## SUSY searches in ATLAS

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on behalf of the ATLAS collaboration



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## Introduction

## The LHC

Living up to the historical tradition of hadronic colliders : discovery machines.

Delivering highest luminosity and collision energy ever  $\Rightarrow$  a whole new mass scale.



### Supersymmetry production

ATLAS has been focusing on searches for the weak scale supersymmetry in different and diverse scenarios

- inclusive and dedicated analyses for gluinos, squarks, gauginos, sleptons, long-lived particles, etc,
- R-parity conservation and violation.

## SUSY searches in ATLAS

### Natural SUSY spectrum

The stabilisation of the Higgs boson mass can be achieved if the typical mass of squarks and gluinos is around the TeV scale.

As the top and bottom quarks are heavy, the mass scale of the lighter superpartners in the third family might stay below the TeV level.



Ref : L. Hall, LBL workshop, 21 Oct 2011

Outline of the talk : selected topics, various final states,  $\int Ldt = 5.8 - 12.8 \text{ fb}^{-1}$  @ 8 TeV

Inclusive squarks and gluinos, dedicated light scalar top and bottom searches : all jets, b-jets, lepton(s) and jets,

Long-lived particles, scalar gluon and R-parity-violating gluino multijet searches.

#### Other searches

MSSM Higgs boson and multilepton analyses : c.f. talks by J. A. Valls and J. Wittkowski.

### R-parity

Most analyses assume R-parity conservation with the LSP being a weakly interacting particle (neutralino or gravitino)  $\Rightarrow$  presence of missing transverse momentum  $E_T^{miss}$  in the final state.

Signal and background separation : exploit the signal-background mass gap whenever possible Jet and lepton multiplicity.

Effective mass  $m_{eff}$ , hadronic transverse mass : different scalar sums of transverse momenta of identified objects in the final state (leptons, jets,  $E_T^{miss}$ ).

Transverse mass  $m_{T2}$ , contransverse mass  $m_{CT}$ : exploit the mass gap between intermediate particles in the decay chain.

Other analysis-dependent variables.

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## General features of SUSY analyses (2/2)

### Background estimation

*Major backgrounds* : normalised using data from appropriately defined control regions (region with substantial contribution from the background of interest)

- Apply  $CR \rightarrow SR$  transfer factor to predict contribution in the signal region.

Multijet and fake (irreducible) backgrounds : determined from data

- Hadronic searches : jet energy resolution smearing.
- Leptonic searches : matrix technique based on loosening the lepton identification requirement.

Smaller irreducible backgrounds : predicted by Monte Carlo only.



#### Limit setting

The profile likelihood ratio test in combination with  $CL_s$  used to get CL = 95% exclusion limit.

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## Inclusive searches : (lepton +) jets + $E_T^{miss}$ ATLAS-CONF-2012-109/104

## Signal

Squark and/or gluino pair production.

Different analyses depending on the jet and lepton multiplicity.

### Main backgrounds

Top, Z+jets, W+jets : validated and estimated from a respective control region.

Diboson : predicted by Monte Carlo.

QCD multijet : estimated from data (jet smearing, matrix method)  $\Rightarrow$  negligible in most cases.

### Discriminating variables

$$E_T^{miss}$$

$$m_{eff} = (p_{T,lep}) + \sum_{i=jets} p_{T,i} + E_T^{miss}$$



## Inclusive searches : (lepton +) jets + $E_T^{miss}$ ATLAS-CONF-2012-109/104



Limit results : MSUGRA/CMSSM model, tan  $\beta = 10$ ,  $A_0 = 0$  and  $\mu > 0$ 

Exclude at  $CL = 95\% m_{1/2} < 350$  GeV for all  $m_0$  and  $m_0 < 740$  GeV for all  $m_{1/2}$  (jets +  $E_T^{miss}$  analysis).

Exclude  $m_{\tilde{q}} = m_{\tilde{g}}$  below 1500 GeV (jets +  $E_T^{miss}$  search) and 1100 GeV (one lepton channel).

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Gluino pair : three b-jets +  $E_T^{miss}$ 

## ATLAS-CONF-2012-145

### Signal

Gluino pair production  $\tilde{g} \rightarrow \tilde{b}_1 b$  or  $\tilde{g} \rightarrow \tilde{t}_1 t$ .

### Main backgrounds

 $t\bar{t}+{\rm jets}$  : validated and estimated from respective control region.

QCD multijet : estimated from data using the jet smearing technique (and cross-checked by the matrix method)  $\Rightarrow$  negligible.

Other backgrounds  $(t\bar{t} + b/b\bar{b}, t\bar{t} + W/Z, W/Z$ +heavy-flavour jets) : predicted by Monte Carlo.

### Discriminating variables

 $E_T^{miss}$ , several variants of  $m_{eff}$ .

 $\Delta \Phi^{4l}_{min}$  : minimum azimuthal separation between any of the four leading jets and  $E_T^{miss}.$ 



## Gluino pair : three b-jets + $E_T^{miss}$

## ATLAS-CONF-2012-145

Signal region	SR4-L	SR6-L
t t+jets	$30 \pm 6$	$12 \pm 4$
$t\overline{t} + b/b\overline{b}$	$8.1\pm8.3$	$4.6 \pm 5.0$
single top	$3.5\pm1.3$	$0.6 \pm 0.3$
$t\overline{t} + W/Z$	$1.4 \pm 0.8$	$0.8\pm0.4$
W/Z	$2.6 \pm 1.9$	$0.1\pm0.1$
Total background	$46 \pm 10$	$18\pm 6$
Observed	38	20

TABLE : Fitted backgrounds in selected signal regions (SR).

### Limit results : simplified models

Gbb model :  $BR( ilde{g} 
ightarrow b ar{b} \chi_1^0) = 100\%$ 

 $Gtt \text{ model}: BR( ilde{g} 
ightarrow t \overline{t} \chi_1^0) = 100\%$ 

- $m_{\chi_1^0} < 200 \text{ GeV}$  : exclude  $\tilde{g}$  mass up to 1240 (1100) GeV in *Gbb* (*Gtt*) model.
- $m_{\tilde{g}} = 1100 \text{ GeV}$  : exclude  $\chi_1^0$  mass below 570 (440) GeV in *Gbb* (*Gtt*) model.



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## Sbottom/stop pair : two b-jets + $E_T^{miss}$

## ATLAS-CONF-2012-165/171

## Signal

Direct light sbottom or stop pair production.

## Main backgrounds

Top production, W/Z produced in association with heavy-flavour hadrons : validated and estimated from respective control regions.

QCD multijet : estimated from data using the jet smearing technique.

Other backgrounds : predicted by Monte Carlo.

### Discriminating variables

 $E_T^{miss}$ ,  $m_{eff}$ 

Contransverse mass  $m_{CT}^2 = [E_T(\nu_1) + E_T(\nu_2)]^2 - [\vec{p}_T(\nu_1) - \vec{p}_T(\nu_2)]^2$ 



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## Sbottom/stop pair : two b-jets + $E_T^{miss}$

## ATLAS-CONF-2012-165/171

### Limit results : sbottom pair production

Assuming  $BR(\tilde{b}_1 \rightarrow b\chi_1^0) = 100\%$ .

- For  $m_{\chi_1^0} < 150~{
  m GeV}$  : exclude  ${ ilde b}_1$  mass up to 620 GeV.
- For  $m_{\tilde{b}_1}$  around 550 GeV : exclude  $\chi^0_1$  mass below 320 GeV.

#### Limit results : stop pair production

Assuming  $BR(\tilde{t}_1 \rightarrow b\chi_1^{\pm}) = 100\%$  and degenerate  $\chi_1^{\pm} - \chi_1^0$  masses.

-  $m_{\chi_1^0} = 100 \text{ GeV}$  : exclude stop mass up to 580 (480) GeV for  $m_{\chi_1^{\pm}} - m_{\chi_1^0} = 5$  (20) GeV.

- 
$$m_{\tilde{t}_1} = 500$$
 (480) GeV : exclude  $\chi_1^0$  mass up to 300 (250) GeV for  $m_{\chi_1^{\pm}} - m_{\chi_1^0} = 5$  (20) GeV.



# Stop pair : $II + E_T^{miss}$

## ATLAS-CONF-2012-167



## Signal

Direct light stop pair production.

## Main backgrounds

Top production, diboson : validated and estimated from respective control regions.

QCD multijet : estimated by the matrix technique.

Other backgrounds : predicted by MC.

### Discriminating variables

Boost vector 
$$\vec{p}_{b}^{ll} = \vec{E}_{T}^{miss} + \vec{p}_{T}^{l_{1}} + \vec{p}_{T}^{l_{2}}$$
.  
 $m_{T2} = \min_{\vec{q}_{T} + \vec{\tau}_{T} = \vec{E}_{T}^{miss}} \left\{ \max[m_{T}(\vec{p}_{T}^{l_{1}}, \vec{q}_{T}), m_{T}(\vec{p}_{T}^{l_{2}}, \vec{r}_{T})] \right\}$ 



## Stop pair : $II + E_T^{miss}$

## ATLAS-CONF-2012-167

TABLE : Fitted background events.

Signal region	SR90	SR100	SR110
tt	$134 \pm 24$	$21\pm9$	$3.8 \pm 1.8$
Wt	$11 \pm 5$	$1.8 \pm 1.9$	$1.4 \pm 0.8$
$t\overline{t} + V$	$1.5\pm0.3$	$0.9 \pm 0.2$	$0.6 \pm 0.2$
WW	$51 \pm 11$	$23 \pm 7$	$15\pm5$
WZ/ZZ	$8.4 \pm 1.9$	$6.3 \pm 1.8$	$4.7 \pm 1.4$
Z+jets	$8\pm6$	$7 \pm 5$	$4\pm 6$
QCD multijet	$9.6 \pm 2.8$	$3.7 \pm 1.4$	$1.4 \pm 0.8$
Total background	$224 \pm 31$	$64 \pm 13$	$31\pm8$
Observed	178	44	22

Limit results : assuming  ${\it BR}(\tilde{t}_1 \to b \chi_1^+) = 100\%$  and massless neutralino

Fixing  $m_{\chi_1^+}=200~{\rm GeV}$  : exclude stop mass between 200 and 335 GeV.

Fixing  $m_{\tilde{t}_1} - m_{\chi_1^\pm} = 10~{\rm GeV}$  : exclude stop mass between 150 and 450 GeV.



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## Stop pair : one lepton + jets + $E_T^{miss}$



## Signal

Direct light stop pair production.

## Main backgrounds

Dileptonic  $t\bar{t}$  with a non-identified lepton, W+jets : validated and estimated from respective control region.

QCD multijet : estimated by the matrix method  $\Rightarrow$  negligible.

Other backgrounds : predicted by Monte Carlo.

### Discriminating variables

 $E_T^{miss}$ , hadronic transverse mass  $H_T$ , lepton transverse mass  $m_T$ ,

Variants of  $m_{T2}$ .

# ATLAS-CONF-2012-166



# Stop pair : one lepton + jets + $E_T^{miss}$

# ATLAS-CONF-2012-166

Region	SRbC	W CR	Top CR
tī	$260 \pm 38$	$306 \pm 94$	$1473 \pm 99$
$t\overline{t} + V$	$8.9\pm3.0$	$2.0 \pm 0.8$	$10 \pm 3$
W+jets	$37 \pm 10$	$1231 \pm 113$	$381 \pm 78$
Single top	$15 \pm 4$	$30 \pm 11$	$140 \pm 33$
Z+jets, VV, multijet	$4.9 \pm 3.1$	$62 \pm 38$	$67 \pm 40$
Total background	$325\pm36$	$1631 \pm 42$	$2071 \pm 47$
Signal $(\tilde{t}_1, \chi^0, \chi^{\pm})$			
= (200, 75, 150)	81.4		
= (350, 150, 300)	69.7		
Observed	314	1631	2071

TABLE : Fitted background events in one example signal region.

Limit results : assuming massless LSP  $m_{\chi_1^0} = 0$ 

 $\tilde{t}_1 \rightarrow t \chi_1^0$  scenario : stop mass excluded between 225 and 560 GeV.

 ${ ilde t}_1 o b\chi_1^\pm$  scenario : stop mass excluded up to 350 GeV for  $m_{\chi_1^\pm}=$  150 GeV.



## Summary of stop pair production limit



The year 2012 was marked by a transition from inclusive squarks and gluinos searches to dedicated analyses focusing on more exclusive processes as occurred in direct stop, sbottom and also direct gaugino pair productions.

Stop searches exploit a rich spectrum of final states involving leptons, jets, b-jets and  $E_T^{miss} \Rightarrow$  offer sensitivity to different overlapping regions.

## Long-lived particles

# arXiv :1211.1597 [hep-ex]

### Signal

Sleptons, R-hadrons (composite colourless states of squarks/gluinos with quarks and gluons).

### Backgrounds

Dominated by high  $p_T$  muons with mis-measured  $\beta$  or large ionisation  $\Rightarrow$  rejected using time-of-flight and specific ionisation energy loss dE/dx.

### Limit results : 4.7 fb<sup>-1</sup>, 7 TeV centre-of-mass.

Stop (sbottom) R-hadron : excluded up to 683 (612) GeV.

Gluino R-hadron : excluded up to 985 GeV (generic interaction model).

Staus : excluded up to 300 GeV (GMSB,  $\tan \beta = 5 - 20$ ).



## Scalar gluon pair : four-jet final state

# arXiv :1210.4826 [hep-ex]

### Signal : pair production of massive scalar gluons.

 $\label{eq:Background:Standard Model multijet} \Rightarrow determined from data using the four-region ABCD method.$ 



 $\theta^*$  : scalar gluon scattering angle.

 $m_1$  and  $m_2$ : invariant masses of the two dijet systems.

## Limit results : 7 TeV centre-of-mass

Combined 2010 and 2011 data : exclude scalar gluon mass between 100 and 287 GeV.



## Gluino pair : six-jet final state

# arXiv :1210.4813 [hep-ex]



Background : Standard Model multijet production.

Two uncorrelated analyses : resolved and boosted jet

*Resolved* : sensitive over large gluino mass range.

- Seek excess in jet multiplicity (njet) spectrum.
- Background predicted from lower njet bins.

Boosted : focus on highly boosted light gluinos.

- Reconstruct large-radius jets from unresolved jets.
- Background estimated from the ABCD method (jet invariant mass and substructure as discriminating variables).

### Limit results : 7 TeV centre-of-mass

Exclude gluino mass up to 666 (255) GeV in resolved (boosted) analysis.



## Mass reach of ATLAS SUSY searches

	ATLAS SUSY	Searches* - 95% CL Lower Limits (Statu	is: Dec 2012)	
MSUGRA/CMSSM : 0 lep + j's + E <sub>7 miss</sub>	L=5.8 fb", 8 TeV [ATLAS-CONF-2012-709]	1.50 TeV q = g mass	· ·	
MSUGRA/CMSSM : 1 lep + j's + E <sub>T miss</sub>	L=5.81b , 8 TeV [ATLAS-CONF-2012-104]	1.24 TeV q = g mass	ATLAS	
Prierio model : 0 lep + js + E <sub>T,miss</sub>	L=5.816 , 8 TeV [ATLAS-CONF-2012-109]	1.18 lev g mass (m(q) < 2 lev, igm χ <sub>1</sub> )	Preliminany	
Chrise med 2 <sup>±</sup> (7 untr <sup>±</sup> ) + 4 les + 7 a + 5	LID.010 , 0 TeV [ATEAS-CONF-2012-100]	and any a mach and any and any and		
GMSP (INI SP) + 2 lop (OS) + 2 + F	LT4.7 ID , 7 TeV [1208.4666]	124 TeV 0 00955 (1001 + 16)	m(X )+m(g))	
<ul> <li>GMSB (TNI SP) : 1-2 t + 0-1 lep + i's + F<sup>T</sup> miss</li> </ul>	Z=4.7 (b <sup>-1</sup> .7 TeV (1210-1214)	1 20 TeV (10055 (100) + 20)		
GGM (bino NLSP) : yy + E <sup>T,miss</sup>	I =4.8 (b <sup>-1</sup> 7 TeV [1203.0753]	107 TeV 0 (00055 (m(x <sup>0</sup> ) > 50 GeV)	1 dt (2 1 12 0) (b)	
GGM (wino NLSP) : y + lep + E <sup>T miss</sup>	1=4.8(b <sup>-1</sup> 7 TeV [ATI AS-CONE-2012-144]	619 GeV 0 mass	Lut = (2.1 - 13.0) ID	
GGM (higgsino-bino NLSP) : γ + b + E <sup>T,miss</sup>	L=4.8 fb <sup>-1</sup> , 7 TeV [1211.1167]	900 GeV 0 mass (m(x) > 220 GeV)	S = 7.8 TeV	
GGM (higgsing NLSP) : Z + jets + E	L=5.8 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-152]	690 GeV 0 mass (mH) > 200 GeV)		
Gravitino LSP : 'monojet' + E	L=10.5 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-147]	645 GeV F <sup>1/2</sup> SCale (m(G) > 10 <sup>-4</sup> eV)		
$r_{1}$ $r_{2}$ $\rightarrow bby$ (virtual b) $0$ lep + 3 b-i's + $F_{2}$	L=12.8 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-145]	1.24 TeV g mass (m(y) < 200 GeV)		
a→tty (virtual t) : 2 lep (SS) + i's + E <sub>T min</sub>	L=5.8 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-105]	850 GeV g mass (m(χ) < 300 GeV)		
B ⊆ G→tty (virtual t) : 3 lep + i's + E <sub>T min</sub>	L=13.0 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-151]	860 GeV g mass (m(x) < 300 GeV)	8 TeV results	
p g→tty, (virtual t): 0 lep + multi-j's + E <sub>T miss</sub>	L=5.8 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-103]	1.00 TeV g mass (m(x) < 300 GeV)	7 TeV results	
(i) G→tty (virtualt): 0 lep + 3 b-j's + E <sub>T miss</sub>	L=12.8 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-145]	1.15 TeV g mass (m(χ) < 200 GeV)		
bb, b, →by : 0 lep + 2-b-jets + E <sub>T mas</sub>	L=12.8 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-165]	620 GeV b mass (m(χ <sup>2</sup> ) < 120 GeV)		
bb, b, →tχ, : 3 lep + j's + E <sub>T miss</sub>	L=13.0 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-151]	405 GeV b mass $(m(\tilde{\chi}_{1}^{0}) = 2 m(\tilde{\chi}_{1}^{0}))$		
$\Xi \subseteq ft (light), t \rightarrow b\chi^{+}: 1/2 lep (+ b-jet) + E_{T,miss}$	L=4.7 fb <sup>-1</sup> , 7 TeV [1208.4305, 1209.2102]67 GeV	t mass $(m(\underline{\chi}) = 55 \text{ GeV})$		
$\approx$ 8 tt (medium), t $\rightarrow$ by 1 lep + b-jet + E <sub>T miss</sub>	L=13.0 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-166]	<b>160-350 GeV</b> t mass $(m(\chi^2) = 0 \text{ GeV}, m(\chi^2) = 150 \text{ GeV})$		
$=$ tt (medium), t $\rightarrow$ b $\chi^{+}_{1}$ : 2 lep + $E_{T,miss}$	L=13.0 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-167]	<b>160-440 GeV</b> t mass $(m(\chi^2) = 0 \text{ GeV}, m(t)-m(\chi^2) = 10 \text{ GeV})$		
$t_{t}$ $t \rightarrow t\chi$ : 1 lep + b-jet + $E_{T,miss}$	L=13.0 fb", 8 TeV [ATLAS-CONF-2012-166]	<b>230-560 GeV</b> t mass $(m(\chi_{1}) = 0)$		
A H H H H H H H H H H H H H H H H H H H	L=4.71b , 7 TeV [1208.1447,1208.2590,1209.418	6] 230-465 GeV t mass $(m(\chi_1) = 0)$		
II (IIatural GMOD) $Z(\rightarrow ii) + D = U + E_T$ miss	L=2.1 fb , 7 TeV [1204.6736]	310 GeV T MASS (115 < m(x,) < 230 GeV)		
$[1], I \rightarrow I\chi$ : 2 lep + $E_{T,miss}$	L=4.7 fb , 7 feV [1208.2884] 85-195 0	eV I mass $(m(\chi_i) = 0)$		
$\chi_{\chi_{\chi_{\chi_{\chi_{\chi_{\chi_{\chi_{\chi_{\chi_{\chi_{\chi_{\chi_{\chi$	L 14.7 18 , 7 16V [1205.2664]	<b>110-340 GeV</b> $\chi_1$ ITIASS $(m(\chi_1) < 10 \text{ GeV}, m(\chi)) = \frac{1}{2}(m(\chi_1) + m(\chi_2)))$		
$\chi_1 \chi_2 \rightarrow (V_1)(VV), W_1(VV), 3 lep + E_{T,miss}$	L-12.0 (b <sup>-1</sup> 8 TeV (ATLAS-CONF-2012-154)	<b>580 GeV</b> $\chi_1$ mass $(m(\chi_1) = m(\chi_2), m(\chi_1) = 0, m(v)$ as	above)	
Direct v pair prod. (AMSB) : long-lived v	1=4.7 (b <sup>-1</sup> 7 TeV [1210 2852]	$\chi^2$ mass $(1 < \pi \sqrt{2}) < 10 \text{ ms}$		
Stable & R-badrons : low & By (full detector)	I=4.7 (b <sup>-1</sup> , 7 TeV [1211 1507]	are day 0 mass		
Stable TR-badrons : low B By (full detector)	L=4.7 fb <sup>-1</sup> , 7 TeV [1211.1597]	683 Gev t mass		
GMSB : stable 7 (full detector)	L=4.7 (b <sup>-1</sup> , 7 TeV [1211.1597]	300 GeV T MASS (5 < tan5 < 20)		
$\overline{\chi}^{0} \rightarrow qqu (RPV) : u + heavy displaced vertex$	L=4.4 fb <sup>-1</sup> , 7 TeV [1210.7451]	700 GeV Q mass (0.3×10 <sup>6</sup> < λ <sub>m</sub> < 1.5×10 <sup>6</sup> , 1 mm	< ct < 1 m,g decoupled)	
I EV : np-v +X v ->e+u resonance	L=4.6 fb <sup>-1</sup> , 7 TeV [Preliminary]	1.61 TeV V, MASS (2,=0.10, 2,	=0.05)	
LFV : $pp \rightarrow \overline{v} + X, \overline{v} \rightarrow e(u) + \tau$ resonance	L=4.6 fb <sup>-1</sup> , 7 TeV [Preliminary]	1.10 TeV V, MASS (λ <sub>111</sub> =0.10, λ <sub>11000</sub> =0.05		
Bilinear RPV CMSSM : 1 lep + 7 j's + E <sub>T miss</sub>	L=4.7 fb <sup>-1</sup> , 7 TeV [ATLAS-CONF-2012-140]	1.2 TeV $\hat{q} = \hat{g} \text{ mass } (c_{1, co} < 1 \text{ mm})$		
$\vec{\chi}^+ \vec{\chi}^-, \vec{\chi}^+ \rightarrow W \vec{\chi}^0, \vec{\chi}^0 \rightarrow eev_{\mu}, e\mu v_{\mu} : 4 lep + E_{\tau_{min}}$	L=13.0 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-153]	700 GeV $\chi_1^*$ mass $(m(\chi_1^0) > 300 \text{ GeV}, \lambda_{121} \text{ or } \lambda_{122}$	> 0)	
$I_{1}I_{1} \rightarrow I_{2}V_{1}V_{2} \rightarrow eev_{1}e\mu v$ : 4 lep + $E_{T_{min}}$	L=13.0 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012-153]	430 Gev I mass (m(χ) > 100 GeV, m(l)=m(l)=m(l), λ <sub>121</sub> or	λ <sub>122</sub> > 0)	
g → gqg ; 3-jet resonance pair	L=4.6 fb <sup>-1</sup> , 7 TeV [1210.4813]	666 GeV g mass		
Scalar gluon : 2-jet resonance pair	L=4.6 fb <sup>-1</sup> , 7 TeV [1210.4826] 10	0-287 GeV SGIUON MASS (incl. limit from 1110.2693)		
wimP interaction (DS, Dirac $\chi$ ) : monojet + E	L=10.5 fb <sup>-1</sup> , 8 TeV [ATLAS-CONF-2012/047]	704 GeV M* \$Cale (m <sub>2</sub> < 80 GeV, limit of < 687 Ge	/ for 08)	
	10 <sup>-1</sup>	1	10	
Mass scale [TeV/				
*Only a selection of the available mass limits on new s	tates or phenomena shown.		111000 30010 [101]	

All limits quoted are observed minus 1 ar theoretical signal cross section uncertainty.

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### ATLAS has been conducting a comprehensive SUSY search program.

The individual searches are sensitive to different complementary regions of the SUSY parameter space with sufficient overlap.

### Observed data has been consistent with the SM background expectation.

95% CL exclusion limits are set within various phenomenological assumptions.

 $\Rightarrow$  the parameter space given by the naturalness argument is being filled up.

#### Results with complete 2012 data forthcoming ...

The LHC has just begun delivering Nature's secrets.

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