Lab 1 – Tuesday Feb 13th 2024

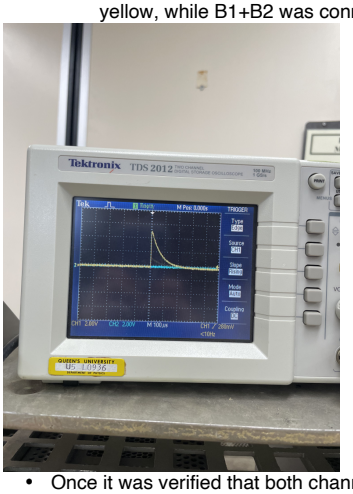
Thursday, February 08, 2024 2:36 PM

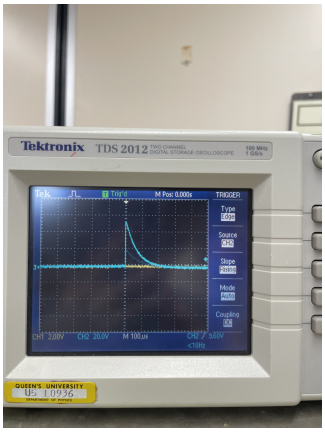
Goals for today's lab session:

- Calibrate the detector using the 22-Na source

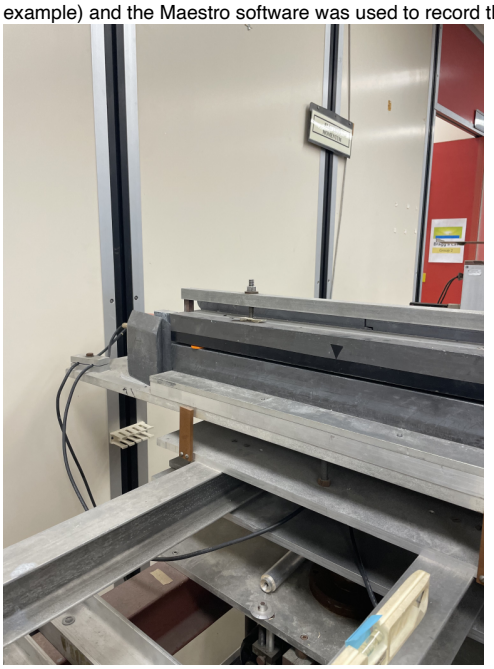
Tasks completed this session:

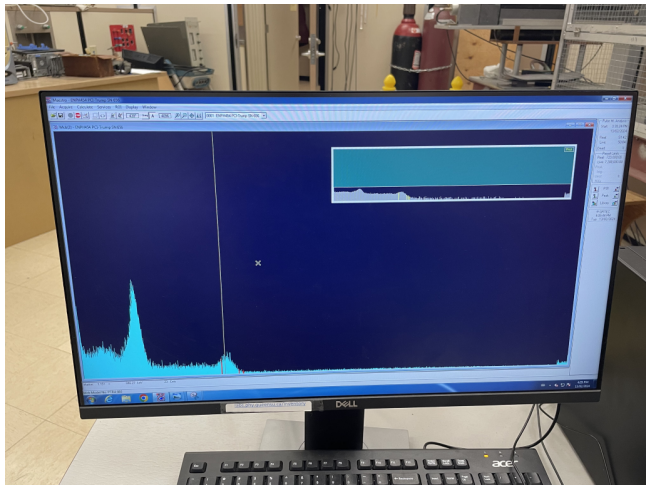
- Calibration of the PMT's (A1+A2) and (B1+B2)
  - First the A1+A2 and the B1+B2 BNC cables were connected to the oscilloscope to verify that the PMT's were producing signal while we waited for access to the source cabinet. A1+A2 was connected to channel 1 of the oscilloscope and can be seen in yellow, while B1+B2 was connected to channel 2 and can be seen in blue.

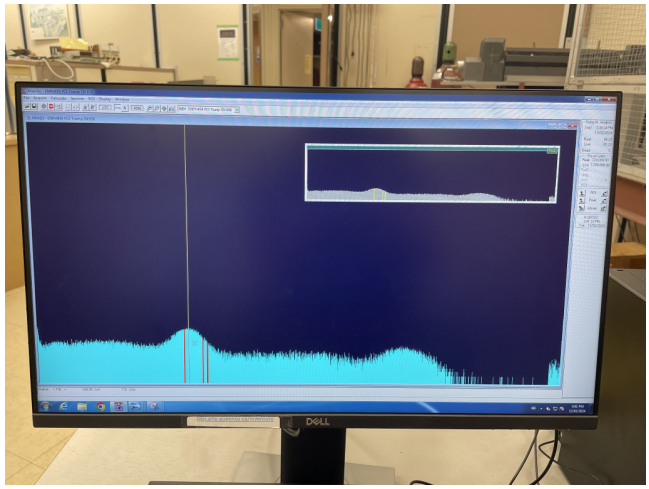




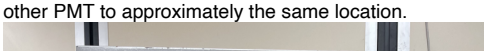
- Once it was verified that both channels were reading signal a Na22 source (2SS511) was signed out to begin the proper calibration of the PTMs.
- To calibrate the PMT's the source was placed close to one PMT (either A1 or A2 for example) and the Maestro software was used to record the given spectrum.

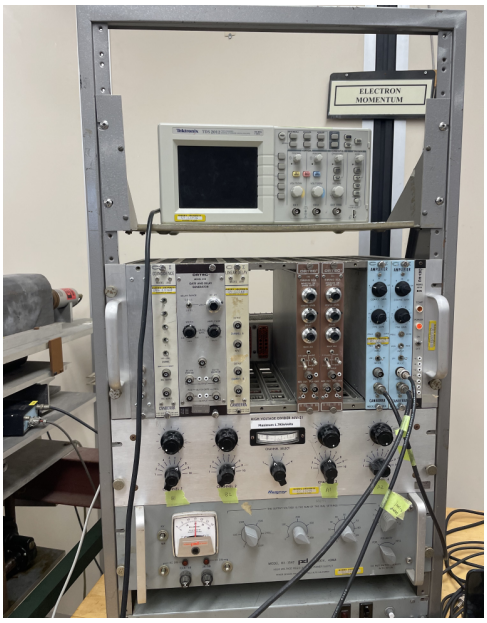






- The spectrums taken during the calibration can be seen on the side
- The spectrum of a Na22 source has 2 distinct peaks, one at 511 KeV and 1.2MeV. The 511 peak was used for the calibration.
- Based on the spectrum collected with the Maestro software, a region of interest was declared where the 511KeV peak was expected to be. The gain and voltage settings were then altered in the experimental set-up to move the corresponding 511KeV peak from the other PMT to approximately the same location.

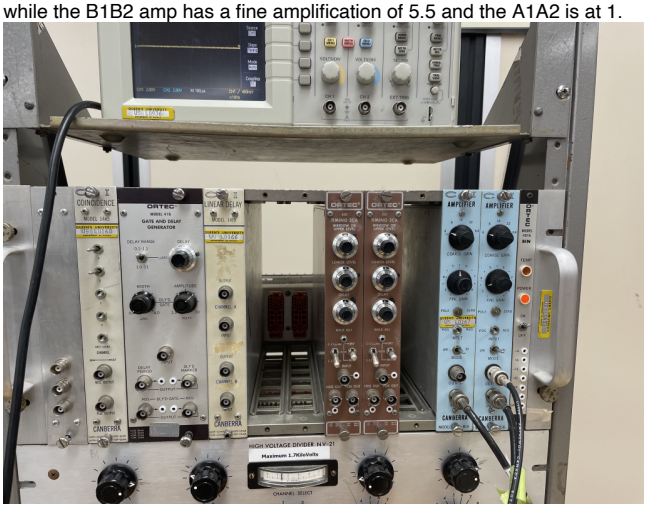




Following this A1 has its peak defined and then A2 was shifted to have its peak in the same region.

- To confirm the calibration the source was then placed in approximately the middle of the PMTs and a spectrum was taken to make sure the peaks aligned with each other to finish the calibration process.
- This was then repeated with the B1 and B2 PMTs. It should be noted that the crystal in those PMTs is cracked causing a doubling of the 2 expected peaks from the reflection/refraction of the light within the interface.
- The B1 and B2 peaks were calibrated as well as the A1 and A2 peaks. The calibration settings can be seen below. B1 has a voltage of 10 V, B2 of 9 V, A1 of 10 V and A2 of 9 V. All of these have fine voltage associations but the voltage step is unknown. This will be asked about next lab period.

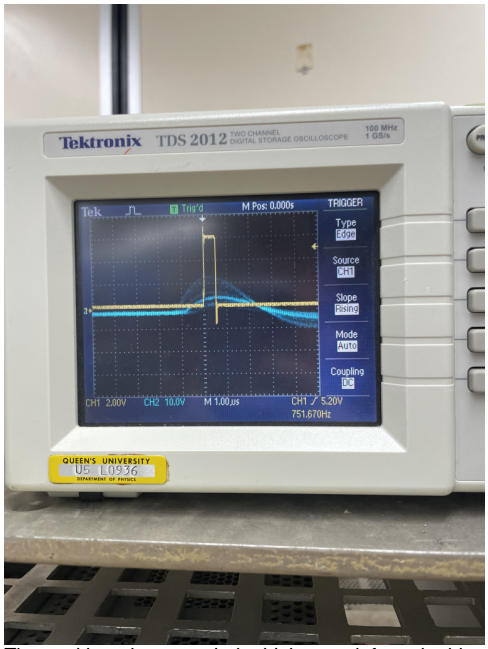
- The amplifier gain was also adjusted and can be seen below. The first amp is connected to B1 and B2, the second is A1 and A2. Both amps are set at a coarse amplification of 4, while the B1B2 amp has a fine amplification of 5.5 and the A1A2 is at 1.



Tasks for next session:

- Now that the PMTs are calibrated the channel window needs to be calibrated. This is done using the timing SCA module. And the oscilloscope to look at the window. The amplifier

signal can be seen in blue (channel 2) and the timing SCA signal can be seen in yellow (channel 1).



- The goal here is to match the higher peak from the blue in the middle of the yellow. This tells the spectrum analyzer on the computer where to look for coincident events from detectors B1B2 and A1A2. The timing SCA signal will be altered in the next lab session to ensure that the blue signal is properly contained. Once this is done the spectrum analyzer software will be used to do more calibration. Once this is done data can be collected.
- The same 22Na source will be used