N3 (GEP=4)

Basic of Data Acquisition, Detector Technique, and Data Analysis

Instructor: Masashi Kaneta (kaneta@lambda.phys.tohoku.ac.jp, Science Complex A, 6F, Rm. 642)

GPPU Experimental Point (GEP): 4

Goal of Study

In this course, we would like you to acquire the following knowledge and techniques.

(a) Construction of a test bench using NIM and VME modules

(b) Control of VME modules and reading/writing data from/to modules (VME access).

(c) Detector construction and data analysis

Contents

Recent high energy particle physics, like Large Hadron Collider (LHC) experiment at CERN, has a few hundred to a few thousand people in the collaboration. The tasks are separated to specialist and it is difficult to understand whole system (detectors, data acquisition, trigger, and analysis frame work) by one person.

On the other hand, the experimental physicist in elementary particle/nuclear physics filed should have an experience of construction of test bench for detector test. The knowledge will be requisite to design an experiment and to be a group leader.

You will learn the following items in this course.

(1) Construction of a test bench for detector test using cosmic-ray.

(2) Assembling of Multi-gap Resistive Plate Chamber (MRPC) and performance study by cosmic-ray and electron/positron beam.

We plant to use plastic scintillation counters and to analyze data to evaluate timing resolution. The data on VME module is a binary data and need to know how to treat those data on memory. Using a simple program written by C/C++, you will learn how to access VME memory. ROOT which is a framework for data processing and born at CERN will be used for analyses.

MRPC is a kind of gaseous ionization detector and developed as a Time-Of-Flight (TOF) detector. It consists of print circuit boards, glass plates, and fishing line as a spacer. You will make MRPC by yourself and investigate its timing resolution and efficiency by cosmic-ray and electron/positron beam.

Textbook and References

The recent references are proceedings of "3th Workshop on Resistive Plate Chambers and Related Detectors (RPC2016)" http://iopscience.iop.org/journal/1748-0221/page/extraproc54. The basic information of MRPC can be found the web page of ALICE experiments: http://aliceinfo.cern.ch/Public/en/Chapter2/Chap2_TOF.html. Also you can find a link to "Technical Design report" in that web page to know detailed information of ALICE-MRPC, https://edms.cern.ch/document/460192/1

Progress Schedule

- Day 1
  Basic of data acquisition system (Lecture and Experiment)
  How to access and control memory on VME modules (Lecture and Experiment)
- Day 2
  Construction of test bench using plastic scintillation counters and NIM/VME modules (Experiment).
- Days 3
  How to get intrinsic timing resolution from TOF information (Lecture).
- Day 4
  Assembly of MRPC (Experiment)
- Day 5
  Construction of test bench using MRPC and plastic scintillation counters. Performance test by cosmic-ray (Experiment).
- Day 6
  Performance test of MRPC by electron/positron beam (Experiment).

Other Details

Course Period	In the second semester of 2020
Place	Science Complex B, 6F, Rm. 642
Number of Students	1 – 6
Evaluation method	The evaluation method will be based on number of date attended (30 %) and depth of understanding (70%).

In Addition

After construction of the test bench, you need one day to a few days for data taking.

Data analysis will be homework.

Date and time of the course will be decided by discussion with attendants