

Date: 2005 – 02-15

Schedule Change Request – Class I

INSTALLATION SCHEDULE OF MACHINE ELEMENTS IN THE CONTINUOUS CRYOSTAT OF SECTOR 8-1

This document describes the sequence of installation of the machine elements in the sector 8-1 and presents a new set of dates to schedule the corresponding work. The various phases (QRL installation, QRL commissioning, Cryo-magnet transport and Cryo-magnet interconnection) are interleaved with a view to gain time with respect to the original scenario presented in EDMS 102509. Part of the delay accumulated with the installation of the QRL is thus recovered, and the continuous cryostat of sector 8-1 would be ready for hardware commissioning by April 2006. The installation sequences of the long straight sections of sector 8-1 (LSS8R and LSS1L) will each be covered in independent SCRs.

<p>Equipment concerned : QRL Local & Network cables Jacks Cryo-magnet transport Cryo-dipole & SSS DFBA</p>	<p>Drawings concerned :</p>	<p>Documents concerned : LHC-PM-MS-0005</p>
<p>PE in charge of the item : Katy Foraz, Sylvain Weisz</p>	<p>PE in charge of parent item in PBS : Paul Proudlock</p>	
<p>Decision of the Project Engineer :</p> <p><input checked="" type="checkbox"/> Rejected.</p> <p><input checked="" type="checkbox"/> Accepted by Project Engineer, no impact on other items. <i>Actions identified by Project Engineer</i></p> <p><input checked="" type="checkbox"/> Accepted by Project Engineer, but impact on other items. <i>Comments from other Project Engineers required Final decision & actions by Project Management</i></p>	<p>Decision of the PLO for Class I changes :</p> <p><input checked="" type="checkbox"/> Not requested.</p> <p><input checked="" type="checkbox"/> Rejected.</p> <p><input checked="" type="checkbox"/> Accepted by the Project Leader Office. <i>Actions identified by Project Leader Office</i></p>	
<p>Date of Approval :</p>	<p>Date of Approval :</p>	
<p>Actions to be undertaken :</p>		
<p>Date of Completion :</p>	<p>Visa of QA Officer :</p>	

Note : when approved, an **Engineering Change Request** becomes an **Engineering Change Order/Notification**.

1. DETAILED DESCRIPTION

by Katy Foraz, Sylvain Weisz

1.1 INTRODUCTION:

This document describes the sequence of installation of the machine elements in the sector 8-1 and presents a new set of dates to schedule the corresponding work. The various phases (QRL installation, QRL commissioning, Cryo-magnet transport and Cryo-magnet interconnection) are interleaved with a view to gain time with respect to the original scenario presented in EDMS 102509. Part of the delay accumulated with the installation of the QRL is thus recovered, and the continuous cryostat of sector 8-1 would be ready for hardware commissioning by April 2006. The installation sequences of the long straight sections of sector 8-1 (LSS8R and LSS1L) will each be covered in independent SCRs. Appendix III gives an overall schematic planning.

1.2 CHRONOLOGY OF ACTIVITIES IN SECTOR 8-1:

The co-ordination of the activities following the installation of the QRL in sector 8-1 and leading to the installation of the continuous cryostat are shown graphically on the set of "chemin de fer" type schedules given in Appendix I.

The main dates to retain are:

- End of installation of the QRL in sub-sector G: 09.02.05
- Start of installation and of the alignment of the support jacks: 14.02.05
- End of the helium tests in sub-sector G: 04.03.05
- Start of magnet transport: 07.03.05
- End of installation of the QRL in arc 8-1: 13.05.05
- Start of the alignment of the cryo-magnet in arc 8-1: 11.04.05
- Start of the magnet interconnect activity: 02.05.05
- End of the pressure test of the QRL in arc 8-1: 20.08.05
- Start of the cold tests of the QRL: 22.08.05
- End of the reception tests of the QRL in arc 8-1: 15.10.05
- Start of the installation of the SSS with jumpers: 24.10.05
- Start of the alignment of the SSS with jumpers: 31.10.05
- Start of the installation of the cryogenics instrumentation: 24.10.05
- Start of the installation of the quench protection equipment: 27.06.05
- Start of the installation of the vacuum control equipment: 12.12.05
- End of the magnet interconnect activity: 20.01.06
- End of the leak and pressure tests: 03.02.06
- End of the sector 8-1 continuous cryostat closure: 31.03.06

1.2.1 PHASE 1 : QRL INSTALLATION

The QRL in sector 8-1 is divided in 9 sub-sectors, named respectively A to I when going from point 8 to point 1.

- **The verification of the positions of the service modules** would be performed in parallel with the QRL element installation, by the survey group.
 - The X-rays tests will be performed during one part of the night shift (agreed with the transport). No access during the tests will be allowed in sector 8-1.

- Once one sub-sector is installed, it is helium tested.

The completion dates of the QRL installation and of the helium tests are summarized in Table I. This is the hypothesis retained for the start of further activity in sector 8-1: an additional delay with respect to the dates of Table I will result in a corresponding time shift of the activities listed in this document.

Sub sector	DCUM start	DCUM end	QRL installed	Helium test (end)
A	23327	23620	13 / 05 / 05	07 / 06 / 05
B	23620	24030	22 / 04 / 05	17 / 05 / 05
C	24030	24458	18 / 03 / 05	11 / 04 / 05
D	24458	24886	28 / 04 / 05	07 / 06 / 05
E	24886	25099	24 / 03 / 05	26 / 04 / 05
F	25099	25527	14 / 03 / 05	05 / 04 / 05
G	25527	25955	09 / 02 / 05	04 / 03 / 05
H	25955	26356	15 / 03 / 05	26 / 04 / 05
I	26356	26616	03 / 05 / 05	07 / 06 / 05

Table I: Installation of each sub-sectors of the QRL in sector 8-1

1.2.2 PHASE 2: QRL COMMISSIONNING

As it is shown in the graphics of Appendix I, this phase, that includes the installation of temporary cryogenics instrumentation, will start before the end of the QRL installation.

- Installation and test of cryogenics instrumentation equipment

For the sector 8-1, the installation and tests of cryogenics equipment can only start when 4 adjacent sub-sectors have been helium tested (E to H).

It will include the installation, connections and tests (local and remote) of all crates and local connections boxes, as well as the tests (local and remote) of the control valves, and the coherence checks of all.

All the control logic is also tested.

Sub-sector	start	End
E-F-G-H	25.04.05	10.06.05
A-B-C-D-I	06.06.05	13.08.05

Table II: Installation and test of cryogenics instrumentation equipment in each sub-sectors of the QRL in sector 8-1

This will be in co-activity with magnets transport, vacuum equipment installation, and the QRL global pressure test of the whole sector.

- **Connection of the QRL vacuum equipment** to the controls and data acquisition network will start once 4 adjacent sectors are installed and helium tested. This will proceed in parallel with the installation of the cryogenics instrumentation. The half sector on point 8 side will be available for that activity from the 27.04.05, the half sector on point 1 side will be available from the 08.06.05

- **The pressure test and the warm tests of the QRL** in the entire sector, will be done from 01.08.05 to 20.08.05
Most of the time is used for preparation and the QRL would be under pressure for a few days only, preferably during week-ends, leaving access in the tunnel for other activities (cryogenics instrumentation, cryo-magnet transport,...).
- **The reception tests of the QRL** will follow: it starts on 22.08.05, lasts 8 weeks and ends on 15.10.05. Access and activity in the tunnel will be restricted during the early phase of the cool-down (to be specified by SC).
- **The removal of the cryogenics test instrumentation** will last from 17.10.05 to 22.10.05. We will also need to remove the heater installed at the extremity of the QRL which allows the return of the helium flow through the warm recovery line. This test element has to be replaced by a pipe module: this activity will be done partially by Air Liquide.
- **The preparation of the QRL service modules** will be done after the reception tests of the QRL. It will last 4 weeks from the 17.10.05 to 19.11.05.

1.2.3 PHASE 3 : CRYO-MAGNET TRANSPORT

- **Installation and alignment of jacks** proceed in three batches :
 - Batch 1: in half-cells C17L1 – C24L1 from 14.02.05 to 26.02.05.
 - Batch 2: in half-cells C33L1 – C25L1, C08L1 to C16L1 and C24R8 – C17R8 from 14.03.05 to 09.04.05. This will be in co-activity with the QRL sub-sector helium tests.
 - Batch 3: the remaining of the jacks will be installed and aligned 14.05.05 to 21.05.05 in co-activity with the QRL sub-sector helium tests
- **Cryo-magnet transport**
 - The first 4 cryo-magnets (4 cryo-dipoles) will be installed to cells 17-18L1 from 07.03.05 to 12.03.05.
 - The lowering down of the cryo-magnets will be carried at a rate of
 - 4 cryo-magnets the first week (07.03.05),
 - 8 cryo-magnets the three following weeks,
 - then 20 cryo-magnets a week from the 04.04.05,
 It will concern all cryo-magnets of the regular arc cells but the short straight sections with jumpers that will be put in place after the commissioning of the QRL and after the preparation of the QRL service modules.
 - The transport date of each individual cryo-magnet in the continuous cryostat of sector 8-1 is given in Appendix II. Cryo-magnets transport will be done in parallel in sector 8-1 and 7-8 from May 2005.
 - The installation of the short straight section with jumpers starts on 24.10.05:
The rate of installation of short straight sections with jumpers is limited by the preparation of the QRL service modules after the cold commissioning of the QRL, we foresee 1 cryo-magnet a day.
 - The cryo-magnets of the dispersion suppressors must be in place whenever the interconnect activity reaches this area, and this is expected for November 2005.

- **The Alignment of cryo-magnets** will proceed in three batches:
 - Batch1: all cryo-magnets except SSS with jumpers, in half-cells C12L1-C33R8 and C17R8-C24R8 from the 11.04.05 to 14.05.05
 - Batch 2: all cryo-magnets except SSS with jumpers, in the remaining half-cells of the continuous cryostat from the 06.06.05 to 24.06.05.
 - Batch 3: SSS with jumpers from the 31.10.05 to 26.11.05.
- The cryo-magnet will be aligned from 30.05.05 to 29.07.05 in the regular arc cells. The SSS with jumpers will be aligned 31.10.05 to 26.11.05.
- **The survey control equipment** will be installed in parallel with the jacks' installation. The tests will be performed in UA87 in the shadow of the installation.
- **The quench protections racks** will be transported and connected as soon as the magnets are in place. It will start the 27.06.05 and ends the 16.09.05.

1.2.4 PHASE 4 : CRYO-MAGNET INTERCONNECTION

- A **pre-series of the interconnection activity** will be done in the half-cells C17L1-C19L1 from 02.05.05 to 03.06.05
- **The interconnection between cryo-magnets (except SSS with jumpers)** will start on the 06.06.05. It would thus proceed from mid arc on two fronts (one progressing toward point 1, the other progressing toward point 8). This first phase will last 21 weeks and should end by 28.10.05. **The mechanical equipment of the vacuum** will be installed during the interconnection activity.
- **The rest of the interconnection activity** will start once the SSS with jumpers are in place and aligned. It will start on 31.10.05 and ends on 20.01.06.
- **The DFBA**s will be installed from the 02.01.06 to 20.01.06.
- **The cryogenic instrumentations** will be installed in parallel of the interconnection activity and after the QRL cold commissioning. It will include the installation, connections and tests (local and remote) of all crates and local connections boxes, and the coherence checks of all. All the control logic is also tested. It will start the 24.10.05 and ends the 25.03.06
- **The vacuum control equipment** will be installed in the parallel of the interconnection activity. It will last 10 weeks from the 12.12.05, and ends the 03.03.06.
- **The racks for the corrector power supply** will be installed during the interconnection activity. It will last 1 week.
- **Pressure and leak tests** of the continuous cryostat will take 2 weeks, from 23.01.06 to 03.02.06. The closure of the interconnection, once the thermal shields are in place, will last from 06.02.06 to 31.03.06.
- **The beam position equipment** will be installed during the closure of the interconnections. It will last 6 weeks, start on 13.02.06 and ends on 24.03.06
- **The local ("last") cabling campaign** will follow the installation of the beam position equipment. It will last 7 weeks from the 13.02.06 to 31.03.06

1.2.5 INSTALLATION IN RE

- **The air-conditioning equipment** in the RE88 will be installed from the 02.05.05 to 28.05.05 and in RE12 from the 30.05.05 to 24.06.05.
- **The fire detection equipment** will be installed from the 26.09.05 to 30.09.05 in RE88, and from the 10.10.05 to 21.10.05 in RE12

1.3 SUMMARY:

This note presents the schedule of installation of the machine elements forming the continuous cryostat in sector 8-1. The dates of the different activities in the main tunnel have been reviewed and are available in the "chemin de fer" type schedule given in Appendix I. The cryo-magnets should be made available at the dates given in Appendix II: there is some flexibility concerning the cryo-magnets of the dispersion suppressors, with a November 2005 deadline corresponding to the interconnection activity in this area.

The installation of the equipments in the Long straight sections (tunnel and alcoves) will be described in other Schedule Change Requests.

2. REASONS FOR CHANGE

by Katy Foraz, Sylvain Weisz

3. IMPACT ON COST, SCHEDULE & PERFORMANCE

by K.Foraz, S.Weisz

4. IMPACT ON OTHER ITEMS

by Katy Foraz, Sylvain Weisz

The scenario proposed for the installation in sector 8-1 does not preclude any modification concerning the other sectors of the LHC machine.

5. CHANGE CLASS

by Katy Foraz, Sylvain Weisz

Class I

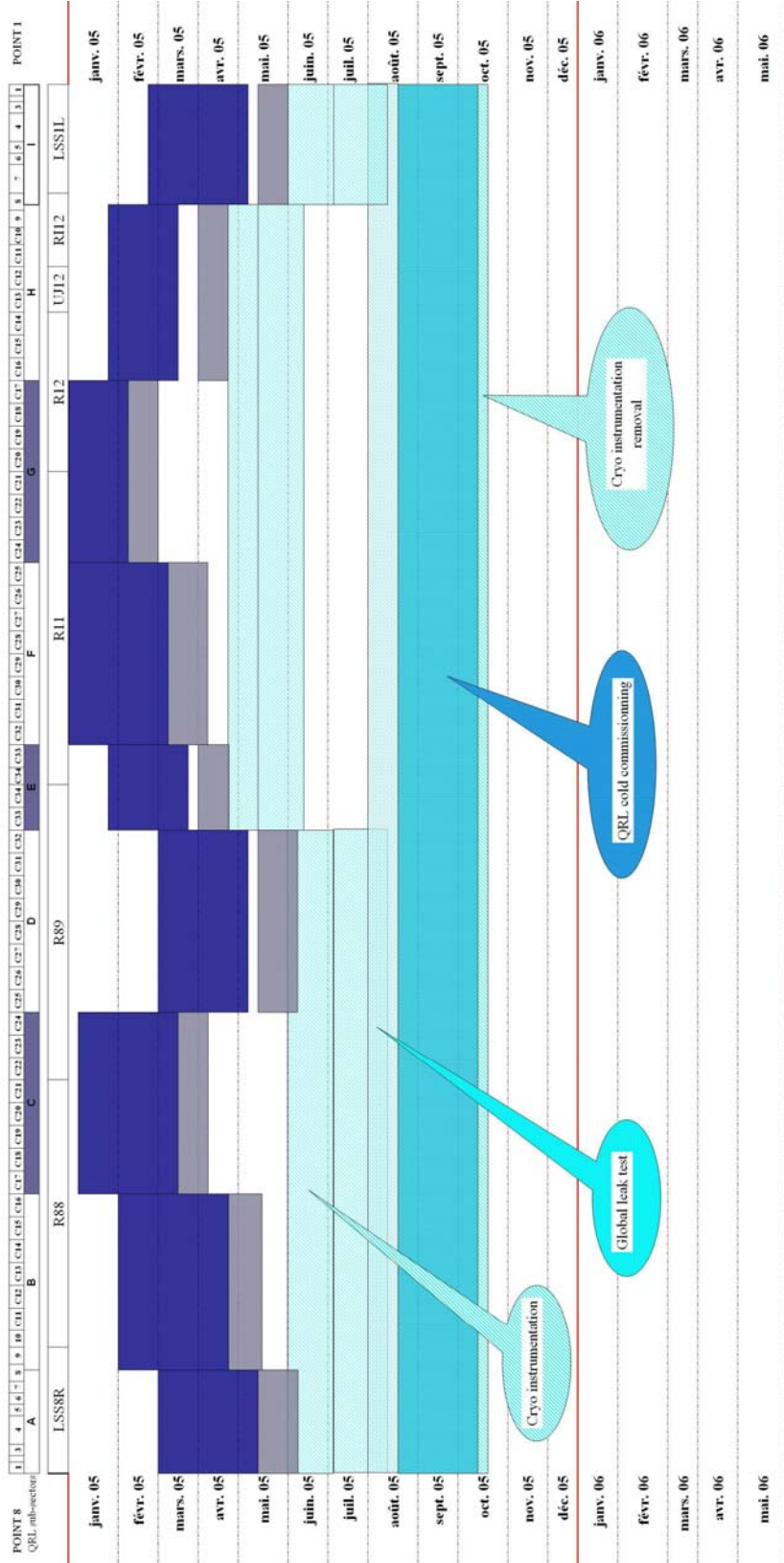
6. COMMENTS (IF REQUIRED)

by other Project Engineers

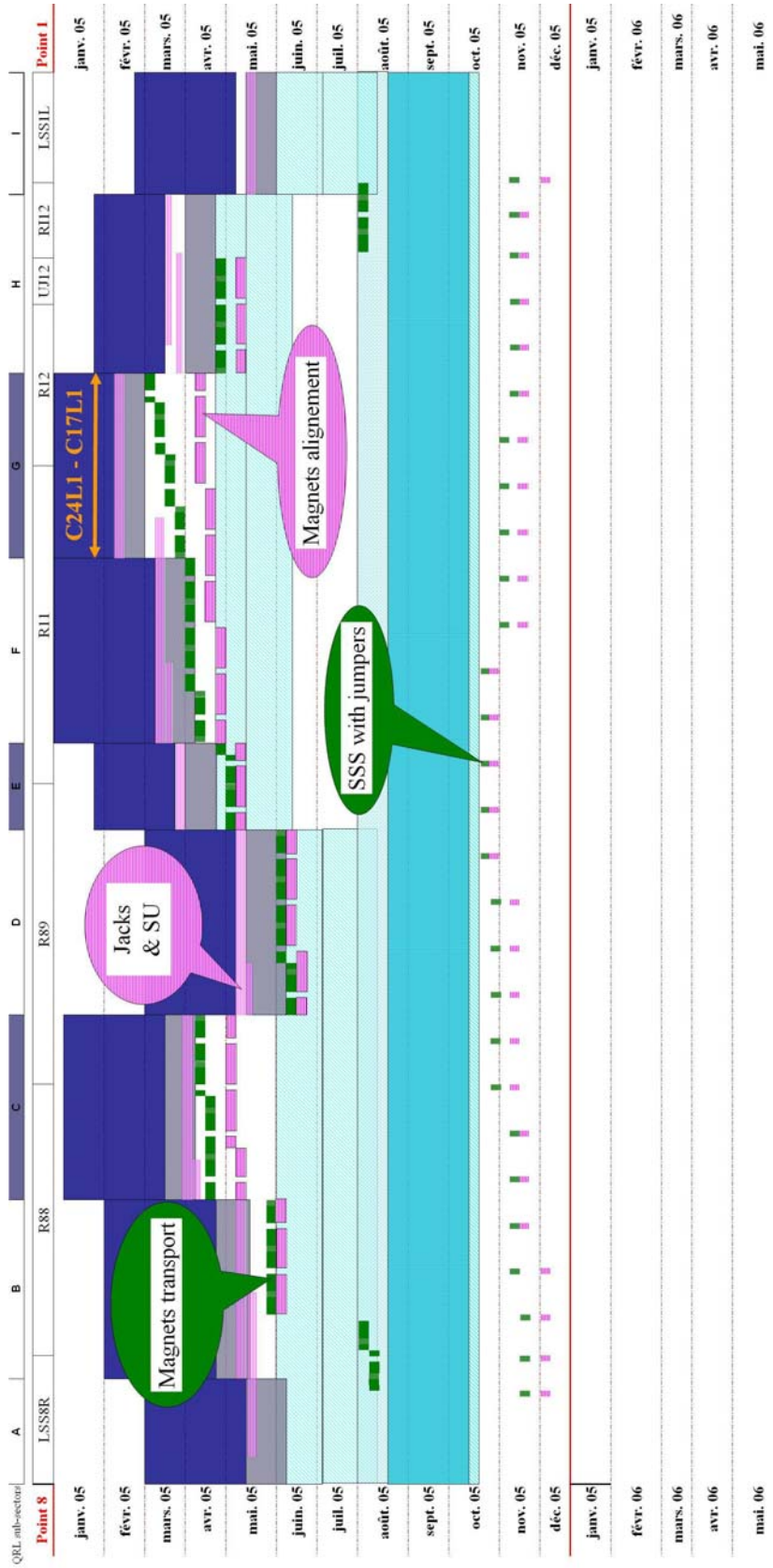
7. COMMENTS (IF ANY)

By PLO Appropriate Committees

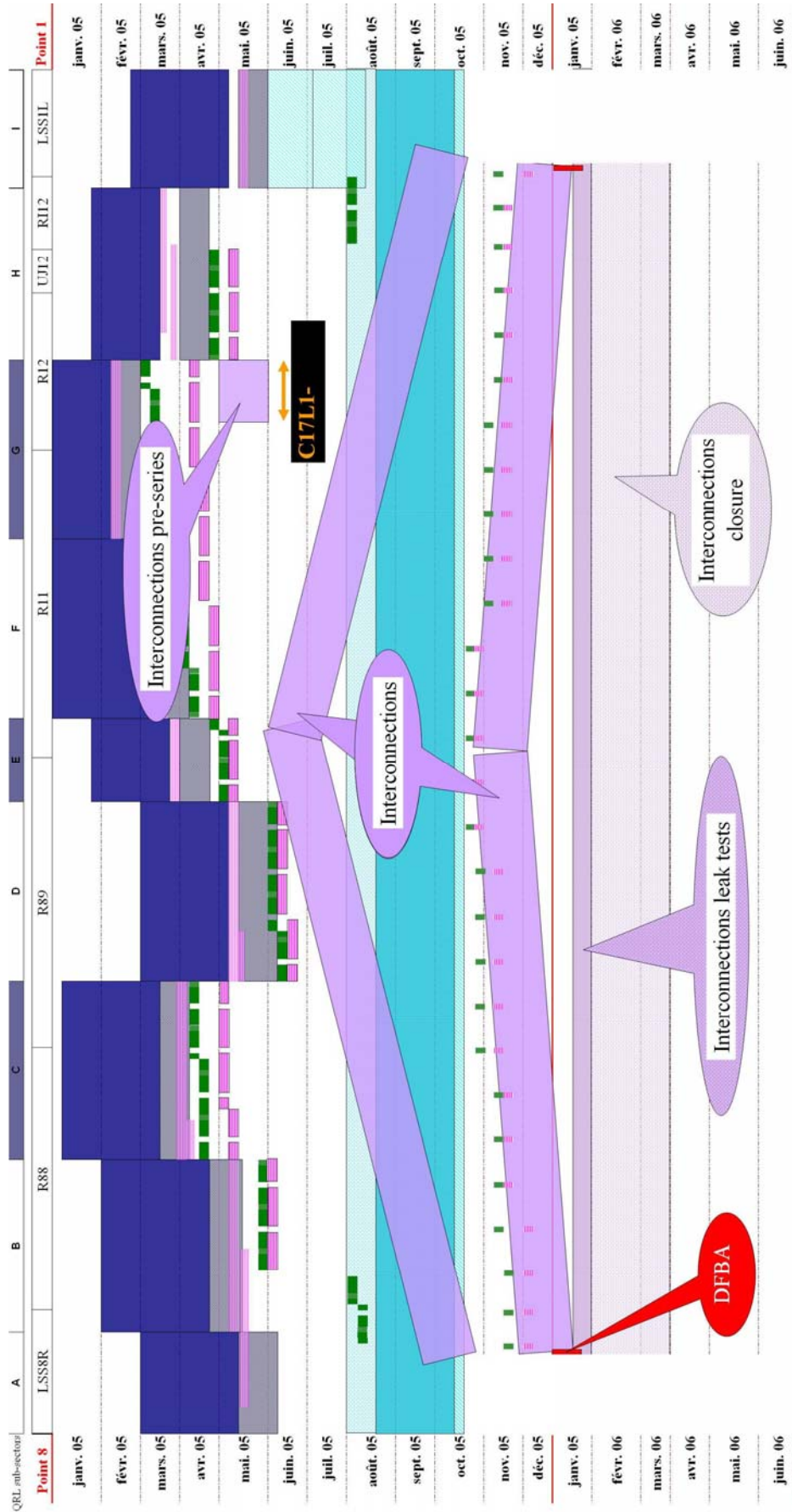
Phase 2 QRL commissioning in arc 8-1



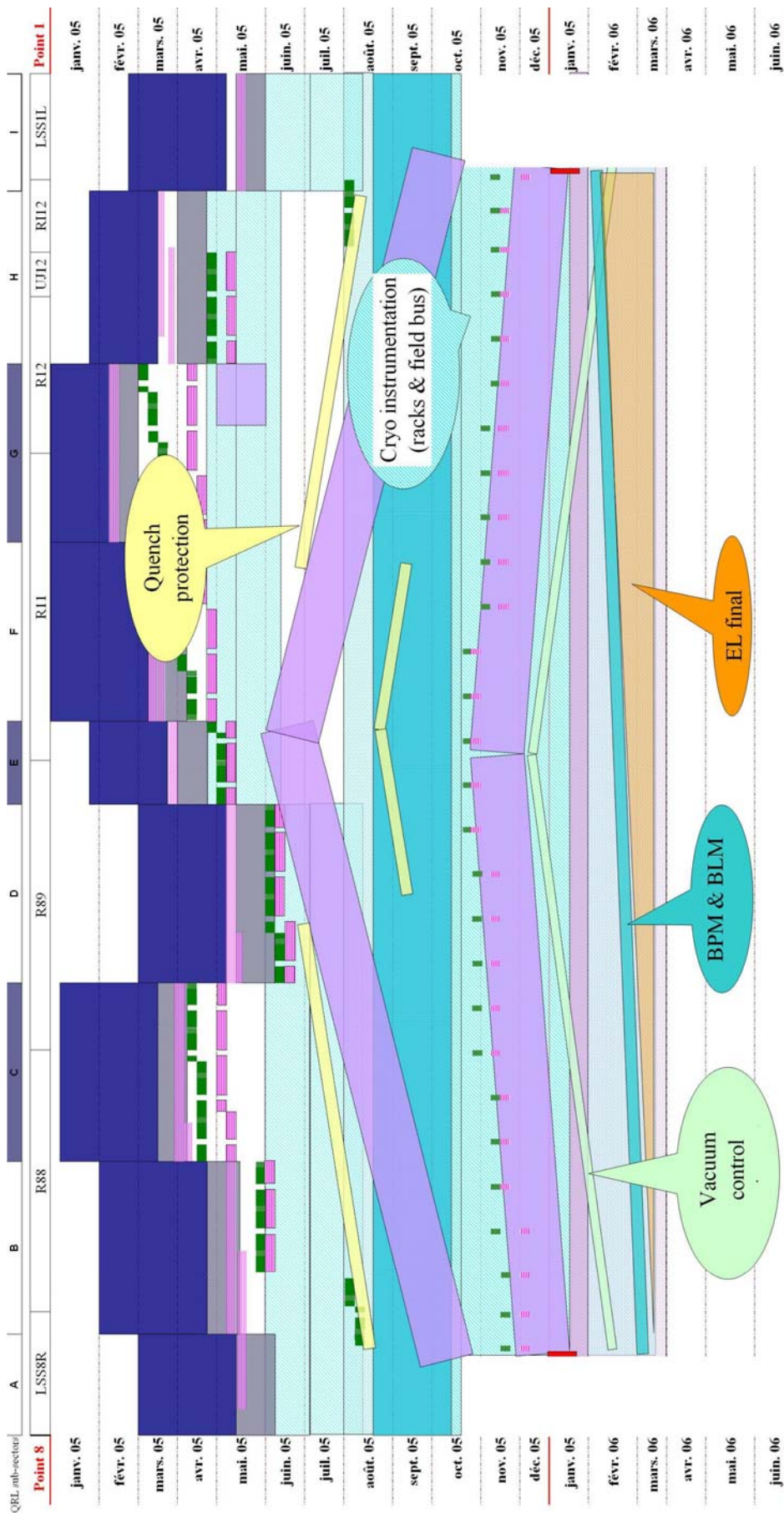
Phase 3 : Magnets transport and alignment in arc 8-1



Phase 4a : Magnet interconnections in arc 8-1



Phase 4b : Electronic equipment installation in arc 8-1



APPENDIX II :**Cryo-magnet availability for transport in sector 8-1**

Position	Assembly name	Availability date for lowering down
18L1	LBBLD	07/03/2005
17L1	LBALA	07/03/2005
17L1	LBBLA	07/03/2005
17L1	LBALB	07/03/2005
20L1	LBALA	14/03/2005
20L1	LBBLD	14/03/2005
19L1	LBALA	14/03/2005
19L1	LBBLA	14/03/2005
19L1	LBALB	14/03/2005
18L1	LQATI	14/03/2005
18L1	LBBLA	14/03/2005
18L1	LBALA	14/03/2005
22L1	LBBLA	21/03/2005
22L1	LBALA	21/03/2005
22L1	LBBLD	21/03/2005
21L1	LBALA	21/03/2005
21L1	LBBLA	21/03/2005
21L1	LBALB	21/03/2005
20L1	LQATI	21/03/2005
20L1	LBBLA	21/03/2005
24L1	LQOAH	28/03/2005
24L1	LBBLA	28/03/2005
24L1	LBALA	28/03/2005
24L1	LBBLD	28/03/2005
23L1	LBALA	28/03/2005
23L1	LBBLA	28/03/2005
23L1	LBALB	28/03/2005
22L1	LQOAH	28/03/2005
30L1	LBBLA	04/04/2005
30L1	LBALA	04/04/2005
30L1	LBBLD	04/04/2005
29L1	LBALA	04/04/2005
29L1	LBBLA	04/04/2005
29L1	LBALB	04/04/2005

Position	Assembly name	Availability date for lowering down
28L1	LQOAN	04/04/2005
28L1	LBBLA	04/04/2005
28L1	LBALA	04/04/2005
28L1	LBBLD	04/04/2005
27L1	LBALA	04/04/2005
27L1	LBBLA	04/04/2005
27L1	LBALB	04/04/2005
26L1	LQOAH	04/04/2005
26L1	LBBLA	04/04/2005
26L1	LBALA	04/04/2005
26L1	LBBLD	04/04/2005
25L1	LBALA	04/04/2005
25L1	LBBLA	04/04/2005
25L1	LBALB	04/04/2005
22R8	LBBLA	11/04/2005
22R8	LBALB	11/04/2005
22R8	LQOAH	11/04/2005
23R8	LBBLA	11/04/2005
23R8	LBALA	11/04/2005
23R8	LBBLD	11/04/2005
24R8	LBALA	11/04/2005
24R8	LBBLA	11/04/2005
24R8	LBALB	11/04/2005
24R8	LQOAH	11/04/2005
32L1	LQOAN	11/04/2005
32L1	LBBLA	11/04/2005
32L1	LBALA	11/04/2005
32L1	LBBLD	11/04/2005
31L1	LBALA	11/04/2005
31L1	LBBLA	11/04/2005
31L1	LBALB	11/04/2005
30L1	LQOAH	11/04/2005
17R8	LBBLA	18/04/2005
17R8	LBALA	18/04/2005
17R8	LBBLD	18/04/2005
18R8	LBALA	18/04/2005
18R8	LBBLA	18/04/2005

Position	Assembly name	Availability date for lowering down
18R8	LBALB	18/04/2005
18R8	LOATI	18/04/2005
19R8	LBBLA	18/04/2005
19R8	LBALA	18/04/2005
19R8	LBBLD	18/04/2005
20R8	LBALA	18/04/2005
20R8	LBBLA	18/04/2005
20R8	LBALB	18/04/2005
20R8	LOATI	18/04/2005
21R8	LBBLA	18/04/2005
21R8	LBALA	18/04/2005
21R8	LBBLD	18/04/2005
22R8	LBALA	18/04/2005
33L1	LBBLA	25/04/2005
33L1	LBALB	25/04/2005
16L1	LOATI	25/04/2005
16L1	LBBLA	25/04/2005
16L1	LBALA	25/04/2005
16L1	LBBLD	25/04/2005
15L1	LBALA	25/04/2005
15L1	LBBLA	25/04/2005
15L1	LBALB	25/04/2005
14L1	LOATI	25/04/2005
14L1	LBBLA	25/04/2005
14L1	LBALA	25/04/2005
14L1	LBBLD	25/04/2005
13L1	LBALA	25/04/2005
13L1	LBBLA	25/04/2005
13L1	LBALB	25/04/2005
12L1	LOATI	25/04/2005
12L1	LBBLA	25/04/2005
12L1	LBALA	25/04/2005
12L1	LBBLD	25/04/2005
33R8	LBBLA	02/05/2005
33R8	LBALA	02/05/2005
33R8	LBBLD	02/05/2005
34R8	LBALA	02/05/2005

Position	Assembly name	Availability date for lowering down
34R8	LBBLA	02/05/2005
34R8	LBALB	02/05/2005
34R8	LQOAN	02/05/2005
34L1	LBBLA	02/05/2005
34L1	LBALA	02/05/2005
34L1	LBBLD	02/05/2005
33L1	LBALA	02/05/2005
12R8	LBALA	30/05/2005
12R8	LBBLA	30/05/2005
12R8	LBALB	30/05/2005
12R8	LQATI	30/05/2005
13R8	LBBLA	30/05/2005
13R8	LBALA	30/05/2005
13R8	LBBLD	30/05/2005
14R8	LBALA	30/05/2005
14R8	LBBLA	30/05/2005
14R8	LBALB	30/05/2005
14R8	LQATI	30/05/2005
15R8	LBBLA	30/05/2005
15R8	LBALA	30/05/2005
15R8	LBBLD	30/05/2005
16R8	LBALA	30/05/2005
16R8	LBBLA	30/05/2005
16R8	LBALB	30/05/2005
16R8	LQATI	30/05/2005
27R8	LBALA	06/06/2005
27R8	LBBLD	06/06/2005
28R8	LBALA	06/06/2005
28R8	LBBLA	06/06/2005
28R8	LBALB	06/06/2005
28R8	LQOAH	06/06/2005
29R8	LBBLA	06/06/2005
29R8	LBALA	06/06/2005
29R8	LBBLD	06/06/2005
30R8	LBALA	06/06/2005
30R8	LBBLA	06/06/2005
30R8	LBALB	06/06/2005
30R8	LQOAN	06/06/2005

Position	Assembly name	Availability date for lowering down
31R8	LBBLA	06/06/2005
31R8	LBALA	06/06/2005
31R8	LBBLD	06/06/2005
32R8	LBALA	06/06/2005
32R8	LBBLA	06/06/2005
32R8	LBALB	06/06/2005
32R8	LQOAH	06/06/2005
25R8	LBBLA	13/06/2005
25R8	LBALA	13/06/2005
25R8	LBBLD	13/06/2005
26R8	LBALA	13/06/2005
26R8	LBBLA	13/06/2005
26R8	LBALB	13/06/2005
26R8	LQOAH	13/06/2005
27R8	LBBLA	13/06/2005
10R8	LBBLF	15/08/2005
10R8	LQNCB	15/08/2005
11R8	LBALA	15/08/2005
11R8	LBBLA	15/08/2005
11R8	LECL	15/08/2005
11L1	LEFL	15/08/2005
11L1	LBALA	15/08/2005
11L1	LBBLP	15/08/2005
10L1	LQNCB	15/08/2005
10L1	LBALE	15/08/2005
10L1	LBBLG	15/08/2005
9L1	LBALE	15/08/2005
9L1	LBBLF	15/08/2005
8L1	LQNCB	15/08/2005
8L1	LBALE	15/08/2005
8L1	LBBLQ	15/08/2005
8R8	LBALE	22/08/2005
8R8	LBBLF	22/08/2005
8R8	LQNCB	22/08/2005
9R8	LBALE	22/08/2005
9R8	LBBLG	22/08/2005
10R8	LBALE	22/08/2005
31R8	LQOAS	24/10/2005
33R8	LQOBG	24/10/2005

APPENDIX III:

Overall schematic planning

