The Compact Muon Solenoid Experiment

Conference Report

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Large Extra Dimensions search in the photon + MET final state in pp Collisions at $\sqrt{s} = 13$ TeV at CMS in LHC

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Abstract

Techniques and results for searching graviton production predicted by the ADD large extra dimensions model in a final state with a photon and missing transverse energy in pp collisions at $\sqrt{s} = 13$ TeV is presented. Data collected by the CMS experiment at the CERN LHC in 2016 corresponding to an integrated luminosity of 12.9 fb⁻¹ is used for the analysis. No excess from Standard Model prediction in this final state observed as yet. Current limits on parameter space are extended.

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Abstract. Techniques and results for searching graviton production predicted by the ADD large extra dimensions model in a final state with a photon and missing transverse energy in pp collisions at $\sqrt{s} = 13$ TeV is presented. Data collected by the CMS experiment at the CERN LHC in 2016 corresponding to an integrated luminosity of 12.9 fb^{-1} is used for the analysis. No excess from Standard Model prediction in this final state observed as yet. Current limits on parameter space are extended.

Keywords: LHC,CMS,Monophoton,ADD

1 Introduction

One of the proposed solutions to the hierarchy problem, is ADD extra dimensions which postulates that there exist n compactified extra dimensions, in which gravitons can propagate freely. In LHC they can be created in proton-proton collisions.

2 Event Selection

The analyzed data sample corresponds to an integrated luminosity of 12.9 fb^{-1} . A single-photon trigger is used that requires at least one photon candidate with $p_T > 165 \text{ GeV}$. The photon candidate is identified by requiring H/E(Hadronic over Electromagnetic calorimeter energy deposit) to be below 0.1 to reject jets. Events require at least one Barrel photon ($|\eta| < 1.44$) with $p_T > 175 \text{ GeV}$ and Missing $E^T(\text{MET}) > 170 \text{ GeV}$. Photon and MET must be separated by minimum 2 radians in ϕ .

Events are rejected if the minimum opening angle between MET and up to four leading jets ($\min \Delta\phi(p_T \text{ miss, jet})$) is less than 0.5. This requirement suppresses the background where jet energy mismeasurement gives rise to large MET. Event is rejected if it contains an electron or a muon with $p_T > 10 \text{ GeV}$ that is away from the photon by $\Delta R > 0.5$.

3 Background Estimation

Bulk of the background($\sim 70\%$) comes from $Z(\rightarrow \nu\nu)+\gamma$ and $W(\rightarrow l\nu)+\gamma$ processes leading to large MET and γ when neutrino escapes detection and lepton may be outside detector acceptance region or not identified. Electrons fake photons when the pixel seed is missing. Jets fake photons when a π_0 decaying to two photons is misidentified as a single photon. Beam halo (when a muon travelling with the beam emits a photon due to bremsstrahlung) and ECAL spikes (anomalous ECAL signals) are also significant contributors.

4 Results

400 events are observed in data, which is in agreement with the total expected background of 414.6 ± 38 events. No excess with respect to the SM prediction is observed. Limits are set on the ADD extra dimension scenario.

Fig. 1. Upper left table compares data and MC. Upper right figure shows number of events as a function of photon pT. Bottom table lists limits for ADD model. [2]

References

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