Search for supersymmetry using final states with heavy flavour jets and missing transverse momentum at the ATLAS and CMS experiments

A. Marzin (University of Oklahoma)

On behalf of the ATLAS and CMS collaborations

Implications of LHC results for TeV-scale physics

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Introduction

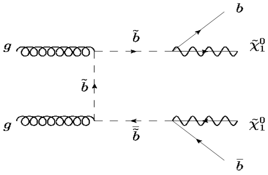
Why SUSY searches with b-jets ?

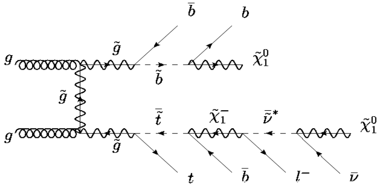
- Sbottom ($\tilde{b}_1$) and stop ($\tilde{t}_1$) mass eigenstates are expected to be significantly lighter than other squarks because of the mixing between right-handed and left-handed squarks ($\tilde{q}_R$ and $\tilde{q}_L$) :

$$m^2(\tilde{t}_{1,2}) = \frac{1}{2}[m^2(\tilde{t}_R) + m^2(\tilde{t}_L)] \mp \frac{1}{2}\sqrt{[m^2(\tilde{t}_R) - m^2(\tilde{t}_L)]^2 + 4m^2(t)[A_t - \mu \tan\beta]^2}$$

- $\tilde{b}_1$ and $\tilde{t}_1$ can be copiously produced at the LHC via direct pair production or, if kinematically allowed, via gluino pair production with subsequent $\tilde{g} \to \tilde{b}_1 b$ or $\tilde{g} \to \tilde{t}_1 t$ decay.

$\Longrightarrow$ Complex final states involving $\not{E}_T$ and several jets among which b-jets. Leptons are also expected in case of stop production.





CMS 0 lepton with $\mathcal{L} = 35\ \mathrm{pb}^{-1}$

ATLAS 0 lepton with $\mathcal{L} = 1.03\ \mathrm{fb}^{-1}$

ATLAS 1 lepton with $\mathcal{L} = 1.03\ \mathrm{fb}^{-1}$

CMS 0 lepton with $\mathcal{L} = 35\ \text{pb}^{-1}$

See also Christopher Young's talk for the M_{T2} analysis with $\mathcal{L} = 1.1\ \text{fb}^{-1}$ using b-jets at low M_{T2} (CMS PAS SUS-11-005)

ATLAS 0 lepton with $\mathcal{L} = 1.03\ \text{fb}^{-1}$

ATLAS 1 lepton with $\mathcal{L} = 1.03\ \text{fb}^{-1}$

■ Reference : PAS-SUS-10-011 (arXiv :1106.3272v1)

■ SUSY Models : results are interpreted in the context of the CMSSM defined by 5 parameters : m_0, $m_{1/2}$, A_0, $\tan\beta$ and sign(μ).

▶ 3 signal benchmark points with different m_0, $m_{1/2}$, A_0, $\tan\beta$ (sign(μ) > 0) and chosen on the edge of the sensitivity of this search are then considered

■ Event Selection : 0 lepton + jets analysis :

- $\geqslant 2$ jets with $p_T > 100$ GeV, $\geqslant 1$ b-jet
- $\not{H}_T / \not{E}_T < 1.25$ → Remove events with artificial $\not{H}_T = |\sum_i \vec{p}_T^{\,j_i}|$
- Veto events with isolated $e/\mu/\gamma$ → suppress W and $t\bar{t}$ with leptonic W decay
- $H_T > 350$ GeV → trigger fully efficient
- $\alpha_T > 0.55$ → Reject QCD events

■ Main background processes : QCD, EWK (W,Z) and $t\bar{t}$ with hadronic τ decay

▶ QCD multijet rejected by the α_T method

▶ data-driven procedure to estimate simultaneously all background

▶ $t\bar{t}$ and $Z \to \nu\bar{\nu}$ cross-checked separately

■ The α_T variable : momentum imbalance of jets in the transverse plane

For 2 jets : $\alpha_T = \frac{E_T^{j_2}}{m_T^{j_1,j_2}}$

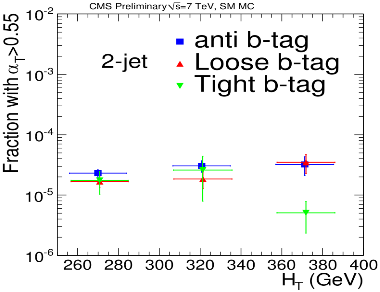
$\Longrightarrow \alpha_T \leqslant 0.5$ in well measured QCD events

■ Bkg prediction using the α_t - H_t extrapolation :

• For $t\bar{t}$ and W,Z + jets processes :
$F(\alpha_T > 0.55)$ has no H_T dependence in MC

• For QCD multijet background :
$F(\alpha_T > 0.55)$ is a decreasing function of H_T because of JER and jet E_T threshold effect

(QCD is found to be negligible in data)



• $F(\alpha_T > 0.55) = 1.48^{+1.93}_{-1.48} \times 10^{-5}$ is measured in data in a CR with $250 < H_T < 350$ GeV and multiplied by N_{evt} in SR before the α_T cut

$\Longrightarrow$ Prediction of background events in SR of $0.33^{+0.43}_{-0.33}$ (stat.) $\pm$ 0.13 (syst.)

Results

■ No excess observed in data w.r.t. data-driven background prediction

	MC	background prediction	Data	LM0	LM1	LMB
N_{evt}	1.61 ± 0.26	$0.33^{+0.43}_{-0.33}$ (stat.) $\pm$ 0.13 (syst.)	1	14	2	5

▶ results are interpreted in the context of 3 CMSSM signal points :

- LM0 : m_0 = 200 GeV, $m_{1/2}$ = 160 GeV, A_0 = -400 GeV, tan β = 10, sign(μ) $>$ 0 ;
- LM1 : m_0 = 60 GeV, $m_{1/2}$ = 250 GeV, A_0 = 0 GeV, tan β = 10, sign(μ) $>$ 0 ;
- LMB : m_0 = 400 GeV, $m_{1/2}$ = 200 GeV, A_0 = 0 GeV, tan β = 50, sign(μ) $>$ 0.

■ Systematic uncertainties on the signal :

b-tagging is the main source of uncertainty : $\approx$ 20%

JES, lumi, $\not{H}_T$ / lepton veto $\approx$ 3-4% $\Longrightarrow$ total uncertainty of $\approx$ 22%

■ direct upper limits at 95% C.L. on the cross-section of each model : $\sigma_{95}^{obs} = \frac{N_{95}^{obs}}{\mathcal{L}.\varepsilon\mathcal{A}}$

	LM0	LM1	LMB
Efficiency	0.7%	0.9%	1.3%
σ_{95}^{obs}	18.9 pb	15.4 pb	10.2 pb

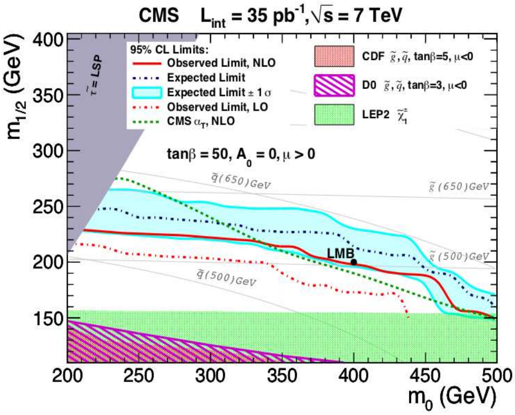
Assuming signal contamination in the CR used to estimate the bkg leads to larger σ_{95}^{obs}
$\Rightarrow$ σ_{95}^{obs} is of 22.1 pb for LM0 and 16.7 pb for LM1 (negligible impact on LMB)

▶ Results are then converted into exclusion limits at 95% C.L. for MSSM in the $(m_0, m_{1/2})$ plane

Hypothesis :

- $A_0 = 0$ GeV
- $\tan\beta = 50$
- $\text{sign}(\mu) > 0$

Cross-sections are calculated at NLO with prospino



▶ *Extend exclusion region from the analysis without b-tagging for $m_0 > 350$ GeV where b production is increased*

CMS 0 lepton with $\mathcal{L} = 35\ pb^{-1}$

ATLAS 0 lepton with $\mathcal{L} = 1.03\ fb^{-1}$

ATLAS 1 lepton with $\mathcal{L} = 1.03\ fb^{-1}$

■ Reference : ATLAS-CONF-2011-098

■ SUSY Models : results are interpreted in the context of 2 scenarios :

- MSSM model in the ($m_{\tilde{g}}$, $m_{\tilde{b}_1}$) plane :

$\tilde{g}\tilde{g}$ and $\tilde{b}_1\tilde{b}_1$ production with $\tilde{g} \to \tilde{b}_1 b$ (BR=100%) and $\tilde{b}_1 \to b + \tilde{\chi}_1^0$ (BR=100%)

- Simplified model in the ($m_{\tilde{g}}$, $m_{\tilde{\chi}_1^0}$) plane :

$\tilde{g}\tilde{g}$ production with $\tilde{g} \to b\bar{b}\tilde{\chi}_1^0$ (BR=100%) via offshell sbottom decay

■ Event Selection : 0 lepton + jets analysis :

- $\geqslant 3$ jets with $p_T > 130, 50, 50$ GeV ; $\not{E}_T > 130$ GeV $\rightarrow$ trigger fully efficient
- Veto events with isolated e/μ

Define the effective mass $m_{eff} = \sum_{i=1}^{3} p_T^{j_i} + \not{E}_T$

- $\not{E}_T / m_{eff} > 0.25$; $\Delta\phi_{min}$ ($\not{E}_T$,jet) > 0.4 $\rightarrow$ Reject QCD events
- Define 4 signal regions : $\geqslant$ 1,2 b-jet ($p_T > 50$ GeV) ; $m_{eff} > 500, 700$ GeV

■ Main background processes : QCD, EWK (W,Z) and $t\bar{t}$

▶ QCD multijet estimated by a data-driven method (jet smearing)

▶ non-QCD bkg estimated from MC (validated with a data-driven method)

Estimation of the QCD multijet background

■ Remaining QCD multijet background with large $\not\!\!E_T$ due to jet energy mismeasurement estimated with a data-driven procedure : jet smearing method

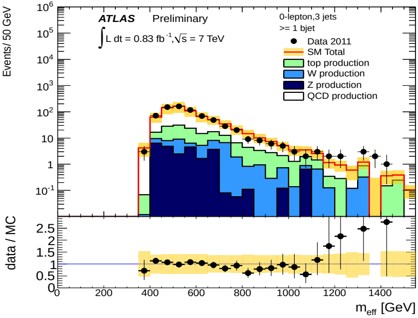
I Determine the jet response function R (p_T^{reco}/p_T^{true}) in MC (tail validated in data)

II Smear p_T^{jets} with R in seed events in data (low $\not\!\!E_T$) to generate QCD pseudo-events

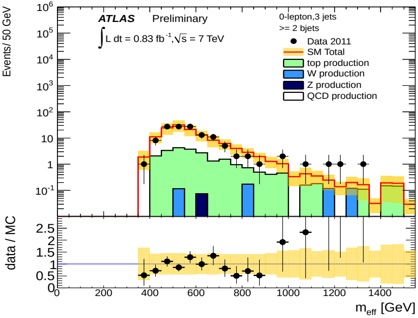
III Extract kinematic shapes from pseudo-events

IV Normalize these shape from a QCD-enriched CR obtained : $\Delta\phi_{min} < 0.4$

$\geqslant 1$ *b*-jet



$\geqslant 2$ *b*-jet



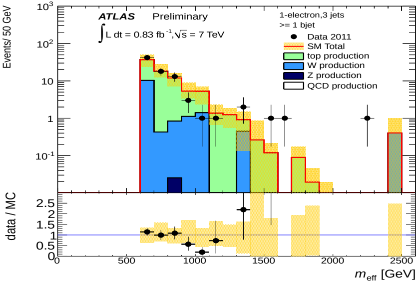
■ Non QCD multijet background estimates are based on Monte Calo simulation

▶ Events from $t\bar{t}$ production represent the largest source of background

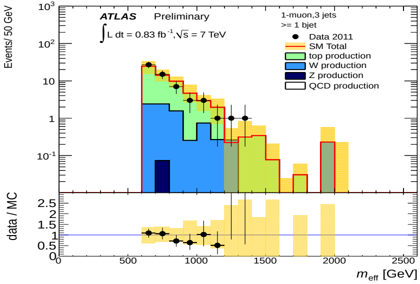
■ $t\bar{t}$ background validated with a data-driven estimate in a 1-lepton (e or μ) control region with the same jets and $\not{E}_T$ cuts than the SR and :

- 1 lepton (e or μ) with $p_T > 20$ GeV
- 40 GeV $< m_T < 100$ GeV

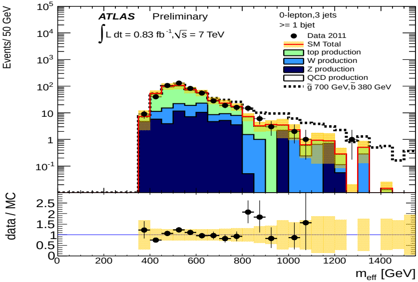
electron channel



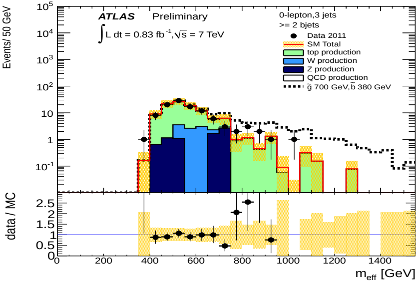
muon channel



$\geqslant 1$ b-jet



$\geqslant 2$ b-jet



- No excess in data
  - Direct upper exclusion limits 95% C.L. on possible signal events in SR
  - Model-independent upper limit on cross-section of new physics : $\sigma^{95}.\varepsilon.\mathcal{A} = \frac{N^{95}}{\mathcal{L}}$

Signal Region	Top	W/Z	QCD (d-d)	Total SM	Data	95% C.L. N events	95% C.L. σ_{eff} (pb)
1 btag $m_{eff}>$500 GeV	221^{+82}_{-68}	121 ± 61	15 ± 7	356^{+103}_{-92}	361	240	0.288
1 btag $m_{eff}>$700 GeV	37^{+15}_{-12}	31 ± 19	1.9 ± 0.9	70^{+24}_{-22}	63	51	0.061
2 btag $m_{eff}>$500 GeV	55^{+25}_{-22}	20 ± 12	3.6 ± 1.8	79^{+28}_{-25}	76	65	0.078
2 btag $m_{eff}>$700 GeV	$7.8^{+3.5}_{-2.9}$	5 ± 4	0.5 ± 0.3	$13.0^{+5.6}_{-5.2}$	12	14	0.017

▶ Results are then converted into exclusion limits at 95% C.L. with CL_S for MSSM in the $(m_{\tilde{b}_1}, m_{\tilde{g}})$ plane

▶ For each point, use the SR with the best expected $S/\sqrt{B}$

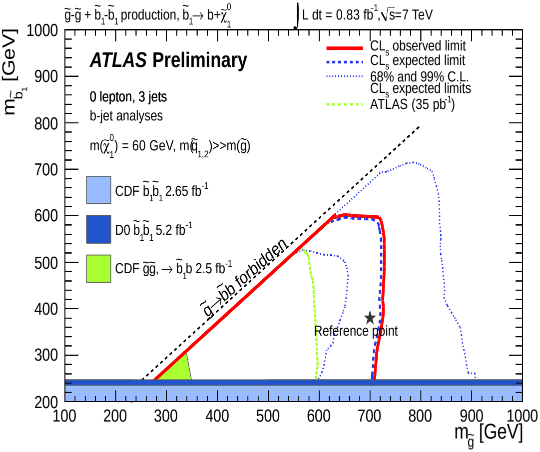
Hypothesis :

- $\tilde{g}\tilde{g} + \tilde{b}_1\tilde{b}_1$ production
- $\tilde{g} \to \tilde{b}_1 b$ (BR=1), $\tilde{b}_1 \to b\tilde{\chi}_1^0$ (BR=1)
- $m(\tilde{\chi}^0) = 60$ GeV, $m(\tilde{\chi}_1^\pm) \approx 2\tilde{\chi}_1^0$

Detector related uncertainties :
JES and b-tag are the dominant
→ total detector unc. of 10-35%

Theoretical uncertainties :

- Renorm/fact scale :
$\approx 16\%$ for $\tilde{g}\tilde{g}$, $\approx 30\%$ for $\tilde{b}_1\tilde{b}_1$
- PDF :
≈ 11-25% for $\tilde{g}\tilde{g}$, ≈ 7-16% for $\tilde{b}_1\tilde{b}_1$



▶ *Gluino masses below 720 GeV are excluded for sbottom masses up to 600 GeV*

Exclusion limits for SO(10) models

Ref : arXiv :0809.0710, arXiv :0911.4739

2 models for Higgs soft terms splitting :

Higgs splitting (HS) and D-term splitting (DR3)

Hypothesis :

- $A_0 = 2m_{10}^2 = 4m_{16}^2$
- $m_{16} \sim 5 - 15$ TeV
- $m_{1/2} \ll m_{16}$
- $\tan\beta \sim 50$

DR3 : $\tilde{g} \to b\bar{b}\tilde{\chi}_1^0$ dominates for $m(\tilde{g}) < 575$ GeV

HS : $\tilde{g} \to b\bar{b}\tilde{\chi}_2^0$ dominates for $m(\tilde{g}) < 500$ GeV

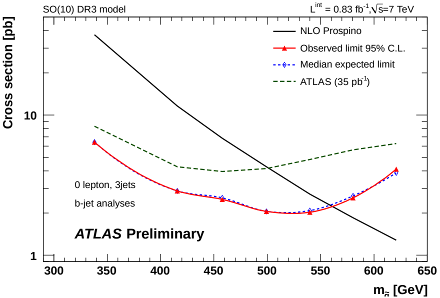
► higher efficiency for DR3

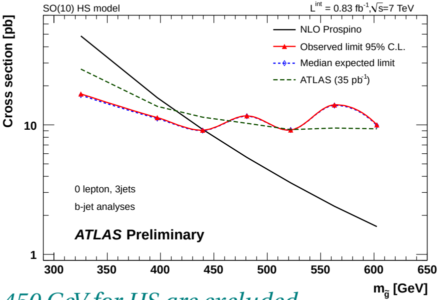
Detector related uncertainties :

JES and b-tag are the dominant unc.

Theoretical uncertainties :

$\tilde{g}\tilde{g}$ unc. are dominant w.r.t. $\tilde{\chi}_1^0/\tilde{\chi}_1^{\pm}$ unc.





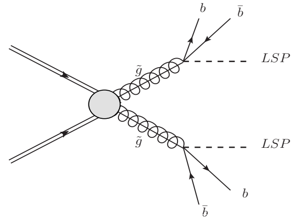
► *Gluino masses below 570 GeV for DR3 and 450 GeV for HS are excluded*

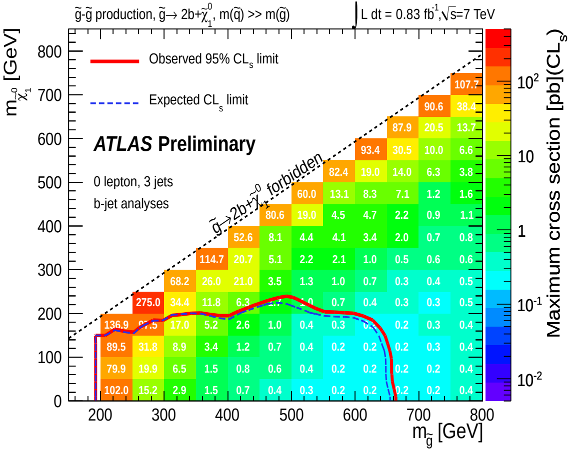
Exclusion limits for simplified models in the $(m_{\tilde{g}}, m_{\tilde{\chi}_1^0})$ plane

■ Results also interpreted in the context of simplified models in the $(m_{\tilde{g}}, m_{\tilde{\chi}_1^0})$ plane

Hypothesis :

- $\tilde{g}\tilde{g}$ production
- $m(\tilde{q}) \gg m(\tilde{g})$
- $\tilde{g}$ 3 body decay into $b\bar{b}\tilde{\chi}_1^0$ via offshell sbottom decay





► *Gluino masses below 660 GeV are excluded for LSP masses up to 200 GeV*

► *Extract the 95% C.L. cross section upper limits :* $\sigma_{95}^{obs} = \frac{N_{95}^{obs}}{\mathcal{L}.\varepsilon\mathcal{A}}$

CMS 0 lepton with $\mathcal{L} = 35\ \mathrm{pb}^{-1}$

ATLAS 0 lepton with $\mathcal{L} = 1.03\ \mathrm{fb}^{-1}$

ATLAS 1 lepton with $\mathcal{L} = 1.03\ \mathrm{fb}^{-1}$

Analysis strategy

- **Reference :** ATLAS-CONF-2011-130

- **SUSY Models :** results are interpreted in the context of 2 scenarios :

• MSSM model in the ($m_{\tilde{g}}$, $m_{\tilde{t}_1}$) plane :

$\tilde{g}\tilde{g}$ and $\tilde{t}_1\tilde{t}_1$ production with $\tilde{g} \to \tilde{t}_1 t$ (BR=100%) and $\tilde{t}_1 \to b + \tilde{\chi}_1^{\pm}$ (BR=100%)

• Simplified model in the ($m_{\tilde{g}}$, $m_{\tilde{\chi}_1^0}$) plane :

$\tilde{g}\tilde{g}$ production with $\tilde{g} \to t\bar{t}\tilde{\chi}_1^0$ (BR=100%) via offshell stop decay

- **Event Selection :** 1 lepton + jets analysis :

• Exactly 1 isolated e (μ) with $p_T > 25$ (20) GeV $\rightarrow$ trigger fully efficient

• $\geqslant 4$ jets with $p_T > 50$ GeV ; $\geqslant 1$ b-jet

• $\not{E}_T > 80$ GeV ; $m_T > 100$ GeV

Define the effective mass $m_{eff} = \sum_{i=1}^{4} p_T^{j_i} + p_T^{\ell} + \not{E}_T$

• $m_{eff} > 600$ GeV.

- **Main background processes :** QCD, EWK (W,Z) and $t\bar{t}$

▶ QCD multijet estimated by a data-driven method (matrix method)

▶ non-QCD bkg estimated with a semi data-driven method

Estimation of the QCD multijet background

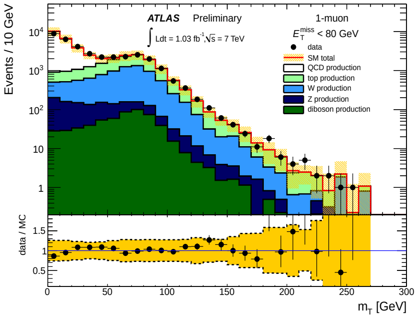
■ Relies on the event count in 2 data samples which differ only in the lepton selection criteria : tight (standard) and loose (relaxed selection) : matrix method

▶ Number of fake leptons : $$N_{fake}^{tight} = \frac{\varepsilon_{fake}}{\varepsilon_{real} - \varepsilon_{fake}} (N^{loose} \varepsilon_{real} - N^{tight}).$$

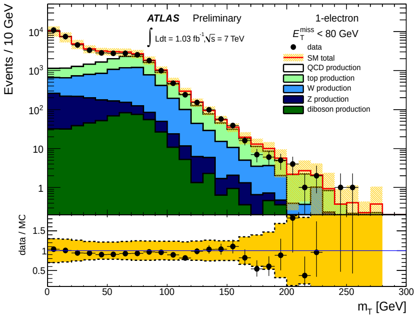
- ε_{fake} (η, p_T) (loose to tight ε for non prompt leptons) : measured in data in a CR enriched in QCD
- ε_{real} (η, p_T) (loose to tight ε for real leptons) : measured in MC with the T&P method

$\Longrightarrow$ QCD background estimate in the the signal region of 0.9 ± 1.2 events

Muon channel



Electron channel



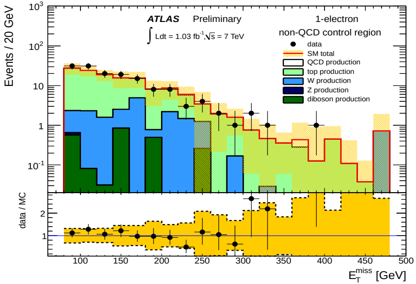
■ Non QCD background estimated with a semi-data driven method in CR1 defined using the same cuts as the SR except for m_T : 40 GeV $< m_T <$ 100 GeV.

► Number of non-QCD background events in the SR is then estimated using a MC transfer function from CR to SR :

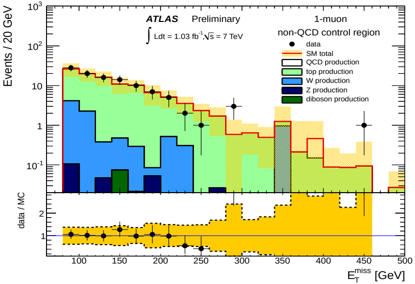
$$N^{SR}_{data} = (N^{CR1}_{data} - N^{CR1}_{QCD})\frac{N^{SR}_{MC}}{N^{CR1}_{MC}} = (N^{CR1}_{data} - N^{CR1}_{QCD})\,T_{MC}$$

To set model dependent limits, the hypothetical signal contamination in CR1 is subtracted

Electron channel



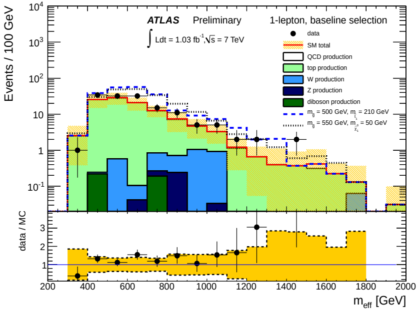
Muon channel



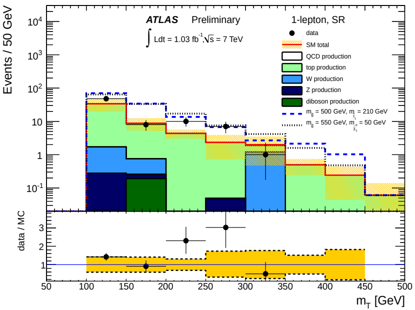
■ Further validation with good data/MC agreement performed in 2 additional CR defined as : m_T>100 GeV, $m_{eff}<$ 600 GeV (CR2) and 40 GeV $< m_T<$ 100 GeV, $m_{eff}<$ 600 GeV (CR3).

Results

m_{eff} before $m_{eff} > 600$ GeV cut



m_T after $m_{eff} > 600$ GeV cut



- Non significant excess in data (1.2 σ)

▶ Direct upper exclusion limits 95% C.L. on possible signal events in SR of 32 events

▶ Model-independent upper limit on cross-section of new physics : $\sigma^{95}.\varepsilon.\mathcal{A} = 46$ fb

Channel	Top	W+jets	Z+jets	diboson	QCD (d-d)	SM (MC)	SM (d-d)	Data
Electron	23 ± 14	1.1 ± 1.3	0.3 ± 0.2	0.2 ± 0.2	0.9 ± 1.0	26 ± 14	28.0 ± 8.4	37
Muon	24 ± 13	2.0 ± 1.9	0.1 ± 0.2	0	< 0.6	26 ± 14	27.4 ± 5.2	37
Sum	48 ± 27	3.1 ± 2.9	0.4 ± 0.3	0.2 ± 0.2	0.9 ± 1.2	52 ± 28	54.9 ± 13.6	74

Exclusion limits in the $(m_{\tilde{t}_1}, m_{\tilde{g}})$ plane

▶ Results are then converted into exclusion limits at 95% C.L. with CL_S for MSSM in the $(m_{\tilde{t}_1}, m_{\tilde{g}})$ plane

Hypothesis :

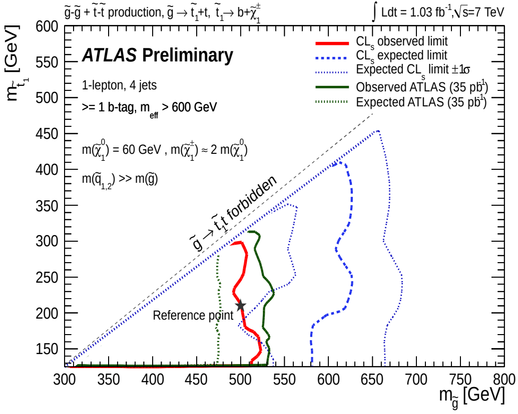
- $\tilde{g}\tilde{g} + \tilde{t}_1\tilde{t}_1$ production
- $\tilde{g} \rightarrow \tilde{t}_1 t$ (BR=1), $\tilde{t}_1 \rightarrow b\tilde{\chi}_1^{\pm}$ (BR=1)
- $m(\tilde{\chi}^0) = 60$ GeV, $m(\tilde{\chi}_1^{\pm}) \approx 2\tilde{\chi}_1^0$

Signal efficiency :
0.01-7% across the $(m_{\tilde{t}_1}, m_{\tilde{g}})$ plane

Detector related uncertainties :
JES and *b*-tag are dominant
→ total detector uncertainty of 10-20%

Theoretical uncertainties :

- Renorm/fact scale :
$\approx 16\%$ for $\tilde{g}\tilde{g}$, $\approx 27\%$ for $\tilde{t}_1\tilde{t}_1$
- PDF : $\approx$ 11-30% for $\tilde{g}\tilde{g}$, $\approx$ 7-16% for $\tilde{t}_1\tilde{t}_1$

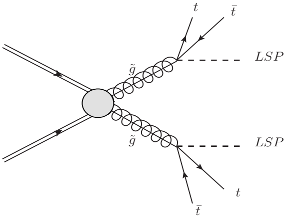


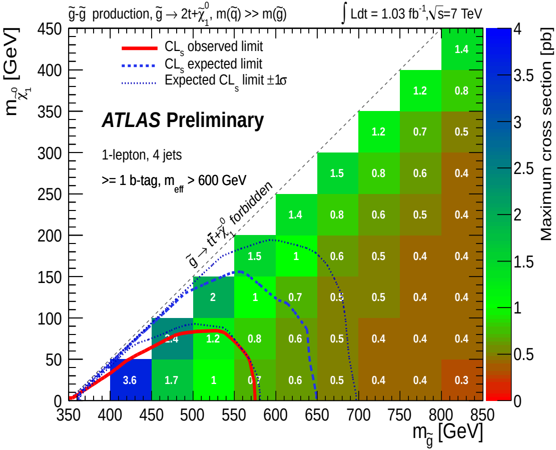
▶ *Previous observed limits are not extended because of the 1.2 σ excess in 1.03 fb^{-1}*

■ Results also interpreted in the context of simplified models in the $(m_{\tilde{g}}, m_{\tilde{\chi}_1^0})$ plane

Hypothesis :

- $\tilde{g}\tilde{g}$ production
- $m(\tilde{q}) \gg m(\tilde{g})$
- $\tilde{g}$ 3 body decay into $t\bar{t}\tilde{\chi}_1^0$ via offshell stop decay





► *$m_{\tilde{\chi}_1^0}$ below 40 (80) GeV are excluded for $m_{\tilde{g}}$ below 570 (540) GeV*

► *Extract the 95% C.L. cross section upper limits :* $\sigma_{95}^{obs} = \frac{N_{95}^{obs}}{\mathcal{L}.\varepsilon\mathcal{A}}$

Conclusion :

Summary :

■ ATLAS and CMS are performing dedicated searches for 3^{rd} generation sparticles

■ No significant excess is observed in data with respect to the expected SM background so far

▶ Upper limits at 95% C.L. on CMSSM and simplified models.

▶ Model-independent 95% C.L. upper limits on the effective cross sections for new processes.

Prospects :

■ We now have more than twice the statistics shown here

▶ Analyses will be updated soon with more data

▶ Investigate new final states to search for direct sbottom and stop pair production

BACK-UP

CMS : Cross-checks for $Z \to \nu\bar{\nu}$ and $t\bar{t}$

■ $Z \to \nu\bar{\nu}$ cross-check :

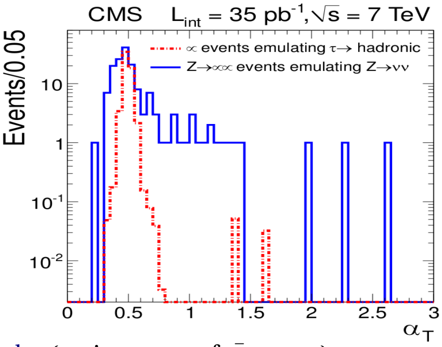
I Measure $F(N_b \geqslant 1)$ in a $Z \to \mu^+\mu^-$ sample

II Select a sample looser than SR and without b-jet requirement

III Scale by $F(N_b \geqslant 1)$

IV correct for ε_μ and $\mathcal{A}_\mu$ and multiply by the BR ratio $\frac{BR(Z\to\nu\bar{\nu})}{BR(Z\to\mu^+\mu^-)} \approx 6$

▶ looser cuts than in the SR leads to an overestimate of the number of $Z \to \nu\bar{\nu}$ events : 0.48 ± 0.39 events



■ $t\bar{t}$ events with hadronic τ decay cross-check : (main source of $t\bar{t}$ events)

I Measure $F(\alpha_T > 0.55)$ in a sample looser than SR and with 1 or 2 μ

II the muons are used to emulate the hadronic τ decay

III Multiply the number of emulated events in SR before the α_T cut by $F(\alpha_T > 0.55)$

IV Correct for ε_μ and $\mathcal{A}_\mu$ and hadronic τ decay BR

V Increased the estimatye by a factor derived from MC to take into account al $t\bar{t}$ events

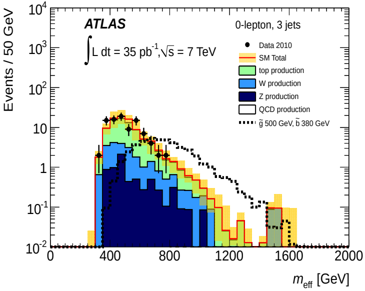
▶ 1.4 ± 0.5 $t\bar{t}$ events are predicted in data

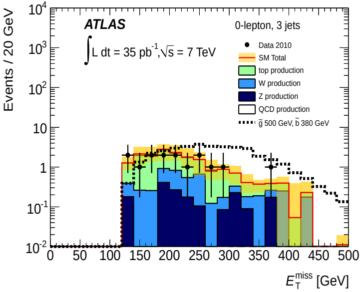
process	0-lepton
$t\bar{t}$ and single top	12.2 ± 5.0
W and Z	6.0 ± 2.0
QCD	1.4 ± 1.0
Total SM	19.6 ± 6.9
Data	15

No excess in data

- direct upper exclusion limits 95% C.L. on possible signal events in SR
- model-independent limit on effective cross-section of new physics

Hypothesis	95% C.L. upper limits
No Uncertainty	$S < 10.4$ events
11% Lumi	$S < 11.1$ events, $\sigma < 0.32$ pb
10%(JES) $\oplus$ 10%(b-tag) $\oplus$ 6%(PU+Trig) $\oplus$ 11% Lumi	$S < 13.9$ events, $\sigma < 0.40$ pb
20%(JES) $\oplus$ 10%(b-tag) $\oplus$ 6%(PU+Trig) $\oplus$ 11% Lumi	$S < 16.3$ events, $\sigma < 0.47$ pb





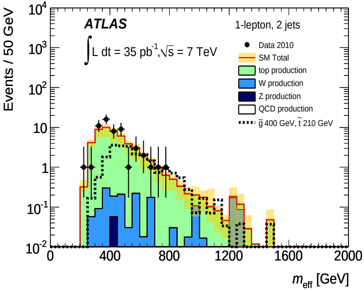
ATLAS 1 lepton with $\mathcal{L} = 35\ \mathrm{pb}^{-1}$: Results

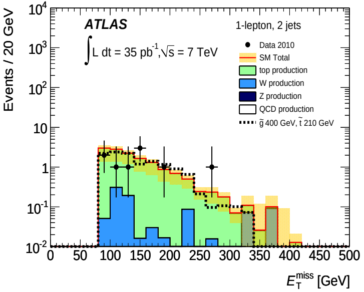
	1-lepton Monte Carlo	1-lepton data-driven
$t\bar{t}$ and single top	12.3 ± 4.0	14.7 ± 3.7
W and Z	0.8 ± 0.4	-
QCD	0.4 ± 0.4	$0^{+0.4}_{-0.0}$
Total SM	13.5 ± 4.1	14.7 ± 3.7
Data	9	9

No excess in data

- ▶ direct upper exclusion limits 95% C.L. on possible signal events in SR
- ▶ model-independent limit on effective cross-section of new physics

Hypothesis	95% C.L. upper limits
No Uncertainty	$S < 4.7$ events
11% Lumi	$S < 4.8$ events, σ <0.14 pb



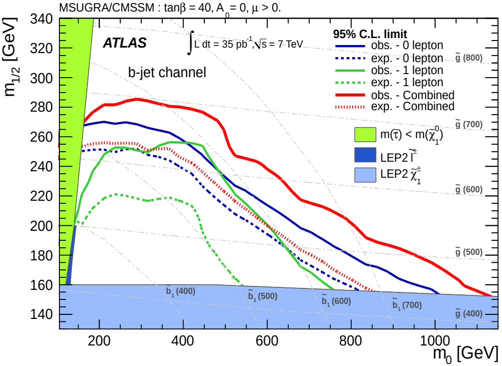


ATLAS with $\mathcal{L} = 35\ \mathrm{pb}^{-1}$: limits on the $(m_0, m_{1/2})$ plane

- Interpretation of the 0-lepton and 1-lepton results in mSUGRA scenario with high $\tan\beta$ (lower $m_{\tilde{b}_1}$ and $m_{\tilde{t}_1}$) :

$\tan\beta = 40, A_0 = 0, \mu > 0.$

▶ Best sensitivity in the 0-lepton channel but the combination of both channels significantly improve the limits



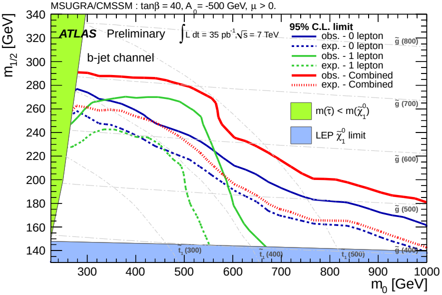
▶ *Exclude sbottom masses < 550 GeV and stop masses below 470 GeV are excluded accross the plane*

▶ *Gluino masses below 500 GeV are excluded in the m_0 range between 100 GeV and 1 TeV*

- Interpretation of the 0-lepton and 1-lepton results in different mSUGRA scenarios :

$\tan\beta = 40, A_0 = \text{-}500, \mu > 0.$

- Most favorable scenario



$\tan\beta = 3, A_0 = 0, \mu > 0.$

- Most conservative scenario