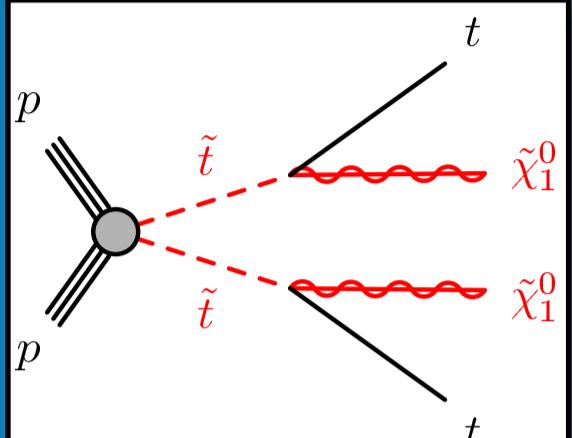


# Search for top squarks in final states with one lepton targeting pure bino LSP scenarios with the ATLAS detector

## Introduction

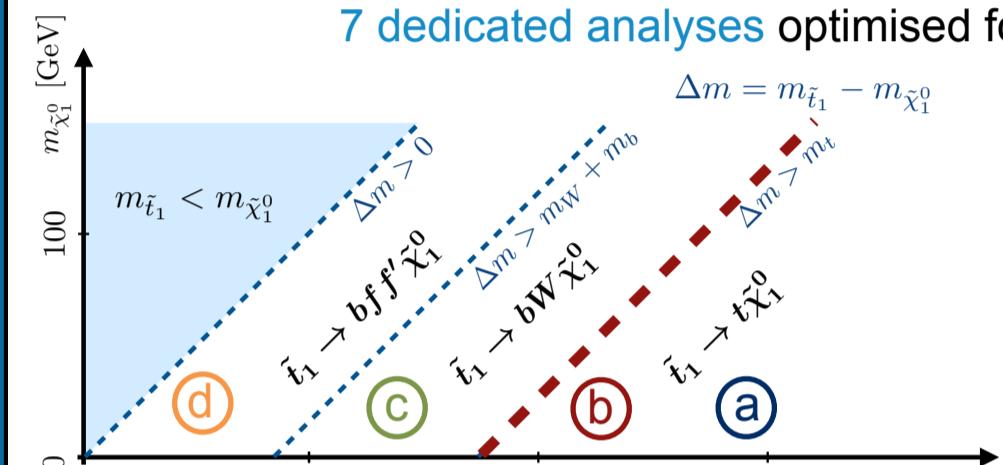
- Supersymmetry is one of the most popular and elegant solution to the hierarchy problem
- Many theories favour a light top squark  $\tilde{t}$ , which is the superpartner of the top quark[1]
- Search for pair produced top squarks in final states with one electron or muon and missing transverse momentum ( $E_T^{\text{miss}}$ )
- Analysis based on  $\sqrt{s} = 13 \text{ TeV}$  pp collisions and an integrated luminosity of  $36 \text{ fb}^{-1}$

## Target decay



- Simplified model
- 2 light sparticles: stop  $\tilde{t}$  and neutralino  $\tilde{\chi}_1^0$
- $\tilde{\chi}_1^0$  is assumed to be the **lightest supersymmetric particle (LSP)**
- LSP provides a **dark matter candidate**
- Assuming a **pure bino LSP**

## Search strategy



Decay scenario governed by:  $\Delta m = m_{\tilde{t}_1} - m_{\tilde{\chi}_1^0}$

- Direct decay into top quark and neutralino
- "Diagonal" region ( $m_{\tilde{t}} \sim m_t$ )
- 3-body decay to b-jet, W and  $\tilde{\chi}_1^0$
- 4-body decay to b-jet, 2 fermions and  $\tilde{\chi}_1^0$

### Common approach

3 different preselection criteria using lepton and  $E_T^{\text{miss}}$  triggers

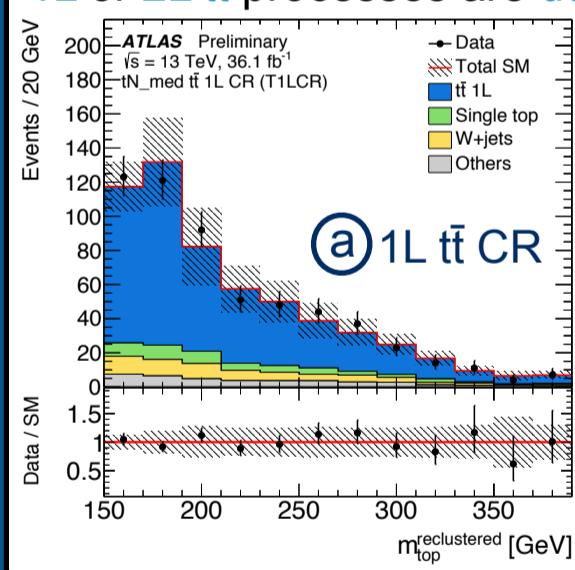
Soft lepton selection ( $p_T > 5 \text{ GeV}$ ) for 4-body scenario

- Fitting SM simulation to data in control regions (CR)
- Extrapolation from CR to signal regions (SR)
- Validation in kinematically close regions (VR)

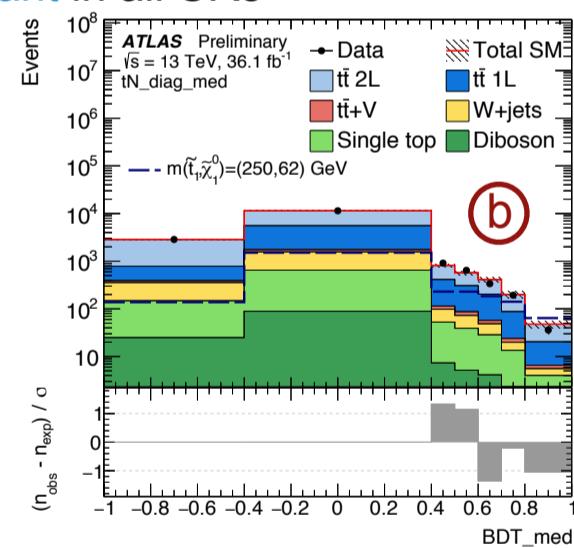
Discrimination from Background via  $m_{T2}$ -based quantities[2], recursive jigsaw variables[3] and reclustered top-tagging

## Signal extraction and background estimation

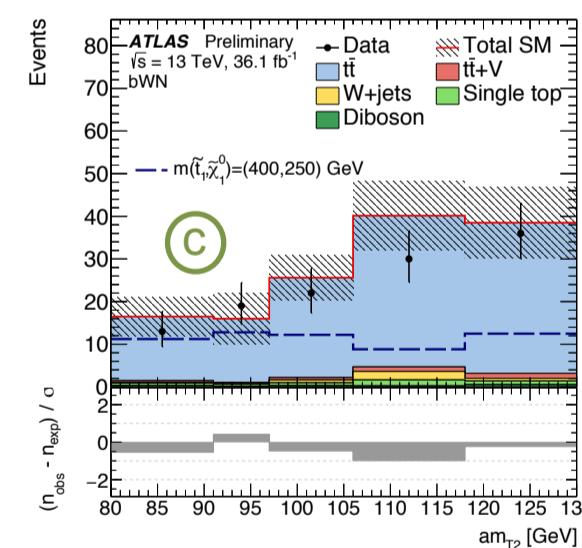
1L or 2L  $t\bar{t}$  processes are dominant in all SRs



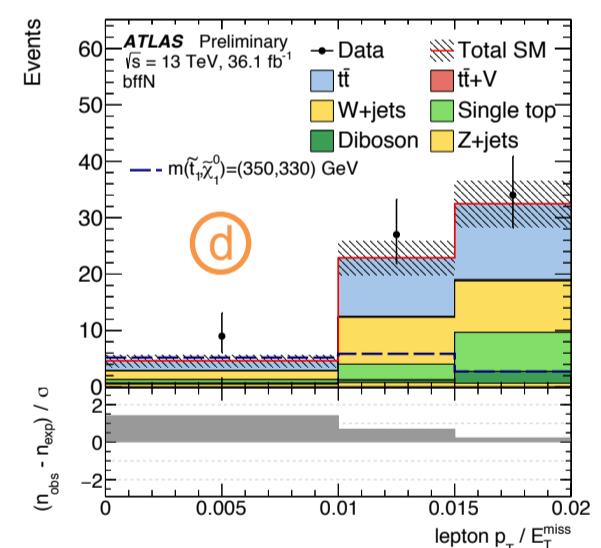
- Exploit boosted top quark topology to define SR and CR



- Challenging due to similarity to  $t\bar{t}$
- 3 BDTs to discriminate signal
- Shape fit in high BDT output score

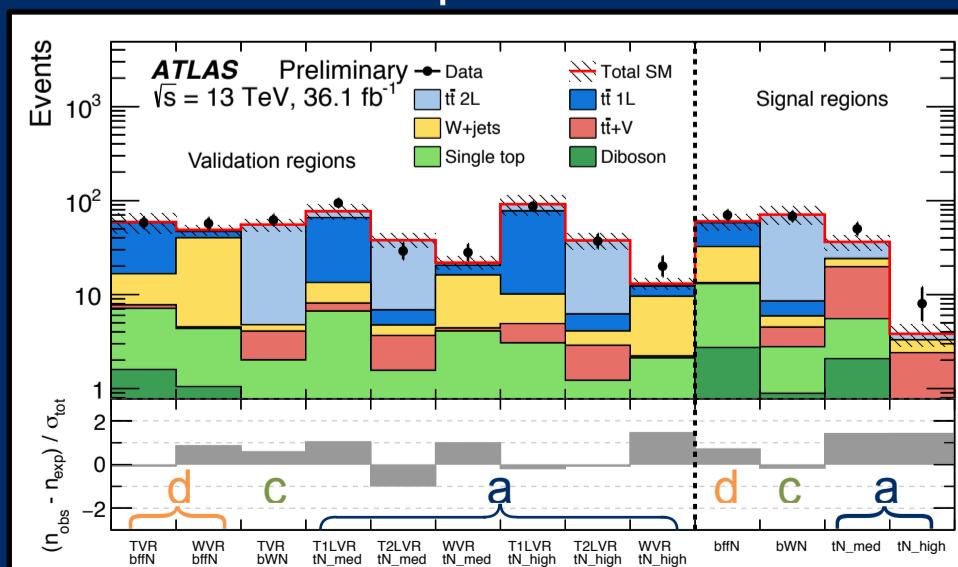


- Dominated by 2L  $t\bar{t}$
- Shape fit in am\_T2



- Hadronic "top-tag" CR
- Shape fit in p\_T^lepton/E\_T^miss

## Results and Interpretation



Data and SM background is in good agreement

Exclusion limits determined for signal models in the  $m_{\tilde{t}} - m_{\tilde{\chi}}$  plane

Find out more:  
ATLAS-CONF-2017-037  
<https://cds.cern.ch/record/2266170>

