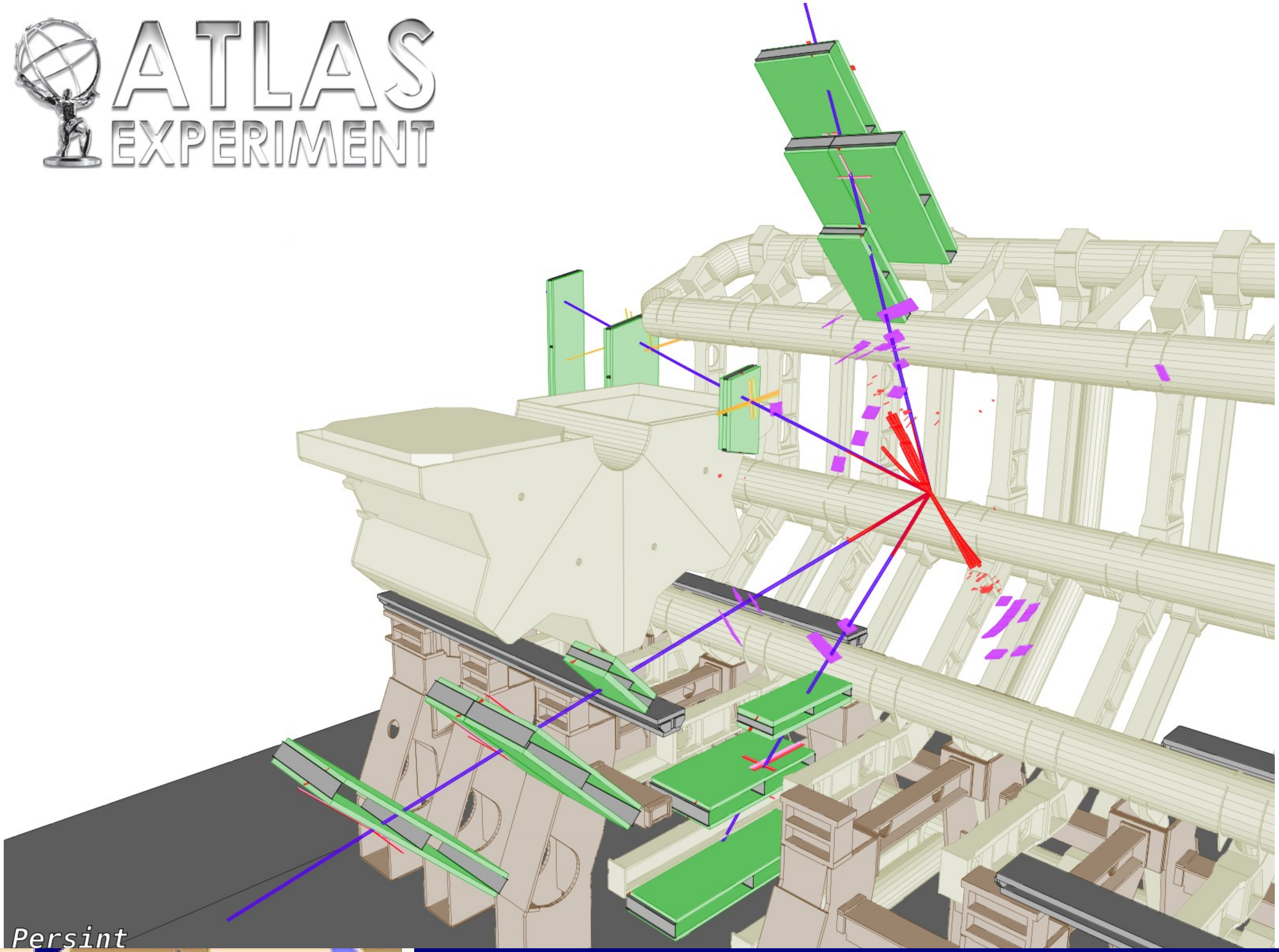
Recent results from ATLAS



Klaus Mönig

on behalf of the

ATLAS
collaboration

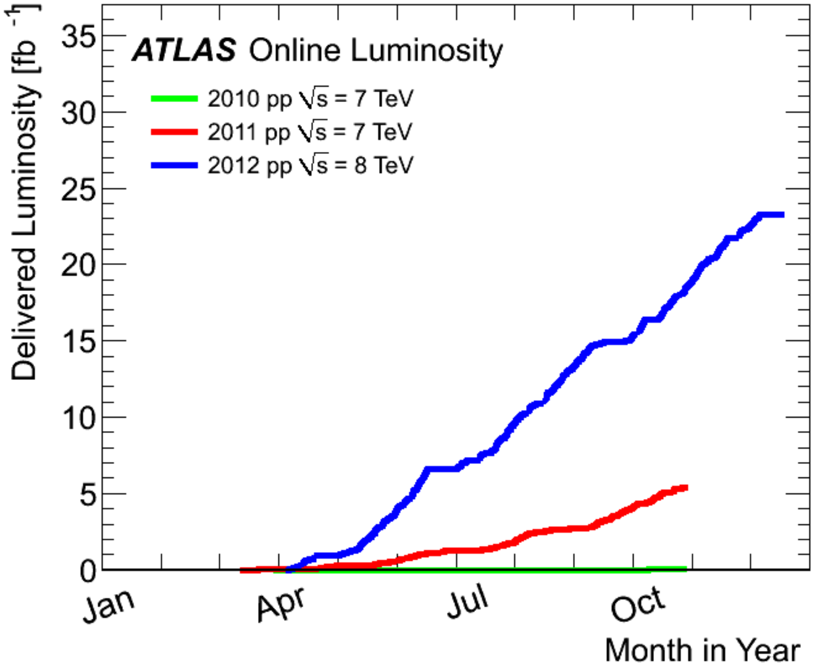
SCALARS 2013
12-16 September 2013
Warsaw, Poland

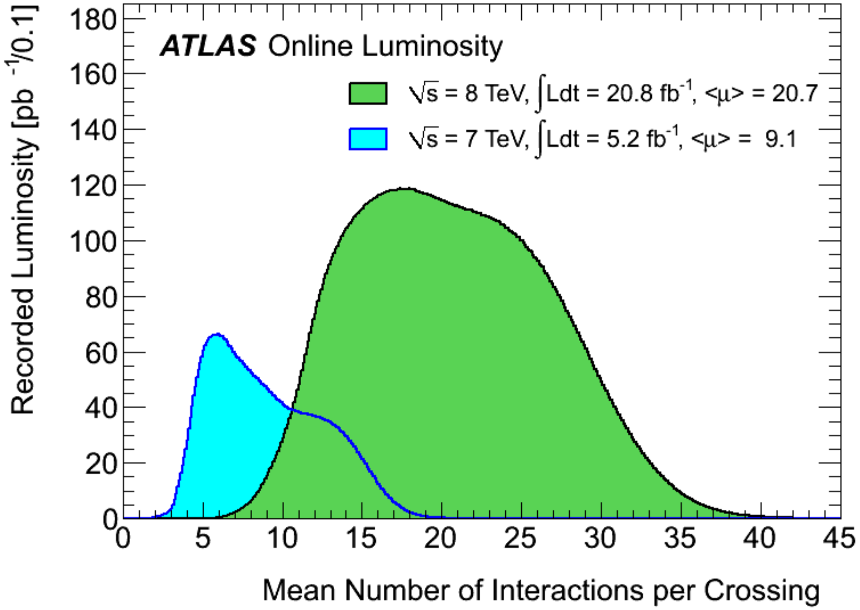
Outline

- Introduction
- Scalars we didn't find
- The scalar we found
- Conclusions

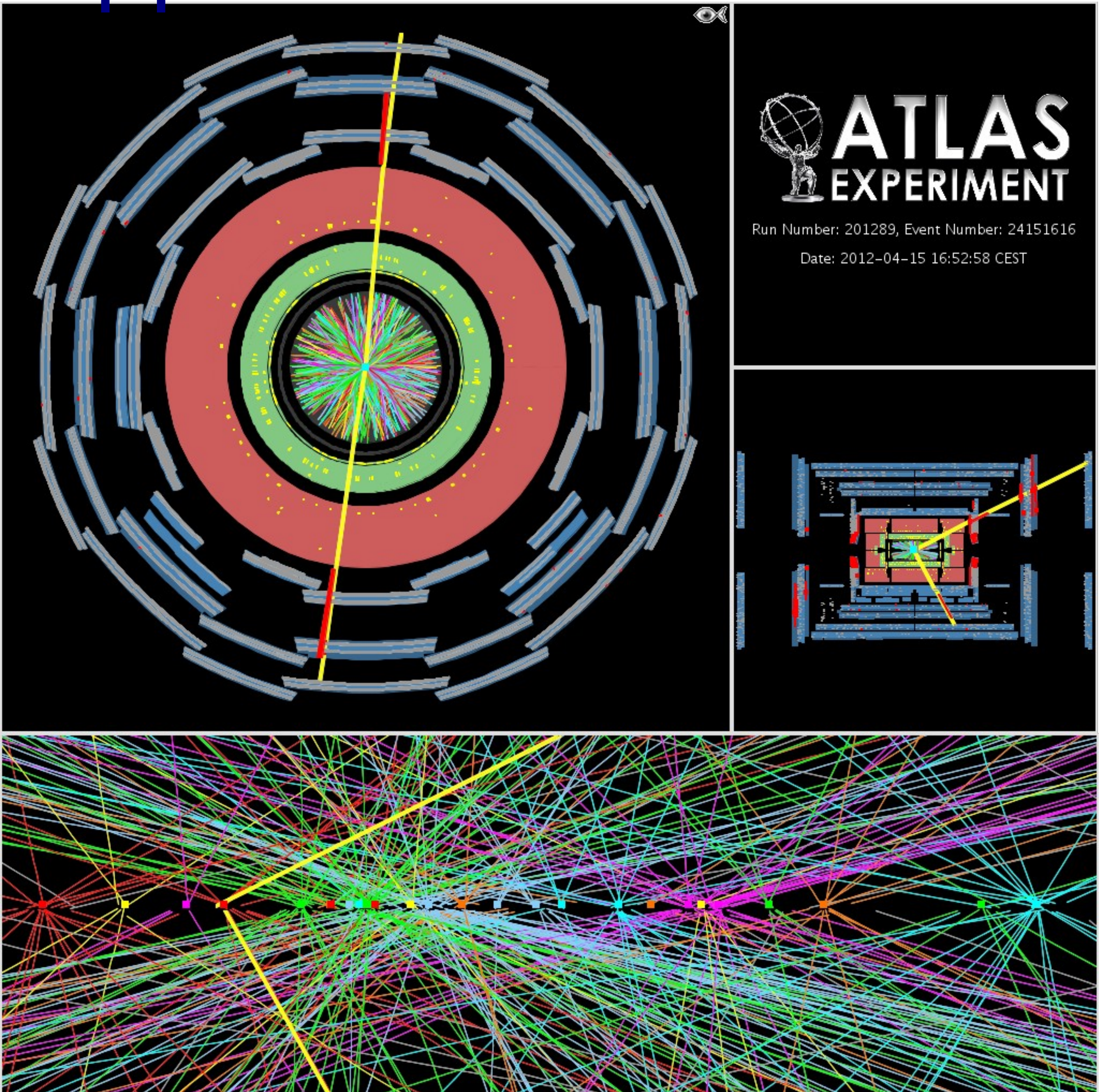
ATLAS at the LHC

- Very successful running in 2011 (7 TeV) and 2012 (8 TeV)
- Data taking efficiency in 2012: 93%, 96% of which is used for physics
- Peak luminosity $7 \cdot 10^{33} cm^{-2} s^{-1}$
- Total data set
  - 7 TeV: 4.8 fb^{-1}
  - 8 TeV: 20.7 fb^{-1}
- Main challenge: high pileup

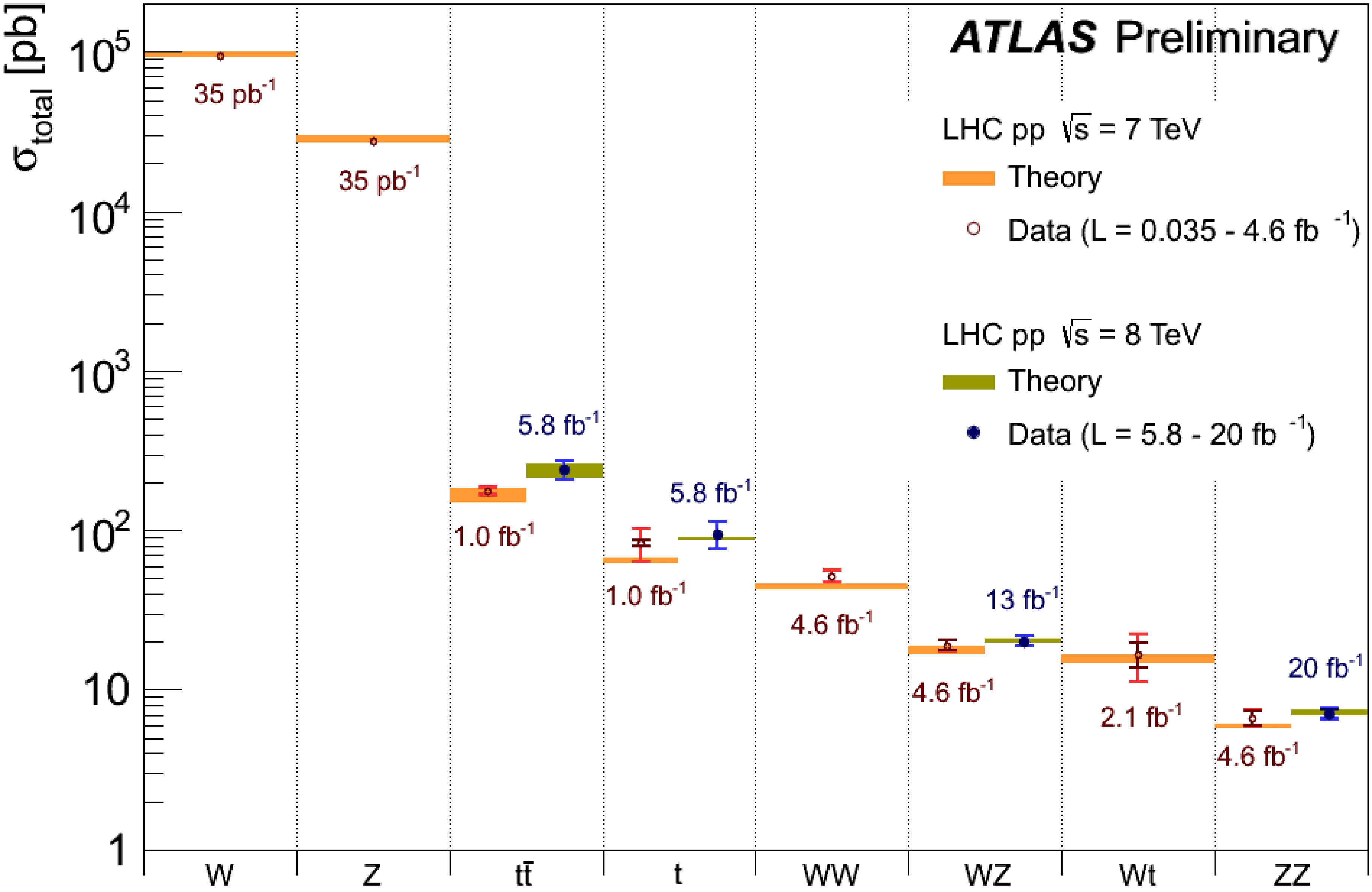




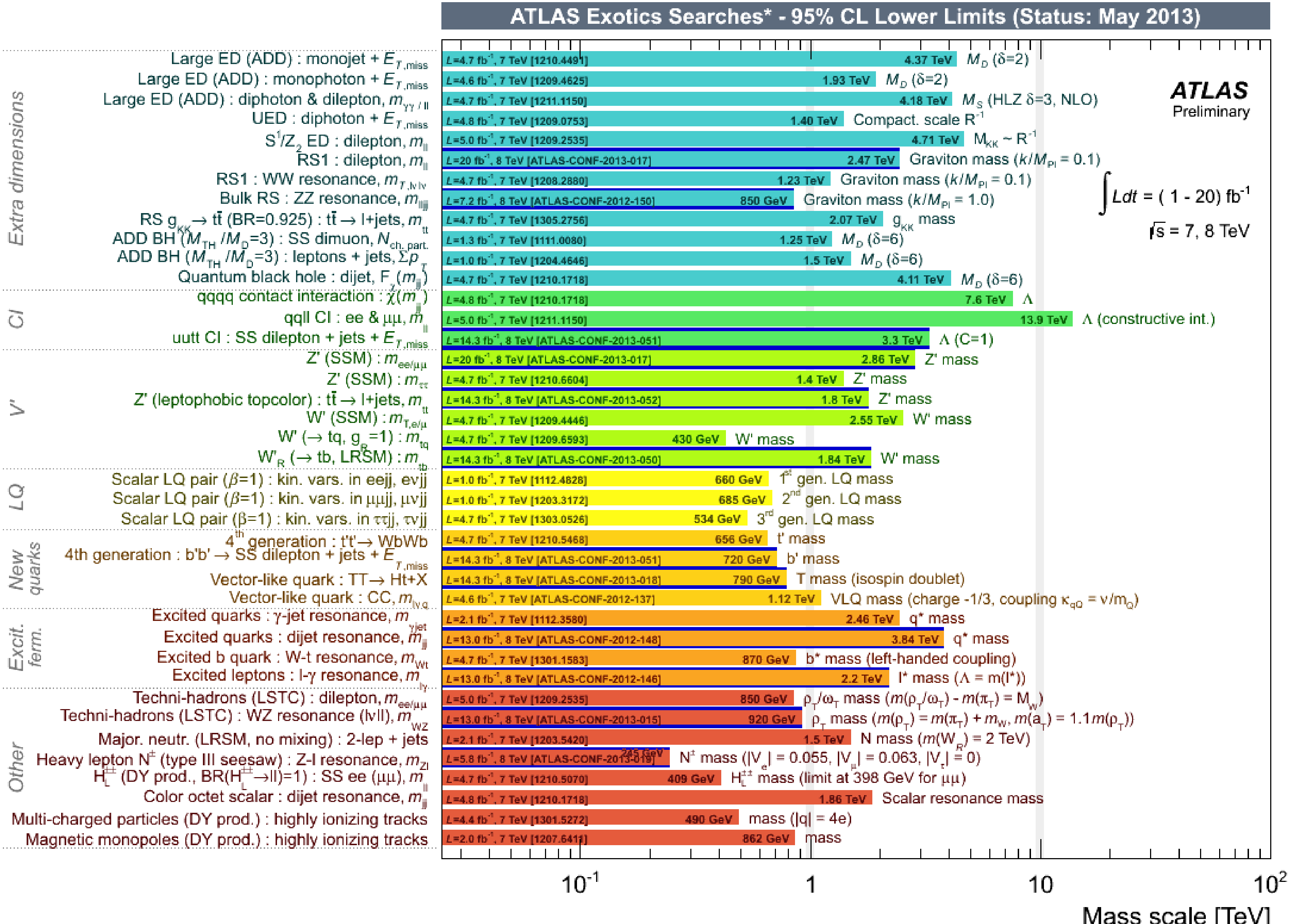
Z→μμ event with 25 vertices



Standard Model measurements



Searches for new phenomena



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

Scalars we didn't find

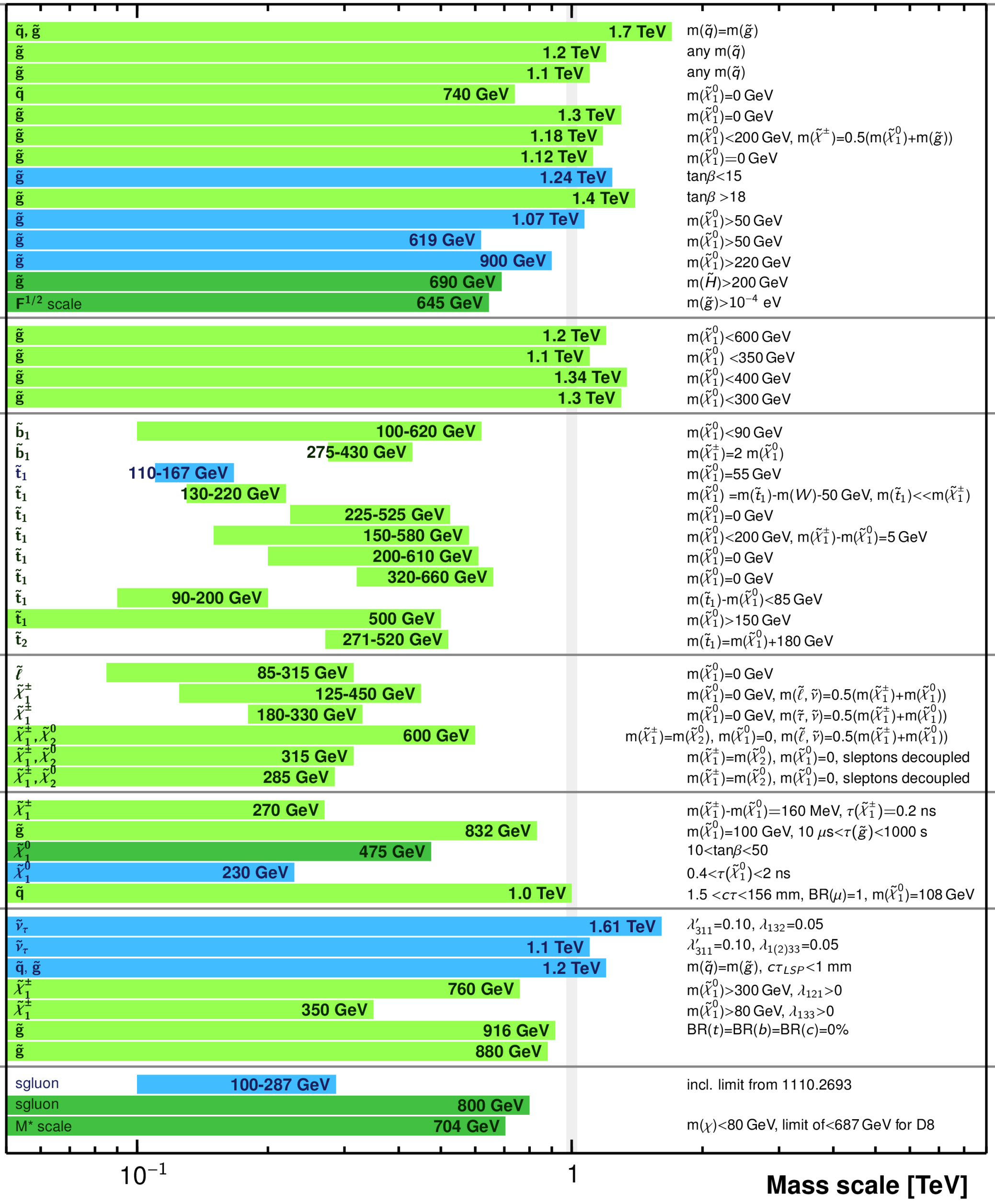
- If you believe in SUSY <5% of the elementary scalars are found
- SUSY searches going on with full intensity
- Standard inclusive searches continuing
- New developments:
  - searches using heavy flavour, e.g. $\tilde{g}\to t\tilde{t}$
  - searches for direct production of heavy squarks (naturalness)
  - searches for electroweak production
  - searches for R-parity violating SUSY

ATLAS SUSY Searches* - 95% CL Lower Limits

Status: SUSY 2013

ATLAS Preliminary

$\int \mathcal{L}\, dt = (4.6 - 22.9)\ \mathrm{fb}^{-1}$ $\sqrt{s} = 7, 8$ TeV

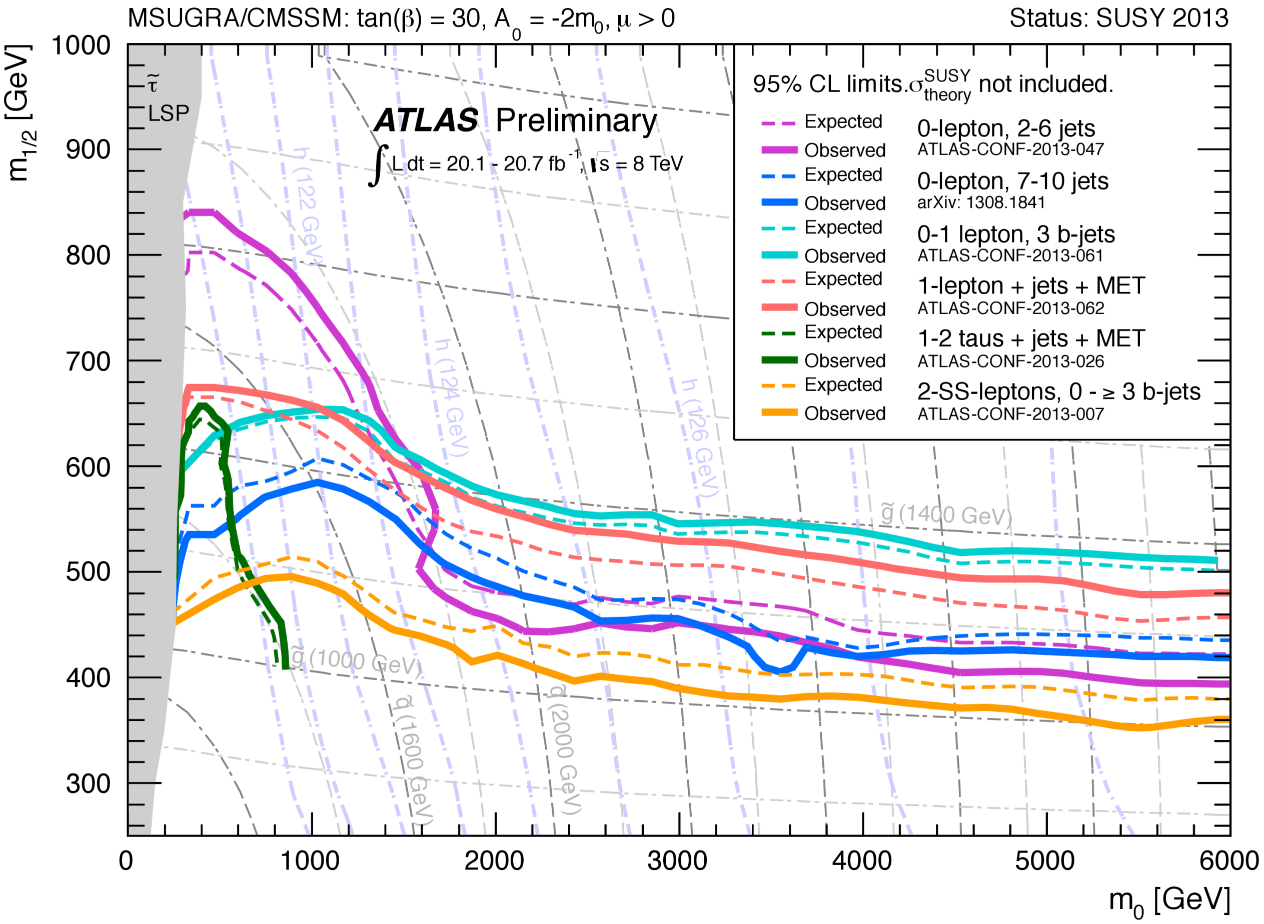


	Model	e, μ, τ, γ	Jets	E_T^{miss}	$\int \mathcal{L}\, dt[\mathrm{fb}^{-1}]$	Mass limit			Reference
Inclusive Searches	MSUGRA/CMSSM	0	2-6 jets	Yes	20.3	$\tilde{q}, \tilde{g}$	1.7 TeV	m($\tilde{q}$)=m($\tilde{g}$)	ATLAS-CONF-2013-047
	MSUGRA/CMSSM	1 e, μ	3-6 jets	Yes	20.3	$\tilde{g}$	1.2 TeV	any m($\tilde{q}$)	ATLAS-CONF-2013-062
	MSUGRA/CMSSM	0	7-10 jets	Yes	20.3	$\tilde{g}$	1.1 TeV	any m($\tilde{q}$)	1308.1841
	$\tilde{q}\tilde{q}$, $\tilde{q}\to q\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{q}$	740 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-047
	$\tilde{g}\tilde{g}$, $\tilde{g}\to q\bar{q}\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{g}$	1.3 TeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-047
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qq\tilde{\chi}_1^{\pm}\to qqW^{\pm}\tilde{\chi}_1^0$	1 e, μ	3-6 jets	Yes	20.3	$\tilde{g}$	1.18 TeV	m($\tilde{\chi}_1^0$)<200 GeV, m($\tilde{\chi}^{\pm}$)=0.5(m($\tilde{\chi}_1^0$)+m($\tilde{g}$))	ATLAS-CONF-2013-062
	$\tilde{g}\tilde{g}$, $\tilde{g}\to qq(\ell\ell/\ell\nu/\nu\nu)\tilde{\chi}_1^0$	2 e, μ	0-3 jets	-	20.3	$\tilde{g}$	1.12 TeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-089
	GMSB ($\tilde{\ell}$ NLSP)	2 e, μ	2-4 jets	Yes	4.7	$\tilde{g}$	1.24 TeV	tanβ<15	1208.4688
	GMSB ($\tilde{\ell}$ NLSP)	1-2 τ	0-2 jets	Yes	20.7	$\tilde{g}$	1.4 TeV	tanβ >18	ATLAS-CONF-2013-026
	GGM (bino NLSP)	2 γ	-	Yes	4.8	$\tilde{g}$	1.07 TeV	m($\tilde{\chi}_1^0$)>50 GeV	1209.0753
	GGM (wino NLSP)	1 $e, \mu + \gamma$	-	Yes	4.8	$\tilde{g}$	619 GeV	m($\tilde{\chi}_1^0$)>50 GeV	ATLAS-CONF-2012-144
	GGM (higgsino-bino NLSP)	γ	1 b	Yes	4.8	$\tilde{g}$	900 GeV	m($\tilde{\chi}_1^0$)>220 GeV	1211.1167
	GGM (higgsino NLSP)	2 e, μ (Z)	0-3 jets	Yes	5.8	$\tilde{g}$	690 GeV	m($\tilde{H}$)>200 GeV	ATLAS-CONF-2012-152
	Gravitino LSP	0	mono-jet	Yes	10.5	$F^{1/2}$ scale	645 GeV	m($\tilde{g}$)>10^{-4} eV	ATLAS-CONF-2012-147
3^{rd} gen. $\tilde{g}$ med.	$\tilde{g}\to b\bar{b}\tilde{\chi}_1^0$	0	3 b	Yes	20.1	$\tilde{g}$	1.2 TeV	m($\tilde{\chi}_1^0$)<600 GeV	ATLAS-CONF-2013-061
	$\tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0	7-10 jets	Yes	20.3	$\tilde{g}$	1.1 TeV	m($\tilde{\chi}_1^0$) <350 GeV	1308.1841
	$\tilde{g}\to t\bar{t}\tilde{\chi}_1^0$	0-1 e, μ	3 b	Yes	20.1	$\tilde{g}$	1.34 TeV	m($\tilde{\chi}_1^0$)<400 GeV	ATLAS-CONF-2013-061
	$\tilde{g}\to b\bar{t}\tilde{\chi}_1^+$	0-1 e, μ	3 b	Yes	20.1	$\tilde{g}$	1.3 TeV	m($\tilde{\chi}_1^0$)<300 GeV	ATLAS-CONF-2013-061
3^{rd} gen. squarks direct production	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to b\tilde{\chi}_1^0$	0	2 b	Yes	20.1	$\tilde{b}_1$	100-620 GeV	m($\tilde{\chi}_1^0$)<90 GeV	1308.2631
	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\to t\tilde{\chi}_1^{\pm}$	2 e, μ (SS)	0-3 b	Yes	20.7	$\tilde{b}_1$	275-430 GeV	m($\tilde{\chi}_1^{\pm}$)=2 m($\tilde{\chi}_1^0$)	ATLAS-CONF-2013-007
	$\tilde{t}_1\tilde{t}_1$(light), $\tilde{t}_1\to b\tilde{\chi}_1^{\pm}$	1-2 e, μ	1-2 b	Yes	4.7	$\tilde{t}_1$	110-167 GeV	m($\tilde{\chi}_1^0$)=55 GeV	1208.4305, 1209.2102
	$\tilde{t}_1\tilde{t}_1$(light), $\tilde{t}_1\to Wb\tilde{\chi}_1^0$	2 e, μ	0-2 jets	Yes	20.3	$\tilde{t}_1$	130-220 GeV	m($\tilde{\chi}_1^0$) =m($\tilde{t}_1$)-m(W)-50 GeV, m($\tilde{t}_1$)<<m($\tilde{\chi}_1^{\pm}$)	ATLAS-CONF-2013-048
	$\tilde{t}_1\tilde{t}_1$(medium), $\tilde{t}_1\to t\tilde{\chi}_1^0$	2 e, μ	2 jets	Yes	20.3	$\tilde{t}_1$	225-525 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-065
	$\tilde{t}_1\tilde{t}_1$(medium), $\tilde{t}_1\to b\tilde{\chi}_1^{\pm}$	0	2 b	Yes	20.1	$\tilde{t}_1$	150-580 GeV	m($\tilde{\chi}_1^0$)<200 GeV, m($\tilde{\chi}_1^{\pm}$)-m($\tilde{\chi}_1^0$)=5 GeV	1308.2631
	$\tilde{t}_1\tilde{t}_1$(heavy), $\tilde{t}_1\to t\tilde{\chi}_1^0$	1 e, μ	1 b	Yes	20.7	$\tilde{t}_1$	200-610 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-037
	$\tilde{t}_1\tilde{t}_1$(heavy), $\tilde{t}_1\to t\tilde{\chi}_1^0$	0	2 b	Yes	20.5	$\tilde{t}_1$	320-660 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-024
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\to c\tilde{\chi}_1^0$	0	mono-jet/c-tag	Yes	20.3	$\tilde{t}_1$	90-200 GeV	m($\tilde{t}_1$)-m($\tilde{\chi}_1^0$)<85 GeV	ATLAS-CONF-2013-068
	$\tilde{t}_1\tilde{t}_1$(natural GMSB)	2 e, μ (Z)	1 b	Yes	20.7	$\tilde{t}_1$	500 GeV	m($\tilde{\chi}_1^0$)>150 GeV	ATLAS-CONF-2013-025
	$\tilde{t}_2\tilde{t}_2$, $\tilde{t}_2\to\tilde{t}_1 + Z$	3 e, μ (Z)	1 b	Yes	20.7	$\tilde{t}_2$	271-520 GeV	m($\tilde{t}_1$)=m($\tilde{\chi}_1^0$)+180 GeV	ATLAS-CONF-2013-025
EW direct	$\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}$, $\tilde{\ell}\to\ell\tilde{\chi}_1^0$	2 e, μ	0	Yes	20.3	$\tilde{\ell}$	85-315 GeV	m($\tilde{\chi}_1^0$)=0 GeV	ATLAS-CONF-2013-049
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to\tilde{\ell}\nu(\ell\tilde{\nu})$	2 e, μ	0	Yes	20.3	$\tilde{\chi}_1^{\pm}$	125-450 GeV	m($\tilde{\chi}_1^0$)=0 GeV, m($\tilde{\ell}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_1^{\pm}$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2013-049
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to\tilde{\tau}\nu(\tau\tilde{\nu})$	2 τ	-	Yes	20.7	$\tilde{\chi}_1^{\pm}$	180-330 GeV	m($\tilde{\chi}_1^0$)=0 GeV, m($\tilde{\tau}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_1^{\pm}$)+m($\tilde{\chi}_1^0$))	ATLAS-CONF-2013-028
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to\tilde{\ell}_L\nu\tilde{\ell}_L\ell(\tilde{\nu}\nu)$, $\ell\tilde{\nu}\tilde{\ell}_L\ell(\tilde{\nu}\nu)$	3 e, μ	0	Yes	20.7	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$	600 GeV	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-2013-035
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to W\tilde{\chi}_1^0 Z\tilde{\chi}_1^0$	3 e, μ	0	Yes	20.7	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$	315 GeV	m($\tilde{\chi}_1^{\pm}$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, sleptons decoupled	ATLAS-CONF-2013-035
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\to W\tilde{\chi}_1^0 h\tilde{\chi}_1^0$	1 e, μ	2 b	Yes	20.3	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$	285 GeV	m($\tilde{\chi}_1^{\pm}$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, sleptons decoupled	ATLAS-CONF-2013-093
Long-lived particles	Direct $\tilde{\chi}_1^+\tilde{\chi}_1^-$ prod., long-lived $\tilde{\chi}_1^{\pm}$	Disapp. trk	1 jet	Yes	20.3	$\tilde{\chi}_1^{\pm}$	270 GeV	m($\tilde{\chi}_1^{\pm}$)-m($\tilde{\chi}_1^0$)=160 MeV, τ($\tilde{\chi}_1^{\pm}$)=0.2 ns	ATLAS-CONF-2013-069
	Stable, stopped $\tilde{g}$ R-hadron	0	1-5 jets	Yes	22.9	$\tilde{g}$	832 GeV	m($\tilde{\chi}_1^0$)=100 GeV, 10 μs<τ($\tilde{g}$)<1000 s	ATLAS-CONF-2013-057
	GMSB, stable $\tilde{\tau}$, $\tilde{\chi}_1^0\to\tilde{\tau}(\tilde{e}, \tilde{\mu})+\tau(e, \mu)$	1-2 μ	-	-	15.9	$\tilde{\chi}_1^0$	475 GeV	10<tanβ<50	ATLAS-CONF-2013-058
	GMSB, $\tilde{\chi}_1^0\to\gamma\tilde{G}$, long-lived $\tilde{\chi}_1^0$	2 γ	-	Yes	4.7	$\tilde{\chi}_1^0$	230 GeV	0.4<τ($\tilde{\chi}_1^0$)<2 ns	1304.6310
	$\tilde{q}\tilde{q}$, $\tilde{\chi}_1^0\to qq\mu$ (RPV)	1 μ, displ. vtx	-	-	20.3	$\tilde{q}$	1.0 TeV	1.5 <$c\tau$<156 mm, BR(μ)=1, m($\tilde{\chi}_1^0$)=108 GeV	ATLAS-CONF-2013-092
RPV	LFV $pp\to\tilde{\nu}_\tau + X$, $\tilde{\nu}_\tau\to e + \mu$	2 e, μ	-	-	4.6	$\tilde{\nu}_\tau$	1.61 TeV	λ'_{311}=0.10, λ_{132}=0.05	1212.1272
	LFV $pp\to\tilde{\nu}_\tau + X$, $\tilde{\nu}_\tau\to e(\mu) + \tau$	1 $e, \mu + \tau$	-	-	4.6	$\tilde{\nu}_\tau$	1.1 TeV	λ'_{311}=0.10, $\lambda_{1(2)33}$=0.05	1212.1272
	Bilinear RPV CMSSM	1 e, μ	7 jets	Yes	4.7	$\tilde{q}, \tilde{g}$	1.2 TeV	m($\tilde{q}$)=m($\tilde{g}$), $c\tau_{LSP}$<1 mm	ATLAS-CONF-2012-140
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to W\tilde{\chi}_1^0$, $\tilde{\chi}_1^0\to ee\tilde{\nu}_\mu$, $e\mu\tilde{\nu}_e$	4 e, μ	-	Yes	20.7	$\tilde{\chi}_1^{\pm}$	760 GeV	m($\tilde{\chi}_1^0$)>300 GeV, λ_{121}>0	ATLAS-CONF-2013-036
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\to W\tilde{\chi}_1^0$, $\tilde{\chi}_1^0\to\tau\tau\tilde{\nu}_e$, $e\tau\tilde{\nu}_\tau$	3 $e, \mu + \tau$	-	Yes	20.7	$\tilde{\chi}_1^{\pm}$	350 GeV	m($\tilde{\chi}_1^0$)>80 GeV, λ_{133}>0	ATLAS-CONF-2013-036
	$\tilde{g}\to qqq$	0	6-7 jets	-	20.3	$\tilde{g}$	916 GeV	BR(t)=BR(b)=BR(c)=0%	ATLAS-CONF-2013-091
	$\tilde{g}\to\tilde{t}_1 t$, $\tilde{t}_1\to bs$	2 e, μ (SS)	0-3 b	Yes	20.7	$\tilde{g}$	880 GeV		ATLAS-CONF-2013-007
Other	Scalar gluon pair, sgluon$\to q\bar{q}$	0	4 jets	-	4.6	sgluon	100-287 GeV	incl. limit from 1110.2693	1210.4826
	Scalar gluon pair, sgluon$\to t\bar{t}$	2 e, μ (SS)	1 b	Yes	14.3	sgluon	800 GeV		ATLAS-CONF-2013-051
	WIMP interaction (D5, Dirac χ)	0	mono-jet	Yes	10.5	M* scale	704 GeV	m(χ)<80 GeV, limit of<687 GeV for D8	ATLAS-CONF-2012-147

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

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

mSUGRA/CMSSM limits

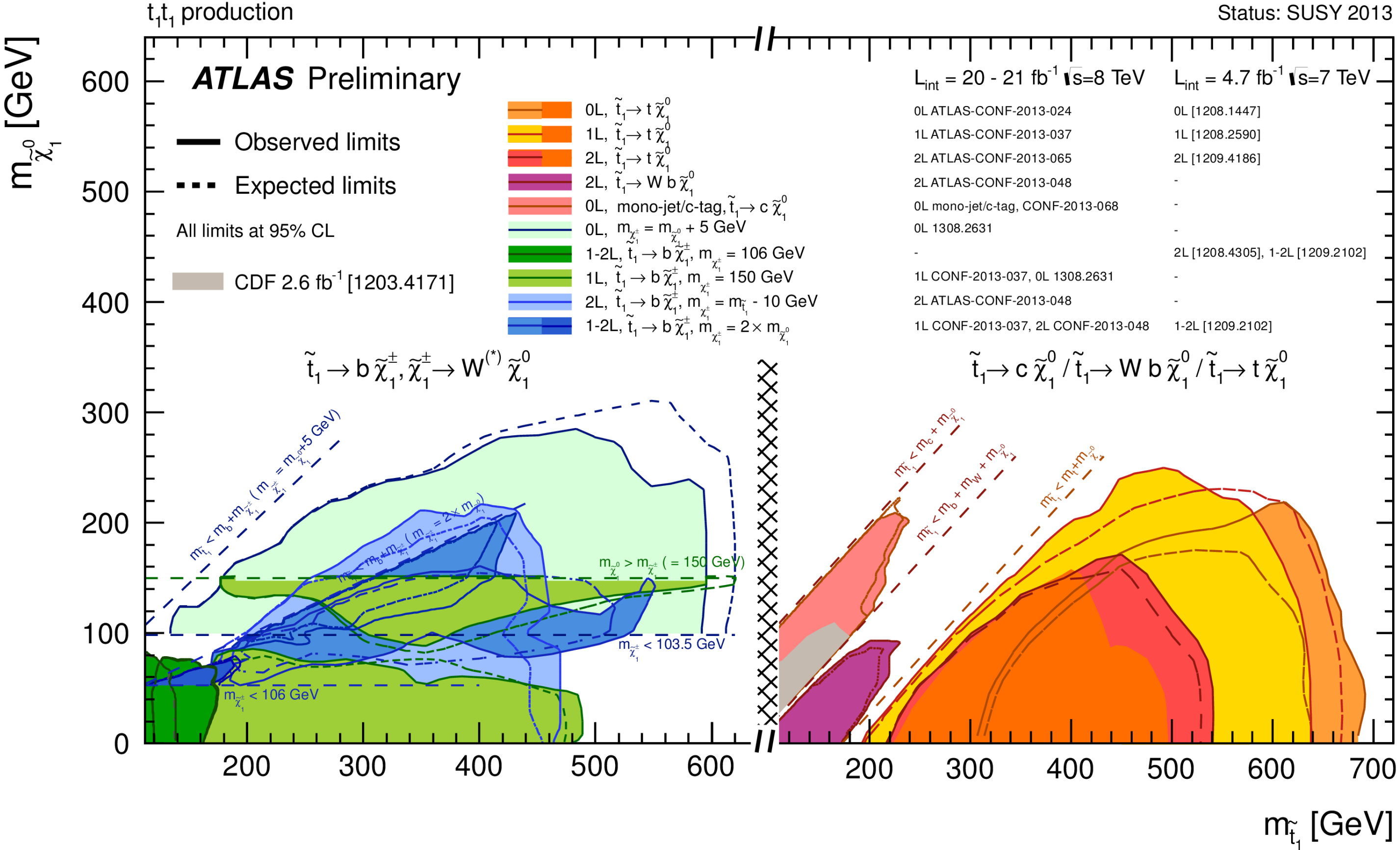


- $m(\tilde{g})>1.3$ TeV
- $m(\tilde{q})>1.7$ TeV

- Gluino limit at large m_0 from 0-1l+3b-jet analysis
- Squark limit from untagged 0-lepton analysis

Searches for direct stop production

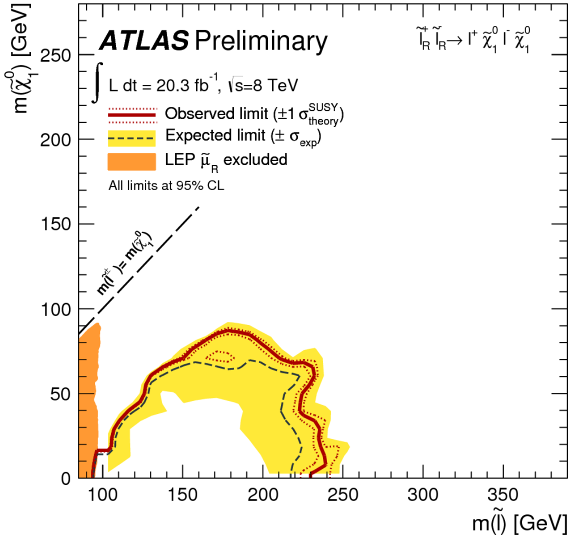
- The solution of the hierarchy problem requires light stops
- Most other superpartners are allowed to be heavy
- Dedicated program for stop and sbottom searches going on
- Maximum stop exclusion of 680 GeV, but can be significantly lower depending on mass and mixing parameters

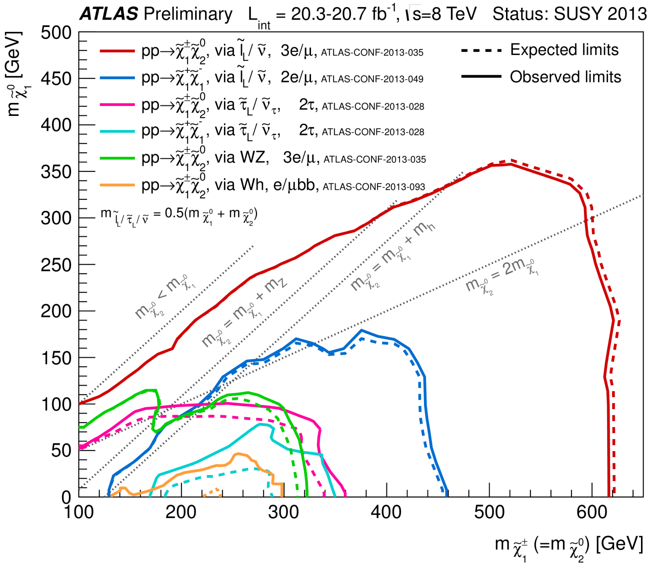


Electroweak production

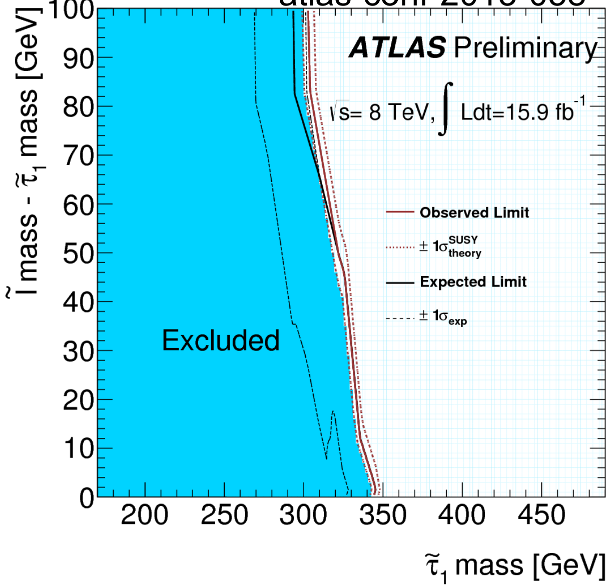
- Searches for electroweak production give chargino mass limits up to 610 GeV
- The limit on sleptons is ~230 GeV for right-handed sleptons increasing to 330 GeV for l-r mass degenerate
- These limits are only valid for a relatively large mass difference (~100 GeV) between the NLSP and the neutralino
- Stable staus (GMSB) are excluded up to 300 GeV

atlas-conf-2013-049

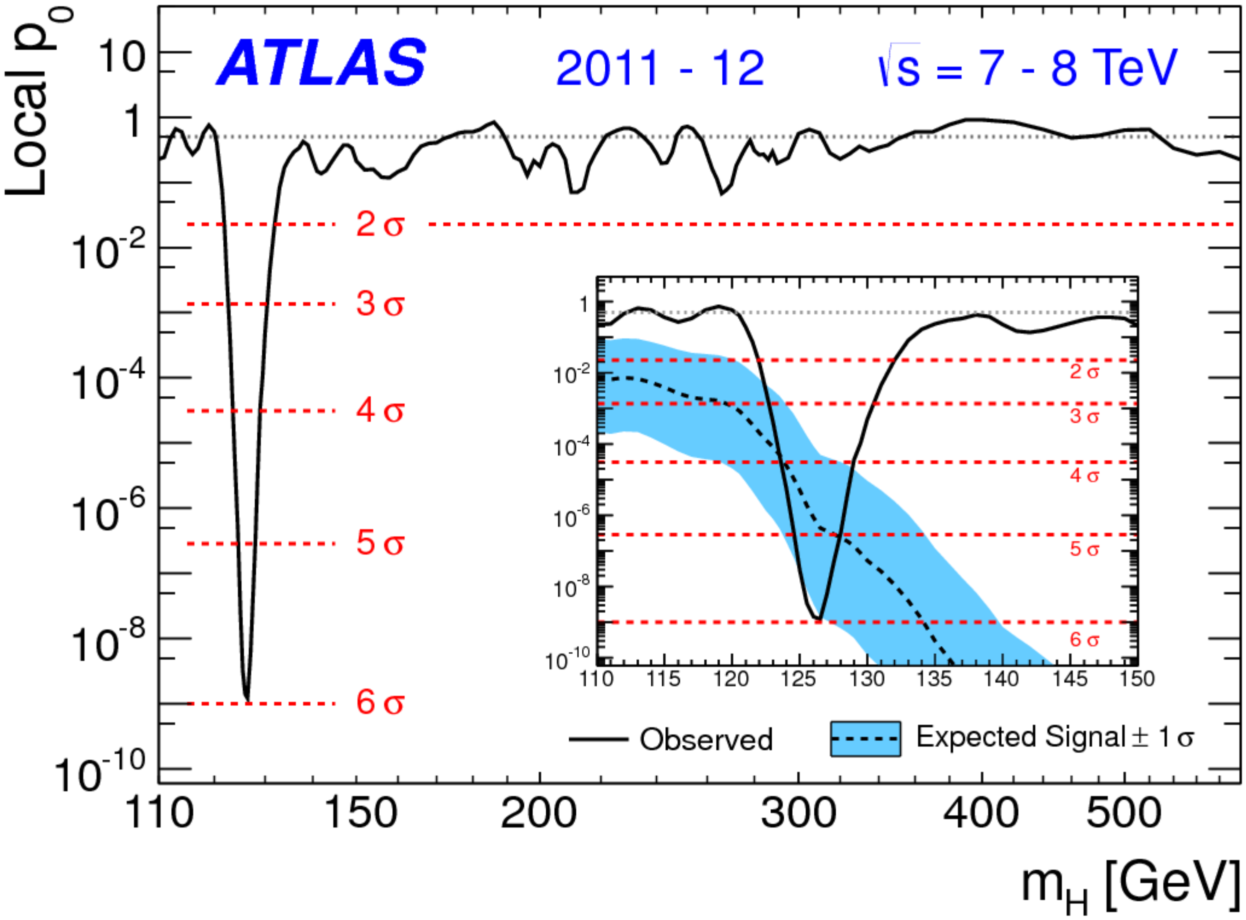




atlas-conf-2013-058



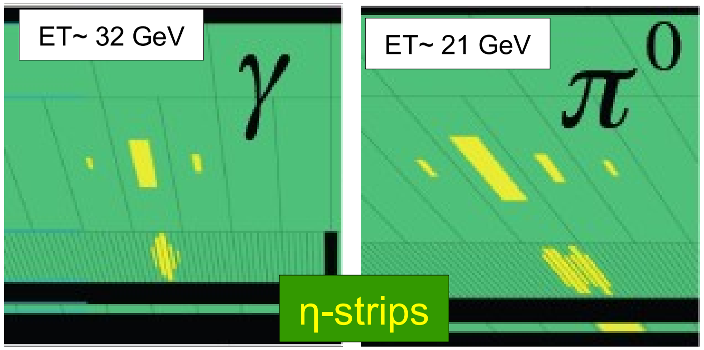
The scalar we found



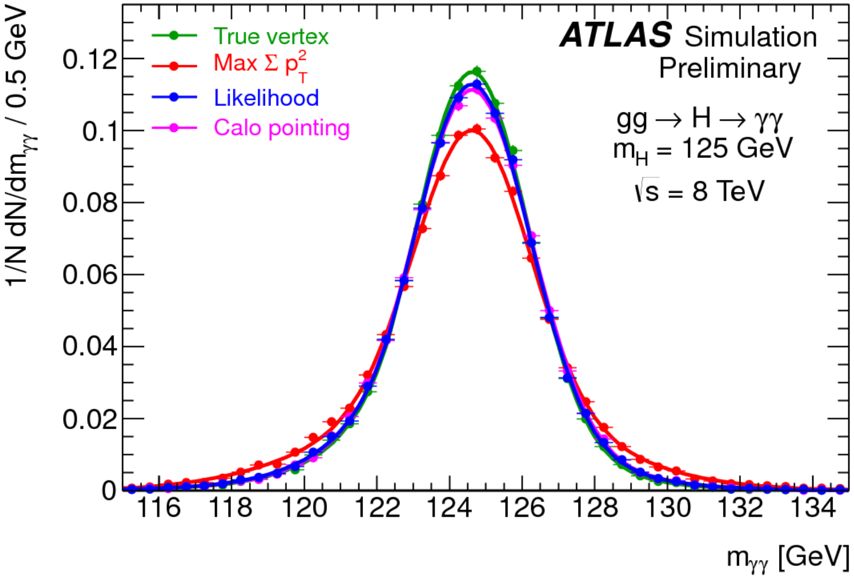
- All modes apart from H→ττ analyses use the full statistics
- Coupling studies using bosonic modes recently published
- The bosonic modes are also used for spin/CP

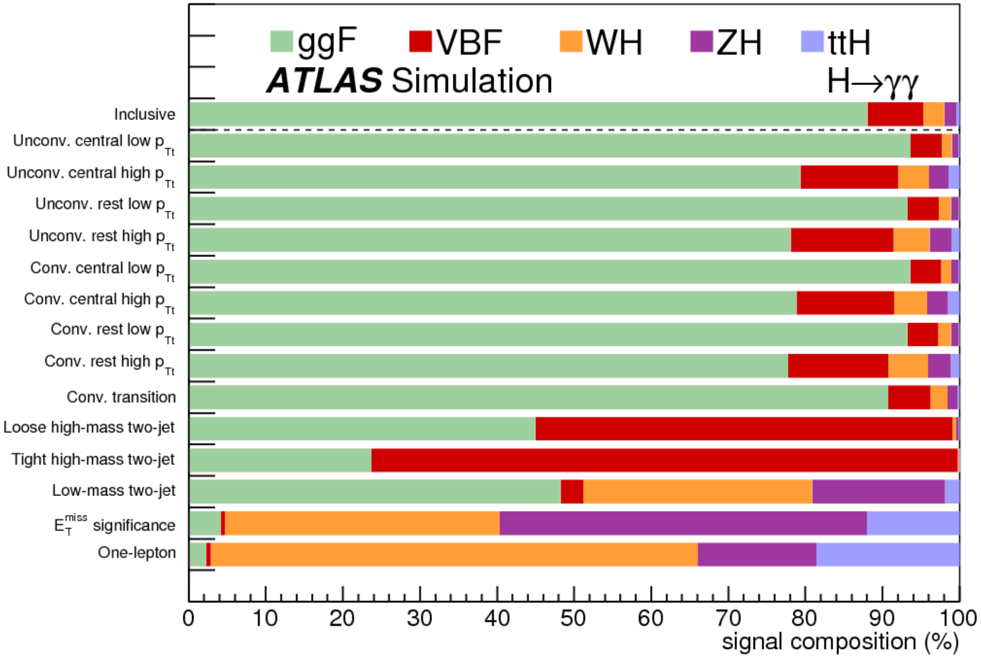
$H \rightarrow \gamma\gamma$

- High granularity in LAr EM calorimeter allows for mass resolution independent of primary vertex (and pile-up) and suppresses reducible γj-background to 25% level



- Categorisation according to conversion status, p_T, additional jets/leptons increases sensitivity and separates production modes



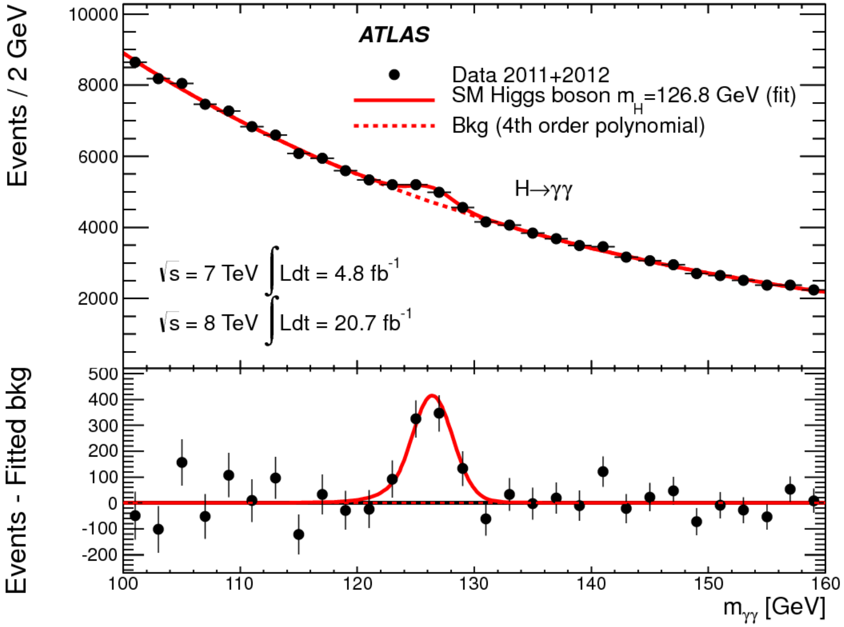


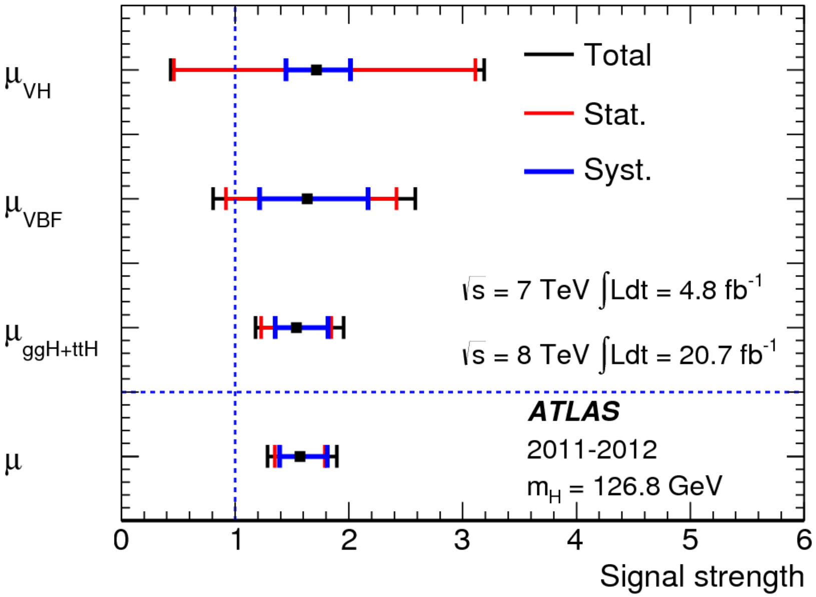
H→γγ (ii)

arxiv:1307.1427

- ATLAS sees 7.4σ signal significance (4.3σ exp.)
- This establishes the Higgs in a single channel
- The μ-values for all production modes are slightly high (but compatible with unity)

$$\begin{aligned}\mu = 1.55 \quad & \pm \quad 0.23(\mathrm{stat}) \\ & \pm \quad 0.15(\mathrm{syst}) \\ & \pm \quad 0.15(\mathrm{theo})\end{aligned}$$

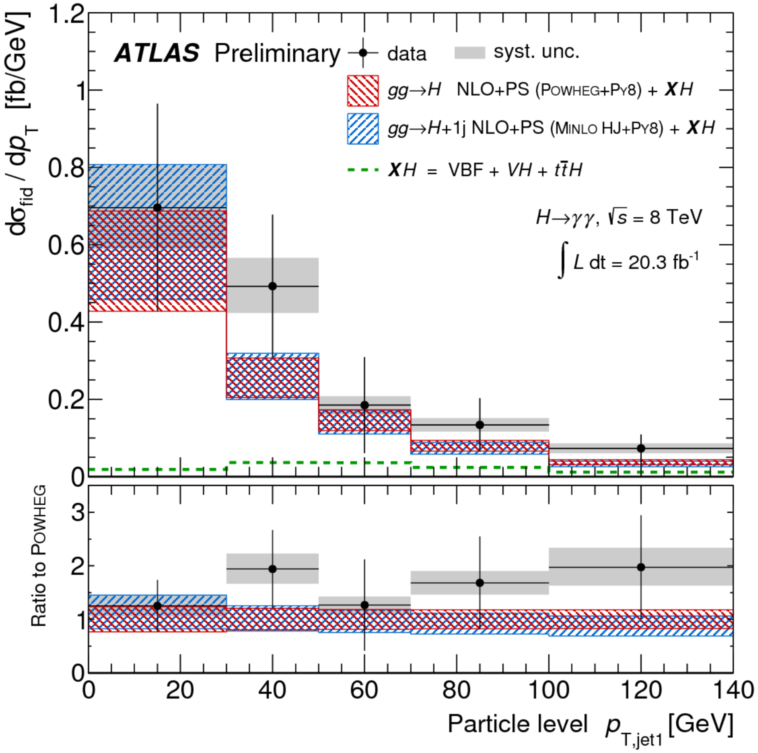


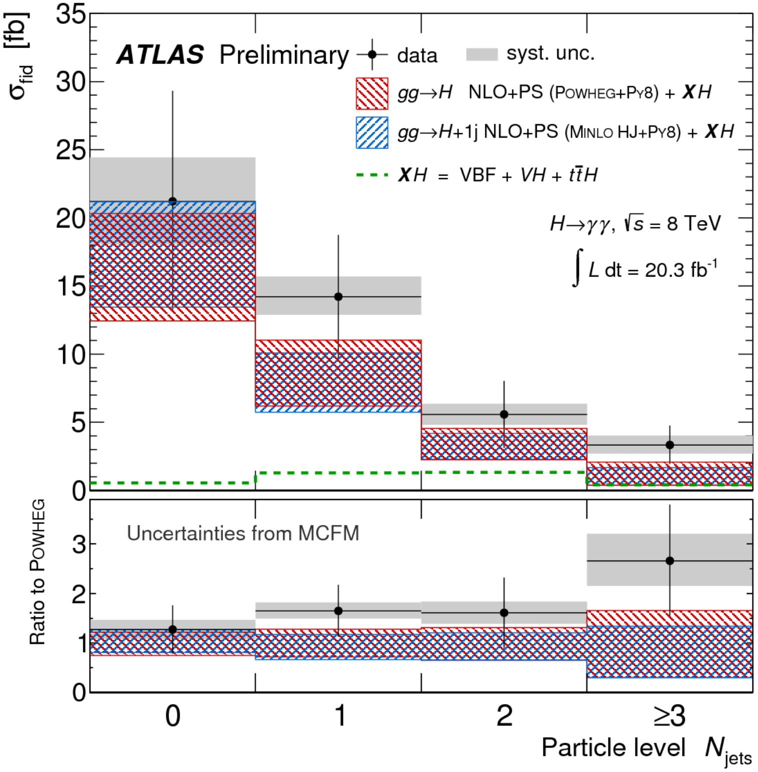


Differential cross section

atlas-conf-2013-072

- The clear signal in H→$\gamma\gamma$ allows the measurement of a differential cross section
- The analysis is done inclusively and dominated by ggF
- Results are presented at the particle level
- There is good agreement with the prediction P(χ^2)>0.3

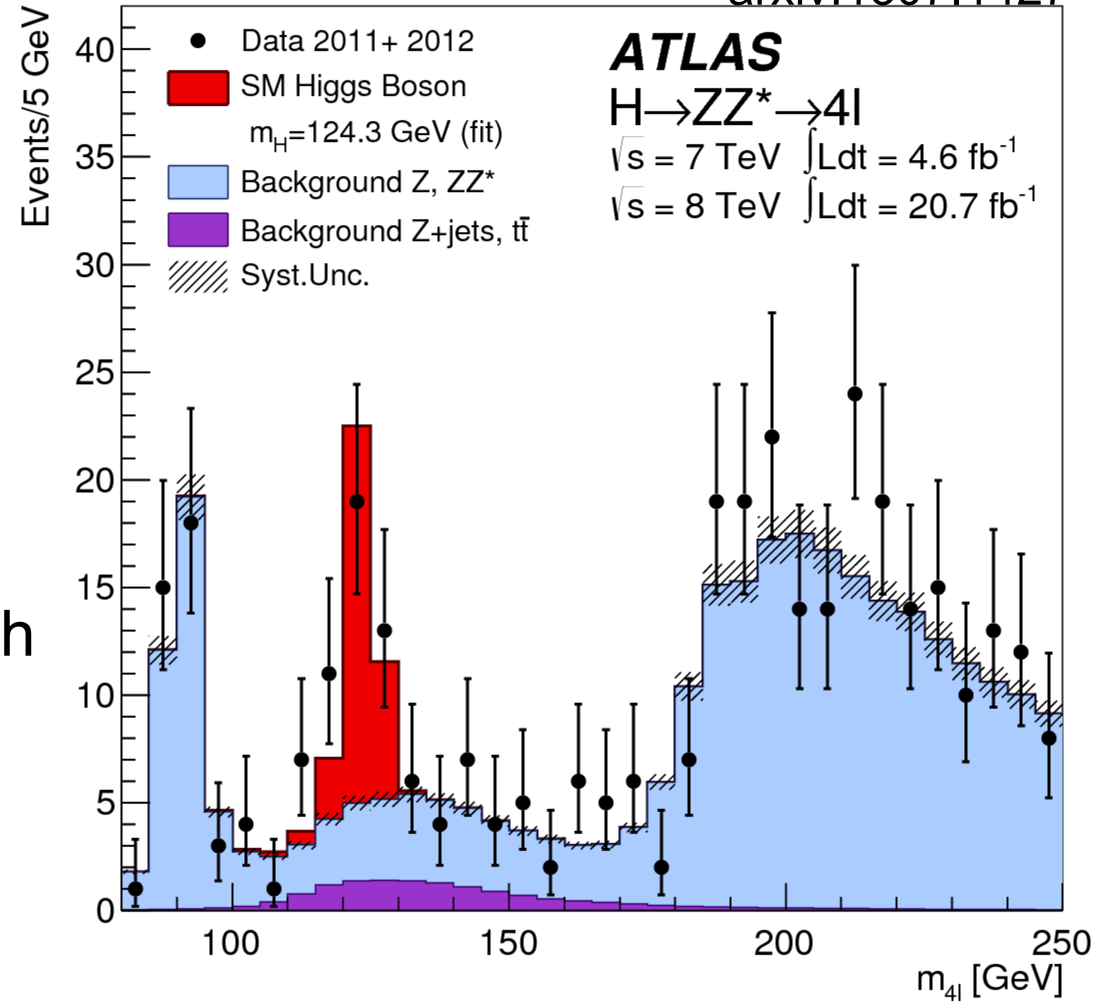




H→ZZ→4l

- Almost background free signal, bg mainly irreducible pp→ZZ
- Clear signal, consistent with SM for Z→4l
- Signal significance 6.6σ (4.4σ exp.)
- μ=1.5±0.4 consistent with SM prediction

arxiv:1307.1427

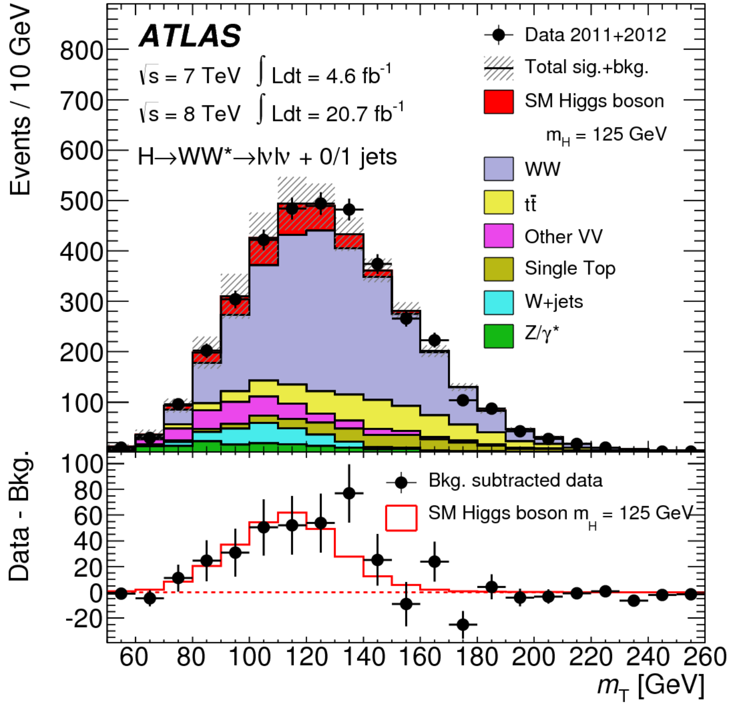


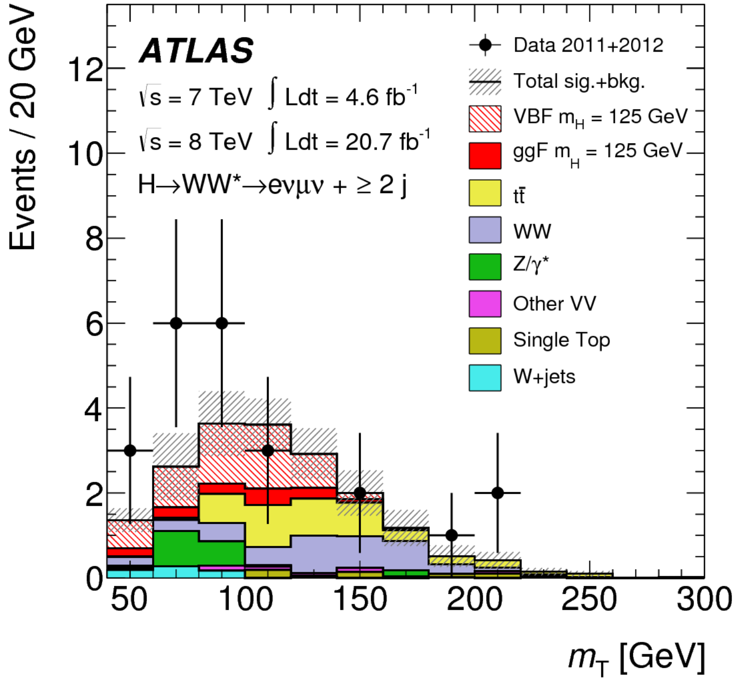
H→WW→2l2ν

- 2 neutrinos → no mass peak→ need well understood background
- SM WW background can be suppressed by angular correlations of leptons
- Analysis separated in jet multiplicity
- Sensitivity is highest for DF and 0-jets, but all jet bins and SF are also considered
- 0 jets: bg. mainly WW
- Significance 3.8σ (3.6σ exp.)

$$\begin{aligned} \mu = 1.01 \quad &\pm \quad 0.21(\mathrm{stat}) \\ &\pm \quad 0.12(\mathrm{syst}) \\ &\pm \quad 0.19(\mathrm{theo}) \end{aligned}$$

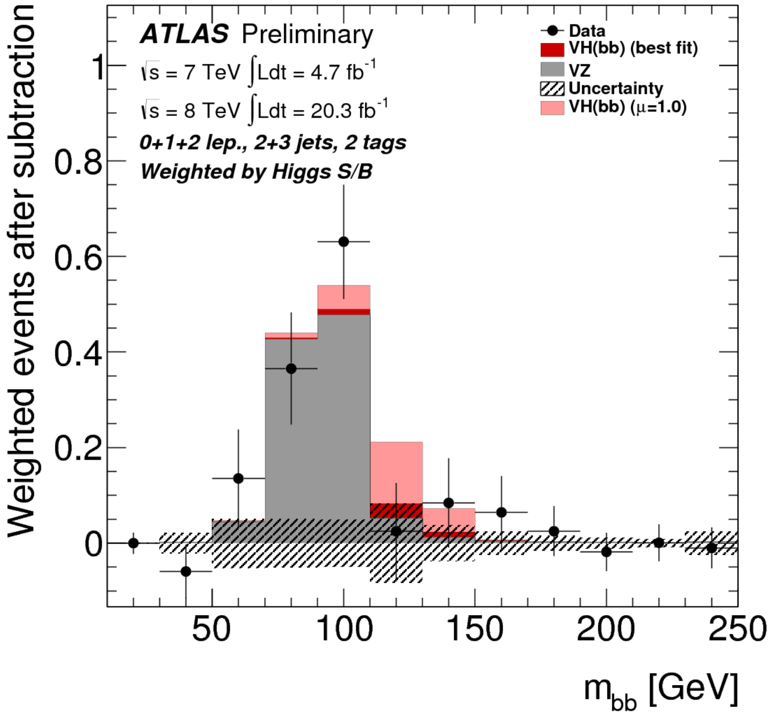
arxiv:1307.1427

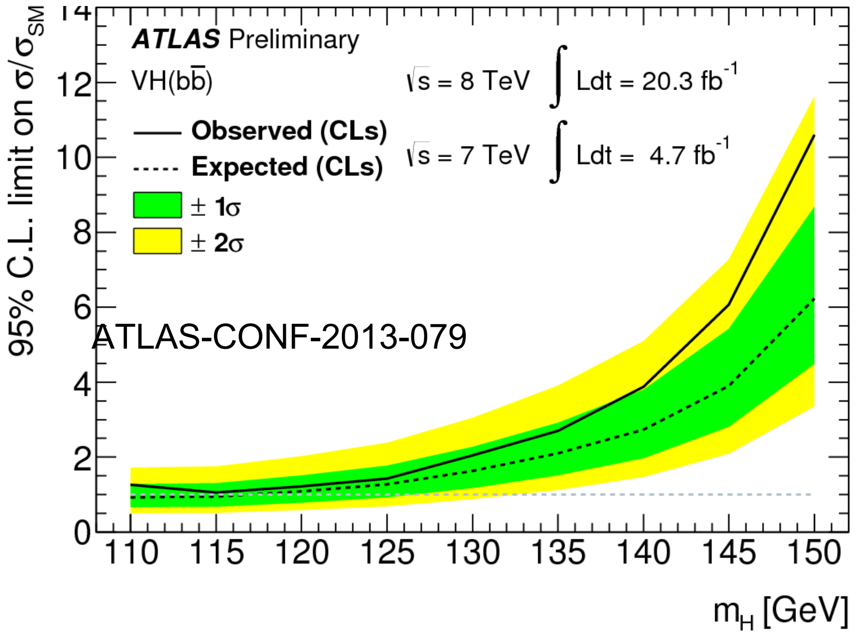




VH→Vb$\bar{b}$

- ggF H→b$\bar{b}$ completely buried under QCD bg.
- Can use lepton or high MET signature from VH→Vb$\bar{b}$ instead
- Enhance signal/bg. by going to boosted topology
- ATLAS finds low value of μ=0.2±0.5±0.4 caused in part by downward fluctuation in 2011 data
- VZ→Vb$\bar{b}$ seen with 5σ significance and consistent with SM



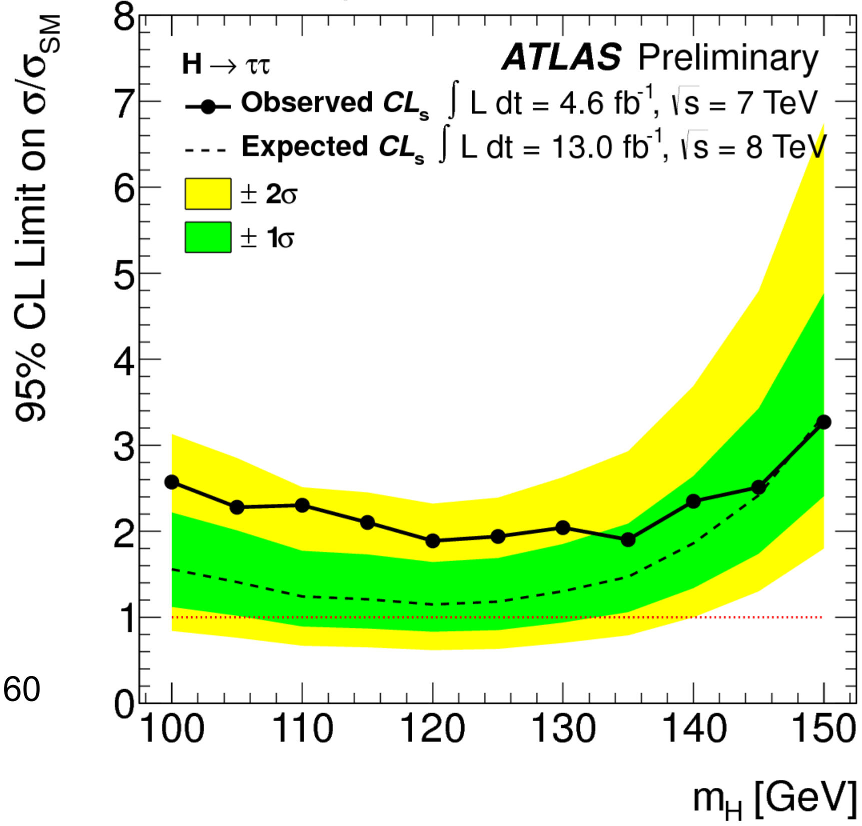


ATLAS-CONF-2013-079

atlas-conf-2013-079

H→ττ

- Analysis still only on partial dataset
- Split according to τ-decay modes: lvvlvv, hvlvv, hvhv
- Categorisation according to jet-multiplicity, ττ-p_T
- Mass resolution profits from larger ττ-p_T → analysis more sensitive to VBF
- No conclusive signal yet: $\mu=0.7\pm0.7$

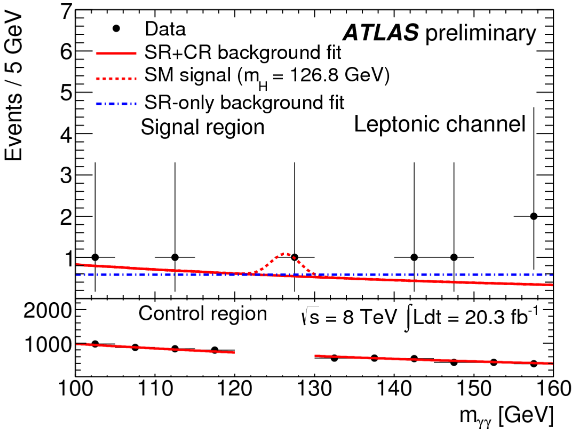


ATLAS-CONF-2012-160

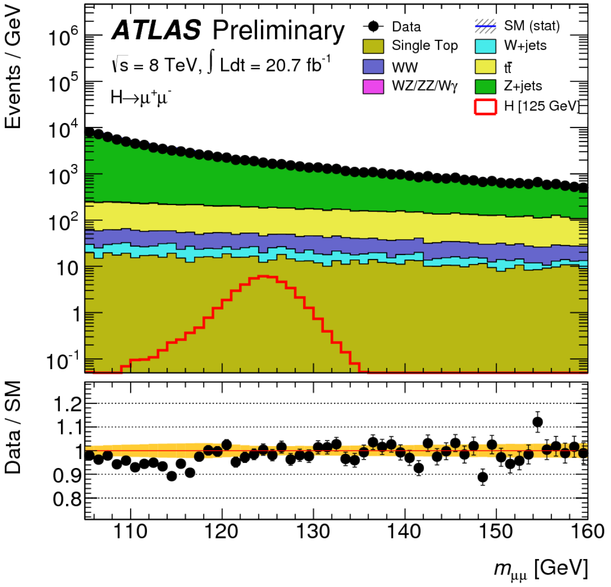
Searches for rare modes

- ATLAS searched for several rare modes
- Limits (95% C.L. meas(exp. no Higgs)):
  - ttH (H→γγ): μ<5.3(6.4)
  - H→μμ: μ<9.8(8.2)
  - H→Zγ: μ<18.2(13.5) ATLAS-CONF-2013-009
  - H→inv.: BR(H→inv)<65%(84%)
  - t→cH: BR(t→cH)<0.83%(0.53%)

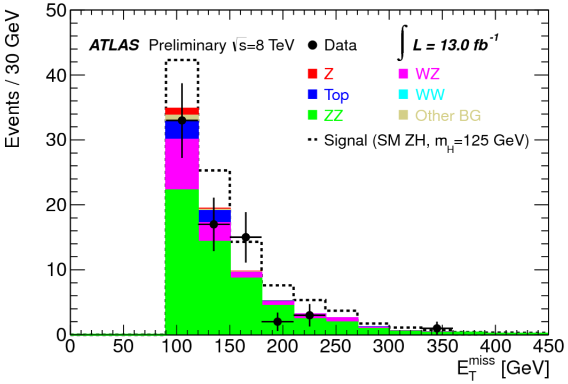
ATLAS-CONF-2013-080



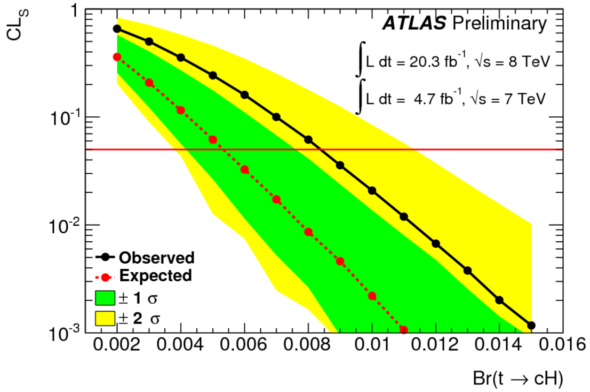
ATLAS-CONF-2013-010



ATLAS-CONF-2013-011



ATLAS-CONF-2013-081



The mass of the Higgs boson

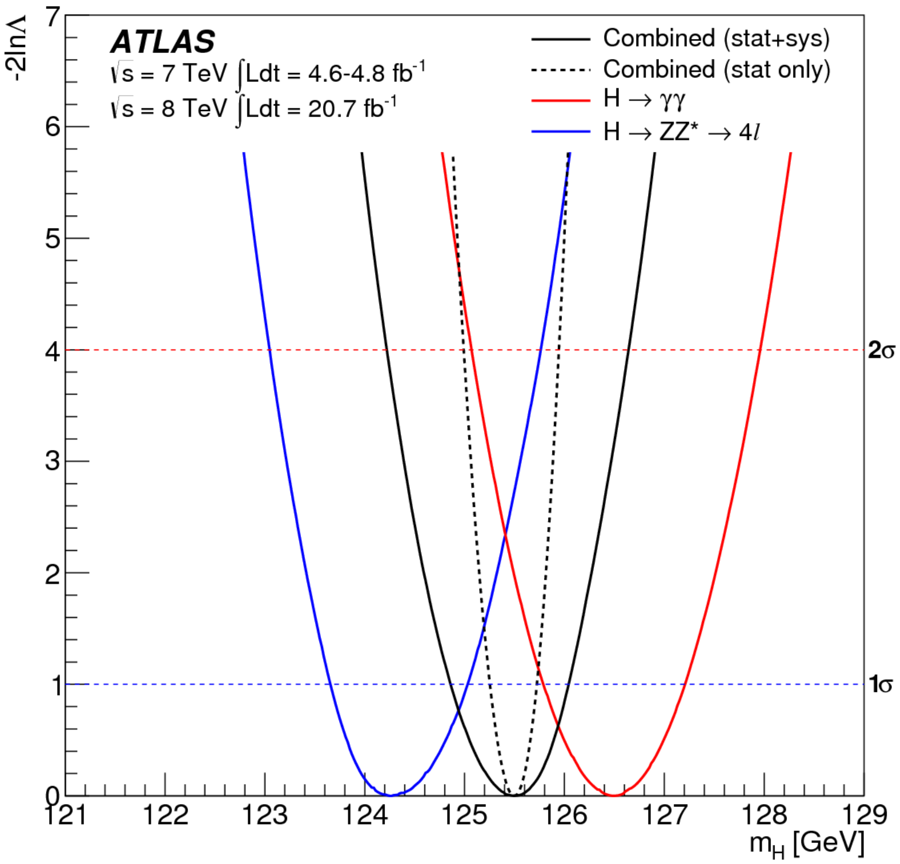
- The mass can be obtained in an (almost) model independent way from the two high resolution channels H→γγ and H→ZZ

$$m_H = 125.5 \pm 0.2 \pm 0.6\,\mathrm{GeV}$$

- Mass difference between the two modes:

$$\Delta m_H = 2.3^{+0.6}_{-0.7} \pm 0.6\,\mathrm{GeV}$$

- This corresponds to 2.4σ (1.5% probability)

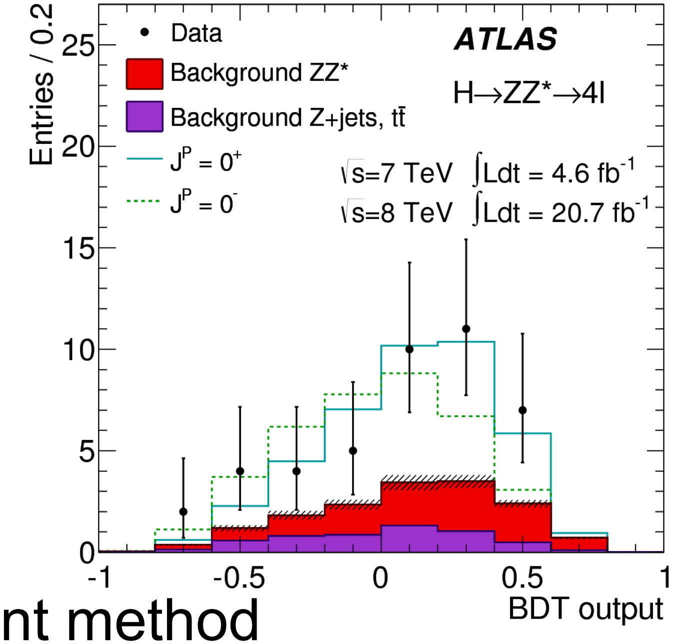


arxiv:1307.1427

Spin and CP of the new boson

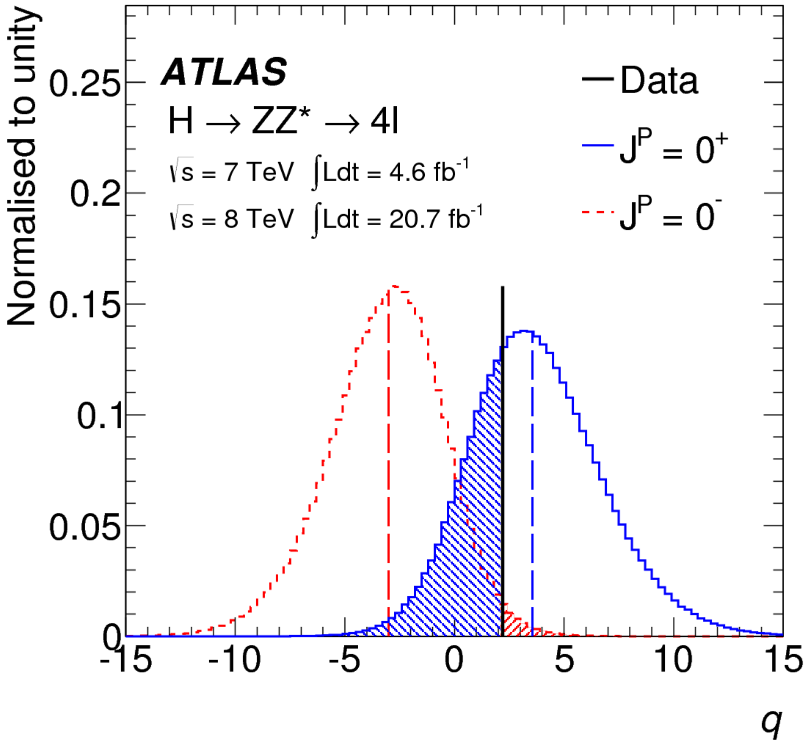
arxiv:1307.1432

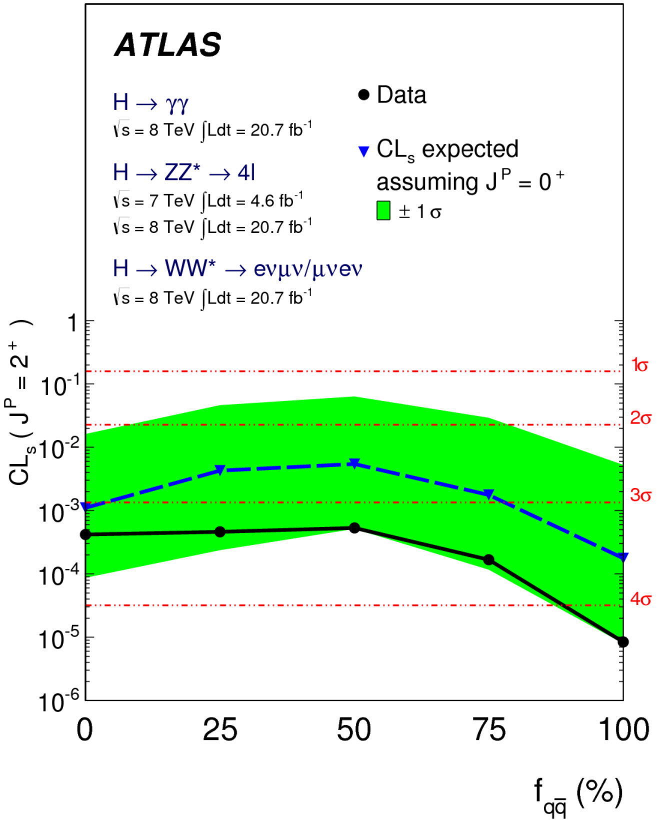
- From the observation of H→γγ one knows that the new particle cannot have J=1 (Landau Yang theorem)
- In general J^P can be measured from the decay angles
- For J≠0 also the production mode (gg, $q\bar{q}$) influences the decay angles
- H→WW→lνlν:
  - several variables (φ_{ll}, m_{ll}) sensitive to J^P, combined with BDT
- H→ZZ→4l:
  - full final state sensitive to J^P can be reconstructed
  - combined in BDT or with matrix element method
- H→γγ:
  - cos(θ*) is sensitive to J, if J=0 no sensitivity to P



Spin and CP (ii)

- Hypotheses tested pair-wise with log likelihood ratio
- 0^- excluded with 97.8% C.L. (CLs) wrt. to 0^+ (99.3% exp.)
- For J=2 use minimal coupling, graviton inspired model
- Using WW(ZZ) and $\gamma\gamma$ complementarity J=2 model excluded with >99.9% C.L. over full range!





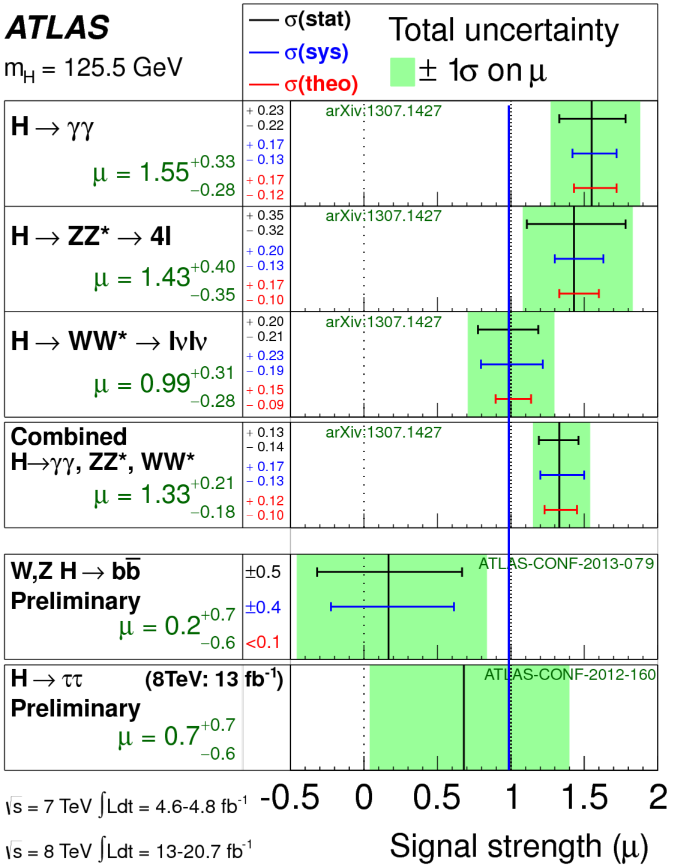
Higgs couplings

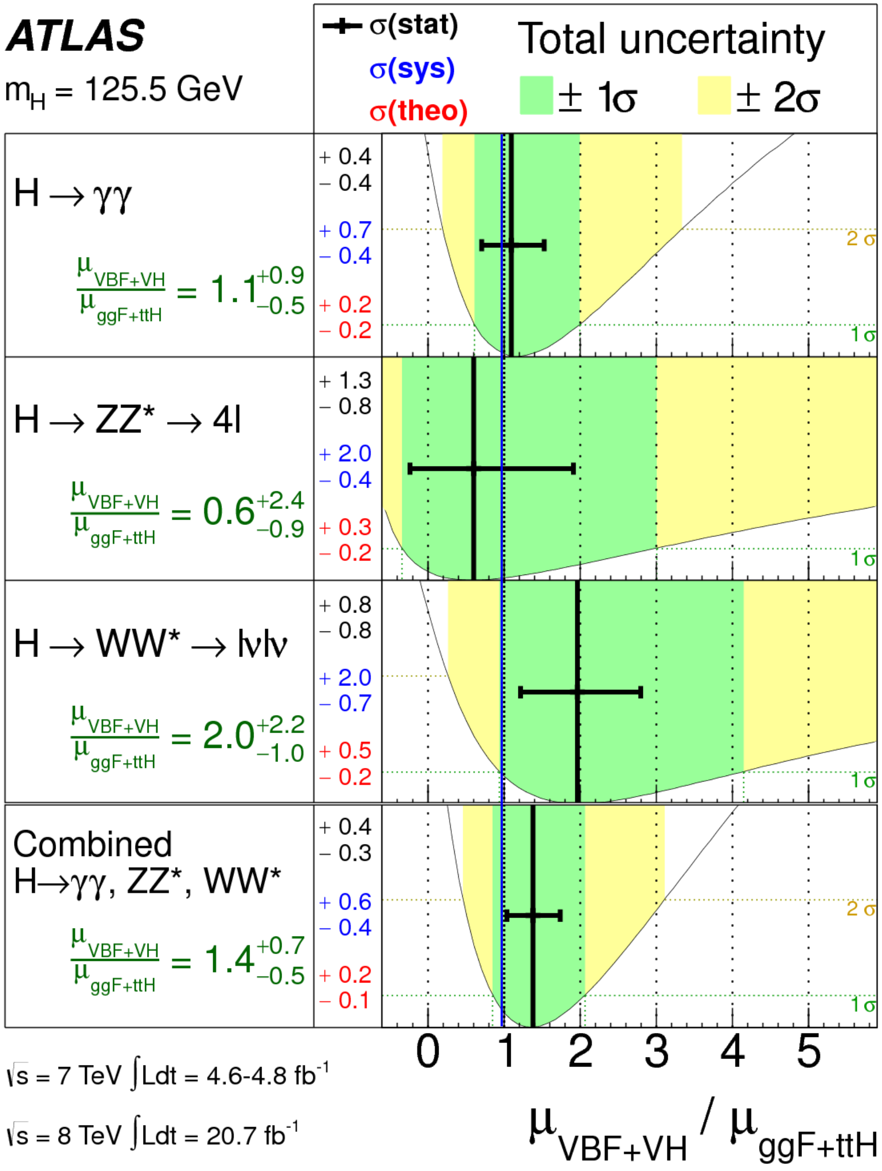
arxiv:1307.1427

- A single Higgs cross section is proportional to $\Gamma_i\Gamma_f/\Gamma_H$
- There is no model independent way to measure the Higgs width and consequently the partial widths
- Model independent measurements:
  - measure cross sections and express results as $\mu=\sigma_{meas}/\sigma_{SM}$
  - from fits to different categories can get ratio of partial widths of initial state
  - from ratio of different analyses can get ratio of partial widths of final state
- Any further interpretation needs model assumptions!

Model independent results

- μ consistent with 1 in all modes
- Combined: $\mu=1.23\pm0.18$
- VBF production established at 3.3σ

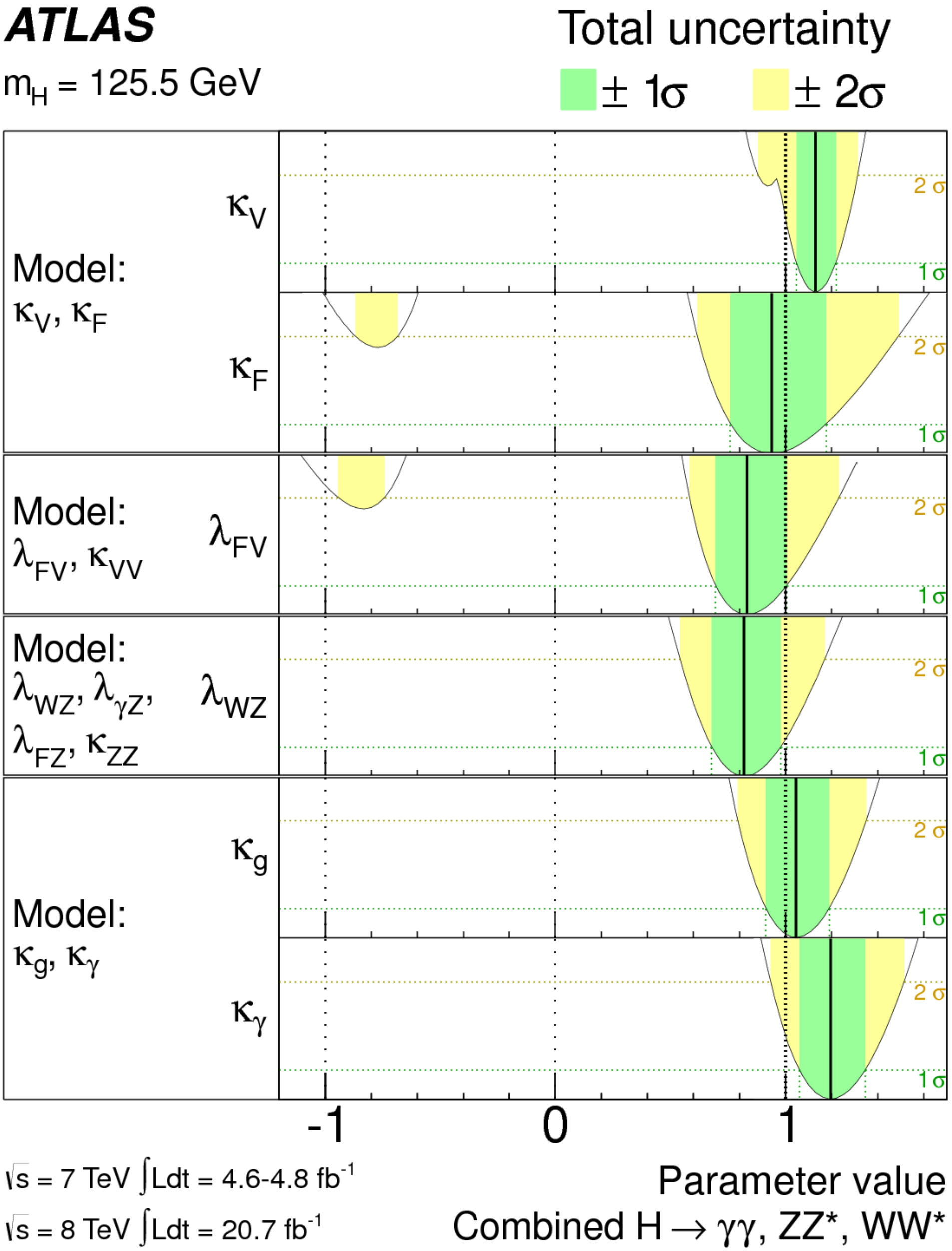




Further fits

- Fit coupling scale factors κ_i
- Fit some factors and set the others the their SM expectation
- If κ_i are fitted assume no new direct Higgs decays
- For fit of κ_V and κ_F assume no new particles in loop couplings
- Fits:
  - Fermion and boson couplings or their ratio ($\kappa_F(=\kappa_b=\kappa_t=\kappa_\tau...), \kappa_V(=\kappa_W=\kappa_Z)$)
  - Custodial symmetry W/Z
  - Loop couplings to g and γ
- All fits agree with SM prediction

$\kappa_{ij}=\kappa_i\kappa_j/\kappa_H^2, \lambda_{ij}=\kappa_i/\kappa_j$



Conclusions

- ATLAS was running well in 2011/2012 and most results contain already the full dataset
- The new particle discovered on July 4, 2012 should be discussed at SCALARS 20nn
- All properties agree with the prediction for a Standard Model Higgs boson with a typical precision of 15%
- Unfortunately no other scalars are found up to now with exclusions up to the TeV scale
- However we start running again 2015 with a factor ~1.75 larger energy and a correspondingly larger search window, so there remains hope...