



**Report of the Production Readiness Review of the
ProtoDUNE Single Phase FermiLab Wave Length
Shifting (WLS) Bars**

May 1, 2017

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 #3402. 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 FermiLab on May 1, 2017.

2.0 Comments

The ProtoDUNE Single Phase WLS Bars team at FermiLab are very experienced and very knowledgeable. The fabrication of the WLS Bars consists of the receipt inspection of the acrylic bars from the supplier consisting of dimensional and visual inspections. The bars are annealed to prevent crazing, then dipped in the TPB coating solution in a low humidity environment. After coating the bars are hung to air dry, then the attenuation length is measured in the warm dark box. The procedures in place for production of the WLS bars are thoroughly detailed in a step by step manner.

There are no open items from the Photon Detector Design Review regarding the FermiLab WLS Bars.

Procedures for working with chemicals reviewed as part of FermiLab's operational readiness clearance for the dipping setup. The operational readiness clearance review was successfully performed on 4/25/2017 (ORC-1316). Procedures for operating dipping setup reviewed as part of FermiLab's operational readiness clearance for the dipping setup. This review was successful and documented in ORC-1316. Dipping procedures were validated with an ethanol-only walk-through of the procedures. Attenuation length dark box test stand has been tested with a visible LED. The test stand will be reworked to include a UV LED and an operational readiness clearance (ORC) will be performed to operate the test stand.

3.0 Recommendations

- 3.1 Add tolerances of the acrylic bars to the drawings.
- 3.2 Procedures should have page numbers, revision and date incorporated to ensure version control.
- 3.3 The Acrylic Bar Annealing Procedures at Operation2, step 9 requires a tag to be attached to the bars. Additional information should be added for the requirements of the label (contents, material, etc.).
- 3.4 The Inspection Checklists should have the name of the person performing the inspection and the date of the inspection.
- 3.5 Packaging and shipping requirements need to be added to a procedure and to the QC Plan.
- 3.6 The Acceptance Criteria referenced in the QC Plan should point back to the document that is used for approving the step. This will either be the applicable procedure or the applicable drawing for dimensions.

4.0 FermiLab WSL Bars 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

4.0 FermiLab WSL Bars Team

Name	Title
Matt Toups	Manager for Fermi Lab WSL Bars
Alberto Marchionni	Scientist
Evan Niner	Research Assistant

5.0 Summary

Upon completion of the recommendations, FNAL will be ready to begin production. The procedures are very well detailed for performing the production requirements. A written response to the recommendations is requested within two weeks of the receipt of this report. If there any questions or a need for more information, contact Kevin Fahey at 630-840-2693.

Attachment A

FNAL Wave Length Shifting (WLS) Bars Production Readiness Review Documentation

- Dipped Bar Acrylic Dimensional Inspection Checklist
- Acrylic bar reception procedure
- Dipped Bar Acrylic Visual Inspection Checklist
- Acrylic bar annealing procedures
- Acrylic bar attenuation length measurement procedures
- Dipped Bar Acrylic Annealing Checklist
- Dipped Bar Dipping Checklist
- PURCHASE ORDER NO. 632814 to EMCO Industrial Plastics for the Clear Acrylic ULTRAN UVT Plastic Strips
- QC Plan for the FNAL Wave Length Shifting (WLS) Bars
- ORC-1316, Lab 6 Dipping Station
- E-mail dated June 7, 2016 accepting the tolerances for the dimensions of the Light Guide Bars
- Dip-coated Light Guide Bars for ProtoDUNE Production Overview

Note: These documents are filed in Docdb 3402.