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Dissertation

SEARCH FOR $WWW \rightarrow \ \ell\nu \ \ell\nu \ \ell\nu$ USING THE ATLAS DETECTOR AT $\sqrt{S} = 8$ TEV

by

BRIAN ALEXANDER LONG

B.S., The University of North Carolina, 2010
M.A., Boston University, 2015

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Approved by

First Reader ____

John M. Butler, PhD
Professor of Physics

Second Reader ____

Kevin M. Black, PhD
Assistant Professor of Physics

Acknowledgments

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(Order No.)

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Boston University, Graduate School of Arts and Sciences, 2016

Major Professor: John M. Butler, Professor of Physics

ABSTRACT

In 2012 a resonance with a mass of 125 GeV resembling the elusive Higgs boson was discovered simultaneously by the ATLAS and CMS experiments using data collected from the Large Hadron Collider (LHC) at CERN. With more data from the LHC, the evidence continues to mount in favor of this being the Higgs boson of the Standard Model. This would finally confirm the mechanism for Spontaneous Electroweak Symmetry Breaking (EWSB) necessary for describing the mass structure of the electroweak gauge bosons. In 2013, Peter Higgs and Francois Englert were awarded the Nobel Prize in physics for their work in developing this theory of EWSB now referred to as the Higgs mechanism. The explanation for EWSB is often referred to as the last piece of the puzzle required to build a consistent theory of the Standard Model. But does that mean that there are no new surprises to be found? Many electroweak processes have yet to be measured and are just starting to become accessible with the data collected at the LHC. Indeed, this unexplored region of electroweak physics may provide clues to as of yet unknown new physics processes at even higher energy scales. Using the 2012 LHC data recorded by the ATLAS experiment, we seek to make the first observation of one such electroweak process, the massive tri-boson final state: WWW. It represents one of the first searches to probe the Standard Model WWWW coupling directly at a collider. This search looks specifically at the channel where each W boson decays to a charged lepton and a neutrino, offering the best sensitivity for making such a measurement. In addition to testing the Standard

Model directly, we also use an effective field theory approach to test for the existence of anomalous quartic gauge couplings which could offer evidence for new physics at higher energies than those produced by the LHC.

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[1]

List of Journal Abbreviations

Nucl. Phys. B	Nuclear Physics B: Particle physics, field theory and statistical systems, physical mathematics

Bibliography

[1] ATLAS Collaboration. The ATLAS Experiment at the CERN Large Hadron Collider. *J. Instrum.*, 3:S08003. 437 p, 2008.

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