Mapping for a Cylindrical Micro-Resistive Well Detector

Design Document

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1.0 INTRODUCTION

1.1 Purpose

This Software Design Document (SDD) describes the overall architecture and detailed system design of the data collection and data processing pipelines for the micro-resistive well detector (μ-RWELL) system. It outlines the structural components, data flow, software modules, interfaces, and design decisions required to ensure reliable acquisition, transformation, storage, and analysis of detector data.

1.2 Scope

The scope of the software to be implemented is to facilitate, streamline, and optimize the end-to-end data workflow for the client's experiment. This includes the complete pipeline starting from raw data collection at the detector level, through intermediate processing and filtering stages, to the generation of fully processed, plotted, and analyzable results.

1.3 Overview

This document is organized in:

1. System architecture diagram.
2. Data collection pipeline.
3. Data analysis flow chart.

1.4 Summary

The existing part of this project consists of the data gathering part as well as some data processing scripts. What is pending to be implemented is creation of an automated pipeline that allows the client to go from root files to plotted analyzable graphs, that can be used in the creation of a paper.

1.4 Definitions and Acronyms

Root File - Root analysis framework file.

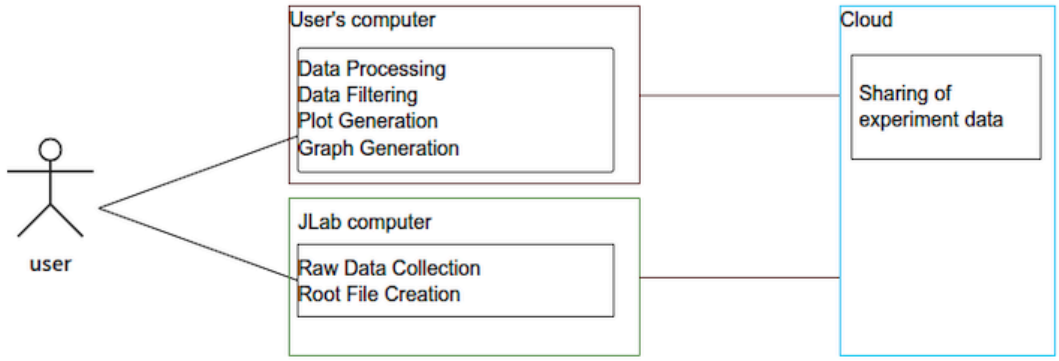
Amore-SRS - Data gathering framework.

APV - Analogue pipeline chip for the detectors.

ADC - Analog to digital converter, converts analog signals to digital data.

2.0 DESIGN

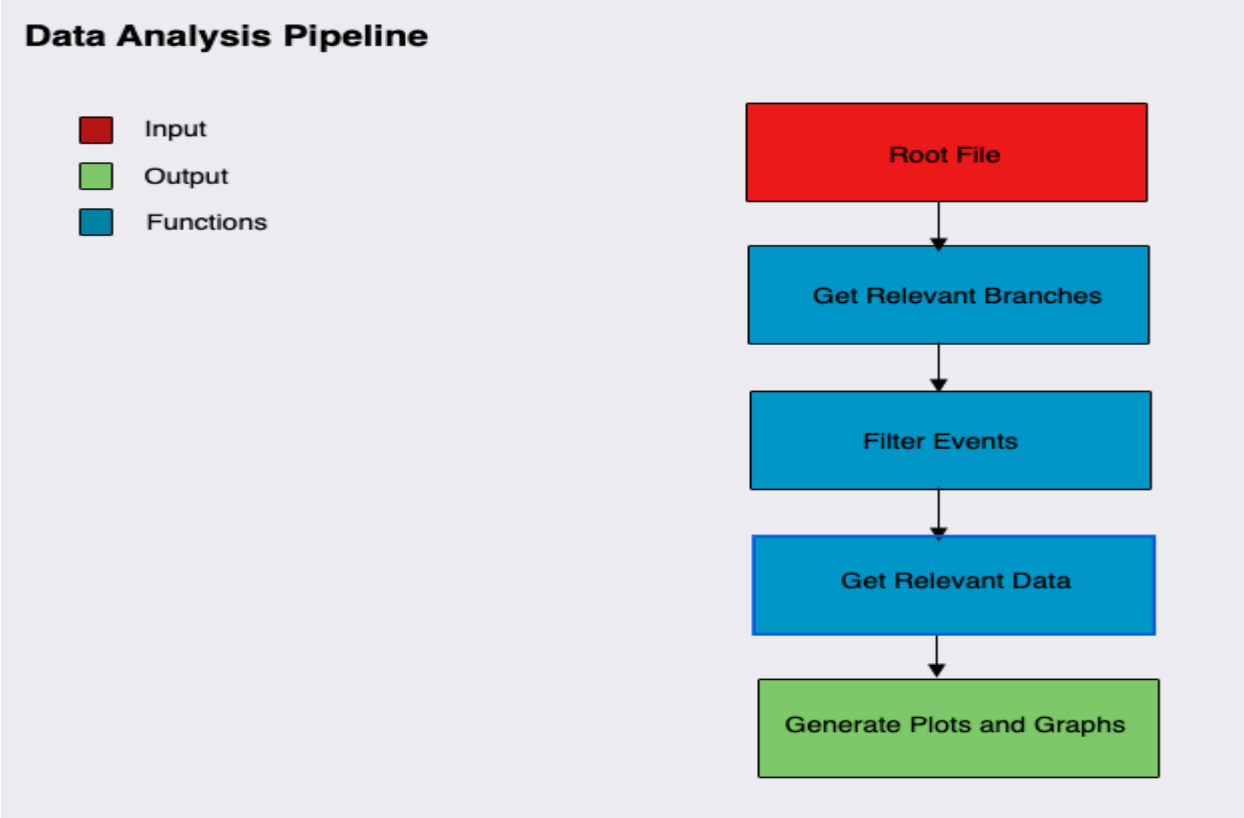
System Architecture Diagram



2.1 System Architecture Rationale

The rationale behind this system architecture is that it is the one that is already in place. And works well within the scope of the project. Generally the experiment is run on a different computer at JLab, which is accessible by the user, and then using the cloud (Google Drive) the root files and other relevant experiment data is stored and shared. Finally the data processing happens in the user's computer.

Data Collection Pipeline



2.2 Data Analysis Pipeline Note

The rationale behind the data analysis pipeline heavily relies on the root file format, which is a tree-like format with branches and leaf nodes. Generally each branch uses the event as an index/id to access the data. It starts with the root file, which contains the data. Then the relevant branches from the tree are separated. Events are filtered according to an ADC threshold set by the user, and finally the relevant data is gathered, and the plots and graphs are constructed.