

**Report of the Production Readiness Review of the ProtoDUNE Single Phase Field Cage Top and Bottom Panels**

**May 4, 2017**

1. 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 Project QA Manager held the review at Stony Brook University (SBU) on May 4, 2017. The FNAL ESH Manager, the BNL/DUNE Project Coordinator and the Project Electrical Engineer participated in the review at SBU. Victor Guarino of Argonne National Labs, Jolie Macier (FNAL) and Michael Andrews (FNAL) attended via telephone. The SBU personnel who participated are listed at the end of this report.

1. Comments

The ProtoDUNE Single Phase Field Cage team at SBU are very experienced and very knowledgeable. The following documents had been uploaded to the Docdb 3027 for the review: Receipt Inspection Checklist, Field Cage Top and Bottom Panels QC Plan, SBU Hazard Analysis, Field Cage Top and Bottom Panels Assembly Procedure and Field Cage Drawings. Mike Wilking of SBU gave an overview of the Field Cage Top and Bottom Panels and the fabrication and QC aspects of the panels.

The components of the Field Cage Top and Bottom Panels will be fabricated at either the Stony Brook physics machine shop or commercial machine shops. The components will be receipt inspected for visual defects and dimensional conformance to the drawings. Copper contact strips will be placed on top of the middle 4 4” standoff I-beams, and then 5 ground planes will be placed on top of these contact strips and standoffs. 4-holed washer plates are placed on top of each ground plane, just above the location of the standoffs, and then these components are all connected with threaded rods and plastic nuts on both sides of the threaded rod.

The primary QC procedure after assembly will be a visual inspection of the sensitive components, such as the ground planes. Ground planes corners must not drop further than 1 cm below the standoff position.

The resistor boards will be attached to each profile at CERN using single-holed lock nuts that can be inserted or removed from the profiles after attaching both endcaps. The QC for the functionality of the resistor boards is the responsibility of Louisiana State University, although a test setup for verifying the resistance values of the boards has been arranged at Stony Brook University, and was used confirm the functionality of the boards used for module 0.

 Recommendations

* 1. Complete the step by step procedure for use at SBU and will be needed by personnel performing the assembly once the parts have been shipped to CERN.
	2. Develop packaging procedure.
	3. Develop training requirements for working in the clean room at CERN.
	4. Revise QC Plan to include all the steps in the assembly procedure.
	5. Revise the assembly procedure to ensure all electrical connections are being made.
	6. Develop QC Checklist for the assembly work to be performed at CERN.

1. SBU Field Cage Top and Bottom Panels Production Readiness Review Team

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

1. SBU Field Cage Top and Bottom Panels Team

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| Name |
| Michael Wilking |

1. Summary

The Review Team recommends the SBU Field Cage Team begin production on the Top and Bottom Panels once the QC Plan and procedures have been revised. The components will be test assembled at Stony Brook University, and then cleaned and packaged for delivery to CERN where the full assembly will take place. A written response to the recommendations is requested within two weeks of the receipt of this report. The response should be sent to Kevin Fahey at Kfahey@fnal.gov. If there any questions or a need for more information, contact Kevin Fahey at 630-840-2693.

Attachment A

SBU Field Cage Top and Bottom Panels Production Readiness Review Documentation

* Receipt Inspection Checklist
* Field Cage Top and Bottom Panels QC Plan
* SBU Hazard Analysis
* Field Cage Top and Bottom Panels Assembly Procedure
* Field Cage Drawings (Docdb 2084)
* Field Cage Parts List

Note: These documents are filed in Docdb 3027