Summer Intern at Jefferson National Lab

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As an intern at Jefferson National Lab (Jlab) I have had an excellent summer working both with physicists and engineers. My work this past summer has taken me from troubleshooting programming to being in charge of my own project within an experiment.

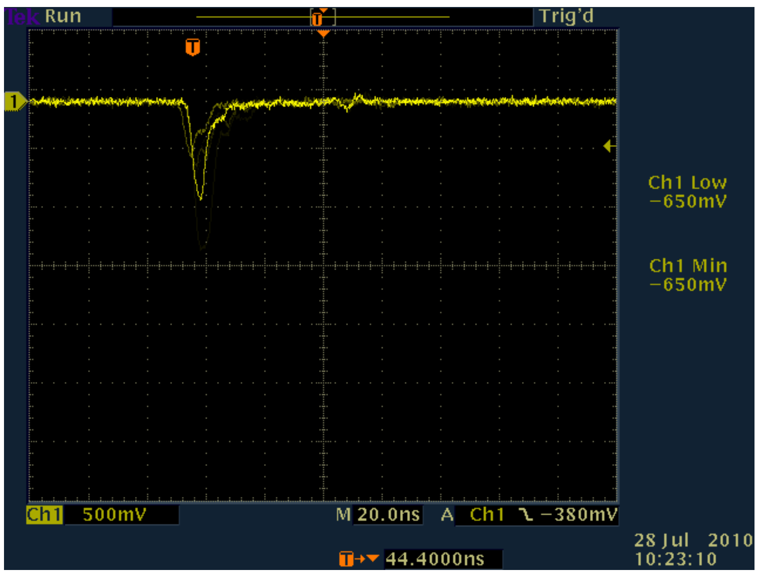
My first job at Jlab was aiding the engineers for the new Hall D that is currently under construction. Here I worked on the Cryogenics Control for the Superconducting solenoid for Hall D. I learned a lot working with the engineers. First I made communications between instruments on the cryogenics control (such as valve control for the liquid helium and nitrogen and temperature monitors) and a hyper terminal on a local laptop. With these communications set up, I then aided the programmer in trouble shooting the program in order for the Programmable Logic Controller (which is on control of the entire system) to recognize and collect data from the instruments. Next I was given a task of making a resistor box to attach to the cryogenic module for the magnet. This involved delicate soldering and wiring.

The rest of my summer was spent working with the Primex II project. In preparation for the experiments run later in 2010, I was given the task of testing and ensuring that the Charged Particle Veto Counter was in good working condition. The Veto counter is composed of twelve scintillating paddles with a photomultiplier tube attached to each end. The veto counters are placed directly in front of the Hycal calorimeter and they are there to reject charged particle backgrounds incident on Hycal. The total of 24 PMTs had to be checked for any light leakage through the black tape and plastic that covers the entire crystal surface.

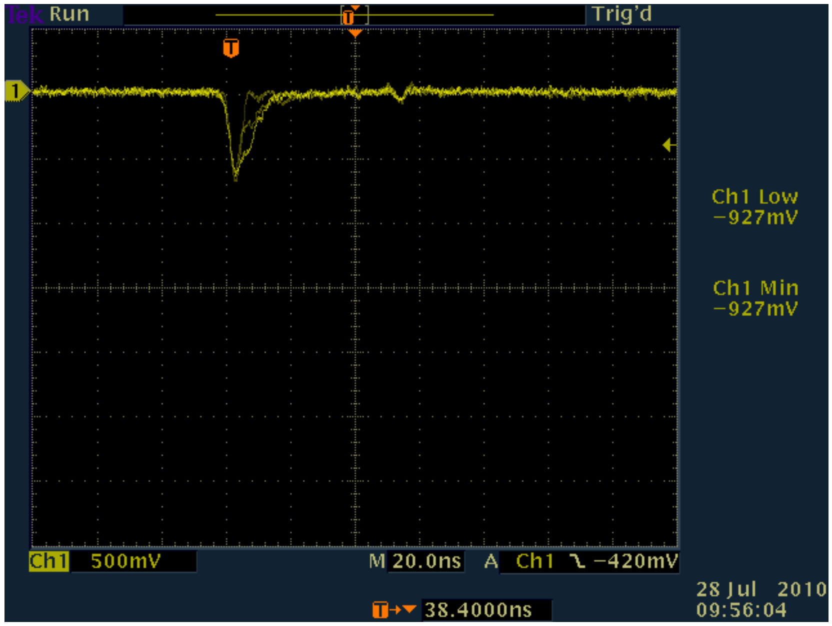
The tools and instruments that I used were an oscilloscope, a high voltage power source, and an older micro amp meter. In order for the PMT to produce a signal that I could read, I had to provide three things: a data cable, a source of power and a 50-Ohm resistor to the dynode. Without the resistor attached, the signal that is revieved by the oscilloscope is a mirrored image of the initial signal. Once all necessary things are attached the process begins.

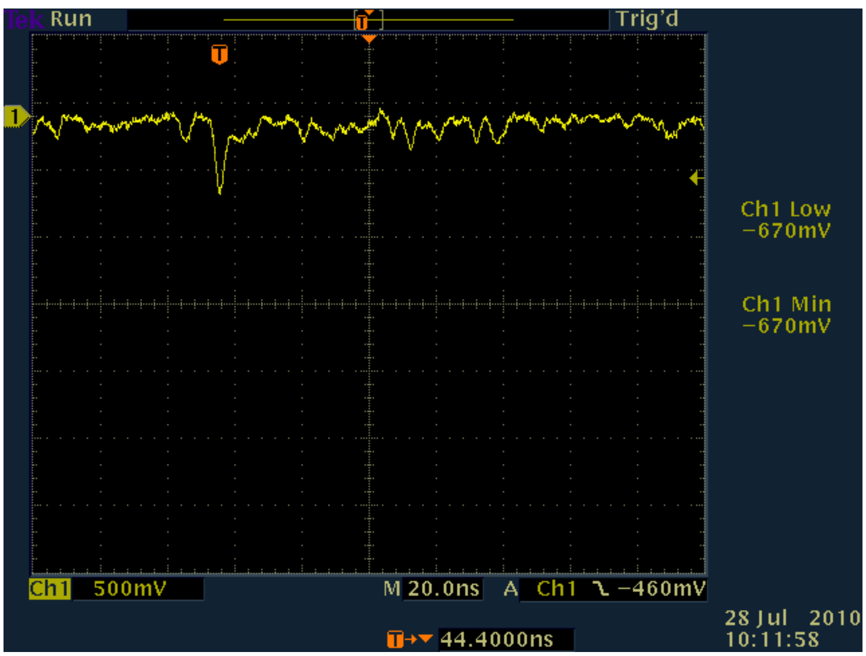
After I have tuned the power to the PMT I am testing to 1.782 kV, I check the wave on the oscilloscope. If there is a lot of interference, then next I switch the cords and check the output in micro amps. A standard output that means I have no light leakage is anything below 8nA to 9nA.

If there is any signal above that then the process of finding the leak and patching it begins. While the PMT is still connected to the micro amp meter, I use black felt and a flashlight to work my way around the joints and up and down the paddle. Once a leak is found the meter spikes up and I know the location. The remaining work on that PMT is simply taping over the location where light is entering the crystal. I repeated this process for all 24 PMT's in the Veto counter until the signal received from the micro amp meter is below 8nA for each PMT. The majority of leaks that I found were around the light guides that connect the scintillating paddles to the light PMTs. The tape surrounding these blocks of glass was simply old and beginning to lift, thus allowing light to leak in. The ability of the veto counter to have a low background signal will increase the efficiency of the counter and the results of the Pirmex II project in the end.



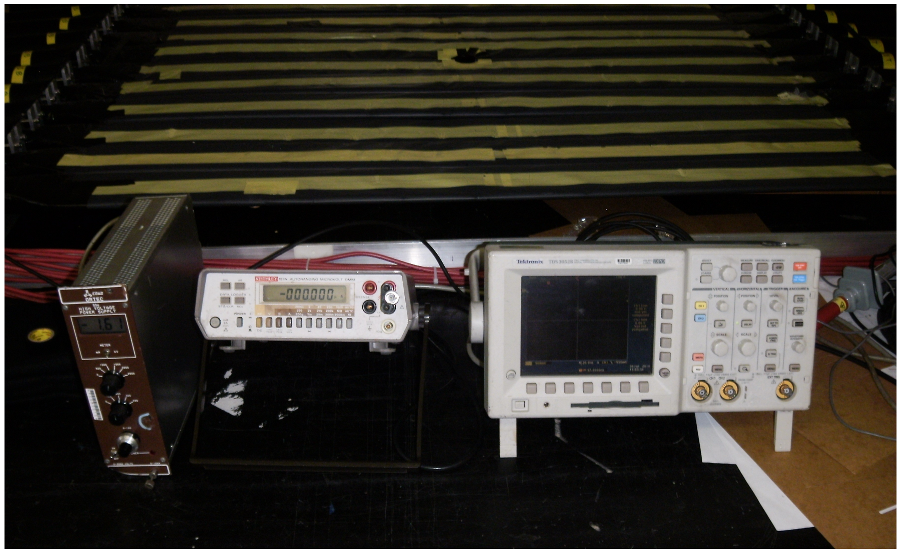
The pictures both above and below this caption are examples of signals received by the Digital TekTronix Oscilloscope that I used to test each PMT output. The signal shown is caused by the incidence of cosmic rays on the scintillating paddles of the Veto Detector. These signals are what I worked to receive from the PMTs.

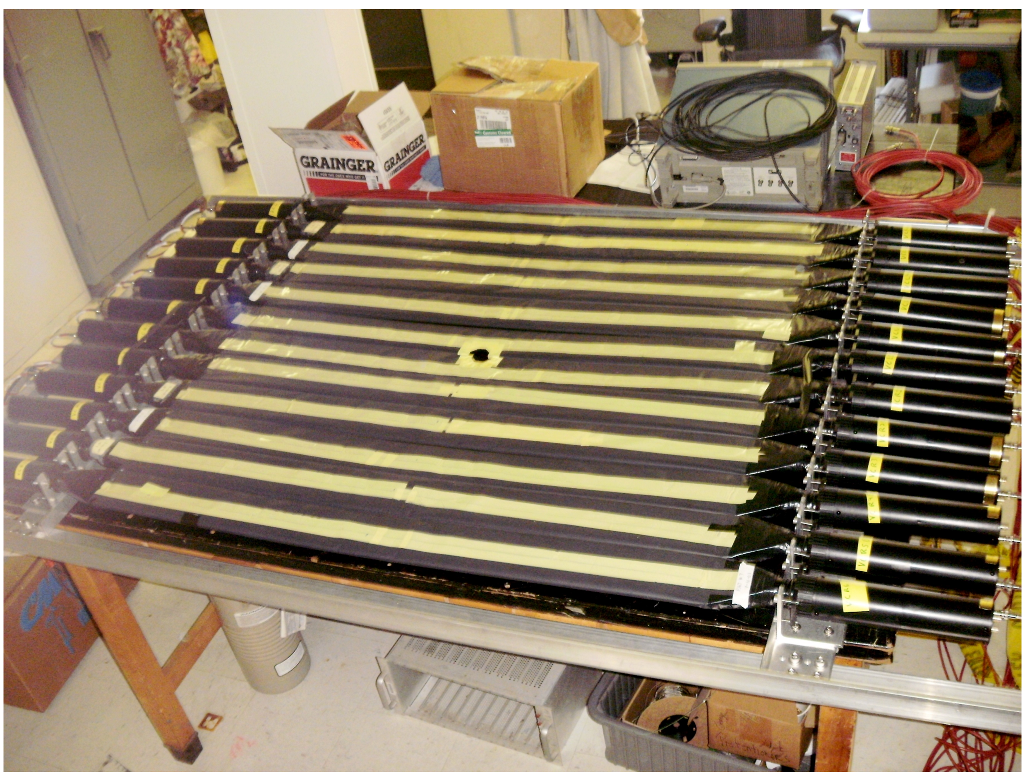




This image from the oscilloscope is a result of light leakage into the protective black plastic covering of the paddle.

Below is an image of my setup inside the trailer 94B on the accelerator site of Jlab.





Above is the Charged Particle Veto Detector.