Search for new physics with a Z boson, jets, and E_T^{miss} at CMS (arXiv:1204.3774)

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1 Introduction

We search for physics beyond the standard model in events containing a leptonically decaying Z boson ($Z \to \ell^+\ell^-$, $\ell = e, \mu$), jets, and missing transverse energy (E_T^{miss}). The search is performed using 4.98 fb^{-1} of $\sqrt{s} = 7$ TeV data collected by the CMS experiment at the LHC in 2011. [1]

After selecting $Z \to \ell^+\ell^-$ ($\ell = e, \mu$), the main backgrounds include Z plus jets where the E_T^{miss} comes from jet mismeasurement, dileptonic $t\bar{t}$ where the dileptons happen to fall in the Z mass window, and diboson processes.

The Z plus jets background is predicted using the E_T^{miss} templates method, flavor symmetric backgrounds (such as $t\bar{t}$) are predicted from opposite flavor ($e\mu$) events, and the diboson background (VZ) is taken from MC simulation.

2 E_T^{miss} Templates Method

This data-driven technique uses γ plus jets events as a control sample to predict the E_T^{miss} in Z plus jets, and is predicated on the fact that fake E_T^{miss} from jet mismeasurement can be parameterized in terms of the N_{jets} and scalar sum of jet p_T (H_T). The E_T^{miss} templates are E_T^{miss} plots in γ plus jets events binned in N_{jets} and H_T, normalized to unity. The prediction of the E_T^{miss} distribution in Z plus jets is formed by summing the templates which correspond to the N_{jets} and H_T in each Z plus jets event.

3 Results

The signal regions are formed by applying E_T^{miss} cuts as shown in the table, and most expected sensitivity comes from $E_T^{miss} > 100$, 200, and 300 GeV. Lower E_T^{miss} cuts are shown as a validation of the background predictions. The results shown here are for $N_{jets} \geq 2$; see the paper (arXiv:1204.3774) for $N_{jets} \geq 3$ results.

The background estimations described above are compared with observed yields and used to derive model independent upper limits (UL) on new physics contributions. Uncertainties include both statistical and systematic contributions. For the observed yield (data), the first (second) number in parentheses is the yield in the *ee* ($\mu\mu$) final state. Background predictions agree with data: no evidence for new physics.

We show yields for two example cMSSM model points (LM4 and LM8), both of which are ruled out.

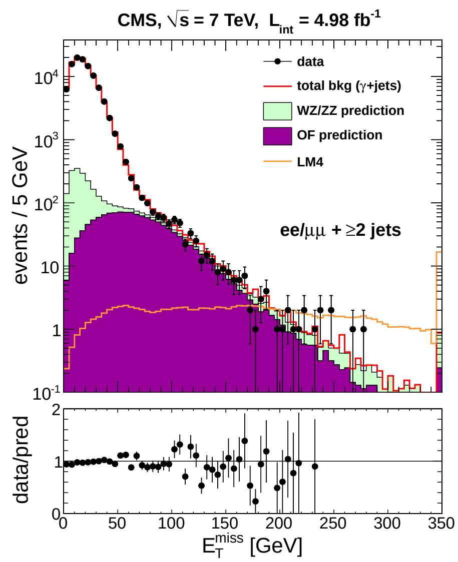

Figure 1: Data and background predictions as a function of E_T^{miss}.

References

[1] S. Chatrchyan *et al.* [CMS Collaboration], arXiv:1204.3774 [hep-ex].

	$N_{\rm jets} > 30$ GeV	$N_{\rm jets} > 60$ GeV	$N_{\rm jets} > 100$ GeV	$N_{\rm jets} > 200$ GeV	$N_{\rm jets} > 300$ GeV
Z bkg	15070 ± 4825	484 ± 156	36 ± 12	2.4 ± 0.9	0.4 ± 0.3
OF bkg	1116 ± 101	680 ± 62	227 ± 21	11 ± 3.2	1.6 ± 0.6
VZ bkg	269 ± 135	84 ± 42	35 ± 17	5.3 ± 2.7	1.2 ± 0.7
Total bkg	16455 ± 4828	1249 ± 174	297 ± 30	19 ± 4.3	3.2 ± 1.0
Data	16483 (8243,8240)	1169 (615,554)	290 (142,148)	14 (8,6)	0
Observed UL	9504	300	57	8.3	3.0
Expected UL	9478	349	60	11	4.6
LM4	120 ± 7.0	108 ± 6.7	93 ± 6.6	53 ± 7.3	24 ± 6.2
LM8	52 ± 3.2	46 ± 3.0	37 ± 2.8	21 ± 2.8	9.1 ± 2.3