Status of the Technical Design Report (TDR) for SAND in the ND complex

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SAND general meeting

April 16, 2024

UNIVERSITÀ DEL SALENTO

L'Ateneo tra i due mari

INFN

Istituto Nazionale di Fisica Nucleare

DUNE

Quantitative analysis of the TDR writeup

Observables: number (*n*) of pages
temporal incremental ratio $\frac{\Delta n}{\Delta t}$

Δn = page increase

Δt = 21 days

Section 1 – Overview

Δn = 4 - 2 = 2 pages

Update of requirements and opportunities
(waiting task-force conclusions)

New: some text about the "old" requirements
(PB, from the CDR)

Section 2 - ECAL

Δn = 11 - 6 = 5 pages

New:

Short description of the calorimeter

Introduction to ECAL electronics

Pictures of the barrel dismounting

Section 3 – Magnet

$$\Delta n = 1 - 1 = 0$$

Only index and keywords

Section 4 – GRAIN

$$\Delta n = 3 - 2 = 1 \text{ page}$$

New: introduction to mechanical design

May 3: plan for a HUGE writeup is expected

Section 5 - Tracker

$$\Delta n = 2 - 2 = 0$$

Only index and keywords

Section 6 – DAQ

$\Delta n = 1 - 1 = 0$

Only index and keywords

Section 7 – Det. Control Syst.

$\Delta n = 3 - 3 = 0$

Some text

Section 8 – Det. Safety Syst.

$\Delta n = 4 - 4 = 0$

Complete
Possible updating

Section 9 – Software & Computing

$\Delta n = 2 - 2 = 0$

Only index and keywords

Section 10 – Event Reconstruction

$\Delta n = 42 - 8 = 34$

New: almost complete !!!
To be reviewed

Section 11 – Analysis

$\Delta n = 1 - 1 = 0$

Only index and keywords

Section 12 – Installation & Integration

Δn = 2-2 = 0

Only index and keywords

Section 13 – Safety

Δn = 1-1 = 0

Only index and keywords

Section 14 – Organization & Management

Δn = 2-2 = 0

Some text

Section 15 – Time Schedule

Δn = 1-1 = 0

Only index and keywords

Section 16 – Possible Upgrades

Δn = 1-1 = 0

Only index and keywords

Glossary

Δn = 4-4 = 0

Bibliography

Δn = 3-1 = 2

Overall

Δn = 88-46 = 42 pages (8 pages, without § 10)

$$\frac{\Delta n}{\Delta t} = 2 \frac{pages}{day}$$

Too slow !!!

TDR estimate ~ 600 pages
Writeup time ~ 300 days

Conclusions

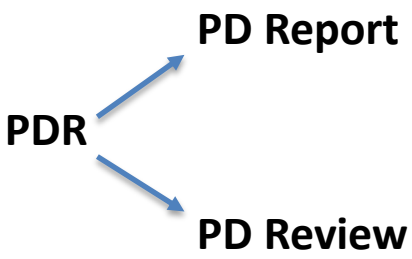
- Present TDR draft in the indico site of this meeting
- 16 sections: 1 complete, 4 with new text
- Many improvements in Event Reconstruction section
- The overall writeup rate is too slow
- A strong commitment is needed
- Convenors must involve other people

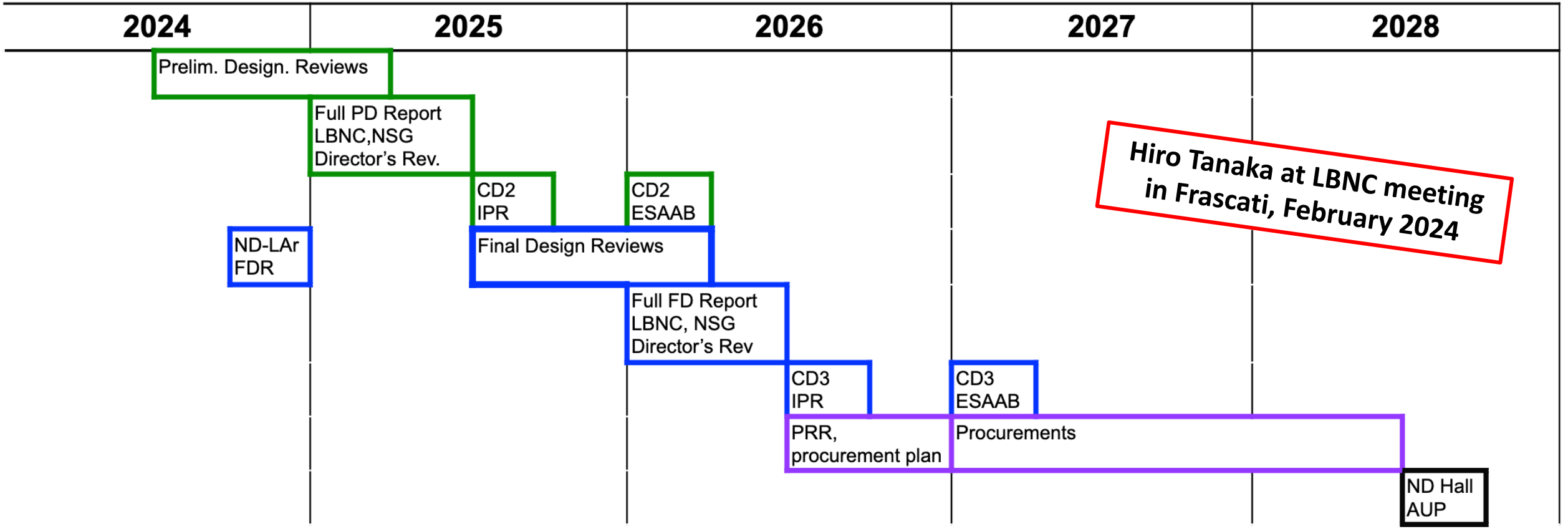
REMIND
July, first review (ECAL+magnet)
December, first TDR draft

OLD SLIDES

Hiro Tanaka at LBNC meeting in Frascati, February 2024

Preliminary design report is “preliminary” version of the technical design report
The technical design report is finalized in the final design/CD3 process as a “final design report”





- Preliminary design reviews to be carried out in mid 2024-early 2025
  - Requires draft PDR chapters as input
  - Revised PDR chapters following review submitted to LBNC for review

PROCESS: REQUIREMENTS

Chair: Mike Kordosky
- **Physics Working Groups**
  - Long Baseline: L. Pickering
  - Cross Sections: L. Muntenau
  - Exotics: J. Justo-Albo
  - Computing/Software: M. Muether
- **ND consortia:**
  - ND-LAr: P. Ochoa Ricoux
  - TMS: D. Naples
  - SAND: M. Tenti

- It all starts with the physics . ..
  - Articulated as requirements for the Near Detector
- Revamp/articulate requirements for the DUNE Near Detector
  - Joint activity between DUNE near detector consortia and physics working group
- Needs:
  - Further refinement of long-baseline requirements
  - Extension to cover cross section and exotic physics
  - Role of SAND beyond “beam monitoring”
- Goals:
  - Revised requirements to be approved at May 2024 DUNE collaboration meeting by Executive Board
  - Present to LBNC at next meeting (June 2024)

Hiro Tanaka at LBNC meeting in Frascati, February 2024

Hiro Tanaka at LBNC meeting in Frascati, February 2024

	Chapter Draft	Design Review	Ready for LBNC
Intro/Physics	Jun 24	N/A	Jul 24
ND-LAr (final)	Nov 24	Dec 24	Feb 25
TMS	Nov 24	Jan 25	Feb 25
SAND*	Jun 24-Feb 25	Jul 24-Mar 25	Apr 25
ND-LAr Cryostat	Jun 24	Jul 24	Aug 24
NS Cryogenics	Jun 24	N/A	Aug 24
DUNE-PRISM	Nov 24	Dec 24	Jan 25
ND DAQ	Nov 24	Jan 25	Feb 25
ND Slow Control			Feb 25
ND I&I	Nov 24	Dec 24	Jan 24

* SAND will divide process into KLOE-2-SAND, Tracker, GRAIN, Integration

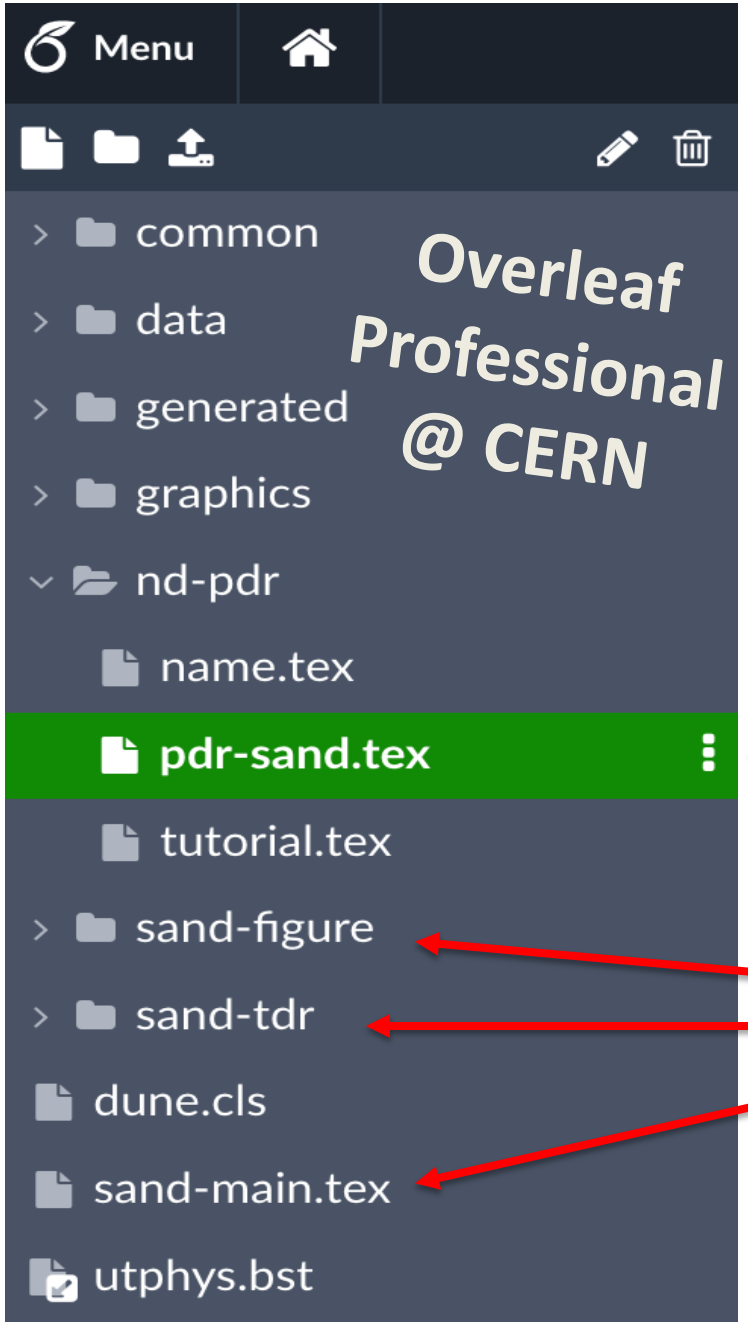
More details

Preliminary Design Review

	topics
Jul 2024	ECAL + magnet
Nov 2024	I & I
Dec 2024/Jan 2025	GRAIN
Mar 2025	Tracker

Review of TDR chapter draft

	reviewer
Jan 2025	SAND consortium
Feb 2025	DUNE collaboration
Mar 2025	LBNC



Overleaf Professional @ CERN

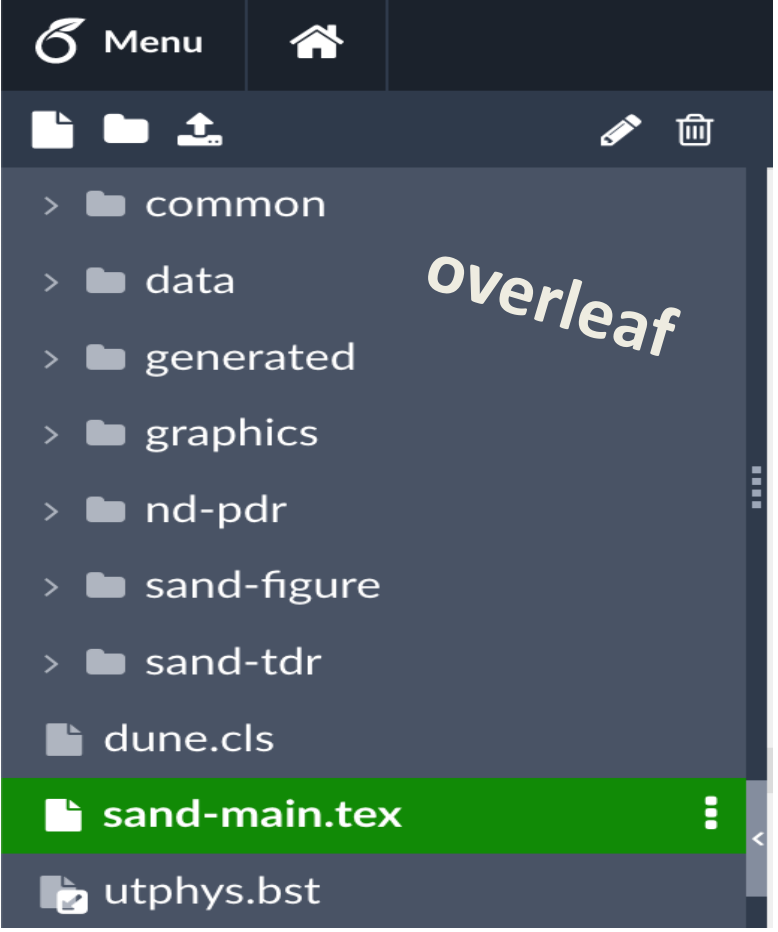
Neutrino Experiment (DUNE) Near Detector Conceptual Design Report. *Instruments* **2021**, *5*, 31. https://doi.org/10.3390/instruments5040031

old CDR text

new for SAND TDR

Overleaf owner P.B.

Other colleagues share (or will share) this overleaf



sand-main.tex

common/preamble

commons/defs
(latex commands)

common/units

generated/parameters
(latex commands)

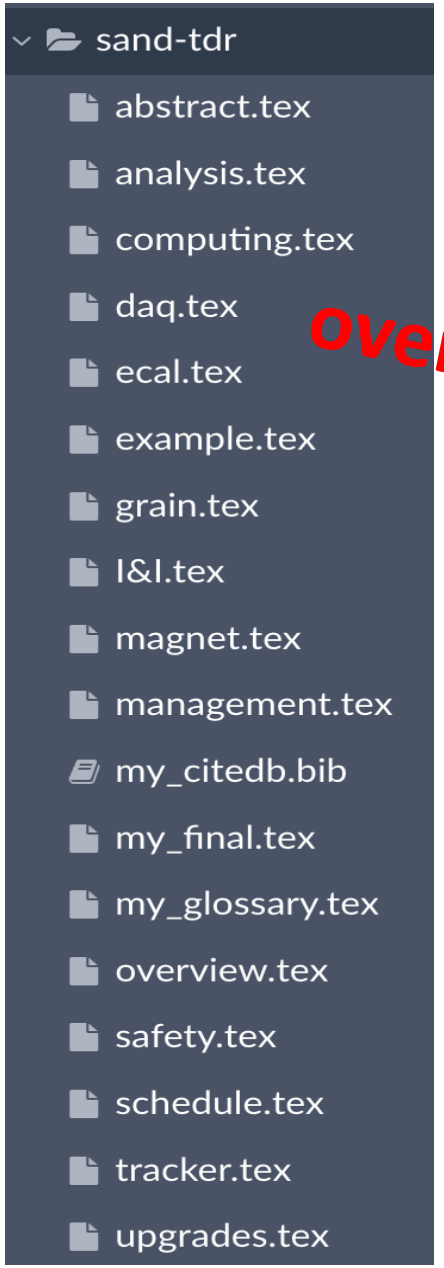
sand-tdr/my_glossary

common/init
(latex style)

sand-tdr/…. (all SAND sections)

sand-figure/…. (all SAND figures)

sand-tdr/my_final → sand-tdr/my_citedb.bib



Present: index + key words (+ also some text)

sand-tdr/overview	?? task force
sand-tdr/ecal	A. Di Domenico + D. Domenici
sand-tdr/magnet	G. Delle Monache
sand-tdr/grain	L. Di Noto + A. Montanari
sand-tdr/tracker	R. Petti + G. Sirri + S. Di Falco
sand-tdr/daq (3 sections)	C. Mariani + S. Di Domizio + N. Tosi
sand-tdr/computing	M. Tenti + A. Surdo
sand-tdr/analysis (2 sections)	M. Tenti + A. Surdo
sand-tdr/I&I	C. Montanari
sand-tdr/safety	C. Montanari + ?? INFN-FNAL people
sand-tdr/management	L. Stanco + S. Bertolucci + L. Patrizii
sand-tdr/schedule	C. Montanari + L. Stanco + S. Bertolucci
sand-tdr/upgrades	??

Possible other sections:

- mechanics (ECAL + GRAIN + tracker)
- muon catcher

Many many rules/instructions in the writing of DUNE documents :

https://github.com/DUNE/document-guidance/releases/	Latex structure
https://ctan.mirror.garr.it/mirrors/ctan/macros/latex/contrib/siunitx/siunitx.pdf	units
https://dune.bnl.gov/docs/technical-proposal/dune-words.pdf	DUNE words
https://ctan.mirror.garr.it/mirrors/ctan/macros/latex/contrib/glossaries/glossaries-user.pdf	glossary

An almost synthetic guidance (49 pages) https://dune.bnl.gov/docs/guidance.pdf

Help by Anne Heavey, scientific editor at FNAL

Instruction 1

Labels to identify a section

3.9.1.1 A Subsubsection

This is a subsubsection.

3.9.1.2 A Second Subsubsection

Remember, if you have one, you need at least one more.

Examples

chapter	1	\label{ch:sand}
section	1.4	\label{sec:sand-grain}
subsection	1.4.3	\label{sec:sand-grain-detect}
subsubsection	1.4.3.1	\label{sec:sand-grain-detect-mask}
subsubsection	1.4.3.2	\label{sec:sand-grain-detect-lens}

Avoid sub-sub-sub-section
(when possible)

Instruction 2

1.9.2 Simulations

1.9.2.1 Neutrino Fluxes

1.9.2.2 Geometry

1.9.2.3 Event Generator

1.9.2.4 Overlays

1.9.2.5 Particle Propagation

1.9.2.6 Detector Simulation

1.9.2.6.1 ECAL

1.9.2.6.2 GRAIN

1.9.2.6.3 Tracker

1.9.2 Simulations

1.9.2.1 Neutrino Fluxes

1.9.2.2 Geometry

1.9.2.3 Event Generator

1.9.2.4 Overlays

1.9.2.5 Particle Propagation

~~1.9.2.6 Detector Simulation~~

1.9.2. 6 ECAL simulation

1.9.2. 7 GRAIN simulation

1.9.2. 8 Tracker simulation

Instruction 3

The string of percent signs just makes it easier to spot where new sections (or subsections) start

```
%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
\subsection{Magnet Specification}\label{sec:sand-magn-specif}
- Experimental requirements ...\\
- Coil parameters (operation current, stored energy ...)\\
- Nominal magnetic field map ...

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
\subsection{Magnet Maintenance and Revamping Options}\label{sec:sand-magn-revamp}
- Status\\
- Subsystems and components maintenance\\
- Obsolete or aged subsystems and components to be replaced\\
- New power supply (CAEN ELS)\\
- Power Electronics (OCEM)\\
- Quench detector (?)\\
- Control system

%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%%
\subsection{Activities at LNF}\label{sec:sand-magn-activ}
- Procurement of the cryogenic systems and materials for magnet cool down\\
- Magnet full operational test (full support for test/dismount/remount by ASG ?)\\
- Coil cool-down\\
- Magnet energizing test\\
- Coil Cryostat extraction\\
- Magnet turret removal\\
- Dismounting of Iron Yoke\\
- Tools, Packaging \& Shipping to \gls{fnal}
```

Instruction 4

All the main words in headings are capitalized

1.4.5 Data acquisition and slow control system

1.4.6 Neutrino event reconstruction

1.4.6.1 Algorithms for track reconstruction with lens images

1.4.5 Data Acquisition and Slow Control System

1.4.6 Neutrino Event Reconstruction

1.4.6.1 Algorithms for Track Reconstruction with Lens Images

Glossary

my_glossary.tex

Insert new DUNE words and new DUNE abbreviations at the end of this file

Check if the word is already present

Instruction 5

To define a DUNE term that has no abbreviation use:

```
\newduneword{label}{term}{description}
```

To define a DUNE term with an abbreviation use:

```
\newduneabbrev{label}{abbrev}{term}{description}
```

Examples

```
\newduneword{detmodule}{detector module}{The entire DUNE far detector is
  segmented into four modules, each with a nominal \SI{10}{\kton}
  fiducial mass}

\newduneabbrev{adc}{ADC}{Analog Digital Converter}{A sampling of a voltage
  resulting in a discrete integer count corresponding in some way to
  the input}
```

Bibliography

my_citedb.bib

Insert references (bibtex format) at the end of this file

Check if the reference is already present

DUNE Words from the glossary

Instruction 6

\dfirst{fnal}	first time	Fermi National Accelerator Laboratory (Fermilab)
\dword{fnal}	following times	Fermilab

More informations in the glossary

Fermi National Accelerator Laboratory (Fermilab) U.S. national laboratory in Batavia, IL. It is the laboratory that hosts Deep Underground Neutrino Experiment (DUNE) and serves as its near site. 1

\dfirst{nd}	near detector (ND)	*with link*
\dword{nd}	ND	*with link*
\dlong{nd}	near detector	*w/o link*
\dshort{nd}	ND	*w/o link*

\dword	singular	\dwords	lower case & plural
\Dword	capital	\Dwords	capital & plural

Instruction 7

common/units.tex to define commands for units

Examples

"m" is written `\si{\meter}` **bare units**

"V" is written `\si{\volt}`.

"123.456" is written as `\num{123.456}`. **bare numbers**

"1±2i" is written as `\num{1+-2i}`.

"3×10^{45}" is written as `\num{3e45}`.

"0.3×10^{45}" is written as `\num{.3e45}`

"120 GeV" is written as `\SI{120}{\GeV}`, **numbers and units**

"4850 ft" is written as `\SI{4850}{\ft}`,

Instruction 8

common/defs.tex to define new commands

Examples

$\bar{\nu}_e$ is written as `\anue`,

Δm^2_{21} is written as `\dm{21}`,

$\sin^2\theta_{13}$ is written as `\sinst{13}`,

$\nu_\mu \to \nu_\mu$ is written as `\numutonumu`,

$p \to K^+\bar{\nu}$ is written as `\ptoknubar`,

Instruction 9

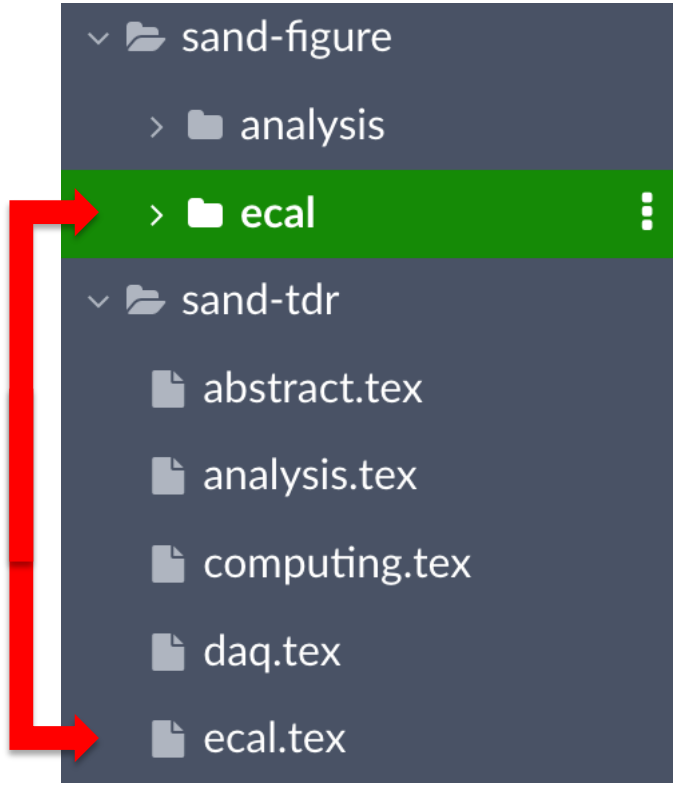
Figures

JPEG use for photographs

PDF use of any line drawings, plots, illustrations

PNG use due to some inability to produce proper JPEG or PDF (contact editors)

folder for the figures associated to each topic



English

- Use American spelling: e.g., ionization (not ionisation), flavor (not flavour) and so on.
- In general, avoid use of first person (e.g., I, we, our). "We" may appear in introductory sections.
- Avoid use of second person, i.e., "you."

SUMMARY

- A preliminary TDR index is available
  (almost all sections have been implemented)
- An overleaf structure is ready
- The writing responsibles have been appointed
  (dedicated mailing list sand-tdr-mail@fnal.gov)
- Next steps
  - complete the index with tasks
  - begin to write
  - first review (ECAL+magnet) at June 2024 (4 months)
  - first TDR draft within December 2024 (10 months)
- Suggestions and contributions are welcome