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Search for new physics with same-sign isolated dilepton events in CMS

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Summary. — An inclusive search for the presence of new physics in events with two isolated same-sign leptons, using the first 4.98 fb^{-1} of CMS data taken in 2011 is presented. The topology is sensitive to many models beyond the standard model like supersymmetric models, extra dimensions, heavy Majorana neutrinos and double-charged Higgs. No excess of data with respect the Standard Model predictions is seen and the results are interpreted as limits on the parameters of the CMSSM model.

PACS 12.60.Jv – Supersymmetric models.
PACS 14.80.Ly – Supersymmetric partners of known particles.
PACS 13.85.Rm – Limits on production of particles.

One of the main goal of LHC is the discovery of new physics (NP) beyond the standard model (BSM). Many strategies to get a hint of NP have been proposed and studied: one of these is to search for events in which two same-sign leptons are present [1]. The production of two leptons with the same charge is very rare in the Standard Model, while it is present in many BSM models, as supersymmetric (SUSY) models, universal extra dimensions models or models with heavy Majorana neutrinos. This paper presents searches for NP in events with two same sign isolated leptons (including ee, $e\mu$, $\mu\mu$, $e\tau$, $\mu\tau$ and $\tau\tau$), missing transverse energy and hadronic activity in the final state on an integrated luminosity of 4.98 fb^{-1}, collected with the CMS detector [2, 3]. To maximize the sensitivity to the presence of NP, four search regions in the (H_T, E_T^{miss}) plane have been defined, where the presence oh high hadronic activity H_T is sensitive to the production of colored *sparticles*, while the presence of missing energy is sensitive to the presence of massive stable particles.

A comparison between observation and background prediction is performed in each region. Leptons that pass the selection can be divided into two categories: background, or *fake leptons*, from either heavy-flavor decays or hadron misidentification; signal, or *prompt leptons* from W, Z or NP particles decays. From this definition, we can categorize the background in three different categories and evaluate it using different techniques. Irreducible background from rare SM processes in which two prompt leptons are present

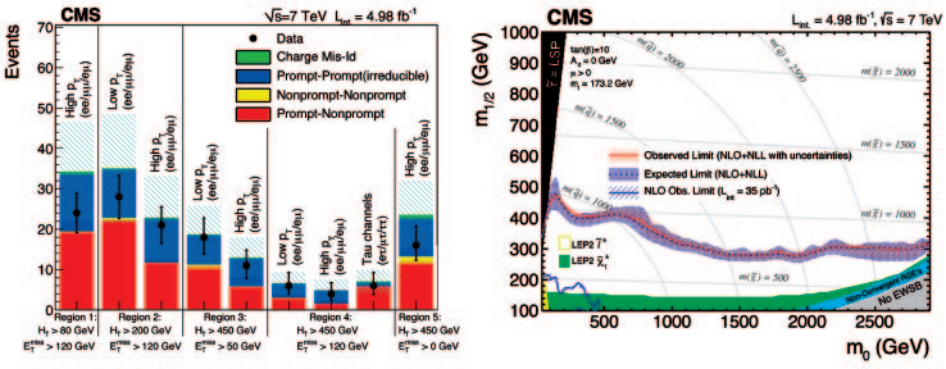

Fig. 1. – Predictions for the different sources of background events, compared with the observations in the various search regions (left) and exclusion region for the CMSSM model in the $(m_0, m_{1/2})$-plane is shown (right).

are estimated using MC simulation and a 50% systematic uncertainty is associated to it. Events with *fake leptons*, mainly originating from jets have been evaluated using a data driven technique, by which the probability that a fake lepton passes the selection is measured in a control sample with loose lepton selection requirements. Finally background events with two opposite sign leptons in which one of these is reconstructed with a wrong charge have been estimated by measuring the charge mis-identification rate from same-sign dielectron or ditau events in the Z mass peak. These various background estimation methods have been tested in background dominated regions, where good agreement have been found between observation and prediction. In fig. 1 (left) the background predictions in the various search regions are shown and compared with the observations.

No excess of observed events is seen compared with the predicted background events, so that these results, together with the uncertainty on the signal acceptance have been used to exclude a region in the $(m_0, m_{1/2})$-plane in the contest of the CMSSM model (*Constrained Minimal Supersymmetric extension of the Standard Model*) [4]. The excluded region is shown in fig. 1 (right).

REFERENCES

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