



# Search for SUSY with Missing Transverse Momentum and Multiple b-jets at 13 TeV with the ATLAS Detector

## Abstract

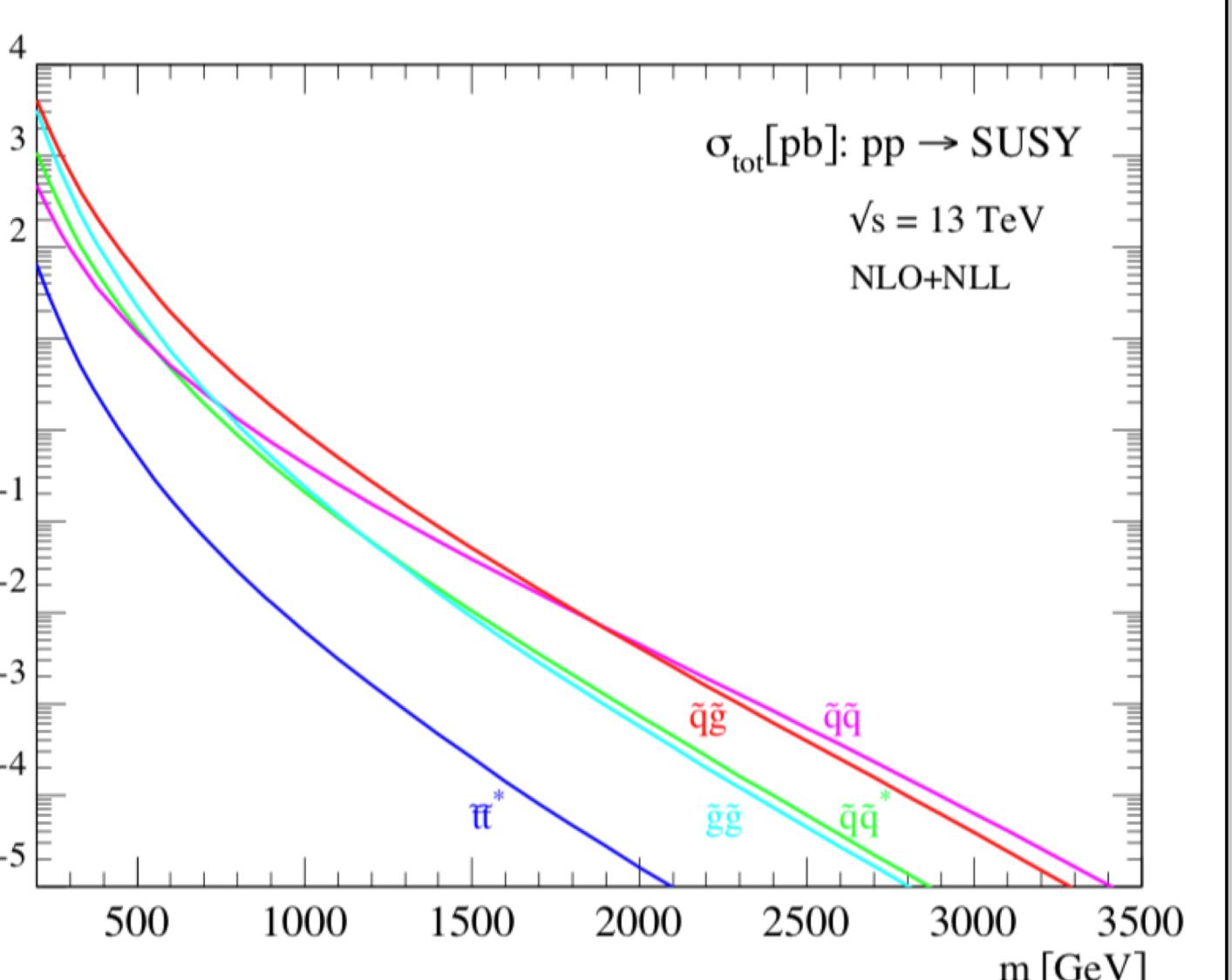
A search for supersymmetry involving the pair production of gluinos decaying via third generation squarks into the lightest neutralino is presented. The analysis uses the large hadron collider proton-proton collision data at a center-of-mass  $\sqrt{s} = 13$  TeV with an integrated luminosity of  $79.8 \text{ fb}^{-1}$  collected with the ATLAS detector in 2015, 2016 and 2017. No excess is found above the Standard Model predicted background. For neutralino masses below approximately 800 GeV, gluino masses of less than 2.2 TeV are excluded at 95% confidence level in simplified models involving the pair production of gluinos that decay via top or bottom squarks.

## SUSY Motivation

Supersymmetry is a generalization of space-time symmetry that predicts new bosonic partners for fermions and vice versa. Some of the open questions solved by SUSY are:

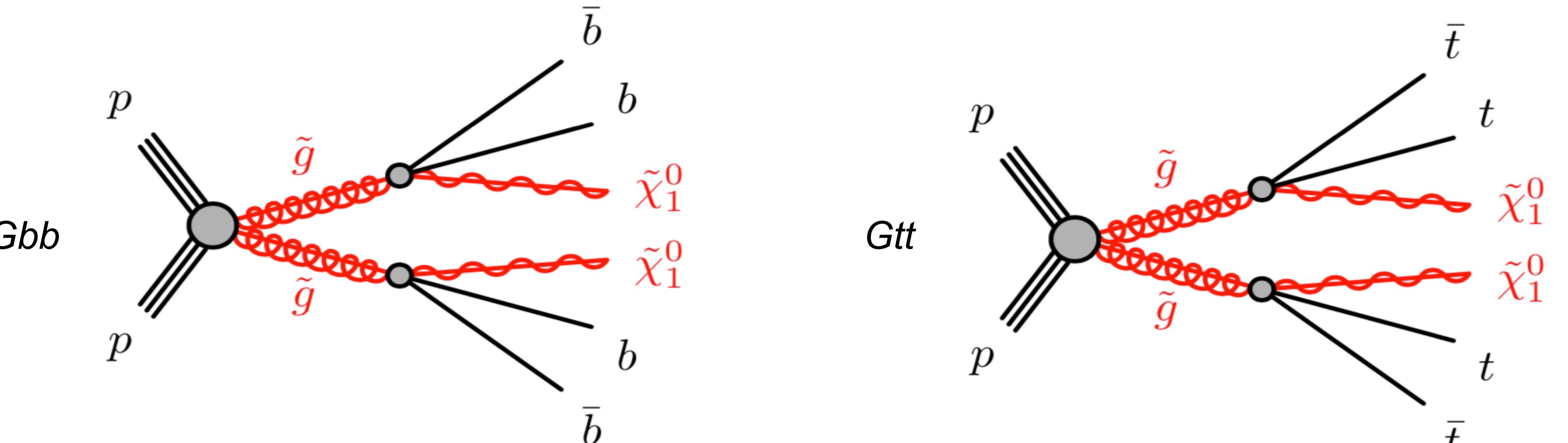
- Hierarchy problem
- The dark matter candidate
- Standard Model gauge coupling unification

Search for gluino-mediated 3<sup>rd</sup> generation squark production is motivated by **high production cross-section** of gluinos at the LHC.



## Strong multi-b Simplified Model

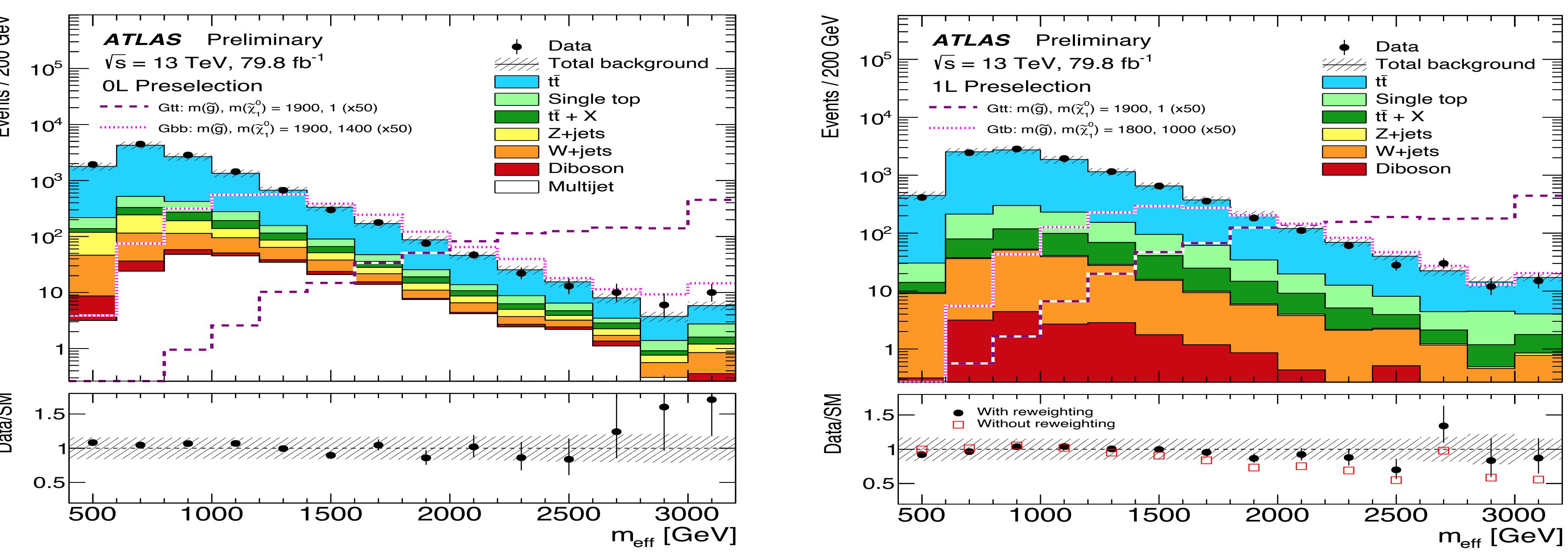
The simplified model featured with **at least four b-jets** originating from the top quark or gluino decays and two neutralinos which escape the detector and resulting in **high  $E_T^{\text{miss}}$** .



## Standard Model Background

Data and background estimation are checked in preselection region using different discriminating variables:

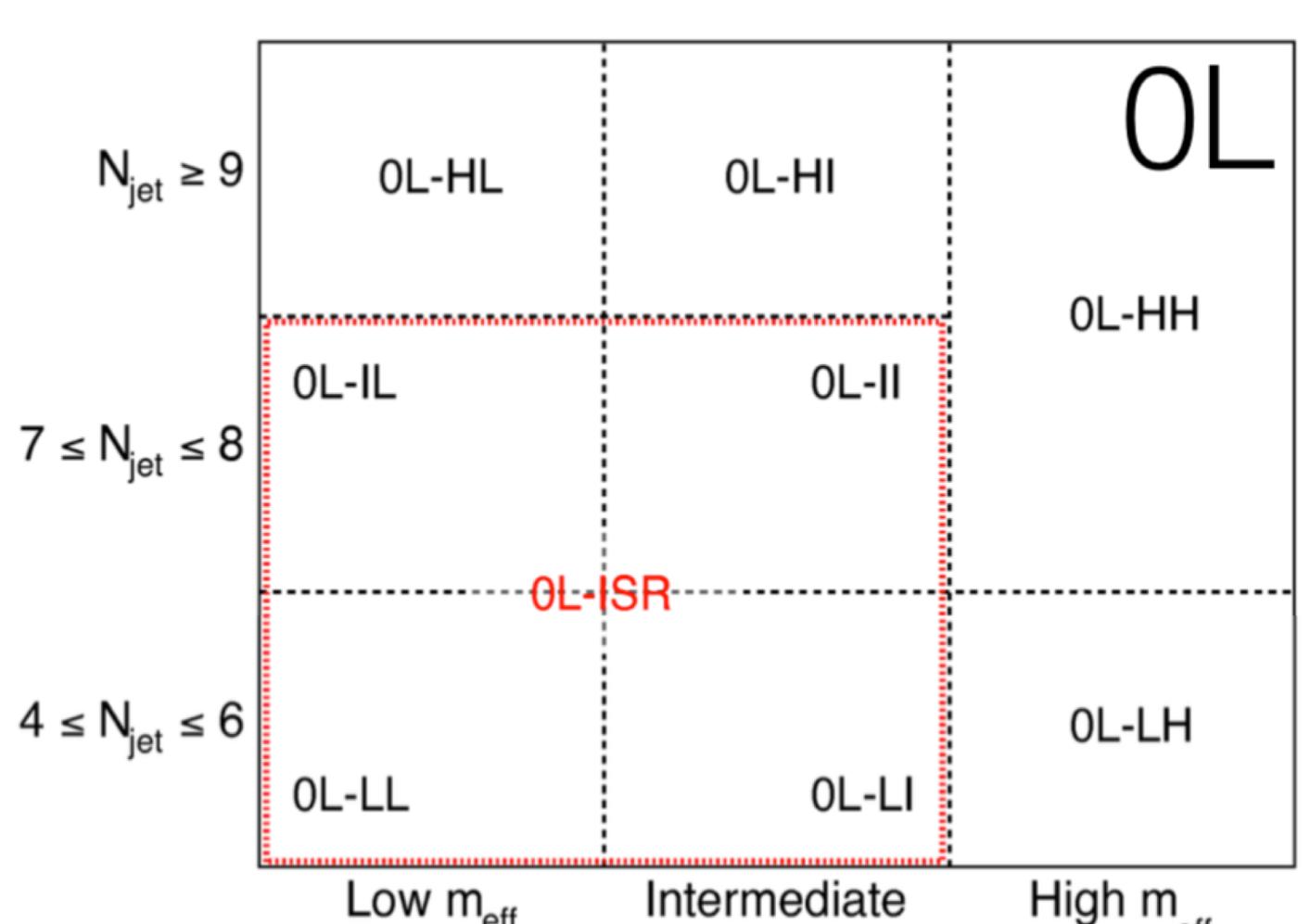
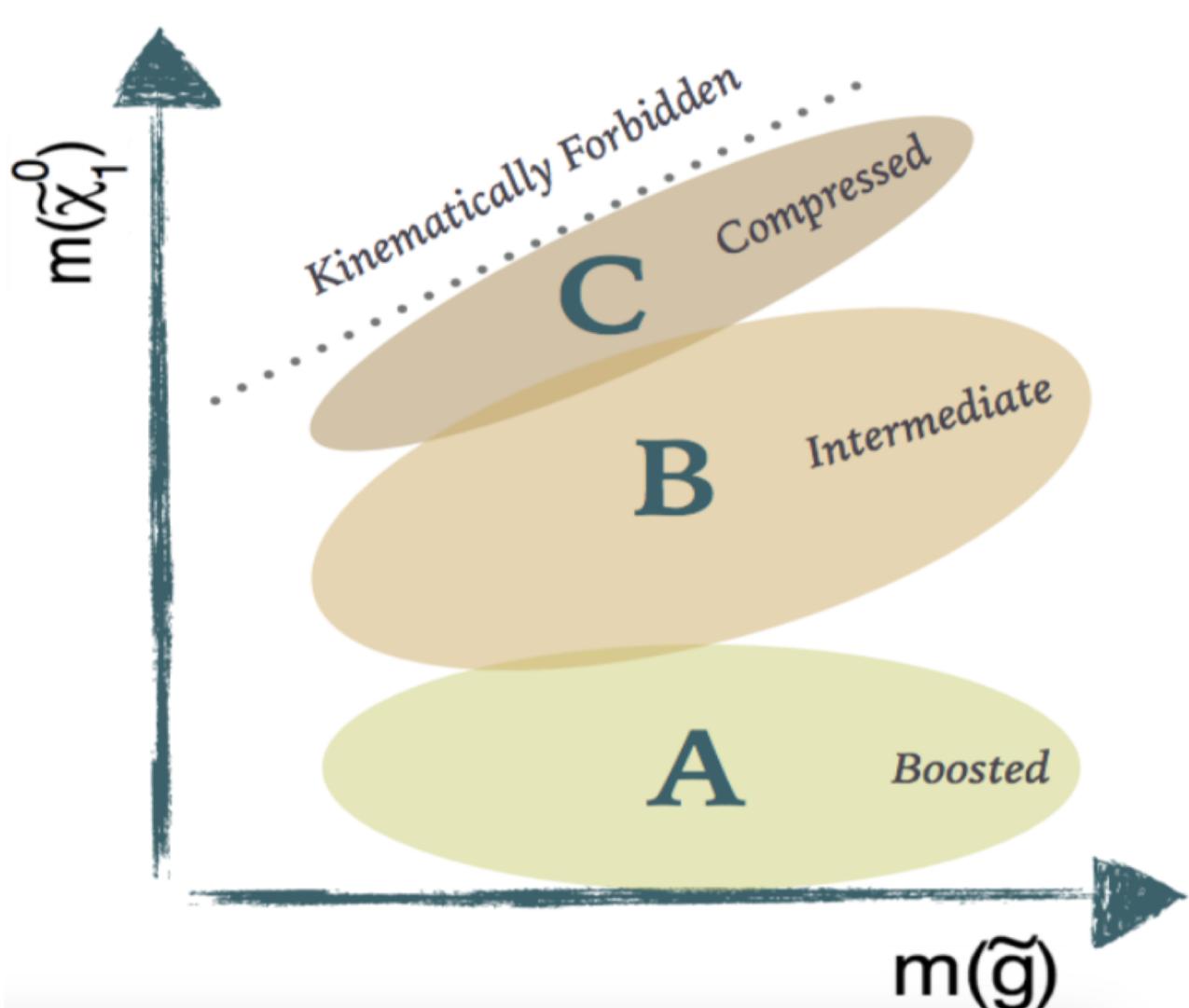
- To increase sensitivity, the analysis is divided depending on the presence (1L) or absence (0L) of electrons or muons.
- Dominant background is semi-data driven  $t\bar{t}$ . All other backgrounds are estimated from MC except QCD.
- Data-driven QCD estimation for 0-lepton channel.
- Kinematic correction (**reweighting**) implemented in 1-lepton channel.
- Largest **experimental uncertainties** are jet related ones: Jet energy scale (JES), Jet energy resolution (JER), and b-tagging efficiency



## Region Definition and Analysis Strategy

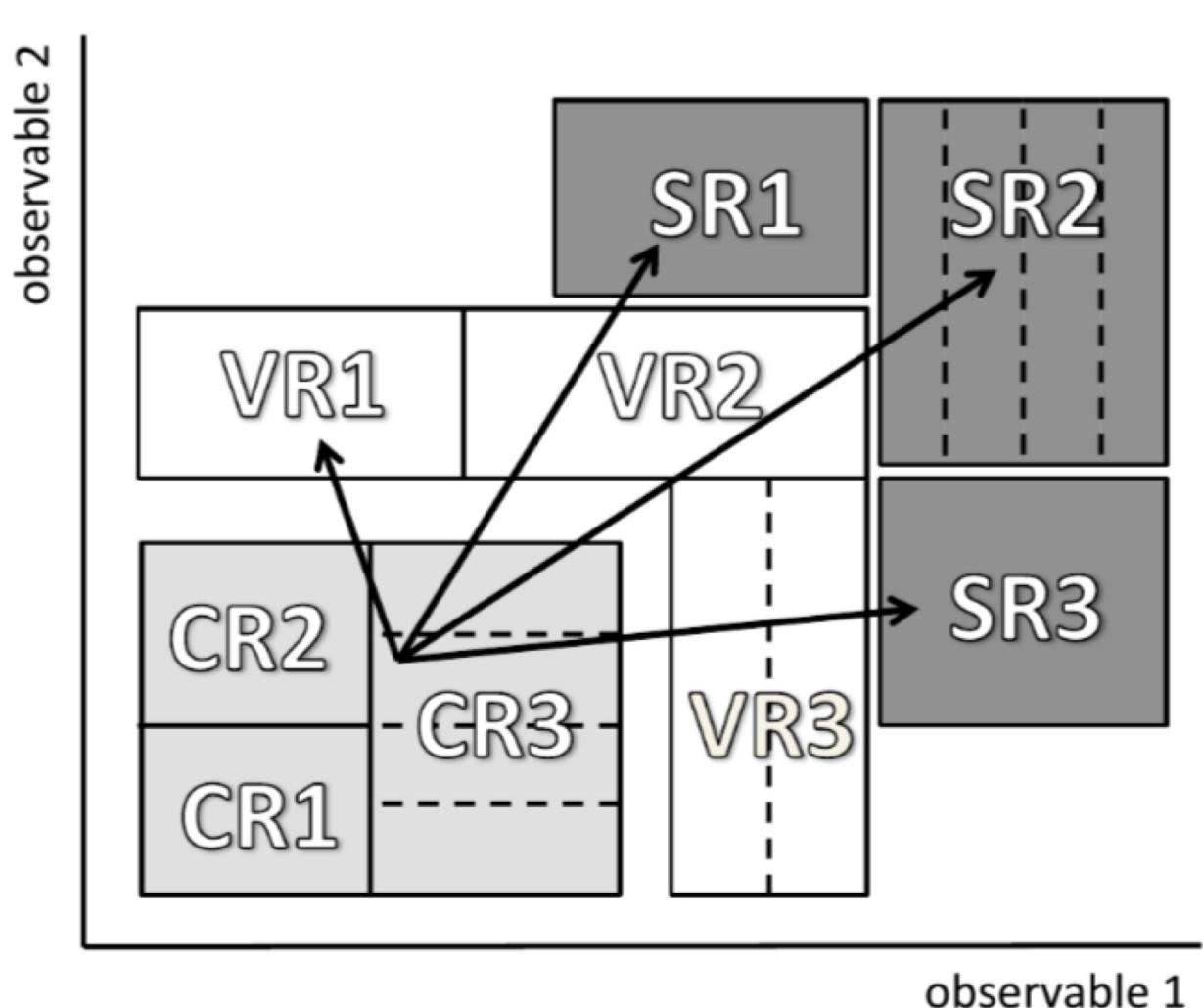
### Cut-and-Count

- Overlapping bins.
- Optimized for maximum expected significance.



### Strategy

- Control Regions (CR) extracting the normalization of the dominant  $t\bar{t}$  background.
- The prediction is extrapolated and verified in Validation Regions (VR).
- Multiple Signal Regions (SR) designed to enhance sensitivity to the signal.
- Compare the background estimation to the data yield in SRs.



## Results/model-dependent Limits

After unblinding the SRs, **no significant excess** above the predicted background is observed.

Multi-bin regions are statistically combined to derive **exclusion limits**.

