

The University of Iowa Quarknet 2012

The summer of 2012 found 5 students and 3 teachers involved in many activities related to the high energy particle physics group at The University of Iowa.

Some of the things the teachers and students did over the summer:

- Performed tests on equipment
- Prepared specimens for beam exposure

Student Research



2012 Research Students and Teachers

The students were engaged in many projects but first we had to take down a lab in one room and set up a lab in another. This involved preparing the room for our research using a soldering station, data acquisition racks, crates and cards along with the associated wires and instruments such as oscilloscopes and power supplies. We also had to prepare the computers for these activities by reformatting them and adding software that would do what we needed.

Once the room was set up, we undertook some projects for the summer. We were involved in preparing glass and fibers for exposure to radiation, testing directional signals from a plastic puck on a PMT, Helium after-pulse measurements and baseline measurements of specimens for radiation exposure. Most of these projects were carried out in our new lab setup.

Specimen Preparation



Camille, Moira and Sierra prepared fibers for exposure to radiation in a test beam at Fermilab after we left the program. They took fibers and stripped their coatings and mounted them in frames so they could be radiated in a test beam. Hayley ran baseline tests on the fibers to determine their transmission and absorption using a Xenon flash tube. After their exposure to radiation, they will be checked again to see what wavelengths of light are changed by exposure to radiation. This project will cast some light on the resistance of the fibers with and without doping to see what the best materials should be used in the upgrade of the Forward Calorimeter (HF) in CMS.

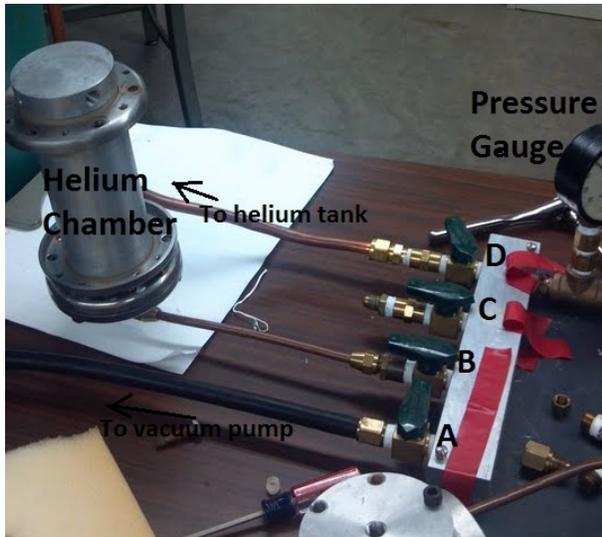
Directional Photo-Multiplier Tube (PMT)



direction of the tube.

Austin Bries and Eli McDonald set up a plastic disk on a large PMT to see if the direction of the signals from cosmic rays could be determined by the signal in the PMT. To accomplish this they measured the signals of cosmic rays with the PMT upright and with it inverted. They used 2 small paddle PMT's as triggers and measured the signals in the large PMT. The data from this exercise was inconclusive so they could not determine the difference between the signals due to the

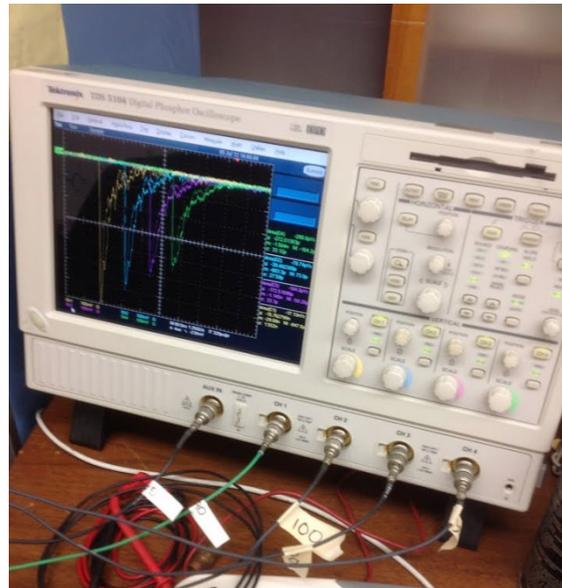
Helium After-Pulse Experiment



The group set a goal of determining how the degradation of the signals in the PMT's would change due to leakage of gas into the vacuum chambers of the tubes. To this end, a tube was exposed to Helium gas and after-pulses were measured to see how much exposure would increase the number of after-pulses in the tubes. A manifold with a chamber, vacuum pump and Helium cylinder was set up to expose the tubes. The tubes were put in the chamber, the air was removed and Helium was introduced. The Helium was exposed for a certain amount of time and the tubes were checked for after-pulses. Since it takes weeks to get a result from these tests, the setup was left with the

group to complete.

To check the after-pulses, the PMT's were placed in a light-tight box where a flashing blue light emitting diode pulsed the tubes. These pulses were measured at 100 ns intervals after the pulse. There should be no pulses after the initial pulse. When the gas has sufficiently compromised the tube, after-pulses should occur in the intervals after the initial pulse. Our setup delayed the pulse for 500 ns in 100 ns intervals to see if pulses would occur. The team continued our procedure after we left so there was no data for this at this time.



Gob Stopper Collider

Implementing learning styles by using Exploration,



developed a "Gob Stopper Collider" (GSC). As an Exploration, reveal the insides of the candies by breaking them apart. would accomplish this Exploration. The comparison to really quite good for an introduction into particle physics. Gob Stoppers inside a couple of 2-liter bottles.

group at The University of Iowa accomplished some steps CMS and developed teaching strategies for implementing high-energy particle physics in the classrooms across Iowa. The research activities promoted materials studies for the upgrade to CMS. The education activities brought together the students and teachers in an effort to spread the ideas of particle physics to the schools in the state.