Search for gluinos and squarks in final states with jets, missing transverse momentum and same-sign leptons at $\sqrt{s} = 13 \text{ TeV}$ with the ATLAS detector

**Introduction**

Gluinos and squarks are one of the primary targets as their pair production may have large cross section. The poster presents recent ATLAS result from searches for gluinos and squarks with same-sign leptons and jets with 139 fb$^{-1}$ data.

**SUSY signal scenario**

$\tilde{g} \rightarrow qqWZ\tilde{\chi}_1^0 \rightarrow b\tilde{t}^\pm \tilde{t} \rightarrow tWW\tilde{\chi}_1^0 \rightarrow \tilde{t}bd$

**Background**

1. Real/Prompt lepton contribution
   - Diboson production (WZ / ZZ)
   - $t\bar{t}$ production with a vector boson
     → Estimated from Monte-Carlo simulation
2. Reducible background
   - Charge flip and Fake/non-prompt lepton
     → Estimated using data-driven method

**Event selection**

5 different signal regions (SR) are defined
- $n_{\ell}, n_{b}, n_{j}$: Number of lepton, b-jet and jets
- $E_{T}^{\text{miss}}$: Missing transverse momentum
- $m_{\text{eff}}$: scalar $P_T$ sum of all jets, lepton and $E_{T}^{\text{miss}}$

<table>
<thead>
<tr>
<th>SR</th>
<th>$n_{\ell}$</th>
<th>$n_{b}$</th>
<th>$n_{j}$</th>
<th>$E_{T}^{\text{miss}}$ [GeV]</th>
<th>$m_{\text{eff}}$ [GeV]</th>
<th>$E_{T}^{\text{miss}}$/ $m_{\text{eff}}$</th>
<th>SUSY</th>
</tr>
</thead>
<tbody>
<tr>
<td>RpCL</td>
<td>$\geq 2$</td>
<td>$\geq 0$</td>
<td>$\geq 6$</td>
<td>$\geq 40$ (GeV)</td>
<td>$\geq 2000$</td>
<td>$\tilde{t}\rightarrow\tilde{b}\tilde{t}^\pm\tilde{t}$</td>
<td>SUSY</td>
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<tr>
<td>RpCL1.0b</td>
<td>$\geq 2$</td>
<td>$\geq 1$</td>
<td>$\geq 6$</td>
<td>$\geq 40$ (GeV)</td>
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<td>$\tilde{t}\rightarrow\tilde{b}\tilde{t}^\pm\tilde{t}$</td>
<td>SUSY</td>
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<tr>
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<td>$\geq 2$</td>
<td>$\geq 6$</td>
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<td>SUSY</td>
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<tr>
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<tr>
<td>RpCL8.5b</td>
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</table>

• Large $m_{\text{eff}}$ and $E_{T}^{\text{miss}}$ except RPV scenarios ($\tilde{g} \rightarrow tbd$)
  • Low $E_{T}^{\text{miss}}$ for RPV sce
  • At least 2 leptons and multiple jets

Rare process in SM → Very low background!

**Background estimation**

Charge flip: Bremsstrahlung or low track curve
- Transform opposite-sign in same sign events
- Muon charge flip is negligible in this analysis
- The rate for electron is measured in data and simulation for $Z \rightarrow ee$

Fake/non-prompt lepton: from heavy/light flavor decays
- Dynamic matrix method with 2 input parameters
  - Real and Fake efficiencies are estimated from data.

Validation regions (VR) are designed to verify the irreducible background.
- Good agreement between data and prediction

**Result**

The yield of 139 fb$^{-1}$ data and the predicted SM background is shown.
- No excess over the expected yields

**Interpretation**

95% CLs exclusion limits are computed.

$m(\tilde{g}) < 1.6 \text{ TeV}$, $m(\tilde{\chi}_1^0) < 1.0 - 1.2 \text{ TeV}$ $m(\tilde{t})$, $m(\tilde{b}) < 750 \text{ GeV}$ can be excluded in the model considered.