1.3 Muon Pysics

Pre-Lab:

- Task:
    - Setup the equipment as the beginning of the experiment
    - With the instruction, finish the step5
    - Discussing about questions in step5
    - Set the equipment for step6

Third Lab session(6 October 2020, 12:05pm):

In this lab session, we would use the electronics box to detect Muons decaying. Comparing with previous session, this time we would not test the pulse of the muons. By adjusting different thresholds, we would obtain different results.

- Procedure:

  1) We connected the PMT output and the PMT input port on the electronics box with BNC cable. The threshold was set to 100mV, the HV was set to -800V. The Muon detecting indicator of the electronics box kept flashing. By running the program, some decaying could be detected. But we found that the records were constructed near 18μs.

  It was because that we forgot to deactivate the pulse of PMT. However, initially, we thought it might be the result of non-zero time interval. Then I adjusted the time interval to zero, the records was still wrong.

  2) After being suggested, we switch off the pulse. Then we obtained the result as Figure 1.

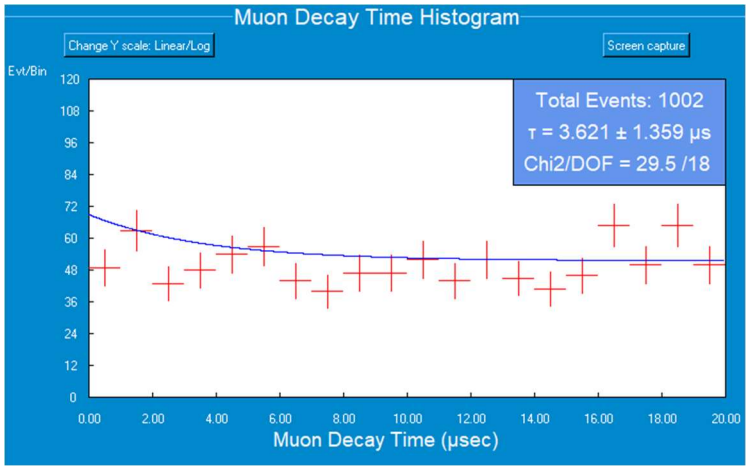

Figure 1

The histogram could be fit as an exponential function, but it looked more like a totally random function with same possibility, as the result of a low threshold.

- Discussion：

  If all data come from random background noise, the possibility will be:

$$P(2, 0\ to\ 20) = \int_0^{20} \frac{(rt)^n e^{-rt}}{n!} dt = 1.277e - 8$$

  It was not appropriate to choose discriminator level as 100mV. The reason is: with higher discriminator threshold, the decay rate, r, will decrease dramatically, leading to a smaller background rate.

$$R_{background} = \frac{P(2, 0\ to\ 20)}{20 * 10^{-6}} = 0.064\%$$

  The result is relatively high. Hence, to get better pattern, we will set a larger discriminator threshold as 400mV for step6.