

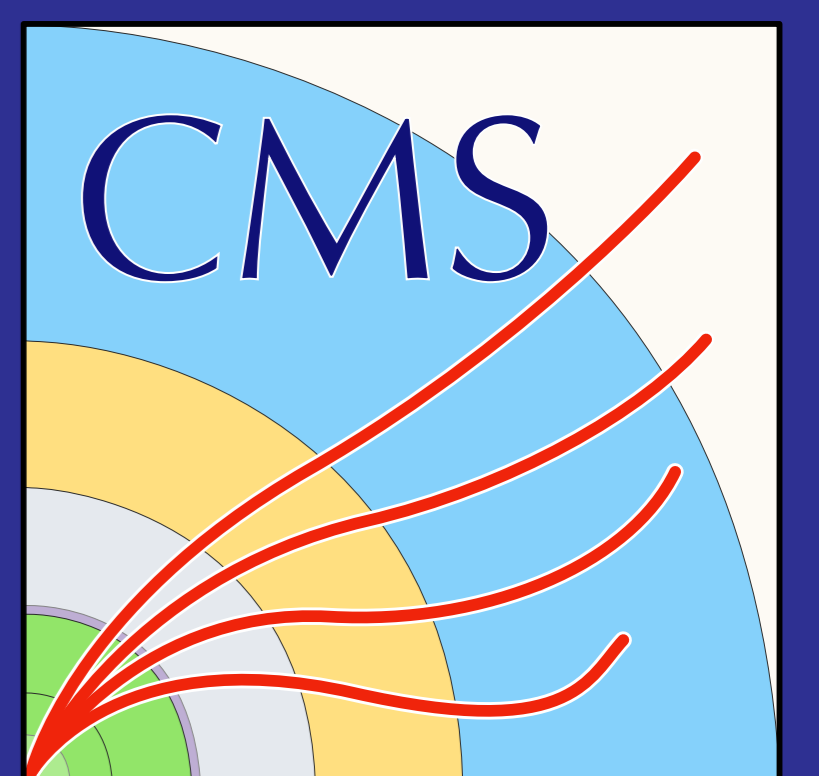
UNIVERSIDAD DE OVIEDO

SUSY searches with two opposite-sign same-flavor leptons at CMS

Probing the ATLAS excess in the on-Z region

S. Sánchez Cruz
on behalf of the CMS Collaboration

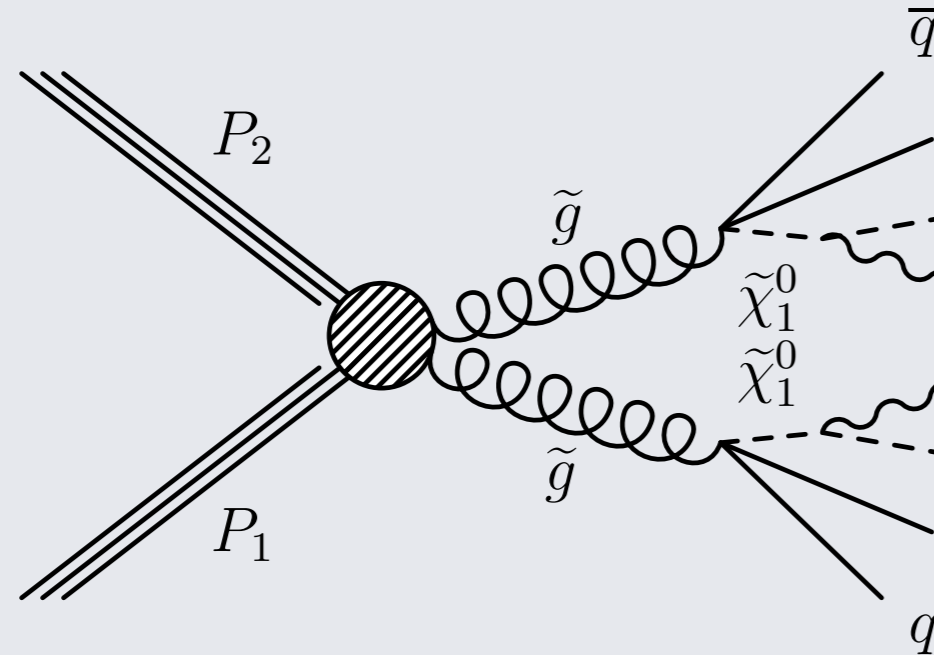
38th International Conference
on High Energy Physics



Introduction

A search for SUSY in events containing **two leptons** (muons and electrons), jets and missing transverse momentum in a dataset of 12.9 fb^{-1} $\sqrt{s} = 13 \text{ TeV}$ pp collisions.

- ▶ The pair of reconstructed leptons is required to be **compatible with the decay of a Z boson** ($91 \text{ GeV} < M_{\ell\ell} < 101 \text{ GeV}$)
- ▶ Search for such topology is motivated by SUSY models involving the production of a real Z boson produced in the decay of a neutralino



Previous analyses

- ▶ Such searches have been performed by the CMS [2] and ATLAS [3,4] Collaborations in $\sqrt{s} = 8 \text{ TeV}$ and 13 TeV
- ▶ Searches performed by CMS were **compatible with SM expectations**
- ▶ The ATLAS Collaboration reported a 3σ excess in Run I and 2.2σ with Run II data

Search strategy and event selection

- ▶ The aim of this search is to further explore the excesses
- ▶ Jet-Z Balance (JZB), an **alternative Drell-Yan estimation method**, is used
- ▶ Events are selected using dilepton triggers and required to have
- ▶ Two leptons with opposite-sign same-flavour and $p_T > 50$ (25) GeV
- ▶ At least two jets $p_T > 35 \text{ GeV}$
- ▶ $\Delta\phi_{\text{jet}, E_T^{\text{miss}}} > 0.4$

SM backgrounds in the search

Flavour-symmetric backgrounds

- ▶ Processes in which an electron or a muon are equally likely to be produced
- ▶ Dominant SM background, mainly $t\bar{t}$ pair production
- ▶ **Estimated in the opposite-flavour channel** and corrected for the different trigger and identification efficiencies between electrons and muons

Drell-Yan + jets

- ▶ Estimated using the **JZB method** and E_T^{miss} templates from a γ +jets data sample

Other rare SM processes

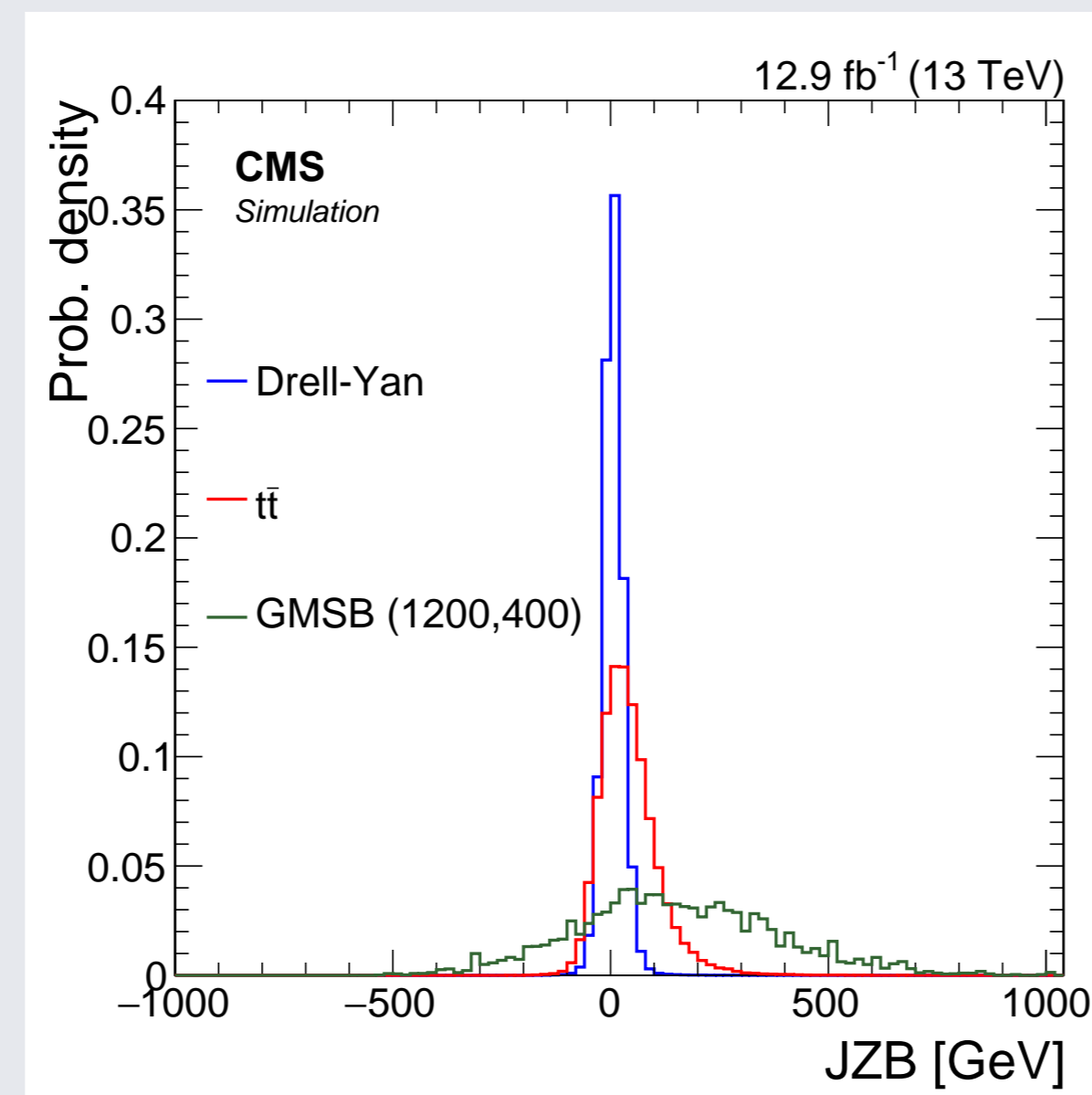
- ▶ Obtained using Monte Carlo **simulations**

JZB method

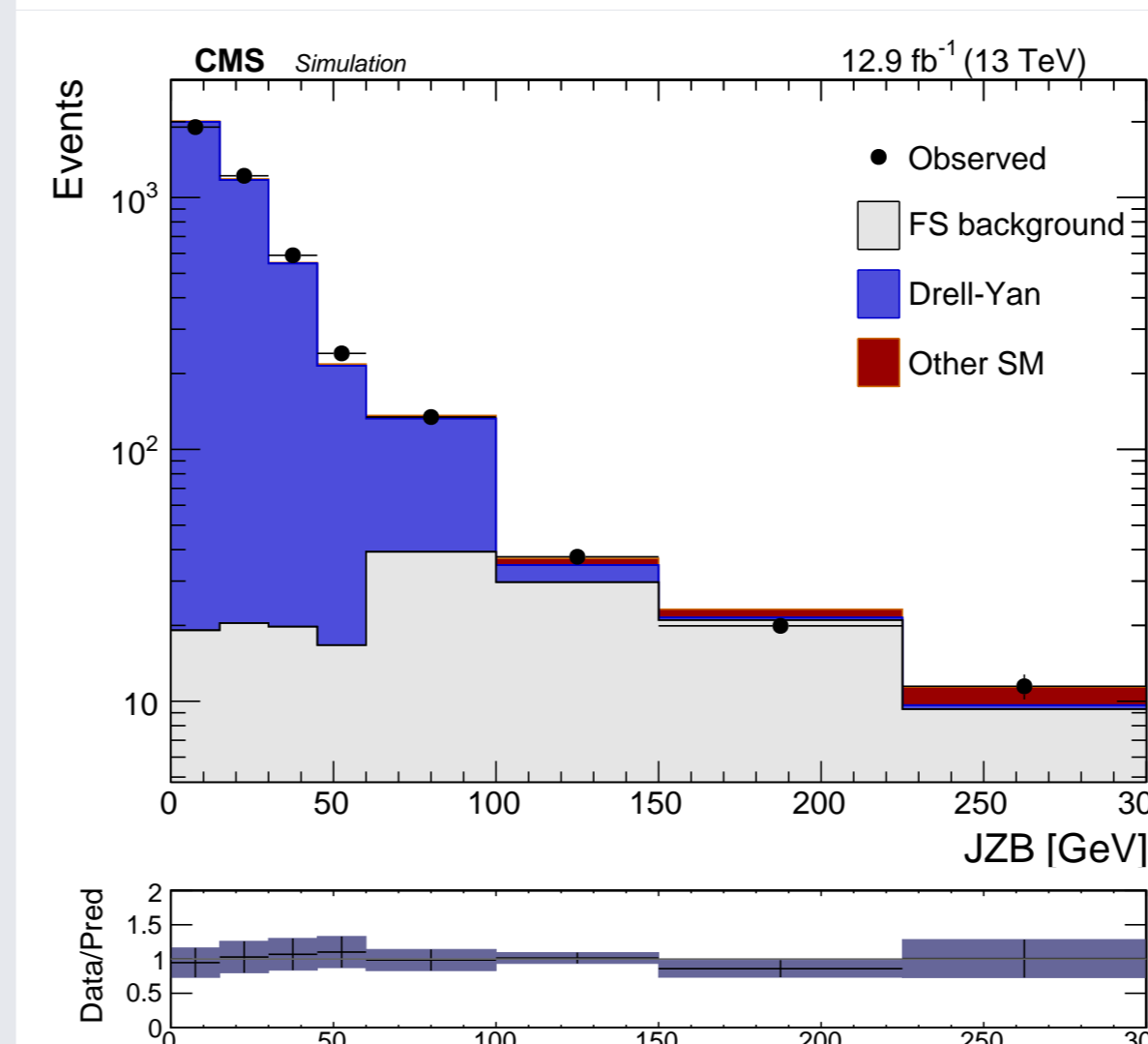
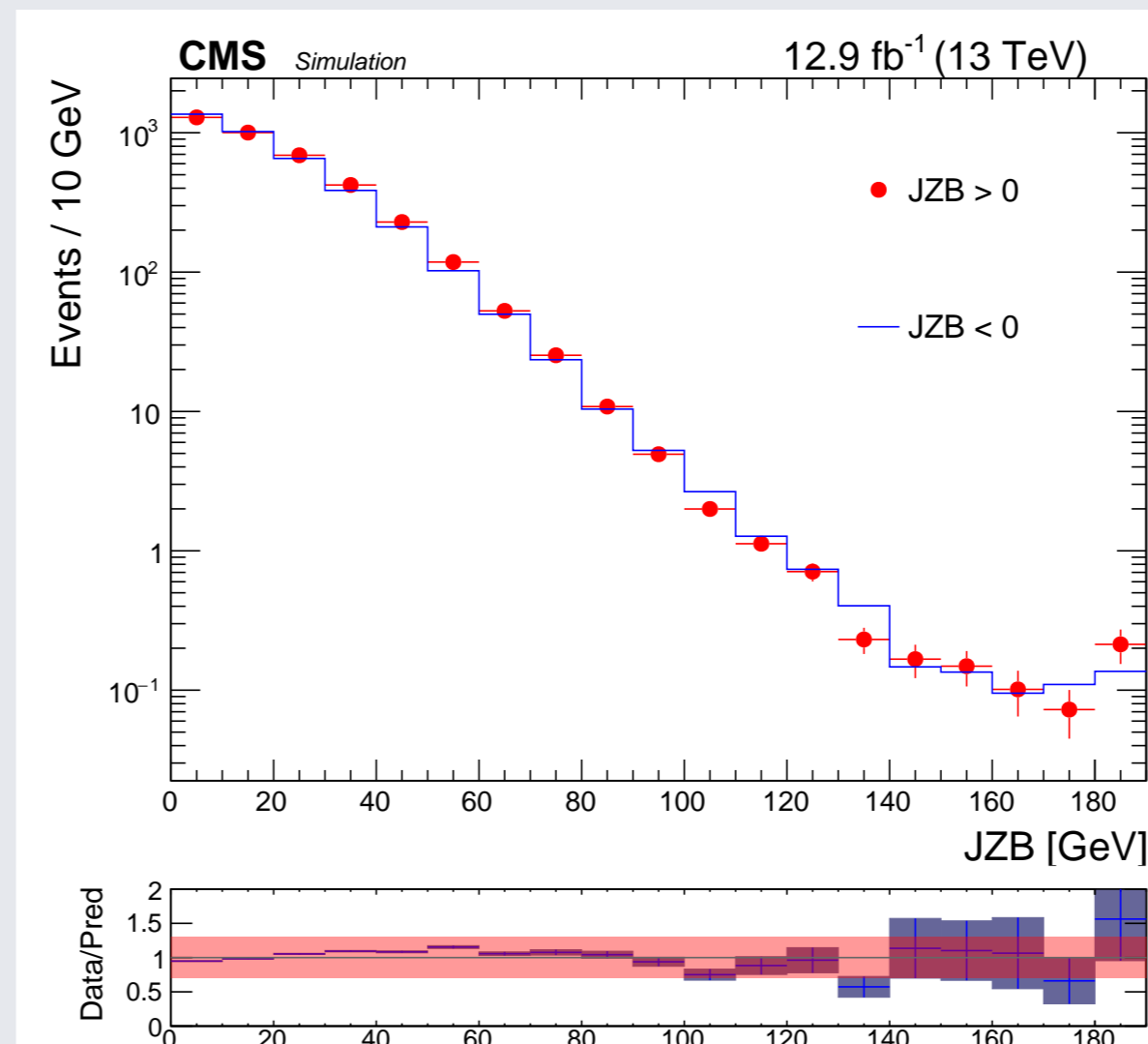
- ▶ JZB is a **measure** of the **momentum unbalance** of an event

$$\text{JZB} = \left| \sum_{\text{jets}} \vec{p}_T - |\vec{p}_T^{\text{lept}}| \right|$$

- ▶ Symmetrically distributed around zero for Drell-Yan
- ▶ Shifted to positive values for $t\bar{t}$ and signal
- ▶ Drell-Yan contribution is obtained from $\text{JZB} < 0$



Closure tests



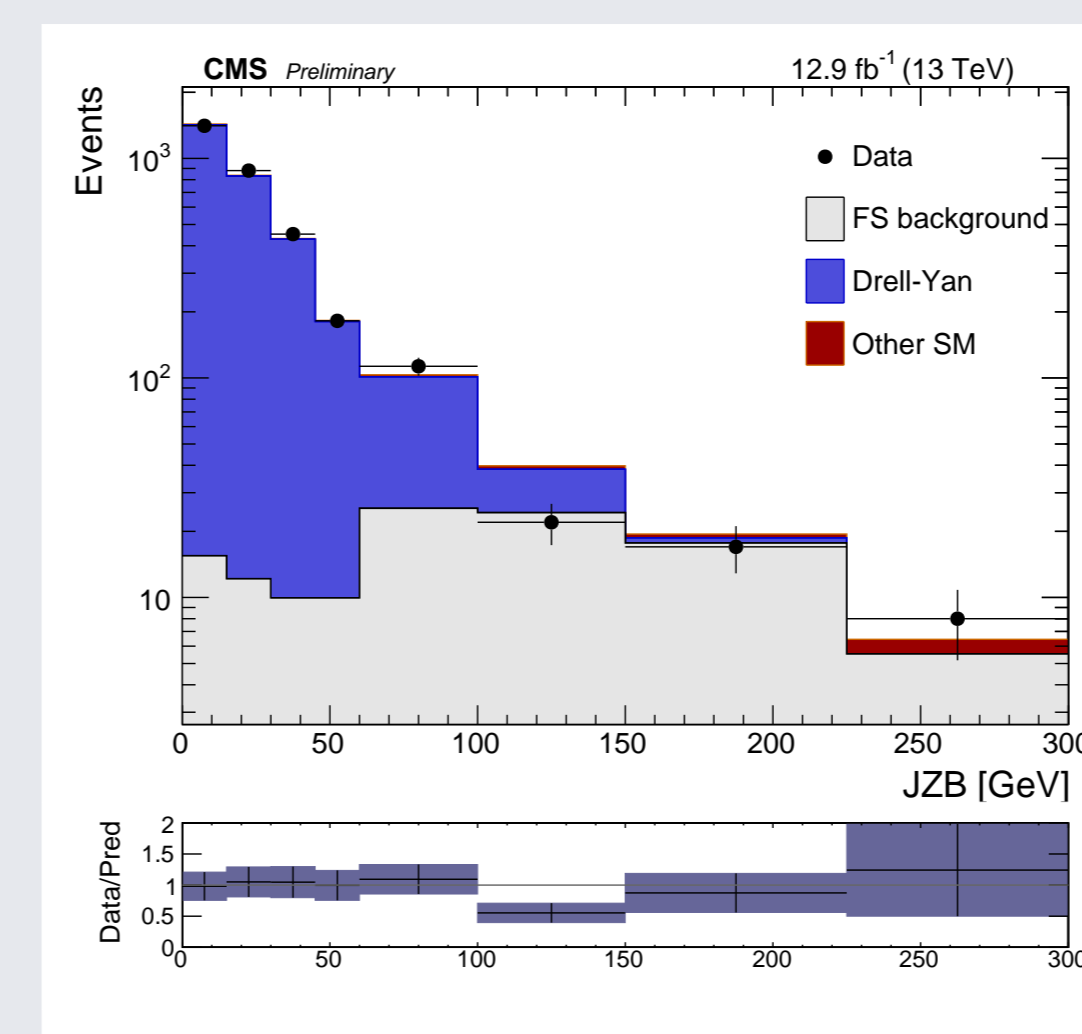
- ▶ **JZB symmetry** is checked in Drell-Yan simulations
- ▶ Overall good agreement
- ▶ Residual differences in the tails, dominated by the statistical precision of the MC sample
- ▶ 30% systematic uncertainty assigned to account for them

- ▶ **Full closure** test of the data-driven estimation methods
- ▶ Clear agreement within systematic uncertainties

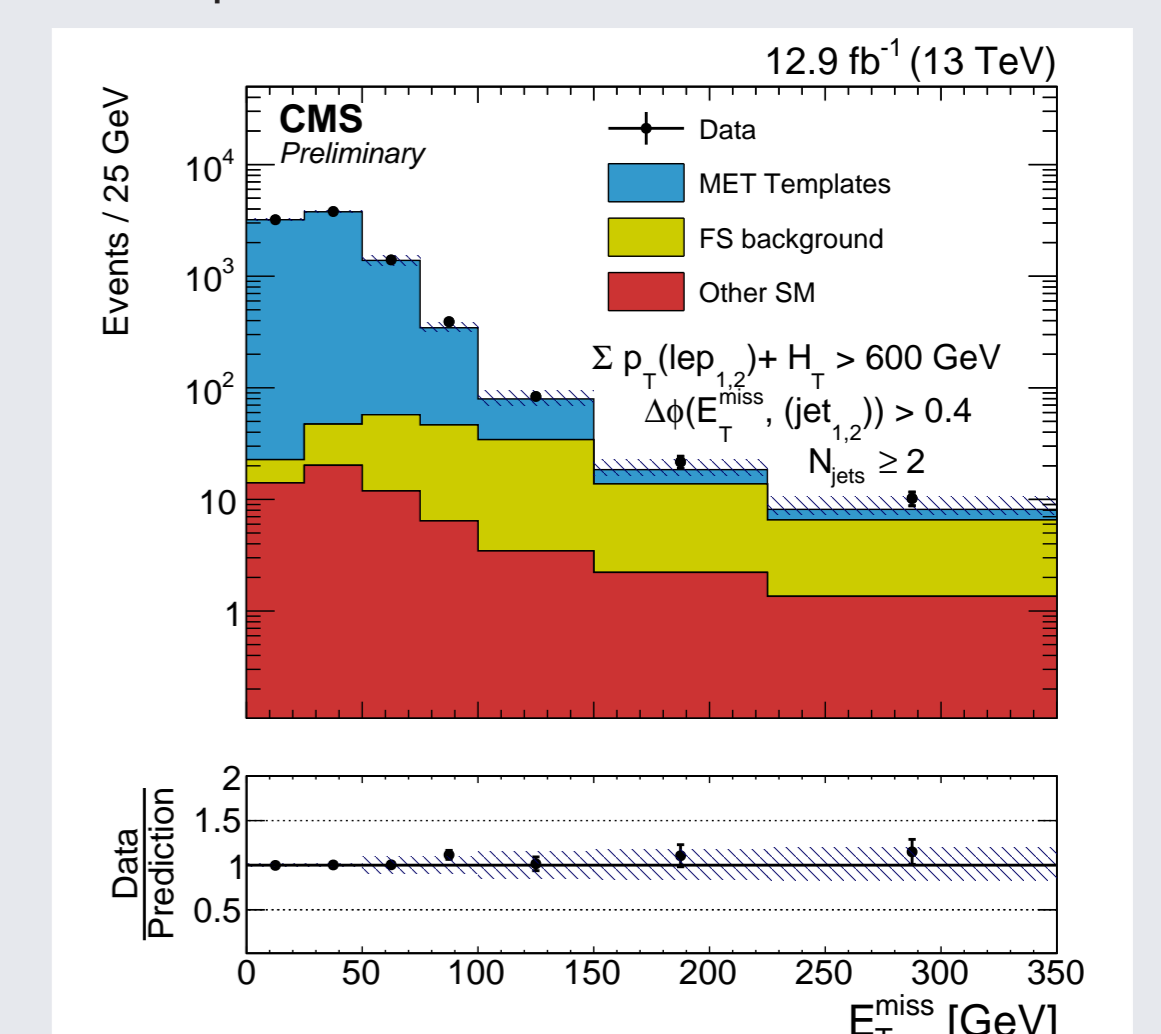
Results

- ▶ Results are **compatible with background hypothesis** for the baseline MET templates region and with the new signal region using the JZB method
- ▶ No clear sign of any excess due to BSM processes

New result with JZB method



E_T^{miss} templates baseline result



FS estimate	4.4	+3.5	-2.1
Drell-Yan like	0.0	+1.8	-0
Other SM	1.7	+0.8	-0.8
Total background	6.1	+4.0	-2.2
Observed	8.0		

Observed events with $\text{JZB} > 225 \text{ GeV}$

Conclusions

- ▶ Momentum unbalance distribution **agrees with the SM expectations**
- ▶ No evidence for BSM physics has been found

References



[1] CMS - $\sqrt{s} = 13 \text{ TeV}$
 $\mathcal{L} = 12.9 \text{ fb}^{-1}$
CMS-SUS-16-021



[2] CMS - $\sqrt{s} = 13 \text{ TeV}$
 $\mathcal{L} = 2.3 \text{ fb}^{-1}$
arXiv:1607.00915



[3] ATLAS - $\sqrt{s} = 8 \text{ TeV}$
 $\mathcal{L} = 20.3 \text{ fb}^{-1}$
arXiv:1503.03290



[4] ATLAS - $\sqrt{s} = 13 \text{ TeV}$
 $\mathcal{L} = 2.3 \text{ fb}^{-1}$
ATLAS-CONF-2015-082