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ATLAS-CONF-2013-089

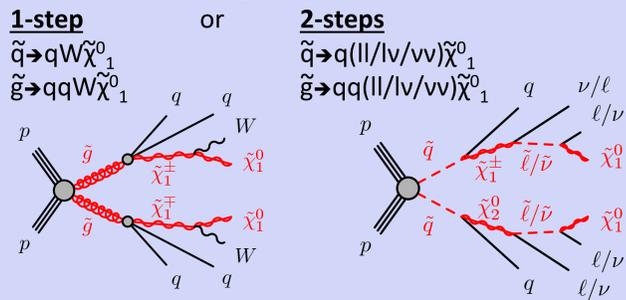
This poster presents a **search for squarks and gluinos** in final states containing two isolated electrons or muons using the **20.3 fb<sup>-1</sup> of  $\sqrt{s} = 8$  TeV pp collisions recorded by the ATLAS Detector at the LHC during 2012**. The search uses a set of variables carrying information on the event kinematics both transverse and parallel to the beam line. No excess above the Standard Model (SM) expectation is observed, therefore exclusion limits on sparticle masses for various simplified model scenarios and a minimal universal extra dimensions model are set.

## Supersymmetry (SUSY)

- **Extension of the Standard Model (SM):**
  - Global symmetry between fermions and bosons
- **Interesting because it provides:**
  - Higgs mass stabilization
  - Unification of gauge couplings
  - Dark matter candidate

## Target Models

- **Simplified Models** with pair production of  $\tilde{g}$  or 1<sup>st</sup> and 2<sup>nd</sup> generation  $\tilde{q}$  which then decay via:

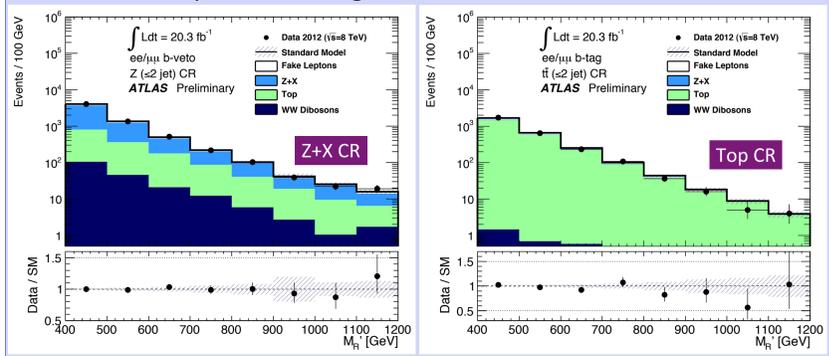


- **mUED:** minimal extension of the SM with one extra spatial dimension

## Background Estimation

- Top [fully-leptonic  $t\bar{t}$ , single top,  $t\bar{t}+EW$ ] and Z + X [Z/ $\gamma$  + jets (where Z decays leptonically), WZ, ZZ]:
  - Estimated with a **binned shape fit**
- **W+jets** and **semi-leptonic  $t\bar{t}$**  (which pass the two-lepton requirement due to jets being misidentified as leptons or due to the detection of a real lepton, sufficiently isolated, coming from a heavy-flavour decay):
  - Estimated with the **data-driven matrix method**
- **WW** diboson:
  - Estimated entirely with **MC**

Data compared to background estimation after the fit in CRs



**Good agreement between data and SM expectations within uncertainties**

## Razor Variables

arXiv:1006.2727

- Exploit the symmetry in the visible portion of sparticle decays when sparticles are produced in pairs
- Group **final state** jets and leptons into 2 "**mega-jets**" ( $j_1, j_2$ ): each represents the decay products of a single sparticle
- "**R-frame**": sparticle rest frame
- Define a characteristic mass in the R-frame:

$$M'_R = \sqrt{(j_{1,E} + j_{2,E})^2 - (j_{1,L} + j_{2,L})^2} \quad j_{i,L}, j_{i,E}: \text{longitudinal momentum and energy in the R-frame}$$

- and its transverse counterpart:

$$M^R_T = \sqrt{\frac{|\vec{E}_T^{miss}| (|\vec{j}_{1,T}| + |\vec{j}_{2,T}|) - \vec{E}_T^{miss} \cdot (\vec{j}_{1,T} + \vec{j}_{2,T})}{2}} \quad j_{i,T}: \text{transverse momentum}, E_T^{miss}: \text{comes from the LSPs}$$

- The **Razor** variable:

$$R = \frac{M^R_T}{M'_R} \quad \begin{cases} \text{tends to peak at low values for SM} \\ \text{uniformly distributed (approx.) for SUSY} \end{cases}$$

**R used as discriminant between background and signal**

## Event Selection

Each type of signal region (SRs) is defined to target a different region of kinematic phase space:

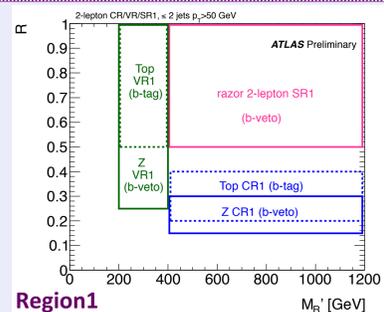
- SR1: small [ $m(\tilde{g}/\tilde{q}) - m(\chi_{\pm 1})$ ]
- SR2: large [ $m(\tilde{g}/\tilde{q}) - m(\chi_{\pm 1})$ ]

Exactly 2 signal leptons (ee,  $\mu\mu$  or  $e\mu$ )

Signal Region	SR1 ee/ $\mu\mu$	SR1 e $\mu$	SR2 ee/ $\mu\mu$	SR2 e $\mu$
b-veto	Yes	Yes	Yes	Yes
Z-veto	Yes	No	Yes	No
Njets (pT > 50 GeV)	$\leq 2$	$\leq 2$	$\geq 3$	$\geq 3$
R	> 0.5	> 0.5	> 0.35	> 0.35
$M'_R$ [GeV]	> 400	> 400	> 800	> 800

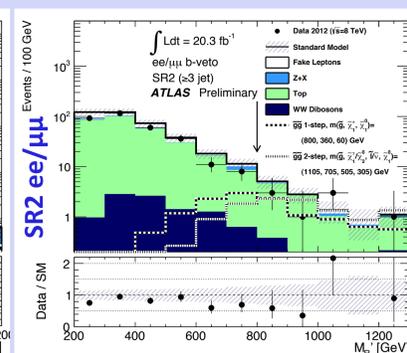
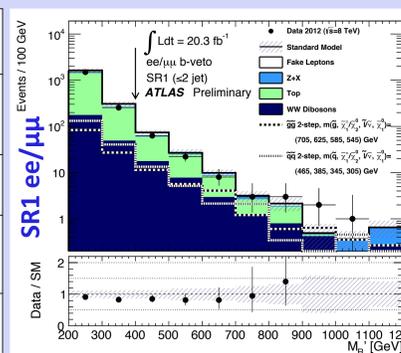
### Binned shape fit

- Define a **control region (CR)** for each relevant background
  - Top CR
  - Z + X CR
- CRs are binned in  $M'_R$
- MC samples normalised simultaneously to data in CRs (profile likelihood fit)
- The result of this fit is extrapolated from CRs to **signal regions (SRs)**
- Define **validation regions (VRs)** to cross-check CR to SR extrapolation



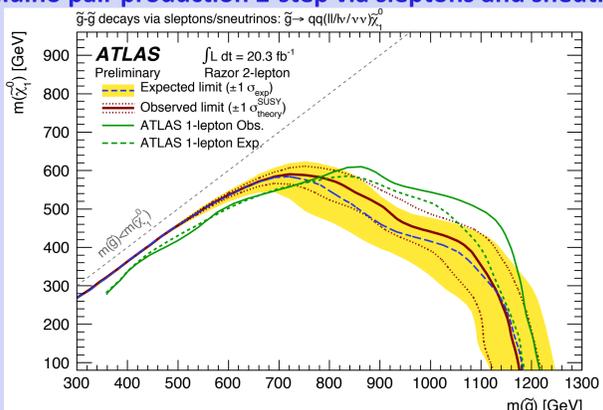
## Results

	Observed data events	Fitted bkg events	
SR1	ee/ $\mu\mu$	102	117 $\pm$ 16
	e $\mu$	87	103 $\pm$ 15
SR2	ee/ $\mu\mu$	8	11.0 $\pm$ 2.8
	e $\mu$	8	10.1 $\pm$ 2.7

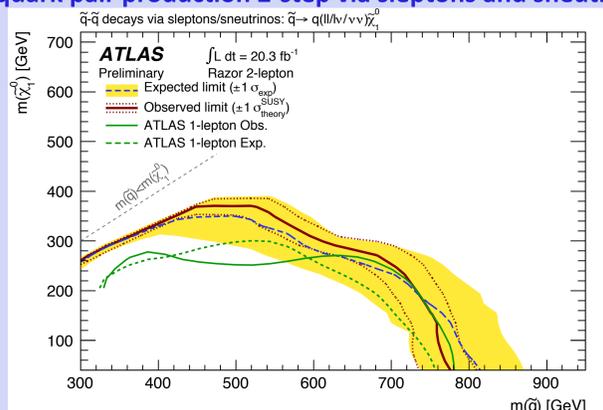


## Interpretations

**Gluino pair production 2-step via sleptons and sneutrinos**



**Squark pair production 2-step via sleptons and sneutrinos**



**mUED**

