Same-Sign Dilepton Excesses at the LHC

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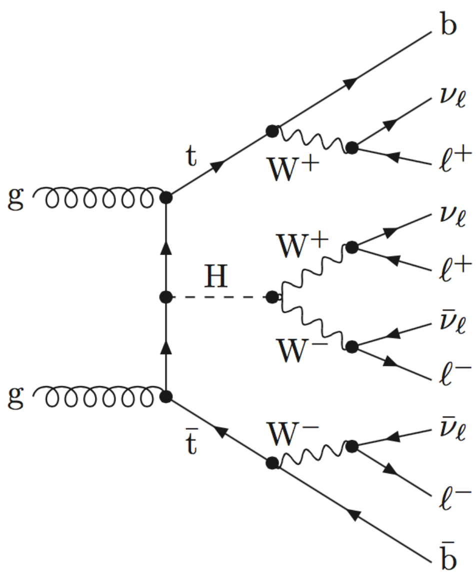
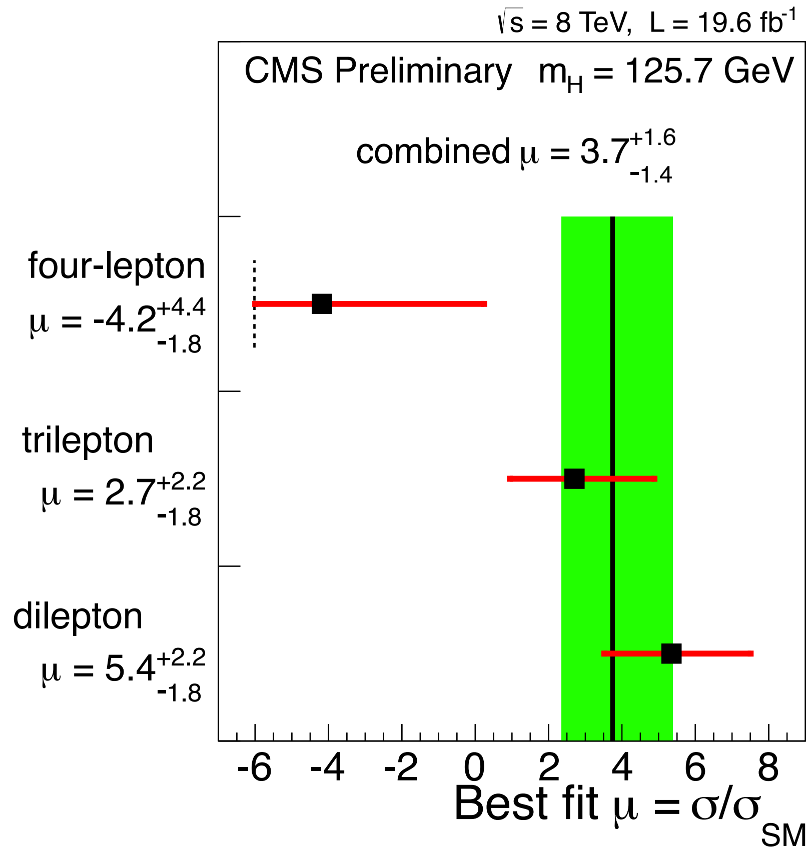
Peisi Huang, Ahmed Ismail, IL and Carlos Wagner: 1507.01601
Chuan-Ren Chen, Hsin-Chia Cheng and IL: 1511.01452

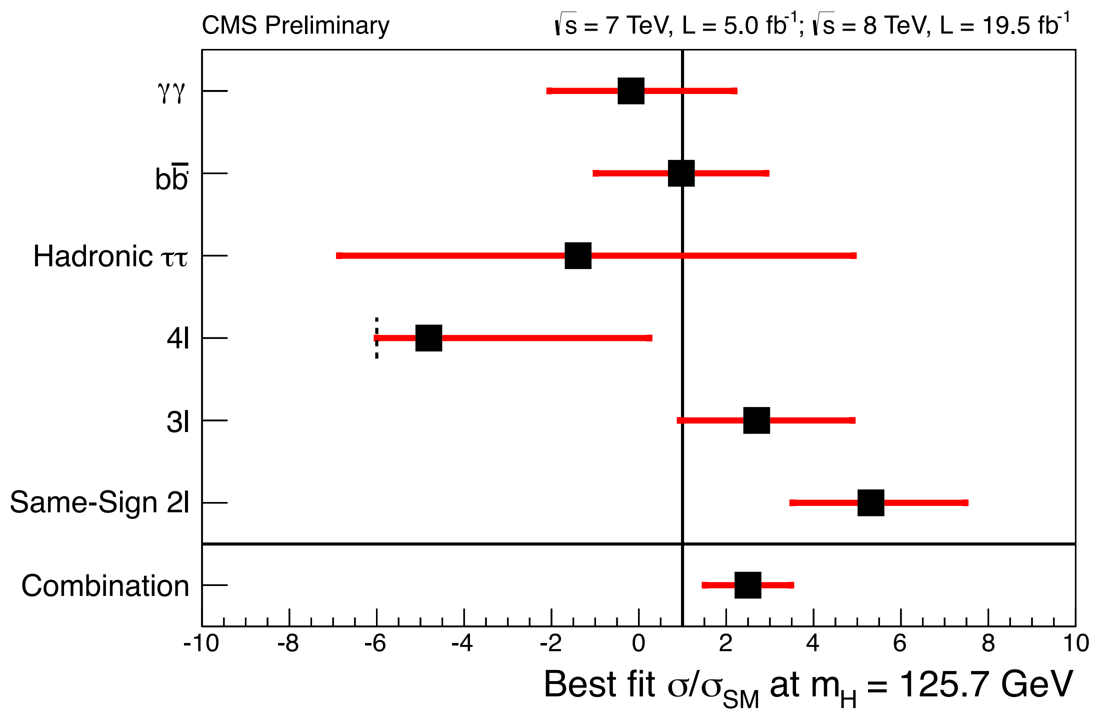
In September of 2013, CMS announced results in searches for ttH in multilepton channel:



This is same-sign dilepton:



However, multilepton is the only channel in ttH searches seeing an excess:



arXiv:1408.1682

If the excess were due to an enhanced htt coupling, the ggH rate would be twice as large as the SM.

Upon a closer look it became clear that tt(H->multileptons) is really not about ttH,

but rather is a search for 2t+2W, or equivalently, 2b+4W final states,

while the tt(H->bb) and tt(H->yy) channels are more genuinely ttH-oriented.

2b+4W gives rise to multilepton signatures such as

SS2l + 2 b-jets + jets + MET

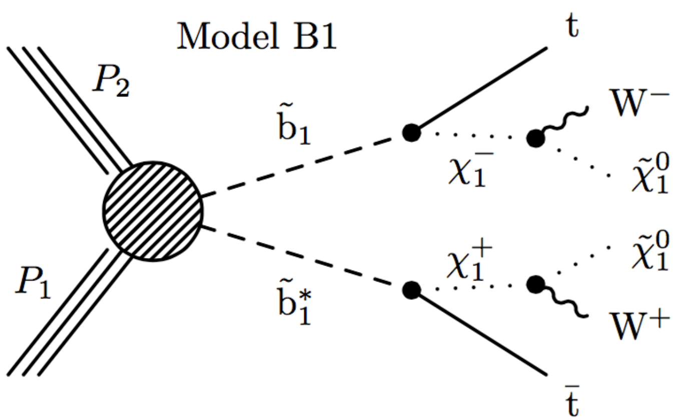
3l + 2 b-jets + jets + MET

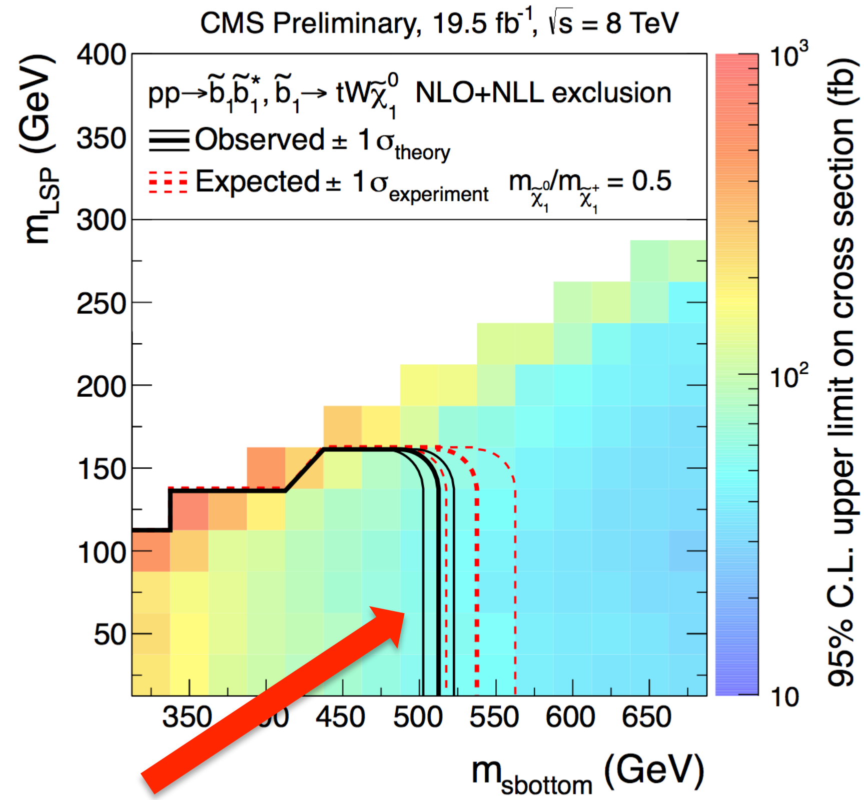
….

These are quintessential BSM signatures!

In fact, two months before the CMS made public their multilepton ttH searches, the SUSY WG put out their SS2l analysis in searches for gluinos and sbottoms:

CMS-PAS-SUSY-13-013





The final state is exactly 2b+4W, the same as the ttH SS2l search.

The degraded limits on sbottoms are driven by an excess in the SS2l+ b-jets + MET channel!

So we learned two things:

- Multilepton excess in ttH search might have nothing to do with ttH.

- There is internal consistency in CMS data analysis: their Run 1 data contain a moderate excess in SS2l + 2 b-jets + jets + MET.

  It is difficult to quantify the overall significance, since SUSY WG gives no signal strength fit.

  Moreover, SS2l in Higgs WG is a MVA analysis while it is a cut-and-count in SUSY WG.

Next question: **What does ATLAS see??**

It turned out ATLAS SUSY analysis on SS2l + b-jets + MET also saw an excess:

ATLAS NOTE

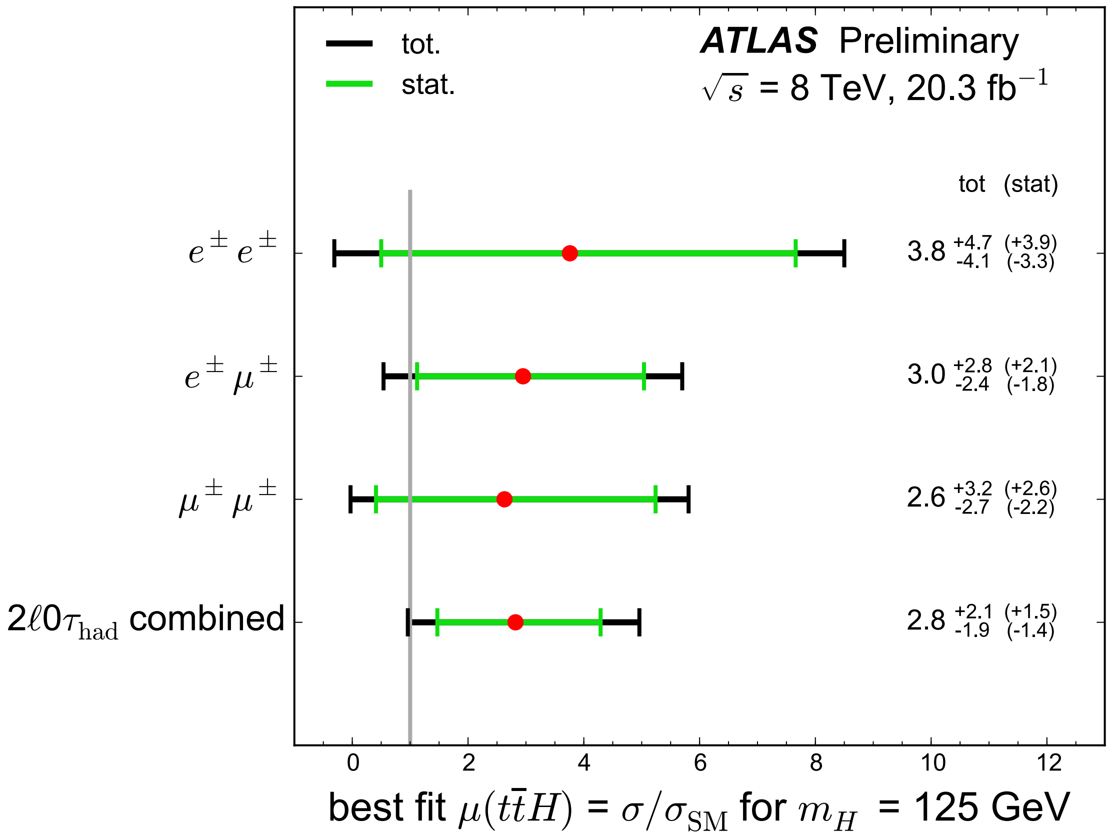
ATLAS-CONF-2013-007

March 1, 2013
Minor Revision: March 10, 2013

Search for strongly produced supersymmetric particles in final states with two same-sign leptons and jets with the ATLAS detector using 21 fb^{-1} of proton–proton collisions at $\sqrt{s}$ = 8 TeV

A) Discovery case	**SR0b**	**SR1b**	**SR3b**
Observed events	5	8	4
Expected background events	7.5 ± 3.3	3.7 ± 1.6	3.1 ± 1.6
Expected $t\bar{t} + V$ events	0.5 ± 0.4	2.2 ± 1.0	1.7 ± 0.8
Expected diboson events	3.4 ± 1.0	0.7 ± 0.4	0.1 ± 0.1
Expected fake lepton events	3.4 ± 3.1	$0.3^{+1.1}_{-0.3}$	$0.9^{+1.4}_{-0.9}$
Expected charge mis-measurement events	0.1 ± 0.1	0.5 ± 0.2	0.4 ± 0.1
p_0	0.50	0.11	0.36

Similarly for the ATLAS ttH SS2l result:



In the end, it doesn't matter where you look, there seems always an excess in SS2l + b-jets+MET:

- CMS SS2l SUSY search in **arXiv:1311.6736** – A cut-and-count analysis; No p-value is given for the excess.
- ATLAS SS2l SUSY search in **arXiv:1404.2500** – A cut-and-count analysis; the p-value is 0.07.
- CMS SS2l HIGGS search in **arXiv:1408.1682** – A MVA analysis; best-fit $\mu = 5.3^{+2.1}_{-1.8}$.
- ATLAS SS2l Exotica search in **arXiv:1504.04605** – A cut-and-count analysis; the p-value is 0.029.
- ATLAS SS2l HIGGS search in **arXiv:1506.05988** – A cut-and-count analysis; best-fit $\mu = 2.8^{+2.1}_{-1.9}$.

- ATLAS measurements on SM $t\bar{t}W$ in **arXiv:1509.05276**: expects a significance of 2.8-sigma and observed 5.0-sigma in the SS2L channel.

- CMS measurements on SM $t\bar{t}W$ in **arXiv:1510.01131**: the observed signal strength (in unit of SM expectation) is $2.04_{-0.61}^{+0.74}$.

These are analyses looking at the two independent dataset with different cuts and different background subtraction methods.

They all seem to reach similar excess.

ATLAS SUSY WG put out a preliminary Run 2 result on SS2l + b-jets +MET at the End-of-Year Jamboree:

ATLAS NOTE

ATLAS-CONF-2015-078

14th December 2015

	SR0b3j	SR0b5j	SR1b	SR3b
Observed events	3	3	7	1
Total bkg events	2.4 ± 0.7	0.98 ± 0.32	4.3 ± 1.0	0.78 ± 0.24
$p(s = 0)$	0.33	0.06	0.12	0.36
Fake/non-prompt leptons	< 0.2	$0.04^{+0.17}_{-0.04}$	0.8 ± 0.8	0.12 ± 0.16
Charge flip	–	0.02 ± 0.01	0.60 ± 0.12	0.19 ± 0.06
$t\bar{t}W, t\bar{t}Z$	0.13 ± 0.06	0.11 ± 0.06	2.0 ± 0.7	0.21 ± 0.09
WZ	1.5 ± 0.5	0.61 ± 0.25	0.17 ± 0.09	< 0.02
$W^{\pm}W^{\pm}jj$	–	0.11 ± 0.05	0.03 ± 0.01	< 0.01
ZZ	0.6 ± 0.4	< 0.14	< 0.03	< 0.03
Triboson	0.09 ± 0.05	0.02 ± 0.01	0.02 ± 0.01	< 0.01
Rare	0.05 ± 0.04	0.05 ± 0.04	0.7 ± 0.4	0.26 ± 0.14

CMS SUSY WG, on the other hand, did something “puzzling” for Jamboree:

Table 7: Event yields in the signal regions with $\mathcal{L} = 2.2\ \text{fb}^{-1}$.

	HH regions		HL regions		LL regions	
	Expected SM	Observed data	Expected SM	Observed data	Expected SM	Observed data
SR1	34.4 ± 7.3	39	42.2 ± 10.9	39	2.01 ± 0.94	1
SR2	11.3 ± 1.8	16	8.7 ± 2.2	9	0.13 ± 0.05	0
SR3	1.01 ± 0.35	2	0.60 ± 0.34	0	3.2 ± 1.5	2
SR4	1.04 ± 0.23	0	0.99 ± 0.38	3	0.04 ± 0.03	0
SR5	2.8 ± 1.0	4	1.35 ± 0.37	0	0.14 ± 0.17	0
SR6	0.10 ± 0.05	0	0.08 ± 0.03	0	0.02 ± 0.01	0
SR7	0.87 ± 0.31	0	25.8 ± 7.6	24	0.03 ± 0.01	0
SR8	0.15 ± 0.10	0	5.1 ± 1.5	13	0.10 ± 0.10	0
SR9	21.2 ± 5.2	25	0.32 ± 0.20	0		
SR10	8.2 ± 1.4	14	2.36 ± 0.99	2		
SR11	2.04 ± 0.92	3	1.26 ± 0.65	0		
SR12	2.14 ± 0.39	1	0.05 ± 0.04	0		
SR13	1.06 ± 0.21	3	4.1 ± 1.3	3		
SR14	0.24 ± 0.11	0	2.01 ± 0.69	1		
SR15	0.35 ± 0.11	0	0.05 ± 0.03	0		
SR16	0.17 ± 0.07	0	0.42 ± 0.10	1		
SR17	5.5 ± 1.4	4	0.28 ± 0.15	0		
SR18	2.70 ± 0.46	1	0.09 ± 0.25	0		
SR19	0.43 ± 0.08	0	0.10 ± 0.09	0		
SR20	1.36 ± 0.24	3	0.15 ± 0.10	0		
SR21	0.36 ± 0.10	0	0.002 ± 0.001	0		
SR22	0.08 ± 0.04	0	0.03 ± 0.04	0		
SR23	0.98 ± 0.93	0	0.03 ± 0.02	0		
SR24	0.13 ± 0.04	1	0.05 ± 0.09	0		
SR25	0.18 ± 0.06	0	0.81 ± 0.25	1		
SR26	0.42 ± 0.11	1	0.24 ± 0.12	0		
SR27	0.004 ± 0.015	0				
SR28	0.03 ± 0.02	0				
SR29	0.014 ± 0.008	0				
SR30	0.02 ± 0.01	0				
SR31	2.28 ± 0.61	1				
SR32	0.82 ± 0.17	1				

However, I should mention that there is an outlier from CMS B2G analyses in SS2l channel for charge-5/3 VLQ:

This is the same 2t+2W final state as in tt(H->WW) analyses!

Run 1:

Channel	ee	$e\mu$	$\mu\mu$	All
Same-sign	0.8 ± 0.2	1.9 ± 0.4	1.3 ± 0.3	4.0 ± 0.8
Chrg. misid.	0.06 ± 0.02	0.04 ± 0.01	—	0.11 ± 0.02
Non-prompt	1.9 ± 1.2	0.6 ± 0.9	0.3 ± 0.6	2.8 ± 1.9
Tot. bkgnd	2.7 ± 1.3	2.5 ± 1.0	1.6 ± 0.7	6.8 ± 2.1
Obs. events	0	6	3	9
$T_{5/3}$	2.1 ± 0.1	4.7 ± 0.3	2.8 ± 0.2	9.7 ± 0.5

arXiv:1312.2391

Run 2:

Channel	PSS MC	NonPrompt	ChargeMisID	Total Background	800 GeV $X_{5/3}$	Observed
Di-electron	2.41 ± 0.29	2.16 ± 1.91	1.90 ± 0.60	6.47 ± 2.02	4.38	7
Electron-Muon	2.98 ± 0.36	5.20 ± 3.21	0.54 ± 0.18	8.72 ± 3.24	9.14	3
Di-muon	0.70 ± 0.12	2.09 ± 1.69	0.00 ± 0.00	2.80 ± 1.70	3.55	1
All	6.09 ± 0.67	9.45 ± 5.49	2.44 ± 0.76	17.98 ± 5.58	17.06	11

B2G-15-006-pas*

***:** private communications from B2G said MC and data do not agree. Analysis will be repeated.

Broadly speaking, the SS2l excess can be characterized as

2 t + 2 W + X

If X = MET, then we have 2 b + 4 W + MET final states.

However "X" could contain MET + additional visible or soft particles.
Example: four tops final state!

We assume the final state comes from pair production of heavy particles proceeding through identical decay chains.

Under these assumptions, the electric charge of the heavy particle can be classified, assuming a neutral stable particle *N* giving rise to additional MET.

- Charge (-1/3) particle with the decay topology:

$$\mathcal{B} \to t + W^- + N$$

This case includes the sbottom in SUSY,

$$\tilde{b}_1 \to t + (\tilde{\chi}_1^- \to W^- \tilde{\chi}_1^0)$$

or the T-odd B-prime fermion in little Higgs theories with T-parity,

$$b' \to t + (W_H^- \to W^- A_H)$$

Under these assumptions, the electric charge of the heavy particle can be classified, assuming a neutral stable particle *N*.

- Charge (+2/3) particle with the decay topology:

$$\mathcal{T} \to t + W^{\pm} + C^{\mp}$$

where $C^{\pm}$ is nearly degenerate with N and subsequently decays

$$C^{\pm} \to N + \text{soft charged particles}$$

Will see an example of this from top squarks.

Under these assumptions, the electric charge of the heavy particle can be classified, assuming a neutral stable particle *N*.

- Charge (+5/3) particle with the decay topology:

$$\mathcal{X}_{5/3} \to t + W^+ + N$$

One closely related illustration is the charged-5/3 fermions in composite Higgs models

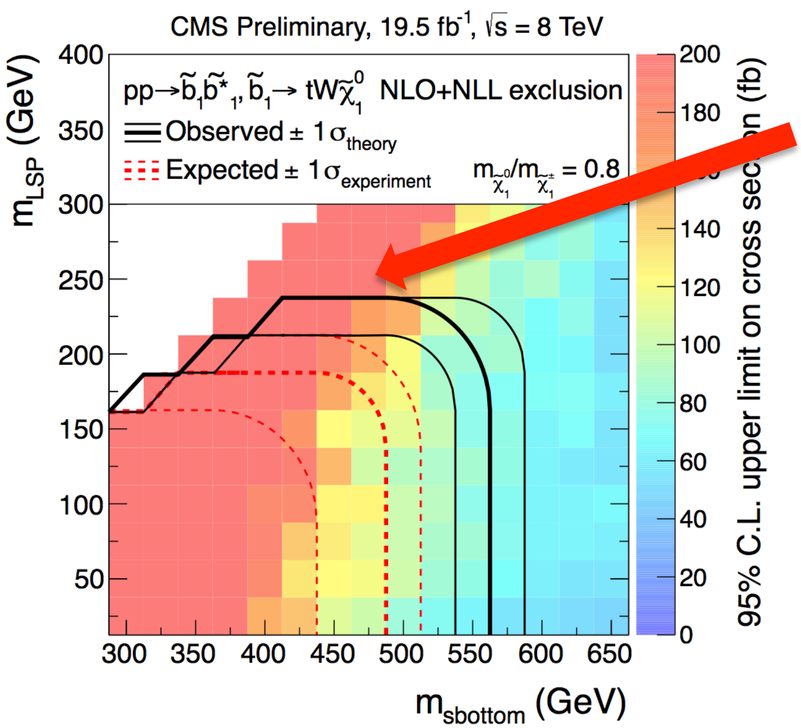
$$X_{5/3} \to t + W^+$$

In which case the MET comes solely from the neutrino in W-decay.

Question: are there searches in channels other than SS2l that could constrain 2b+4W final state?

SUSY WG have searches in the trilepton channel.

CMS saw a deficit at Run 1, in spite of the mild excess in 3L channel from ttH result:



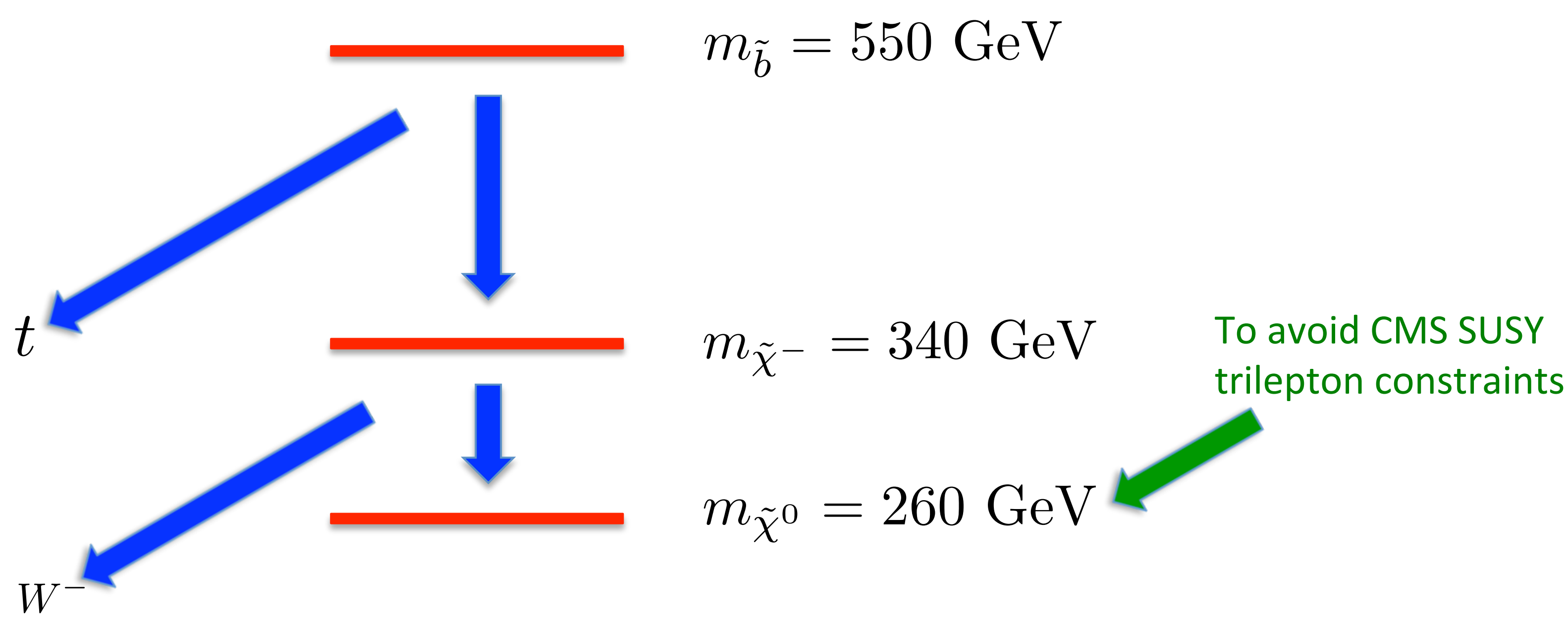
The bound disappears once the LSP is heavier than 240 GeV.

CMS SUS-13-008, which never made into publication!

Since the ttH analysis gives a best-fit signal strength in unit of SM ttH expectataion, we will do the same:

Normalize the signal strength to the SM ttH strength.

As a starter, one could consider the sbottom decays with the spectrum:



$$\mu_{\tilde{b}}/\mu_{ttH} = 1.8$$

$$\mu_{tot} = 2.8$$

We considered the "sbottom" case a simplified model, because in MSSM it's difficult to suppress the other decay channel of the sbottom:

$$\tilde{b}_1 \to b + \tilde{\chi}_1^0$$

A more "realistic" scenario is to consider the following stop spectrum:

A pure right-handed stop: $\tilde{t}_1 = \tilde{t}_R \;;\; 550 \text{ GeV}$

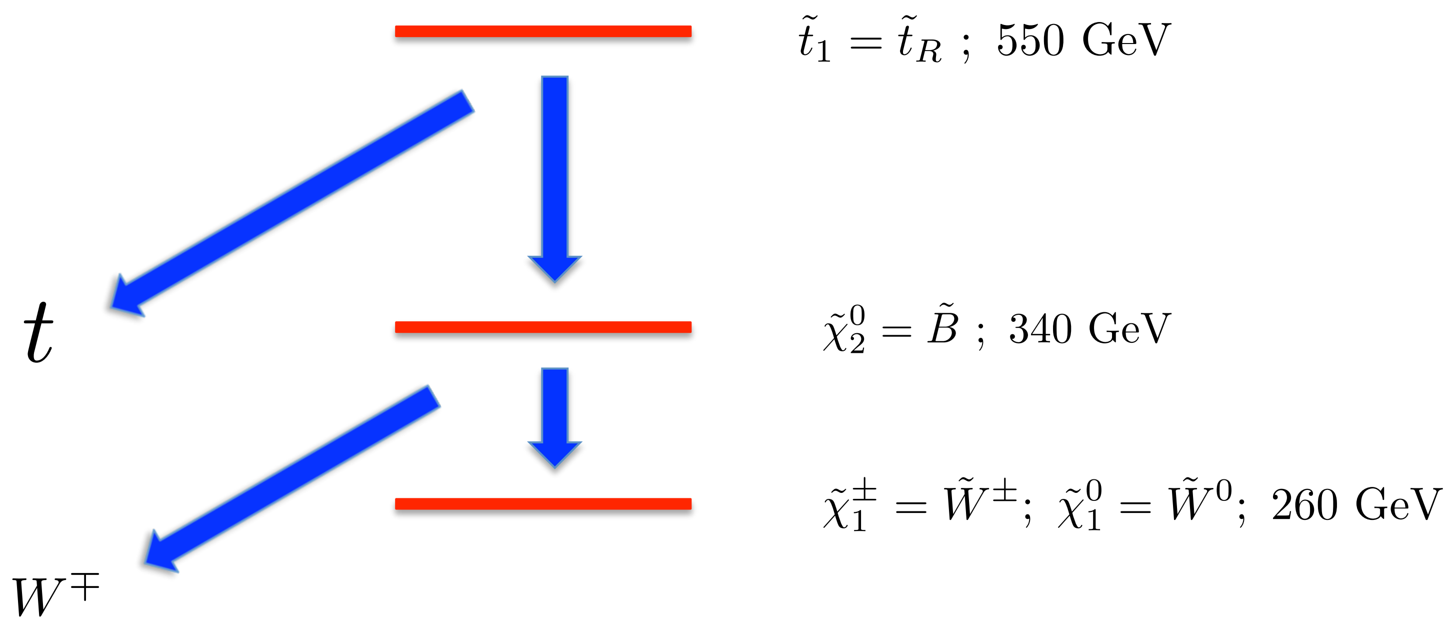
A pure Bino: $\tilde{\chi}_2^0 = \tilde{B} \;;\; 340 \text{ GeV}$

Pure winos: $\tilde{\chi}_1^\pm = \tilde{W}^\pm; \; \tilde{\chi}_1^0 = \tilde{W}^0; \; 260 \text{ GeV}$

The LSP mass is chosen to avoid trilepton constraint;

The neutralino mass differences is chosen to suppress $\tilde{\chi}_2^0 \to \tilde{\chi}_1^0 + H$

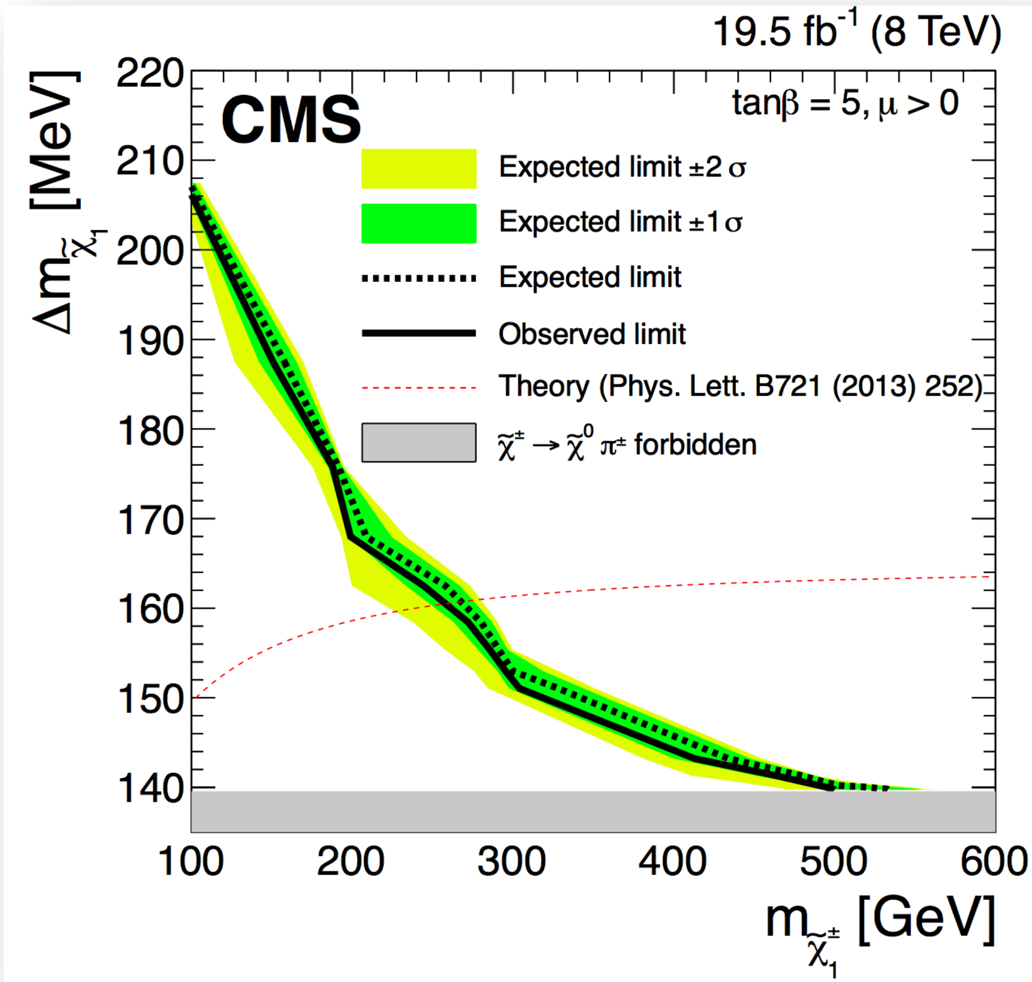
Then this decay BR is almost 100%:



$$\mu_{\tilde{t}} = 1.83$$

$$\mu_{\rm tot} = 2.83$$

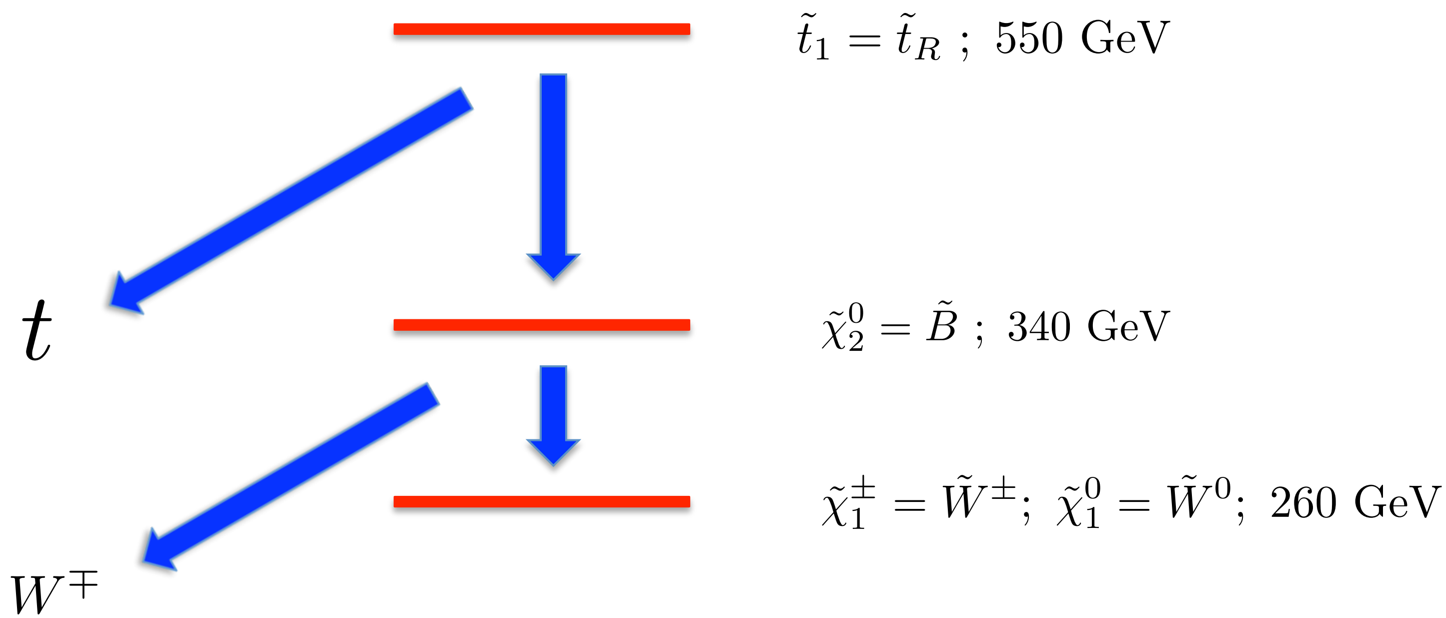
A possible constraint on the mass splitting of the charged and neutral winos is the disappearing charged track, which is not very strong:



1411.6006

A spectacular(?) signature unique to the stop decay is the same-sign trilepton final state:

SS3L + 2 b-jets + MET :



W-boson here can be either sign!

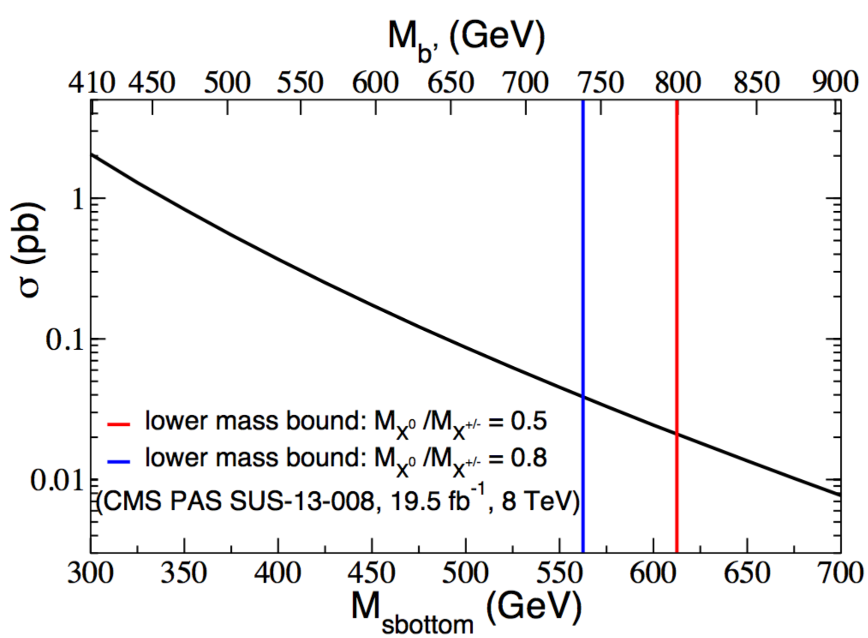
We also considered VLQ with the decay:

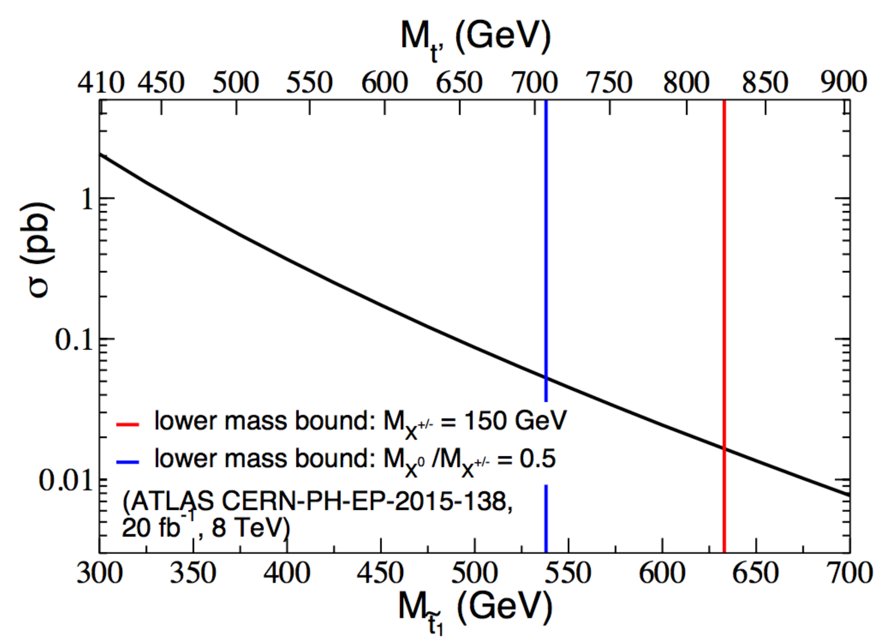
$$b' \to t + (W_H^- \to W^- + A_H)$$

VLQ decays containing a stable neutral particle are well-motivated in little Higgs models with T-parity.

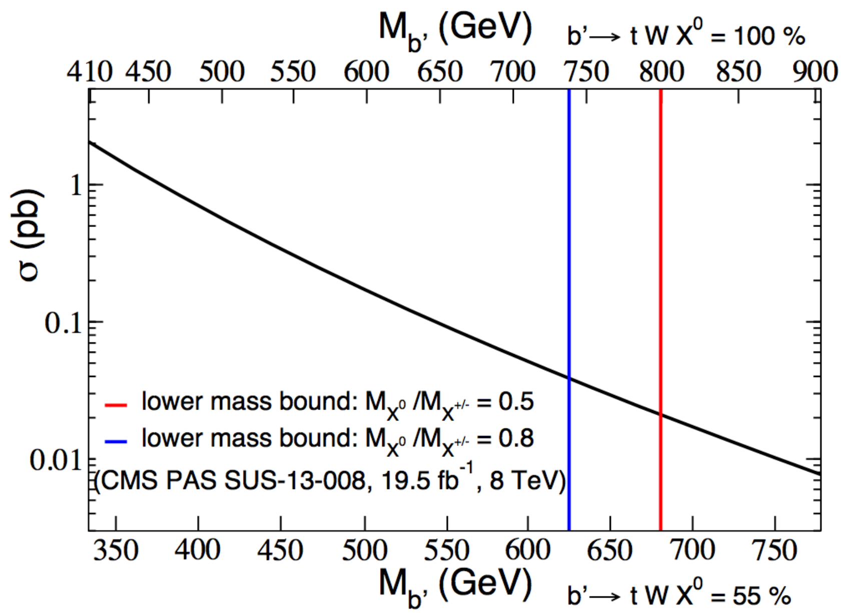
However they have NOT been searched for at Run 1!

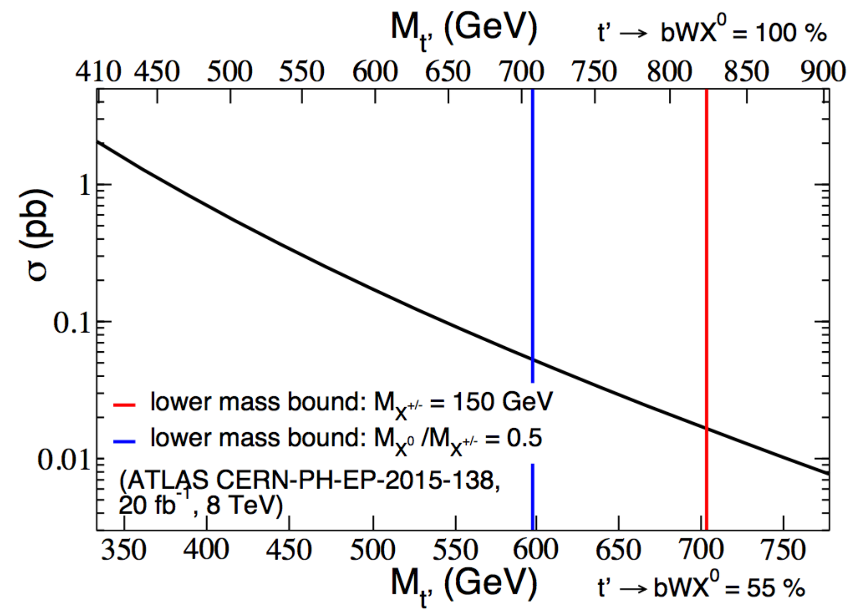
We “translated” the bound from similar decay channels in sbottom searches:





In realistic models the decay BR is typically at O(55%). So the bounds are even weaker:



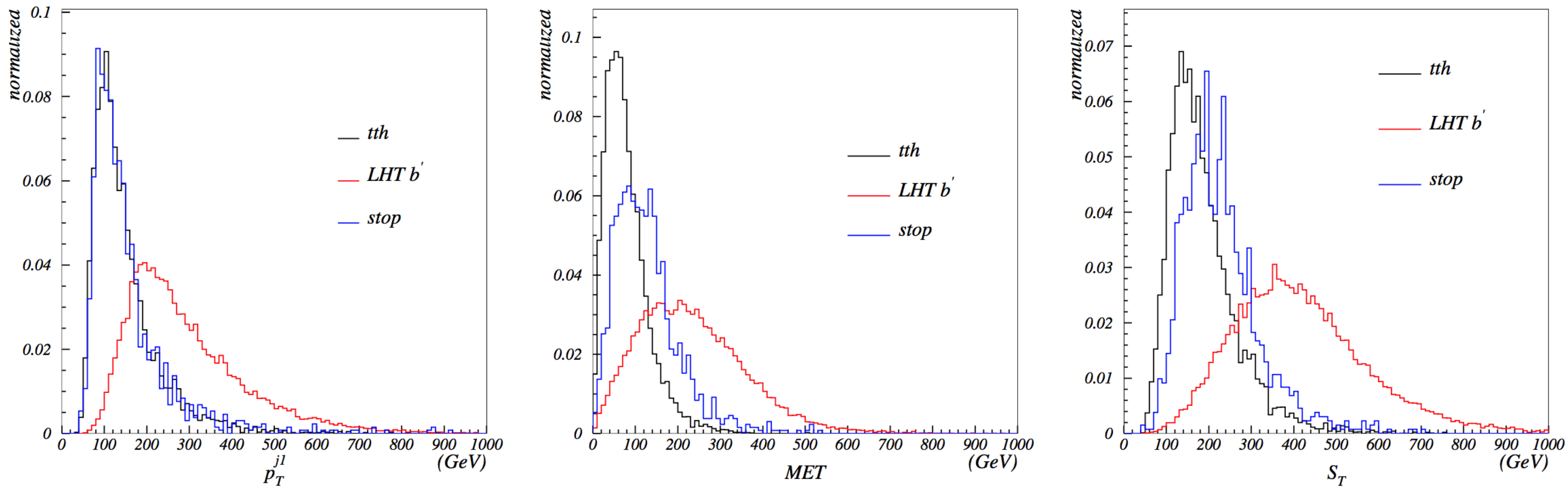


A benchmark with VLQ:

$$m_{b'} = 750 \text{ GeV} \,, \qquad m_{W_H} = 320 \text{ GeV} \,, \qquad m_{A_H} = 66 \text{ GeV}$$

$$\mu = \mu_{b'} + \mu_{\text{ttH}} = 2.0$$

In general, kinematic distributions from the fermionic benchmark look harder than those of the scalar benchmark:



(a) (b) (c)

FIG. 6: *Normalized distributions of (a) transverse momentum the leading jet, (b)* $E_{\rm T}^{\rm miss}$ *and (c)* $S_T = p_T^{\ell_1} + p_T^{\ell_2} + E_{\rm T}^{\rm miss}$ *. The black, red and blue histograms are from SM ttH, T-odd* b' *with mass of* 750 *GeV, and a* 550 *GeV stop in MSSM considered in Ref. [1], respectively.*

Run 2 projection is a monkey business….

With the following assumptions:

- The background x-section increases at the same or slower pace than the SM ttH.
- We ignore systematic uncertainties.

We estimate that a discovery can be made with O(40 1/fb) of in Run 2.

(This is just an estimate, without including systematics!)

Conclusions:

- There're moderate excesses seen by both ATLAS and CMS in SS2l + b-jets + MET channel at LHC Run 1.

- It's difficult for theorists to quantify the significance because of different analysis techniques involved (cut-and-count vs MVA).

- These excesses should NOT be interpreted in the narrow context of ttH.

- These are quintessential BSM signatures; no need to invent weird stuff. Easy to find simple and natural narratives in many "big picture" models.

Back-up slides

The SUSY search is a simple cut-and-count analysis:

Table 7: Predicted and observed yields for the low-, and high-p_T signal regions.

SR	low-p_T Expected	low-p_T Observed	high-p_T Expected	high-p_T Observed
1	44 ± 16	50	51 ± 18	48
2	12 ± 4	17	9.0 ± 3.5	11
3	12 ± 5	13	8.0 ± 3.1	5
4	9.1 ± 3.4	4	5.6 ± 2.1	2
5	21 ± 8	22	20 ± 7	12
6	13 ± 5	18	9 ± 4	11
7	3.5 ± 1.4	2	2.4 ± 1.0	1
8	5.8 ± 2.1	4	3.6 ± 1.5	3
11	32 ± 13	40	36 ± 14	29
12	6.0 ± 2.2	5	3.8 ± 1.4	5
13	17 ± 7	15	10 ± 4	6
14	10 ± 4	6	5.9 ± 2.2	2
15	13 ± 5	9	11 ± 4	11
16	5.5 ± 2.0	5	3.9 ± 1.5	2
17	4.2 ± 1.6	3	2.8 ± 1.1	3
18	6.8 ± 2.5	11	4.0 ± 1.5	7
21	7.6 ± 2.8	10	7.1 ± 2.5	12
22	1.5 ± 0.7	1	1.0 ± 0.5	1
23	7.1 ± 2.7	6	3.8 ± 1.4	3
24	4.4 ± 1.7	11	2.8 ± 1.2	7
25	2.8 ± 1.1	1	2.9 ± 1.1	4
26	1.3 ± 0.6	2	0.8 ± 0.5	1
27	1.8 ± 0.8	0	1.2 ± 0.6	0
28	3.4 ± 1.3	3	2.2 ± 1.0	2

When you look closer,
there is an excess in SR24:

What is the definition of SR24?

Table 3: Definition of the signal regions for the high-p_T analysis. The low-p_T analysis employs a tighter requirement $H_T > 250$ GeV and uses the same numbering scheme where the first number in the name represents the requirement on the number of b-tagged jets for that search region, i.e. SR01, SR11, SR21 correspond to SRs with N_{b-jets} $0, 1 \geq 2$ respectively.

N_{b-jets}	E_T^{miss} (GeV)	N_{jets}	$H_T \in [200, 400]$ (GeV)	$H_T > 400$ (GeV)
$= 0$	50-120	2-3	SR01	SR02
		≥ 4	SR03	SR04
	> 120	2-3	SR05	SR06
		≥ 4	SR07	SR08
$= 1$	50-120	2-3	SR11	SR12
		≥ 4	SR13	SR14
	> 120	2-3	SR15	SR16
		≥ 4	SR17	SR18
≥ 2	50-120	2-3	SR21	SR22
		≥ 4	SR23	SR24
	> 120	2-3	SR25	SR26
		≥ 4	SR27	SR28

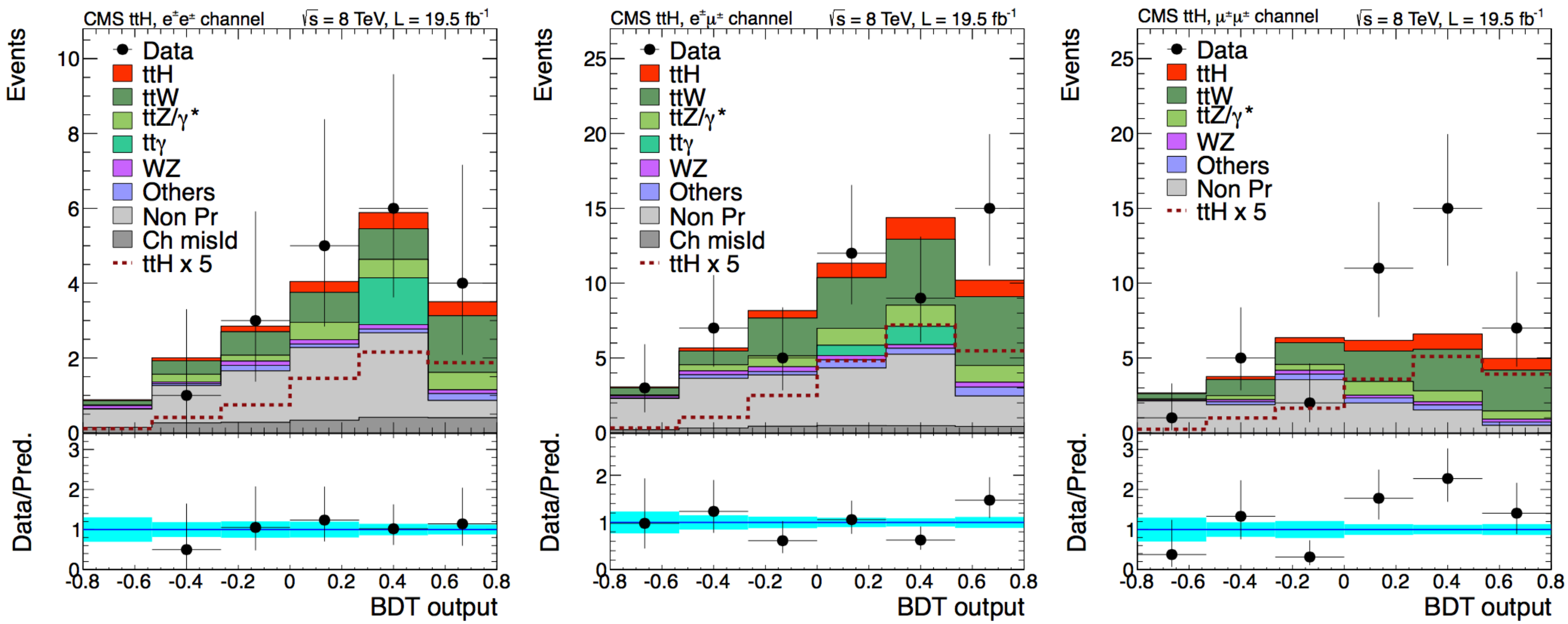
SR24: SS2l + 2 b-jets + N_{jets} (>=4)+ MET

The MVA nature of the ttH analysis cannot be ignored, for the number of observed events is not far from expectation:

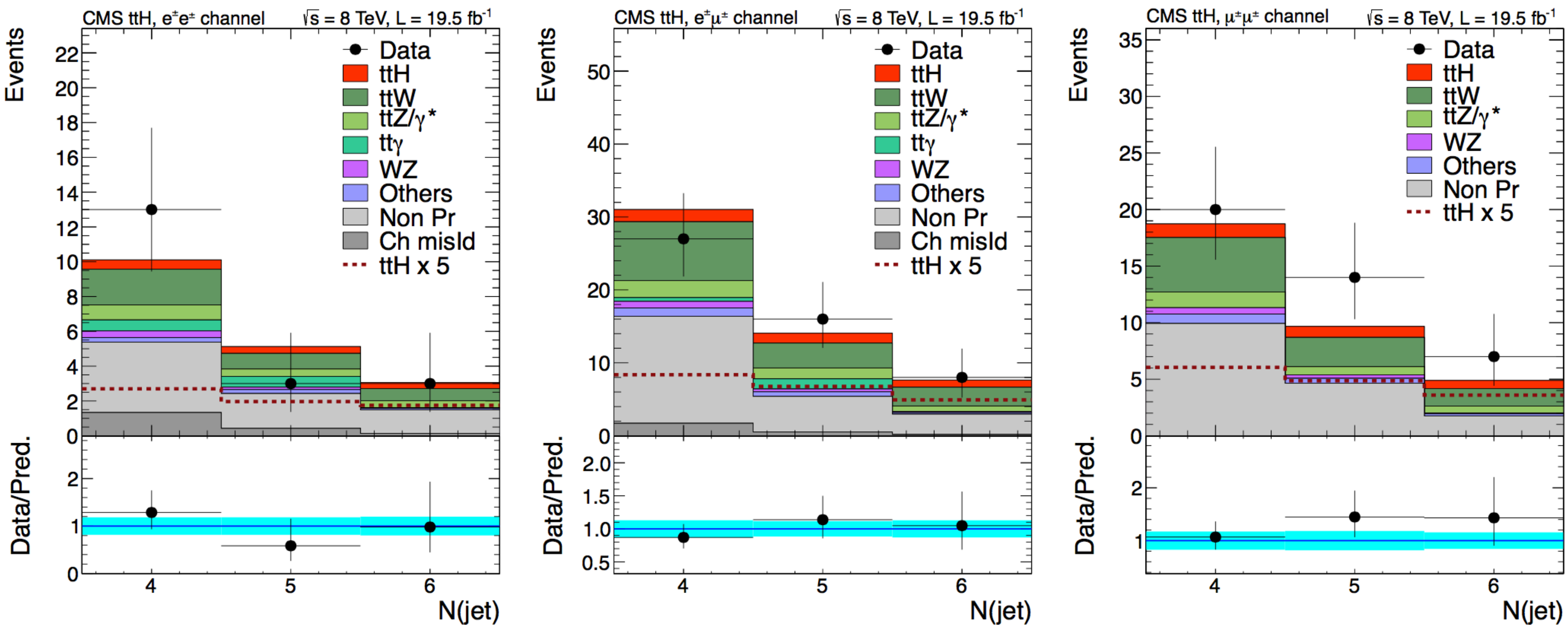
	ee	eμ	μμ	3ℓ	4ℓ
$t\bar{t}H$, $H \to WW$	1.0 ± 0.1	3.2 ± 0.4	2.4 ± 0.3	3.4 ± 0.5	0.29 ± 0.04
$t\bar{t}H$, $H \to ZZ$	—	0.1 ± 0.0	0.1 ± 0.0	0.2 ± 0.0	0.09 ± 0.02
$t\bar{t}H$, $H \to \tau\tau$	0.3 ± 0.0	1.0 ± 0.1	0.7 ± 0.1	1.1 ± 0.2	0.15 ± 0.02
$t\bar{t}W$	4.3 ± 0.6	16.5 ± 2.3	10.4 ± 1.5	10.3 ± 1.9	—
$t\bar{t}Z/\gamma^*$	1.8 ± 0.4	4.9 ± 0.9	2.9 ± 0.5	8.4 ± 1.7	1.12 ± 0.62
$t\bar{t}WW$	0.1 ± 0.0	0.4 ± 0.1	0.3 ± 0.0	0.4 ± 0.1	0.04 ± 0.02
$t\bar{t}\gamma$	1.3 ± 0.3	1.9 ± 0.5	—	2.6 ± 0.6	—
WZ	0.6 ± 0.6	1.5 ± 1.7	1.0 ± 1.1	3.9 ± 0.7	—
ZZ	—	0.1 ± 0.1	0.1 ± 0.0	0.3 ± 0.1	0.47 ± 0.10
Rare SM bkg.	0.4 ± 0.1	1.6 ± 0.4	1.1 ± 0.3	0.8 ± 0.3	0.01 ± 0.00
Non-prompt	7.6 ± 2.5	20.0 ± 4.4	11.9 ± 4.2	33.3 ± 7.5	0.43 ± 0.22
Charge misidentified	1.8 ± 0.5	2.3 ± 0.7	—	—	—
All signals	1.4 ± 0.2	4.3 ± 0.6	3.1 ± 0.4	4.7 ± 0.7	0.54 ± 0.08
All backgrounds	18.0 ± 2.7	49.3 ± 5.4	27.7 ± 4.7	59.8 ± 8.0	2.07 ± 0.67
Data	19	51	41	68	1

You would not have called any excess if this were a cut-and-count!

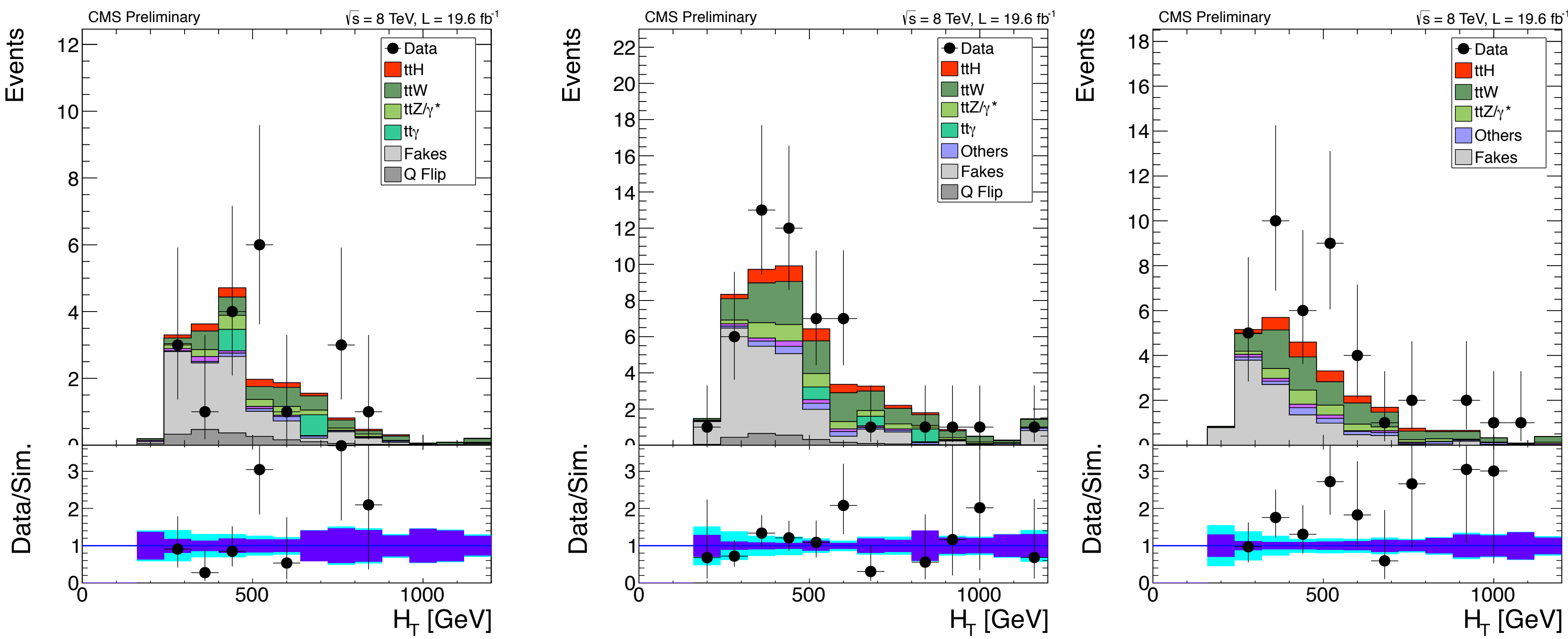
But BDT is calling a large number of these events “Signal”:



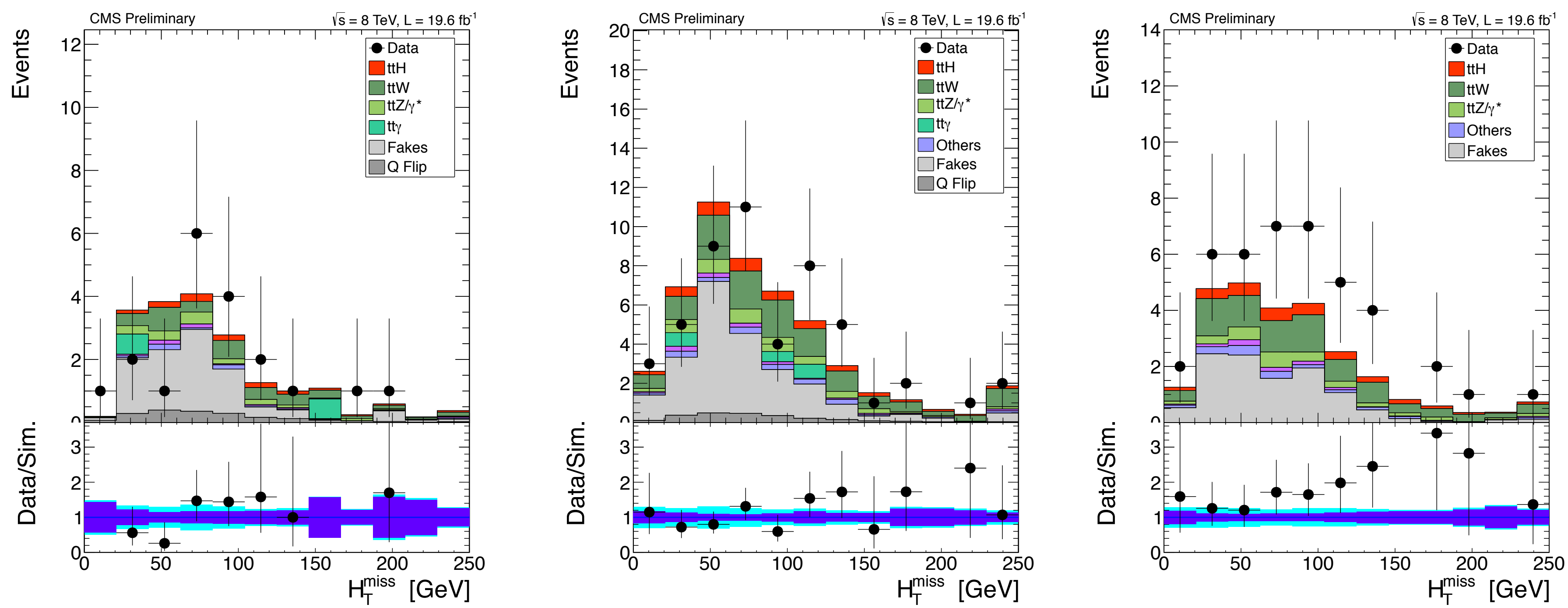
N_{jet} distributions:



H_T distributions:



H^{miss}_T distributions:



Except when you look closer…

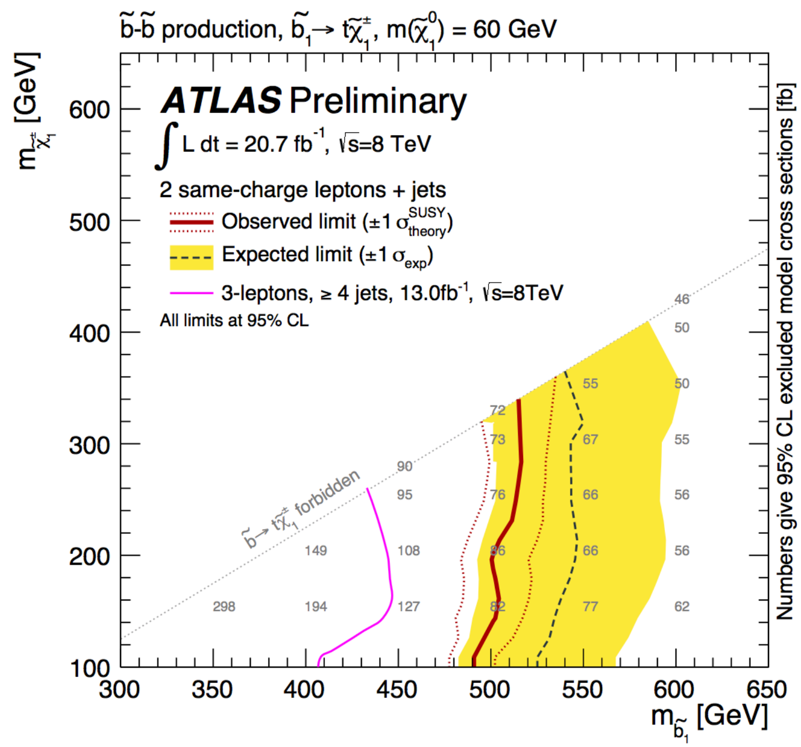
A) Discovery case	**SR0b**	**SR1b**	**SR3b**
Observed events	5	8	4
Expected background events	7.5 ± 3.3	3.7 ± 1.6	3.1 ± 1.6
Expected $t\bar{t} + V$ events	0.5 ± 0.4	2.2 ± 1.0	1.7 ± 0.8
Expected diboson events	3.4 ± 1.0	0.7 ± 0.4	0.1 ± 0.1
Expected fake lepton events	3.4 ± 3.1	$0.3^{+1.1}_{-0.3}$	$0.9^{+1.4}_{-0.9}$
Expected charge mis-measurement events	0.1 ± 0.1	0.5 ± 0.2	0.4 ± 0.1
p_0	0.50	0.11	0.36

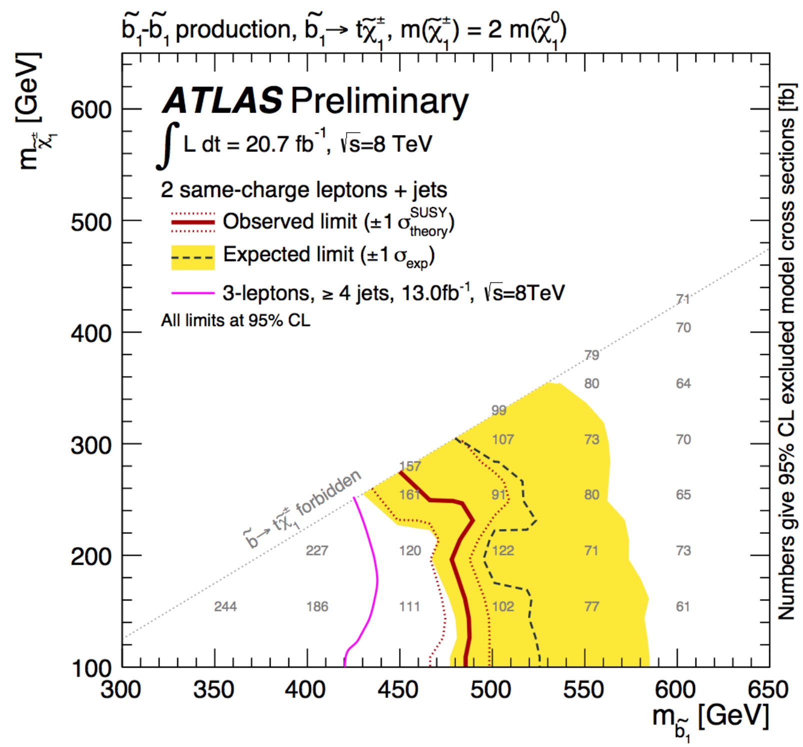
(You now say “Please tell me what SR1b is!!”)

They are

Signal region	$\mathbf{N_{b-jets}}$	**Signal cuts (discovery case)**
SR0b	0	$N_{\text{jets}} \geq 3$, $E_{\text{T}}^{\text{miss}} > 150$ GeV
		$m_{\text{T}} > 100$ GeV, $m_{\text{eff}} > 400$ GeV
SR1b	≥ 1	$N_{\text{jets}} \geq 3$, $E_{\text{T}}^{\text{miss}} > 150$ GeV
		$m_{\text{T}} > 100$ GeV, $m_{\text{eff}} > 700$ GeV
SR3b	≥ 3	$N_{\text{jets}} \geq 4$
		-

Similar to CMS, ATLAS only presented “degraded exclusion limits”:

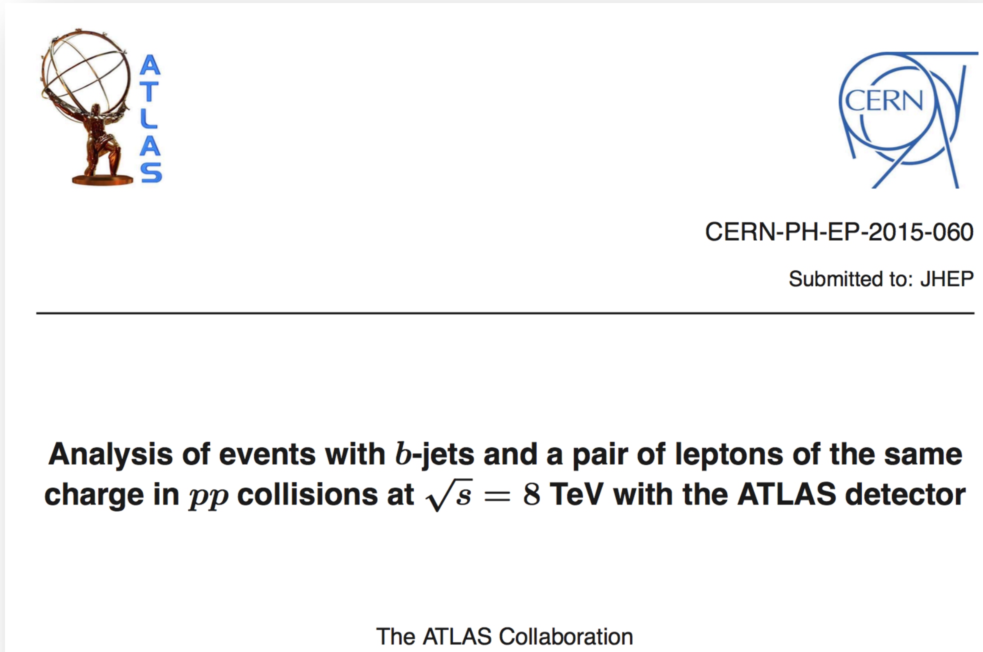




So now if there’s any internal consistency in ATLAS analyses, SS2l in ttH should also see an excess!

So we waited…and waited…and waited…

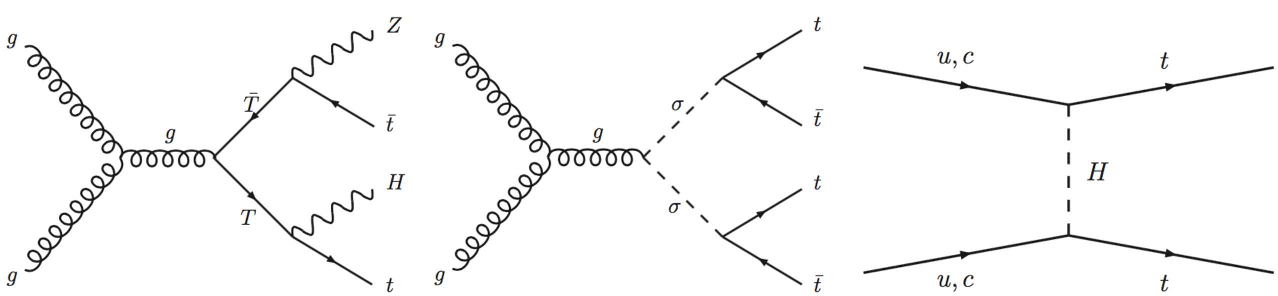
In fact, there's a third ATLAS analysis looking at SS2l in the Exotica WG:


CERN-PH-EP-2015-060

Submitted to: JHEP

Analysis of events with b-jets and a pair of leptons of the same charge in pp collisions at $\sqrt{s} = 8$ TeV with the ATLAS detector

The ATLAS Collaboration



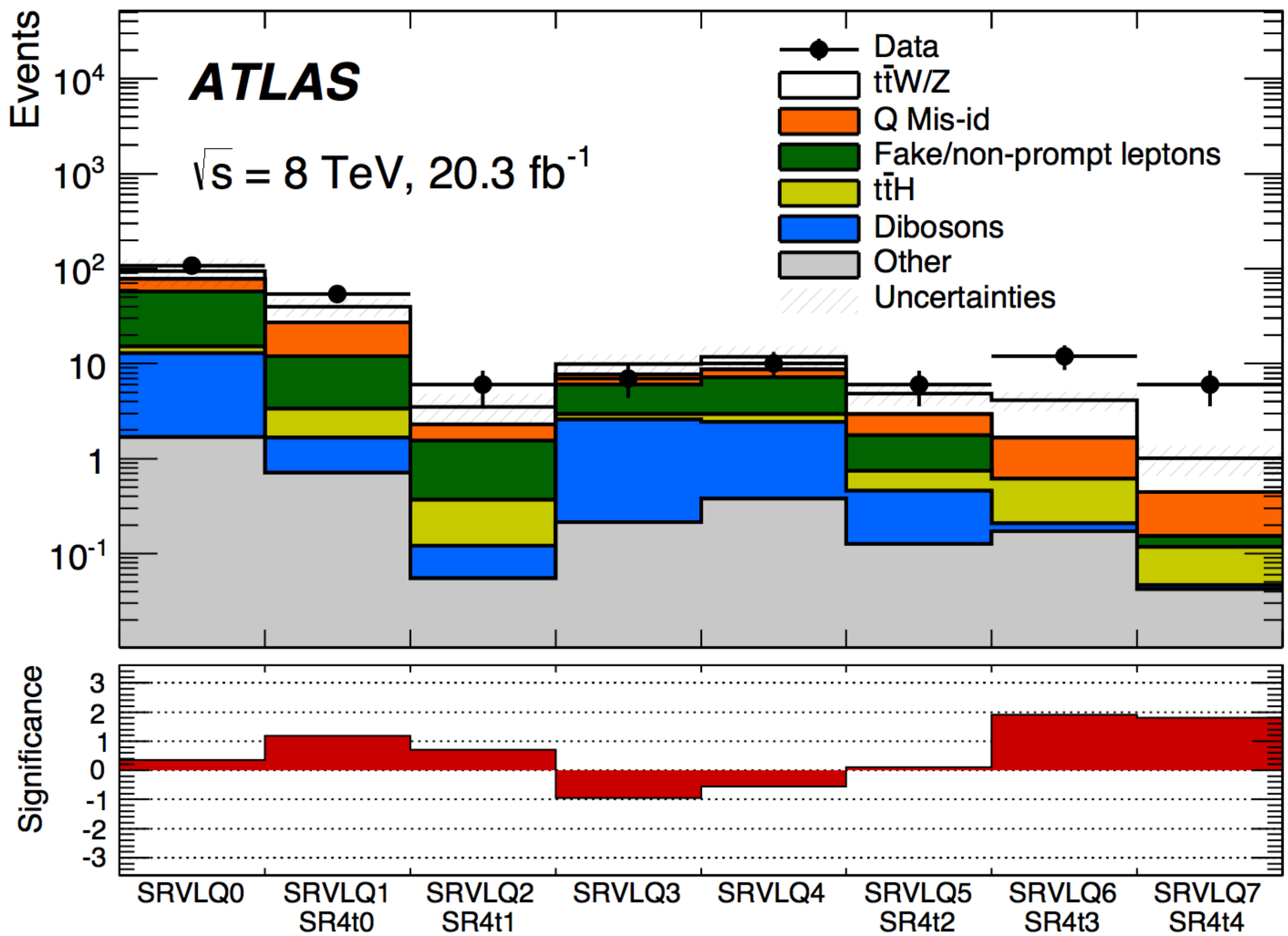
(a) (b) (c)

Here's the "interesting result"

	SRVLQ5/SR4t2	SRVLQ6/SR4t3	SRVLQ7/SR4t4
$t\bar{t}W/Z$	$1.87 \pm 0.09 \pm 0.80$	$2.46 \pm 0.11 \pm 1.06$	$0.57 \pm 0.05 \pm 0.25$
$t\bar{t}H$	$0.31 \pm 0.04 \pm 0.05$	$0.44 \pm 0.04 \pm 0.06$	$0.08 \pm 0.02 \pm 0.02$
Dibosons	$0.33 \pm 0.14 \pm 0.10$	$0.04 \pm 0.12 \pm 0.03$	$0.00 \pm 0.12 \pm 0.00$
Fake/Non-prompt	$1.03 \pm 0.97 \pm 0.60$	$0.00 \pm 1.02 \pm 0.28$	$0.04 \pm 0.83 \pm 0.24$
Q mis-Id	$1.17 \pm 0.16 \pm 0.38$	$1.09 \pm 0.14 \pm 0.34$	$0.30 \pm 0.09 \pm 0.10$
Other bkg.	$0.16 \pm 0.08 \pm 0.02$	$0.23 \pm 0.08 \pm 0.05$	$0.14 \pm 0.08 \pm 0.08$
Total bkg.	$4.9 \pm 1.0 \pm 1.0$	$4.3 \pm 1.1 \pm 1.1$	$1.1 \pm 0.9 \pm 0.4$
Data	6	12	6
p-value	0.46	0.029	0.036

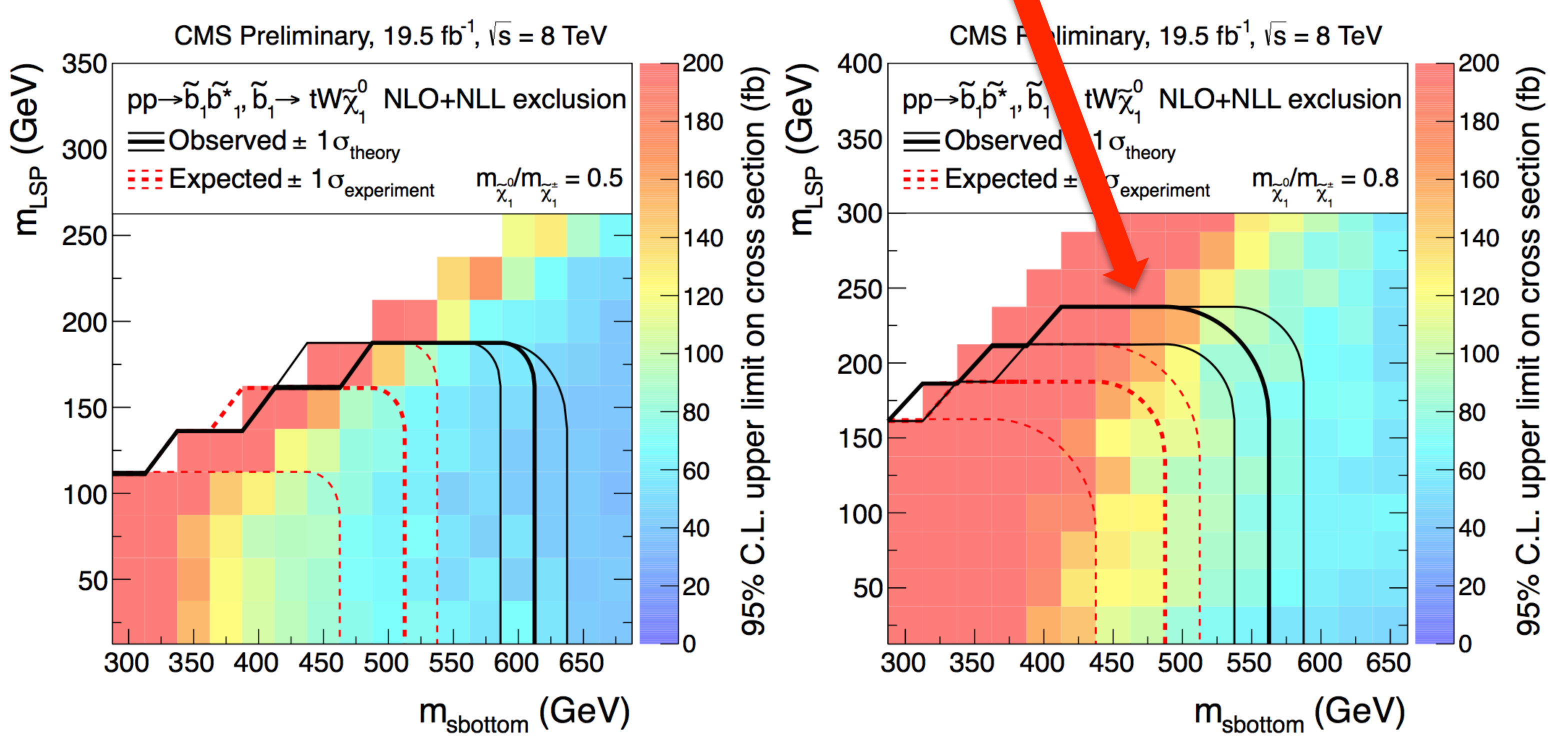
Definition			Name	
$e^{\pm}e^{\pm} + e^{\pm}\mu^{\pm} + \mu^{\pm}\mu^{\pm} + eee + ee\mu + e\mu\mu + \mu\mu\mu$, $N_j \geq 2$				
$400 < H_T < 700$ GeV	$N_b = 1$	$E_T^{miss} > 40$ GeV	SRVLQ0	
	$N_b = 2$		SRVLQ1	SR4t0
	$N_b \geq 3$		SRVLQ2	SR4t1
$H_T \geq 700$ GeV	$N_b = 1$	$40 < E_T^{miss} < 100$ GeV	SRVLQ3	
		$E_T^{miss} \geq 100$ GeV	SRVLQ4	
	$N_b = 2$	$40 < E_T^{miss} < 100$ GeV	SRVLQ5	SR4t2
		$E_T^{miss} \geq 100$ GeV	SRVLQ6	SR4t3
	$N_b \geq 3$	$E_T^{miss} > 40$ GeV	SRVLQ7	SR4t4
$e^{\pm}e^{\pm}$, $e^{\pm}\mu^{\pm}$, $\mu^{\pm}\mu^{\pm}$, $N_j \in [2,4]$, $\Delta\phi_{\ell\ell} > 2.5$				
$H_T > 450$ GeV	$N_b \geq 1$	$E_T^{miss} > 40$ GeV	SRttee, SRtteμ, SRtt$\mu\mu$	

The significance:



The answer is YES, from SUSY trilepton searches on sbottoms:

The bound disappears once the LSP is heavier than 240 GeV.



CMS SUS-13-008, which never made into publication!