

Undergraduate Research Paper

Fall 2017

Christopher Bracci

Researching under Dr. Hohlmann

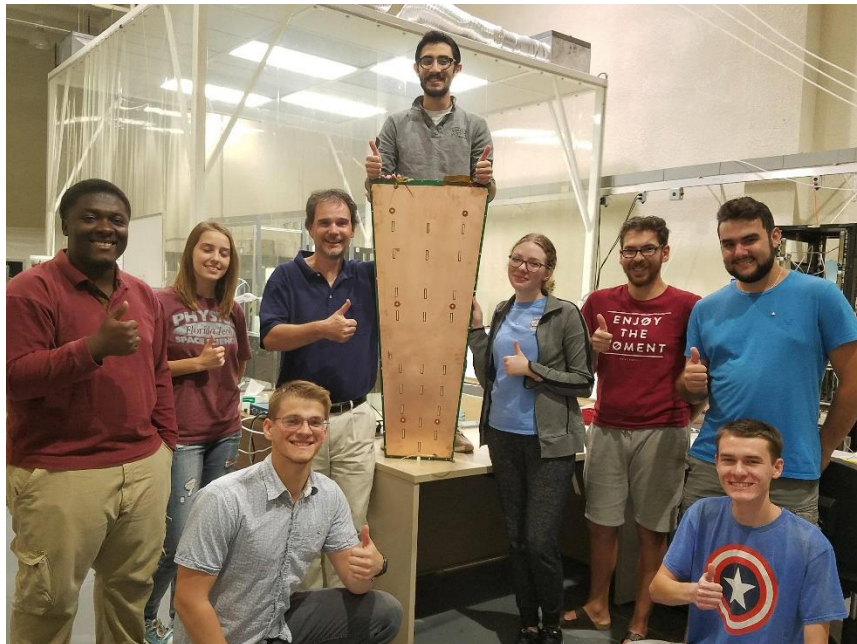
High Energy Physics, GEM Detector

For the Fall 2017 Semester I studied with Dr. Hohlmann on the High Energy Physics team working with the assembly and quality testing of the production model GEM GE1/1 detectors for CERN. I have been with the group for nearly four years working on older versions of the GEM GE series and working other minor projects around the lab such as the radiation sealed chamber we use to test our GEM detectors. My work this semester involved learning the new procedures developed specifically for the assembly of the new GE1/1 series of detectors and their quality control tests. Other duties this semester included maintaining the website for our group as I have done in previous semesters. Besides other undergraduates in our lab I also worked under the guidance of Stefano Colafranceschi and Mehdi Rahmani during this semester in learning the procedures.

The month of September was spent preparing for the arrival of the GE1/1 detector including going over assembly steps and practicing the QC steps. The old GE 113 detector was used as the practice detector for the five QC tests to ensure that people drilled on what to do for the tests and to ensure that the equipment was working and ready to go. There were some initial problems with noise in the lines and with the pre-amp in the set for QC 4 and 5. After these problems were solved tests with GE 113 could begin inside the testing chamber. During this time, I uploaded the videos and manuals detailing the assembly and QC process to our website at the bottom of the archive page.

After the detector parts themselves arrived at Florida Tech the assembly of the detector could begin with testing the components to ensure they were up to standard. The parcel that the detector came in displayed some possible damage from shipping and possible customs opening it up. Special attention was of course given to the GEM foils in case they were damaged and to ensure that they remained in pristine condition. I myself took part more in QC 4 and 5 testing

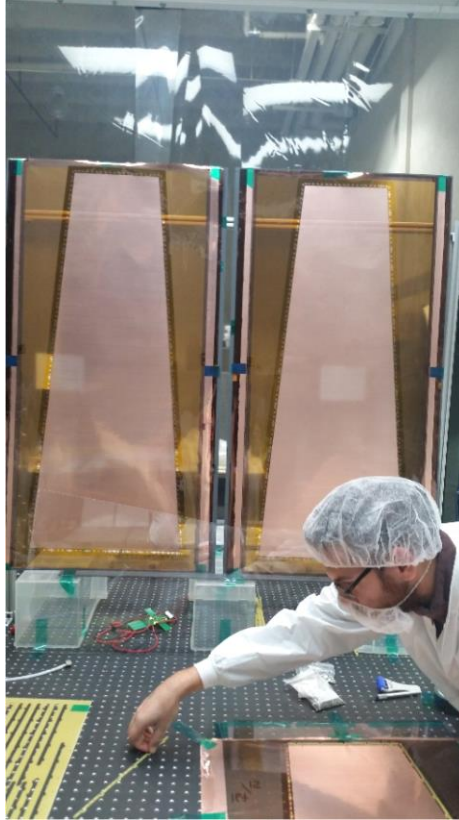
and data taking for gain measurements. Meger tests were performed foils to make sure that their total resistance in $10\text{ M}\Omega$ over the entire foil. Individual sectors were tested as well so that if there any detected problems with the foils it could be isolated. There were set backs now and again due to noise in data taking, set up problems, and some programing issues. I helped where possible, however Stefano and Mehdi took care of most of these problems. Amazingly the assembly of FIT 0001 of the foils turned out excellent for our group and none of the foils were damaged during the testing.



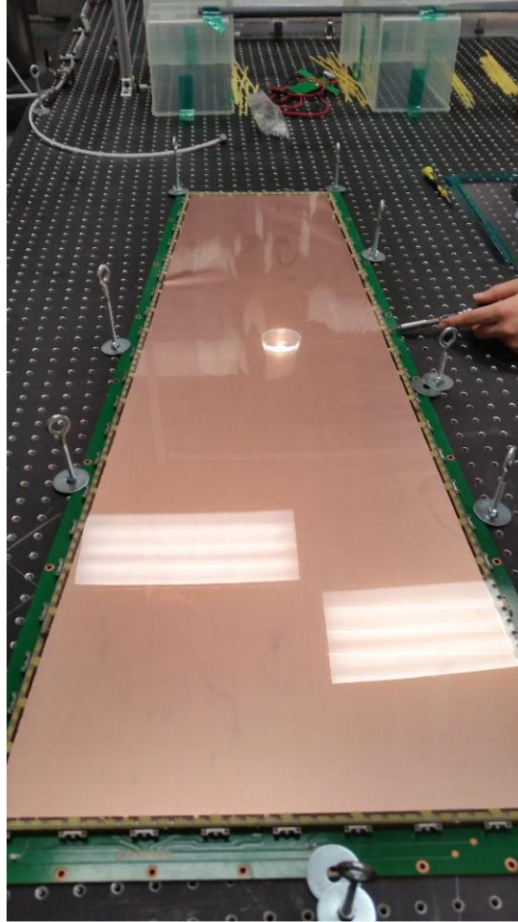
Our GEM assembly team with GE1/1-S-X-FIT0001

I also assisted with the final assembly of FIT0002 during December in preparation for sending the detector back to CERN. The final steps for assembling the frames and tightening the foils were performed under Stefano and Mehdi. The foils were stretched to 7 Ncm and QC2 showed positive results with maximum resistance detected on the foils. The maximum resistace

of the foils might have to do with the dry weather experienced at time; Florida is normally very hot and humid.



Preparing the frames after setting the first foil in the 3-1-2 configuration



All foils are set in the frame and are being stretched with a torque controlled screwdriver. The plexiglass screen can be seen in place until the detector is fully sealed to protect the foils.

At this point FIT0002 is assembled and tests so far have showed promising results. More work and tests will be done over the holiday break before the detector is sent back to CERN for possible installation.