ABSTRACT

We present techniques used to estimate the backgrounds in the search for the Standard Model Higgs boson in the H→WW→llvv decay channel with ATLAS at the LHC. The dataset corresponds to 13 fb−1 of integrated luminosity taken at a center of mass energy of 8 TeV. Only the final states with an electron, muon, and zero or one jet are presented here.

MOTIVATION

Good understanding of Standard Model (SM) processes which act as backgrounds to the Higgs are the key to the search for the SM Higgs boson. Accurate background estimates with low systematic uncertainties are necessary to enhance the expected significance of a Higgs signal. The methods presented here show the various ways we achieve this goal.

H→WW→llvv & ITS BACKGROUNDS

The Standard Model WW background is estimated in a control region which uses the SR preselection cuts (two leptons, missing transverse energy) and is separated into jet bins. While the SR requires m_T > 50 GeV, the WW CR requires m_T > 80 GeV. This is the largest background in the SR.

STANDARD MODEL WW BACKGROUND

The Standard Model WW background is estimated in a control region which uses the SR preselection cuts (two leptons, missing transverse energy) and is separated into jet bins. While the SR requires m_T > 50 GeV, the WW CR requires m_T > 80 GeV. This is the largest background in the SR.

W+JETS BACKGROUND

The W+jets control region is defined in data by requiring one lepton with the same identification and isolation criteria as the signal leptons. The second lepton is required to be anti-identified, satisfying loosened isolation criteria and failing at least one identification requirement. These events are then required to pass the full signal selection.

W+JETS “FAKE FACTOR” METHOD

A fake factor, the ratio of the number of fully identified lepton candidates passing all selections to the number that are anti-identified, is derived in an inclusive data dijet sample. This factor is used to scale the number of events in the control region to the signal region. The total relative uncertainty on the estimate is 50%, dominated by the fake factor uncertainty.

FINAL BACKGROUND ESTIMATES AND SIGNAL REGION

Other backgrounds not discussed in detail above include the Z+jets and diboson (WW/ZZ/WW) backgrounds. Z+jets MC is normalized to data in a control region requiring m_T < 80 GeV and Δφ_{ll} > 2.8, separated into jet bins. The remaining backgrounds are taken from MC alone.

Wjets “FAKE FACTOR” METHOD

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BACKGROUND IN H→WW→llvv WITH ATLAS

On behalf of the ATLAS Collaboration

Tobar and Single Top Background

The zero-jet top background estimate: A CR with only the SR preselection is used to estimate the fraction of top events passing a jet veto. A second, b-tagged jet is used to estimate the probability of having no other jets reconstructed and is used as a correction to the first fraction estimate.

Kinematic variables in a same sign validation region (where two same sign leptons are required rather than opposite sign leptons) are shown in the plots above. The left plot shows the transverse mass while the right plot shows the Δφ between the two leptons.

The W+jets background comes from SM W boson production in association with jets where one jet produces an object reconstructed as a lepton. This can be a real lepton produced by heavy quark decay or a product of the fragmentation incorrectly reconstructed as an electron.