Report of the Production Readiness Review of the DUNE Single Phase Louisiana State University Field Cage Endwall

April 5, 2017

DEEP UNDERGROUND NEUTRINO EXPERIMENT

1.0 PURPOSE/ SCOPE

The purpose of this review is to ensure there is a fabrication process in place and documented. The fabrication process should include the fabrication steps taken to complete the component and the define the quality control inspections and tests that will be performed to ensure the component meets its design and intended function.

The scope of the review included a review of the applicable documentation that had been uploaded to an Indico site and Docdb. The documentation reviewed is listed at the end of this report in Attachment A. These documents were reviewed by the Project Electrical and Mechanical Engineers, the Project ESH Manager, the Project QA Manager and the DUNE-US Project Manager. The DUNE QA Manager held the review at Louisiana State University (LSU) on April 5, 2017. Theresa Shaw (Project Electrical) and Victor Guarino (ANL Field Cage Lead) attended via teleconference.

2.0 Comments

The DUNE Single Phase Field Cage Endwall team at LSU are very experienced and very knowledgeable. LSU is responsible for the fabrication of all panel components and their assembly into frames. Parts will be cut at a local water jet shop, a water jet on the LSU campus or machined in the LSU machine shop. CERN provides the aluminum profiles. Polyethylene endcaps are provided by BNL. The drawings, labeling scheme, assembly procedure, hanging sequence, the QC Plan, hazard analysis and inspection checklists have been uploaded into Docdb. Handling, Storage and Packaging procedures are to be developed along with the Shipping Plan.

Each box beam and all FRP stock will be inspected for dimensions, deformations, surface scratches and delamination defects. If the inspection is not passed, the parts will be rejected.

Preliminary assembly of panels will take place in the high-bay area at LSU outside the clean room area, which allows for full crane access. After assembly, individual panels will be hung of each other in pairs of two to test the interconnections of panels. Hanging would be performed in the following sequence: top-panel + 2nd + 3rd panel and 3rd + 4th panel. This process will be repeated for the additional 3 endwalls. All parts will be labeled to uniquely identify their position. After disassembly, all parts are cleaned in the high-bay area at LSU before being moved into the clean room, where they will be inspected again. Final assembly will occur in a dedicated clean laboratory space adjacent to the high-bay area in the Department of Physics & Astronomy at LSU.

Each panel will undergo mechanical and quality control tests at LSU. Electrical quality control tests will be performed at CERN after installation of all Al profiles and resistor divider chains. All resistor divider chain boards shall pass quality control checks before being shipped to CERN.

The roles and responsibilities for Environmental, Safety, and Health support and oversight are defined and integrated into the management of the ProtoDUNE Single Phase Field Cage End Wall activities at Louisiana State University. Thomas Kutter, as the L3 manager, understands his ESH oversight responsibilities for the work taking place at LSU. In Addition, the LSU ESH Manager, Jason Lejeune, provides ESH support and oversight to validate that the ProtoDUNE work activities are compliant with LSU ESH requirements. The LSU ESH organization also provides subject matter experts (industrial hygiene, etc.) in support of the field cage end wall activities.

The machine shop technical staff have a clear understanding of the ESH requirements for work performed within the shop and clean room. There are is hazard analysis documentation in place for the work activities including the hanging of panels and cleaning of components within the clean room. A flipping table has been designed by Brookhaven National Laboratory engineering support and built by the LSU machine shop technicians. The LSU ESH Manager will complete an operational readiness review of the flipping table prior to operation.

During the walk-through of the high bay area the following safety issues were identified but are unrelated to the ProtoDUNE activities.

- materials stored directly in front of electrical panels not maintaining 36" clearance for access
- unsecured/improperly stored nitrogen gas cylinder in front of the loading dock
- unsecured/improper storage of a propane gas tank on the edge of the loading dock
- unsecured/improper storage of a liquid nitrogen dewar on the loading dock
- Housekeeping needs improvement in the high bay area.

These issues were communicated to Jason Lejeune, LSU ESH Manager, who attended the walk-through.

3.0 Recommendations

None

4.0 LSU Field Cage Endwall Production Readiness Review Team

Name	Title
Kevin Fahey	LBNF/DUNE QA Manager
Michael Andrews	LBNF /DUNE ESH Manager
Theresa Shaw	DUNE Project Electrical Engineer
Jack Fowler	DUNE Project Mechanical Engineer
Jolie Macier	DUNE-US Project Manager
Steve Kettell	DUNE International Project Manager

4.0 LSU Field Cage Endwall Team

Name	Title
Thomas Kutter	Manager for the Field Cage Endwall (LSU)
Victor Guarino	Field Cage Lead (ANL)
Brandon Amos,	LSU machine shop
Donnie Olano	LSU machine shop
Vince Vaughn	LSU machine shop
Brad Ellison	LSU electronics shop

Jason Lejeune	LSU ESH
Rahul Sharma	Engineering and design (BNL)
Joseph Bell	LSU Chem. E. machine shop

5.0 Summary

The Review Team recommends the LSU Field Cage Endwall begin production. Handling, Storage and Packaging procedures will be developed along with the Shipping Plan prior to packaging and shipment to CERN. There are no recommendations requiring response. If there any questions or a need for more information, contact Kevin Fahey at 630-840-2693.

Attachment A

Field Cage Endwall Production Readiness Review Documentation

- FC Endwall Assembly Description
- FC Endwall Part Identifier Scheme
- FC Endwall W1 Top Panel Drawings
- FC Endwall W4 Baseline Panel Drawings
- FC Endwall Beam Plug Panel Drawings
- FC Endwall Box Beam Drawing
- Field Cage Endwall Assembly Procedure
- Hanging Sequence for FC Endwall Description
- Hazard Analysis for Hanging of FC Endwall Panels
- QC Plan for Field Cage Endwall
- Inspection Checklists

Note: These documents are filed in Docdb 2443

- Resistor Divider Board Documentation in Docdb 1504