

Search for pair production of Higgs bosons
in the $b\bar{b}b\bar{b}$ final state using proton–proton
collisions at $\sqrt{s} = 13$ TeV with the ATLAS
detector

A DISSERTATION PRESENTED
BY
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FOR THE DEGREE OF
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Search for pair production of Higgs bosons in the $b\bar{b}b\bar{b}$ final state using proton–proton collisions at $\sqrt{s} = 13$ TeV with the ATLAS detector

ABSTRACT

We present a search for Higgs boson pair production, with two $b\bar{b}$ pairs in the final state. This analysis uses the full 2015 and 2016 data collected by the ATLAS Collaboration at $\sqrt{s} = 13$ TeV, corresponding to $X \pm \gamma \text{ fb}^{-1}$ of 2015 and $\mathcal{A} \pm B \text{ fb}^{-1}$ of 2016 pp collision data. The data are interpreted in the context of the bulk Randall-Sundrum warped extra dimension model with a Kaluza-Klein graviton decaying to hh . Relative to the 2015 analysis, this analysis focuses on improvements in the boosted analysis in the highest resonance mass range (between 2000 GeV and 3000 GeV). The data is found to be compatible with the Standard model, and no signs of new physics have been observed.

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THIS IS THE DEDICATION.

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It was five years ago when I made the decision, that of all the schools I visited, Melissa is the only one that will make my life "suffer" the most for the next five years.

THANK YOU MY FATHER WEIDONG TONG, who has always been the greatest inspiration for me.

THANK YOU MY MOTHER LIPING SUN, who has always been the greatest understanding for me.

0

Introduction

Why do we look for $b\bar{b} \rightarrow 4b$?

Knowledge knows no bounds.

Random People

1

Motivation for searches beyond the Standard Model

THERE'S SOMETHING OUT THERE THAT WE DON'T KNOW.

1.1 THE STANDARD MODEL

1.2 PROBLEMS WITH THE STANDARD MODEL

1.3 PATHS BEYOND THE STANDARD MODEL

Run.

Random Person

2

Machine of discovery–The Large Hadron Collider

2.1 DESIGN

2.2 PERFORMANCE

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Eyes of giant–The ATLAS Detector

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Game of Jigsaw–Reconstruction

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Censor of work–Data Quality

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Event Selection

6.1 b TAGGING

b -tagging, which is the identification of the b hadron,¹ is the core and main limiting factor of this analysis. Because of the relatively long lifetime, it is possible to tag the b hadron using the inner detector informations. A higher b -tagging efficiency will increase the signal selection efficiency, while a lower b -tagging fake rate will reduce the background like $g\bar{g} \rightarrow c\bar{c}$ in the signal regions.

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Background Estimation

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Systematics

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Result

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Interpretation

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Conclusion

We will find something new one day, because there is always something new.



Some extra stuff

Some appendix.

References

- [1] Georges Aad et al. Performance of b -Jet Identification in the ATLAS Experiment. *JINST*, 11 (04):P04008, 2016. doi: 10.1088/1748-0221/11/04/P04008.