Something something something physics

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Abstract

LHCb is a b-physics detector experiment which will take data at the 14 TeV LHC accelerator at CERN from 2007 onward...

Declaration

This dissertation is the result of my own work, except where explicit reference is made to the work of others, and has not been submitted for another qualification to this or any other university. This dissertation does not exceed the word limit for the respective Degree Committee.

Andy Buckley

Acknowledgements

Of the many people who deserve thanks, some are particularly prominent, such as my supervisor…

Preface

This thesis describes my research on various aspects of the LHCb particle physics program, centred around the LHCb detector and LHC accelerator at CERN in Geneva.

For this example, I'll just mention Chapter **??** and Chapter **??**.

Contents

"Writing in English is the most ingenious torture ever devised for sins committed in previous lives."

— James Joyce

Chapter 1.

Theory

"There, sir! that is the perfection of vessels!"
— Jules Verne, 1828–1905

1.1. Particle Flow Calorimetry

1.1.1. Overview

Particle flow calorimetry is a method of calorimetry where the goal is to reconstruct every visible particle in any given event. This prcoesses has numerous advantages over traditional calorimetry in that it yeilds superior energy resolutions as well as more topological information that can be used further downstream in physics analyses. Careful use of this approach to calorimetry allows us to make signficant strides forward in physics understanding in comparison to traditional calorimetric methods.

The application of particle flow calorimetry creates new challenges for detector response on both the hardware and software side. Fine granularity calorimeters are crucial to be able to track the energy deposits from individual particles and sophisticated pattern recongition software is essential for piecing these energy deposits back together into reconstructed particles. For particle flow calorimetry to be successful there has to be a synergy between the hardware and software so that the two work together well with success being dictated by physics performance.

The immense benefits offered by particle flow calorimetry have made it the front runner in terms of the calorimetric approach and as such has been adopted by the future linear lepton-lepton collider.

1.1.2. Paradigm

The principle of particle flow calorimetry is a simple one, that is to record the energy deposited by a particle in a dectector in the subsystem that offers the best energy resolution. While a relatively simple aim the application of such a paradigm is challenging as different particles deposit energy throughout the detector in different regions.

The stable particles that it is possible to measure in a particle collider detector are relatively few in number and can be broken into three categories depending upon their energy depositions. There are:

- Charged hardons. These produce energy depoits in the tracker and both the electromangetic and hadronics calorimeters.
- Neutral hadrons. These produce energy depoits in the electromangetic and hadronics calorimeters.
- Photons. These produce energy deposits primarily in the electromangetic calorimeters.

As the energy resolution offered by the tracker is signifcantly better that that offered by the calorimeters it is desirable to measure the energy of charged particles in the tracker. As photons and neutral hadrons do not produce tracks these energy deposits must come from the calorimeter. This approach is to be contrasted with traditional calorimetry where all energy deposits arise from the calorimeters.

1.2. Physics Theory

Appendix A.

Pointless extras

"Le savant n'étudie pas la nature parce que cela est utile;
il l'étudie parce qu'il y prend plaisir,
et il y prend plaisir parce qu'elle est belle."
— Henri Poincaré, 1854–1912

Appendixes (or should that be "appendices"?) make you look really clever, 'cos it's like you had more clever stuff to say than could be fitted into the main bit of your thesis. Yeah. So everyone should have at least three of them…

A.1. Like, duh

Padding? What do you mean?

A.2. $y = \alpha x^2$

See, maths in titles automatically goes bold where it should (and check the table of contents: it *isn't* bold there!) Check the source: nothing needs to be specified to make this work. Thanks to Donald Arsenau for the teeny hack that makes this work.

Colophon

This thesis was made in LaTeX 2_ε using the "hepthesis" class [1].

Bibliography

[1] A. Buckley, The hepthesis LaTeX class.

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