A search for R-parity violating decays of the top squark in four jet final states with the ATLAS experiment at \( \sqrt{s} = 13 \) TeV (ATLAS-CONF-2016-022)

**Experimental viewpoint**

Study particle physics in new energy regime in LHC Run II.

ATLAS has a rich search program in jet final states: dijet, four jet, multi jet etc.

Focus of this poster is the search for new particles in four jet final state.

Pair production of resonances, each of which further decay into two SM quarks.

**Theory scenario**

Naturalness requires top squark (stop) mass to be within TeV scale.

Consider pair production of stops.

Each stop decays to a \( b \) and an \( s \)-quark via R-parity violating couplings.

**Selections**

- 4jet trigger, \( p_T > 85 \) GeV
- Four jets with \( p_T > 150 \) GeV, \( |\eta| < 2.4 \)
- Pair jets according to their angular separation

\[ \delta R_{\text{min}} = \sum_{i=1,2} |\delta R_i - 1.0| \]

One jet in each pair need to be \( b \)-tagged.

Require \( \delta R_{\text{min}} < 1.6 \)

**Background prediction**

SM particles are uncorrelated in \( A, |\cos(\theta)|, \text{#}(b\text{-tags}) \).

Use ABCD method to predict expected SM count in small values of \( A, |\cos(\theta)|, \text{ and two } b\text{-tags} \).

Optimised selection: \( A < 0.075, |\cos(\theta)| < 0.6 \)

Search in windows of \( m_{\text{avg}} \).

**ABCD method**

- \( N_A, N_B, N_C, N_D \)

\[ \frac{N_A}{N_B} = \frac{N_C}{N_D} \]

**Average mass of reconstructed resonances**

\[ m_{\text{avg}} = \frac{m_1 + m_2}{2} \]

**Mass asymmetry of reconstructed resonances**

\[ A = \frac{|m_1 - m_2|}{m_1 + m_2} \]

**Stop production angle, \( \theta^* \)**

in the COM frame

**ATLAS Preliminary**

\( \sqrt{s} = 13 \) TeV, 3.2 fb\(^{-1} \)

Data, \( m_{\text{avg}} \) spectrum for SM particles with different numbers of \( b\)-tags

**Summary**

LHC delivered 3.2 fb\(^{-1} \) of proton-proton collision data in 2015. No statistical evidence of new particles in four jet final state.

Placed limits on cross section and mass of considered stop model. Observed mass limit for stops: 345 GeV.