

Studies of the Higgs boson with the
ATLAS experiment at the LHC:
Observation, measurement, and searches
for new physics

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LHC:
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ABSTRACT

We measured things. And searched for other things. Here is what we found, please let me graduate.

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THIS IS THE DEDICATION.

Acknowledgments

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Introduction

Part I

Preliminaries

1

The Standard Model and beyond: a theoretical overview

- 1.1 THE STANDARD MODEL OF PARTICLE PHYSICS
- 1.2 ELECTROWEAK SYMMETRY BREAKING AND THE HIGGS
- 1.3 HIGGS BOSON PRODUCTION AND DECAY
- 1.4 PHYSICS BEYOND THE STANDARD MODEL

This is some random quote to start off the chapter.

Firstname lastname

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The ATLAS detector and the Large Hadron Collider

2.1 THE LARGE HADRON COLLIDER

2.2 THE ATLAS DETECTOR

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Object reconstruction in ATLAS

3.1 LEPTON RECONSTRUCTION

3.1.1 ELECTRON RECONSTRUCTION

3.1.2 MUON RECONSTRUCTION

3.2 JET RECONSTRUCTION AND B-TAGGING

3.2.1 JET RECONSTRUCTION

3.2.2 B-TAGGING

3.3 MISSING TRANSVERSE ENERGY

3.3.1 CALORIMETER-BASED

3.3.2 TRACK-BASED

Part II

Observation and measurement of Higgs
boson decays to WW^* with the ATLAS
detector in LHC Run I at $\sqrt{s} = 7$ and 8
TeV

4

$H \rightarrow WW^* \rightarrow \ell\nu\ell\nu$ Analysis Strategy

4.1 PRODUCTION AND DECAY MODES

4.2 MAIN BACKGROUNDS

4.3 SIGNAL AND CONTROL REGION DEFINITIONS

4.4 MEASURING PARAMETERS OF INTEREST

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The role of WW in the Higgs discovery

6

Background reduction and estimation in
the same-flavor final state

7

Evidence for VBF production

8

Final Run 1 results

Part III

Search for Higgs pair production in the
 $HH \rightarrow b\bar{b}b\bar{b}$ channel in LHC Run 2 at \sqrt{s}
= 13 TeV

9

Run 2 detector upgrades

9.1 IBL AND IMPROVED B-TAGGING PERFORMANCE

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Resolved channel

11

Boosted Channel

12

Results with 2015 dataset

Part IV

Looking ahead

13

Conclusion

We found the Higgs. Then measured it. Then used it to look for new physics. What a time to be alive!



ATLAS New Small Wheel Upgrade

References



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