PDR of the Accelerator Racks

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Lilla Tuna, ESS Lund, Monday 28th of November 2016

Rack PDR- Purpose of the review

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- ☐ Definition of system
- ☐ Definition of interfaces and requirements' description
- ☐ Description of the mechanical and cooling design
- ☐ Power distribution, UPS and rack accessorising (Jörgen's talk)
- ☐ Installation and contract implementation (Frithiof's talk)
- ☐ System properly defined and documented
- ☐ Market Survey
- ☐ Call for tender readiness

System Description -Definition

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- This system covers rack cabinets, equivalent components and incorporated rack cooling used for the electronics, controllers and power supplies of the accelerator systems that will be installed in the ESS Accelerator buildings, more specifically the Front End Building level 090 (G01), the Klystron Gallery (G02 building) and the Gallery Supporting Area (GSA).
- The racks provide power, mechanical protection and cooling to the crates - they basically provide a “housing service” to the equipment.
- The challenge: The integration of a collection of crates of miscellaneous sizes, temperature requirements that regulate the operation of equipment with different characteristics, under a design that would fit it all and would still be highly flexible
  - in order to optimise the usage of space, robust mechanical construction that will last long termly and without jeopardising the performance of the machine!

System Interfaces

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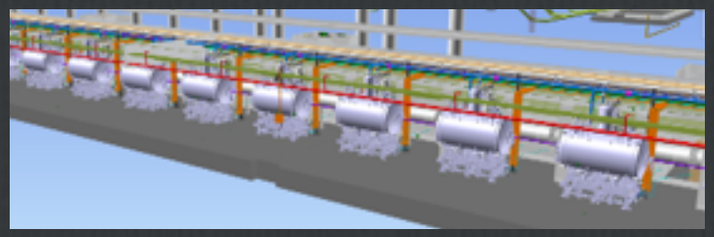
Inputs and constraints



the accelerator systems

the buildings

Output interfaces

conventional power

water cooling

Interface Requirements- Accelerator Systems

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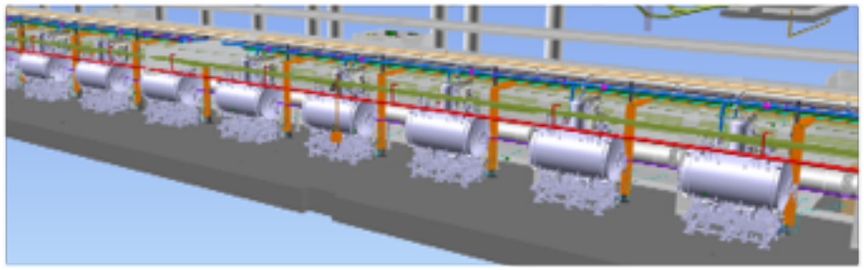

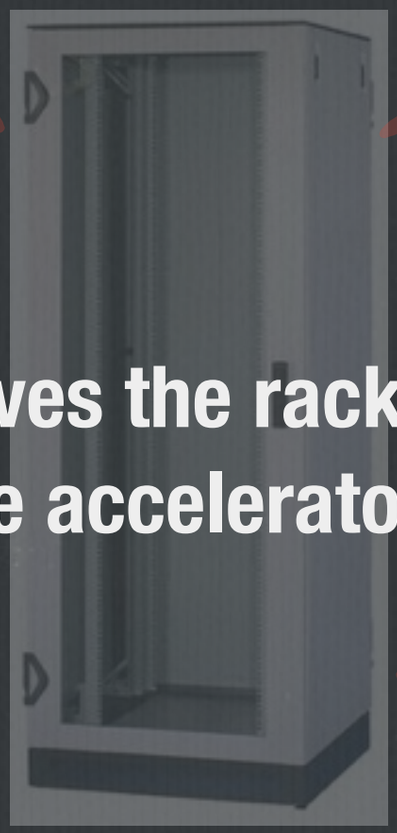

- Main Input that drives the rack design: the requirements of the accelerator and ICS systems

Interface Requirements with Accelerator Systems- main design survey questions

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WP	System Name
WP3	NCFE
WP4 and WP5	Cryomodules
WP7	Beam Instrumentation
WP8	RF Systems
WP11	Cryogenics Distribution Line
WP12	Vacuum
WP17	Power Converters
ICS	Personal Safety Systems
ICS	Machine Protection Systems
ICS	Integration Racks
Target	Target Safety Systems

- ☐ How many racks are needed per section?
- ☐ What is the expected power consumption? need for UPS?
- ☐ What is the total heat dissipation per rack?
- ☐ What is the desired temperature inside the rack and how much can it vary?
- ☐ Are there any mechanical protection or EMC issues that should be factored?
- ☐ What is the optimal position of the rack inside the row?
- ☐ What is the population and installation scheme? Is there any special agreement with the partners?

Interface Requirements with Accelerator Systems- Outcome of survey

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- The requirements are collected in the “rack wiki page”:

https://ess-ics.atlassian.net/wiki/display/AWES/Requirements+on+rack+mounted+equipment+per+system

- Minutes of meetings, internal rack designs, evolution of the design

Interface Requirements with Accelerator Systems- Rack Allocation

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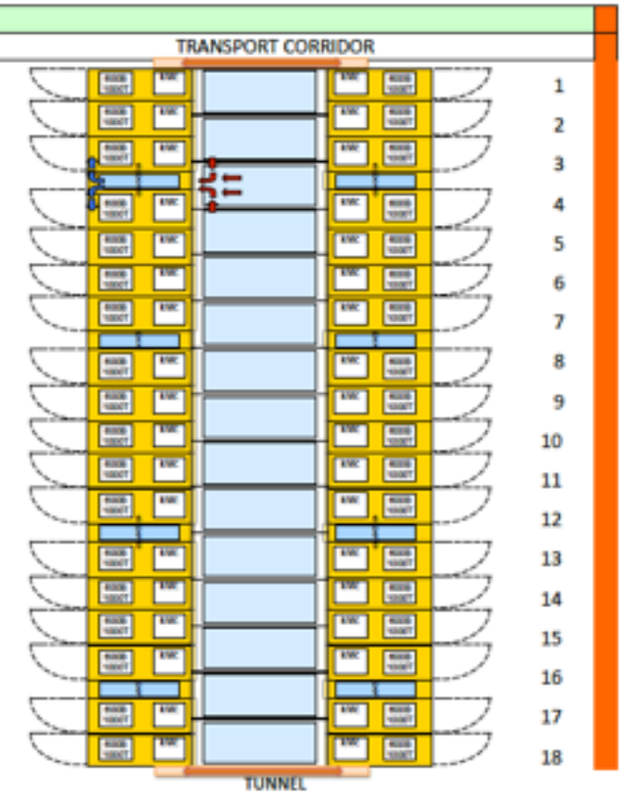
☐ **the outcome of this work is reflected in the document:**
ESS-0085695:Appendix 02, Rack space, power and heat dissipation requirements

HBL-010ROW	NAME	System	Power(kW)	Nominal Current (A)	Installed Fuse (A)	UPS (kW)	UPS Current (A)	UPS Fuse (A)	Heat Dissipation (kW	Temperature (°C)	Type
Rack #											
1	HBL-010ROW:CNPW-U-001	PS	21,6	36,72	50		0,0		2,22	25°C, +/- 10°C	I
2	HBL-010ROW:CNPW-U-002	MPS	1,0	1,70	10		0,0		1,00	25°C, +/-5°C	P
3	HBL-010ROW:CNPW-U-003	VACUUM	1,5	2,55	10	1,5	2,6	3	0,30	10-35C	B10
4	HBL-010ROW:CNPW-U-004	VACUUM	4,0	6,80	10		0,0		0,80	10-35C	C10
5	HBL-010ROW:CNPW-U-005	CM/CDL	3,0	5,10	10	1,0	1,7	2	2,10	25°C, +/-5°C	S
6	HBL-010ROW:CNPW-U-006	RF	22,5	38,25	50		0,0		1,90	25°C, +/- 1°C	G
7	HBL-010ROW:CNPW-U-007	RF	4,8	8,08	16	1,7	2,9	3	0,55	25°C, +/- 1°C	E
8	HBL-010ROW:CNPW-U-008	RF	2,6	4,34	10	1,8	3,1	3	2,02	25°C, +/- 1°C	D
9	HBL-010ROW:CNPW-U-009	RF	22,5	38,25	50		0,0		1,90	25°C, +/- 1°C	G
10	HBL-010ROW:CNPW-U-010	RF	4,8	8,08	16	1,7	2,9	3	0,55	25°C, +/- 1°C	E
11	HBL-010ROW:CNPW-U-011	RF	2,6	4,34	10	1,8	3,1	3	2,02	25°C, +/- 1°C	D
12	HBL-010ROW:CNPW-U-012	RF	22,5	38,25	50		0,0		1,90	25°C, +/- 1°C	G
13	HBL-010ROW:CNPW-U-013	RF	4,8	8,08	16	1,7	2,9	3	0,55	25°C, +/- 1°C	E
14	HBL-010ROW:CNPW-U-014	RF	2,6	4,34	10	1,8	3,1	3	2,02	25°C, +/- 1°C	D
15	HBL-010ROW:CNPW-U-015	RF	22,5	38,25	50		0,0		1,90	25°C, +/- 1°C	G
16	HBL-010ROW:CNPW-U-016	RF	4,8	8,08	16	1,7	2,9	3	0,55	25°C, +/- 1°C	E
17	HBL-010ROW:CNPW-U-017	RF	2,6	4,34	10	1,8	3,1	3	2,02	25°C, +/- 1°C	D
18	HBL-010ROW:CNPW-U-018	BI	2,7	4,51	10		0,0		1,86	25°C, +/- 1°C	R
			153,0	260,0	404	16,5	28,1	29	26,16		



Interface Requirements with Accelerator Systems- Rack count spreadsheet

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- ☐ Number of racks per section
- ☐ Space allocation for each system -rack distribution
- ☐ Rack naming
- ☐ Conventional and UPS power needs
- ☐ Desired temperature and temperature stability & heat dissipation in order to design the suitable cooling solution
- ☐ Indicative layout with in row coolers

=>The spreadsheet “concatenates” all the requirements will be fulfilled by the integrated rack design

Interface Requirements with Accelerator Systems- Outcome of survey- Space Needs

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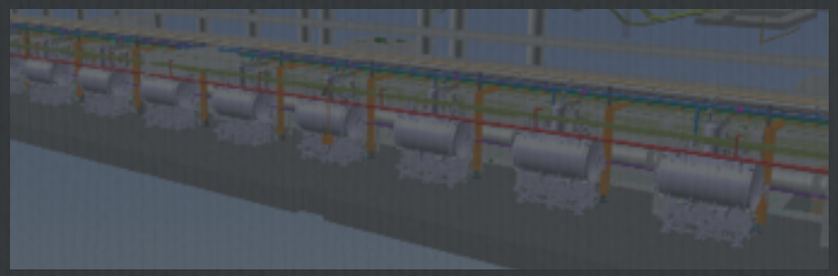
Space needs

Building	Rack capacity- Space reserved per building
FEB	54
Gallery	708
HEBT	49
TS2	26
GSA	9
	846

Number of Racks	System
20	NCFE
42-shared	Cryomodules sharing with Cryo-Distribution Line
43	Beam Instrumentation
428	RF Systems
42- shared	Cryo- Distribution Line - sharing with cryomodule controllers
53	Vacuum
44	Power Converters
3	Raster Magnets -A2T
36	Personal Safety Systems
49	Machine Protection Systems
23	ICS- Integration Racks
26	Test Stand 2
5-7	Target Safety Systems
774	

Interface Requirements- Buildings



- [ ] Building Requirements- “Rack Space Envelopes”

Interface Requirements- Buildings -Constraints

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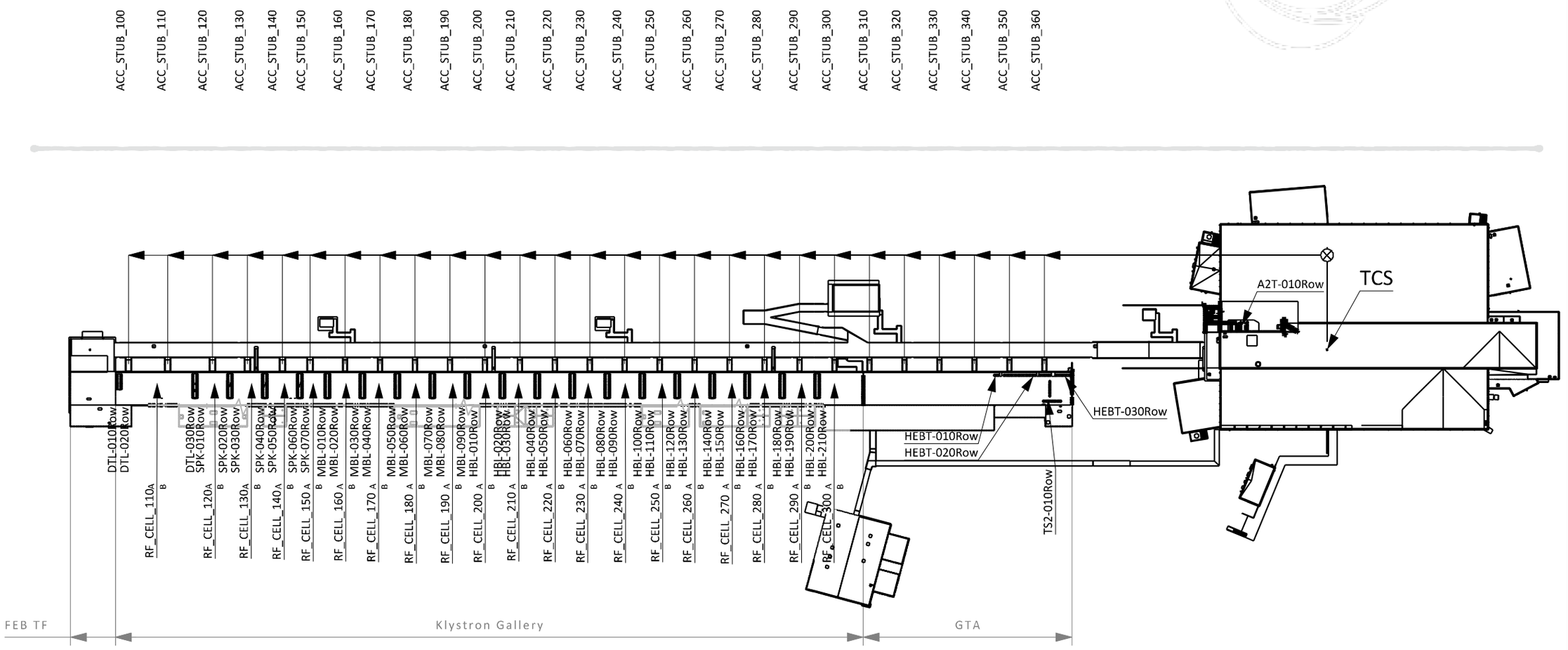
- ☐ Predefined rack envelopes - “building rack capacity”
- ☐ No heat dissipation in the ambient air of the gallery
- ☐ Sufficient space to be able to remove and reinstall racks
- ☐ No blocking of the transport zones and dismantle of other equipment
- ☐ Not allowed to use the ceiling trusses to fix the cable trays

Rack Row Positioning and Naming

Level_100



All dimensions in mm

Stub names: ACC_STUB_xxx

Accelerator Space names: ACC_SPACE_xxx

RF cell names: RF_CELL_xxx

Rack Row names: xxx-xxxRow

ASSY WEIGHT: - kg		DRAWING TYPE; TITLE; SUPPLEMENTARY TITLE	
General Tolerances		- ACCSYS Names	
Linear Dimensions, Form and Position:	ISO 2768-mK	MODELED BY: daniellundgren	DATE: 07/10/2016
Chamfers, Radii and Angular Dim's:	ISO 2768-vK	DRAWN BY: daniellundgren	DATE: 03/11/2016
SURFACE FINISH Min. Ra 3.2		CHECKED BY	DATE
Documentation protection as per ISO 16016		APPROVED BY	DATE
EUROPEAN SPALLATION SOURCE	DESIGN SITE: ESS Lund	QUALITY CONTROLLED BY	DATE

DRAWING NUMBER			
ESS-0025905.1			
LIFECYCLE LABEL	REV.	SHEET	
Preliminary	2.0	1/2	
LEVEL OF MATURITY	MC	SIZE	SCALE
	B	A3	1:1

Produced to **ISO 1101, 8015** and **1302**

Interface Requirements-Buildings-space envelopes

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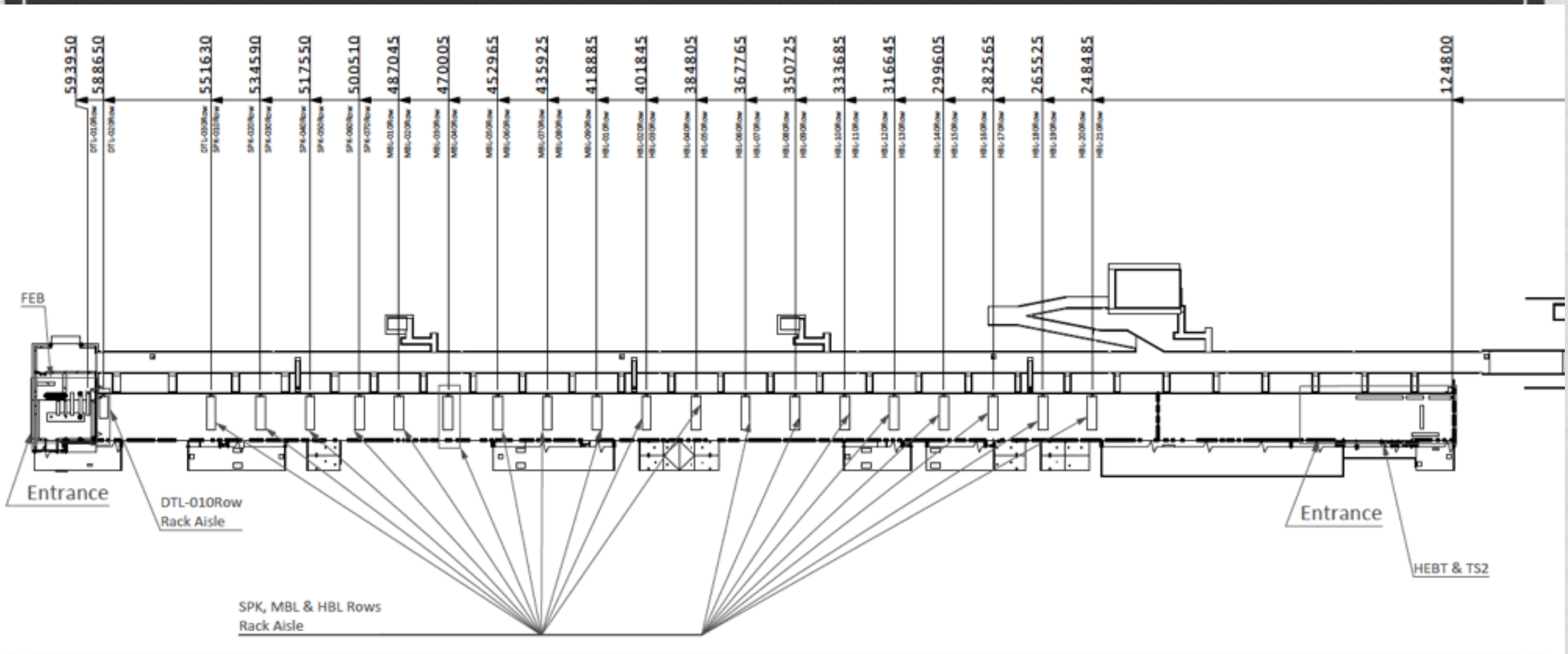
☐ ESS-0085079



Interface Requirements- Buildings- space envelopes FEB

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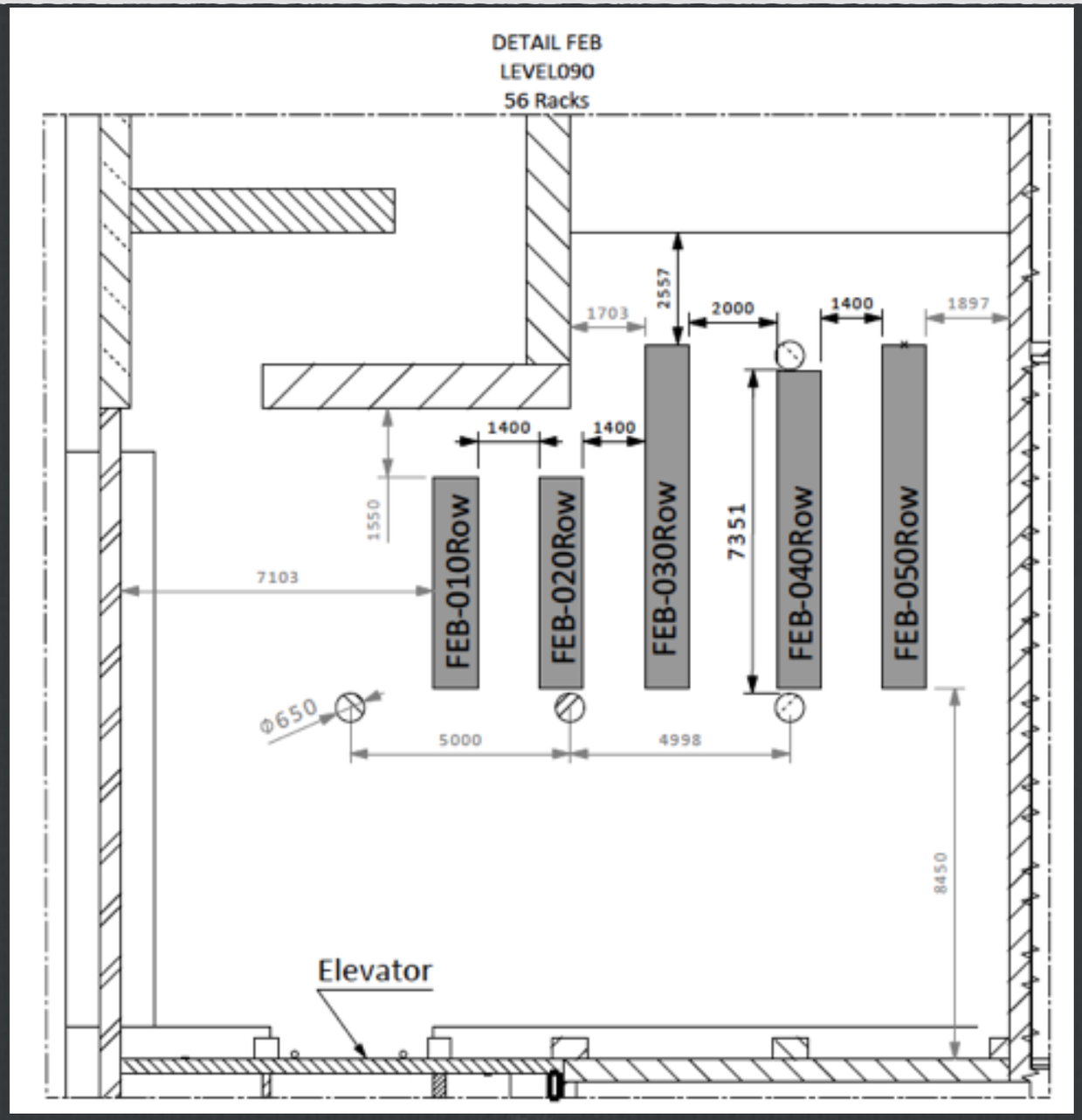

Interface Requirements-Buildings-G02

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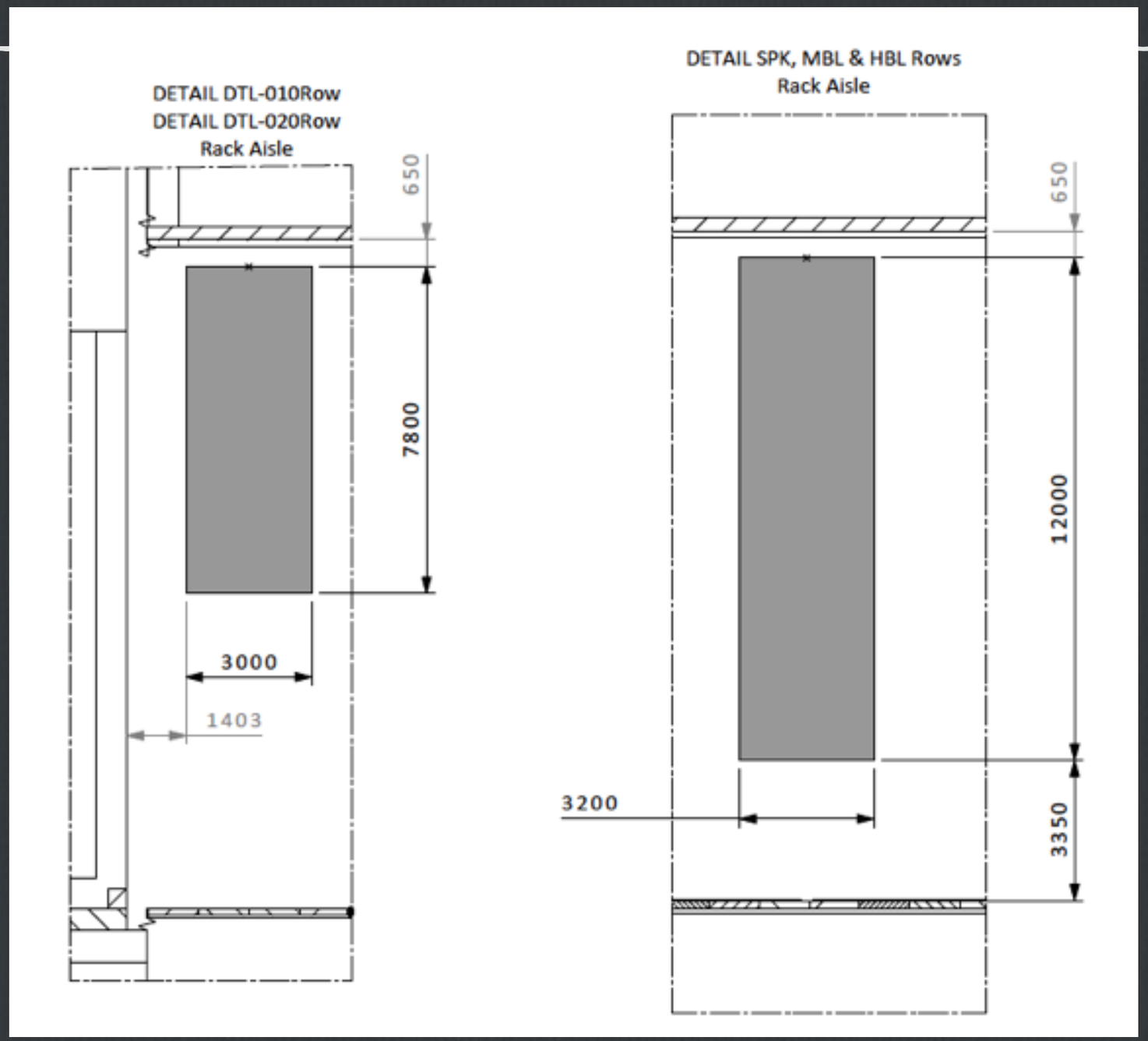

Interface Requirements- Buildings HEBT and TS2

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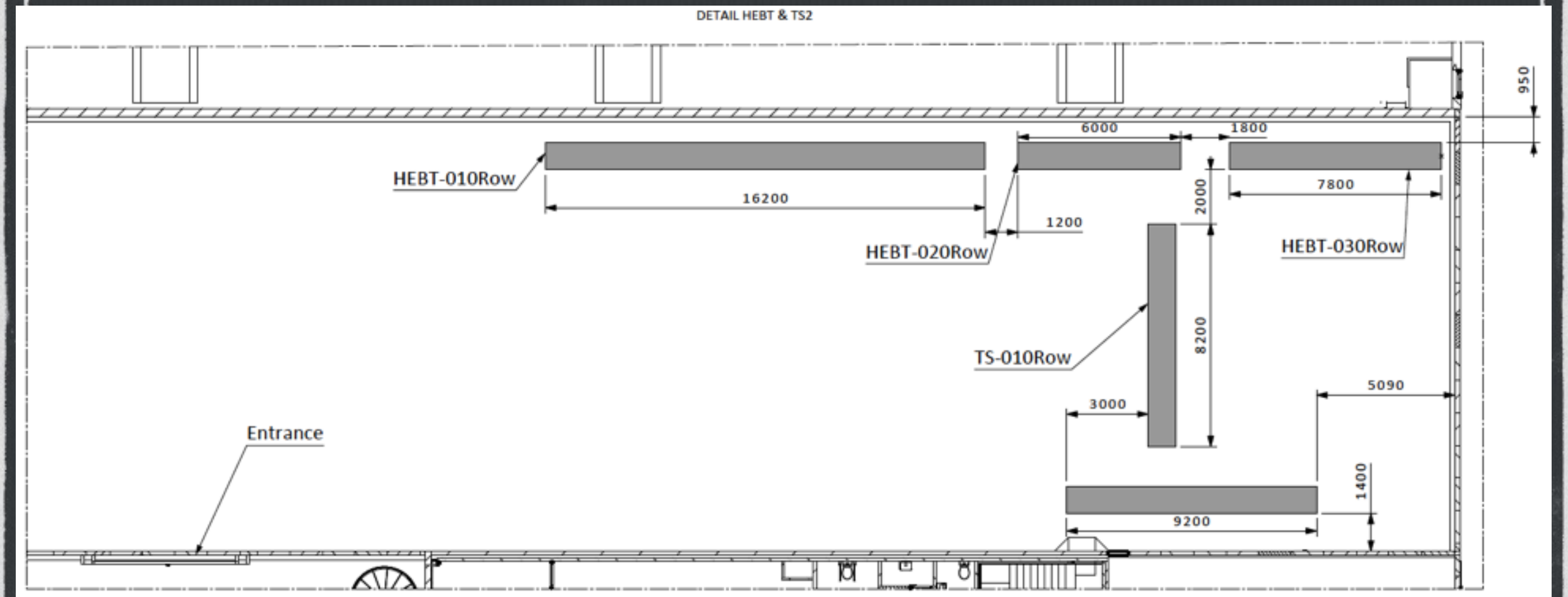

Interface Requirements- Buildings- GSA(2)

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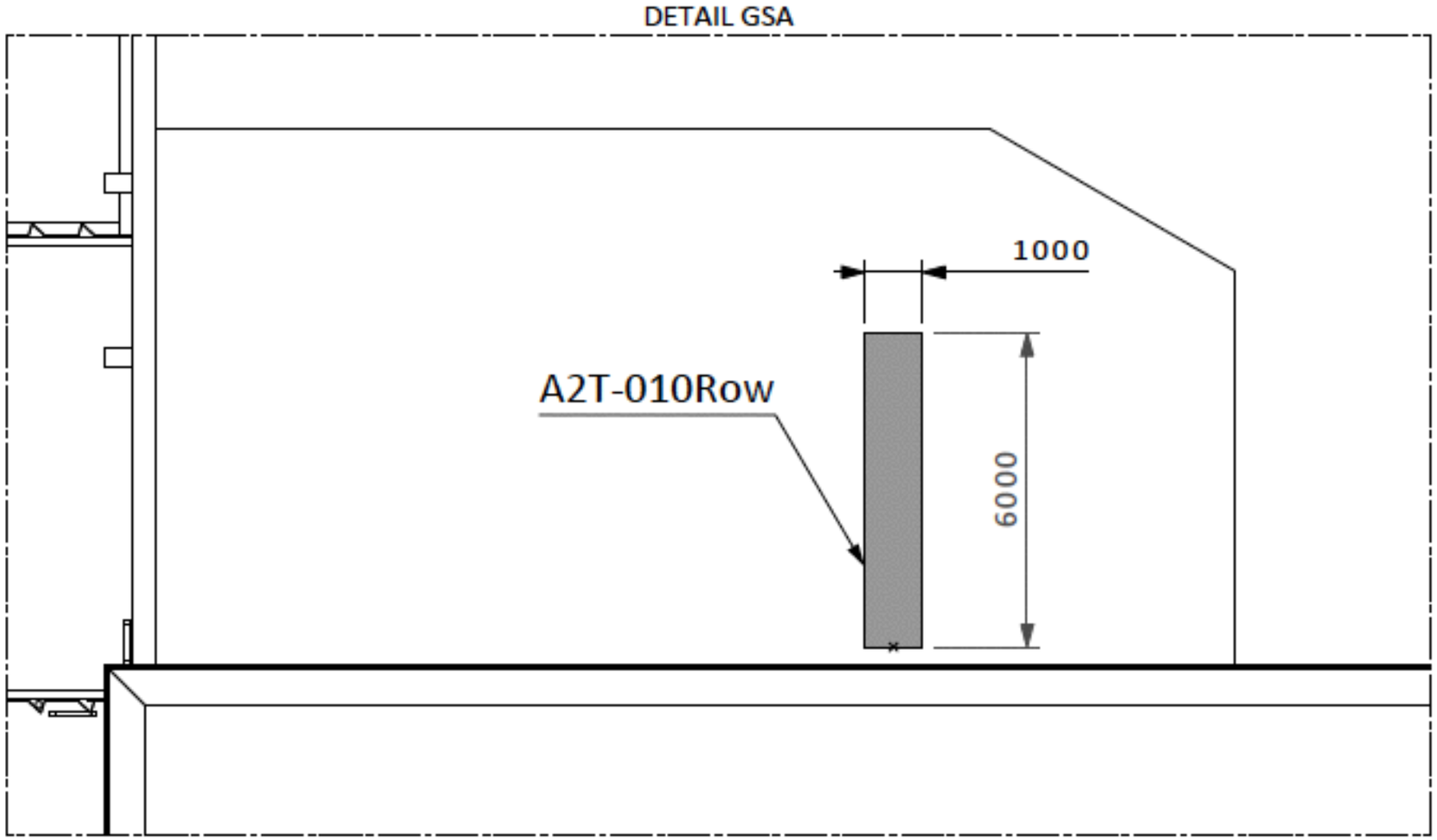

Interface Requirements-Buildings-G02(2)

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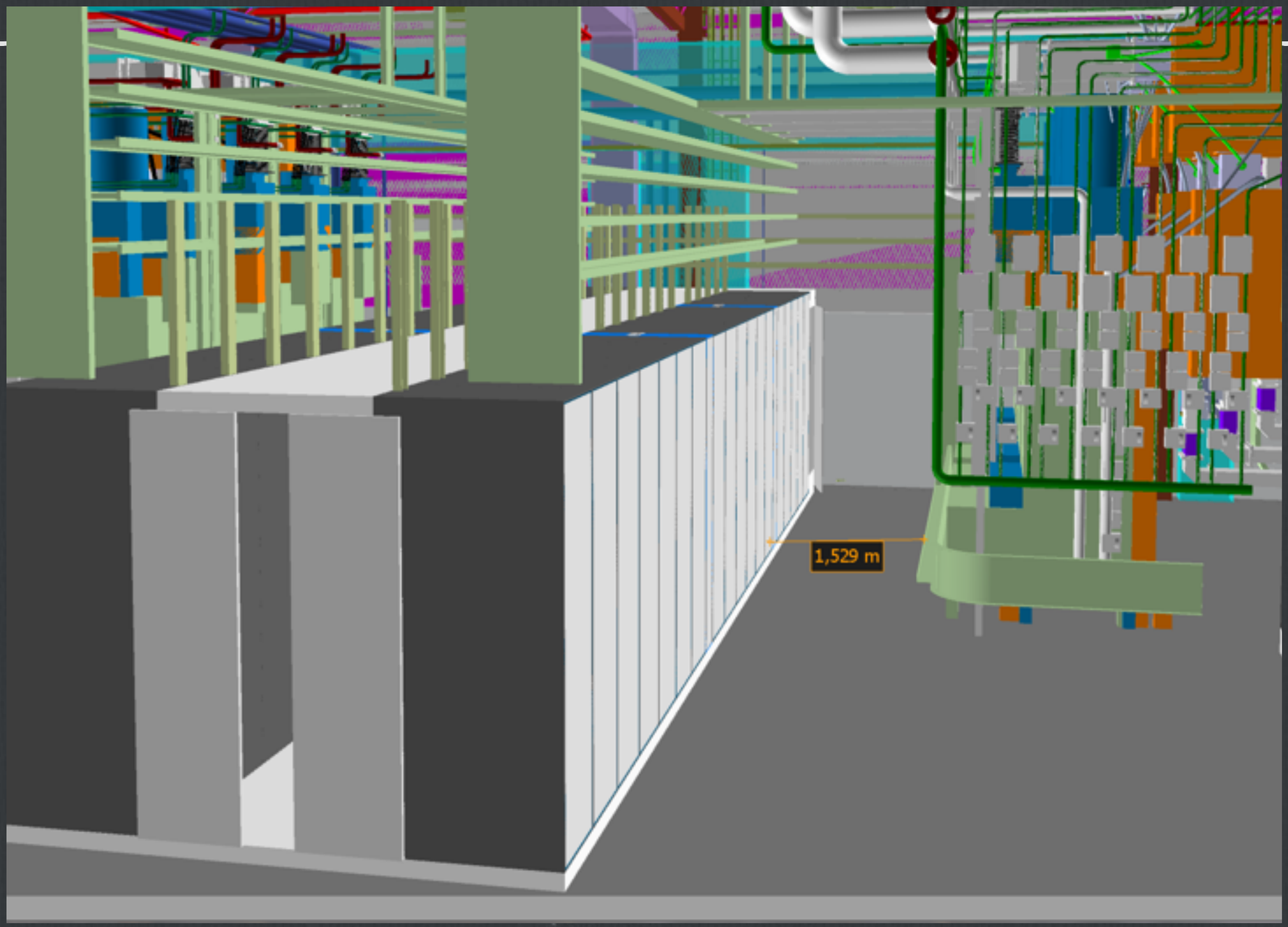

Interface Requirements- Conventional Power

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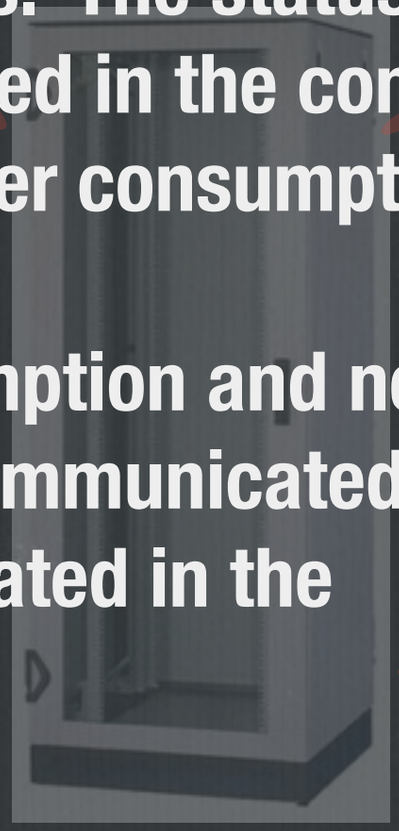
- ☐ All the rack rows are powered directly from the 400V CF substations. The status of the breaker will be monitored in the control room. (on, off, trip, power consumption)



- ☐ The total power consumption and needed UPS power has been communicated to CF and is already incorporated in the switchgear design

- ☐ More details at the next presentation

Power and UPS needs

Interface Requirements- Conventional Power- Load list ESS-0042523

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Document Type: Technical Documentation
Document Number: ESS-0042523

Document Date: Oct 22, 2015
Revision: 1(1)
State: Preliminary

Location	Equipment	Description of equipment	Connection point	Voltage [V]	Current [A]	Rated Power [kVA]	Actual Power [kVA]	Diversity factor	Interlock [Yes/No]	UPS Y/N	UPS Responsible	Ge p Y/N	V)
FEB, "Ion Source", G01.090.5216	ISrc	LV Distribution Board for: ISrc, ***5.026***	=63C:01-N13	400	630		300	1.0	No	No	N/A	No	
FEB, "Front End Building", G01.100.5233	WTRC	LV Distribution Board for: ***5.025***	=63C:01-N12	400	433	300	200	1-0	No	No	N/A	No	1,5
FEB, "Front End Building", G01.100.5233	UPS	UPS system for: Master	=63C:01-N14 5.026	400	63	40	3	1.0	No	No	ACCSYS	Yes	1
MEBT, "Klystron Gallery", G02.100.2.001 (at RF_CELL_110A)	MEBT-01	19" Racks, LVDP	=63C:01-N13 ***5.026***	400	180		90	1.0	No	No	N/A	No	1,7 1,8
DTL, "Klystron Gallery", G02.100.2.001 (at RF_CELL_110A)	DTL-01, RFQ-01	19" Racks, LVDP	=63C:01-N11 ***5.025***	400	250		130	1.0	No	No	N/A	No	1,7 1,8
DTL, "Klystron Gallery", G02.100.2.001 (at RF_CELL_110A)	DTL-02	19" Racks, LVDP	=63C:01-N12 ***5.025***	400	250		114	1.0	No	No	N/A	No	1,7 1,8
DTL, "Klystron Gallery", G02.100.2.001 (at	DTL-03	19" Racks, LVDP	=63C:01-N13 ***5.026***	400	200		97	1.0	No	No	N/A	No	1,7 1,8

16,5

Interface Requirements- Water Cooling Systems

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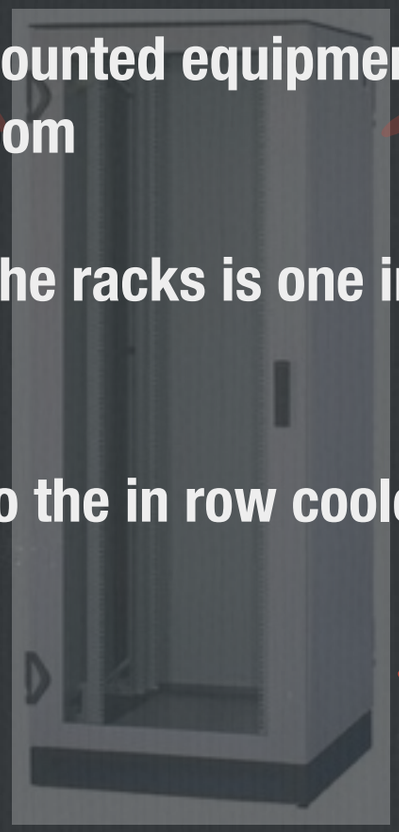
- ☐ Heat dissipation estimation depicted in ESS-0085695: Appendix 02 and technical specification
- ☐ 1MW heat produced by the rack mounted equipment and this is pushed back to water - and won't be dissipated in the room
- ☐ the interface between WP16 and the racks is one inlet and one outlet connection for each rack row
- ☐ All the piping from these outlets to the in row coolers will be performed by the rack vendor



temperature requirements

heat dissipation- Interface with water

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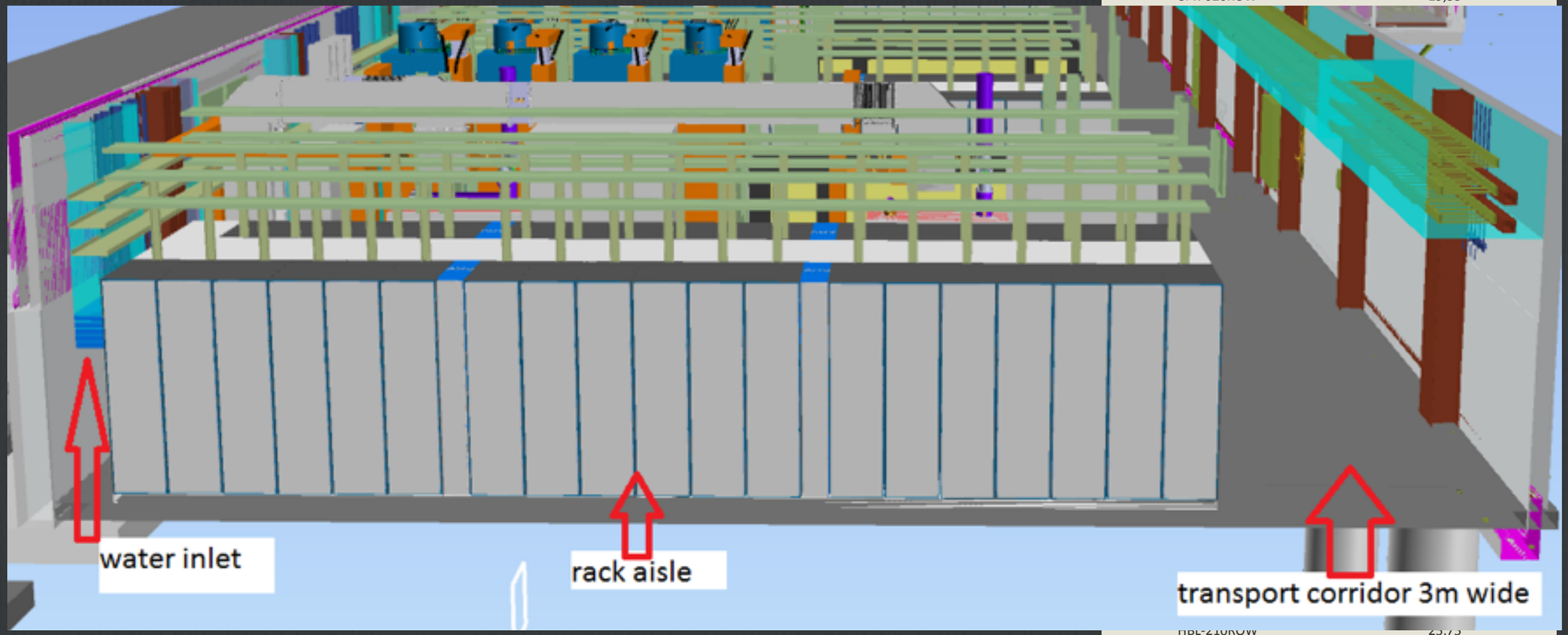
FEB-010ROW	3,75
FEB-020ROW	4,4
FEB-030ROW	30,95
FEB-040ROW	23,5
FEB-050ROW	17,45
DTL-010RPW	11,36
DTL-020ROW	15,7
DTL-030ROW	17,09
SPK-010ROW	19,96
SPK-020ROW	19,33



HBL-210ROW	23,73
HEBT-010ROW	4,28
HEBT-020ROW	2,6
HEBT-030ROW	11,025
HEBT-040ROW	43,08
TS2	11,21
GSA	5,45

Mechanical Design

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- ☐ ONE rack size for all the applications and the buildings
- ☐ Different cooling configurations to fit the requirements and the available space
- ☐ Options for stand alone racks, individually water cooled racks
- ☐ Statement of work: ESS-0085079
- ☐ Rack Standard Description: ESS-0017175

General Rack Design

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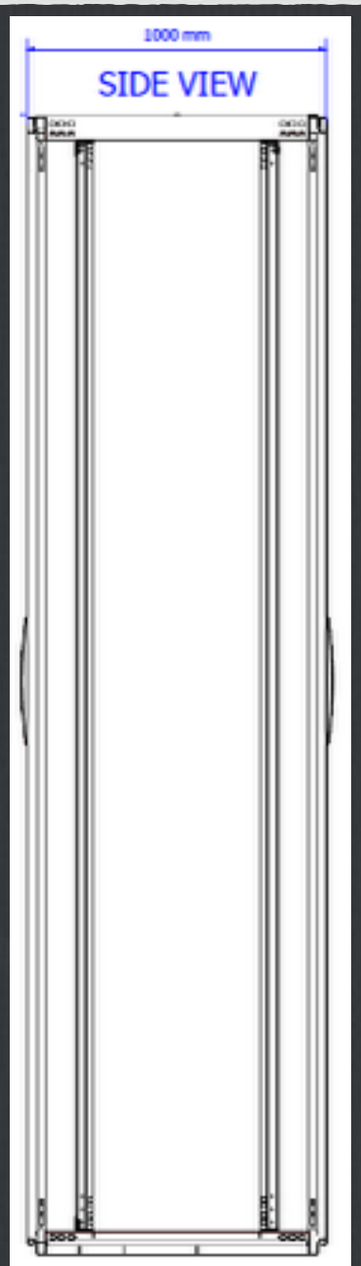
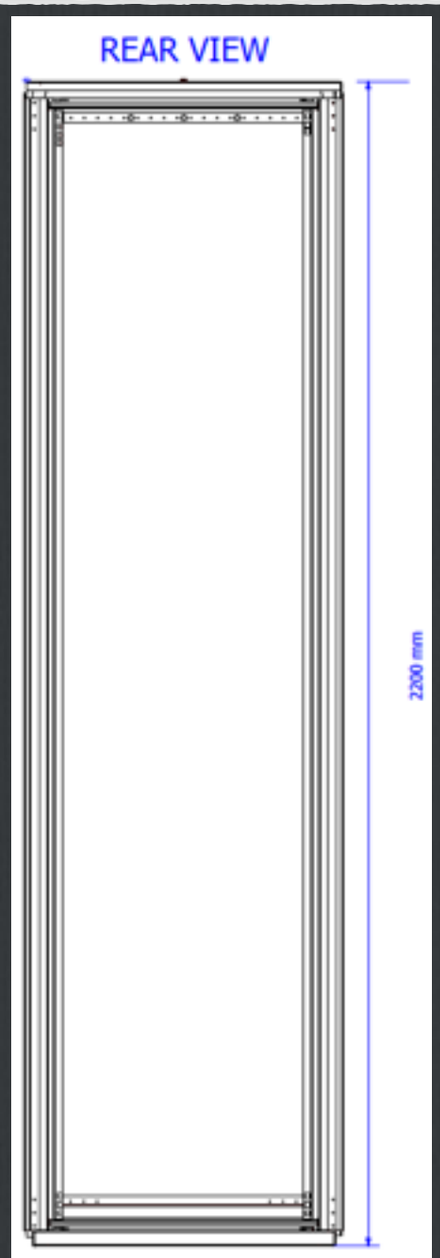
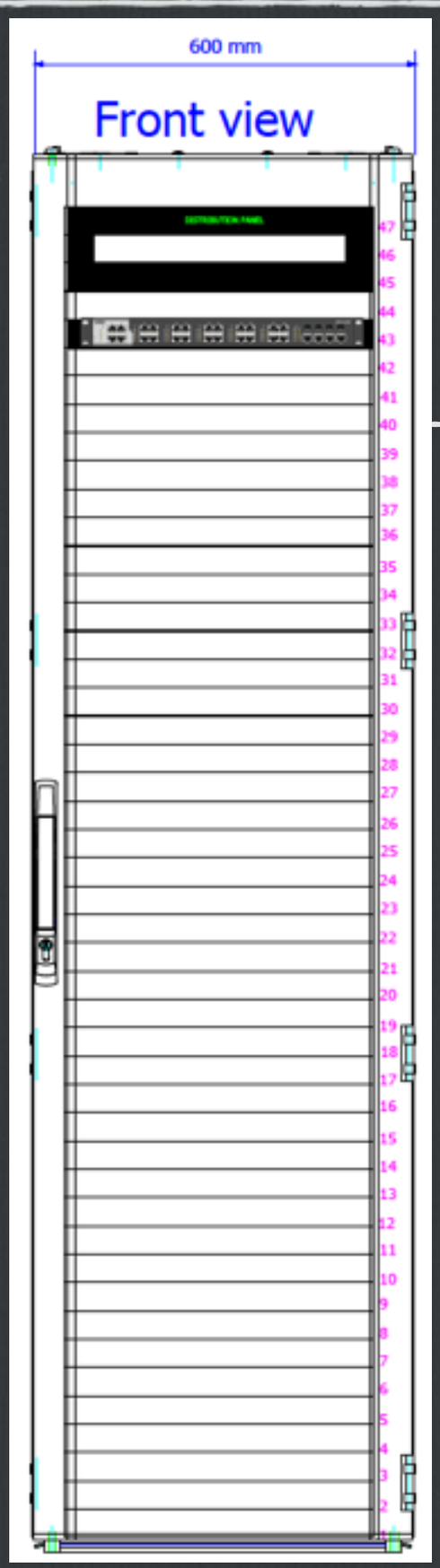




- ☐ Size 2200 mm high (47U), 1000 mm deep and 600 mm wide (19 inches),colour RAL 7035
- ☐ Glass Front Door
- ☐ Side, bottom plates and rear door selected according to the cooling solution
- ☐ Doors shall be lockable with a handle
- ☐ Each rack is fitted with front and back mounting rails. The rack units (U) of the rack are defined by the pre-threaded holes



General Rack Design

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- ☐ 3 U reserved in all the racks for a PDP
- ☐ 1 U for the ICS patch panel
- ☐ All the racks mounted on 100mm high plinths
- ☐ The protection class IP20
- ☐ All racks are supplied by a 400 V AC, 3-phase, mains supply.

General Rack Design

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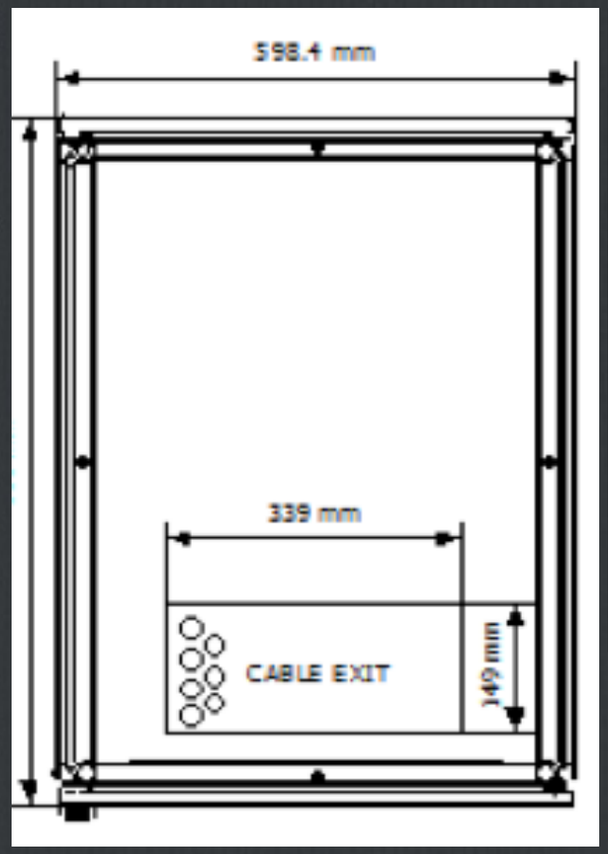
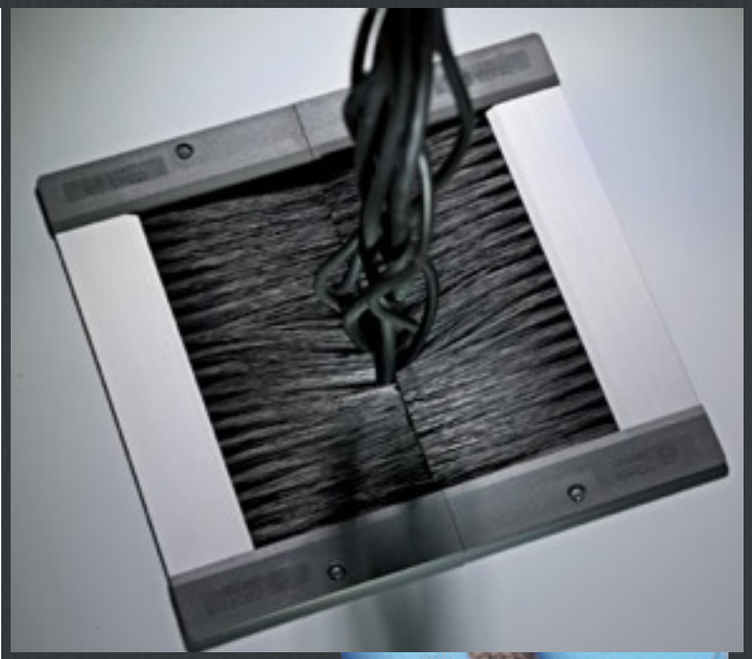
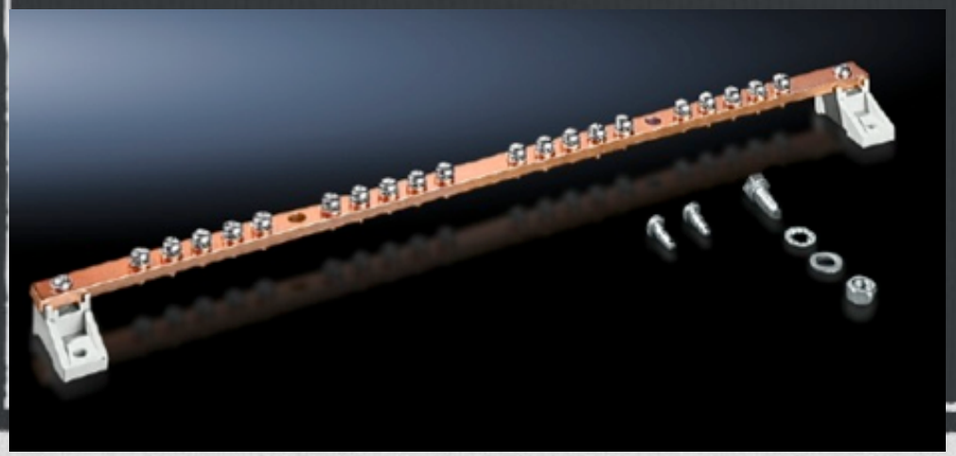




- ☐ Cable entries : top of the cabinet
- ☐ sealing of the cable openings will be performed with the use of air tight brush type sealants in most of the racks and with EMC sponge type sealants in the cases where EMC should be considered
- ☐ 2 earthing bars, the one connected to the equipotential bonding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



Rack Rows

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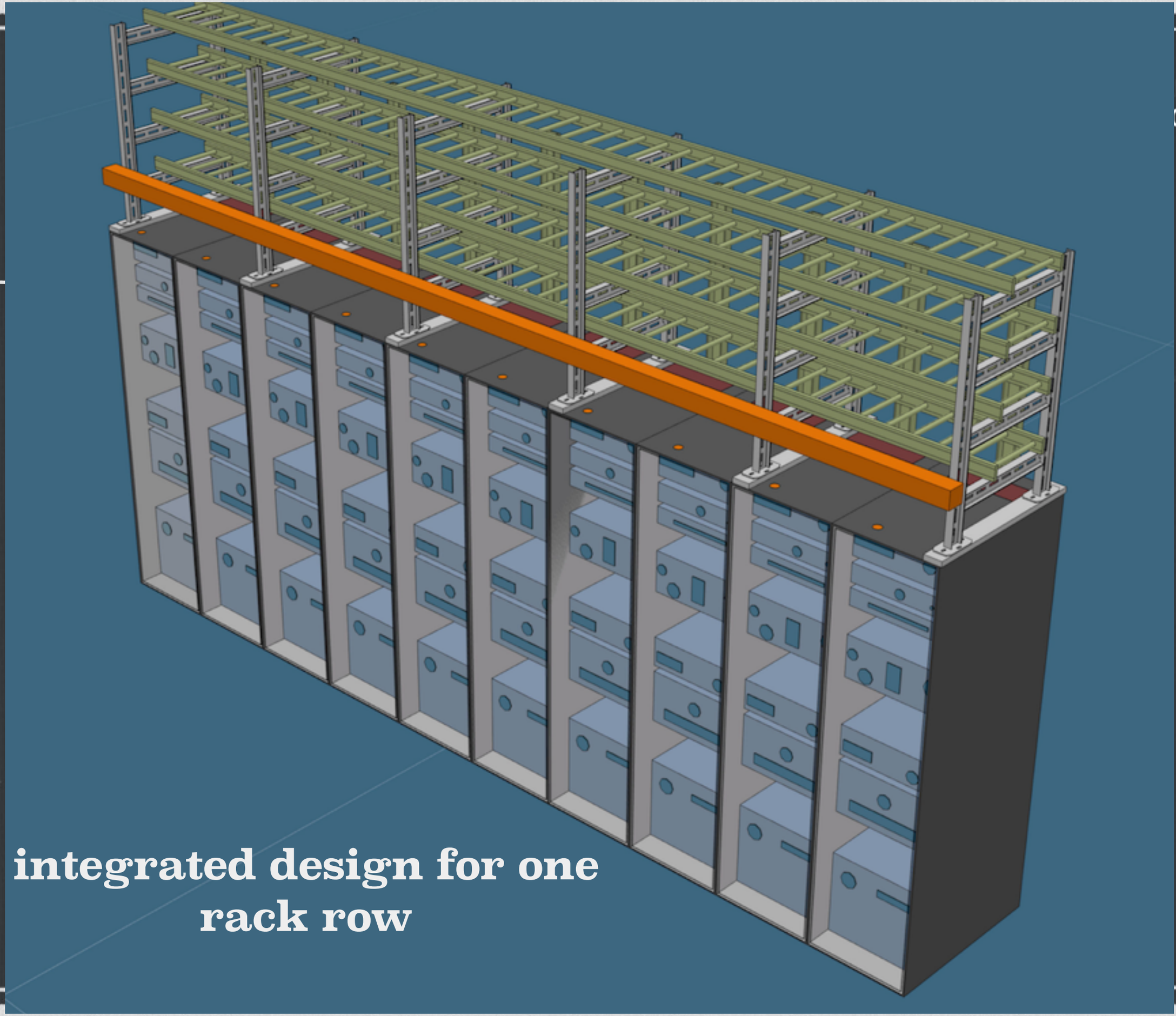
- ☐ The vast majority of the racks fitted together side-to-side forming rows. The length of each row is defined by the space availability.
- ☐ The rack row will also carry a frame structure that will hold all the cable trays and the power distribution bus bar trunking system.
- ☐ The frame of the racks and the in-row coolers is heavy- duty type, welded and can bear up to 1000 kgr.



integrated design for one rack row

integrated design for one rack row

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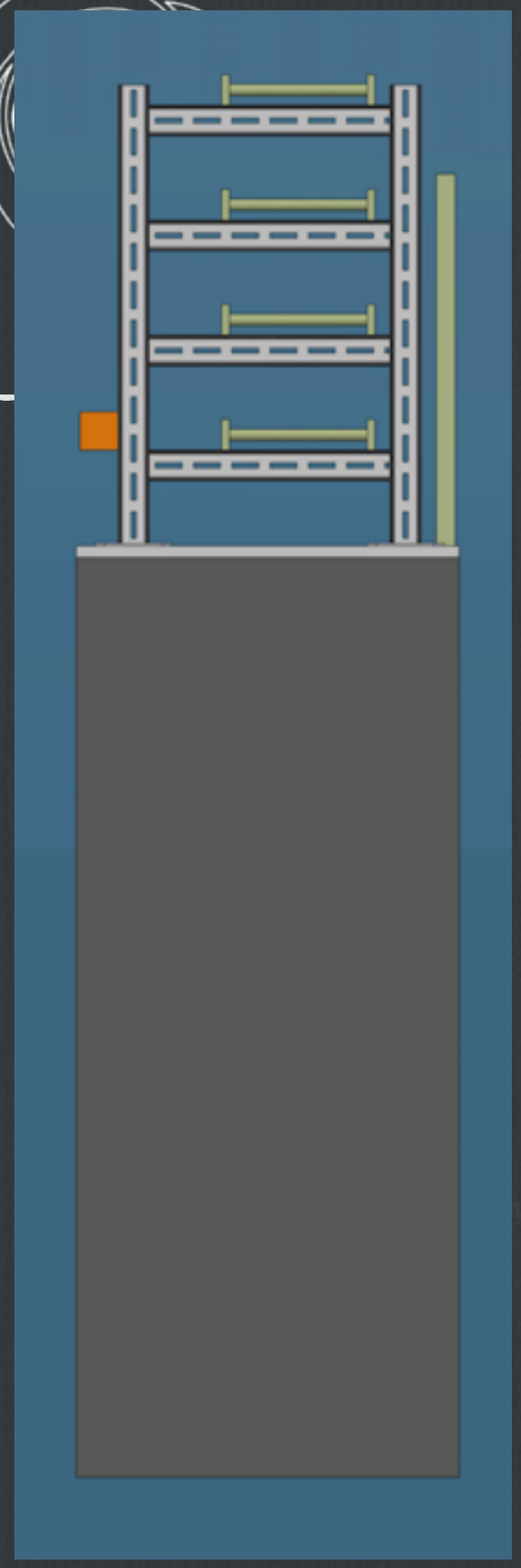
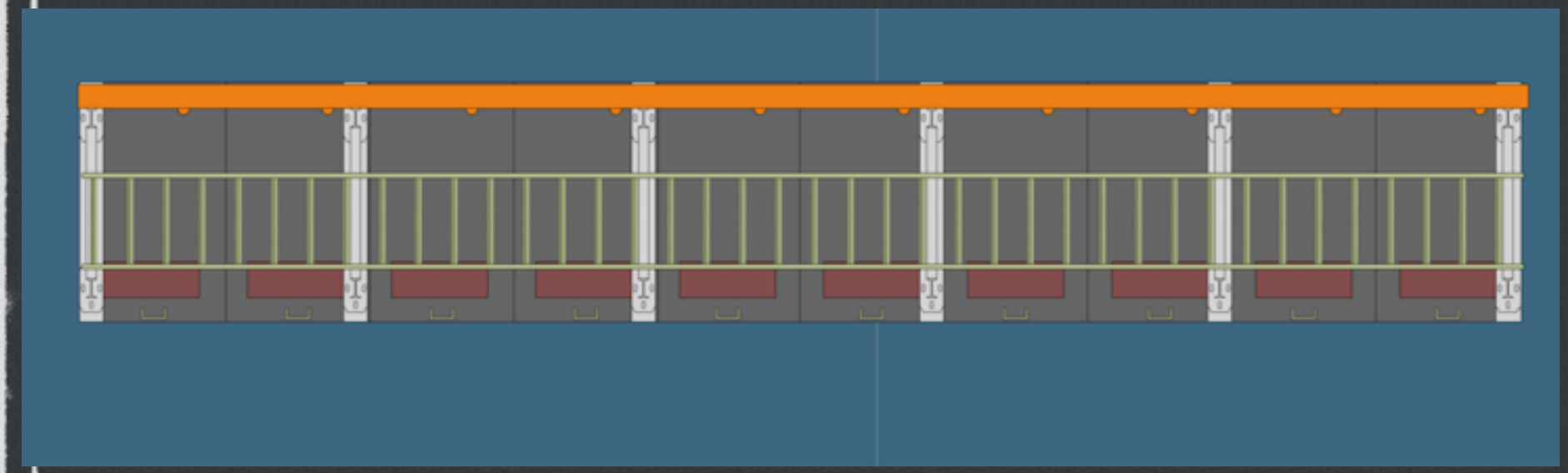
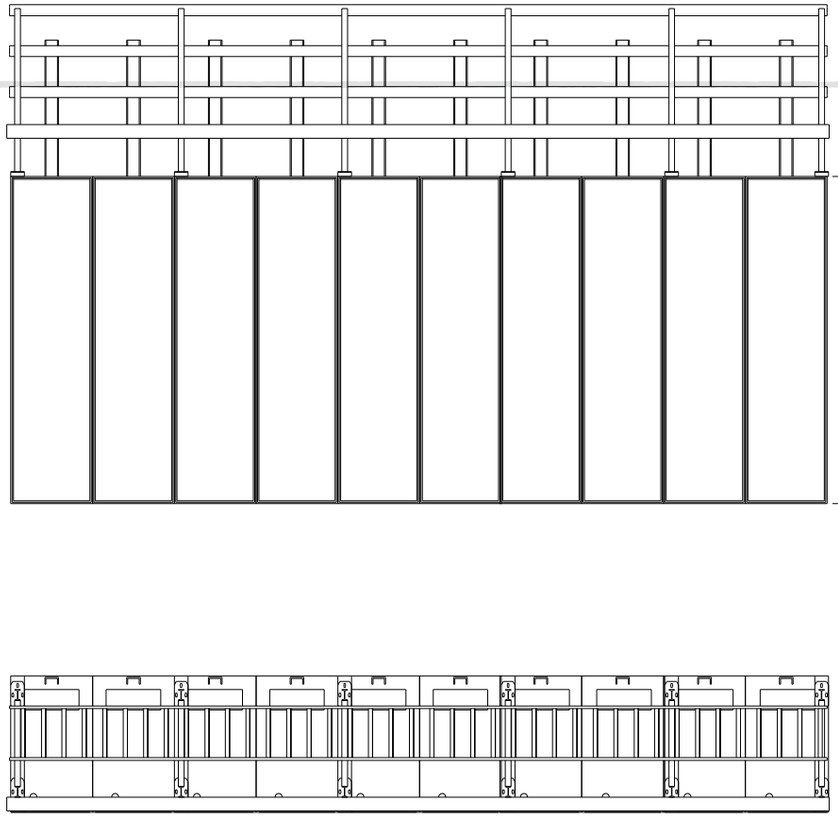
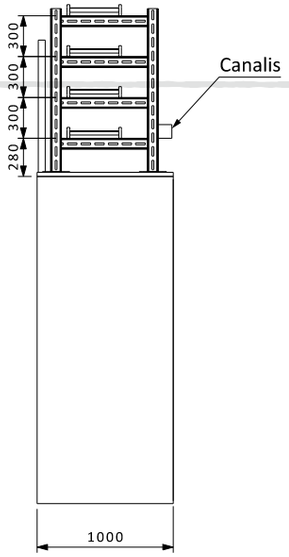
integrated design for one rack row- views

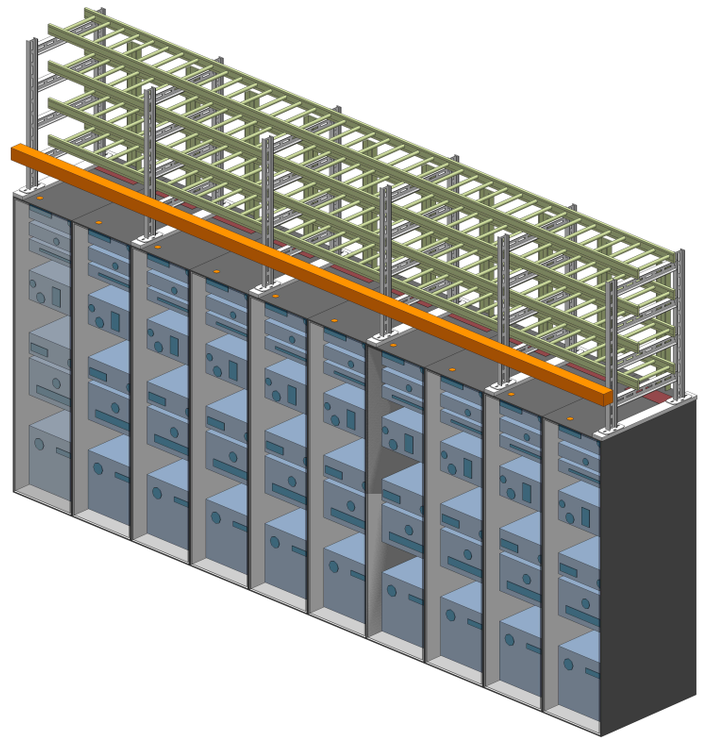




integrated design for one rack row







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

Heat management- cooling design- temperature requirements- input specifications

EUROPEAN SPALLATION SOURCE

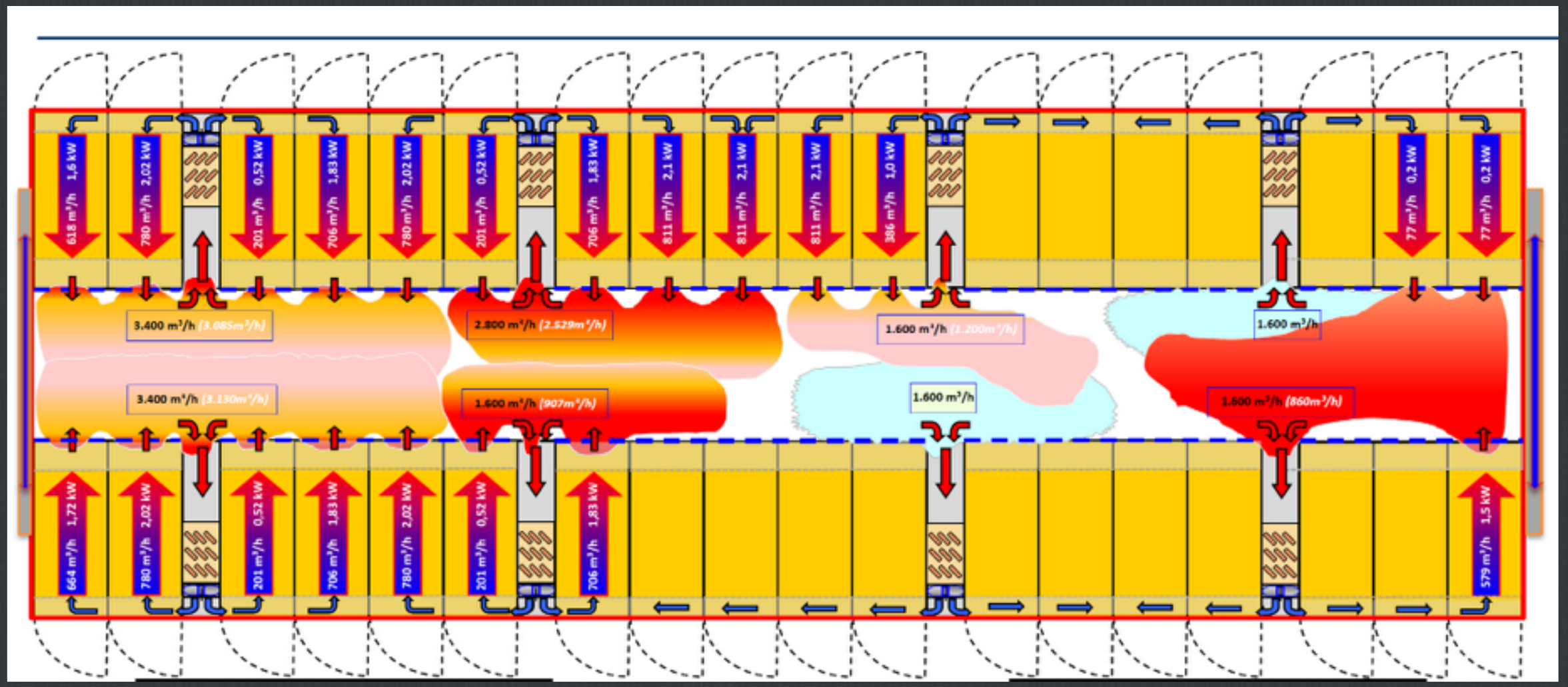
Rack equipment	Temperature	Temperature stability
LLRF	25°C	+/- 1°C
HPRF	22-25°C, Max 30°C	+/- 1°C
Vacuum	10-35°C	
BI	25°C	+/- 1°C
CTL	25°C	+/- 5°C
Cryomodules	25°C	+/- 5°C
PS	25°C	+/- 10°C
MPS	25°C	+/- 5°C
ICS	25°C	+/- 10°C
PSS	25°C	+/- 5°C
TSS	25°C	+/- 5°C

- **CW temperature: 12° C feed**
- **Max. acceptable delta p = 3 bar.**
- **Return Air temperature and humidity: Cold side temperature should be 25°C, equipment delta T expected to be around 8-10 .**
- **Humidity 80%**
- **the crates should have front-to-back cooling fans**

Heat management- cooling design- “hot aisle”

EUROPEAN SPALLATION SOURCE

- all the cooling solutions suggested by the vendors we’ve been in contact with, converge to the adoption of the “hot aisle” solution for the cooling
- from the “space allocation spreadsheet”, the designer can see the air flow that is needed, based on the heat dissipation
- 11.500 m./h= Calculated air volume based on the total heat dissipation of 30 kW and the specified dT of 8° K



Heat management- cooling design- how it works

EUROPEAN SPALLATION SOURCE

	Total available air volume 8 SHX3D		air volume demand	Usage rate		Calculation	
1.600m³/h	30%	12.800 m³/h	11.580 m³/h	90,5%	Cooling demand	30,00 kW	5
2.200m³/h	40%	17.600 m³/h	11.580 m³/h	65,8%	Air volume demand	11.580 m³/h	6
2.800m³/h	50%	22.400 m³/h	11.580 m³/h	51,7%	Available air volume at 60%	27.200 m³/h	7
3.400m³/h	60%	27.200 m³/h	11.580 m³/h	42,6%	Usage rate at 60%	42,6%	8
3.800m³/h	65%	30.400 m³/h	11.580 m³/h	38,1%	Power consumption at 60%	2,80kW	9
4.100m³/h	70%	32.800 m³/h	11.580 m³/h	35,3%	Available air volume variable	17.600 m³/h	10
4.400m³/h	75%	35.200 m³/h	11.580 m³/h	32,9%	Usage rate variable	65,8%	11
4.800m³/h	80%	38.400 m³/h	11.580 m³/h	30,2%	Power consumption variable	1,98kW	12
5.600m³/h	100%	44.800 m³/h	11.580 m³/h	25,8%	Energy savings	29%	13
	1	2	3	4			

	Available air volume 7 SHX3D		Air volume demand	Usage rate	Power consumption
30%	11.200 m³/h	11.580 m³/h	103,4%	0,2kW	
40%	15.400 m³/h	11.580 m³/h	75,2%	0,26kW	
50%	19.600 m³/h	11.580 m³/h	59,1%	0,28kW	
60%	23.800 m³/h	11.580 m³/h	48,7%	0,35kW	
65%	26.600 m³/h	11.580 m³/h	43,5%	0,43kW	
70%	28.700 m³/h	11.580 m³/h	40,3%	0,51kW	
75%	30.800 m³/h	11.580 m³/h	37,6%	0,63kW	
80%	33.600 m³/h	11.580 m³/h	34,5%	0,76kW	
100%	39.200 m³/h	11.580 m³/h	29,5%	1,08kW	
	14			15	

Remarks:

1. Adjusted speed of the SHX fans (min. 30%)
2. ∑ Air volume of all SHX at fan speed shown in column 1. (min. 30% -> 1600 m³/h each SHX , 8x SHX providing 12.800 m³/h)
3. Required air volume due to the specified total heat dissipation of 30 W.
4. Usage rate of the availabe air flow at fan speed 30% (11.580 m³/h / 12.800m³/h x 100 = 90,5%). Spare volume = 9,5 % 1.120 m³/h.
5. 30 kW = ∑ Power requirement specified by ESS
6. 11.500 m³/h = Calculated air volume based on the total heat dissipation of 30K and the specified dT of 8° K
7. 27.200 m³/h = ∑ Air volume provided by all SHX if the fan speed of all SHX is adjusted at 60%.
8. 42,6% = Used air volume of the available air volume of 27.200 m³/h.
9. 2,80kW = Required energy if all fans are working with a speed of 60%.
10. 17.600 m³/h = 2x SHX working with 60% fan speed + 1x SHX with 50% + 5x SHX with 30%
    (2x 3.400 m³/h + 1x 2.800 m³/h + 5x 1.600 m³/h = 17.600 m³/h)
12. 1,98kW = Required energy if the fans of SHX are working with different fan speed.
13. 29% = 1,98 kW/2,80 kW x 100
14. This sheets shows the situation if only 7 SHX are working.
15. This column shows the power consumption of each SHX in relation with the fan speed.

Rack row cooling- advantages of the hot aisles

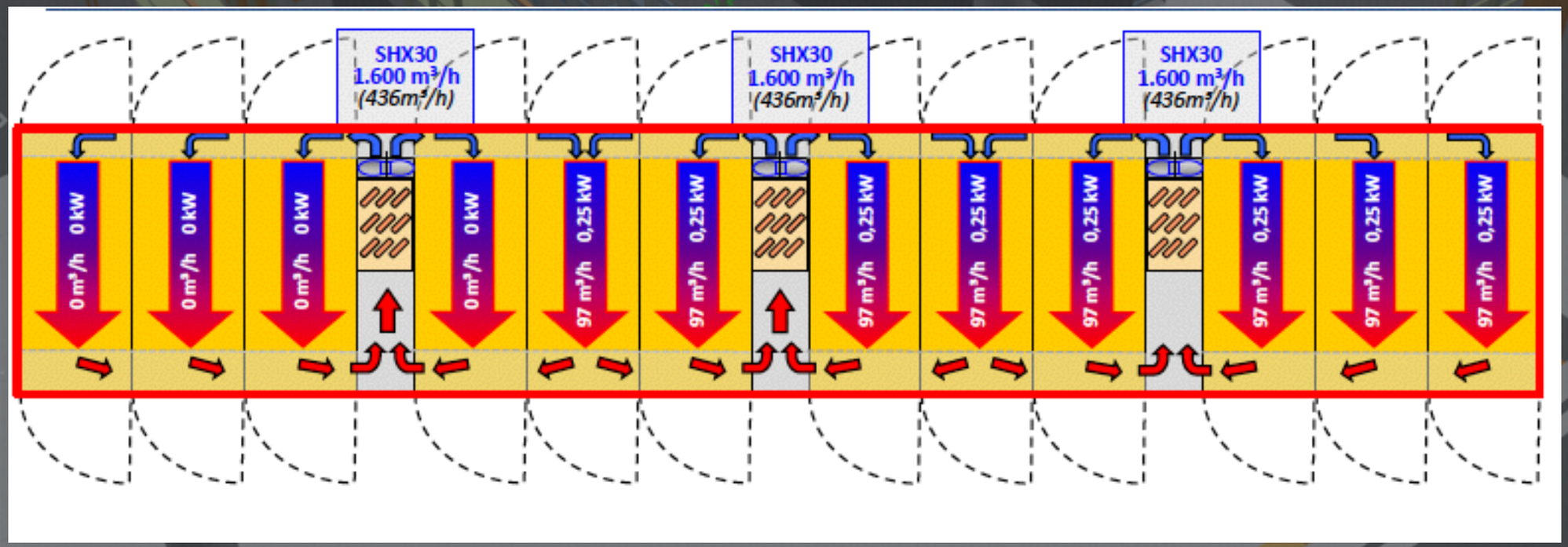
EUROPEAN SPALLATION SOURCE

- ☐ Symmetrical configuration of racks and in-row coolers that provides homogenous air flow in front of all the racks
- ☐ it covers all the air flow needs due to the different heat loads and temperature stability.
- ☐ Redundancy mode is considered in case of failures of in-row-coolers.
- ☐ It allows a variation of fan speeds depending on the heat loads in the different sectors and provides options for energy savings.
- ☐ energy consumption for 8 coolers at 80% fan speed: 1,9kW
- ☐ status of coolers can be monitored at the control room

FEB- rack row cooling

EUROPEAN SPALLATION SOURCE

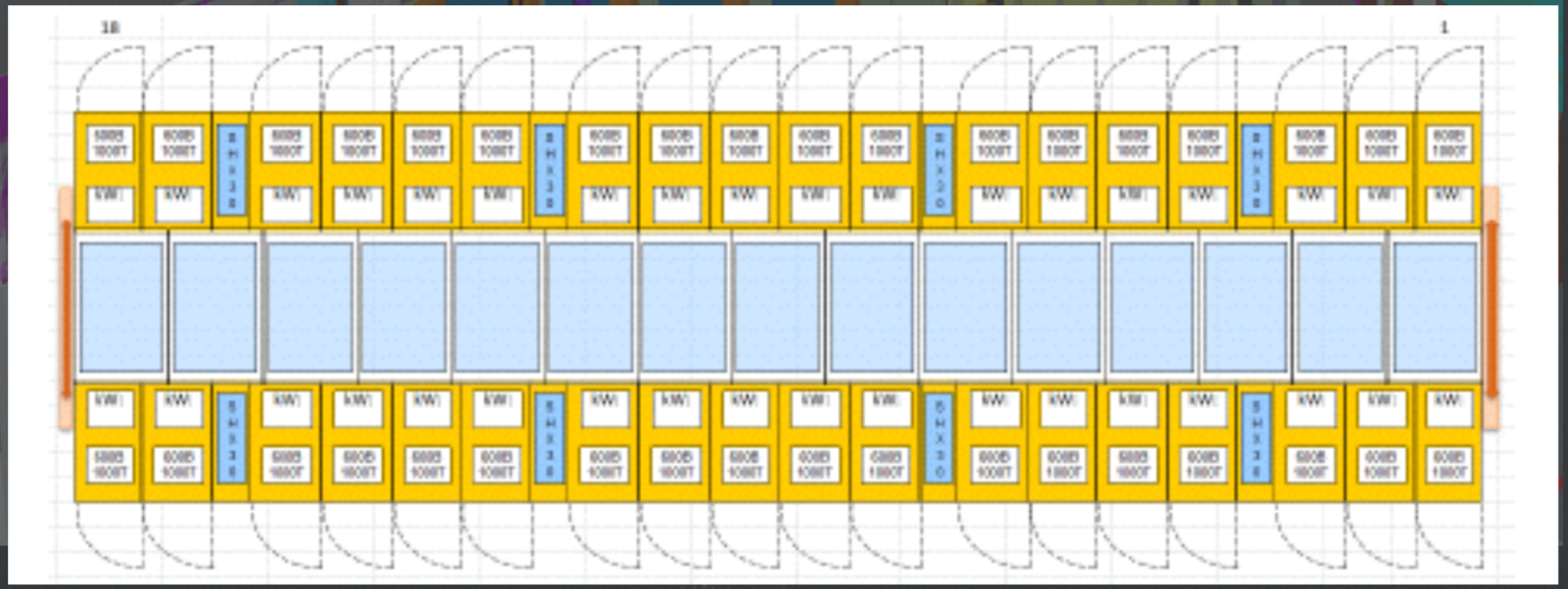
- ☐ 54 racks in 5 rows
- ☐ In line coolers



Gallery- DTL, SPK, MBL, HBL sections- rack row cooling

EUROPEAN SPALLATION SOURCE

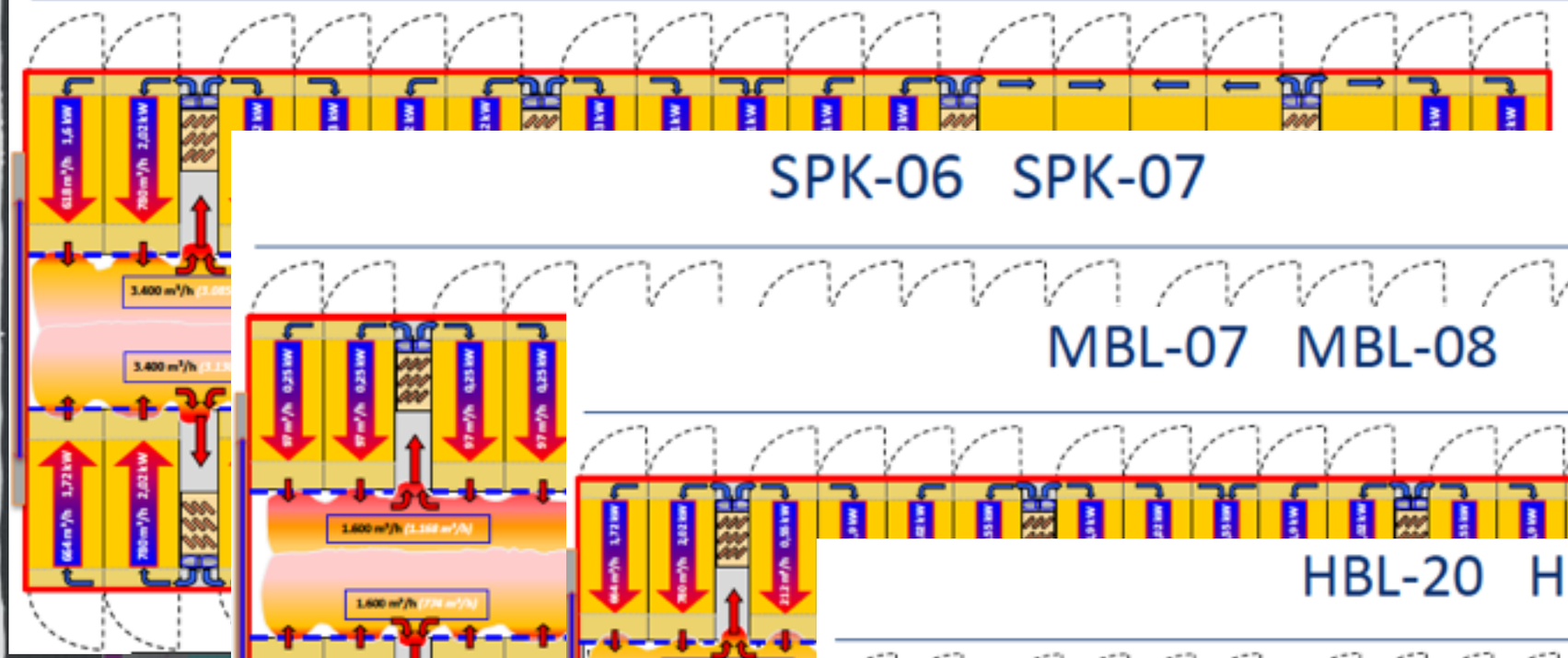
- In the gallery, the 40 rack rows (with the exception of HEBT and test Stand) are grouped together by two(back-to-back), leaving a 1,2-meter distance between them, forming a “hot aisle”. The glassed-door front will be facing the gallery side. The aisle will be closed with one sliding door, allowing easy access to people servicing the equipment.
- the aisle should be equipped with its own independent light and smoke detectors. The aisle is 12m long, and has one exit. CF fire safety engineers have confirmed that there is no need for a second one.

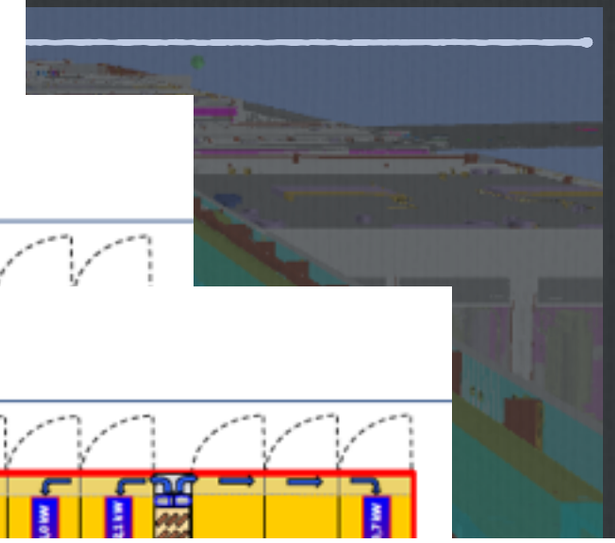


Gallery- DTL, SPK, MBL, HBL

EUROPEAN SPALLATION SOURCE

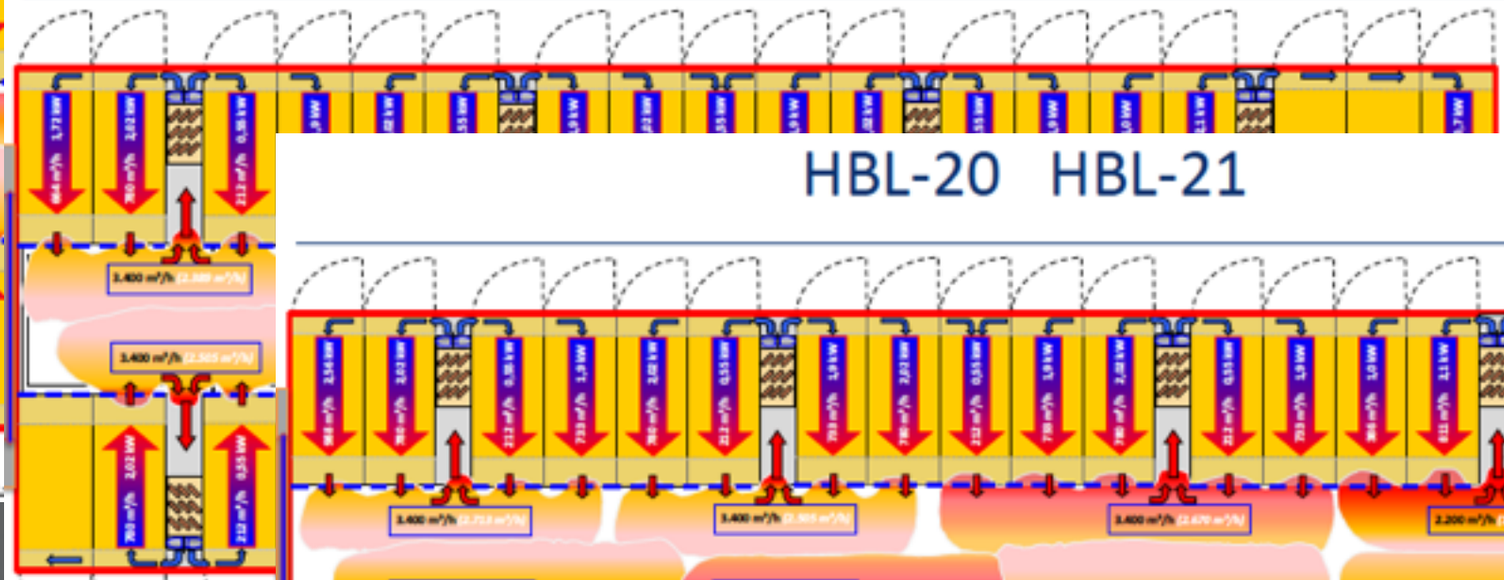
DTL-01 DTL-02

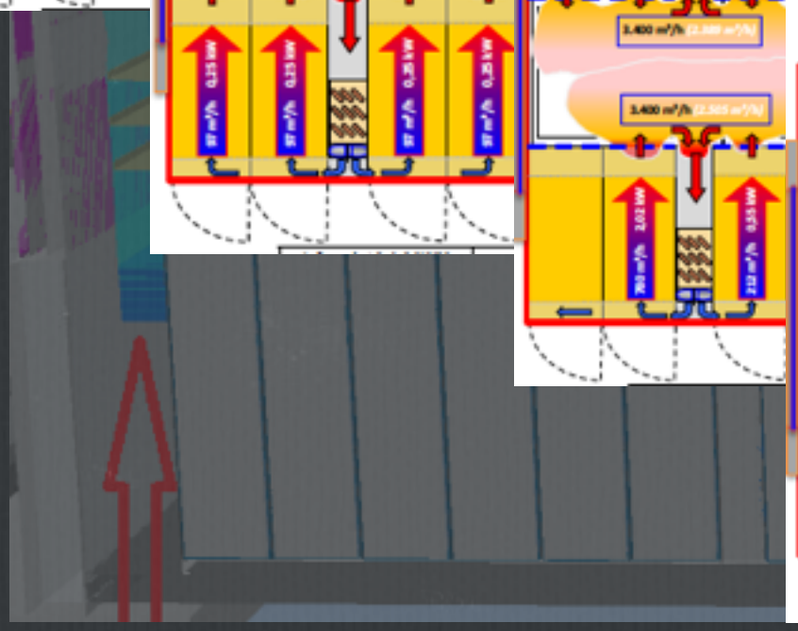




SPK-06 SPK-07

MBL-07 MBL-08



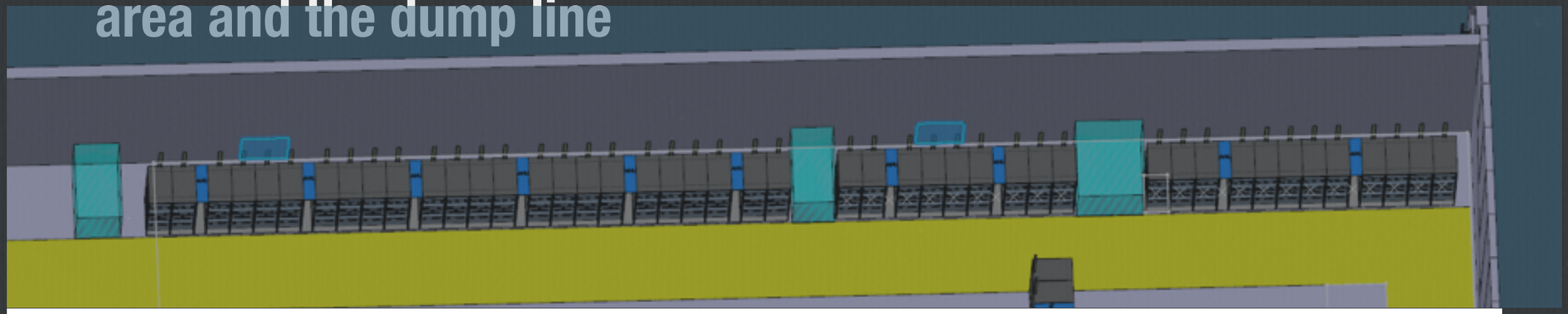


HBL-20 HBL-21

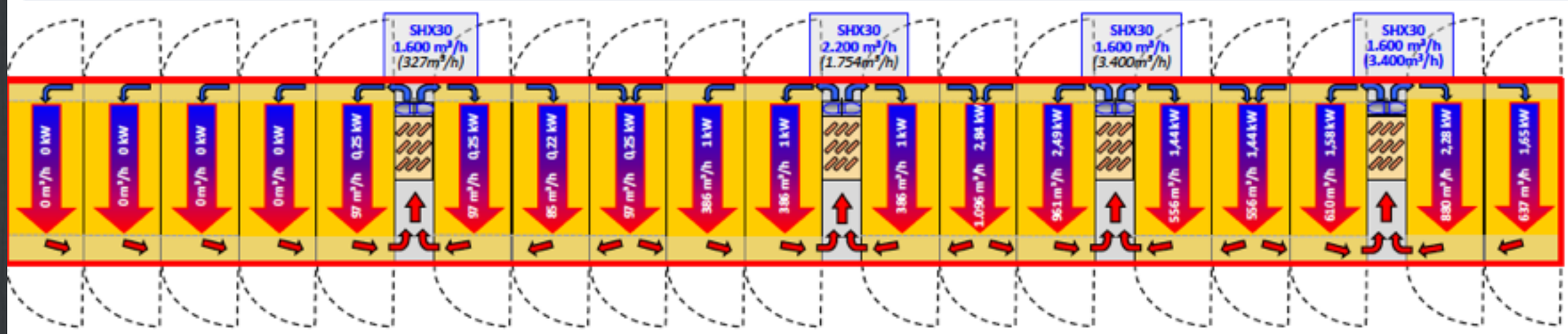
HEBT

EUROPEAN SPALLATION SOURCE

- 44 racks servicing ALL the equipment up to the A2T area and the dump line



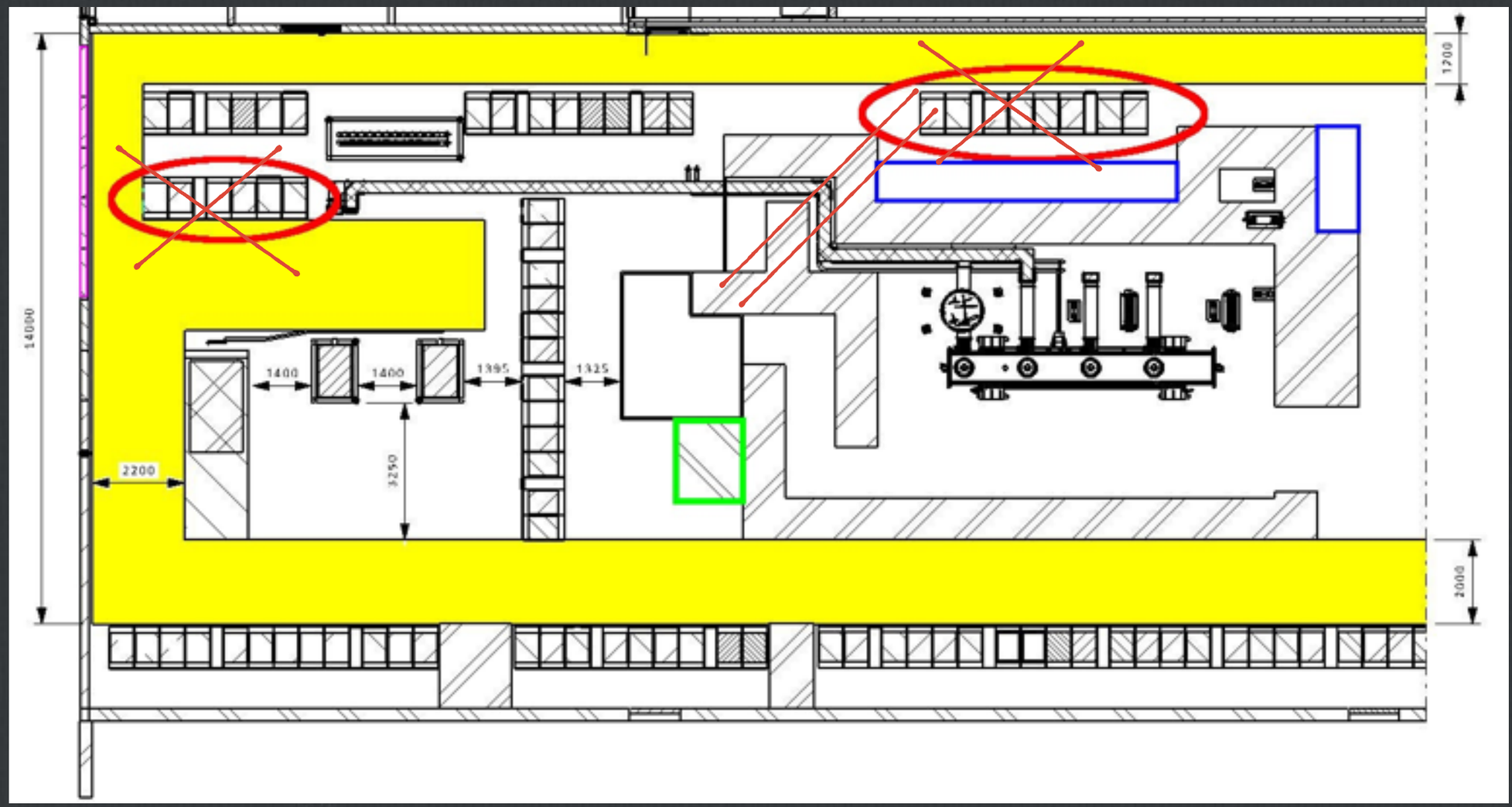
HEBT-02



Test Stand Area

EUROPEAN SPALLATION SOURCE

- 26 racks- same cooling idea with in-row coolers



Gallery Supporting Area

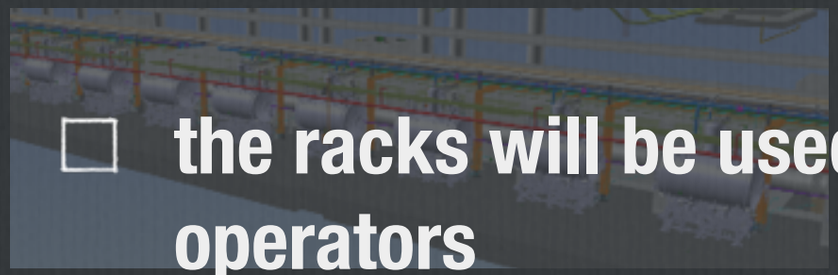
EUROPEAN SPALLATION SOURCE

- ☐ cable duct connecting GSA with A2T
- ☐ power and water requirements communicated to CF
- ☐ envelope definition drawing ESS-0006000.16

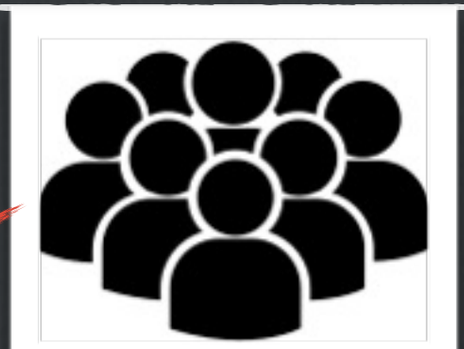
Rack Name	System
A2T-010ROW:CNPW-U-001	PS-Raster Magnets
A2T-010ROW:CNPW-U-002	PS-Raster Magnets
A2T-010ROW:CNPW-U-003	PS-Raster Magnets
A2T-010ROW:CNPW-U-004	BI
A2T-010ROW:CNPW-U-005	BI
A2T-010ROW:CNPW-U-006	BI
A2T-010ROW:CNPW-U-007	BI
A2T-010ROW:CNPW-U-008	MPS
A2T-010ROW:CNPW-U-009	ICS

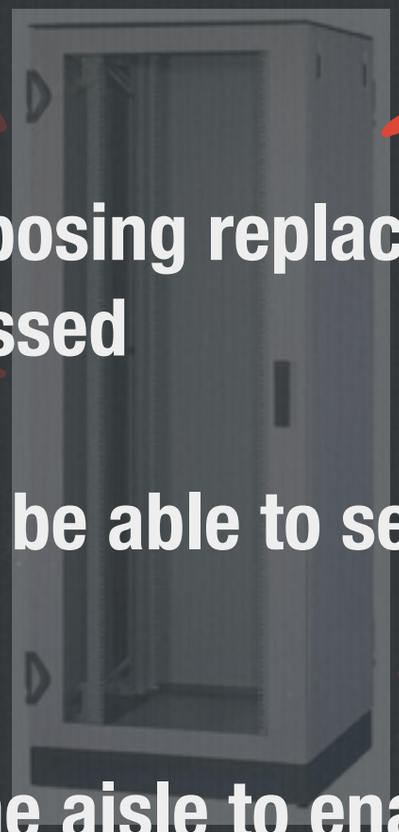
other issues to consider- Operation Phase

EUROPEAN SPALLATION SOURCE



- ☐ the racks will be used for 40 years by many operators





- ☐ Retrofitting options and posing replacement of racks had to be addressed

- ☐ Glass door in the front to be able to see all the warning lights

- ☐ sufficient space inside the aisle to enable access with a test bench

Putting it all together-Does the design meet the requirements?

EUROPEAN SPALLATION SOURCE

- ☐ How many racks are needed per section?
  - Documented in Appendix 2
- ☐ What is the expected power consumption? need for UPS?
  - Documented in Appendix 2, communicated to CF as an interface requirement with conventional power
- ☐ What is the total heat dissipation per rack?
  - Documented in Appendix 2, communicated to WP16 as an interface requirement
- ☐ What is the desired temperature inside the rack and how much can it vary?
  - Documented in Appendix 2, implemented by the cooling design
- ☐ Are there any mechanical protection or EMC issues that should be factored?
  - Documented in Appendix 3, by having different rack types
- ☐ What is the optimal position of the rack inside the row?
  - Documented in Appendix 2
- ☐ What is the population and installation scheme? What is the agreement this the partners?
  - the statement of work specifies that the design should be flexible and it shall allow the removal and reinstallation of one rack without undermining the structural integrity of the rack row

Documentation Overview

EUROPEAN SPALLATION SOURCE

- ☐ ESS-0085079
  - Statement of work
  - Envelope Definition (ESS-0085079.2_
  - Rack count and space allocation
  - Rack Types Definition
  - Installation Plan
  - Mechanical Design basic features (ESS-0086188)
- ☐ ESS-0025905, Naming and positioning

Market Survey on Rack Systems

EUROPEAN SPALLATION SOURCE

- ☐ APC- Schneider
- ☐ Rittal
- ☐ Pentair- Schroff
- ☐ Emerson
- ☐ Verotec

Putting it all together-2

EUROPEAN SPALLATION SOURCE

- ☐ The interfaces have been recognised, defined and documented
- ☐ The maturity of each system's design allows us to say that rack count can be considered complete
- ☐ The standard rack size and general configuration allows flexibility and fulfils the general requirements of the users
- ☐ The suggested cooling solutions from the vendors all converge to the same idea and adhere to the temperature requirements

Questions?

- thank you all for your attention, contribution and patience!!

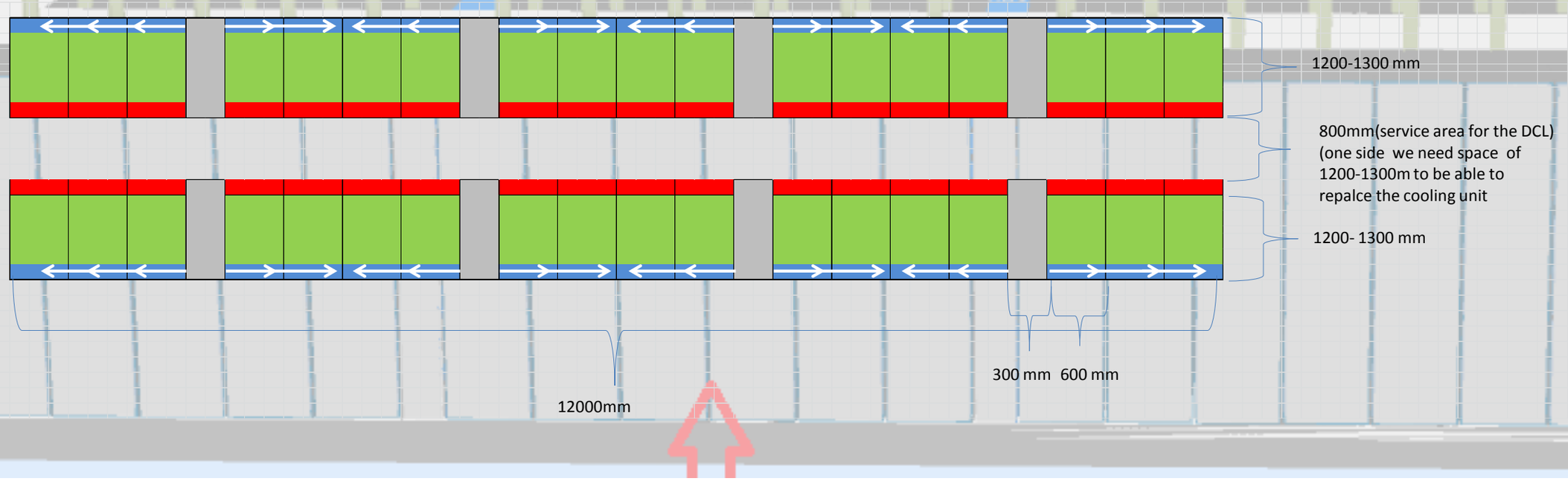
Brief History-Back up slide

EUROPEAN SPALLATION SOURCE

- Requirements' collection had been a marathon race that has lasted almost 3 years
- Eugene's first estimate had perfectly helped to establish the preliminary space envelope and power needs (that had to be communicated to CF)
- Even then the decision was to use only one common standard rack format for all the applications
- Rack Task Force established in April 2015 to confirm the total number of racks, optimise the rack count and sharing/co-habiting of racks as appropriate and establish a route to centralised procurement of racks- several meetings were held with all the groups of stakeholder
- The survey had enter up with a huge heat load
- Beginning of 2016 a new iteration of collection of requirements was initiated by Edgar- ending up with much clearer heat loads (1MW)

Gallery- Alternative Configuration

No need for hot aisle containement- totally contained free standing solution
Depth: 1200-1300 mm , Width: 300mm, Height: 2400mm
Total length row: 12 000mm with four cooling units per row
Lateral discharge of the air
Front cold side closed with the racks, back hot side opened Comfort cooled corridor/ room no redundancy- we will have to open the doors in case of raised temperatures



initial cooling concept for the aisles that had been rejected

EUROPEAN SPALLATION SOURCE