



DUNE: TDR Planning

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Meeting with DUNE Consortium Leaders and Coordinators

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- **This presentation:**
 - 1. Plans for TDR
 - Overall Structure
 - 2. Structure of Detector Volumes
 - Other Documentation
 - 3. Organization
 - 4. Technical Proposal
 - Motivation
 - Structure
 - 5. Timeline
 - 6. Summary

1. TDR Plans

- **Structure**

- The TDR will consist of multiple volumes. Each volume is expected to be between 150 – 200 pages, may be some exceptions
- Detector volumes (single-phase and dual-phase) divided into:
 - Overview volume
 - Sub-system volumes

- **Volumes**

- Volume 1: Executive Summary
- Volume 2: Physics
- Volume 3: Single-Phase Far Detector: Overview
 - + sub-system volumes
- Volume 4: Dual-Phase Far Detector: Overview
 - + sub-system volumes
- CDRs: Computing and Near Detector

Volume 1: DUNE

- **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 (content TBD)

Intended as a high-level overview of overall project

Volume 2: Physics

- **Volume 2: Physics**

- DUNE Physics goals (primary, secondary, ancillary)
- Far Detector Reconstruction
- Long-Baseline Neutrino Oscillations
- Supernova Neutrinos
- Nucleon Decay
- Beyond the SM Physics
- Other Topics
- Near Detector Physics

Similar to CDR content, but more realism in studies

Volume 3: FD-SP

- **Volume 3: Single-Phase Far Detector: Overview**
 - Design Motivation
 - Cryostat and cryogenics
 - Overview of the Single-Phase Far Detector
 - ProtoDUNE-SP
 - Detector Performance
- **Volume 3A: APAs**
- **Volume 3B: High Voltage System**
- **Volume 3C: TPC Electronics**
- **Volume 3D: Photon Detection System**
- **Volume 3E: DAQ**
- **Volume 3F: Slow Controls and Cryogenic Instrum.**
- **Volume 3G: Installation and Integration**

Each volume expected to be 150-200 pages

Volume 4: FD-DP

- **Volume 4: Dual-Phase Far Detector: Overview**
 - Design Motivation
 - Cryostat and cryogenics
 - Overview of the Dual-Phase Far Detector
 - ProtoDUNE-DP
 - Detector Performance
- **Volume 3A: CRPs**
- **Volume 3B: High Voltage System**
- **Volume 3C: TPC Electronics**
- **Volume 3D: Photon Detection System**
- **Volume 3E: DAQ**
- **Volume 3F: Slow Controls and Cryogenic Instrum.**
- **Volume 3G: Installation and Integration**

Volume 3 and 4: Comments

- **Structure follows consortium structure**
 - But we have put in place three joint SP/DP consortia
- **There will be some common content/overlap**
 - High-Voltage System
 - Feedthroughs, cathodes, field cage
 - DAQ
 - Slow controls and cryogenic instrumentation
- **But, there will be some specifics to SP / DP**
 - even though developed in a single consortium
- **For common systems decided to have separate SP/DP volumes**
 - Simpler to put together, easier to read/review
 - Could be repeated sections, e.g. backend DAQ, field cage bars

Computing CDR

- **Content still to be determined:**
 - Will include overall computing model
 - Needs to be forward-looking
 - Matched to computing landscape in mid-2020s

2. Detector System Volumes

- **Each volume will follow a common overall structure**
- **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
 - Calibration?
- **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

2.1 Additional Documentation

- **Needs to be agreed with LBNC/Cost Group**
- **We believe the following are essential:**
 - 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.).

3. TDR Organization

- **Co-Spokespersons intend to appoint a central editorial team consisting of (at least) two Overall Editors supported by a Technical Editor**
 - coordinate the TDR activities
 - 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**
 - Volume 2 (Physics): **Physics TDR Editors**
 - Volume 3 (SP Far Detector): **One of the Overall Editors**
 - Volume 3A-3F (SP Systems): **Nominated by the consortia**
 - Volume 3G (Installation and Integration): **Nominated by the TC**
 - Volume 4 (DP Far Detector): **One of the Overall Editors**
 - Volume 4A-4F (DP Systems): **Nominated by the consortia**
 - Volume 4G (Installation and Integration): **Nominated by the TC**
 - CDR (Computing): **DUNE Computing Coordinators**

4. Technical Proposal

- **TP** needs to be written in approximately 6 months
 - November 2017 – April 2018
- **Leaves 12 months for TDR**
 - May 2018 – April 2019
- **It is essential that TP is on the path to the TDR and not a detour**
 - 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. Plan for that TP sections will be approximately five times shorter than the corresponding TDR section.

Technical Proposal Structure

- **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 Beam Instrumentation (~20 pages)
- Detector Performance (~10 pages)
- Responsibilities (~10 pages)

Technical Proposal Structure

- **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 Beam Instrumentation (~20 pages)
 - Detector Performance (~10 pages)
 - Responsibilities (~10 pages)
- **Volume 4: Software and Computing** (30-50 pages)
 - Computing needs and horizon scanning?

NOTE: no standalone physics “TP” volume

5. Timeline/Milestones

Planning milestones:

- **Nov-17:** Editors of TDR volumes appointed
- **Nov-17:** First TP/TDR editors meeting – outline of contents
- **Dec-17:** 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

6. Summary

- **We believe we have a strong plan**
 - Challenging, but doable
 - We think the structure is sound
 - TP as a stepping stone to the TDR is important
- **Organization will have to ramp rapidly**
 - Editorial team will be in place soon
 - Section headings by end of 2017
- **Action for next two weeks**
 - **Identify editorial team**

Questions?