Phys 586 Laboratory

Lab 2

Goal: In this lab you will do a more precise HV plateau curve for plastic scintillation counters and measure the cosmic ray muon flux.

Reading: Knoll pp219-231, pp247-252, pp265-286

Lab:

1. Set up a cosmic ray telescope with three scintillation counters.
2. Set the initial HV for the three counters at the plateau voltage you found from last lab or at a value that gives approximately 200 Hz noise rate in the counter and a robust source signal on the oscilloscope.
3. Configure the counter geometry to look for cosmic ray muons. Set up the appropriate NIM logic to make a double and triple coincidences of the three counters. You need to be aware of and/or adjust the discriminator thresholds and discriminator and logic unit widths. You also need to ensure the signals used in the logic units are in time.
4. Plateau the counter by measuring the ratio of triple coincidences to double coincidences as a function of PMT HV. Take data from 2000 to 1400V in 200V steps and make any finer measurements as necessary.
5. The correct operating HV should be about 100 V above the knee of the plateau.
6. Using your setup and at the operating voltage, estimate the vertical cosmic ray muon flux. Your flux should be quoted with an associated error. The formula will be discussed in class.
7. Using your setup, estimate the background (non-cosmic ray muon) rate on your measurement.

In your lab writeup, please include:

1. Counter IDs used.

2. Plateau curves.

3. Your estimate of the vertical cosmic ray muon flux and error.

4. Your estimate of the background (non-cosmic ray muon) rate and how you measured it.

Also, please answer the following questions:

1. Why is this method of plateauing the scintillation counters an improvement over that used in Lab 1.

2. Counting with cosmic ray muons is slow. Could we use a gamma or beta source to make this measurement? Explain.

3. What is expected vertical cosmic ray muon flux?

4. Estimate the number of photoelectrons produced in a 1cm thick plastic scintillator.