

Planning for DUNE TDRs

This document outlines a draft plan for the DUNE Technical Design Report (TDR) and the Technical Proposal (TP). It includes the overall structure of the documentation that will be produced for the LBNC reviews in 2018 (TP) and 2019 (TDR).

1. Overall Structure

The TDR will consist of multiple volumes. Each volume is expected to be between 150 – 200 pages long, although there may be some exceptions:

- **Volume 1: Executive Summary**
 - Introduction
 - LBNF and Far Site Facilities
 - DUNE Physics
 - DUNE Far Detectors
 - DUNE Near Detector
 - Project Strategy
 - Project Management
 - Cost and Schedule

- **Volume 2: Physics at DUNE**
 - DUNE Physics goals (primary, secondary, ancillary)
 - Far Detector Reconstruction
 - Long-Baseline Neutrino Oscillations
 - Supernova Neutrinos
 - Nucleon Decay
 - Beyond the SM Physics
 - Other Physics

- **Volume 3: Single-Phase Far Detector: Overview**
 - Design Motivation
 - Cryostat and cryogenics
 - Overview of the Single-Phase Far Detector
 - Calibration Strategy
 - ProtoDUNE-SP
 - Detector Performance
- **Volume 3A: Anode Plane Assemblies (APAs)**
- **Volume 3B: High Voltage System**
- **Volume 3C: TPC Electronics**
- **Volume 3D: Photon Detection System**
- **Volume 3E: DAQ**
- **Volume 3F: Slow Controls and Cryogenic Instrumentation**
 - Including fluid flow
- **Volume 3G: Installation and Integration**

- **Volume 4: Dual-Phase Far Detector: Overview**
 - Design Motivation

- Cryostat and cryogenics
- Overview of the Dual-Phase Far Detector
- Calibration Strategy
- ProtoDUNE-DP
- Detector Performance
- **Volume 4A: Charge Readout Planes (CRPs)**
- **Volume 4B: High Voltage System**
- **Volume 4C: TPC Electronics**
- **Volume 4D: Photon Detection System**
- **Volume 4E: DAQ**
- **Volume 4F: Slow Controls and Cryogenic Instrumentation**
- **Volume 4G: Installation and Integration**

On the same timescale as the TDR, DUNE will produce two Conceptual Design Reports:

- **DUNE Computing CDR**
 - Computing Plan etc.
- **DUNE Near Detector CDR**

1.1 Detector System Volumes

The different sub-system TDR volumes will follow a common overall structure, although the details will vary. The example below shows the proposed structure for Volume 3A: APAs.

Volume 3A: Anode Plane Assemblies (150-200 pages)

- **Chapter 1: Overview** (10 pages)
 - Introduction
 - Design Considerations
 - Scope
- **Chapter 2: APA Design** (50 pages)
 - Frames
 - Boards
 - Wires
 - QA
 - Feedthroughs (where appropriate, not for APA)
- **Chapter 3: Production and Assembly** (40 pages)
 - Wire Winding Machine
 - Tooling
 - Assembly Procedures
- **Chapter 4: Interfaces** (10 pages)
 - LBNF Cryostat/Detector Support Structure
 - Photon Detection system
 - TPC electronics
- **Chapter 5: Installation, Integration and Commissioning** (30 pages)
 - Transport/Handling
 - Integration with PDS and TPC electronics
- **Chapter 6: Quality Control** (10 pages)
 - Production and Assembly (Local)
 - Post-factory Installation (Remote)
- **Chapter 7: Safety** (5 pages)
- **Chapter 8: Organization** (20 pages)
 - Consortium organization

- Planning Assumptions
- WBS and responsibilities
- High-level Cost and Schedule

1.2 Additional Documentation

In addition to the TDR volumes, DUNE will provide the LBNC/Cost Scrutiny group with:

- Cost book (in agreed format);
- DUNE Management Plan;
- Risk Register for the international DUNE project;
- Interface documentation;
- Project schedule (MS project);
- Change-control process documentation;
- QA/QC Management Plan;
- Safety Management Plan;
- WBS Dictionary;
- Engineering Management Plan (Standards etc.).

1.2 Near Detector

The Near Detector Conceptual Design Report will be produced on the same timeline as the TDR.

2. TDR Organisation and Responsibilities

The DUNE Co-Spokespersons intend to appoint a central editorial team consisting of (at least) two Overall Editors supported by a Technical Editor, to coordinate the TDR activities and to ensure a uniform high standard across the volumes of the TDR. Each volume will have one or more responsible editor(s):

- Volume 1 (Executive Summary): Co-Spokespersons
 - **Ed Blucher** and **Mark Thomson**
- Volume 2 (Physics): Physics TDR Editors:
 - **Albert de Roeck**
 - **Jon Urheim**
- Volume 3 (SP Far Detector): One of the Overall Editors:
 - **Sam Zeller** and **Tim Bolton**
- Volume 3A-3F (SP Systems): Nominated by the consortia:
 - APAs: **Dave Schmitz**
 - HV System: **Rob Plunkett**
 - TPC Electronics: **Michael Mooney**
 - PDS: **Bob Wilson**
 - DAQ: **Jim Brooke** and **Brett Viren**
 - Slow controls/cryo-instrum: **Glenn Horton-Smith** and **Carmen Palomares**
- Volume 3G (Installation and Integration): Nominated by the Technical Coordinator:
 - **Steve Kettell**
- Volume 4 (DP Far Detector): One of the Overall Editors
 - **Sam Zeller** and **Tim Bolton**
- Volume 4A-4F (DP Systems): Nominated by the consortia
 - CRPs: **TBD**
 - HV System: **TBD**
 - TPC Electronics: **Slavic Galymov** and **Jamie Dawson**
 - PDS: **Burak Bilki** and **Clara Cuesta**
 - DAQ: **Jim Brooke** and **Brett Viren**

- Slow controls/cryo-instrum: **Glenn Horton-Smith** and **Carmen Palormares**
- Volume 4G (Installation and Integration): Nominated by the Technical Coordinator:
 - **Steve Kettell**
- Computing CDR: DUNE Computing Coordinators:
 - **Andrew Norman** and **Heidi Schellman**
- Near Detector CDR: Near Detector Coordinators
 - **TBD**

The central editorial team will define the conventions used for writing the TDR, for example, US English, conventions for symbols, conventions for units, and the overall style templates. The TDRs will be written in LaTeX and github will be used as the central repository.

3. Technical Proposal

The technical proposal is intended as a pathway to the TDR, providing an important intermediate milestone. For this reason, the technical proposal will broadly follow the structure of the TDR, with almost identical chapter/section headings, but the information will be in a compressed form. It is expected that the TP sections will be approximately five times shorter than the corresponding TDR section.

3.1 Structure of the Technical Proposal

The TP will consist of four volumes, mirroring the TDR structure. A physics volume is not currently foreseen.

- **Volume 1: Executive Summary**
 - LBNF and Far Site Facilities
 - DUNE Far Detectors
 - DUNE Near Detector
 - DUNE Physics
- **Volume 2: Single-Phase DUNE Far Detector**
 - Design Motivation (~5 pages)
 - Overview of the Single-Phase Far Detector (~10 pages)
 - APAs (~30 pages)
 - HV System (~30 pages)
 - TPC Electronics (~30 pages)
 - Photon Detection System (~30 pages)
 - DAQ (~30 pages)
 - Slow Controls and Cryogenic Instrumentation (~20 pages)
 - Detector Performance (~10 pages)
 - Responsibilities (~10 pages)
- **Volume 3: Dual-Phase DUNE Far Detector**
 - Design Motivation (~5 pages)
 - Overview of the Dual-Phase Far Detector (~10 pages)
 - CRPs (~30 pages)
 - HV System (~30 pages)
 - TPC Electronics (~30 pages)
 - Photon Detection System (~30 pages)
 - DAQ (~30 pages)
 - Slow Controls and Cryogenic Instrumentation (~20 pages)
 - Detector Performance (~10 pages)
 - Responsibilities (~10 pages)
- **Volume 4: Software and Computing** (30-50 pages)

- Computing model and technology options

4. Timeline and Milestones

There are number of assumed dates that frame the programme of work:

- Oct-17: Editors of TDR volumes appointed
- Nov-17: TP/TDR Kick-off meeting – outline of contents
- Dec-17: Complete tables of contents of TDR and TP (section heading level)
- Apr-18: Complete drafts of the TP volumes
- May-18: Final version of the TP submitted to the LBNC
- Jul-18: LBNC review of the TP
- Feb-19: First drafts of all TDR volumes
- Mar-19: TDR internal review
- Apr-19: Final version of TDR submitted to the LBNC
- May-19: Cost appendix submitted to RRB Cost Scrutiny Group
- Jun-19: Finalize response to questions from LBNC
- Jul-19: LBNC review of TDR