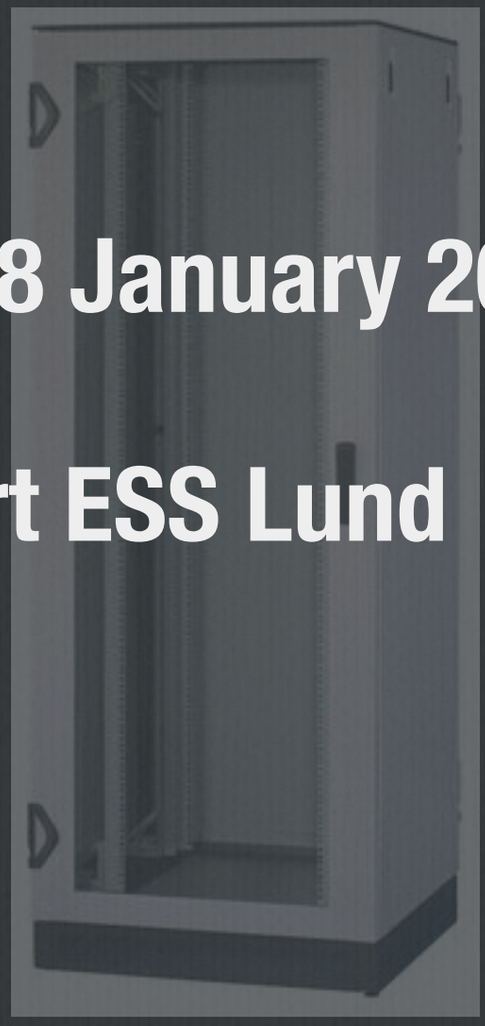
Cable and rack integration and installation issues

EUROPEAN SPALLATION SOURCE



- NCFE workshop, INFN Catania, 17-18 January 2017

Evangelia Vaena, Electrical Support ESS Lund

Cable and rack installation issues- Overview

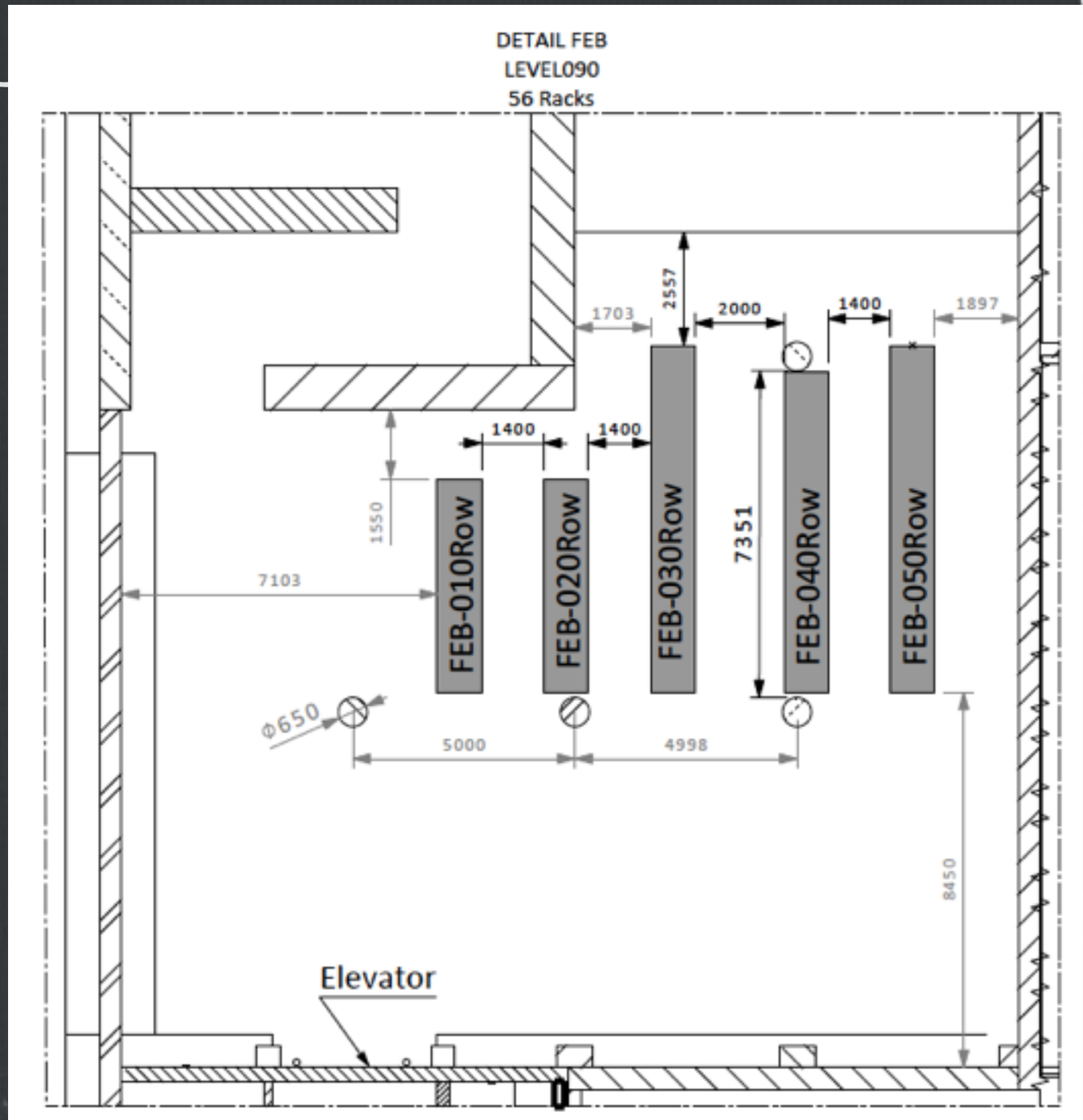
EUROPEAN SPALLATION SOURCE

- ☐ General Rack space, layout for NCFE and mechanical issues
- ☐ Installation plan for the racks
- ☐ Power distribution status and cable tray layout
- ☐ Cable pulling preparation and information needed to keep RFI date
- ☐ Wrapping-up -Next Steps

Rack space and layout

EUROPEAN SPALLATION SOURCE

- 5 rack rows of 54 racks of the standard accelerator dimensions (600mm wide, 1000m deep, 2200mm high)
- Not included in the rack rows: HV power supply and Isolation Transformer for the source, the 2 ground racks for the source, MPS and EMU rack



Rack space survey -FEB

EUROPEAN SPALLATION SOURCE

FEB-010ROW	Name	System	Power(kW)	UPS (kW)	Heat Dissipatic	Temperature (°C)	Type
Rack #							
1	FEB-010ROW:CNPW-U-001	PSS	1,5	N/A	0,25	25°C, +/- 5°C	A
2	FEB-010ROW:CNPW-U-002	PSS	1,5	N/A	0,25	25°C, +/- 5°C	A
3	FEB-010ROW:CNPW-U-003	PSS	1,5	N/A	0,25	25°C, +/- 5°C	A
4							
5							
6							
7							
8							
SUM							
Reserved for future spare							

FEB-020ROW	Name	System	Power(kW)	UPS (kW)	Heat Dissipatic	Temperature (°C)	Type
Rack #							
1	FEB-020ROW:CNPW-U-001	PSS	1,5	N/A	0,25	25°C, +/- 5°C	A
2	FEB-020ROW:CNPW-U-002	PSS	1,5	N/A	0,25	25°C, +/- 5°C	A
3	FEB-020ROW:CNPW-U-003	PSS	1,5	N/A	0,25	25°C, +/- 5°C	A
4	F						
5	F						
6	F						
7	F						
8	F						
SUM							

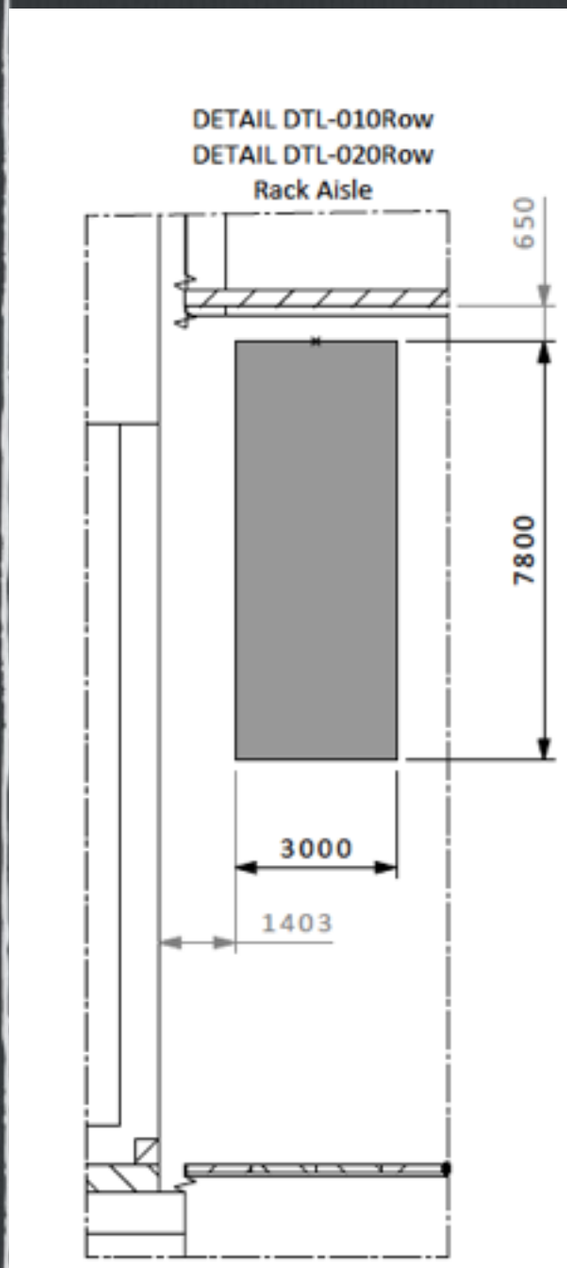
FEB-030ROW	Name	System	Power(kW)	UPS (kW)	Heat Dissipatic	Temperature (°C)
Rack #						
1	FEB-030ROW:CNPW-U-001	VACUUM (LEBT)	4,8	1,2	1,22	10-35C
2	FEB-030ROW:CNPW-U-002	VACUUM (RFQ)	1,2	1,2	0,31	10-35C
3	FEB-030ROW:CNPW-U-003	VACUUM (RFQ)	8,0	N/A	2,04	10-35C
4	FEB-030ROW:CNPW-U-004	VACUUM (MEBT)	1,8	0,8	0,46	10-35C

FEB-040ROW	Name	System	Power(kW)	UPS (kW)	Heat Dissipatic	Temperature (°C)
Rack #						
1	FEB-040ROW:CNPW-U-001	MEBT Chopper PS	2,5	N/A	0,40	10-35C
2	FEB-040ROW:CNPW-U-002	MEBT Chopper PS	2,5	N/A	0,40	10-35C
3	FEB-040ROW:CNPW-U-003	PS-Q1-MEBT	12,5	N/A	2,50	10-35C
4	FEB-040ROW:CNPW-U-004	PS-Q2-MEBT	12,5	N/A	2,50	10-35C

FEB-050ROW	Name	System	Power(kW)	UPS (kW)	Heat Dissipatic	Temperature (°C)
Rack #						
1	FEB-050ROW:CNPW-U-001	BI (DTL)	2,1	N/A	2,50	25°C, +/- 1°C
2	FEB-050ROW:CNPW-U-002	BI (DTL)	1,3	N/A	1,55	25°C, +/- 1°C
3	FEB-050ROW:CNPW-U-003	VACUUM (DTL)	1,2	1,2	0,41	10-35C
4	FEB-050ROW:CNPW-U-004	VACUUM (DTL)	15,0	N/A	5,10	10-35C
5	FEB-050ROW:CNPW-U-005	PS-Q10-MEBT	12,5	N/A	2,50	10-35C
6	FEB-050ROW:CNPW-U-006	PS-Q11-MEBT	12,5	N/A	2,50	10-35C
7	FEB-050ROW:CNPW-U-007	PS-steerers-MEBT	1,8	N/A	0,54	10-35C
8	FEB-050ROW:CNPW-U-008	PS-steerers-MEBT	1,8	N/A	0,54	10-35C
9	FEB-050ROW:CNPW-U-009	PS-steerers-MEBT	1,8	N/A	0,54	10-35C
10	FEB-050ROW:CNPW-U-010	PS-steerers-MEBT	1,8	N/A	0,54	10-35C
11	FEB-050ROW:CNPW-U-011	PS-steerers-MEBT	1,8	N/A	0,54	10-35C
12	FEB-050ROW:CNPW-U-012	PS-scraper-MEBT	1,0	N/A	0,20	10-35C
13	FEB-050ROW:CNPW-U-013	SPARE	0,0	N/A	0,00	10-35C
SUM			54,6	1,2	17,45	
			71,0	1,6	22,69	

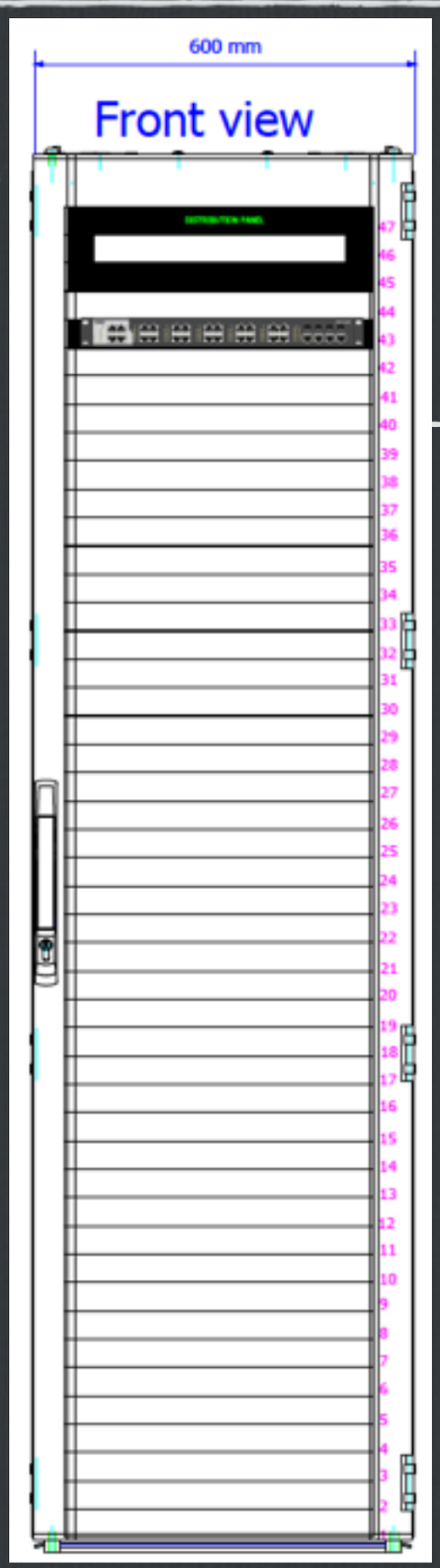
Rack space survey-RFQ and DTL Gallery

EUROPEAN SPALLATION SOURCE



DTL-010ROW	Name	System	Power(kW)	Installed Fuse (A)	UPS (kW)	UPS Fuse (A)	Heat Dissipation (kW)	Temperature (°C)	Type
Rack #									
1	DTL-010ROW:CNPW-U-001	SPARE	0,0	N/A	N/A	N/A	N/A	N/A	U
2	DTL-010ROW:CNPW-U-002	SPARE	0,0	N/A	N/A	N/A	N/A	N/A	U
3	DTL-010ROW:CNPW-U-003	SPARE	0,0	N/A	N/A	N/A	N/A	N/A	U
4	DTL-010ROW:CNPW-U-004	ICS	0,2	10	N/A	N/A	0,05	25°C, +/- 10°C	V10
5	DTL-010ROW:CNPW-U-005	MPS	1,0	10	N/A	N/A	1,00	25°C, +/- 5°C	V10
6	DTL-010ROW:CNPW-U-006	RF	22,5	50	N/A	N/A	1,83	25°C, +/- 1°C	G
7	DTL-010ROW:CNPW-U-007	RF	4,8	16	1,7	3	0,52	25°C, +/- 1°C	E
8	DTL-010ROW:CNPW-U-008	RF	2,4	10	1,8	3	2,02	25°C, +/- 1°C	D
9	DTL-010ROW:CNPW-U-009	RF	22,5	50	N/A	N/A	1,83	25°C, +/- 1°C	G
10	DTL-010ROW:CNPW-U-010	RF	4,8	16	1,7	3	0,52	25°C, +/- 1°C	E
11	DTL-010ROW:CNPW-U-011	RF	2,4	10	1,8	3	2,02	25°C, +/- 1°C	D
12	DTL-010ROW:CNPW-U-012	BI	2,3	10			1,58	25°C, +/- 1°C	V10
SUM			62,6	182	7,0	12	11,36		
			81,4		9,1		14,76		

DTL-020ROW	Name	System	Power(kW)	Installed Fuse (A)	UPS (kW)	UPS Fuse (A)	Heat Dissipation (kW)	Temperature (°C)	Type
Rack #									
1	DTL-020ROW:CNPW-U-001	PS	30,0	80	N/A	N/A	1,50	25°C, +/- 10°C	I
2	DTL-020ROW:CNPW-U-002	TSS	5,5	16	N/A	N/A	1,38	25°C, +/- 10°C	T
3	DTL-020ROW:CNPW-U-003	TSS	5,5	16	N/A	N/A	1,38	25°C, +/- 10°C	T
4	DTL-020ROW:CNPW-U-004	TSS	5,5	16	N/A	N/A	0,00	25°C, +/- 10°C	T
5	DTL-020ROW:CNPW-U-005	MPS	1,0	10	N/A	N/A	1,00	25°C, +/- 5°C	V10
6	DTL-020ROW:CNPW-U-006	RF	22,5	50	N/A	N/A	1,83	25°C, +/- 1°C	G
7	DTL-020ROW:CNPW-U-007	RF	4,8	16	1,7	3	0,52	25°C, +/- 1°C	E
8	DTL-020ROW:CNPW-U-008	RF	2,4	10	1,8	3	2,02	25°C, +/- 1°C	D
9	DTL-020ROW:CNPW-U-009	RF	22,5	50	N/A	N/A	1,83	25°C, +/- 1°C	G
10	DTL-020ROW:CNPW-U-010	RF	4,8	16	1,7	3	0,52	25°C, +/- 1°C	E
11	DTL-020ROW:CNPW-U-011	RF	2,4	10	1,8	3	2,02	25°C, +/- 1°C	D
12	DTL-020ROW:CNPW-U-012	BI	2,5	10	N/A	N/A	1,72	25°C, +/- 1°C	V10
			109,2	300	7,0	12	15,70		
Reserved for future spare			141,9		9,1		20,40		



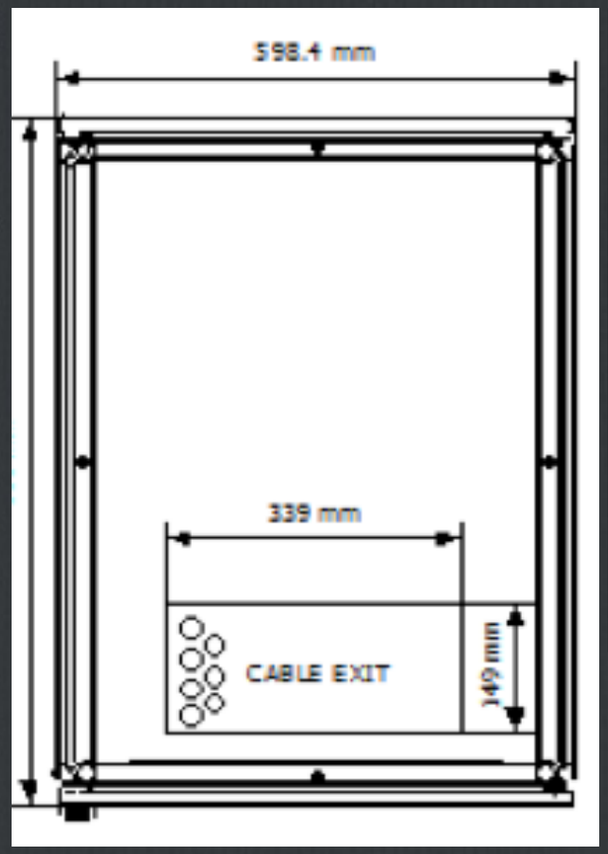
General Rack Design

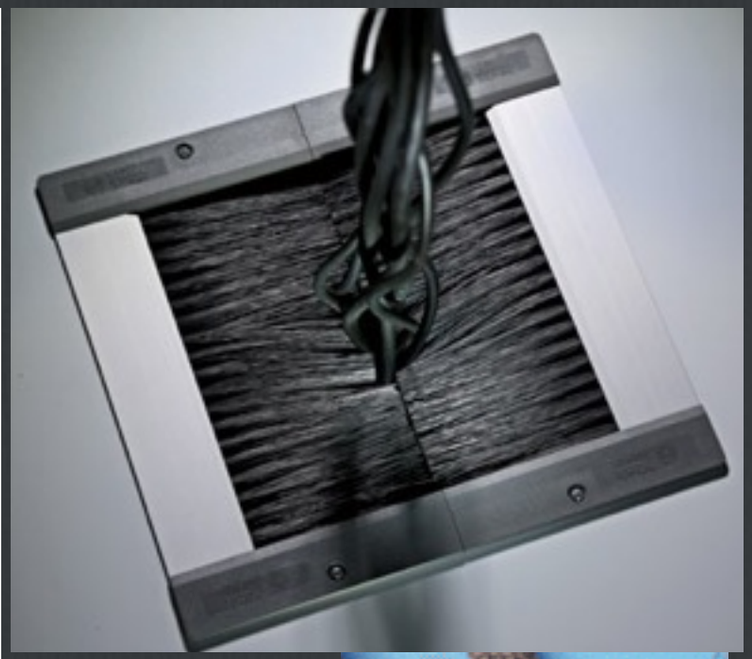
EUROPEAN SPALLATION SOURCE

- ☐ 3 U reserved in all the racks for a PDP
- ☐ 1 U for the ICS patch panel
- ☐ All racks are supplied by a 400 V AC, 3-phase, mains supply.

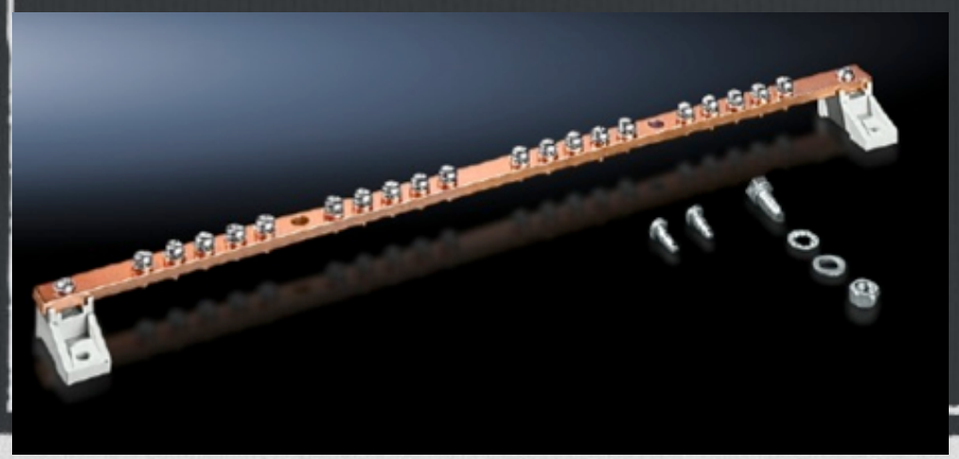
General Rack Design

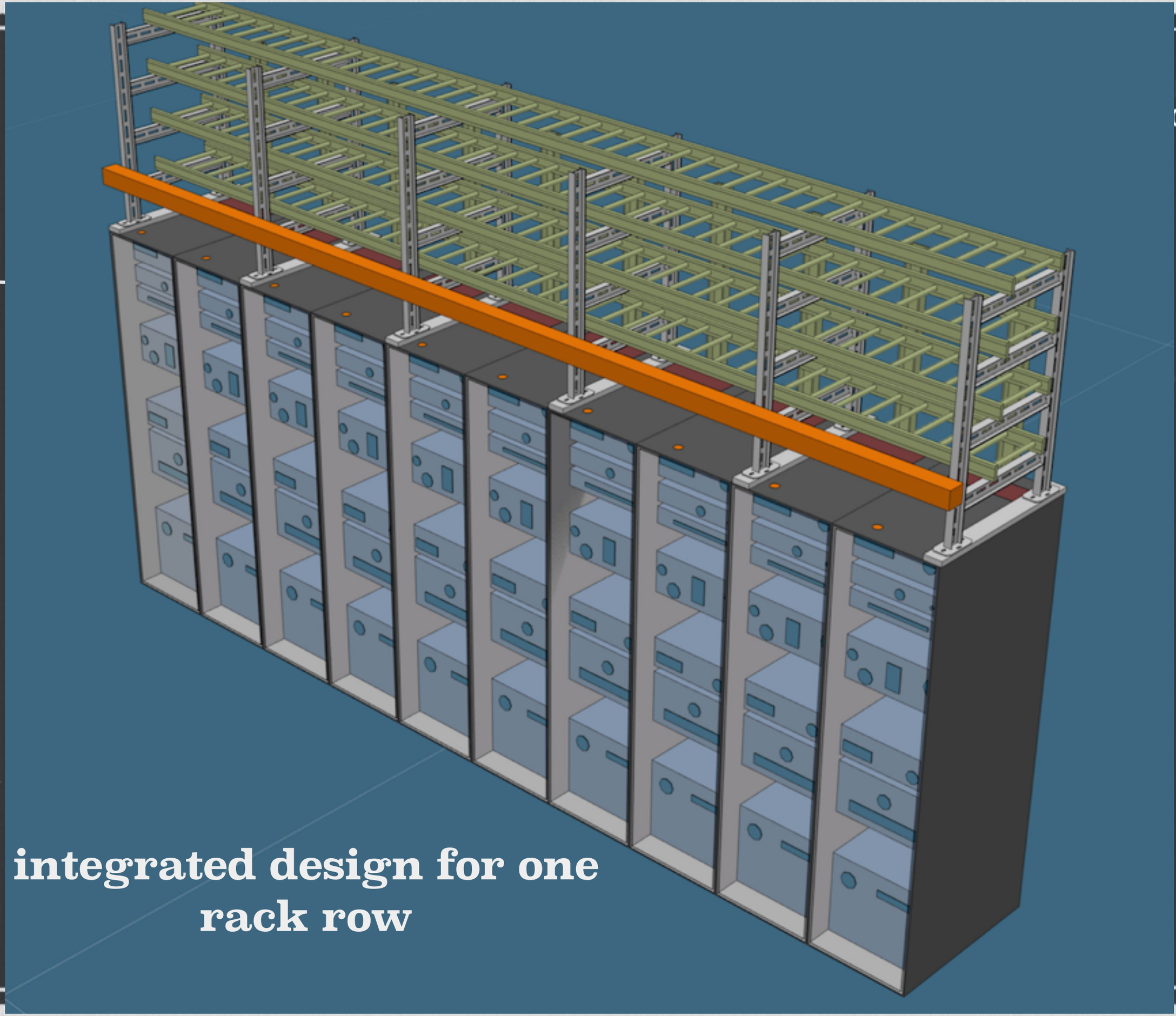
EUROPEAN SPALLATION SOURCE





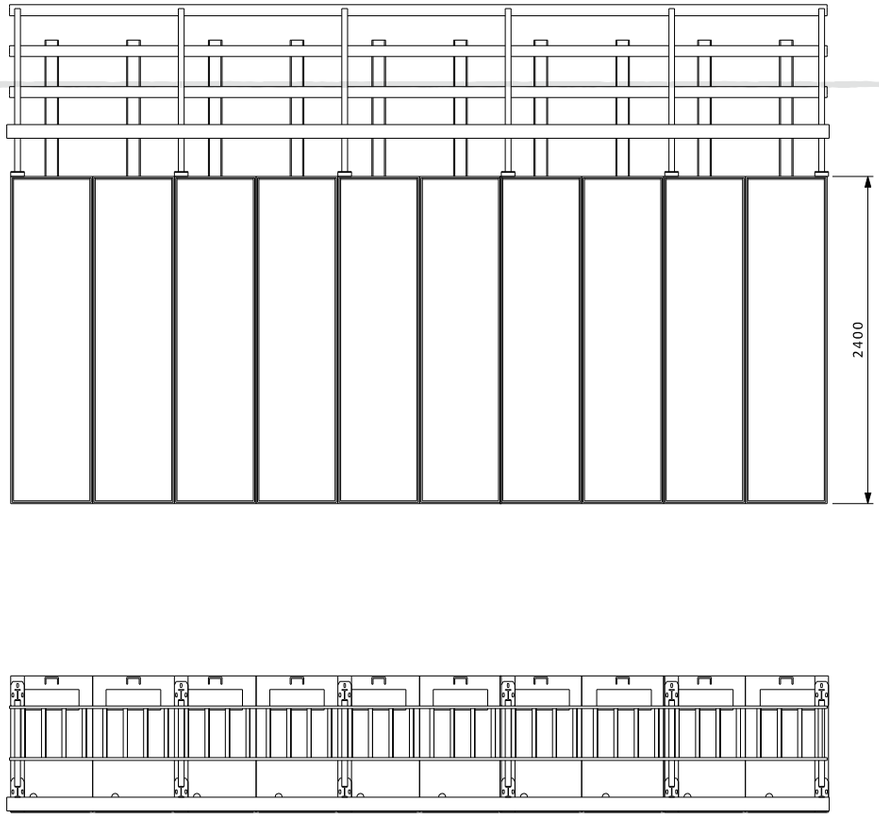
- ☐ Cable entries : top of the cabinet
- ☐ Sealing of the cable openings will be performed with the use of air tight brush type sealants in most of the racks and with EMC sponge type sealants in the cases where EMC should be considered
- ☐ 2 earthing bars, the one connected to the equipotential bonding bar (PB) and the other one connected to the EMC grid through the gallery floor pads or the wall mounted grounding bus bar

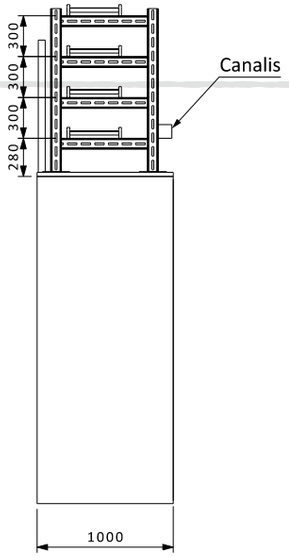


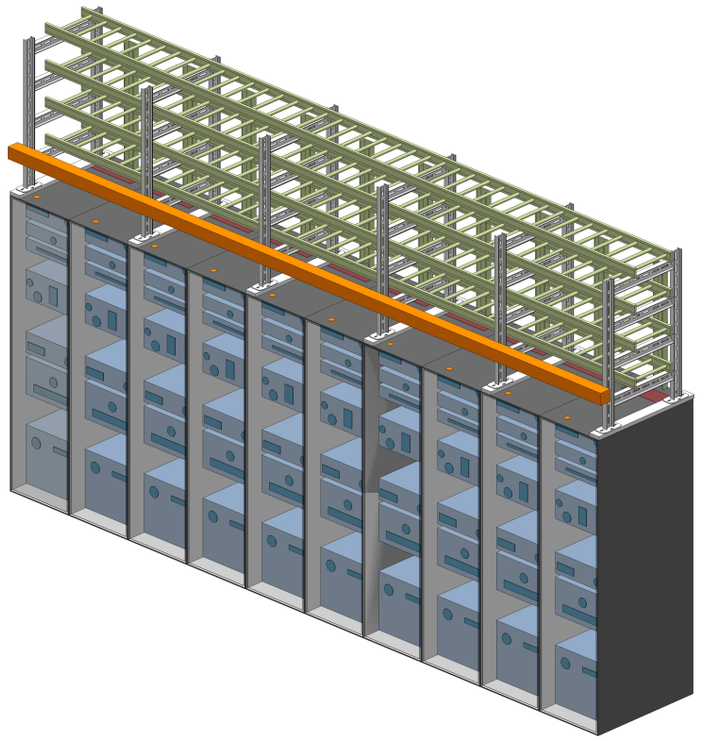


integrated design for one rack row

conceptual integrated design for one rack row







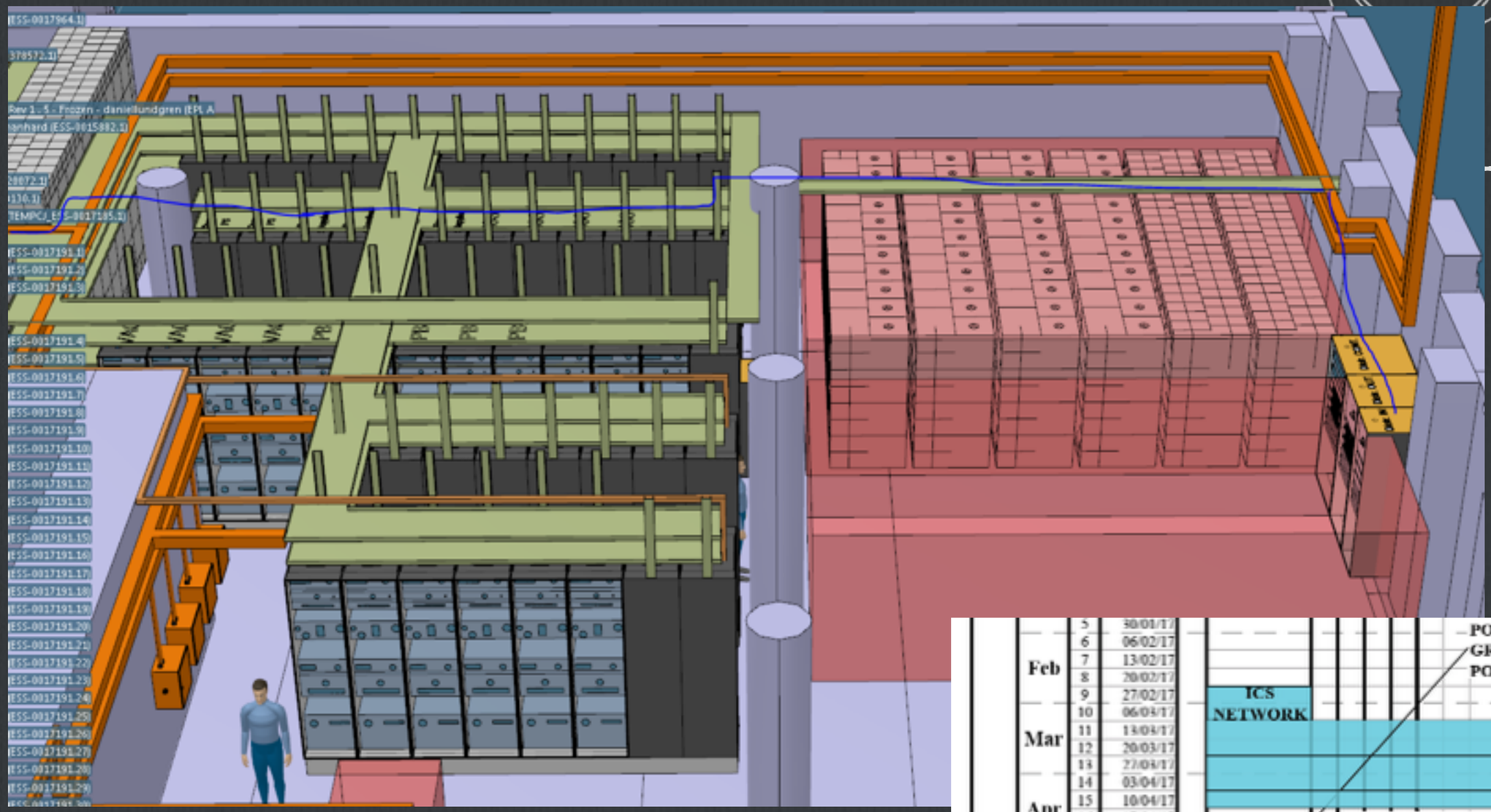
ASSY WEIGHT: - kg	DRAWING TYPE; TITLE; SUPPLEMENTARY TITLE: Rack Supports 1-row		
General Tolerances			
Linear Dimensions, Form and Position: ISO 2768-mK	MODELED BY: carljohanhard	DATE: 25/11/2016	DRAWING NUMBER: ESS-0086188.2
Chamfers, Radii and Angular Dim's: ISO 2768-vK	DRAWN BY: carljohanhard	DATE: 25/11/2016	
SURFACE FINISH Min. Ra 3.2	CHECKED BY	DATE	LIFECYCLE LABEL: Preliminary; REV.: 1.0; SHEET: 1/1
Documentation protection as per ISO 16016	APPROVED BY	DATE	LEVEL OF MATURITY: M4; SIZE: A1; SCALE: 1:20
EUROPEAN SPALLATION SOURCE; DESIGN SITE: ESS Lund	QUALITY CONTROLLED BY	DATE	Produced to ISO 1101, 8015 and 1302

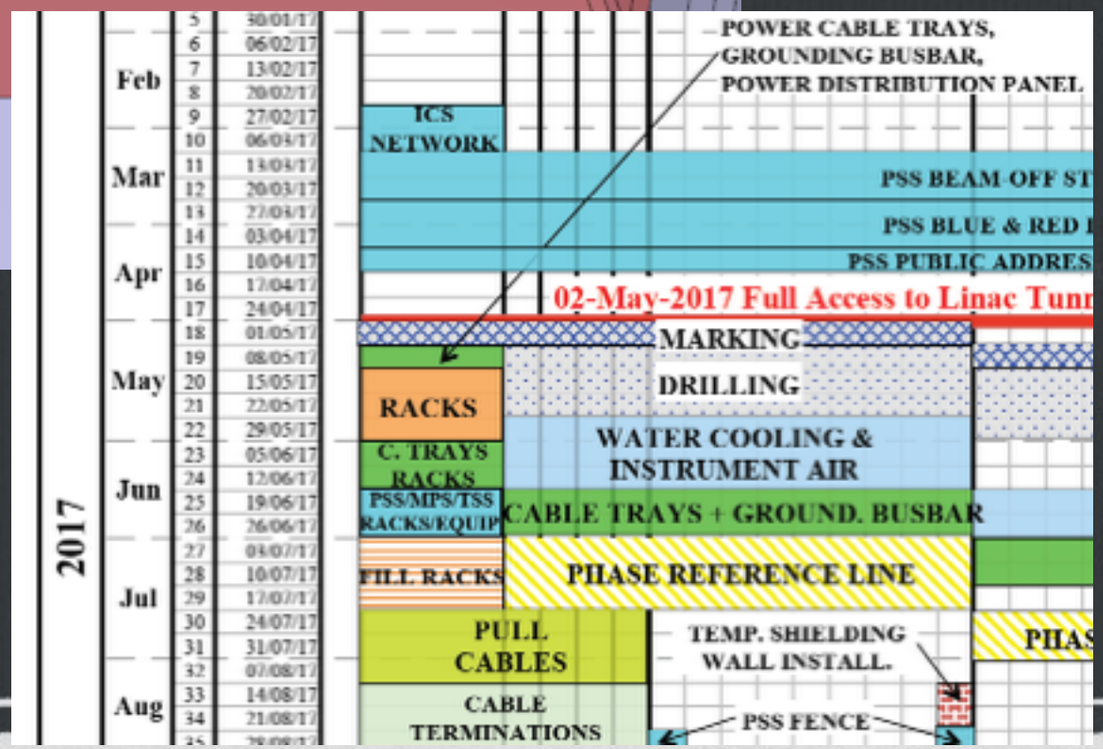
integrated design for one rack row

EUROPEAN SPALLATION SOURCE

Power distribution and cable tray layout

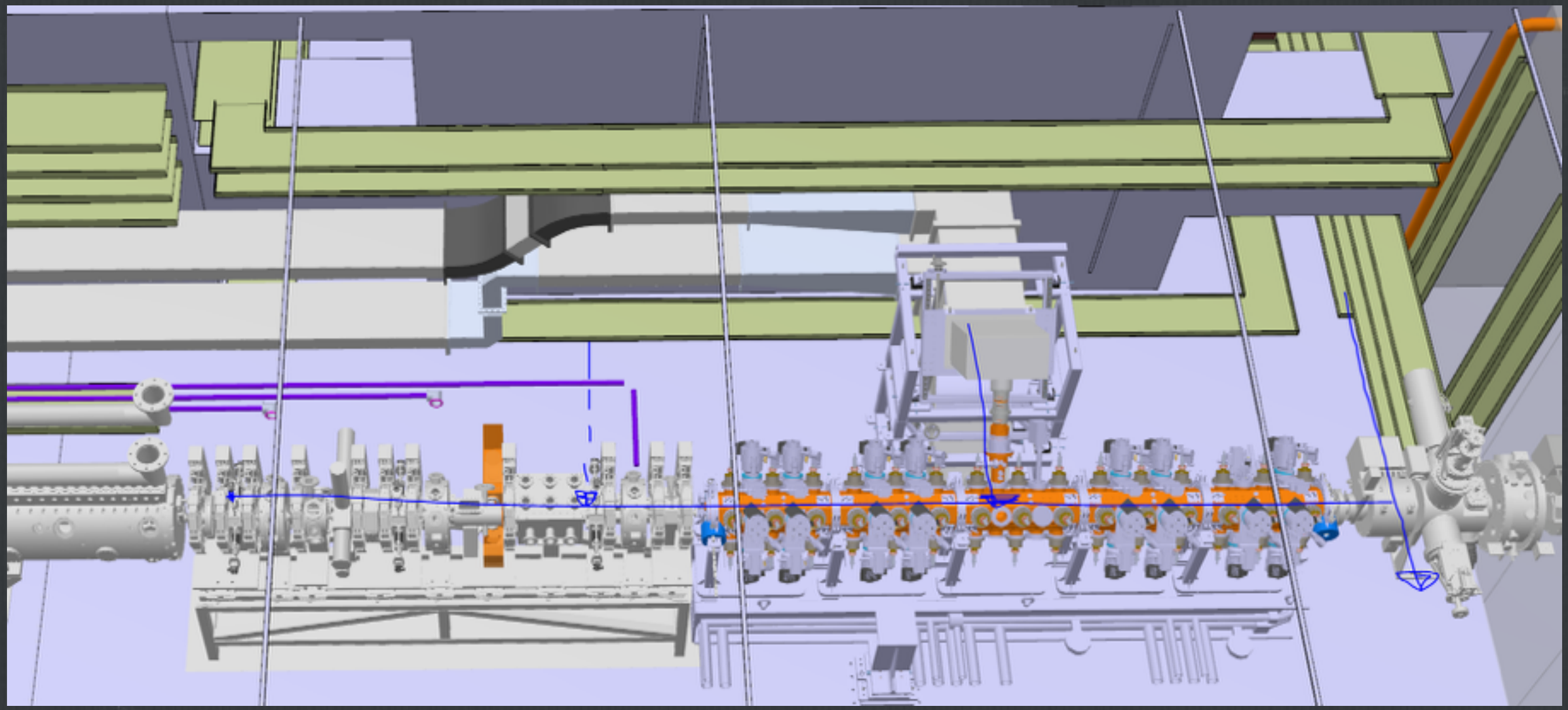
EUROPEAN SPALLATION SOURCE





Power distribution and cable tray layout

EUROPEAN SPALLATION SOURCE



Power Distribution FEB level 090- Installation Readiness

EUROPEAN SPALLATION SOURCE

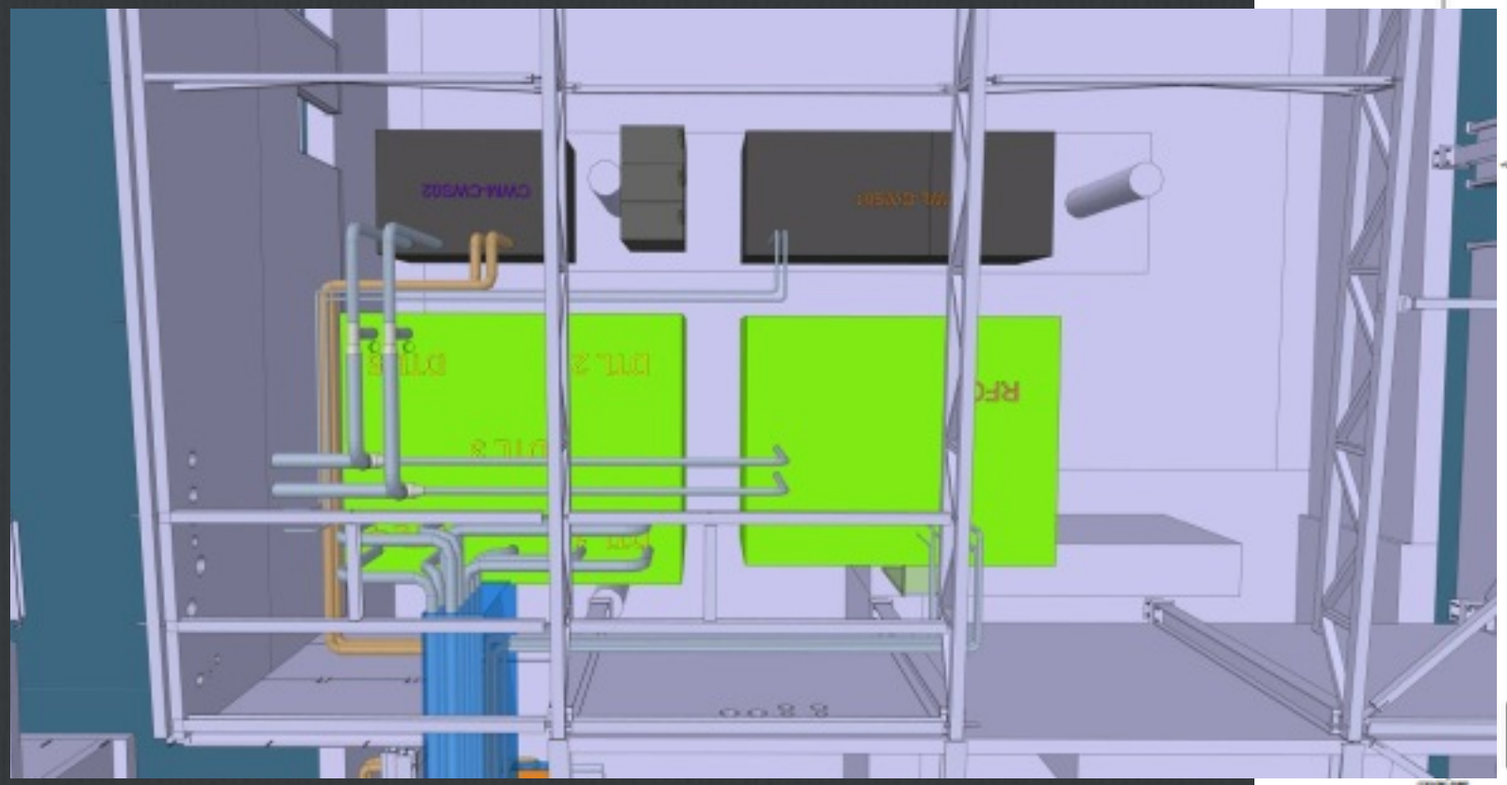
- ☐ FEB level 090- power distribution panel to rack rows and Ion source equipment : Distribution panel design, cable sizing and cable tray design complete

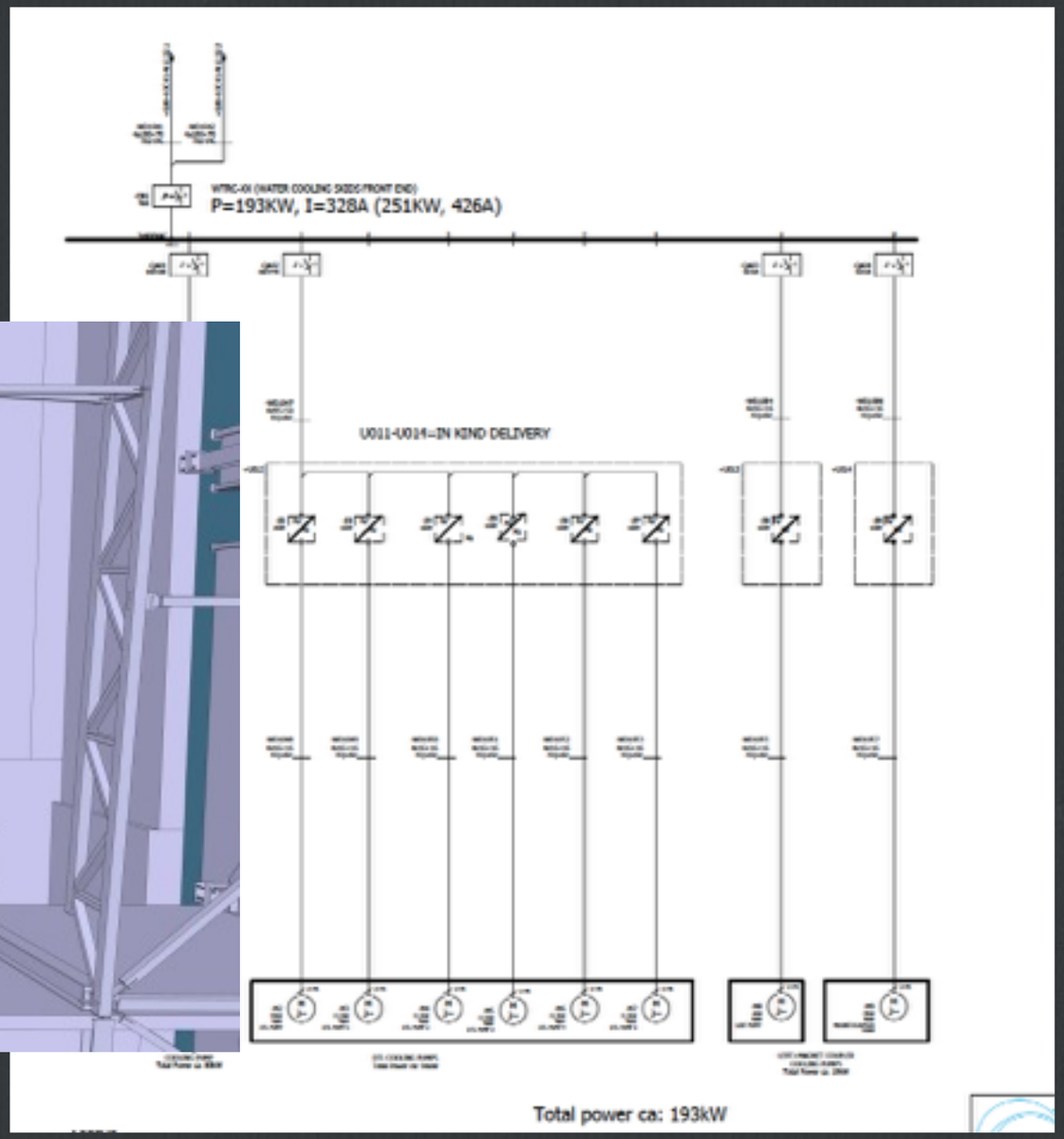
Object	Fuse Connection A	Switchgear Connection B	Nominal Current	Cable	Size	Min allowed Current Value acc SS424 14 24 Utg 6 Table 1	Nominel Current acc to SS424 14 24 Utg 6 Table A.2	Num Cabl Cable	Diversity factor SS424 14 24 Utg 6 Glan Raised Temp 40°C Table A.8	Installation t SS424 14 24	Diversity fac SS424 14 24 Skid Instalation Table A.10	C C S T
Switchgear 0,4kV		63C:01-N13	3200									
Supply to Local Cabinet	63C:01-N13U2Q2	FEB-CNPW-N1U1	635	FXQJ EMC	2//4x240+120	715	538	2	LNPI 0,91	Type E	0,77	
Potential Boundary		63C:01-N13		RQ Black	95			1	M40			
Cabinetlight	FEB-CNPW-N1U3FC101	FEB-CNPW-N1U1:XD06	10	ÖLFLEX 135CH BK	5G2,5	13	25	1	M25 0,91	Type E	0,77	
Supply to FEB-010ROW	FEB-CNPW-N1U1QA01	FEB-010ROW:CNPW-WC01	30	FXQJ EMC	4x16+16	44	100	1	M40 0,91	Type E	0,77	
Supply to FEB-020ROW	FEB-CNPW-N1U1QA02	FEB-020ROW:CNPW-WC01	30	FXQJ EMC	4x16+16	44	100	1	M40 0,91	Type E	0,77	
Supply to FEB-030ROW	FEB-CNPW-N1U1QA03	FEB-030ROW:CNPW-WC01	125	FXQJ EMC	4x70+35	138	246	1	M50 0,91	Type E	0,77	
Supply to FEB-040ROW	FEB-CNPW-N1U1QA04	FEB-040ROW:CNPW-WC01	250	FXQJ EMC	4x185+95	276	456	1	LNPI 0,91	Type E	0,77	
Supply to FEB-050ROW	FEB-CNPW-N1U1QA05	FEB-050ROW:CNPW-WC01	125	FXQJ EMC	4x70+35	138	246	1	M50 0,91	Type E	0,77	
Supply to Stand alone Ion Source	FEB-CNPW-N1U1QA06	HW Power Supply	40	FXQJ EMC	4x25+16	44	127	1	M40 0,91	Type E	0,77	
Supply to Stand alone Ion Source	FEB-CNPW-N1U1QA07	Isolation Transformer	55	FXQJ EMC	4x35+16	88	158	1	M40 0,91	Type E	0,77	
Supply to Stand alone Ion Source	FEB-CNPW-N1U1QA08	GND Rack 1	30	FXQJ EMC	4x16+16	35	100	1	M40 0,91	Type E	0,77	
Supply to Stand alone Ion Source	FEB-CNPW-N1U1QA09	GND Rack 2	30	FXQJ EMC	4x16+16	35	100	1	M40 0,91	Type E	0,77	

Power Distribution- level 100- Installation Readiness

EUROPEAN SPALLATION SOURCE

- FEB level 100- power distribution panel to water cooling skids

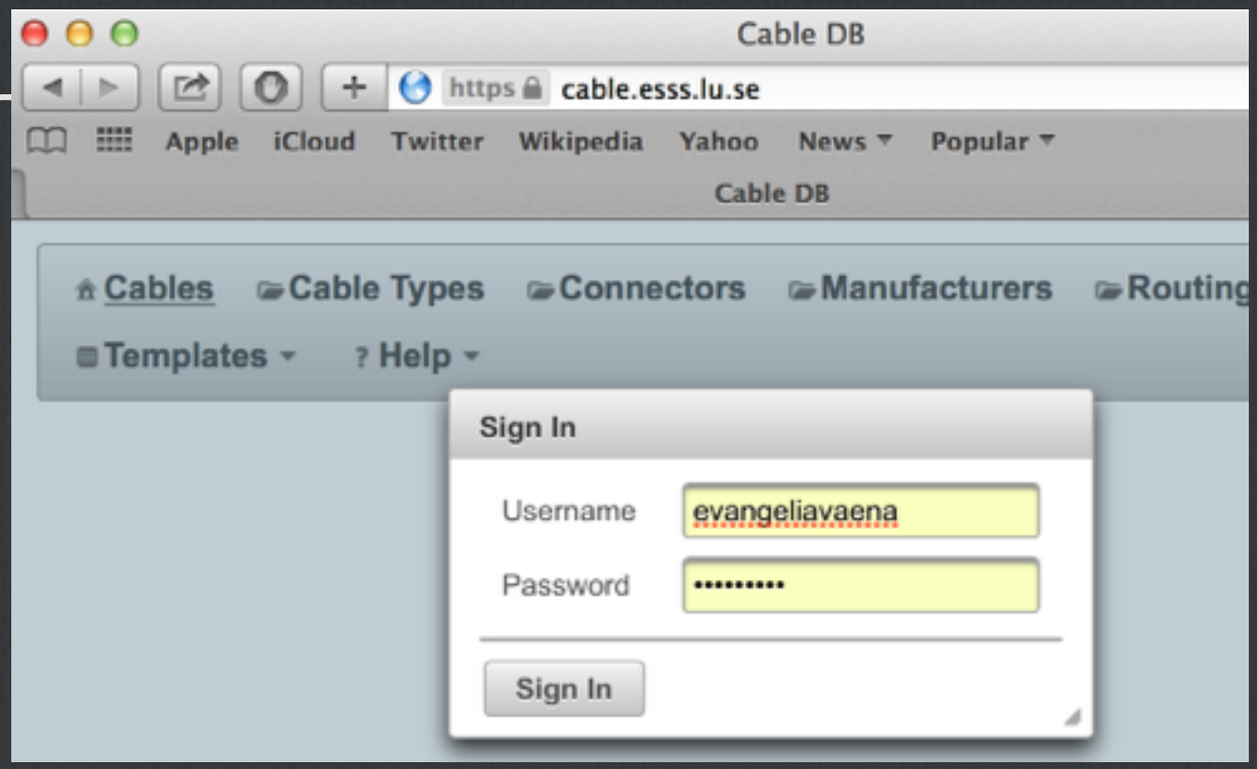




Cable installation

EUROPEAN SPALLATION SOURCE

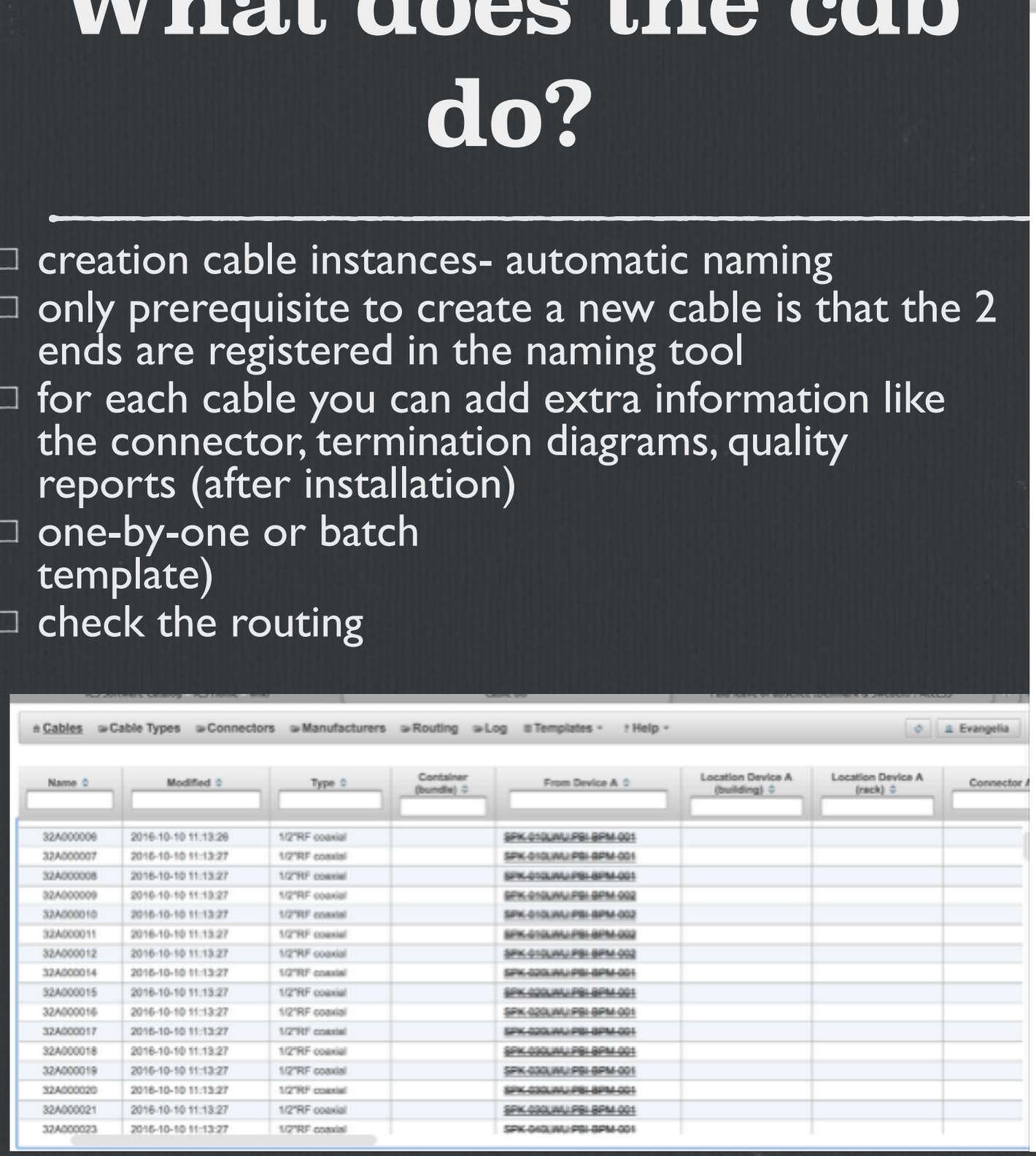
- The management of the cable plant will be done through the ICS cable database : (https://cable.esss.lu.se/)

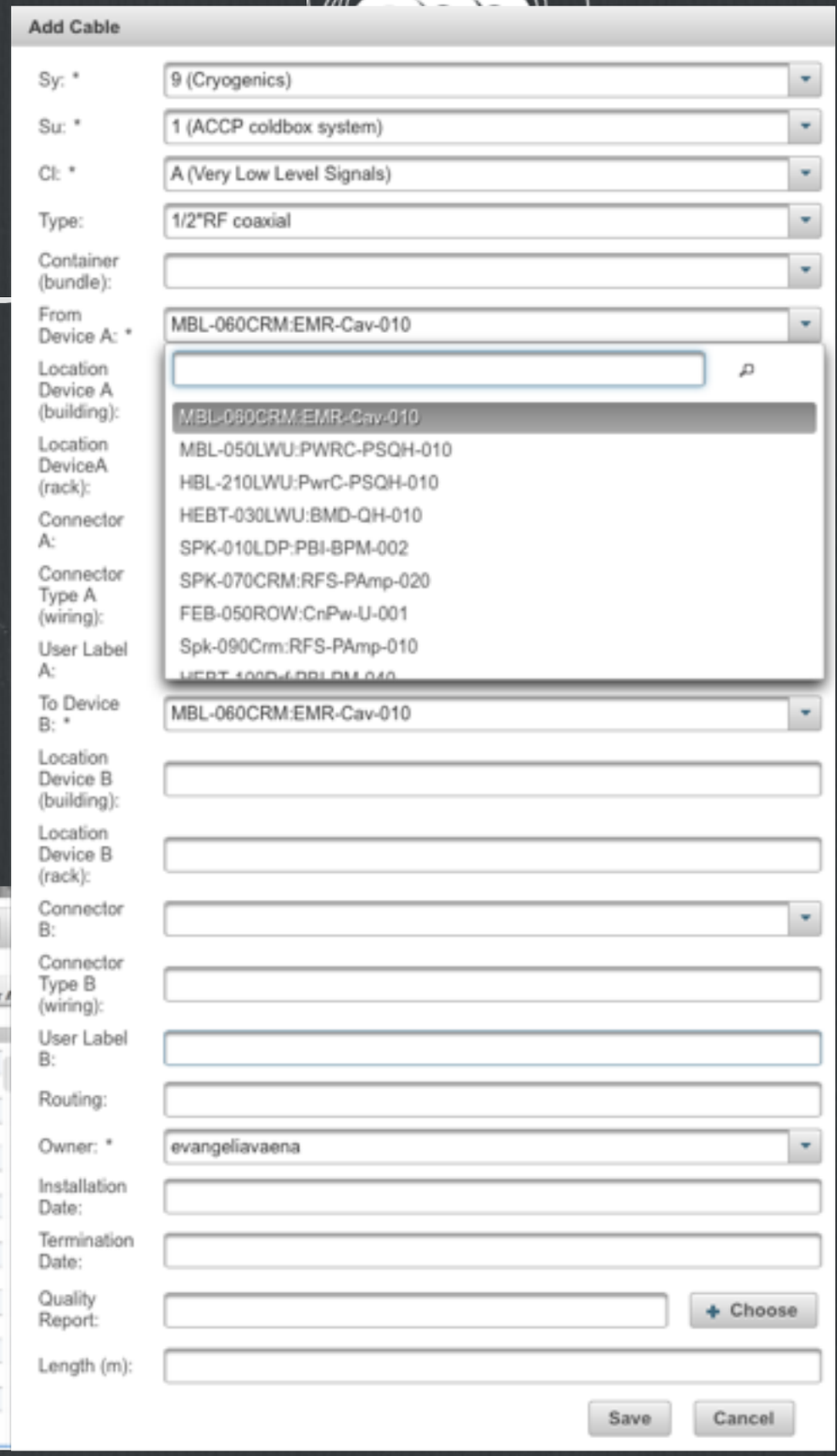


- The Cable Database (CDB) supports the tracking, configuration and naming of cables in all phases of the ESS project (design, installation, operation, shut downs). This information is then consumed both by end-users and other ICS applications (e.g. CCDB and naming tool) to enable these to successfully perform their domain specific businesses.

What does the cdb do?

- creation cable instances- automatic naming
- only prerequisite to create a new cable is that the 2 ends are registered in the naming tool
- for each cable you can add extra information like the connector, termination diagrams, quality reports (after installation)
- one-by-one or batch template)
- check the routing





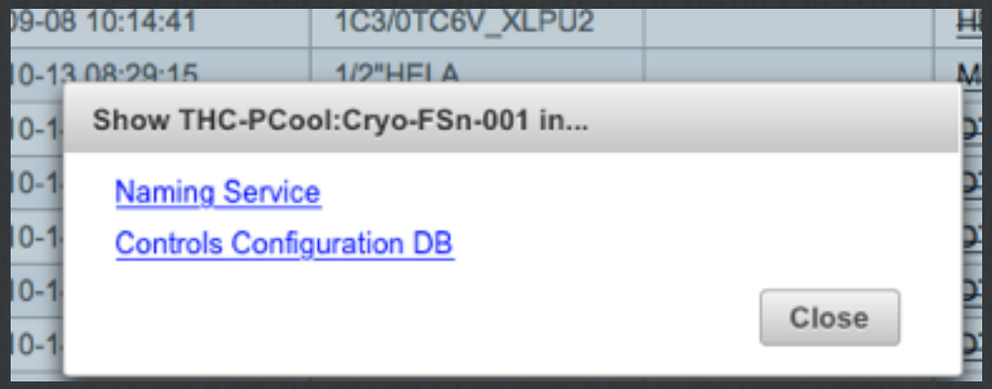
what does the cdb do?

EUROPEAN SPALLATION SOURCE

Cable history

Timestamp	User	Operation (All)	Entity Name	Entity ID	Change
2016-09-20 02:14:30	evangeliavaena	Update	82J001220	1220	Updated (Attribute: newValue (oldValue)): Device A: Off-INFN-Src:ISS-Magtr (THC-PCool:Cryo-FSn-001)
2016-09-20 02:13:45	evangeliavaena	Update	82J001220	1220	Updated (Attribute: newValue (oldValue)): Number: 82J001220 (92J001220) Cable Type Id: 64 (107) Length: 65.0 (null)
2016-09-20 02:12:34	evangeliavaena	Update	92J001220	1220	Updated (Attribute: newValue (oldValue)): Number: 92J001220 (90J001220) Connector A: USB (null) Device B: MBL-020Crm:RFS-PAmp-020 (THC-PCool:Cryo-FSn-001)
2016-09-20 01:44:19	evangeliavaena	Create	90J001220	1220	Created cable with number: 90J001220

- edit information-history is kept
- adjust your workspace and make queries, export spreadsheets
- navigate through ccdb and naming convention



why use the cable database

EUROPEAN SPALLATION SOURCE

single point of truth
- not an endless collection of excel files
- revision control

unique cable name/number

centralised cable types and connectors management
- easier **procurement**
- all choices available to everyone, less components

cable database

complete, **integral** image of the status of rack, cable and field devices

Repository for connection diagrams, quality forms, installation details

routing information and implementation oriented to optimise **installation**

Accessible to everyone

Easy to **cross check** information uploaded by other engineering disciplines

To be ready in July:

EUROPEAN SPALLATION SOURCE

- ☐ Step 1: Get your device names registered and approved by ICS and Linac Group
- ☐ Step 2: Check if the cable types you plan to use exist in the cdb. If not, make a request for a new cable type
- ☐ Step 3: Create your cable instances, with as much information as possible-keep in mind that information can be edited or new fields can be filled later on
- ☐ Step 4: Define your connector types
- ☐ Step 5: Indicate when there is a particularity about a cable—different scope, special characteristics, etc.

workflow for creation of cables and preparation of pulling campaigns

EUROPEAN SPALLATION SOURCE

WP XX registers devices in naming tool

WP XX is uploading the new cable instances

WP 15 is allocating space on the cable trays for the new cable instances

WP 15 is adding the length of the cable in the cdb

WP XX is approving the cable path and length

WP 15 is purchasing most of the cables and connectors

WP 15 is preparing the cable lists for the electrical contractor

WP 15 is pulling the cable and installing the connectors

WP XX is terminating the cable

WP XX

WP 15

there will be exceptions!

Cable installation preparation- Documentation for installer

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1. Cable pulling lists (containing information about the termination points, connectors, cable type and cable drum to be used) that the electrical contractor will use.

- ☐ For each cable in the list, there will also be information about its routing, depending on the type and signal rating.

2. 2D drawings of the cable trays- named and separated according to their position and cables they house

- ☐ The contractor by comparing these documents has the overall image about cables to be pulled, at which path and materials needed

Wrapping Up

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- [ ] Final cross check of the rack space claim and power demands
- [ ] Preparation for the cable installation as described
- [ ] Clarification of all the interfaces and deliverables between electrical support and other NC systems

thank you for your attention!

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Questions?

back up slides

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Back up slide- FEB- rack row cooling

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- ☐ 54 racks in 5 rows
- ☐ In line coolers