MY THESIS

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An Homage to The Elements of Typographic Style

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ABSTRACT

PUBLICATIONS

Some ideas and figures have appeared previously in the following publications:

Put your publications from the thesis here. The packages `multibib` or `bibtopic` etc. can be used to handle multiple different bibliographies in your document.

ACKNOWLEDGEMENTS

Put your acknowledgements here.

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LIST OF FIGURES

LIST OF TABLES

LISTINGS

ACRONYMS

LHC Large Hadron Collider

IBL Inner B Layer

NN Neural Network

Part I

INTRODUCTION

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1 INTRODUCTION

The pages that follow detail the author's work on the ATLAS experiment from 2011 through 2016, focusing on an analysis of 13TeV proton-proton collisions at the Large Hadron Collider (LHC) looking for Supersymmetry with the ATLAS Detector.

CHAPTER 1 outlines the theory behind Supersymmetry and the motivation behind this particular analysis.

Part II

THEORY AND MOTIVATION

You can put some informational part preamble text here.

2 THEORY AND MOTIVATION

Some kind of preamble here I guess.

2.1 THE STANDARD MODEL

2.1.1 *How do you explain the standard model?*

I will put this off for now.

2.1.2 *Problems in the Standard Model*

2.2 SUPERSYMMETRY

Part III

WHERE DATA COME FROM

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3 THE LARGE HADRON COLLIDER

The LHC is unique in the world, producing particle collisions at energies an order of magnitude higher than any accelerator before. It provides unique environments in its proton-proton collisions where massive, unstable particles can exist for an instant, then decay to the ordinary material of the universe.

3.1 OPERATION OF THE LARGE HADRON COLLIDER

4 THE ATLAS DETECTOR

The ATLAS detector circumscribes the LHC ring, enclosing the collision point with a series of particle detecting subsystems, aimed at making as many measurements of the particles leaving the interaction as possible. Its goal is to get a precise measurement of all the stable particles flying from proton-proton collisions at its center, allowing analyzers to fully reconstruct the kinematics of the underlying event.

4.1 SUBDETECTORS OF ATLAS

The ATLAS Detector consists of many layers of detectors, each of which contributes to the measurements of the position and energy of particles in different ways. This section will describe each of these detetors, in the order in which they are traversed by a particle coming from the collision point.

4.1.1 *The Pixel Detector*

The Pixel detector lies closest to the beam pipe of the LHC, and has four layers comprising 92 million read-out channels. There are three standard layers, referred to as L1-L3, and an additional layer added for the 2015 datataking, called the Inner B Layer (IBL).

4.1.1.1 *The Original Pixel Detector*

4.1.1.2 *Addition of the IBL*

In 2015, the IBL was lowered into the ATLAS cavern and added to the Pixel Detector. As its name suggests, it was added to improve detection of B mesons, whose non-trivial lifetimes create secondary vertices in ATLAS events, which allow them to be distinguished from other particles with precise track measurement. The IBL is closer to the interaction point and has a smaller spacing between sensors, giving it a better chance to see these slightly displaced vertices.

5 APPLICATION OF NEURAL NETWORKS TO THE PIXEL CLUSTERING

I suppose I have to explain the NN.

5.1 CLUSTERING IN THE PIXEL DETECTOR

5.1.1 *Analog Clustering*

5.1.2 *A Neural Network*

To improve on this simple approach to clustering, a Neural Network (NN) was created [1] [2].

Robustness [3]

5.2 IMPACT OF THE NEURAL NETWORK

Part IV

SEARCHING FOR SUSY

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Part V

CONCLUSIONS

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Part VI

APPENDIX

[1] ATLAS Collaboration. "A neural network clustering algorithm for the ATLAS silicon pixel detector." In: *JINST* 9 (2014), P09009. DOI: 10.1088/1748-0221/9/09/P09009. arXiv: 1406.7690 [hep-ex].

[2] ATLAS Collaboration. *Measurement of performance of the pixel neural network clustering algorithm of the ATLAS experiment at* $\sqrt{s} = 13$ *TeV*. ATL-PHYS-PUB-2015-044. 2015. URL: http://cdsweb.cern.ch/record/2054921.

[3] ATLAS Collaboration. *Robustness of the Artificial Neural Network Clustering Algorithm of the ATLAS experiment*. ATL-PHYS-PUB-2015-052. 2015. URL: http://cdsweb.cern.ch/record/2116350.