EKA Advanced Physics Laboratory

Counting Statistics and Artificial Radioactivity

Getting Started Guide

In this experiment you will be using a Geiger counter to study radiation emitted by radioactive isotopes, particularly the statistics of how they are distributed. The purpose of this document isn't to explain the experimental procedure or the physics involved, but to provide a step-by-step guide to get started with the equipment.

The best way to begin is to turn on the computer, which will provide step-by-step instructions. After you power on the computer, the lab software should load automatically.

You will see a title screen which says "Geiger Counter Experiment," and press Enter to begin. Press Enter.

You will see a menu screen with five options:

1. Turn on counter
2. Rate - determines counting rate
3. Count - takes N counts and writes to FILEC.DAT
4. INTRVL - takes N time intervals and writes to FILET.DAT
5. Exit

Options 2-4 will be used during the experiment to provide different data-taking modes.

For now, select option (1) and follow the instructions. All the equipment should be correctly connected and only needs to be powered on; if there are any problems see an instructor.

To get you oriented here are some pictures of the equipment you'll be using.

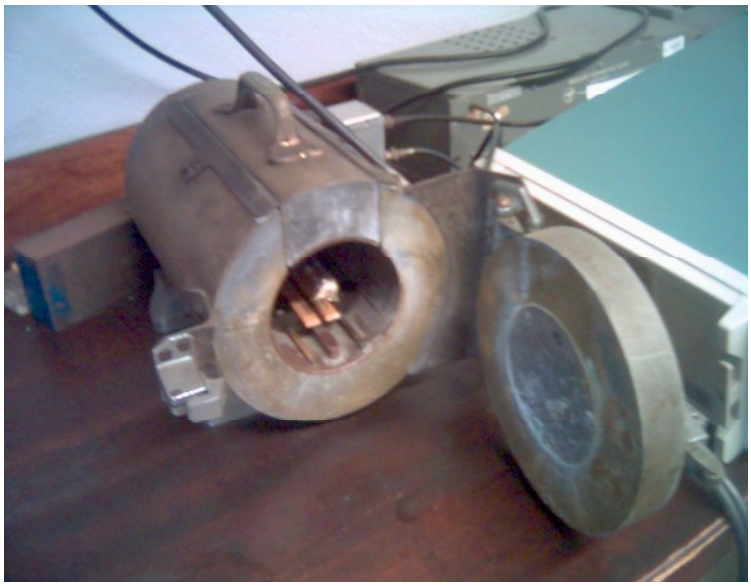

Figure 1: *The Geiger counter. The actual detector is the tube at center; sources are placed on the small wooden trays below the detector.*

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Figure 2: *The High Voltage Power Supply, which supplies voltage to the detector tube. The power switch and indicators are at left; the voltage is controlled by the three knobs at center and right.*

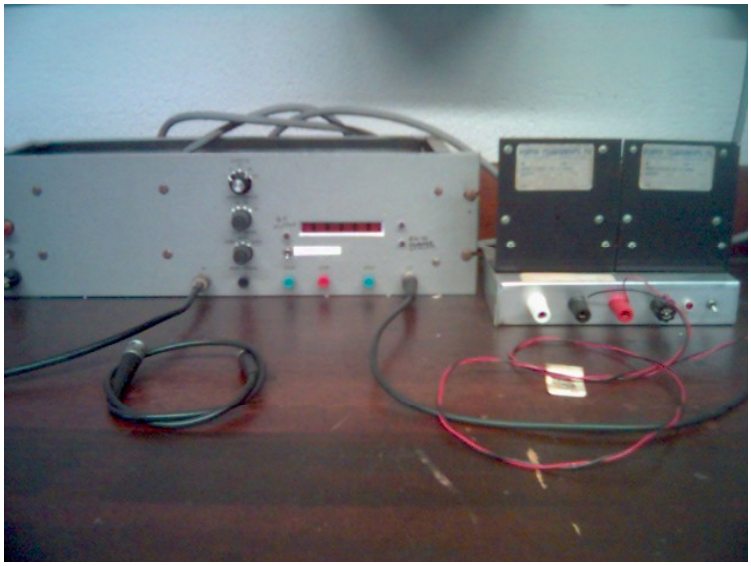

Figure 3: *The amplifier/scaler (L) and computer interface (R). These take the output from the detector and translate it into machine-readable form. Note that the amplifier/scaler has two power switches, and the interface has one.*

Once you've powered on all the switches and set the voltage as prompted by the computer, you are ready to insert a sample and begin measuring, after waiting for the computer-prompted 30-second delay.

CAUTION: *Be sure* ***the voltage never exceeds 1200V,*** *or you may damage the Geiger counter!*

Notes:

- The total voltage is the sum of the three knob readings on the power supply.
- In order for the scaler to begin counting, press "**Reset**" and then "**Start**" on the amplifier/scaler.
- The samples are in a locked storage room; you should see a lab instructor to get the samples.

A note on the timing settings on the computer interface:

Intervals (over which counts are summed and binned) are set by the knob on the front of the interface. The switch has five cumbersomely-named positions, corresponding to time intervals of 1.28 (knob label 1.28), 5.12 (knob label 1S), 20.48 (knob label 4S), 81.92 (knob label 10S) and 327.68 (knob label 40S) seconds (as written on the piece of paper attached to the hardware).

When prompted by the software to enter the time interval being used, enter the time values 1.28, 5.12, etc., *NOT* 1S, 4S, or whatever the knob says.

Note also that at the higher interval settings, the computer may take a while to respond, up to twice the interval time (since it must wait for an interval to end in order to perform a task). This is normal; don't reset the computer if it seems to "hang" (for up to 10 seconds at 5.12s setting, or up to 10 minutes at the 327.67s setting!)

Figure 4: *The samples. Each sample is numbered and the sheet on the bottom indicates the activity level.*

Once you've loaded the sample, follow the instructions in the manual and reference literature.

Your first step will be to determine counting rate (Option #2) as a function of applied high voltage from 900 volts and up, in order to determine the threshold voltage for detection and to find the "plateau" region. Above the plateau region is a region where count rate increases very rapidly. Take care not to go far into this region, or you will damage the detector!