



SEARCHES FOR R-PARITY CONSERVING SUPERSYMMETRY WITH THE ATLAS DETECTOR

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On behalf of ATLAS collaboration

Outline

- ▣ Introduction
 - ATLAS, search strategy
- ▣ Inclusive search
 - squark / gluino production
- ▣ Exclusive search
 - 3rd generation (stop/sbottom)
 - direct gaugino and slepton
- ▣ Summary

The ATLAS Detector

General purpose, high resolution, hermetic detector in LHC

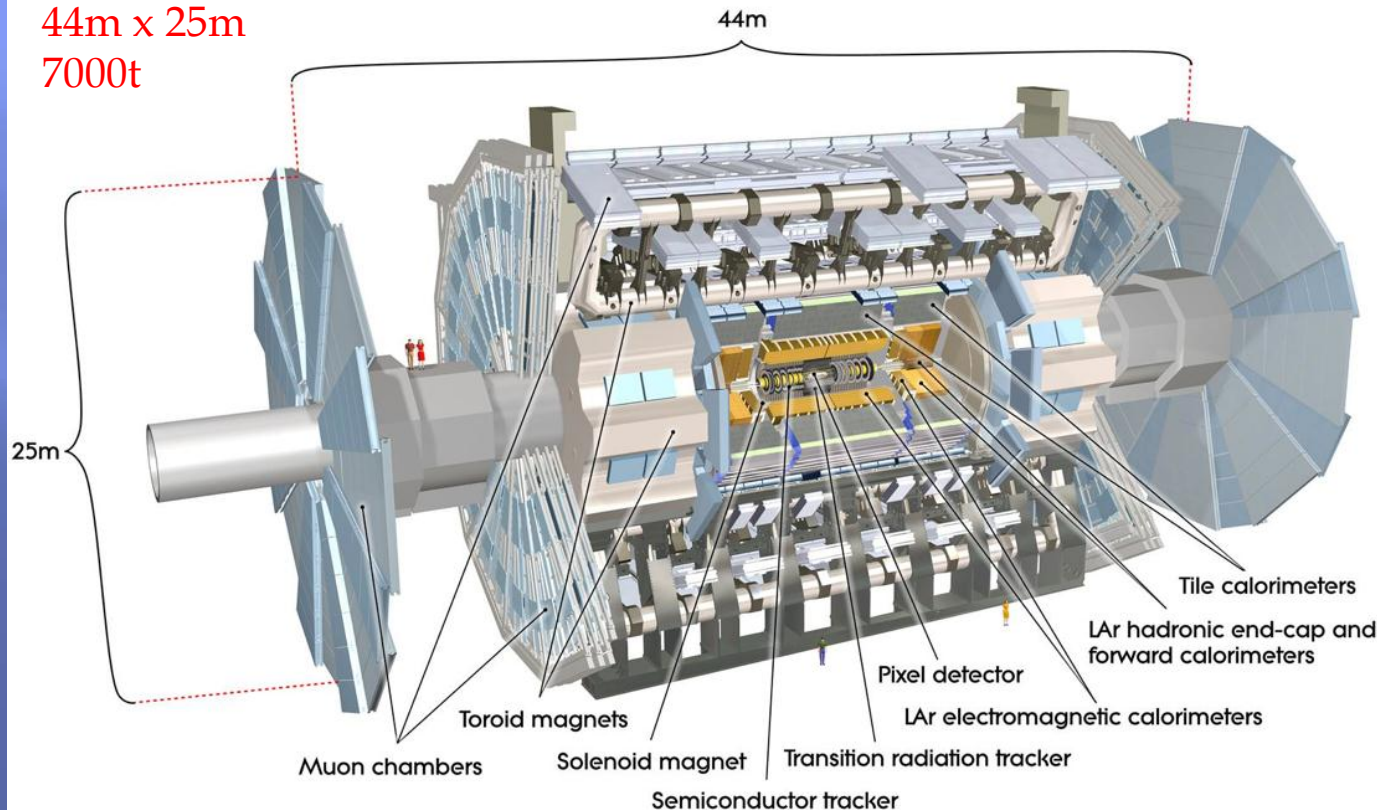
Inner Detector: Pixel, Silicon, Transition Radiation Tracker

Calorimeter: EM(LAr), Had(Tile) Cal

Muon: Trigger(RPC,TGC) + Precision chambers(MDT,CSC)

Magnetic: Central Solenoid(2T) + Barrel and Endcap Toroids

44m x 25m
7000t



Reconstructed objects

- Lepton (e, μ, τ)
- Photon
- Jet (with b-tagging)
- Missing ET(MET)

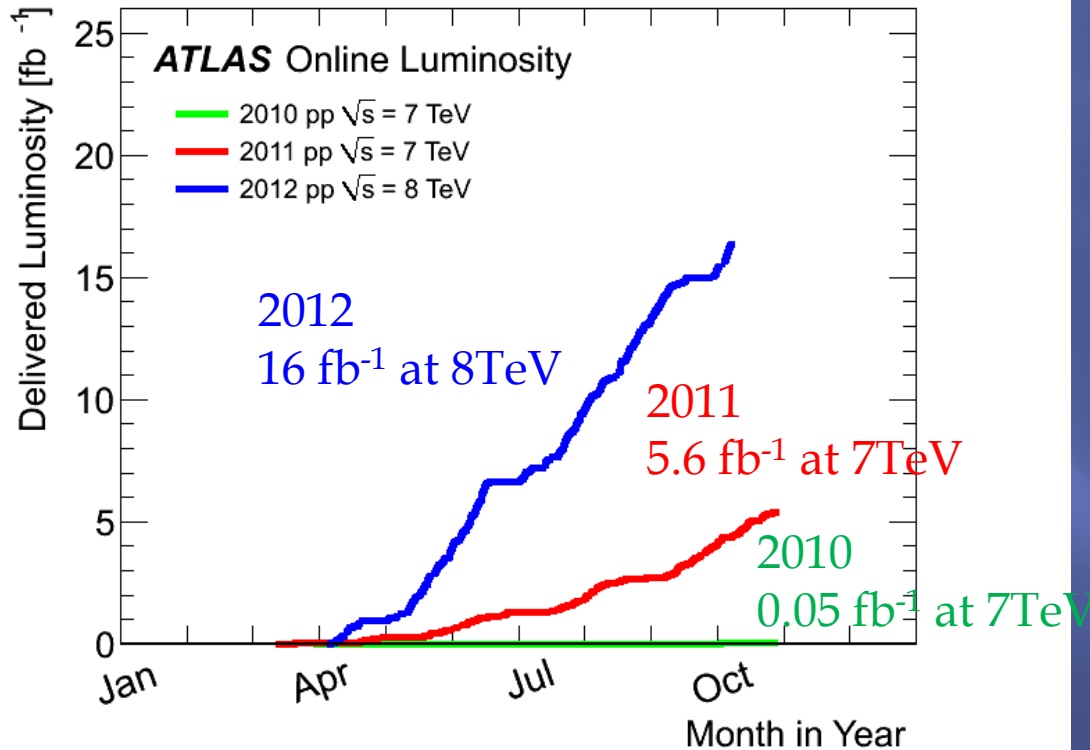
Kinematic variables

$$p_T = p \sin\theta$$

$$\eta = -\ln \tan(\theta/2)$$

Data taking

Integrated luminosity



Peak luminosity
 $7.7 \times 10^{33} \text{ cm}^{-2} \text{ s}^{-1}$
 (~ 30 pile up events)

Integrated luminosity
 2012 Oct: 16 fb⁻¹ at 8TeV
 2011: 5.6 fb⁻¹ at 7TeV
 2010: 0.05 fb⁻¹ at 7TeV

Data quality
 93.7% ready for Physics

ATLAS p-p run: April-Sept. 2012

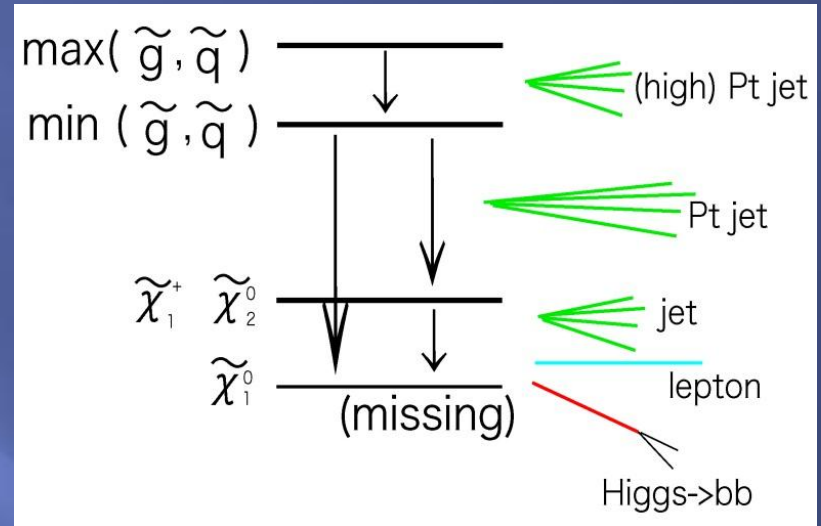
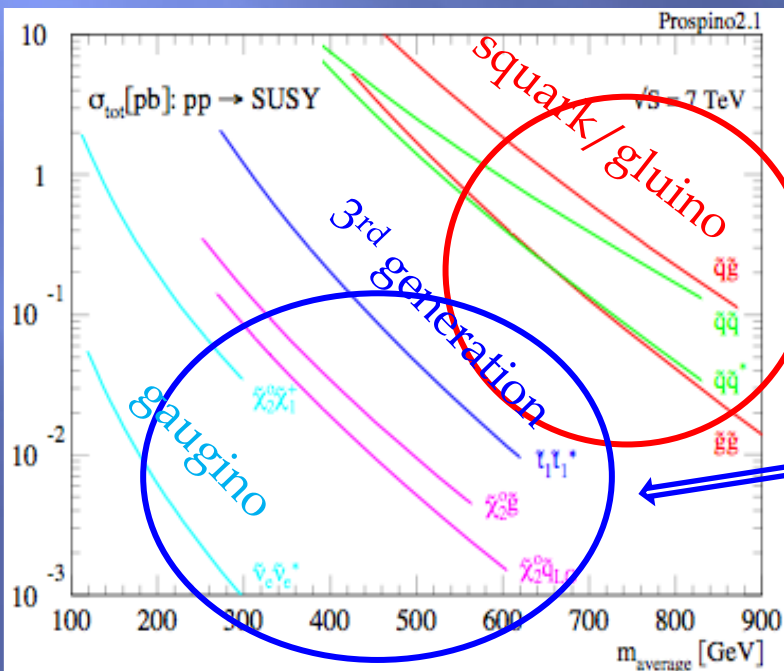
Inner Tracker			Calorimeters		Muon Spectrometer				Magnets	
Pixel	SCT	TRT	LAr	Tile	MDT	RPC	CSC	TGC	Solenoid	Toroid
100	99.3	99.5	97.0	99.6	99.9	99.8	99.9	99.9	99.7	99.2
All good for physics: 93.7%										

SUSY in ATLAS

Generic phenomenology

- Strongly interacting particle (squark, gluino) dominates
- Several high-pT jets in decay chain
- LSP is stable (R-parity), escape from detector (Missing ET)

cross section of SUSY



Search strategy

1. Inclusive search

multi-jets + MET + (0~4leptons)
 + (photon, b-jets)

2. Dedicated exclusive channels

3rd generation, gaugino sector, etc

Public results

<https://twiki.cern.ch/twiki/bin/view/AtlasPublic/SupersymmetryPublicResults>

8TeV

channel	date	\sqrt{s} (TeV)	L (fb ⁻¹)	ATLAS-CONF-	arXiv	paper
0 lepton + ≥ 2 -6jets + MET	08/2012	8	5.8	2012-109		
0 lepton + ≥ 6 -9jets + MET	08/2012	8	5.8	2012-103		
1 lepton + ≥ 4 jets + MET	08/2012	8	5.8	2012-104		
2 same-sign leps + ≥ 4 jets + MET	08/2012	8	5.8	2012-105		

7TeV

1-2 taus + 0-1 leptons + jets + MET [GMSB]	10/2012	7	4.7		1210.1314	submitted to EPJC
2 leptons + jets + MET [Medium stop]	09/2012	7	4.7		1209.4186	submitted to JHEP
1-2 b-jets + 1-2 leps + jets + MET [Light stop]	09/2012	7	4.7		1209.2102	submitted to PLB
2 photons + ≥ 2 -4jets + MET	09/2012	7	4.7		1209.0753	submitted to PLB
1-2 leptons + ≥ 2 -4jets + MET	08/2012	7	4.7		1208.4688	accepted by PRD
2 leptons + ≥ 1 jet + MET [very light stop]	08/2012	7	4.7		1208.4305	submitted to EPJC
3 leptons + MET [Direct gauginos]	08/2012	7	4.7		1208.3144	submitted to PLB
2 leptons + MET [Direct gauginos/sleptons]	08/2012	7	4.7		1208.2884	submitted to PLB
1 lepton + ≥ 4 jets (≥ 1 b) + MET [heavy stop]	08/2012	7	4.7		1208.2590	accepted by PRL
0 lepton + 1-2 b + 5-4 jets + MET [heavy stop]	08/2012	7	4.7		1208.1447	accepted by PRL
0 lepton + ≥ 2 -6jets + MET	08/2012	7	4.7		1208.0949	submitted to PRD
0 lepton + ≥ 3 b + ≥ 1 -3j + MET [GM, stop, sb]	07/2012	7	4.7		1207.4686	EPJC
0 lepton + ≥ 6 -9jets + MET	06/2012	7	4.7		1206.1760	JHEP 1207 (2012) 167
Z+ll + bjet + jets + MET [direct stop in GMSB]	04/2012	7	2.05		1204.6736	PLB 715 (2012) 44
1 lepton + ≥ 7 jets + MET	10/2012	7	4.7	2012-140		
3 lepton + jets + MET	08/2012	7	4.7	2012-108		
2 b-jets + MET [Direct sbottom]	08/2012	7	4.7	2012-106		
General new phenomena	08/2012	7	4.7	2012-107		
4-leptons + MET	01/2012	7	2.05	2012-001		
Z \rightarrow ll + jets + MET [GGM]	04/2012	7	1.04	2012-046		

Only the most recent result for topics listed

Inclusive searches

(squark / gluino production)

Search channels

channels

generally, look for

multi-jets + MET + (e, μ , τ , γ)

LSP = neutralino (mSUGRA)

- Squark/gluino \rightarrow multi-jets + LSP
 \rightarrow 0 lepton + 2-9 jets + MET
- with leptonic gaugino/slepton decay
 \rightarrow 1/2 lepton + jets + MET
- with 3rd generation
 \rightarrow b-jets + MET

LSP = gravitino (GMSB, etc)

topology depend on NLSP

- squark/gluino
with stau/neutralino \rightarrow LSP
 \rightarrow 2 taus/leptons + jets + MET
 \rightarrow 2 photons + MET

variables

discriminating variable for SUSY

- Missing ET (MET)
= - Σ visible energy (Calo, muon)
- **Effective Mass (M_{eff})** =
MET + Σ pT of jets + (leptons)
- Missing ET significance =
MET / sqrt(HT) : HT = Σ pT of jets

for simple topology 2-body decay
(visible and invisible)

- Contransverse mass (M_{CT})
- M_{T2}

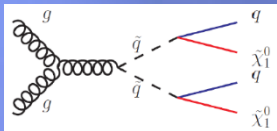
discriminating variable for $W \rightarrow l \nu$

- Transverse mass (M_{T}) =
 $\text{sqrt}[2 \times p_{\text{T}}(l) \times \text{MET} \times \{1 - \cos(\Delta\phi(l, \text{MET}))\}]$

Event Selection

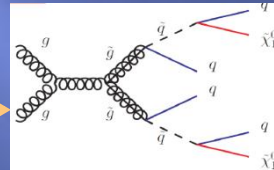
0 lepton mode event selection

squark/squark

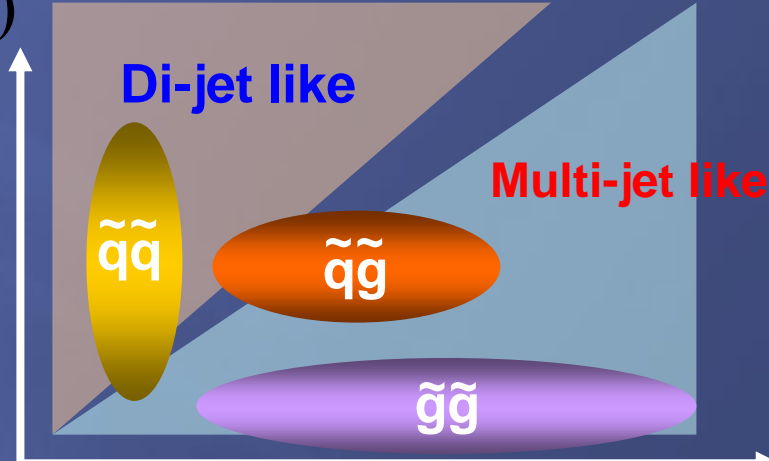


N jets depend on initial production

gluino/gluino



$m(\tilde{g})$



$m(\tilde{q})$

Requirement	Channel				
	A 2-jets	B 3-jets	C 4-jets	D 5-jets	E 6-jets
$E_T^{\text{miss}} [\text{GeV}] >$	160				
$p_T(j_1) [\text{GeV}] >$	130				
$p_T(j_2) [\text{GeV}] >$	60				
$p_T(j_3) [\text{GeV}] >$	-	60	60	60	60
$p_T(j_4) [\text{GeV}] >$	-	-	60	60	60
$p_T(j_5) [\text{GeV}] >$	-	-	-	60	60
$p_T(j_6) [\text{GeV}] >$	-	-	-	-	60
$\Delta\phi(\text{jet}, \mathbf{E}_T^{\text{miss}})_{\text{min}} [\text{rad}] >$	0.4 ($i = \{1, 2, (3)\}$)		0.4 ($i = \{1, 2, 3\}$), 0.2 ($p_T > 40 \text{ GeV jets}$)		
$E_T^{\text{miss}}/m_{\text{eff}}(N_j) >$	0.3/0.4/0.4 (2j)	0.25/0.3/- (3j)	0.25/0.3/0.3 (4j)	0.15 (5j)	0.15/0.25/0.3 (6j)
$m_{\text{eff}}(\text{incl.}) [\text{GeV}] >$	1900/1300/1000	1900/1300/-	1900/1300/1000	1700/-/-	1400/1300/1000

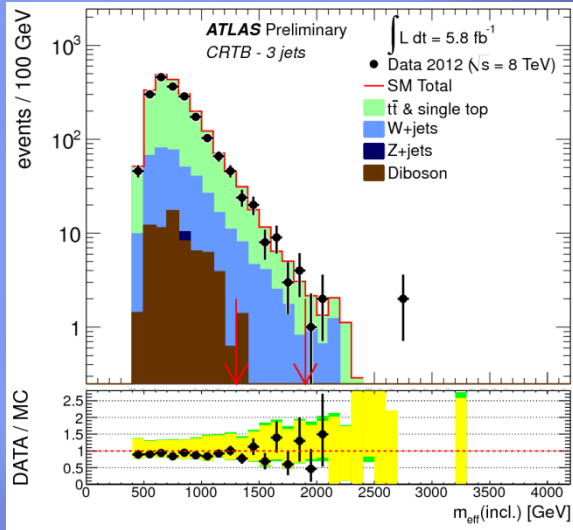
multi jets N=2~6(>60GeV)

MET cut
(300~400GeV)

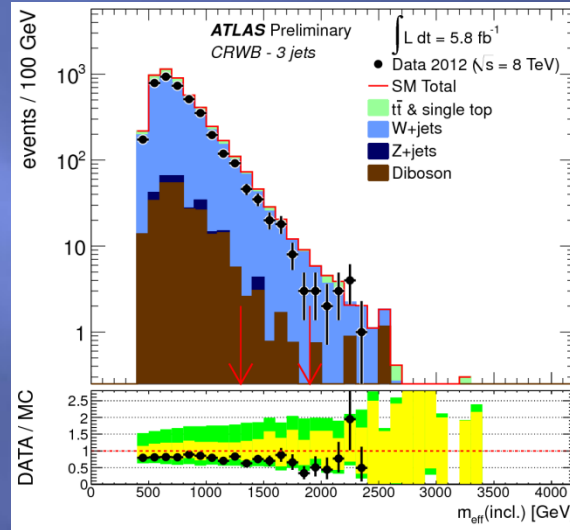
Effective Mass cut
(1TeV~2TeV)

SM Backgrounds

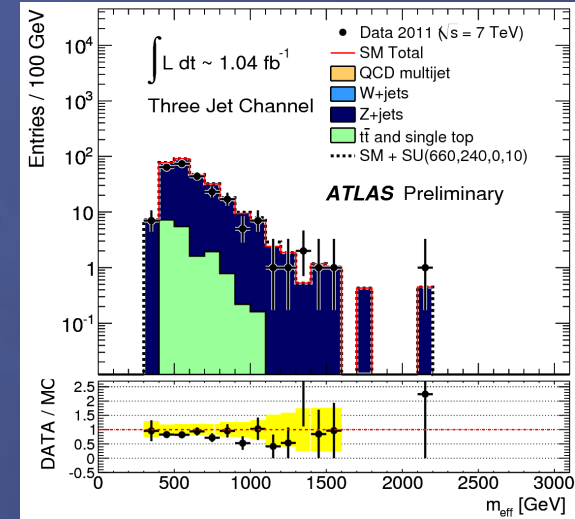
$t\bar{t}$ + multi-jets



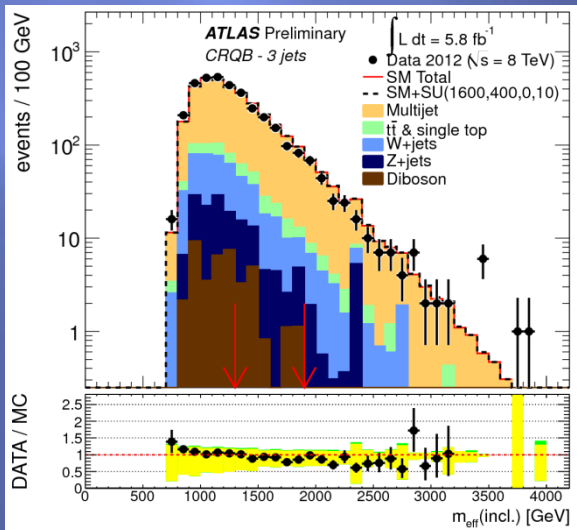
W + multi-jets



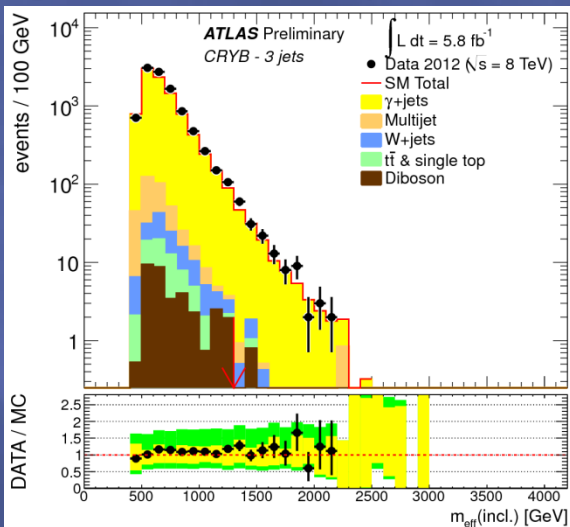
Z + multi-jets



QCD (multi-jets)



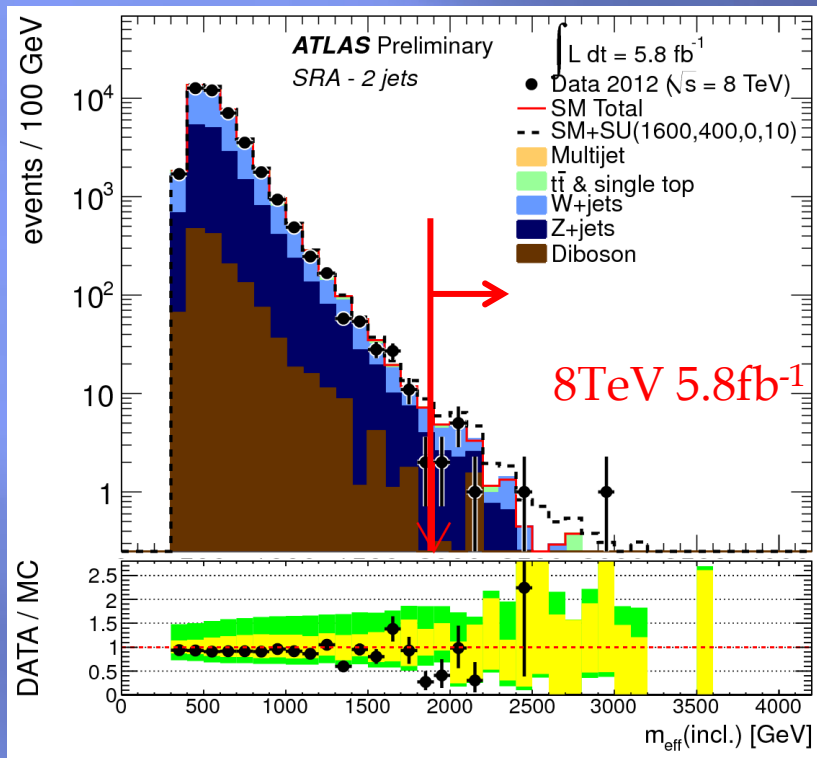
gamma + multi-jets



- understand BGs in control regions
~ signal depleted
~ pure as possible
- normalize MC, extrapolate to signal region using MC

Signal regions

0 lepton + ≥ 2 jets + MET



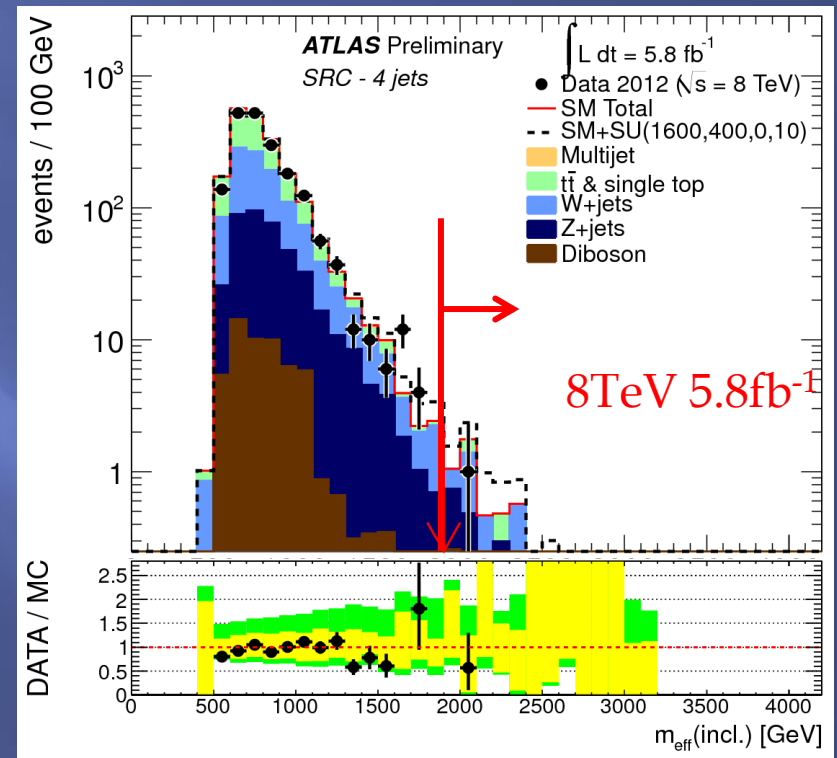
$M_{\text{eff}} > 1900 \text{ GeV}$

Data 10

MC 14 \pm 5

(W:3,Z:7,tt:1:Di:3)

0 lepton + ≥ 4 jets + MET



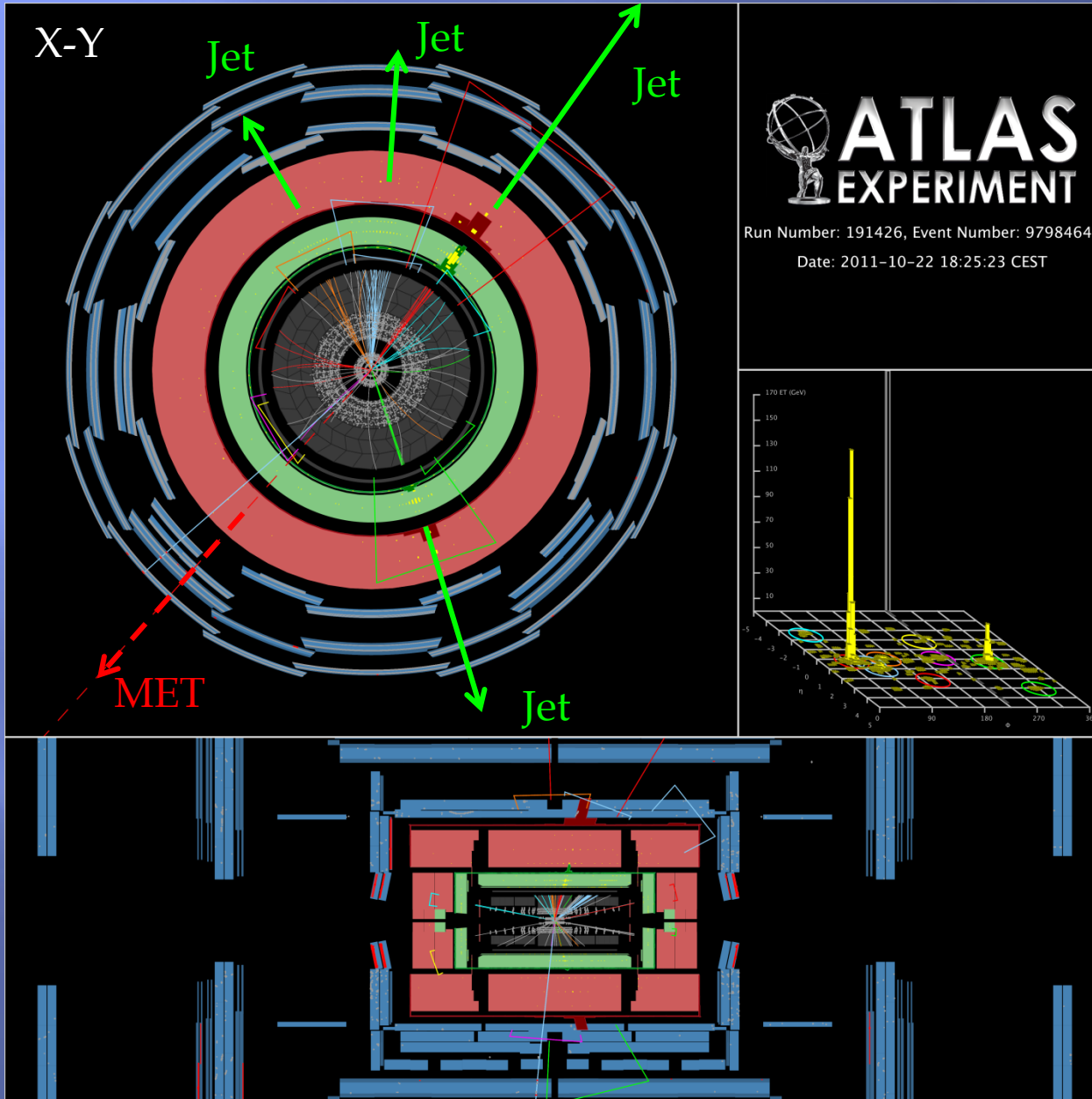
$M_{\text{eff}} > 1900 \text{ GeV}$

Data 1

MC 2.8 \pm 1.2

(W:0.3,Z:2.0,tt:0.6,Di:--)

Event display



Run:191426 #97984647
(7TeV 2011)

Effective Mass
2441 GeV

MET
984 GeV

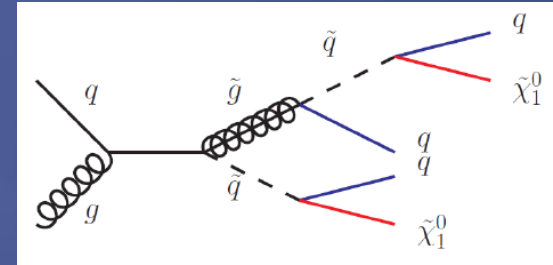
Jets (>40GeV)
974, 276, 146, 61 GeV

Leptons (e, μ)
No (>10GeV)

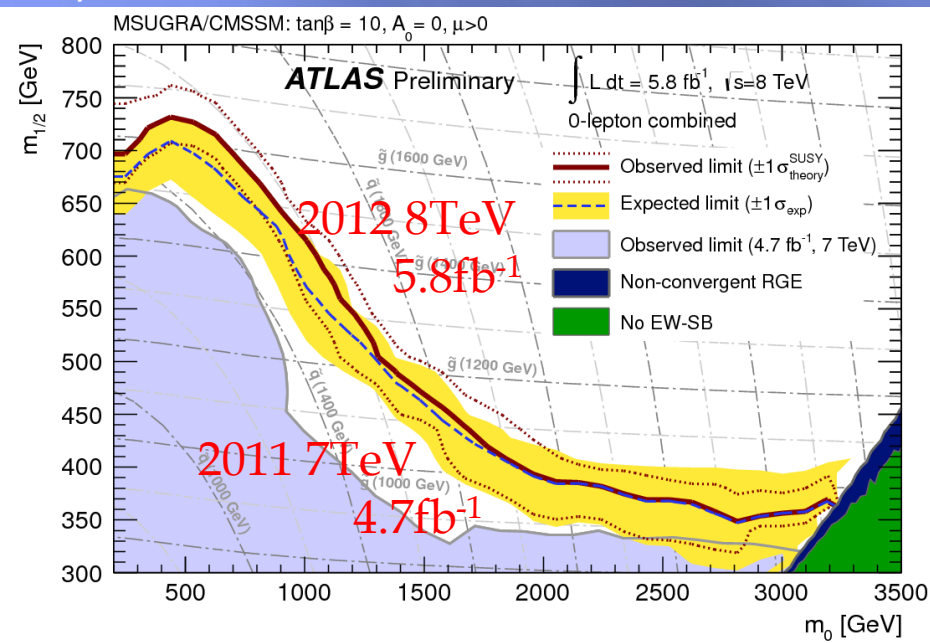
Exclusion region

0 lepton + 2-6 jets + MET (most sensitive)

- no evidence so far (at 5.8fb^{-1} , 8TeV)
- exclude $\sim 1.5\text{TeV}$ for $M_{\text{squark}} \sim M_{\text{gluino}}$, $\sim 1\text{TeV}$ for $M_{\text{squark}} \gg M_{\text{gluino}}$
- widely extended at 8TeV (cross section $\times 2 \sim 5$)

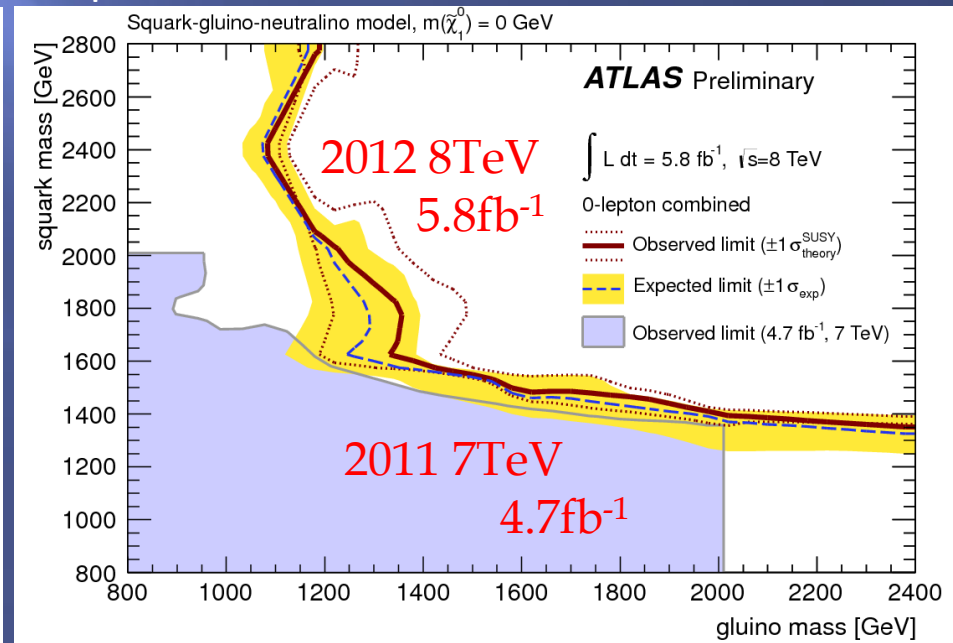


$M_{1/2}$ MSUGRA ($\tan\beta=10, A=0, \mu>0$)



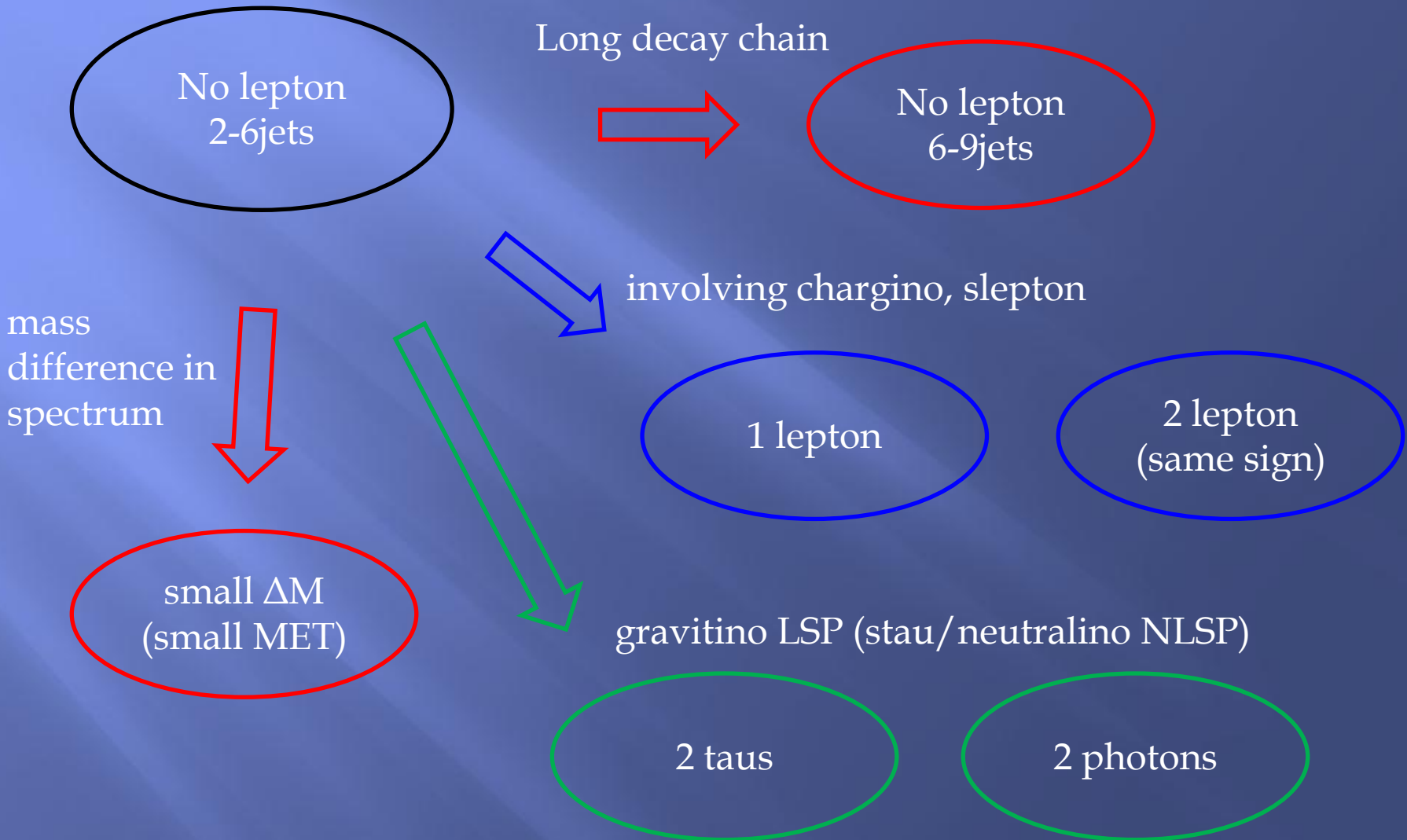
M_0

M_{squark} Simplified squark/gluino model



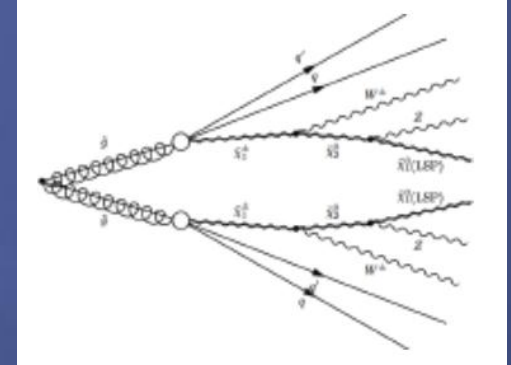
M_{gluino}

Relaxing constraints

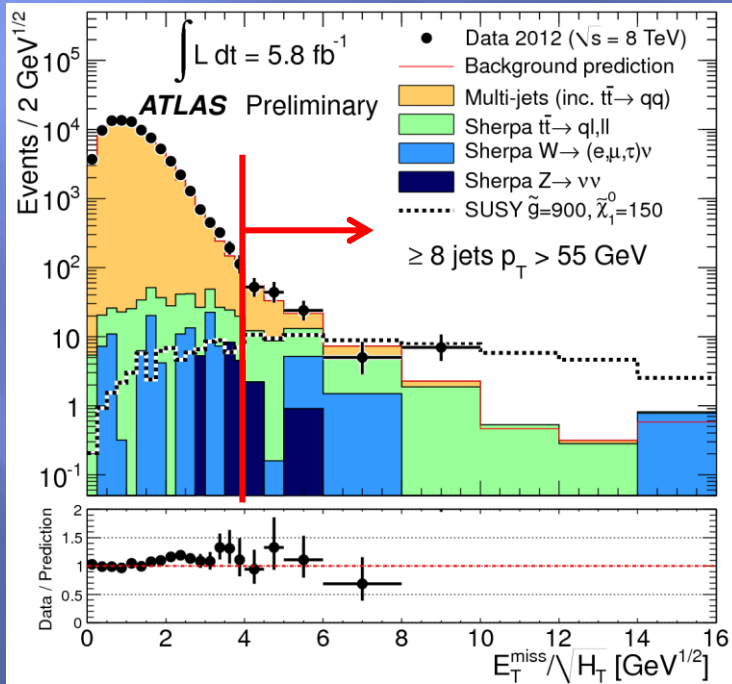


Long decay chain

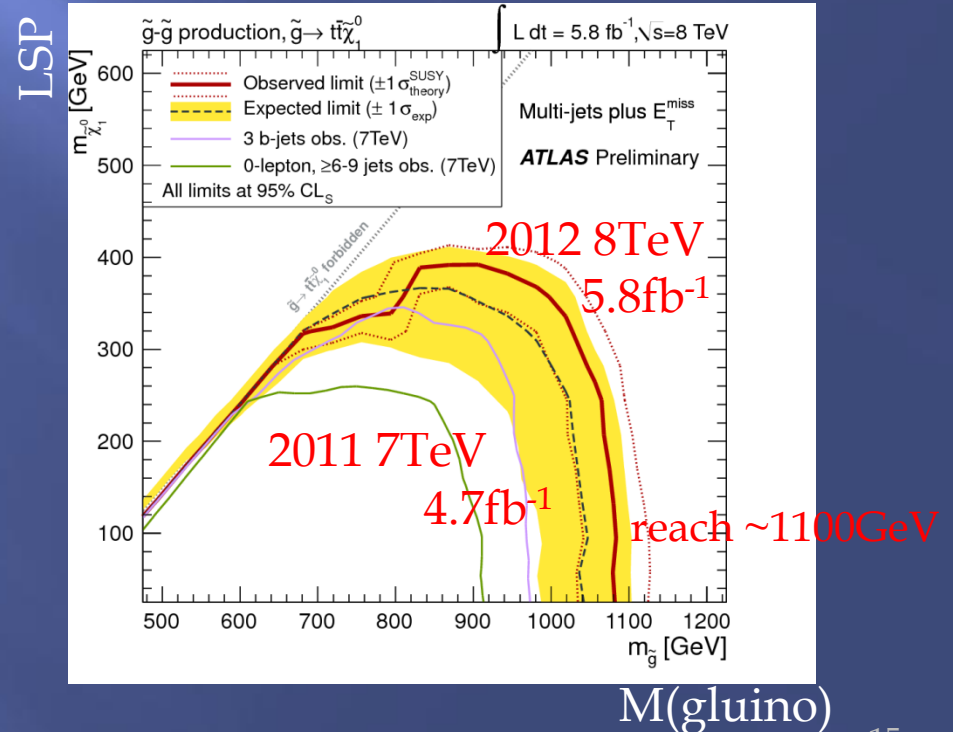
- target for gluino pair production, (especially involving stop, higher gaugino, etc)
0 lepton + $\geq 6-9$ jets + MET
- change BG composition: QCD, $t\bar{t}$ (hadronic)
MET significance = $\text{MET} / \sqrt{\text{HT}}$



Simplified: gluino \rightarrow stop + top \rightarrow 2 top + LSP



MET significance

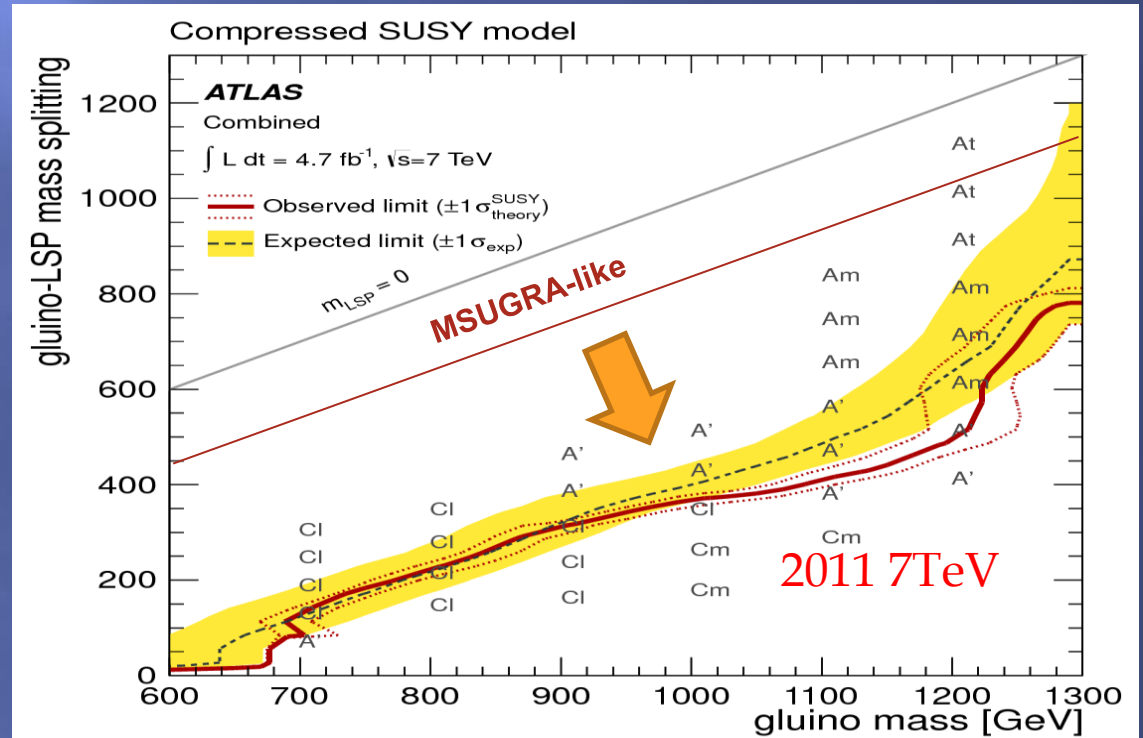
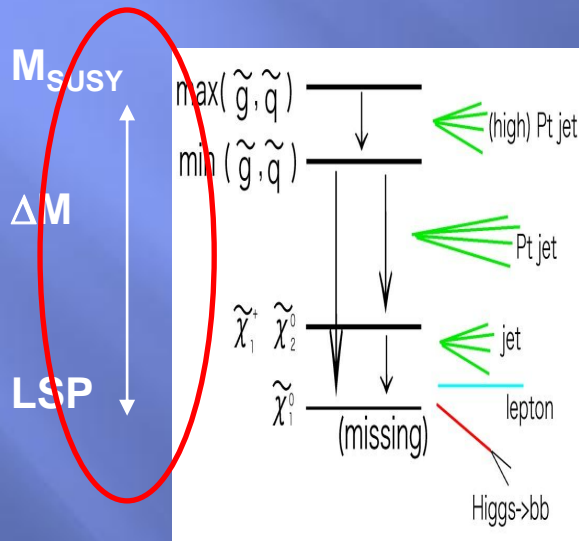


$M(\text{gluino})$

Small mass difference

- mSugra-like spectrum
large ΔM ($M(\text{squark}) - \text{LSP}$) ~ 0.85
- explore to small ΔM region by using simplified model

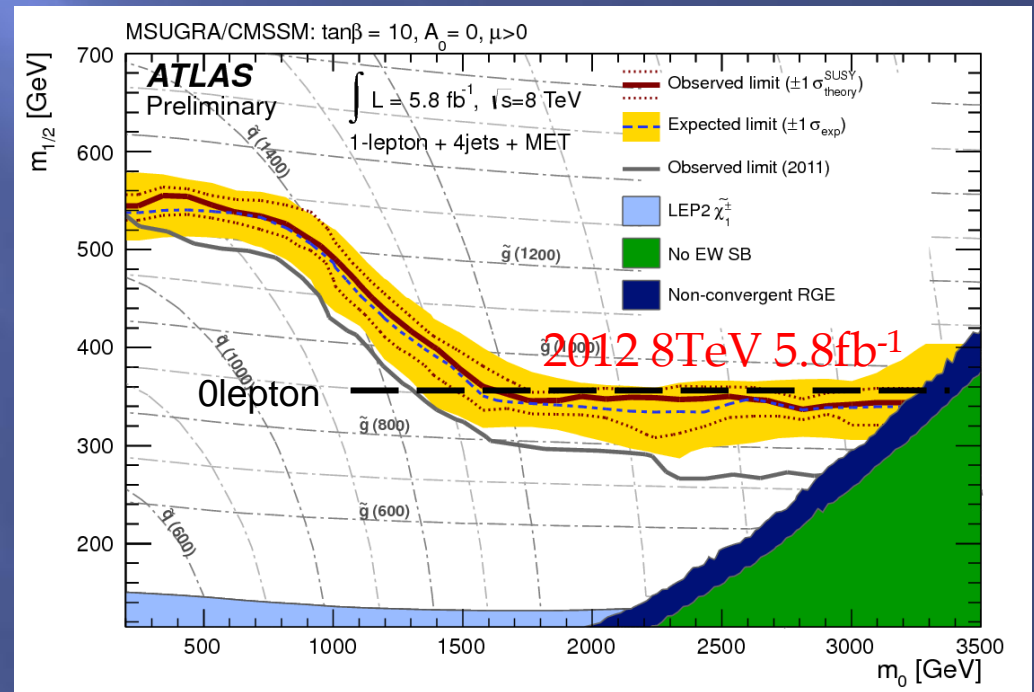
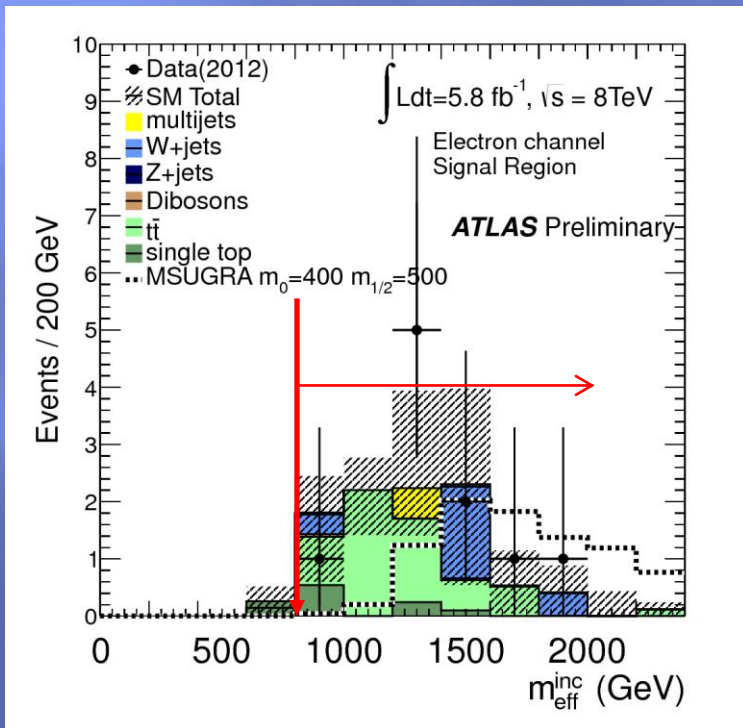
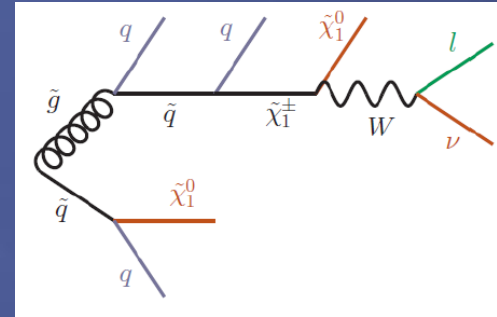
ΔM ($M_{\text{susy}} - \text{LSP}$)



- gluino mass limit depends on ΔM
- exclude $\Delta M \sim 0.4$ at $M(\text{gluino}) \sim 1 \text{ TeV}$

1 lepton mode

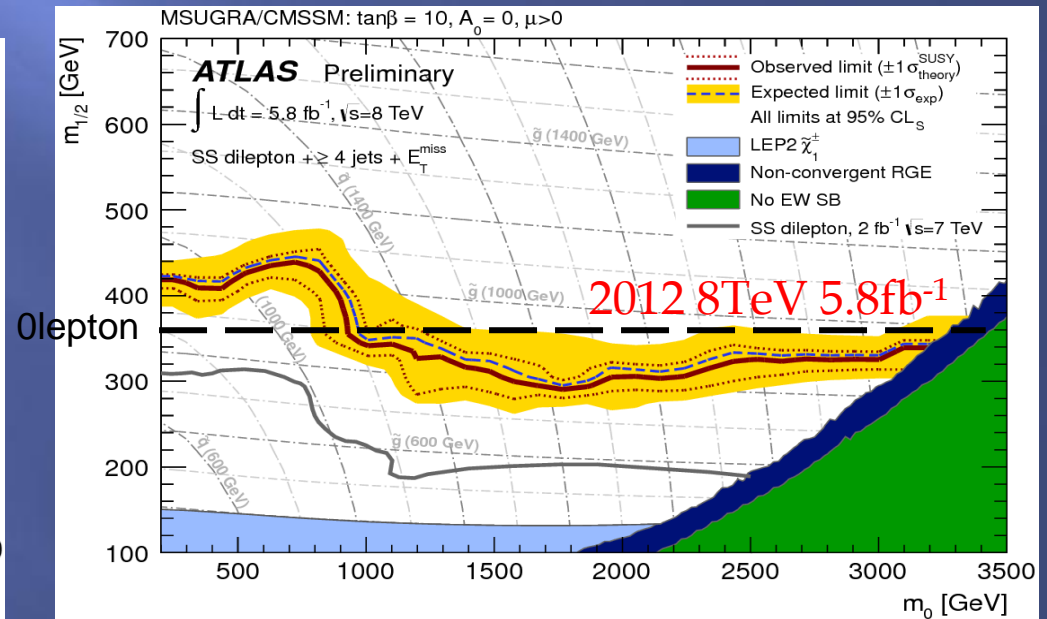
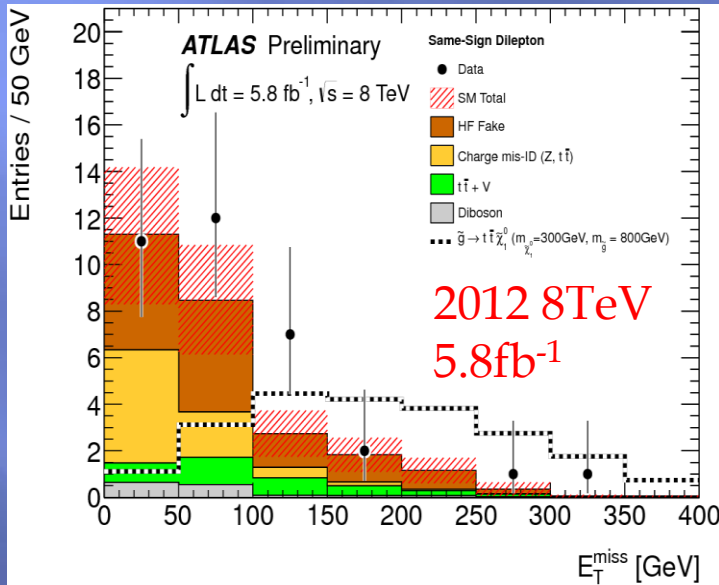
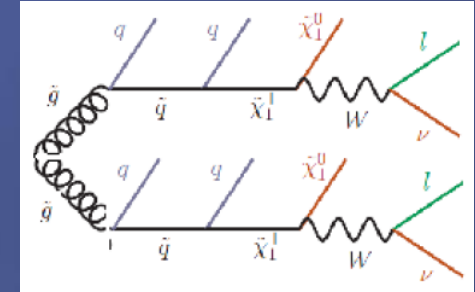
- focus on leptonic gaugino / slepton decay
1 lepton ($>25\text{GeV}$) + 4 jets + MET
- good to control backgrounds
 - eliminate QCD, $Z \rightarrow \nu\nu$
 - reject $W/ tt(\rightarrow bbl\nu qq)$ by transverse mass cut



competitive at high M_0 (gluino production)

2 lepton (same sign)

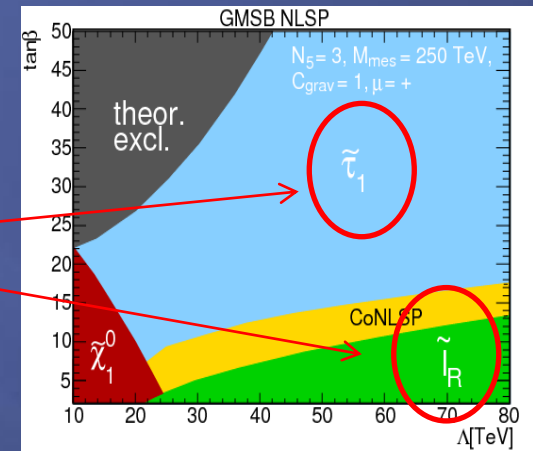
- leptonic gaugino / slepton decay
2 lepton (same sign) + 4 jets + MET
- statistics limited but high rejection to SM BG
- reject opposite sign SM background (ttbar)
(1/2 case is same sign in SUSY)



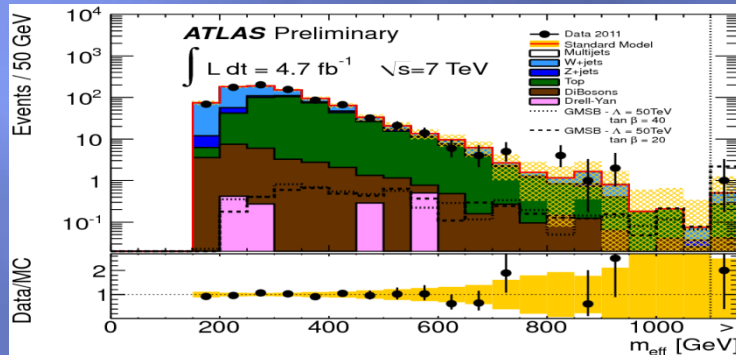
competitive at high M_0 (gluino production)

2 taus / 2l (GMSB)

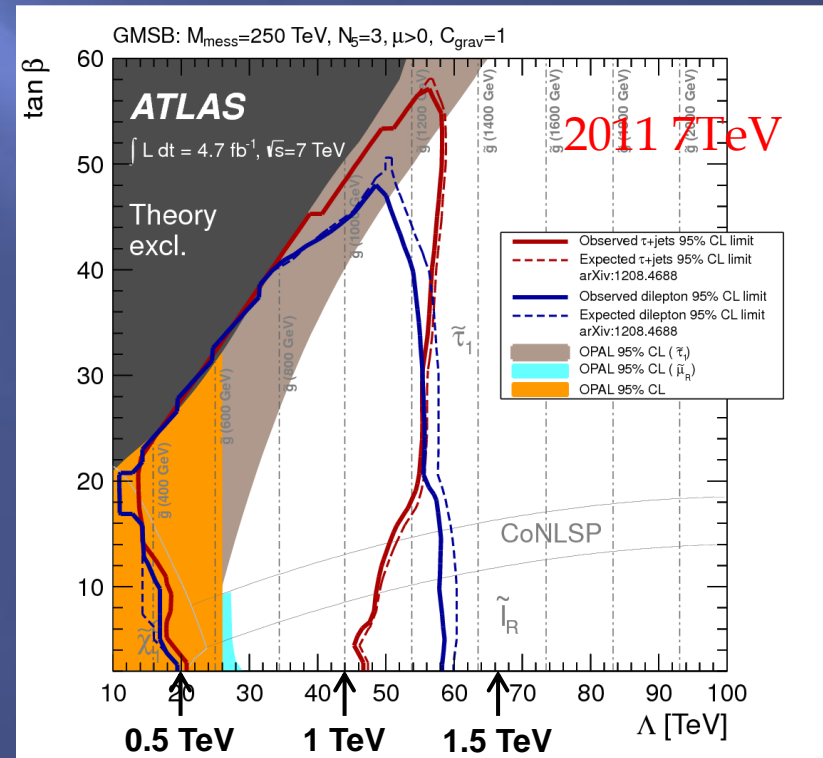
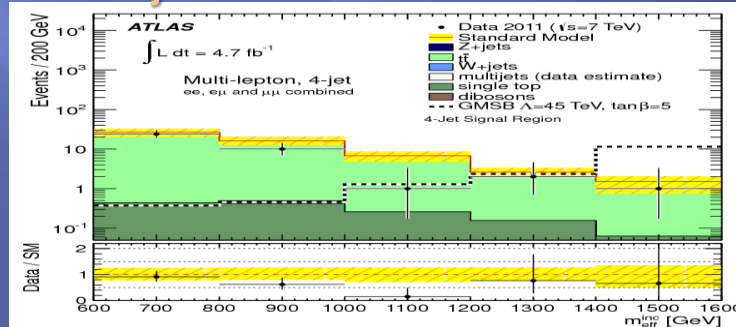
- Gravitino LSP in GMSB
- Topology depend on NLSP
 - stau / slepton NLSP enhance tau/leptons
 - 2 taus + jets + MET
 - 2 opposite sign leptons(e,μ) + jets + MET



τ+μ +jets



2l + 4jets

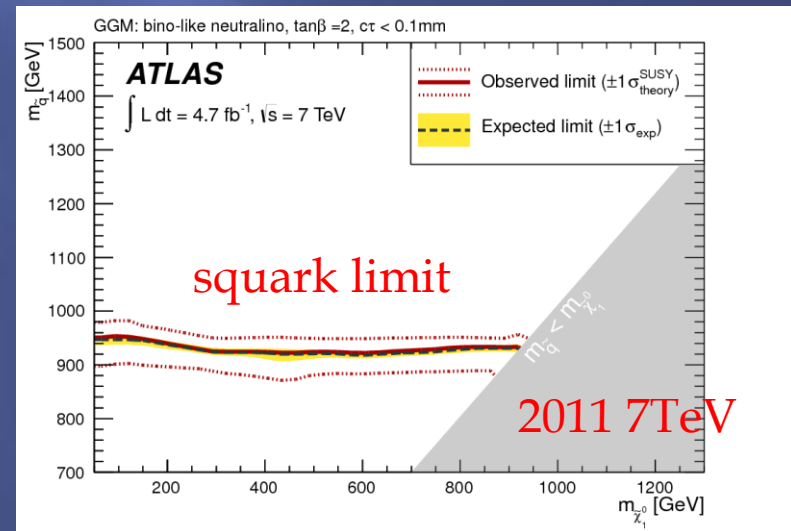
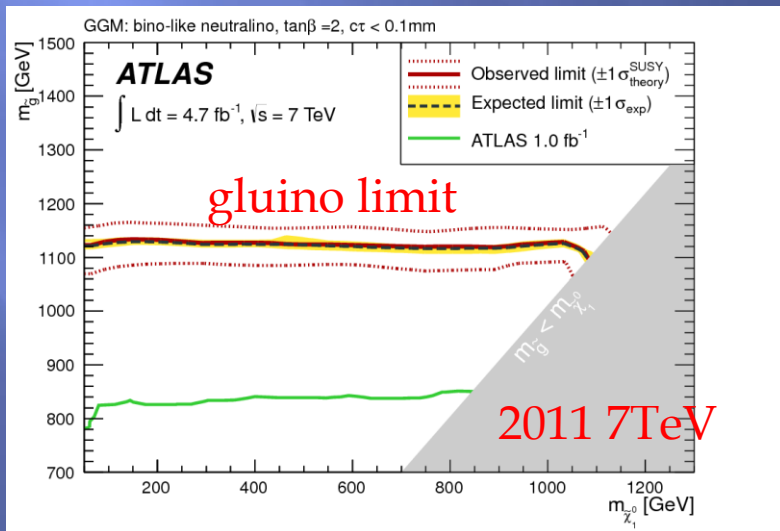
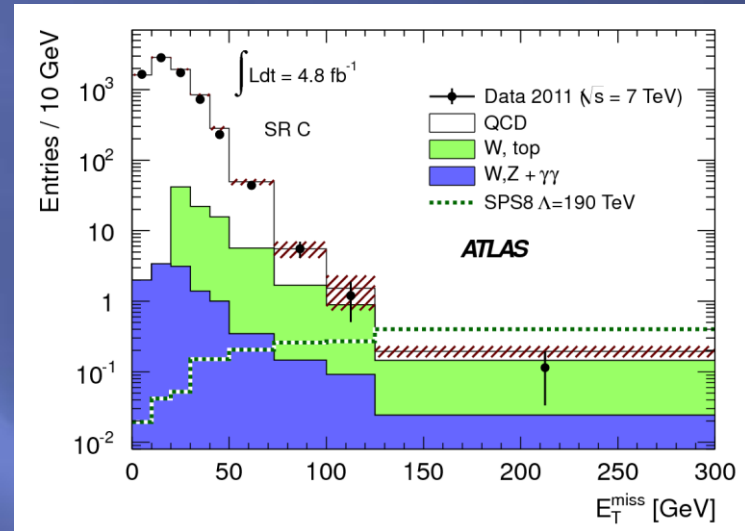


sensitive to gluino up to 1.3 TeV

2 photons (GGM)

- Neutralino NLSP case (in GGM) decay into gravitino and photon
 \rightarrow 2 photons($>50\text{GeV}$) + jets + MET

2 gamma $>50\text{GeV}$ + MET $>125\text{GeV}$



Exclusive search

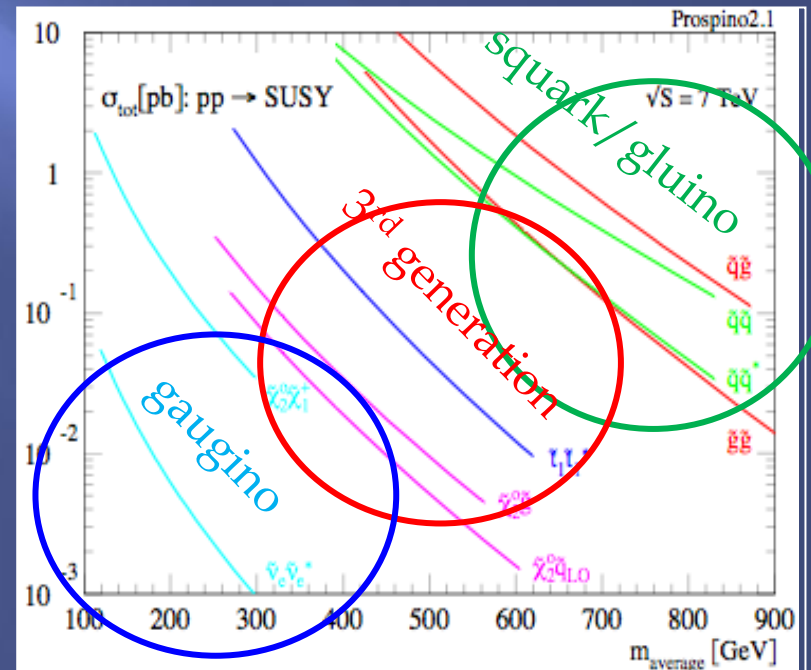
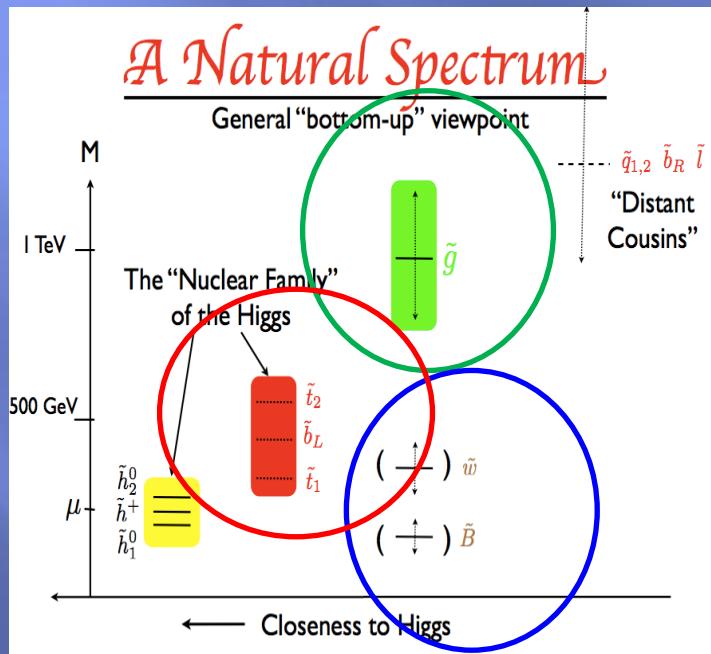
(3rd generation / gaugino and slepton)

Natural SUSY searches

- Light squarks / Gluino ... no evidence so far
- 3rd generation (stop, sbottom) direct production
- gaugino direct production

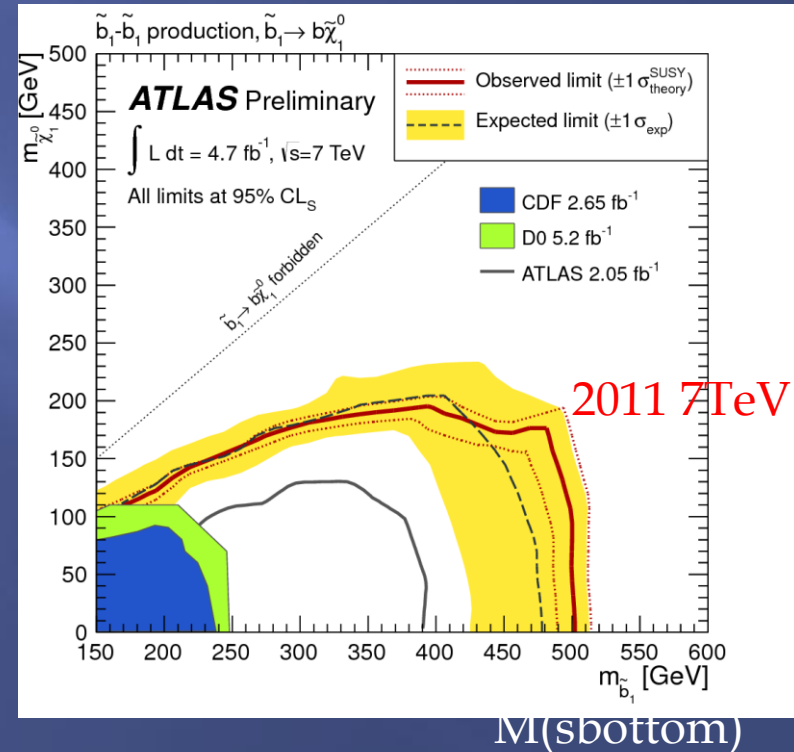
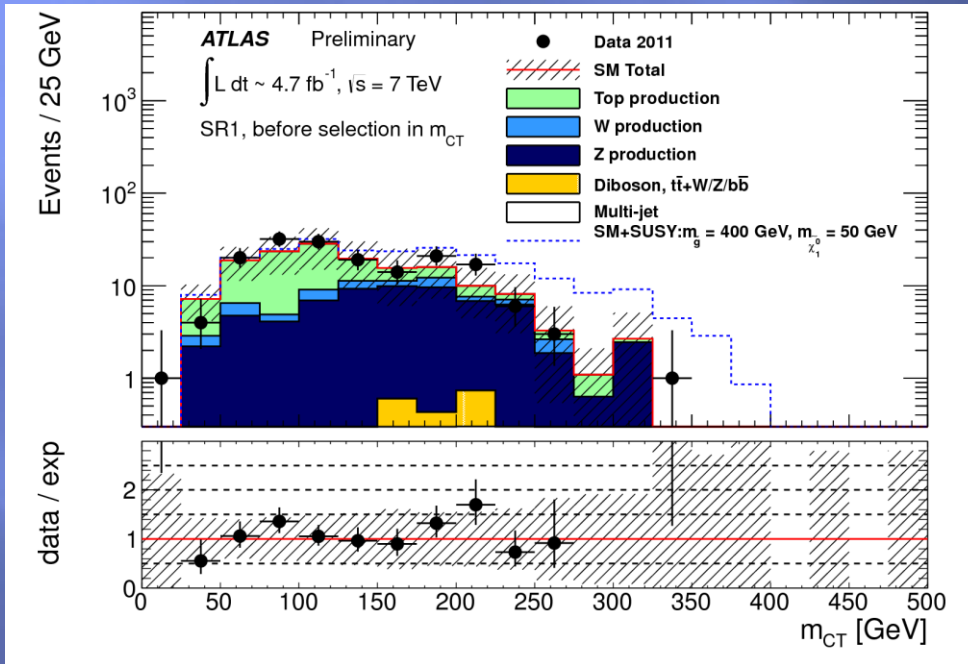
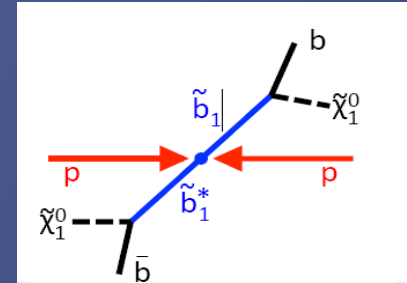
small cross section but prominent characteristics → dedicated exclusive search

cross section of SUSY



Direct sbottom

- Direct sbottom production, $s_{\text{bottom}} \rightarrow b + \text{LSP}$ (2body decay)
2 b-jets / 2-bjets + ISR
- cut on M_{CT} (useful for 2 body decay, endpoint related to M_{susy})

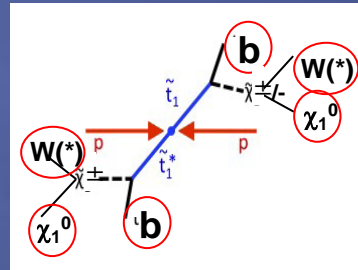


sensitive up to $M(\text{sbottom}) \sim 500 \text{ GeV}$

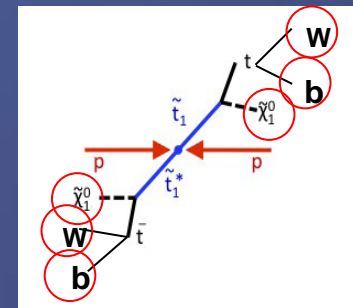
Direct stop

- Direct stop production
 1. $M(\text{Stop}) < m(\text{top})$
stop \rightarrow chargino + b
 2. $M(\text{Stop}) > m(\text{top})$
stop \rightarrow top + neutralino \rightarrow exclusive channels for final states

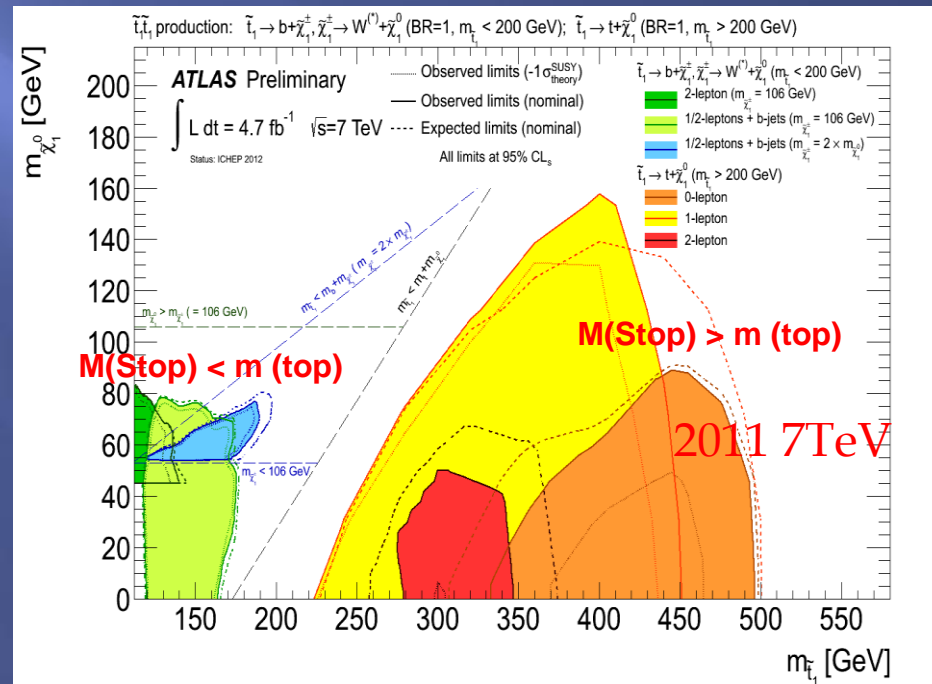
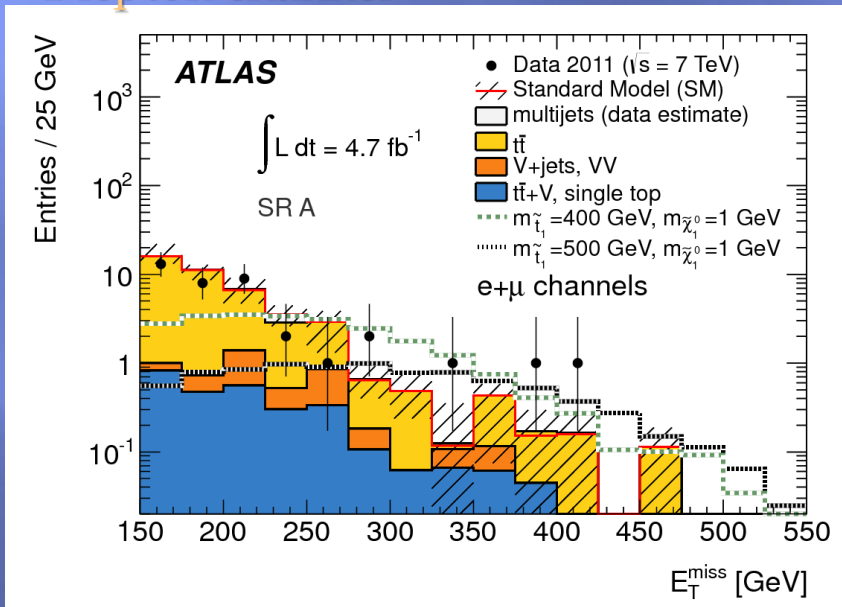
$M(\text{Stop}) < m(\text{top})$



$M(\text{Stop}) > m(\text{top})$



1 lepton channel

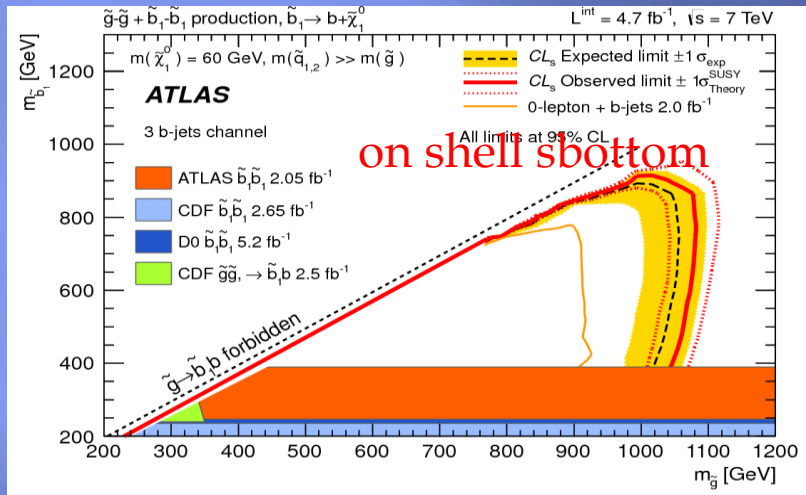


sensitive up to $M(\text{stop}) \sim 500\text{GeV}$

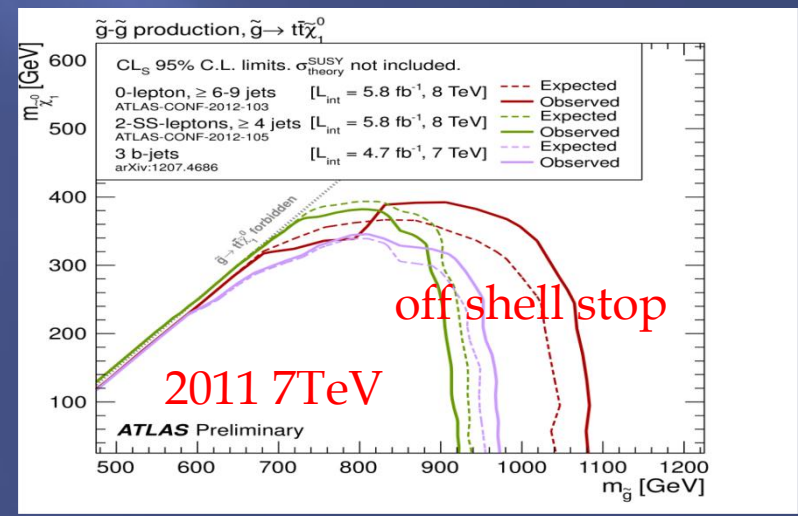
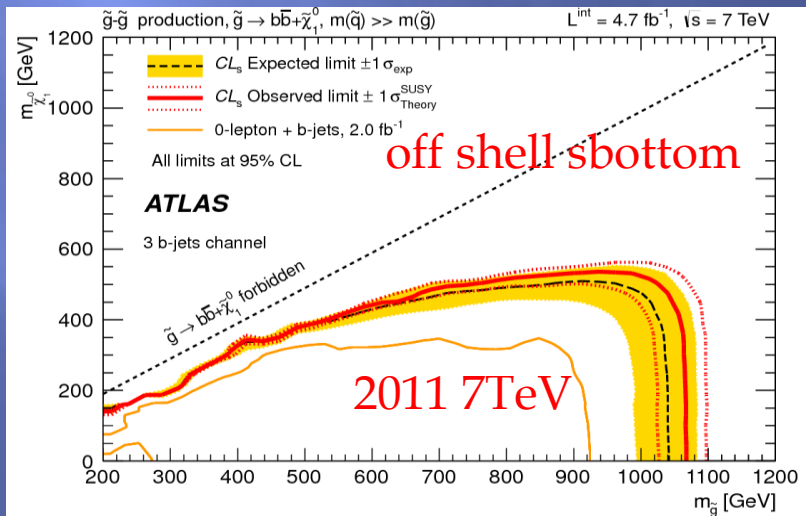
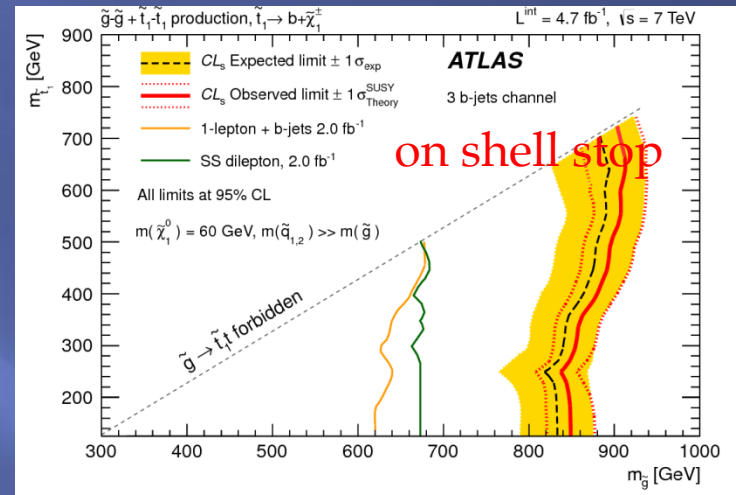
Glauino mediated sbottom/stop

- sbottom/stop search in gluino decay chain

gluino \rightarrow (sbottom + b) \rightarrow 2b + LSP



gluino \rightarrow (stop + top) \rightarrow 2top + LSP

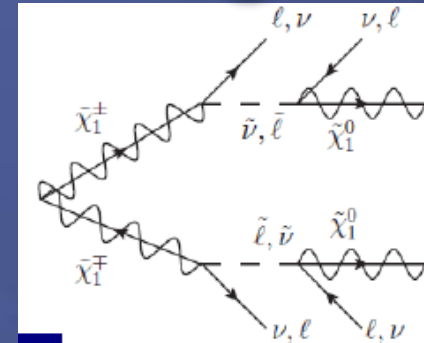


M(gluino) < 1 TeV for LSP < 500 GeV

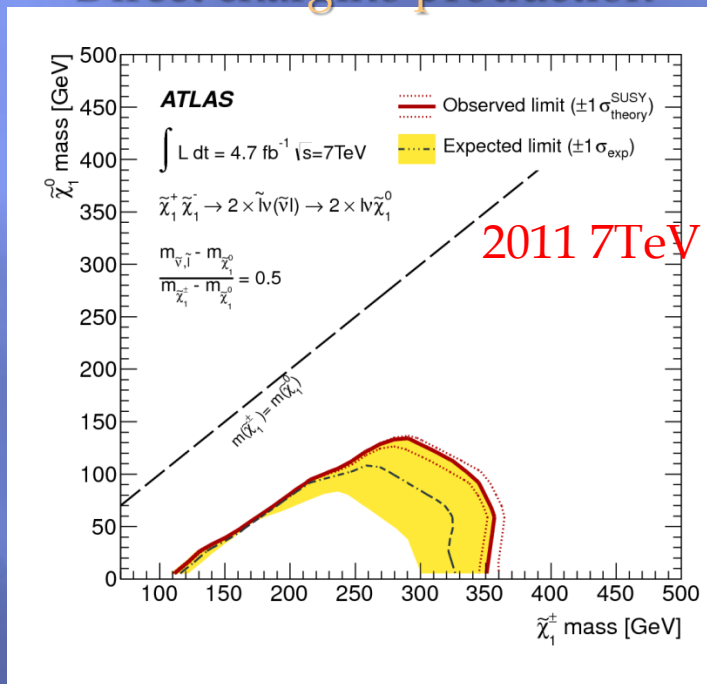
M(gluino) < 1 TeV for LSP < 380 GeV 25

Direct slepton, Direct chargino

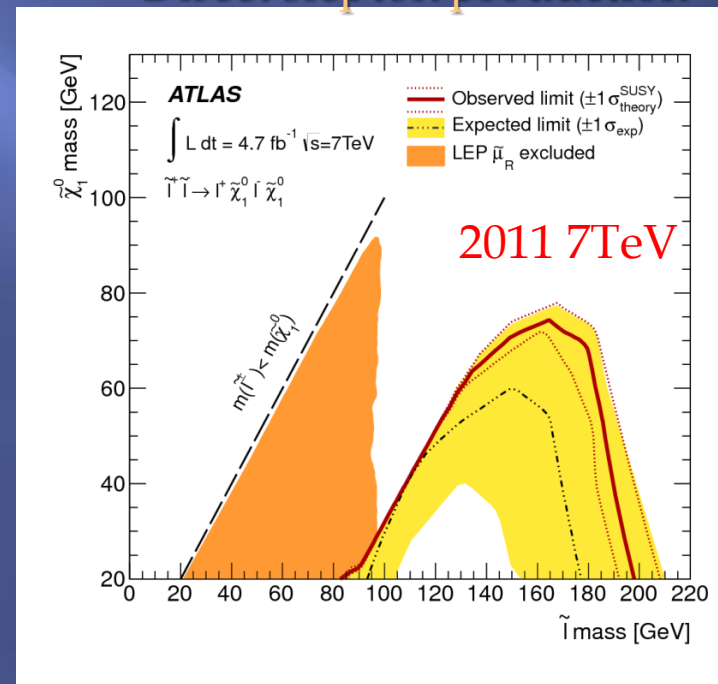
- direct slepton or chargino production
 - chargino \rightarrow lepton + ν + neutralino
 - slepton \rightarrow lepton + neutralino
 - 2 lepton[e, μ] + MET + jet veto
- cut on MT2 (useful for simple topology of 2 objects)



Direct chargino production



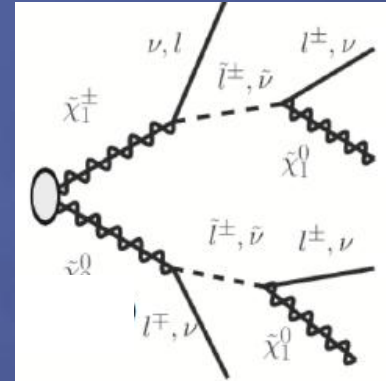
Direct slepton production



sensitive also to slepton mass

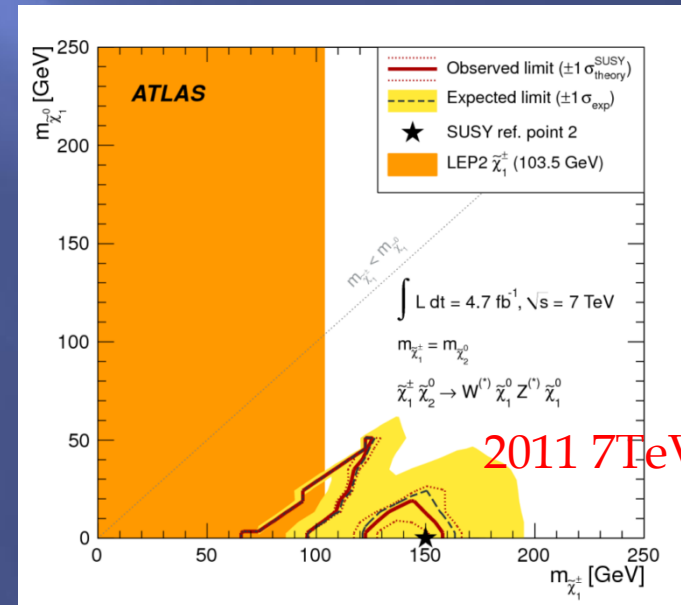
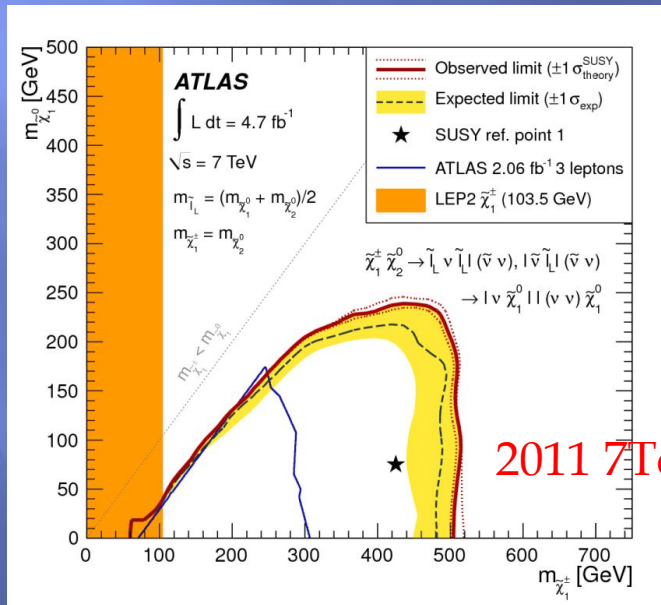
Direct chargino+neutralino

- chargino + neutralino production, decay into 3 leptons [e,μ] + MET



2slepton + lepton + 3ν → 3lep. + MET
(intermediate slepton)

W+Z+2LSP → 3lep. + MET
(intermediate W/Z)



summary

Mass limit summary

Inclusive search

Exclusive search

Extended LLP+RPV MSSM

Inclusive searches	MSUGRA/CMSSM : 0 lep + j's + $E_{T,miss}$
	MSUGRA/CMSSM : 1 lep + j's + $E_{T,miss}$
	Pheno model : 0 lep + j's + $E_{T,miss}$
	Pheno model : 0 lep + j's + $E_{T,miss}$
3rd gen. squarks	Glauino med. $\tilde{\chi}^{\pm}$ ($\tilde{g} \rightarrow q\tilde{q}\tilde{\chi}^{\pm}$) : 1 lep + j's + $E_{T,miss}$
	GMSB : 2 lep (OS) + j's + $E_{T,miss}$
	GMSB : 1-2 τ + 0-1 lep + j's + $E_{T,miss}$
	GGM : $\gamma\gamma$ + $E_{T,miss}$
	$\tilde{g} \rightarrow b\tilde{b}\tilde{\chi}_0^0$ (virtual b) : 0 lep + 1/2 b-j's + $E_{T,miss}$
	$\tilde{g} \rightarrow b\tilde{b}\tilde{\chi}_1^0$ (virtual b) : 0 lep + 3 b-j's + $E_{T,miss}$
	$\tilde{g} \rightarrow b\tilde{b}\tilde{\chi}_1^0$ (real b) : 0 lep + 3 b-j's + $E_{T,miss}$
	$\tilde{g} \rightarrow t\tilde{t}\tilde{\chi}_0^0$ (virtual t) : 1 lep + 1/2 b-j's + $E_{T,miss}$
	$\tilde{g} \rightarrow t\tilde{t}\tilde{\chi}_1^0$ (virtual t) : 2 lep (SS) + j's + $E_{T,miss}$
	$\tilde{g} \rightarrow t\tilde{t}\tilde{\chi}_1^0$ (virtual t) : 3 lep + j's + $E_{T,miss}$
3rd gen. squarks	$\tilde{g} \rightarrow t\tilde{t}\tilde{\chi}_1^0$ (virtual t) : 0 lep + multi-j's + $E_{T,miss}$
	$\tilde{g} \rightarrow t\tilde{t}\tilde{\chi}_2^0$ (virtual t) : 0 lep + 3 b-j's + $E_{T,miss}$
	$\tilde{g} \rightarrow t\tilde{t}\tilde{\chi}_2^0$ (real t) : 0 lep + 3 b-j's + $E_{T,miss}$
	$b\tilde{b}, b_1 \rightarrow b\tilde{\chi}_1^{\pm}$: 0 lep + 2-b-jets + $E_{T,miss}$
	$b\tilde{b}, b_1 \rightarrow t\tilde{\chi}_1^{\pm}$: 3 lep + j's + $E_{T,miss}$
	\tilde{t} (very light), $\tilde{t} \rightarrow b\tilde{\chi}_1^{\pm}$: 2 lep + $E_{T,miss}$
	\tilde{t} (light), $\tilde{t} \rightarrow b\tilde{\chi}_1^{\pm}$: 1/2 lep + b-jet + $E_{T,miss}$
	\tilde{t} (heavy), $\tilde{t} \rightarrow t\tilde{\chi}_0^0$: 0 lep + b-jet + $E_{T,miss}$
	\tilde{t} (heavy), $\tilde{t} \rightarrow t\tilde{\chi}_1^0$: 1 lep + b-jet + $E_{T,miss}$
	\tilde{t} (heavy), $\tilde{t} \rightarrow t\tilde{\chi}_2^0$: 2 lep + b-jet + $E_{T,miss}$
EW	$\tilde{l}_L, \tilde{l} \rightarrow \tilde{\chi}_1^0$: 2 lep + $E_{T,miss}$
	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0 \rightarrow \nu(\bar{\nu}) + \nu(\bar{\nu})$: 2 lep + $E_{T,miss}$
Long-lived particles	$\tilde{\chi}_1^{\pm}, \tilde{\chi}_2^0 \rightarrow 3(\nu\bar{\nu}) + \nu + 2\tilde{\chi}_1^0$: 3 lep + $E_{T,miss}$
	AMSB (direct $\tilde{\chi}_1^{\pm}$ pair prod.) : long-lived $\tilde{\chi}_1^{\pm}$
RPV	Stable \tilde{g} R-hadrons : Full detector
	Stable \tilde{l} R-hadrons : Full detector
Other	Metastable \tilde{g} R-hadrons : Pixel det. only
	GMSB : stable $\tilde{\tau}$

ATLAS SUSY Searches* - 95% CL Lower Limits (Status: SUSY 2012)			
$L=5.8 \text{ fb}^{-1}, 8 \text{ TeV}$ [ATLAS-CONF-2012-109]	1.50 TeV	$\tilde{q} = \tilde{g}$ mass	$\int Ldt = (1.00 - 5.8) \text{ fb}^{-1}$ $\sqrt{s} = 7, 8 \text{ TeV}$
$L=5.8 \text{ fb}^{-1}, 8 \text{ TeV}$ [ATLAS-CONF-2012-104]	1.24 TeV	$\tilde{q} = \tilde{g}$ mass	
$L=5.8 \text{ fb}^{-1}, 8 \text{ TeV}$ [ATLAS-CONF-2012-108]	1.18 TeV	\tilde{g} mass ($m(\tilde{q}) < 2 \text{ TeV}$, light $\tilde{\chi}_1^0$)	
$L=5.8 \text{ fb}^{-1}, 8 \text{ TeV}$ [ATLAS-CONF-2012-109]	1.38 TeV	\tilde{q} mass ($m(\tilde{q}) < 2 \text{ TeV}$, light $\tilde{\chi}_1^0$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-041]	900 GeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) < 200 \text{ GeV}$, $m(\tilde{\chi}_2^0) = \frac{1}{2}(m(\tilde{\chi}_1^0) + m(\tilde{g}))$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [Preliminary]	1.24 TeV	\tilde{g} mass ($\tan\beta < 15$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-112]	1.20 TeV	\tilde{g} mass ($\tan\beta > 20$)	
$L=4.8 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-072]	1.07 TeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) > 50 \text{ GeV}$)	
$L=2.1 \text{ fb}^{-1}, 7 \text{ TeV}$ [1203.6193]	900 GeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) < 300 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [1207.4686]	1.02 TeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) < 400 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [1207.4686]	1.00 TeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) = 60 \text{ GeV}$)	
$L=2.1 \text{ fb}^{-1}, 7 \text{ TeV}$ [1203.6193]	710 GeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) < 150 \text{ GeV}$)	
$L=5.8 \text{ fb}^{-1}, 8 \text{ TeV}$ [ATLAS-CONF-2012-105]	850 GeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) < 300 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-108]	760 GeV	\tilde{g} mass (any $m(\tilde{\chi}_1^0) < m(\tilde{g})$)	
$L=5.8 \text{ fb}^{-1}, 8 \text{ TeV}$ [ATLAS-CONF-2012-103]	1.00 TeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) < 300 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [1207.4686]	940 GeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) < 50 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [1207.4686]	820 GeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) = 60 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-106]	480 GeV	\tilde{b} mass ($m(\tilde{\chi}_1^0) < 150 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-108]	380 GeV	\tilde{g} mass ($m(\tilde{\chi}_1^0) = 2m(\tilde{\chi}_1^0)$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [CONF-2012-059]	135 GeV	\tilde{t} mass ($m(\tilde{\chi}_1^0) = 45 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [CONF-2012-070]	120-173 GeV	\tilde{t} mass ($m(\tilde{\chi}_1^0) = 45 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [1208.1447]	380-465 GeV	\tilde{t} mass ($m(\tilde{\chi}_1^0) = 0$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [CONF-2012-073]	230-440 GeV	\tilde{t} mass ($m(\tilde{\chi}_1^0) = 0$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [CONF-2012-071]	298-305 GeV	\tilde{t} mass ($m(\tilde{\chi}_1^0) = 0$)	
$L=2.1 \text{ fb}^{-1}, 7 \text{ TeV}$ [1204.6736]	310 GeV	\tilde{t} mass ($115 < m(\tilde{\chi}_1^0) < 230 \text{ GeV}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [CONF-2012-076]	93-180 GeV	\tilde{l} mass ($m(\tilde{\chi}_1^0) = 0$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [CONF-2012-076]	120-330 GeV	$\tilde{\chi}_1^{\pm}$ mass ($m(\tilde{\chi}_1^0) = 0, m(\tilde{l}, \tilde{\nu}) = \frac{1}{2}(m(\tilde{\chi}_1^{\pm}) + m(\tilde{\chi}_1^0))$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [CONF-2012-077]	60-500 GeV	$\tilde{\chi}_1^{\pm}$ mass ($m(\tilde{\chi}_1^0) = m(\tilde{\chi}_2^0), m(\tilde{\chi}_1^0) = 0, m(\tilde{l}, \tilde{\nu})$ as above)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-111]	210 GeV	$\tilde{\chi}_1^{\pm}$ mass ($1 < \tau(\tilde{\chi}_1^{\pm}) < 10 \text{ ns}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-075]	985 GeV	\tilde{g} mass	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-075]	683 GeV	\tilde{t} mass	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-075]	910 GeV	\tilde{g} mass ($\tau(\tilde{g}) > 10 \text{ ns}$)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-075]	310 GeV	$\tilde{\tau}$ mass ($5 < \tan\beta < 20$)	
$L=1.1 \text{ fb}^{-1}, 7 \text{ TeV}$ [1109.3089]	1.32 TeV	$\tilde{\nu}_e$ mass ($\lambda_{311}^2=0.10, \lambda_{312}^2=0.05$)	
$L=1.0 \text{ fb}^{-1}, 7 \text{ TeV}$ [1109.6606]	760 GeV	$\tilde{q} = \tilde{g}$ mass ($c\tau_{LSP} < 15 \text{ mm}$)	
$L=2.1 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-035]	1.77 TeV	\tilde{g} mass	
$L=4.4 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-113]	700 GeV	\tilde{q} mass ($3.0 \times 10^{-6} < \lambda_{211}^2 < 1.5 \times 10^{-5}, 1 \text{ mm} < c\tau < 1 \text{ m}, \tilde{g}$ decoupled)	
$L=4.6 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-110]	100-287 GeV	sgluon mass (incl. limit from 1110.2693)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-084]	709 GeV	M^* scale ($m_{\chi} < 100 \text{ GeV}$, vector D5, Dirac χ)	
$L=4.7 \text{ fb}^{-1}, 7 \text{ TeV}$ [ATLAS-CONF-2012-084]	548 GeV	M^* scale ($m_{\chi} < 100 \text{ GeV}$, tensor D9, Dirac χ)	

ATLAS Preliminary

10⁻¹ 1 10 Mass scale [TeV]

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

Summary

- ▣ No evidence so far
 - 4.7 fb⁻¹ at 7TeV, and 5.8 fb⁻¹ at 8TeV in some analyses
 - Inclusive searches and also dedicated searches for third generation, direct gaugino and sleptons
 - widely as possible (model-independent)
- ▣ Prospects
 - We have 16fb⁻¹ data already, expect 20~25fb⁻¹ by early 2013
 - many analyses for 8TeV in progress

backup

$$(E_T^{\text{miss}})_{x(y)}^{\text{RefFinal}} = (E_T^{\text{miss}})_{x(y)}^{\text{RefEle}} + (E_T^{\text{miss}})_{x(y)}^{\text{RefGamma}} + (E_T^{\text{miss}})_{x(y)}^{\text{RefJet}} + (E_T^{\text{miss}})_{x(y)}^{\text{Muons}} + (E_T^{\text{miss}})_{x(y)}^{\text{SoftJets}} + (E_T^{\text{miss}})_{x(y)}^{\text{CellOut}},$$

$$m_T = \sqrt{2 \cdot p_T^\ell \cdot E_T^{\text{miss}} \cdot (1 - \cos(\Delta\phi(\ell, E_T^{\text{miss}})))},$$

$$H_T = p_T^\ell + \sum_{j=1}^{N_{jet}} p_T^{jet_j}$$

$$m_{\text{eff}}^{\text{incl}} = H_T + E_T^{\text{miss}} = p_T^\ell + \sum_{j=1}^{N_{jet}} p_T^{jet_j} + E_T^{\text{miss}}$$

$$M_{CT}^2(v_1, v_2) = 2p_T(v_1)p_T(v_2)(1 + \cos\phi_{12}),$$

$$m_{T2}^2(\chi) \equiv \min_{\not{q}_T^{(1)} + \not{q}_T^{(2)} = \not{p}_T} \left[\max \left\{ m_T^2(\mathbf{p}_T^{\pi^{(1)}}, \not{q}_T^{(1)}; \chi), m_T^2(\mathbf{p}_T^{\pi^{(2)}}, \not{q}_T^{(2)}; \chi) \right\} \right].$$