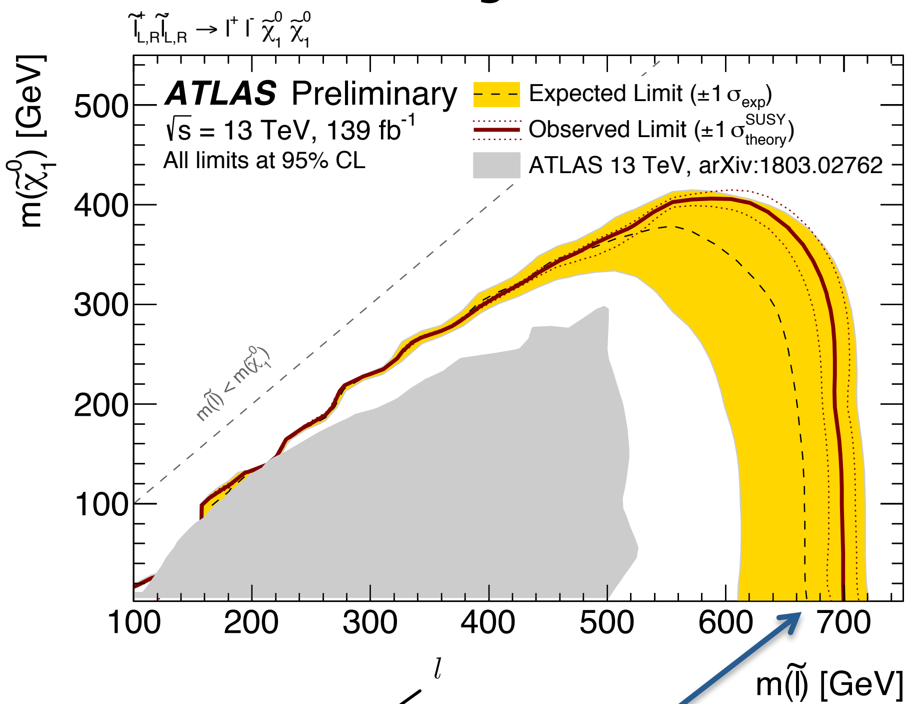
Two lepton + MET: Limits

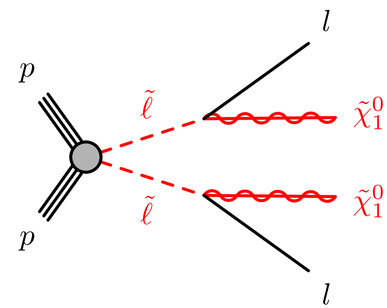
- ⇨ Interpretations for direct chargino and direct slepton production
- ⇨ Simplified models assuming 100% BR and wino charginos





Significantly improved sensitivity beyond Run 1!



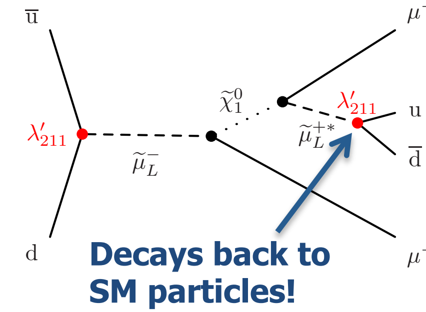


Light flavor sleptons excluded up to 700 GeV

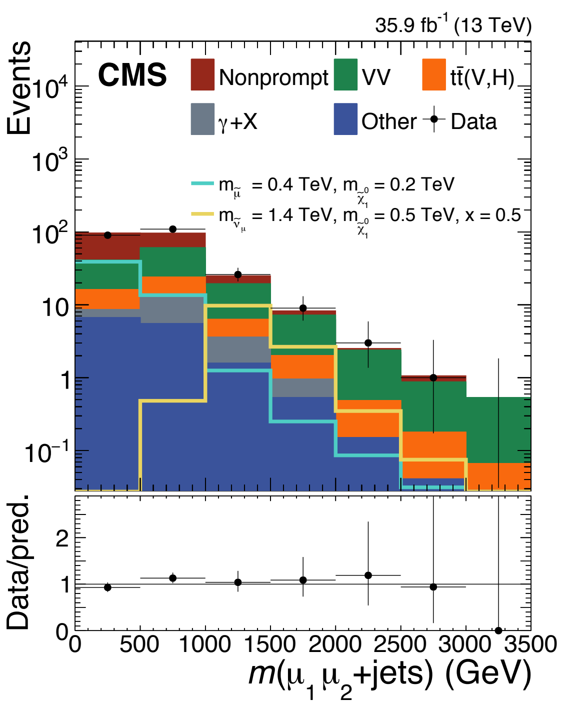
Resonant RPV sleptons

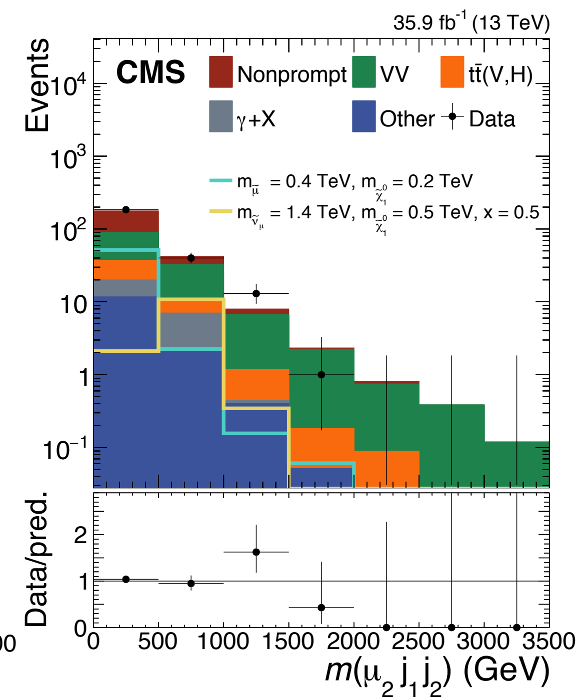
- ⇨ R-parity violating (RPV) models can lead to completely different signatures than their conserving counterparts

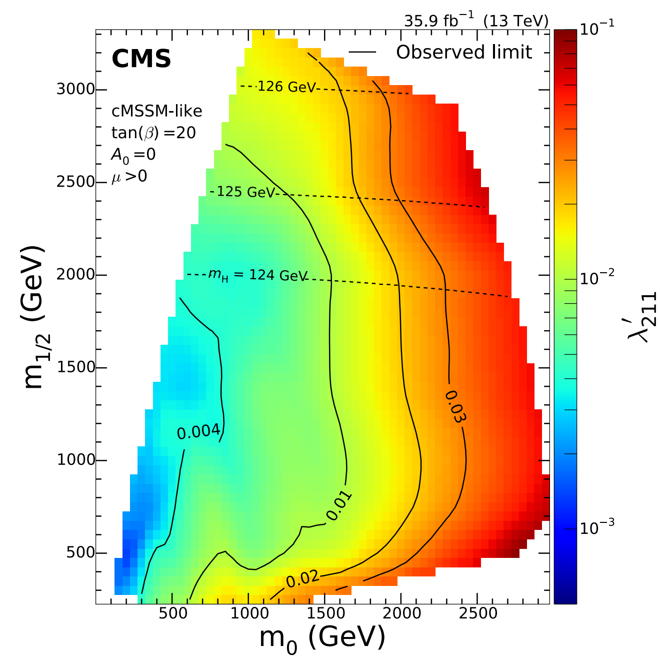
$$W_{\mathrm{RPV}} = \frac{1}{2}\lambda_{\mathrm{ijk}} L_{\mathrm{i}} L_{\mathrm{j}} \overline{E}_{\mathrm{k}} + \lambda'_{\mathrm{ijk}} \underline{L_{\mathrm{i}} Q_{\mathrm{j}} \overline{D}_{\mathrm{k}}} - \kappa_{\mathrm{i}} L_{\mathrm{i}} H_{\mathrm{u}} + \frac{1}{2}\lambda''_{\mathrm{ijk}} \overline{U}_{\mathrm{i}} \overline{D}_{\mathrm{j}} \overline{D}_{\mathrm{k}}.$$



- ⇨ Search for events two same sign muons and two jets
- ⇨ Multiple categories with $m(\mu_1\mu_2\text{+jets})$ and $m(\mu_2 j_1 j_2)$ cuts

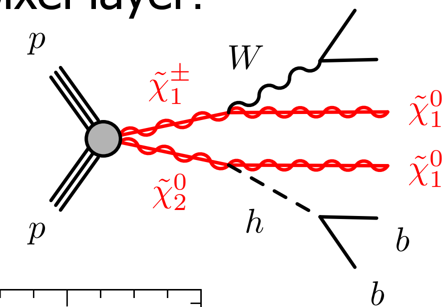


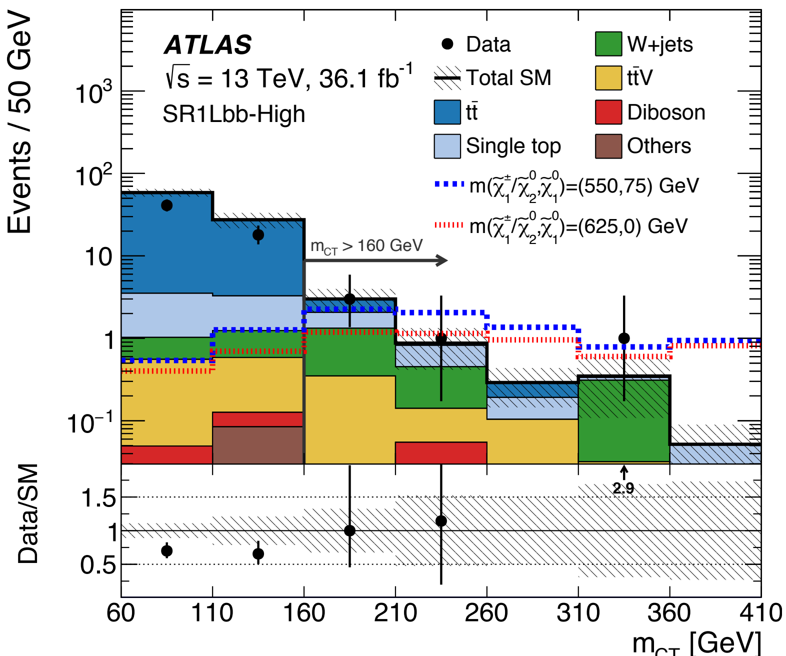


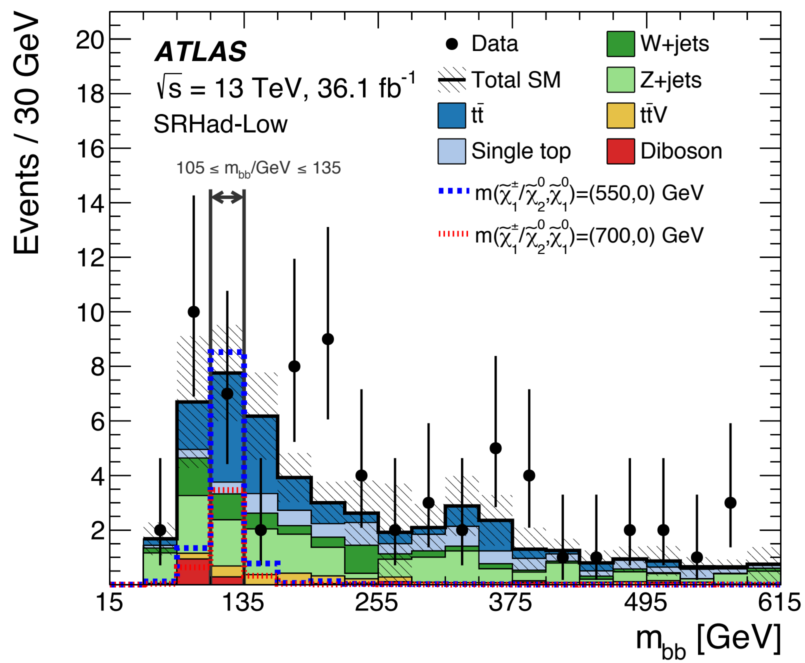


Chargino/Neutralino: Wh→bb

- ⇨ Search for h→bb final state with 105 GeV < m_{bb} < 135 GeV
- ⇨ Benefit from improved light-flavor rejection due to new IBL pixel layer!
- ⇨ Events triggered with MET > 200 GeV and selected with large contransverse mass m_{CT} to reduce top backgrounds
- ⇨ No excesses in either zero or one lepton final states



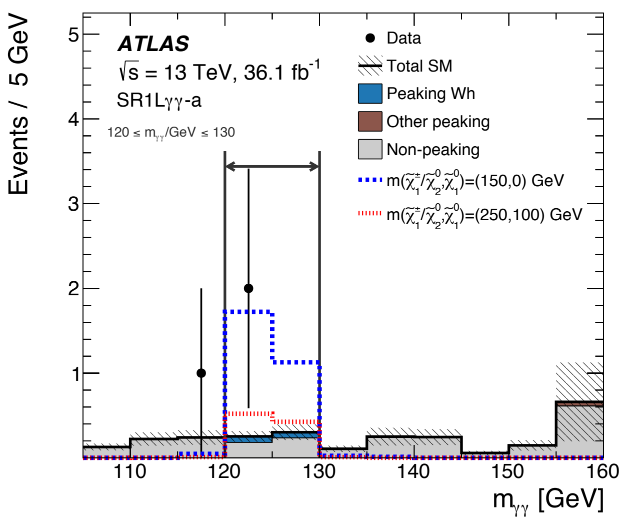


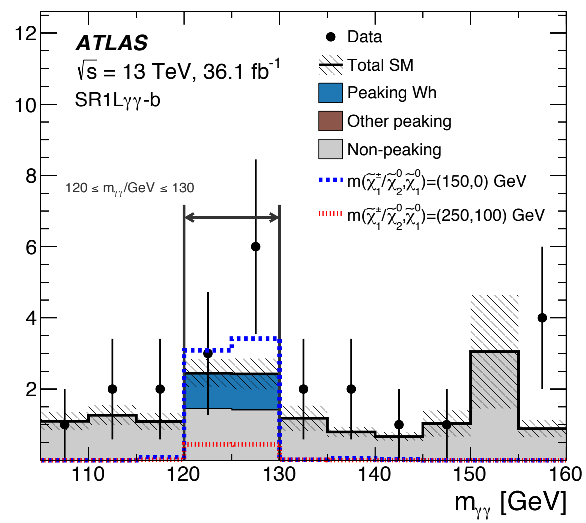


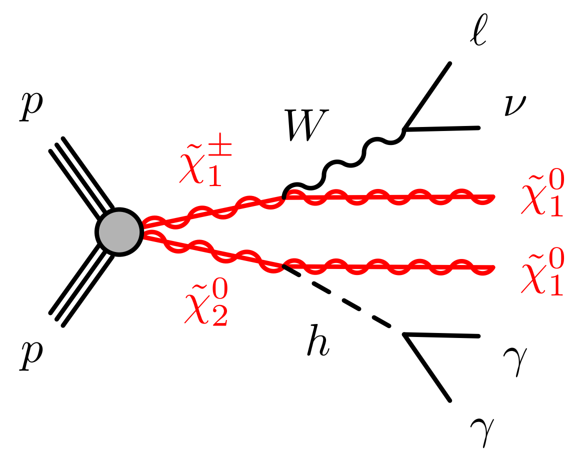
$$m_{\rm CT} = \sqrt{2p_{\rm T}^{b_1} p_{\rm T}^{b_2} (1 + \cos \Delta\phi_{bb})},$$

Chargino/Neutralino: Wh→γγ

- Search for narrow resonance from h->γγ decay in Wh signature
- Robust background estimation:
  - **Non-peaking contributions** → side band fit in 105 GeV < $m_{\gamma\gamma}$ < 160 GeV
  - **Peaking standard model Higgs** → dominant contribution from Wh, taken from Monte Carlo and normalized to NLO cross section







SR channels	SR1L$\gamma\gamma$-a	SR1L$\gamma\gamma$-b
Observed events	2	9
Total bkg events	0.37 ± 0.22	5.3 ± 1.0
Wh background	0.09 ± 0.01	1.8 ± 0.3
Other peaking backgrounds	0.04 ± 0.01	0.19 ± 0.02
Non-peaking background	0.22 ± 0.22	3.3 ± 0.9

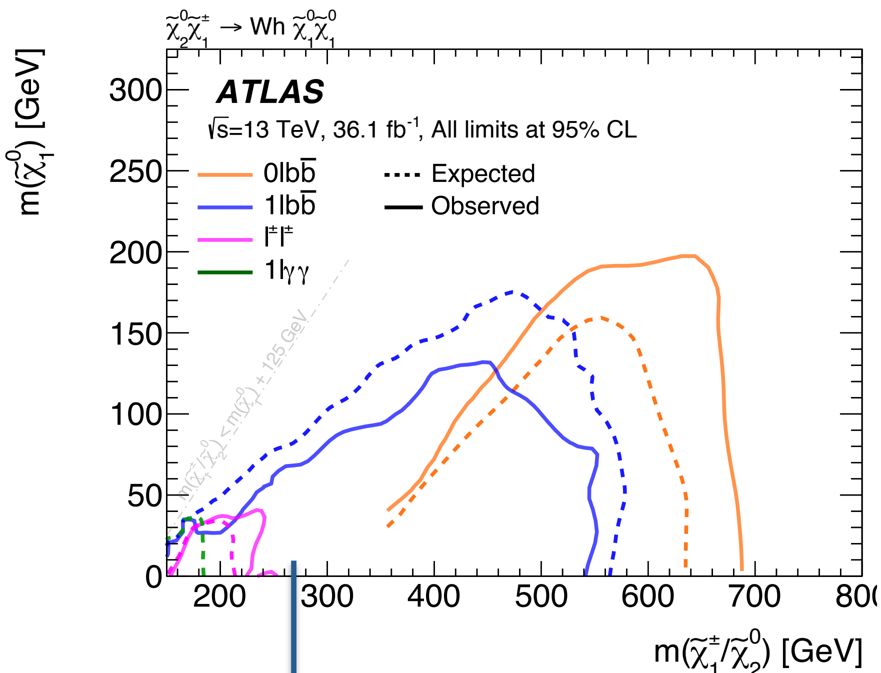
Discovery p_0 values:

→ **SR1Lγγ-a: 0.03**

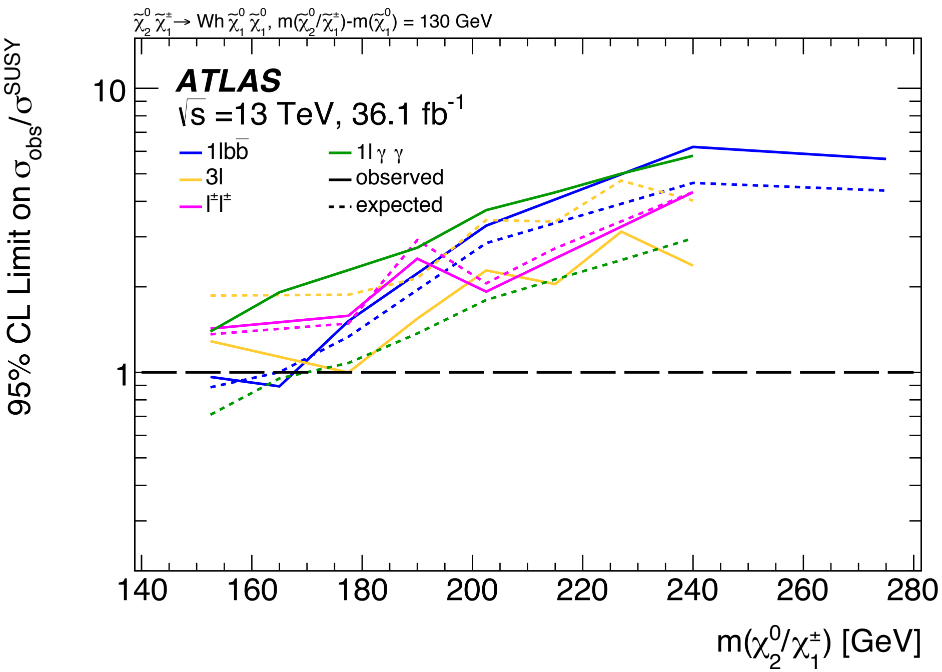
→ **SR1Lγγ-b: 0.09**

Wh exclusion

- ⇨ No significant excesses observed for ATLAS Wh searches
- ⇨ Excluding chargino masses up to 680 GeV for a massless LSP
- ⇨ Significant improvement in sensitivity compared to Run 1 analysis!



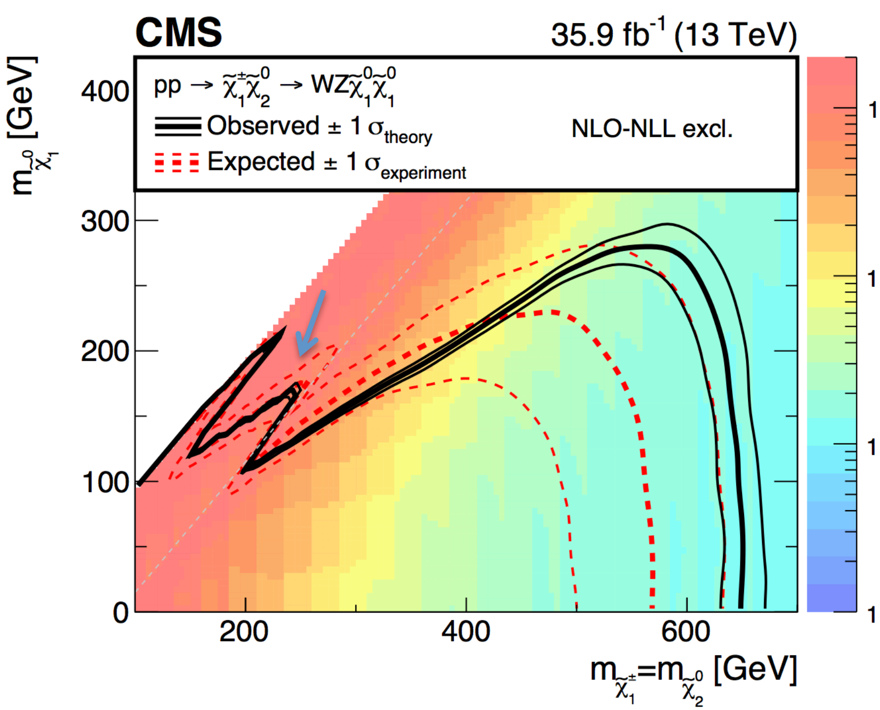
ATLAS Run 1 combined limit for a massless lightest neutralino



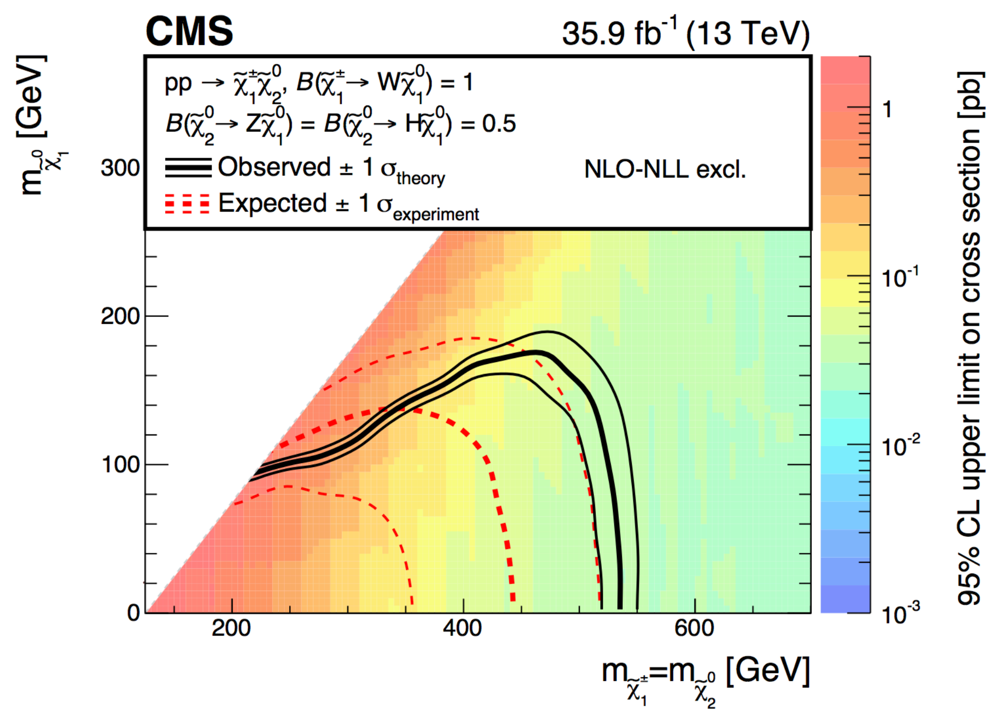
Submitted to PRD; arXiv:1812.09432

Chargino/Neutralino combinations

- ⇨ Searches for charginos and neutralinos decaying through WZ or Wh
- ⇨ Statistical combination of analyses targeting WZ and Wh
  - – Dedicated efforts to target the challenging scenario $m_{\tilde{\chi}_2^0} - m_{\tilde{\chi}_1^0} \approx m_Z$
- ⇨ Interpretation assuming mixed decays to Wh / WZ



Decays to WZ 100%



Decays to WZ=WH=50%

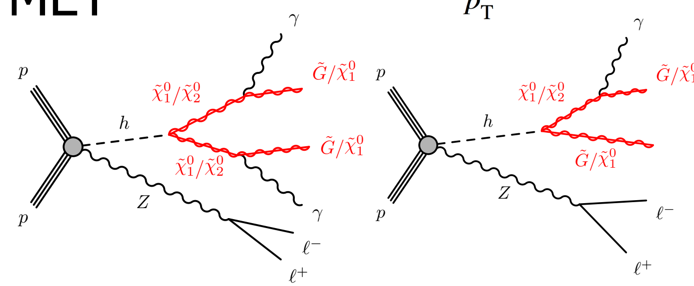
Exotic Higgs decays with photons

- Gauge Mediated Supersymmetry Breaking (GMSB) model
- Events with MET > 95 GeV and no jets with p_T>20 GeV
- Require balance between Z→ll and higgs + MET
- **Dominant backgrounds**
  - Electron faking a photon (WZ→eνll)
  - Z+jets with jet faking a photon
  - SM Zγ → shape from MC, normalization in CRs

(Electron faking a photon and Z+jets with jet faking a photon: **Data-driven**)

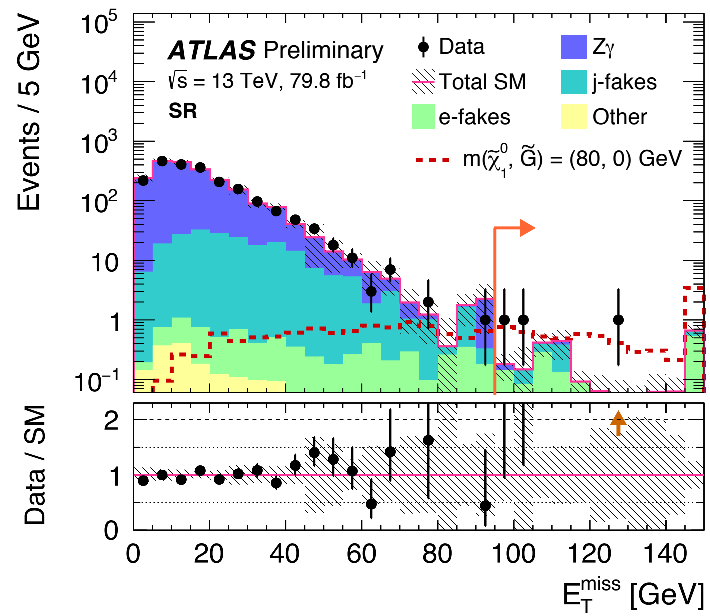
$$\Delta\phi_{\ell\ell,\gamma E_T^{miss}}$$

$$\frac{|p_T^{\ell\ell} - p_T^{\gamma E_T^{miss}}|}{p_T^{\gamma E_T^{miss}}}$$



Observations consistent with predictions

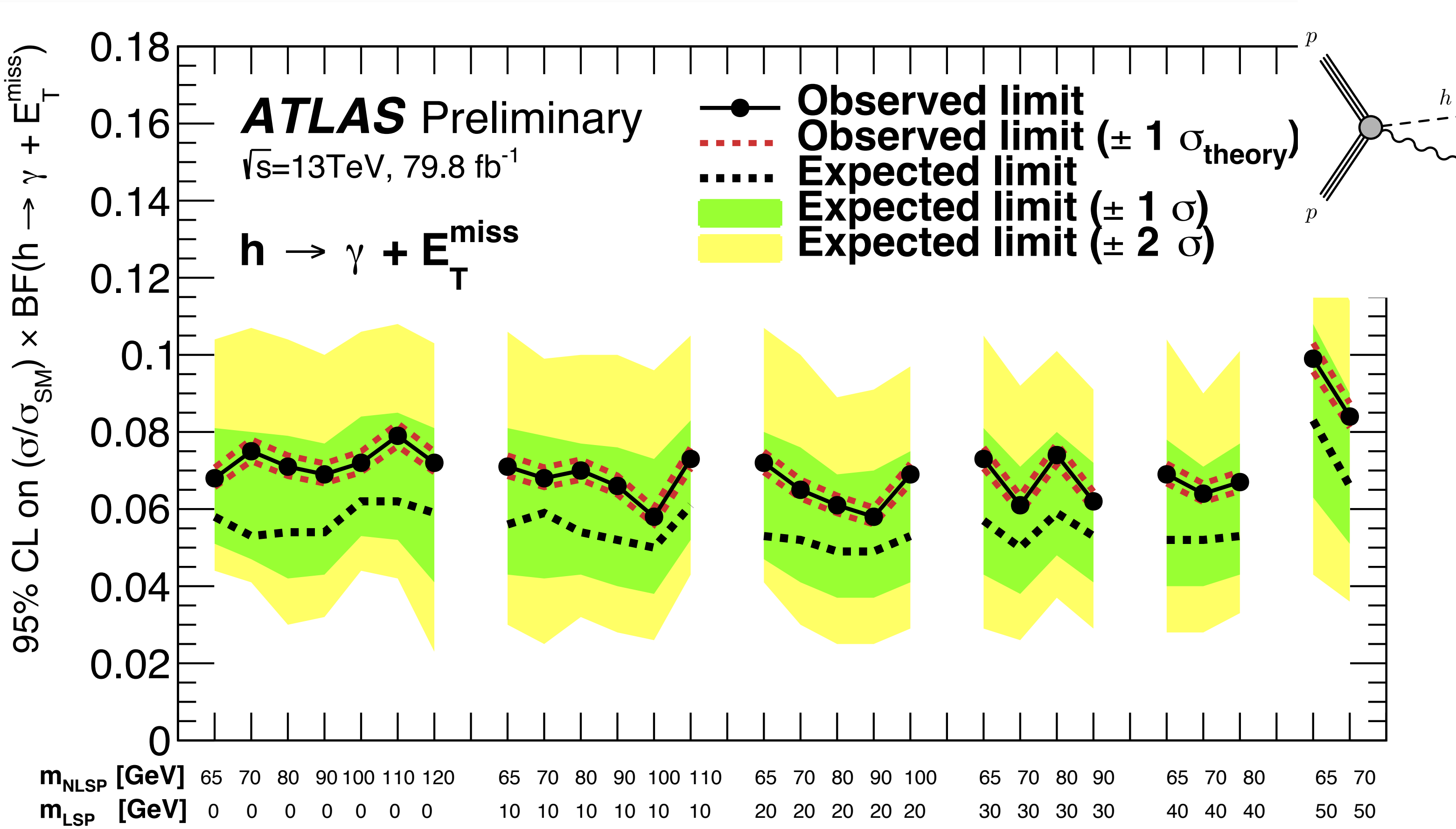
Observed events	3
Expected background events	2.1 ± 0.5
Expected signal events m_{NLSP}, m_{LSP} = 80, 0 GeV	8.1
$e \rightarrow \gamma$ fakes	1.5 ± 0.3
$\mathrm{j} \rightarrow \gamma$ fakes	0.6 ± 0.3
SM $Z\gamma$	$0.03^{+0.15}_{-0.03}$
Other	$0.00^{+0.01}_{-0.00}$

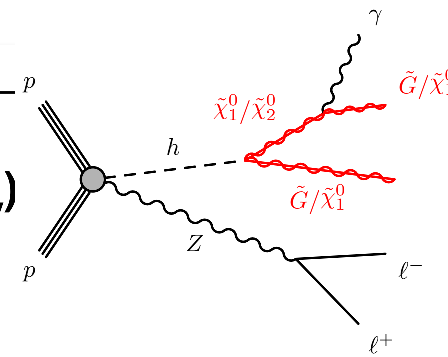


ATLAS-CONF-2018-019

Exotic Higgs decays with photons

⇨ Upper limits of the BR of Higgs boson decays to one or two photons in this GMSB model ranges from ~5-15%

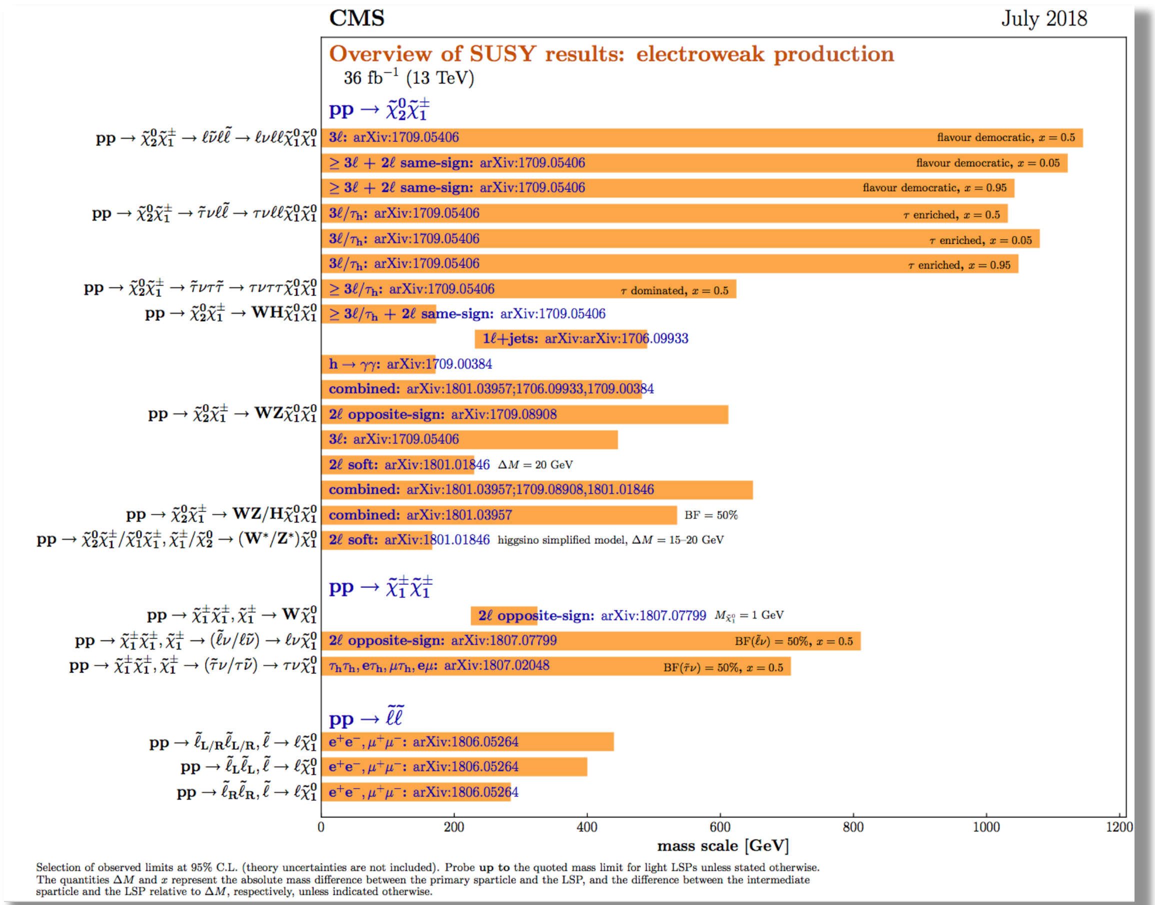




Summary

ATLAS and CMS have a rich electroweak SUSY search program

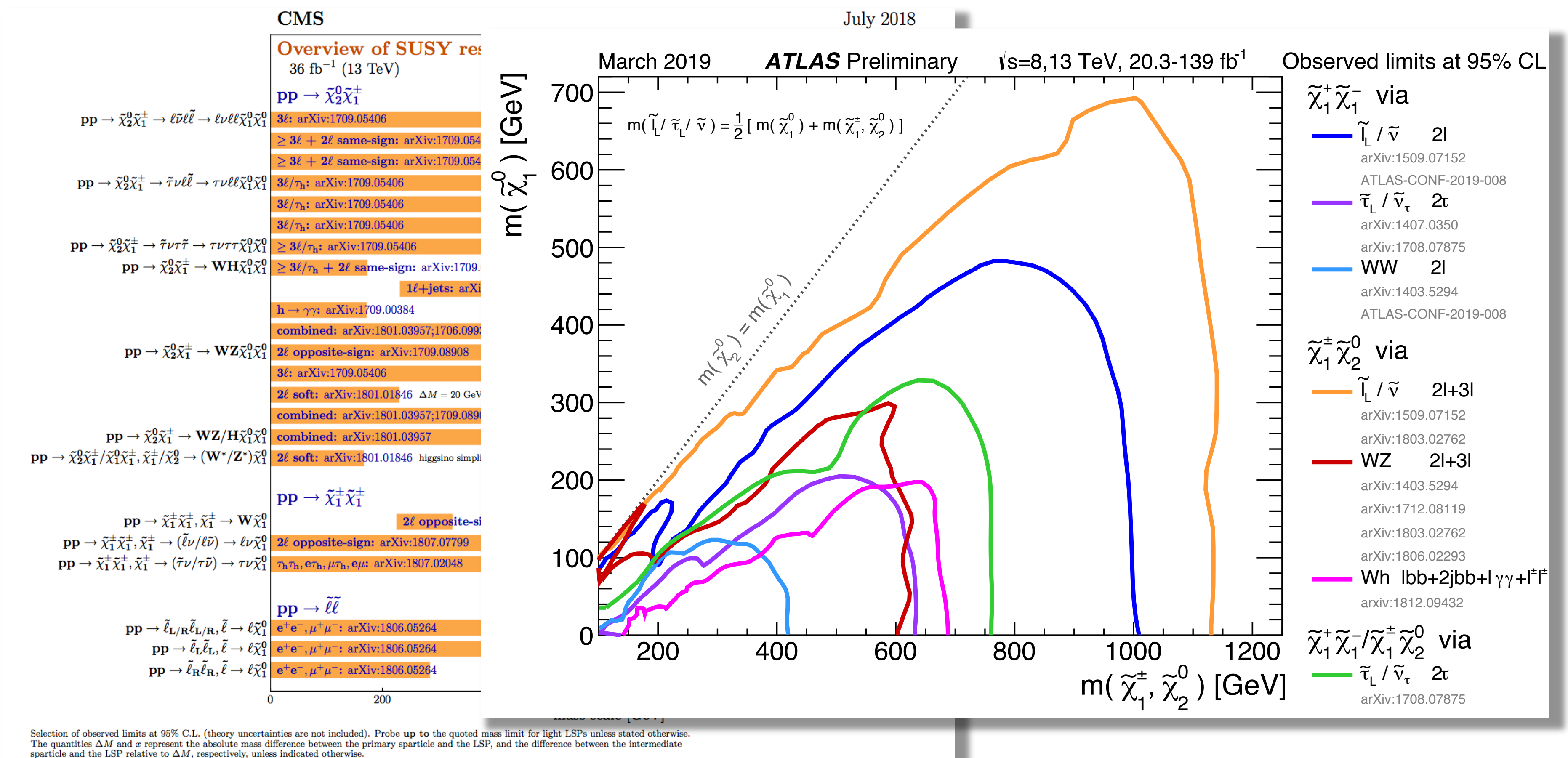
→ Strong constraints on electroweak SUSY parameter space



Summary

ATLAS and CMS have a rich electroweak SUSY search program

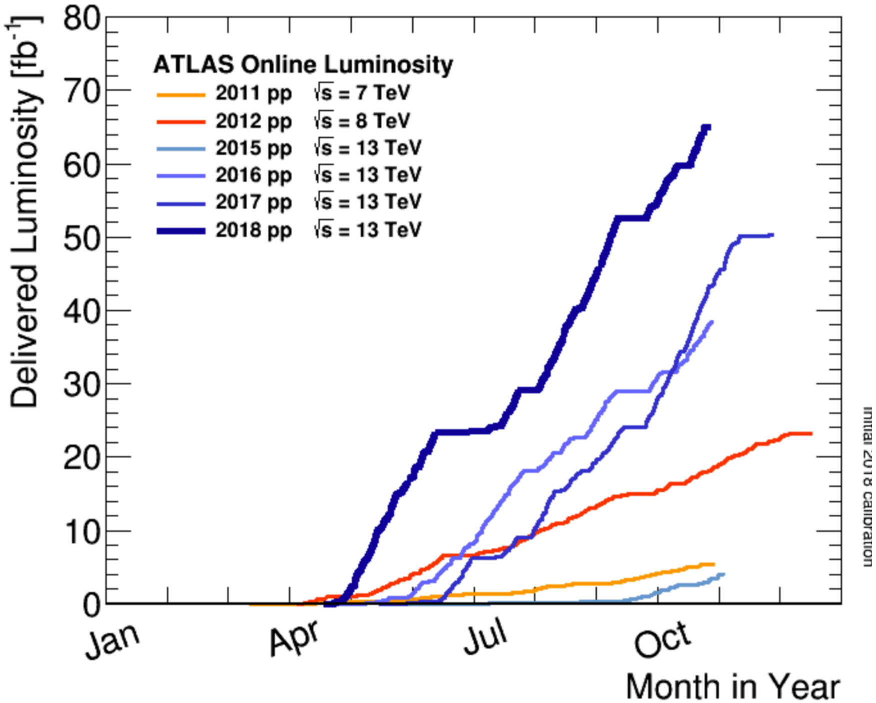
→ Strong constraints on electroweak SUSY parameter space

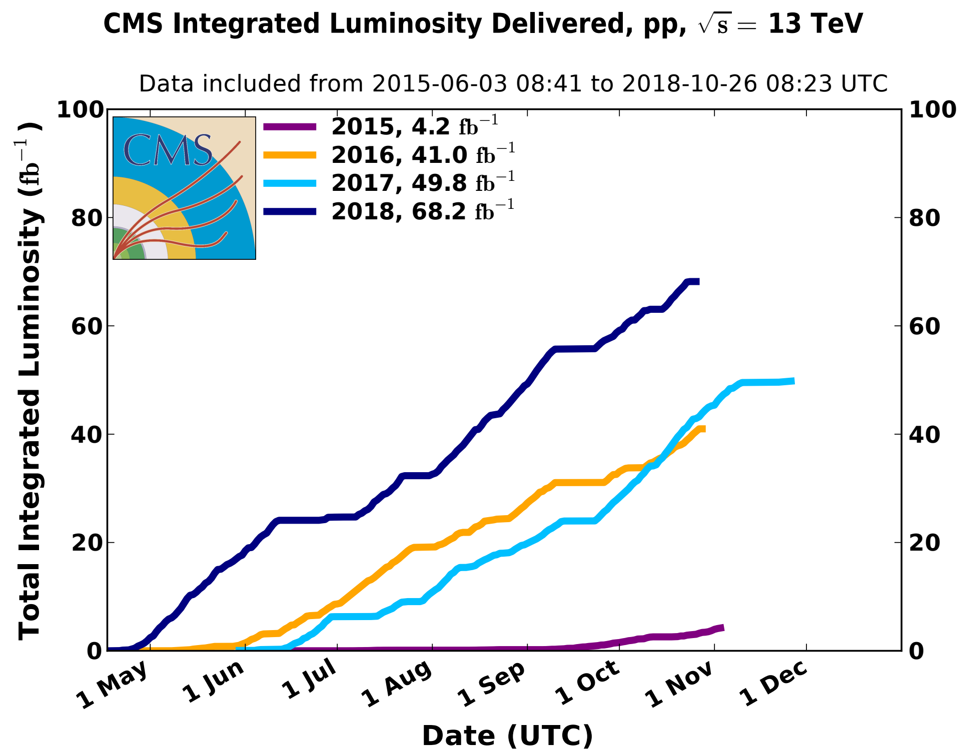


Summary

ATLAS and CMS have a rich electroweak SUSY search program

→ Strong constraints on electroweak SUSY parameter space

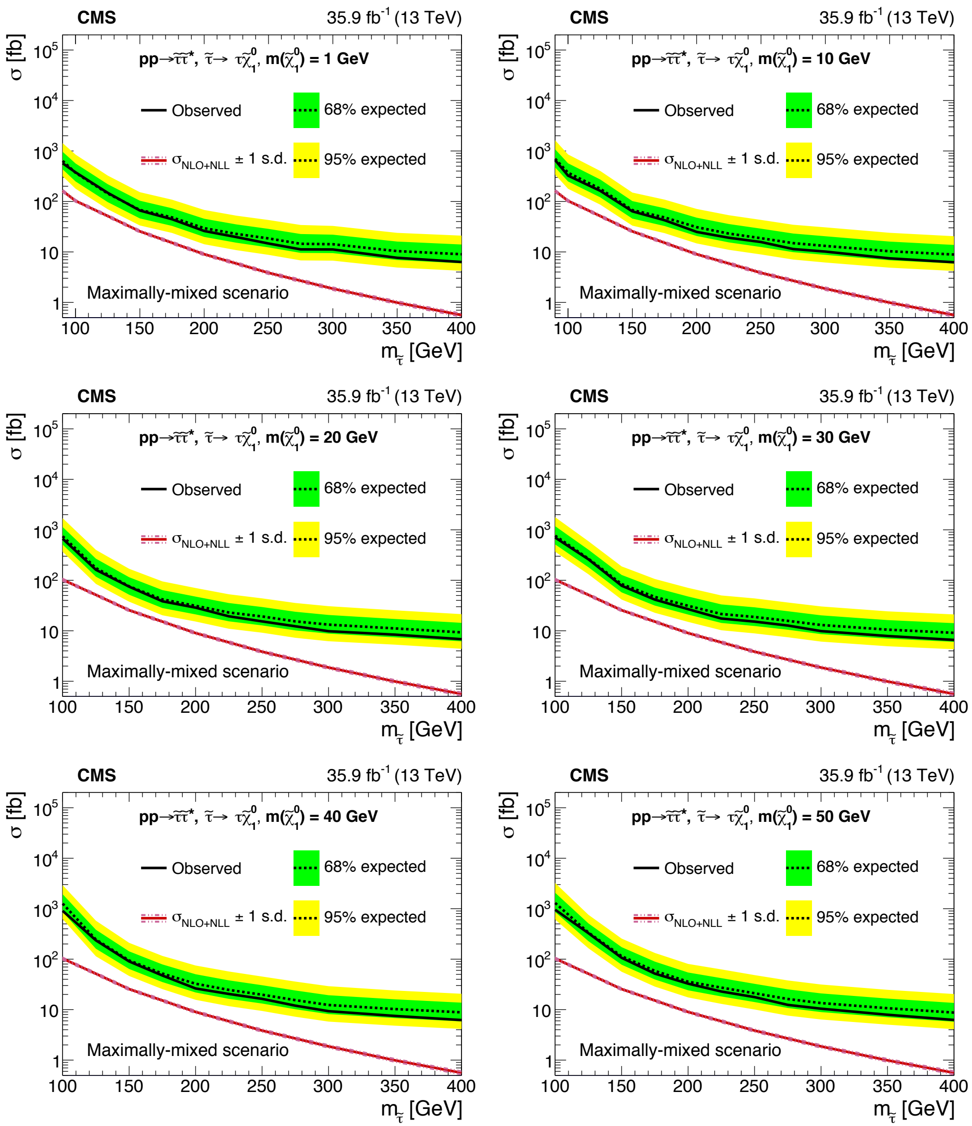


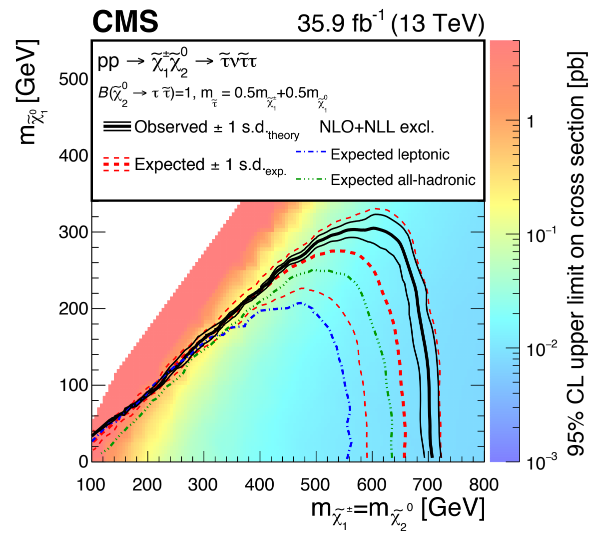


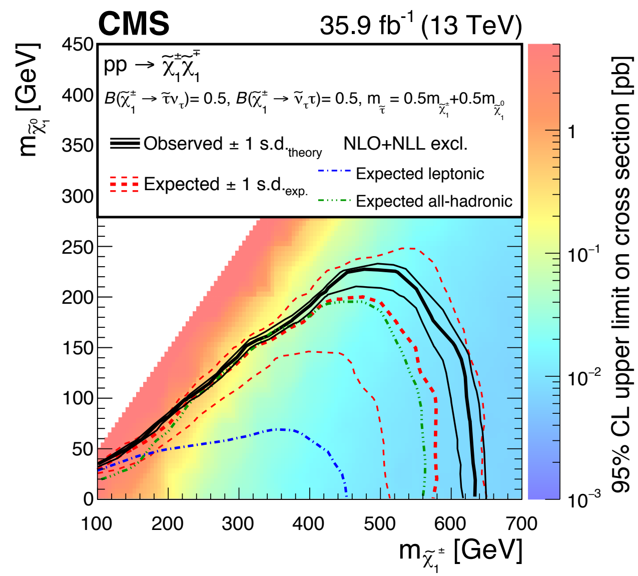
Both experiments have a lot more data on tape ! Stay tuned !

Backup slides

Stau limits

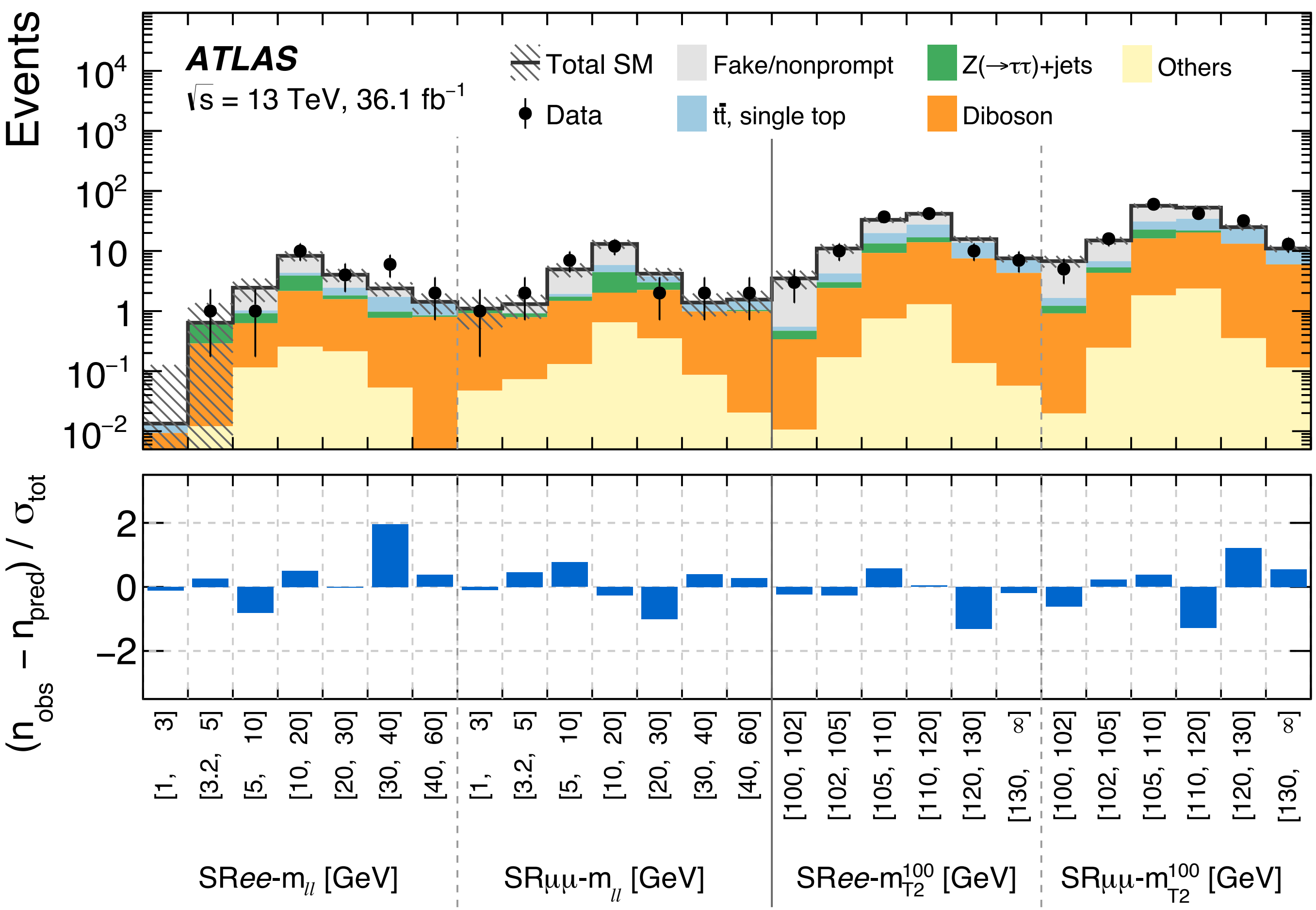

CMS
35.9 fb^{-1} (13 TeV)
pp→$\tilde{\tau}\tilde{\tau}^*$, $\tilde{\tau}$→ $\tau\tilde{\chi}^0_1$, m($\tilde{\chi}^0_1$) = 1 GeV
pp→$\tilde{\tau}\tilde{\tau}^*$, $\tilde{\tau}$→ $\tau\tilde{\chi}^0_1$, m($\tilde{\chi}^0_1$) = 10 GeV
pp→$\tilde{\tau}\tilde{\tau}^*$, $\tilde{\tau}$→ $\tau\tilde{\chi}^0_1$, m($\tilde{\chi}^0_1$) = 20 GeV
pp→$\tilde{\tau}\tilde{\tau}^*$, $\tilde{\tau}$→ $\tau\tilde{\chi}^0_1$, m($\tilde{\chi}^0_1$) = 30 GeV
pp→$\tilde{\tau}\tilde{\tau}^*$, $\tilde{\tau}$→ $\tau\tilde{\chi}^0_1$, m($\tilde{\chi}^0_1$) = 40 GeV
pp→$\tilde{\tau}\tilde{\tau}^*$, $\tilde{\tau}$→ $\tau\tilde{\chi}^0_1$, m($\tilde{\chi}^0_1$) = 50 GeV
Observed
68% expected
$\sigma_{NLO+NLL}$ ± 1 s.d.
95% expected
Maximally-mixed scenario
σ [fb]
$m_{\tilde{\tau}}$ [GeV]

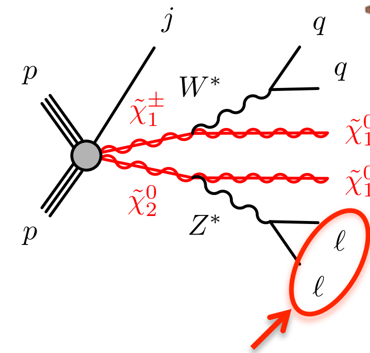

CMS
35.9 fb^{-1} (13 TeV)
pp → $\tilde{\chi}^{\pm}_1\tilde{\chi}^0_2$ → $\tilde{\tau}\nu\tilde{\tau}\tau$
$B(\tilde{\chi}^0_2 \rightarrow \tau\tilde{\tau})$=1, $m_{\tilde{\tau}} = 0.5m_{\tilde{\chi}^{\pm}_1} + 0.5m_{\tilde{\chi}^0_1}$
Observed ± 1 s.d.$_{theory}$
NLO+NLL excl.
Expected ± 1 s.d.$_{exp.}$
Expected leptonic
Expected all-hadronic
$m_{\tilde{\chi}^0_1}$ [GeV]
$m_{\tilde{\chi}^{\pm}_1} = m_{\tilde{\chi}^0_2}$ [GeV]
95% CL upper limit on cross section [pb]


CMS
35.9 fb^{-1} (13 TeV)
pp → $\tilde{\chi}^{\pm}_1\tilde{\chi}^{\mp}_1$
$B(\tilde{\chi}^{\pm}_1 \rightarrow \tilde{\tau}\nu_\tau)$= 0.5, $B(\tilde{\chi}^{\pm}_1 \rightarrow \tilde{\nu}_\tau\tau)$= 0.5, $m_{\tilde{\tau}} = 0.5m_{\tilde{\chi}^{\pm}_1} + 0.5m_{\tilde{\chi}^0_1}$
Observed ± 1 s.d.$_{theory}$
NLO+NLL excl.
Expected ± 1 s.d.$_{exp.}$
Expected leptonic
Expected all-hadronic
$m_{\tilde{\chi}^0_1}$ [GeV]
$m_{\tilde{\chi}^{\pm}_1}$ [GeV]
95% CL upper limit on cross section [pb]

Compressed results

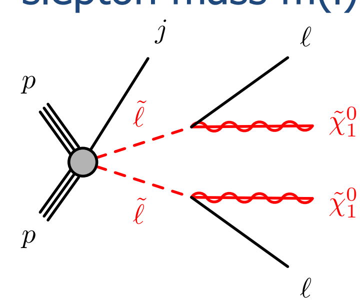
Observations in agreement with predictions





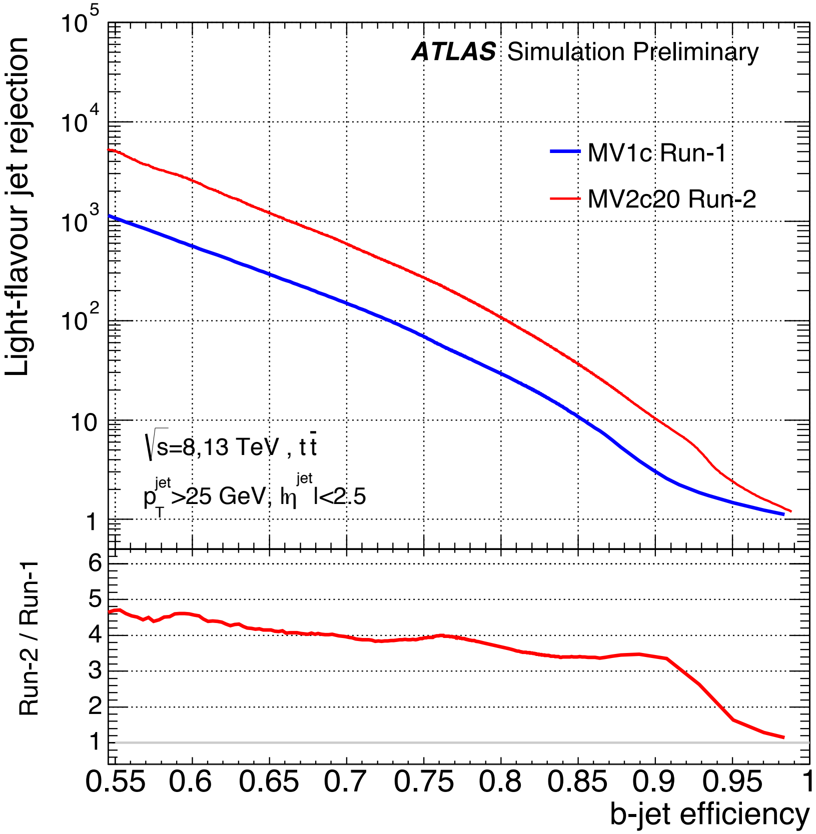
- Shape fit in dil-epton invariant mass m_{ll}
- Sensitivity to a range of mass splittings!

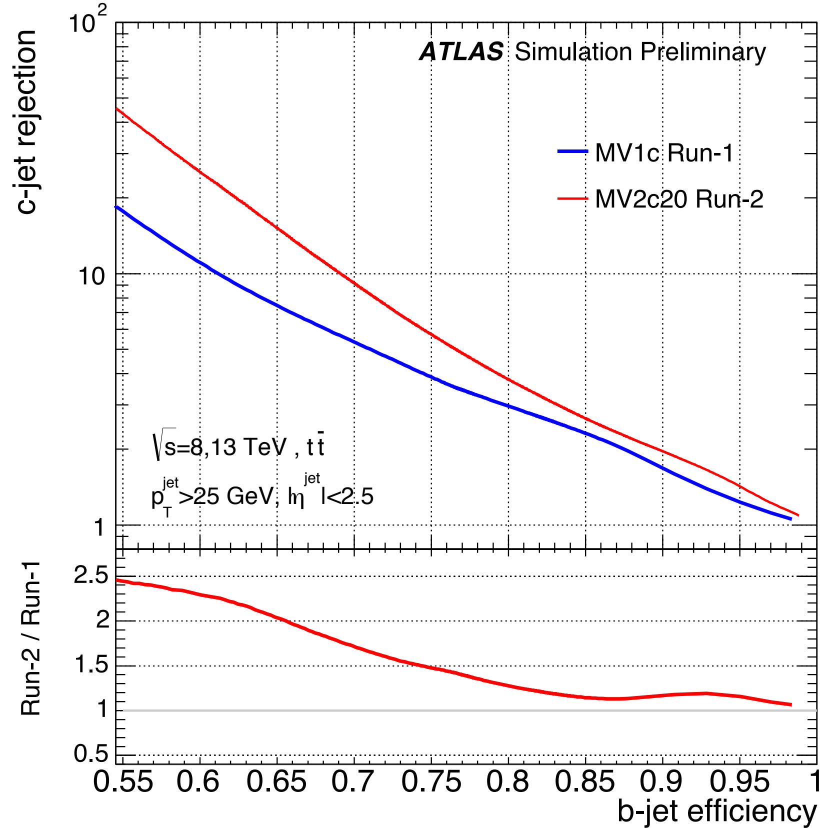
- Shape fit stransverse mass m_{T2}
- Bound from above by slepton mass m(l)



$$m_{T2}^{m_\chi}\left(\mathbf{p}_T^{\ell_1}, \mathbf{p}_T^{\ell_2}, \mathbf{p}_T^{miss}\right) = \min_{\mathbf{q}_T}\left(\max\left[m_T\left(\mathbf{p}_T^{\ell_1}, \mathbf{q}_T, m_\chi\right), m_T\left(\mathbf{p}_T^{\ell_2}, \mathbf{p}_T^{miss} - \mathbf{q}_T, m_\chi\right)\right]\right)$$

ATLAS B-tagging improvements

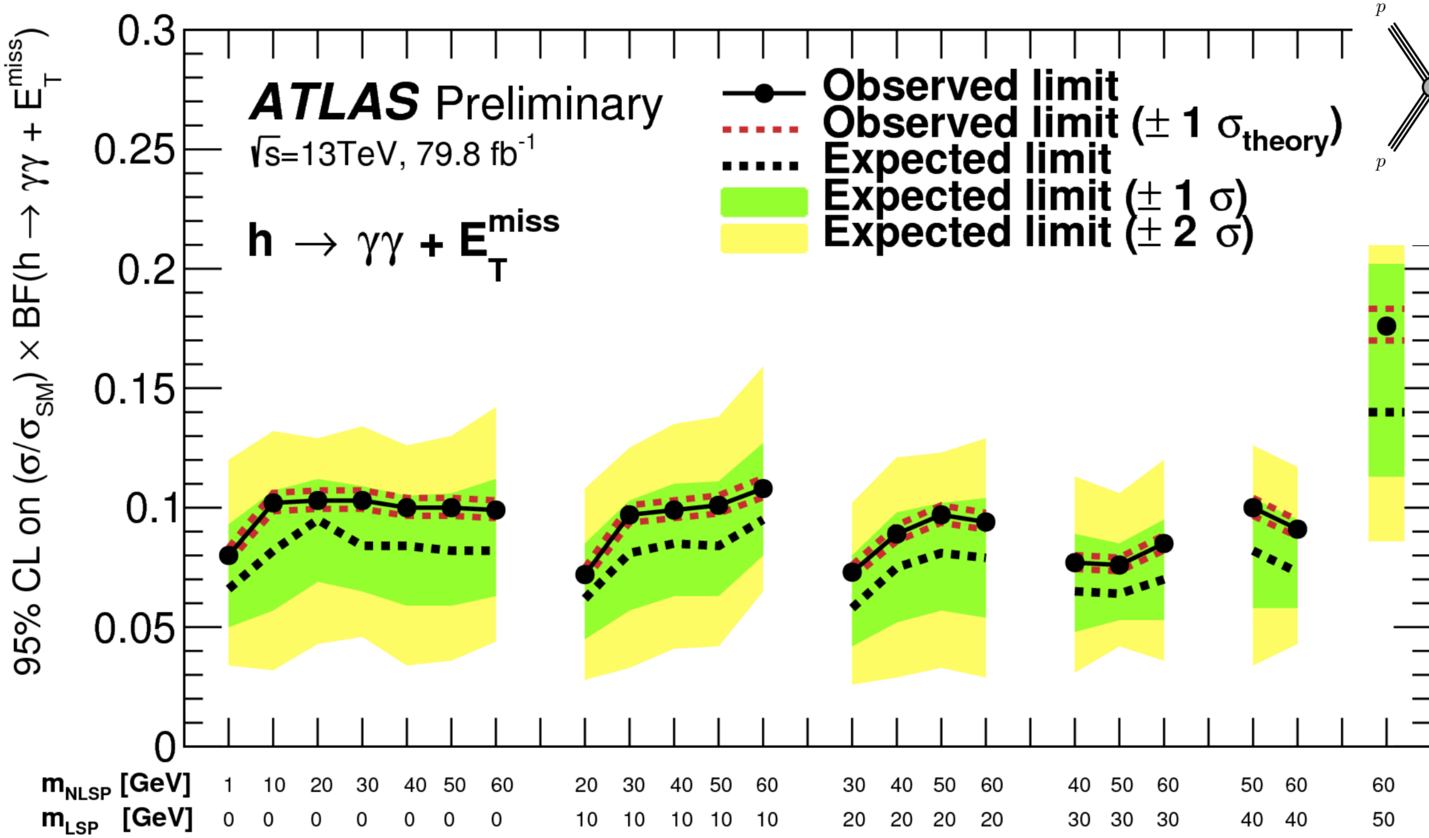


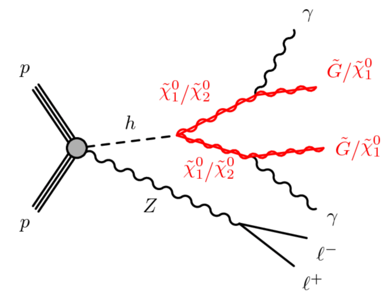


ATL-PHYS-PUB-2015-022

Exotic Higgs decays with photons

⇨ GMSB diphoton limits



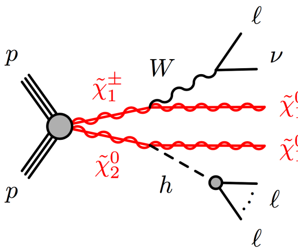


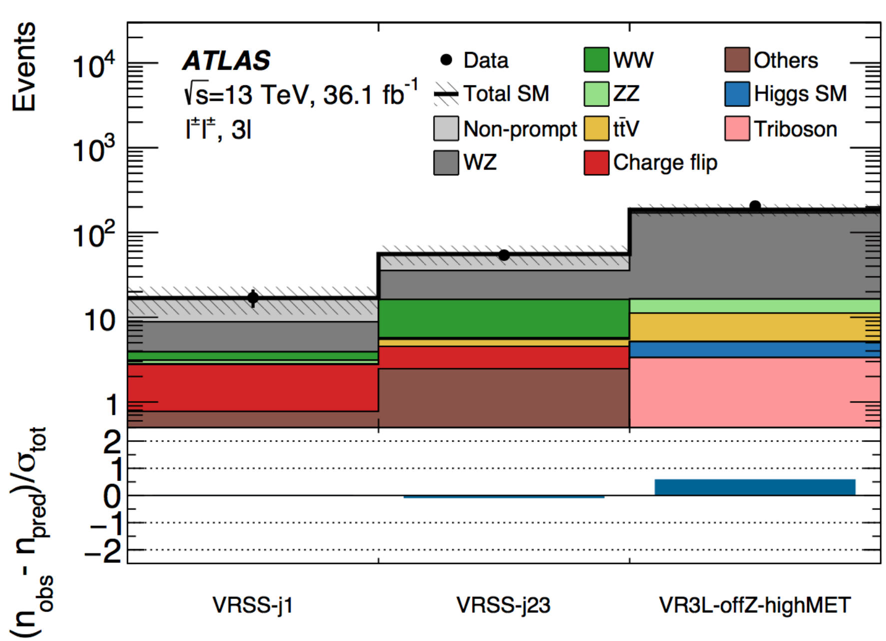
GMSB event selection

Cut	CR WZ	CR $Z\gamma$	VR $Z\gamma$	VR jets	SR
Pass triggers and vetos	✓	✓	✓	✓	✓
2 signal leptons	✓	✓	✓	✓	✓
At least 1 signal photon	> 25 GeV(electron)	> 25 GeV	> 25 GeV	> 25 GeV	> 25 GeV
$m_{\ell\ell}^{\mathrm{win}}$	81-101 GeV	81-101 GeV	81-101 GeV	85-120 GeV	81-101 GeV
$E_{\mathrm{T}}^{\mathrm{miss}}$	> 95 GeV	20-35 GeV	35-70 GeV	> 35 GeV	> 95 GeV
$\mathrm{Bal}_{p_{\mathrm{T}}}$	< 0.2	< 0.2	< 0.2	-	< 0.2
$\Delta\phi_{\ell\ell,\gamma E_{\mathrm{T}}^{\mathrm{miss}}}$	> 2.8	-	-	< 2.2	> 2.8
$\Delta\phi(\ell,\ell)$	< 1.4	< 2.0	< 2.0	-	< 1.4

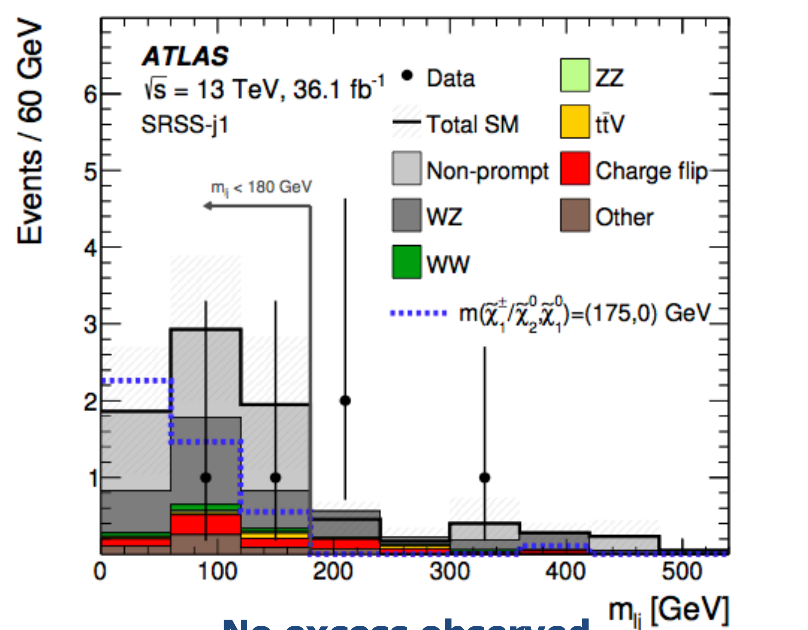
Chargino/Neutralino: Wh→leptons

- Searches for Wh using 2-3 leptons + MET, h → WW/ZZ/ττ
- Backgrounds estimated from data and MC:
  - Non-prompt leptons from heavy flavor jets → data-driven matrix method
  - Charge flip probability extracted from Z→ee events vs p_T and η
  - Real backgrounds from WZ and ZZ production → MC estimate validated in VRs





Good agreement in all validation regions



No excess observed in any of the 8 SRs

Wh lepton SRs

0lbb

Variable	SRHad-High	SRHad-Low
N_{lepton}	$= 0$	$= 0$
N_{jet} ($p_{\text{T}} > 30$ GeV)	$\in [4,\ 5]$	$\in [4,\ 5]$
$N_{b\text{-jet}}$	$= 2$	$= 2$
$\Delta\phi^{4j}_{\text{min}}$	> 0.4	> 0.4
$E_{\text{T}}^{\text{miss}}$ [GeV]	> 250	> 200
m_{eff} [GeV]	> 900	> 700
$m_{b\bar{b}}$ [GeV]	$\in [105, 135]$	$\in [105, 135]$
$m_{q\bar{q}}$ [GeV]	$\in [75, 90]$	$\in [75, 90]$
m_{CT} [GeV]	> 140	> 190
$m_{\text{T}}^{b,\text{min}}$ [GeV]	> 160	> 180

1lbb

Variable	SR1Lbb-Low	SR1Lbb-Medium	SR1Lbb-High
N_{lepton}		$= 1$	
p_{T}^{ℓ} [GeV]		> 27	
N_{jet} ($p_{\text{T}} > 25$ GeV)		$= 2$ or 3	
$N_{b\text{-jet}}$		$= 2$	
$E_{\text{T}}^{\text{miss}}$ [GeV]		> 200	
m_{CT} [GeV]		> 160	
m_{T} [GeV]	$\in [100, 140]$	$\in [140, 200]$	> 200
$m_{b\bar{b}}$ [GeV]		$\in [105, 135]$	

1lγγ

Variable	SR1L$\gamma\gamma$-a	SR1L$\gamma\gamma$-b
N_{γ}	$= 2$	
p_{T}^{γ} [GeV]	$> (40, 31)$	
N_{lepton}	$= 1$	
p_{T}^{ℓ} [GeV]	> 25	
$E_{\text{T}}^{\text{miss}}$ [GeV]	> 40	
$\Delta\phi_{W,h}$	> 2.25	
$m_{\gamma\gamma}$ [GeV]	$\in [120, 130]$	
$N_{b\text{-jet}}$ ($p_{\text{T}} > 30$ GeV)	$= 0$	
$m_{\text{T}}^{W\gamma_1}$ [GeV]	≥ 150	
$m_{\text{T}}^{W\gamma_2}$ [GeV]	> 140	$\in [80, 140]$
m_{T} [GeV]	> 110	< 110

SS leptons

Variable	SRSS-j1	SRSS-j23
$\Delta\eta_{\ell\ell}$	< 1.5	-
N_{jet} ($p_{\text{T}} > 20$ GeV)	$= 1$	$= 2$ or 3
$N_{b\text{-jet}}$	$= 0$	$= 0$
$E_{\text{T}}^{\text{miss}}$ [GeV]	> 100	> 100
m_{T} [GeV]	> 140	> 120
m_{eff} [GeV]	> 260	> 240
$m_{\ell j(j)}$ [GeV]	< 180	< 130
m_{T2} [GeV]	> 80	> 70

3l

Variable	SR3L-SFOS-0Ja	SR3L-SFOS-0Jb	SR3L-SFOS-1J
N_{jet} ($p_{\text{T}} > 20$ GeV)	$= 0$	$= 0$	> 0
$N_{b\text{-jet}}$	$= 0$	$= 0$	$= 0$
$E_{\text{T}}^{\text{miss}}$ [GeV]	$\in [80, 120]$	> 120	> 110
$m_{\text{T}}^{\text{min}}$ [GeV]	> 110	> 110	> 110
$m_{\text{SFOS}}^{\text{min}}$	> 20 GeV, $\notin [81.2, 101.2]$	> 20 GeV, $\notin [81.2, 101.2]$	> 20 GeV, $\notin [81.2, 101.2]$

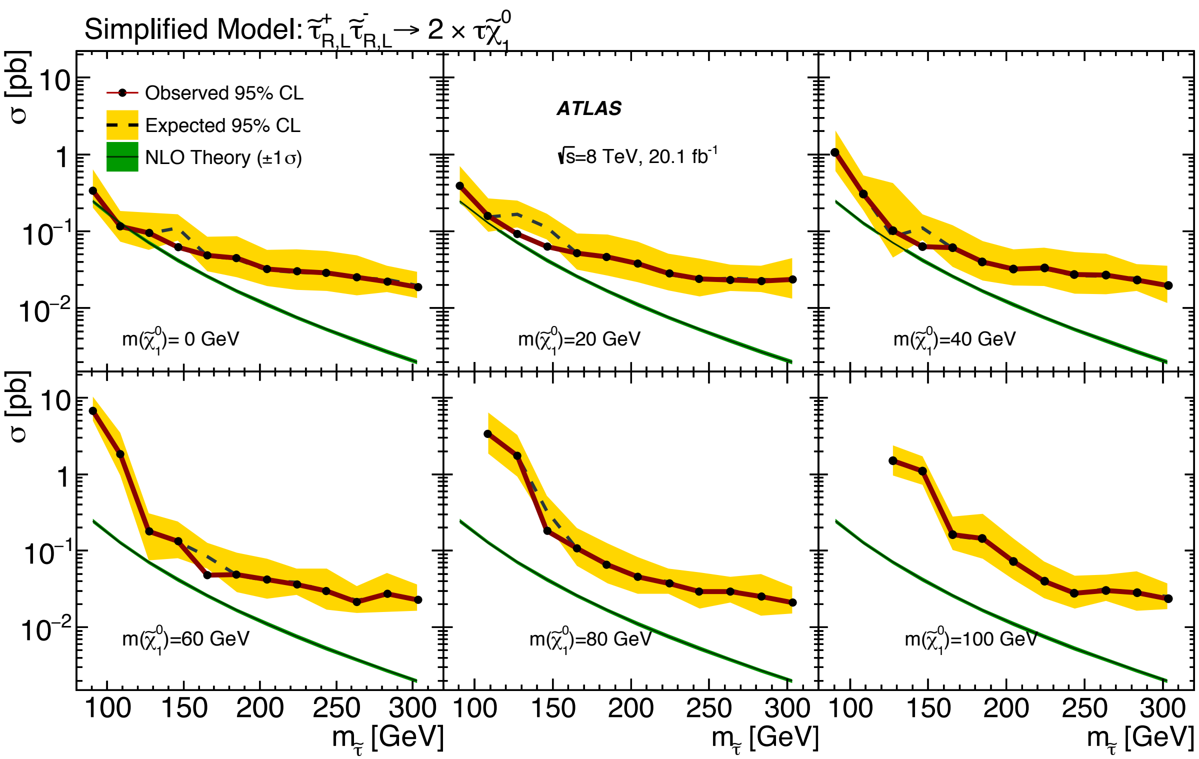
WZ Corridor SRs

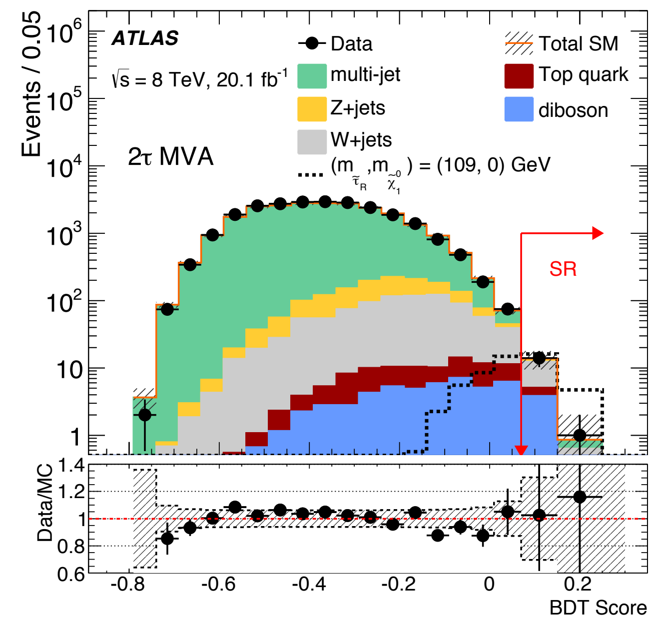
$m_{\ell\ell}$ (GeV)	M_T (GeV)	p_T^{miss} (GeV)	$H_T < 100$ GeV		$100 \le H_T < 200$ GeV		$H_T \ge 200$ GeV	
0–75	0–100	50–100	175 ± 20		166		39 ± 6	41
		100–150	27 ± 4		23			
		150–200	5 ± 1		6			
		$\geq$200	2.5 ± 0.8		1			
	100–160	50–100	50 ± 8		56		10 ± 3	13
		100–150	12 ± 3		13			
		$\geq$150	1.2 ± 0.4		1			
	$\geq$160	50–100	12 ± 2		13		6 ± 2	11
		100–150	11 ± 3		14			
		150–200	2.6 ± 0.9		2			
		$\geq$200	1.2 ± 0.5		1			
75–105	0–100	50–100	(WZ CR)		279 ± 34	250	310 ± 40	292
		100–150	286 ± 44	260	87 ± 13	81		
		150–200	62 ± 14	51	26 ± 6	20	81 ± 18	69
		200–250	20 ± 5	10	8 ± 2	10		
		250–350	16 ± 4	9	6 ± 1	5	25 ± 6	23
		$\geq$350					13 ± 3	8
	100–160	50–100	321 ± 42	297	54 ± 8	49	45 ± 6	45
		100–150	50 ± 14	38	11 ± 3	11	14 ± 3	12
		150–200	5 ± 2	2	2.2 ± 0.9	2	4 ± 2	5
		200–250	1.1 ± 0.5	2	0.5 ± 0.4	2	1.9 ± 0.8	1
		250–300					1.8 ± 0.8	2
		$\geq$300					1.0 ± 0.5	1
	$\geq$160	50–100	25 ± 6	18	6 ± 2	5	9 ± 3	12
		100–150	12 ± 5	13	3.0 ± 1.3	2	4 ± 2	2
		150–200	5 ± 2	5	1.1 ± 0.4	0	2.0 ± 0.7	2
		200–250	4 ± 2	2	0.9 ± 0.4	3	1.5 ± 0.7	2
		250–300					0.6 ± 0.3	1
		$\geq$300					1.1 ± 0.5	1
$\geq$105	0–100	$\geq$50	173 ± 21				170	
	100–160	$\geq$50	44 ± 7				28	
	$\geq$160	$\geq$50	23 ± 6				12	

$m_{\ell\ell}$ (GeV)	M_T (GeV)	p_T^{miss} (GeV)	$H_T < 100$ GeV	$100 \le H_T < 200$ GeV	$H_T \ge 200$ GeV
0–75	0–100	50–100	SR 01		SR 12
		100–150	SR 02		
		150–200	SR 03		
		$\geq$200	SR 04		
	100–160	50–100	SR 05		SR 13
		100–150	SR 06		
		$\geq$150	SR 07		
	$\geq$160	50–100	SR 08		SR 14
		100–150	SR 09		
		150–200	SR 10		
		$\geq$200	SR 11		
75–105	0–100	50–100	(WZ CR)	SR 27	SR 40
		100–150	SR 15	SR 28	
		150–200	SR 16	SR 29	SR 41
		200–250	SR 17	SR 30	
		250–350	SR 18	SR 31	SR 42
		$\geq$350			SR 43
	100–160	50–100	SR 19	SR 32	SR 44
		100–150	SR 20	SR 33	SR 45
		150–200	SR 21	SR 34	SR 46
		200–250	SR 22	SR 35	SR 47
		250–300			SR 48
		$\geq$300			SR 49
	$\geq$160	50–100	SR 23	SR 36	SR 50
		100–150	SR 24	SR 37	SR 51
		150–200	SR 25	SR 38	SR 52
		200–250	SR 26	SR 39	SR 53
		250–300			SR 54
		$\geq$300			SR 55
$\geq$105	0–100	$\geq$50	SR 56		
	100–160	$\geq$50	SR 57		
	$\geq$160	$\geq$50	SR 58		

ATLAS direct stau results

- ⇨ ATLAS limits from 8 TeV data using 20.1 fb^{-1} of data
- ⇨ BDT trained to separate signal from backgrounds
- ⇨ Exclude stau (left+right) mass of 108 GeV for a massless LSP!





Phys. Rev. D 93, 052002 (2016)