PHOTON 2015
BINP, Novosibirsk

Highlights from the ATLAS Experiment

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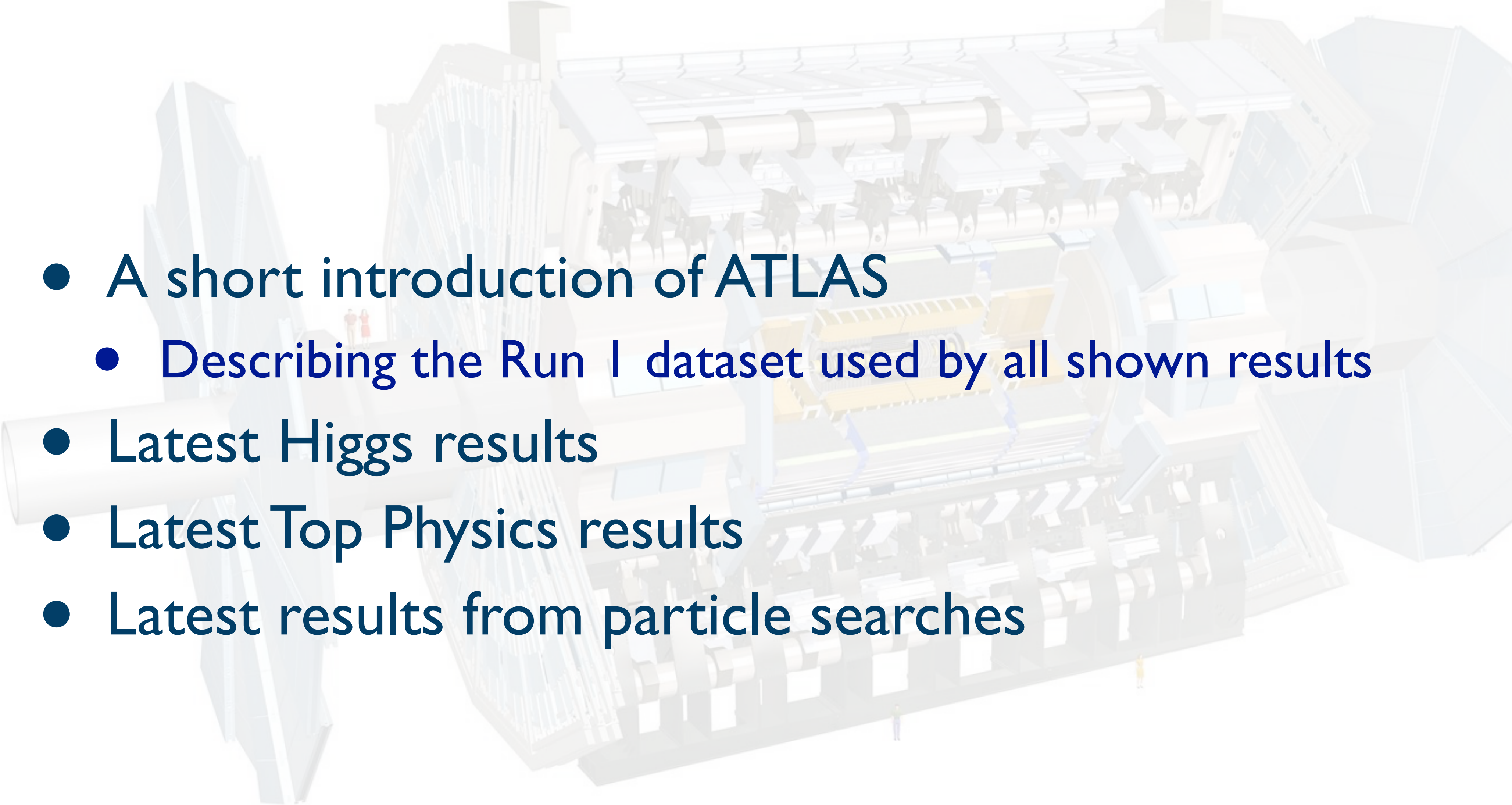
for the ATLAS Collaboration

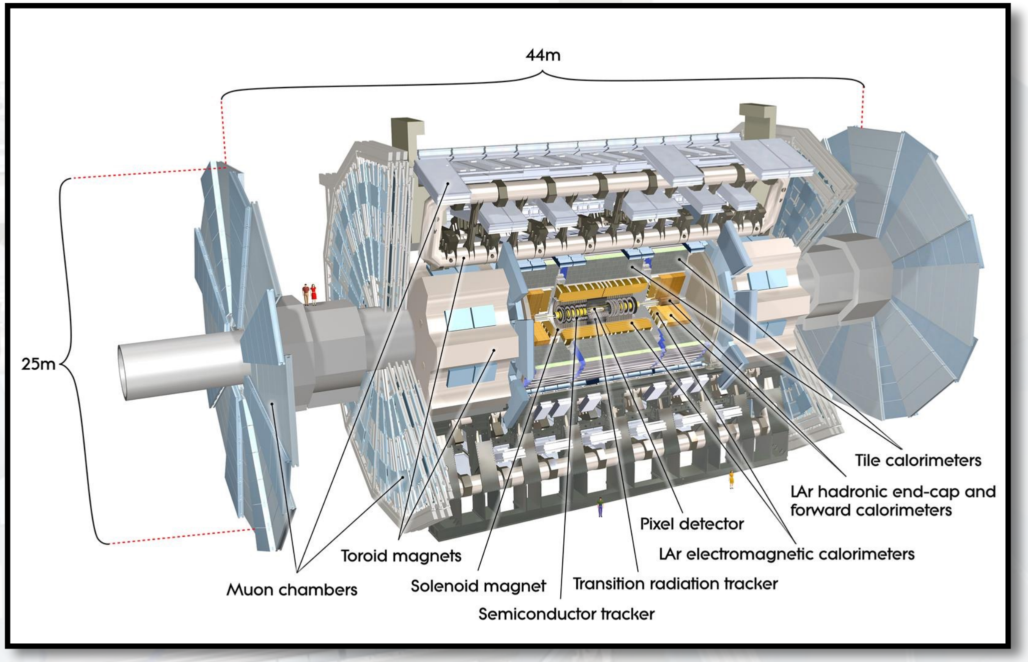
Overview

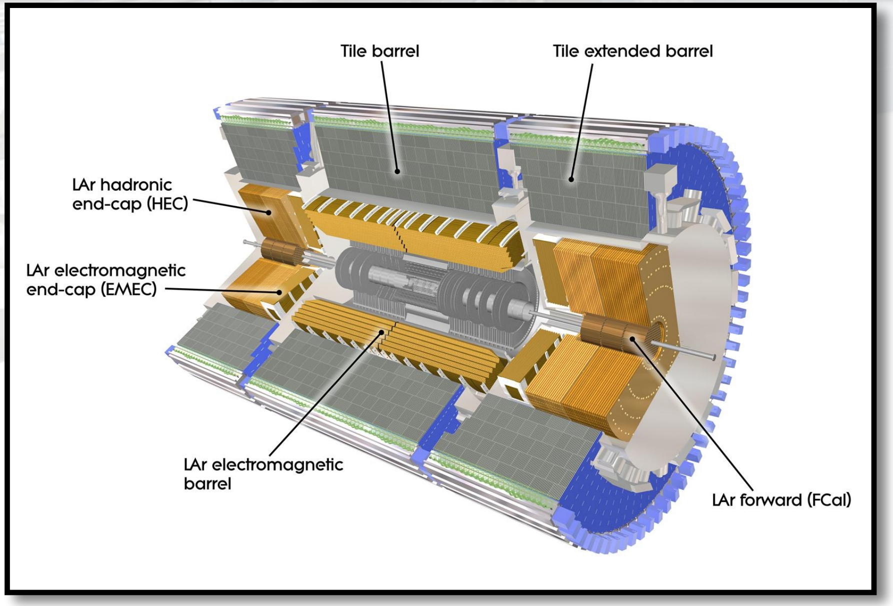


- A short introduction of ATLAS
    - Describing the Run I dataset used by all shown results
- Latest Higgs results
- Latest Top Physics results
- Latest results from particle searches

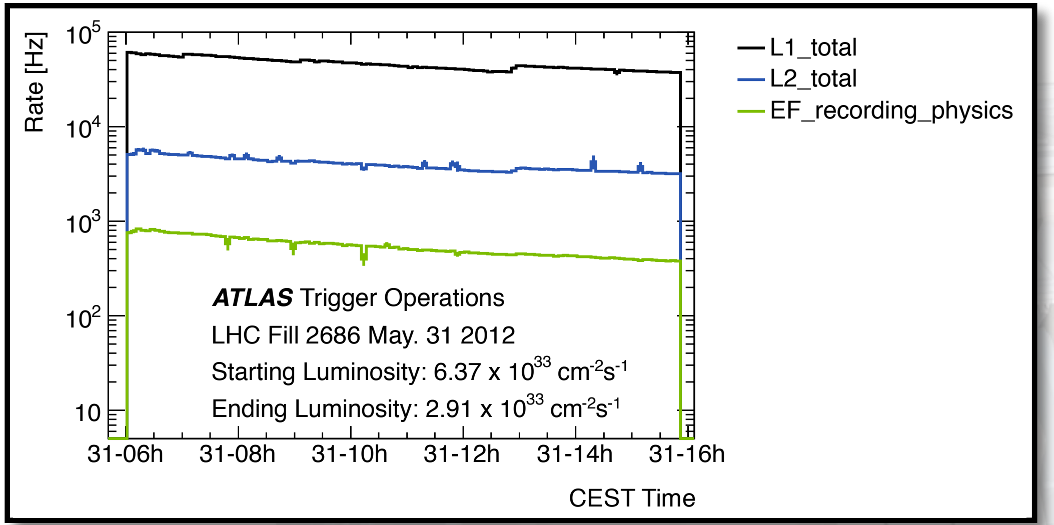
The ATLAS Experiment

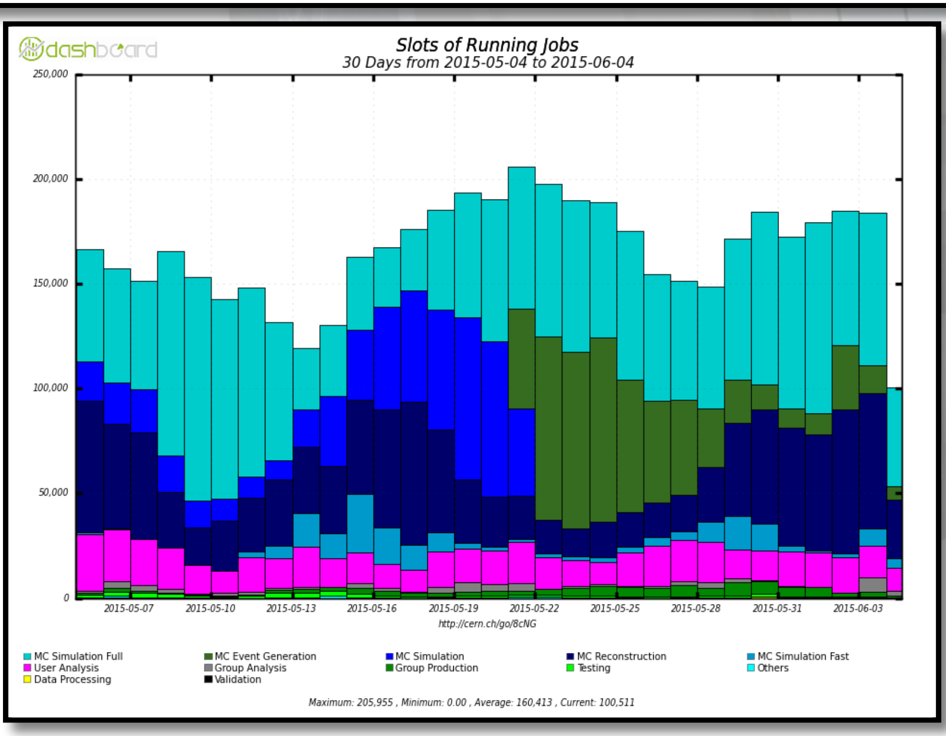
- Is one of the general purpose experiments at the Large Hadron Collider
  - Designed to be able to study a very wide range of physics processes
- Was built and is operated in the collaboration of >3000 people
  - Making it one of the largest scientific collaborations





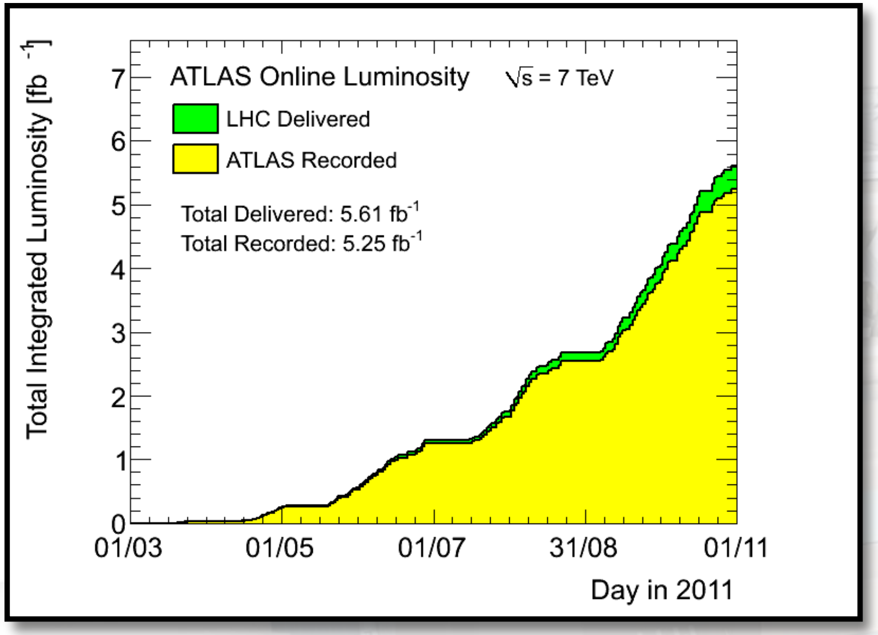
The ATLAS Experiment

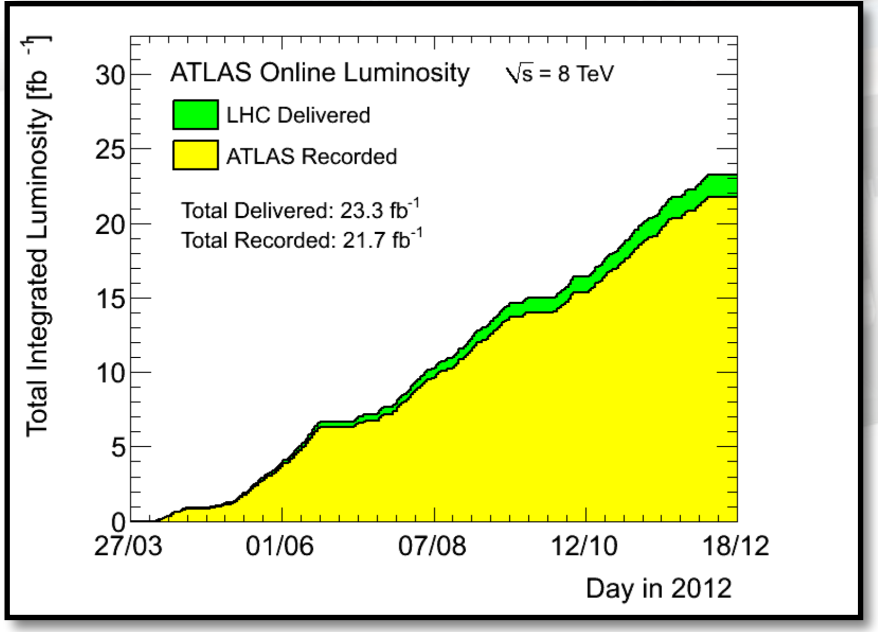




- Uses a multi-level trigger system to select interesting events from O(20MHz) of p-p bunch crossings
  - In Run 1 collected events for physics analysis with ~400 Hz. Is now raised to ~1 kHz for Run 2.
  - Interesting events are selected by searching for O(1k) different signatures
- Events collected at CERN are first reconstructed in CERN's Tier 0 computing centre, and then distributed around the world
  - The petabytes of data are then processed/analysed by O(200k) CPUs around the world

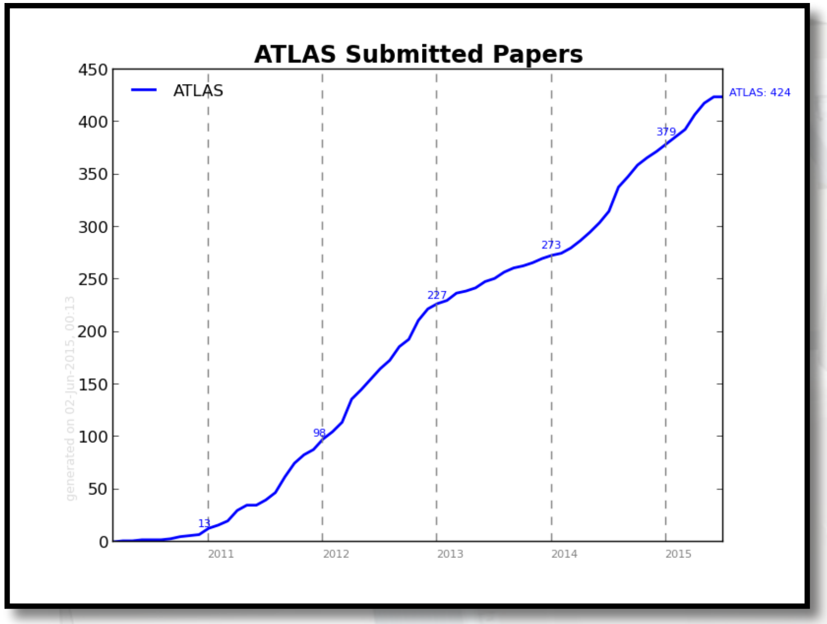
Run 1 Data Taking

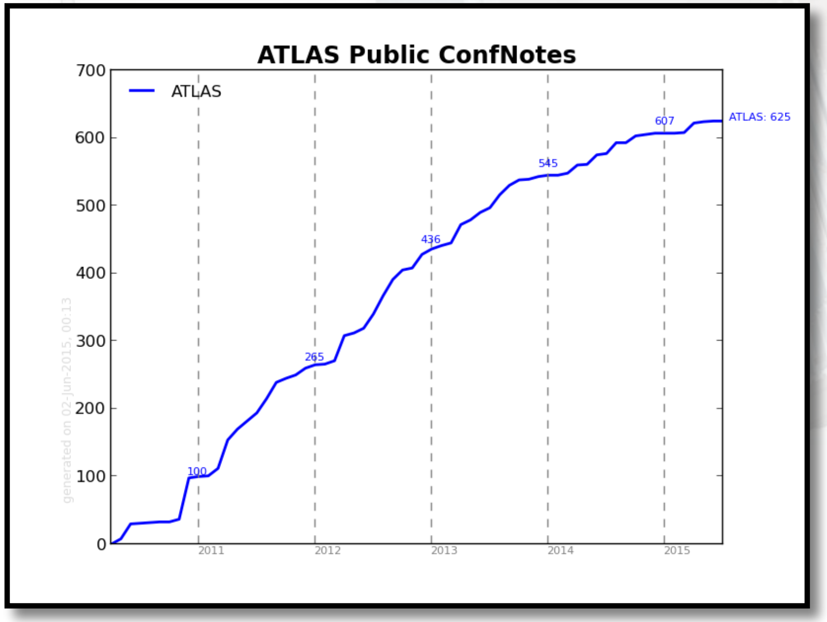




- LHC's Run 1 lasted from 2009 until the beginning of 2013
  - With most of the p-p data collected in 2011-2012
  - ATLAS collected ~25 fb^{-1} of good quality data in this period
- The Run 1 dataset is the source for all public ATLAS results so far
  - The first Run 2 results will start coming out soon

Published Papers



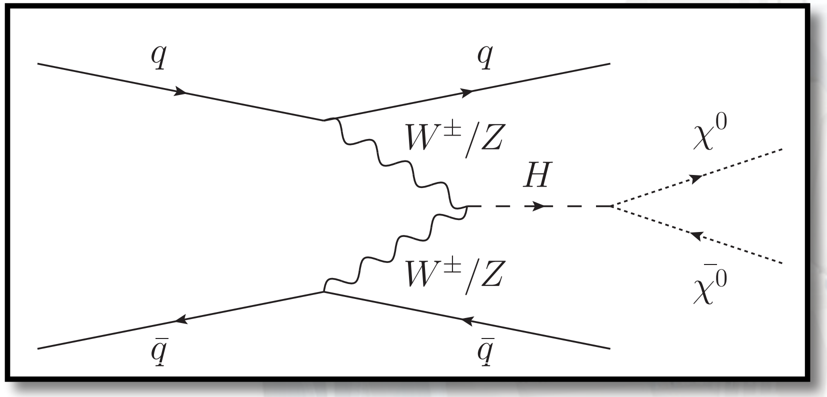


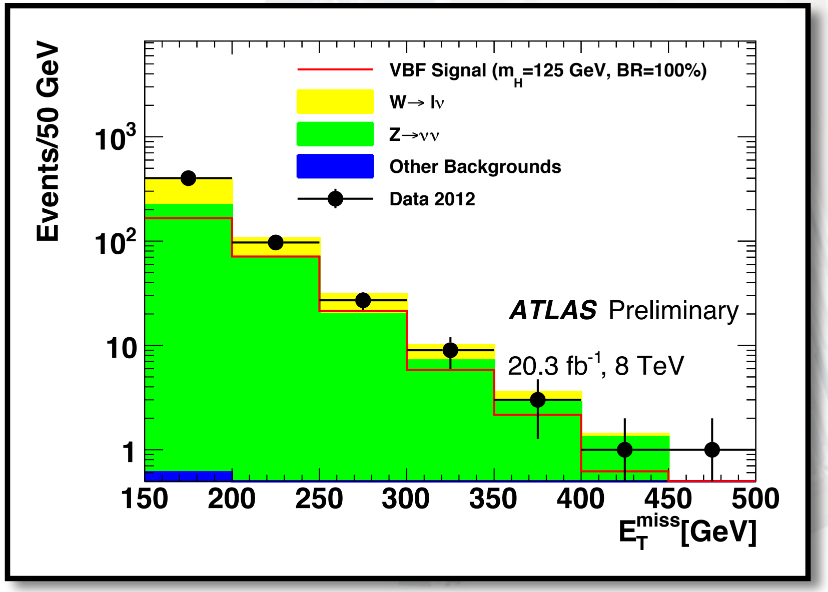
- Many papers were submitted to journals, just this year
  - Can’t present results from all of them today
- Will just be selecting some of the most interesting results in the talk
- For a list of all the material published by ATLAS, visit:

https://twiki.cern.ch/twiki/bin/view/AtlasPublic

Invisible Higgs Decay via VBF

ATL-CONF-2015-004



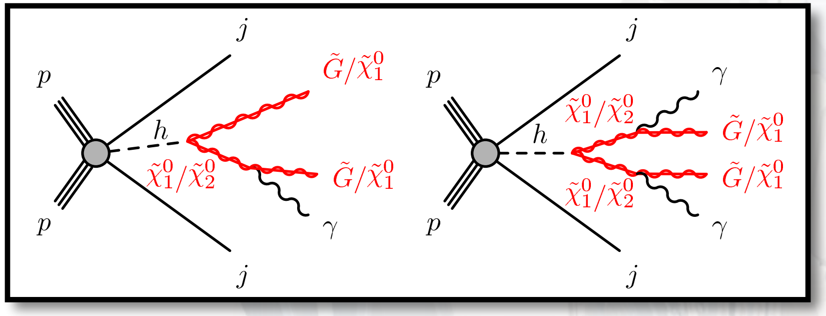


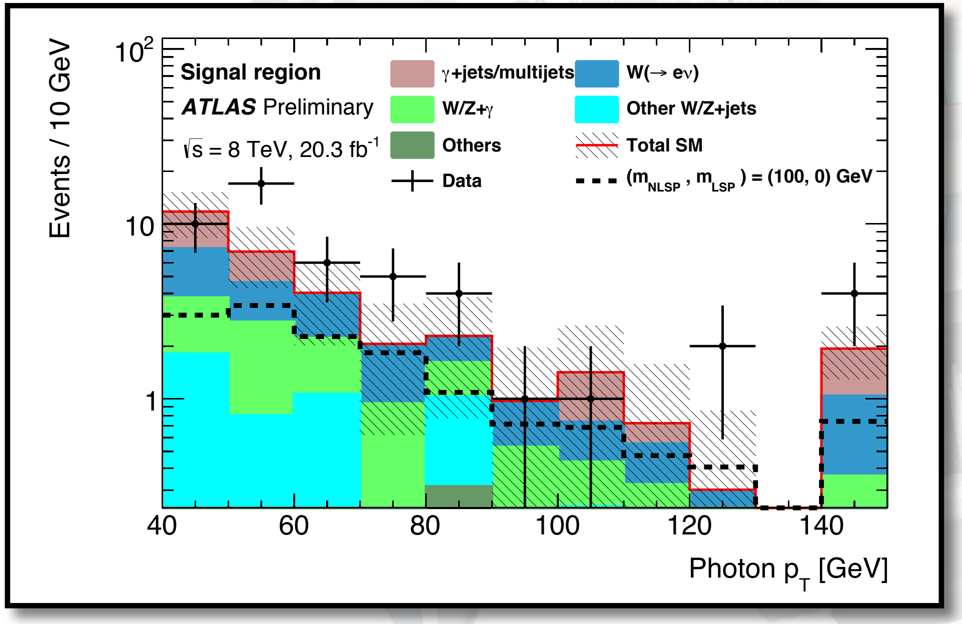
- Require 2 jets with p_T > 75 and 50 GeV, respectively
  - To select VBF events, require $\Delta\eta_{jj}$ > 4.8 and m_{jj} > 1 TeV
- E_T^{miss} > 150 GeV
- Backgrounds from Z and W are simulated, and fitted to data in control regions
- The multijet background is estimated directly from data
- No excess over expected backgrounds is found with a maximum likelihood fit
  - BR(H→invisible) < 29% at 95% CL

Process	Yield	±	Stat	±	Syst
ggH Signal	20	±	6	±	10
VBF Signal	286	±	5	±	49
$Z \rightarrow \nu\nu$+jets	339	±	22	±	13
$W \rightarrow \ell\nu$+jets	237	±	17	±	18
Multijet	2	±	2		
Other Backgrounds	0.7	±	0.2	±	0.3
Total Background	578	±	38	±	30
Data	539				

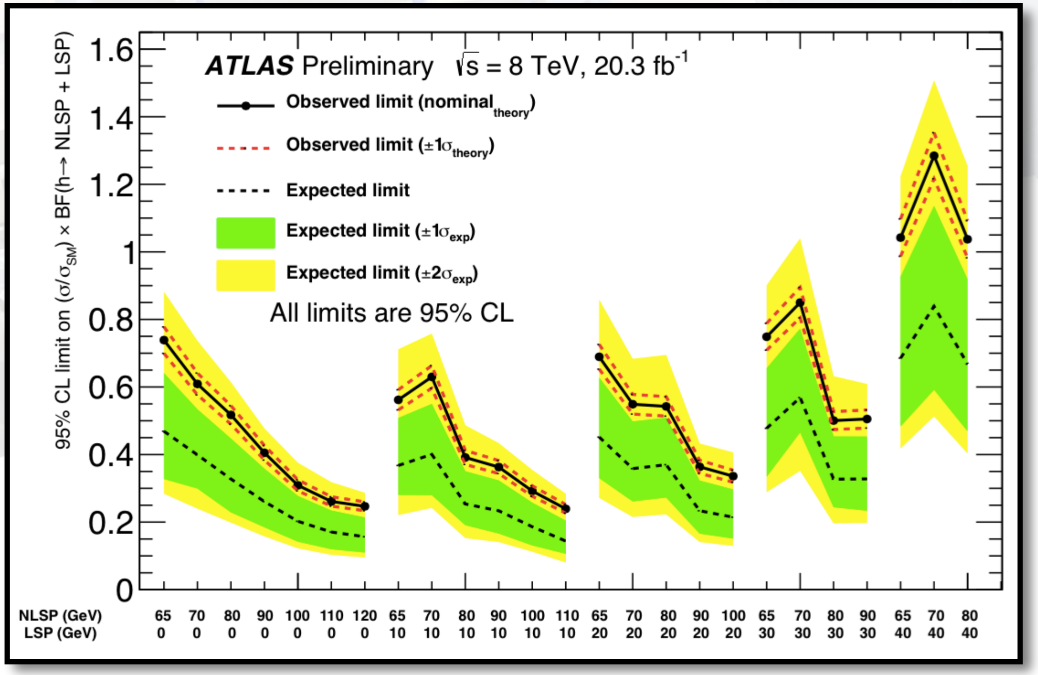
Exotic Higgs Decays with Photons

ATL-CONF-2015-001

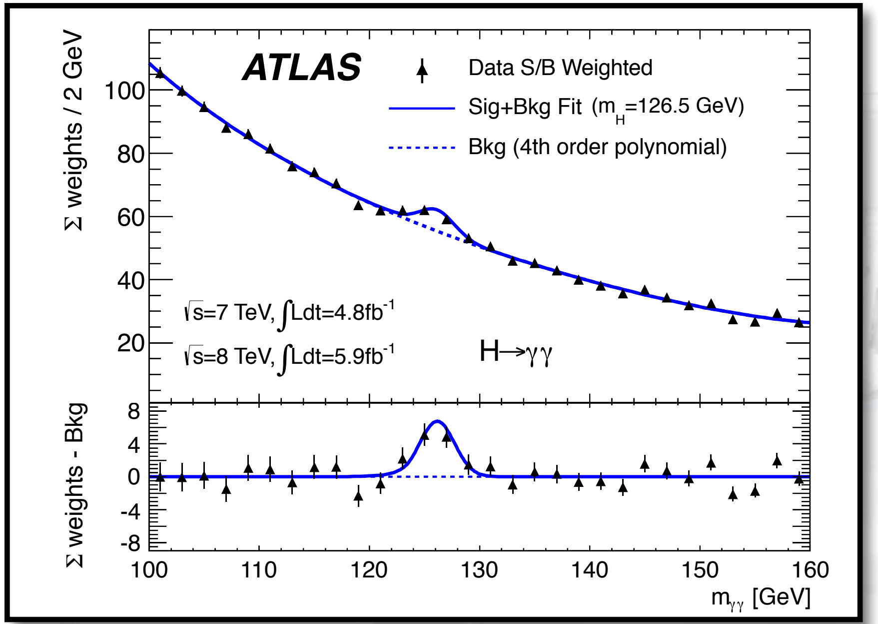


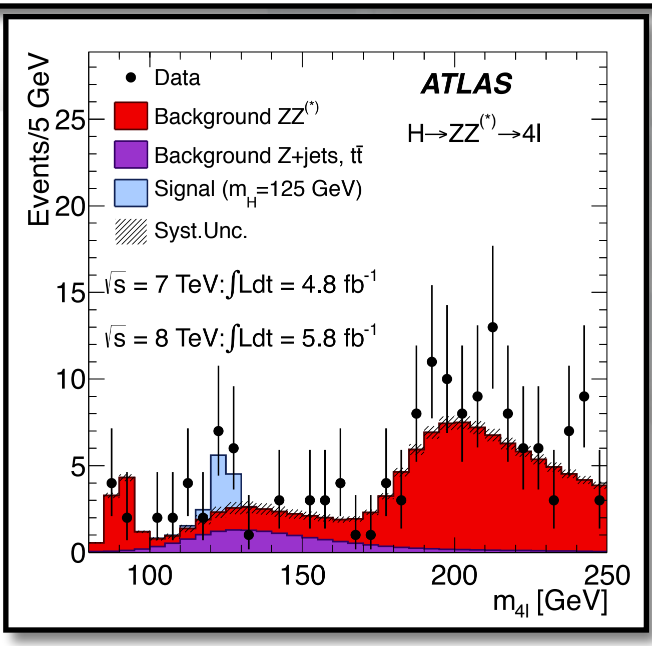


- Isolated, well identified photons are required, with E_T^{miss} > 50 GeV and two jets with p_T > 40 GeV, m_{jj} > 400 GeV, $\Delta\eta_{jj}$ > 3.0
- No excess is found, obtained limits are similar or stronger than the ones taken from coupling measurements



Higgs Production, Decay Rates and Couplings





- ATLAS and CMS announced the discovery of a new particle in July 2012
  - A particle that decays to bosons, and has a mass of ~125 GeV/c^2
- While in agreement with the expectations for the Standard Model Higgs boson, an extensive set of analyses have been done since to check this as best as possible
  - Measuring all possible properties of the new particle, and comparing them to the expectations of the Standard Model, or more exotic Higgs models

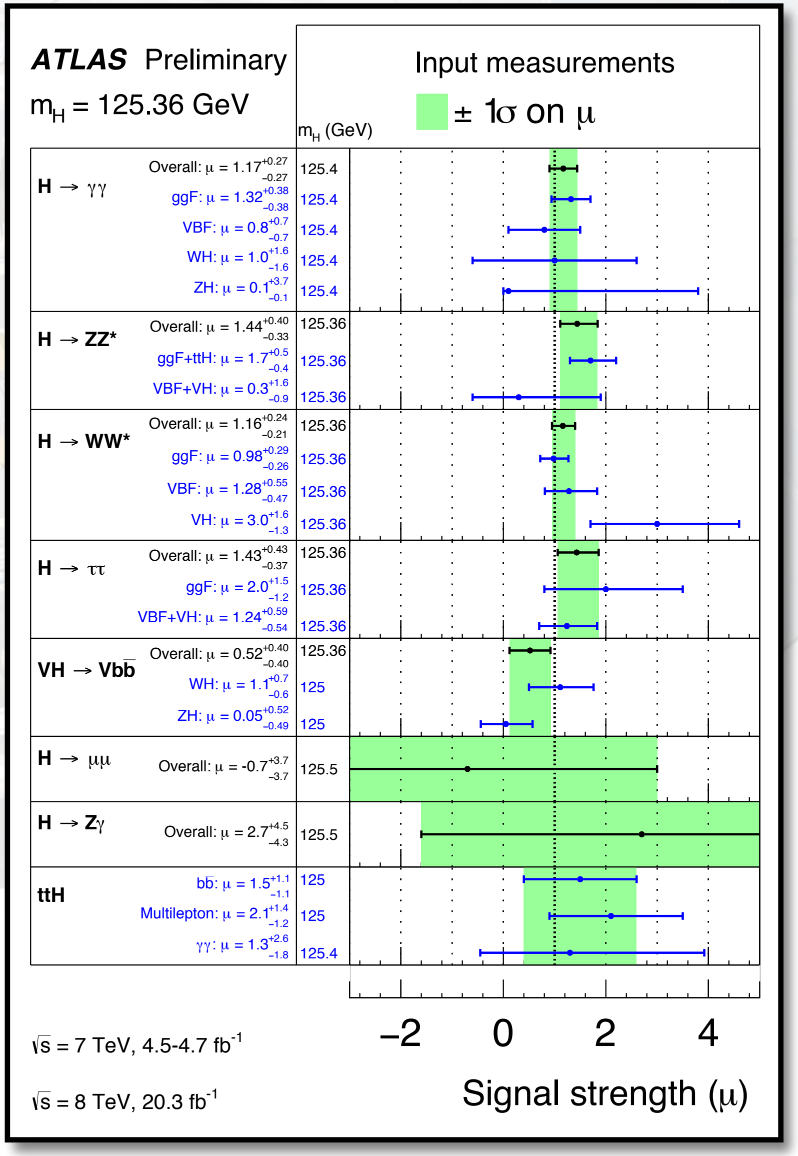
Higgs Production, Decay Rates and Couplings

- Combined the results from analyses of the decay modes: H → $\gamma\gamma$, ZZ^*, WW^*, $Z\gamma$, bb, $\tau\tau$ and $\mu\mu$
  - Using the full 2011-2012 dataset for most of these
- Also adding a measurement for off-shell $H^* \rightarrow ZZ$, $H^* \rightarrow WW$ production
- Combinations are made based on the $\Lambda(\alpha)$ profile likelihood ratio

$$\Lambda(\alpha) = \frac{L(\alpha, \hat{\hat{\theta}}(\alpha))}{L(\hat{\alpha}, \hat{\theta})}$$

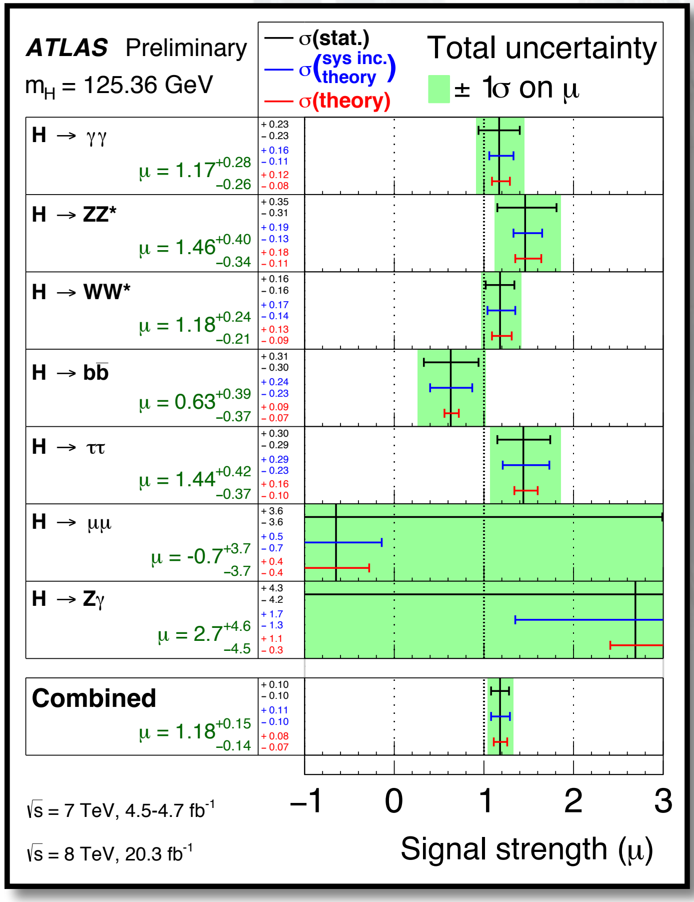
  - Where the test statistic can depend on one or more parameters of interest

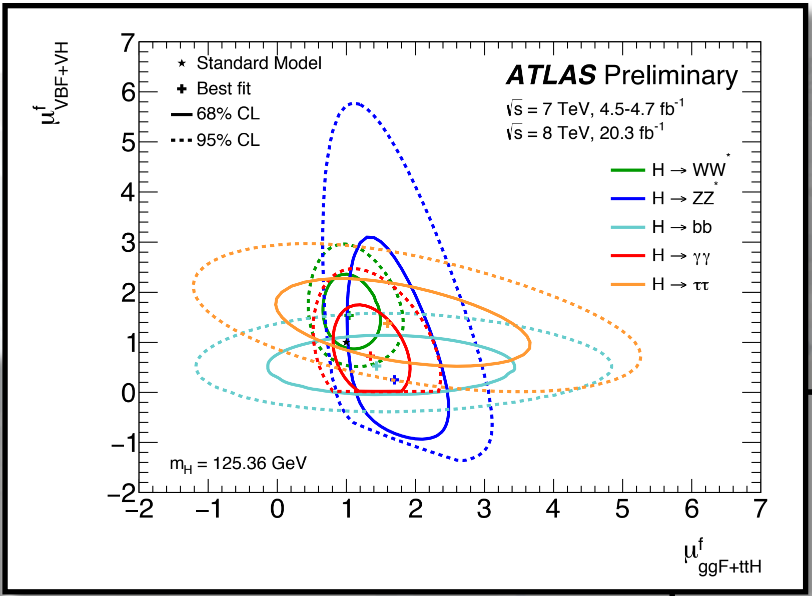
ATL-CONF-2015-007



Higgs Production, Decay Rates and Couplings

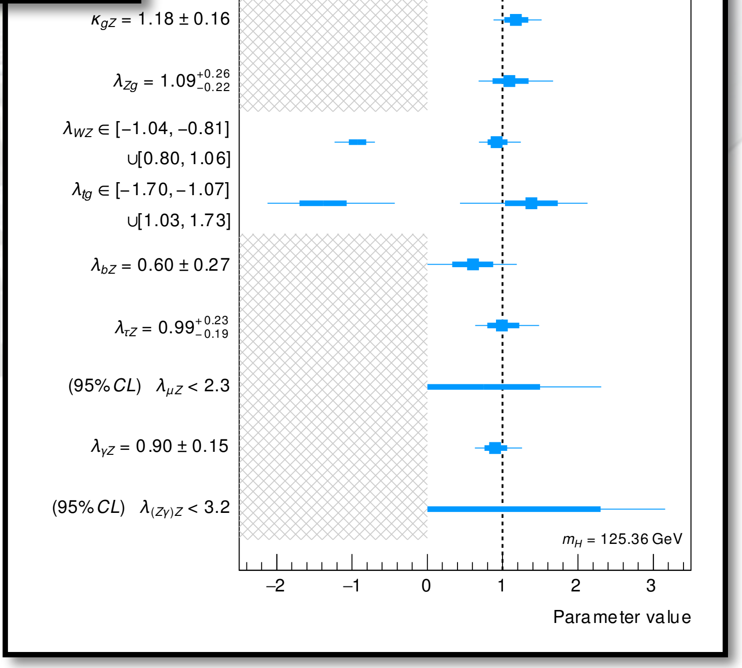
ATL-CONF-2015-007





Coupling strength fits are made in a variety of models, with varying levels of model dependence.

Including a most generic model, to measure the ratios of coupling strengths.



Higgs Spin and Parity

ATLAS-CONF-2015-008

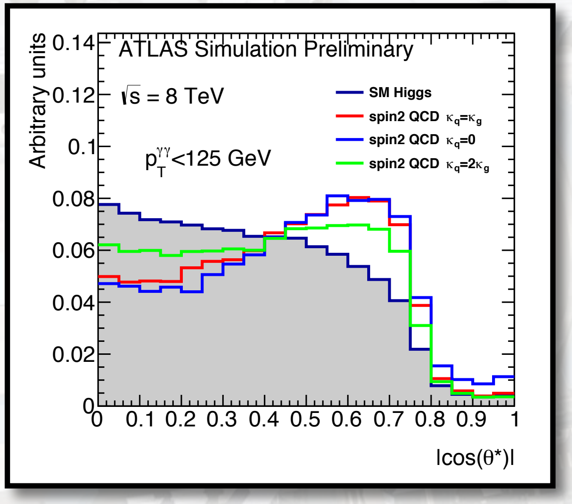
- The measurements from H→ZZ*→4l, H→WW*→eνμν and H→γγ are combined
- Various observables are fed into MVA classifications, the output of which are put though a maximum likelihood fit
- All tested non-SM ($J^P = 0^+$) models were excluded
- Non-SM tensor couplings outside

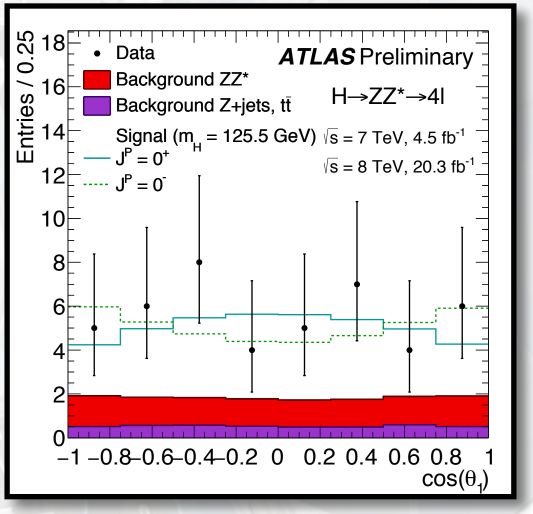
$$-0.73 < \tilde{\kappa}_{HVV}/\kappa_{SM} < 0.63$$

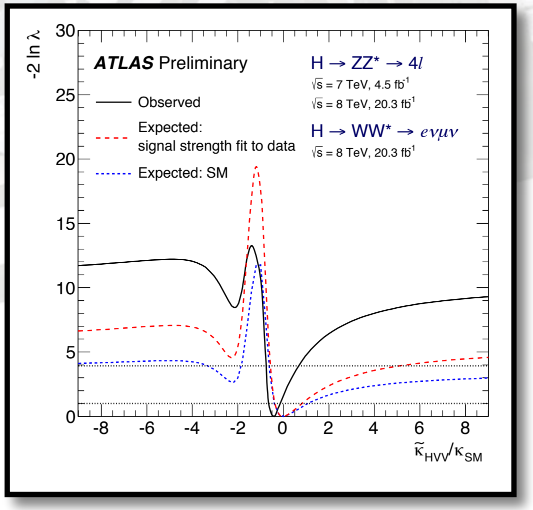
and

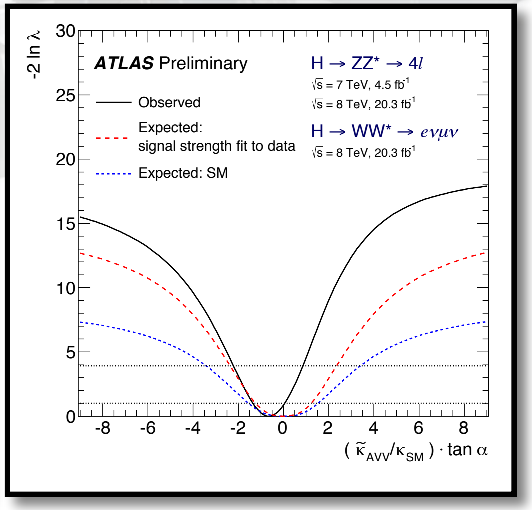
$$-2.18 < (\tilde{\kappa}_{AVV}/\kappa_{SM}) \cdot \tan\alpha < 0.83$$

are excluded at a 95% CL



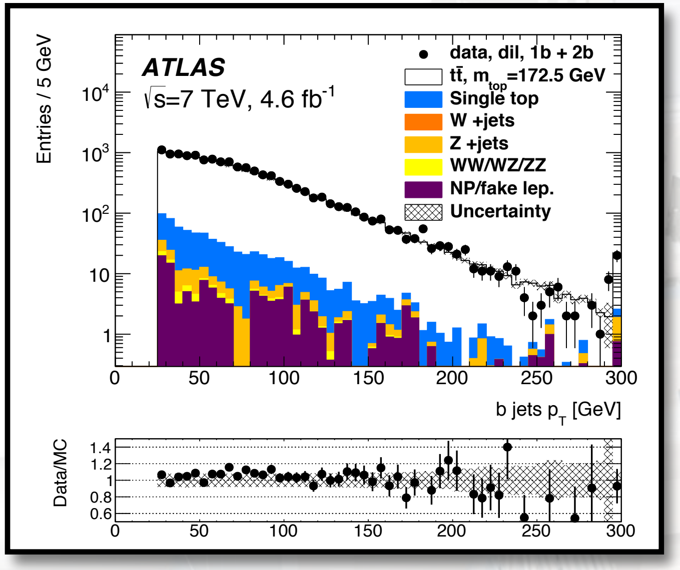


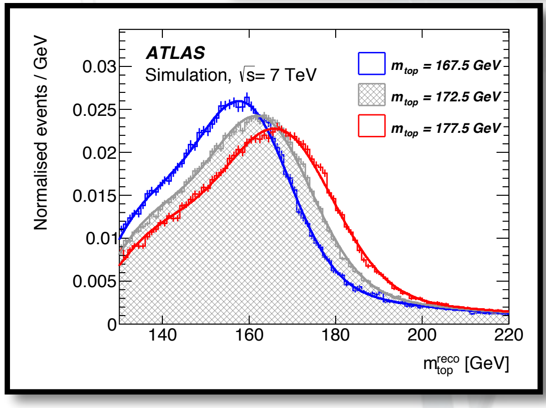


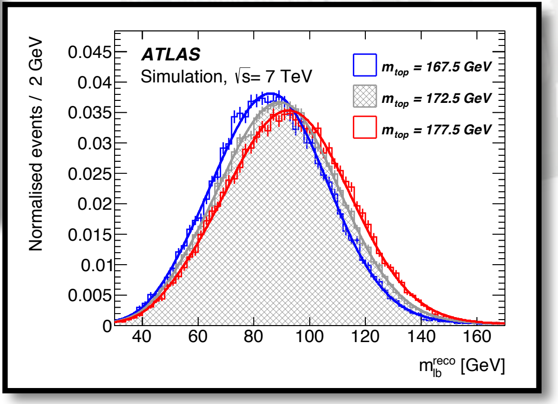


Top Quark Mass

arXiv: 1503.05427 (Submitted to EPJC)





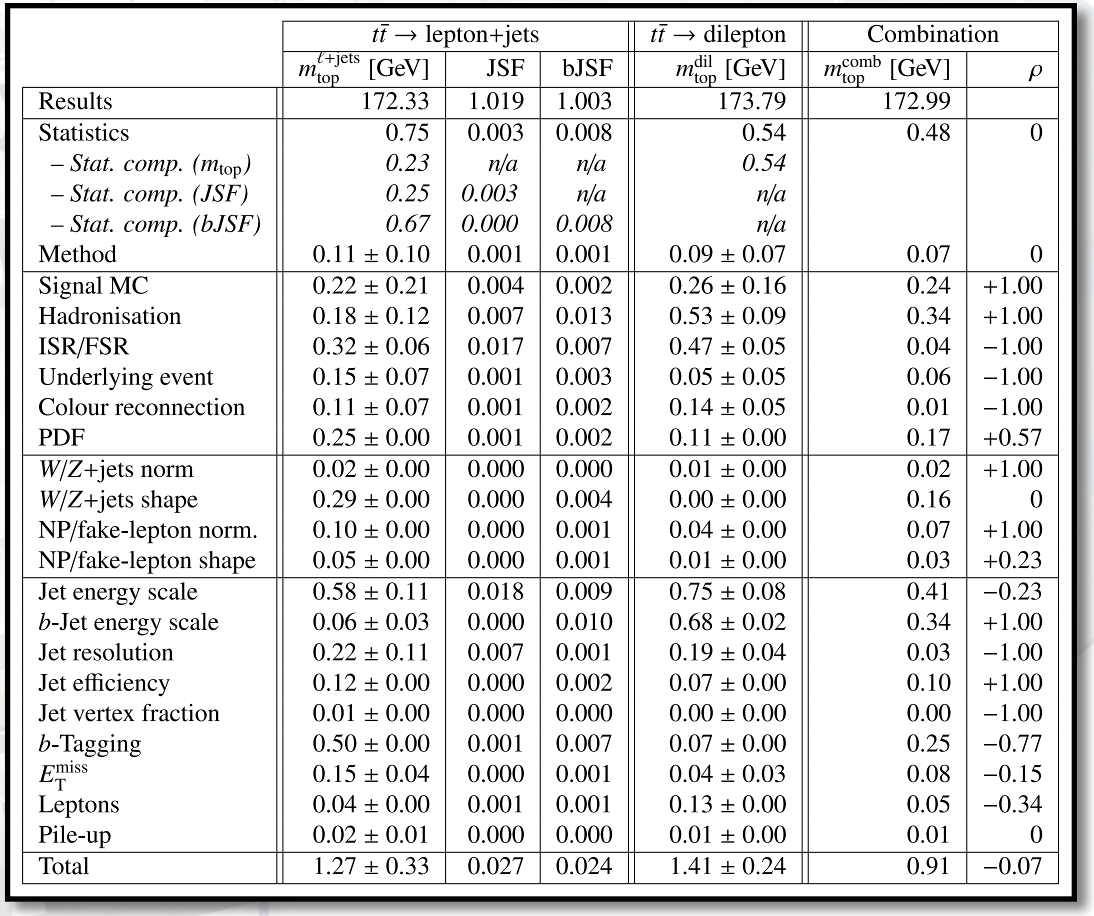


- The top quark mass was measured with the 2011 dataset using 1D and 3D template fits
  - A 3D fit is used on $m_{\text{top}}^{\text{reco}}$, m_W^{reco} and R_{bq}^{reco} in the lepton+jets channel to constrain the JES and bJES while extracting the top mass
  - In the dilepton channel a 1D fit is used on m_{lb}^{reco}
- A standard di-lepton and lepton plus jet event selection is made
- The $t\bar{t}$ kinematics are fully reconstructed in the lepton+jets final state, according to the leading order representation of the decay
  - While the di-lepton final state uses the m_{top} sensitive m_{lb} variable

Top Quark Mass

arXiv: 1503.05427 (Submitted to EPJC)

- Signal templates are derived from MC for:
  - $m_{\text{top}}^{\text{reco}}$, m_{W}^{reco} and R_{bq}^{reco} (lepton +jets)
  - m_{lb}^{reco} (dilepton)
- These are used in an unbinned likelihood fit to the data
- The systematic uncertainties are evaluated very carefully, to keep the overall uncertainty as low as possible

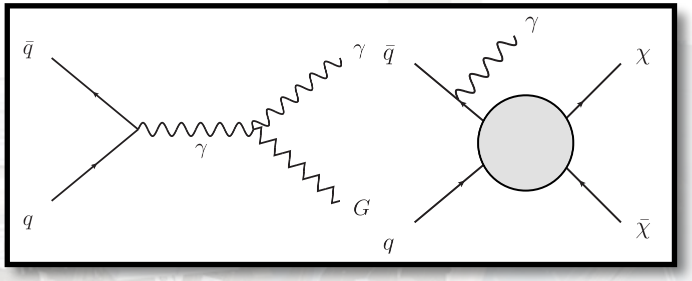


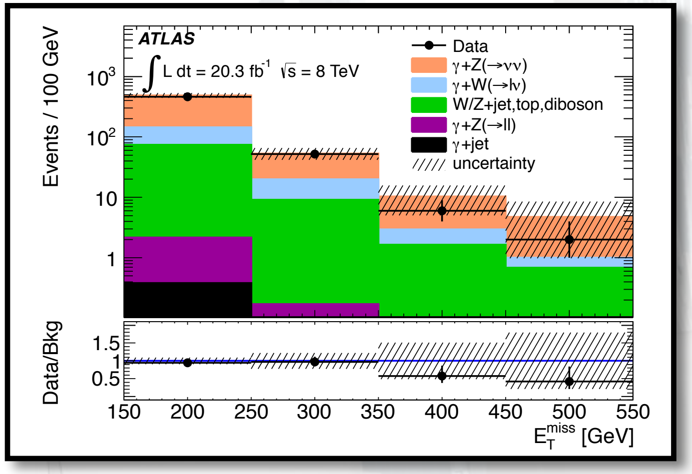
	$t\bar{t} \to$ lepton+jets			$t\bar{t} \to$ dilepton	Combination	
	$m_{\text{top}}^{\ell+\text{jets}}$ [GeV]	JSF	bJSF	$m_{\text{top}}^{\text{dil}}$ [GeV]	$m_{\text{top}}^{\text{comb}}$ [GeV]	ρ
Results	172.33	1.019	1.003	173.79	172.99	
Statistics	0.75	0.003	0.008	0.54	0.48	0
– *Stat. comp.* (m_{top})	*0.23*	*n/a*	*n/a*	*0.54*		
– *Stat. comp. (JSF)*	*0.25*	*0.003*	*n/a*	*n/a*		
– *Stat. comp. (bJSF)*	*0.67*	*0.000*	*0.008*	*n/a*		
Method	0.11 ± 0.10	0.001	0.001	0.09 ± 0.07	0.07	0
Signal MC	0.22 ± 0.21	0.004	0.002	0.26 ± 0.16	0.24	+1.00
Hadronisation	0.18 ± 0.12	0.007	0.013	0.53 ± 0.09	0.34	+1.00
ISR/FSR	0.32 ± 0.06	0.017	0.007	0.47 ± 0.05	0.04	−1.00
Underlying event	0.15 ± 0.07	0.001	0.003	0.05 ± 0.05	0.06	−1.00
Colour reconnection	0.11 ± 0.07	0.001	0.002	0.14 ± 0.05	0.01	−1.00
PDF	0.25 ± 0.00	0.001	0.002	0.11 ± 0.00	0.17	+0.57
W/Z+jets norm	0.02 ± 0.00	0.000	0.000	0.01 ± 0.00	0.02	+1.00
W/Z+jets shape	0.29 ± 0.00	0.000	0.004	0.00 ± 0.00	0.16	0
NP/fake-lepton norm.	0.10 ± 0.00	0.000	0.001	0.04 ± 0.00	0.07	+1.00
NP/fake-lepton shape	0.05 ± 0.00	0.000	0.001	0.01 ± 0.00	0.03	+0.23
Jet energy scale	0.58 ± 0.11	0.018	0.009	0.75 ± 0.08	0.41	−0.23
b-Jet energy scale	0.06 ± 0.03	0.000	0.010	0.68 ± 0.02	0.34	+1.00
Jet resolution	0.22 ± 0.11	0.007	0.001	0.19 ± 0.04	0.03	−1.00
Jet efficiency	0.12 ± 0.00	0.000	0.002	0.07 ± 0.00	0.10	+1.00
Jet vertex fraction	0.01 ± 0.00	0.000	0.000	0.00 ± 0.00	0.00	−1.00
b-Tagging	0.50 ± 0.00	0.001	0.007	0.07 ± 0.00	0.25	−0.77
$E_{\text{T}}^{\text{miss}}$	0.15 ± 0.04	0.000	0.001	0.04 ± 0.03	0.08	−0.15
Leptons	0.04 ± 0.00	0.001	0.001	0.13 ± 0.00	0.05	−0.34
Pile-up	0.02 ± 0.01	0.000	0.000	0.01 ± 0.00	0.01	0
Total	1.27 ± 0.33	0.027	0.024	1.41 ± 0.24	0.91	−0.07

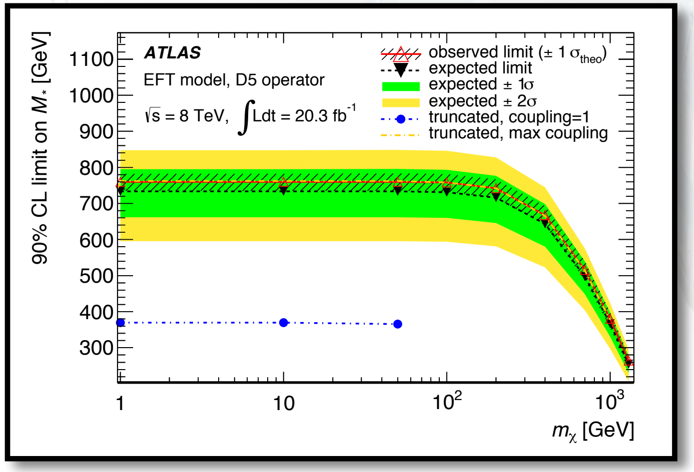
$$m_{\text{top}}^{\text{comb}} = 172.99 \pm 0.48(\text{stat}) \pm 0.78(\text{syst})\ \text{GeV} = 172.99 \pm 0.91\ \text{GeV}$$

Photon + E_T^{Miss} Searches

Phys. Rev. D 91 012008 (2015)







- Events are selected with E_T^{Miss} > 150 GeV and p_T^{γ} > 125 GeV
  - With either 0 or 1 jet
  - With no lepton
- Signature can be used to search for a lot of different BSM signals
- Data events passing the final selection can be well described by SM background predictions
  - Exclusion limits are set for various WIMP models

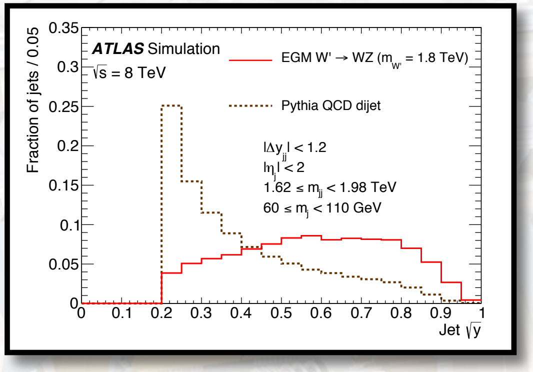
Search for X’→VV’→JJ

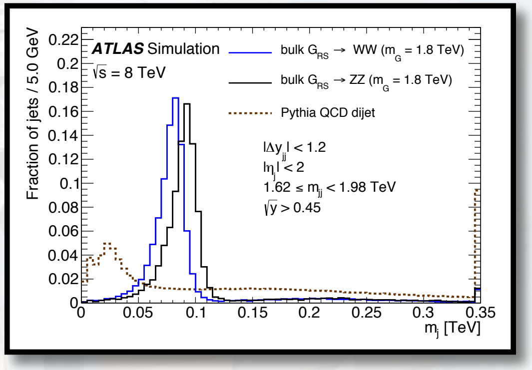
- A search is made for di-boson final states (ZZ, WW, ZW) in the all hadronic channel
  - Two large radius, high-p_T jets are tagged as coming from a boson, based on the reconstructed jet’s properties, with m_{jj} > 1.05 TeV
- The background is modelled by a smoothly falling distribution

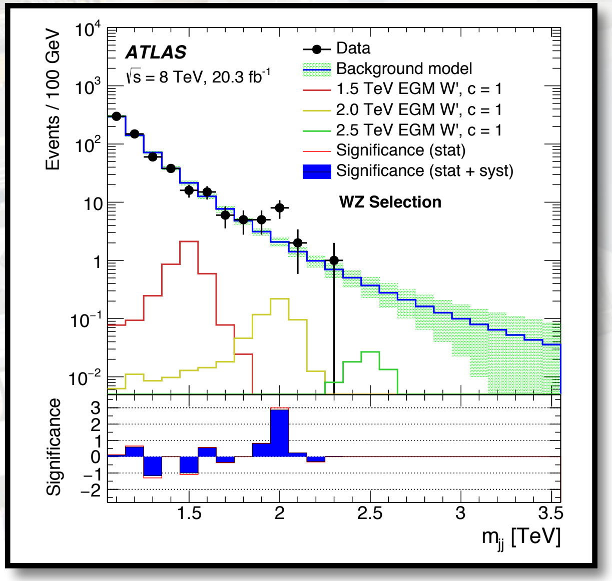
$$\frac{\mathrm{d}n}{\mathrm{d}x} = p_1(1-x)^{p_2-\xi p_3}x^{p_3}$$

- Results are interpreted in a frequentist analysis

arXiv: 1506.00962 (Submitted to JHEP)





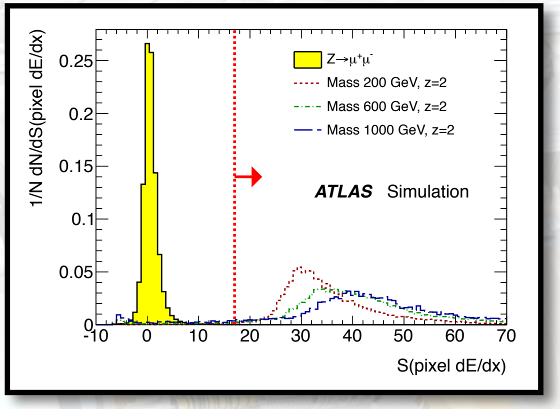


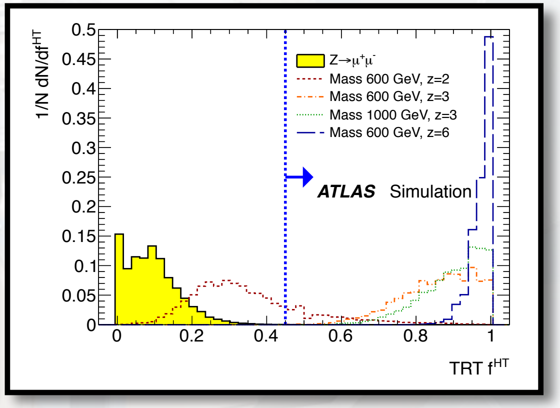
Largest deviation from background model in WZ channel, with a 3.4 (2.5) σ local (global) significance

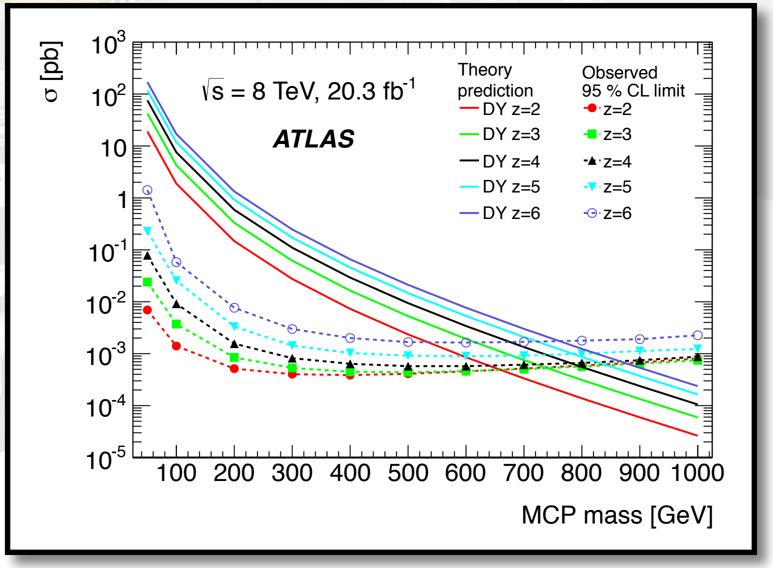
Long Lived Particle Searches

- Searches were made for long lived charged and neutral particles, in different scenarios
  - Neutral particles are searched for by looking for displaces vertices
  - Highly charged (|q|≥2e) particles are searched for using their highly ionising trail
- Highly ionising particles can be identified by multiple sub-detectors
  - Candidate events are selected using a combination of requirements
- No candidates are found in data, limits for different hypotheses are set

1504.05162, 1504.03634, 1504.04188



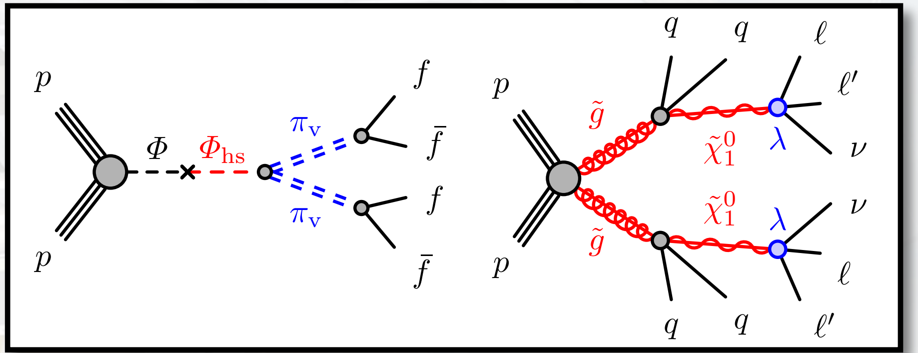


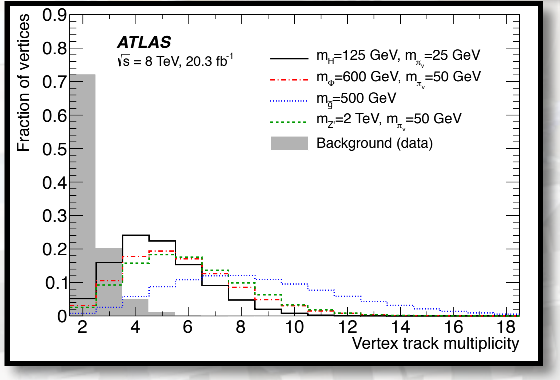


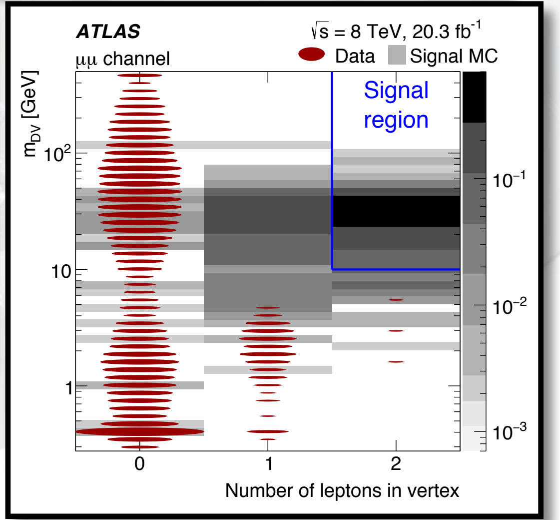
Long Lived Particle Searches

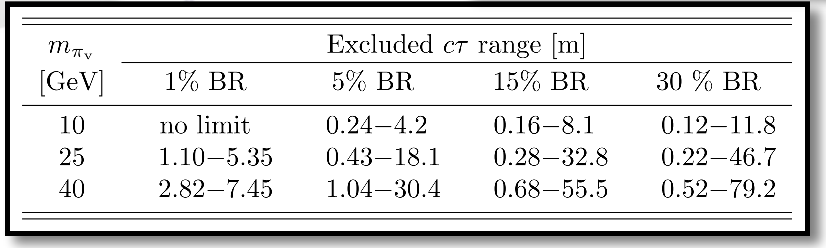
[1504.05162](), [1504.03634](), [1504.04188]()

- Displaces vertices are searched for both in the inner detector, and the muon spectrometer
  - The different analyses use varying techniques for their reconstruction
- No excess over background estimations is found in data
  - Exclusion limits are set on a list of hypotheses, including the Higgs decaying to invisible particles
- The results are applicable to alternative hypotheses as well



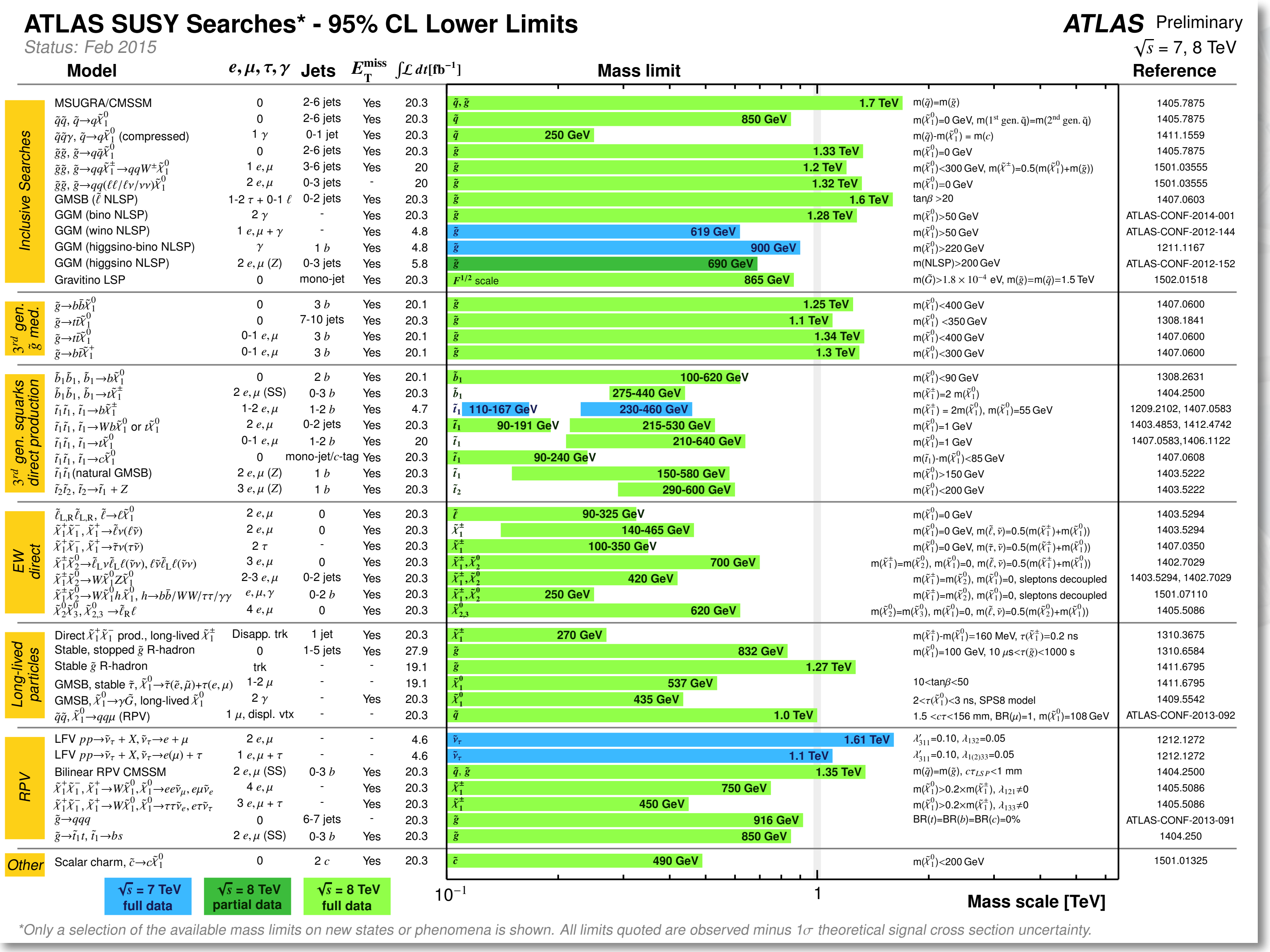






m_{π_v}	Excluded $c\tau$ range [m]			
[GeV]	1% BR	5% BR	15% BR	30 % BR
10	no limit	0.24–4.2	0.16–8.1	0.12–11.8
25	1.10–5.35	0.43–18.1	0.28–32.8	0.22–46.7
40	2.82–7.45	1.04–30.4	0.68–55.5	0.52–79.2

Exclusion Summaries



ATLAS SUSY Searches* - 95% CL Lower Limits

Status: Feb 2015

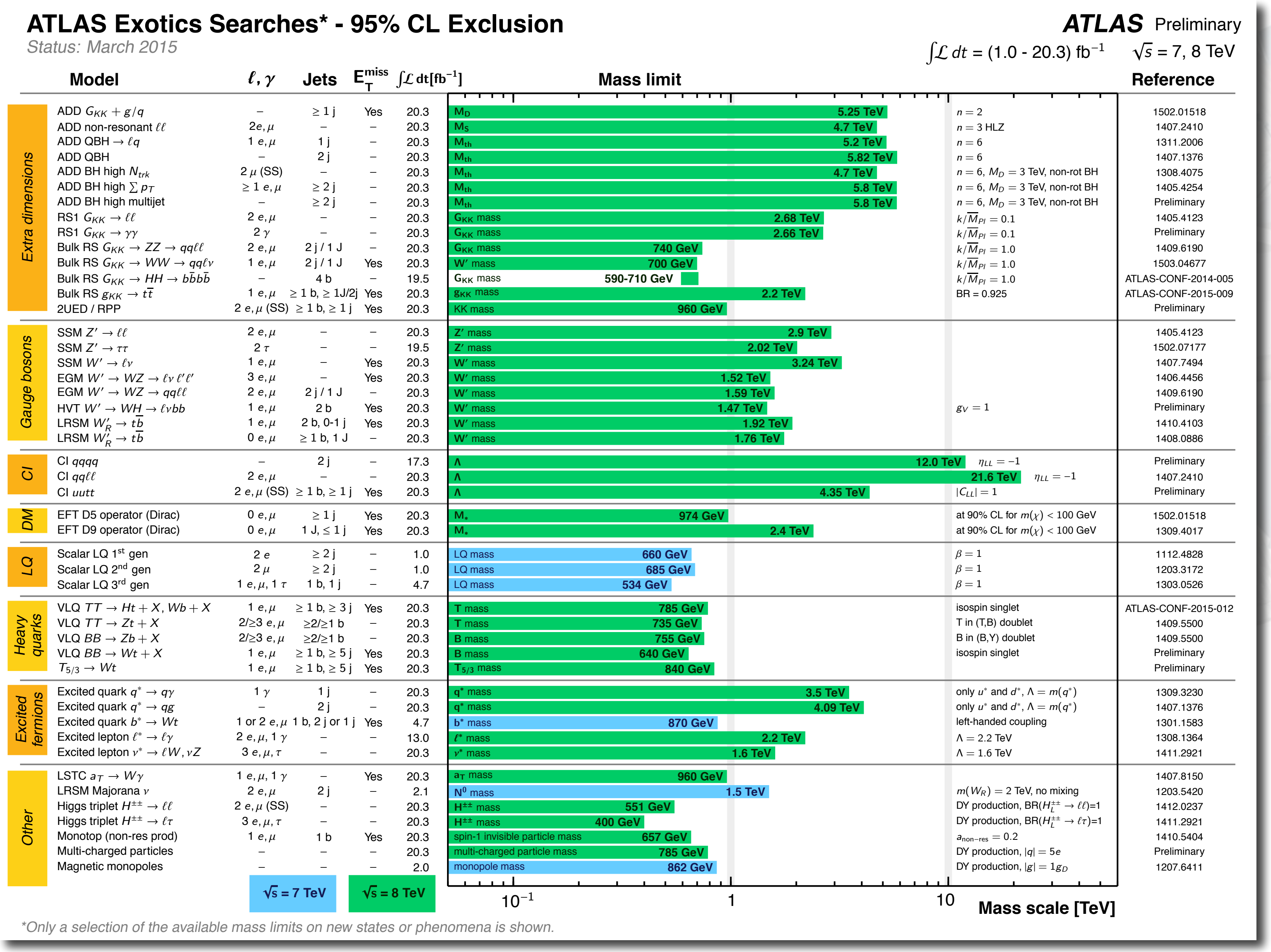
ATLAS Preliminary

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

	Model	e, μ, τ, γ	Jets	E_T^{miss}	$\int \mathcal{L}\, dt[fb^{-1}]$	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($\tilde{g}$)	1405.7875
	$\tilde{q}\tilde{q}$, $\tilde{q}\rightarrow q\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{q}$	850 GeV	m($\tilde{\chi}_1^0$)=0 GeV, m(1^{st} gen. $\tilde{q}$)=m(2^{nd} gen. $\tilde{q}$)	1405.7875
	$\tilde{q}\tilde{q}\gamma$, $\tilde{q}\rightarrow q\tilde{\chi}_1^0$ (compressed)	1 γ	0-1 jet	Yes	20.3	$\tilde{q}$	250 GeV	m($\tilde{q}$)-m($\tilde{\chi}_1^0$) = m(c)	1411.1559
	$\tilde{g}\tilde{g}$, $\tilde{g}\rightarrow q\bar{q}\tilde{\chi}_1^0$	0	2-6 jets	Yes	20.3	$\tilde{g}$	1.33 TeV	m($\tilde{\chi}_1^0$)=0 GeV	1405.7875
	$\tilde{g}\tilde{g}$, $\tilde{g}\rightarrow qq\tilde{\chi}_1^{\pm}\rightarrow qqW^{\pm}\tilde{\chi}_1^0$	1 e, μ	3-6 jets	Yes	20	$\tilde{g}$	1.2 TeV	m($\tilde{\chi}_1^0$)<300 GeV, m($\tilde{\chi}^{\pm}$)=0.5(m($\tilde{\chi}_1^0$)+m($\tilde{g}$))	1501.03555
	$\tilde{g}\tilde{g}$, $\tilde{g}\rightarrow qq(\ell\ell/\ell\nu/\nu\nu)\tilde{\chi}_1^0$	2 e, μ	0-3 jets	-	20	$\tilde{g}$	1.32 TeV	m($\tilde{\chi}_1^0$)=0 GeV	1501.03555
	GMSB ($\tilde{\ell}$ NLSP)	1-2 τ + 0-1 ℓ	0-2 jets	Yes	20.3	$\tilde{g}$	1.6 TeV	tanβ >20	1407.0603
	GGM (bino NLSP)	2 γ	-	Yes	20.3	$\tilde{g}$	1.28 TeV	m($\tilde{\chi}_1^0$)>50 GeV	ATLAS-CONF-2014-001
	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(NLSP)>200 GeV	ATLAS-CONF-2012-152
	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
3^{rd} gen. $\tilde{g}$ med.	$\tilde{g}\rightarrow b\bar{b}\tilde{\chi}_1^0$	0	3 b	Yes	20.1	$\tilde{g}$	1.25 TeV	m($\tilde{\chi}_1^0$)<400 GeV	1407.0600
	$\tilde{g}\rightarrow t\bar{t}\tilde{\chi}_1^0$	0	7-10 jets	Yes	20.3	$\tilde{g}$	1.1 TeV	m($\tilde{\chi}_1^0$) <350 GeV	1308.1841
	$\tilde{g}\rightarrow t\bar{t}\tilde{\chi}_1^0$	0-1 e, μ	3 b	Yes	20.1	$\tilde{g}$	1.34 TeV	m($\tilde{\chi}_1^0$)<400 GeV	1407.0600
	$\tilde{g}\rightarrow b\bar{t}\tilde{\chi}_1^+$	0-1 e, μ	3 b	Yes	20.1	$\tilde{g}$	1.3 TeV	m($\tilde{\chi}_1^0$)<300 GeV	1407.0600
3^{rd} gen. squarks direct production	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\rightarrow b\tilde{\chi}_1^0$	0	2 b	Yes	20.1	$\tilde{b}_1$	100-620 GeV	m($\tilde{\chi}_1^0$)<90 GeV	1308.2631
	$\tilde{b}_1\tilde{b}_1$, $\tilde{b}_1\rightarrow t\tilde{\chi}_1^{\pm}$	2 e, μ (SS)	0-3 b	Yes	20.3	$\tilde{b}_1$	275-440 GeV	m($\tilde{\chi}_1^{\pm}$)=2 m($\tilde{\chi}_1^0$)	1404.2500
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\rightarrow b\tilde{\chi}_1^{\pm}$	1-2 e, μ	1-2 b	Yes	4.7	$\tilde{t}_1$	110-167 GeV 230-460 GeV	m($\tilde{\chi}_1^{\pm}$) = 2m($\tilde{\chi}_1^0$), m($\tilde{\chi}_1^0$)=55 GeV	1209.2102, 1407.0583
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\rightarrow Wb\tilde{\chi}_1^0$ or $t\tilde{\chi}_1^0$	2 e, μ	0-2 jets	Yes	20.3	$\tilde{t}_1$	90-191 GeV 215-530 GeV	m($\tilde{\chi}_1^0$)=1 GeV	1403.4853, 1412.4742
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\rightarrow t\tilde{\chi}_1^0$	0-1 e, μ	1-2 b	Yes	20	$\tilde{t}_1$	210-640 GeV	m($\tilde{\chi}_1^0$)=1 GeV	1407.0583,1406.1122
	$\tilde{t}_1\tilde{t}_1$, $\tilde{t}_1\rightarrow c\tilde{\chi}_1^0$	0	mono-jet/c-tag	Yes	20.3	$\tilde{t}_1$	90-240 GeV	m($\tilde{t}_1$)-m($\tilde{\chi}_1^0$)<85 GeV	1407.0608
	$\tilde{t}_1\tilde{t}_1$(natural GMSB)	2 e, μ (Z)	1 b	Yes	20.3	$\tilde{t}_1$	150-580 GeV	m($\tilde{\chi}_1^0$)>150 GeV	1403.5222
	$\tilde{t}_2\tilde{t}_2$, $\tilde{t}_2\rightarrow\tilde{t}_1 + Z$	3 e, μ (Z)	1 b	Yes	20.3	$\tilde{t}_2$	290-600 GeV	m($\tilde{\chi}_1^0$)<200 GeV	1403.5222
EW direct	$\tilde{\ell}_{L,R}\tilde{\ell}_{L,R}$, $\tilde{\ell}\rightarrow\ell\tilde{\chi}_1^0$	2 e, μ	0	Yes	20.3	$\tilde{\ell}$	90-325 GeV	m($\tilde{\chi}_1^0$)=0 GeV	1403.5294
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\rightarrow\tilde{\ell}\nu(\ell\tilde{\nu})$	2 e, μ	0	Yes	20.3	$\tilde{\chi}_1^{\pm}$	140-465 GeV	m($\tilde{\chi}_1^0$)=0 GeV, m($\tilde{\ell}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_1^{\pm}$)+m($\tilde{\chi}_1^0$))	1403.5294
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\rightarrow\tilde{\tau}\nu(\tau\tilde{\nu})$	2 τ	-	Yes	20.3	$\tilde{\chi}_1^{\pm}$	100-350 GeV	m($\tilde{\chi}_1^0$)=0 GeV, m($\tilde{\tau}, \tilde{\nu}$)=0.5(m($\tilde{\chi}_1^{\pm}$)+m($\tilde{\chi}_1^0$))	1407.0350
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\rightarrow\tilde{\ell}_L\nu\tilde{\ell}_L\ell(\tilde{\nu}\nu), \ell\tilde{\nu}\tilde{\ell}_L\ell(\tilde{\nu}\nu)$	3 e, μ	0	Yes	20.3	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$	700 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($\tilde{\chi}_1^0$))	1402.7029
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\rightarrow W\tilde{\chi}_1^0 Z\tilde{\chi}_1^0$	2-3 e, μ	0-2 jets	Yes	20.3	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$	420 GeV	m($\tilde{\chi}_1^{\pm}$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, sleptons decoupled	1403.5294, 1402.7029
	$\tilde{\chi}_1^{\pm}\tilde{\chi}_2^0\rightarrow W\tilde{\chi}_1^0 h\tilde{\chi}_1^0$, $h\rightarrow b\bar{b}/WW/\tau\tau/\gamma\gamma$	e, μ, γ	0-2 b	Yes	20.3	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0$	250 GeV	m($\tilde{\chi}_1^{\pm}$)=m($\tilde{\chi}_2^0$), m($\tilde{\chi}_1^0$)=0, sleptons decoupled	1501.07110
	$\tilde{\chi}_2^0\tilde{\chi}_3^0$, $\tilde{\chi}_{2,3}^0\rightarrow\tilde{\ell}_R\ell$	4 e, μ	0	Yes	20.3	$\tilde{\chi}_{2,3}^0$	620 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
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	1310.3675
	Stable, stopped $\tilde{g}$ R-hadron	0	1-5 jets	Yes	27.9	$\tilde{g}$	832 GeV	m($\tilde{\chi}_1^0$)=100 GeV, 10 μs<τ($\tilde{g}$)<1000 s	1310.6584
	Stable $\tilde{g}$ R-hadron	trk	-	-	19.1	$\tilde{g}$	1.27 TeV		1411.6795
	GMSB, stable $\tilde{\tau}$, $\tilde{\chi}_1^0\rightarrow\tilde{\tau}(\tilde{e}, \tilde{\mu})+\tau(e, \mu)$	1-2 μ	-	-	19.1	$\tilde{\chi}_1^0$	537 GeV	10<tanβ<50	1411.6795
	GMSB, $\tilde{\chi}_1^0\rightarrow\gamma\tilde{G}$, long-lived $\tilde{\chi}_1^0$	2 γ	-	Yes	20.3	$\tilde{\chi}_1^0$	435 GeV	2<τ($\tilde{\chi}_1^0$)<3 ns, SPS8 model	1409.5542
	$\tilde{q}\tilde{q}$, $\tilde{\chi}_1^0\rightarrow qq\mu$ (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 $pp\rightarrow\tilde{\nu}_\tau + X, \tilde{\nu}_\tau\rightarrow e + \mu$	2 e, μ	-	-	4.6	$\tilde{\nu}_\tau$	1.61 TeV	λ'_{311}=0.10, λ_{132}=0.05	1212.1272
	LFV $pp\rightarrow\tilde{\nu}_\tau + X, \tilde{\nu}_\tau\rightarrow e(\mu) + \tau$	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	2 e, μ (SS)	0-3 b	Yes	20.3	$\tilde{q}, \tilde{g}$	1.35 TeV	m($\tilde{q}$)=m($\tilde{g}$), $c\tau_{LSP}$<1 mm	1404.2500
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\rightarrow W\tilde{\chi}_1^0, \tilde{\chi}_1^0\rightarrow ee\tilde{\nu}_\mu, e\mu\tilde{\nu}_e$	4 e, μ	-	Yes	20.3	$\tilde{\chi}_1^{\pm}$	750 GeV	m($\tilde{\chi}_1^0$)>0.2×m($\tilde{\chi}_1^{\pm}$), $\lambda_{121}\neq0$	1405.5086
	$\tilde{\chi}_1^+\tilde{\chi}_1^-$, $\tilde{\chi}_1^+\rightarrow W\tilde{\chi}_1^0, \tilde{\chi}_1^0\rightarrow\tau\tau\tilde{\nu}_e, e\tau\tilde{\nu}_\tau$	3 $e, \mu + \tau$	-	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
	$\tilde{g}\rightarrow qqq$	0	6-7 jets	-	20.3	$\tilde{g}$	916 GeV	BR(t)=BR(b)=BR(c)=0%	ATLAS-CONF-2013-091
	$\tilde{g}\rightarrow\tilde{t}_1 t$, $\tilde{t}_1\rightarrow bs$	2 e, μ (SS)	0-3 b	Yes	20.3	$\tilde{g}$	850 GeV		1404.250
Other	Scalar charm, $\tilde{c}\rightarrow c\tilde{\chi}_1^0$	0	2 c	Yes	20.3	$\tilde{c}$	490 GeV	m($\tilde{\chi}_1^0$)<200 GeV	1501.01325

**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.*

Exclusion Summaries



ATLAS Exotics Searches* - 95% CL Exclusion

Status: March 2015

ATLAS Preliminary

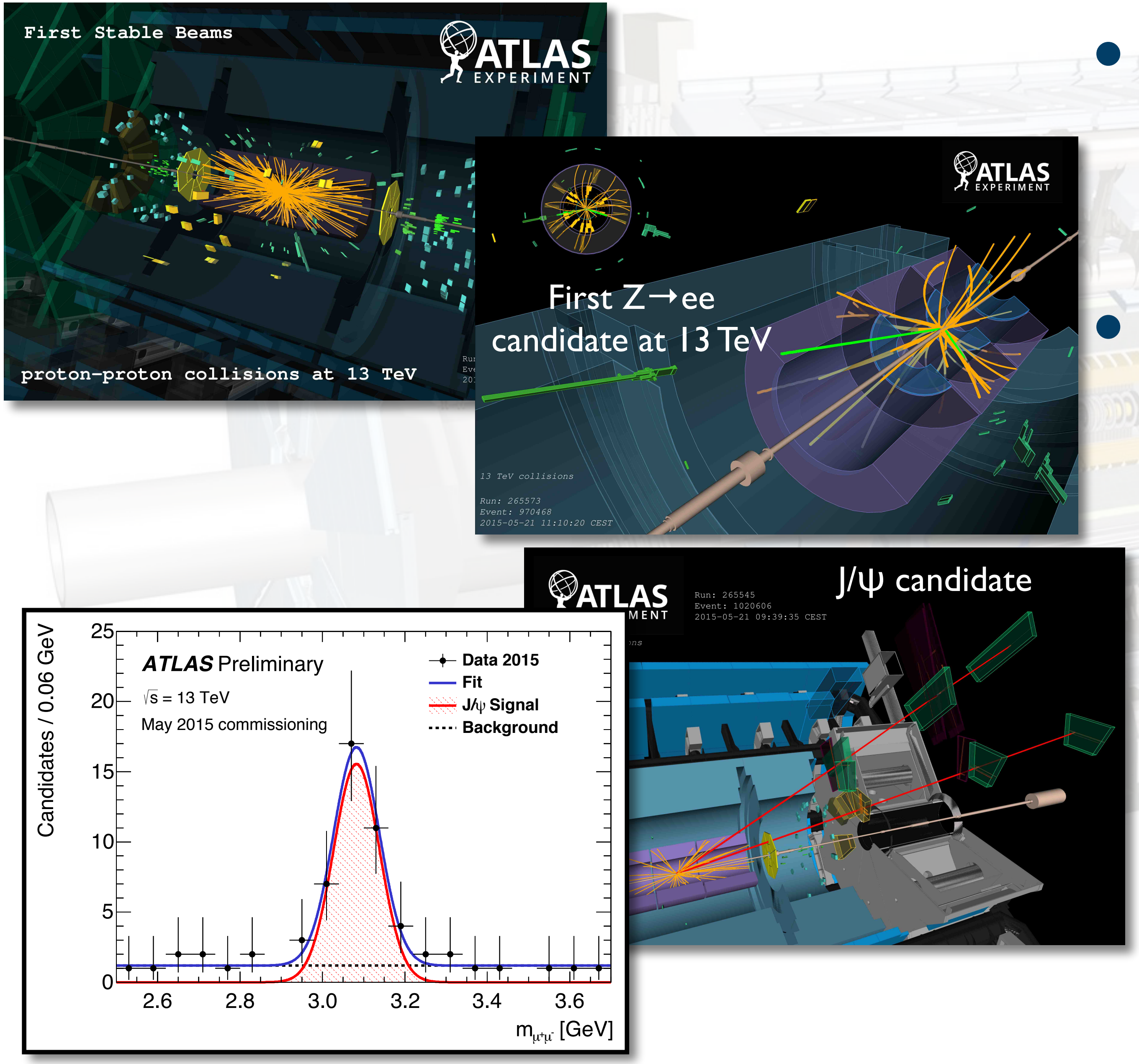
$\int\mathcal{L}\,dt$ = (1.0 - 20.3) fb^{-1} $\sqrt{s}$ = 7, 8 TeV

	Model	ℓ,γ	Jets	E_T^{miss}	$\int\mathcal{L}\,dt[\mathrm{fb}^{-1}]$	Mass limit		Reference
Extra dimensions	ADD $G_{KK}+g/q$	–	≥ 1 j	Yes	20.3	🟩 M_D 5.25 TeV	$n=2$	1502.01518
	ADD non-resonant $\ell\ell$	$2e,\mu$	–	–	20.3	🟩 M_S 4.7 TeV	$n=3$ HLZ	1407.2410
	ADD QBH $\to \ell q$	1 e,μ	1 j	–	20.3	🟩 M_{th} 5.2 TeV	$n=6$	1311.2006
	ADD QBH	–	2 j	–	20.3	🟩 M_{th} 5.82 TeV	$n=6$	1407.1376
	ADD BH high N_{trk}	2 μ (SS)	–	–	20.3	🟩 M_{th} 4.7 TeV	$n=6$, $M_D=3$ TeV, non-rot BH	1308.4075
	ADD BH high $\sum p_T$	≥ 1 e,μ	≥ 2 j	–	20.3	🟩 M_{th} 5.8 TeV	$n=6$, $M_D=3$ TeV, non-rot BH	1405.4254
	ADD BH high multijet	–	≥ 2 j	–	20.3	🟩 M_{th} 5.8 TeV	$n=6$, $M_D=3$ TeV, non-rot BH	Preliminary
	RS1 $G_{KK}\to\ell\ell$	2 e,μ	–	–	20.3	🟩 G_{KK} mass 2.68 TeV	$k/\overline{M}_{Pl}=0.1$	1405.4123
	RS1 $G_{KK}\to\gamma\gamma$	2 γ	–	–	20.3	🟩 G_{KK} mass 2.66 TeV	$k/\overline{M}_{Pl}=0.1$	Preliminary
	Bulk RS $G_{KK}\to ZZ\to qq\ell\ell$	2 e,μ	2 j / 1 J	–	20.3	🟩 G_{KK} mass 740 GeV	$k/\overline{M}_{Pl}=1.0$	1409.6190
	Bulk RS $G_{KK}\to WW\to qq\ell\nu$	1 e,μ	2 j / 1 J	Yes	20.3	🟩 W' mass 700 GeV	$k/\overline{M}_{Pl}=1.0$	1503.04677
	Bulk RS $G_{KK}\to HH\to b\bar{b}b\bar{b}$	–	4 b	–	19.5	🟩 G_{KK} mass 590-710 GeV	$k/\overline{M}_{Pl}=1.0$	ATLAS-CONF-2014-005
	Bulk RS $g_{KK}\to t\bar{t}$	1 e,μ	≥ 1 b, ≥ 1J/2j	Yes	20.3	🟩 g_{KK} mass 2.2 TeV	BR = 0.925	ATLAS-CONF-2015-009
	2UED / RPP	2 e,μ (SS)	≥ 1 b, ≥ 1 j	Yes	20.3	🟩 KK mass 960 GeV		Preliminary
Gauge bosons	SSM $Z'\to\ell\ell$	2 e,μ	–	–	20.3	🟩 Z' mass 2.9 TeV		1405.4123
	SSM $Z'\to\tau\tau$	2 τ	–	–	19.5	🟩 Z' mass 2.02 TeV		1502.07177
	SSM $W'\to\ell\nu$	1 e,μ	–	Yes	20.3	🟩 W' mass 3.24 TeV		1407.7494
	EGM $W'\to WZ\to\ell\nu\,\ell'\ell'$	3 e,μ	–	Yes	20.3	🟩 W' mass 1.52 TeV		1406.4456
	EGM $W'\to WZ\to qq\ell\ell$	2 e,μ	2 j / 1 J	–	20.3	🟩 W' mass 1.59 TeV		1409.6190
	HVT $W'\to WH\to\ell\nu bb$	1 e,μ	2 b	Yes	20.3	🟩 W' mass 1.47 TeV	$g_V=1$	Preliminary
	LRSM $W'_R\to t\bar{b}$	1 e,μ	2 b, 0-1 j	Yes	20.3	🟩 W' mass 1.92 TeV		1410.4103
	LRSM $W'_R\to t\bar{b}$	0 e,μ	≥ 1 b, 1 J	–	20.3	🟩 W' mass 1.76 TeV		1408.0886
CI	CI $qqqq$	–	2 j	–	17.3	🟩 Λ 12.0 TeV	$\eta_{LL}=-1$	Preliminary
	CI $qq\ell\ell$	2 e,μ	–	–	20.3	🟩 Λ 21.6 TeV	$\eta_{LL}=-1$	1407.2410
	CI $uutt$	2 e,μ (SS)	≥ 1 b, ≥ 1 j	Yes	20.3	🟩 Λ 4.35 TeV	$\lvert C_{LL}\rvert=1$	Preliminary
DM	EFT D5 operator (Dirac)	0 e,μ	≥ 1 j	Yes	20.3	🟩 M_* 974 GeV	at 90% CL for $m(\chi)<100$ GeV	1502.01518
	EFT D9 operator (Dirac)	0 e,μ	1 J, ≤ 1 j	Yes	20.3	🟩 M_* 2.4 TeV	at 90% CL for $m(\chi)<100$ GeV	1309.4017
LQ	Scalar LQ 1st gen	2 e	≥ 2 j	–	1.0	🟦 LQ mass 660 GeV	$\beta=1$	1112.4828
	Scalar LQ 2nd gen	2 μ	≥ 2 j	–	1.0	🟦 LQ mass 685 GeV	$\beta=1$	1203.3172
	Scalar LQ 3rd gen	1 e,μ, 1 τ	1 b, 1 j	–	4.7	🟦 LQ mass 534 GeV	$\beta=1$	1303.0526
Heavy quarks	VLQ $TT\to Ht+X, Wb+X$	1 e,μ	≥ 1 b, ≥ 3 j	Yes	20.3	🟩 T mass 785 GeV	isospin singlet	ATLAS-CONF-2015-012
	VLQ $TT\to Zt+X$	2/≥3 e,μ	≥2/≥1 b	–	20.3	🟩 T mass 735 GeV	T in (T,B) doublet	1409.5500
	VLQ $BB\to Zb+X$	2/≥3 e,μ	≥2/≥1 b	–	20.3	🟩 B mass 755 GeV	B in (B,Y) doublet	1409.5500
	VLQ $BB\to Wt+X$	1 e,μ	≥ 1 b, ≥ 5 j	Yes	20.3	🟩 B mass 640 GeV	isospin singlet	Preliminary
	$T_{5/3}\to Wt$	1 e,μ	≥ 1 b, ≥ 5 j	Yes	20.3	🟩 $T_{5/3}$ mass 840 GeV		Preliminary
Excited fermions	Excited quark $q^*\to q\gamma$	1 γ	1 j	–	20.3	🟩 q^* mass 3.5 TeV	only u^* and d^*, $\Lambda=m(q^*)$	1309.3230
	Excited quark $q^*\to qg$	–	2 j	–	20.3	🟩 q^* mass 4.09 TeV	only u^* and d^*, $\Lambda=m(q^*)$	1407.1376
	Excited quark $b^*\to Wt$	1 or 2 e,μ	1 b, 2 j or 1 j	Yes	4.7	🟦 b^* mass 870 GeV	left-handed coupling	1301.1583
	Excited lepton $\ell^*\to\ell\gamma$	2 e,μ, 1 γ	–	–	13.0	🟩 ℓ^* mass 2.2 TeV	$\Lambda=2.2$ TeV	1308.1364
	Excited lepton $\nu^*\to\ell W,\nu Z$	3 e,μ,τ	–	–	20.3	🟩 ν^* mass 1.6 TeV	$\Lambda=1.6$ TeV	1411.2921
Other	LSTC $a_T\to W\gamma$	1 e,μ, 1 γ	–	Yes	20.3	🟩 a_T mass 960 GeV		1407.8150
	LRSM Majorana ν	2 e,μ	2 j	–	2.1	🟦 N^0 mass 1.5 TeV	$m(W_R)=2$ TeV, no mixing	1203.5420
	Higgs triplet $H^{\pm\pm}\to\ell\ell$	2 e,μ (SS)	–	–	20.3	🟩 $H^{\pm\pm}$ mass 551 GeV	DY production, BR($H_L^{\pm\pm}\to\ell\ell$)=1	1412.0237
	Higgs triplet $H^{\pm\pm}\to\ell\tau$	3 e,μ,τ	–	–	20.3	🟩 $H^{\pm\pm}$ mass 400 GeV	DY production, BR($H_L^{\pm\pm}\to\ell\tau$)=1	1411.2921
	Monotop (non-res prod)	1 e,μ	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, $\lvert q\rvert=5e$	Preliminary
	Magnetic monopoles	–	–	–	2.0	🟦 monopole mass 862 GeV	DY production, $\lvert g\rvert=1g_D$	1207.6411

🟦 $\sqrt{s}$ = 7 TeV 🟩 $\sqrt{s}$ = 8 TeV

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

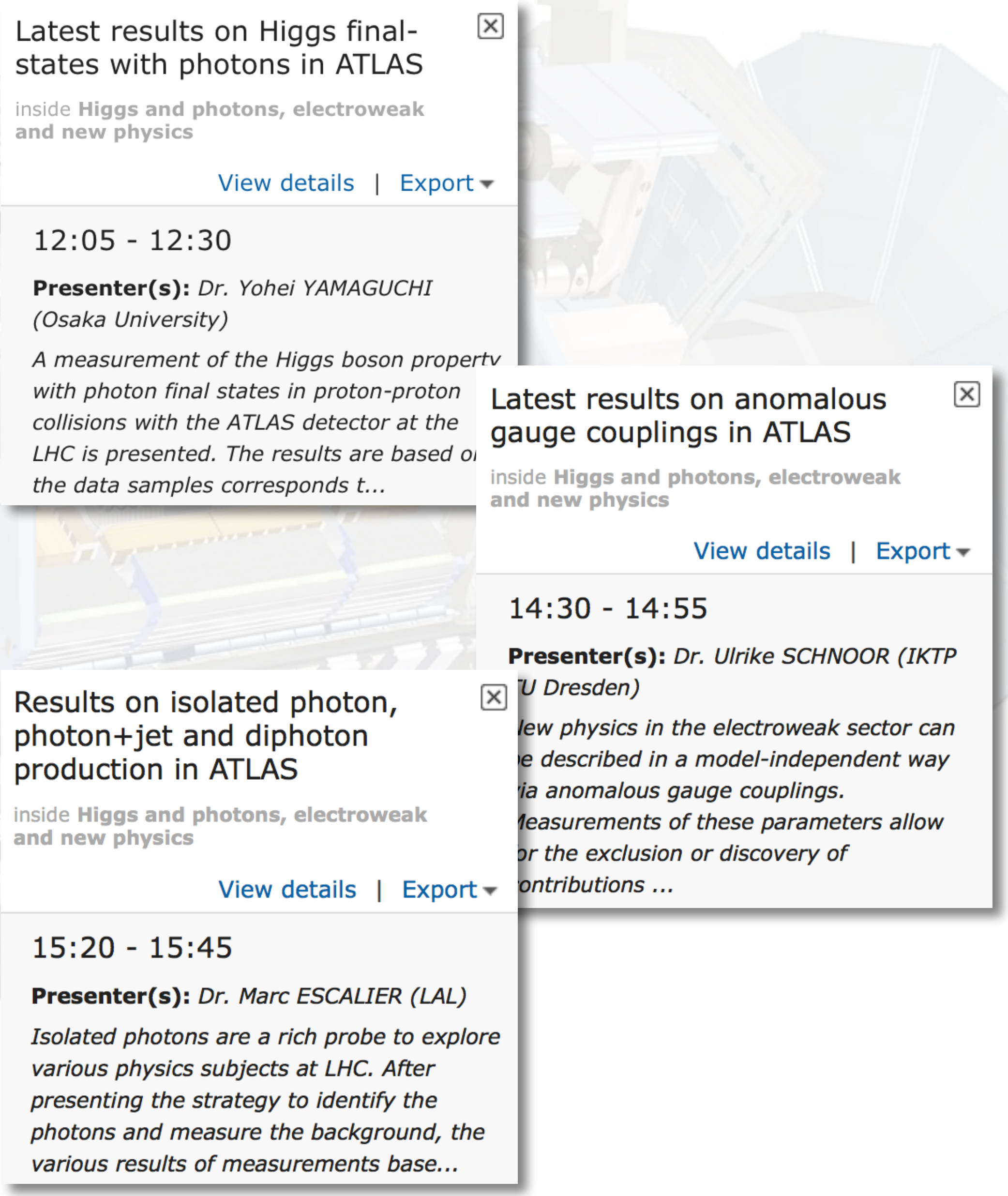
First Run 2 Results



- After LHC's first long shutdown (LS1), ATLAS is once again taking collision data
- With:
  - New detector components added, and faulty modules fixed
  - A much improved trigger system, allowing for more flexible event selections
  - A new data processing and analysis model, helping in deriving results more easily

Other ATLAS Talks

- The other ATLAS speakers will be able to give more detail about their topics in their upcoming presentations
  - Latest results on Higgs final-states with photons in ATLAS
    - Yohei Yamaguchi
  - Latest results on anomalous gauge couplings in ATLAS
    - Ulrike Schnoor
  - Results on isolated photon, photon+jet and diphoton production in ATLAS
    - Marc Escalier



Latest results on Higgs final-states with photons in ATLAS

inside **Higgs and photons, electroweak and new physics**

12:05 - 12:30

Presenter(s): *Dr. Yohei YAMAGUCHI (Osaka University)*

A measurement of the Higgs boson property with photon final states in proton-proton collisions with the ATLAS detector at the LHC is presented. The results are based o the data samples corresponds t...

Latest results on anomalous gauge couplings in ATLAS

inside **Higgs and photons, electroweak and new physics**

14:30 - 14:55

Presenter(s): *Dr. Ulrike SCHNOOR (IKTP U Dresden)*

lew physics in the electroweak sector can e described in a model-independent way ia anomalous gauge couplings. leasurements of these parameters allow or the exclusion or discovery of ontributions ...

Results on isolated photon, photon+jet and diphoton production in ATLAS

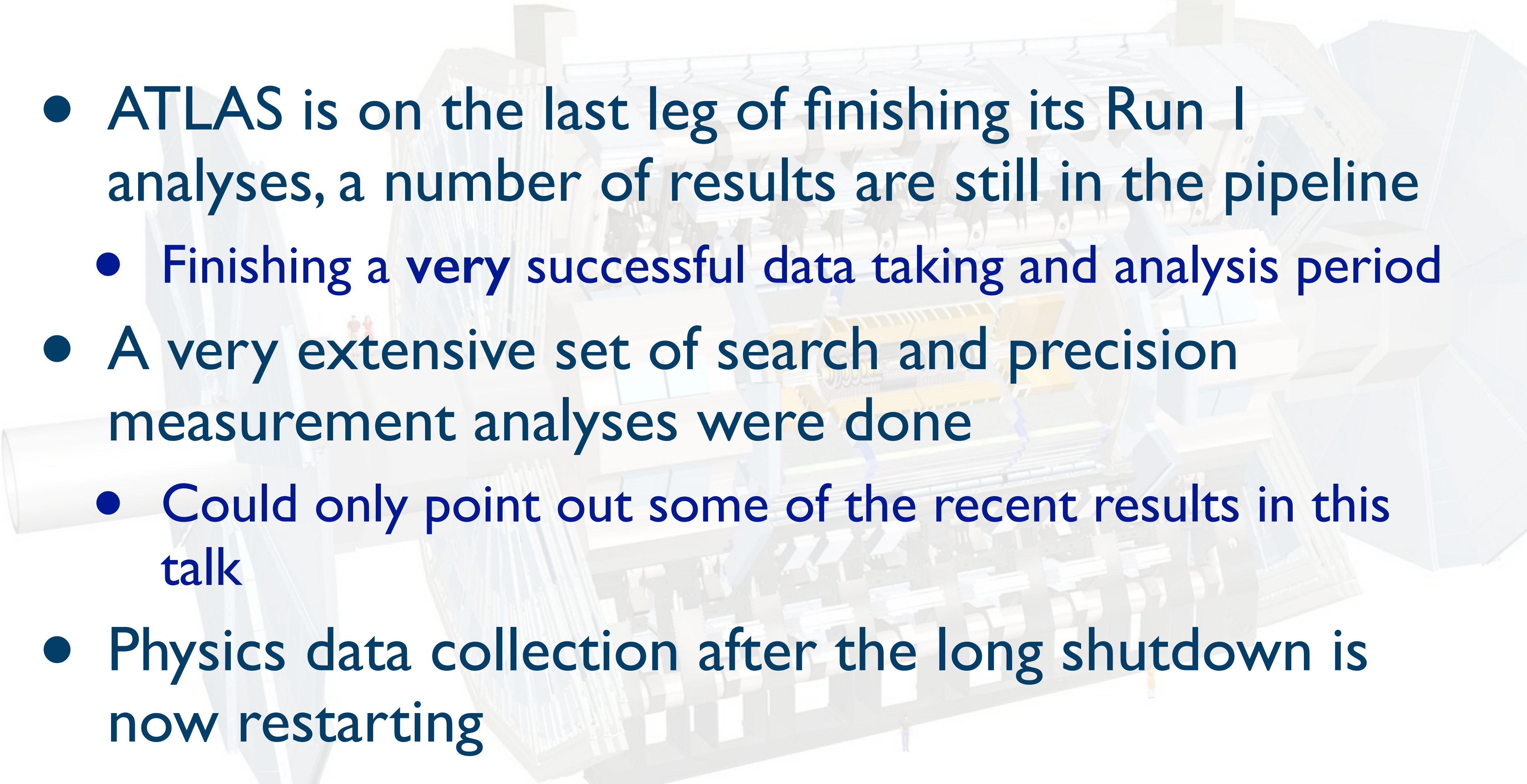
inside **Higgs and photons, electroweak and new physics**

15:20 - 15:45

Presenter(s): *Dr. Marc ESCALIER (LAL)*

Isolated photons are a rich probe to explore various physics subjects at LHC. After presenting the strategy to identify the photons and measure the background, the various results of measurements base...

Summary



- ATLAS is on the last leg of finishing its Run I analyses, a number of results are still in the pipeline
  - Finishing a **very** successful data taking and analysis period
- A very extensive set of search and precision measurement analyses were done
  - Could only point out some of the recent results in this talk
- Physics data collection after the long shutdown is now restarting
  - First results will be published in the near future