

SUSY Searches in the $Z+Jets+\cancel{E}_T$ Final State in 7 TeV Collisions with the Jet-Z-Balance Method

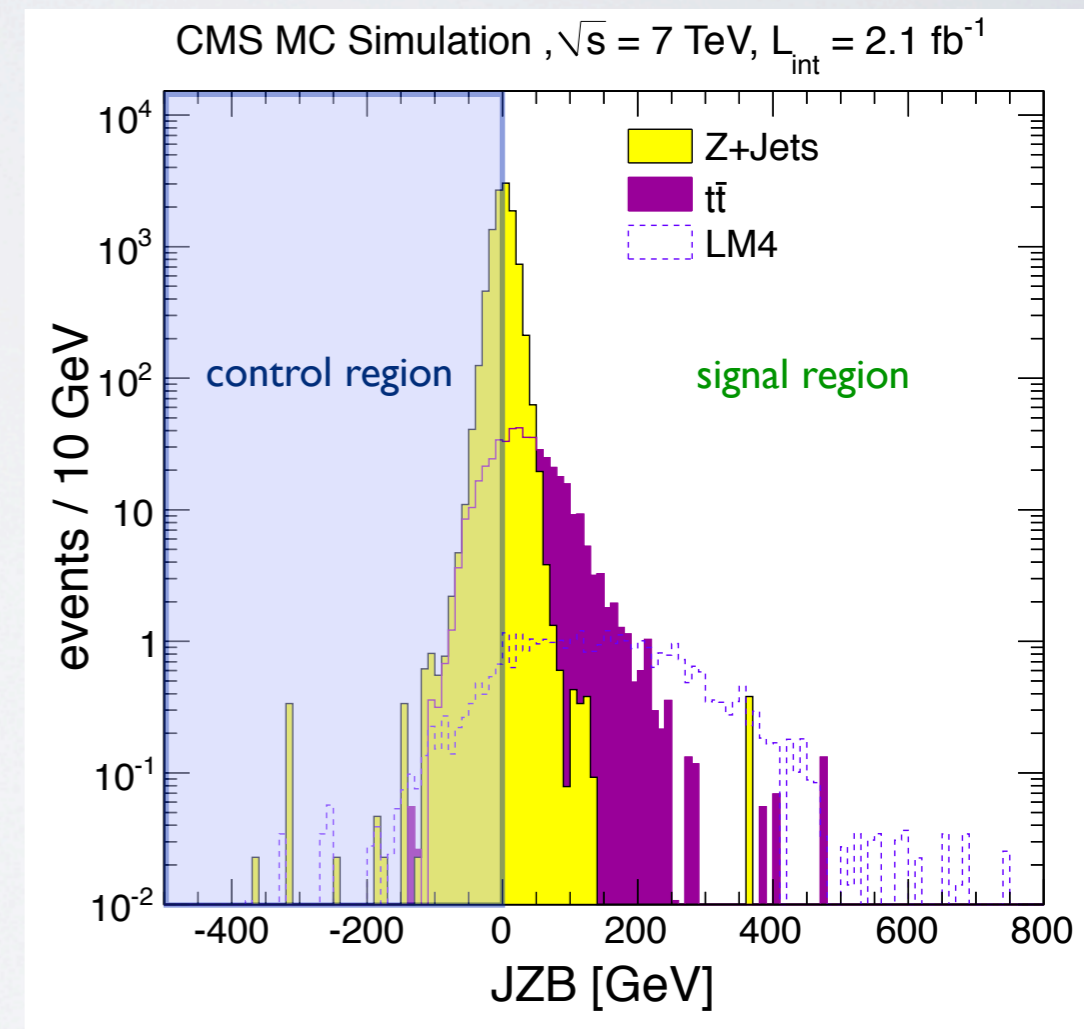
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for the
CMS Collaboration

Work in progress

JET-Z BALANCE

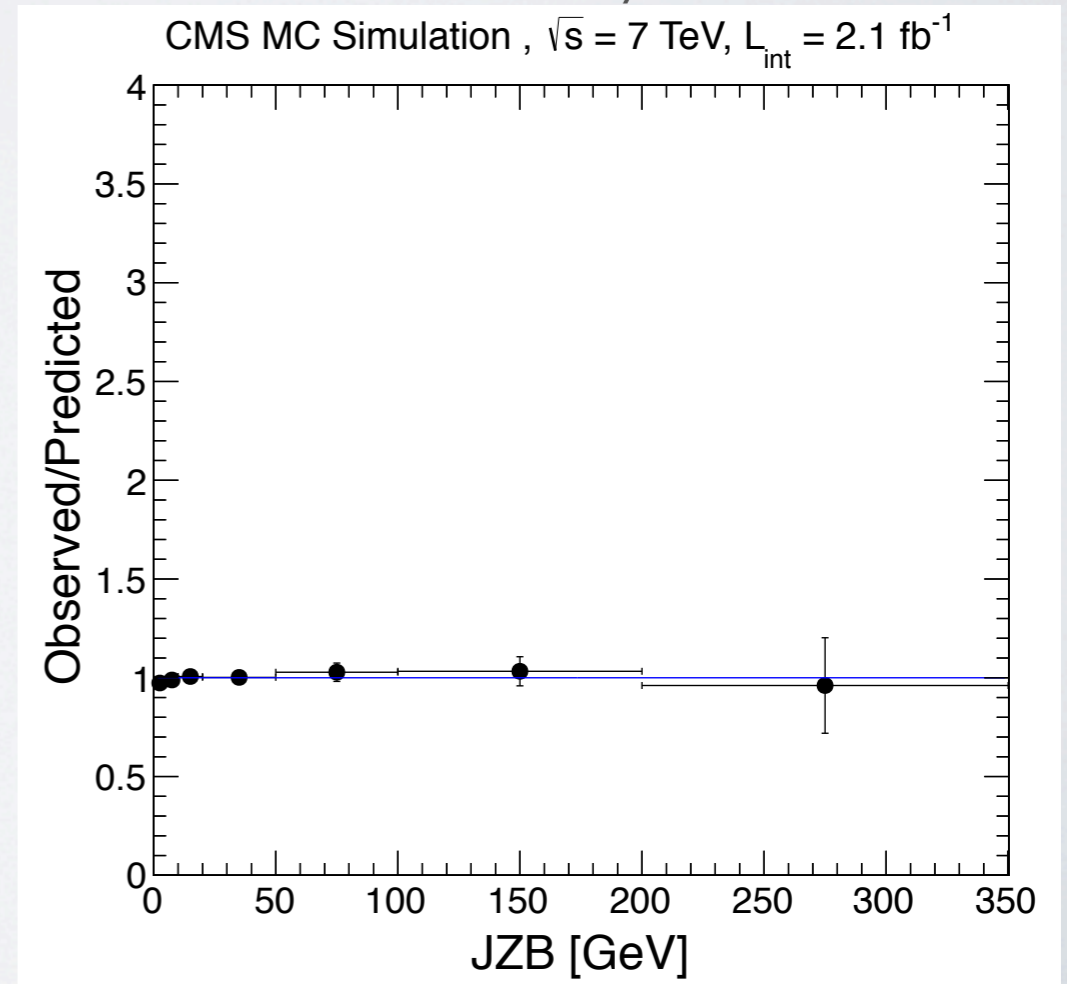
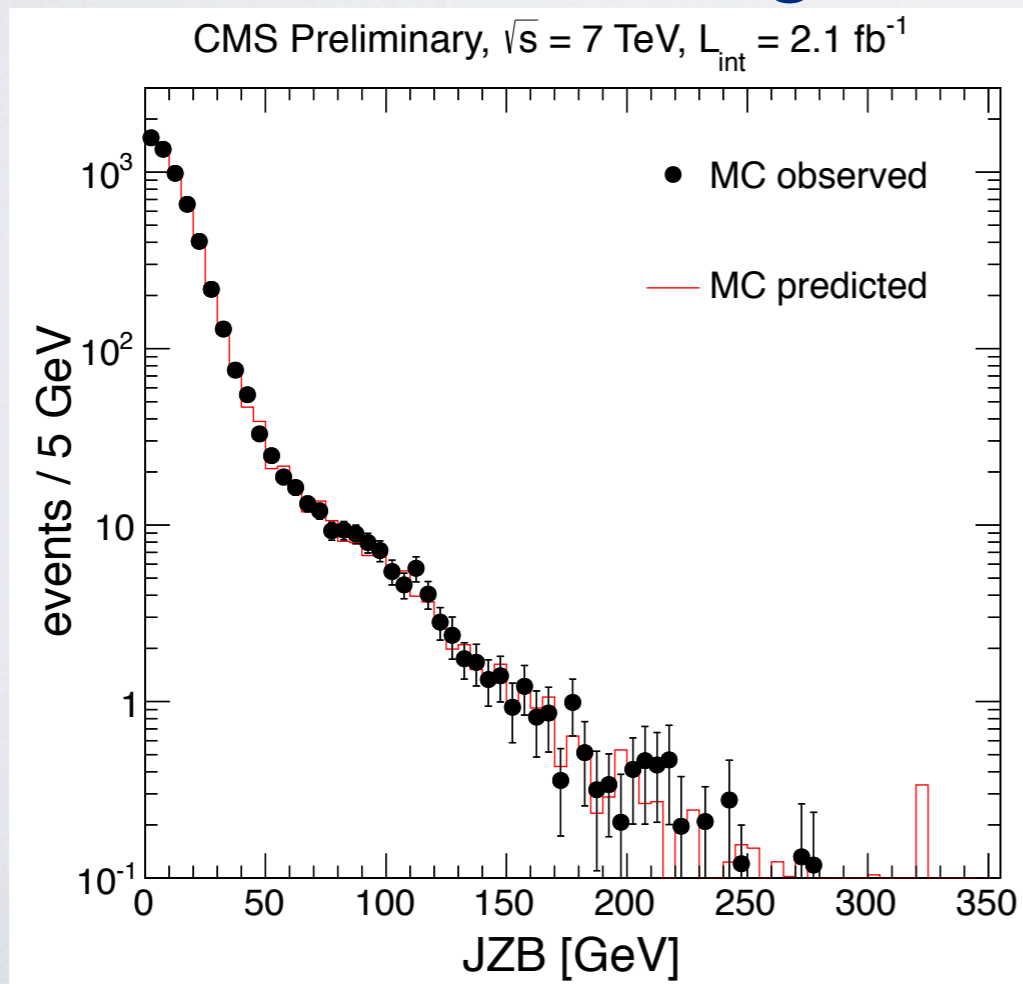
- Search in the Z +Jets+MET final state (clean signature for new physics searches), with $Z \rightarrow ee$ or $\mu\mu$
- Selecting events with ≥ 3 jets and two leptons with a m_{ll} in Z peak region
- Two major backgrounds:
 - Z +Jets with artificial MET
 - Top decays with accidental m_{ll} mass
- Define JZB

$$JZB = \left| \sum_{jets} \vec{p}_T \right| - |\vec{p}_T^Z|$$
- High discriminative power
- Z +Jets evenly populate left and right side
- Use **data control samples**



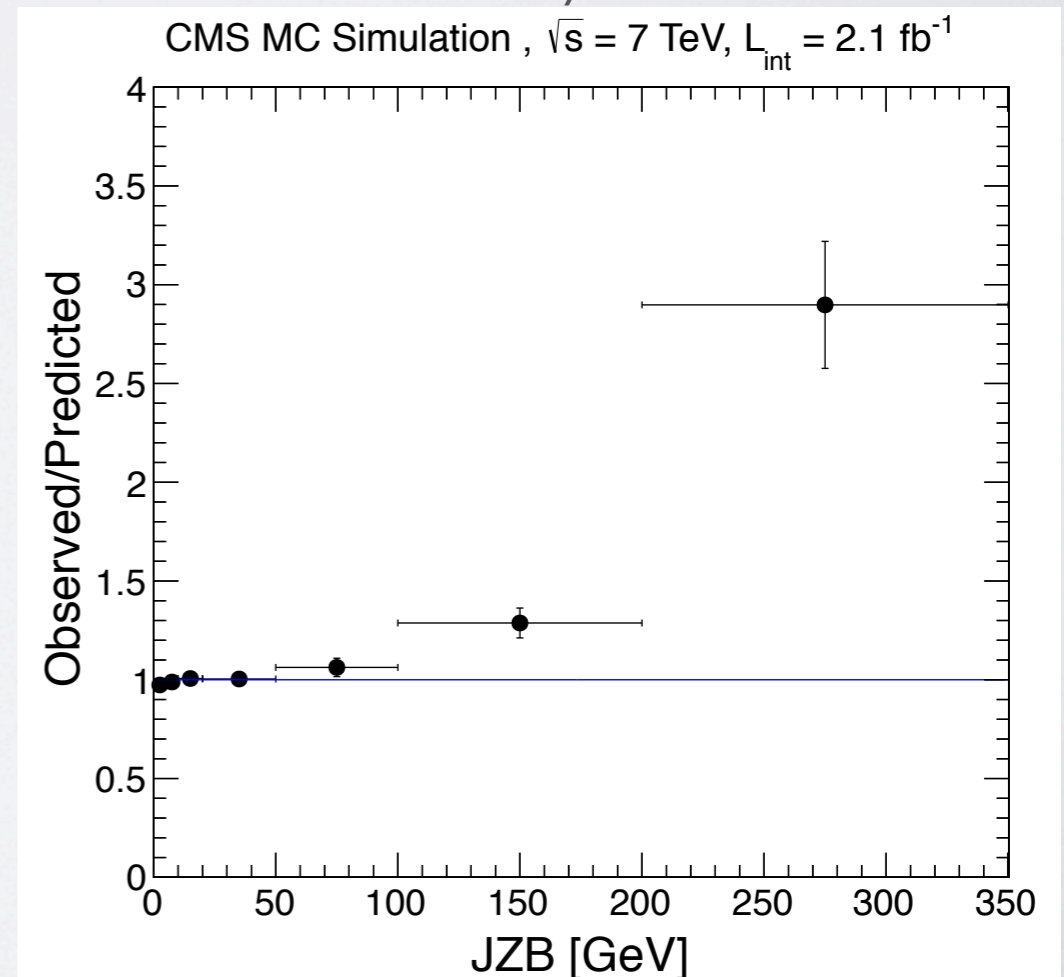
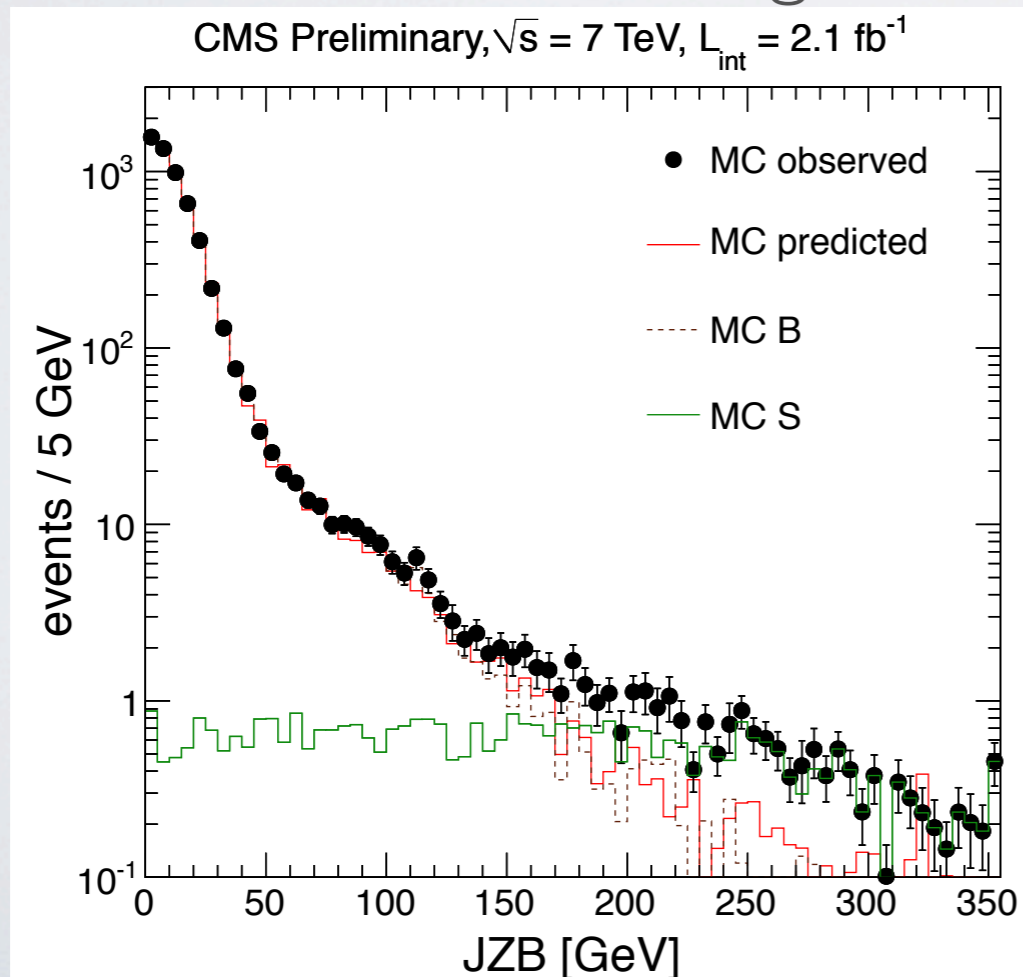
JET-Z BALANCE

- Background prediction:
 - Consists of two components, background *with* a Z and bg *without* a Z
 - B w/o Z prediction based on three control samples to improve statistics
- Compare prediction with observation
- Do this three times: **SM backgrounds**, SM + SUSY, and finally data



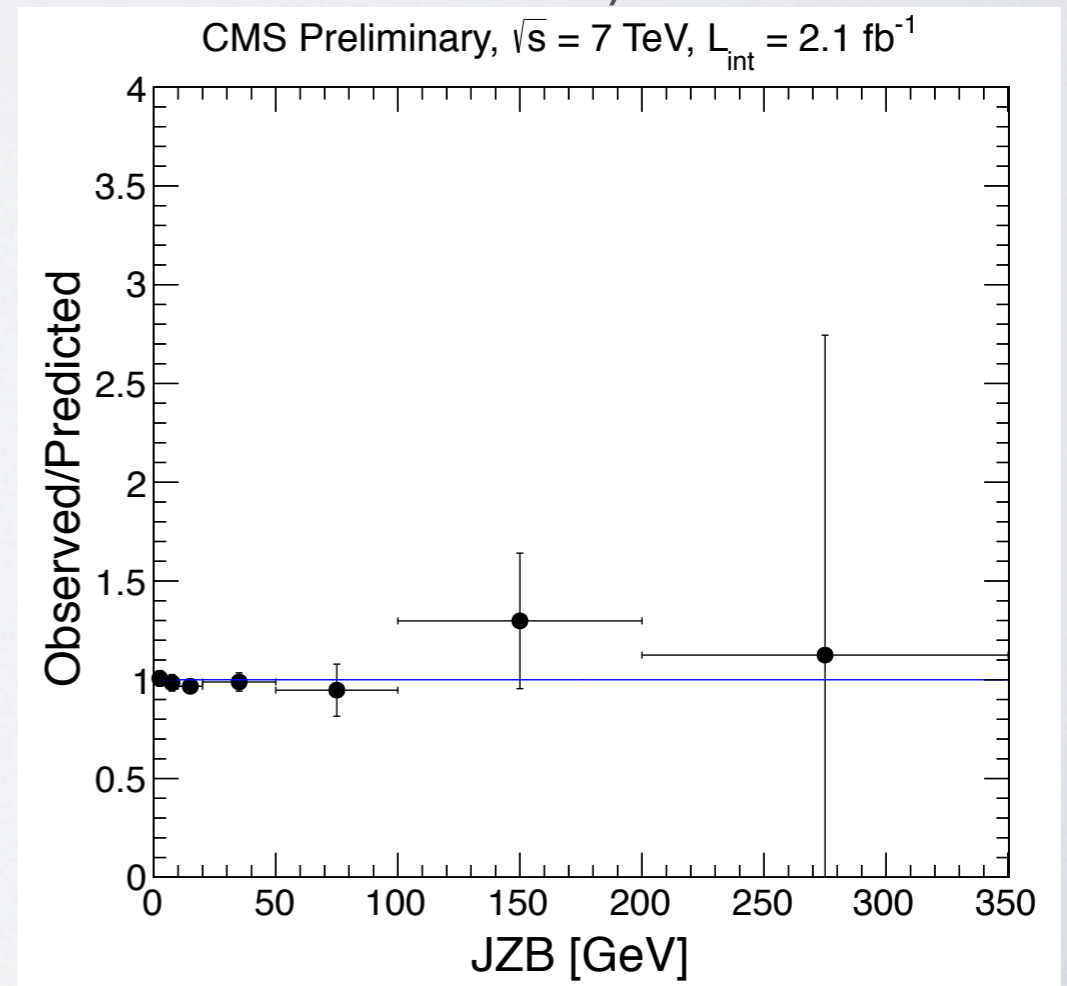
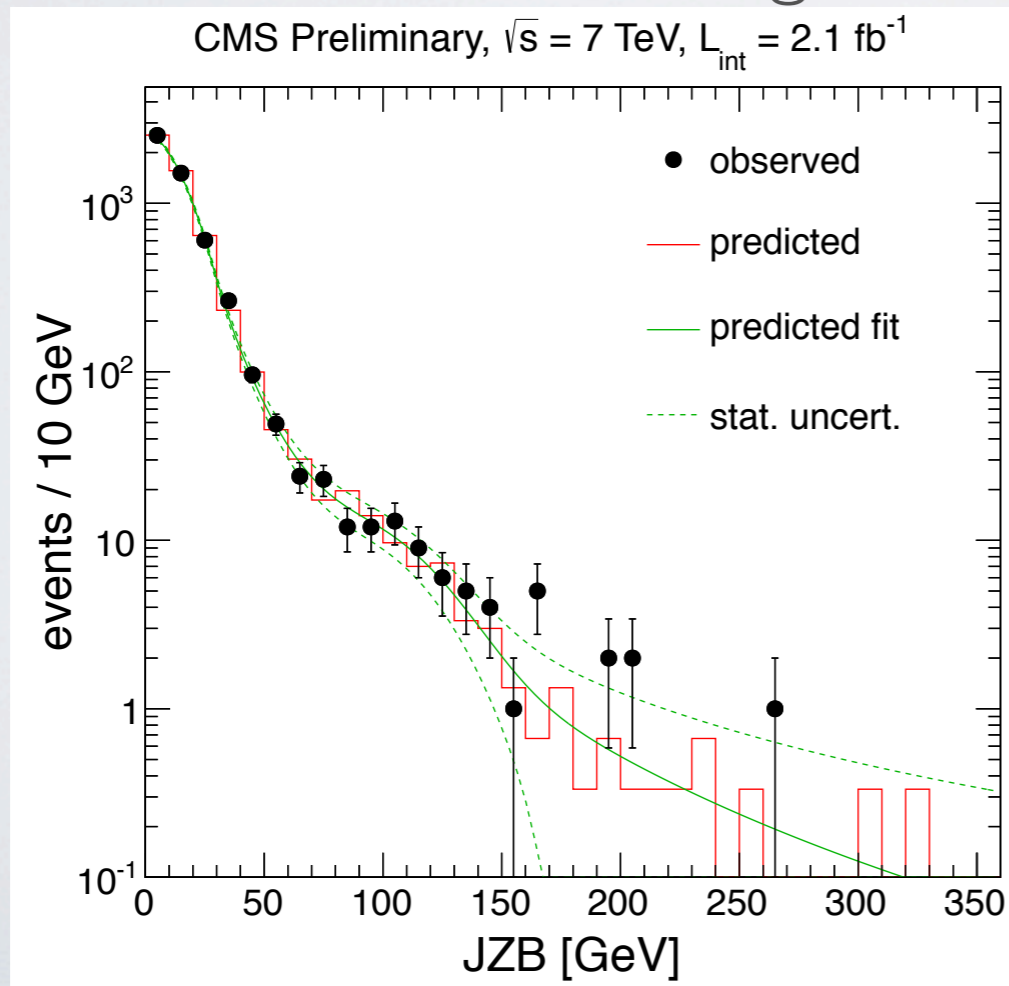
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JET-Z BALANCE

- Define three search regions ($JZB > 50, 100, 150$ GeV) for which the predicted and observed yields are compared:

Region	Observed events	Prediction
$JZB > 50$ GeV	168	164 ± 10 (stat) ± 42 (sys)
$JZB > 100$ GeV	48	37 ± 4 (stat) ± 10 (sys)
$JZB > 150$ GeV	11	7.0 ± 1.5 (stat) ± 2.1 (sys)

- In the absence of any significant excess, upper limits are set on two benchmark points

Scenario	$JZB > 50$ GeV	$JZB > 100$ GeV	$JZB > 150$ GeV	cross section
LM4	7.4 pb	3.8 pb	1.9 pb	2.53 pb
LM8	7.9 pb	4.2 pb	2.0 pb	1.03 pb

Ref: [PAS-SUS-11-019: Search for Physics Beyond the Standard Model in Z+Jets+MET events at the LHC \(2.1 fb⁻¹\)](#)
[PAS-SUS-11-012: Search for Physics Beyond the Standard Model in Z+Jets+MET events at the LHC \(191 pb⁻¹\)](#)
[PAS-SUS-10-010: Search for Physics Beyond the Standard Model in Z+Jets+MET events at the LHC \(34 pb⁻¹\)](#)

BACKUP

CONTROL REGIONS

- Split up according to relative lepton flavor and dilepton mass:
- Define 20 GeV Z mass peak window ($|m_{ll} - m_Z| < 20$ GeV) and sidebands
- The three control regions for the top production prediction are:
 - Opposite flavor, m_{ll} in Z mass peak
 - Same flavor, m_{ll} in sidebands
 - Opposite flavor, m_{ll} in sidebands
- Control region for the Z +Jets estimate: same flavor Z peak $J_Z B < 0$ region
- Compare prediction with observation

SYSTEMATICS

Table 2: Summary of systematic uncertainties on the Monte Carlo simulation signal efficiency. Uncertainties on model-dependent efficiencies are indicated as ranges.

Source	Uncertainty [%]
Trigger efficiency	5
Lepton selection efficiency	2
Luminosity	4.5
Jet energy scale	3 – 6
JZB scale uncertainty	3 – 14
JZB Resolution	2 – 15
PDF uncertainty	< 3