Master's Thesis in Electrical Engineering

# Digital Pulse Detection

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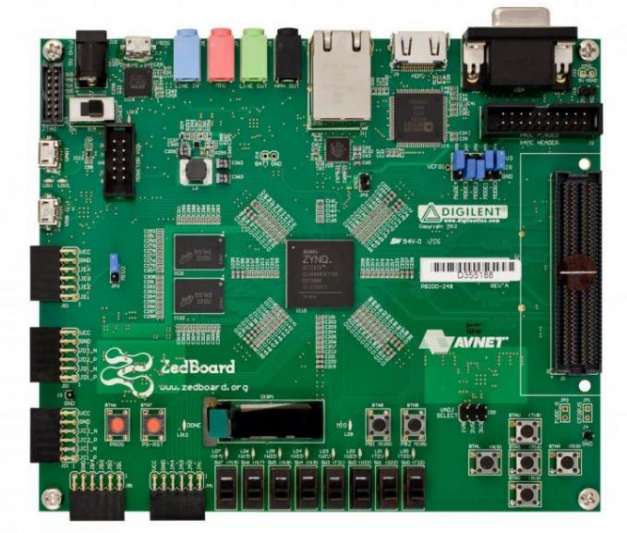


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# Abstract

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## Rettelser

# 1

# Introduction

When acquiring data in nuclear physic, a high spacial and time resolution is necessary to investigates the nuclear process. The high resolution results in a immense analog data, flowing from the detectors. To process the nuclear spectrometry signal involves finding the energy and timestamps of the particle detected. A major problem is particles hitting the detector in a short period of time, resulting in a pile up and discarding the measurements.
Therefore, in this thesis I investigate and propose a method for processing the nuclear spectrometry signals based upon a Field Programmable Gate Array (FPGA) solution. The idea is to take advantage of the reconfigurable interconnects of the FPGA that allows flexibility. The structure of the FPGA makes pipelining suitable. Pipelining the data flow enables executing processes in parallel and thereby increasing the throughput, which is critical for high data flows. The thesis is conducted in cooperation with the department of Physics of Aarhus University. With their current system are analog, which have multiple issues such as discarded pulses, inflexibility and ??. Therefore, this thesis seeks to process multiple channels real-time and outputs a energy histogram of the detected particles by using a new proposed method.

Test[2] [3][1]

## 1.1 Reading Guide

The structure of the Thesis is shown below:

**Chapter 1** The introduction.

**Chapter 2** The background.

## 1.2 Problem Definition

## 1.3 Thesis goal, Approach and Scope

This section describes the goals, the approach used and the scope of the master thesis.

[1] FiXme Note: test af biblatex

### 1.3.1 Thesis goal

**Goal 1:**

**Goal 2:**

**Goal 3:**

### 1.3.2 Approach

**Phase 1: Preliminary work and background**

The first phase is carried out prior to the thesis.

**Phase 2: Experiments**

The second phase involves the conduction of a number of experiments. The purpose of this phase is to narrow down the proposed methods in the first phase to only the most promising one.

**Phase 3 : Analysis**

In the third phase the proposed method is investigated further and research activities are carried out in order to study and assess related algorithms in other application fields.

**Phase 4: First Design**

The fourth phase deals with the development of a first algorithm. The phase builds upon the concepts explored throughout the analysis.

**Phase 5: Advanced Design**

The fifth phase involves two subgoals improving both timing performance and accuracy. A real-time system is designed executing the proposed algorithm according to the specified performance requirements. Based on the results of the first proposed algorithm, possible improvements are investigated in order to solve potential problems.

**Phase 6: Evaluation**

In the last phase the proposed algorithms are evaluated and compared based on an acquired test set. Accuracy and timing performance are recorded and compared to the real-time requirements.

### 1.3.3 Scope

# 2

# Background

## 2.1 Data Acquisition System today

The data system

## 2.2 Related Work

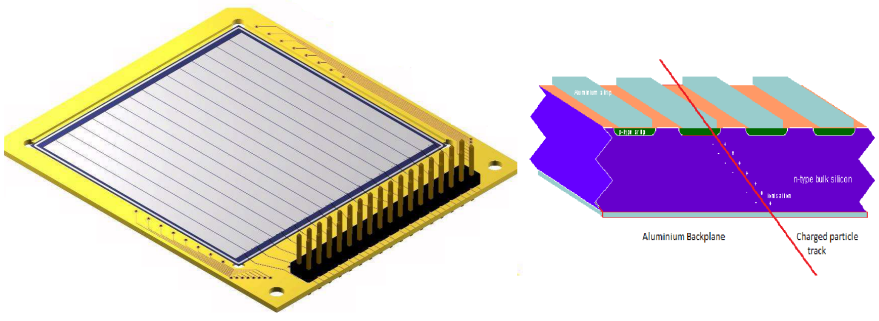


Figure 2.1: Mechanism of detection.[1]

and Software

# 3

# Pulse Analysis

# 4

# System Design

# 5

# Results and Discussion

# 6

# Conclusion and Future Work

# Bibliography

[1] T. P. P. D. at the Rutherford Appleton Laboratory, "Silicon strip detectors in the atlas experiment." http://hepwww.rl.ac.uk/OpenDays98/Detectors/silicon.htm, 24/9 2015.

[2] M. Dummy, "Latex modules." https://github.com/Limro/LatexModules, 9 2015.

[3] M. Dummy and M. Dummies, "How to build latex documents," GitHub monthly Best of the Meh-good-enough, vol. 1, pp. 1–2, 2015.