Recent ATLAS Results

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BNL Forum 2011

Introduction

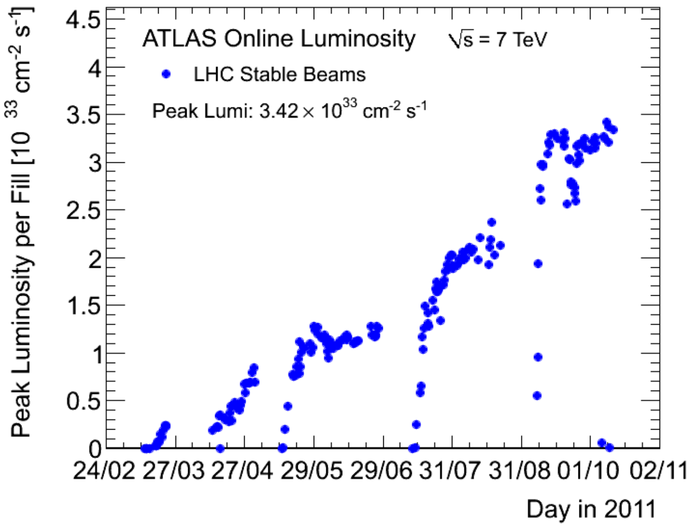
- A very exciting and productive year → long list of results
- I will focus on some of most recent results on searches:
  - (brief summary of SM and top physics)
  - Higgs
  - Supersymmetry
  - Exotic searches

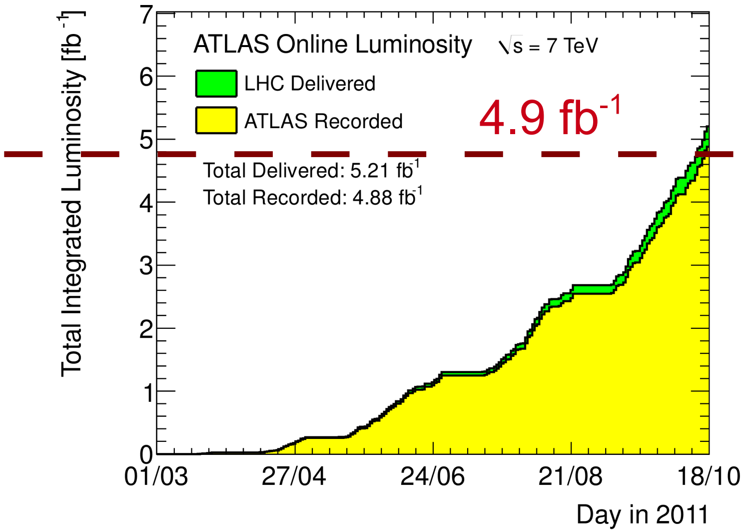
- Complete information about all results:

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

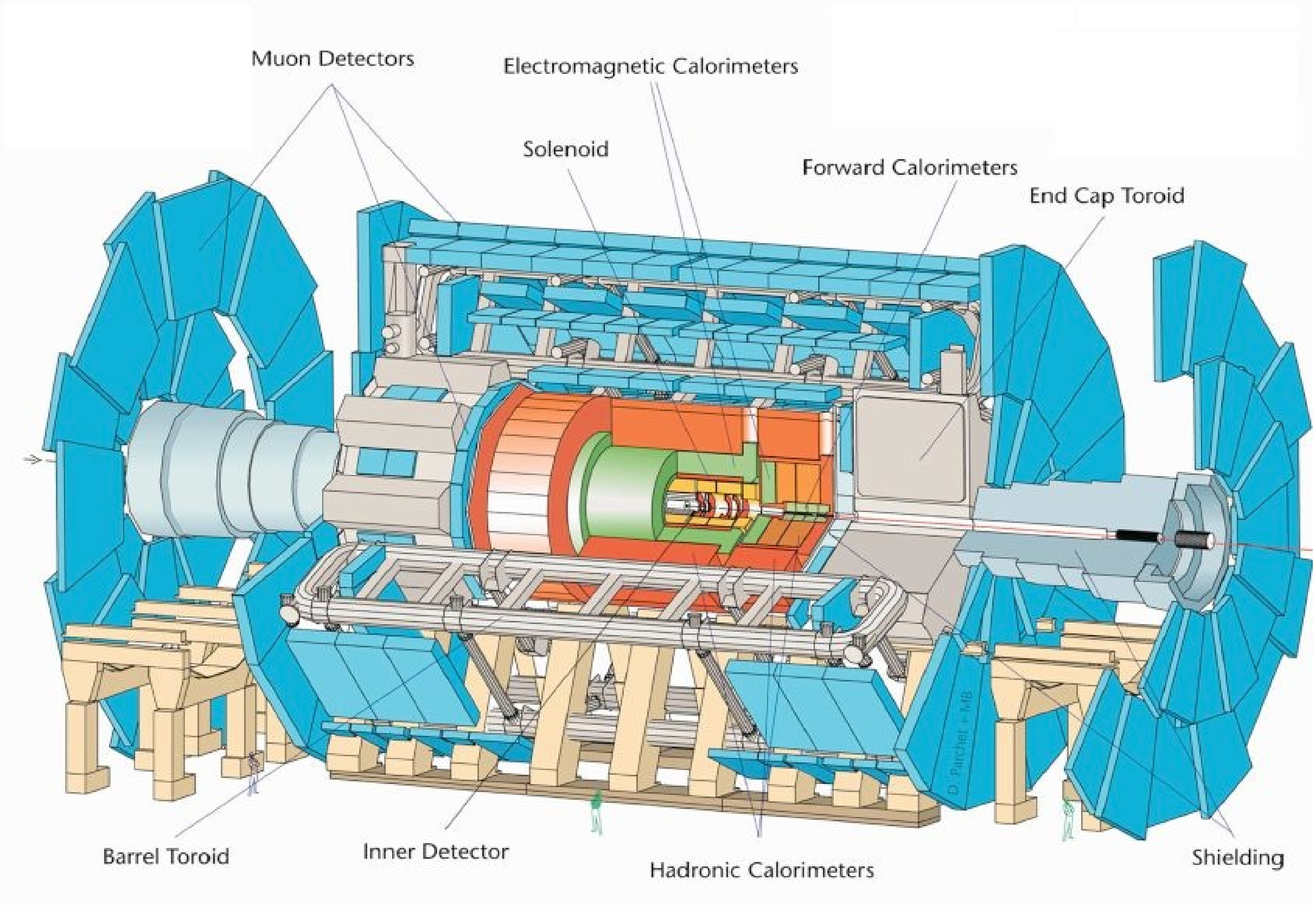
The Large Hadron Collider (LHC)

- pp collisions at $\sqrt{s}$ = 7 TeV
  (and PbPb at $\sqrt{s_{NN}}$ = 2.76 TeV, not covered in this talk)
- LHC has performed extremely well this year:
  - → 3.4 10^{33} /cm^2/s peak luminosity
  - → 4.9 fb^{-1} delivered, thanks!
- 50 ns bunch spacing
- 6 collisions / crossing in 1st 2 fb^{-1} (~ twice more in recent data)
- Results shown today: up to 2.3 fb^{-1}





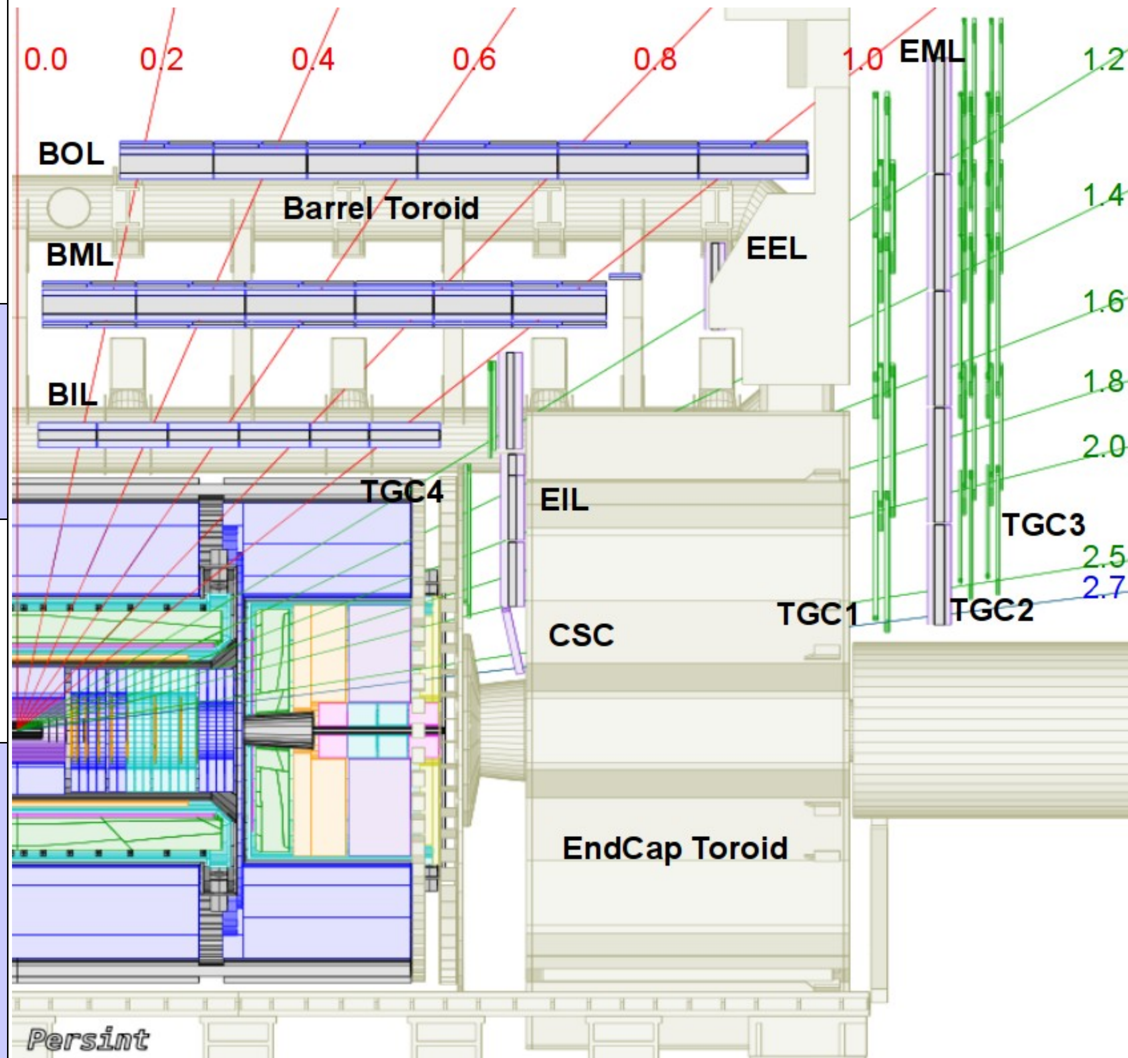
The ATLAS Detector



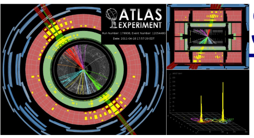
The ATLAS Detector

Already close to nominal performance!

Muon Spectrometer	Toroids B.dl ~ 1-7 T.m RPC + TGC: triggers MDT + CSC: precision σ/p_T = 2% @ 50 GeV σ/p_T ~ 13% @ 1 TeV
Hadronic Calorimeter	Fe+scint. or Cu/W+LAr $\sigma/E \sim 50\%/E^{1/2} \oplus 3\%$ Thickness ~ 10 λ
EM Calorimeter	Lead+LAr $\sigma/E \sim 10\%/E^{1/2} \oplus 1.5\%$ Thickness ~ 24 X_0
Inner Detector	2 Tesla solenoid Si pixels + strips TRT $\sigma/p_T = 5 \times 10^{-4}\, p_T \oplus 0.01$



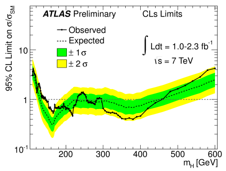
Outline



SM in one slide

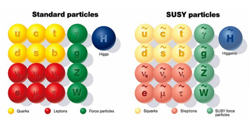
- → Electroweak Measurements
- → Top Quark

SM Higgs



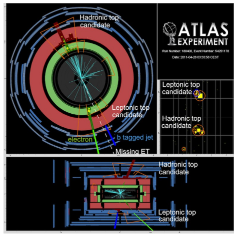
- → $H \rightarrow gg$
- → $H \rightarrow ZZ \rightarrow 4l$
- → $H \rightarrow WW \rightarrow l\nu l\nu$
- → Combination

Supersymmetry



- → Jets + MET
- → Lepton(s) + MET
- → 3rd generation + MET
- → Photon(s) + MET
- → “Exotic” SUSY (no MET)

Exotic Searches



- → Heavy Resonances
- → Same-sign Dilepton
- → Top-Antitop Properties
- → TeV-gravity

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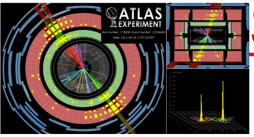

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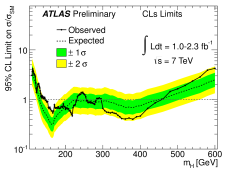

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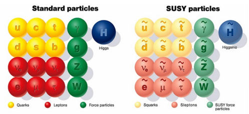

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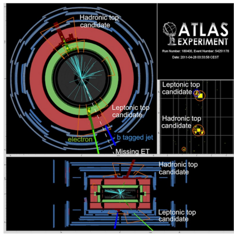

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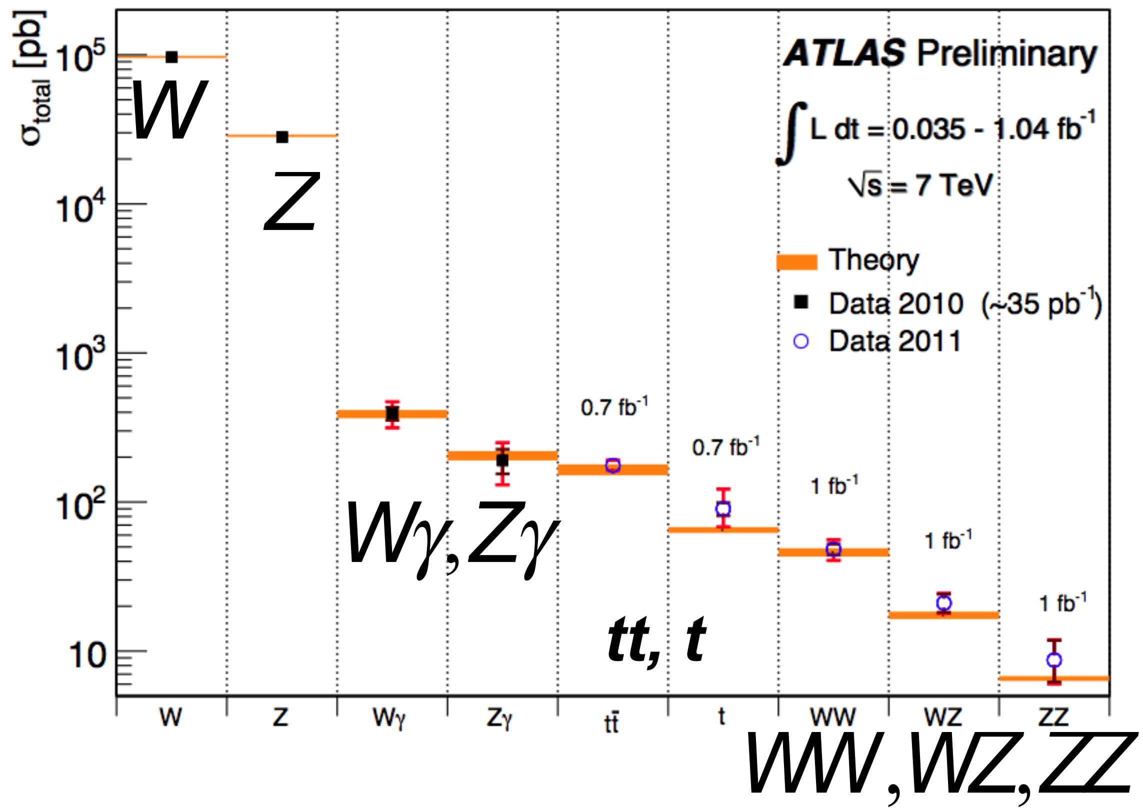
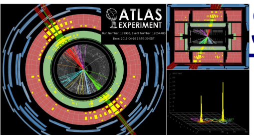
The Standard Model at √s = 7 TeV

- SM measurements are the foundations of all searches



- 33 ATLAS papers on Standard Model measurements to date

Outline



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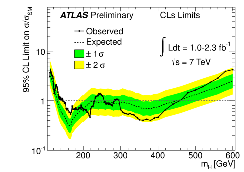

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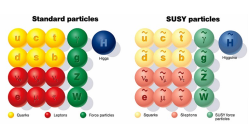

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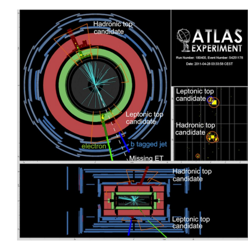

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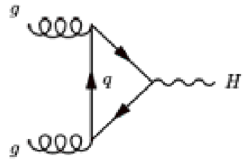
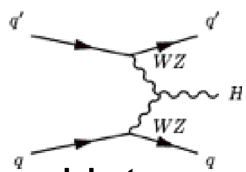
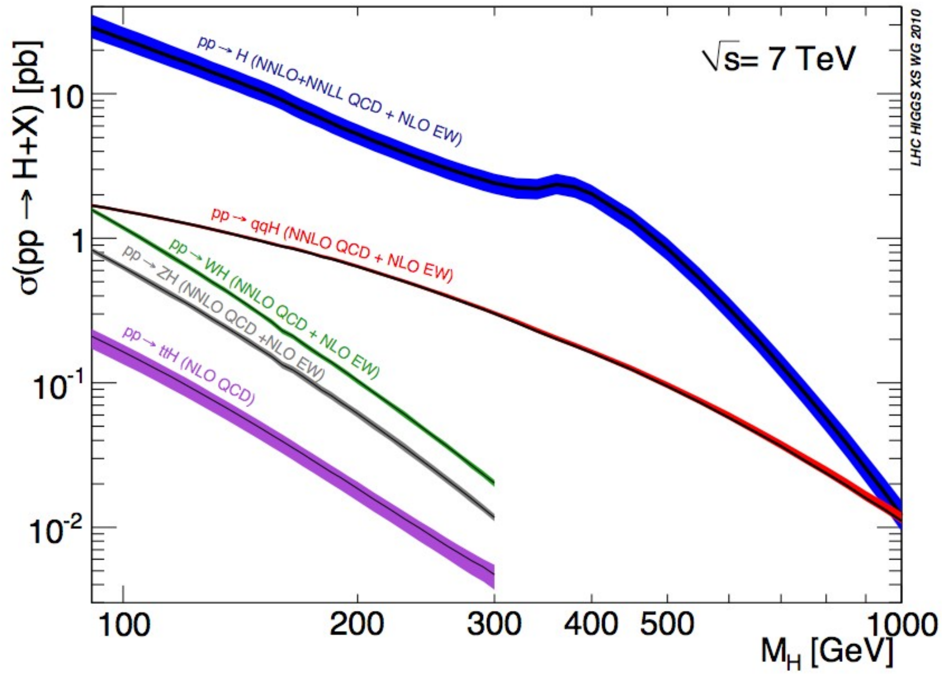
Higgs Production at the LHC

- Gluon fusion:
  

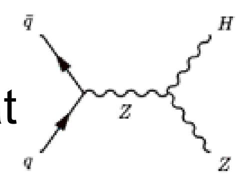
  - → Largest c-s
  - → Needs clean decay channel
  - → e.g. H → γγ, H → ZZ

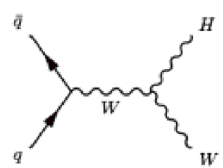


- Vector boson fusion:
  - → Distinctive feature: forward jets and rapidity gap
  - → Allows more difficult decays
  - → e.g. H → ττ

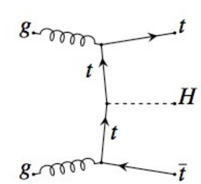


- WH, ZH associated prod:
  - → Small cross-section except at low mass
  - → Very distinctive feature: W/Z leptonic decay
  - → e.g. H → bb



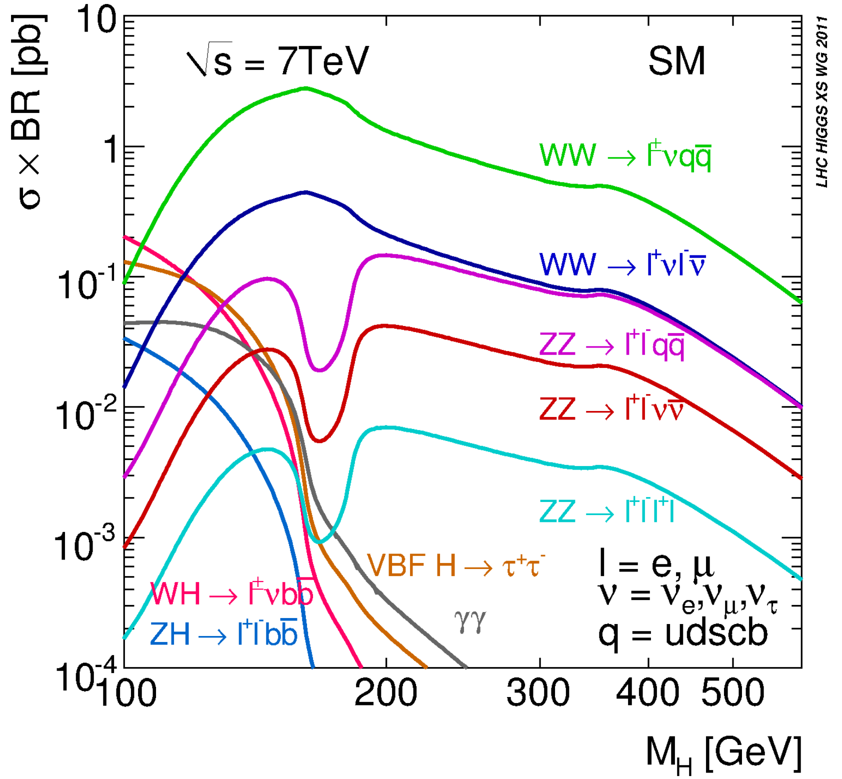


- ttH associated prod:
  - → Very small c-s
  - → Complex final state



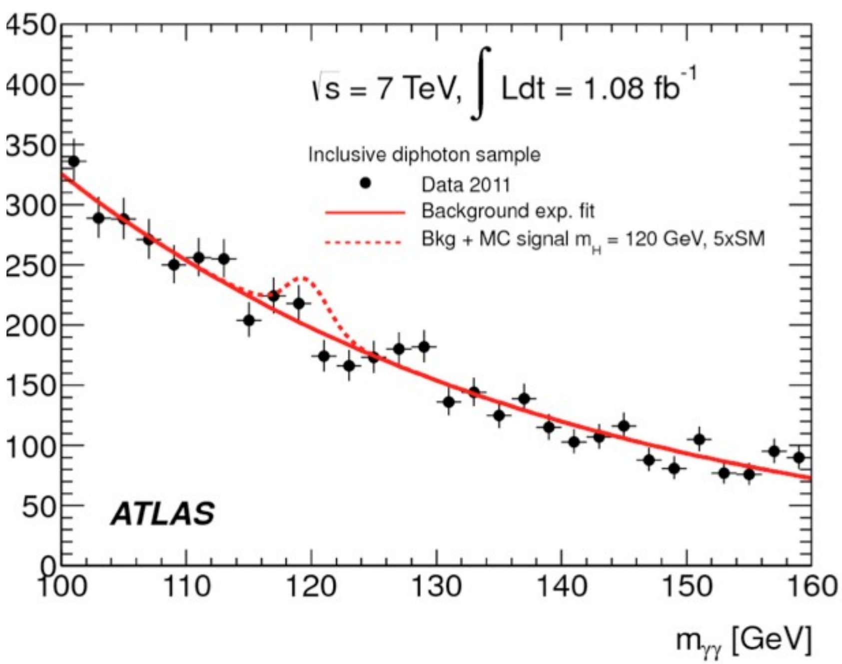
Higgs Decay Channels

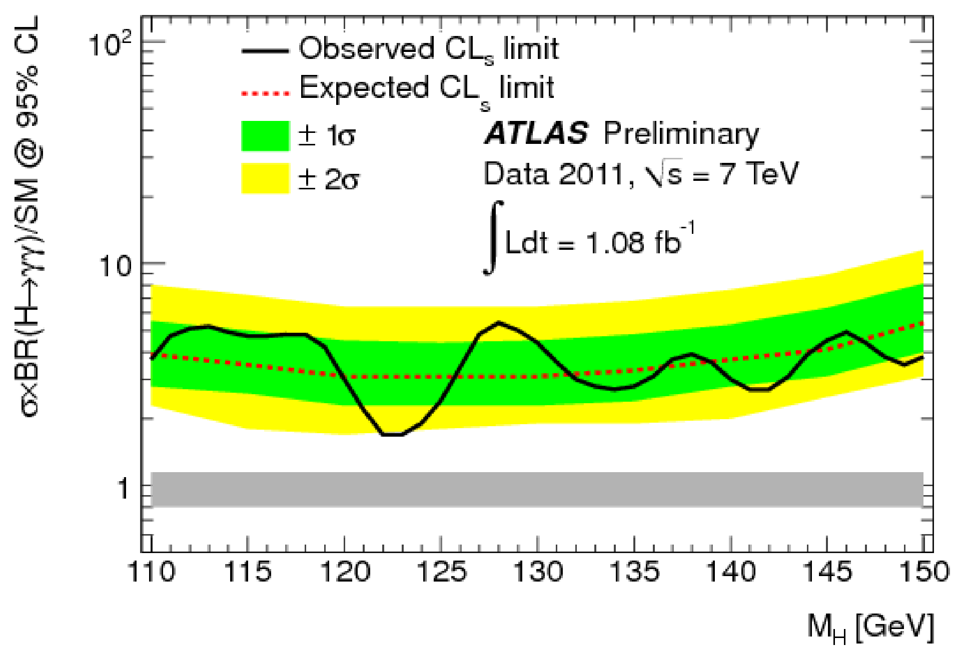
- Low mass:
  - → **H → γγ: small B.R. but sizable yield**
  - → H → bb in associated prod
  - → H → ττ in VBF production
- Intermediate mass:
  - → **H → WW → lvlv: large yield but poor mass resolution**
  - → **H → ZZ → 4l: "golden channel", low yield but low background and excellent mass resolution**
- High mass:
  - → H → WW → lvqq
  - → H → ZZ → llqq
  - → H → ZZ → llvv



$H \rightarrow \gamma\gamma$

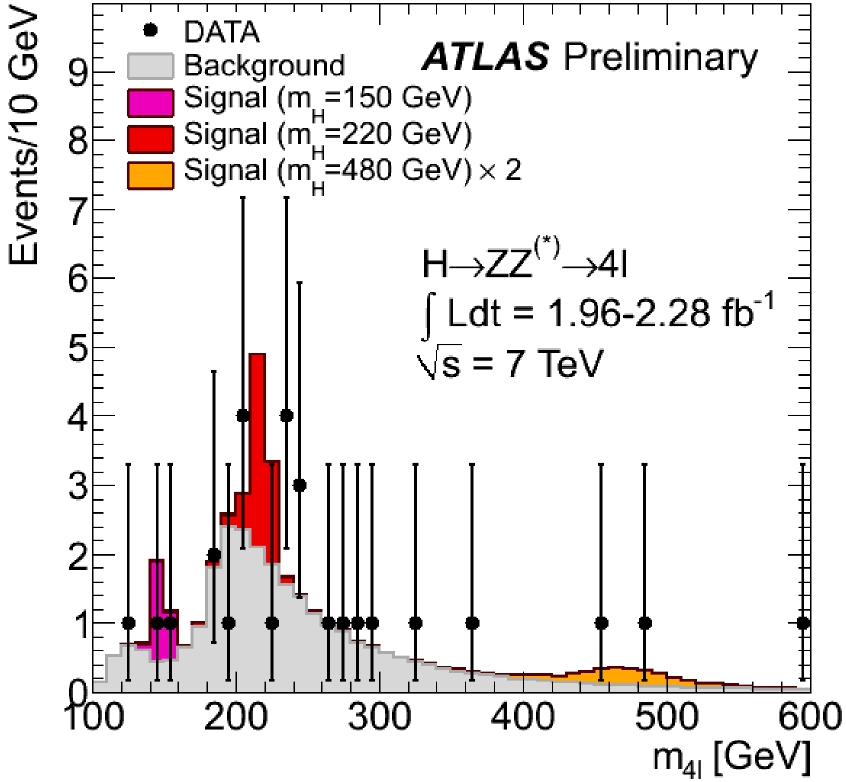
- "Benchmark channel", drove the design of experiments:
  - → Fake rejection
  - → Mass resolution
- Most important channel at very low mass

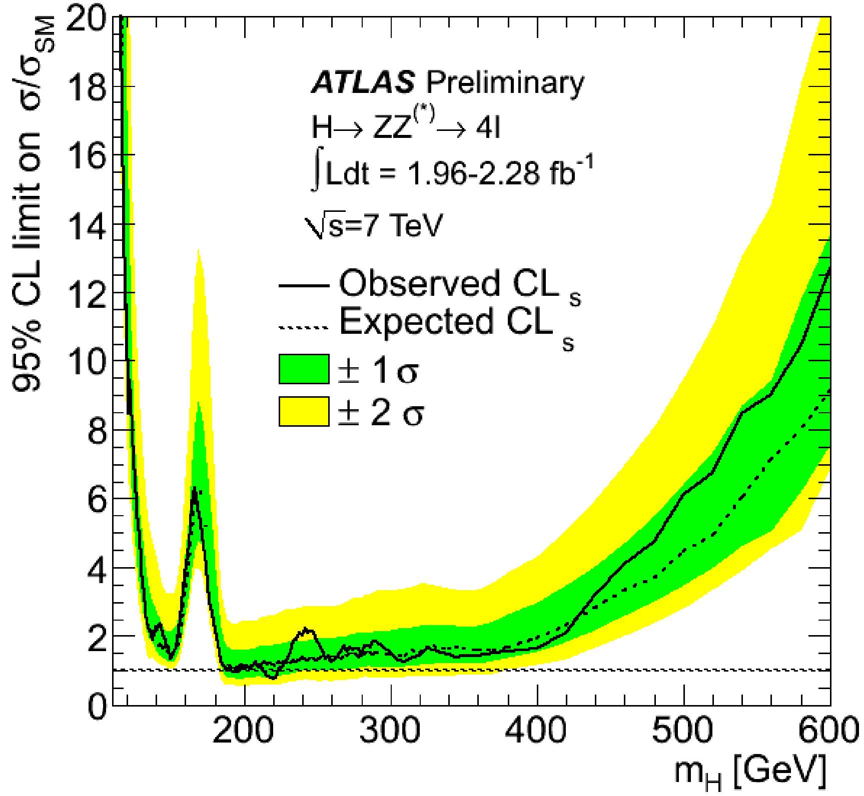




$H \to ZZ \to 4$ leptons

- "Golden channel": best Higgs mass resolution and low background

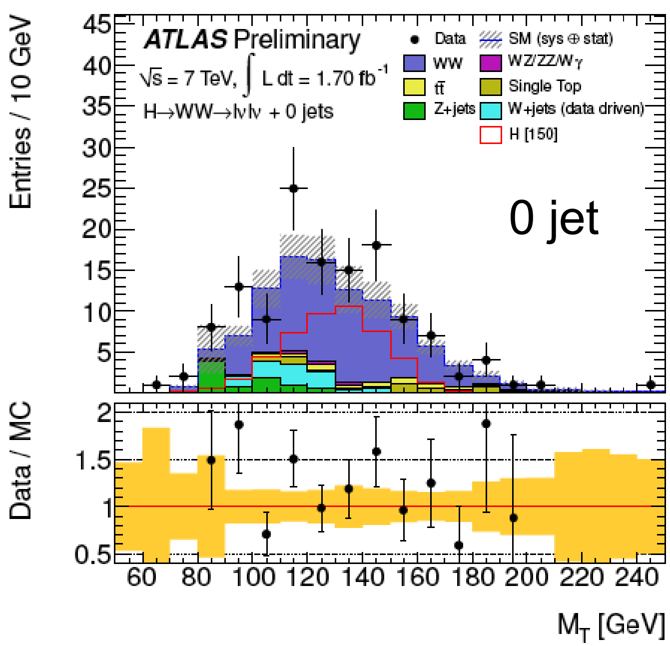


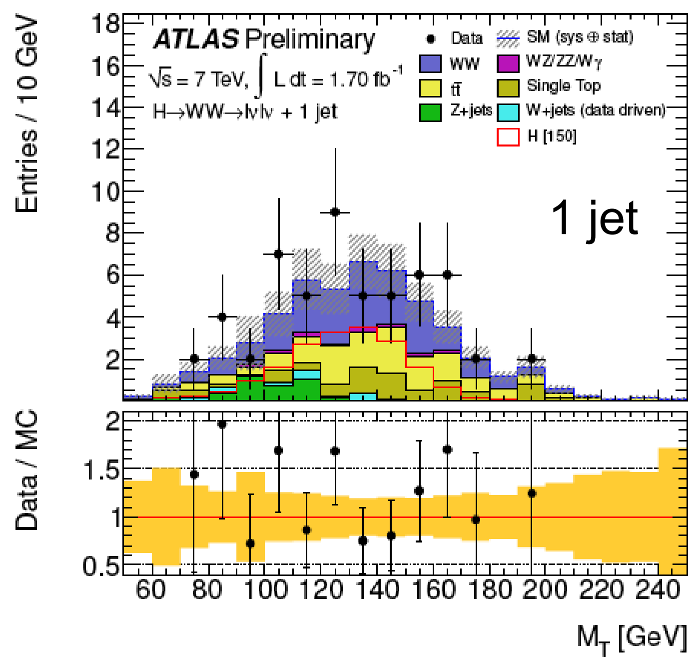


$H \rightarrow WW \rightarrow l\nu l\nu$

- Poor mass resolution, difficult background, but large yield
- Top and WW bgds estimated from data

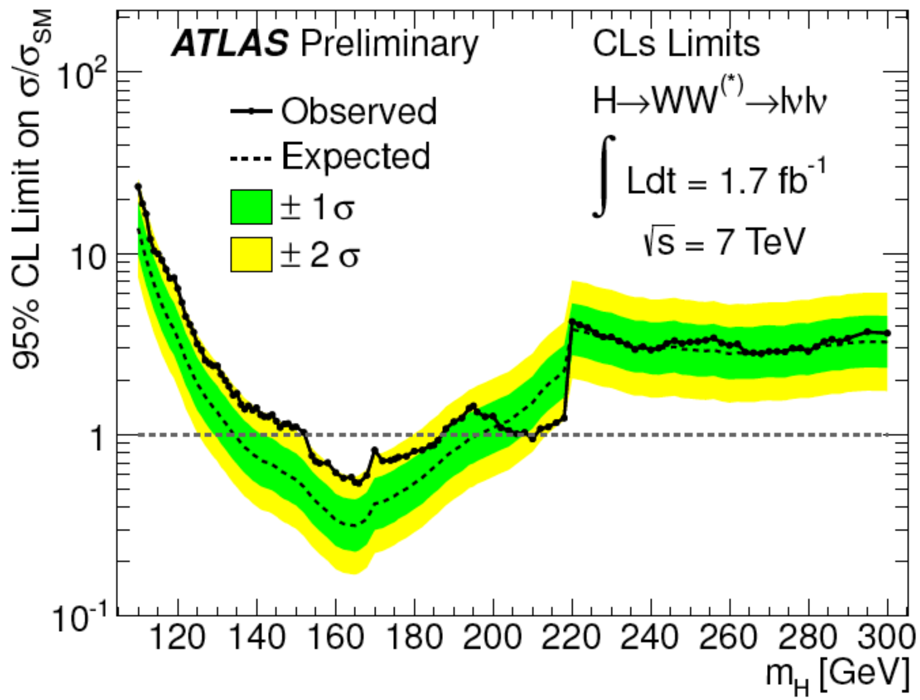
$$m_{\mathrm{T}} = \sqrt{(E_{\mathrm{T}}^{\ell\ell} + E_{\mathrm{T}}^{\mathrm{miss}})^2 - (\mathbf{P}_{\mathrm{T}}^{\ell\ell} + \mathbf{P}_{\mathrm{T}}^{\mathrm{miss}})^2}$$



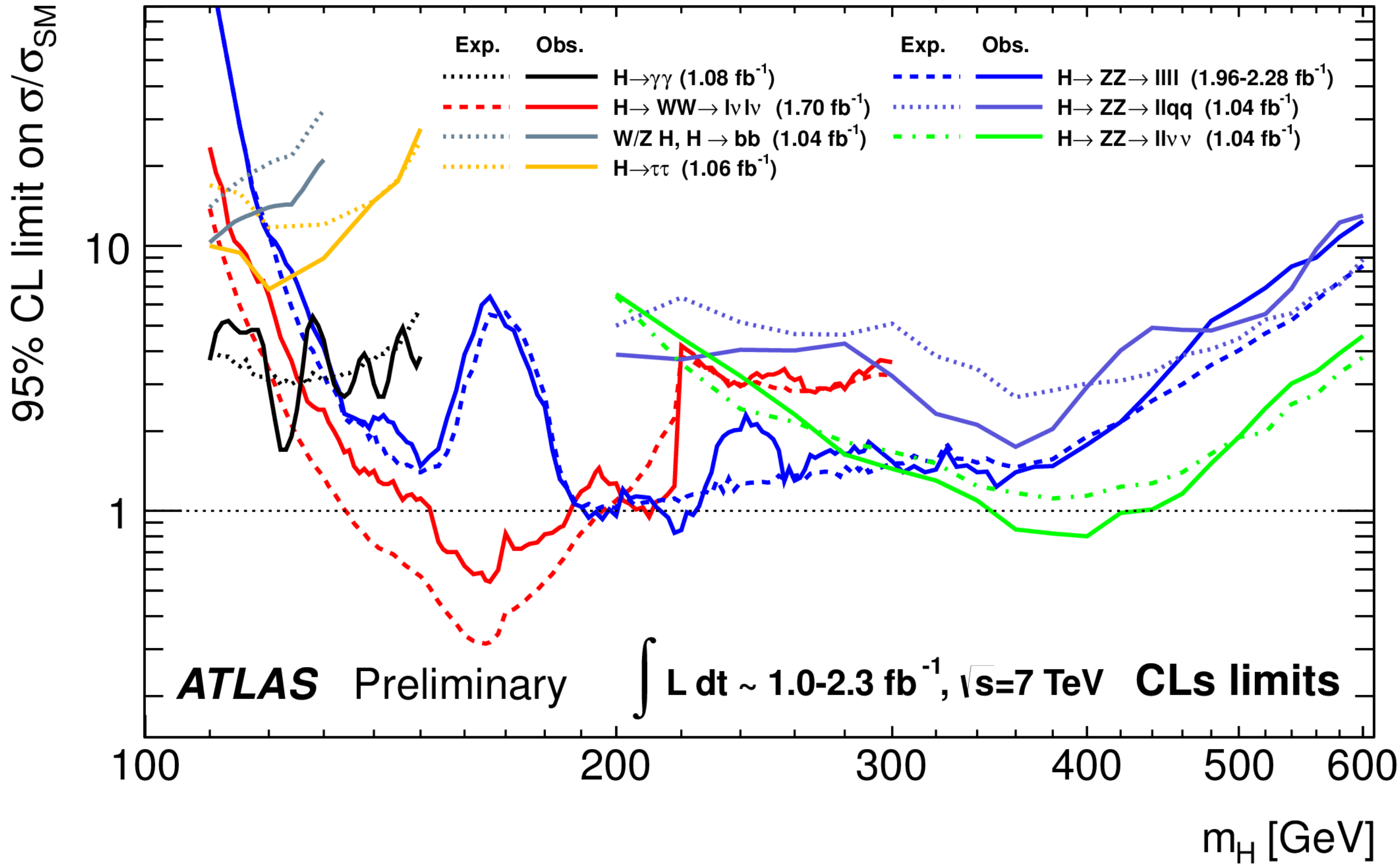


H → WW → lνlν

- Poor mass resolution, difficult background, but large yield
- Most sensitive of all channels
- Powerful over a wide range
- Top and WW bgds estimated from data



Higgs Search: Combination of Channels



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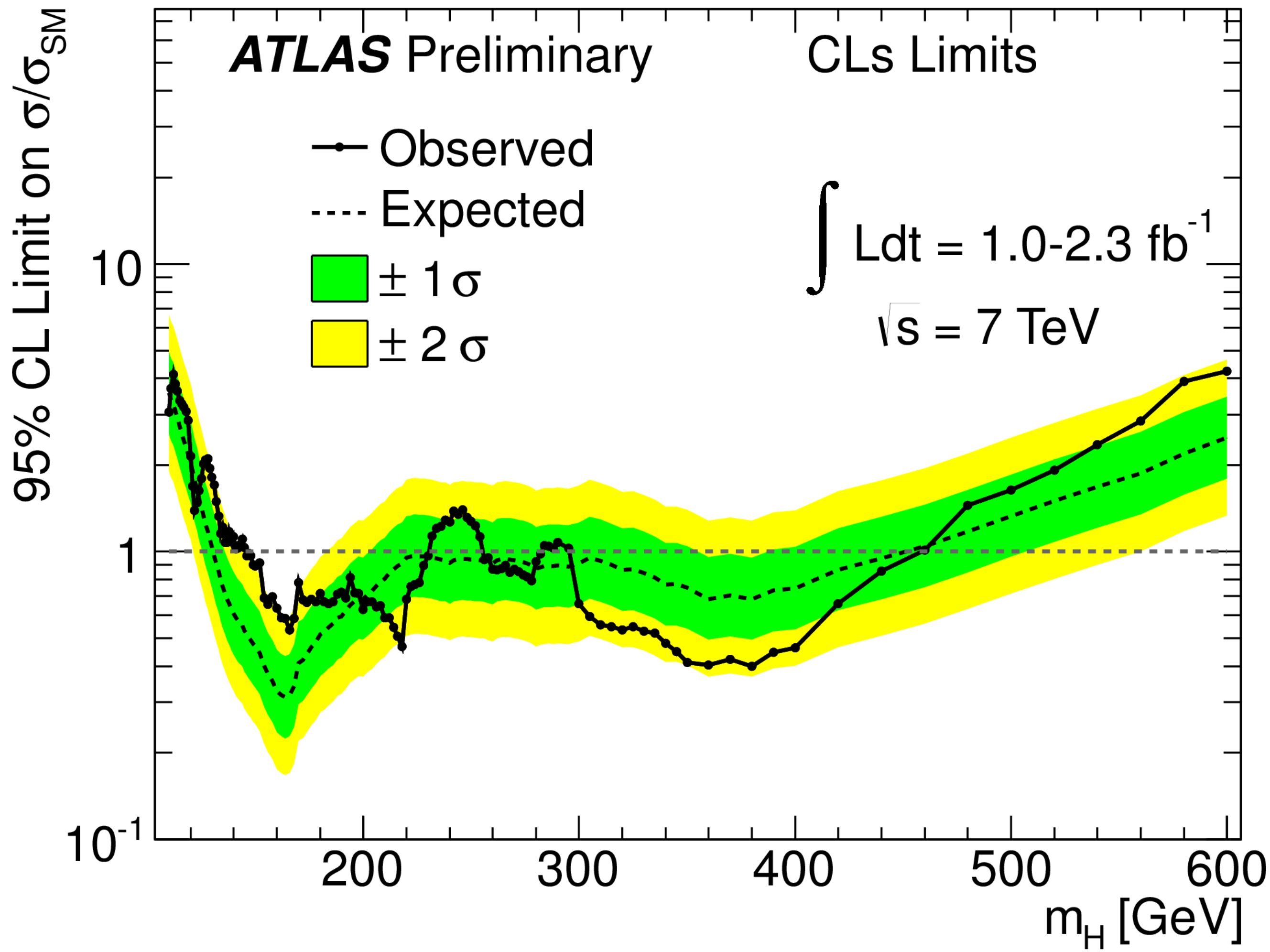


Expected to exclude [131 – 450] GeV

Observed : ranges [146-230] , [256-282] , [296-459] GeV exluded at 95% C.L.

Higgs Search: Summary

- With 2 fb^{-1}, ATLAS excludes SM Higgs over wide range:

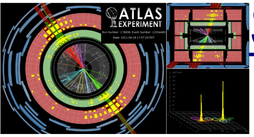
  ranges [146-230] , [256-282] , [296-459] GeV exluded at 95% C.L.

- The 2 experiments combined could exclude the SM Higgs over the entire range with 5 fb^{-1} (2011 data)

- Discovery at low mass is most challenging

- Discovery is within reach for any mass with ~20 fb^{-1} (end of 2012)

Outline



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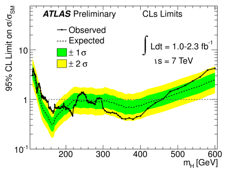

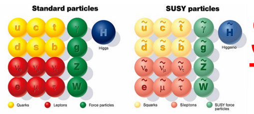

Supersymmetry

- → Jets + MET
- → Lepton(s) + MET
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Exotic Searches

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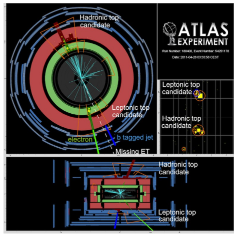
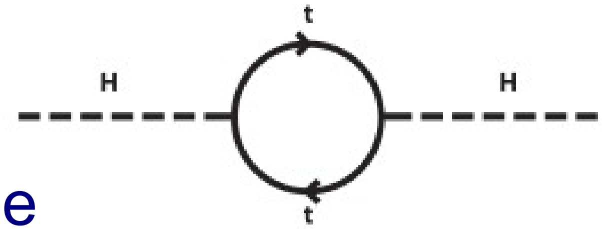
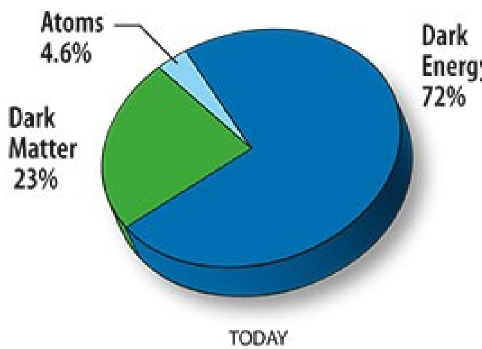
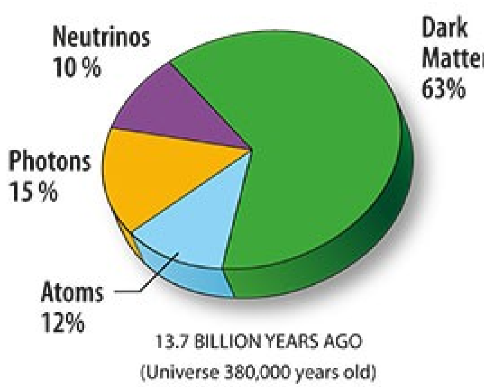


Why look "beyond" the Standard Model?

- The Standard Model is a (very) effective theory that breaks down at a certain scale
  - → Hierarchy: quadratic divergence of the Higgs mass, extremely fine-tuned
  - → What is the underlying nature of EWSB?
- Dark Matter
  - → cannot be explained by SM
- Neutrinos have mass
  - → where are the right-handed neutrinos?
- BSM models attempt to solve the SM limitations







A very long list of models x signatures

- Many extensions of the SM have been developed over the past decades:
- Supersymmetry
- Extra-Dimensions
- Technicolor(s)
- Little Higgs
- No Higgs
- GUT
- Hidden Valley
- Leptoquarks
- Compositeness
- 4^{th} generation (t', b')
- LRSM, heavy neutrino
- etc...

(for illustration only)

- 1 jet + MET
- jets + MET
- 1 lepton + MET
- Same-sign di-lepton
- Dilepton resonance
- Diphoton resonance
- Diphoton + MET
- Multileptons
- Lepton-jet resonance
- Lepton-photon resonance
- Gamma-jet resonance
- Diboson resonance
- Z+MET
- W/Z+Gamma resonance
- Top-antitop resonance
- Slow-moving particles
- Long-lived particles
- Top-antitop production
- Lepton-Jets
- Microscopic blackholes
- Dijet resonance
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A complex 2D problem

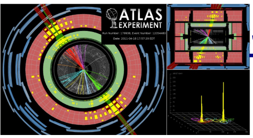
Experimentally, a **signature standpoint** makes a lot of sense:

→ Practical

→ Less model-dependent

→ Important to cover every possible signature

Outline



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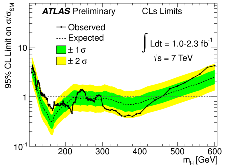

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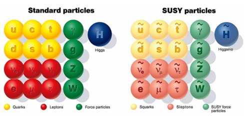

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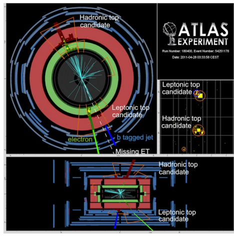

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Supersymmetry

Cascade ending with LSP
→ large MET

1 Jets+MET: Gluino and Squark prod. dominate

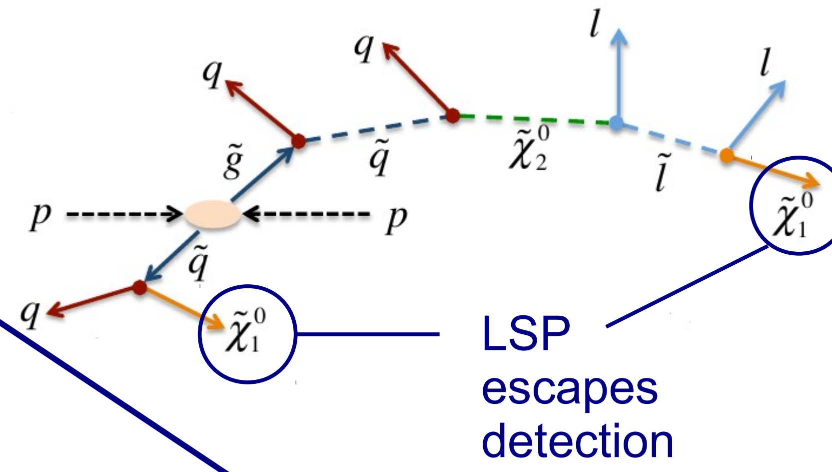
2 Leptons(+jets)+MET: lower branching ratio/cross-section but complementary

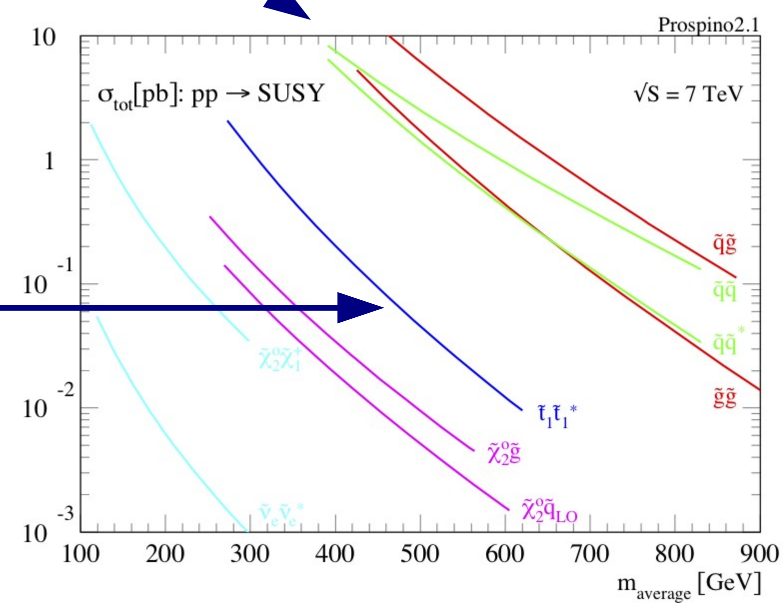
3 3rd generation (b or t)+MET:

- → in cascade
- → direct production requires > 1 fb^{-1} → coming soon

4 Photon(s)+MET: GMSB models

5 “Exotic” SUSY: long-lived, no MET





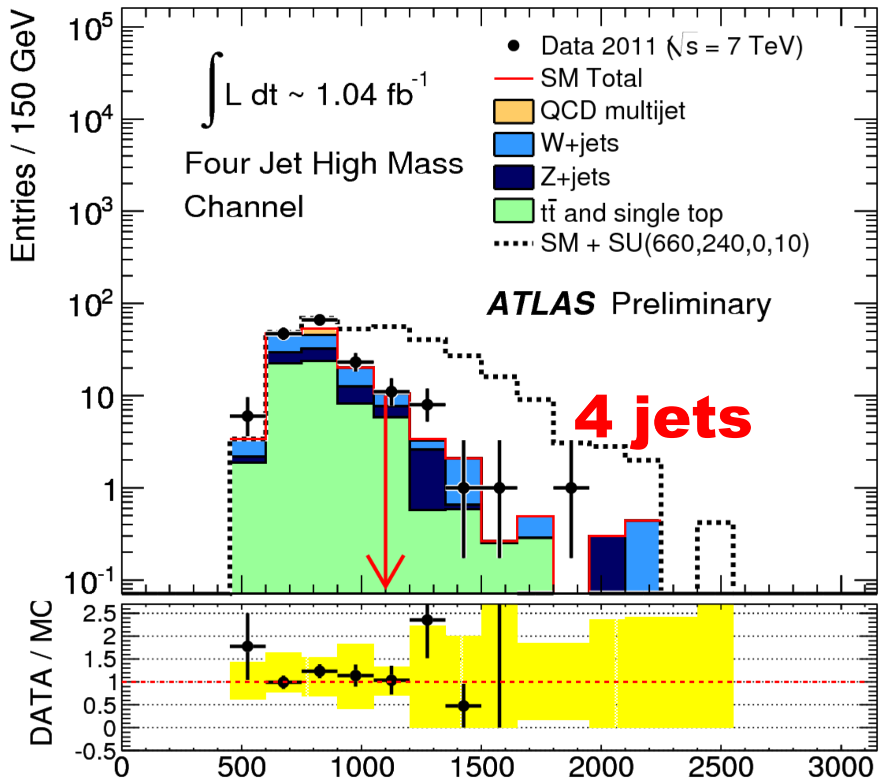
1. SUSY: Jets + Missing E_T

$\tilde{q} \rightarrow q\tilde{\chi}_1^0$

$\tilde{g} \rightarrow qq\tilde{\chi}_1^0$

- "Workhorse" analysis
  - → $m_{eff} = H_T$ + Missing E_T
  - → Optimize cut on m_{eff} and Missing ET for each jet multiplicity
  - → Combine 5 channels (2-4 jets)

Signal Region	≥ 2 jets	≥ 3 jets	≥ 4 jets	High mass
E_T^{miss}	> 130	> 130	> 130	> 130
Leading jet p_T	> 130	> 130	> 130	> 130
Second jet p_T	> 40	> 40	> 40	> 80
Third jet p_T	–	> 40	> 40	> 80
Fourth jet p_T	–	–	> 40	> 80
$\Delta\phi(\text{jet}, E_T^{miss})_{min}$	> 0.4	> 0.4	> 0.4	> 0.4
E_T^{miss}/m_{eff}	> 0.3	> 0.25	> 0.25	> 0.2
m_{eff} [GeV]	> 1000	> 1000	> 500/1000	> 1100



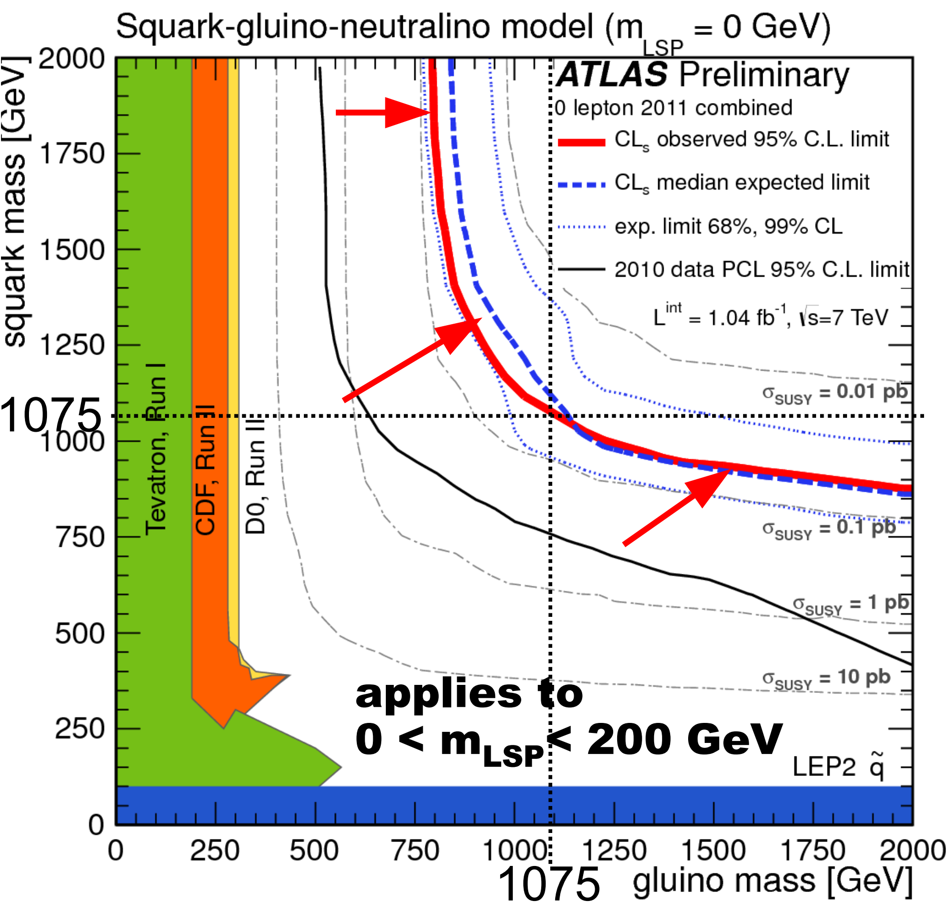
$m_{eff} = H_T$ + Missing E_T

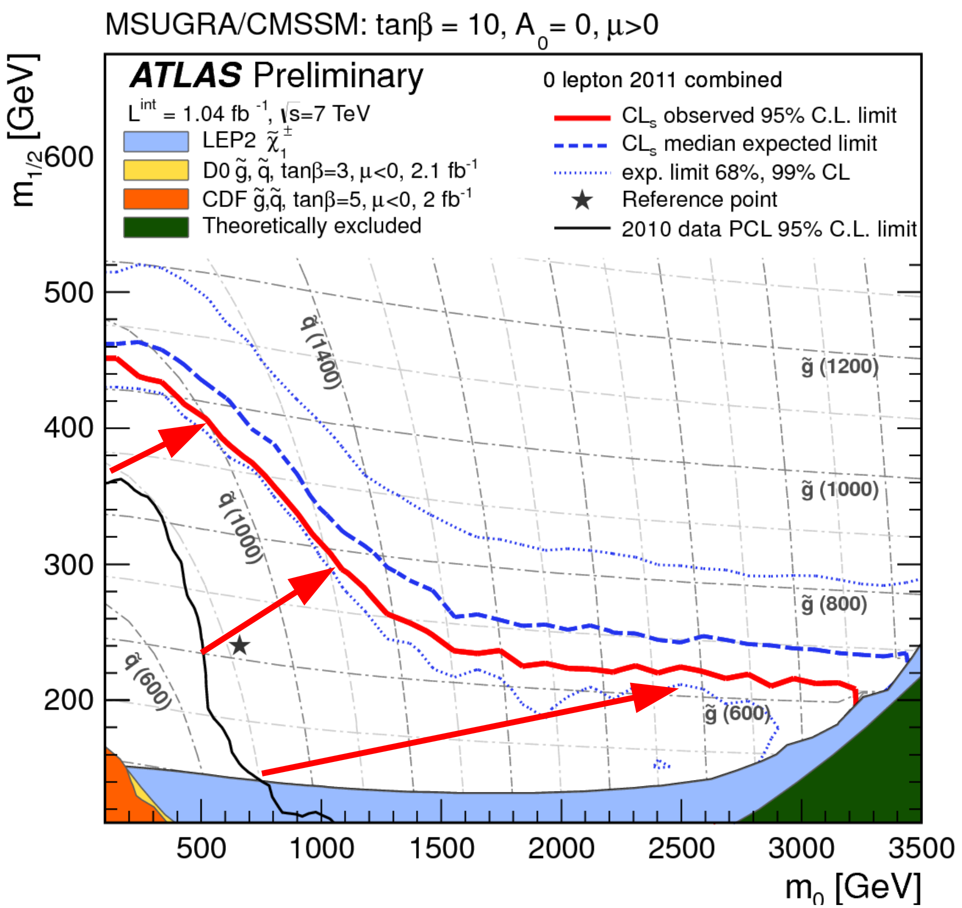
Submitted to PLB
arxiv:1109.6572

1. SUSY: Jets + Missing E_T

$\tilde{q} \rightarrow q\tilde{\chi}_1^0$
$\tilde{g} \rightarrow qq\tilde{\chi}_1^0$

- Exclude up to ~ 1 TeV for m(squark) = m(gluino)



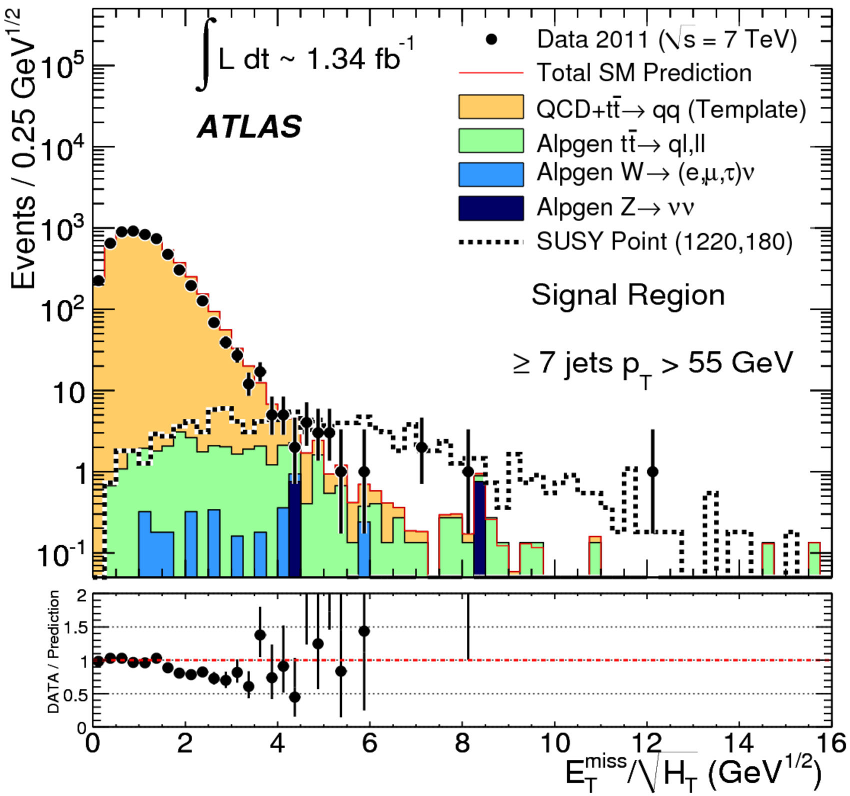


1. SUSY: Jets + Missing E_T

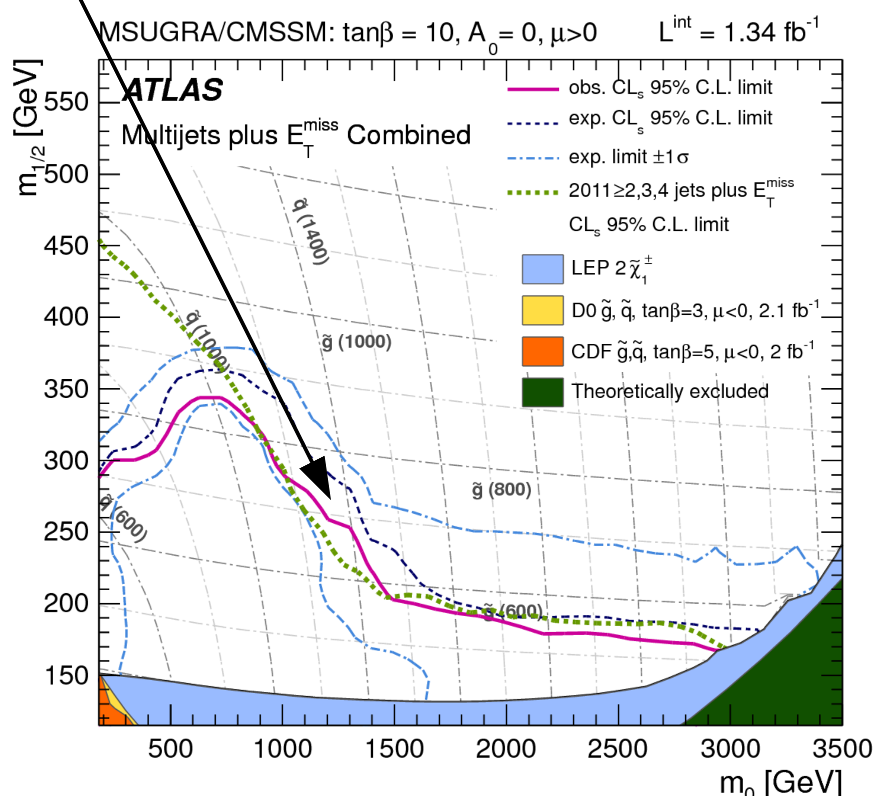
$\tilde{q} \rightarrow q\tilde{\chi}_1^0$

$\tilde{g} \rightarrow qq\tilde{\chi}_1^0$

- Large Jet Multiplicity (6 jets and more)
  - → Increase reach in some region of parameter space



NEW



arxiv:1110.2299

3. SUSY: b-Jets + lepton + Missing E_T

- What if gluinos decay preferentially to 3rd generation?
- Consider several pheno. scenarii, such as:

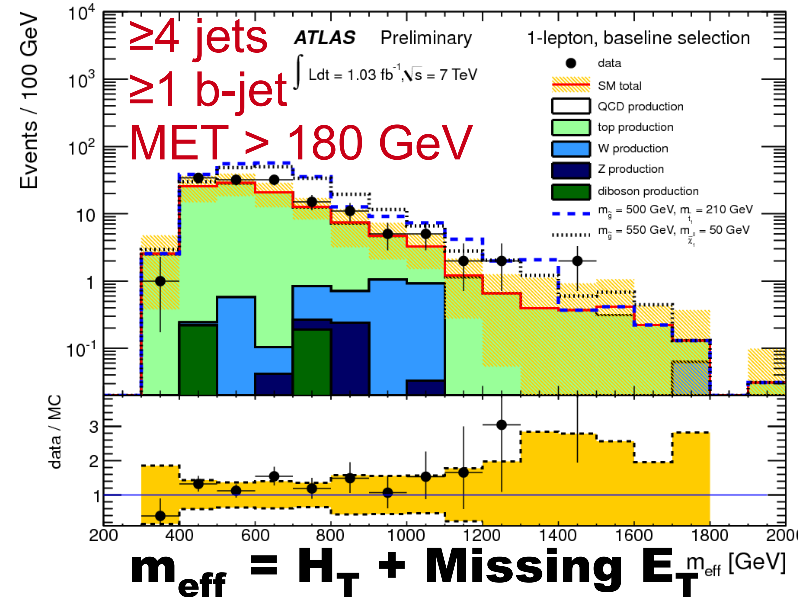
  Assume $m(\tilde{g}) > m(\tilde{t}_1) > m(\tilde{\chi}_1^{\pm}) > m(\tilde{\chi}_1^0)$ (and everything else heavier)

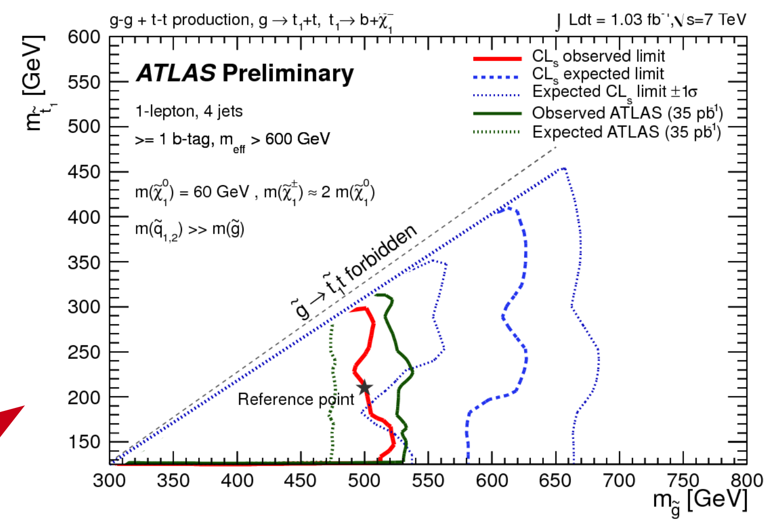
  Consider only the following decays:

  $\tilde{g} \rightarrow \tilde{t}_1 t$; $\tilde{t}_1 \rightarrow b\tilde{\chi}_1^{\pm}$

  and $\tilde{\chi}_1^{\pm} \rightarrow W^* \tilde{\chi}_1^0$
- Complex final states with lepton(s) and b-jets
- Limit on gluino mass:

  m(gluino) > 500 GeV at 95% C.L.



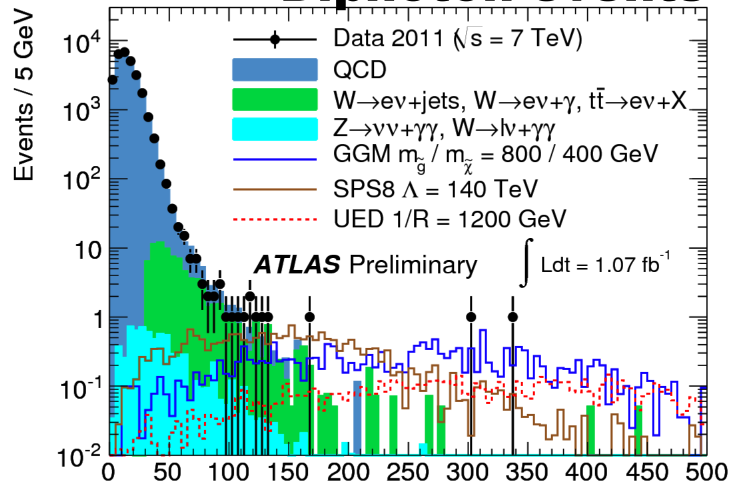


ATL-CONF-2011-098

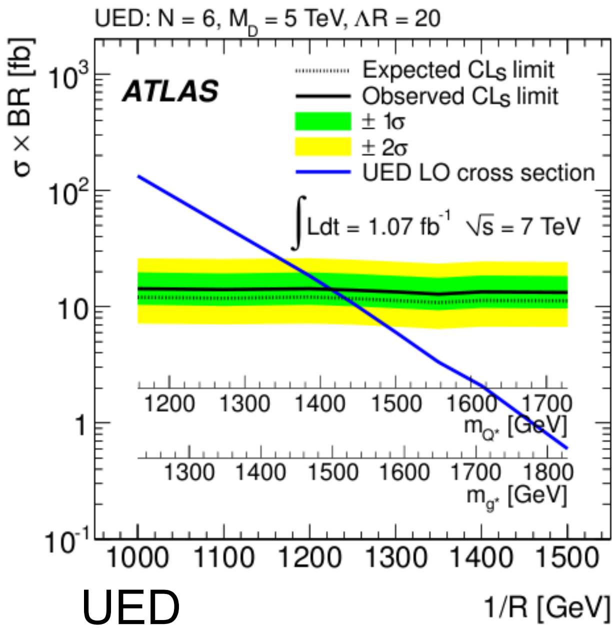
4. SUSY: diphoton + jet + Missing E_T

- Gauge-Mediated SUSY Breaking:
  - → LSP = Gravitino
  - → NLSP = Neutralino
  - → NLSP → LSP + Photon
- Also interpreted as Universal Extra-Dimension (UED)

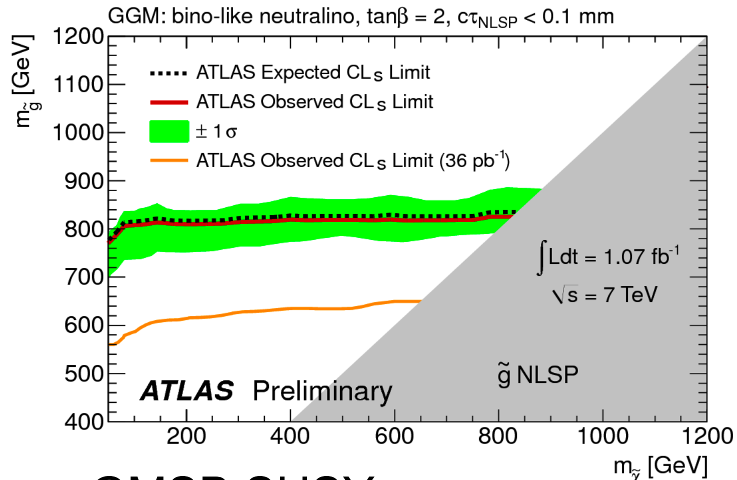
Diphoton events



Missing E_T



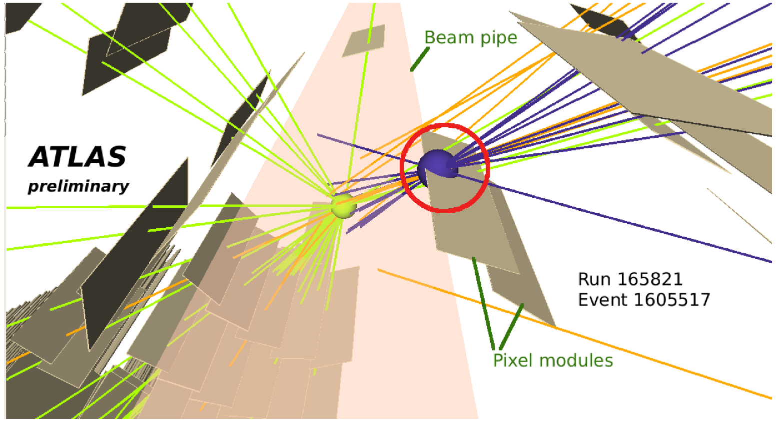
UED

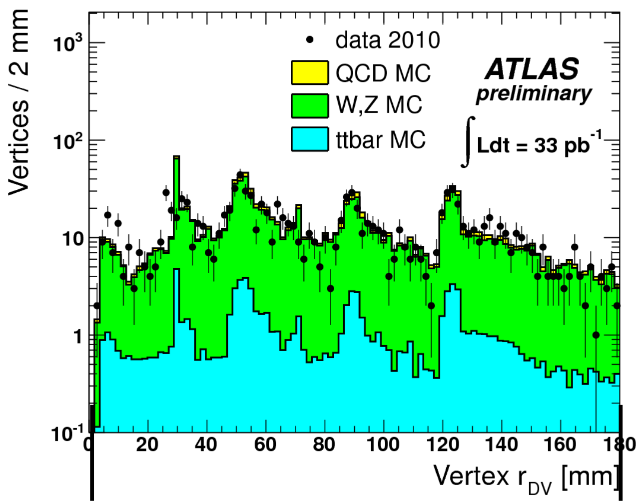


GMSB SUSY

5. "Exotic" SUSY: One Example

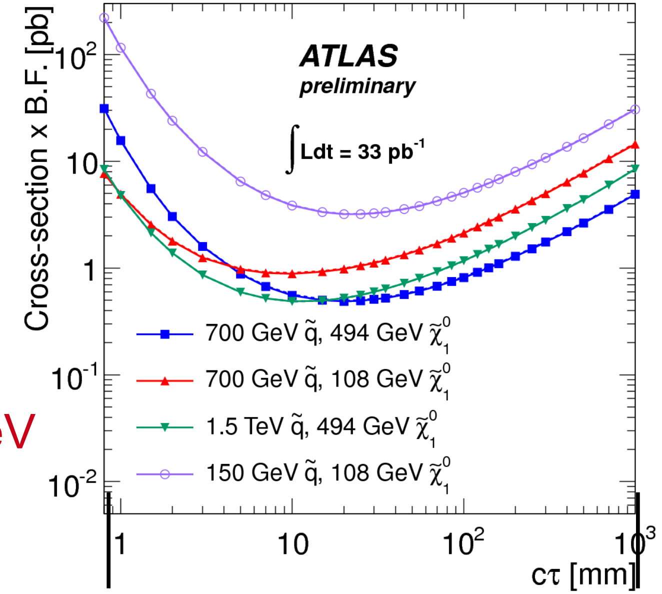
- R- hadrons (hadronized squarks or gluinos)
- Vertex outside the beampipe, in association with a high-pT muon
- Requires good understanding of tracking, detector passive material





0 cm Decay Radius 18 cm

Signal Region:
* Ntracks > 4
* Vertex Mass > 10 GeV

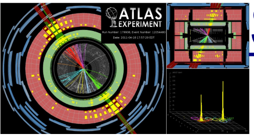


1 mm 1 m

Supersymmetry: Summary

- SUSY in its most hoped for incarnation is starting to be in trouble
  - → Of course we will continue looking and increasing our reach
- What if SUSY were hiding? (e.g. no Missing E_T)
  - → "Split", "low-MET", "squashed", "mashed?"
  - → Even if very soft cascade at tree level, Initial State Radiation still creates MET, but this needs to be studied further
- With >1 fb^{-1}, other SUSY prod. mechanisms open up → exclusive chargino/neutralino and 3rd generation production
- SUSY without MET: e.g. R-Parity Violation, Long-Lived Particles

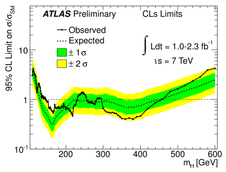
Outline



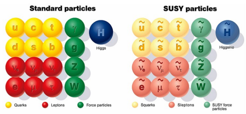
SM in one slide

- → Electroweak Measurements
- → Top Quark

SM Higgs



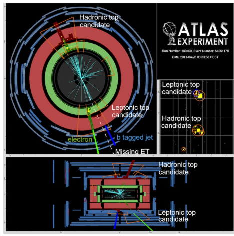
- → H → gg
- → H → ZZ → 4l
- → H → WW → lvlv
- → Combination



Supersymmetry

- → Jets + MET
- → Lepton(s) + MET
- → 3rd generation + MET
- → Photon(s) + MET
- → “Exotic” SUSY (no MET)

Exotic Searches

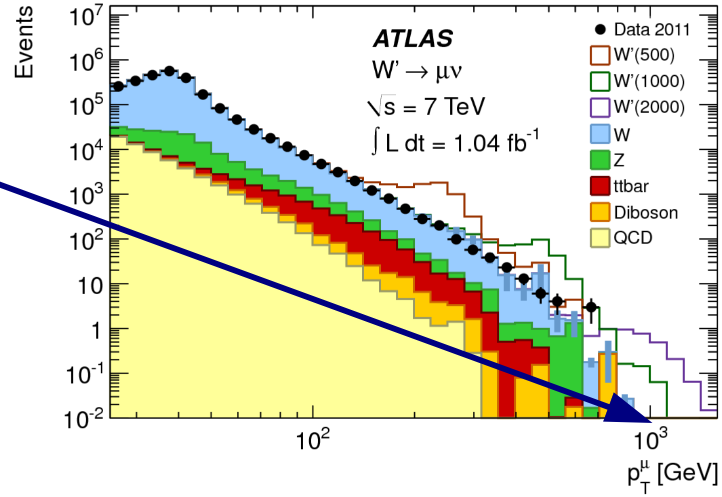


- → Heavy Resonances
- → Same-sign Dilepton
- → Top-Antitop Properties
- → TeV-gravity

Search for Heavy Resonance

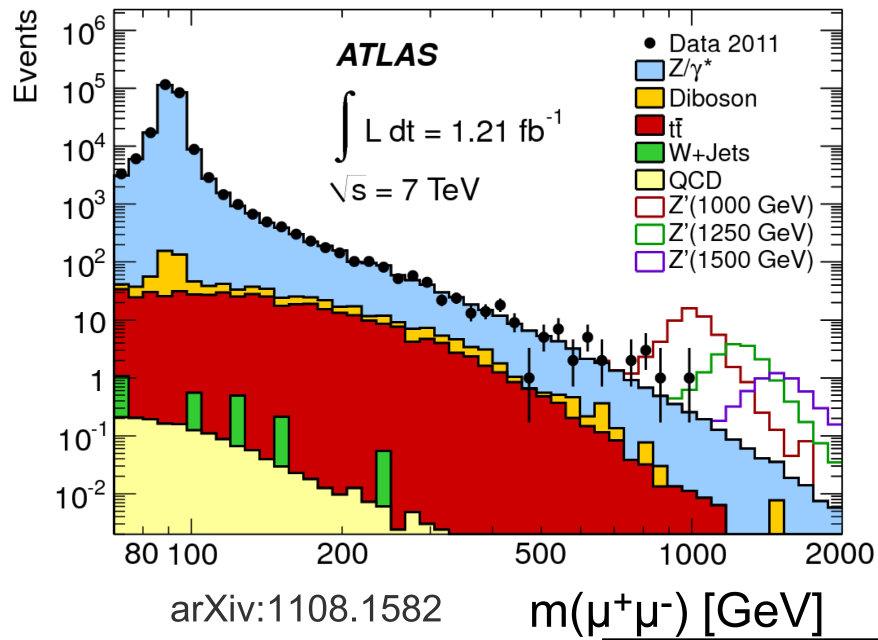
- Predicted by numerous extensions of the Standard Model:
  - → GUT-inspired theories, Little Higgs → heavy gauge boson(s) Z' (W')
  - → Technicolor → narrow technihadrons
  - → Randall-Sundrum ED → Kaluza-Klein graviton
- Experimental challenge: understand detector performance (resolution, efficiency) for a signal with (almost) no control sample at very high momentum → confidence in alignment, simulation, etc...
- Electrons and muons:

  Rapidly approaching 1 TeV!



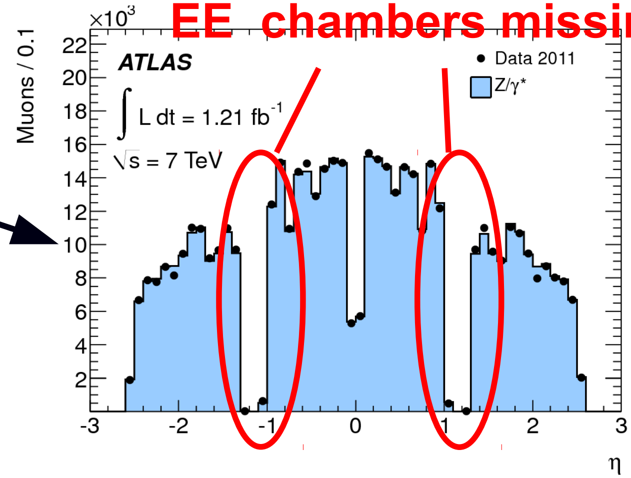
Search for Heavy Resonance: dilepton channel

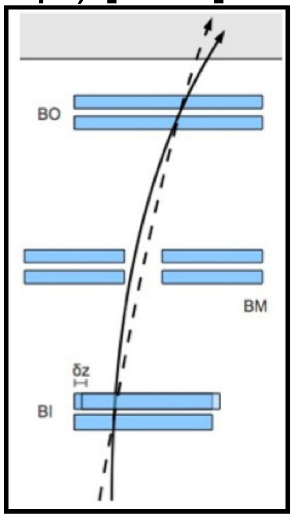
- Neutral heavy gauge boson
- Randall-Sundrum KK graviton excitation
- Technihadron
- Muon channel: Require 3 station tracks for good resolution → loss of acceptance in intermediate region between barrel and end-cap (missing chambers)



arXiv:1108.1582

EE chambers missing

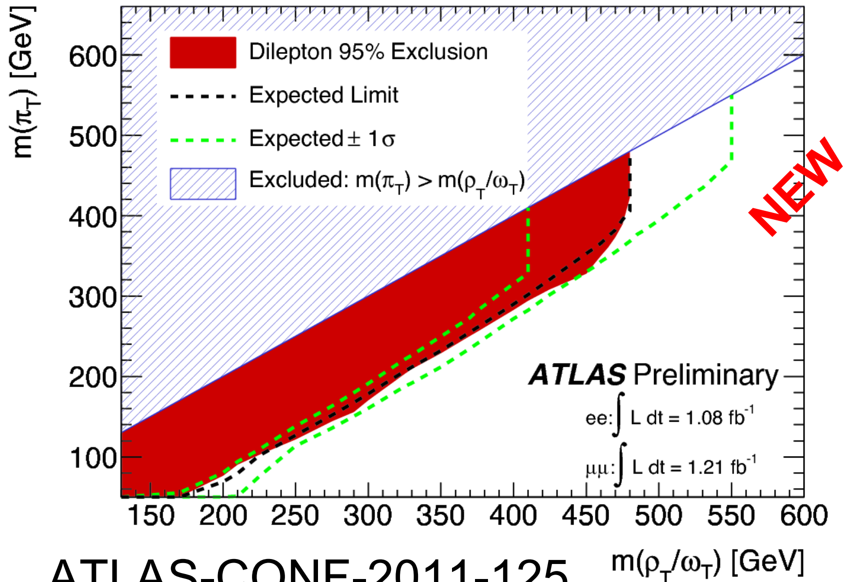




Search for Heavy Resonance: dilepton channel

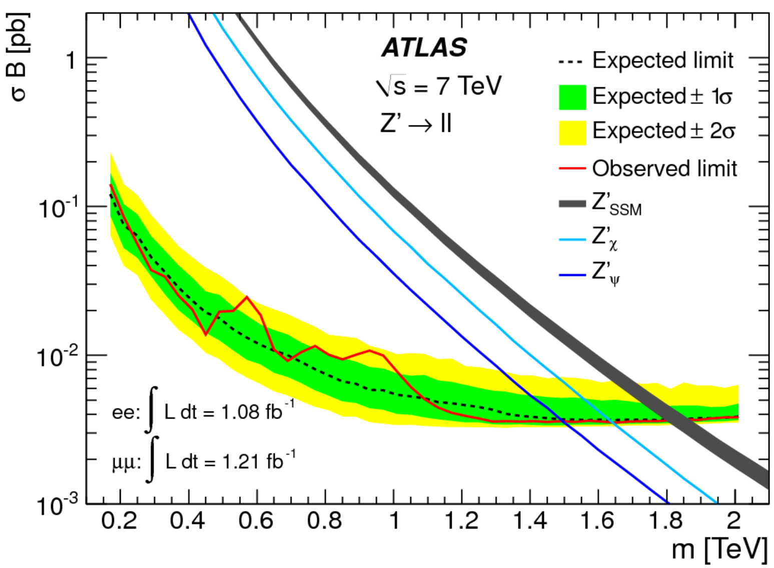
- Neutral heavy gauge boson
- Randall-Sundrum KK graviton excitation
- Technihadron

Sequential SM:
m(Z') > 1.8 TeV at 95% C.L.
RS graviton (k/M_{Pl} = 0.1):
m(G) > 1.6 TeV at 95% C.L.



ATLAS-CONF-2011-125

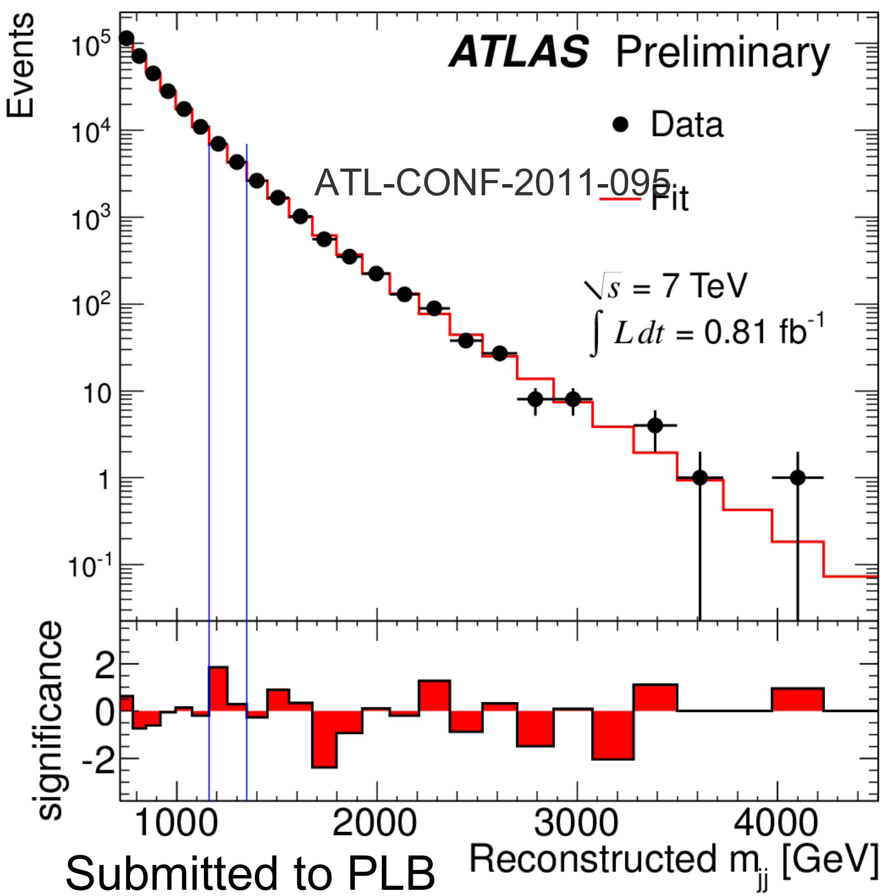
Accepted by PRL
arXiv:1108.1582



Search for Heavy Resonance: Dijet

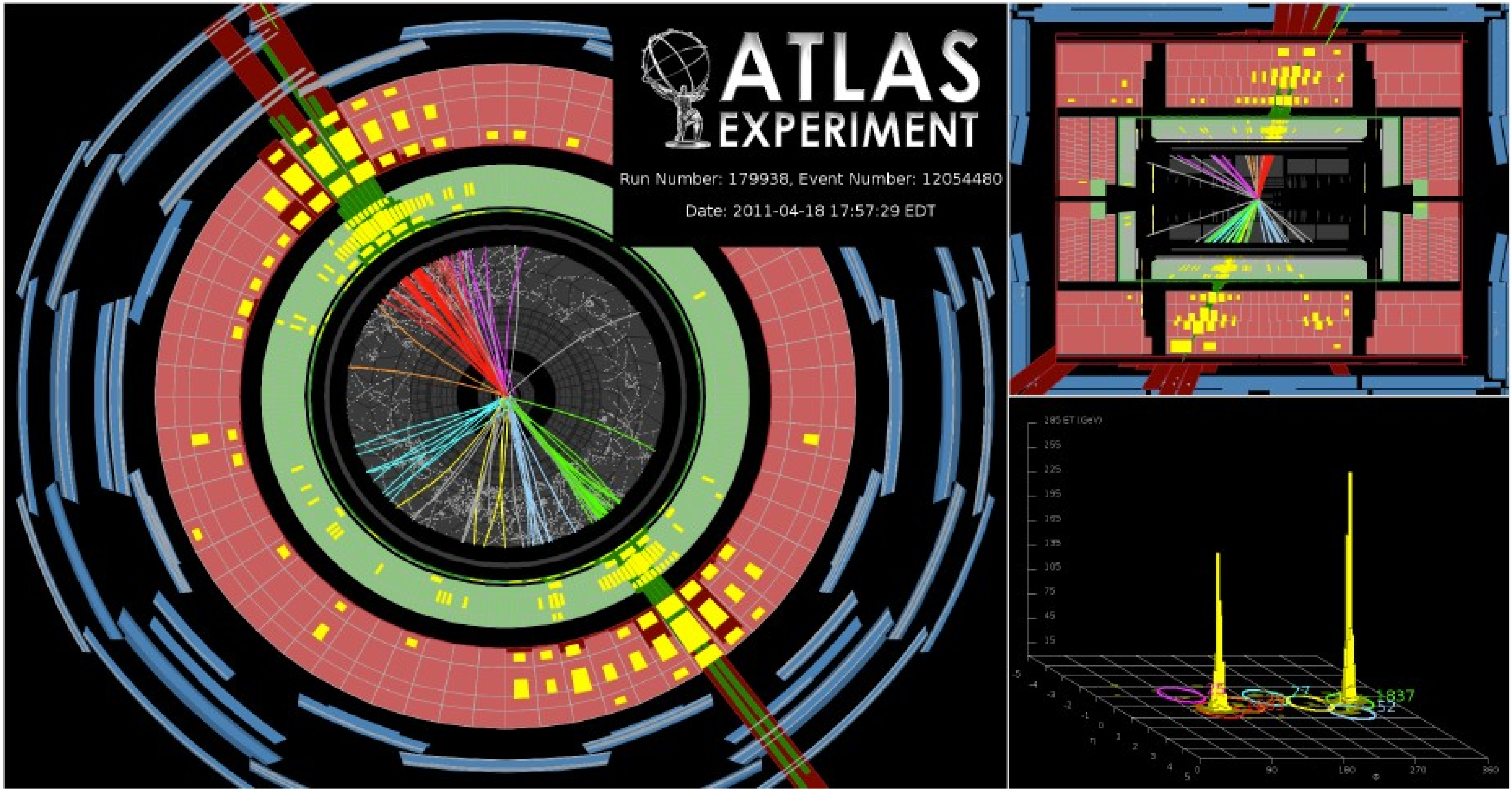
- Excited quarks, strong gravity, contact interaction
- Look for resonance ("BumpHunter") above phenomenological fit of the data

Probing the quark structure beyond 4 TeV



Submitted to PLB
arXiv:1108.6311

Search for Heavy Resonance: Dijet

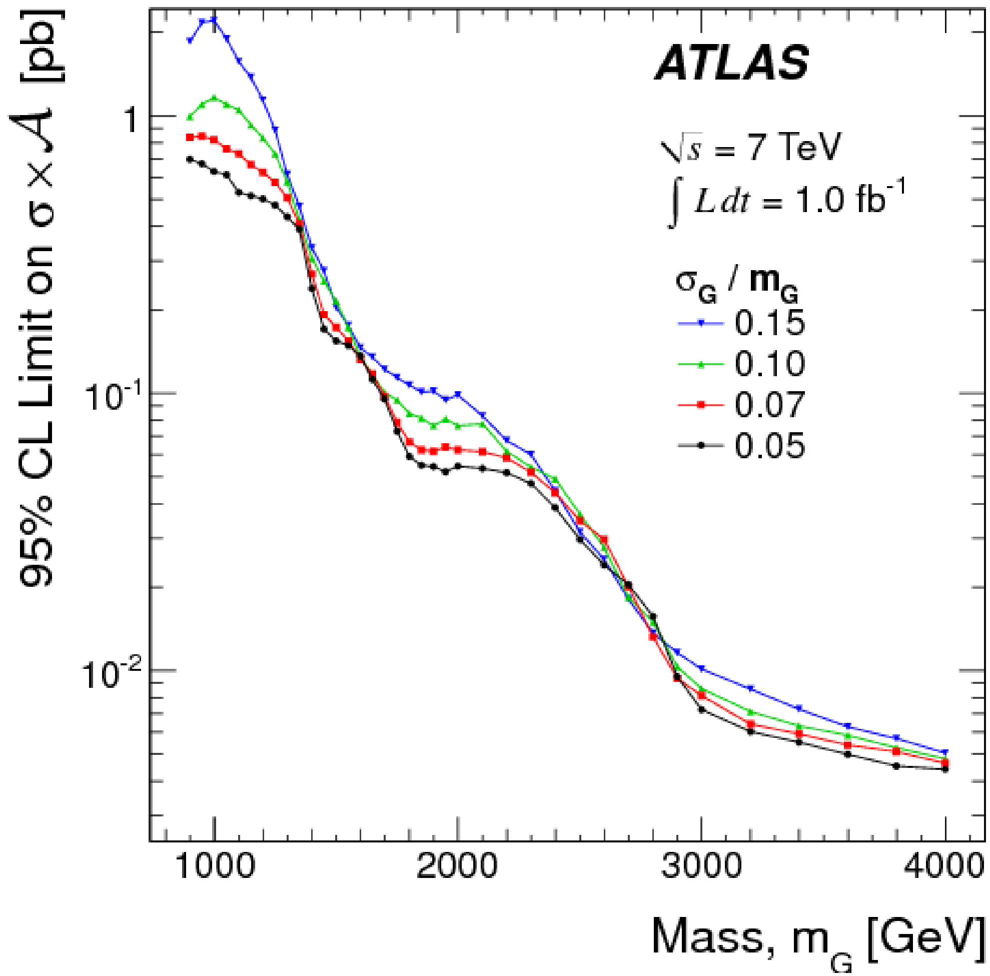


m(jet-jet) = 4.0 TeV **Missing E_T = 100 GeV**

Search for Heavy Resonance: Dijet

Model	95% CL Limits (TeV)	
	Expected	Observed
Excited Quark q^*	2.81	2.99
Axigluon	3.07	3.32
Colour Octet Scalar	1.77	1.92

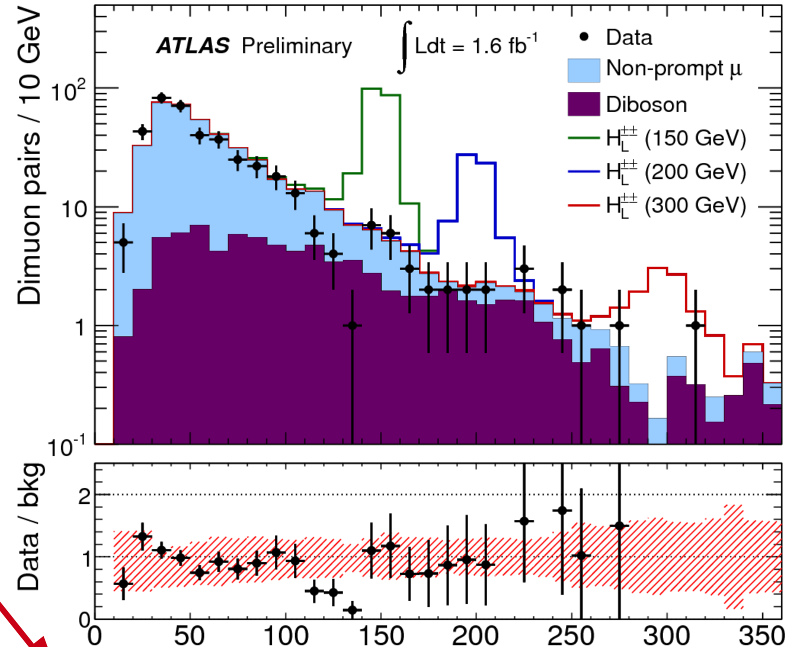
- Also providing model-independent limits:

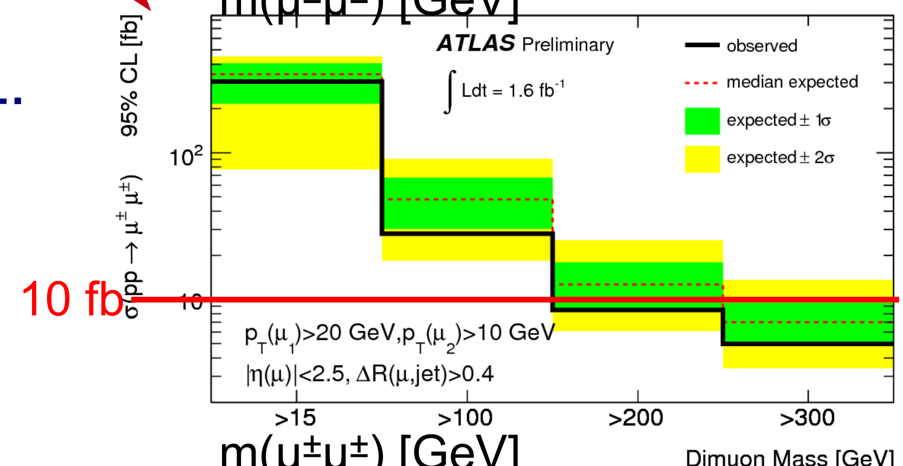


Search for ~~Heavy Resonance~~ Inclusive search: Same-Sign Dilepton

- Predicted by many models
- Very clean signature
- Inclusive, model-independent search:
  - Fiducial cross-section limit as function of m(μ±μ±)
- Interpretation in terms of same-sign top production:

  σ(tt) < 2.9 – 4.1 pb at 95% C.L.

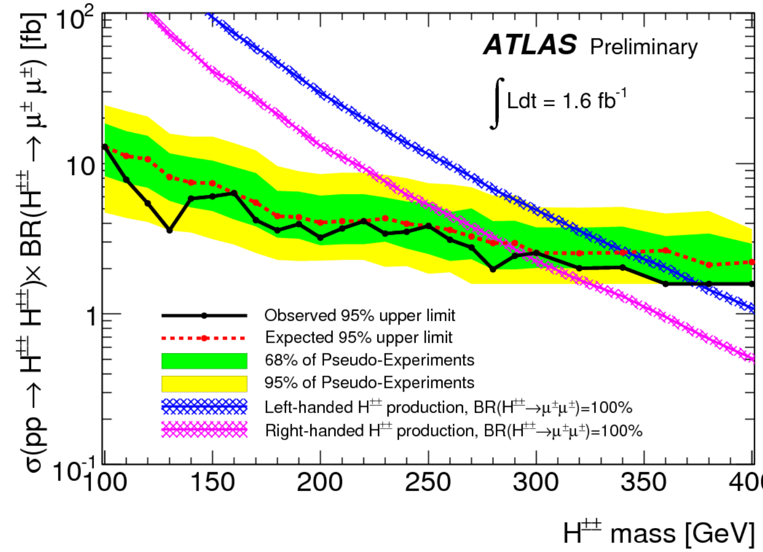




ATL-CONF-2011-126

Search for Heavy Resonance: Same-Sign Dilepton

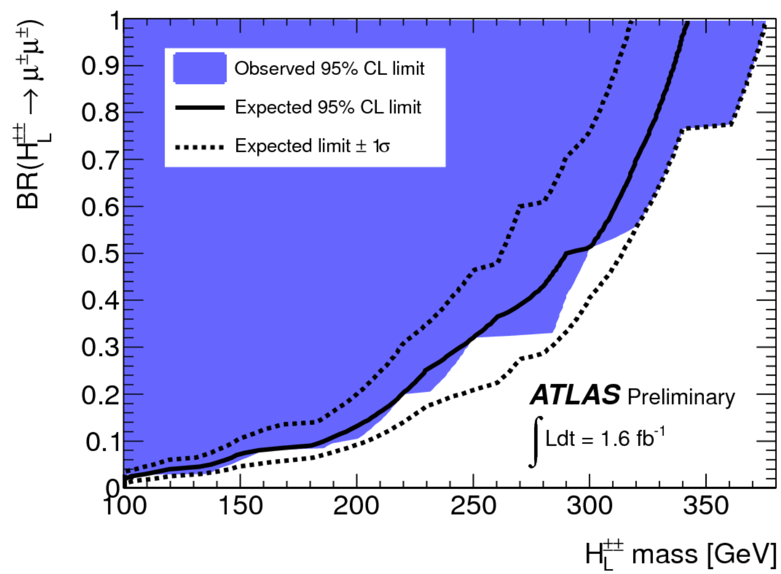
- Doubly-charged Higgs search
  - → based on same analysis as inclusive search
  - → window 10% around Higgs mass



Assuming $BR(\mu^{\pm}\mu^{\pm}) = 100\%$:

$m(H_L) > 375$ GeV (exp. 342 GeV)

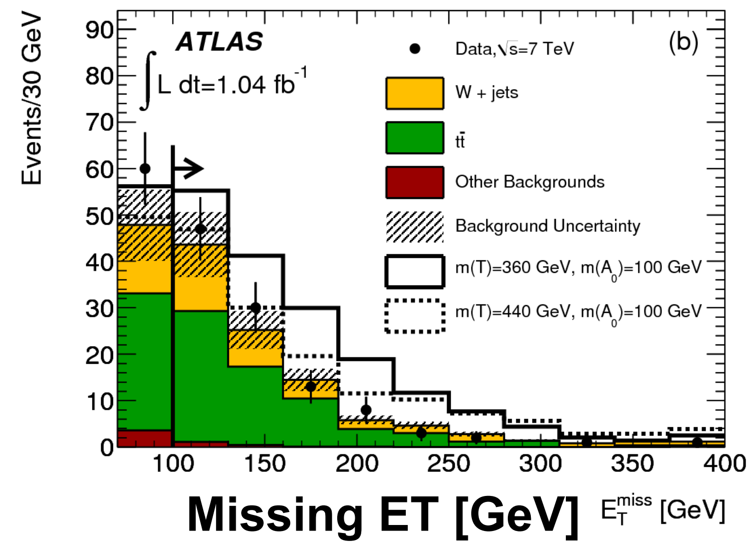
$m(H_R) > 295$ GeV (exp. 286 GeV)

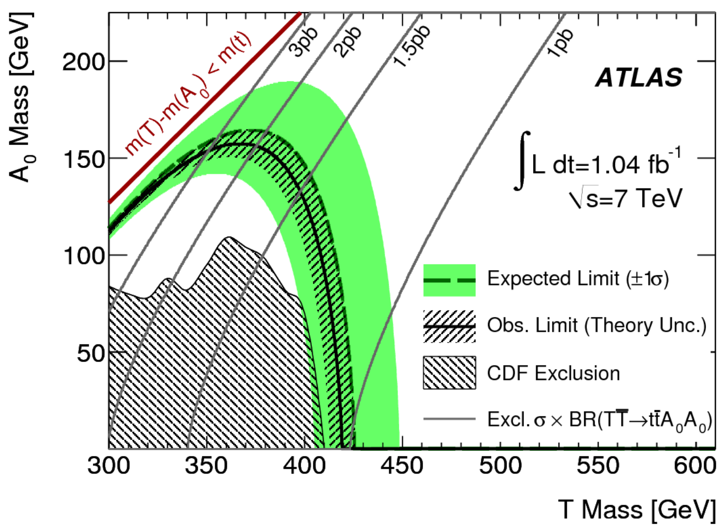


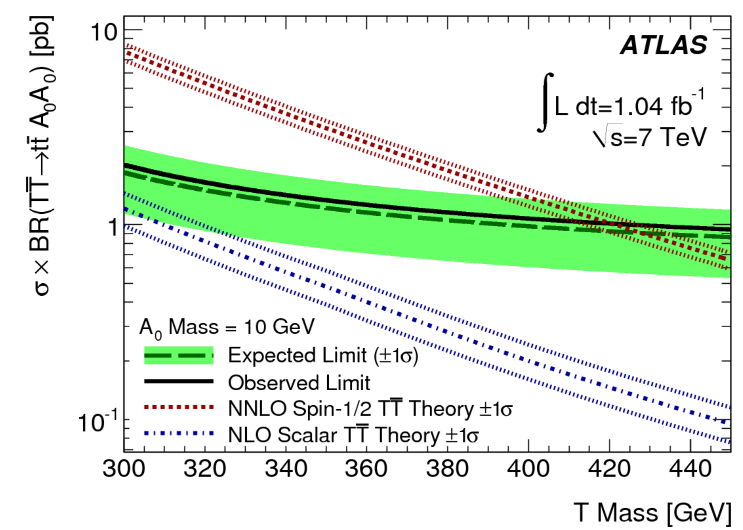
ATL-CONF-2011-127

Top-antitop + Missing Energy NEW

- Look for topology: T T → tt A_0 A_0
- T can be:
  - → Spin ½: 4th generation
  - → Scalar: stop, leptoquark







Submitted to PRL

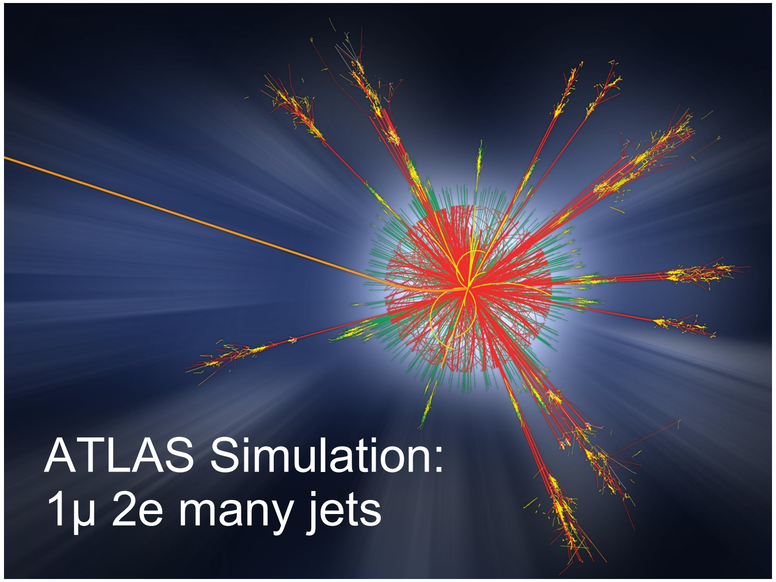
arXiv:1109.4725

Strong Gravity at TeV-scale, Microscopic Black Holes

- Large Extra-D (ADD):
  - → Brings the Plank scale down to the TeV scale:

$$M_{Pl}{}^{2} \sim M_{D}{}^{2+n} R^{n}$$

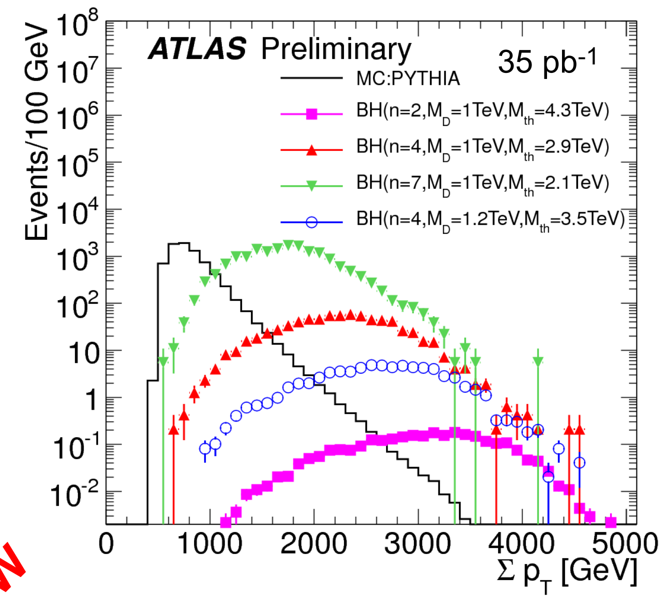
  - → Gravity becomes strong at TeV
- Microscopic black-holes decaying through Hawking radiation
- Large uncertainty on models due to our ignorance of quantum gravity

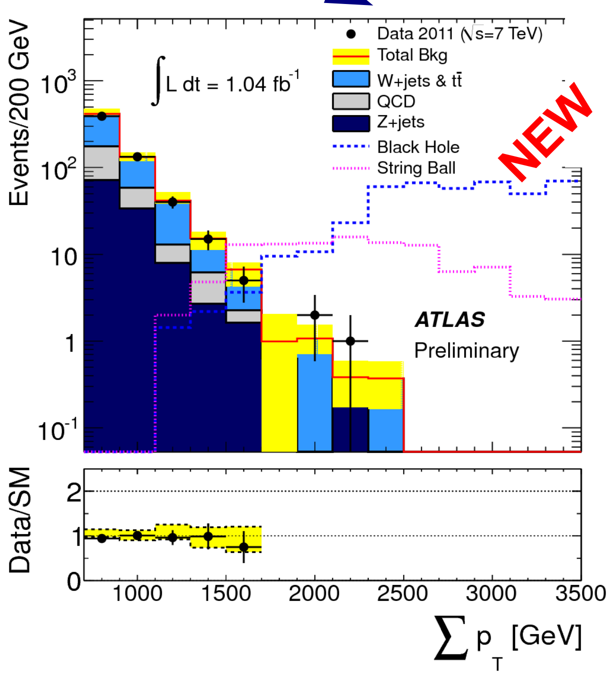


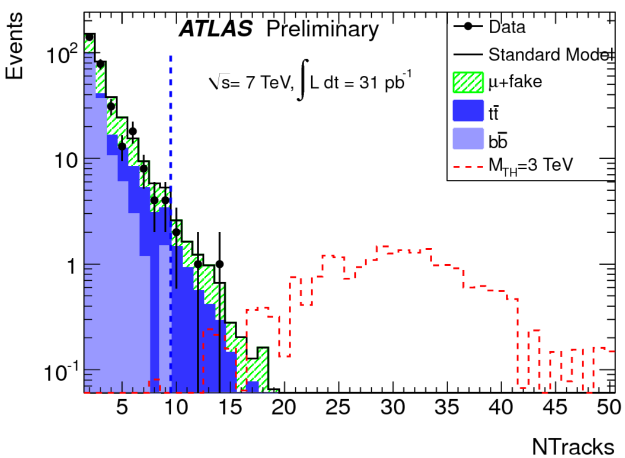
- Semi-classical models only for m(B.H.) >> m(threshold)
- A safe bet: decay is democratic and isotropic
- **Look for (many) jets and leptons at high mass**

Black Holes: Multi-Jets, Lepton+Jets, Same-Sign

- Multijet
- L+Jets
- Same-sign Dimuon



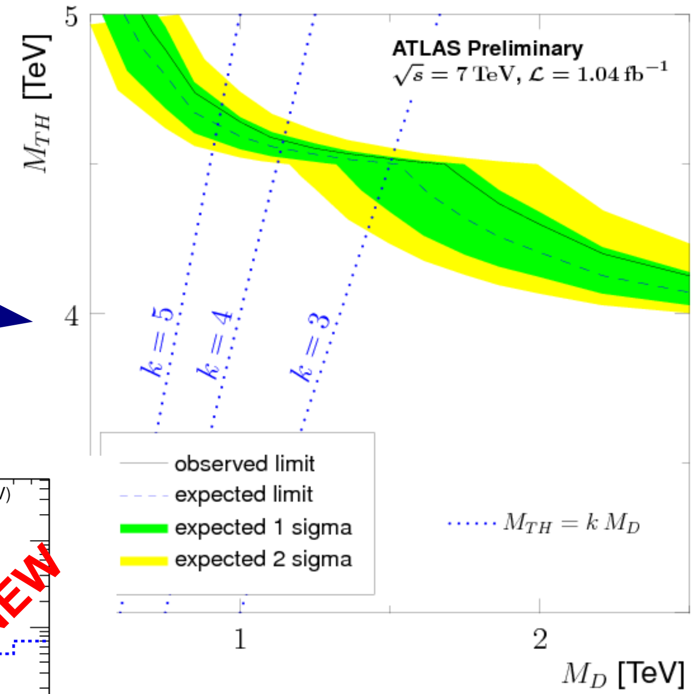


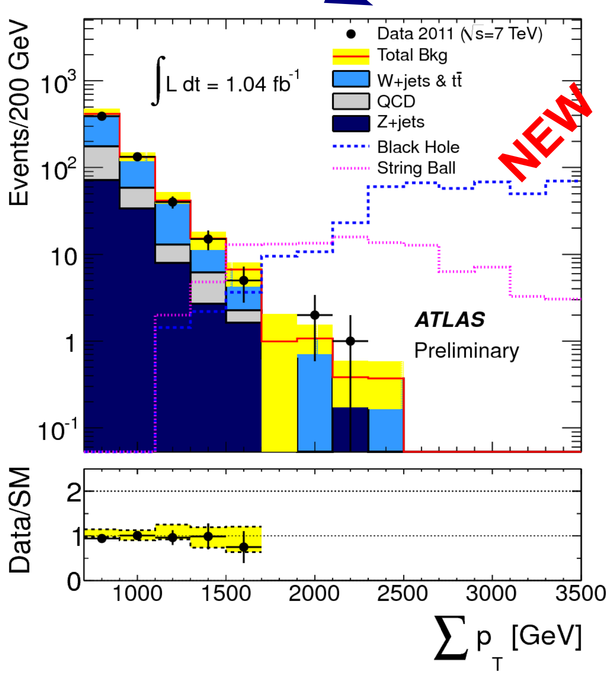


high-pT Tracks

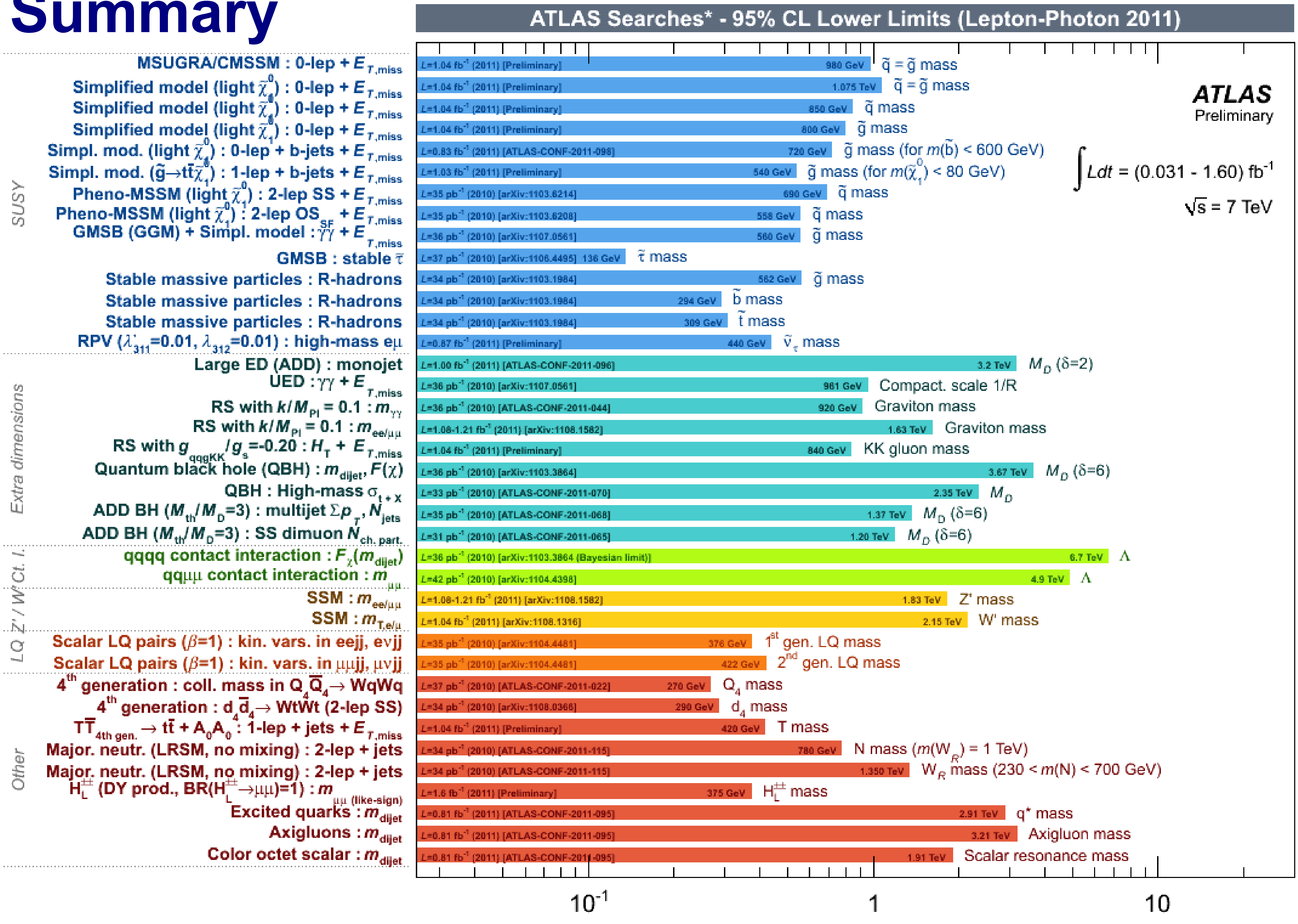
Black Holes: Multi-Jets, Lepton+Jets, Same-Sign

- Multijet
- L+Jets
- Same-sign Dimuon





Summary



*Only a selection of the available results leading to mass limits shown

My own one-slide summary

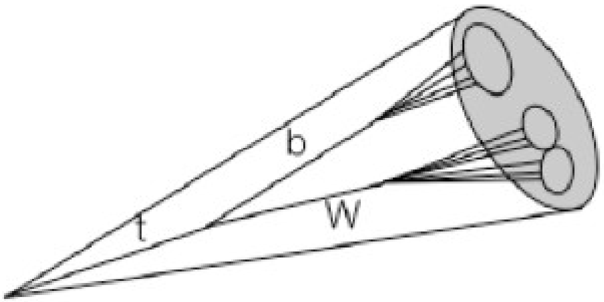
Unfortunately, no hint of New Physics in the LHC data (yet)

	Lower Limit (95% C.L.)
SUSY ($m_{\tilde{q}} = m_{\tilde{g}}$)	1 TeV
Gauge bosons (SSM)	2 TeV
Excited quark	3 TeV

Conclusion

- SM Higgs is around the corner (or is not)

- Experimental challenges as we enter further the Multi-TeV world:
  - → Improved analysis techniques (multivariate analyses etc...)
  - → TeV leptons
  - → Reconstruction of boosted objects (W, top)
  - → Investigate less obvious signatures (SUSY without MET, signature with non-isolated leptons, etc...)

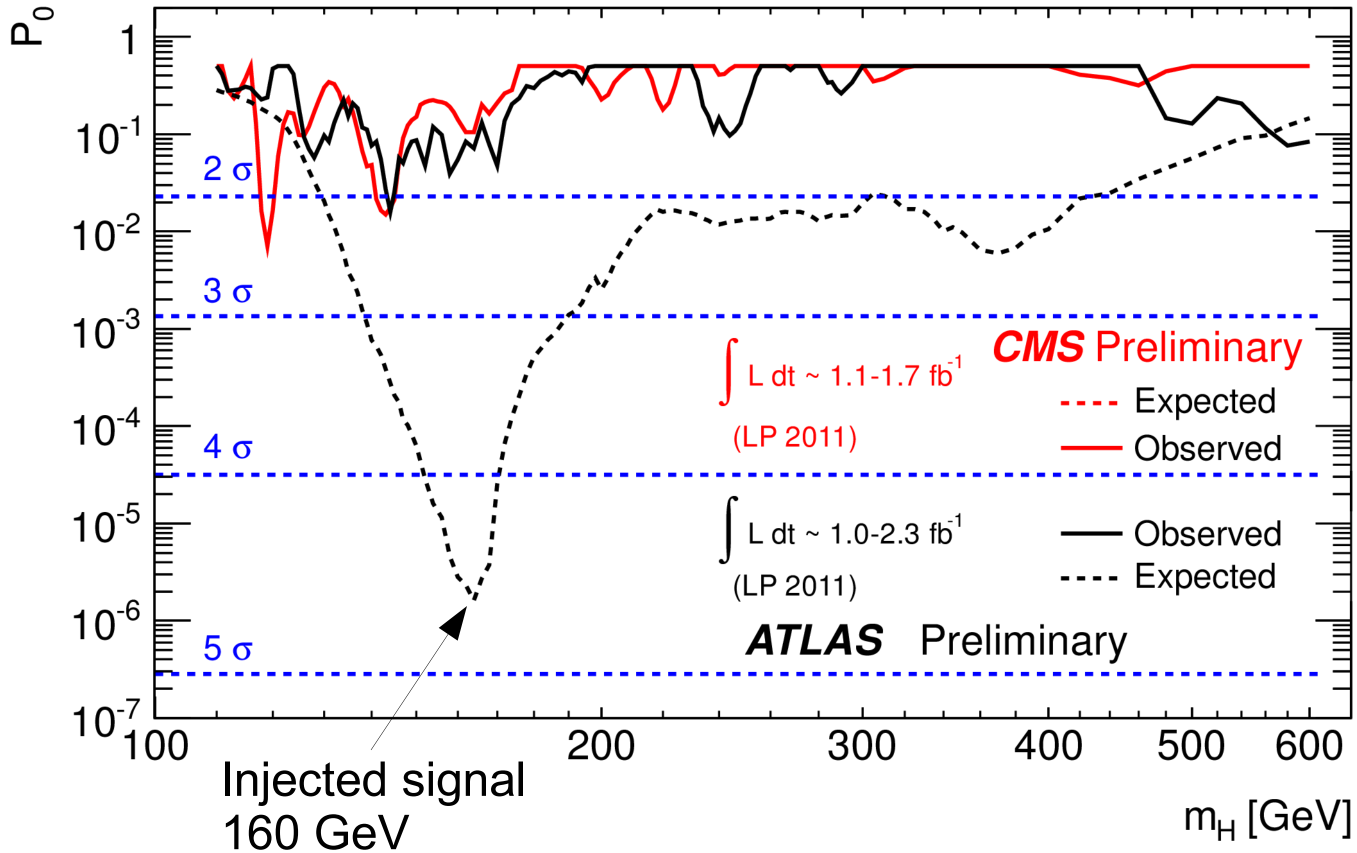


- It's only the beginning!

Backup

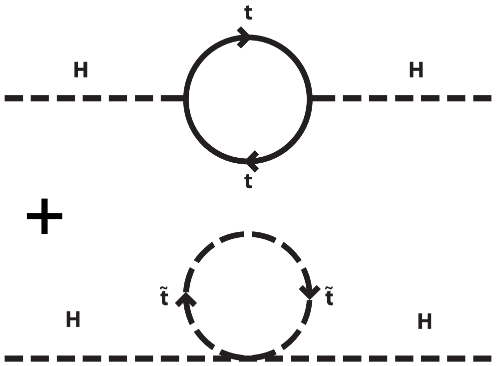
Higgs Search: Combination of Channels

- One step back: before setting limits, let's see if we found anything...

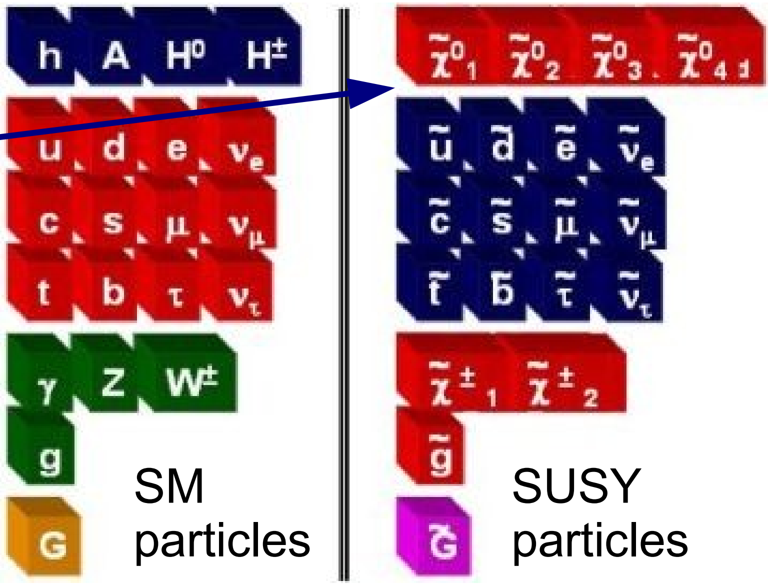


Supersymmetry

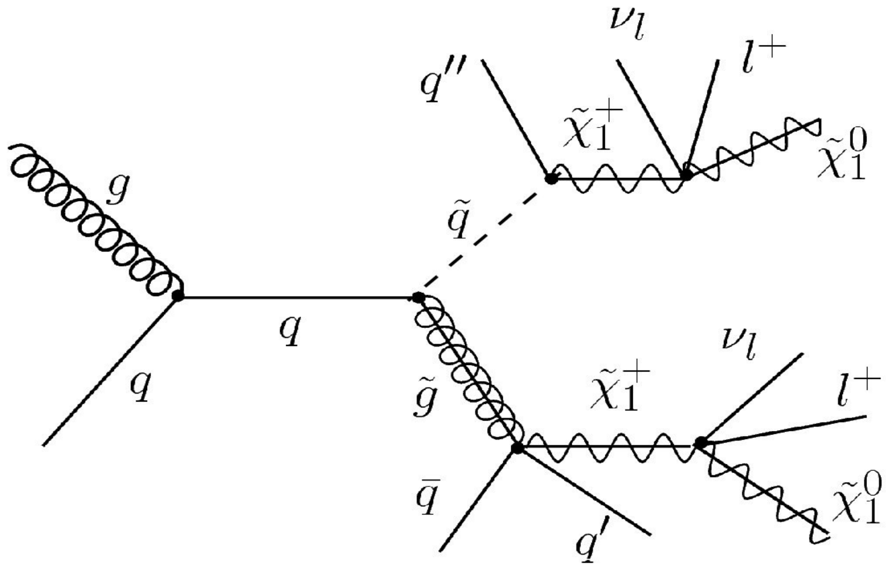
- Extension of the Poincaré algebra
- Fermion ↔ Boson symmetry
- Solves many problems of the SM, esp. stabilizes Higgs sector
- If R-parity ($R = (-1)^{3(B-L)+2s}$) is conserved, Lightest SUSY Particle (LSP) is an excellent Dark Matter candidate
- Phenomenology is **very** diverse



≈ 0 (if t̃ is light)



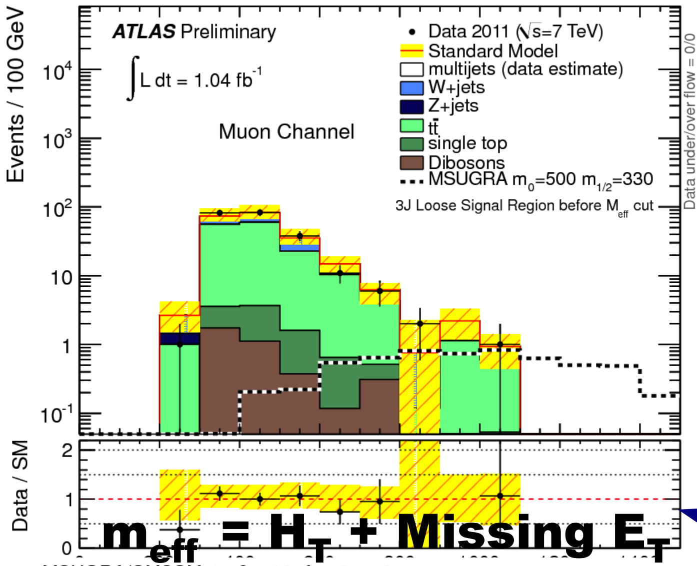
2. SUSY: Lepton(s) + Jets + Missing ET

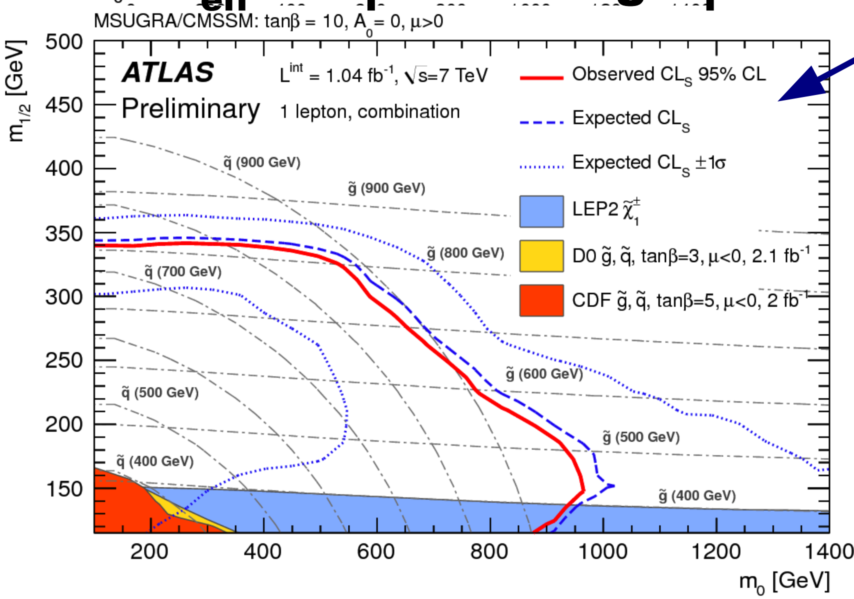


- Leptons arise from slepton or charginos or W/Z decays
- Due to smaller Branching Ratio, less stringent limits than fully hadronic but complementary
- Look for 1-l+Jets+MET
- Look for 2-l+Jets+MET
  - → (same-sign or opposite sign)
  - → Flavor subtraction selects flavor-correlated decays

(l = e or μ)

2. SUSY: Lepton(s) + Jets + Missing ET





- Leptons arise from slepton or charginos or W/Z decays
- Due to smaller Branching Ratio, less stringent limits than fully hadronic but complementary
- Look for 1-l+Jets+MET
- Look for 2-l+Jets+MET
  - → (same-sign or opposite sign)
  - → Flavor subtraction selects flavor-correlated decays

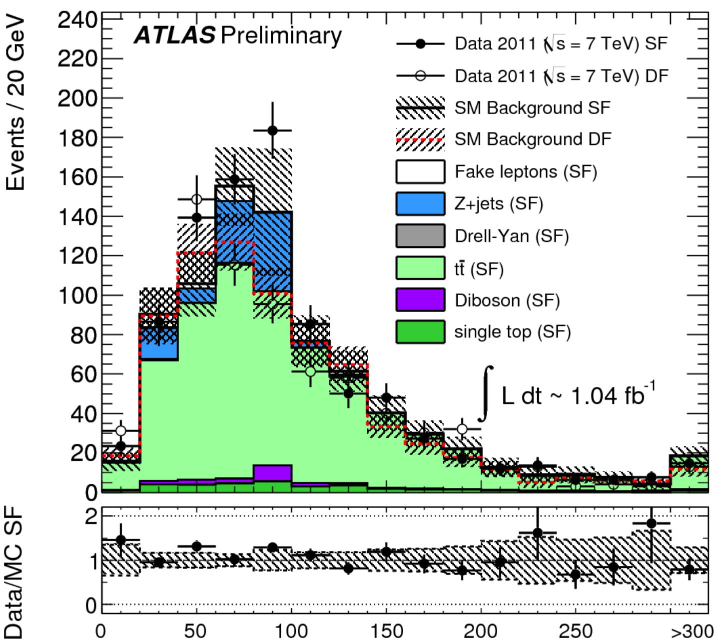
Submitted to PRD
arxiv:1109.6606

(l = e or μ)

2. SUSY: Lepton(s) + Jets + Missing ET

Dilepton (+jets) + MET, ATLAS 1 fb^{-1}

		Background	Obs.	95% C.L.
opposite sign	OS-SR1	$15.5 \pm 1.2 \pm 4.4$	13	9.5 fb
	OS-SR2	$13.0 \pm 1.8 \pm 4.1$	17	15.2 fb
	OS-SR3	$5.7 \pm 1.1 \pm 3.5$	2	5.0 fb
same sign	SS-SR1	$32.6 \pm 4.4 \pm 4.4$	25	10.2 fb
	SS-SR2	$24.9 \pm 4.1 \pm 6.6$	28	20.3 fb



m(ll) [GeV]

≥2 jets
MET>80 GeV

- Leptons arise from slepton or charginos or W/Z decays
- Due to smaller Branching Ratio, less stringent limits than fully hadronic but complementary
- Look for 1-l+Jets+MET
- Look for 2-l+Jets+MET
  - → (same-sign or opposite sign)
  - → Flavor subtraction selects flavor-correlated decays

ee + μμ - eμ

(l = e or μ)

SUSY: Lepton(s) + Jets + Missing ET

- ATLAS SUSY 2-lepton event selection:
  - → Opposite-sign

Signal Region	OS-SR1	OS-SR2	OS-SR3
$E_{\mathrm{T}}^{\mathrm{miss}}$ [GeV]	250	220	100
Leading jet p_{T} [GeV]	-	80	100
Second jet p_{T} [GeV]	-	40	70
Third jet p_{T} [GeV]	-	40	70
Fourth jet p_{T} [GeV]	-	-	70

(b)

  - → Same-sign

Signal Region	SS-SR1	SS-SR2
$E_{\mathrm{T}}^{\mathrm{miss}}$ [GeV]	100	80
Leading jet p_{T} [GeV]	-	50
Second jet p_{T} [GeV]	-	50

(c)

  - → Flavor-subtraction

Signal Region	FS-SR1	FS-SR2	FS-SR3
$E_{\mathrm{T}}^{\mathrm{miss}}$ [GeV]	80	80	250
Number jets	≥ 2	-	-
m_{ll} veto [GeV]	-	80-100	-

3. SUSY: b-Jets + lepton + Missing E_T

- What if gluinos decay preferentially to 3[rd] generation?
- Consider several pheno. scenarii, such as:

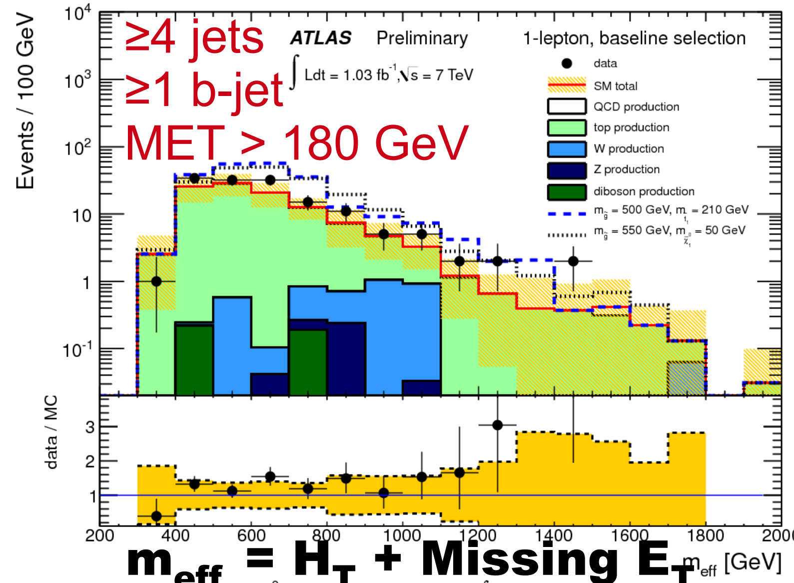
  Assume $m(\tilde{g}) << m(\tilde{t}_1) << m(\tilde{q}_{1,2}) \approx m(\tilde{b}_1)$

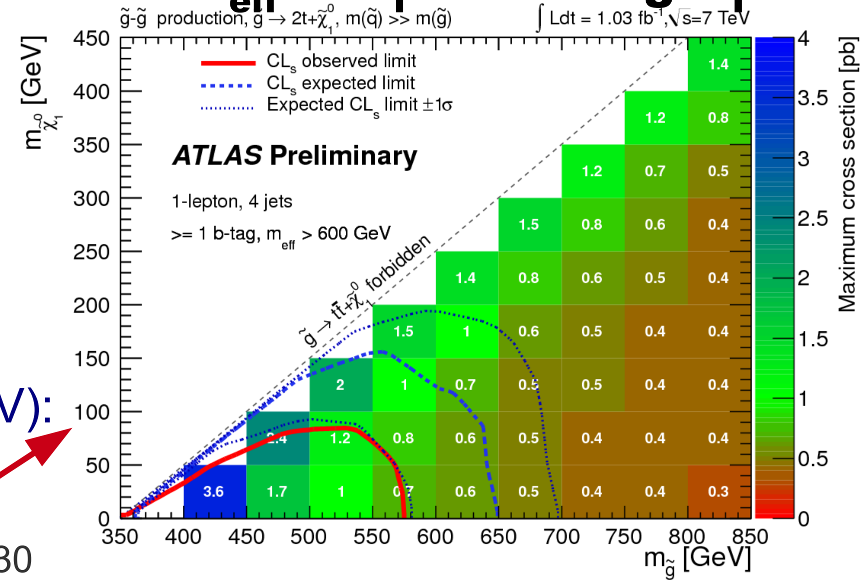
  Consider only gluino-gluino production followed by decay through off-shell stop:

  $\tilde{g} \rightarrow \tilde{t}_1{}^{*}t \rightarrow tt\tilde{\chi}_1^0$

- Complex final states with lepton(s) and b-jets
- Limit on gluino mass ($m(\chi_1^0) < 80$ GeV):

  m(gluino) > 540 GeV at 95% C.L.





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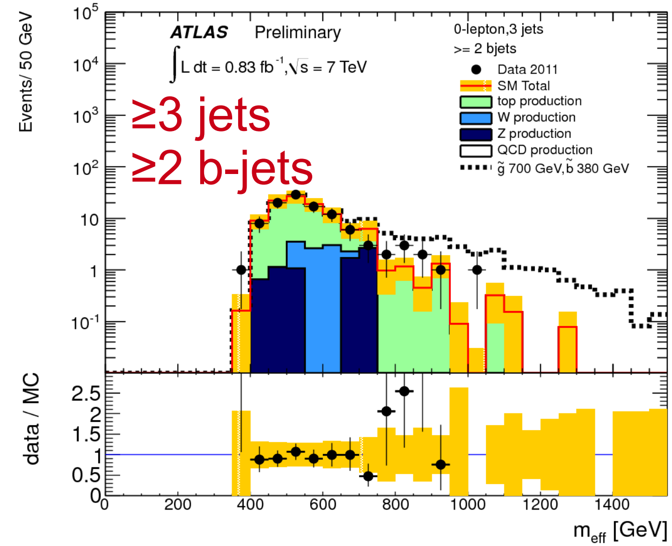
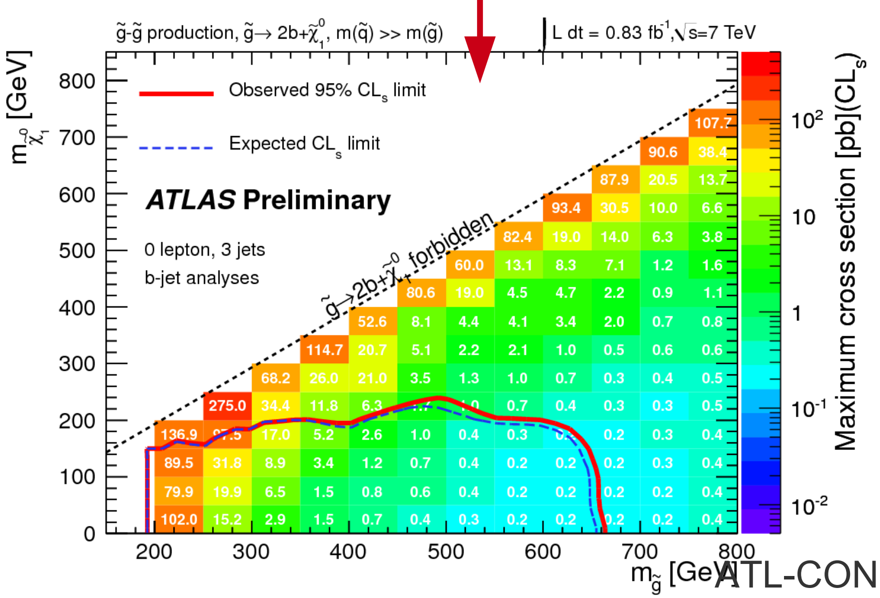
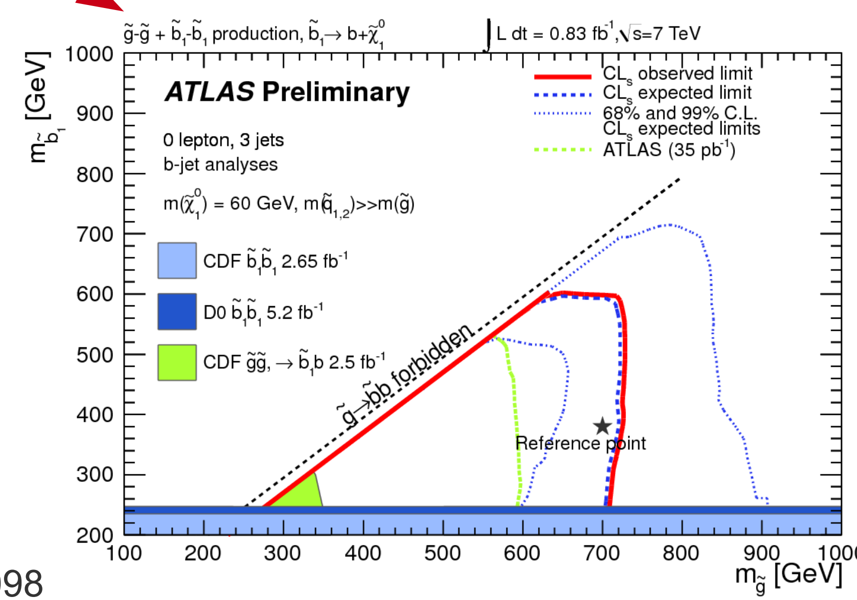
3. SUSY: b-Jets + Missing E_T

- What if gluinos decay preferentially to 3rd generation?
- Consider 0-lepton two phenomenological scenarii:

$$\tilde{b}_1\tilde{b}_1 \rightarrow b\tilde{\chi}_1^0\, b\tilde{\chi}_1^0$$
$$\tilde{g}\tilde{g} \rightarrow 2x\,(\tilde{b}_1^{(*)}\, b) \rightarrow 2x\,(bb\tilde{\chi}_1^0)$$







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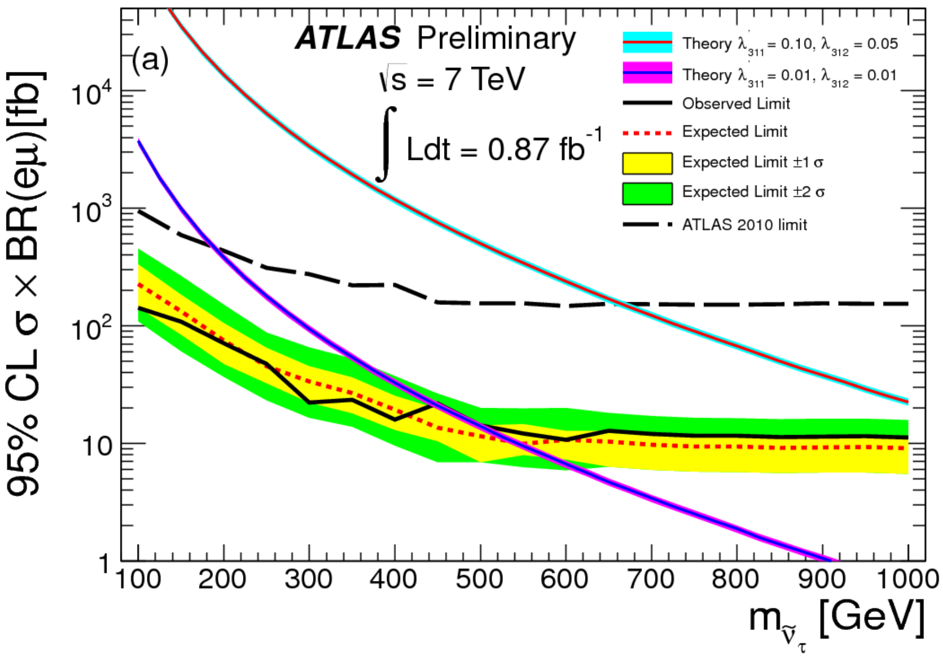
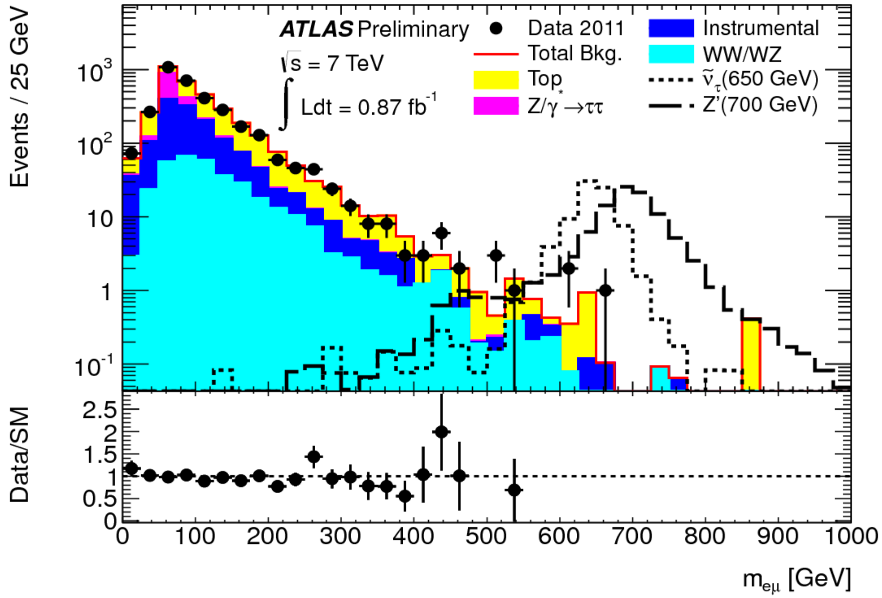
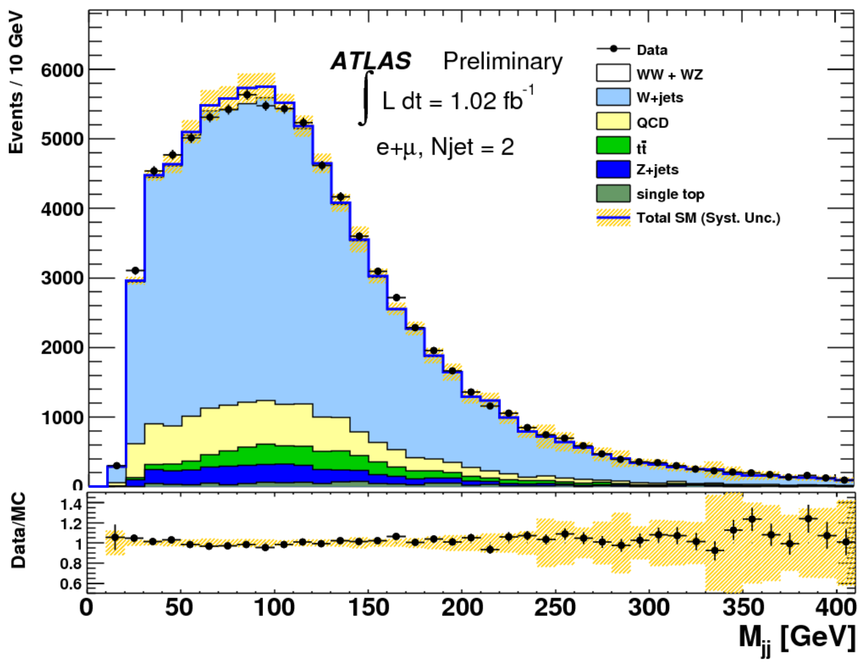
Search for Heavy Resonance: eμ

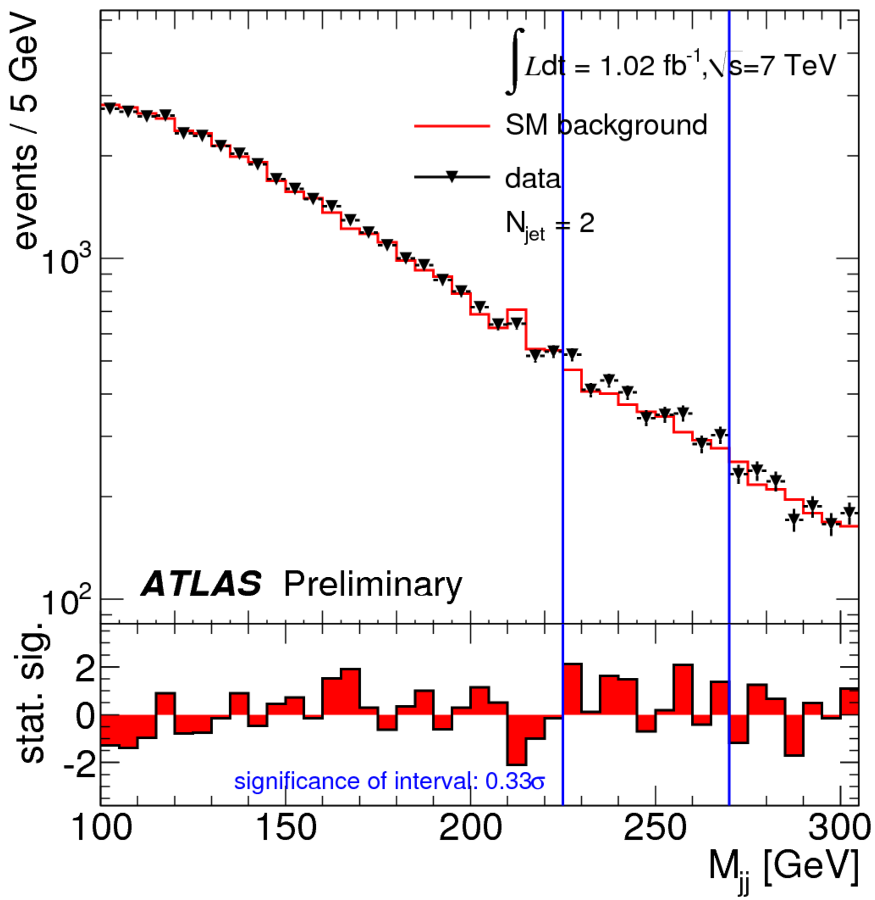
- Lepton Flavor Violation occurs e.g. in RP-Violation SUSY
  - → sneutrino decaying to eμ
- Limit of 11 fb at high mass
- Constrains on RPV coupings





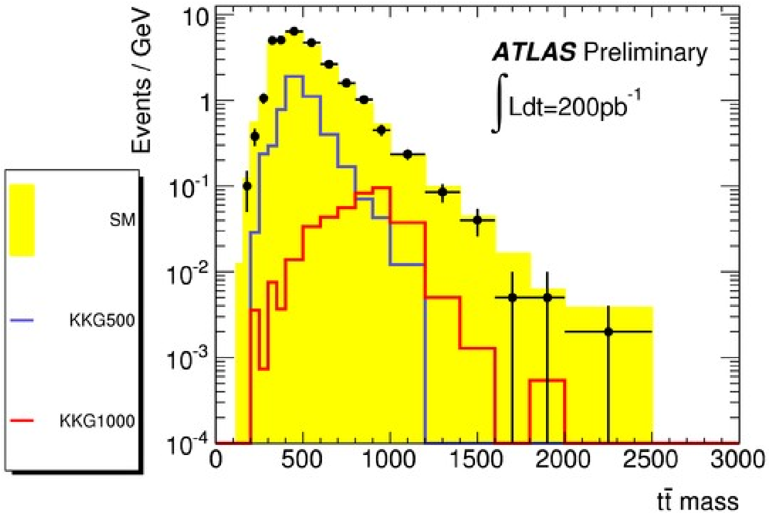
Wjj

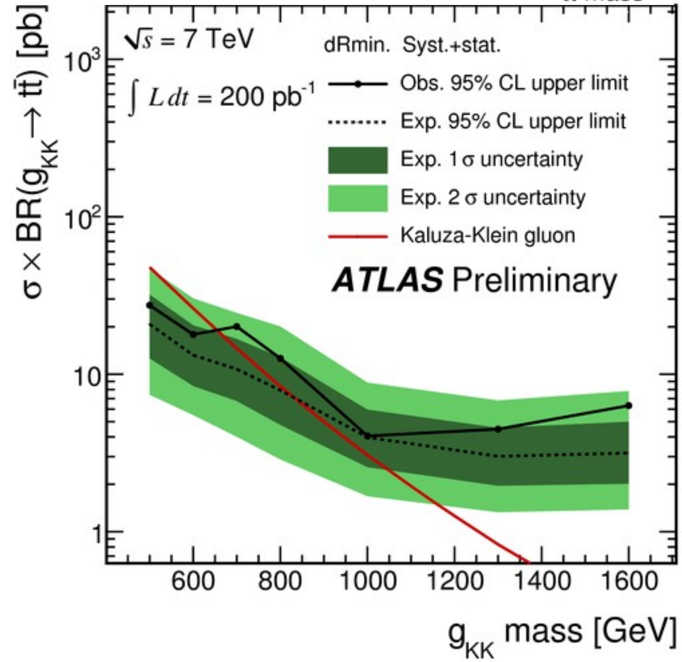

ATLAS Preliminary
∫ L dt = 1.02 fb⁻¹
e+μ, Njet = 2
Data
WW + WZ
W+jets
QCD
tt̄
Z+jets
single top
Total SM (Syst. Unc.)
Events / 10 GeV
Data/MC
M_jj [GeV]


∫ L dt = 1.02 fb⁻¹, √s=7 TeV
SM background
data
N_jet = 2
ATLAS Preliminary
events / 5 GeV
stat. sig.
significance of interval: 0.33σ
M_jj [GeV]

Top-antitop Resonance

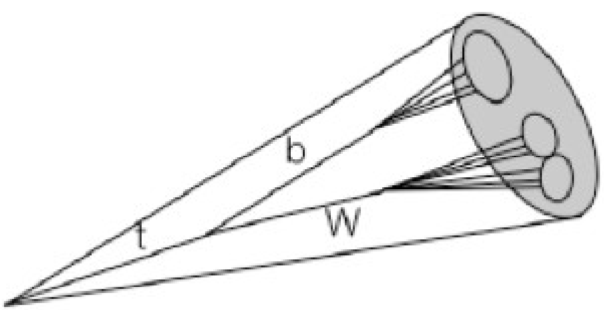
- RS graviton might decay mostly to ttbar
- Limit with 200 pb^{-1} :
  m(RS graviton) > 620 GeV
  (being updated with 1fb^{-1})

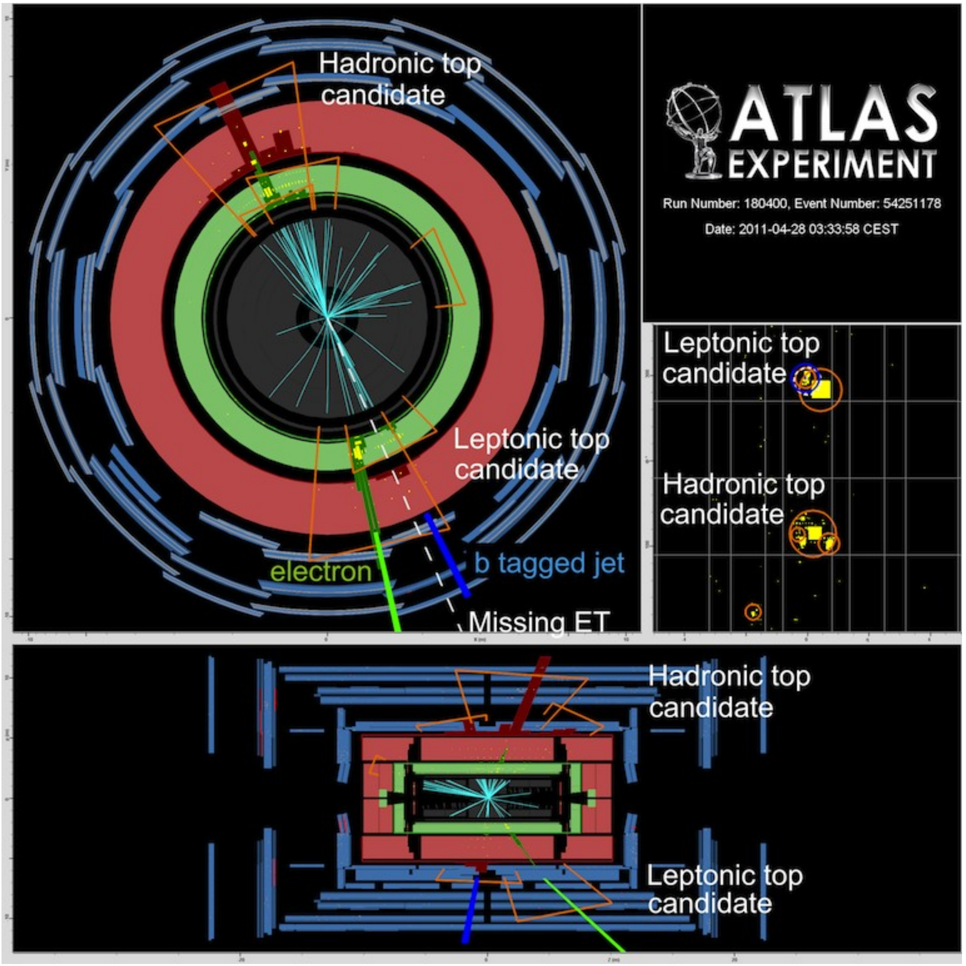




Top-antitop Resonance

- RS graviton might decay mostly to ttbar
- Limit with 200 pb^{-1} :
  m(RS graviton) > 620 GeV
  (being updated with $1fb^{-1}$)
- At high mass, requires special boosted top reconstruction





Top-antitop Resonance

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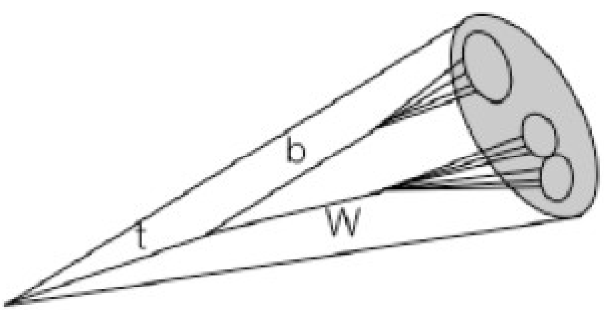
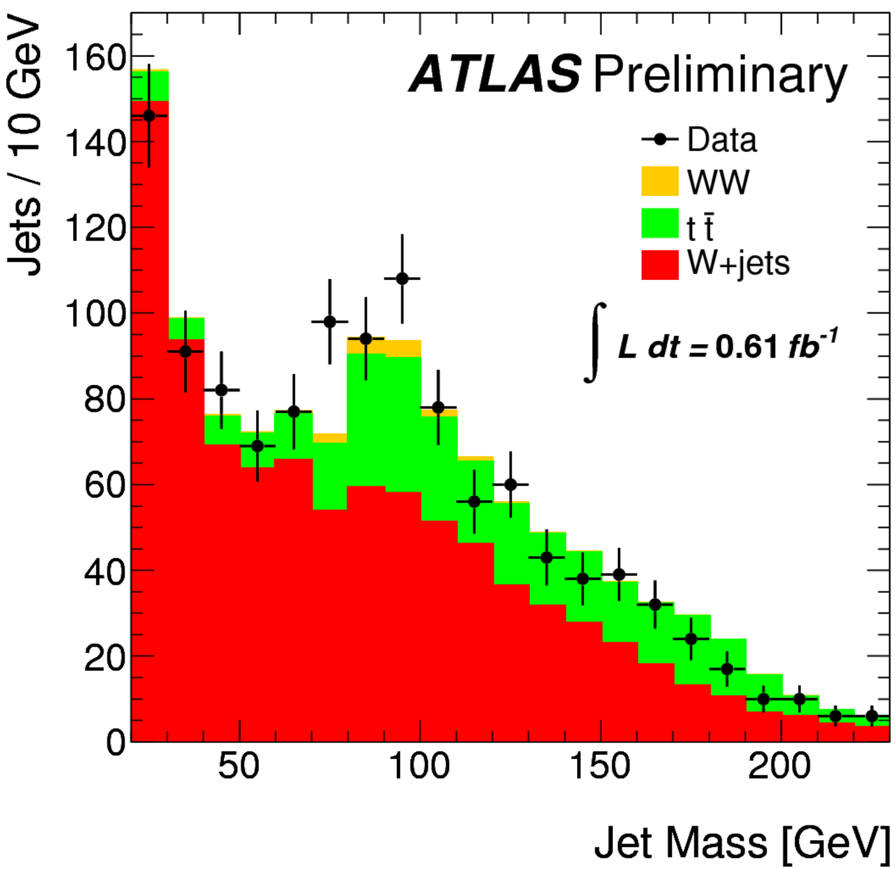
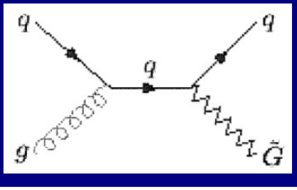




Search for Monojets



- **Large Extra-D (ADD):**
  - → Brings the Plank scale down to the TeV scale:

$$M_{Pl}{}^{2} \sim M_{D}{}^{2+n} R^{n}$$

  - → Graviton escapes detector
- **Also Split SUSY**
- **Look for a jet and ~ nothing else**
- **Challenge:**
  - → Instrumental background
  - → Understanding Z(→ νν) + jets

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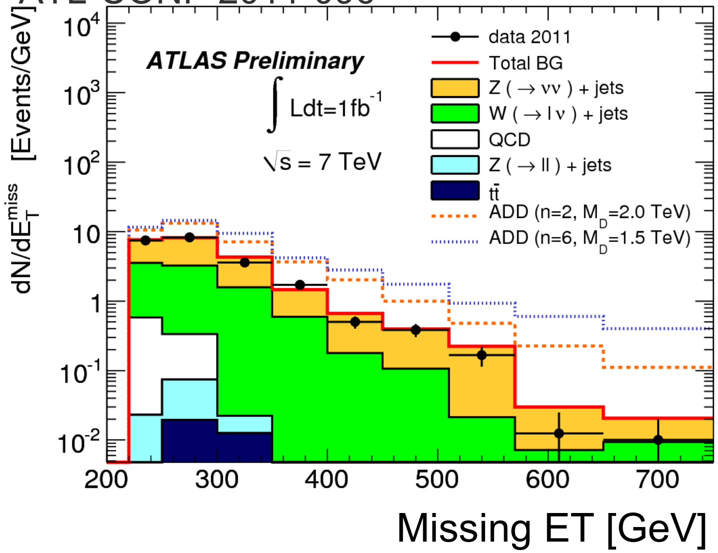
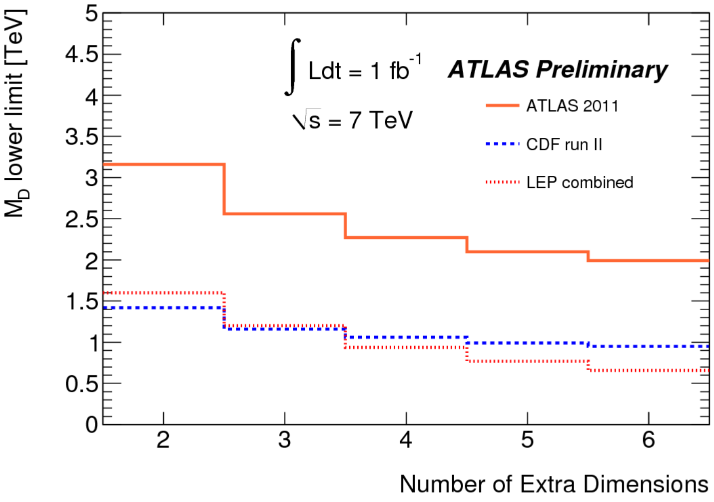


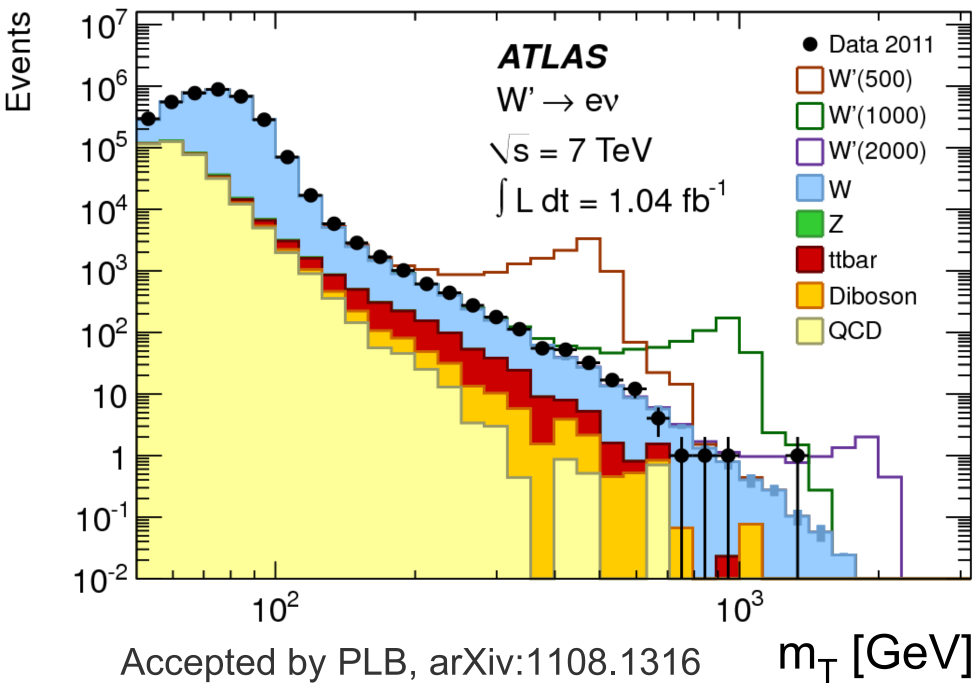


Search for Heavy Resonance: W' → lν

- Heavy charged gauge boson
- Technirho, Little Higgs
- 1 lepton + Missing E_T
- Look for Jacobian peak

$$m_T = \sqrt{2 p_T \not{E}_T (1 - cos\Delta\phi_{\ell,\not{E}_T})}$$

Sequential SM:
m(W') > 2.15 TeV at 95% C.L.



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