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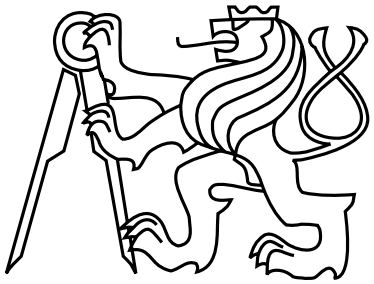

Bachelor's Project

Interactive visualization system for hybrid active pixel detectors within the ATLAS experiment at CERN

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Study Programme: Open Informatics

Field of Study: Computer and Information Science

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Aknowledgements

Zde můžete napsat své poděkování, pokud chcete a máte komu děkovat.

Declaration

I declare that I elaborated this thesis on my own and that I mentioned all the information sources and literature that have been used in accordance with the Guideline for adhering to ethical principles in the course of elaborating an academic final thesis.

In Prague on May 15, 2016 .....

Abstract

Translation of Czech abstract into English.

Abstrakt

Abstrakt práce by měl velmi stručně vystihovat její obsah. Tedy čím se práce zabývá a co je jejím výsledkem/přínosem.
Očekávají se cca 1 – 2 odstavce, maximálně půl stránky.

Contents

List of Figures

List of Tables

Chapter 1

Introduction

1.1 About the Timepix Detectors

1.2 The Timepix Network at ATLAS

1.3 The Problem of Efficient Data Manipulation

1.4 Structure of This Document

Chapter 2

Data Structure and Storage

2.1 Output Produced by Timepix

Similarly to chips found in common digital cameras, Timepix detectors generate measurements in the form of individual frames. A single captured frame consists of values recorded by all pixels over a given time period, length of which is referred to as *the acquisition time*. Returning to our camera analogy, this figure resembles the time of exposition. Upon prolonging it, we can expect more particles to interact with our detector's pixels, making the resulting frames ultimately more saturated.

The technical principle behind the measurements is analogous to that of the Medipix sensor. Every pixel is equipped with an integer register called *the counter*. When acquisition starts, this counter is set to zero. Throughout the set time period, the counter is possibly incremented multiple times, and its value at the end of the acquisition is read out as measurement's result for the individual pixel. This process is synchronized across all detector's pixels, producing an integer matrix constituting the captured frame. Since the pixels may not be identical due to material irregularities and manufacturing errors, every pixel has a *threshold* parameter, which is subject to calibration. If, during the measurement, the analog input measured from the pixel's semiconductor exceeds this threshold, the pixel is considered to be interacting with a particle.

2.1.1 Raw Output

Provided that every Timepix detector has 2 layers of 256×256 pixel matrices, every captured frame consists of 131,072 integer values. The interpretation of these values depends on another parameter, *the operation mode*. While it is technically possible to configure every pixel in a different mode, for reasons of practicality we have so far preferred to configure all pixels identically, making this essentially a not a parameter of a pixel, but that of a frame.

The following operation modes are available:

Hit Detection Mode (One-Hit Mode) In this mode, the counter is set to one, when the theshold is exceeded. Upon multiple interactions, the counter is not further incremented. The result is a Boolean value, indicating whether the pixel has interacted with a particle.

Hit Counting Mode (Medipix Mode) In this mode, the counter is incremented upon every transition from state below the threshold to state above the threshold. The result is an integer value representing the number of particles which have interacted with the pixel.

Time over Threshold Mode In this mode, the counter is incremented by every clock cycle spent above the threshold. The result is an integer value corresponding to the energy of the interacting particle. Further calibration to convert counter value to energy is required, though.

Time of Arrival Mode In this mode, the counter is incremented by every clock cycle after the threshold is first exceeded. The result is an integer value corresponding to the time interval before the end of the measurement.

If captured frame contains data from pixels configured in multiple different modes, the frame is said to be captured in the **Mixed Mode**.

2.1.2 Cluster Analysis

2.2 Common Storage Formats

2.2.1 The Single-Frame and Multi-Frame Formats

2.2.2 The ROOT Format

2.3 Expected Volume of Acquired Data

2.4 Performance Optimizations

Chapter 3

Communication Protocol

3.1 Requirements

3.2 Underlying Standards

3.3 Web Methods

Chapter 4

Data Server

4.1 Role of the Application

4.2 Decomposition

4.3 Dependencies

4.4 Object-Oriented Design

4.5 A Note on Parallelism

4.6 Performance Optimizations

Chapter 5

Web Visualization

5.1 Naive Decomposition

5.2 Final Decomposition

5.3 Underlying Standards

5.4 Dependencies

5.5 Website Structure

Chapter 6

Conclusion

6.1 System Deployment

6.2 Data Import

6.3 Automating Data Acquisition

6.4 Future of the Application

Appendix A

Obsah přiloženého CD

Tato příloha je povinná pro každou práci. Každá práce musí totiž obsahovat přiložené CD. Viz dále.

Může vypadat například takto. Váš seznam samozřejmě bude odpovídat typu vaší práce. (viz [**?**]):

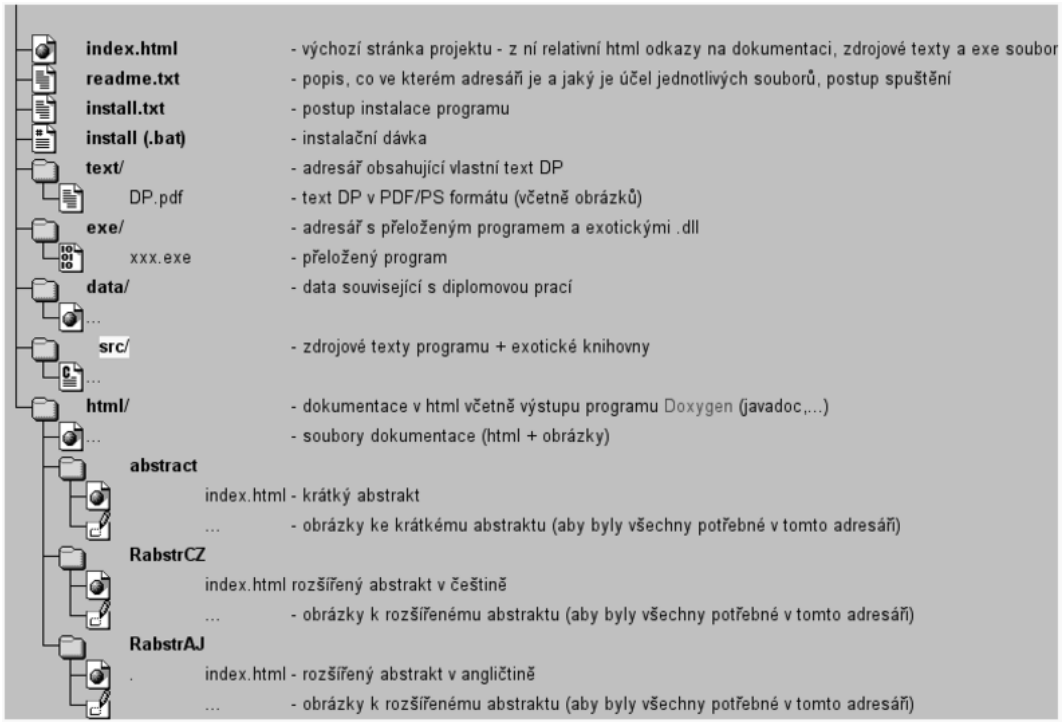

Figure A.1: Seznam přiloženého CD — příklad