Searches for New Phenomena with the ATLAS detector

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on behalf of the ATLAS Collaboration

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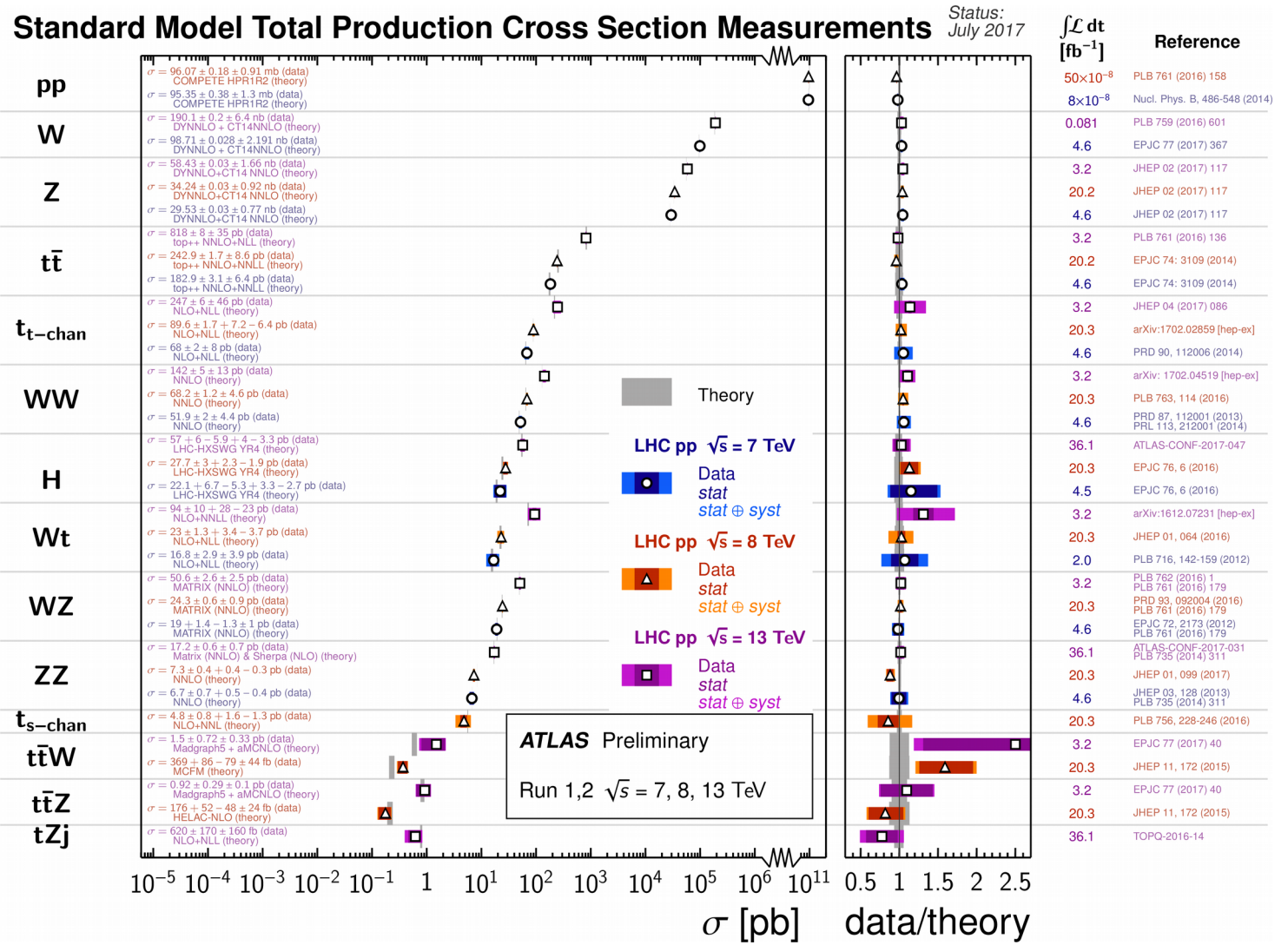
PANIC17

The Standard Model Measurements

The Standard Model is working very nicely! HEP experiments give values consistent with theory.



But...

The Standard Model Problems

Hierarchy problem

- Higgs mass only correct if parameters are very precise for cancellations to occur

- **Matter/Antimatter asymmetry**
  - SM says matter/antimatter are almost the same, but world tells us that there is more matter

- **Dark Matter**
  - Cosmological observations show large blobs of unseen mass and SM cannot explain them

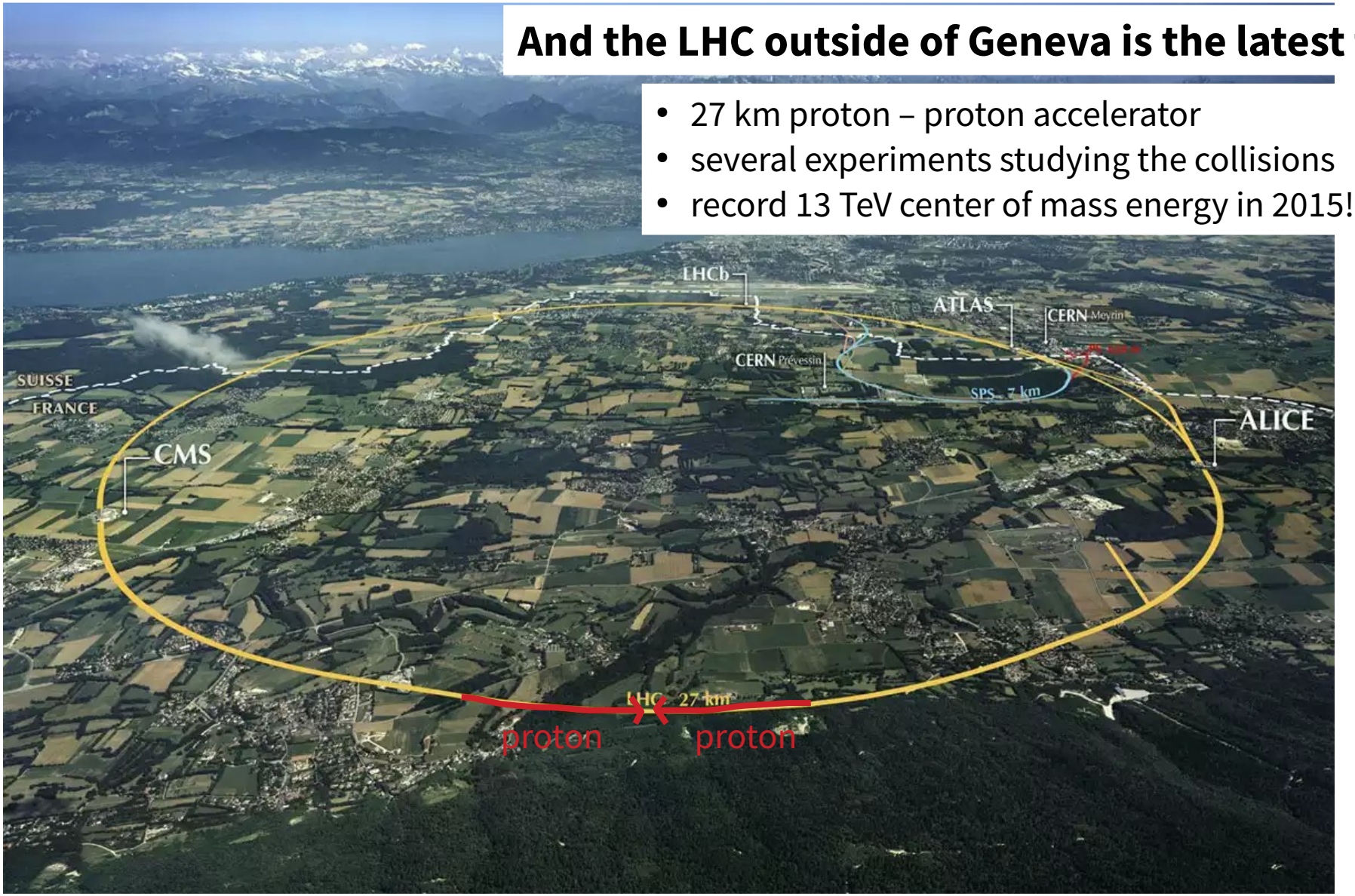
- **No gravity, Dark Energy, neutrino masses...**

Large Hadron Collider

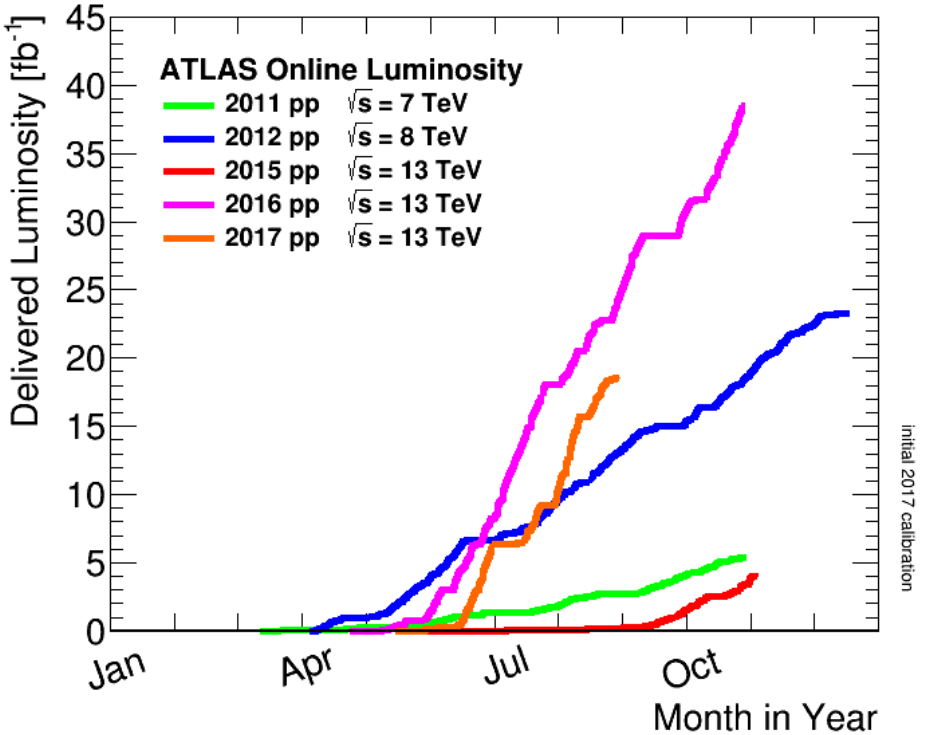
The Standard Model can be tested by smashing particles at high energies

And the LHC outside of Geneva is the latest tool.

- 27 km proton – proton accelerator
- several experiments studying the collisions
- record 13 TeV center of mass energy in 2015!



Runs I and II



Run I

Higgs discovery!

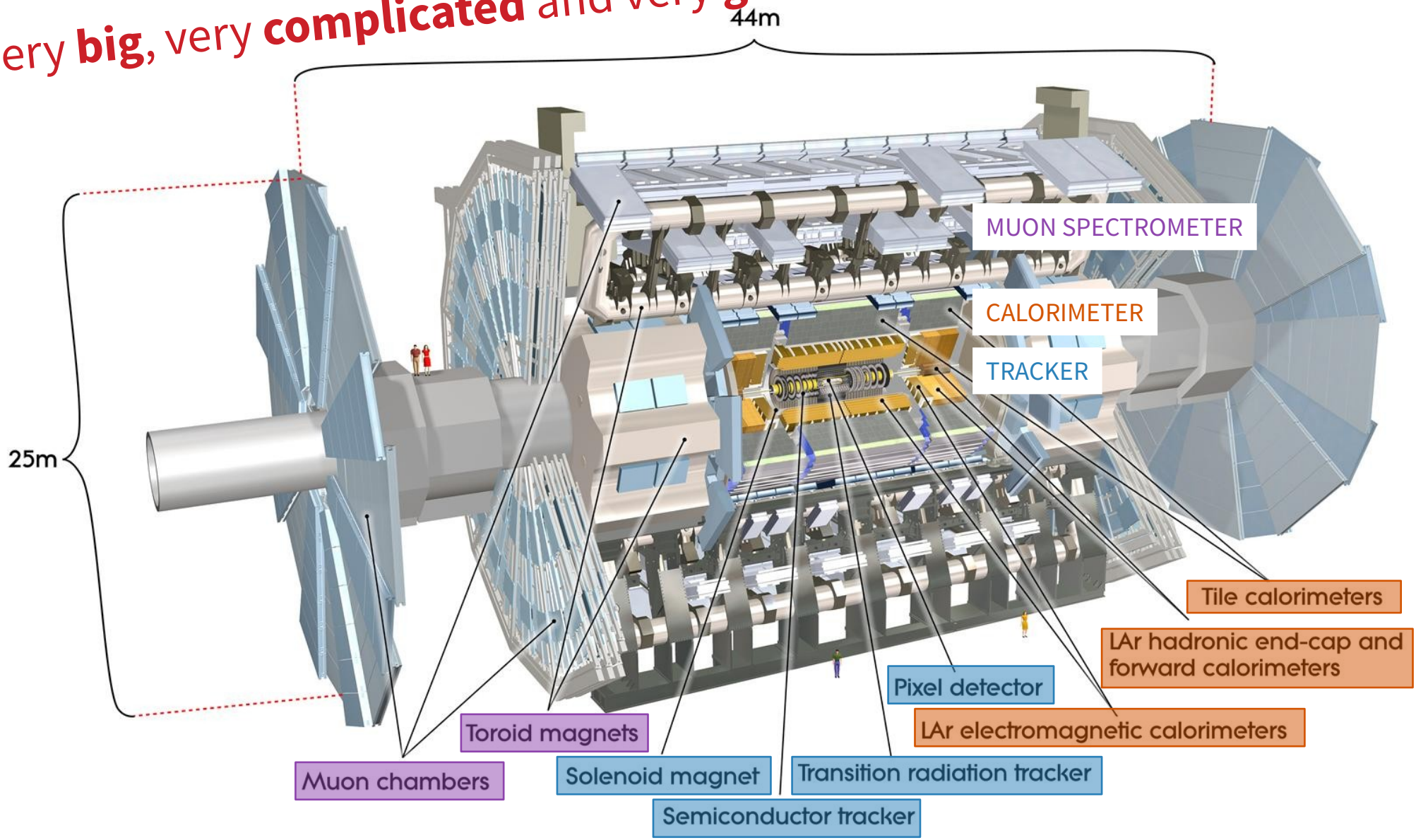
- Physics data at 7 TeV in 2011 (5.2 fb^{-1})
- Energy increased to 8 TeV in 2012 (21.7 fb^{-1})

Run II

- Started running at 13 TeV in end of 2015 (3.9 fb^{-1})
- Received much more data in 2016! (35.6 fb^{-1})
  - Results presented here use 2015+2016 data.
- Already have 18.0 fb^{-1} in 2017
- Ends in 2018 with total of 100 fb^{-1} planned

ATLAS Particle Detector

Very **big**, very **complicated** and very **general**!



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	$m(\tilde{q})=m(\tilde{g})$	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	$m(\tilde{G})>1.8\times10^{-4}$ 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
	$\tilde{g}\tilde{g}, \tilde{g}\to b\bar{t}\tilde{\chi}_1^+$	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	$\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}, \tilde{\ell}\to\ell\tilde{\chi}_1^0$	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
	$\tilde{\chi}_1^\pm\tilde{\chi}_1^\mp/\tilde{\chi}_2^0, \tilde{\chi}_1^+\to\tilde{\tau}\nu(\tau\tilde{\nu}), \tilde{\chi}_2^0\to\tilde{\tau}\tau(\nu\tilde{\nu})$	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
	$\tilde{g}\tilde{g}, \tilde{\chi}_1^0\to ee\nu/e\mu\nu/\mu\mu\nu$	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	$m(\tilde{q})=m(\tilde{g})$, $c\tau_{LSP}$<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.

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	$m(\tilde{q})=m(\tilde{g})$	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 [illegible]	$m(\tilde{\chi}_1^0)$<950 GeV, $c\tau$(NLSP)<0.1 mm, μ<0	1507.05493
	GGM (higgsino-bino NLSP)	γ	2 jets	Yes	13.3	$\tilde{g}$ [illegible] 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 [illegible]	$m(\tilde{G})>1.8\times10^{-4}$ 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	$\tilde{g}$ [illegible]	$m(\tilde{\chi}_1^0)$<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	$\tilde{g}$ [illegible]	$m(\tilde{\chi}_1^0)$<200 GeV	ATLAS-CONF-2017-021
	$\tilde{g}\tilde{g}, \tilde{g}\to b\bar{t}\tilde{\chi}_1^+$	0-1 e, μ	3 b	Yes	20.1	$\tilde{g}$ [illegible]	$m(\tilde{\chi}_1^0)$<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	$\tilde{b}_1$ [illegible]	$\tilde{\chi}_1^0$)<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	$\tilde{b}_1$ [illegible]	[illegible]^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	= $2m(\tilde{\chi}_1^0)$, $m(\tilde{\chi}_1^0)$=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	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	$\tilde{t}_1$ [illegible]	$m(\tilde{\chi}_1^0)$=5 GeV	1604.07773
	$\tilde{t}_1\tilde{t}_1$ (natural GMSB)	2 e, μ (Z)	1 b	Yes	20.3	$\tilde{t}_1$ [illegible]	$m(\tilde{\chi}_1^0)$>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	$\tilde{t}_2$ [illegible]	$m(\tilde{\chi}_1^0)$=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	$\tilde{t}$ [illegible]	$m(\tilde{\chi}_1^0)$=0 GeV	ATLAS-CONF-2017-019
EW direct	$\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}, \tilde{\ell}\to\ell\tilde{\chi}_1^0$	2 e, μ	0	Yes	36 [illegible]	[illegible]	$m(\tilde{\chi}_1^0)$=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	[illegible]	[illegible]	$m(\tilde{\chi}_1^0)$=0, $m(\tilde{\ell},\tilde{\nu})=0.5(m(\tilde{\chi}_1^\pm)+m(\tilde{\chi}_1^0))$	ATLAS-CONF-2017-039
	$\tilde{\chi}_1^\pm\tilde{\chi}_1^\mp/\tilde{\chi}_2^0, \tilde{\chi}_1^+\to\tilde{\tau}\nu(\tau\tilde{\nu}), \tilde{\chi}_2^0\to\tilde{\tau}\tau(\nu\tilde{\nu})$	2 τ	-	[illegible]	[illegible]	[illegible]	$m(\tilde{\chi}_1^0)$=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	[illegible]	[illegible]	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 [illegible]	[illegible]	[illegible]	[illegible]	$m(\tilde{\chi}_1^\pm)=m(\tilde{\chi}_2^0)$, $m(\tilde{\chi}_1^0)$=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					$m(\tilde{\chi}_1^\pm)=m(\tilde{\chi}_2^0)$, $m(\tilde{\chi}_1^0)$=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				[illegible]35 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	-				$c\tau$<1 mm	1507.05493
	GGM (bino NLSP) weak prod., $\tilde{\chi}_1^0\to\gamma\tilde{G}$	2 γ	-			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			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	-			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			850 GeV	$m(\tilde{\chi}_1^0)$=100 GeV, 10 μs<$\tau(\tilde{g})$<1000 s	1310.6584
	Stable $\tilde{g}$ R-hadron	trk	-	-		1.58 TeV		1606.05129
	Metastable $\tilde{g}$ R-hadron	dE/dx trk	-	-		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	-	-		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		440 GeV	1<$\tau(\tilde{\chi}_1^0)$<3 ns, SPS8 model	1409.5542
	$\tilde{g}\tilde{g}, \tilde{\chi}_1^0\to ee\nu/e\mu\nu/\mu\mu\nu$	displ. $ee/e\mu/\mu\mu$	-	-	[illegible]	$\tilde{\chi}_1^0$ 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	$m(\tilde{q})=m(\tilde{g})$, $c\tau_{LSP}$<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.

SEVERAL DEDICATED CONTRIBUTIONS

- Squarks and Gluinos by M. Backes (Sunday)
- Stop pairs by F. Meloni (Sunday)
- EW SUSY by A. Marzin (Sunday)
- RPV SUSY by Y. Liu (poster)

ATLAS Exotics Searches* - 95% CL Upper Exclusion Limits

Status: July 2017

ATLAS Preliminary

$\int \mathcal{L}\, dt = (3.2 - 37.0)\ \mathrm{fb}^{-1}$ $\sqrt{s} = 8, 13$ TeV

	Model	ℓ, γ	Jets†	E_T^{miss}	$\int \mathcal{L}\, dt[\mathrm{fb}^{-1}]$	Limit		Reference
Extra dimensions	ADD $G_{KK} + g/q$	$0\ e, \mu$	$1-4$ j	Yes	36.1	M_D 7.75 TeV	$n = 2$	ATLAS-CONF-2017-060
	ADD non-resonant $\gamma\gamma$	$2\ \gamma$	–	–	36.7	M_S 8.6 TeV	$n = 3$ HLZ NLO	CERN-EP-2017-132
	ADD QBH	–	2 j	–	37.0	M_{th} 8.9 TeV	$n = 6$	1703.09217
	ADD BH high $\sum p_T$	$\geq 1\ e, \mu$	≥ 2 j	–	3.2	M_{th} 8.2 TeV	$n = 6$, $M_D = 3$ TeV, rot BH	1606.02265
	ADD BH multijet	–	≥ 3 j	–	3.6	M_{th} 9.55 TeV	$n = 6$, $M_D = 3$ TeV, rot BH	1512.02586
	RS1 $G_{KK} \to \gamma\gamma$	$2\ \gamma$	–	–	36.7	G_{KK} mass 4.1 TeV	$k/\overline{M}_{Pl} = 0.1$	CERN-EP-2017-132
	Bulk RS $G_{KK} \to WW \to qq\ell\nu$	$1\ e, \mu$	1 J	Yes	36.1	G_{KK} mass 1.75 TeV	$k/\overline{M}_{Pl} = 1.0$	ATLAS-CONF-2017-051
	2UED / RPP	$1\ e, \mu$	≥ 2 b, ≥ 3 j	Yes	13.2	KK mass 1.6 TeV	Tier (1,1), $\mathcal{B}(A^{(1,1)} \to tt) = 1$	ATLAS-CONF-2016-104
Gauge bosons	SSM $Z' \to \ell\ell$	$2\ e, \mu$	–	–	36.1	Z' mass 4.5 TeV		ATLAS-CONF-2017-027
	SSM $Z' \to \tau\tau$	$2\ \tau$	–	–	36.1	Z' mass 2.4 TeV		ATLAS-CONF-2017-050
	Leptophobic $Z' \to bb$	–	2 b	–	3.2	Z' mass 1.5 TeV		1603.08791
	Leptophobic $Z' \to tt$	$1\ e, \mu$	≥ 1 b, ≥ 1J/2j	Yes	3.2	Z' mass 2.0 TeV	$\Gamma/m = 3\%$	ATLAS-CONF-2016-014
	SSM $W' \to \ell\nu$	$1\ e, \mu$	–	Yes	36.1	W' mass 5.1 TeV		1706.04786
	HVT $V' \to WV \to qqqq$ model B	$0\ e, \mu$	2 J	–	36.7	V' mass 3.5 TeV	$g_V = 3$	CERN-EP-2017-147
	HVT $V' \to WH/ZH$ model B	multi-channel			36.1	V' mass 2.93 TeV	$g_V = 3$	ATLAS-CONF-2017-055
	LRSM $W'_R \to tb$	$1\ e, \mu$	2 b, 0-1 j	Yes	20.3	W' mass 1.92 TeV		1410.4103
	LRSM $W'_R \to tb$	$0\ e, \mu$	≥ 1 b, 1 J	–	20.3	W' mass 1.76 TeV		1408.0886
CI	CI $qqqq$	–	2 j	–	37.0	Λ 21.8 TeV	η_{LL}^-	1703.09217
	CI $\ell\ell qq$	$2\ e, \mu$	–	–	36.1	Λ 40.1 TeV	η_{LL}^-	ATLAS-CONF-2017-027
	CI $uutt$	2(SS)/$\geq 3\ e, \mu$	≥ 1 b, ≥ 1 j	Yes	20.3	Λ 4.9 TeV	$\lvert C_{RR}\rvert = 1$	1504.04605
DM	Axial-vector mediator (Dirac DM)	$0\ e, \mu$	$1-4$ j	Yes	36.1	m_{med} 1.5 TeV	g_q=0.25, g_χ=1.0, $m(\chi) < 400$ GeV	ATLAS-CONF-2017-060
	Vector mediator (Dirac DM)	$0\ e, \mu, 1\ \gamma$	≤ 1 j	Yes	36.1	m_{med} 1.2 TeV	g_q=0.25, g_χ=1.0, $m(\chi) < 480$ GeV	1704.03848
	$VV_{\chi\chi}$ EFT (Dirac DM)	$0\ e, \mu$	1 J, ≤ 1 j	Yes	3.2	M_* 700 GeV	$m(\chi) < 150$ GeV	1608.02372
LQ	Scalar LQ 1st gen	$2\ e$	≥ 2 j	–	3.2	LQ mass 1.1 TeV	$\beta = 1$	1605.06035
	Scalar LQ 2nd gen	$2\ \mu$	≥ 2 j	–	3.2	LQ mass 1.05 TeV	$\beta = 1$	1605.06035
	Scalar LQ 3rd gen	$1\ e, \mu$	≥ 1 b, ≥ 3 j	Yes	20.3	LQ mass 640 GeV	$\beta = 0$	1508.04735
Heavy quarks	VLQ $TT \to Ht + X$	0 or 1 e, μ	≥ 2 b, ≥ 3 j	Yes	13.2	T mass 1.2 TeV	$\mathcal{B}(T \to Ht) = 1$	ATLAS-CONF-2016-104
	VLQ $TT \to Zt + X$	$1\ e, \mu$	≥ 1 b, ≥ 3 j	Yes	36.1	T mass 1.16 TeV	$\mathcal{B}(T \to Zt) = 1$	1705.10751
	VLQ $TT \to Wb + X$	$1\ e, \mu$	≥ 1 b, ≥ 1J/2j	Yes	36.1	T mass 1.35 TeV	$\mathcal{B}(T \to Wb) = 1$	CERN-EP-2017-094
	VLQ $BB \to Hb + X$	$1\ e, \mu$	≥ 2 b, ≥ 3 j	Yes	20.3	B mass 700 GeV	$\mathcal{B}(B \to Hb) = 1$	1505.04306
	VLQ $BB \to Zb + X$	$2/\geq 3\ e, \mu$	$\geq 2/\geq 1$ b	–	20.3	B mass 790 GeV	$\mathcal{B}(B \to Zb) = 1$	1409.5500
	VLQ $BB \to Wt + X$	$1\ e, \mu$	≥ 1 b, ≥ 1J/2j	Yes	36.1	B mass 1.25 TeV	$\mathcal{B}(B \to Wt) = 1$	CERN-EP-2017-094
	VLQ $QQ \to WqWq$	$1\ e, \mu$	≥ 4 j	Yes	20.3	Q mass 690 GeV		1509.04261
Excited fermions	Excited quark $q^* \to qg$	–	2 j	–	37.0	q^* mass 6.0 TeV	only u^* and d^*, $\Lambda = m(q^*)$	1703.09127
	Excited quark $q^* \to q\gamma$	$1\ \gamma$	1 j	–	36.7	q^* mass 5.3 TeV	only u^* and d^*, $\Lambda = m(q^*)$	CERN-EP-2017-148
	Excited quark $b^* \to bg$	–	1 b, 1 j	–	13.3	b^* mass 2.3 TeV		ATLAS-CONF-2016-060
	Excited quark $b^* \to Wt$	1 or 2 e, μ	1 b, 2-0 j	Yes	20.3	b^* mass 1.5 TeV	$f_g = f_L = f_R = 1$	1510.02664
	Excited lepton ℓ^*	$3\ e, \mu$	–	–	20.3	ℓ^* mass 3.0 TeV	$\Lambda = 3.0$ TeV	1411.2921
	Excited lepton ν^*	$3\ e, \mu, \tau$	–	–	20.3	ν^* mass 1.6 TeV	$\Lambda = 1.6$ TeV	1411.2921
Other	LRSM Majorana ν	$2\ e, \mu$	2 j	–	20.3	N^0 mass 2.0 TeV	$m(W_R) = 2.4$ TeV, no mixing	1506.06020
	Higgs triplet $H^{\pm\pm} \to \ell\ell$	2,3,4 e, μ (SS)	–	–	36.1	$H^{\pm\pm}$ mass 870 GeV	DY production	ATLAS-CONF-2017-053
	Higgs triplet $H^{\pm\pm} \to \ell\tau$	$3\ e, \mu, \tau$	–	–	20.3	$H^{\pm\pm}$ mass 400 GeV	DY production, $\mathcal{B}(H_L^{\pm\pm} \to \ell\tau) = 1$	1411.2921
	Monotop (non-res prod)	$1\ e, \mu$	1 b	Yes	20.3	spin-1 invisible particle mass 657 GeV	$a_{\text{non-res}} = 0.2$	1410.5404
	Multi-charged particles	–	–	–	20.3	multi-charged particle mass 785 GeV	DY production, $\lvert q\rvert = 5e$	1504.04188
	Magnetic monopoles	–	–	–	7.0	monopole mass 1.34 TeV	DY production, $\lvert g\rvert = 1g_D$, spin 1/2	1509.08059

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

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

*Only a selection of the available mass limits on new states or phenomena is shown.

†Small-radius (large-radius) jets are denoted by the letter j (J).

ATLAS Exotics Searches* - 95% CL Upper Exclusion Limits

Status: July 2017

ATLAS Preliminary

$\int \mathcal{L}\, dt = (3.2 - 37.0)\ \mathrm{fb}^{-1}$ $\sqrt{s} = 8, 13$ TeV

	Model	ℓ, γ	Jets†	E_T^{miss}	$\int \mathcal{L}\, dt[\mathrm{fb}^{-1}]$	Limit		Reference
Extra dimensions	ADD $G_{KK} + g/q$	$0\ e, \mu$	$1-4$ j	Yes	36.1	M_D 7.75 TeV	$n = 2$	ATLAS-CONF-2017-060
	ADD non-resonant $\gamma\gamma$	$2\ \gamma$	–	–	36.7	M_S 8.6 TeV	$n = 3$ HLZ NLO	CERN-EP-2017-132
	ADD QBH	–	2 j	–	37.0	M_{th} 8.9 TeV	$n = 6$	1703.09217
	ADD BH high $\sum p_T$	$\geq 1\ e, \mu$	≥ 2 j	–	3.2	M_{th} 8.2 TeV	$n = 6$, $M_D = 3$ TeV, rot BH	1606.02265
	ADD BH multijet	–	≥ 3 j	–	3.6	M_{th} 9.55 TeV	$n = 6$, $M_D = 3$ TeV, rot BH	1512.02586
	RS1 $G_{KK} \to \gamma\gamma$	$2\ \gamma$	–	–	36.7	G_{KK} mass 4.1 TeV	$k/\overline{M}_{Pl} = 0.1$	CERN-EP-2017-132
	Bulk RS $G_{KK} \to WW \to qq\ell\nu$	$1\ e, \mu$	1 J	Yes	36.1	G_{KK} mass 1.75 TeV	$k/\overline{M}_{Pl} = 1.0$	ATLAS-CONF-2017-051
	2UED / RPP	$1\ e, \mu$	≥ 2 b, ≥ 3 j	Yes	13.2	KK mass 1.6 TeV	Tier (1,1), $\mathcal{B}(A^{(1,1)} \to tt) = 1$	ATLAS-CONF-2016-104
Gauge bosons	SSM $Z' \to \ell\ell$	$2\ e, \mu$	–	–	36.1	Z' mass 4.5 TeV		ATLAS-CONF-2017-027
	SSM $Z' \to \tau\tau$	$2\ \tau$	–	–	36.1	Z' mass 2.4 TeV		ATLAS-CONF-2017-050
	Leptophobic $Z' \to bb$	–	2 b	–	3.2	Z' mass 1.5 TeV		1603.08791
	Leptophobic $Z' \to tt$	$1\ e, \mu$	≥ 1 b, ≥ 1J/2j	Yes	3.2	Z' mass 2.0 TeV	$\Gamma/m = 3\%$	ATLAS-CONF-2016-014
	SSM $W' \to \ell\nu$	$1\ e, \mu$	–	Yes	36.1	W' mass 5.1 TeV		1706.04786
	HVT $V' \to WV \to qqqq$ model B	$0\ e, \mu$	2 J	–	36.7	V' mass 3.5 TeV	$g_V = 3$	CERN-EP-2017-147
	HVT $V' \to WH/ZH$ model B	multi-channel			36.1	V' mass 2.93 TeV	$g_V = 3$	ATLAS-CONF-2017-055
	LRSM $W'_R \to tb$	$1\ e, \mu$	2 b, 0-1 j	Yes	20.3	W' mass 1.92 TeV		1410.4103
	LRSM $W'_R \to tb$	$0\ e, \mu$	≥ 1 b, 1 J	–	20.3	W' mass 1.76 TeV		1408.0886
CI	CI $qqqq$	–	2 j	–	37.0	Λ 21.8 TeV	η_{LL}^-	1703.09217
	CI $\ell\ell qq$	$2\ e, \mu$	–	–	36.1	Λ 40.1 TeV	η_{LL}^-	ATLAS-CONF-2017-027
	CI $uutt$	2(SS)/$\geq 3\ e, \mu$	≥ 1 b, ≥ 1 j	Yes	20.3	Λ 4.9 TeV	$\lvert C_{RR}\rvert = 1$	1504.04605
DM	Axial-vector mediator (Dirac DM)	$0\ e, \mu$	$1-4$ j	Yes	36.1	m_{med} 1.5 TeV	g_q=0.25, g_χ=1.0, $m(\chi) < 400$ GeV	ATLAS-CONF-2017-060
	Vector mediator (Dirac DM)	$0\ e, \mu, 1\ \gamma$	≤ 1 j	[illegible]	[illegible]	[illegible]	g_q=0.25, g_χ=1.0, $m(\chi) < 480$ GeV	1704.03848
	$VV\chi\chi$ EFT (Dirac DM)	$0\ e, \mu$	1 J, ≤ 1 j				$m(\chi) < 150$ GeV	1608.02372
LQ	Scalar LQ 1st gen	$2\ e$	≥ 2 j				$\beta = 1$	1605.06035
	Scalar LQ 2nd gen	$2\ \mu$	≥ 2 j				$\beta = 1$	1605.06035
	Scalar LQ 3rd gen	$1\ e, \mu$	≥ 1 b, ≥ 3				$\beta = 0$	1508.04735
Heavy quarks	VLQ $TT \to Ht + X$	0 or 1 e, μ	≥ 2 b, ≥ 3 j	Yes	13.2	T mass 1.2 TeV	$\mathcal{B}(T \to Ht) = 1$	ATLAS-CONF-2016-104
	VLQ $TT \to Zt + X$	$1\ e, \mu$	≥ 1 b, ≥ 3 j	Yes	36.1	T mass 1.16 TeV	$\mathcal{B}(T \to Zt) = 1$	1705.10751
	VLQ $TT \to Wb + X$	$1\ e, \mu$	≥ 1 b, ≥ 1J/2j	Yes	36.1	T mass 1.35 TeV	$\mathcal{B}(T \to Wb) = 1$	CERN-EP-2017-094
	VLQ $BB \to Hb + X$	$1\ e, \mu$	≥ 2 b, ≥ 3 j	Yes	20.3	B mass 700 GeV	$\mathcal{B}(B \to Hb) = 1$	1505.04306
	VLQ $BB \to Zb + X$	$2/\geq 3\ e, \mu$	$\geq 2/\geq 1$ b	–	20.3	B mass 790 GeV	$\mathcal{B}(B \to Zb) = 1$	1409.5500
	VLQ $BB \to Wt + X$	$1\ e, \mu$	≥ 1 b, ≥ 1J/2j	Yes	36.1	B mass 1.25 TeV	$\mathcal{B}(B \to Wt) = 1$	CERN-EP-2017-094
	VLQ $QQ \to WqWq$	$1\ e, \mu$	≥ 4 j	Yes	20.3	Q mass 690 GeV		1509.04261
Excited fermions	Excited quark $q^* \to qg$	–	2 j	–	37.0	q^* mass 6.0 TeV	only u^* and d^*, $\Lambda = m(q^*)$	1703.09127
	Excited quark $q^* \to q\gamma$	$1\ \gamma$	1 j	–	36.7	q^* mass 5.3 TeV	only u^* and d^*, $\Lambda = m(q^*)$	CERN-EP-2017-148
	Excited quark $b^* \to bg$	–	1 b, 1 j	–	13.3	b^* mass 2.3 TeV		ATLAS-CONF-2016-060
	Excited quark $b^* \to Wt$	1 or 2 e, μ	1 b, 2-0 j	Yes	20.3	b^* mass 1.5 TeV	$f_g = f_L = f_R = 1$	1510.02664
	Excited lepton ℓ^*	$3\ e, \mu$	–	–	20.3	ℓ^* mass 3.0 TeV	$\Lambda = 3.0$ TeV	1411.2921
	Excited lepton ν^*	$3\ e, \mu, \tau$	–	–	20.3	ν^* mass 1.6 TeV	$\Lambda = 1.6$ TeV	1411.2921
Other	LRSM Majorana ν	$2\ e, \mu$	2 j	–	20.3	N^0 mass 2.0 TeV	$m(W_R) = 2.4$ TeV, no mixing	1506.06020
	Higgs triplet $H^{\pm\pm} \to \ell\ell$	2,3,4 e, μ (SS)	–	–	36.1	$H^{\pm\pm}$ mass 870 GeV	DY production	ATLAS-CONF-2017-053
	Higgs triplet $H^{\pm\pm} \to \ell\tau$	$3\ e, \mu, \tau$	–	–	20.3	$H^{\pm\pm}$ mass 400 GeV	DY production, $\mathcal{B}(H_L^{\pm\pm} \to \ell\tau) = 1$	1411.2921
	Monotop (non-res prod)	$1\ e, \mu$	1 b	Yes	20.3	spin-1 invisible particle mass 657 GeV	$a_{\text{non-res}} = 0.2$	1410.5404
	Multi-charged particles	–	–	–	20.3	multi-charged particle mass 785 GeV	DY production, $\lvert q\rvert = 5e$	1504.04188
	Magnetic monopoles	–	–	–	7.0	monopole mass 1.34 TeV	DY production, $\lvert g\rvert = 1g_D$, spin 1/2	1509.08059

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

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

COVERED HERE, with exception of

- DM searches (see A. Cortes-Ganzalez' talk)

*Only a selection of the available mass limits on new states or phenomena is shown.

†Small-radius (large-radius) jets are denoted by the letter j (J).

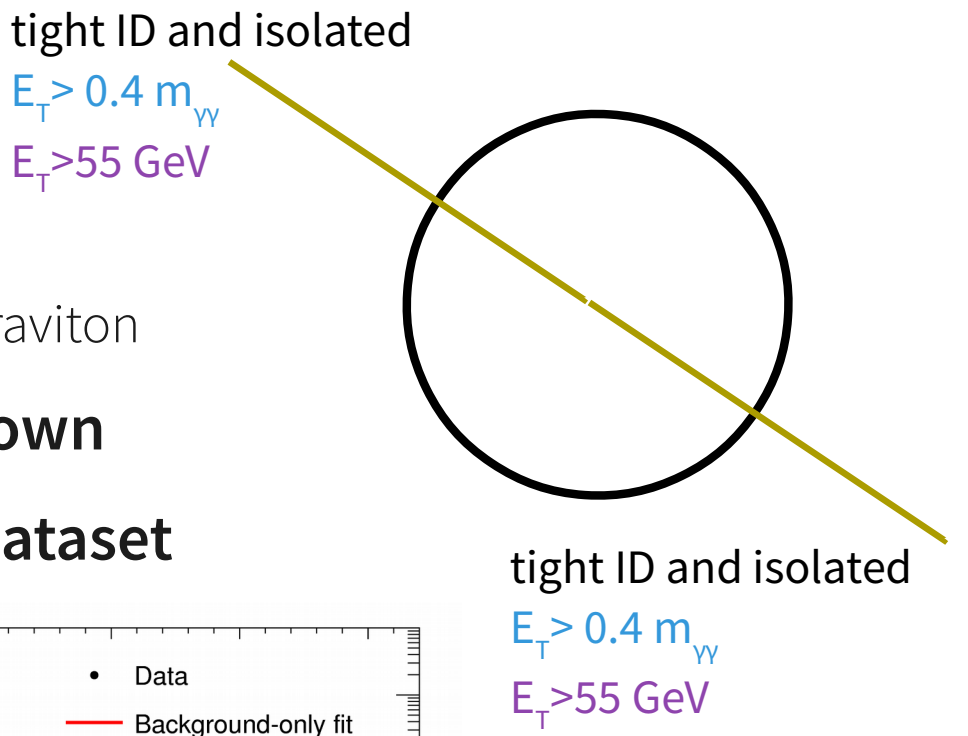
Analyses Covered

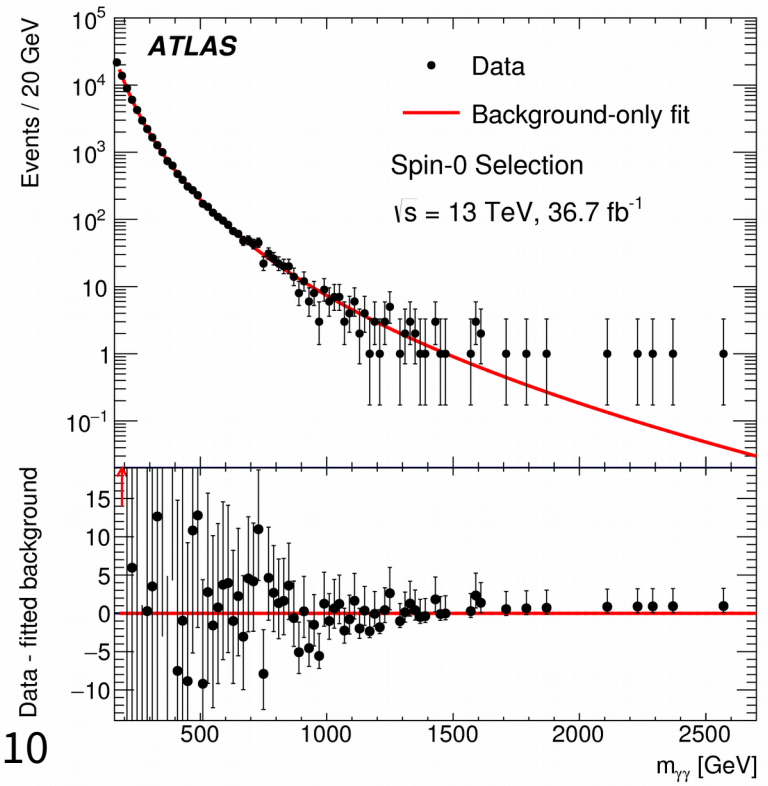
- Diphoton
- Dilepton
- Lepton + MET
- Dijet
- Diboson (qqqq, lvqq, llll, lllv, qqbb, vvbb, lvbb, llbb)
- Doubly-charged Higgs

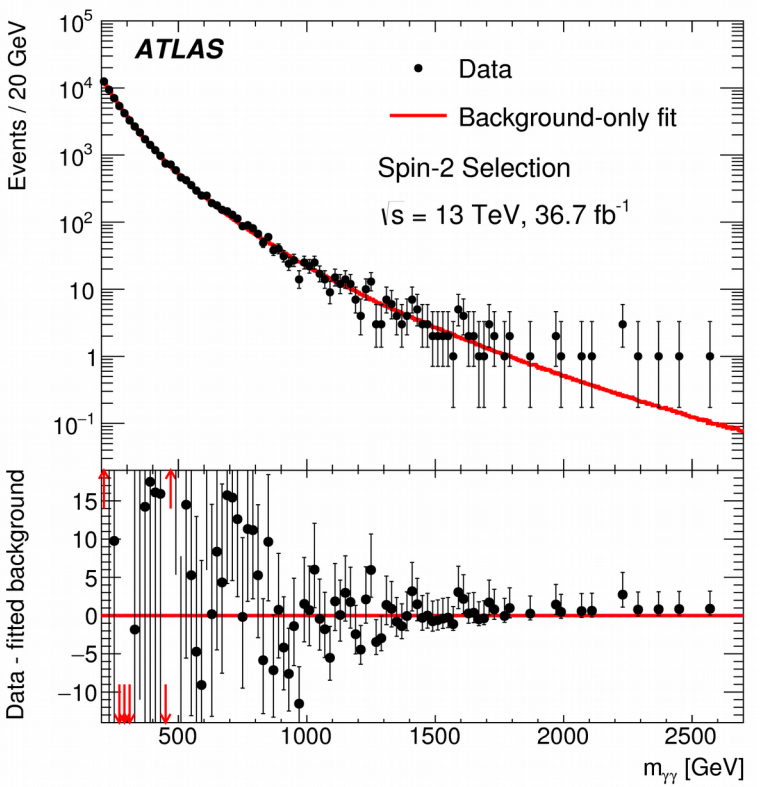
Diphoton Search

arXiv:1707.04147

- **Two selections optimized for**
  - Spin 0 "heavy Higgs"
  - Spin 2 resonant RS1 and non-resonant ADD graviton
- **Significance of 750 GeV excess went down**
- **Largest excess is at 708 GeV in spin 2 dataset**

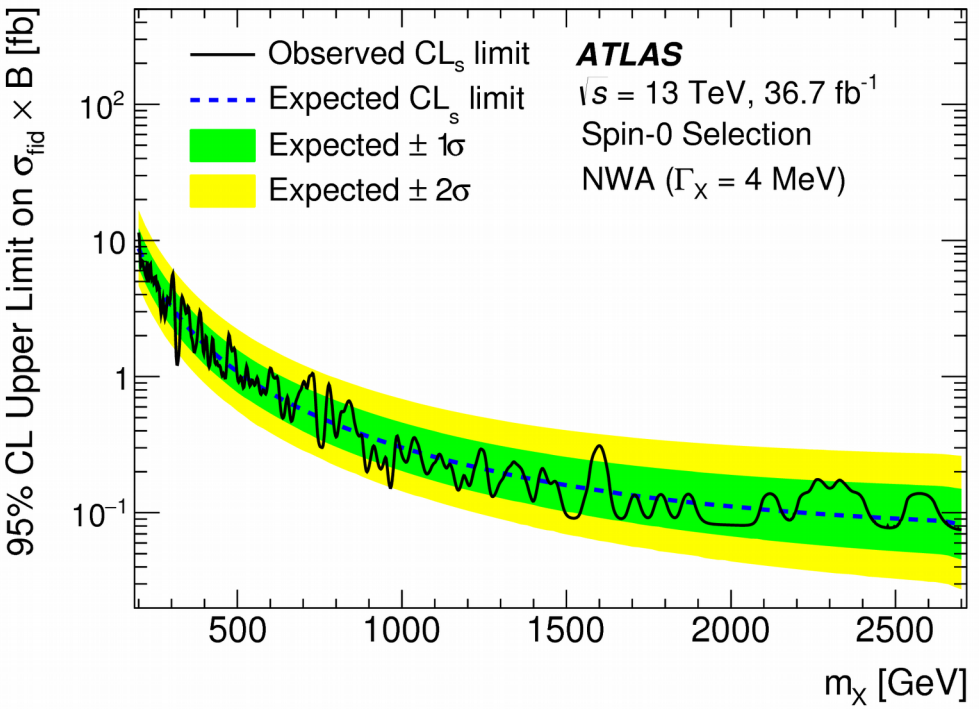


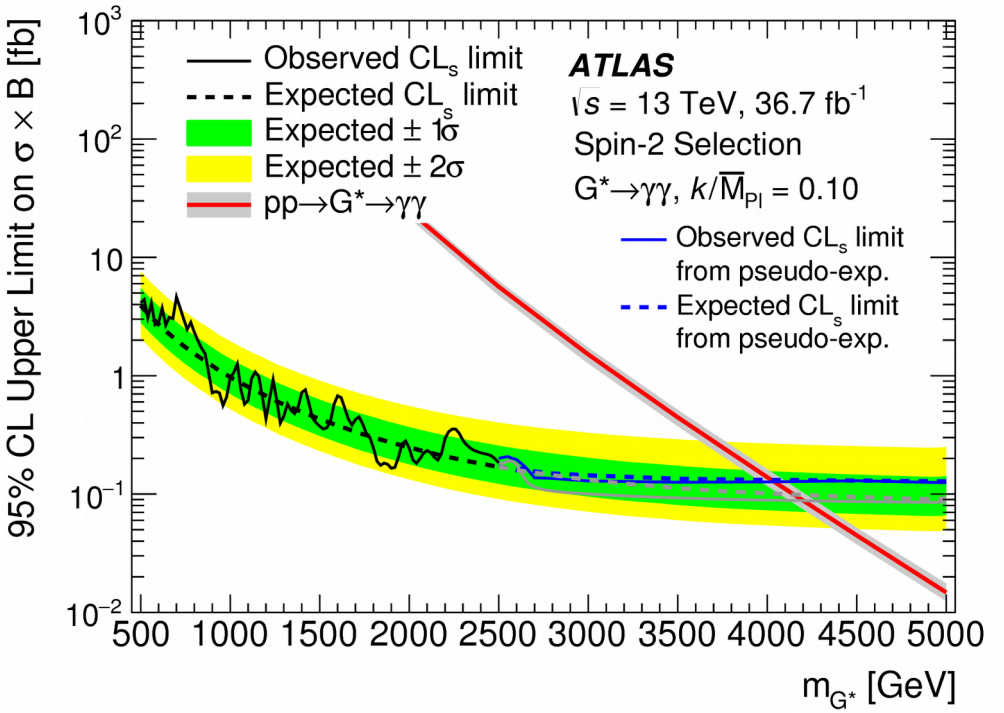




Diphoton Search - Limits

arXiv:1707.04147

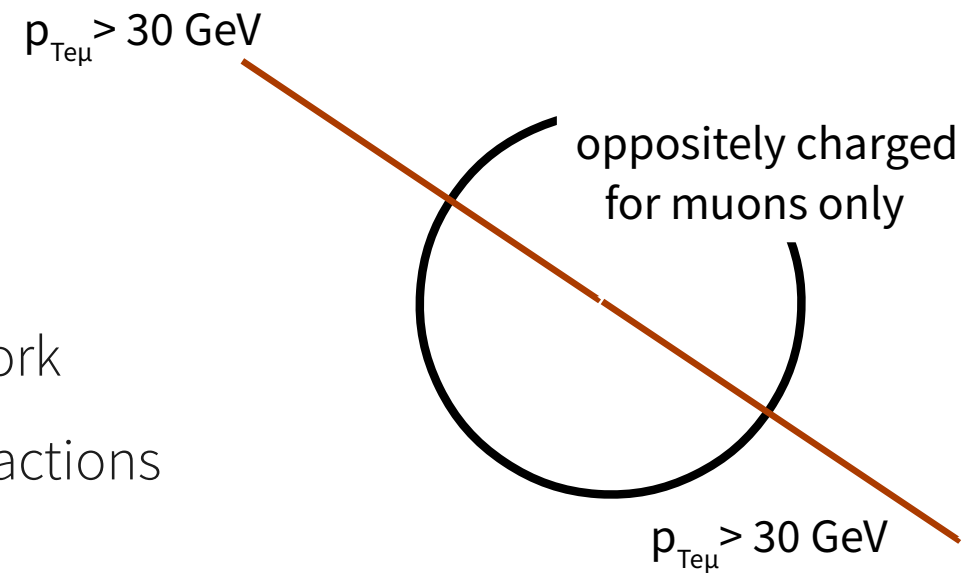




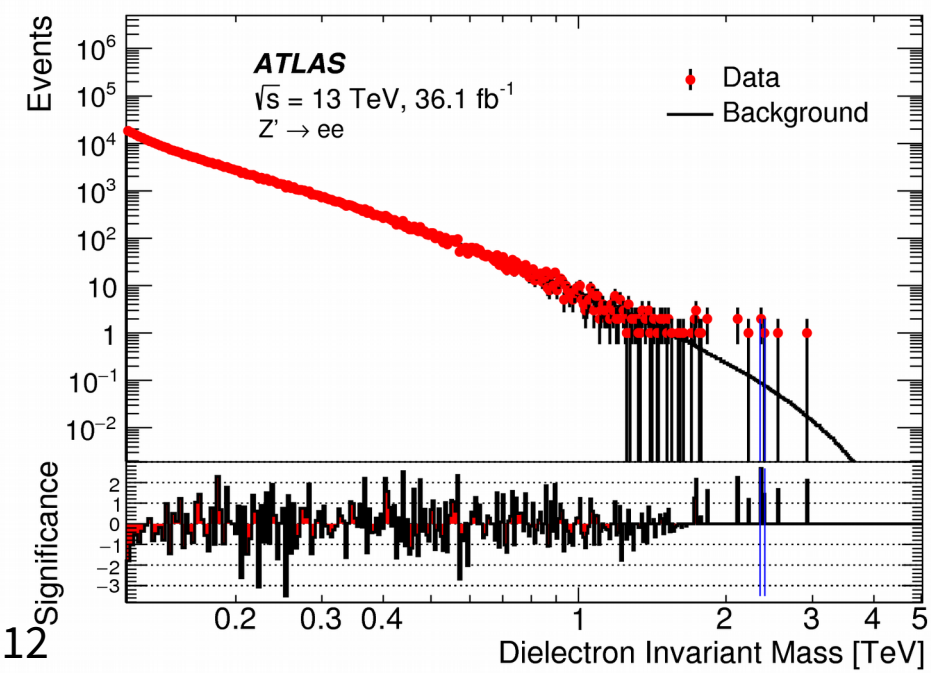
Non-resonant search expects 4.3±0.1 events with $m_{\gamma\gamma}$>2240 GeV and observes 4 events. Limits on ~M_S > 7 TeV.

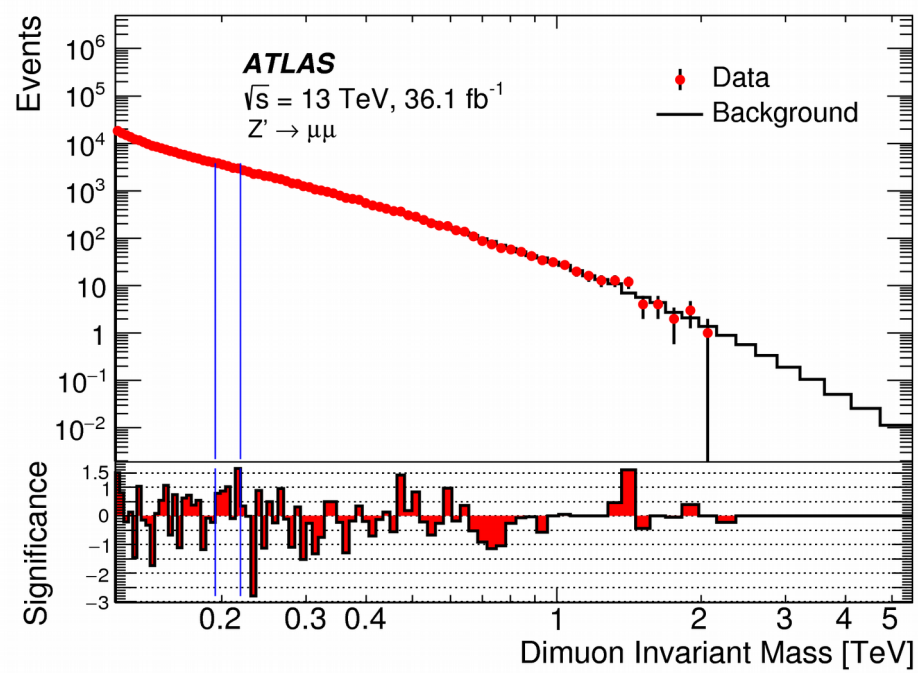
Dilepton Search

arXiv:1707.02424



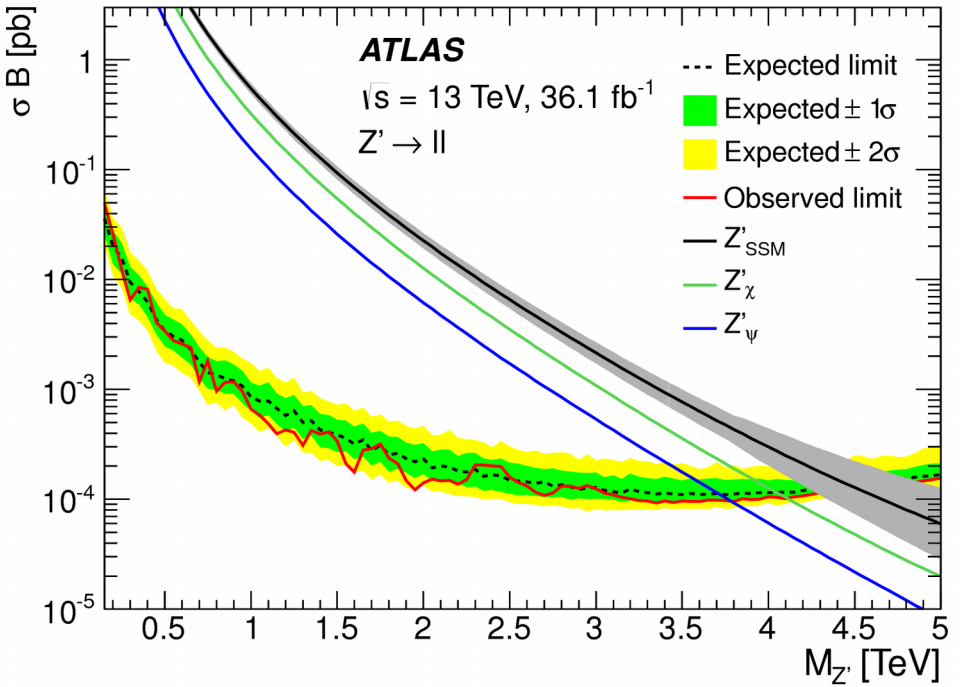
- **Two models used for limit setting**
  - Resonant search using Minimal Z' framework
  - Non-resonant search for qqll contact interactions

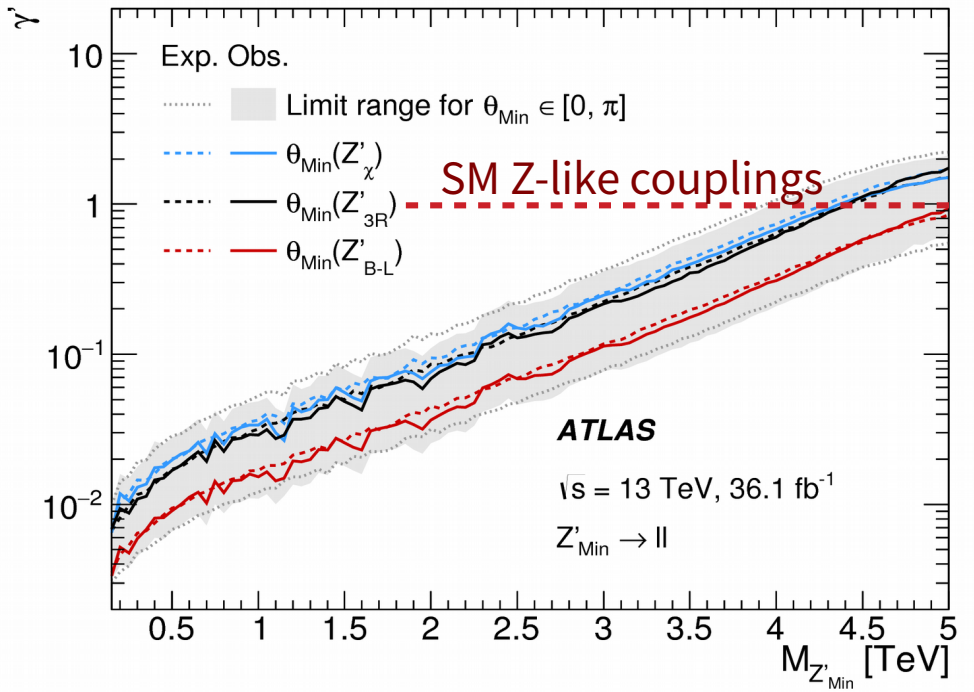




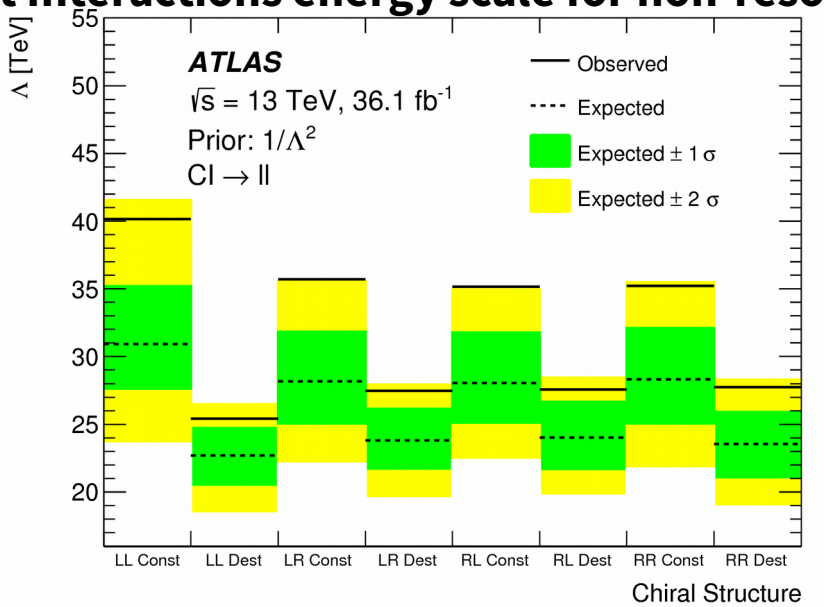
Dilepton Search - Limits

arXiv:1707.02424





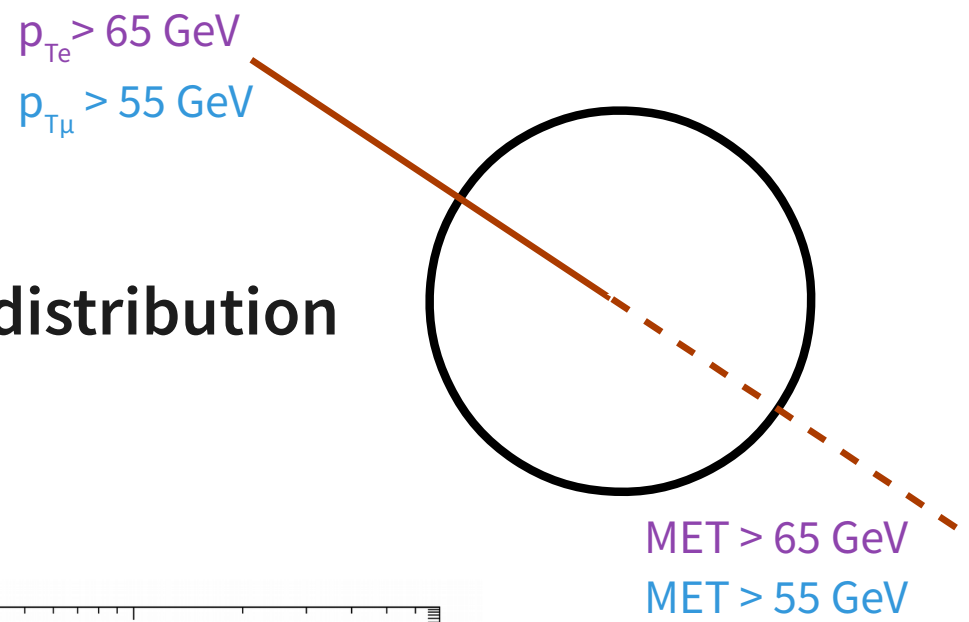
Lower limits on Contact Interactions energy scale for non-resonant models

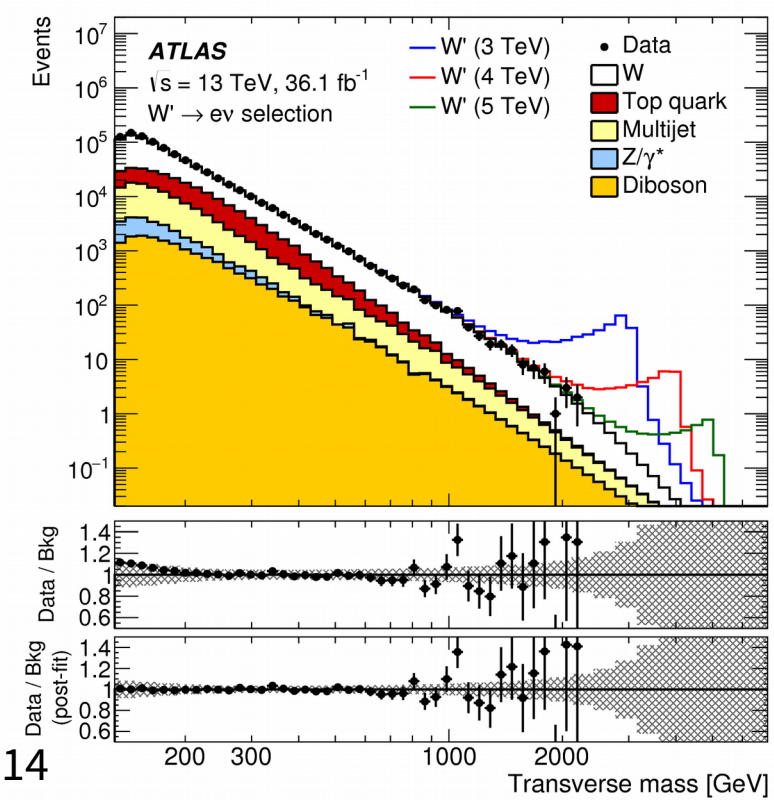


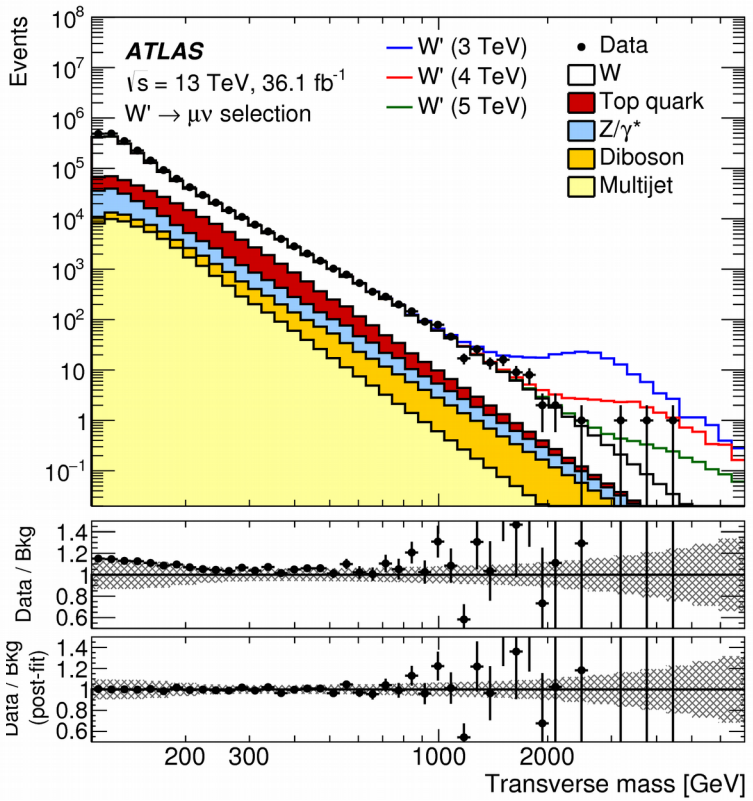
Lepton + MET Search

arXiv:1706.04786

- Search targets SSM W' model
- Look for excess in transverse mass distribution





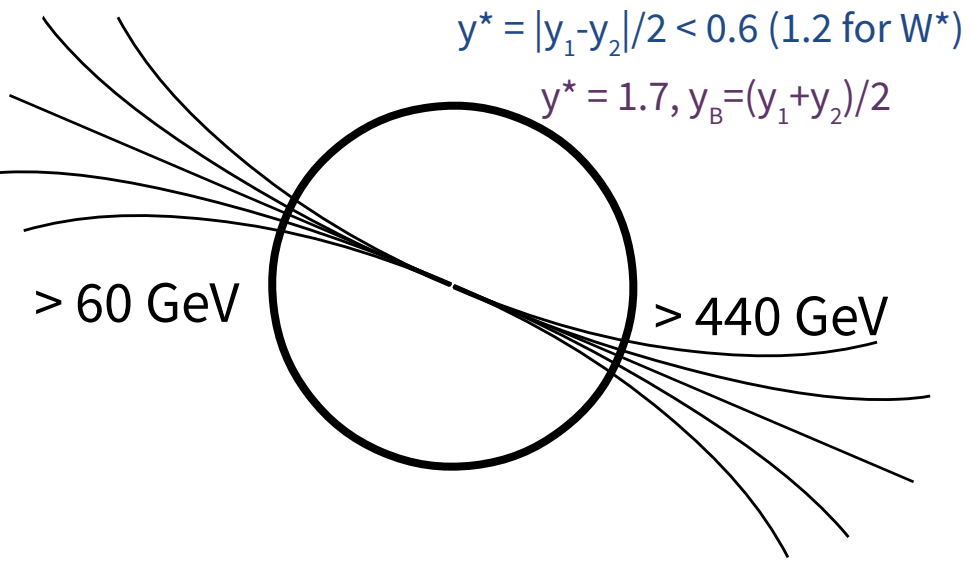


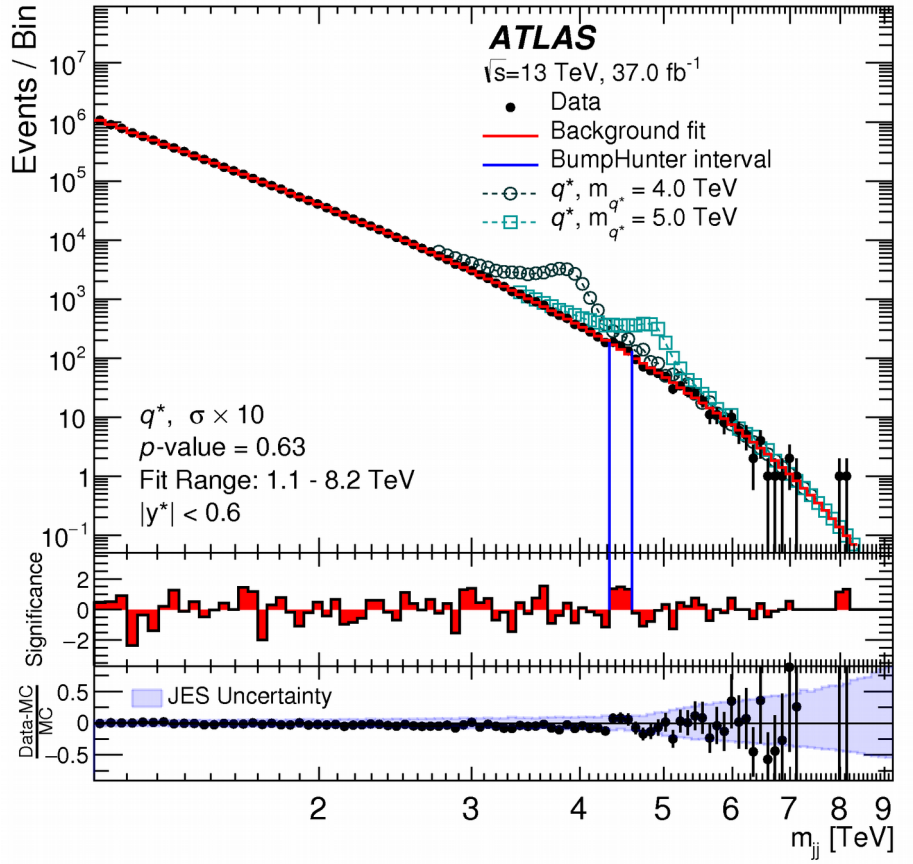
RESULTING LIMITS

Decay	$m_{W'}$ lower limit [TeV] Expected	Observed
$W' \to e\nu$	5.1	5.2
$W' \to \mu\nu$	4.7	4.5
$W' \to \ell\nu$	5.2	5.1

Dijet Search

arXiv:1703.09127

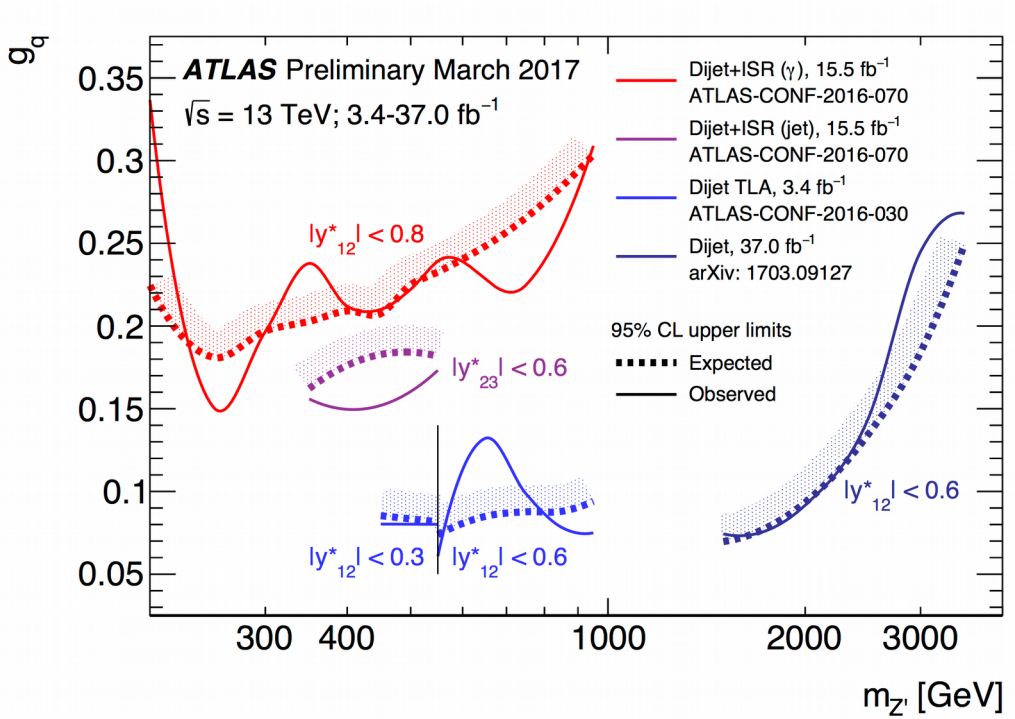


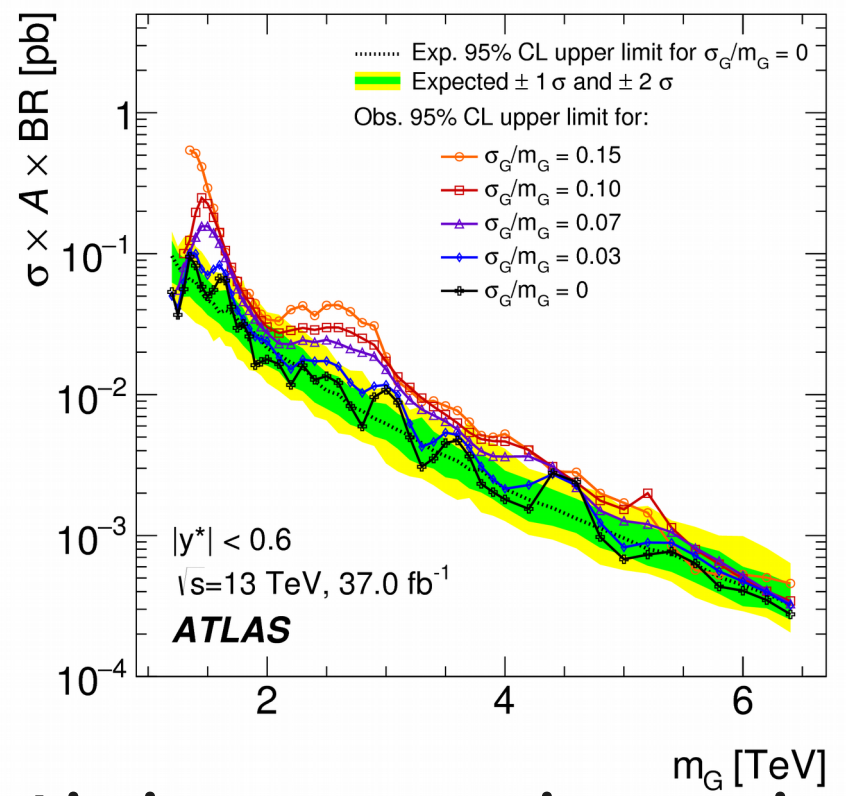


- **Resonant search looks for peaks in m_{jj}>1.1 TeV (1.7 TeV for y*<1.2 SR)**
  - Benchmark models are q*, QBH, W', Z', W*
- **Non-resonant search looks for excess in $\chi=e^{2|y^*|}$ binned by m_{jj}**
  - Benchmark models are contact interactions

Dijet Search - Limits

arXiv:1703.09127



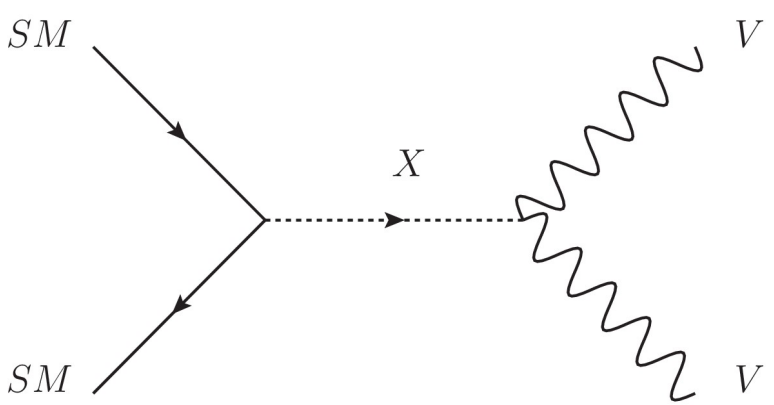


Limits on a generic gaussian signal exclude cross-sections less than 100-1 fb.

Diboson Resonances (pp→X→VV, V=W/Z/H)

Benchmark Models:

- Heavy Higgs (spin 0)
- Heavy Vector Triplet (spin 1)
  - Model A → dominant decays to fermions
  - Model B → dominant decays to SM VV
- Bulk RS graviton (spin 2)



Channels grouped by V decay

- Hadronic W/Z decays have a big BR
  - and full reconstructed final state
- Leptonic W/Z decays easy to trigger
- H→bb decays used for Higgs channels
- Have 2 V's → can mix and match

Hadronic decays of V's can become merged

- Happens for ~$P_{T,V}$>200 GeV
- Requires the use of jet substructure techniques
- “boson tagger” uses D2 and trimmed jet mass

Existing ATLAS Diboson Results

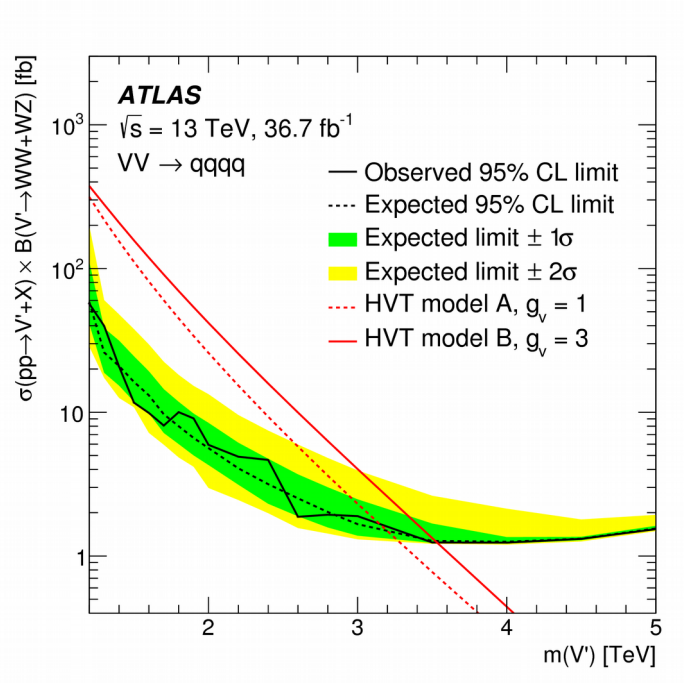
Final State	√s	Luminosity	Reference
qqqq	13 TeV	36.7 fb^{-1}	arXiv:1708.04445
lνqq	13 TeV	36.1 fb^{-1}	ATLAS-CONF-2017-051 NEW
lll'l', llν'ν'	13 TeV	36.1 fb^{-1}	ATLAS-CONF-2017-058
ννqq, lνqq, llqq	13 TeV	3.2 fb^{-1}	arXiv:1606.04833
lνl'l'	8 TeV	20.3 fb^{-1}	arXiv:1406.4456
lνl'ν'	7 TeV	4.7 fb^{-1}	arXiv:1208.2880
llqq	7 TeV	1.2 fb^{-1}	arXiv:1203.0718
qqbb	13 TeV	36.1 fb^{-1}	arXiv:1707.06958
ννbb, lνbb, llbb	13 TeV	36.1 fb^{-1}	ATLAS-CONF-2017-055 NEW

H→bb

Diboson Limits

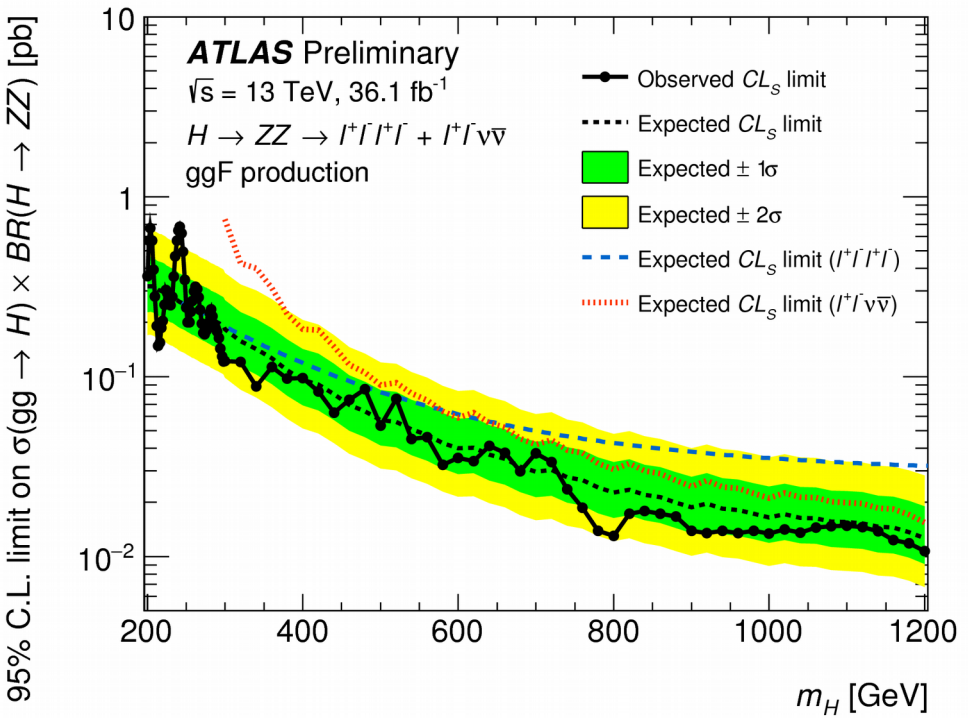
Excluded mass ranges in TeV of Z', W' and Bulk RS Graviton.

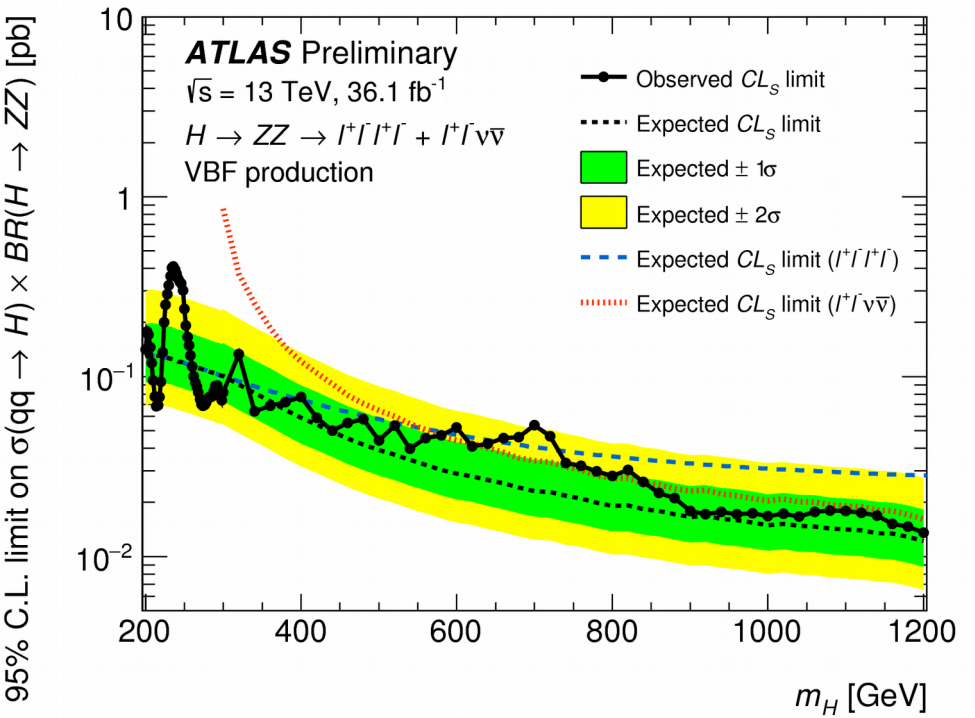
		HVT model A	HVT model B	Bulk RS, $k/M_{pl} = 1$
WW	qqqq	1.20-2.20	1.20-2.80	1.30-1.45
	lνqq (DY)	0.40-2.75	0.40-3.09	0.40-1.76
WZ	qqqq	1.20-3.00	1.20-3.30	
	lνqq (DY)	0.40-3.09	0.40-2.82	
WW+VZ	qqqq	1.20-3.10	1.20-3.50	1.30-1.60
WH	qqbb	1.10-2.40	1.10-2.50	
	lνbb, llbb	0.5-2.67	0.50-2.86	
ZH	qqbb	1.10-2.35	1.10-2.60	
	ννbb, llbb	0.50-2.65	0.50-2.83	



ZZ → lll'l', llν'ν' Results

ATLAS-CONF-2017-058

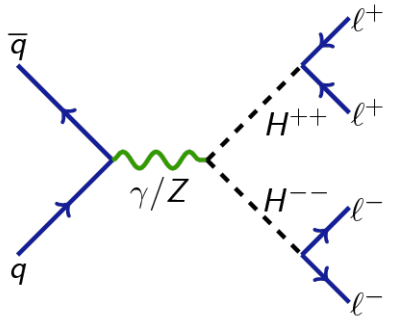


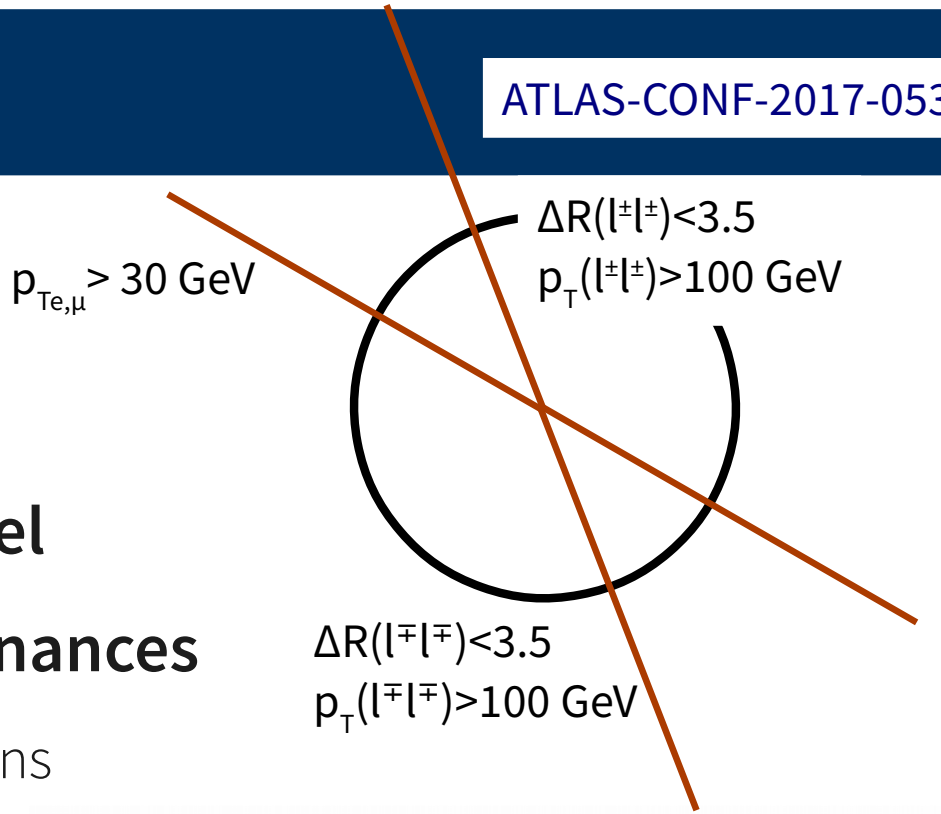


- **A modest excess seen at 240 GeV and 700 GeV in lll'l', but**
  - 240 GeV excess only observed in 4e channel
  - 700 GeV excess is excluded by more sensitive llν'ν'

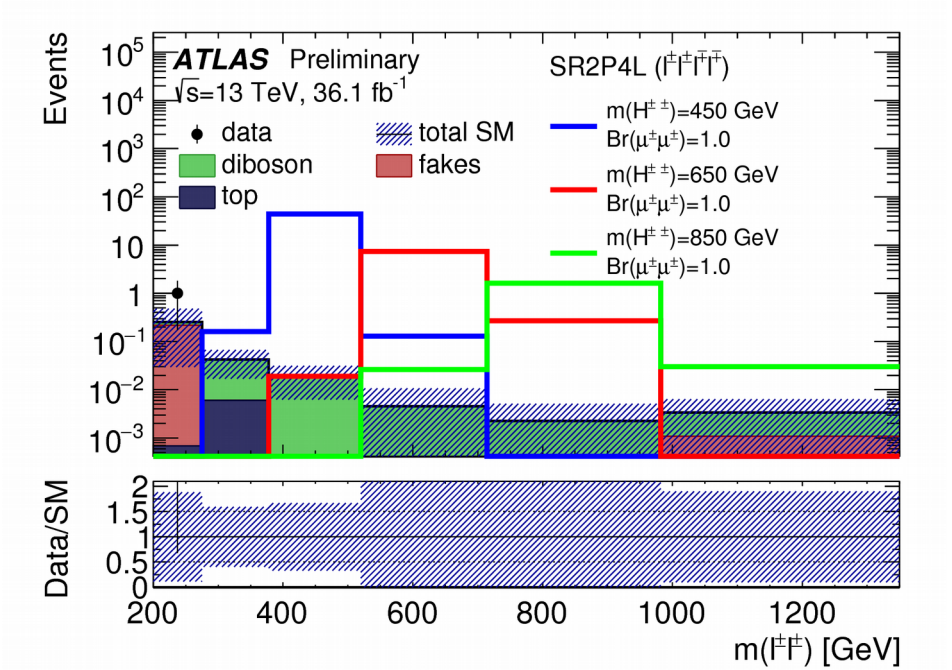
Doubly Charged Higgs

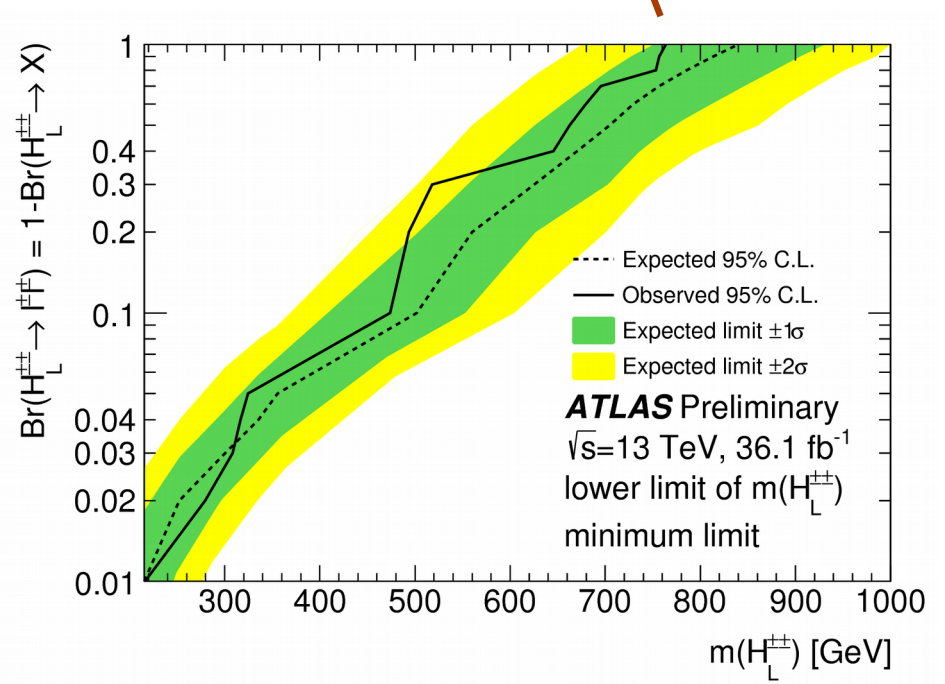
ATLAS-CONF-2017-053





- **Target left-right symmetric model**
- **Looks for same-sign lepton resonances**
  - There are 4, 3 and 2 lepton signal regions





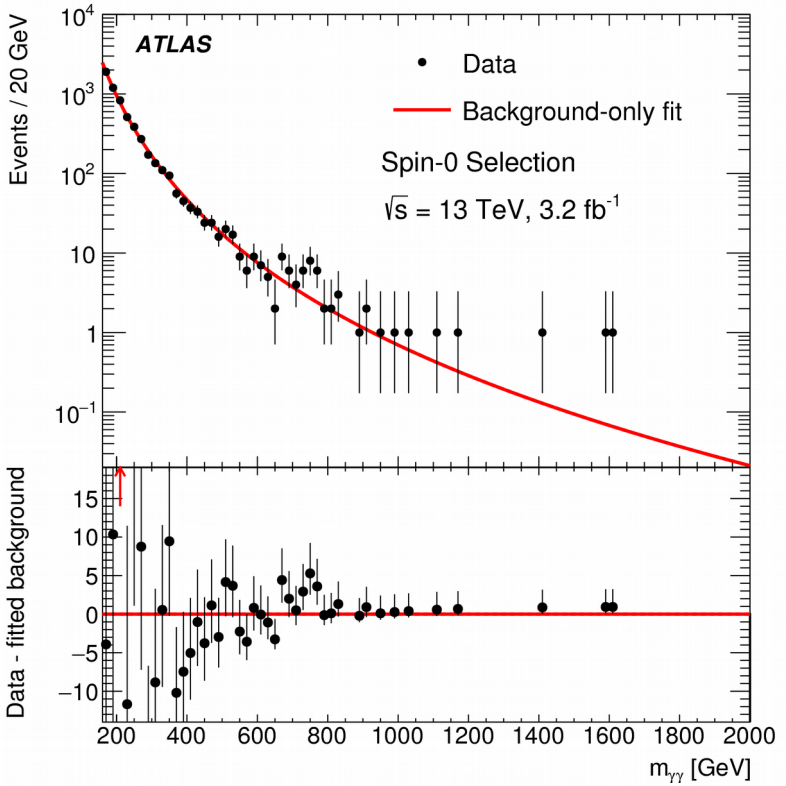
Conclusion

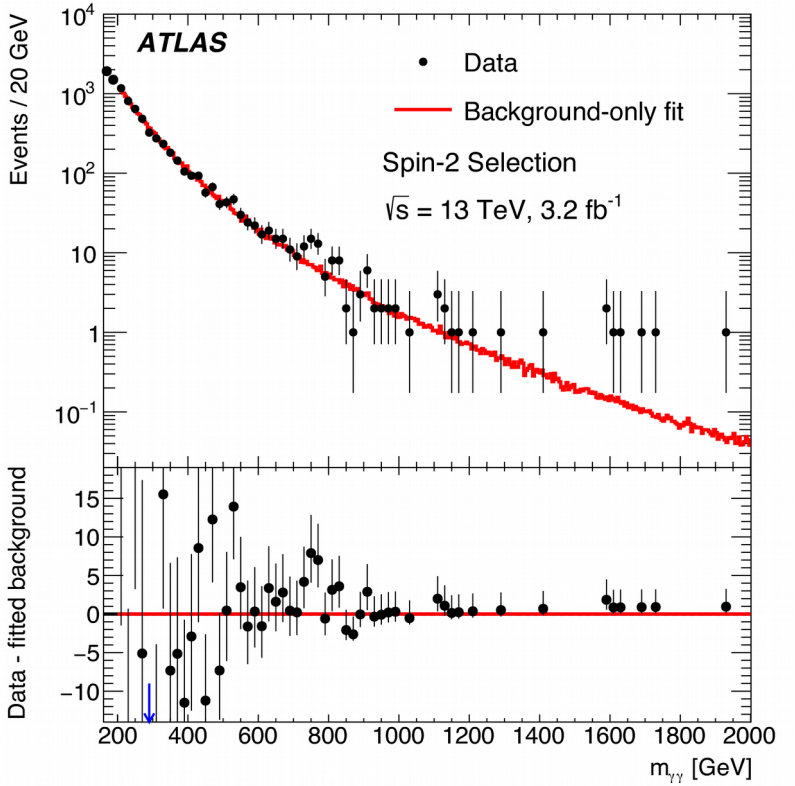
- **ATLAS has a large program searching for new BSM particles**
- **Nothing seen so far, but strong limits are being set**
  - Diphoton: no RS1 graviton below 4 TeV
  - Dilepton: no new Z-like particle below 4.5 TeV
  - Lepton+MET: no new W-like particle below 5 TeV
  - Dijet: no leptophobic W' below 3 TeV
  - Diboson: no new heavy boson below 3 TeV
- **Multi-channel boson searches important as they allow for cross-checks**

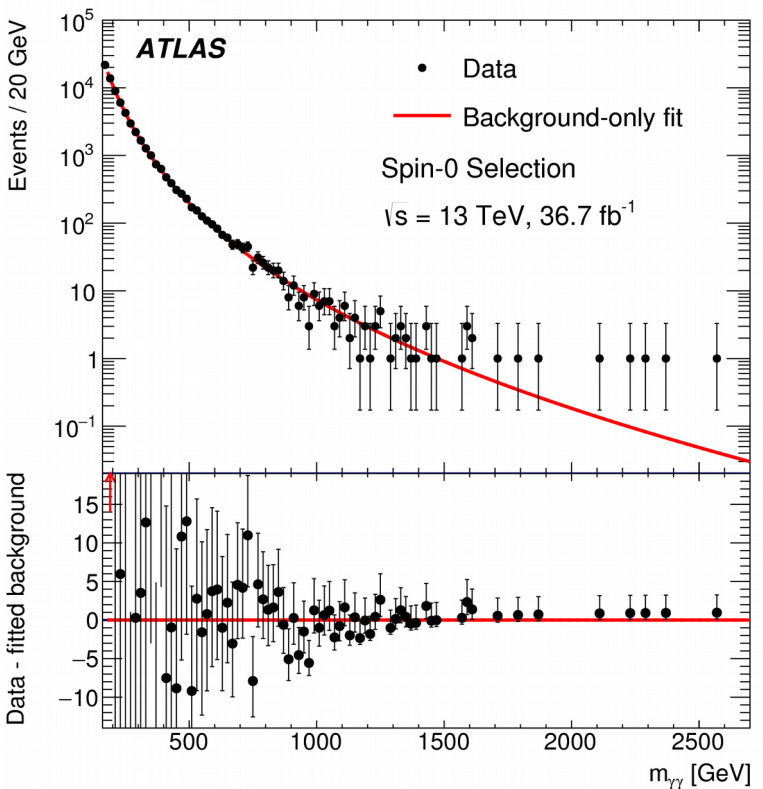
BACKUP SLIDES

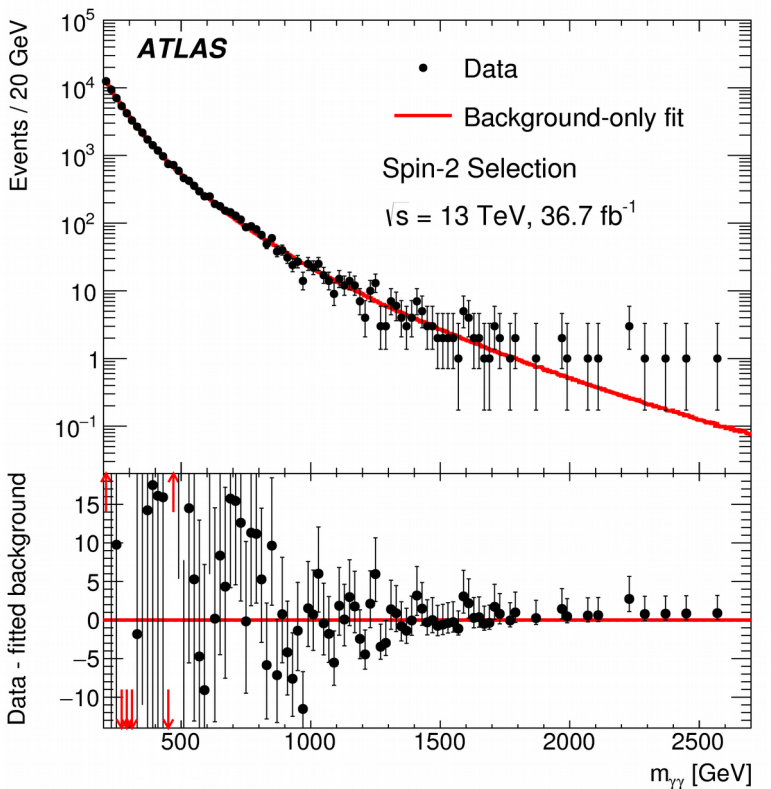
ATLAS Exotics Results on 2015+2016 Data (36 fb^{-1})

Search for Diboson Resonances with Boson-tagged Jets in pp Collisions at √s=13 TeV with the ATLAS Detector	Aug 2017
Search for Heavy Resonances Decaying to a W or Z Boson and a Higgs Boson in the qq(')bb Final State in pp Collisions at √s =13 TeV with the ATLAS Detector	Jul 2017
Search for new phenomena in high-mass diphoton final states using 37/fb of proton-proton collisions collected at √s=13 TeV wit h the ATLAS detector	Jul 2017
Search for pair production of heavy vector-like quarks decaying to high-pT W bosons and b quarks in the lepton-plus-jets final s tate in pp collisions at √s=13 TeV with the ATLAS detector	Jul 2017
Search for new high-mass phenomena in the dilepton final state using 36.1/fb of proton-proton collision data at √s = 13 TeV wit h the ATLAS detector	Jul 2017
Search for Dark Matter Produced in Association with a Higgs Boson Decaying to bb using 36/fb of pp collisions at √s= 13 TeV w ith the ATLAS Detector	Jul 2017
Search for a new heavy gauge boson resonance decaying into a lepton and missing transverse momentum in 36/fb of pp collisi ons at √s= 13 TeV with the ATLAS experiment	Jun 2017
Search for dark matter in association with a Higgs boson decaying to two photons at √s= 13 TeV with the ATLAS detector	Jun 2017
Search for pair production of vector-like top quarks in events with one lepton, jets, and missing transverse momentum in √s=13 TeV pp collisions with the ATLAS detector	May 2017
Search for dark matter at √s=13 TeV in final states containing an energetic photon and large missing transverse momentum wit h the ATLAS detector	Apr 2017
Search for new phenomena in dijet events using 37 fb-1 of pp collision data collected at √s=13 TeV with the ATLAS detector	Mar 2017
Search for dark matter and other new phenomena in events with an energetic jet and large missing transverse momentum usin g the ATLAS detector	Jul 2017
Search for heavy resonances decaying to a W or Z boson and a Higgs boson in final states with leptons and b-jets in 36.1 fb-1 o f pp collision data at √s = 13 TeV with the ATLAS detector	Jul 2017
Search for doubly-charged Higgs boson production in multi-lepton final states with the ATLAS detector using proton-proton collis ions at √s = 13 TeV	Jul 2017
Search for WW/WZ resonance production in lνqq final states in pp collisions at √s = 13 TeV with the ATLAS detector	Jul 2017
Search for Higgs decays to beyond the standard model light gauge bosons in four-lepton events with the ATLAS detector √s = 13 TeV	Jul 2017


ATLAS
Data
Background-only fit
Spin-0 Selection
√s = 13 TeV, 3.2 fb-1
Events / 20 GeV
Data - fitted background
mγγ [GeV]


ATLAS
Data
Background-only fit
Spin-2 Selection
√s = 13 TeV, 3.2 fb-1
Events / 20 GeV
Data - fitted background
mγγ [GeV]


ATLAS
Data
Background-only fit
Spin-0 Selection
√s = 13 TeV, 36.7 fb-1
Events / 20 GeV
Data - fitted background
mγγ [GeV]


ATLAS
Data
Background-only fit
Spin-2 Selection
√s = 13 TeV, 36.7 fb-1
Events / 20 GeV
Data - fitted background
mγγ [GeV]

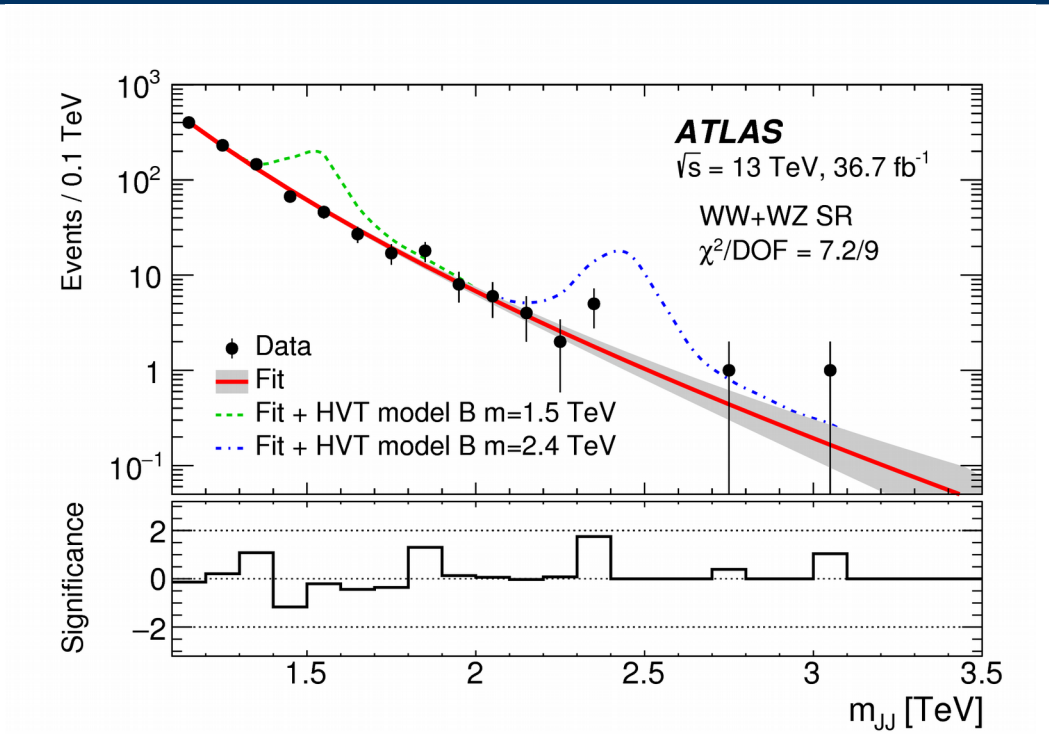
Dijet Search - Limits

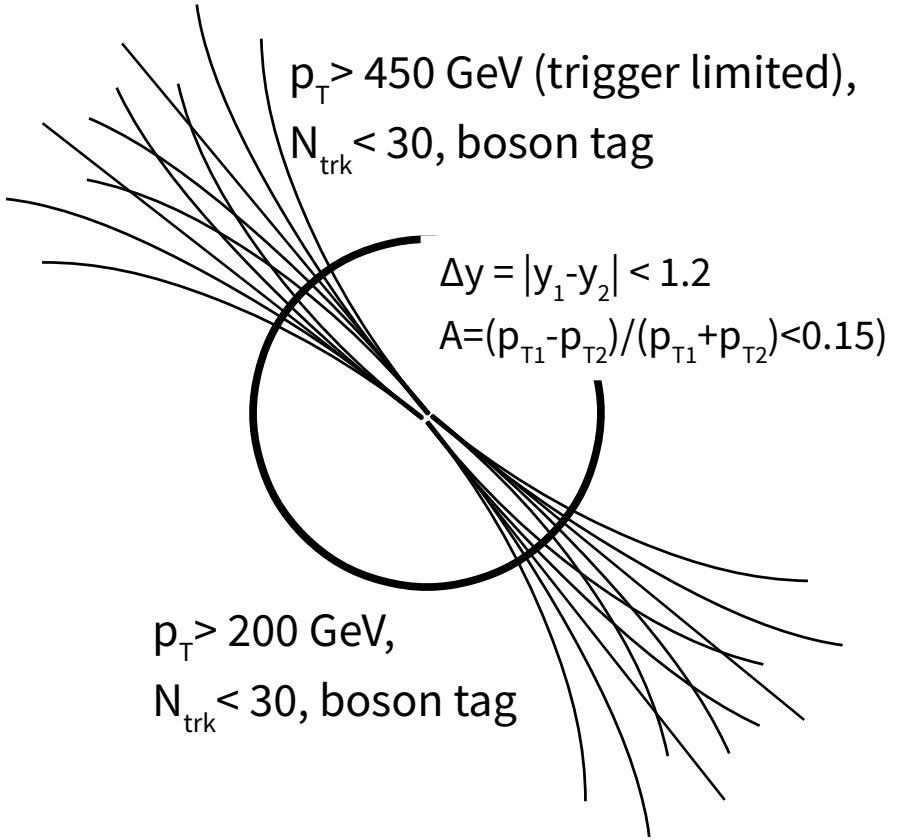
arXiv:1703.09127

Model	95% CL exclusion limit	
	Observed	Expected
Quantum black hole	8.9 TeV	8.9 TeV
W'	3.6 TeV	3.7 TeV
W^*	3.4 TeV 3.77 TeV – 3.85 TeV	3.6 TeV
Excited quark	6.0 TeV	5.8 TeV
Z' $(g_q = 0.1)$	2.1 TeV	2.1 TeV
Z' $(g_q = 0.2)$	2.9 TeV	3.3 TeV
Contact interaction $(\eta_{\mathrm{LL}} = -1)$	21.8 TeV	28.3 TeV
Contact interaction $(\eta_{\mathrm{LL}} = +1)$	13.1 TeV 17.4 TeV – 29.5 TeV	15.0 TeV

VV → qqqq

arXiv:1708.04445



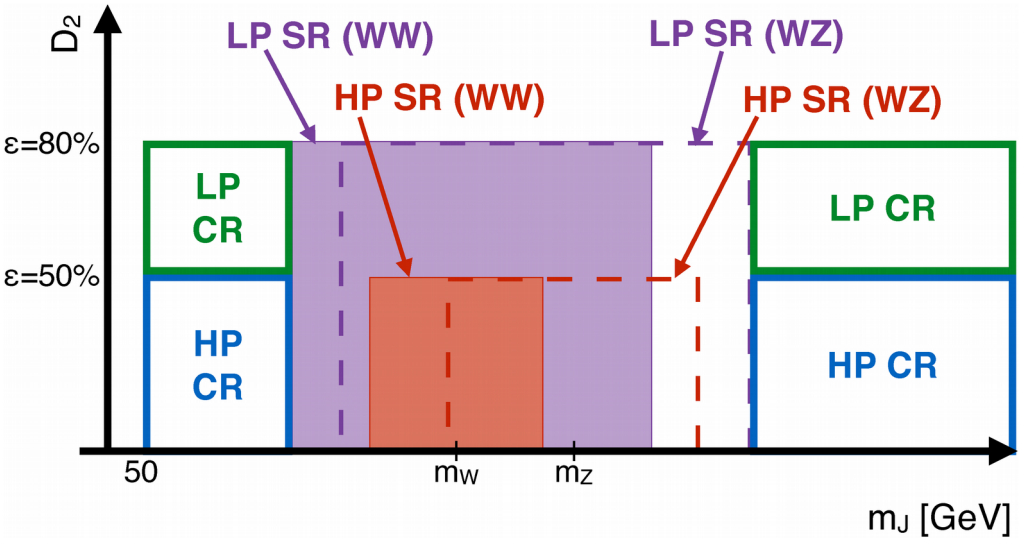


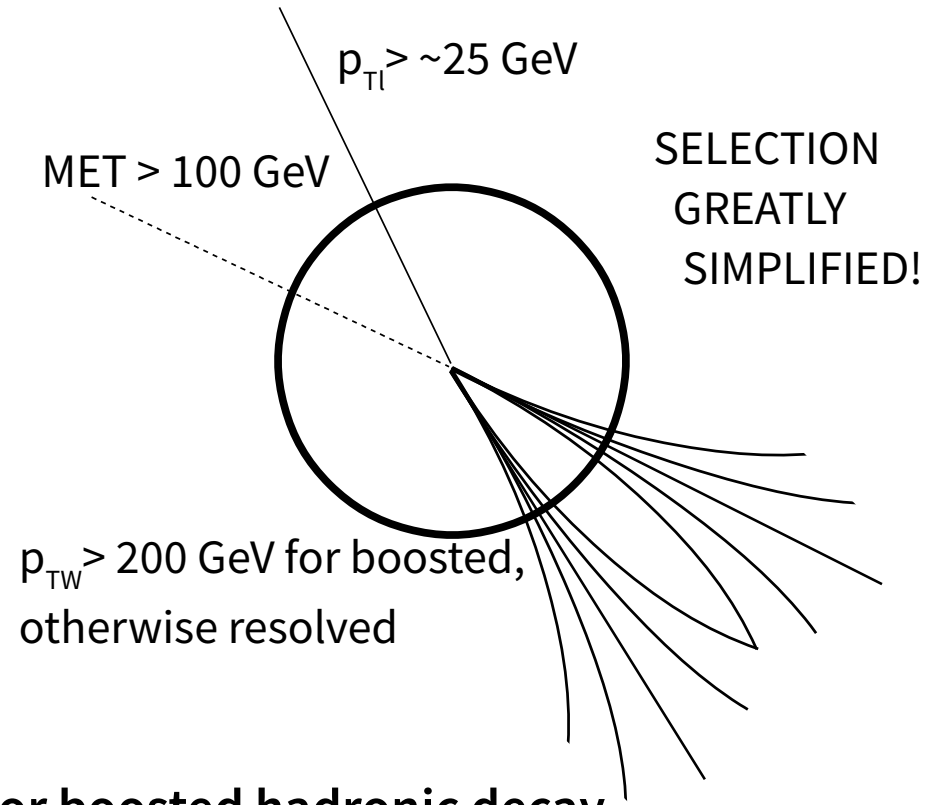
- Unprescaled large-R jet trigger
- Boson tagger based on D_2 and V mass window
- Events with leptons and MET vetoed
- Search starts at m_{JJ}>1.1 TeV
- WW, ZZ, WZ and combination signal regions

VV → lνqq

ATLAS-CONF-2017-051

There are VBF + DY versions, and a resolved SR...

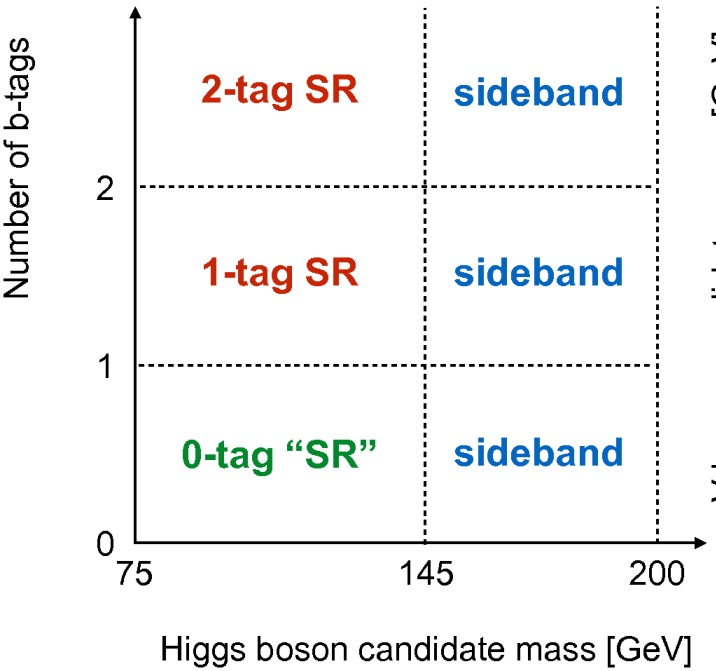


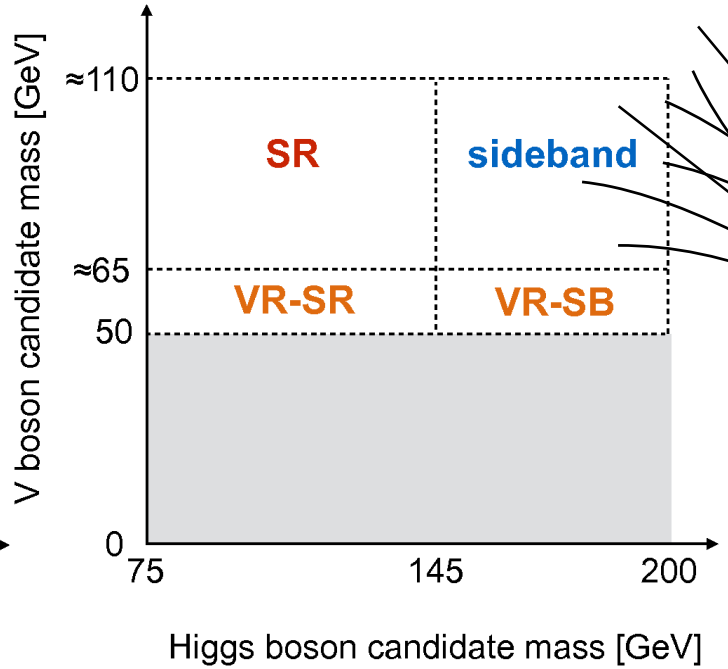


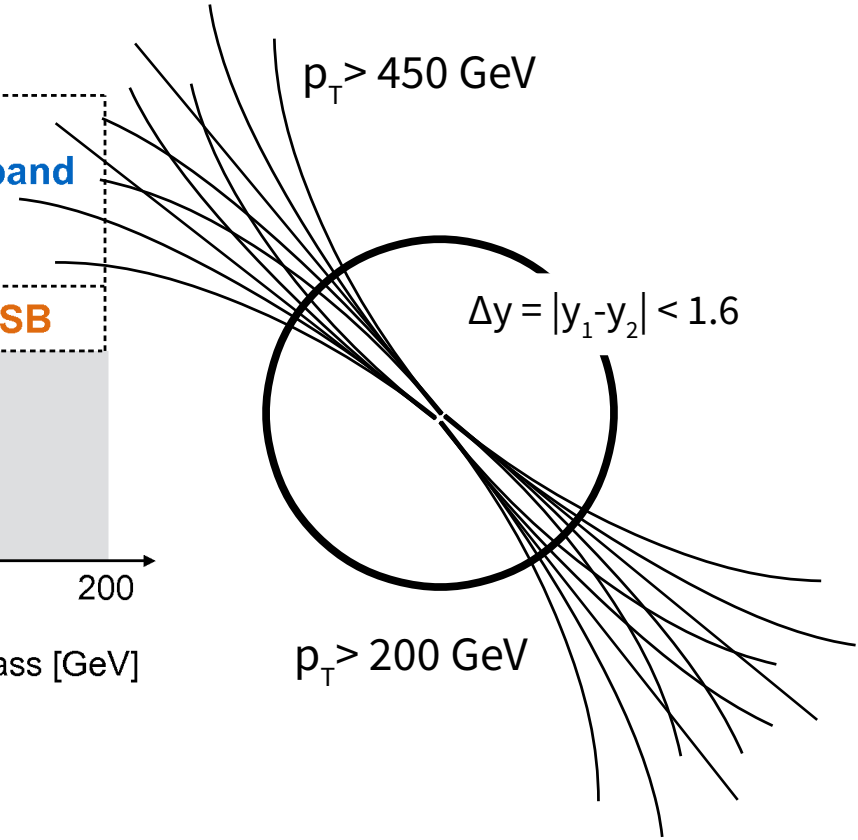
- Unprescaled electron, muon or MET trigger
- Boson tagger based on D_2 and V mass window for boosted hadronic decay
- l+ν system reconstructed from MET and W mass for leptonic W decay
- Veto b-jets to supress ttbar background
- Search starts at m_{JJ}>0.4 TeV
- WW and WZ signal regions (inside VBF+DY and boosted+resolved selections)

VH → qqbb

arXiv:1707.06958



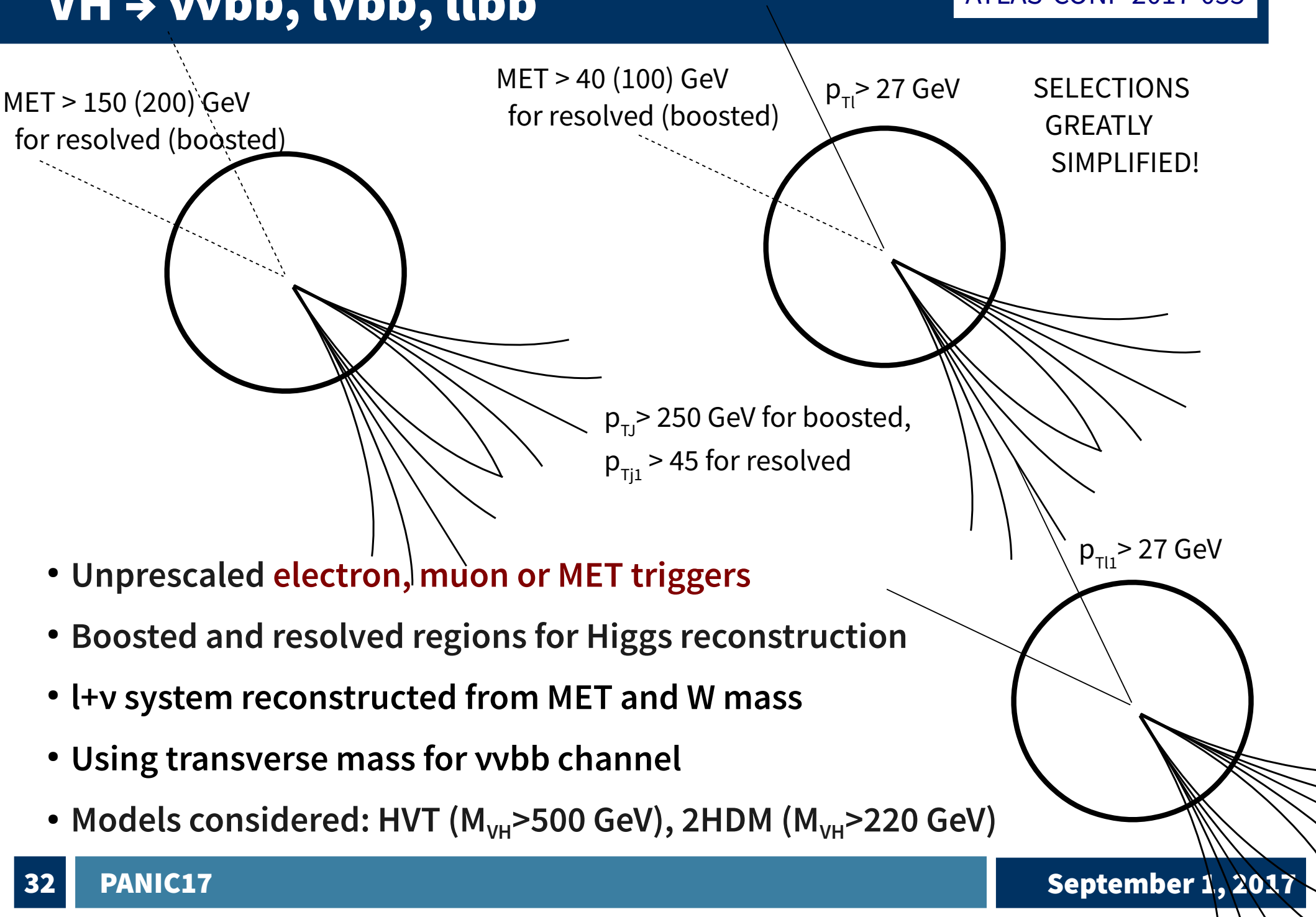




- **Unprescaled large-R jet trigger**
- **Heavier jet is considered as the Higgs candidate**
  - Higgs tagger based on b-subjets and mass window
  - Boson tagger based on D_2 and V mass window
- **Events with leptons and MET vetoed**
- **Search starts at m_{JJ}>1.1 TeV**
- **Overlapping WH and ZH signal regions**

VH → ννbb, lνbb, llbb

ATLAS-CONF-2017-055



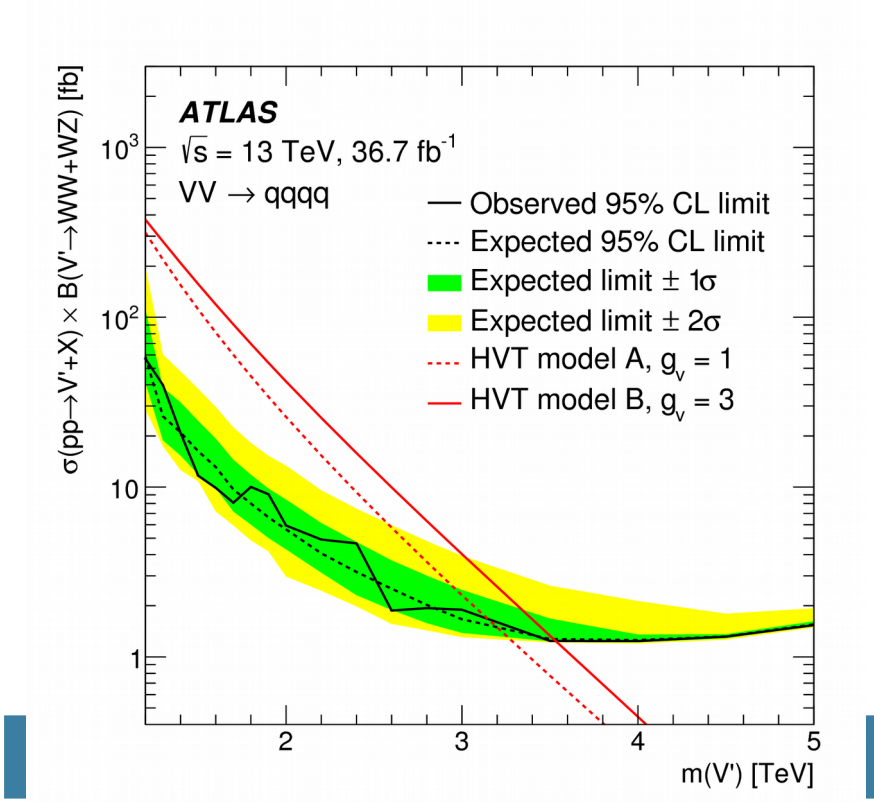
- Unprescaled electron, muon or MET triggers
- Boosted and resolved regions for Higgs reconstruction
- l+ν system reconstructed from MET and W mass
- Using transverse mass for ννbb channel
- Models considered: HVT (M_{VH}>500 GeV), 2HDM (M_{VH}>220 GeV)

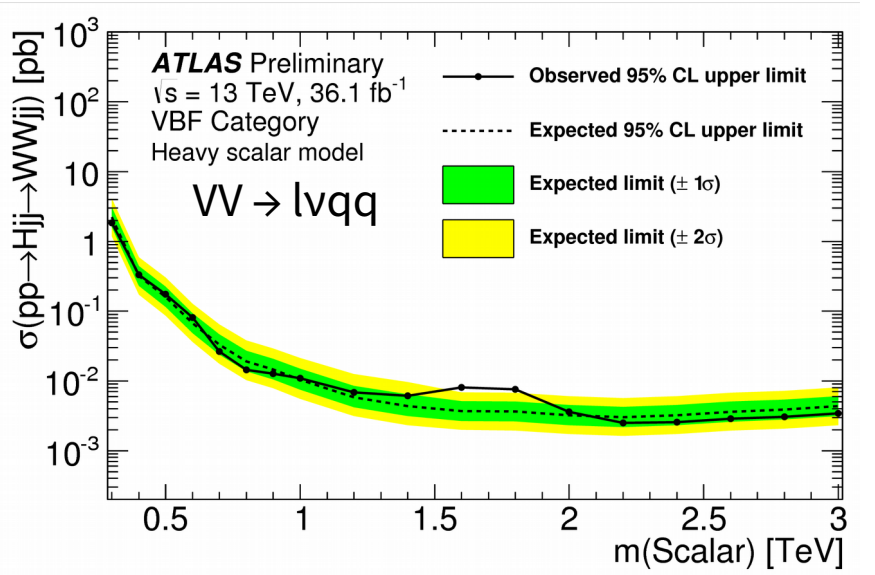
VV → qqqq and VV → lνqq Limits

Excluded mass ranges in TeV

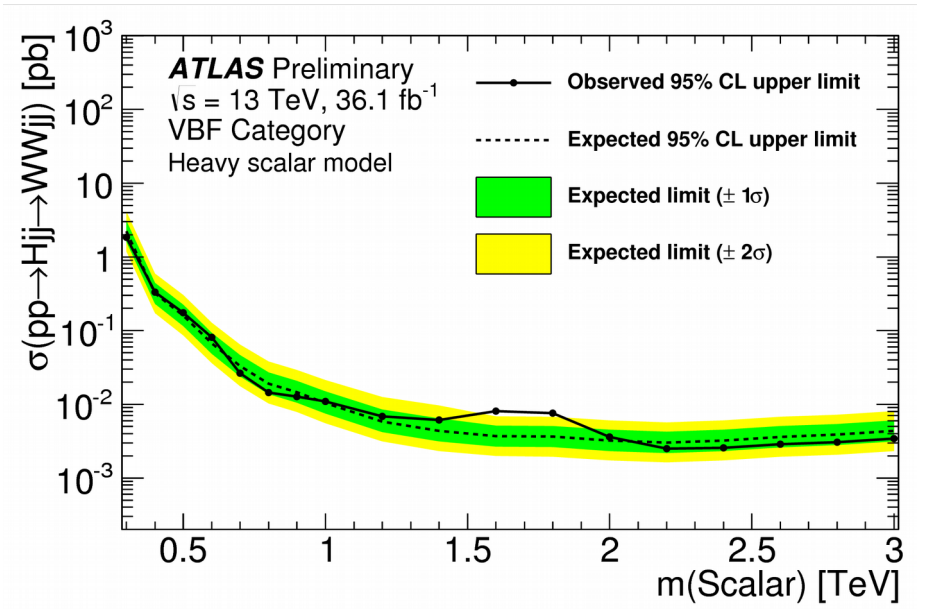
	WW		WZ		WW+VZ
Model	qqqq	lνqq (DY)	qqqq	lνqq (DY)	qqqq
HVT model A	1.2 – 2.2	0.4 – 2.75	1.2 – 3.0	0.4 – 3.09	1.2 – 3.1
HVT model B	1.2 – 2.8	0.4 – 3.09	1.2 – 3.3	0.4 - 2.82	1.2 – 3.5
Bulk RS, $k/M_{pl} = 1$	1.30 – 1.45	0.4 – 1.76	none	none	1.30 – 1.60

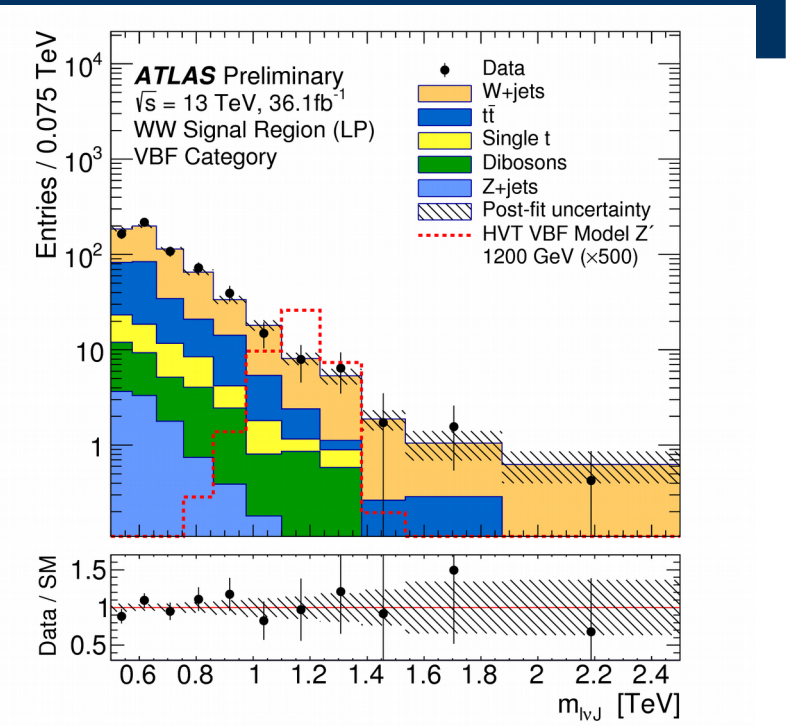
Exclude HVTs <3 TeV and gravitons <1.5 TeV.

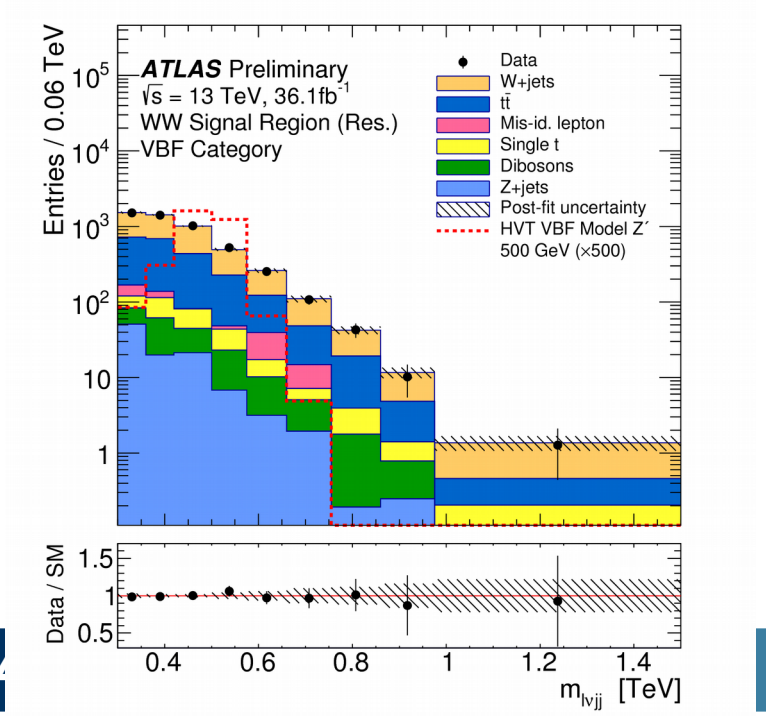


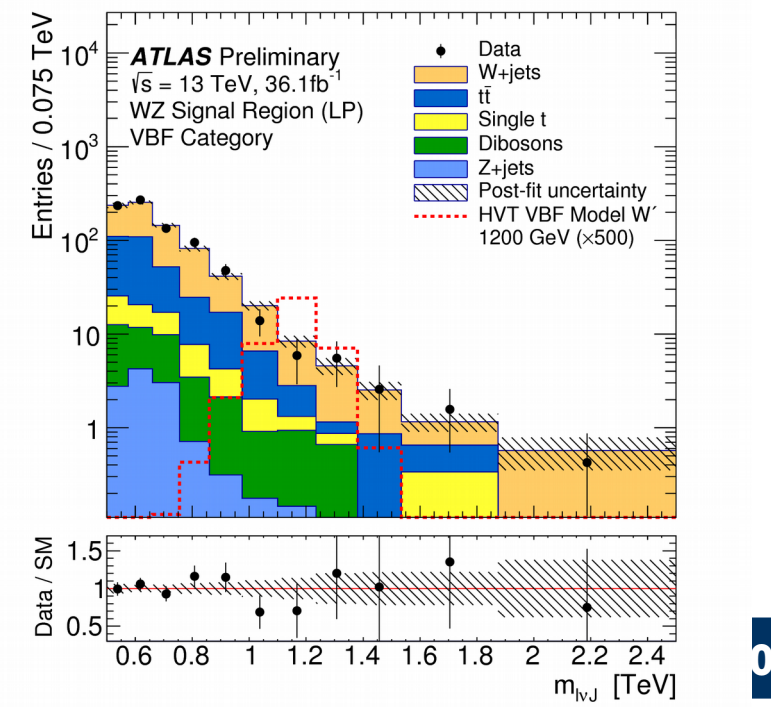


VV → lvqq VBF Category

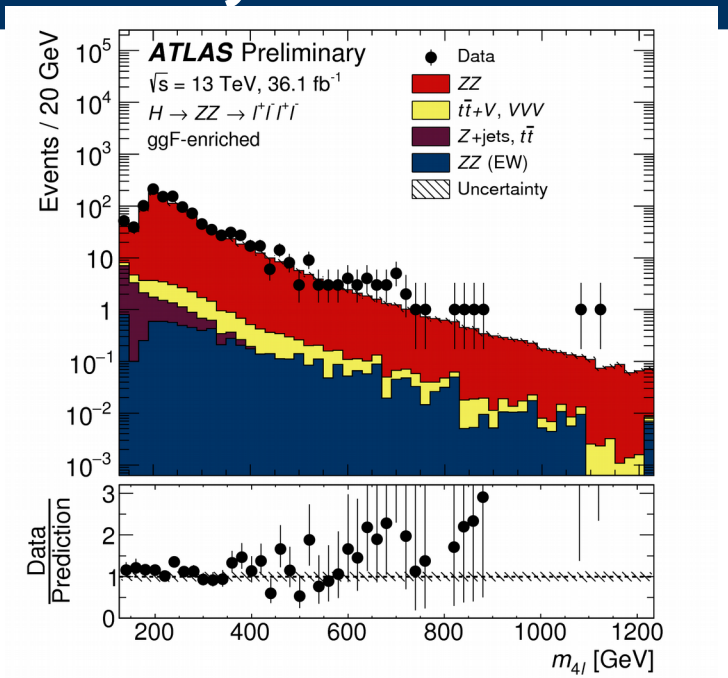


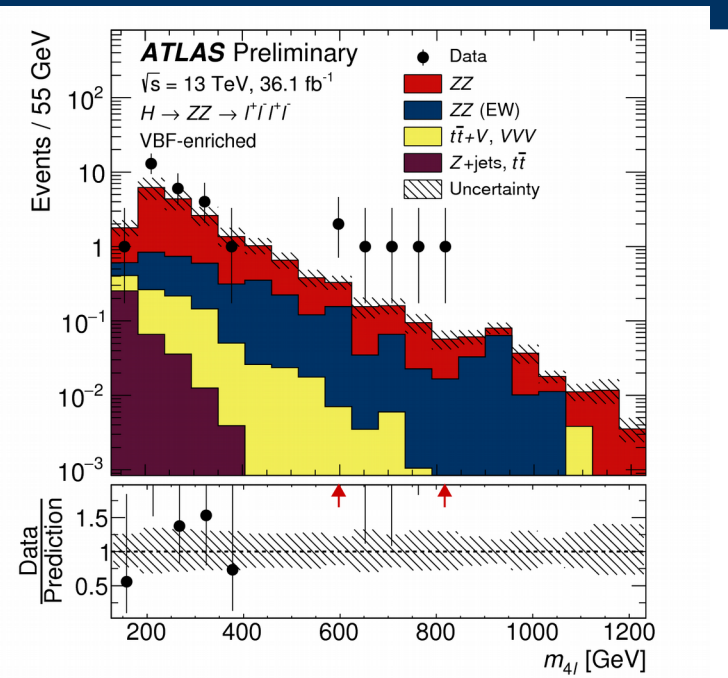


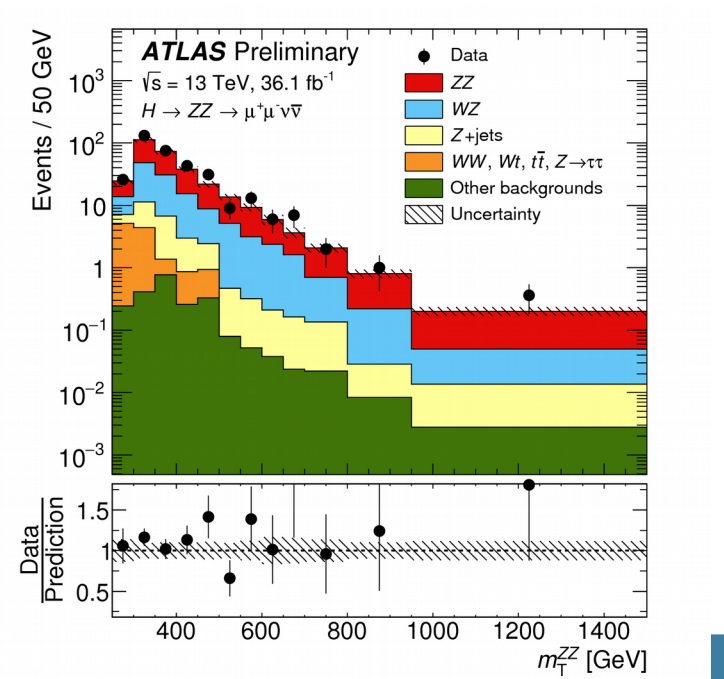


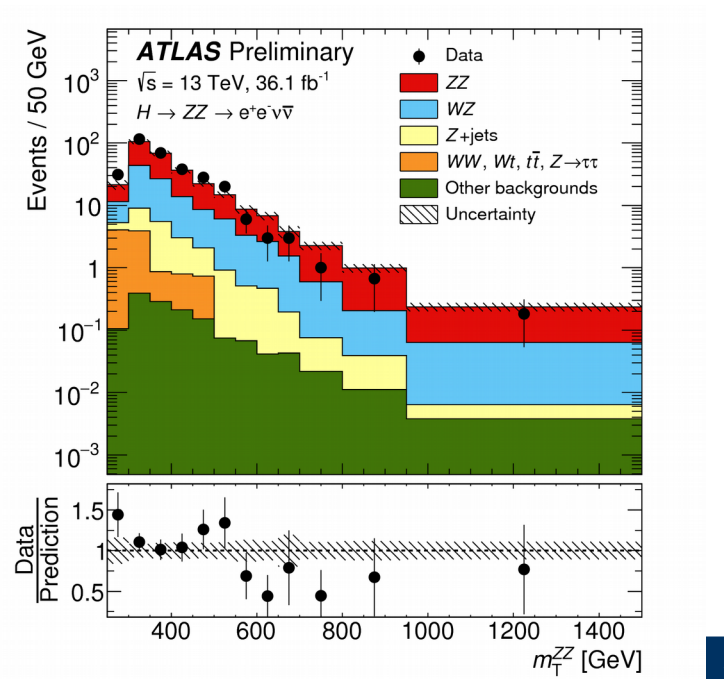


ZZ → lll'l', llν'ν'

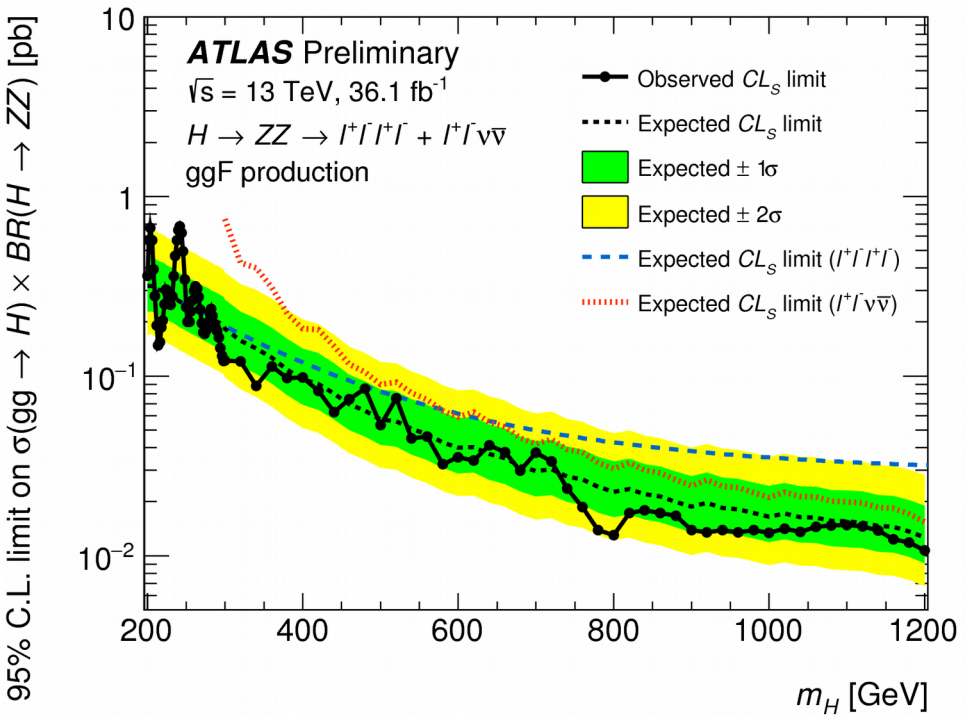

ATLAS Preliminary
√s = 13 TeV, 36.1 fb-1
H → ZZ → l+l-l+l-
ggF-enriched
Data
ZZ
tt̄+V, VVV
Z+jets, tt̄
ZZ (EW)
Uncertainty
Events / 20 GeV
Data / Prediction
m4l [GeV]

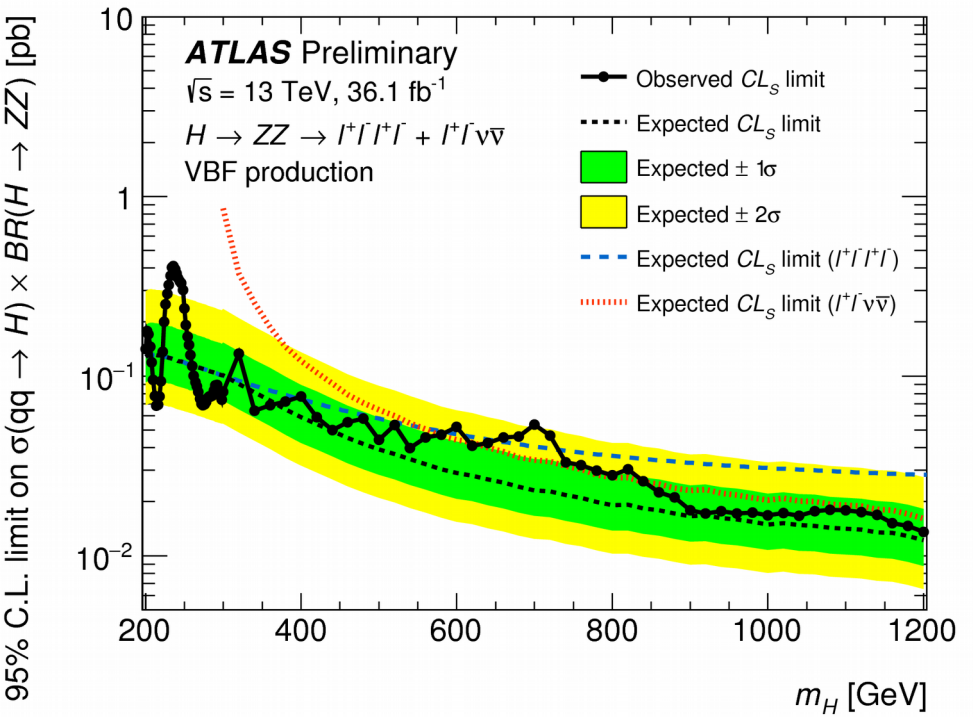

ATLAS Preliminary
√s = 13 TeV, 36.1 fb-1
H → ZZ → l+l-l+l-
VBF-enriched
Data
ZZ
ZZ (EW)
tt̄+V, VVV
Z+jets, tt̄
Uncertainty
Events / 55 GeV
Data / Prediction
m4l [GeV]


ATLAS Preliminary
√s = 13 TeV, 36.1 fb-1
H → ZZ → μ+μ-νν̄
Data
ZZ
WZ
Z+jets
WW, Wt, tt̄, Z→ττ
Other backgrounds
Uncertainty
Events / 50 GeV
Data / Prediction
mTZZ [GeV]


ATLAS Preliminary
√s = 13 TeV, 36.1 fb-1
H → ZZ → e+e-νν̄
Data
ZZ
WZ
Z+jets
WW, Wt, tt̄, Z→ττ
Other backgrounds
Uncertainty
Events / 50 GeV
Data / Prediction
mTZZ [GeV]

ZZ → lll'l', llν'ν'


ATLAS Preliminary
√s = 13 TeV, 36.1 fb-1
H → ZZ → l+l-l+l- + l+l-νν̄
ggF production
Observed CLs limit
Expected CLs limit
Expected ± 1σ
Expected ± 2σ
Expected CLs limit (l+l-l+l-)
Expected CLs limit (l+l-νν̄)
95% C.L. limit on σ(gg → H) × BR(H → ZZ) [pb]
mH [GeV]


ATLAS Preliminary
√s = 13 TeV, 36.1 fb-1
H → ZZ → l+l-l+l- + l+l-νν̄
VBF production
Observed CLs limit
Expected CLs limit
Expected ± 1σ
Expected ± 2σ
Expected CLs limit (l+l-l+l-)
Expected CLs limit (l+l-νν̄)
95% C.L. limit on σ(qq → H) × BR(H → ZZ) [pb]
mH [GeV]