

# Quarknet 2007

## University of Iowa

### Summer Program

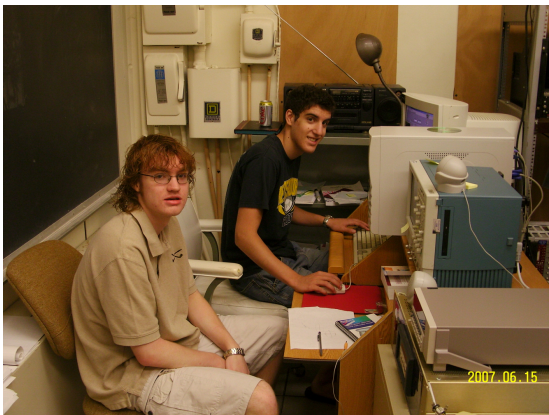
The Quarknet summer program at the University of Iowa consisted of many different activities. We had a data acquisition team, a vapor deposition team, a virtual control room team, a web team, a fiber damage team along with helping the staff with its various research projects. Quarknet brought seven high school students and three high school teachers to the research facility in the Van Allen building on a daily basis for eight weeks. There, we blended with the research effort to help accomplish the goals of the High Energy Physics team led by Dr. Yasar Onel. We were solely in charge of data acquisition, fiber damage and vapor deposition. We collaborated with the staff on the virtual control room, the web page and testing of materials for use in the Compact Muon Solenoid detector at CERN.

### Data Acquisition (DAQ)

Our data acquisition team consisted of Nathan Premo, Tom Johnson and Mitch Miller. They did the bulk of plate, sensor and fiber testing during summer of 2007. They tested many quartz and plastic plates for radiation hardness and sensitivity to various radiations. Most tests included a stimulus of UV or visible radiation and detection of light into phototubes and a variety of alternative sensors. Some of the



**Teacher Chris Like, Nate (back) and Mitch (front) set up a test**



**Nate and Mitch run the DAQ computer**

plates were deposited with P-terphenyl (PTP) from the vacuum pump operation. Sensors included new silicon photodiodes and a set of avalanche diodes. These materials were prepared for radiation exposure at CERN, Fermi Lab and Argonne National Laboratory. These materials were being considered for use in

the next generation of detectors at CERN when radiation levels will increase by many factors.

## Vapor Deposition

Teacher Moira Truesdell and Brittany Swearengen worked on the vacuum system to use for vapor deposition of PTP onto the quartz plates. They had to bring an old pump system into working condition and use it for the deposition. After replacing the readouts to match the thermocouples, changing the oil in the diffusion pump, replacing some old wiring and fixing the cooling system plumbing, the system proved to be quite reliable.

The system was used to deposit PTP onto the quartz plates to increase their sensitivity to ultra violet light. The PTP would absorb the ultraviolet light and emit a blue light that was in the peak wavelength of the photomultiplier or photodiode sensor for the plate. This was in an effort to make the small Cherenkov radiation signal into a more robust visible signal. The quartz plates were a good replacement for plastic plates as their radiation hardness was better. The presence of PTP was a promising way to enhance the signal in quartz plates while maintaining radiation hardness.



**Teacher Moira Truesdell (left) and Brittany add liquid nitrogen to the diffusion pump trap.**



**Analytical Balance used for PTP measurement**

## Virtual Control Room and Web Team

Anna Selser, Jake Hemberger and Alex Bruecken spent many hours setting up a virtual control room and building our quarknet web page. They did everything from ordering carpet and moving furniture to setting up computers and making posters. They set up the control room as a comfortable place for people to directly access Fermi lab and CERN experiments by using the computer facilities “be there” for experimental runs and communications between staff. The modern methods of chat are to be used to collaborate with people in areas remote to Iowa City.



Anna and Jake work on web page

This room will house the equipment to make these communication sessions both comfortable and technically friendly. A trip to Fermi Lab with a visit to their control room inspired these young people to make the University of Iowa’s control room second to none.



The Quarknet group at Fermi Tour

## Fiber Damage



Alex ponders the delicate fibers...

Alex Bruecken and Tom Johnson assisted teacher Peter Bruecken with a continuing project from last summer. Several samples of cut fibers were prepared and tested and then sent to Argonne National Laboratory for exposure to radiation in their Intense Pulsed Neutron Source facility in September of 2006. These fibers needed to be tested after their exposure. This team performed the tests and compared the performance of the fibers before and after radiation exposure. This

information will lead to a decision as to which fiber is best suited for implementation into the new, high-radiation detector applications. The work was very meticulous and care needed to be taken to make this summer's data comparable with last summer's data. Data from this activity has led to publication and this year's data should continue that effort.



**U of I fiber testing station**

## **Participation in staff projects**

The Quarknet team participated in projects by staff members on a day-to-day basis. Whenever there was a deadline to be met and the other staff needed assembly of materials such as light-tight wrapping quartz plates or connecting wires to source drivers for CERN, the quarknet team pitched in and helped with those tasks. The students and teachers experienced the valuable teamwork that characterizes high-energy particle physics research. From changing diffuser oil to learning LabView to analyzing data and producing data plots of sets of measurements, the quarknet team experienced the “whatever needs to be done...” functions that are so much a part of research. The teachers and students that participated had a memorable experience that will impact their perceptions of just what physics research embodies.