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The first thing we did this week was record data to finish the angular correlation experiment for Cobalt-60. We had decided to use the MCA coincidence mode to collect our data after verifying the coincidence mode works the same as a coincidence circuit with a Timing SCA. To decide where to place our detectors, we had to take variables into account like efficiency and angular resolution. We want the detectors close enough to the source that the efficiency is high, but not so close that the angular resolution renders our data useless. Due to the size of our detectors and activity of our source, we are heavily limited. We chose to set the detectors 6cm away from the source, resulting in a poor angular resolution of ~52 degrees. We ran each trial for about ~6 hours to get more than 10,000 counts to reduce our statistical uncertainty. After getting the data, we were able to see the angular correlation, which was fit and the sinusoidal pattern was observed (figure in weekly slides report). This concludes the angular correlation experiment.

The rest of the week was spent working on our research proposal to submit for beam time at the lab as well as preparing for the beam time. This involved calculating our expected results as well as laying out how we expect to conduct the experiment. Our beam will be alpha particles and our beam energy will be 28.5 MeV. We plan to use Gadolinium-156 as our target, and our target has a thickness of 3.05 mg/cm^2. We calculated the cross sections/excitation function for both the total reaction, as well as for the specific channel of the reaction we are worried about, (the decay of Dysprosium-160 to Dysprosium-158). Using these, we were also able to calculate the expected counts/second. Because we are using a germanium semiconductor detector, we can only get to around 10,000 counts per second before we start dealing with serious pileup. We hope to have around 6,000-8,000 counts per second. Approximating our detector efficiency to be ~4% we can achieve this cps by using a beam intensity of ~0.5 pnA.

In the background this whole week, we also have been considering how we want to analyze the data we plan to get. Using the list mode in the MCA, we get information about the counts, but also get event data like time, which we want to record. The downside is the files created by the list mode are too large for something like a jupyter-notebook to analyze. The main plan is to convert the text files into ROOT files and then use ROOT to analyze the data instead.