LBNE NDS May 2014 Quarterly Report

1. Design of Beamline Muon Detectors in NuMI Alcove 1

Work has begun on the design of the beamline muon detectors in NuMI alcove 1. Alcove 2 includes the prototype muon detectors, while alcove 1 is the location of the production muon detectors. Figure 1 shows a draft layout of NuMI alcove 1, and Figure 2 shows a schematic drawing of the "positioner", which will be able to remotely position the Cherenkov detector in position and orientation. The production Cherenkov detector in alcove 1 will be the same detector deployed in the LBNE beamline, except that an extension will be added to the phototube arm. Production ionization detectors and stopping muon detectors will also reside in alcove 1.

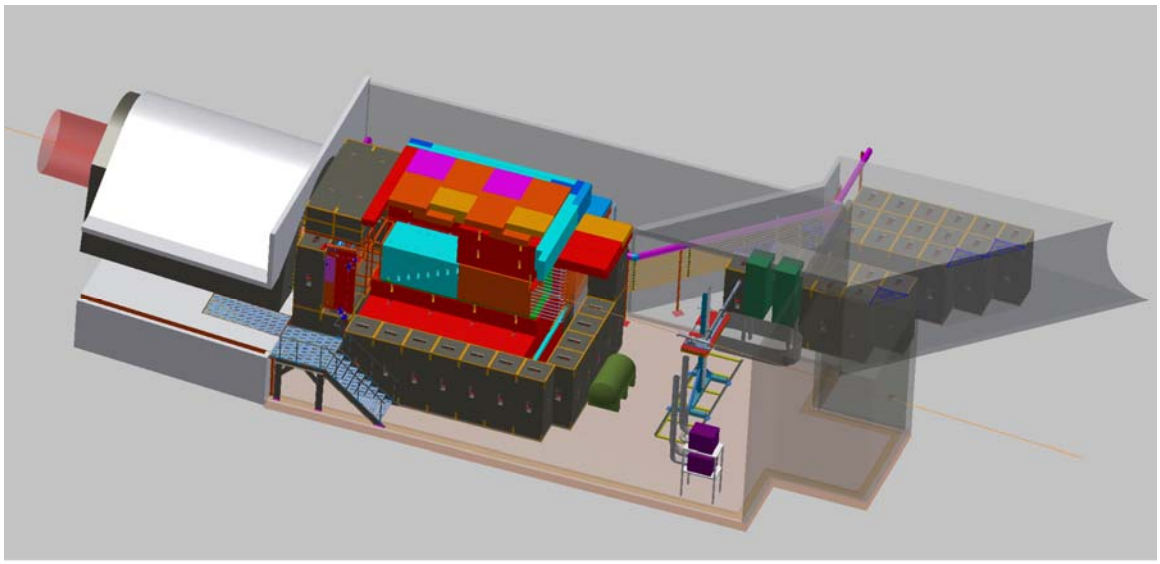

Figure 1: A draft layout of NuMI alcove 1.

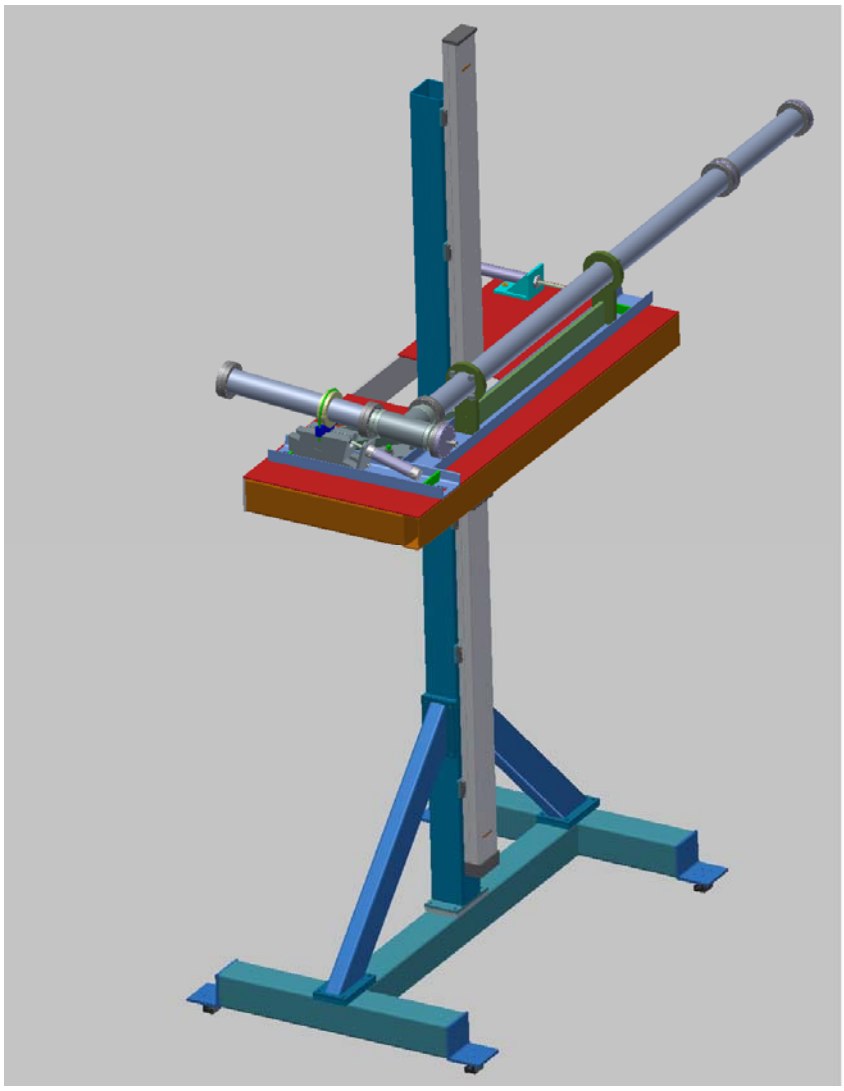

Figure 2: A schematic drawing of the "positioner", which will be able to remotely position the Cherenkov detector in position and orientation.

2. NuMI Horn Scan with the Prototype Cherenkov Detector in Alcove 2

On March 29, a joint horn-current scan and Cherenkov-pressure scan was performed in NuMI alcove 2 with the MINERvA/MINOS ion chambers. For each horn current setting, data were taken at five different Cherenkov detector pressures with ~30 waveforms collected for each pressure. Figure 3 shows the response of the Cherenkov detector for the nominal horn current setting. The data are now being

analyzed, and results will be presented in the near future.

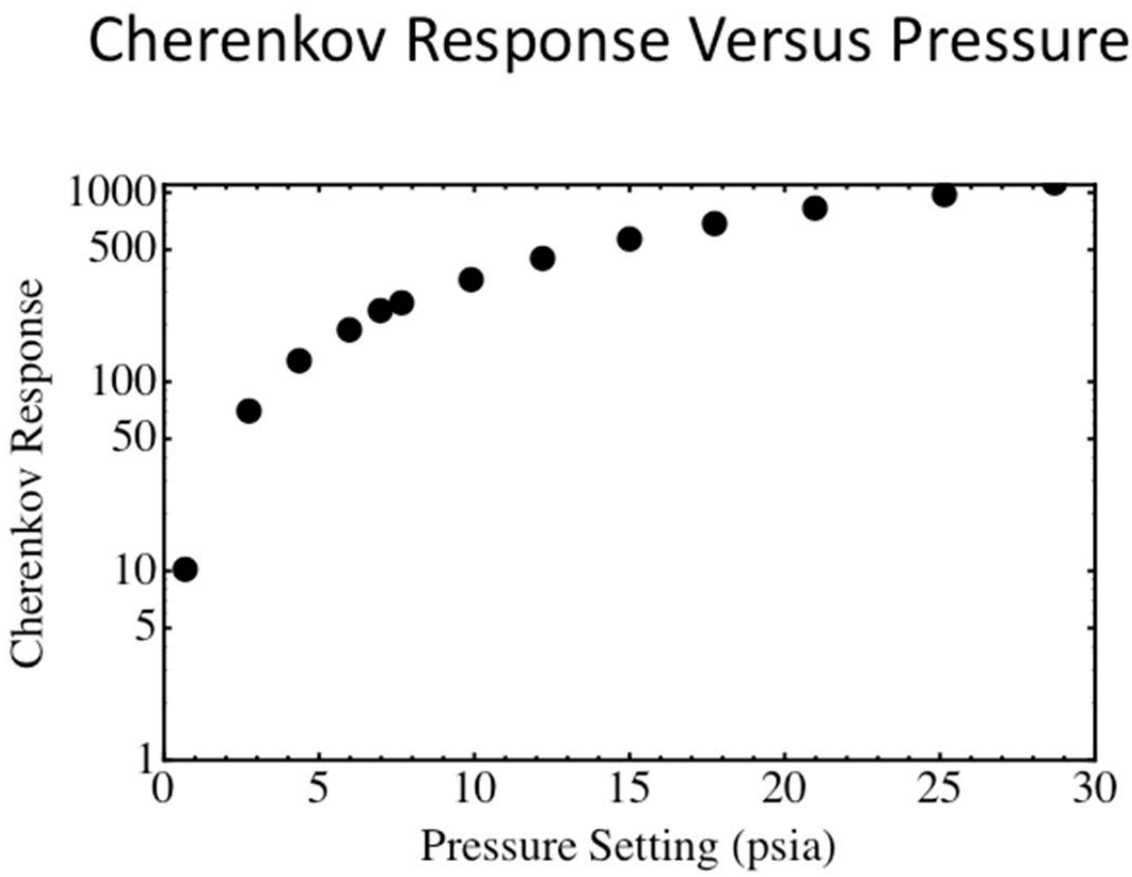

Figure 3: A plot of Cherenkov response versus argon pressure for the prototype Muon Cherenkov Detector system, installed in Muon Alcove 2 of the NuMI facility.

3. Near Neutrino Detector Electromagnetic Calorimeter Design

Work has begun on a more detailed design of the near neutrino detector electromagnetic calorimeter (ECAL). A space of 10 cm is assumed for electronics, cooling, and cabling. The longer "Y" scintillator slats are readout at each end, while the shorter "X" slats are readout at only one end with the wave shifter fiber mirrored on the other end. All scintillator slats have a width of 2.84 cm and a thickness of 1 cm. The Pb thicknesses are 1.75 mm for the downstream ECAL module and 3.5 mm for the barrel and upstream modules. A barrel ECAL module, shown in Figure 4, has an overall size of 3.90m x 1.98 m x 0.255 and an active area of 3.66m x 1.83 m. Figure 5 is a schematic drawing of the barrel ECAL inside the dipole magnet. A schematic drawing of the downstream ECAL module is shown in Figure 6.

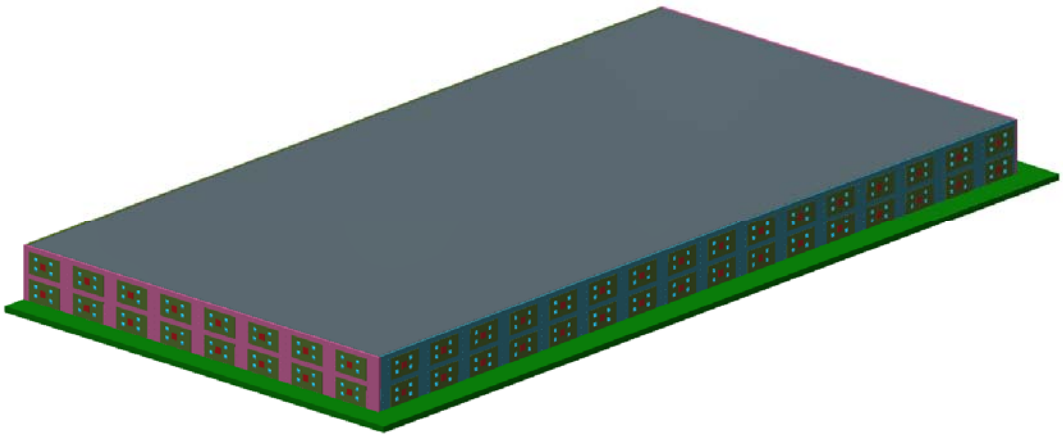

Figure 4: A schematic drawing of an electromagnetic calorimeter barrel module.

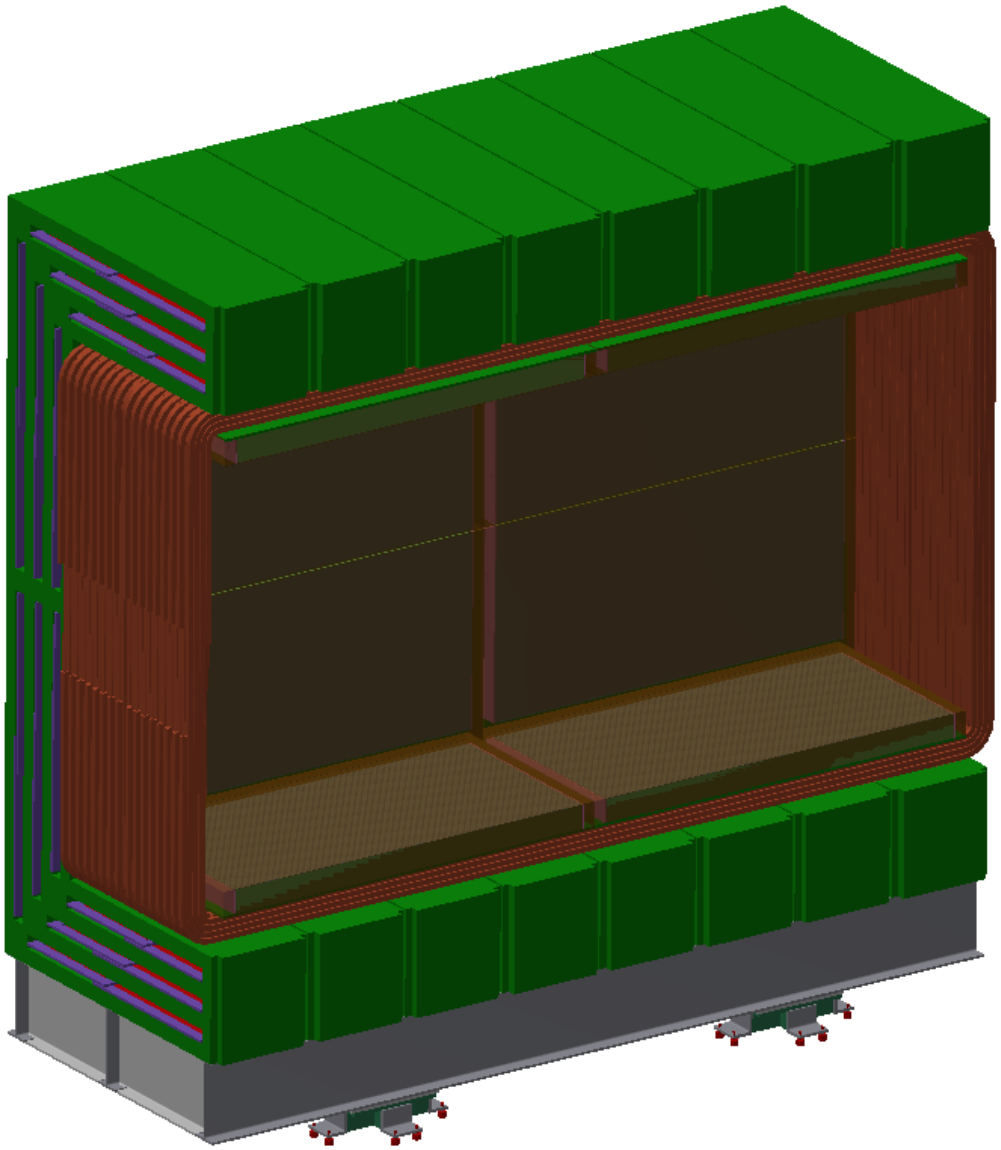

Figure 5: A schematic drawing of the barrel electromagnetic calorimeter inside the dipole magnet.

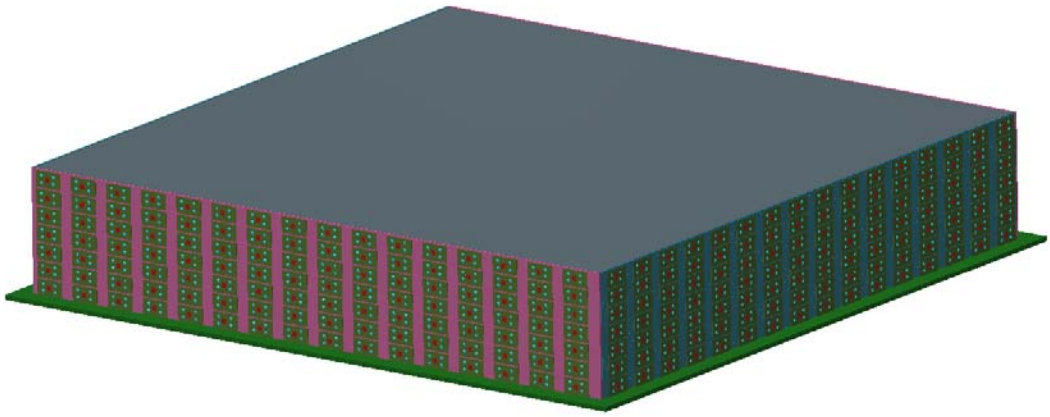

Figure 6: A schematic drawing of the downstream electromagnetic calorimeter.

4. Near Neutrino Detector Installation Assuming MINOS-Style Equipment Shaft

Work has begun on designing the near neutrino detector installation, assuming a MINOS-style equipment shaft. As shown in Figure 6, the draft design has a 50-foot wide near neutrino detector hall and a surface building that is rotated 90 degrees from previous designs. The detector hall will have Hilman rollers and steel rails for transporting the detector elements from the elevator shaft to the detector location, and a fixture, not yet designed, for rotating the 600-ton magnet carriage. The magnet coil must be rotated and then supported after being lowered down the shaft, while the magnet "C's" must be moved downstream, once lowered, to fit on the carriage. Figure 7 shows a schematic drawing of the fully assembled near neutrino detector in the detector hall.

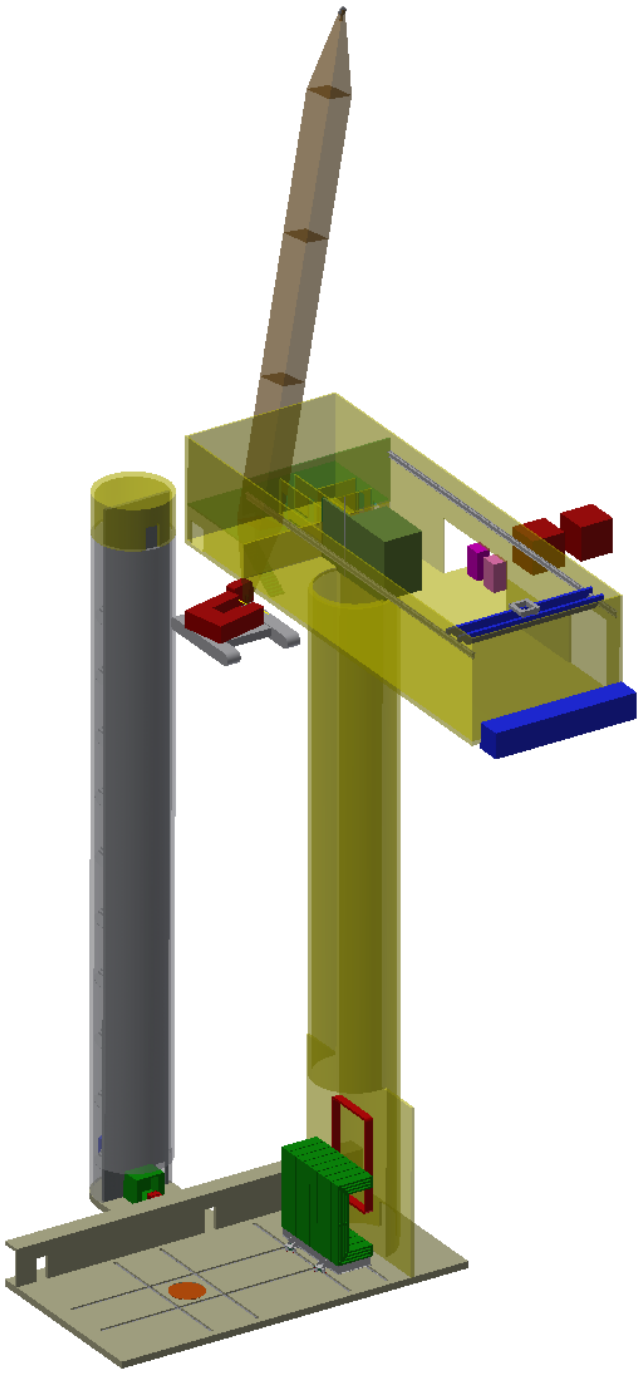

Figure 6: A draft design of the near neutrino detector hall and surface building. An elevator shaft (yellow) transports detector elements from the surface building to the detector hall, while stairs (gray shaft) allow for personnel egress. A 500-ton crawler crane is shown next to the surface building. The orange circle shows the location of the rotation fixture.

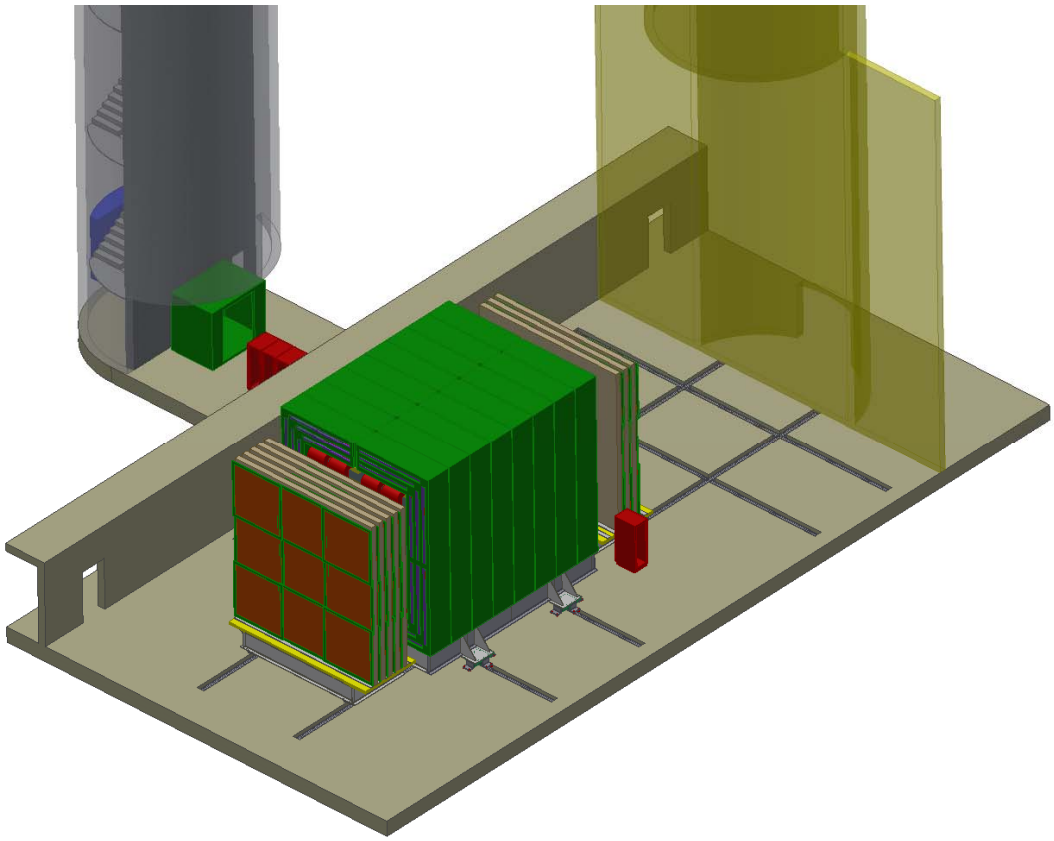

Figure 7: A schematic drawing of the fully assembled near neutrino detector in the detector hall.