Draft

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**Design Review Plan for DUNE Far Detector**

**Scope**

The scope of this document is:

* Internal components of the DUNE far detector which include: the time projection chamber, detector support structure, feedthroughs, cables, instrumentation and installation.
* External components of the DUNE far detector which include racks, rack services, instrumentation, feedthroughs, warm cables and fibers, DAQ equipment in the CUC, equipment and infrastructure for detector assembly and installation and equipment for use at the integration and test facility.

It does not include conventional facilities, cryostats, cryogenics, cryogenics distribution and infrastructure.

Operational Readiness Reviews will be required before equipment may operate. Such reviews are outside the scope of the design review process and will be organized separately.

**Objective**

This document defines the design and production review process and its stages. It includes the deliverables expected at each of the design review phases. The process is meant to be common and applicable to all consortia supplying design services and components for the far detector.

**Applicable Documents**

Following documents form the basis of this review process. Other documents may be added as needed.

1. Far detector engineering risk assessment (DUNE DocDB213)
2. Fermilab engineering manual
3. DUNE far detector interface documents
4. Dune International Schedule (DocDB 7677)
5. LBNF/DUNE QA Plan (DocDB 120)
6. Fermilab Environmental, Safety, and Health Manual

**Design Review Process and Responsibility**

The engineering risk analysis has identified the design review process risk as standard. As such, the review process will be conducted internally within the consortia and DUNE technical coordination. The consortia and technical coordination may elect to engage other experts. Particularly, in the final design review, experts from other consortia are expected to participate. (Review committee makeup, roles and responsibilities to be added)

In general, all reviews are under the purview of technical coordination. The responsibility for the 30% full subsystem design review (or conceptual design review) may be delegated to the consortia. The production progress reviews (PRR) may be primarily organized by the consortia, but technical coordination may also organize PRRs. All other reviews are the responsibility of and arranged by technical coordination. Individual consortia sub-component reviews are the responsibility of the consortia to organize with technical coordination involvement. The consortia may ask technical coordination to organize sub-component reviews as appropriate. Reviews with significant technology selection will be organized by technical coordination.

The following sections define the minimum requirements and deliverables at each of the design review stages:

30% basic deliverables (conceptual design)

* Design requirements in accordance with detector requirements
* Design concept and approach to production
* Preliminary engineering drawings, schematics, models and interface drawings
* Preliminary interface documents
* Preliminary engineering analyses and documentation, plan for further analyses
* Preliminary installation and testing plans
* Identification of applicable design codes and standards
* Market survey and manufacturing concepts
* Rough cost estimates and schedule

60% basic deliverables (preliminary design)

* Design choice identified
* Detail engineering drawings, schematics, and preliminary parts list
* Interface documentation review with other systems
* Complete engineering analyses and documentation
* Incorporation of ProtoDUNE lessons learned
* Finalization of applicable design codes and standards
* Manufacturing methods and acquisition strategy
* Plans for production and evaluation of prototypes
* Draft manufacturing, quality assurance, testing and procurement plans
* Installation plans including special tools and fixtures
* Preliminary cost and schedule estimate
* Value engineering exercise
* Resolution of 30% review recommendations

90% basic deliverables (final design)

* Complete manufacturing drawings, schematics, and specifications
* Engineering and safety analysis reports
* Procurement specifications and bid documents
* Production site plans for all production sites
* Evaluation of prototypes and design modifications
* Final quality assurance plan and quality control tools
* Final cost and schedule estimate
* Resolution of 60% review recommendations

Production readiness review

* Performed at production facility
* Final QA plans for institutions not adopting the LBNF/DUNE QA Plan
* Final production drawings, specifications and manufacturing and test procedures
* Final safety documents (i.e. Hazard Analysis documentation)
* Component QC plan (i.e. travelers, test reports, software verification and validation documents, supplier documentation)
* Final procurement documents per institution practice
* Completion and evaluation of prototypes, review of production process and QC results

Production progress reviews

* Performed at production facility
* Periodic review of production status
* Verification of QC program
* Validation of product quality

**Design Review Target Dates**

The following table contains target dates for 30% and 60% design reviews.

* The 60% design review date is derived from tasks as outlined by consortia in Dune International Schedule (DocDB 7677). A task identifier is inserted in the table to show the logic for the choice of date.
* The 30% design review is combined with 60% design review for systems that have been developed and prototyped for ProtoDUNE. In the cases of slow controls and DAQ, the date is chosen to be well in advance of the 60% review and as early as possible. In the case of single phase photon detector, the date is chosen to be after the expected date of technology choice.
* The exact date of reviews may change with approval from Technical Coordination. However, the 60% design reviews must be completed before Technical Deign Report.

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| Review | 60% Review Date | Predecessor Task ID | 30% Review Date |
| Cryogenic Instrumentation | 1/1/2019 | 22-27 | Combine with 60% |
| Slow Controls | 1/31/2019 | 41 | 11/1/2018 |
| Anode Panel Assembly | 1/1/2019 | 95 | Combine with 60% |
| DAQ | 3/22/2019 | 129 | 10/1/2018 |
| DP Electronics | 3/22/2019 | 344 | Combine with 60% |
| DP Photon Detector | 3/28/2019 | 221 | Combine with 60% |
| High Voltage | 3/1/2019 | 421, 422 | Combine with 60% |
| SP Electronics | 2/18/2019 | 403 | Combine with 60% |
| SP Photon Detector | 2/22/2019 | 317 | 11/1/2018 |
| Detector Support System | 1/1/2019 | NA | 8/20/2018 |