SEARCH FOR PAIR PRODUCTION OF GLUINOS IN FINAL STATES WITH MANY B-JETS AND $E_T^{\text{miss}}$ AT $\sqrt{s}=13$ TeV WITH THE ATLAS DETECTOR

**ABSTRACT**

This poster presents a search for gluino pair production, in which both gluinos decay through virtual third generation squarks, stop or sbottom, into a final state with many b-jets, missing transverse momentum ($E_T^{\text{miss}}$, coming from the lightest neutralino) and, in the case of stop-mediated decays, potentially also isolated leptons. The full dataset collected in 2015 by the ATLAS experiment in pp collisions at a center-of-mass energy of 13 TeV is used, amounting to a total integrated luminosity of 3.2 fb$^{-1}$. No excess over the Standard Model prediction is found, and limits are set on simplified models, extending significantly those obtained in Run 1.

**INTRODUCTION**

Supersymmetry: promising extension of the Standard Model (SM), postulates a super-partner for each SM particle. Particularly interesting if super-partners of gluons (gluinos) and of 3rd generation quarks (top and sbottoms) are light.

Two simplified models targeted: gluino pair production, with decay through (virtual) sbottom or stop into a final state with many b-jets and $E_T^{\text{miss}}$.

**EVENT SELECTION**

After preselection (high $E_T^{\text{miss}}$ and at least 3 b-jets) the SRs are defined based on optimisation to maximise the expected significance across the plane of neutralino mass vs gluino mass.

$Gbb$ → 3 SRs with different requirements on $E_T^{\text{miss}}$, momentum of the jets and effective mass.

$Gtt$ → 3 SRs for the 0-lepton (0L) search and 2 SRs for the 1-lepton (1L) search, with different requirements on many variables including the transverse mass ($m_T$) and one of its variation ($m_T^\text{blind}$). 3 of the 5 Gtt SRs require the presence of a top-tagged re-clustered large-R jet.

$Gbb$ model

$Gtt$ model

Strategy: cut and count analysis. The use of discriminating variables allows the definition of signal-rich regions (signal regions, SRs), depending on the specific signal model under consideration. The comparison of the observed yields in the SRs with the expected SM background yields is used to test the compatibility of the data with different hypotheses.

**RESULTS**

The extrapolation of the $t\bar{t}$ normalisation factors from the CRs to the SRs is tested in validation regions (VRs).

Data and Monte Carlo agree within uncertainties. In the SRs, no excess over predicted background.

**INTERPRETATION**

No excess over the expected background is found → results are used to set limits.

<table>
<thead>
<tr>
<th>Channel</th>
<th>$\sigma_{\text{SM}}$</th>
<th>$\sigma_{\text{Gbb}}$</th>
<th>$\sigma_{\text{Gtt}}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR-Gbb-A</td>
<td>1.08</td>
<td>3.6 (2.7)</td>
<td>3.9 ($^{+0.7}_{-0.5}$)</td>
</tr>
<tr>
<td>SR-Gbb-B</td>
<td>1.18</td>
<td>4.9 (3.8)</td>
<td>4.1 ($^{+0.7}_{-0.4}$)</td>
</tr>
<tr>
<td>SR-Gbb-C</td>
<td>1.60</td>
<td>5.5 (4.6)</td>
<td>3.7 ($^{+0.6}_{-0.4}$)</td>
</tr>
<tr>
<td>SR-Gtt-1L-A</td>
<td>1.48</td>
<td>5.0 (4.1)</td>
<td>4.1 ($^{+0.6}_{-0.4}$)</td>
</tr>
<tr>
<td>SR-Gtt-1L-B</td>
<td>1.06</td>
<td>3.6 (2.6)</td>
<td>3.7 ($^{+0.5}_{-0.4}$)</td>
</tr>
<tr>
<td>SR-Gtt-0L-A</td>
<td>1.17</td>
<td>3.9 (3.8)</td>
<td>4.2 ($^{+0.6}_{-0.5}$)</td>
</tr>
<tr>
<td>SR-Gtt-0L-B</td>
<td>1.18</td>
<td>3.9 (3.8)</td>
<td>4.3 ($^{+0.6}_{-0.5}$)</td>
</tr>
<tr>
<td>SR-Gtt-0L-C</td>
<td>1.06</td>
<td>3.9 (3.8)</td>
<td>4.3 ($^{+0.6}_{-0.5}$)</td>
</tr>
</tbody>
</table>

Model-independent upper limits on the visible cross section ($\sigma_{\text{vis}}$) and on the number of observed and expected signal events ($N_{\text{obs}}$ and $N_{\text{exp}}$) in each SR. The main results are obtained with pseudo-experiments, while the number in parenthesis are obtained with the asymptotic approximation.

Limits are set also on the Gbb and Gtt models. For each signal mass, the SR that leads to the best expected exclusion is chosen.

Gbb

$\sigma_{\text{SM}}$ $\sigma_{\text{Gbb}}$ $\sigma_{\text{Gtt}}$

Gtt

**CONCLUSION**

The full dataset collected in 2015 by the ATLAS detector has been analysed, searching for pair-produced gluinos decaying through stop or sbottom. No excess has been found, and the results have been used to place limits on new physics. On the Gbb and Gtt simplified models, these limits extend significantly the ones from Run 1, reaching respectively about 1.8 TeV and 1.7 TeV in gluino mass for a low-mass neutralino.