AREA INTEGRATION REPORT

INTEGRATION OF RR13 AND RR17 CAVERNS

Abstract

This document summarizes the changes in the RR13 and RR17 service caverns for the HL-LHC era.

It contains:

1) Equipment presently installed (01/10/2016)
2) The list of the necessary modifications in order to fulfill the requirements for the HL-LHC lay-out in reference (baseline June 2016)
3) The expected radiation levels which will serve as target values when defining the R2E requirements to be fulfilled by the equipment to be installed in the RR caverns

Each equipment owner requiring space in the LS3 in the above mentioned RRs shall provide request to the HL-LHC integration and be listed in this document, which will be the base for the preparation of the LS3 RRs activities and their phasing. In addition to being listed in this document they will commit to be compliant with the associated R2E qualification producedure and requirements for which the radiation environment here shown and serving as input.

Area affected by ionized radiation	**Yes**

TRACEABILITY

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Verified by: HL-LHC-WP15-CERN	***Date:*** 20YY-MM-DD
Approved by: WPL, P. Fessia as head of Integration	***Date:*** 20YY-MM-DD
Distribution: HL-LHC-WP15-CERN	

Rev. No.	***Date***	***Description of Changes*** *(major changes only, minor changes in EDMS)*
X.0	20YY-MM-DD	[Description of changes]

1 LOCATION OF RR13 AND RR17 CAVERNS

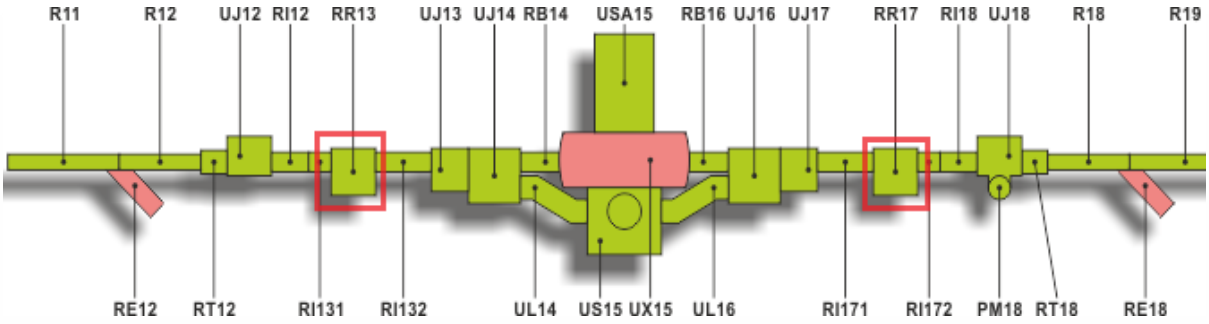


Figure 1: LHC Point-1 area layout showing the location of RR13 and RR17

2 EQUIPMENT AND ITS LOCATION AS OF 01/10/2016

Figures 2 and 3 give an overwiew of the installed equipment and its function in the RR13 cavern. Please note that the figures show only the RR13. RR17 is equivalent, only symmetric in its arrangement towards the interaction point. For more information please check “Point 1 – Equipment Inventory”, EMDS No: 1086566.

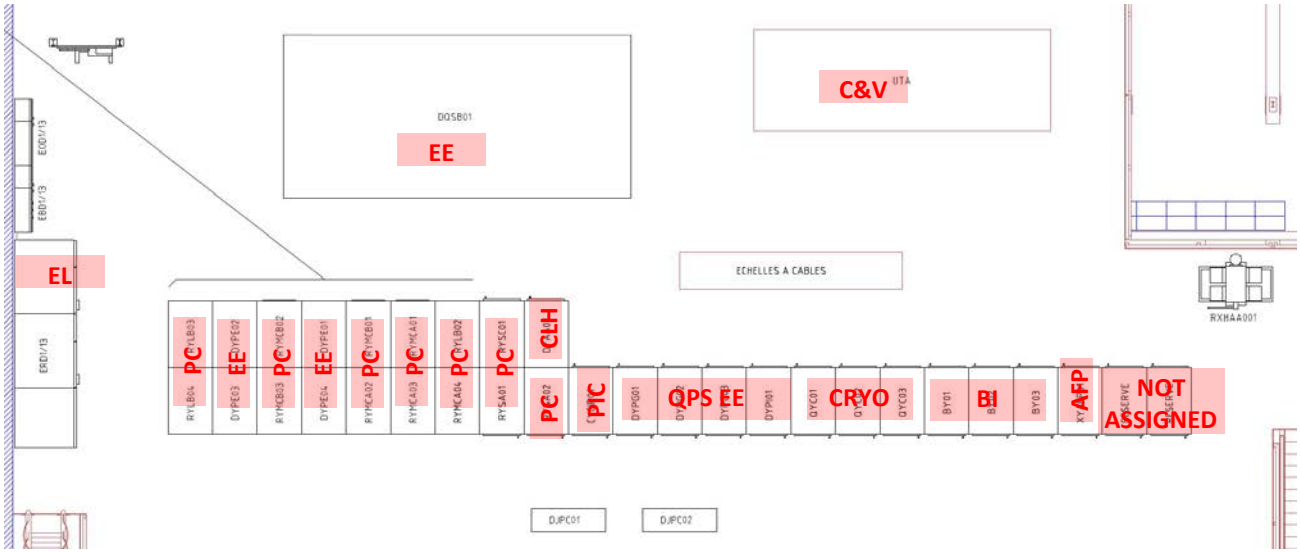


Figure 2: Present layout of the installed equipment in the first floor of RR13

Figure 3: Present layout of the installed equipment in the ground floor of RR1

The following figures are views of the Catia 3D model for RR13.

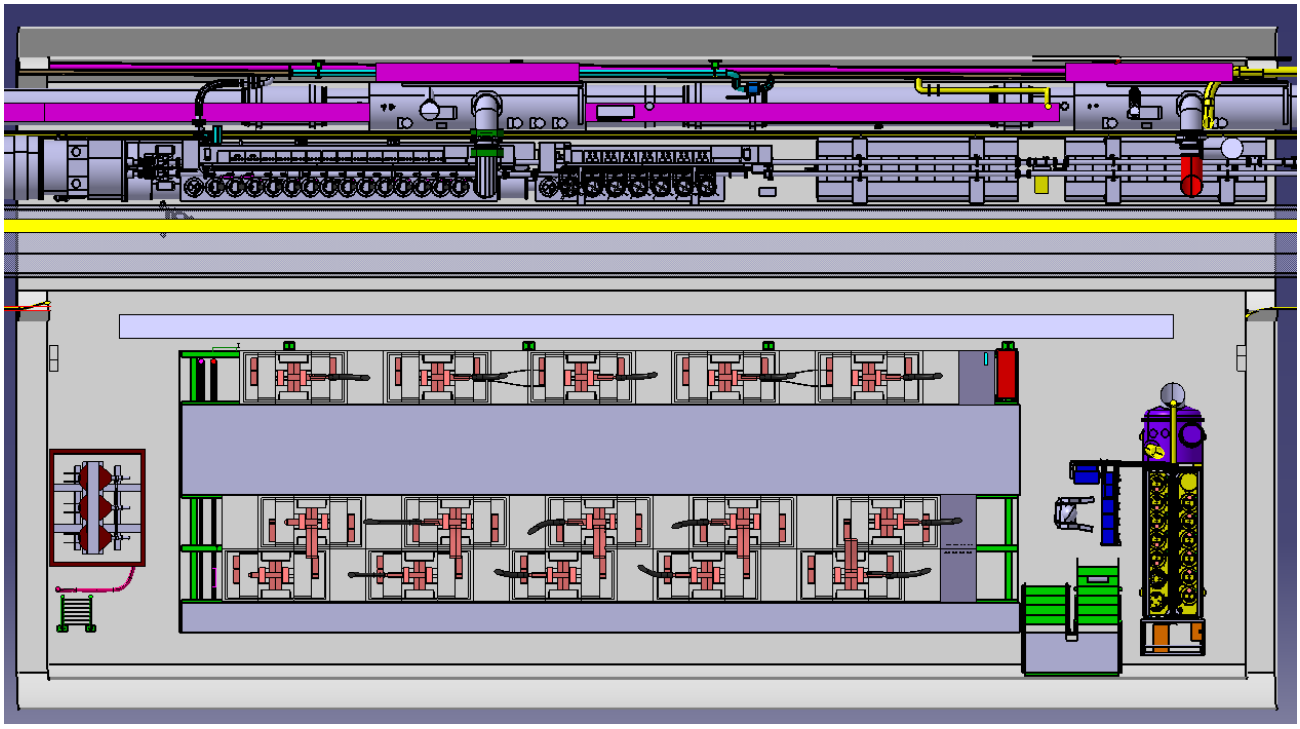


Figure 4: Present CAD drawing layout of the installed equipment in the ground floor of RR13 + LHC half cell, ST number ST0509462

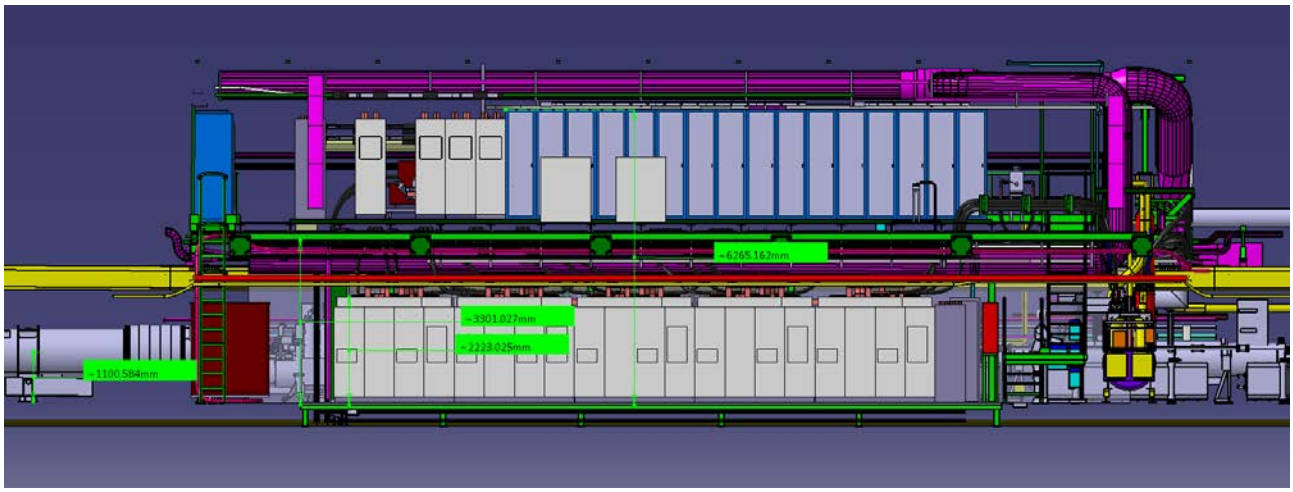


Figure 5: Present CAD drawing layout of the installed equipment in RR13 with equipment heights, ST number ST0509462

3 R2E RADIATION LEVELS FOR EQUIPMENT IN RR13/RR17

As specified in Chapter 10 of [HL-LHC TDR, 2016 update], the radiation levels in the RRs near P1 will be larger than what is expected from luminosity scaling of the present LHC levels (3.6×108 HEH/cm2 in average for the RadMon 2016 measurements and 20 fb-1 integrated luminosity) due to the tight settings expected for the TCL6 collimator for magnet protection purposes. The expected annual radiation levels according to the FLUKA simulations are shown in Table 1:

Table 1: Expected annual radiation levels for RR13 and RR17 according to the dedicated FLUKA study and considering an annual integrated luminosity of 250 fb^{-1}.

HEH fluence (cm^{-2})	~10^{10}
1 MeV neutron equivalent fluence (cm^{-2})	~10^{11}
Integrated Dose (Gy)	~10

The EDMS document number for RaDMon levels is:

4 CABLING DE-INSTALLATION

The next table contains the different systems and the EDMS number to the DEC (Demande d'enlevement de câbles, EDMS No 1314019) available for each system. A DEC will be completed by the users in case of the need for de-installing cables if the equipment is removed, if the cables have to be replaced or for integration reasons.

Table 2: List of systems and EDMS DEC No

System	Brief description	EDMS DEC No

5 CABLING INSTALLATION

The next table contains as well the different systems and the EDMS number to the DIC (Demande d'installation de câbles EDMS No 1210369 and 1301560) for new cables or modification of the existing ones available for each system. A DIC will be completed by the users in case of the need for installation or modification of cables.

Table 3: List of systems and EDMS number to DIC

System	Brief description	EDMS DIC No

6 LIST OF EQUIPMENT IN RR13/RR17 AND MODIFICATIONS

The Annex 1 consists of a table list with the present status as of October 2016 of all the equipment installed in the RR13/RR17 caverns and it describes its main users and owners. It also shows if the listed equipment will be kept, modified or de-installed for HL-LHC and the equipment installed instead. For the new equipment, r2e related comments are added as well (e.g, active, passive equipment, possible sensitive components, followed qualification procedure, etc.).

The racks becoming empty will be attributed to other systems following the request formulated in the table 4 of Annex 1. Their names will be changed in consequence; the layout drawings and database will be updated.

All the actions in place concerning the racks, new installation, removal or modification, have to be formulated through a DIR (Demande d'installation de racks, EDMS No 1391684).

6.1 RR13/17 layouts of equipment to be de-installed

The drawings in aAnnex 2, Figures 7, 8, 9 and 10 show the installed equipment and the status for HL-LHC. The equipments that will be de-installed are represented with a red cross. In floor 0, the power converter that feeds the D2 magnet will be de-installed and there will be space to install up to four racks with three PC (±120 A) to feed the orbit correctors (Q4, Q5 and Q6). In the first floor of RR13/RR17 the racks belonging to the Forward Detectors of ATLAS experiment will be de-installed. The components in racks feeding from Q1 to D2 will also be de-installed and they are represented with orange triangles. It is also identified in the drawings which racks are currently (LHC era) empty or serve as spares. These are noted with a yellow arrow.

Annexe 1

Table 4: Equipment installed in RR13 during LHC, its main users and equipment to be installed for HL-LHC

Type of System	Owner	Main Users[1]	Rack Identifier	Floor	Status	New equipment/ Comments	R2E Reference (Annex 3)
Powering Interlock Controller (PIC)	TE-MPE	PC, QPS, BIS, Cryogenics, UPS, AUG	CYCIP01	1	Modify		
Beam Position Monitors/Beam Loss Monitor	BE-BI	Beam Orbit reader	BY01	1	Modify		
			BY02	1	Modify		
			BY03	1	Empty/Spares		
Current Lead Heaters	TE-MPE	Temperature regulation of the top part of current leads	DYAA01	1	Modify		
Power Converters	TE-EPC	DFBL	RYLB01 (LHC120A/10V)	0	Keep		
			RYLC01 (LHC120A/10V)	0	Keep		
			RYLB02 (LHC120A/10V)	1	Keep		
			RYLB03 (LHC120A/10V)	1	Keep		
			RYLB04 (LHC120A/10V)	1	Keep		
	TE-EPC	Power Converters	RYMCB01 (LHC600A/10V)	1	Keep		
			RYMCB02 (LHC600A/10V)	1	Keep		

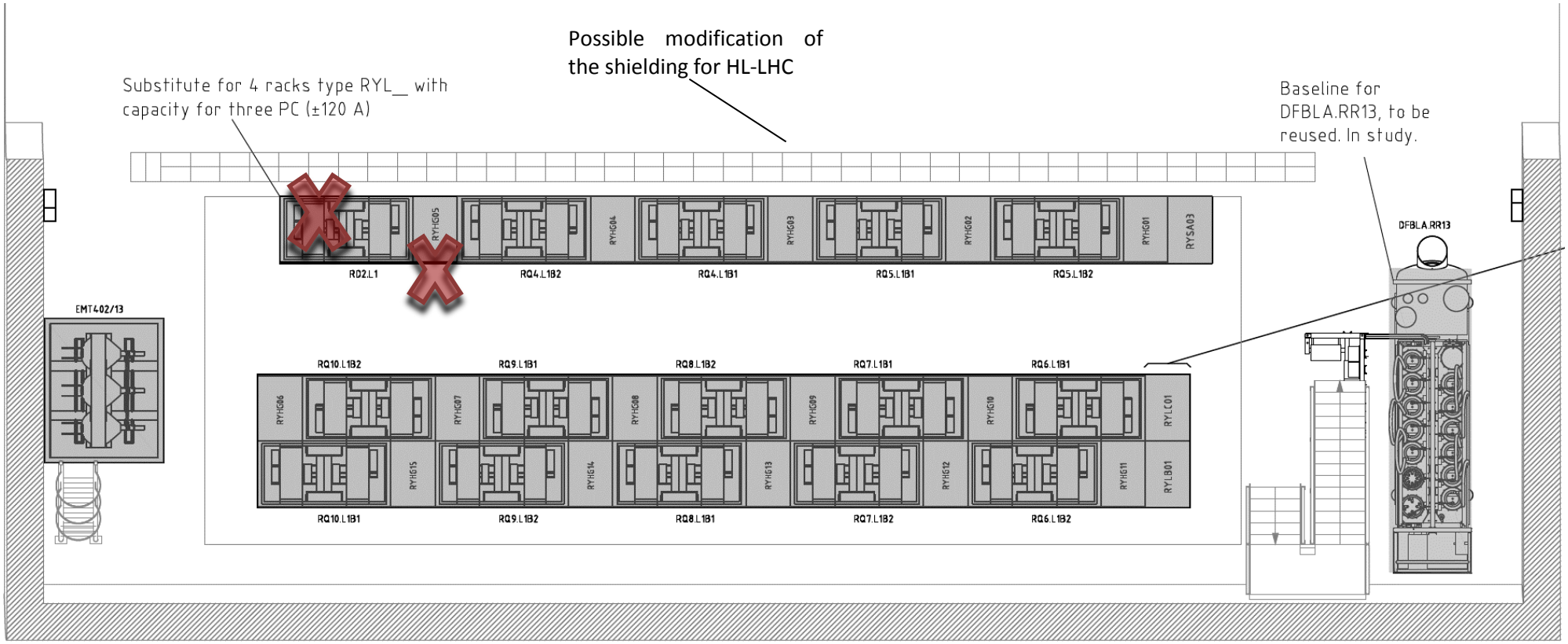
[1]"Point 1 Equipment Inventory", G. Spiezia, M. Brugger. EDMS No 1086566

			RYMCB03 (LHC600A/10V)	1	Keep		
			RYMCA01 (LHC600A/10V)	1	Keep		
			RYMCA02 (LHC600A/10V)	1	Keep		
			RYMCA03 (LHC600A/10V)	1	Keep		
			RYMCA04 (LHC600A/10V)	1	Keep		
			RYSA01 (Spares parts), RYSA02 (Spares parts)	1	Empty/Spares		
			RYSC01 (Powered spares)	1	Empty/Spares		
			RYSA03 (Powered spares)	0	Empty/Spares		
	TE-EPC	RQ5.L1B2 RQ5L1B1	RYHG01 (6kA) RYHG02 (6kA)	0	Keep		
	TE-EPC	RQ4.L1B1 RQ4.L1B2	RYHG03 (6kA) RYHG04 (6kA)	0	Keep		
	TE-EPC	RD2.L1	RYHG05 (6kA)	0	To de-install	Space to install up to four racks with three PC (±120 A) Type RYL%	
	TE-EPC	RQ10.L1B2 RQ10.L1B1	RYHG06 (6kA) RYHG15 (6kA	0	Keep		
	TE-EPC	RQ9.L1B2 RQ9.L1B1	RYHG07 (6kA) RYHG14 (6kA)	0	Keep		
	TE-EPC	RQ8.L1B2 RQ8.L1B1	RYHG08 (6kA) RYHG13 (6kA)	0	Keep		
	TE-EPC	RQ7.L1B2 RQ7.L1B1	RYHG09 (6kA) RYHG12 (6kA)	0	Keep		
	TE-EPC	RQ6.L1B2 RQ6.L1B1	RYHG10 (6kA) RYHG11 (6kA)	0	Keep		

Energy Extraction Switch for Dipole Magnets	TE-MPE	Dipole Magnets	DQSB01	1	Keep		
Energy Extraction	TE-MPE	Interface module for 13 kA EE system	DYPI01	1	Modify		
General Quench Protection	TE-MPE	Protection D2, Q7, Q8, Q9, Q10	DYPG01	1	Modify		
General Quench Protection	TE-MPE	Protection Q4, Q5, arc correctors	DYPG02	1	Keep		
General Quench Protection	TE-MPE	Protection Q6, arc correctors, protection main circuits	DYPG03	1	Modify		
Energy Extraction	TE-MPE	600 A energy extraction systems	DYPE01	1	Keep		
			DYPE02	1	Keep		
			DYPE03	1	Keep		
			DYPE04	1	Keep		
Cryogenics Instrumentation and Electronics	TE-CRG	Conditioners, measuring temperature, pressure, liquid helium level and digital valves status; Actuators, providing AC and DC power.	QYC01	1	Keep		
			QYC02,	1	Keep		
			QYC03 (Spare)	1	Keep		
Rack experiment AFP (Atlas Forward Proton)	ATLAS	Atlas Forward Proton Experiment	XYAFP01	1	Empty	Change status to “not assigned”	
Empty rack	Not assigned	Not assigned	Reserve	1	Empty	Assign to QPS WP7 for D2 protection	
Empty rack	Not assigned	Not assigned	Reserve	1	Empty		
Electric equipment	EN-EL	Equipment inside RR13/17	ERD1/13	1	Modify	1 feeder of 16 A, per new PC (±120) rack	

			EBD1/13, EOD1/13,	1	Keep		
Electric equipment, Transfo 18KV/0.4KV 0.63VA	EN-EL	Equipment inside RR13/17	EMT402/13	0	Keep		
Cooling and Ventilation Equipment	EN-CV	LHC Tunnel/Caverns ventilation	UTA	1	Keep		
Polarity inversor	TE-EPC	Equipment inside RR13/17	RXHAA001	1	Keep	Not in use	
EE switch cabinets	Unknown	Electric	DJPC01, DJPC02	1	Keep		

Annexe 2



To de-install

Figure 6: RR13 Floor 0 equipment to be removed

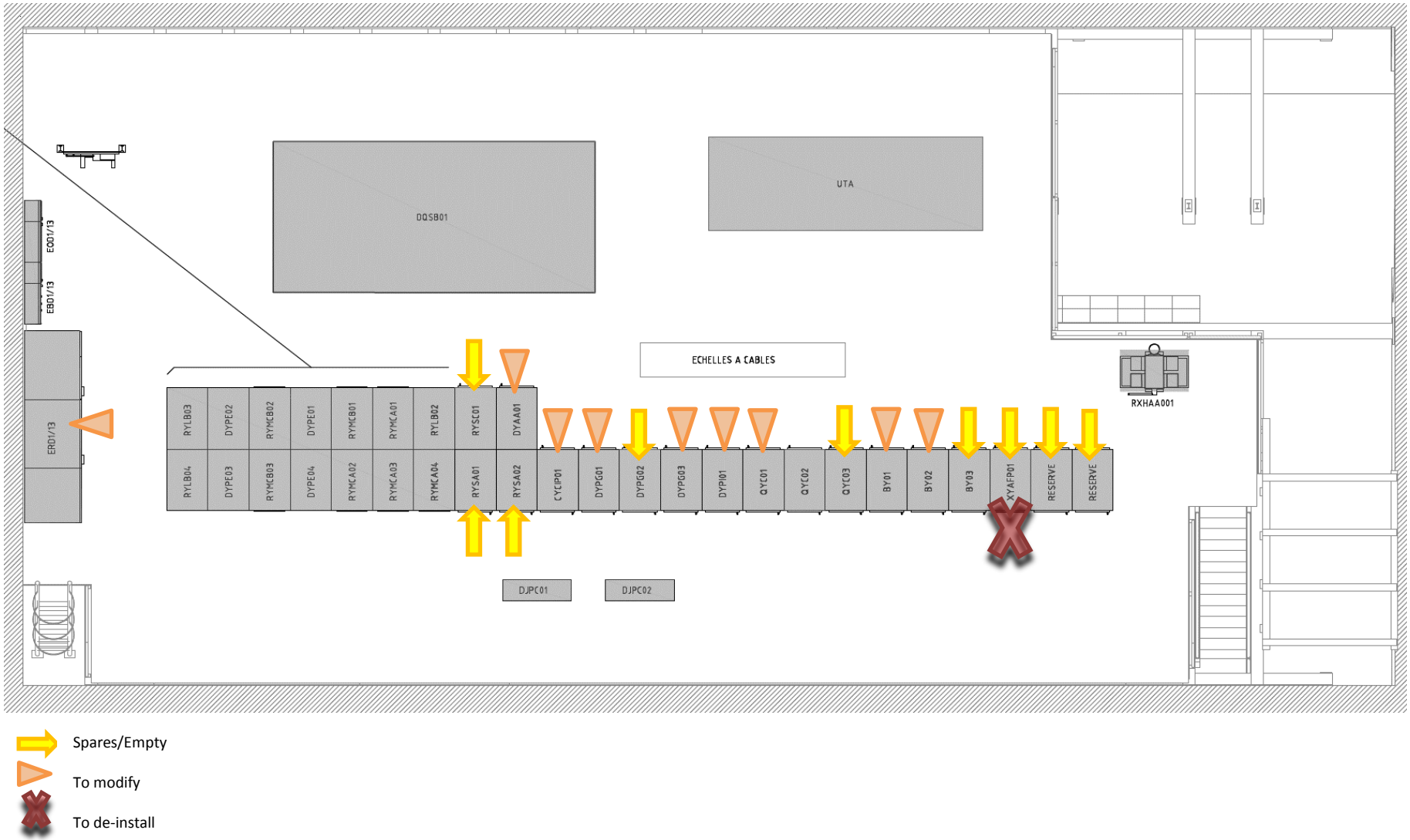


Figure 7: RR13 Floor 1 equipment to be removed

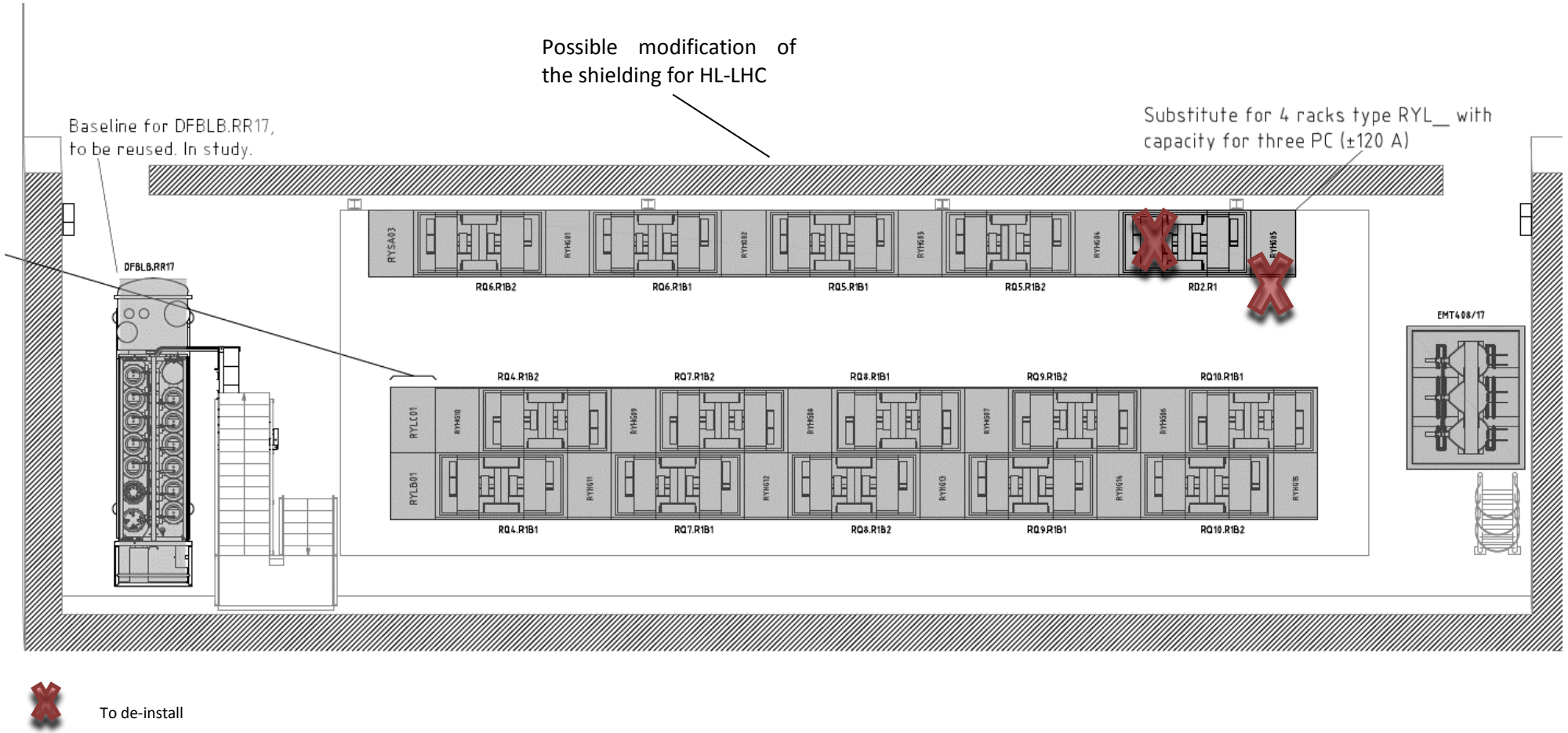


Figure 8: RR17 Floor 0 equipment to be removed

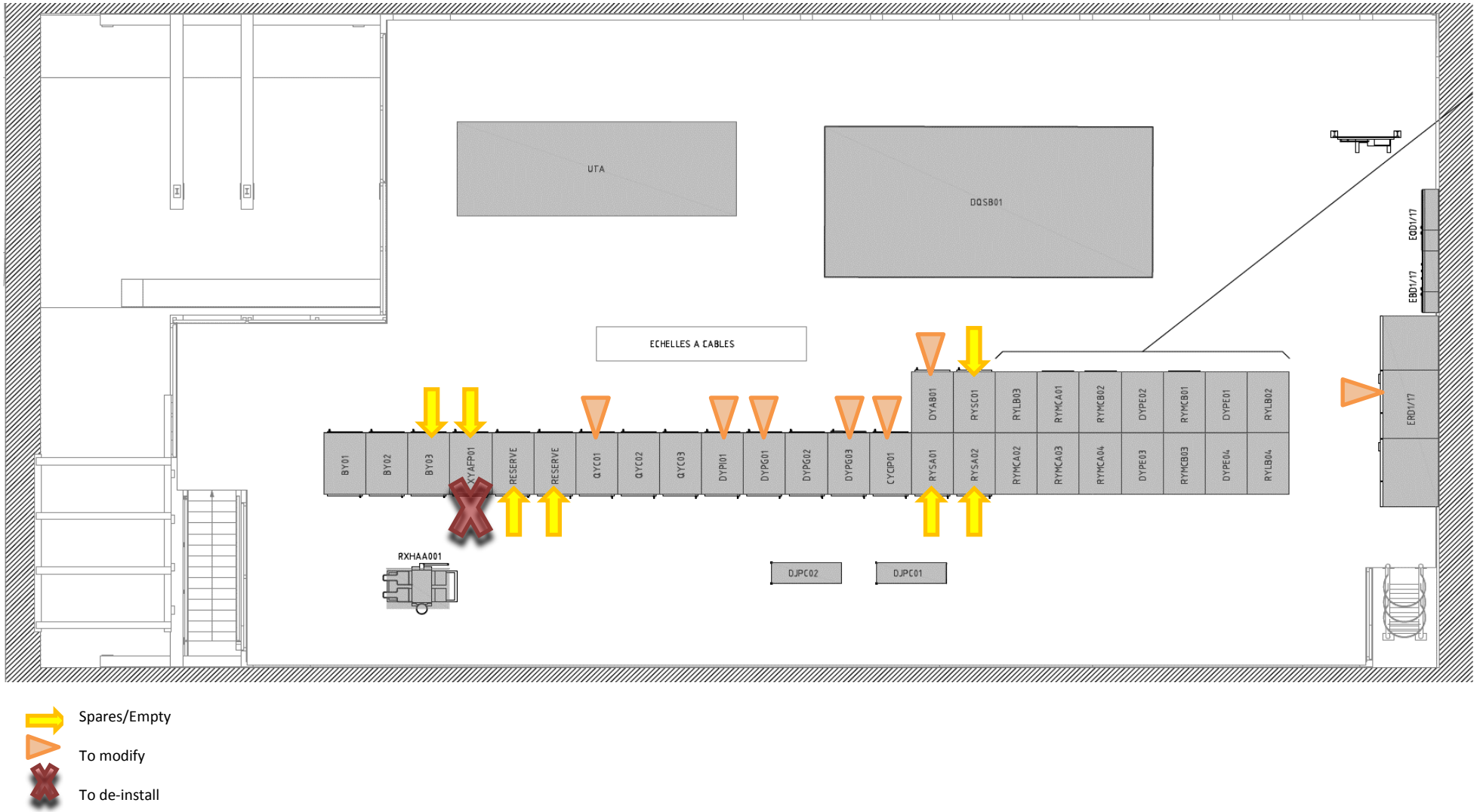


Figure 9: RR17 Floor 1 equipment to be removed

Annexe 3

Table 5: R2E Approval equipment log

R2E Reference	Request for approval date	Approval date	EDMS No to the approval document

Annexe 4

See approval process of the document, EDMS No 1748251.