Searches for SUSY and Dark Matter from ATLAS and CMS

With an emphasis on Post-EPS results and t final states

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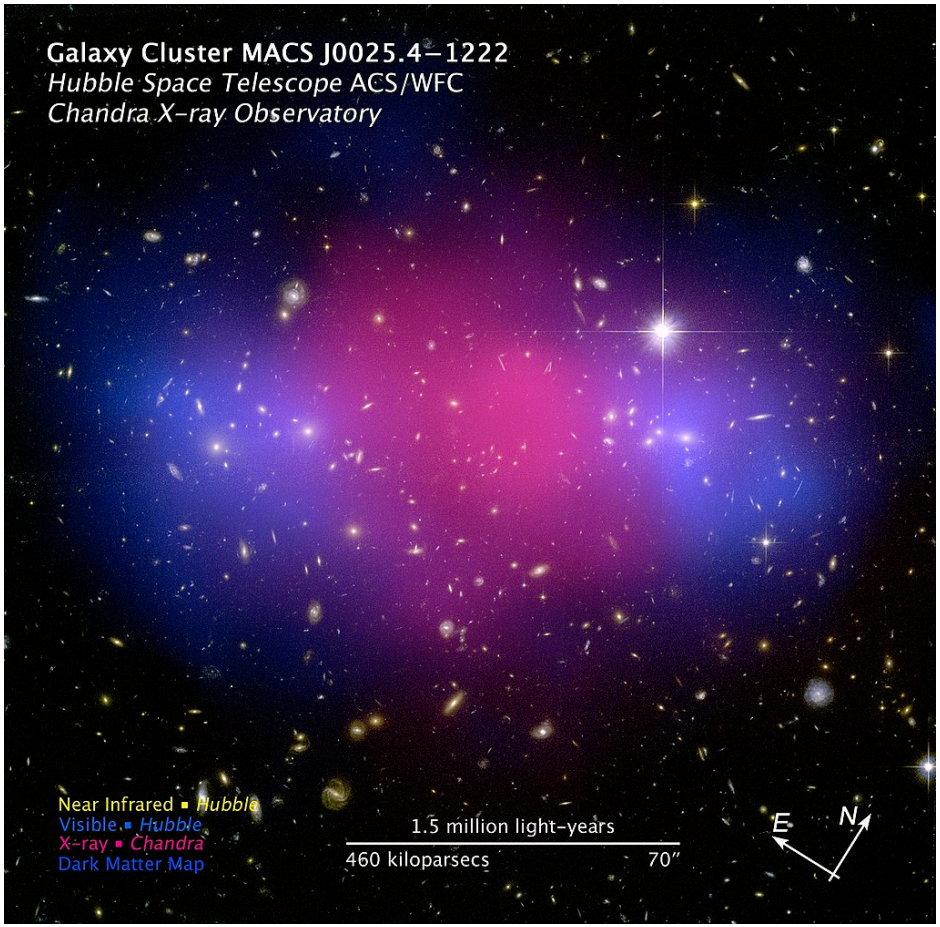
On behalf of ATLAS and CMS

UC Irvine

September 1, 2017

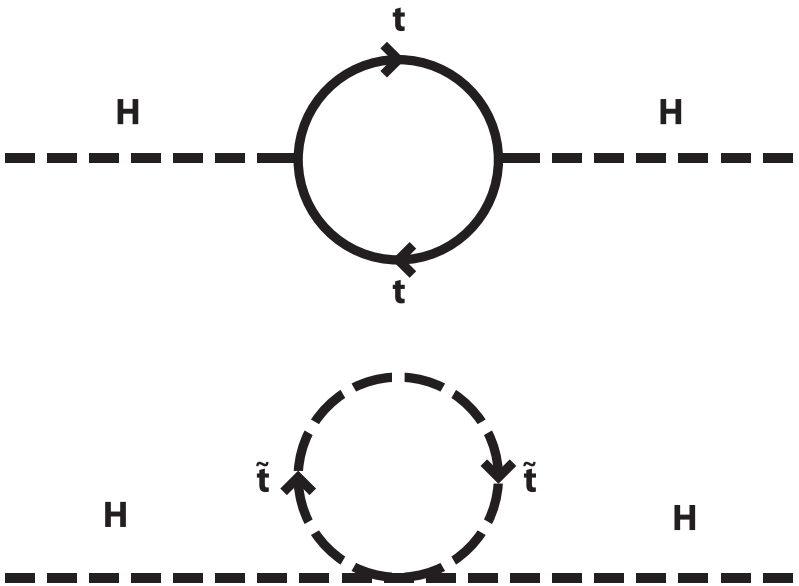
Theoretical Motivation

Dark Matter



- No particle evidence

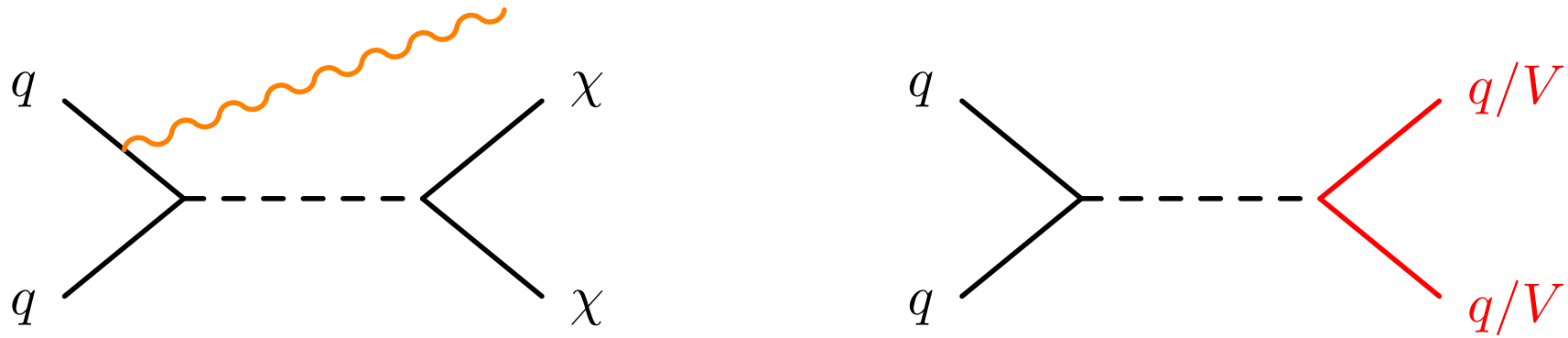
Supersymmetry



- Mitigates t corrections to m_H
- Provides dark matter
- Also no evidence

Dark Matter: Simplified Models

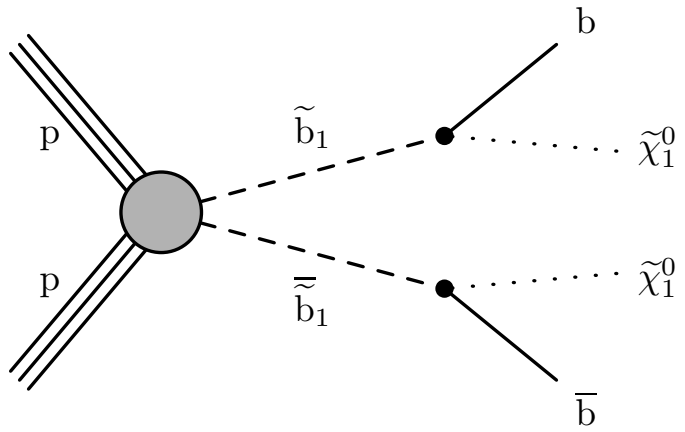
- Introduce a collection of *simplified models*
  - *Mediators* stand in for more complex theories

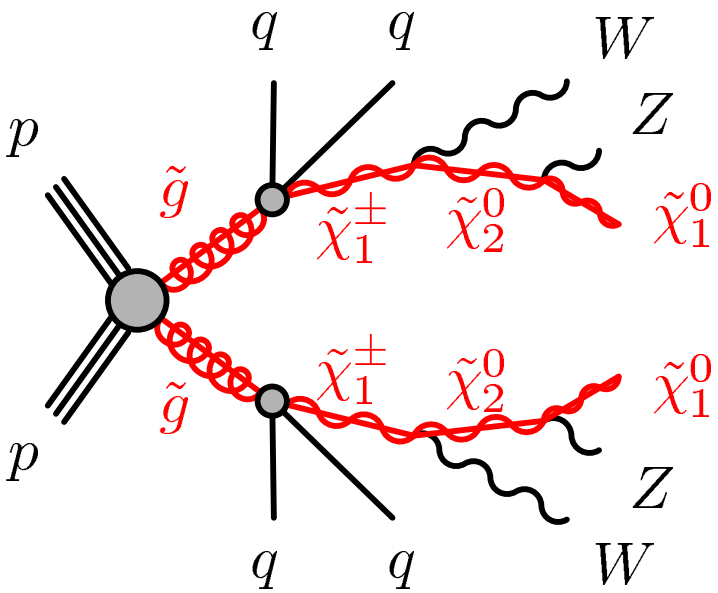


- Signature is $E_{\mathrm{T}}^{\mathrm{miss}}$ + associated particles
- **Bonus:** we can look for the visible mediator decay products!
- At LHC, grouped into mono-X, di-X searches
- Formalized via the LHC Dark Matter Forum (arXiv:1507.00966, arXiv:1603.04156, arXiv:1705.04664)

SUSY: Less simplified models

- Some are more model based, use SUSY variables
  - m_{T2}, m_{CT}, etc
  - Used to extract SUSY with multiple DM particles in final state

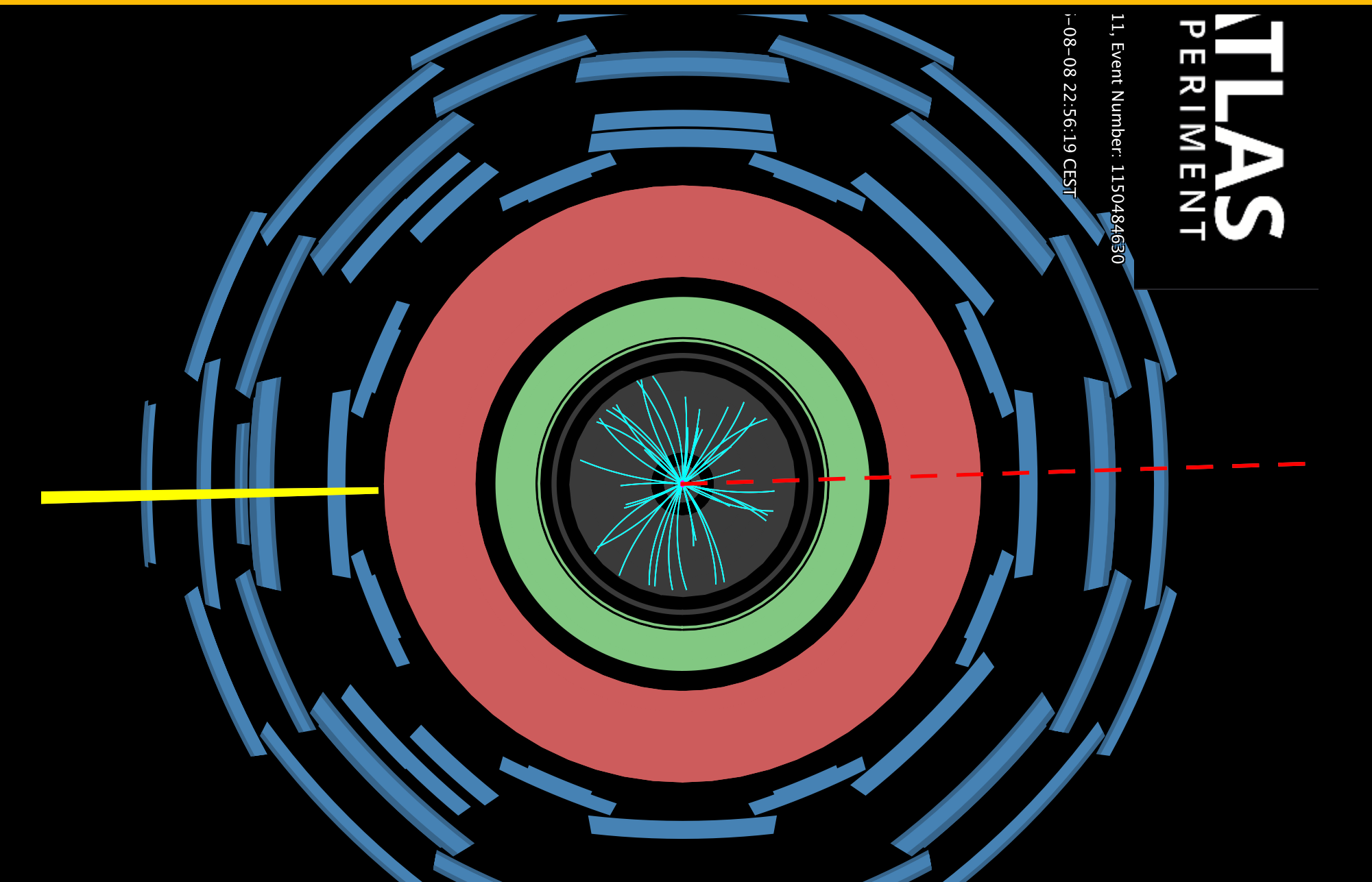




- Some complicated enough that the signature becomes generic, e.g.
  - Multijet + $E_{\mathrm{T}}^{\mathrm{miss}}$: SUSY-2016-13
  - Multijet: SUS-16-040

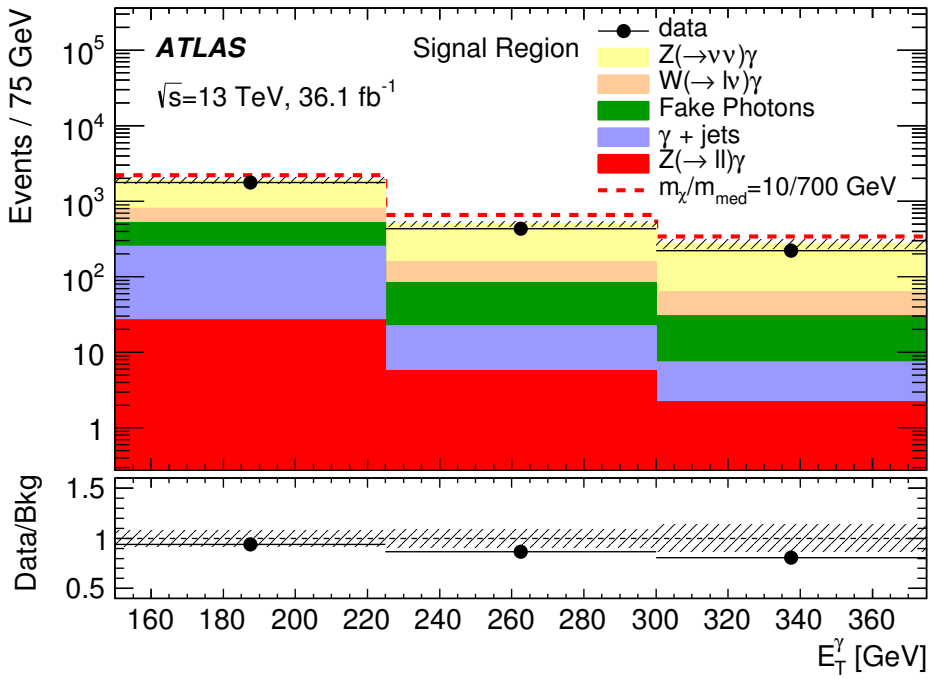
Mono-Everything (Photon Shown)

https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/EXOT-2016-32/



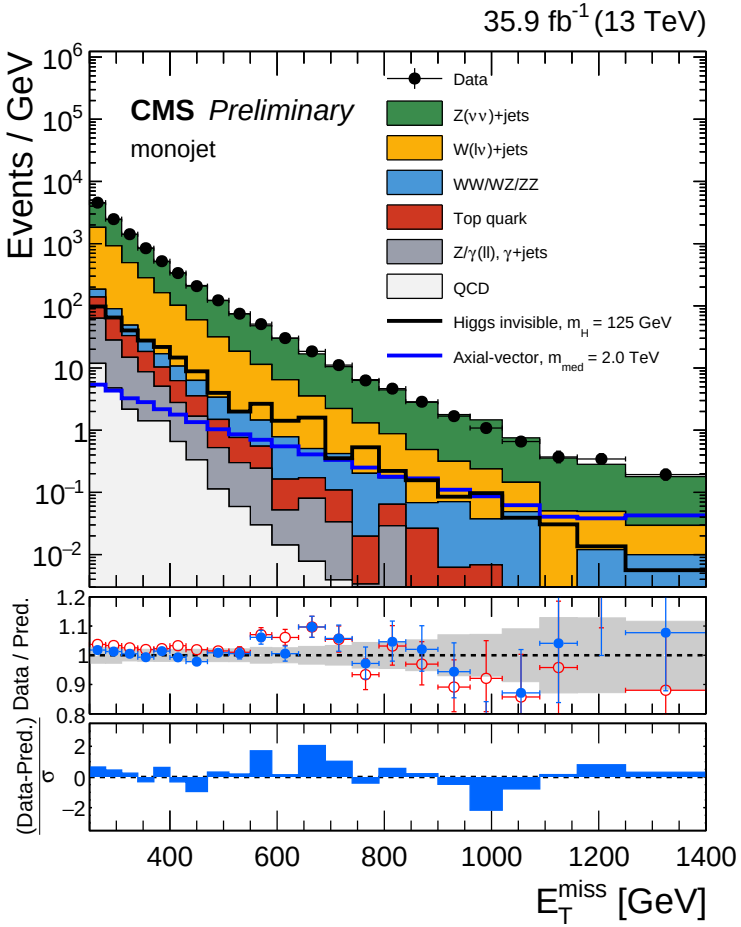
The "Easy" Final States: Mono-γ, Mono-jet

Mono-γ (arXiv:1704.03848)



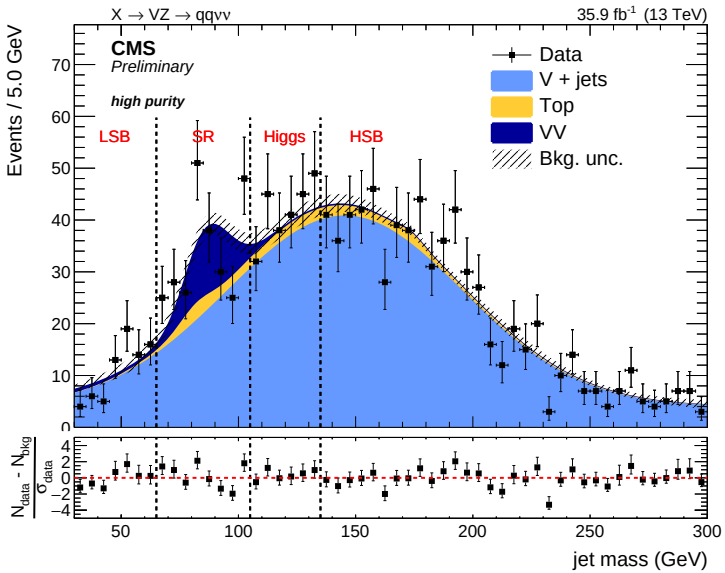
- Require precise $E_{\mathrm{T}}^{\mathrm{miss}}$, object calibration
- Many interpretations

Monojet (PAS: EXO-16-048)

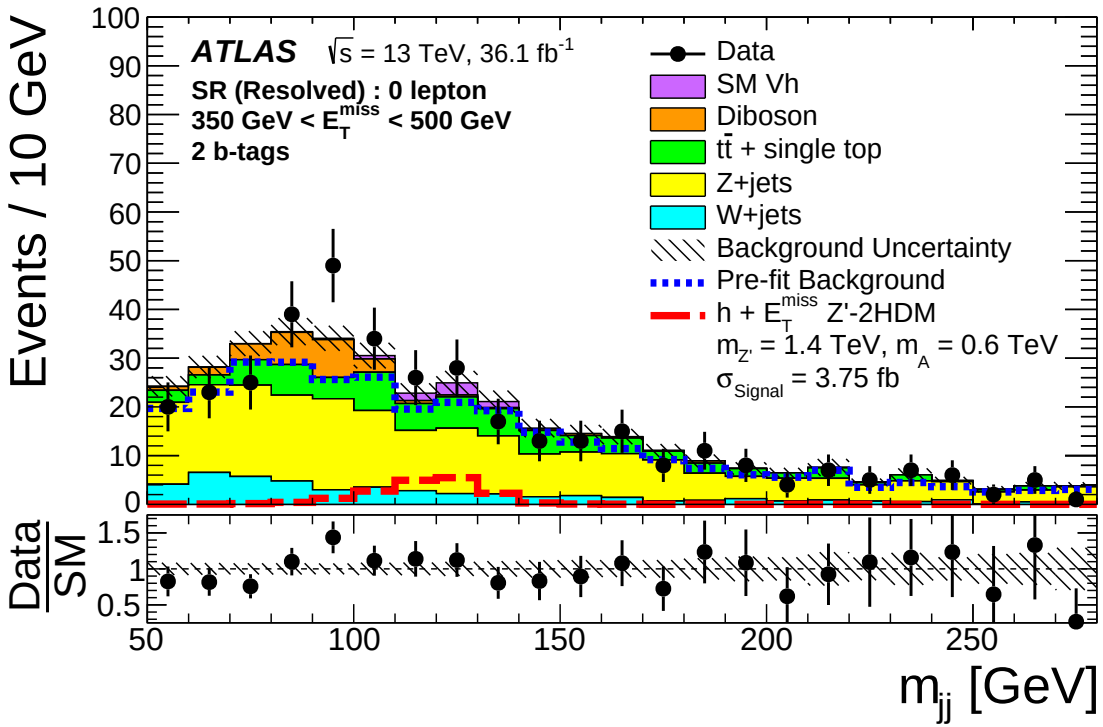


Next in Line: Mono Boson

Mono-W/Z (PAS: B2G-17-005)



Mono-H (arXiv:1707.01302)



- Rely heavily on large-R "fat" jets
- Include subjet b-tagging, substructure

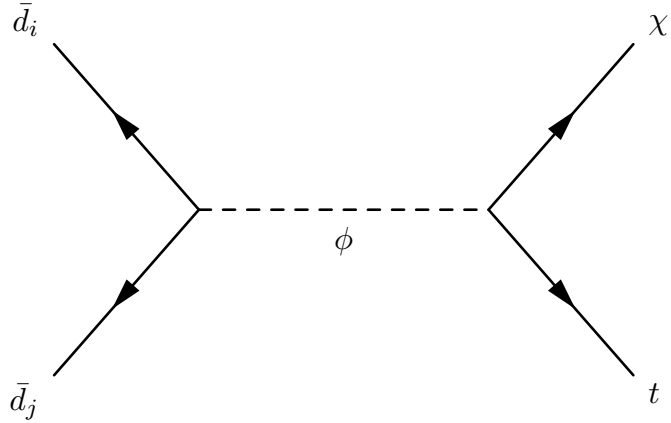
Mono Top, Hadronic (PAS: EXO-16-051)

- Trigger: $H_{\mathrm{T}}^{\mathrm{miss}} > x \cap E_{\mathrm{T}}^{\mathrm{miss}} > x$
  - $x \in \{90, 100, 110, 120\}$, depending on lumi
- Veto leptons, extra b-jets
- One $R = 1.4$ jet passing top selection
- Two production modes: resonant and non-resonant

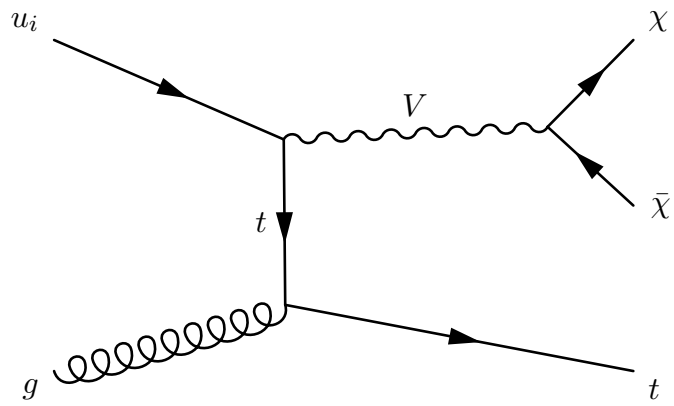
ATLAS Result

- Similar signal model at $\sqrt{s} = 8\,\mathrm{TeV}$
- Single lepton, m_{T}-based selection
- arXiv:1410.5404

Resonant



Non-resonant

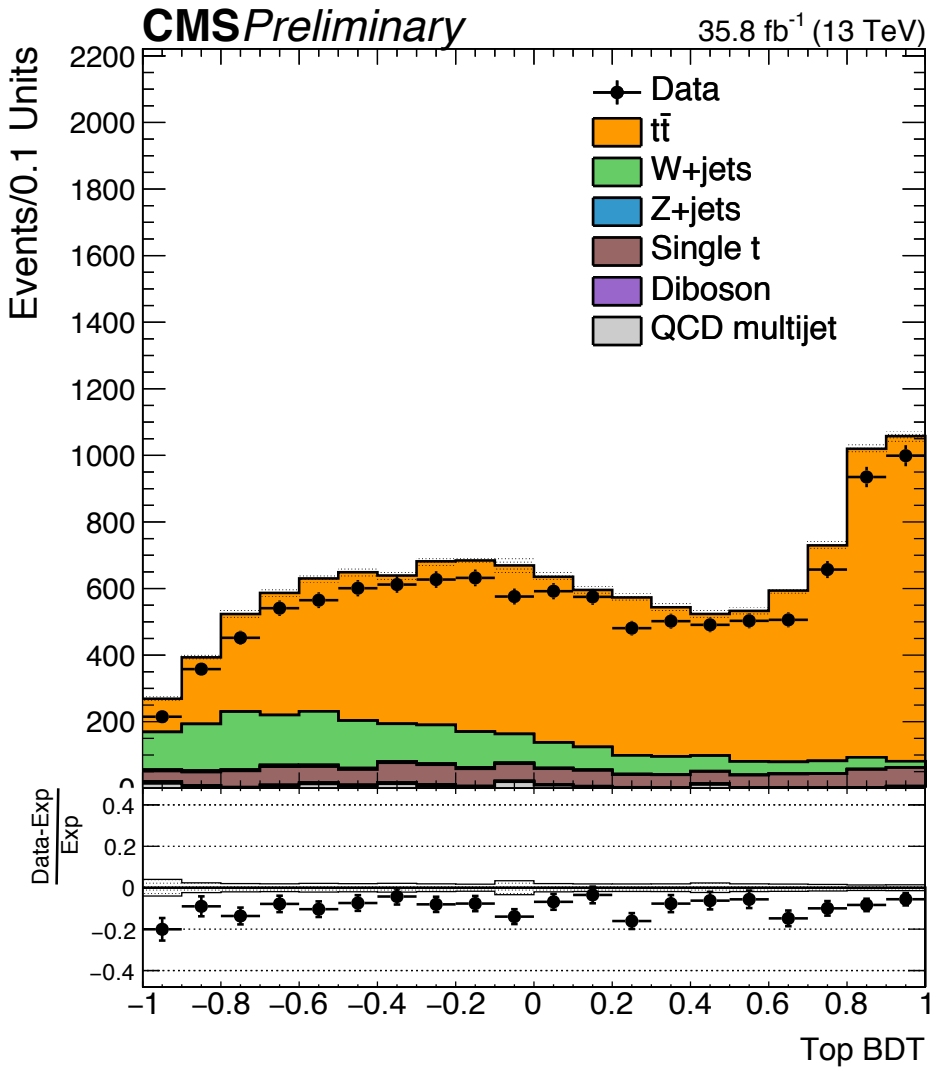


CMS Mono Top: Top Tagger

- Soft Drop Mass 110–210 GeV
- b tagged subjet
- Top BDT:
  - HEPTopTaggerV2
  - τ_{32}
  - 11 ECF ratios
- Similar to ATLAS approach
  - ATLAS-CONF-2017-064

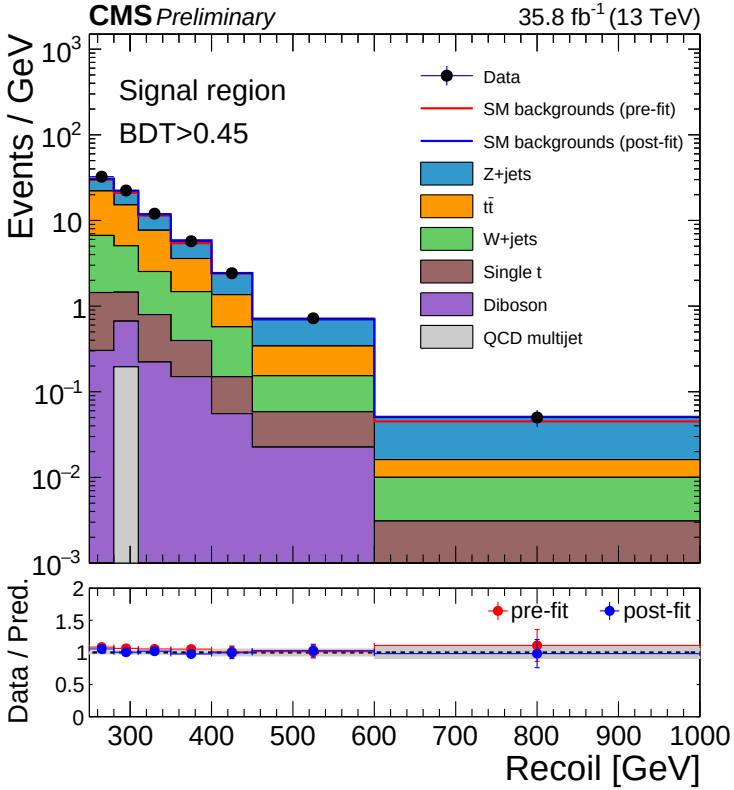
Control Regions

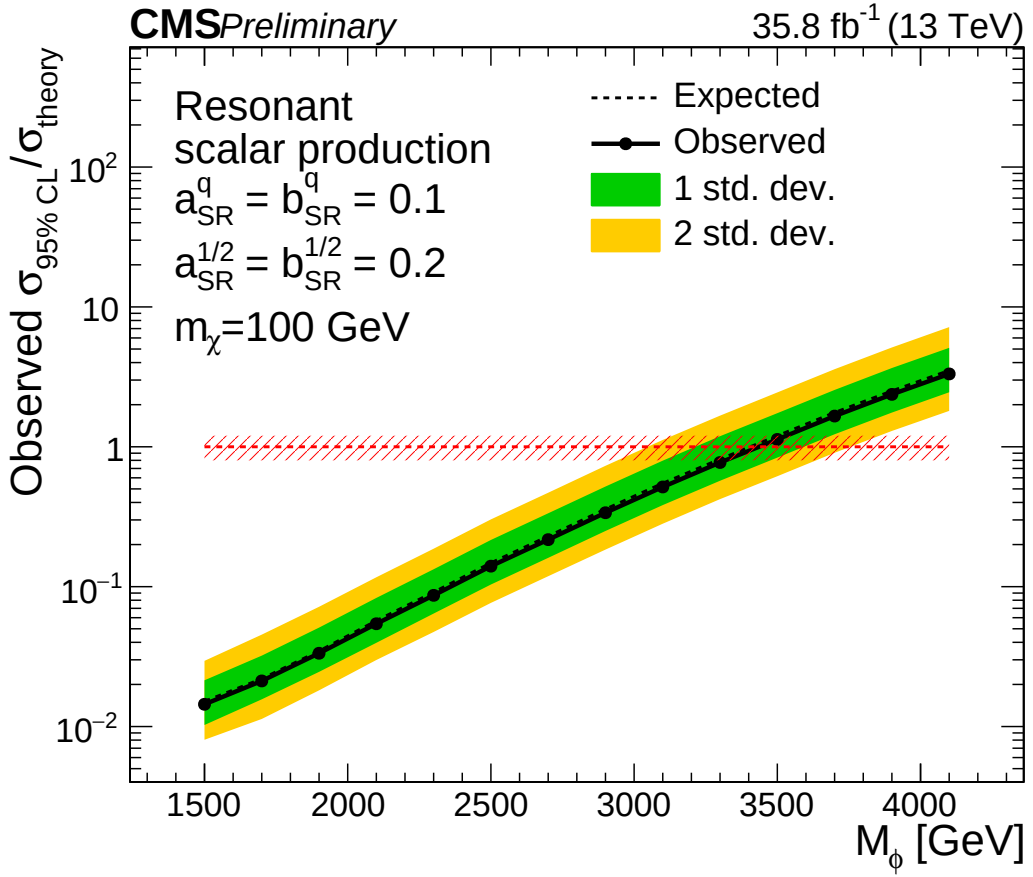
- $t\bar{t}$ (mu + had), 6%
- $Z \to \mu\mu$ + jets, 7%



Single-μ Selection

Mono Top

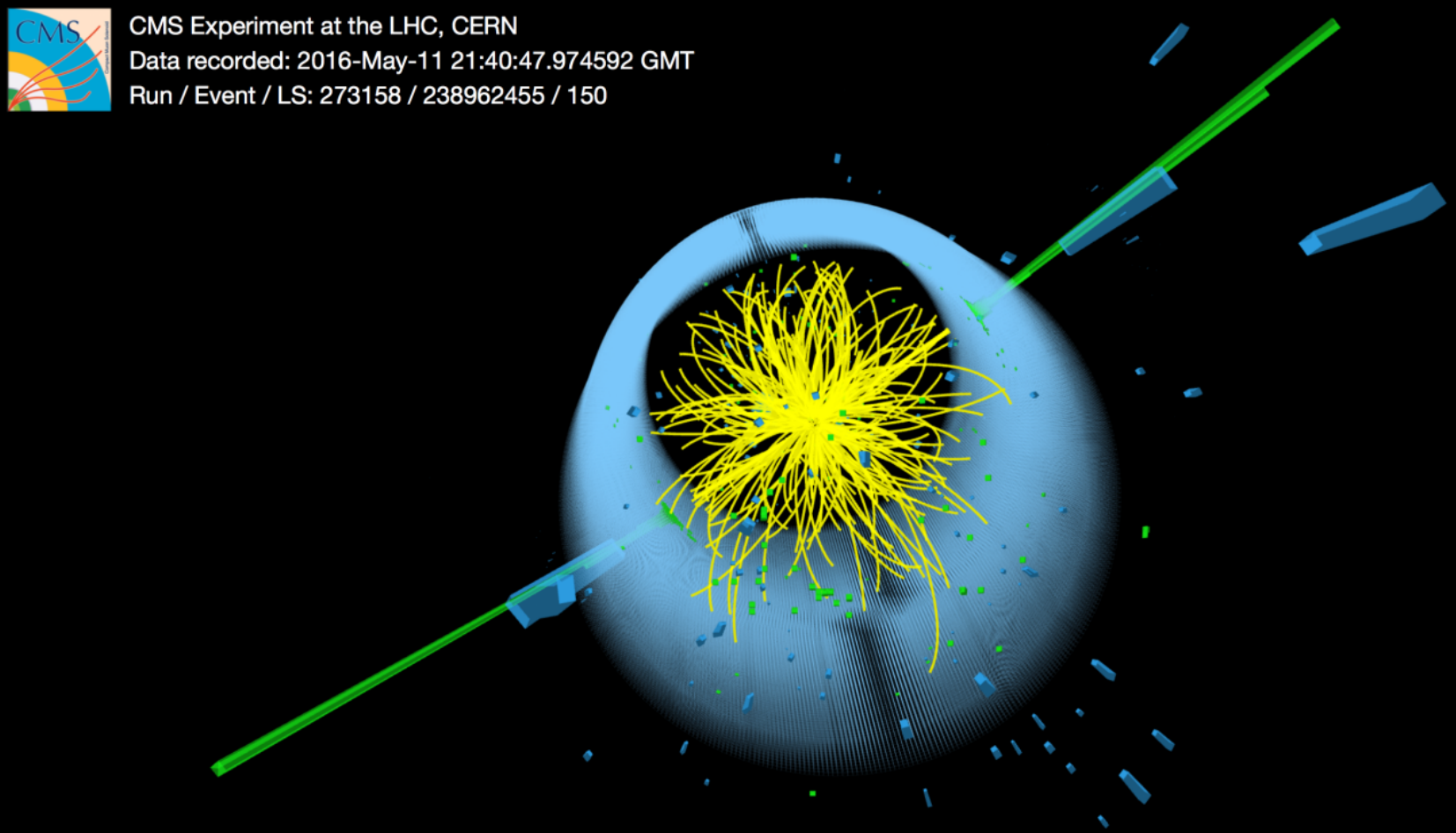




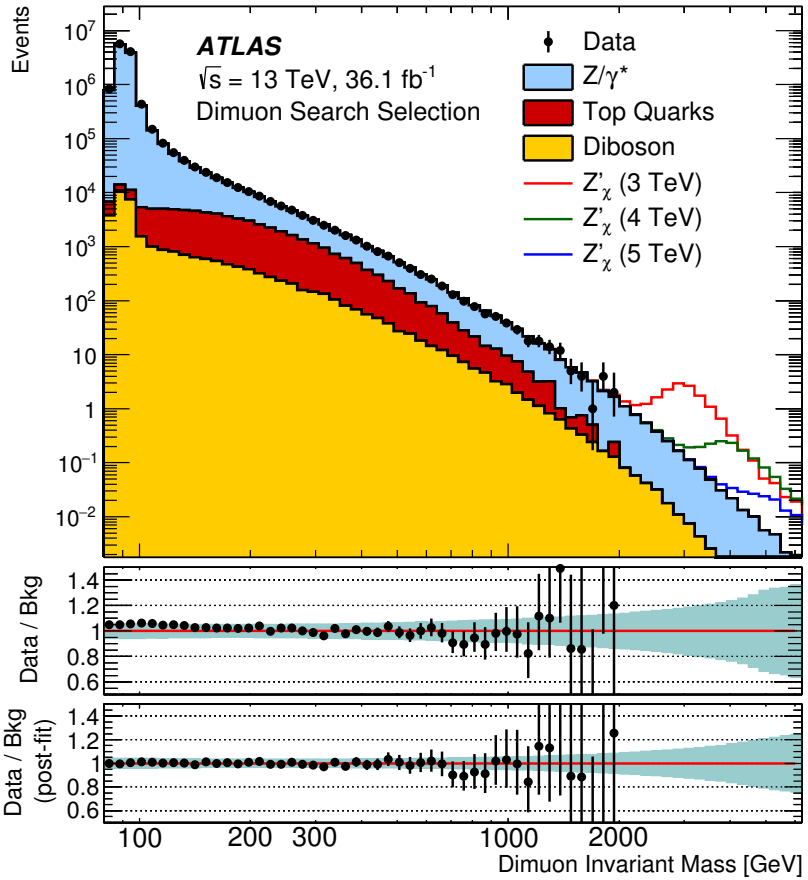
- No deviation from standard model
- Previous limits on on similar models: $M_\phi \lesssim 700\,\text{GeV}$

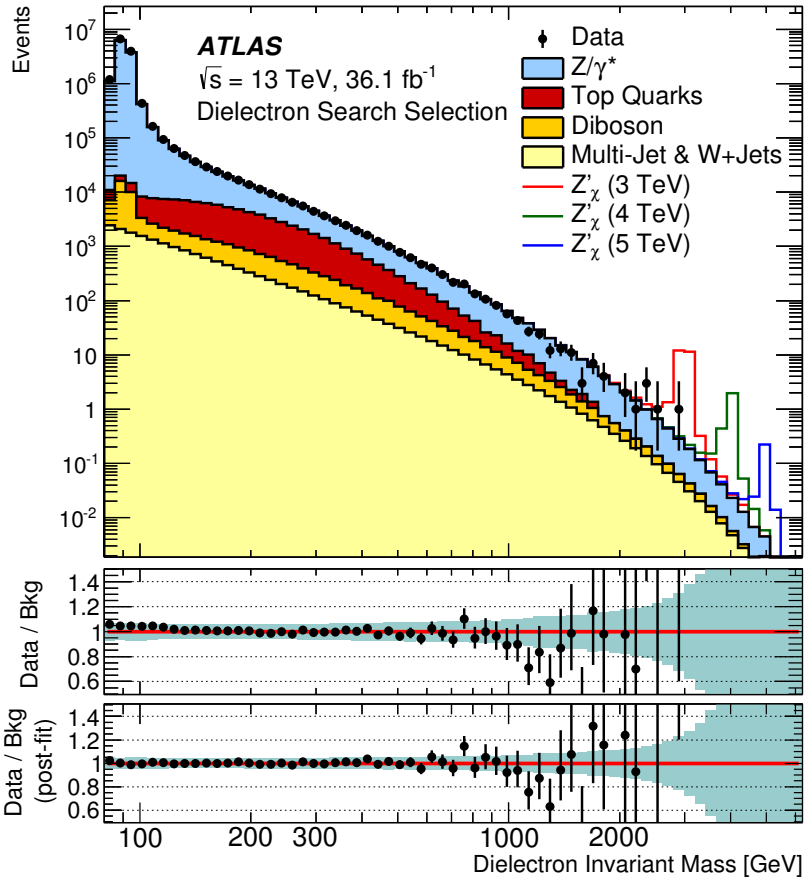
Two-body Decays

https://cds.cern.ch/record/2203615



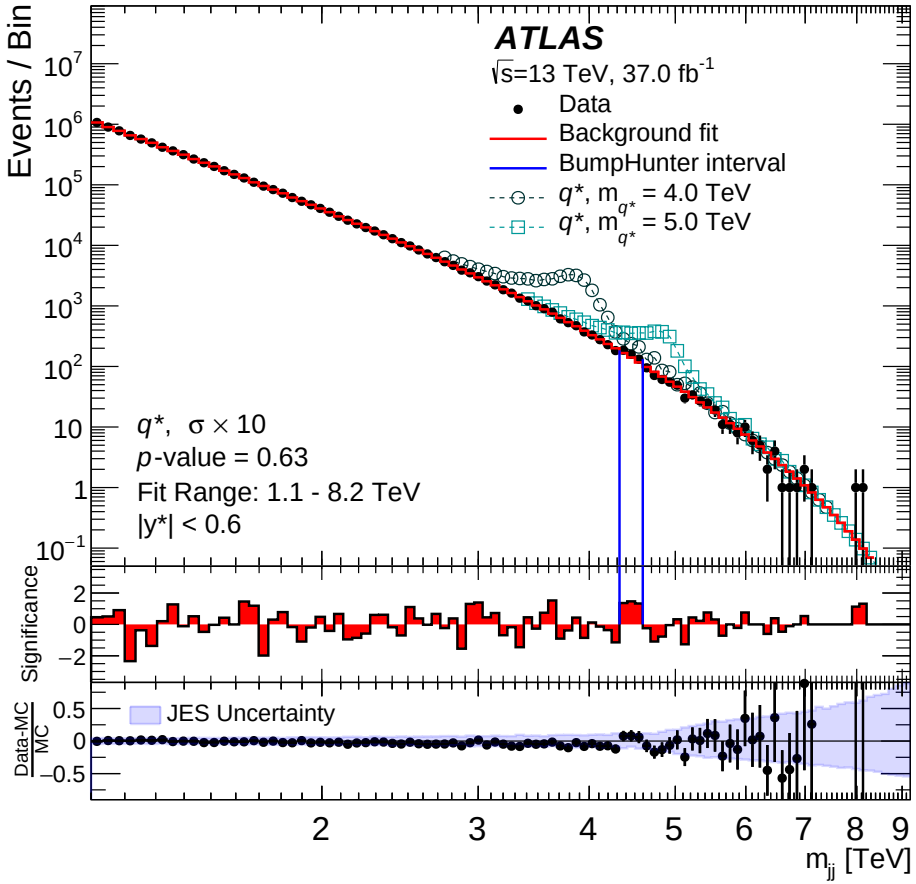
2 ℓ (ATLAS: arXiv:1707.02424, CMS: EXO-16-031)

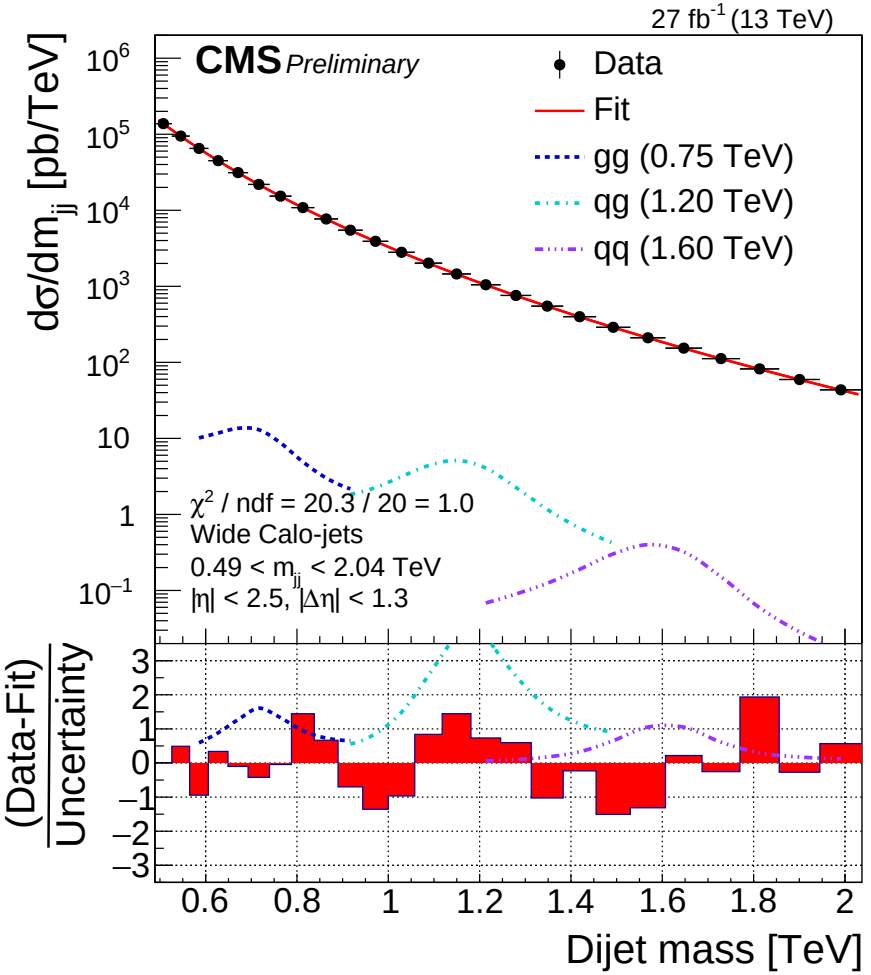




- Look for bumps on a smooth background
- Rules lots of (simplified) parameter space

Dijet (ATLAS: arXiv:1703.09127, CMS: EXO-16-056)

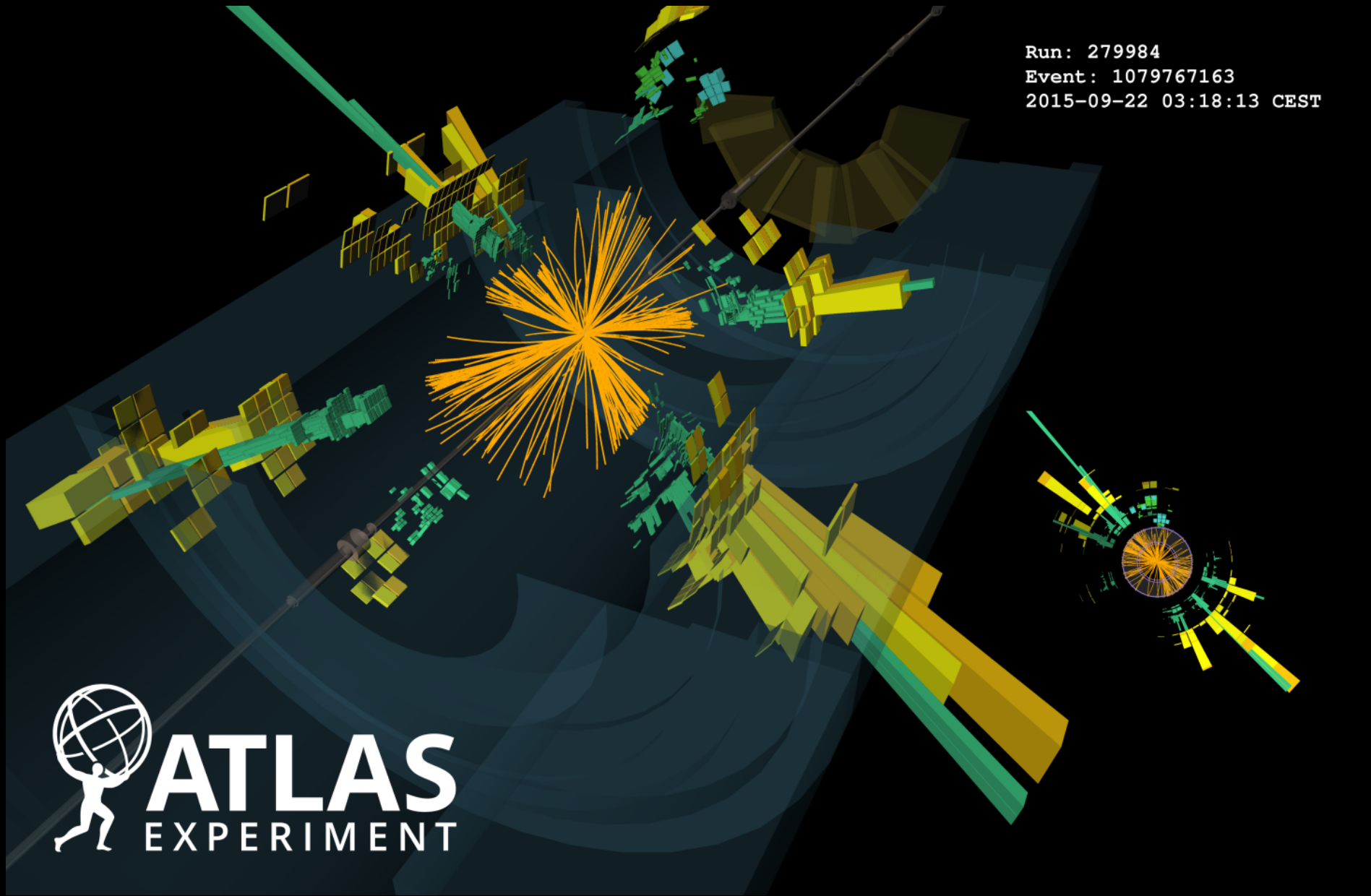




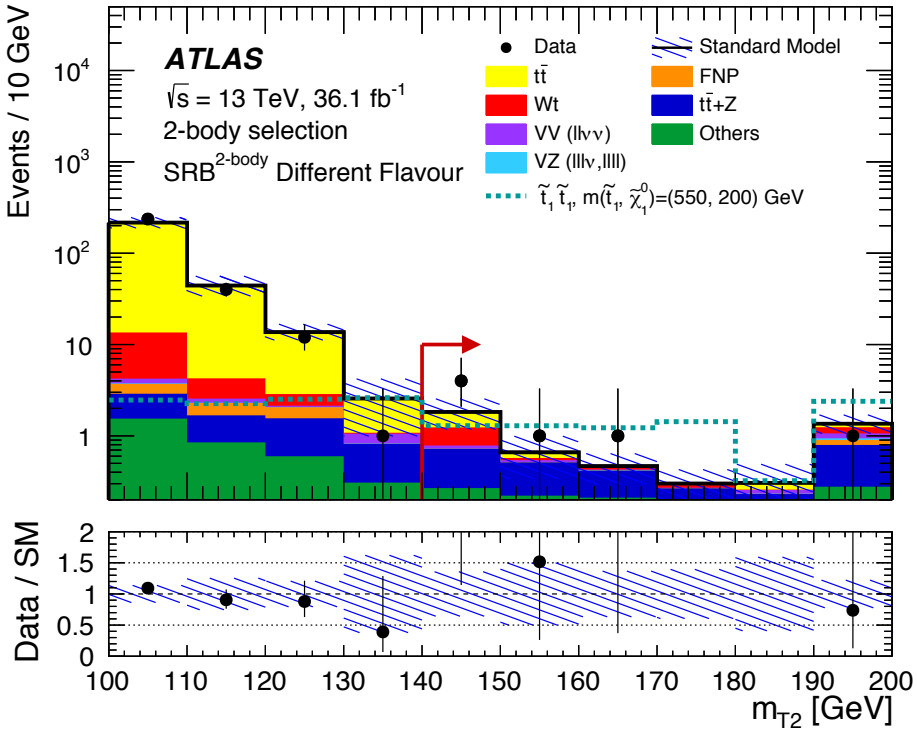
- Low mass: both experiments use "trigger scouting" and ISR

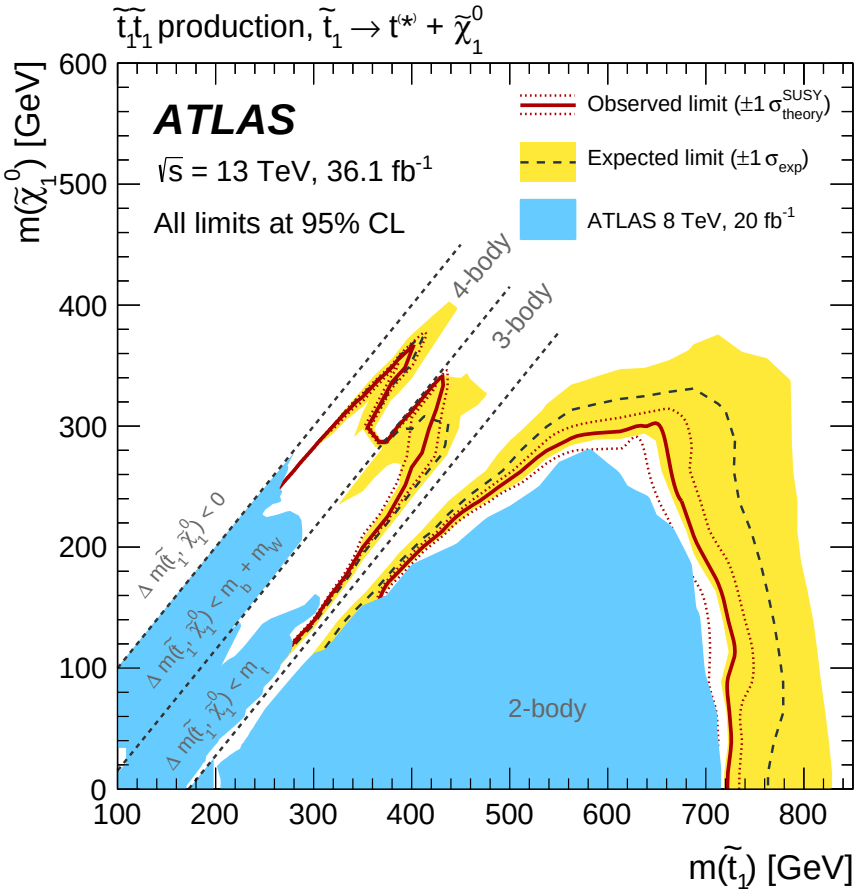
SUSY Searches

https://cds.cern.ch/record/2113241



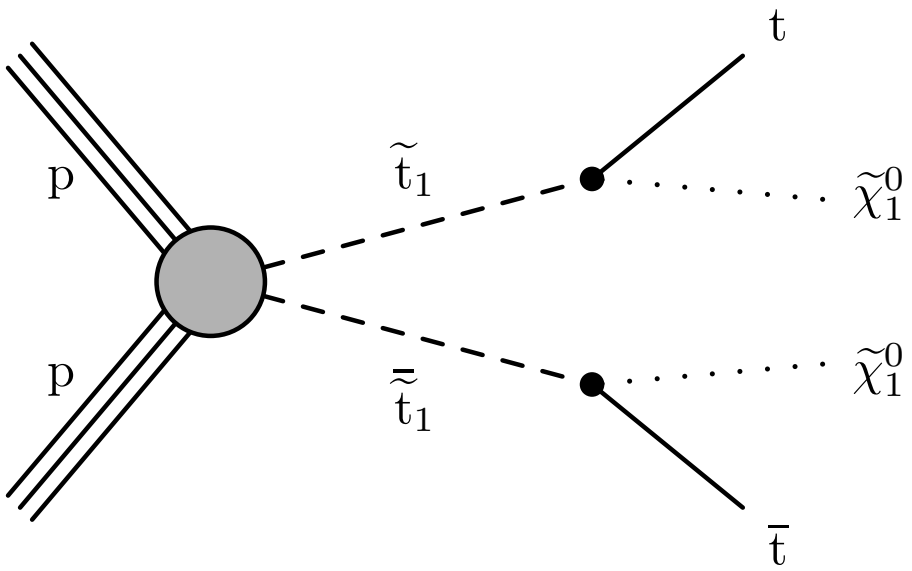
$2\tilde{t} \to 2\ell + 2b + E_{\mathrm{T}}^{\mathrm{miss}}$ (arXiv:1708.03247)

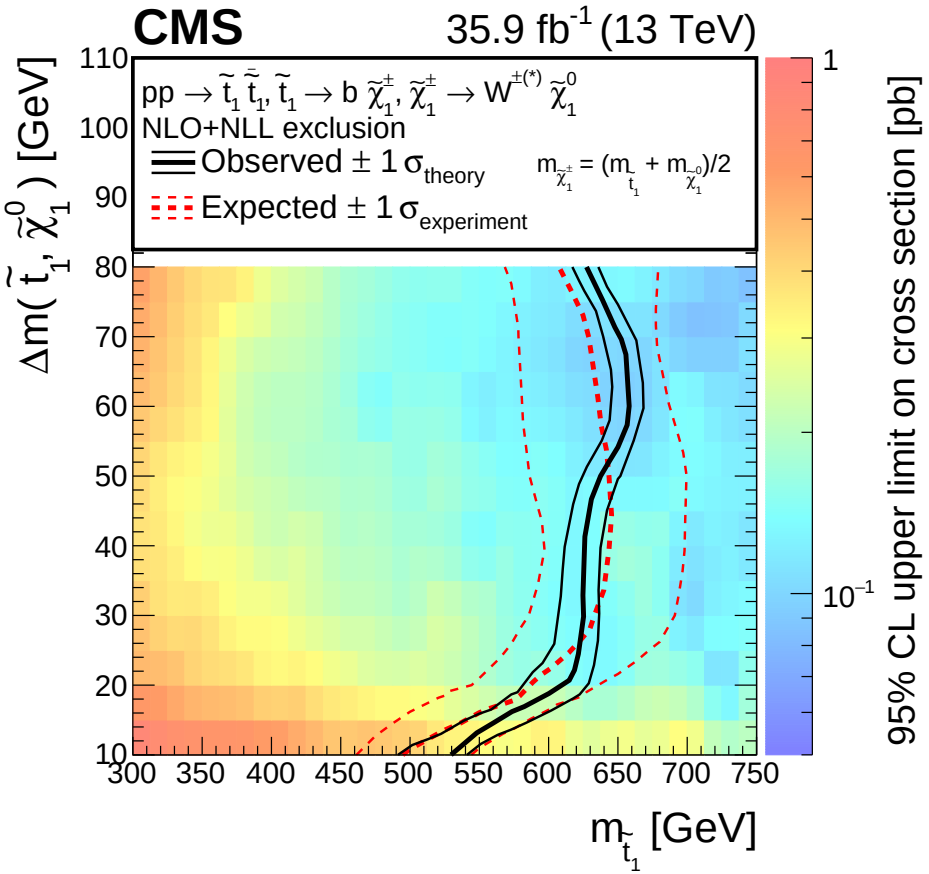




- Separate from $t\bar{t}$ by cutting hard on m_{T2} (arXiv:hep-ph/0304226)
- Still leaves "gaps" e.g. where $m_{\tilde{t}} - m_t \approx m_{\tilde{\chi}_1^0}$

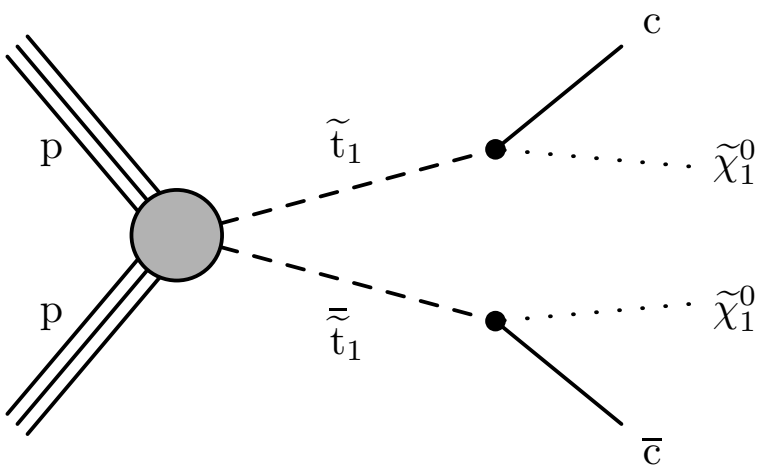
Full Hadronic $\tilde{t} \to t + E_{\mathrm{T}}^{\mathrm{miss}}$ (arXiv:1707.03316)



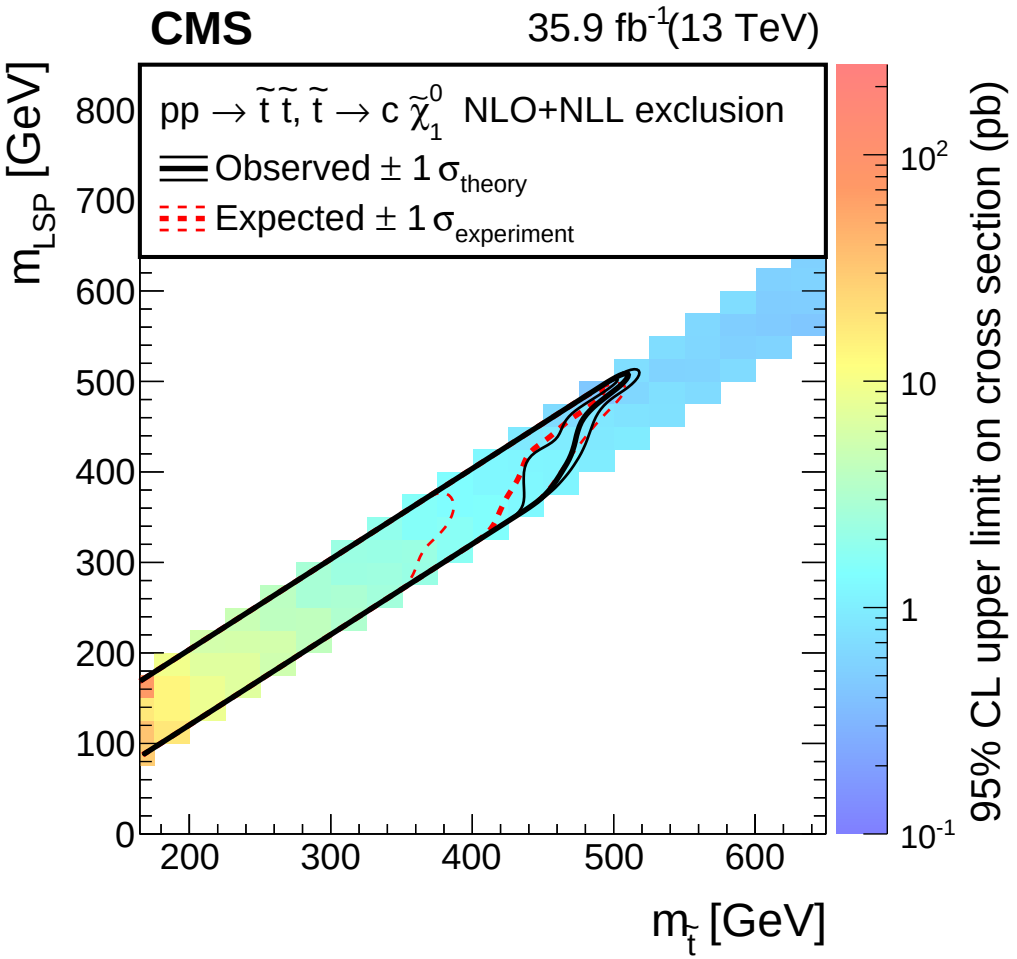


- Focus on "compressed": small $\Delta m \equiv m_{\tilde{t}} - m_{\tilde{\chi}_1^0}$
- Custom SV-based discriminant to identify b-jets with $p_{\mathrm{T}} < 20\,\mathrm{GeV}$

3rd Generation Squark $\rightarrow c, b$ (arXiv:1707.07274)

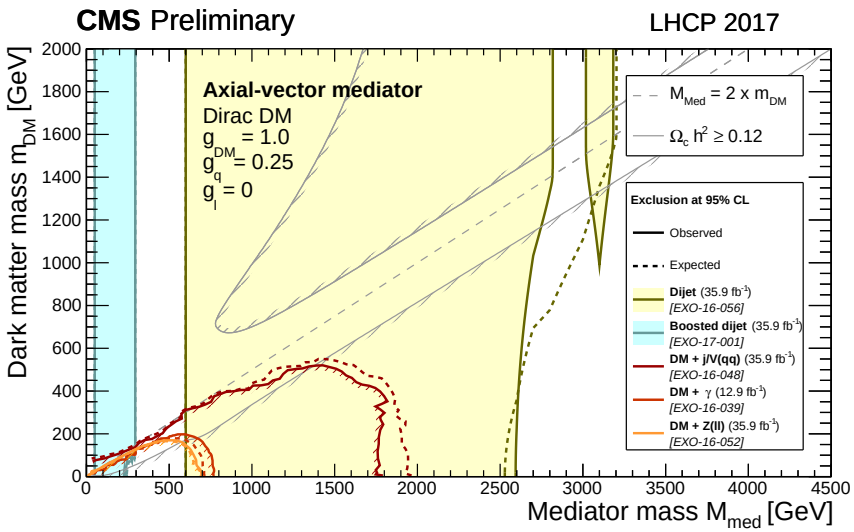


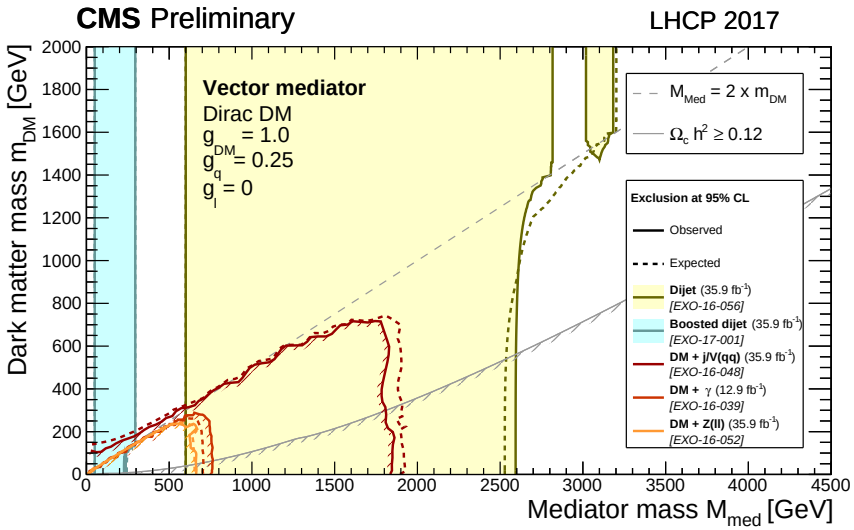
- Favored when $m_{\tilde{t}} - m_{\tilde{\chi}_1^0} < m_W$
- Use c-tagging to identify FCNC $\tilde{t}$ decays

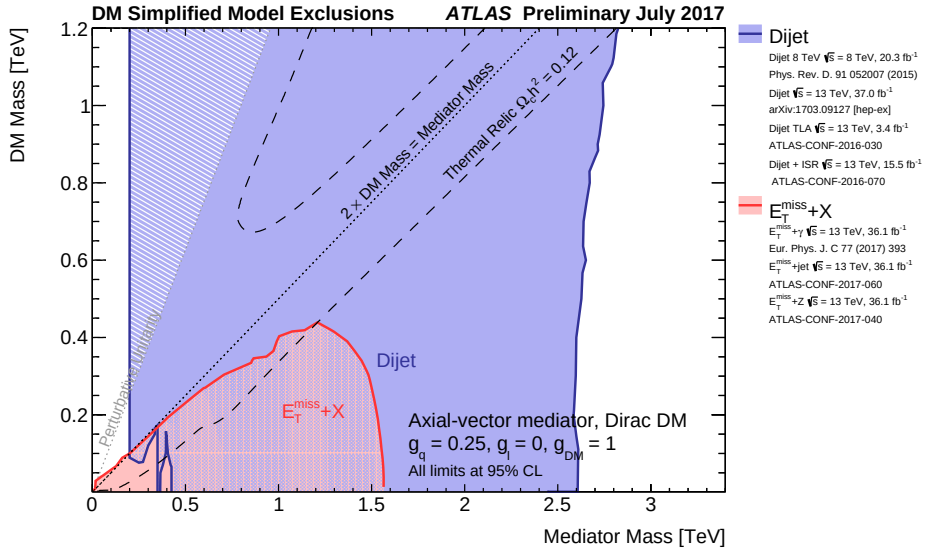


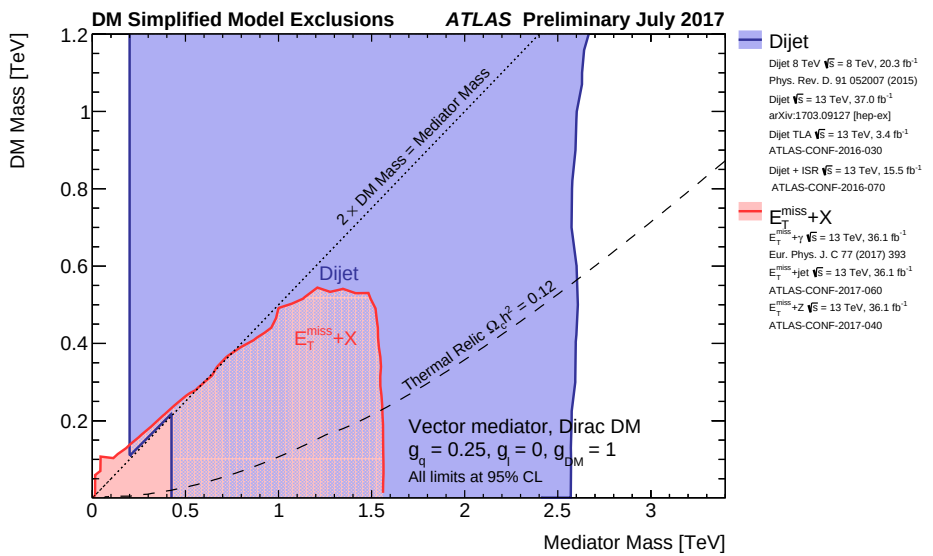
- Similar final state to arXiv:1407.0608

Summary: Simplified Mediator ($g_q = 0.25, g_\ell = 0.0$)

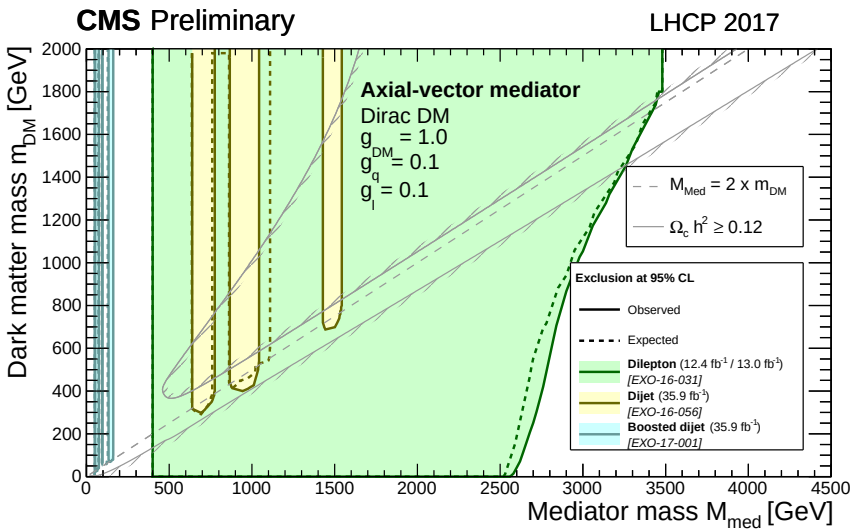


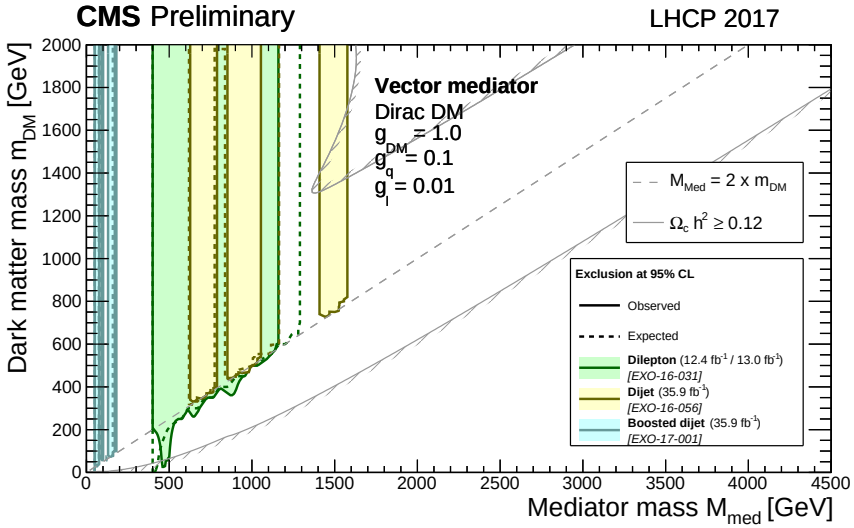


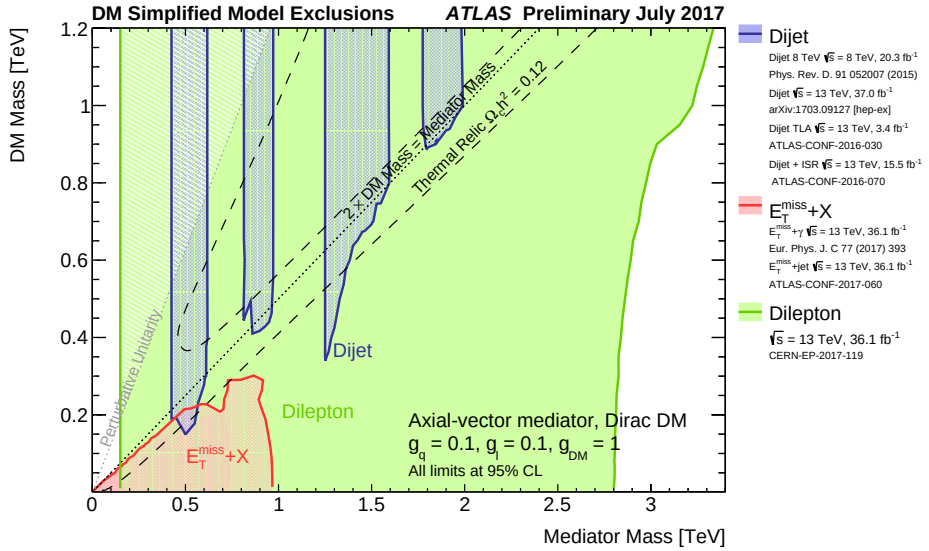


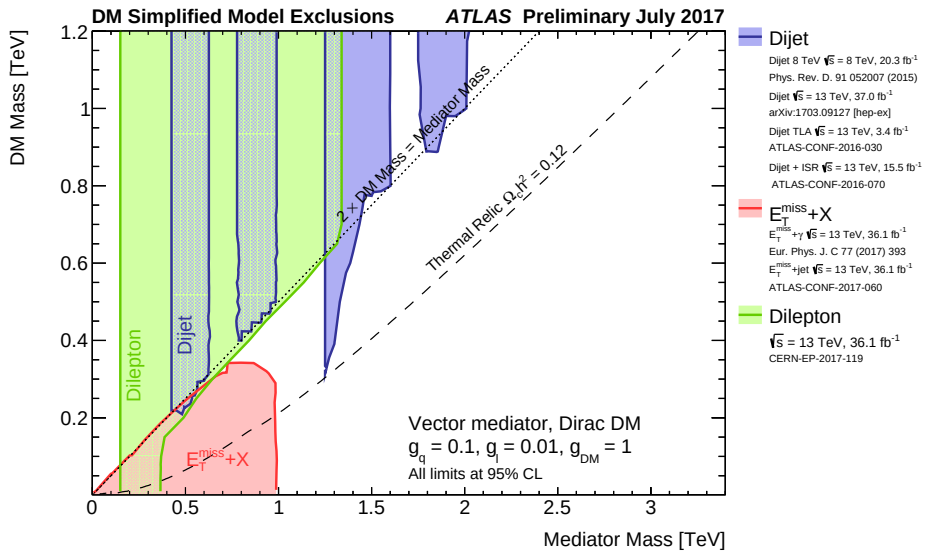


Simplified Mediator ($g_q = 0.1, g_\ell^A = 0.1, g_\ell^V = 0.01$)



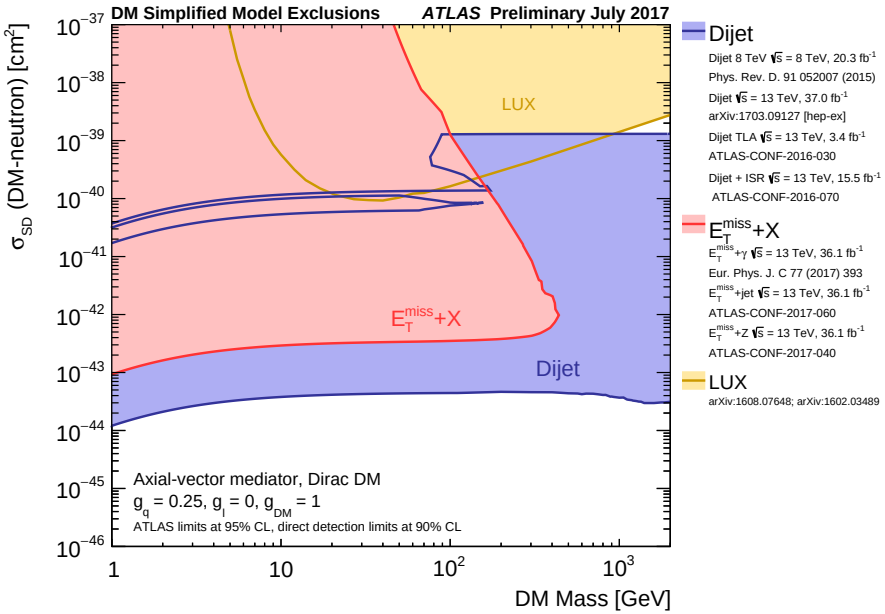




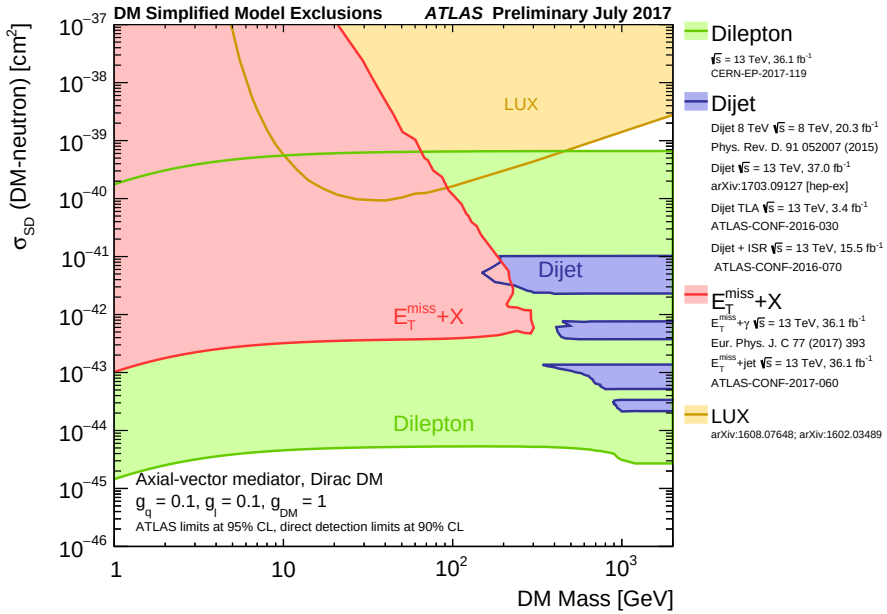


Comparison to direct detection

$g_q = 0.25, g_\ell = 0.0$



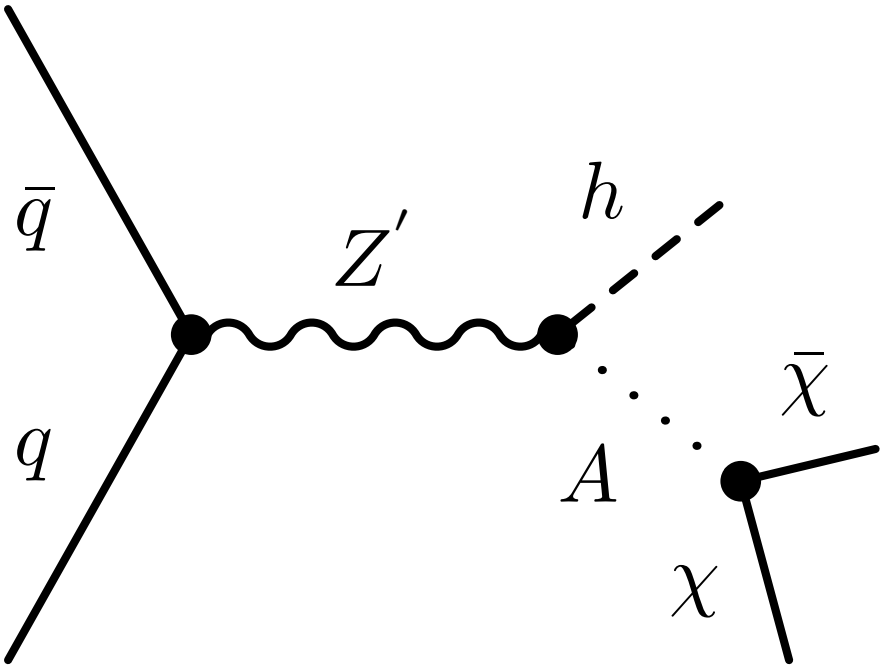
$g_q = 0.1, g_\ell = 0.1$

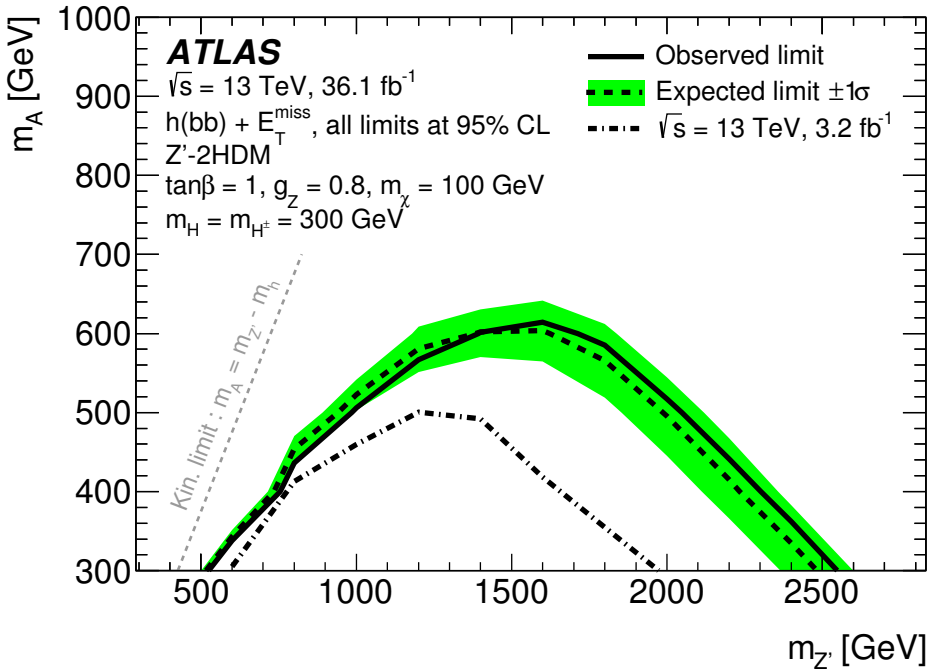


- In the low energy limit, we can compare to direct detection

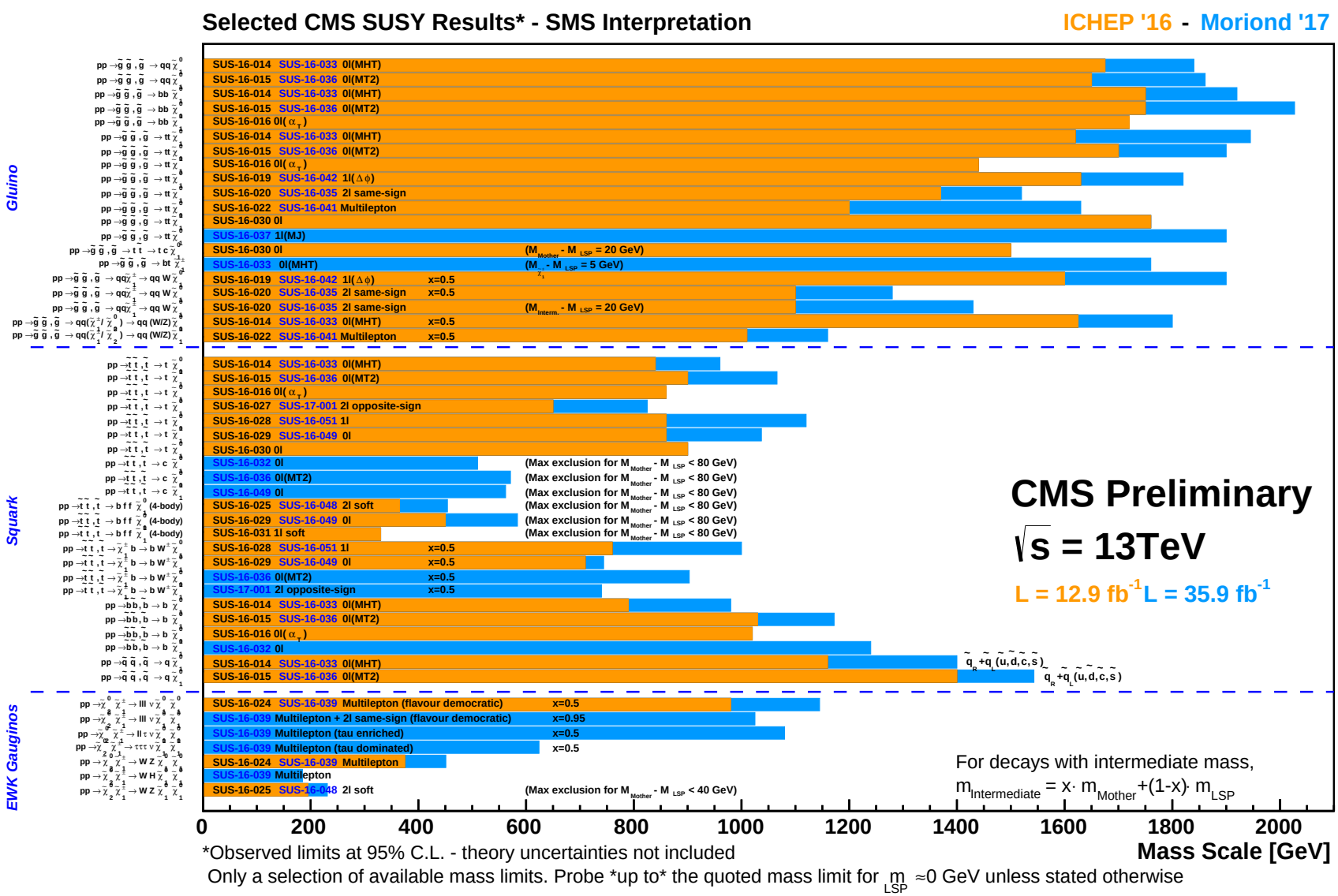
$$\frac{g_\chi g_q}{Q^2 - M^2} = -\frac{g_\chi g_q}{M^2}\left(1 + \frac{Q^2}{M^2} + O\left(\frac{Q^4}{M^4}\right)\right) \approx -\frac{g_\chi g_q}{M^2}$$

Bonus Exclusions: Mono-H





- Showing ATLAS $H \to bb$ (arXiv:1707.01302)
- CMS results in backup



*Observed limits at 95% C.L. - theory uncertainties not included

Only a selection of available mass limits. Probe *up to* the quoted mass limit for $m_{LSP} \approx 0$ GeV unless stated otherwise

ATLAS SUSY Searches* - 95% CL Lower Limits

May 2017

ATLAS Preliminary

$\sqrt{s}$ = 7, 8, 13 TeV

	Model	e, μ, τ, γ	Jets	E_T^{miss}	$\int \mathcal{L}\, dt$[fb^{-1}]	Mass limit	$\sqrt{s}$ = 7, 8 TeV / $\sqrt{s}$ = 13 TeV	Reference
Inclusive Searches	MSUGRA/CMSSM	0-3 e, μ/1-2 τ	2-10 jets/3 b	Yes	20.3	$\tilde{q}, \tilde{g}$	1.85 TeV	m($\tilde{g}$)=m($\tilde{q}$)	1507.05525
	$\tilde{q}\tilde{q}, \tilde{q}\to q\tilde{\chi}_1^0$	0	2-6 jets	Yes	36.1	$\tilde{q}$	1.57 TeV	m($\tilde{\chi}_1^0$)<200 GeV, m(1st gen. $\tilde{q}$)=m(2nd gen. $\tilde{q}$)	ATLAS-CONF-2017-022
	$\tilde{q}\tilde{q}, \tilde{q}\to q\tilde{\chi}_1^0$ (compressed)	mono-jet	1-3 jets	Yes	3.2	$\tilde{q}$	608 GeV	m($\tilde{q}$)-m($\tilde{\chi}_1^0$)<5 GeV	1604.07773
	$\tilde{g}\tilde{g}, \tilde{g}\to q\bar{q}\tilde{\chi}_1^0$	0	2-6 jets	Yes	36.1	$\tilde{g}$	2.02 TeV	m($\tilde{\chi}_1^0$)<200 GeV	ATLAS-CONF-2017-022
	$\tilde{g}\tilde{g}, \tilde{g}\to qq\tilde{\chi}_1^\pm\to qqW^\pm\tilde{\chi}_1^0$	0	2-6 jets	Yes	36.1	$\tilde{g}$	2.01 TeV	m($\tilde{\chi}_1^0$)<200 GeV, m($\tilde{\chi}^\pm$)=0.5(m($\tilde{\chi}_1^0$)+m($\tilde{g}$))	ATLAS-CONF-2017-022
	$\tilde{g}\tilde{g}, \tilde{g}\to qq(\ell\ell/\nu\nu)\tilde{\chi}_1^0$	3 e, μ	4 jets	-	36.1	$\tilde{g}$	1.825 TeV	m($\tilde{\chi}_1^0$)<400 GeV	ATLAS-CONF-2017-030
	$\tilde{g}\tilde{g}, \tilde{g}\to qqWZ\tilde{\chi}_1^0$	0	7-11 jets	Yes	36.1	$\tilde{g}$	1.8 TeV	m($\tilde{\chi}_1^0$) <400 GeV	ATLAS-CONF-2017-033
	GMSB ($\tilde{\ell}$ NLSP)	1-2 τ + 0-1 ℓ	0-2 jets	Yes	3.2	$\tilde{g}$	2.0 TeV		1607.05979
	GGM (bino NLSP)	2 γ	-	Yes	3.2	$\tilde{g}$	1.65 TeV	$c\tau$(NLSP)<0.1 mm	1606.09150
	GGM (higgsino-bino NLSP)	γ	1 b	Yes	20.3	$\tilde{g}$	1.37 TeV	m($\tilde{\chi}_1^0$)<950 GeV, $c\tau$(NLSP)<0.1 mm, μ<0	1507.05493
	GGM (higgsino-bino NLSP)	γ	2 jets	Yes	13.3	$\tilde{g}$	1.8 TeV	m($\tilde{\chi}_1^0$)>680 GeV, $c\tau$(NLSP)<0.1 mm, μ>0	ATLAS-CONF-2016-066
	GGM (higgsino NLSP)	2 e, μ (Z)	2 jets	Yes	20.3	$\tilde{g}$	900 GeV	m(NLSP)>430 GeV	1503.03290
	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
3rd gen. $\tilde{g}$ med.	$\tilde{g}\tilde{g}, \tilde{g}\to b\bar{b}\tilde{\chi}_1^0$	0	3 b	Yes	36.1	$\tilde{g}$	1.92 TeV	m($\tilde{\chi}_1^0$)<600 GeV	ATLAS-CONF-2017-021
	$\tilde{g}\tilde{g}, \tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0-1 e, μ	3 b	Yes	36.1	$\tilde{g}$	1.97 TeV	m($\tilde{\chi}_1^0$)<200 GeV	ATLAS-CONF-2017-021
	$\tilde{g}\tilde{g}, \tilde{g}\to bt\tilde{\chi}_1^+$	0-1 e, μ	3 b	Yes	20.1	$\tilde{g}$	1.37 TeV	m($\tilde{\chi}_1^0$)<300 GeV	1407.0600
3rd gen. squarks direct production	$\tilde{b}_1\tilde{b}_1, \tilde{b}_1\to b\tilde{\chi}_1^0$	0	2 b	Yes	36.1	$\tilde{b}_1$	950 GeV	m($\tilde{\chi}_1^0$)<420 GeV	ATLAS-CONF-2017-038
	$\tilde{b}_1\tilde{b}_1, \tilde{b}_1\to t\tilde{\chi}_1^\pm$	2 e, μ (SS)	1 b	Yes	36.1	$\tilde{b}_1$	275-700 GeV	m($\tilde{\chi}_1^0$)<200 GeV, m($\tilde{\chi}_1^\pm$)= m($\tilde{\chi}_1^0$)+100 GeV	ATLAS-CONF-2017-030
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to b\tilde{\chi}_1^\pm$	0-2 e, μ	1-2 b	Yes	4.7/13.3	$\tilde{t}_1$	117-170 GeV 200-720 GeV	m($\tilde{\chi}_1^\pm$) = 2m($\tilde{\chi}_1^0$), m($\tilde{\chi}_1^0$)=55 GeV	1209.2102, ATLAS-CONF-2016-077
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to Wb\tilde{\chi}_1^0$ or $t\tilde{\chi}_1^0$	0-2 e, μ	0-2 jets/1-2 b	Yes	20.3/36.1	$\tilde{t}_1$	90-198 GeV 205-950 GeV	m($\tilde{\chi}_1^0$)=1 GeV	1506.08616, ATLAS-CONF-2017-020
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to c\tilde{\chi}_1^0$	0	mono-jet	Yes	3.2	$\tilde{t}_1$	90-323 GeV	m($\tilde{t}_1$)-m($\tilde{\chi}_1^0$)=5 GeV	1604.07773
	$\tilde{t}_1\tilde{t}_1$(natural GMSB)	2 e, μ (Z)	1 b	Yes	20.3	$\tilde{t}_1$	150-600 GeV	m($\tilde{\chi}_1^0$)>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	36.1	$\tilde{t}_2$	290-790 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2017-019
	$\tilde{t}_2\tilde{t}_2, \tilde{t}_2\to\tilde{t}_1+h$	1-2 e, μ	4 b	Yes	36.1	$\tilde{t}_2$	320-880 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2017-019
EW direct	$\tilde{\ell}_{LR}\tilde{\ell}_{LR}, \tilde{\ell}\to\ell\tilde{\chi}_1^0$	2 e, μ	0	Yes	36.1	$\tilde{\ell}$	90-440 GeV	m($\tilde{\chi}_1^0$)=0	ATLAS-CONF-2017-039
	$\tilde{\chi}_1^+\tilde{\chi}_1^-, \tilde{\chi}_1^+\to\tilde{\ell}\nu(\ell\tilde{\nu})$	2 e, μ	0	Yes	36.1	$\tilde{\chi}_1^\pm$	710 GeV	m($\tilde{\chi}_1^0$)=0, m($\tilde{\ell}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_1^\pm$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2017-039
	$\tilde{\chi}_1^\pm\tilde{\chi}_1^0/\tilde{\chi}_2^0, \tilde{\chi}_1^+\to\tilde{\tau}\nu(\tau\tilde{\nu}), \tilde{\chi}_2^0\to\tilde{\tau}\tau(\nu\tilde{\nu})$	2 τ	-	Yes	36.1	$\tilde{\chi}_1^\pm$	760 GeV	m($\tilde{\chi}_1^0$)=0, m($\tilde{\tau}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_1^\pm$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2017-035
	$\tilde{\chi}_1^\pm\tilde{\chi}_2^0\to\tilde{\ell}_L\nu\tilde{\ell}_L\ell(\tilde{\nu}\nu), \ell\tilde{\nu}\tilde{\ell}_L\ell(\tilde{\nu}\nu)$	3 e, μ	0	Yes	36.1	$\tilde{\chi}_1^\pm, \tilde{\chi}_2^0$	1.16 TeV	m($\tilde{\chi}_1^\pm$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, m($\tilde{\ell}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_1^\pm$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2017-039
	$\tilde{\chi}_1^\pm\tilde{\chi}_2^0\to W\tilde{\chi}_1^0Z\tilde{\chi}_1^0$	2-3 e, μ	0-2 jets	Yes	36.1	$\tilde{\chi}_1^\pm, \tilde{\chi}_2^0$	580 GeV	m($\tilde{\chi}_1^\pm$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, $\tilde{\ell}$ decoupled	ATLAS-CONF-2017-039
	$\tilde{\chi}_1^\pm\tilde{\chi}_2^0\to W\tilde{\chi}_1^0h\tilde{\chi}_1^0, h\to b\bar{b}/WW/\tau\tau/\gamma\gamma$	e, μ, γ	0-2 b	Yes	20.3	$\tilde{\chi}_1^\pm, \tilde{\chi}_2^0$	270 GeV	m($\tilde{\chi}_1^\pm$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, $\tilde{\ell}$ decoupled	1501.07110
	$\tilde{\chi}_2^0\tilde{\chi}_3^0, \tilde{\chi}_{2,3}^0\to\tilde{\ell}_R\ell$	4 e, μ	0	Yes	20.3	$\tilde{\chi}_{2,3}^0$	635 GeV	m($\tilde{\chi}_2^0$)=m($\tilde{\chi}_3^0$), m($\tilde{\chi}_1^0$)=0, m($\tilde{\ell}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_2^0$)+m($\tilde{\chi}_1^0$))	1405.5086
	GGM (wino NLSP) weak prod., $\tilde{\chi}_1^0\to\gamma\tilde{G}$	1 e, μ + γ	-	Yes	20.3	$\tilde{W}$	115-370 GeV	$c\tau$<1 mm	1507.05493
	GGM (bino NLSP) weak prod., $\tilde{\chi}_1^0\to\gamma\tilde{G}$	2 γ	-	Yes	20.3	$\tilde{W}$	590 GeV	$c\tau$<1 mm	1507.05493
Long-lived particles	Direct $\tilde{\chi}_1^+\tilde{\chi}_1^-$ prod., long-lived $\tilde{\chi}_1^\pm$	Disapp. trk	1 jet	Yes	36.1	$\tilde{\chi}_1^\pm$	430 GeV	m($\tilde{\chi}_1^\pm$)-m($\tilde{\chi}_1^0$)~160 MeV, $\tau(\tilde{\chi}_1^\pm)$=0.2 ns	ATLAS-CONF-2017-017
	Direct $\tilde{\chi}_1^+\tilde{\chi}_1^-$ prod., long-lived $\tilde{\chi}_1^\pm$	dE/dx trk	-	Yes	18.4	$\tilde{\chi}_1^\pm$	495 GeV	m($\tilde{\chi}_1^\pm$)-m($\tilde{\chi}_1^0$)~160 MeV, $\tau(\tilde{\chi}_1^\pm)$<15 ns	1506.05332
	Stable, stopped $\tilde{g}$ R-hadron	0	1-5 jets	Yes	27.9	$\tilde{g}$	850 GeV	m($\tilde{\chi}_1^0$)=100 GeV, 10 μs<$\tau(\tilde{g})$<1000 s	1310.6584
	Stable $\tilde{g}$ R-hadron	trk	-	-	3.2	$\tilde{g}$	1.58 TeV		1606.05129
	Metastable $\tilde{g}$ R-hadron	dE/dx trk	-	-	3.2	$\tilde{g}$	1.57 TeV	m($\tilde{\chi}_1^0$)=100 GeV, τ>10 ns	1604.04520
	GMSB, stable $\tilde{\tau}$, $\tilde{\chi}_1^0\to\tilde{\tau}(\tilde{e}, \tilde{\mu})+\tau(e, \mu)$	1-2 μ	-	-	19.1	$\tilde{\chi}_1^0$	537 GeV	10<tanβ<50	1411.6795
	GMSB, $\tilde{\chi}_1^0\to\gamma\tilde{G}$, long-lived $\tilde{\chi}_1^0$	2 γ	-	Yes	20.3	$\tilde{\chi}_1^0$	440 GeV	1<$\tau(\tilde{\chi}_1^0)$<3 ns, SPS8 model	1409.5542
	$\tilde{g}\tilde{g}, \tilde{\chi}_1^0\to eev/e\mu\nu/\mu\mu\nu$	displ. $ee/e\mu/\mu\mu$	-	-	20.3	$\tilde{\chi}_1^0$	1.0 TeV	7 <$c\tau(\tilde{\chi}_1^0)$< 740 mm, m($\tilde{g}$)=1.3 TeV	1504.05162
	GGM $\tilde{g}\tilde{g}, \tilde{\chi}_1^0\to Z\tilde{G}$	displ. vtx + jets	-	-	20.3	$\tilde{\chi}_1^0$	1.0 TeV	6 <$c\tau(\tilde{\chi}_1^0)$< 480 mm, m($\tilde{g}$)=1.1 TeV	1504.05162
RPV	LFV $pp\to\tilde{\nu}_\tau+X, \tilde{\nu}_\tau\to e\mu/e\tau/\mu\tau$	$e\mu, e\tau, \mu\tau$	-	-	3.2	$\tilde{\nu}_\tau$	1.9 TeV	λ'_{311}=0.11, $\lambda_{132/133/233}$=0.07	1607.08079
	Bilinear RPV CMSSM	2 e, μ (SS)	0-3 b	Yes	20.3	$\tilde{q}, \tilde{g}$	1.45 TeV	m($\tilde{g}$)=m($\tilde{g}$), $c\tau_{LSP}$<1 mm	1404.2500
	$\tilde{\chi}_1^+\tilde{\chi}_1^-, \tilde{\chi}_1^+\to W\tilde{\chi}_1^0, \tilde{\chi}_1^0\to ee\nu, e\mu\nu, \mu\mu\nu$	4 e, μ	-	Yes	13.3	$\tilde{\chi}_1^\pm$	1.14 TeV	m($\tilde{\chi}_1^0$)>400GeV, $\lambda_{12k}\neq0$ (k = 1, 2)	ATLAS-CONF-2016-075
	$\tilde{\chi}_1^+\tilde{\chi}_1^-, \tilde{\chi}_1^+\to W\tilde{\chi}_1^0, \tilde{\chi}_1^0\to\tau\tau\nu_e, e\tau\nu_\tau$	3 e, μ + τ	-	Yes	20.3	$\tilde{\chi}_1^\pm$	450 GeV	m($\tilde{\chi}_1^0$)>0.2×m($\tilde{\chi}_1^\pm$), $\lambda_{133}\neq0$	1405.5086
	$\tilde{g}\tilde{g}, \tilde{g}\to qqq$	0	4-5 large-R jets	-	14.8	$\tilde{g}$	1.08 TeV	BR(t)=BR(b)=BR(c)=0%	ATLAS-CONF-2016-057
	$\tilde{g}\tilde{g}, \tilde{g}\to qq\tilde{\chi}_1^0, \tilde{\chi}_1^0\to qqq$	0	4-5 large-R jets	-	14.8	$\tilde{g}$	1.55 TeV	m($\tilde{\chi}_1^0$)=800 GeV	ATLAS-CONF-2016-057
	$\tilde{g}\tilde{g}, \tilde{g}\to t\bar{t}\tilde{\chi}_1^0, \tilde{\chi}_1^0\to qqq$	1 e, μ	8-10 jets/0-4 b	-	36.1	$\tilde{g}$	2.1 TeV	m($\tilde{\chi}_1^0$)= 1 TeV, $\lambda_{112}\neq0$	ATLAS-CONF-2017-013
	$\tilde{g}\tilde{g}, \tilde{g}\to\tilde{t}_1t, \tilde{t}_1\to bs$	1 e, μ	8-10 jets/0-4 b	-	36.1	$\tilde{g}$	1.65 TeV	m($\tilde{t}_1$)= 1 TeV, $\lambda_{323}\neq0$	ATLAS-CONF-2017-013
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to bs$	0	2 jets + 2 b	-	15.4	$\tilde{t}_1$	410 GeV 450-510 GeV		ATLAS-CONF-2016-022, ATLAS-CONF-2016-084
	$\tilde{t}_1\tilde{t}_1, \tilde{t}_1\to b\ell$	2 e, μ	2 b	-	36.1	$\tilde{t}_1$	0.4-1.45 TeV	BR($\tilde{t}_1\to be/\mu$)>20%	ATLAS-CONF-2017-036
Other	Scalar charm, $\tilde{c}\to c\tilde{\chi}_1^0$	0	2 c	Yes	20.3	$\tilde{c}$	510 GeV	m($\tilde{\chi}_1^0$)<200 GeV	1501.01325

10^{-1} 1 **Mass scale [TeV]**

*Only a selection of the available mass limits on new states or phenomena is shown. Many of the limits are based on simplified models, c.f. refs. for the assumptions made.

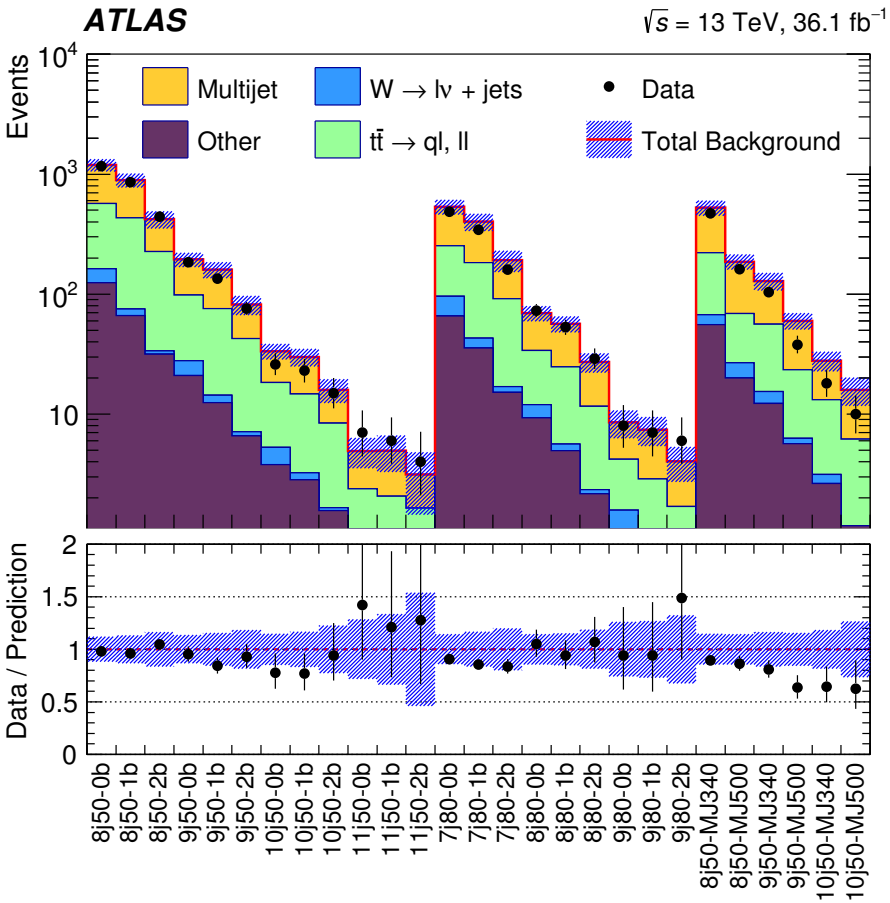
Wrap Up

- No new physics, but...
- Lots of new ways to look for physics
  - Mono-X searches: Mono-t, Mono-H
  - Two body decays from simplified DM models
    - Trigger scouting
    - ISR + dijet
- Also many new SUSY searches
- A lot has happened since EPS 2017

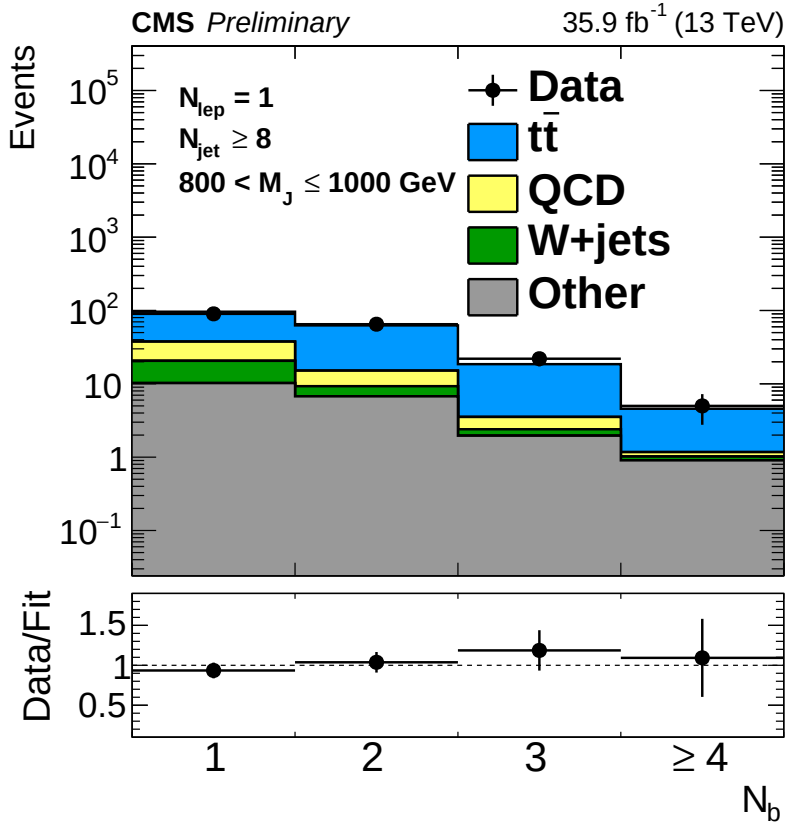
BONUS SLIDES

Multijet + Large R Jet

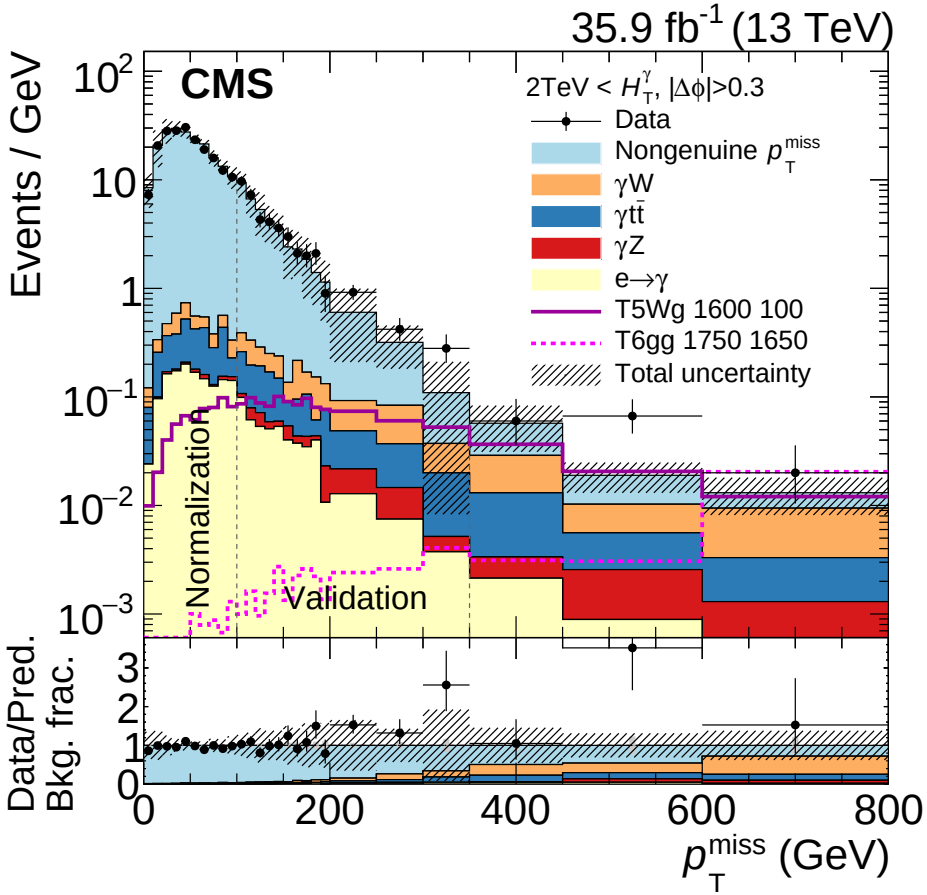
$E_{\mathrm{T}}^{\mathrm{miss}}$ + jets (new)

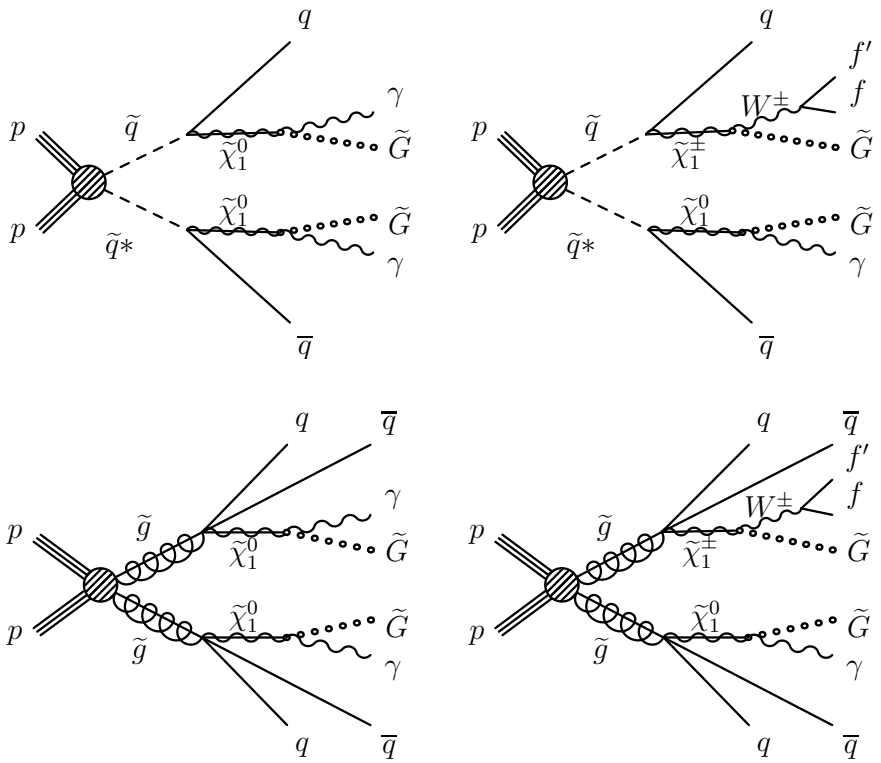


Jets, no $E_{\mathrm{T}}^{\mathrm{miss}}$ (new)



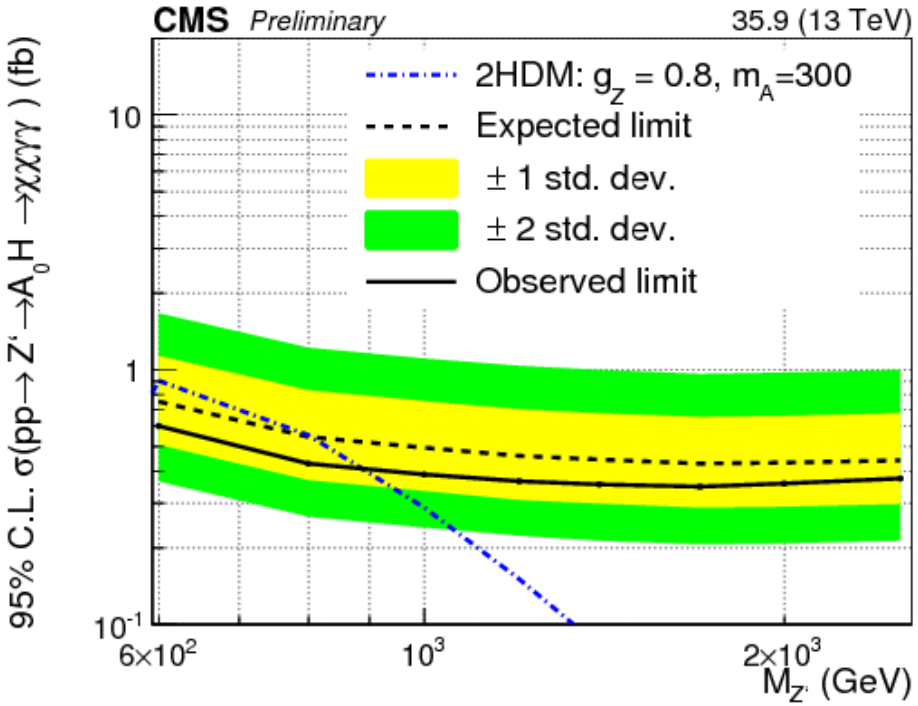
$\gamma + E_{\mathrm{T}}^{\mathrm{miss}} + H_{\mathrm{T}}$ (arXiv:1707.06193)





CMS Mono-H

$H \to \gamma\gamma$ (EXO-16-054)



$H \to bb$