

Systems Engineering – Requirements and Clearance Envelope Drawings

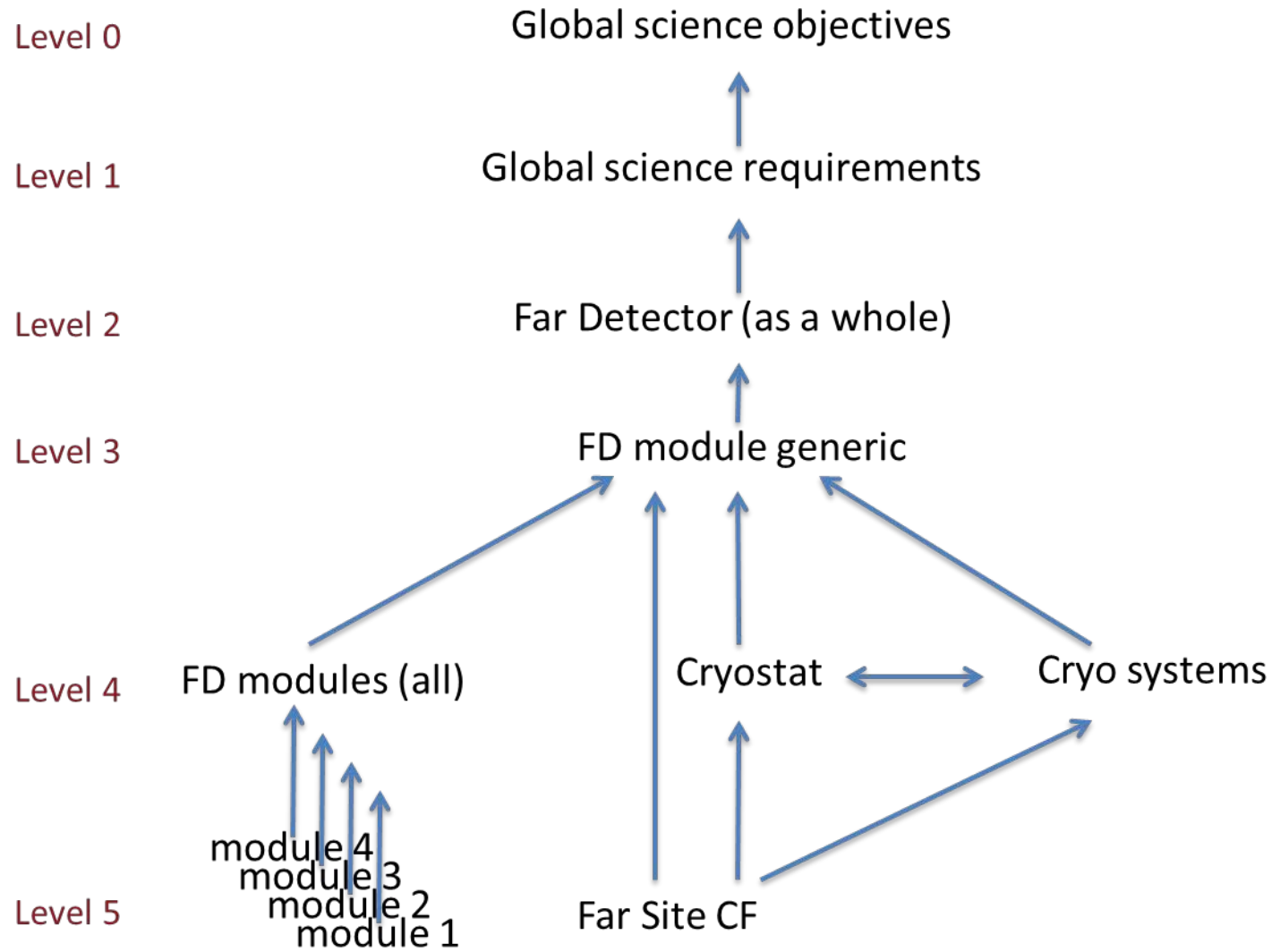
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ARUP Final Design Kick-off Meeting
8 November 2017



Introduction and Background

- LBNF will provide Arup with the latest set of requirements and clearance envelope drawings. Arup needs to review all these requirements to assure that all are appropriately addressed by the final design.
- To aid this process we have looked at all requirements that Arup listed in document (DUNE Docdb-136, “EXC Preliminary Design Report”, 100 % Preliminary Design Files) and compared it with current LBNF requirements. While not all inclusive we have noted a few areas where changes have been made.
- To provide additional background information LBNF will provide copies of our Interface Control Documents (ICDs) that describe interfaces between CF, Cryogenics, Cryostat and DUNE.
- First a summary of the LBNF requirements process

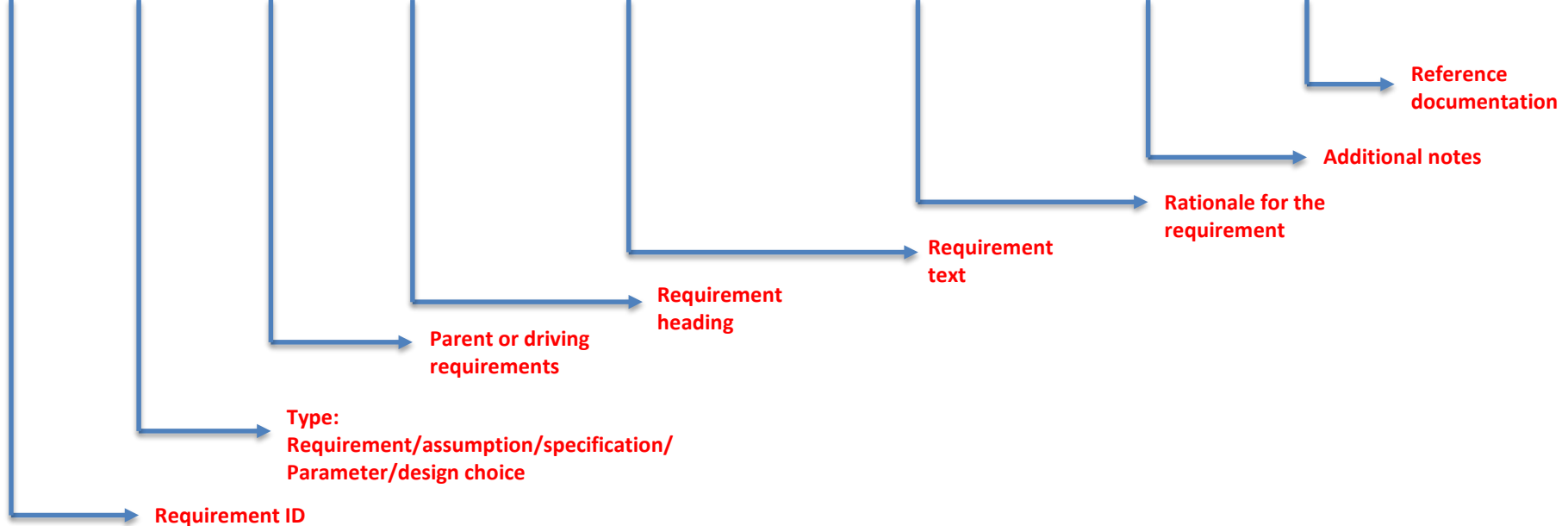
LBNF/DUNE Requirements Structure and Trace Back Path



Requirements Template

- Requirements are in spreadsheets with the following format

ID	Type	Parents	Object Heading	Object Text	Rationale	Notes	Reference	Old ID	Old Parents
FSCF-Engr-021	requirement	cryostat-005, cryostat-041, Cryosys-046	Condensation	FSCF shall ensure a minimum of 15,000 cfm per detector module or one air change per hour per cavern for both detector caverns (four chambers) and the CUC	Analysis work indicates that this will prevent condensation formation along the bottom and sides of the cryostats		DUNE docdb-519	FSCF-Engr-15a	



Requirements Comparison

- Comparison of older requirements with current LBNF requirements

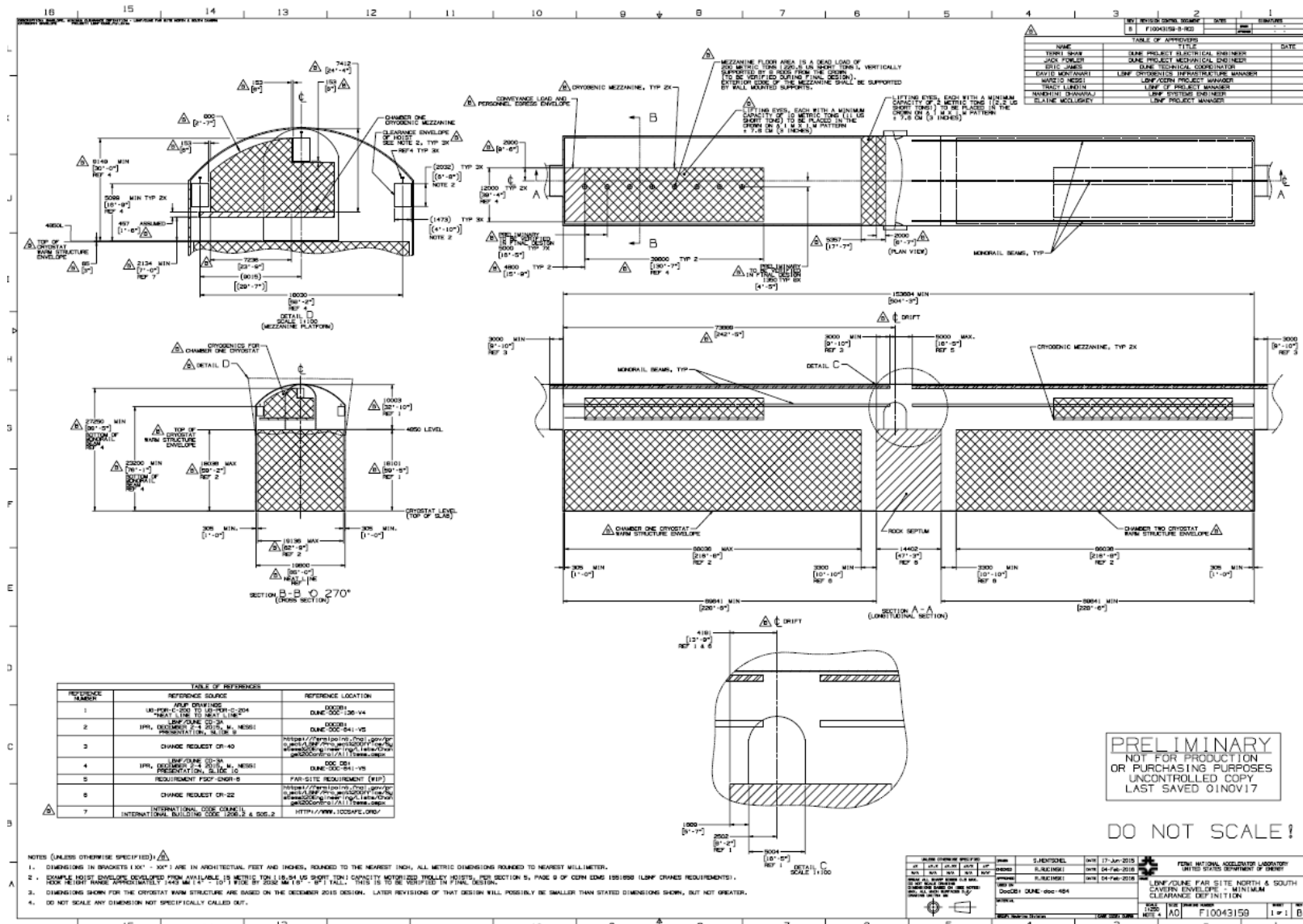
S. No	Heading	Requirements from ARUP as of 100% PD August 2015	LBNF current requirements	Current Requirments ID	Notes
3	FD orientation	The detector pit shall be aligned within +/- 6 degrees of the Fermilab beam as measured in a horizontal plane.	FSCF shall ensure that the Far Detector caverns are aligned to within +/- 1.0 degree of the Fermilab beam as measured in a 4850L horizontal plane.	FSCF-Engr-039	
9	FSCF Parameters	Parameters table, section 3.3	Clearance envelope drawing in Docdb-464		
15	Cryostat controlled interface dimensions	LBNE DD-11215, drawing F10043159- original version	DUNE docdb-464, drawing F10043159-B	FSCF-Engr-006	
16	Cavern staging dimensions	Rock septum 15 m wide with bulkhead reducing that to 10 m	Refer to DUNE docdb-464, drawing F10043159-B for changes		

Requirements Comparison (contd.)

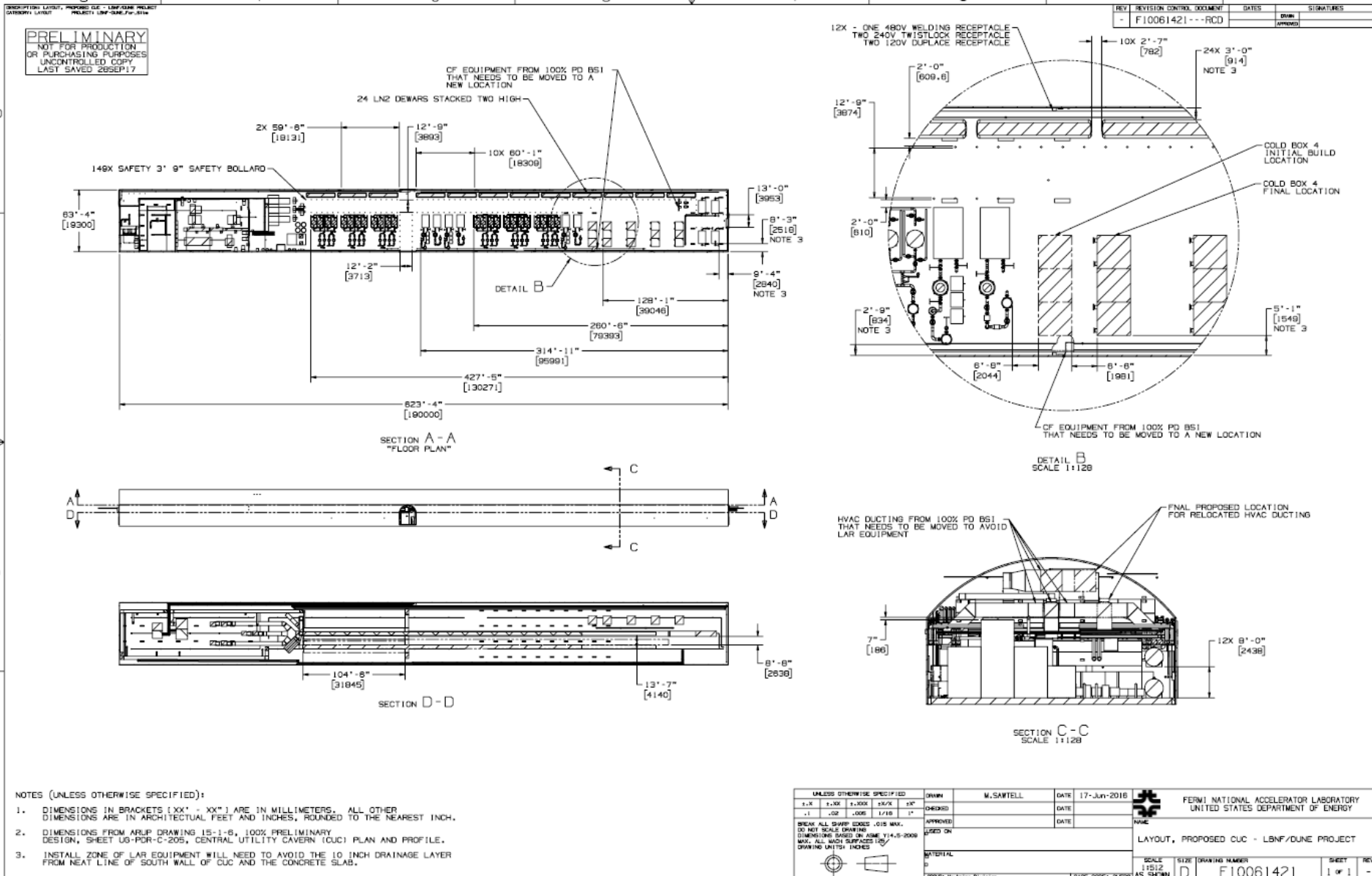
- Comparison of older requirements with current LBNF requirements

S. No	Heading	Requirements from ARUP as of 100% PD August 2015	LBNF current requirements	Current Requirments ID	Notes
21	Monorail	No specific requirement on height clearance under the monorail. Rails to extend a minimum of 5 m over the central laydown area, leaving a 5 m gap	See docdb-464 for dimensional changes.	FSCF-Engr-073 through 079, FSCF-Engr-082, FSCF-Engr-083	More details after conveyance workshop Dec 2017
22	Material delivery route	All materials can be brought in from center of the cavern	The cryostat pieces will come in from east and west and the rest of the material through north-south drifts.	FSCF-Engr-015	
23	Peak particle velocity	CASPAR and BHUC indicated that standard civil limit of 0.5 in/s blast vibration is acceptable for this equipment	FSCF shall ensure that the peak particle velocity during blasting and air over pressure, measured at nearest surface property boundary and nearest experiment underground, comply with the limits described in docdb-1655	FSCF-Engr-129	

Interface Drawings – Cavern 1, Chambers 1 and 2, DUNE Docdb-464



Interface Drawings – Central Utility Cavern, DUNE Docdb-4070



Summary

- LBNF Requirements and Interface Drawings have been updated
- Arup needs to review all these requirements to assure that all are appropriately addressed by the final design
- LBNF will provide copies of ICDs for further background information

References:

Requirements – DUNE Docdb-112

ICDs Chart – DUNE Docdb-110