Developent of SiPM readout electronics

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Goal of Study

In this course, you will learn the basics of the analogue and digital pulse processing and the I/O between an electronics board and a computer by actually designing and building a multi-channel signal readout system of the SiPM photon detector.

Contents

The SiPM, also known as MPPC, is a one-photon sensitive device. It is now widely used for the particle detectors because of the high efficiency, large gain and low cost. To take full advantage of these, it is desired that the readout electronics board is low cost can read out multiple channels. In this course, we will design such an electronics board consisting of amplifier, peak-hold circuit, multiplexer and ADC. The board will be controlled and readout by Raspberry Pi. Electronics circuit simulation will be conducted to confirm the function of the board. Then, we will build the board and test the performance.

Textbook and References

[1] https://www.hamamatsu.com/us/en/product/optical-sensors/mppc/what_is_mppc/index.html

[2] "The T2K fine-grained detectors", P.A. Amaudruz et al., Nucl.Instrum.Meth.A 696 (2012) 1, DOI:10.1016/j.nima.2012.08.020

[3] https://www.analog.com/en/design-center/design-tools-and-calculators/ltspice-simulator.html

Progress Schedule

✧ Day 1

    Lecture 1: SiPM

    Experiment 1: operation of SiPM

    Lecture 2: concept of the SiPM readout circuit

✧ Day 2

    Experiment 2: Spice simulation

✧ Day 3

    Experiment 3: Circuit building

✧ Days 4

    Experiment 4: Circuit building and test of the circuit

Other Details

Course Period	2021 Summer
Place	Physics & Chemistry Annex 1st floor
Number of Students	1—3
Evaluation method	The evaluation method will be based on the discussion during the experiment (50%), and the presentation after the experiment (50%).

In Addition