PROCEEDINGS OF SCIENCE

# Search for new phenomena in events with a monojet and large $E_T^{miss}$ with the ATLAS detector

**Valerio ROSSETTI on behalf of the ATLAS collaboration**
*Institut de Fisica des Altes Energias - Barcelona*
*E-mail:* rossetti@ifae.es

This contribution reports preliminary results on a model independent search for new phenomena in events with a monojet and large missing transverse momentum. The data sample corresponds to 1 fb$^{-1}$ of integrated luminosity collected in 2011 with the ATLAS detector. Good agreement is observed between the data and the Standard Model predictions. The results are translated into limits on cross section times acceptance and into limits on a Large Extra Dimensions model.

*The 2011 Europhysics Conference on High Energy Physics-HEP 2011,*
*July 21-27, 2011*
*Grenoble, Rhône-Alpes France*

 

PoS(EPS-HEP2011)426

## 1. Introduction

Many theoretical models beyond the Standard Model lead to final states with a monojet signature. For example in the Arkani-Hamed, Dimopoulos, and Dvali (ADD) Large Extra Dimensions (LED) model [1] gravitons are produced in association with a parton and do not interact with the detector, which results in a monojet signature in the final state.

This contribution presents preliminary results by the ATLAS experiment on a search for new phenomena in pp collision events at $\sqrt{s} = 7$ TeV with a single hard jet plus large missing transverse momentum ($E_T^{miss}$) in the final state. An integrated luminosity of 1 fb$^{-1}$ has been used. More details on this analysis are given in [2] and in [3].

## 2. Object definition and event selection

For this analysis jets are reconstructed from calorimeter energy deposits using the anti-kt jet algorithm [4] with $R$=0.4 and calibrated with corrections retrieved from MC [5]. The $E_T^{miss}$ is reconstructed using all locally-calibrated energy deposits in the calorimeter up to pseudorapidity $|\eta|$ of 4.5 [6]. Events with identified leptons (electrons and muons) in the final state are rejected. Electrons (muons) candidates are required to have $p_T > 20$ GeV ($p_T > 10$ GeV) and $|\eta| < 2.47$ ($|\eta| < 2.4$) and to pass *medium* quality requirements as defined in [7] (*combined* requirements for muons as defined in [8]).

The events are collected using a trigger based on $\mathrm{E_T^{miss}}$ that is more than 98% efficient for events with $E_T^{miss} > 120$ GeV. Events have been selected accordingly to three sets of requirements:

- LowPt selection: $E_T^{miss} > 120$ GeV, one jet with $p_T > 120$ GeV and no other jets with $p_T > 30$ GeV
- HighPt selection: $E_T^{miss} > 220$ GeV, one jet with $p_T > 250$ GeV and no second jet with $p_T > 60$ GeV
- veryHighPt selection: $E_T^{miss} > 300$ GeV, one jet with $p_T > 350$ GeV and no second jet with $p_T > 60$ GeV

Events with a third jet with $p_T > 30$ GeV are rejected. Second jets with $p_T > 30$ GeV are required to have an azimuthal separation $\Delta\phi$ with the $E_T^{miss}$ larger then 0.5 .

## 3. Estimation of the background processes

The production of Z and W bosons in association with jets is the main source of background for this search analysis due to the presence of misidentified leptons and high $p_T$ neutrinos. In particular the process $\mathrm{Z}(\rightarrow \nu\bar{\nu})$ + jets is a dominant irreducible background. For this background contribution, samples of Alpgen MC [9] events are normalized with data driven scale factors retrieved in control samples, orthogonal to the signal regions, defined with identified electrons or muons.

The contribution of the QCD multijet background is estimated by extrapolating the second leading jet $p_T$ distribution below the threshold, in events with $\Delta\phi(2^{nd}\,jet, E_T^{miss}) < 0.5$. This contributes a 2% of the total background. The main source of non collision background comes from

high momentum beam-halo muons overlaid with genuine proton-proton collisions and has been estimated matching calorimeter clusters of energy and muon spectrometer tracks parallel to the beam direction. This constitutes a 1% to 2% of the total background.

## 4. Results

The number of events in data with the three selections are in agreement with the background expectations. Results are translated to 95% confidence level upper limits on cross section times acceptance. These limits for the LowPt, HighPt, and veryHighPt selections are respectively 1.7 pb, 0.11 pb, and 0.035 pb. The results are also interpreted in the ADD LED scenario for which $M_D$ values up to 3.2 TeV (up to 2.0 TeV) are excluded at the 95% confidence level in scenarios with 2 (with 6) extra dimensions, and are summarized in fig.1-right.

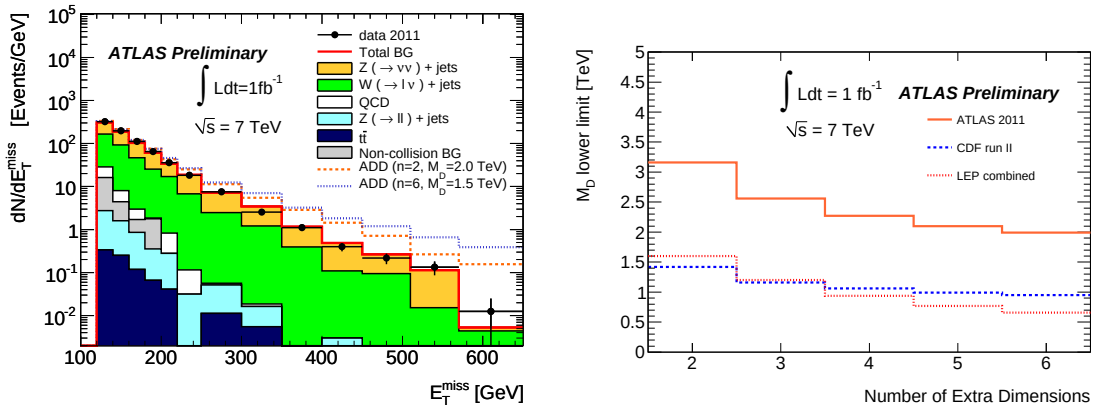


**Figure 1: Left** - $E_T^{miss}$ distribution for events passing the LowPt selection in data and for the simulated background processes. For illustration the ADD signal is added to the SM expectation. **Right** - Upper limits on $M_D$ extracted from the HighPt results. Both figures are from [2].

## References


[1] N.Arkani-Hamed, S.Dimopoulos and G.R.Dvali, Phys. Lett. B 429 263 (1998).

[2] The ATLAS Collaboration, ATLAS-CONF-2011-096 (2011). http://cdsweb.cern.ch/record/1369187

[3] The ATLAS Collaboration, Phys. Lett. B 705 294 (2011).

[4] M. Cacciari, G. P. Salam and G. Soyez, JHEP 0804 063 (2008).

[5] The ATLAS Collaboration, ATLAS-CONF-2011-032. http://cdsweb.cern.ch/record/1337782
The ATLAS Collaboration, ATLAS-CONF-2010-054. http://cdsweb.cern.ch/record/1281310

[6] The ATLAS Collaboration, ATLAS-CONF-2011-080. http://cdsweb.cern.ch/record/1355703

[7] The ATLAS Collaboration, JHEP 12 060 (2010).

[8] The ATLAS Collaboration, ATLAS-CONF-2011-063 (2011). http://cdsweb.cern.ch/record/1345743

[9] M.L. Mangano et al., JHEP 01 0307 (2003).