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WORK PACKAGE ANALYSIS

Installation of the CC Full Assembly DURING THE LONG SHUTDOWN 2
LHC – P2

ABSTRACT:

This document describes the list of activities related to the installation of the CC Full Assembly in LHC P2 (HL-LHC WP11) which will take place during the Long shutdown 2 (LS2), and covers all organisational, logistics and safety aspects.

PLAN :??
ECR : LHC-LE-EC-0005
Track* :

**référence EN-ACE*

DOCUMENT PREPARED BY:	DOCUMENT TO BE CHECKED BY:	DOCUMENT TO BE APPROVED BY:
Daniel Schoerling Sebastien Elias Bustamante [Representative of the Coordination Unit EN-ACE] [Representative HSE-RP] [Representative EN-HE] [Representatives from the concerned groups]	[Group Leaders] [DSO] [Representative from the LS2 Committee]	[Department Heads] J.M. Jimenez

DOCUMENT SENT FOR INFORMATION TO:

[List of persons this document must be sent to]

HISTORY OF CHANGES

REV. NO.	DATE	PAGES	DESCRIPTIONS OF THE CHANGES
0.0	201X-XX-XX	n	

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All grey areas are reserved for the EN-ACE Coordination Unit and cannot be modified.

Chapters appearing in blue can be filled in directly in the document or by using the Excel sheet at your disposal as an annex.

1. GENERAL INFORMATION AND PLANNING

1.1 GENERAL DESCRIPTION

It is foreseen to substitute in the DS region at point 2 two ~12 m long connection cryostats each with a cryo-assembly composed by a pair of 5.3 m-long cryostats with in the middle a 2.2m long bypass cryostat in which is hosted the TCLD collimator. Thanks to this change the luminosity foreseen for the ion collision after LS2, following the ALICE upgrade, can be reached without surpassing the quench limit of the MB and MQ superconducting circuits.

This document aims at presenting a complete list of all activities required to ensure the installation. In detail, it includes:

- All the preparatory works required for the installation of the new cryo-assemblies in the two before mentioned locations;
- The installation of all the equipment required to ensure magnet powering and magnet protection;
- The installation and connection of the two cryo-assemblies in the LHC;
- The tests required for quality assurance, compliance with safety, functional and operational requirements.

This document does not describe:

- the activities related to the removal of the presently installed LEBR.11L2 and LECL.11R2. The execution of these activities will be shared with DISMAC and magnet replacement projects. The details of these activities are presented in the DISMAC WPA in detail (EDMS xxxx)
- the activities related to the TCLD installation in the bypass cryostat. This activity is described in detail in the TCLD WPA (EDMS xxxx). In this document, all preparatory work, which needs to be finalized before the CC installation, is mentioned and taken into account in the presented schedules.

1.2 ORGANISATION

The organigram of WP11 is provided in Fig. 1.

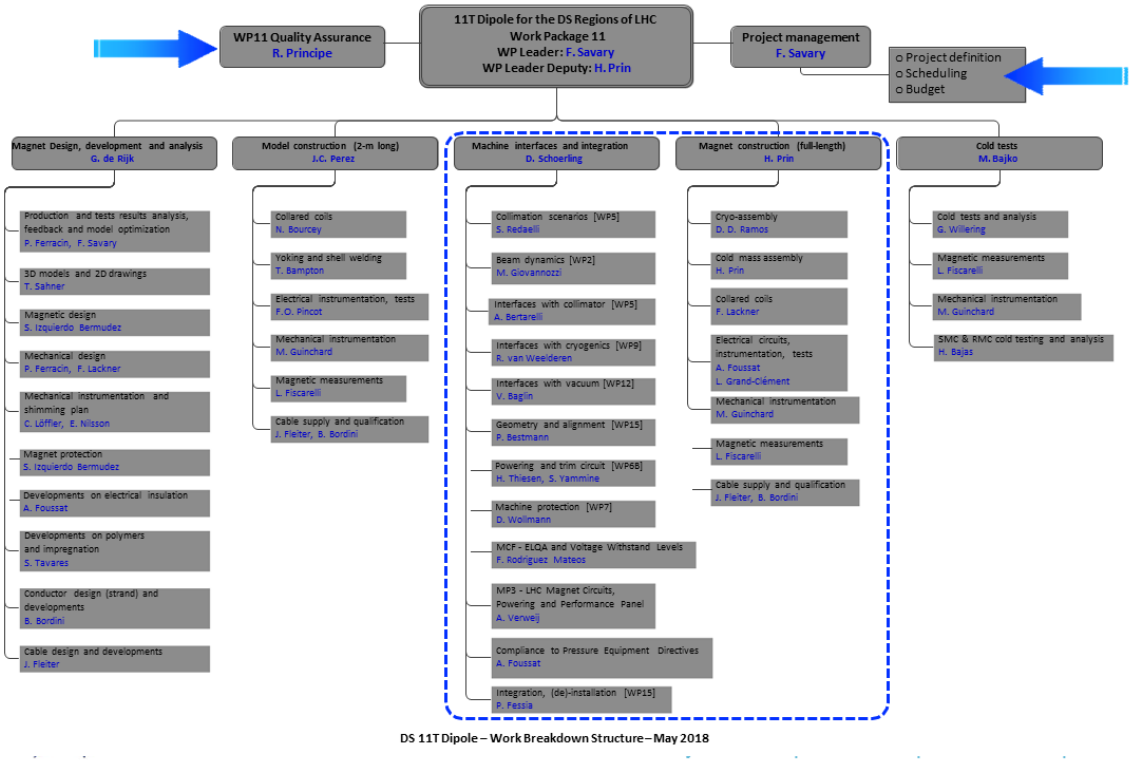


Fig 1: Organigram of the WP11

1.2.1 CONTACT PERSONS

1.2.1.1 COORDINATION UNIT

The contact list for the members of the Coordination Unit in charge of coordinating the accelerators shutdown during LS2 is available in **Annex A1**. Please note this list may evolve during the LS2 and will be updated on the following website: www.cern.ch/ls1ls2

1.2.1.2 WORKS AND SERVICES SUPERVISOR

Activity (precise if **test**)	**Group**	**Name of CERN responsible** (staff)	**Phone Number**
Preparatory works prior Dipole Removal			
BLM disconnection, cable-au fil removal and cabling re-routing	BE-BI	C Zamantzas	
Dipole Removal			
Dipole Disconnection and removal through PMI2 - See DISMAC WPA	TE-MSC/EN-HE	S Le Naour, N Bourcey, S Pelletier	
IC Works - See DISMAC WPA	TE-MSC	S Le Naour, N Bourcey	
CC Installation Preparatory works			
Floor leveling (= removal of semelles en beton)	EN-ACE	M Arnaud	
Floor Tracing (CC + TCLD)	EN-SMM	J-F Fuchs	
Jacks holes drilling	EN-EA	M Arnaud	
BLM Cabling re-routing	BE-BI	C Zamantzas	
Cable trays displacement at TCLD Area	EN-EL	Y Maurer	

Jacks installation (Cryo assembly + TCLD)	EN-EA/EN-STI	M Arnaud/ I Lamas Garcia	
Jacks' head to nominal position alignement Cryo assembly + TCLD)	EN-SMM	J-F Fuchs	
Jack's anchoring sole	EN-EA	M Arnaud	
TCDL Support installation	EN-STI	I Lamas Garcia	
TCLD Platform above QRL installation	EN-EA	I Lamas Garcia	
11T Installation			
CC Assembly Installation (x2)			
CC Transport in tunnel From P2(RB24) and installation	EN-HE	P Brunero/S Pelletier	
CC Alignement wrt adjacent cryo magnet	EN-SMM	J-F Fuchs	
Reconnection & Tests - See DISMAC WPA	TE-MSC	S Le Naour, N Bourcey	
ELQA Tests Global	TE-MPE	G D'Angelo	
Cryo ByPass Installation			
Transport in tunnel From P2	EN-HE	P Brunero/S Pelletier	
Alignement wrt adjacent CC	EN-SMM	J-F Fuchs	
Reconnection & Tests - See DISMAC WPA	TE-MSC	S Le Naour, N Bourcey	
ELQA Tests Global	TE-MPE	G D'Angelo	
Components to be reinstalled /displaced/ modified			
Installation of 6U crates under MB.10L2/10R2	TE-MPE	G D'Angelo	
Cabling installation, re-routing and modification	EN-EL	G Girardot	
TE-CRG Limited stay areas	SMB-SE	C Biot	
New BLM Installation	BE-BI	C Zamantzas	
New Compressed air connections	EN-CV	R Langlois	
Sector valves cabling	TE-VSC	G Bregliozzi	
Post CC installation activities			
Target Collimator Long Dispersion Suppressor (TCLD) installation + alignment -See WPA HL-LHC WP5	EN-STI	I Lamas Garcia	
DN90 Valves closing in adjacent quadrupoles	TE-VSC	G Bregliozzi	
Flow meters + temperature sensors installation	TE-CRG	P Gayet	
Full Assembly smoothing wrt adjacent component during arc smoothing activity @ cold	EN-SMM	J-F Fuchs	
Sector Pump down	TE-VSC	G Bregliozzi	
Project Follow-Up			
Coordination	EN-ACE		
Activity leader	TE-MSC		

1.2.1.3 RADIOPROTECTION CONTACTS

[To be filled by the HSE-RP correspondents]

	Name	**Phone**
Responsible / Studies		
RPR		
Operational		
RPO		

1.3 PRELIMINARY CONDITIONS TO WORKS

Electrical and cryogenics lockouts shall be ensured throughout the whole project implementation. Accordingly, lockout requests will be asked by the work supervisors of each activity.

1.4 TRAINING

1.4.1 MANDATORY TRAINING FOR ACCELERATOR ACCESS

		LHC	**SPS**	**PS&TT2**	**PSB**	**LEIR**	**Linac4**	**Linac2**
Safety at CERN	10010	X	X	X	X	X	X	X
Electrical Safety - Awareness	10200	X	X	X	X	X	X	X
CERN - Beam Facilities	10800	X	X	X	X	X	X	X
Radiation Protection - Controlled Area - Initial	Safety Training	X	X	X	X	X	X	X
Prerequisites:								
• Emergency Evacuation	SIR	X	X	X	X	X	X	X
• Radiation Protection – Awareness	SIR	X	X	X	X	X	X	X
• Radiation Protection - Supervised Area	SIR	X	X	X	X	X	X	X
Radiation Protection - Controlled Area - Refresher	SIR	X	X	X	X	X	X	X
Self Rescue Mask	10390	X	X					
LHC - Machine	10810	X						
SPS - Machine	10820		X					

1.4.2 SPECIFIC TRAINING

[Definition of specific training necessary for the work package implementation]

1.5 COMPLETION CRITERIA

The Work and Services Supervisors (ref. 1.2.1.2) shall ensure that the worksite is cleaned of all waste that could be generated during the work execution.

The activities related to this work package concern the exchange of 2 LHC dipoles by 2 new cryo assemblies designed to allow the integration of 2 TCLD. Therefore, it is fundamental to ensure full installation of the complete cryo assemblies before TCDL installation.

1.6 PLANNING

Plannings from the Coordination Unit must be followed. The Facility coordinator shall be informed as soon as possible of any delay or modification to the planning in order to analyse consequences for the overall LS2 activities.

[Extract from the Facility Coordinators planning]

1.7 MATERIALS & EQUIPMENT REMOVED / REMAINING

1.7.1 MATERIALS REMOVED

Equipment name	DCUM	IP2	Comments
LEBR.11L2	2900.2557 m	– 432.1047 m	
LECL.11R2	3751.6904 m	419.33 m	

1.7.2 MATERIALS REMAINING

Equipment name	DCUM	IP2	Comments
-	-	-	

1.7.2.1 MATERIALS TO BE DISPLACED

Equipment name	DCUM	IP2	Comments
BLMEL.11L2.B2I20_LEBR	2907.01 m	-	BLMEL.G11L2, old DCUM given
BLMEI.11L2.B2I20_LEBR	2907.36 m		BLMEI.H11L2, old DCUM given
BLMEL.11R2.B1I20_LECL	3757.01 m	-	BLMEL.H11R2 , old DCUM given
BLMEI.11R2.B1I20_LECL	3757.36 m		BLMEI.I11R2, old DCUM given

1.7.3 WASTE MANAGEMENT

All the equipment and pieces removed from the tunnel will be check by the RP team and stored in surface (where?)

2. ACCESS AND LOGISTICS

2.1 ACCESS

All documents and drawings for inter-locked areas sectorisation managed by BE-ICS are listed in **Annex A2**.

	LHC	SPS	PS&TT2	PSB	LEIR	Linac4	Linac2
EDH access request	LHC-TNL	SPS	PS	PS	PS	b.400 LN4-TNL	PS

2.2 STORAGE SPACE / WORKSHOPS

2.2.1 SURFACE STORAGE SPACE / WORKSHOPS

[Detail the surface space provisioned for storage and workshops]

2.2.2 UNDERGROUND STORAGE SPACE / WORKSHOPS

[Detail the underground space provisioned for storage and workshops]

2.3 PERSONNEL & MATERIAL TRANSIT

All the personnel and material required for CC systems installation will enter in LHC tunnel via PM25 lift.

Cryo assemblies components (LBHRxx and LENRxx) will be transported from PX25 or TBC with ALICE. Accordingly shielding in RB24 will have to be dismantled to allow passage ALICE cavern to LHC tunnel

2.4 TRANSPORT AND HANDLING

[Define if the transport and handling will be executed by the external companies, the group in charge of the work package or required the support of the CERN EN-HE Group]

For any requests to EN-HE, please follow the instructions below:

- For any **transport** and/or **handling**, make an EDH request: https://edh.cern.ch/Document/SupplyChain/TransportRequest (in case of doubt choose the tab "transport & handling")
- Deadlines to respect:
  - 48 hours for a standard operation
  - 5 days for a crane operation or for complex operation (more if study and specific tools required)
- It is very important to respect the weights, dimensions (right of withdrawal of the contractor in case of error or omission) and value of insurance

- No name should be put in address if it is not necessary (non obligatory field which imposes a signature if one fills it)
- Copy the request to the CERN supervisor (**ref.1.2.1.2**)
- For a non-standard operation: contact the CERN supervisor (contact another person of the section in case of absence → link to the EN-HE-HH organigram: https://espace.cern.ch/en-dep-HE/HH/_layouts/15/start.aspx#/SitePages/HH%20Structure.aspx)
- For a nacelle rental (PEMP): contact Eric DUGUE at 164686
- **SAFETY**: Respect markings and safety perimeters (pay attention to the displacement of the cranes and forklifts, risk of crushing and falling of object)
- **IMPACT**: Add the CERN transport supervisor (as "supervisor") of the affected area in IMPACT and notify them

3. DESCRITPION OF ACTIVITIES

See Attached Excel file EDMS:

3.1 WORKS PERIMETER AND CONSTRAINTS

[Localisation of the works and description of the access constraints generated during the implementation of the work package. Detailing of the compensatory measures and generated constraints]

3.2 PROCEDURES AND OPERATION

See Attached Excel file EDMS:

Shall be completed by you and or equipment owner

3.3 WORKSITE SERVICES

See Attached Excel file EDMS:

4. SPECIFIC MEASURES RELATED TO SAFETY

4.1 GENERATED RISKS

[Detailing of the risks issuing from the work package implementation and definition of the compensatory measures]

4.1.1 ASBESTOS RISK

4.1.2 FIRE RISK

4.1.3 ELECTRICAL RISK

4.1.4 RADIOLOGICAL RISK

Details of the radiological measurements performed by HSE-RP are available on the following links: Radiation Protection PS Complex & Meyrin Site and Radiation Protection for the LHC and SPS.

[Define the ALARA level]

	DIMR I	DIMR II	DIMR III
Délais indicatifs	≥ 3 jours	≥ 3 semaines	≥ 3 mois
Dose collective	500 µHSv	5000 µHSv	
Dose individuelle	100 µSv	1000 µSv	
Débit de dose	50 µSv/h	2 mSv/h	
Contamination atmosphérique	5 CA	200 CA	
Contamination surfacique	10 CS	100 CS	

Figure 1 - ALARA Levels

4.1.4.1 RADIOLOGICAL MEASURES AND CONTROLS

[Define with the RPR and RPO

- The areas where the dismantled equipment (ref.1.7) will be considered as radioactive and where the dismantled equipment will be considered as non-radioactive
- If the radiological controls done following the TREC procedures (Procedure EDMS 1719797) will be held in the buffer zones or in a specific areas (specify which one)
- Which in-sites transport classification is expected for any materials/equipment with a dose over 100 µSv/h (Procedure EDMS 1107233)
- Which containers will be used for equipment that will be sent to waste (if radioactive or non-radioactive)]

4.1.4.2 CHANGE OF RADIOLOGICAL CLASSIFICATION

[Localisation of the machine areas requiring a radiological declassification]

4.1.4.3 RADIOGRAPHY

[Precise if the installations require radiological controls (x-rays or tomograph)]

[Precise the EN-MME-MM CERN responsible in charge to follow those controls]

4.1.5 OTHER RISK

4.2 PREVENTIVE MEASURES (LOCK-OUT AND AUTHORISATIONS)

[Detailing of the lock-outs and authorisations (cryogenic, fluid, mechanical, electrical, etc…) necessary for the work package implementation]

4.3 ADDITIONAL INFORMATION RELATED TO INDIVIDUAL TESTING

Test	Access mode (EIS-m)	Control	Vacuum (Beam line)	Warm Interlock Controller	Other	Detail	**Are these tests prerequisite to hardware tests?** (Yes/No) TBC by BE-OP	**Preferred start date** (if defined)	**Duration**

4.4 DOCUMENTATION AND RULES RELATED TO SAFETY

4.4.1 SAFETY COORDINATION FOR WORKS AND SERVICES (GSI-WS-1)

The purpose of this General Safety Instruction (GSI-WS-1 EDMS 1440245) is to define the minimum Safety requirements for the Safety coordination of operations, managed by CERN or otherwise and executed on the CERN site. This General Safety Instruction does not apply to the following:

- design aspects;
- technical provisions for the layout of the work area and the execution of works and services;
- organisation of medical monitoring based on the risks associated with the activity or with the location where the operation is carried out.

Training course « Superviseur de travaux et prestations de services – rôles et responsabilités » is at your disposal in the CERN training catalogue to identify the role and responsibilities of the CERN works and services supervisors in matters of safety as well as to be able to perform joint inspection visits (VIC) onsite (links En Fr).

4.4.2 VISITE D'INSPECTION COMMUNE (VIC)

Extract from the GSI-WS-1 regarding the VIC :

Each one-off operation shall be the subject of a VIC when it is required by:

- *the organic unit responsible for the coordination of the Technical Stop;*
- *any operating entity, particularly in the framework of work taking place adjacent to or above/below other work;*
- *any CERN Safety representative.*

Each VIC shall be:

- *organised and led by the Works and Services Supervisor, in the presence of a CERN Safety representative if the latter so requests;*
- *minuted using the announcement system for works and services and distributed via this system.*

In addition to the GSI-WS-1, the EN-ACE Coordination Unit may request that only one VIC be organized with several involved participants in order to cover several specific interventions. They shall define and communicate the safety requirements at any time during the technical stop.

[Specify how many VIC will be organized]

4.4.3 PLAN DE COORDINATION DES TRAVAUX ET DE LA SÉCURITÉ (PCTS)

The Work and Safety Coordination Plan (PCTS – EDMS 1963236) addresses anyone working in the accelerators complex, whether it be CERN or contracted personnel.

This document provides a brief information on the organizational dispositions applicable in matters of planning and work coordination, general safety and radioprotection.

4.4.4 PLANS DE PRÉVENTION (PDP)

Safety form applicable for the preparation of the prevention plans (EDMS 1147736)

Safety form applicable for the preparation of the simplified prevention plans (EDMS 1713876)

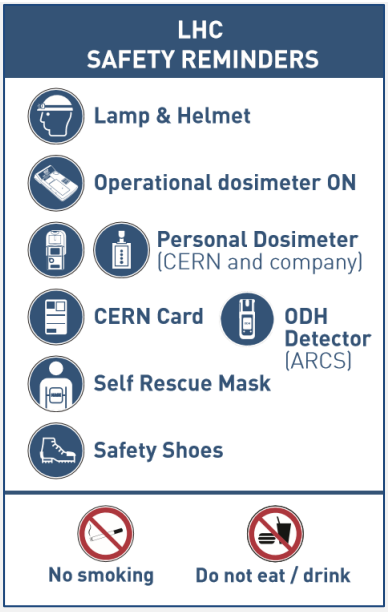
4.4.5 DECLARING ACTIVITIES IN IMPACT

Any activities related to the implementation of a work package shall be declared in IMPACT and shall contain all approval of the associated VIC.

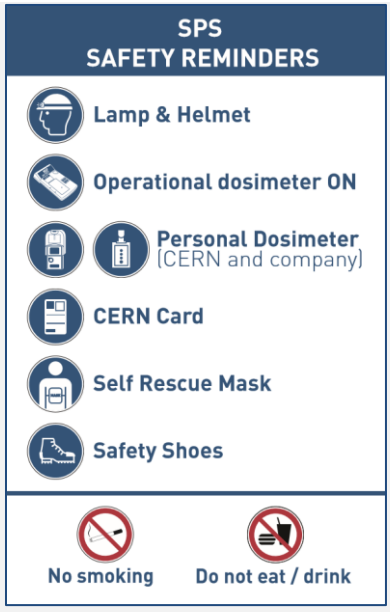
In case delay or modification of the planning and failure to follow the rules described in this document, the Coordination Unit is entitled to prevent one or several IMPACT requests.

4.4.6 SAFETY REMINDER

Here-below is a brief reminder of the Personal Protective Equipment (PPI) requested to access the LHC and SPS. This information is available in card form in the Coordination Unit's offices.



EDMS 1816296



EDMS 1753648

Complexe PS
En cours d'édition

EDMS 1816300

4.4.7 SPECIFIC SAFETY INSTRUCTIONS FOR ACCELERATORS

- **General information applicable to all machines**
  - CERN Safety Files (EDMS CERN-0000092982)
  - Quality insurance principles applicable to EIS-beam and EIS-machine equipment (EDMS 1211886)
- **Specific to the LHC machine**
  - Helium Spill Working Group Recommendations (EDMS 1410247)
  - Access and exit from the LHC in case of maintenance of or lift failure (EDMS 1236746)
  - Drilling procedure for GGPSO points (EDMS 1889443)
  - Request for electrical lock-out in the LHC (EDMS 1965169)
- **Specific to PS and TT2**

- Procedure for Blind Access in general mode (EDMS 1381250)

4.4.8 SPECIFIC SAFETY INSTRUCTIONS

[Definition of safety instructions specific to the work package implementation]

5. REFERENCES

EDMS 1155899 – « Prestations sur le Site du CERN / Working on the CERN Site »

[List of document references]

ANNEX A1

Contact list of the Coordination Unit members

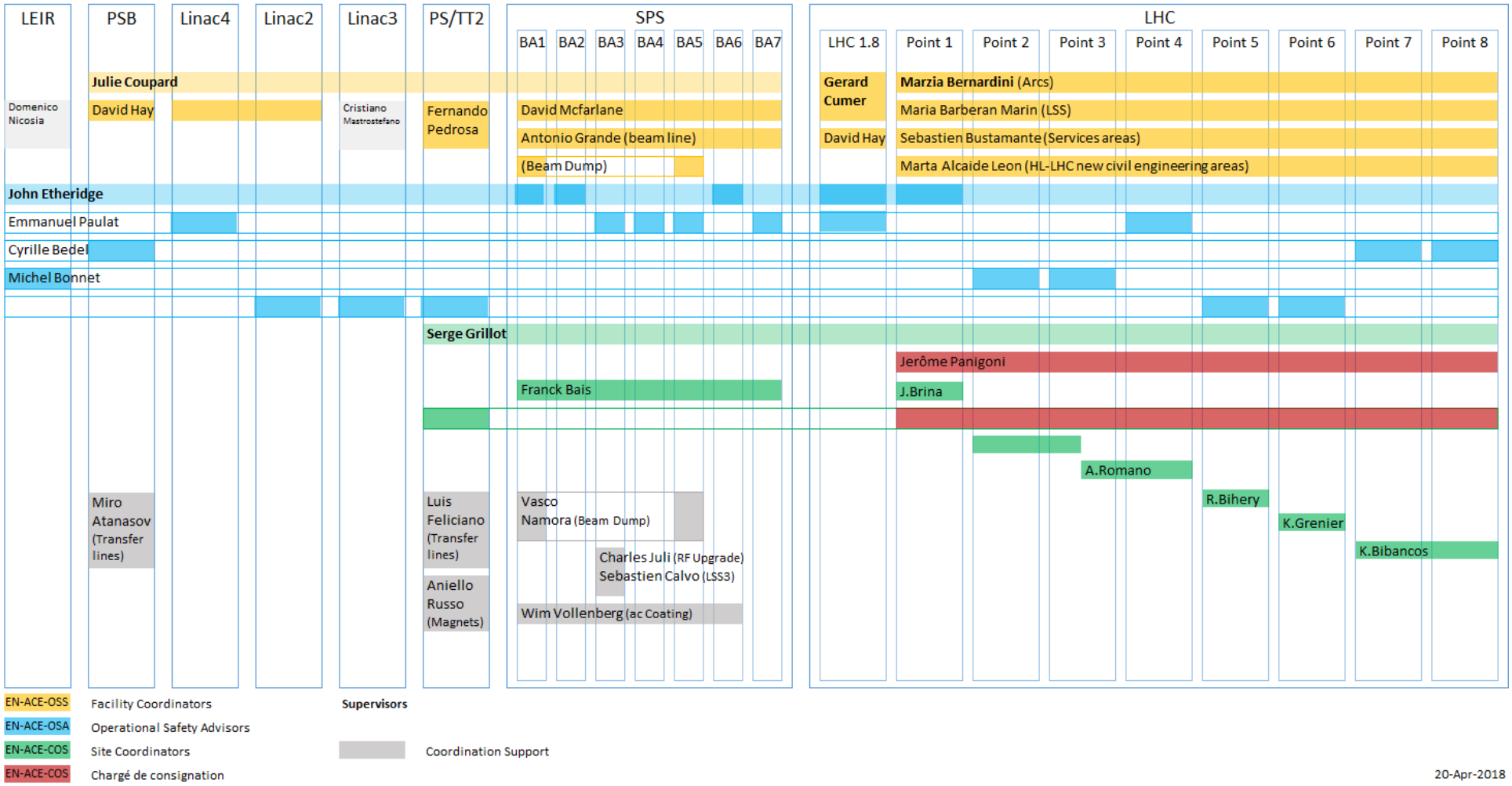
EN-ACE-OSS		EN-ACE-OSA		EN-ACE-COS	
Marzia Bernardini	**16 60 75**	**John Etheridge**	**16 46 47**	**Serge Grillot**	**16 06 15**
Marta Alcaide Leon	16 24 55	Gerard Bailly	16 03 17	Franck Bais	16 54 67
Maria Barberan Marin	16 74 42	Cyrille Bedel	16 08 04	Kevin Bibancos	16 97 61
Sebastien Bustamante	16 12 28	Michel Bonnet	16 63 47	Romuald Bihery	16 06 47
Julie Coupard	16 56 75	Emmanuel Paulat	16 38 70	Julien Brina	16 44 84
Gerard Cumer	16 05 92			Kevin Grenier	16 06 99
Antonio Grande	16 27 21			Jérôme Panigoni	16 24 23
David Hay	16 33 17			Antony Romano	16 97 56
David Mcfarlane	16 42 47				
Fernando Pedrosa	16 22 37				

Service/stand-by numbers:

- PS complex 16 17 37
- SPS 16 17 35
- LHC 16 16 69

Coordination Unit Organisation for LS2

CERN Complex Accelerators



ANNEX A2

Inter-locked and Beam Areas Access Sectorisation

- **LHC Machine**

– Inter-sites doors:	EDMS LHC-Y-ES-0101
– Points 1 et 1.8 :	EDMS LHC-Y-ES-0102
– Points 2 et 3.2 :	EDMS LHC-Y-ES-0103
– Point 3.3 :	EDMS LHC-Y-ES-0104
– Point 4 :	EDMS LHC-Y-ES-0105
– Point 5 :	EDMS LHC-Y-ES-0106
– Point 6 :	EDMS LHC-Y-ES-0107
– Point 7 :	EDMS LHC-Y-ES-0108
– Point 8 :	EDMS LHC-Y-ES-0109

- **SPS**

– SPS areas (before refurbishment)	EDMS 639241
– SPS areas (after refurbishment)	EDMS 1701407

- **PS complex**

Full view of the inter-locked areas sectorisation for PS complex is available on EDMS 990200.

- **PS and TT2**

– PS area	EDMS PS-Y-ES-0001
– PS Switch Yard area (before connection to Linac4)	EDMS 990206
– PS Switch Yard area (after connection to Linac4)	EDMS CPS-Y-ES-0008
– TT2 area	EDMS CPS-Y-ES-0004

- **PS Booster**

– PS Booster area	EDMS PSB-Y-ES-0001

- **LEIR**

– LEIR area	EDMS 990207

- **Linac2 and Linac4**

– Linac2 (before connection to Linac4)	EDMS CPS-Y-ES-0007
– Linac2 (after connection to Linac4)	EDMS XXXXXXX
– Linac4	EDMS L4-Y-ES-0001