ANSEL Lab Reports: Template

ANSEL Report: Tests with analog and digital nuclear electronics

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Abstract
The first ANSEL experiment entailed hands-on tests of the functionalities of a digital oscilloscope and of various NIM electronic modules to be used in subsequent experiments. The response of a radiation detector was simulated with precision pulse generators and processed with main amplifiers. Discriminators were used to produce digital signals employed to set up trigger logics for the data acquisition system. The linearity of the analog circuitry, tested with a pulse generator, was found to be better than 1%.

1. Introduction (Motivation/Purpose)

The tasks given for the first ANSEL experiments are designed to practice basic operations of digital oscilloscopes, as well as analog and digital electronics. Th… cations for the subsequent experiments with gamma and … electronics is needed to define acceptance criteria and to p… system. The system was to be tested with a pulser calibrat…

2. Experimental setup and procedures

For the first task with analog electronic modules, a low … an ORTEC 419 precision pulse generator. Figure 1 illus… output signal observed on the oscilloscope. Its amplitude … 2μs. This pulse was obtained with the pulser settings …..

Next, the pulser signal was inserted into an ORTEC 57… to lowest coarse (x..) and fine gains (x…). Input polarity … Fig.2, the amplifier output signal shape was less than ideal … 45 mV, which was cor-rected to less than 2 mV by activat…

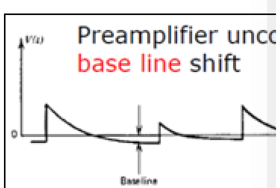

Figure 1: Output pulse shape of an ORTEC 419 precisio… are _ V/division and …μs/division, resp.

Table 1: ORTEC 419 Pulse Shape Para…

The discriminator output signals were duplicated with a Fan-In… signals were used to produce a wider "gate" signal, the other was … producing a copy of the input signal but delayed by an adjustable … width of ….., the delayed signal had a width of only …ns. Undela… were put into a Universal Coincidence Module (Type) to test coinc… The setup is represented by the schematic electronics block diagra… cludes the analog part of the electronics.

In the tests, the delayed signal……. The resulting coincidence … pected, to be equal to …., i.e., equal to _ A similar test was done us…

3. Data Analysis

Describe the results of the various phases of the experiments, as far as a data reduction was done. Include a discussion of statistical and systematic uncertainties.

…………

The approximate pulser signal shape $U(t)$ was observed to have an analytical form given by

$$U(t) = U_0 \cdot t^{a} \cdot \exp\{-\beta \cdot t\} \qquad (1)$$

Approximate fit parameters are listed in Table 1, together with their estimated uncertainties.

MS Word Report Template
Title, bylines, dates
Abstract

Main Text

I. Introduction
II. Theory (contingent)
III. Experimental Setup and Procedures
IV. Data Analysis
V. Summary and Conclusions
VI. References

ANSEL Report Contents

Abstract: Brief description of experiment goals and main results.

Structure of Main Report

Introduction: General background and goals of experiment.

Theory: Discuss essential ideas underlying experiment, note and explain formulas used in analysis and interpretation; provide references. Can be omitted in purely technical experiments.

Experimental setup & procedures: Describe briefly experimental detector and electronics setup, note geometry and electronic/DAQ adjustments in sufficient detail for a repeat. Note observations. Include diagrams and sketches of geometric & logic setup.

Data Analysis and discussion: Show raw data, describe systematic and statistical errors and their sources. Show, tabulate and illustrate main quantitative results. Compare to theoretical predictions or literature results.

Summary and conclusions: Describe briefly execution and results of experiments and their comparison to expectations. Suggestions.

Rubrics Example: NaI Spectroscopy Experiment

General presentation of Abstract and main narrative Sections, discussion of tasks, quality of figures and tables, language.

1. **Introduction**
   Background, broader context, examples of applications of experimental methods.

2. **Theory: Understanding the theoretical background for applied techniques**
   Principles of spectroscopy with scintillation detectors, photon multipliers;
   Explanation for absorption of photons and dissipation of photon energy in matter;
   Main processes, formulas used in data analysis.

3. **Experimental Setup and Procedures**
   Block diagrams of general (mechanical) setup and electronics;
   Generation/origin of radiation to be studied;
   Generation and processing of electronic signals;
   Define goals and principles of measurement;
   Anticipated general results of measurements.

4. **Experimental Results**
   Briefly discuss performance of electronics & data acquisition system;
   Show typical (close to) raw, energy spectra indicating quality of data obtained;
   Explain data reduction and analysis procedures, indicate systematic and statistical uncertainties;
   Show typical examples of line fit procedures, definition of fit region;
   Show energy calibration fit graphically and numerically, include data tables;
   Discuss main sources of uncertainty;
   Show and discuss energy spectra of photons from background and unknown sources.

5. **Discussion of Results/Conclusions**
   Discuss resolution of detector, peak-to-background ratio, estimated efficiency;
   Discuss intensity of background radiation and main activities;
   Discuss the measured effects of shielding electromagnetic radiation with different materials.

6. **References**

Rubrics Example: Mössbauer Experiment

Comments apply to an excellent report graded A-.

1. **General Presentation**
   Abstract: Comprehensive, clear structure of report.
   Narrative, Tasks: Extensive, comprehensive discussions, executed most but not all tasks.

2. **Understanding theoretical background**
   Foundational Principles of MB Spectroscopy:
   Good explanation for recoilless emission/absorption, not for non-res. (background) absorption.
   The Doppler Effect for Photons:
   Math. derivation is missing, plausibility explanation of shape is missing

3. **Experimental Setup**
   Diagrams of general setup and electronics: sketches are shown.
   Principles of measurement have been well explained.
   Anticipated results of measurements Quantitative form given for shape of velocity spectrum for non-resonant absorption.

4. **Experimental Methods, Detail**
   Detection with PC as gas amplification counter with multiple response (escape lines) explained.
   Absorption/transmission as functions of gamma energy well explained
   Energy calibration fit shown.

5. **Velocity Spectrum**
   Discussed how discriminator window was set on PC energy wave.
   Raw velocity spectrum shown, corrected spectrum shown
   Function T(v) not derived or shown. Some misconceptions about resonance absorption vs total absorption.

6. **Results, Completeness, Accuracy**
   Correct absorption dips for isomer shifts and quadrupole HF splittings. However, no comparison to literature, and only brief discussion of nuclear or lattice properties.