

DUNE FD1-HD TPC electronics: Documentation for the Final Design Review

V. Tishchenko
Brookhaven National Laboratory

Final Design Review
29 September 2022

How to access the documentation for the review

Event in Indico: <https://indico.fnal.gov/event/56228>

Clickable link.
Open this page

The screenshot shows the Indico event page for 'DUNE FDR: FD1 TPC electronics'. The page title is 'DUNE FDR: FD1 TPC electronics'. The event date is 'September 29, 2022' and the time zone is 'America/Chicago'. There is a search bar with the placeholder text 'Enter your search term'. On the left side, there is a navigation menu with the following items: 'Overview', 'Timetable', 'Review Documentation', and 'Support'. The 'Review Documentation' item is highlighted with a red circle. Below the navigation menu, there is a list of links: 'Review Links', 'Review Home', and 'Charge Letter'. The 'Review Links' link is highlighted with a red circle. In the main content area, there is a section for 'Starts' and 'Ends' with the following information: 'Starts Sep 29, 2022, 8:00 AM' and 'Ends Sep 29, 2022, 10:00 AM' in the 'America/Chicago' time zone. There is also a 'Zoom' section with the following information: 'Zoom ID: 6308408610' and 'See Review Documentation Page for Zoom passcode'. Below the Zoom section, there is a list of names: 'Cheng-Ju Lin', 'David Christian', 'Eric James', and 'Philippe Farthouat'. At the bottom of the page, there is a section for 'Reviewers' with the following information: 'David Cussans, Kevin Fahey, Philippe Farthouat (Chair), Xueye Hu, Giovanna Lehmann Miotto, Mitch Newcomer, Jamieson Olsen, Srini Rajagopalan, Paul Rubinov, Theresa Shaw, Christoph Schwick'. Below the 'Reviewers' section, there is a section for 'Ex-officio' with the following information: 'Mike Andrews, Linda Bagby, Olga Beltramello, Mary Bishai, Kevin Fahey, Jack Fowler, Eric James, Jolie Macier, Jim Mateyack, Bill Miller, Marzio Nessi, Duane Newhart, Terri Shaw, Jim Stewart, Kyle Zeug'.

Click here.

“Review Documentation” page in Indico

DUNE FDR: FD1 TPC electronics

September 29, 2022

Zoom

America/Chicago timezone



Overview

Timetable

Review Documentation

Support

✉ maxine@fnal.gov

Review Documentation

The review will take place in Zoom. For the open session the Zoom connection will be: <https://fnal.zoom.us/j/6308408610> (a passcode is required that will be distributed via a separate E-mail - DUNE members with access to DocDB can open the PDF file in DocDB-26728: [certificate access](#) / [password access](#))

In case of problem accessing the documents in EDMS please contact [Cheng-Ju Lin](#)

FD1 TPC Electronics Final Review Documentation:

The first two documents are good starting point for the reviewers to jump start on this document-based review.

- **FD1 TDR Chapter on TPC Electronics** (<https://edms.cern.ch/document/2606690>): This TDR chapter has been extensively updated for the review. It's a good place for people to read about the full TPC electronics system and scope.
- **FDR support document** (<https://edms.cern.ch/document/2782297>): This document describes the design evolution (e.g. differences between PDR and FDR design), performance results, and QA/QC plan.
- **Complete list of the review documentation** is provided in the excel file in [EDMS#2783308](#). Instructions on how to navigate the spreadsheet is given in the presentation [Documentation For The Review](#).

“Review Documentation” page in Indico

DUNE FDR: FD1 TPC electronics

September 29, 2022
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FD1 TPC Electronics Final Review Documentation:

The first two documents are good starting point for the reviewers to jump start on this document-based review.

- **FD1 TDR Chapter on TPC Electronics** (<https://edms.cern.ch/document/2606690>): This TDR chapter has been extensively updated for the review. It's a good place for people to get a sense of the full TPC detector system and scope.
- **FDR support document** (<https://edms.cern.ch/document/2782297>): This document describes the design evolution (e.g. differences between PDR and FDR design), performance results, and QA.
- **Complete list of the review documentation** is provided in the excel file in [EDMS#2783308](#). Instructions on how to navigate the spreadsheet is given in the presentation [Documentation For The Review](#).

Spreadsheet with links
to the review documents

Spreadsheet with links to FDR documentation

Category	Subcategory	EDMS	File	Description	Charge question
Technical Design Reports		2606684	DUNE-FD-TDR-vol-IV-SP-for-arxiv.pdf	DUNE Technical Design Report, Volume 4: DUNE FD SP Technology (copy or arXiv:2002:03010, also published in JINST 15 (2020) 08, T08010)	2,3,4,6
		2606690	Post_TDR_Update__FD1_HD_TPC_Electronics-82.pdf	Updated chapter 4 of TDR: TPC electronics that accurately describes sub-system design at time of Final Design Review.	
		2782297	CE_FDR_Document_docx_cpdf.pdf	Detailed summary of DUNE FD1-HD TPC Electronics design evolution; characterization; QA and QC	
		2782614	ProtoDUNE_II_StatusAndPlans.pdf	The most recent summary of results of system tests in ProtoDUNE	4
ASIC documentation		2314428	LArASIC_P5B_Datasheet_V1.pdf	LArASIC P5B Datasheet	2
		2314429	COLDADC_P2_Datasheet_docx_cpdf.pdf	COLDADC P2 Datasheet	
		2314430	COLDATA_P3_Datasheet_docx_cpdf.pdf	COLDATA P3 Datasheet	
Grounding & Shielding Plan		2095975	tms_DUNE_Grounding_8APR2018.pdf	DUNE Far Site Detector Grounding System Requirements	2
		2095958	Dune_Grounding_and_Shielding_Guidelines_25FEB2019_rev0_docx_cpdf.pdf	Dune Grounding and Shielding Guidelines	
		2364510	FD1_TPCElectronics_GroundingShielding.pdf	FD1 TPC Electronics Grounding and Shielding Plan	
		2364510	ProtoDUNE_LV_Power_Distributions_FD1.pdf	Grounding scheme for the low voltage power supplies	
		2339405	TechCoordination_grounding.pdf	Detector grounding - TDR chapter	
Specification of Warm Electronics		2341138	WIB_v3_requirements_v1_docx_cpdf.pdf	Specification for WIB (v3)	2
		2731292	PTC_Requirements_docx_cpdf.pdf	Specification for PTC (upgrade)	
Mechanical CAD Model for Sub-system		2783038	HIERARCHY_OF_DUNE_CE_ASSEMBLY_DRAWINGS.pdf	Click the link in Column D to access the tree structure of models with links to drawings	2
		2774711		Feedthrough, Warm Interface Electronics Crate (WIEC), Frontend Motherboards (FEMB), cold cables	
		2771732		Cable Tray-Trolley, temporary Vertical Cable, Cross port	
Mechanical Engineering Drawings		2771733	2771733_2774712_Drawings_index.pdf	Click the link in Column D to access Index of drawings with links	2
		2774712		Feedthrough, WIEC	
		2771733		Cable trays, trolley, crossing tube, x-shape spool piece, cables, CE Box	
Design Documents Electrical Schematics & Board Layouts		2712913	layout_io1826-1c.pdf	FEMB PCB	2
		2712913	Schematics_DUNE_Monolithic_SAMTEC_FEMB_IO1826-C.pdf	FEMB schematics	
		2712914	IO-1750-1-B_artwork.pdf	WIB PCB	
		2712914	DUNE_WIB_V3_IO-1750-1B.pdf	WIB schematics	
		2712915	io1866-1.pdf	PTB PCB	
		2712915	DUNE_PTБ.pdf	PTB schematics	
		2712916	io1863-1.pdf	Flange board PCB	
		2712916	DUNE_FLANGE.pdf	Flange board schematics	
		2712917	GerberFiles.pdf	Warm bias voltage filter board PCB	
		2712917	PD2WarmBiasFilterBoardSchematic_6-16-2021.pdf	Warm bias voltage filter board schematics	
		2339398	PTC3B_preview.pdf	PTC PCB	
		2339398	PTC3A_SchematicsDraft_20180129.pdf	PTC schematics	

Spreadsheet with links to FDR documentation

Category	Subcategory	EDMS	File	Description	Charge question	
Electrical Design Review		2606684	DUNE-FD-TDR-vol-IV-SP-for-arxiv.pdf	DUNE Technical Design Report, Volume 4: DUNE FD SP Technology (copy or arXiv:2002:03010, also published in JINST 15 (2020) 08, T08010)	2,3,4,6	
				Updated chapter 4 of TDR: TPC electronics that accurately describes sub-system design at time of Final Design Review.		
				Detailed summary of DUNE FD1-HD TPC Electronics design evolution; characterization; QA and QC		
ASIC documents				The most recent summary of results of system tests in ProtoDUNE	4	
				LArASIC P5B Datasheet	2	
				COLDADC P2 Datasheet		
Grounding & Shielding Plan				COLDATA P3 Datasheet	2	
				DUNE Far Site Detector Grounding System Requirements		
				Dune Grounding and Shielding Guidelines		
Specification of VME Electronics				FD1 TPC Electronics Grounding and Shielding Plan	2	
				Grounding scheme for the low voltage power supplies		
				Detector grounding - TDR chapter		
Mechanical CAD for Sub-system				DUNE CE Bias Schematic Diagram	2	
				Specification for WIB (v3)		
				Specification for PTC (upgrade)		
Mechanical Engineering Drawings		2771733	2771733_2774712_Drawings_index.pdf	Click the link in Column D to access the tree structure of models with links to drawings	2	
				Feedthrough, Warm Interface Electronics Crate (WIEC), Frontend Motherboards (FEMB), cold cables		
				Cable Tray-Trolley, temporary Vertical Cable, Cross port		
Design Documents	Electrical Schematics & Board Layouts			Click the link in Column D to access Index of drawings with links	2	
				Feedthrough, WIEC		
				Cable trays, trolley, crossing tube, x-shape spool piece, cables, CE Box		
				layout_io1826-1c.pdf		FEMB PCB
				Schematics_DUNE_Monolithic_SAMTEC_FEMB_IO1826-C.pdf		FEMB schematics
				IO-1750-1-B_artwork.pdf		WIB PCB
				DUNE_WIB_V3_IO-1750-1B.pdf		WIB schematics
				io1866-1.pdf		PTB PCB
				DUNE_PT.B.pdf		PTB schematics
				io1863-1.pdf		Flange board PCB
				DUNE_FLANGE.pdf		Flange board schematics
				GerberFiles.pdf		Warm bias voltage filter board PCB
PD2WarmBiasFilterBoardSchematic_6-16-2021.pdf	Warm bias voltage filter board schematics					
PTC3B_preview.pdf	PTC PCB					
PTC3A_SchematicsDraft_20180129.pdf	PTC schematics					

The documents are grouped into "Categories" and "Subcategories", as originally defined by the Review Office

Spreadsheet with links to FDR documentation

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Design Documents	Technical Design Reports	2606684		DUNE Technical Design Report, Volume 4: DUNE FD SP Technology published in JINST 15 (2020) 08, T08010	2,3,4,6	
		2606690		Electronics that accurately describes in Review.		
		2782297		Electronics design evolution;		
		2782614		system tests in ProtoDUNE	4	
	ASIC documentation	2314428				2
		2314429				
		2314430				
	Grounding & Shielding Plan	2095975			Requirements	
		2095958	Dune_Gro			
		2364510			Shielding Plan	2
		2364510			power supplies	
		2339405				
	Specification of Warm Electronics	2341138				2
		2731292				
	Mechanical CAD Model for Sub-system	2783038			tree structure of models with	
2774711				ics Crate (WIEC), Frontend	2	
2771732				Vertical Cable, Cross port		
Mechanical Engineering Drawings	2771733		2771733_2774712_Drawings_index.pdf	Click the link in Column D to access Index of drawings with links		
	2774712			Feedthrough, WIEC	2	
	2771733			Cable trays, trolley, crossing tube, x-shape spool piece, cables, CE Box		
Electrical Schematics & Board Layouts	2712913		layout_io1826-1c.pdf	FEMB PCB		
	2712913		Schematics_DUNE_Monolithic_SAMTEC_FEMB_IO1826-C.pdf	FEMB schematics		
	2712914		IO-1750-1-B_artwork.pdf	WIB PCB		
	2712914		DUNE_WIB_V3_IO-1750-1B.pdf	WIB schematics		
	2712915		io1866-1.pdf	PTB PCB		
	2712915		DUNE_PT.B.pdf	PTB schematics		
	2712916		io1863-1.pdf	Flange board PCB		
	2712916		DUNE_FLANGE.pdf	Flange board schematics		
	2712917		GerberFiles.pdf	Warm bias voltage filter board PCB		
	2712917		PD2WarmBiasFilterBoardSchematic_6-16-2021.pdf	Warm bias voltage filter board schematics		
	2339398		PTC3B_preview.pdf	PTC PCB		
2339398		PTC3A_SchematicsDraft_20180129.pdf	PTC schematics			

Column "EDMS" Contains links to EDMS documents. These are the main links.

Each EDMS document contains one or more files.

Spreadsheet with links to FDR documentation

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		2606684	DUNE-FD-TDR-vol-IV-SP-for-arxiv.pdf	DUNE Technical Design Report, Volume 4: DUNE FD SP Technology (copy or arXiv:2002:03010, also published in JINST 15 (2020) 08, T08010)	
Technical Design			Post_TDR_Update_ED1_HD_TPC_Electronics_82.pdf	Updated chapter 4 of TDR: TPC electronics that accurately describes	2,3,4,6

Example:
The TDR EDMS contains only one file

2606684 v.2 Released Public access

DUNE Technical Design Report Volume IV: DUNE Far Detector Single-phase Technology

Report by Cheng-Ju Lin

Created on 2022-09-24
Last Modified on 2022-09-24

Info

Description: Published version from arXiv:2002.03010, February 2020. External reference: Keywords:

Details

Local administrators: [List of Administrators](#) Equipment code:

Context: CENF-LBNF-DUNE Release procedure: DOC-OWNER
CENF-LBNF-DUNE Simple document release procedure

Associated Links: TDR Volume 1: Introduction to DUNE CDN Links:
TDR Volume 2: DUNE Physics
TDR Volume 3: Far Detector Technical Coordination
TDR Volume 4: Far Detector Single Phase Technology

This page <https://edms.cern.ch/document/2606684/2>

Files

Name	Size	Last modified date	Last modified by
DUNE-FD-TDR-vol-IV-SP-for-arxiv.pdf	104.0 M	2021-07-12 10:31:25	MARCO VERZOCCHI

Page 1 of 1 Total: 1 (displaying 1 - 1)

Spreadsheet with links to FDR documentation

Category	Subcategory	EDMS	File	Description	Charge question
		2606684	DUNE-FD-TDR-vol-IV-SP-for-arxiv.pdf	DUNE Technical Design Report, Volume 4: DUNE FD SP Technology (copy or arXiv:2002:03010, also published in JINST 15 (2020) 08, T08010)	
Technical Design		2606684	Post_TDR_Update_ED1_H5_TPC_Electronics_82.pdf	Updated chapter 4 of TDR: TPC electronics that accurately describes	2,3,4,6

... such file is also linked in column "File" for direct access

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DUNE Technical Design Report Volume IV: DUNE Far Detector Single-phase Technology

Report by Cheng-Ju Lin

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CENF-LBNF-DUNE Simple document release procedure

Associated Links: TDR Volume 1: Introduction to DUNE CDN Links:
TDR Volume 2: DUNE Physics
TDR Volume 3: Far Detector Technical Coordination
TDR Volume 4: Far Detector Single Phase Technology

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Files

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Per page 10 View mode:

Name	Size	Last modified date	Last modified by
DUNE-FD-TDR-vol-IV-SP-for-arxiv.pdf	104.0 M	2021-07-12 10:31:25	MARCO VERZOCCHI

Page 1 of 1 Total: 1 (displaying 1 - 1)

More info

Spreadsheet with

2086112 v.1 Released Public access
Cold bias voltage cable by MARCO VERZOCCHI

Description: Bias voltage cable used for the connection between the Cold Electronics flange and the SHV board mounted on the APA. Bundles of 8 cables are needed for each APA. Cables come in two lengths, one for the top APA (~9 m) and one for the bottom APA (~22 m)

External reference: [Blank]
Keywords: [Blank]

Details

Local administrators: List of Administrators
Context: CENF-LBNF-DUNE
Associated Links: [Blank]

Equipment code: [Blank]
Release procedure: DOC-OWNER
Simple document release procedure

CDN Links: [Blank]

Drawing Data

Creation system: [Blank]
Design office: [Blank]
Source address: [Blank]

Format: US-A
Scale: [Blank]
CDD Control 1 Date: [Blank]
CDD Control 2 Date: [Blank]

This page <https://edms.cern.ch/document/2086112/1>

Files

Name	Size	Last modified date	Last modified by
Pasternack_SHV_cable_drawing_PE34432.pdf	104.5 KE	2019-02-07 17:41:54	MARCO VERZOCCHI
WFJ110407A.pdf	71.4 KB	2020-02-21 15:34:48	MARCO VERZOCCHI
RG316-U.pdf	425.0 KE	2020-02-21 15:34:48	MARCO VERZOCCHI
RG316-U_ROHS.pdf	581.7 KE	2020-02-21 15:34:48	MARCO VERZOCCHI
RG316-U_Reach.pdf	160.1 KE	2020-02-21 15:34:48	MARCO VERZOCCHI

Some EDMS documents contain more than one file. If there is a particularly relevant file, it is linked in the column "File" as usual.

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Design Documents	2771733		
	2774712		
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Specification of Electrical Cabling and Wiring Connections	2712916		
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	2339398		
	2086112	Pasternack_SHV_cable_drawing_PE34432.pdf	Cold bias voltage cable drawing. See the EDMS folder for more documents.
	2086114	DCCBL02_22M_REV_C.pdf	Cold power cable drawing. More documents in the EDMS folder.
	2086113	HDR-223199-XX-ECDP.pdf	Cold clock and data cable drawing. More documents in the EDMS folder.
	2332922	2857_1.pdf	Cold fallback return current datasheet
	2332924	RE_Low_Voltage_AWG_10_-_FW_cable_04.08.82.060.2_2x6_mm2.pdf	Warm bias voltage cables datasheet
2332923	605eREV3.pdf	Warm power cable from the PL506 to the PTC - technical specifications	

Spreadsheet with

The screenshot shows the EDMS interface for document 2086112 v.1, titled 'Cold bias voltage cable' by MARCO VERZOCCHI. The document is released and has public access. The description states: 'Bias voltage cable used between the Cold Electronics Board mounted on the bottom APA are needed for lengths, one for the bottom APA...'. The 'Files' section lists several PDF documents, including 'Pasternack_SHV_cable_drawing_PE34432.pdf'.

The Description may indicate that there are more documents in the EDMS folder.

Category	Subcategory	EDMS	File
Design Documents	ASIC documentation	2314429	
		2314430	
	Grounding & Shielding Plan	2095975	
		2095958	Dune
		2364510	
		2364510	
		2339405	
	Specification of Warm Electronics	2341138	
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	Mechanical CAD Model for Sub-system	2783038	
		2774711	
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	Mechanical Engineering Drawings	2771733	
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Electrical Schematics & Board Layouts	2712913		
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Specification of Electrical Cabling and Wiring Connections	2339398		
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	2332925	PTC3B_preview.pdf PTC PCB	
	2086112	PTC3A_SchematicsDraft_20180129.pdf PTC schematics	
	2086114	TPCElectronics_Cabling_docx_cpdf.pdf TPC Electronics Cabling Description and Numbering Scheme	
	2086113	Pasternack_SHV_cable_drawing_PE34432.pdf Cold bias voltage cable drawing. See the EDMS folder for more documents.	
	2332922	DCCBL02_22M_REV_C.pdf Cold power cable drawing. More documents in the EDMS folder.	
	2332924	HDR-223199-XX-ECDP.pdf Cold clock and data cable drawing. More documents in the EDMS folder.	
	2332923	2857_1.pdf Cold Fallback return current datasheet	
		RE_Low_Voltage_AWG_10_-_FW_cable_04.08.82.060.2_2x6_mm2.pdf Warm bias voltage cables datasheet	
	605eREV3.pdf Warm power cable from the PL506 to the PTC - technical specifications		

Cold bias voltage cable drawing. See the EDMS folder for more documents.

Spreadsheet with links to FDR documentation

Category	Subcategory	EDMS	File	Description	Charge question
ASIC documentation		2314429	COLDADC_P2_Datasheet_docx_cpdf.pdf	COLDADC P2 Datasheet	2
		2314430	COLDATA_P3_Datasheet_docx_cpdf.pdf	COLDATA P3 Datasheet	
		2095975	tms_DUNE_Grounding_8APR2018.pdf	DUNE Far Site Detector Grounding System Requirements	
Grounding & Shielding Plan		2095958	Dune_Grounding_and_Shielding_Guidelines_25FEB2019_rev0_docx_cpdf.pdf	Dune Grounding and Shielding Guidelines	2
		2364510	FD1_TPCelectronics_GroundingShielding.pdf	FD1 TPC Electronics Grounding and Shielding Plan	
		2364510	ProtoDUNE_LV_Power_Distributions_FD1.pdf	Grounding scheme for the low voltage power supplies	
		2339405	TechCoordination_grounding.pdf	Detector grounding - TDR chapter	
		2341139	TPC_Bias_Scheme_08-30-2022.pdf	DUNE CE Bias Schematic Diagram	
Specification of Warm Electronics		2341138	WIB_v3_requirements_v1_docx_cpdf.pdf	Specification for WIB (v3)	2
		2731292	PTC_Requirements_docx_cpdf.pdf	Specification for PTC (upgrade)	
Mechanical CAD Model for Sub-system		2783038	HIERARCHY_OF_DUNE_CE_ASSEMBLY_DRAWINGS.pdf	Click the link in Column D to access the tree structure of models with links to drawings	2
		2774711		Feedthrough, Warm Interface Electronics Crate (WIEC), Frontend Motherboards (FEMB), cold cables	
		2771732		Cable Tray-Trolley, temporary Vertical Cable, Cross port	
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		2771733		Cable Tray, Trolley, crossing tube, x-shape spool piece, cables, CE Box	
Design Documents	Electrical Schematics & Board Layouts	2712913			2
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2339398					
Specification of Electrical Cabling and Wiring Connections		2332925		Description and Numbering Scheme drawing. See the EDMS folder for more	2
		2086112			
		2086114		ing. More documents in the EDMS folder.	
		2086113		ca cable drawing. More documents in the EDMS folder.	
		2332922	2857_1.pdf	Cold Fallback return current datasheet	
		2332924	RE_Low_Voltage_AWG_10_-_FW_cable_04.08.82.060.2_2x6_mm2.pdf	Warm bias voltage cables datasheet	
	2332923	605eREV3.pdf	Warm power cable from the PL506 to the PTC - technical specifications		

If no files are linked in the "File" column, refer to the EDMS folder to see the files.

Spreadsheet with links to FDR documentation

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			LArASIC_P5B_Datasheet_V1.pdf	LArASIC P5B Datasheet	2	
			COLDADC_P2_Datasheet_docx_cp.pdf	COLDADC P2 Datasheet		
			COLDATA_P3_Datasheet_docx_cp.pdf	COLDATA P3 Datasheet		
			DUNE_Far_Site_Detector_Grounding_System_Requirements_8APR2018.pdf	DUNE Far Site Detector Grounding System Requirements	2	
			Dune_Grounding_and_Shielding_Guidelines_rev0_docx_cp.pdf	Dune Grounding and Shielding Guidelines		
			FD1_TPC_Electronics_Grounding_and_Shielding_Plan_GroundingShielding.pdf	FD1 TPC Electronics Grounding and Shielding Plan		
			Grounding_scheme_for_the_low_voltage_power_supplies_Distributions_FD1.pdf	Grounding scheme for the low voltage power supplies		
			Detector_grounding_-_TDR_chapter_10.pdf	Detector grounding - TDR chapter		
			DUNE_CE_Bias_Schematic_Diagram_08-30-2022.pdf	DUNE CE Bias Schematic Diagram	2	
			Specification_for_WIB_v3_08-30-2022.pdf	Specification for WIB (v3)		
			Specification_for_PTC_upgrade_08-30-2022.pdf	Specification for PTC (upgrade)		
				DRAWINGS.pdf	Click the link in Column D to access the tree structure of models with links to drawings	2
					Feedthrough, Warm Interface Electronics Crate (WIEC), Frontend Motherboards (FEMB), cold cables	2
					Cable Tray-Trolley, temporary Vertical Cable, Cross port	
		Drawings_index.pdf	Click the link in Column D to access Index of drawings with links			
			Feedthrough, WIEC	2		
			Cable trays, trolley, crossing tube, x-shape spool piece, cables, CE Box			
			FEMB_PCB_layout_io1826-1c.pdf		FEMB PCB	
			FEMB_schematics_io1826-C.pdf	FEMB schematics	2	
			WIB_PCB_layout_io1750-1-B_artwork.pdf	WIB PCB		
			WIB_schematics_DUNE_WIB_V3_IO-1750-1B.pdf	WIB schematics		
			PTB_PCB_layout_io1866-1.pdf	PTB PCB		
			PTB_schematics_DUNE_PT_B.pdf	PTB schematics		
			Flange_board_PCB_layout_io1863-1.pdf	Flange board PCB		
			Flange_board_schematics_DUNE_FLANGE.pdf	Flange board schematics		
			Warm_bias_voltage_filter_board_PCB_GerberFiles.pdf	Warm bias voltage filter board PCB		
			Warm_bias_voltage_filter_board_schematics_PD2WarmBiasFilterBoardSchematic_6-16-2021.pdf	Warm bias voltage filter board schematics		
			PTC3B_preview.pdf	PTC PCB		
			PTC3A_SchematicsDraft_20180129.pdf	PTC schematics		

This column provides a brief information about the linked EDMS documents.

Spreadsheet with links to FDR documentation

Category	Subcategory	EDMS	File	Description	Charge question
Technical Design Reports		2606684	DUNE-FD-TDR-vol-IV-SP-for-arxiv.pdf	DUNE Technical Design Report, Volume 4: DUNE FD SP Tech... (copy or arXiv:2002:03010, also published in JINST 15... T08010	
		2606690	Post_TDR_Update__FD1_HD_TPC_Electronics-82.pdf	Updated chapter 4 of TDR: TPC electronics... describes sub-system design at time of F...	2,3,4,6
		2782297	CE_FDR_Document_docx_cp.pdf	Detailed summary of DUNE... electronics design evolution; characterization...	
		2782614		... tests in ProtoDUNE	4
ASIC documentation		2314428			
		2314429			2
		2314430			
Grounding & Shielding Plan		2095975			
		2095958	Dune_Grounding_and...		
		2364510			2
		2364510			
		2339405			
Specification of Warm Electronics		2341138			2
		2731292			
Mechanical CAD Model for Sub-system		2783038		... of models with	
		2774711		... Frontend	2
		2771732			
Mechanical Engineering Drawings		2771733		... with links	2
		2774712			
		2771733		... cables, CE Box	
Design Documents	Electrical Schematics & Board Layouts	2712913			
		2712913	Schematics_DUNE...		
		2712914	IO-1750-1-B_artwork.pdf	WIB PCB	
		2712914	DUNE_WIB_V3_IO-1750-1B.pdf	WIB schematics	
		2712915	io1866-1.pdf	PTB PCB	
		2712915	DUNE_PT.B.pdf	PTB schematics	
		2712916	io1863-1.pdf	Flange board PCB	
		2712916	DUNE_FLANGE.pdf	Flange board schematics	
		2712917	GerberFiles.pdf	Warm bias voltage filter board PCB	
		2712917	PD2WarmBiasFilterBoardSchematic_6-16-2021.pdf	Warm bias voltage filter board schematics	
		2339398	PTC3B_preview.pdf	PTC PCB	
		2339398	PTC3A_SchematicsDraft_20180129.pdf	PTC schematics	

This column can be useful for people trying to answer the charge questions.

Drawings and CAD models

Category	Subcategory	EDMS	File	Description	Charge question
Technical Design Reports		2606684	DUNE-FD-TDR-vol-IV-SP-for-arxiv.pdf	DUNE Technical Design Report, Volume 4: DUNE FD SP Technology (copy or arXiv:2002:03010, also published in JINST 15 (2020) 08, T08010)	2,3,4,6
		2606690	Post_TDR_Update__FD1_HD_TPC_Electronics-82.pdf	Updated chapter 4 of TDR: TPC electronics that accurately describes sub-system design at time of Final Design Review.	
		2782297	CE_FDR_Document_docx_cpdf.pdf	Detailed summary of DUNE FD1-HD TPC Electronics design evolution; characterization; QA and QC	
		2782614	ProtoDUNE_II_StatusAndPlans.pdf	The most recent summary of results of system tests in ProtoDUNE	4
ASIC documentation		2314428	LArASIC_P5B_Datasheet_V1.pdf	LArASIC P5B Datasheet	2
		2314429	COLDADC_P2_Datasheet_docx_cpdf.pdf	COLDADC P2 Datasheet	
		2314430	COLDATA_P3_Datasheet_docx_cpdf.pdf	COLDATA P3 Datasheet	
Grounding & Shielding Plan		2095975	tms_DUNE_Grounding_8APR2018.pdf	DUNE Far Site Detector Grounding System Requirements	2
		2095958	Dune_Grounding_and_Shielding_Guidelines_25FEB2019_rev0_docx_cpdf.pdf	Dune Grounding and Shielding Guidelines	
		2364510	FD1_TPCElectronics_GroundingShielding.pdf	FD1 TPC Electronics Grounding and Shielding Plan	
		2364510	ProtoDUNE_LV_Power_Distributions_FD1.pdf	Grounding scheme for the low voltage power supplies	
		2339405	TechCoordination_grounding.pdf	Detector grounding - TDR chapter	
Specification of Warm Electronics		2341138	WIB_v3_requirements_v1_docx_cpdf.pdf	Specification for WIB (v3)	2
		2731292	PTC_Requirements_docx_cpdf.pdf	Specification for PTC (upgrade)	
Mechanical CAD Model for Sub-system		2783038	HIERARCHY_OF_DUNE_CE_ASSEMBLY_DRAWINGS.pdf	Click the link in Column D to access the tree structure of models with links to drawings	2
		2774711		Feedthrough, Warm Interface Electronics Crate (WIEC), Frontend Motherboards (FEMB), cold cables	
		2771733		Cable Tray-Trolley, temporary Vertical Cable, Cross port	
Mechanical Engineering Drawings		2772792	2771733_2774712_Drawings_index.pdf	Click the link in Column D to access Index of drawings with links	2
		2774712		Feedthrough, WIEC	
		2771733		Cable trays, trolley, crossing tube, x-shape spool piece, cables, CE Box	
Design Documents Electrical Schematics & Board Layouts		2712903	layout_io1826-1c.pdf	FEMB PCB	2
		2712903	Schematics_DUNE_Monolithic_SAMTEC_FEMB_IO1826-C.pdf	FEMB schematics	
		2712903	IO-1750-1-B_artwork.pdf	WIB PCB	
		2712903	DUNE_WIB_V3_IO-1750-1B.pdf	WIB schematics	
		2712903	io1866-1.pdf	PTB PCB	
		2712903	DUNE_PTБ.pdf	PTB schematics	
		2712903	io1863-1.pdf	Flange board PCB	
		2712903	DUNE_FLANGE.pdf	Flange board schematics	

Drawings are distributed between two EDMS documents
CAD models are distributed between two EDMS documents as well

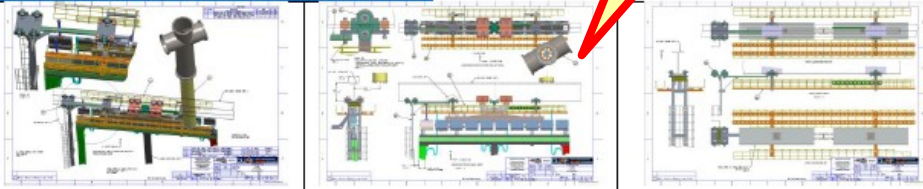
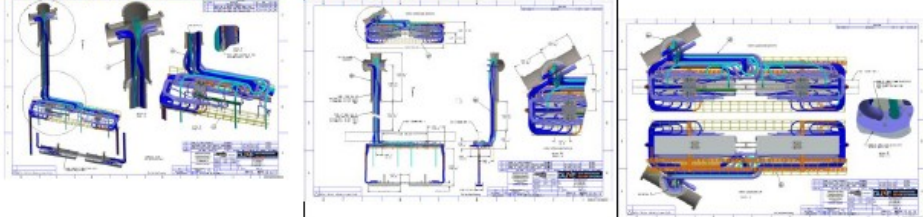
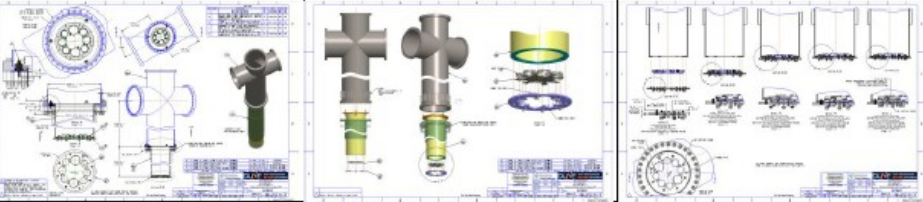

Index file for Engineering Drawings

Thumbnail images

FD1-HD TPC Electronics: Index of drawings

<https://edms.cern.ch/document/2771733>

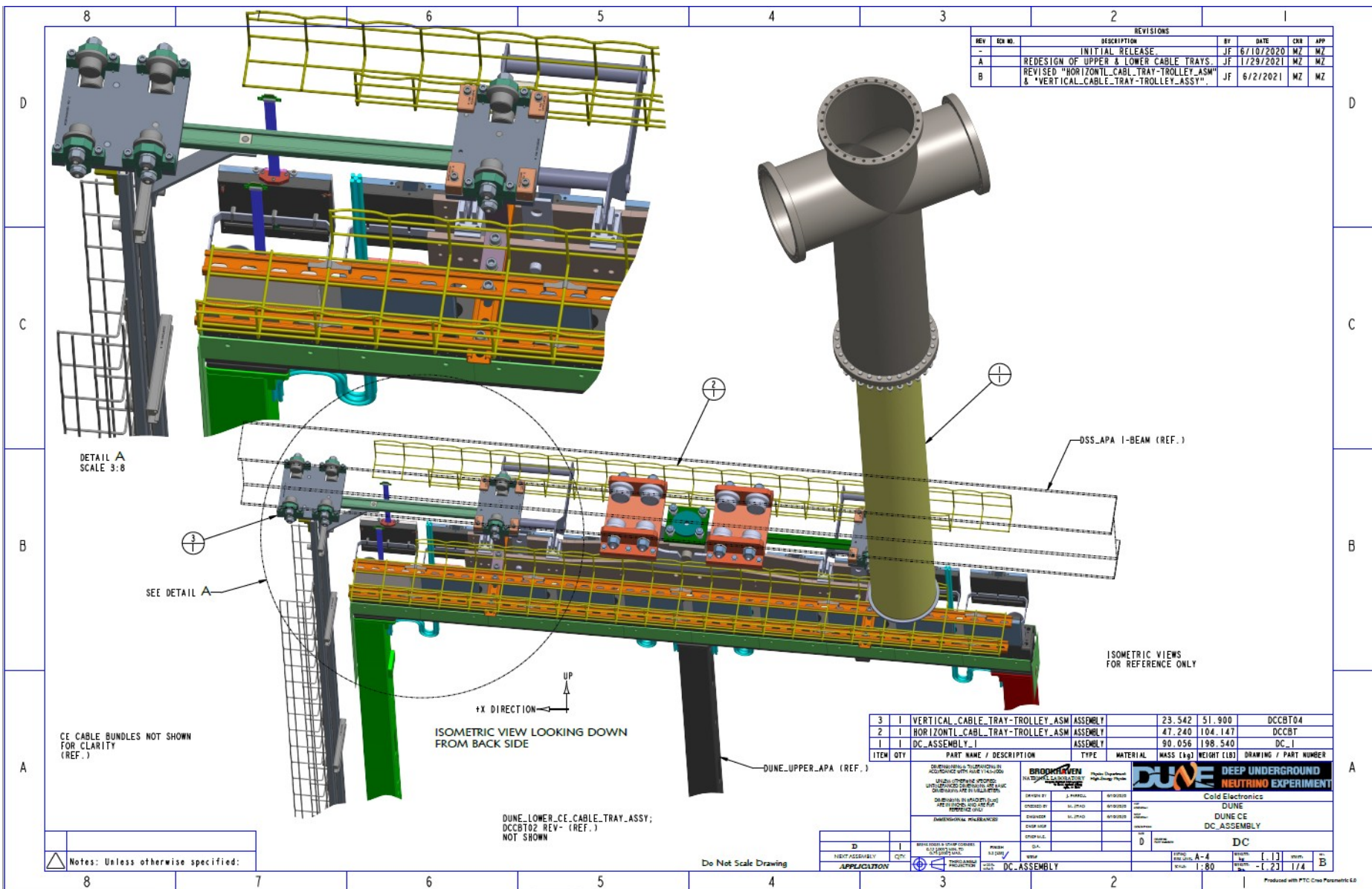
DC_ASSEMBLY

Nr	File link / thumbnail images
1.	https://edms.cern.ch/ui/file/2771733/1/DC_REV_B.pdf 
2.	https://edms.cern.ch/ui/file/2771733/1/DC_1_REV_B.pdf 
3.	https://edms.cern.ch/ui/file/2771733/1/DCFDT_REV_E.pdf 
4.	https://edms.cern.ch/ui/file/2771733/1/DCCBT_REV_D.pdf 

Link to the drawing file in EDMS in PDF format

Example:

https://edms.cern.ch/ui/file/2771733/1/DC_REV_B.pdf



Example:

https://edms.cern.ch/ui/file/2771733/1/DC_REV_B.pdf

REVISIONS					
REV	ECN NO.	DESCRIPTION	BY	DATE	CRB APP
1		INITIAL RELEASE	JF	6/10/2020	MZ MZ
2		REDESIGN OF UPPER & LOWER CABLE TRAYS	JF	1/29/2021	MZ MZ
3		REVISED "HORIZONTAL_CABL_TRAY-TROLLEY_ASM" & "VERTICAL_CABLE_TRAY-TROLLEY_ASSY".	JF	6/2/2021	MZ MZ

ITEM	QTY	PART NAME / DESCRIPTION	TYPE	MATERIAL	MASS [kg]	WEIGHT [LB]	DRAWING / PART NUMBER
3	1	VERTICAL_CABLE_TRAY-TROLLEY_ASM	ASSEMBLY		23.542	51.900	DCCBT04
2	1	HORIZONTAL_CABL_TRAY-TROLLEY_ASM	ASSEMBLY		47.240	104.147	DCCBT
1	1	DC_ASSEMBLY_I	ASSEMBLY		90.056	198.540	DC_I

DIMENSIONING & TOLERANCING IN ACCORDANCE WITH ASME Y14.5-2009

UNLESS OTHERWISE SPECIFIED: UNTOLERANCED DIMENSIONS ARE BASIC DIMENSIONS ARE IN MILLIMETERS

DIMENSIONS IN BRACKETS [x.xx] ARE IN INCHES AND ARE FOR REFERENCE ONLY

DIMENSIONAL TOLERANCES

BROOKHAVEN NATIONAL LABORATORY
managed by Brookhaven Science Associates for the U.S. Department of Energy

Physics Department
High-Energy Physics

DRAWN BY: J. FARRELL 6/10/2020

CHECKED BY: M. ZHAO 6/10/2020

ENGINEER: M. ZHAO 6/10/2020

ENGR MGR:

CHIEF M.E.:

WBS#:

DUNE DEEP UNDERGROUND NEUTRINO EXPERIMENT

Cold Electronics

DUNE
DUNE CE
DC_ASSEMBLY

BREAK EDGES & SHARP CORNERS 0.12 [0.005"] MIN. TO 0.75 [0.030"] MAX.

FINISH 3.2 [125] ✓

Q.A.

SIZE: D

DRAWING PART NUMBER: **DC**

ESH&Q RISK LEVEL: A-4

WEIGHT: [.] kg

WEIGHT: - [. 2] lbs.

SHEET: 1 / 4

REV: **B**

SCALE: 1:80

MODEL NAME: DC_ASSEMBLY

THIRD ANGLE PROJECTION

ITEM	QTY	PART NAME / DESCRIPTION	TYPE	MATERIAL	MASS [kg]	WEIGHT [LB]	DRAWING / PART NUMBER
3	1	VERTICAL_CABLE_TRAY-TROLLEY_ASM	ASSEMBLY		23.542	51.900	DCCBT04
2	1	HORIZONTAL_CABL_TRAY-TROLLEY_ASM	ASSEMBLY		47.240	104.147	DCCBT
1	1	DC_ASSEMBLY_I	ASSEMBLY		90.056	198.540	DC_I

BROOKHAVEN NATIONAL LABORATORY
managed by Brookhaven Science Associates for the U.S. Department of Energy

Physics Department
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DRAWN BY: J. FARRELL 6/10/2020

CHECKED BY: M. ZHAO 6/10/2020

ENGINEER: M. ZHAO 6/10/2020

ENGR MGR:

CHIEF M.E.:

WBS#:

Physics Department
High-Energy Physics

Cold Electronics

DUNE
DUNE CE
DC_ASSEMBLY

SIZE: D

DRAWING PART NUMBER: **DC**

ESH&Q RISK LEVEL: A-4

WEIGHT: [.] kg

WEIGHT: - [. 2] lbs.

SHEET: 1 / 4

REV: **B**

SCALE: 1:80

MODEL NAME: DC_ASSEMBLY

THIRD ANGLE PROJECTION

Example:

https://edms.cern.ch/ui/file/2771733/1/DC_REV_B.pdf

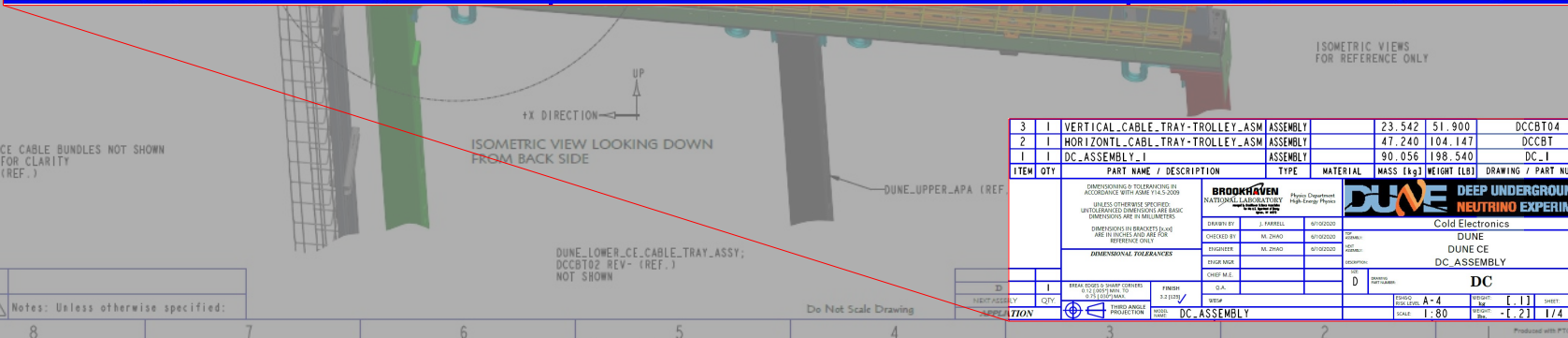
This drawing is an assembly.
It contains 3 items

All three items are assemblies as well

REV	ECN NO.	DESCRIPTION	BY	DATE	CRD	APP
-		INITIAL RELEASE	JF	6/10/2020	MZ	MZ
A		REDESIGN OF UPPER & LOWER CABLE TRAYS	JF	1/29/2021	MZ	MZ
		"HORIZONTAL_CABL_TRAY-TROLLEY_ASM"	JF	6/2/2021	MZ	MZ
		"CABLE_TRAY-TROLLEY_ASSY"	JF	6/2/2021	MZ	MZ

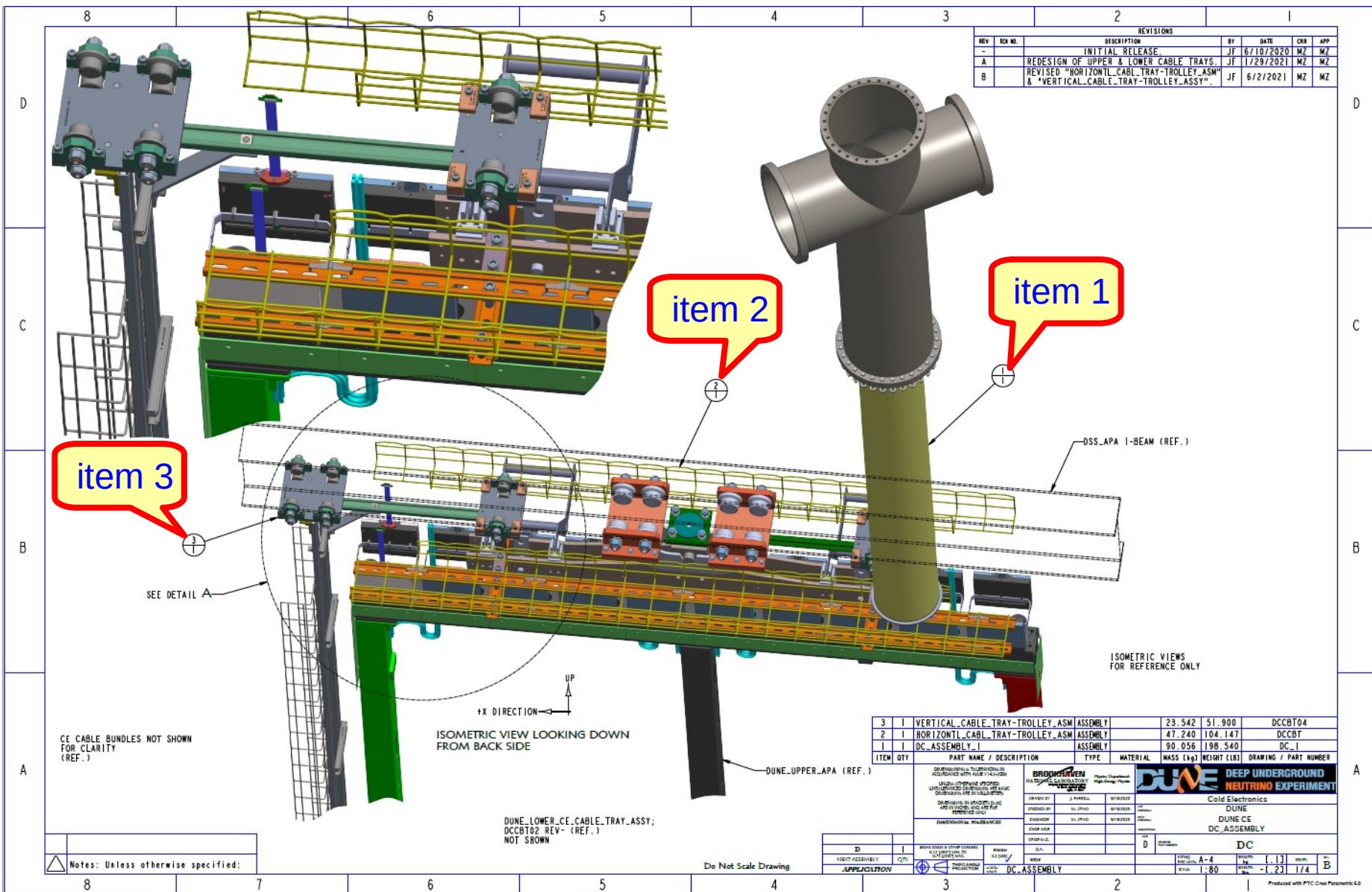
ITEM	QTY	PART NAME / DESCRIPTION	TYPE	MATERIAL	MASS [kg]	WEIGHT [LB]	DRAWING / PART NUMBER
3	1	VERTICAL_CABLE_TRAY-TROLLEY_ASM	ASSEMBLY		23.542	51.900	DCCBT04
2	1	HORIZONTAL_CABL_TRAY-TROLLEY_ASM	ASSEMBLY		47.240	104.147	DCCBT
1	1	DC_ASSEMBLY_I	ASSEMBLY		90.056	198.540	DC_I

DIMENSIONING & TOLERANCING IN ACCORDANCE WITH ASME Y14.5-2009 UNLESS OTHERWISE SPECIFIED: UNTOLERANCED DIMENSIONS ARE BASIC DIMENSIONS ARE IN MILLIMETERS DIMENSIONS IN BRACKETS [x.xx] ARE IN INCHES AND ARE FOR REFERENCE ONLY		BROOKHAVEN NATIONAL LABORATORY Physics Department High-Energy Physics <small>managed by Brookhaven Science Associates for the U.S. Department of Energy</small>					
DIMENSIONAL TOLERANCES		DRAWN BY: J. FARRELL / 6/10/2020 CHECKED BY: M. ZHAO / 6/10/2020 ENGINEER: M. ZHAO / 6/10/2020 ENGR MGR: CHIEF M.E.:	TOP ASSEMBLY: NEXT ASSEMBLY: DESCRIPTION:	Cold Electronics DUNE DUNE CE DC_ASSEMBLY			
BREAK EDGES & SHARP CORNERS 0.12 [0.005"] MIN. TO 0.75 [0.30"] MAX.	FINISH 3.2 [125]	Q.A. WBS#	SIZE: D DRAWING PART NUMBER:	DC			
THIRD ANGLE PROJECTION	MODEL NAME: DC_ASSEMBLY	ESH&Q RISK LEVEL: A-4 SCALE: 1:80	WEIGHT: [.] kg WEIGHT: - [. 2] lbs.	SHEET: 1 / 4	REV. B		



Example:

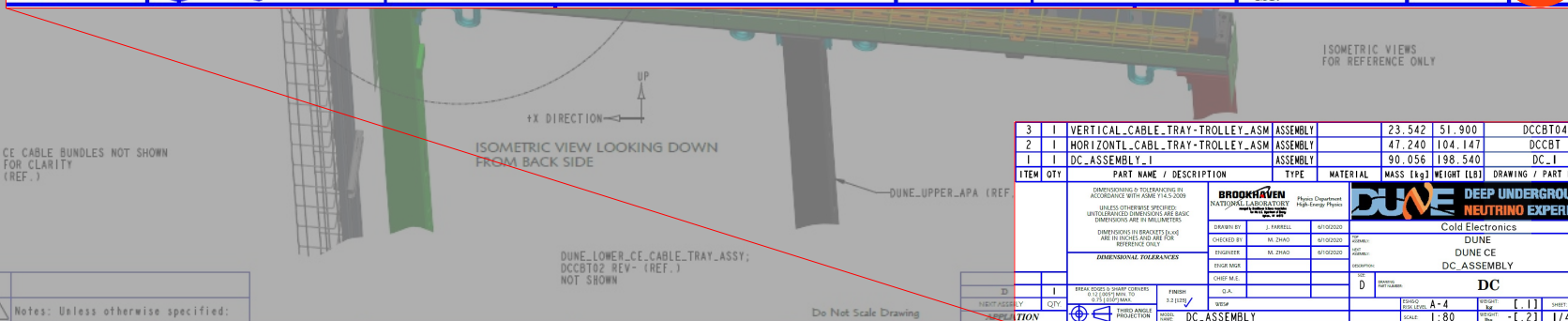
https://edms.cern.ch/ui/file/2771733/1/DC_REV_B.pdf



Drawing name for Item 1: **DC_1_REV_B**

ITEM	QTY	PART NAME / DESCRIPTION	TYPE	MATERIAL	MASS [kg]	WEIGHT [LB]	DRAWING / PART NUMBER
3	1	VERTICAL_CABLE_TRAY-TROLLEY_ASM	ASSEMBLY		23.542	51.900	DCCBT04
2	1	HORIZONTAL_CABL_TRAY-TROLLEY_ASM	ASSEMBLY		47.240	104.147	DCCBT
1	1	DC_ASSEMBLY_I	ASSEMBLY		90.056	198.540	DC_I

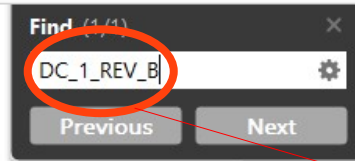
DIMENSIONING & TOLERANCING IN ACCORDANCE WITH ASME Y14.5-2009 UNLESS OTHERWISE SPECIFIED: UNTOLERANCED DIMENSIONS ARE BASIC DIMENSIONS ARE IN MILLIMETERS DIMENSIONS IN BRACKETS [x.xx] ARE IN INCHES AND ARE FOR REFERENCE ONLY		BROOKHAVEN NATIONAL LABORATORY Physics Department High-Energy Physics <small>managed by Brookhaven Science Associates for the U.S. Department of Energy under contract DE-AC02-99OR22700</small>					
DIMENSIONAL TOLERANCES		DRAWN BY: J. FARRELL CHECKED BY: M. ZHAO ENGINEER: M. ZHAO ENGR MGR: CHIEF M.E.:	6/10/2020 6/10/2020 6/10/2020 6/10/2020	Cold Electronics DUNE DUNE CE DC_ASSEMBLY			
BREAK EDGES & SHARP CORNERS 0.12 [0.005"] MIN. TO 0.75 [0.030"] MAX.	FINISH 3.2 [125]	Q.A. WBS#	SIZE: D DRAWING PART NUMBER: DC	ESH&Q RISK LEVEL: A-4 SCALE: 1:80	WEIGHT: [.] kg WEIGHT: - [. 2] lbs.	SHEET: 1 / 4 REV. B	



FD1-HD TPC Electronics: Index of drawings

<https://edms.cern.ch/document/2771733>

DC_ASSEMBLY



You can search it in the Index file

here is ...

Nr	File link / thumbnail images
1.	https://edms.cern.ch/ui/file/2771733/1/DC_REV_B.pdf
2.	https://edms.cern.ch/ui/file/2771733/1/DC_1_REV_B.pdf
3.	https://edms.cern.ch/ui/file/2771733/1/DCFDT_REV_E.pdf

you can always search it in EDMS if you prefer to work with EDMS directly

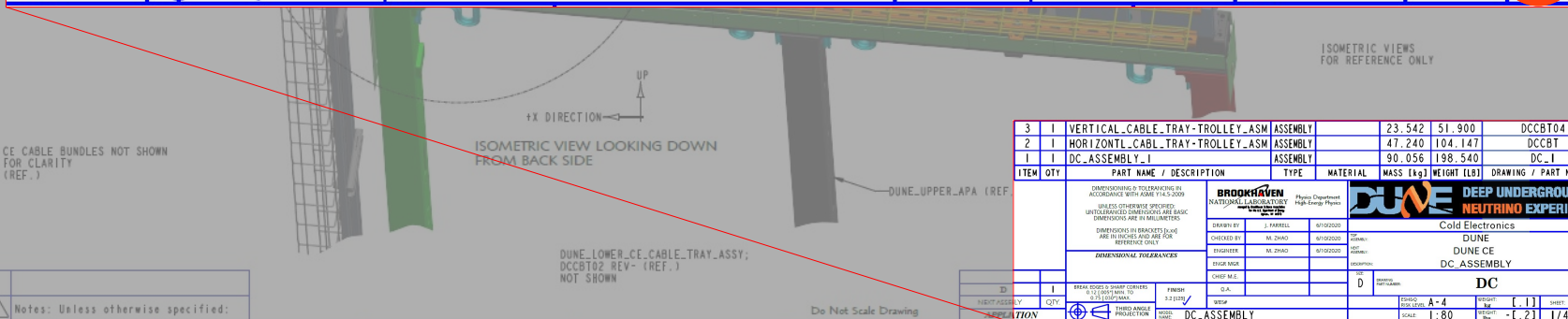
Example:

https://edms.cern.ch/ui/file/2771733/1/DC_REV_B.pdf

CAD model for Item 1: DC_ASSEMBLY_1_REV_B

ITEM	QTY	PART NAME / DESCRIPTION	TYPE	MATERIAL	MASS [kg]	WEIGHT [LB]	DRAWING / PART NUMBER
3	1	VERTICAL_CABLE_TRAY-TROLLEY_ASM	ASSEMBLY		23.542	51.900	DCCBT04
2	1	HORIZONTAL_CABLE_TRAY-TROLLEY_ASM	ASSEMBLY		47.240	104.147	DCCBT
1	1	DC_ASSEMBLY_1	ASSEMBLY		90.056	198.540	DC_I

DIMENSIONING & TOLERANCING IN ACCORDANCE WITH ASME Y14.5-2009 UNLESS OTHERWISE SPECIFIED: UNTOLERANCED DIMENSIONS ARE BASIC DIMENSIONS ARE IN MILLIMETERS DIMENSIONS IN BRACKETS [x.xx] ARE IN INCHES AND ARE FOR REFERENCE ONLY		BROOKHAVEN NATIONAL LABORATORY Physics Department High-Energy Physics <small>managed by Brookhaven Science Associates for the U.S. Department of Energy under contract no. DE-AC02-99OR22700</small>					
DIMENSIONAL TOLERANCES		DRAWN BY: J. FARRELL CHECKED BY: M. ZHAO ENGINEER: M. ZHAO ENGR MGR: CHIEF M.E.:	6/10/2020 6/10/2020 6/10/2020 6/10/2020	Cold Electronics DUNE DUNE CE DC_ASSEMBLY			
BREAK EDGES & SHARP CORNERS 0.12 [.005"] MIN. TO 0.75 [.030"] MAX.	FINISH 3.2 [125]	Q.A. WBS#	SIZE: D DRAWING PART NUMBER: DC	ESH&Q RISK LEVEL: A-4 SCALE: 1:80	WEIGHT: [.] kg WEIGHT: - [. 2] lbs.	SHEET: 1 / 4 REV: B	



Locating a CAD model

Category	Subcategory	EDMS	File	Description	Charge question
Technical Design Reports		2606684	DUNE-FD-TDR-vol-IV-SP-for-arxiv.pdf	DUNE Technical Design Report, Volume 4: DUNE FD SP Technology (copy or arXiv:2002:03010, also published in JINST 15 (2020) 08, T08010)	2,3,4,6
		2606690	Post_TDR_Update__FD1_HD_TPC_Electronics-82.pdf	Updated chapter 4 of TDR: TPC electronics that accurately describes sub-system design at time of Final Design Review.	
		2782297	CE_FDR_Document_docx_cp.pdf.pdf	Detailed summary of DUNE FD1-HD TPC Electronics design evolution; characterization; QA and QC	
		2782614	FD1_TPC_Electronics_System_Test_Summary.pdf	Summary of results of system tests in ProtoDUNE	
ASIC documentation		2314428			2
		2314429			
		2314430			
Grounding & Shielding Plan		2095975		For Grounding System Requirements	2
		2095958	Dune_Grounding_and_Shielding_Guidelines.pdf	Grounding and Shielding Guidelines	
		2364510	FD1_TPC_Electronics_GroundingShielding.pdf	FD1 TPC Electronics Grounding and Shielding Plan	
		2364510	ProtoDUNE2_Grounding_Distributions_FD1.pdf	Grounding scheme for the low voltage power supplies	
		2339405	Coordination_grounding.pdf	Detector grounding - TDR chapter	
Specification of Warm Electronics		2341139	WIEC_Bias_Scheme_08-30-2022.pdf	DUNE CE Bias Schematic Diagram	2
		2341138	WIB_requirements_v1_docx_cp.pdf.pdf	Specification for WIB (v3)	
Mechanical CAD Model for Sub-system		2731292	PTC_Requirements_docx_cp.pdf.pdf	Specification for PTC (upgrade)	2
		2783038	HIERARCHY_OF_DUNE_CE_ASSEMBLY_DRAWINGS.pdf	Click the link in Column D to access the tree structure of models with links to drawings	
		2774711		Feedthrough, Warm Interface Electronics Crate (WIEC), Frontend Motherboards (FEMB), cold cables	
Mechanical Engineering Drawings		2771733	2771733_2774712_Drawings_index.pdf	Cable Tray-Trolley, temporary Vertical Cable, Cross port	2
		2771733		Click the link in Column D to access Index of drawings with links	
		2771733		Feedthrough, WIEC	
Design Documents Electrical S		2913	layout_io1826-1c.pdf	Cable trays, trolley, crossing tube, x-shape spool piece, cables, CE Box	2
		2913	Schematics_DUNE_Monolithic_SAMTEC_FEMB_IO1826-C.pdf	FEMB PCB	
		2914	IO-1750-1-B_artwork.pdf	FEMB schematics	
		2914	DUNE_WIB_V3_IO-1750-1B.pdf	WIB PCB	
		2915	io1866-1.pdf	WIB schematics	
		2915	DUNE_PT.B.pdf	PTB PCB	
		2915	io1863-1.pdf	PTB schematics	
			DUNE_FLANGE.pdf	Flange board PCB	
			GerberFiles.pdf	Flange board schematics	
			WarmBiasFilterBoardSchematic_6-16-2021.pdf	Warm bias voltage filter board PCB	
		PTC3B_preview.pdf	Warm bias voltage filter board schematics		
		PTC3A_SchematicsDraft_20180129.pdf	PTC PCB		
			PTC schematics		

search the model in the hierarchy tree list

or go to EDMS documents directly

HIERARCHY OF DUNE-FD1 CE ASSEMBLY DRAWINGS

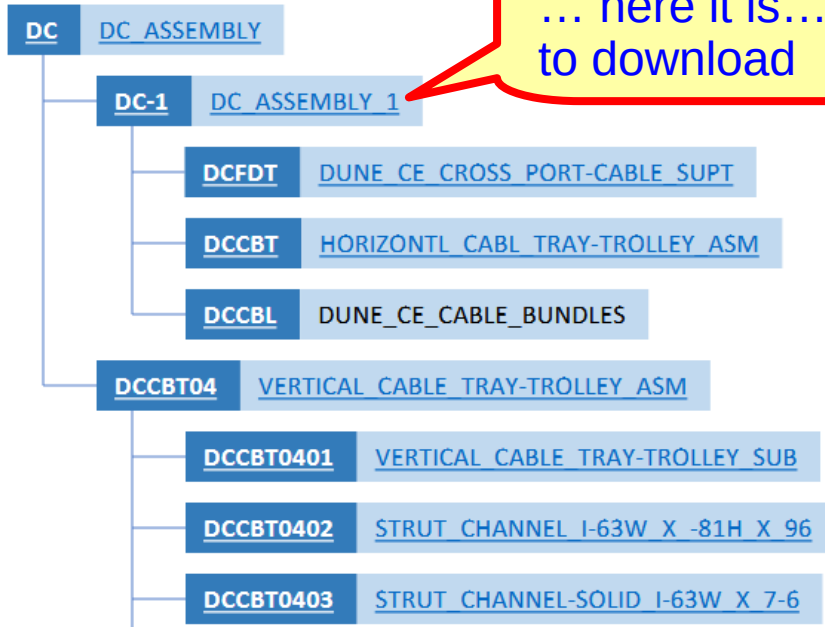
List of acronyms

- DC: DUNE CE
- DCFDT: DUNE CE Feedthrough
- DCCBT: DUNE CE Cable Tray
- DCCBL: DUNE CE Cable
- PDII: ProtoDUNE-II
- BCT: Bridge Cable Tray
- W_HDW: With Hardware

Link to drawing

DC DC ASSEMBLY

Link to CAD model



... here it is... click it to download

Note: The models are either ZIP file archives, or individual STEP files. A special engineering software is needed to open these files.