Phys 586 Laboratory

Lab 1

Goal: In this lab you will do a rough HV plateau curve for plastic scintillation counters.

Reading: Knoll pp219-228, pp247-252, pp265-276

Lab:

1. Each student should record which scintillator counter with which you are working.
2. Identify each of the parts of scintillation counter.
3. Use your eyes. Look over the counter and fix any obvious openings which would allow light to enter the scintillator or PMT.
4. Hook up the PMT base to an analog scope. Note the PMT base anode output circuit is set to drive 50 ohms so use proper termination. Make sure the HV supply is set to NEGATIVE. Set the HV to -1700V initially.
5. Check for light leaks using the black cloth. If a large (or intense) pulse is seen a light leak exists that must be located and plugged.
6. Make a quick sketch the dark current pulse noting time and pulse height information.
7. Now place one of the gamma sources close to the counter. Sketch the signal. Include a time and voltage scale in your drawing. What is the rise and fall time of the signal?
8. Do the same using the digital scope. What is the rise and fall time of the signal?
9. Set the discriminator threshold to be 30 mV. Set the discriminator width to be 50 ns. Connect the output of the discriminator to the visual scaler. Do a quick run through the gamma sources in the box.

Which have the highest and second highest activity? Does this agree with your expectations?

10. Do a crude scintillation counter plateau by measuring the count rate as a function of PMT voltage. You might record the count rates from 1200 to 2000V in 100V steps and then make any finer measurements as necessary. DO NOT EXCEED 2200V without permission of the instructor.

11. Do a quick graph of the count rate versus PMT high voltage. Sometimes a log scale on the y-axis makes the plateau clearer.

In your lab writeup, please include:

1. Counter number and source used
2. Sketches of the pulse with and without the source at the plateau voltage
3. A table of the raw data you collected
4. The plateau curve
5. A summary of your analysis of the results. In this lab, please include an estimate of the error on your plateau voltage.

Also, please answer the following questions

1. Which gamma source in the box has the most activity?
2. Which gamma source in the box has the second highest activity?
3. What is the source of signals seen with no source?
4. How could this particular plateau curve method be improved?
5. A better way of plateauing counters like these is to use three counters and take appropriate coincidences. Design such a circuit using discriminators, fanouts, and coincidence units. We will use this design to plateau the counters in a more robust manner next lab.