Gamma Ray Absorption Lab Instructions

Follow the instructions in the Lab Manual to perform the following experiments:

PRELIMINARY EXPERIMENTS (section 7.4)

Tube Calibration (section 7.4.1)

1. Pulse amplitude versus GM tube voltage *(pg. GR-6)*
2. Count rate versus GM tube voltage *(pg. GR-6)*

Intrinsic Capacitance and Resistance (section 7.4.1)

3. Determine internal R and C values
    - Externally modify R and C. Measure the pulse amplitudes and time constants, before and after modifications. How does the pulse change when R and C are externally modified.

Background Counting Rate (section 7.4.2)

4. Measure the background counting rate.

Counting Statistics (section 7.4.3)

5. Experiment given on *pg. GR-10*

Dead Time (section 7.4.4)

6. Use the oscilloscope trace to estimate the dead time *(pg. GR-11)*
7. Use two sources to estimate the dead time *(pg. GR-12)*

MAIN EXPERIMENT (section 7.5)

The Absorption of Gamma Rays by Lead

8. Place sheets of lead of different thicknesses between the source and the detector to absorb gamma rays from your source. Details are given in *pgs. GR-16,17,* the following is a rough guide:
    - Compare count rate with no lead at all to count rate with 1 mm of lead. Explain what is happening.
    - Take measurements with different thicknesses of lead
    - Incorporate background counting rate (from section 7.4.2) in your data-taking
    - Plot I vs x, fit to the appropriate model, calculate best fit parameters, find χ^2 of the fit. Do any of the points seem weird? Explain why, and try the fit without these points.
9. Plot the data in Table 7.1 of the lab manual to show how μ depends on the gamma energy *(pg. GR-17)*
    - Assess how your value of μ compares with the theoretical value

ADDITIONAL COMPARISON:

Z-Shielding (section 7.6)

Measure the count rate with the following configurations *(pg. GR-17,18)*

- Z-shield (shiny side up)
- Z-shield (shiny side down)