

Universiteit Gent

DOCTORAL THESIS

Search for heavy neutral leptons in events with three charged leptons in pp collision at $\sqrt{s}=13$ TeV at CMS detector

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A thesis submitted in fulfillment of the requirements for the degree of Doctor of Philosophy

in the

Experimental Particle Physics Department of Physics and Astronomy "porca paletta."

MV

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Summary

Faculty Name Department of Physics and Astronomy

Doctor of Philosophy

Search for heavy neutral leptons in events with three charged leptons in pp collision at $\sqrt{s}=13$ TeV at CMS detector

by Martina VIT

The Thesis Abstract is written here (and usually kept to just this page). The page is kept centered vertically so can expand into the blank space above the title too...

Contents

Ał	strac	t i	ii
In	trodu	ction	1
Ι	Phy	sics introduction	3
1	The 1.1 1.2 1.3 1.4	Standard Model and Beyond Introduction	5 5 5 6
		1.4.1 ?Heavy Neutral Leptons?	6
2	The 2.1 2.2 2.3	Introduction The LHC and the LHC experiments 2.2.1 The Large Hadron Collider 2.2.2 Experiments at the LHC 2.2.3 Design and performance of the LHC The CMS experiment 2.3.1 The CMS coordinate system 2.3.2 The solenoid magnet 2.3.3 The charged-particle tracker 2.3.4 The electromagnetic calorimeter 2.3.5 The hadronic calorimeter 2.3.6 The muon detector 2.3.7 Triggering and data acquisition Event reconstruction 2.4.1 Track reconstruction 2.4.2 Reconstruction performances	7777777777777777
II	Sea	rch for heavy neutral leptons	9
3	The 3.1	Heavy neutral leptons	1 1
4	4.1 4.2 4.3	Data and simulation samples	13 14 14 14

		4.4.1	Baseline selection	14
		4.4.2	Low mass search	14
		4.4.3	High mass search	14
	4.5	Backgr	round estimation	14
		4.5.1		14
		4.5.2		14
		4.5.3		14
		4.5.4		14
		4.5.5		14
	4.6	Systen	natic uncertainties	14
	4.7	Result		14
		4.7.1	Low mass results	14
		4.7.2	High mass results	14
		4.7.3	Summary	14
	4.8	Interp	retation	14
		4.8.1	Lifetime correction to upper limits	14
	4.9	Conclu	asion	14
5	Sear	ch for l	ong-lived heavy neutral leptons in final states with three charged	l
Ŭ			l displaced vertices	15
	5.1	Chang	ge of scenario	15
			Displaced signature at CMS	15
	5.2		simulation	15
	5.3		ets	15
		5.3.1	Data	15
		5.3.2	Simulation	15
	5.4	Trigge	r strategy	15
	5.5	00	reconstruction and identification	15
		5.5.1	Prompt leptons	15
		5.5.2	Displaced vertices	15
		5.5.3	Displaced leptons	15
	5.6	Event	reconstruction	16
		5.6.1	Displaced leptons pair (i.e. HNL candidate) selection	16
		5.6.2	Secondary displaced vertex fit and lepton extrapolation	16
		5.6.3	Event kinematics and baseline selection	16
	5.7	Backgr	round estimation	16
		5.7.1	Background composition	16
		5.7.2	Fake lepton background	16
	5.8	Correc	ctions and efficiencies	16
	5.9	Systen	natic uncertainties	16
	5.10	Result	s	16
		5.10.1	Statistical analysis	16
		5.10.2	Limits on V_{Nl} : Dirac HNL	16
		5.10.3	Limits on V_{Nl} : Majorana HNL	16
		5.10.4	Limits on V_{Nl} : Tau coupling	16
			Summary	16

6 C	onclusion and perspective	17
6.	1 Prompt HNL analysis possible improvements	17
6.2		
6.3	3 HNL searches perspectives and LHC and beyond	17
6.4	4 Conclusions	17
A Fr	requently Asked Questions	23
A	.1 How do I change the colors of links?	23

For/Dedicated to/To my...

Introduction

introduction

Part I Physics introduction

The Standard Model and Beyond

- 1.1 Introduction
- 1.2 The Standard Model of Elementary Particles
- 1.3 The mathematical framework of the Standard Model

1.4 Beyond the Standard Model

1.4.1 ?Heavy Neutral Leptons?

The LHC and the CMS Experiment

^ 4	T .	1 4.
2.1	Intro	oduction
Z .		,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,

- 2.2 The LHC and the LHC experiments
- 2.2.1 The Large Hadron Collider
- 2.2.2 Experiments at the LHC
- 2.2.3 Design and performance of the LHC
- 2.3 The CMS experiment
- 2.3.1 The CMS coordinate system
- 2.3.2 The solenoid magnet
- 2.3.3 The charged-particle tracker
- 2.3.4 The electromagnetic calorimeter
- 2.3.5 The hadronic calorimeter
- 2.3.6 The muon detector
- 2.3.7 Triggering and data acquisition
- 2.4 Event reconstruction
- 2.4.1 Track reconstruction
- 2.4.2 Reconstruction performances

Part II Search for heavy neutral leptons

Theory introduction to HNL

- 3.1 Heavy neutral leptons
- 3.1.1 Previous and current results

Search for HNL in events with three charged prompt leptons

4.1	Data and simulation samples
4.2	Trigger strategy
4.3	Event reconstruction and object selection
4.4	Analysis strategy
4.4.1	Baseline selection
4.4.2	Low mass search
4.4.3	High mass search
4.5	Background estimation
4.5.1	
4.5.2	
4.5.3	
4.5.4	
4.5.5	
4.6	Systematic uncertainties

- 4.7 Results
- 4.7.1 Low mass results
- 4.7.2 High mass results
- 4.7.3 Summary
- 4.8 Interpretation
- 4.8.1 Lifetime correction to upper limits
- 4.9 Conclusion

Search for long-lived heavy neutral leptons in final states with three charged leptons and displaced vertices

- 5.1 Change of scenario
- 5.1.1 Displaced signature at CMS
- 5.2 Signal simulation
- 5.3 Datasets
- 5.3.1 Data
- 5.3.2 Simulation
- 5.4 Trigger strategy
- 5.5 Object reconstruction and identification
- 5.5.1 Prompt leptons

Muons

Electrons

- 5.5.2 Displaced vertices
- 5.5.3 Displaced leptons

Muons

Electrons

Event reconstruction 5.6

- 5.6.1 Displaced leptons pair (i.e. HNL candidate) selection
- 5.6.2 Secondary displaced vertex fit and lepton extrapolation
- Event kinematics and baseline selection
- 5.7 **Background estimation**
- 5.7.1 **Background composition**
- 5.7.2 Fake lepton background
- Corrections and efficiencies 5.8
- Systematic uncertainties 5.9
- 5.10 Results
- 5.10.1 Statistical analysis
- 5.10.2 Limits on V_{Nl} : Dirac HNL
- 5.10.3 Limits on V_{Nl} : Majorana HNL
- Limits on V_{Nl} : Tau coupling 5.10.4
- 5.10.5 **Summary**

Conclusion and perspective

- 6.1 Prompt HNL analysis possible improvements
- 6.2 Displaced HNL analysis possible improvements
- 6.3 HNL searches perspectives and LHC and beyond
- 6.4 Conclusions

List of Figures

List of Tables

Appendix A

Frequently Asked Questions

A.1 How do I change the colors of links?

The color of links can be changed to your liking using:

\hypersetup{urlcolor=red}, or

\hypersetup{citecolor=green}, or

\hypersetup{allcolor=blue}.

If you want to completely hide the links, you can use:

\hypersetup{allcolors=.}, or even better:

\hypersetup{hidelinks}.

If you want to have obvious links in the PDF but not the printed text, use:

\hypersetup{colorlinks=false}.

Acknowledgements

The acknowledgments and the people to thank go here, don't forget to include your project advisor...