SEARCH FOR LEPTON FLAVOUR VIOLATING DECAYS OF THE HIGGS BOSON

A Dissertation

Submitted to the Graduate School
of the University of Notre Dame
in Partial Fulfillment of the Requirements
for the Degree of

Doctor of Philosophy

by

Fanbo Meng,

Colin Jessop, Director

Graduate Program in Physics
Notre Dame, Indiana
February 2019

SEARCH FOR LEPTON FLAVOUR VIOLATING DECAYS OF THE HIGGS BOSON

Abstract

by

Fanbo Meng

A search for lepton flavour violation Higgs decay in the $H \to \mu\tau_h$ and $H \to e\tau_h$ in which tau leptons decay hadronically is presented. The search of tau lepton hadronic decay channels and the searches that are combined with tau lepton leptonic decays are presented. The $H \to e\tau_h$ search utilizes the 2012 proton-proton collision dataset at LHC with an integrated luminosity of 19.7 fb^{-1} at a center-of-mass energy of 8 TeV collected by CMS experiment. No significant excess was observed. The upper limits on branching fraction is $B < 0.69$ and the corresponding Yukawa coupling is set as $Y_{e\tau} < 2.4 \times 10^{-3}$ at 95% CL. For the H $\to \mu\tau_h$ search, the full 2016 proton-proton collision dataset with an integrated luminosity of 35.9 fb^{-1} at a center-of-mass energy of 13 TeV was used. No significant excess was observed. The upper limits on branching fraction $H \to \mu\tau$ is $B < 0.25\%$ and the corresponding Yukawa coupling is set as $Y_{\mu\tau} < 1.43 \times 10^{-3}$ at 95% CL.

To my family

CONTENTS

FIGURES iv

TABLES v

ACKNOWLEDGMENTS vi

FIGURES

TABLES

ACKNOWLEDGMENTS

First I would like to thank my adviser Prof.Colin Jessop for the constant guidance, help and support in the past years in both research and everyday life. Thanks for Colin's advises step by step towards being a qualified researcher and great helps and understanding when I was in difficulties. I would also like to thank the help and accompanies from my friends at Notre Dame and CERN. Thanks for making my life colorful. Thanks for the high energy group providing me the opportunity of working at CERN. The CMS is a great collaboration with the best research environment, researchers and collaborators.

Finally I would like to thank the love and supports from my family.

This document was prepared & typeset with pdfLaTeX*, and formatted with* NDdiss2$_\varepsilon$ *classfile (v3.0[2005/07/27]) provided by Sameer Vijay.*