

The University of Iowa Quarknet Summer Institute

Principal Investigator:

Dr. Yasar Onel

Teacher\Mentors:

Peter G. Bruecken, Christopher Like and Moira Truesdell

Students:

William Fawcett, John Guhin, Lindsay Matthews, Nate Perk, Preston Ross and Archie Weindruch



During the summer of 2014, The University of Iowa hosted involved six students from Bettendorf High School and 19 teachers in a combination of research activities and a teacher institute. The work was directed by our Principal investigator, Dr. Yasar Onel and mentored by three of the teachers, Peter Bruecken, Christopher Like and Moira Truesdell. The summer activities focused on the following three projects: Preparing scintillating plates for a test beam at Fermilab, Building a demonstration model of CMS and a week-long teacher institute for 16 teachers from across the state of Iowa.

Activity 1: Building a demonstration model of CMS:

Three of the students aided a graduate student in executing his grant to build a demonstration model of The Compact Muon Solenoid (CMS) at CERN. The students drew parts in a proprietary program for a 3D printer, programmed Arduino® controller boards and helped design the assembly of the printer. The task consisted of making a 1/160 scale drawing of each functional part of CMS and printing the separate parts on the 3D printer. The students then programmed the controller boards to simulate, using lights, the particle interactions in the model

when a cosmic ray triggered an event. The students programmed a Silicon Photomultiplier board to sense the presence of a cosmic ray and trigger a string of interactions in the model. Later, an app for mobile devices would enhance the event for observers of the model. The students drew and printed many parts for the demonstration as well as programmed some of the light boards for the model.

Activity 2: Scintillating plates:

Three other students aided two mentor/teachers in making quartz plates for a test beam at Fermilab. The students brought a legacy vacuum system into working condition and did vapor deposition of organic materials on quartz plates. The students then annealed the plates to make the deposition materials transparent and attached wave-shifting fibers to the edges of the plates to simulate tiles used in an actual calorimeter at CERN. This work set up a test to compare the performance of the materials for consideration in updating instruments.

Activity 3: Teacher Institute:

The three mentor teachers participated in providing a five-day, 40 hour institute for 16 other teachers who came from all parts of Iowa to hone their skills in particle physics and educational methodology. They focussed on the content of particle physics, the Next Generation Science Standards and pedagogy of implementing them. The teachers made lessons that focused the standards on high-energy particle physics topics. The institute was highlighted by a visit to Fermilab complete with tours and a talk with a research physicist.