Search For New Physics with same-sign isolated dilepton events with jets and missing transverse energy at LHC

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Motivation:
- This search is motivated by the fact that events with same-sign isolated lepton pairs from hadron collisions are very rare in Standard Model but appear very naturally in many new physics scenarios.
- Moreover the requirement of a large hadronic activity is expected for new physics signals with the largest cross sections.

One example of New Physics scenarios is Supersymmetry, in which the probability for a Tau lepton passing the loose selection to go to a Tau lepton is measured in QCD multi-jet events as a function of the tau pT and pseudo-rapidity.

The isolation is included in the loose selection, so the bias due to different physics environment is expected to be reduced for two classes of events:
- No NN identification
- No dependence on the jet flavor

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The probability for a Tau lepton passing the loose selection to pass also the tight one is measured in QCD multi-jet events as a function of the tau pT and pseudo-rapidity.

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Main systematics:
- It has been possible by using few different strategies

- No dependence on the jet flavor
- No NN identification

Background from mis-measurement of the electron charge

The charge can be contaminated due to correlated photons from e+e- interactions.

The probability for this is taken into account and demonstrated to be under control by a systematic uncertainty of 50%.

50% of systematic uncertainty due to limited statistics to validate the method.

No excess over SM prediction

Set Upper Limit to the event number

Efficiency model

Lepton reconstruction efficiencies and MET, Higgs resolution are provided so that any model can be tested with these results.

An integrated luminosity of 35 fb\(^{-1}\) collected at LHC in 2010 has been used in these searches.

The variable H\(_{\ell}\) (defined as the sum of the transverse energy of jets with pT > 30 GeV) is used as an indication of the hadronic activity.

fake leptons: defined as leptons coming neither from vector bosons nor from new physics particles.

Combining activity around the lepton candidate as measured by ECAL, HCAL and tracker system.

The main background contributions are due to fake leptons and are estimated with data-driven methods.

Background from SM with same sign leptons in the final state

qq → WZ, ZZ

qq → q\bar{q} W, W\bar{W}

t\bar{t} W

VV

Double Parton Scattering: 2 × (qq → W\pm)

They constitute only few percents for each channel estimated from MC. A systematic uncertainty of 50% is assigned.

To identify the intermediate states, the hadronic activity around the lepton candidate is used as an independent check of the hadronic activity.

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