**Sample Chm286/486 Report: Tests with Electronics**

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**Abstract**

The text below is for an experimental lab report for an experimental chemistry/physics course (ANSEL). For the present Chm 286/486 course research reports, the same format should be used. The report should start with an abstract, followed by an intro into the topic, e.g., motivation for the study or why it is important. Then a description of the research should follow, e.g., a description of how the data were collected. Then should a summary of the meaning inferred from the data should follow, and finally a summary of the main results.

1. **Introduction (Motivation/Purpose)**

The tasks given for the first experiments are designed to practice basic operations of digital oscilloscopes, as well as analog and digital electronics. The object was to practice spectroscopic applications for the subsequent experiments with gamma and charged-particle radiation detectors. Digital electronics is needed to define acceptance criteria and to produce signals to trigger the data acquisition system. The system was to be tested with a pulser calibration.

1. **Experimental setup and procedures**

For the first task with analog electronic modules, a low-amplitude pulser signal was generated using an ORTEC 419 precision pulse generator. Figure 1 illustrates the typical shape of the direct pulser output signal observed on the oscilloscope. Its amplitude is …V, and it has a decay time constant of …s. This pulse was obtained with the pulser settings …………**…**

……….Next, the pulser signal was inserted into an ORTEC 572 (?) Spectroscopy Amplifier. The amplifier to lowest coarse (x..) and fine gains (x…). Input polarity was set to…. As shown by the screen shot in Fig.2, the amplifier output signal shape was less than ideal …….It also showed a DC base line offset of 45 mV, which was corrected to less than 2 mV by activating the base line restorer (Automatic BLR).



Figure 1: Signal shape for a precision pulse generator (Taken from….).

….base line restorer toggle switch (BLR) to automatic

**………**

The ORTEC 419 pulse generator allows one to adjust the output signal shape by adjusting various front panel controls, including rise and fall time, in addition to pulse amplitude and frequency. Table 1 lists the corresponding parameters read off the scope display and compares them

to the control settings. Rise times were varied between …. and …., fall times from …. to…..

Table 1: Title for table column entries

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**Figure 2 with caption, reference**

Following tests of the behaviour of analog electronic modules, the experiment was set up to generate a logical circuitry. First, a digital NIM signal was produced by inserting the …..output signal into a fast leading-edge discriminator. The term “leading edge” implies that …… The discriminator used (Type …) has two modes of operation, an integral, lower level threshold, and a differential window (single-channel) mode. Figure 3, taken from Ref [2] illustrates the two functions……. In the integral mode,…In the differential mode,…...

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**Figure 3 with caption**

The discriminator output signals were duplicated with a Fan-In/Fan-Out module. One of the latter signals were used to produce a wider “gate” signal, the other was fed into a Delay Generator (Type ) producing a copy of the input signal but delayed by an adjustable time delay. The gate signal had a width of ….., the delayed signal had a width of only …ns. Undelayed gate and delayed NIM signals were put into a Universal Coincidence Module (Type) to test coincidence and anticoincidence modes. The setup is represented by the schematic electronics block diagram shown in Fig. 4, which also includes the analog part of the electronics..

In the tests, the delayed signal……. The resulting coincidence resolution time turned out, as expected, to be equal to …., i.e., equal to ….

A similar test was done using the Veto input of the …..

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**Figure 4**

The veto resolution time, i.e., the time interval blocking the transmission of the normal signal, turned out to be equal to…

As a further test, the function of a terminator on cables was illustrated by……

Finally, a synthetic pulse height spectrum was accumulated with the DDC-8 based data acquisition system. The analog signal was produced with the ORTEC 419 Precision Pulse Generator fed into a ……The trigger signal was derived from the output of the coincidence unit, as depicted in the block diagram of Fig. 4. The measurement was taken in 2-minute intervals for a series of pulser signal amplitudes *U1,…,U10*  between ­*0*V *and +2* V*.*

1. **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

(1)

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

The results of the “pulser fence” measurement described in the previous section are displayed in Fig. 5 where the counts/bin or channel are plotted vs. bin or channel number. The corresponding correlation between input signal amplitude (S) in V and channel number (Ch) is displayed in Fig. 6 as solid dots. The straight line drawn through the data points represents a calibration of the abscissa in volts,

(2)

Obviously, Fig. 6 indicates an excellent linearity of . …….. The chi-squared value for this calibration turned out to be ……

1. **Summary and conclusions**

Overall, the first experiments with analog and digital electronics worked out well. All modules used were in working order and functioned as described in the manual. Understanding and using the data acquisition system efficiently will probably require some more practice but the quick start sheet was sufficiently detailed to allow a simple setup and running. ……..

The main lessons taken away from these experiments can be summarized as follows:

1)

2)

…

Acknowledgements (optional). The authors thank the Teaching Associates for their extra efforts in completing the required tasks in over time.

1. **References**

[1] Glenn F. Knoll, *Radiation Detection and Measurement,* Wiley & Son, 2000, Ch. 16.

[2] W. U. Schroeder, ANSEL Lecture Notes, Lect 3, 2012