

Installation and SX5 Activities Update and Plans

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CMS week,
CERN
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Installation Plan (Before Magnet Test)

YB+0

- 8 chambers below cryostat (S10, S11) : 2MB1, 2MB2, 2MB3, 2MB4/10
- 12 chambers in S02, S03, S06: 3MB1, 3MB2, 3MB3, 3MB4

YB-0

- 11 chambers below cryostat (S8, S9, S12):3MB1, 3MB2, 3MB3,2MB4

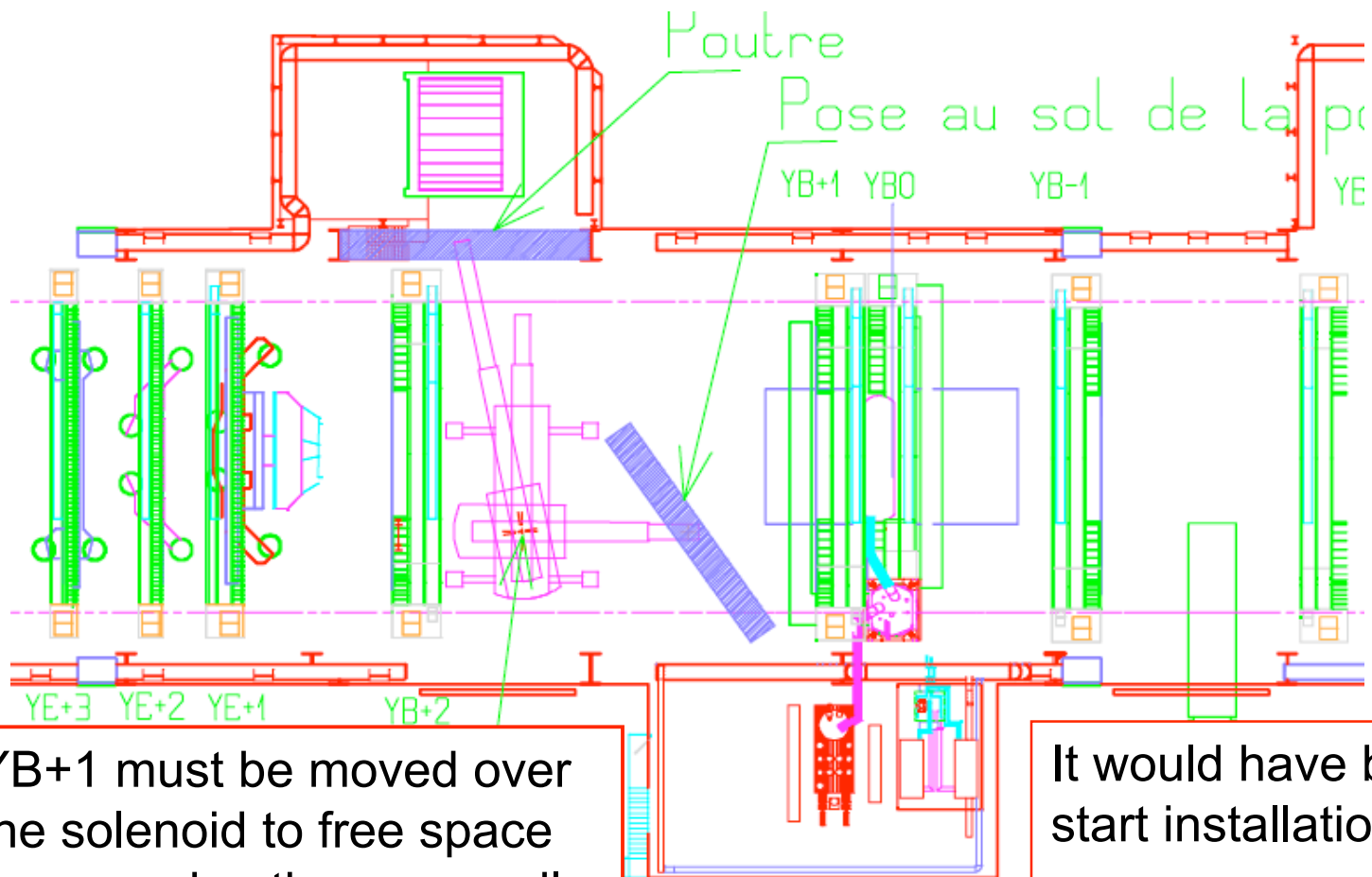
YB-1, YB-2

- 16 chambers in S0, S11: 4MB1, 4MB2, 4MB3,4MB4/10
 - 5 MB4 chambers: S02, S08, S12 in YB-1 and S03, S08 in YB-2
- ➡ for a total of 52 chambers (+2 feet chambers in YB+1)

Insertion test in a vertical sector (S01 or S07)

- ➡ 51 chambers have been installed due to RPC problem with YB-2 S08

Scheduling Constraints



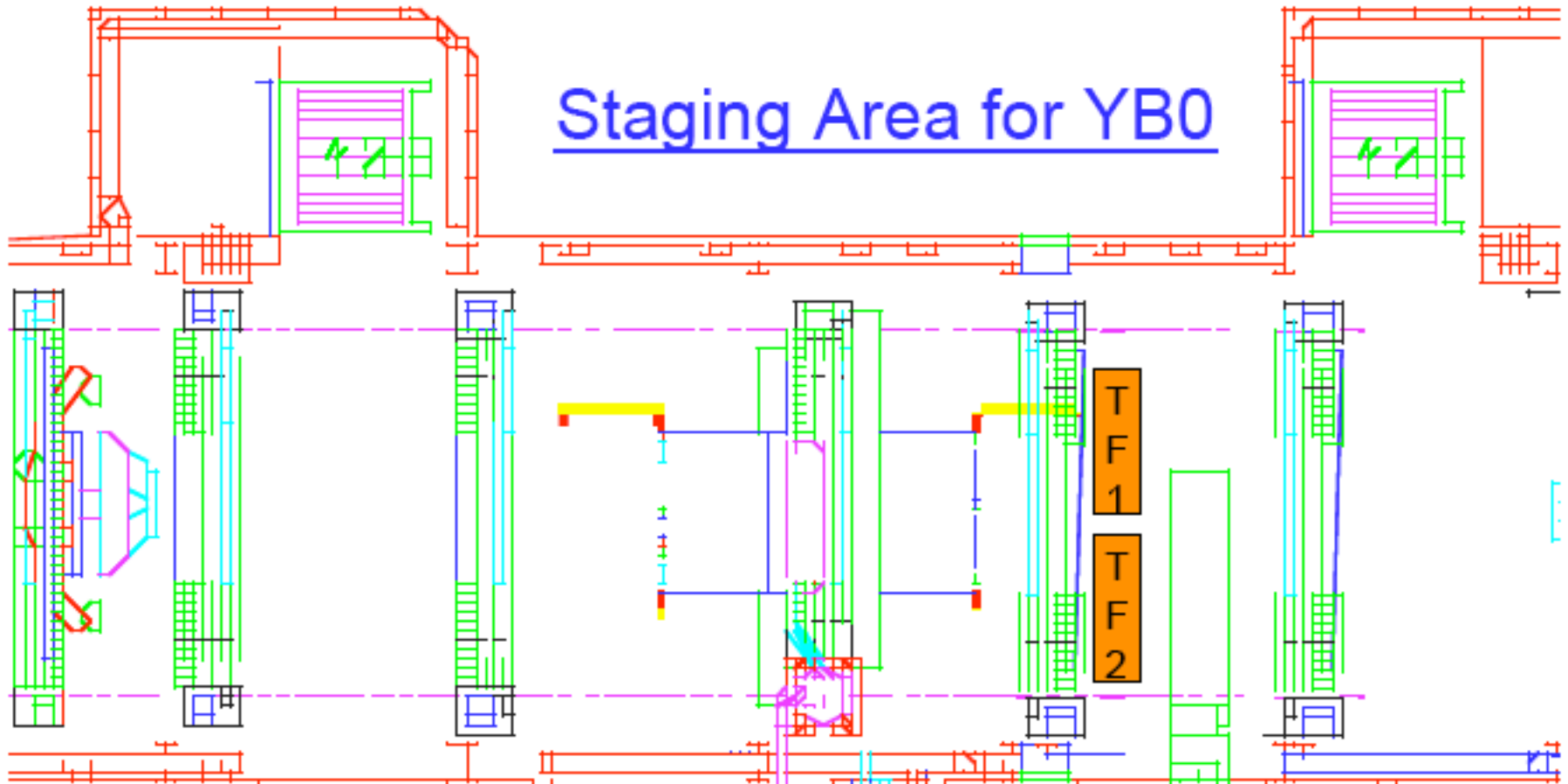
YB+1 must be moved over the solenoid to free space for removing the crane rail.

This operation cannot be done until YB+0 installation is completed

It would have been better to start installation on YB-0.

However YB+0 installation was completed on Feb. 14th and YB+1 was moved on Feb. 21st.

Staging Area for YB0

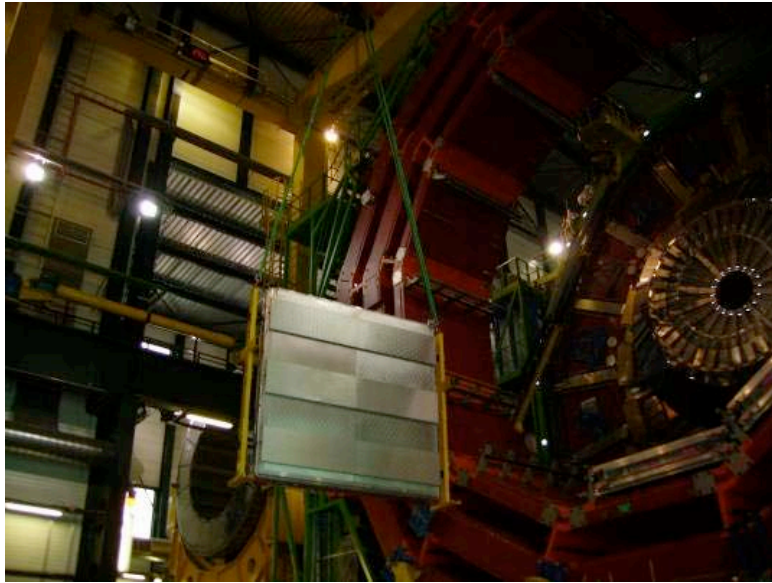


Position Transport Frames on YB-1 side and cradle on YB0 side.

Unload chamber, put on table, HV, MC tests and move table to plus side under tower "near" side.

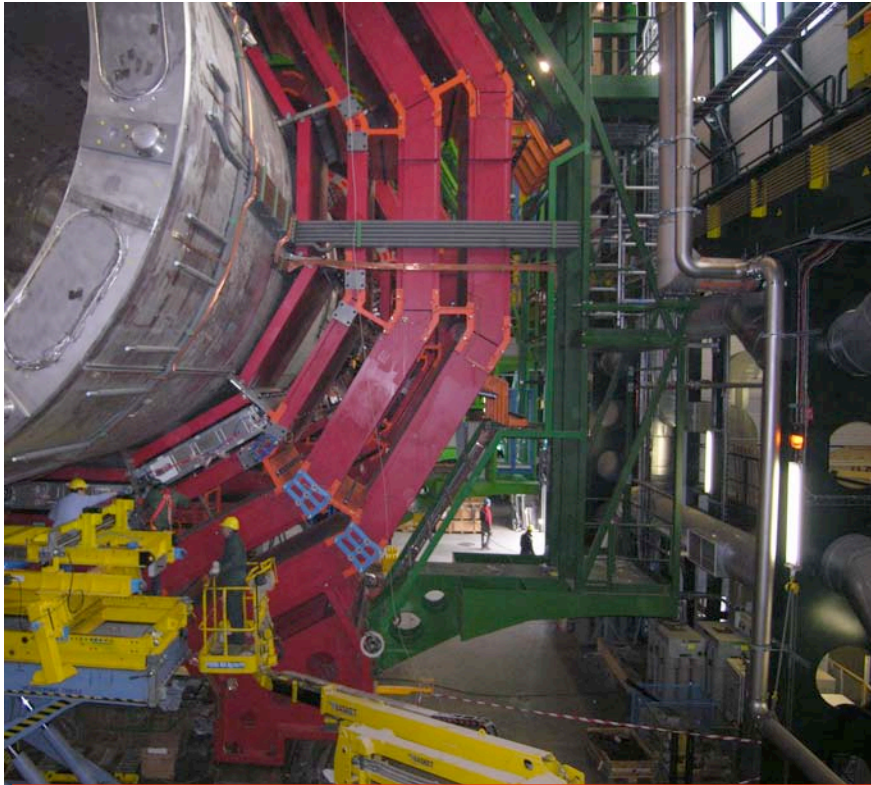
Unload second chamber put horizontal on blocks, perform tests during chamber 1 installation.

Requires additional set of forks and lifting pieces built by Aachen.



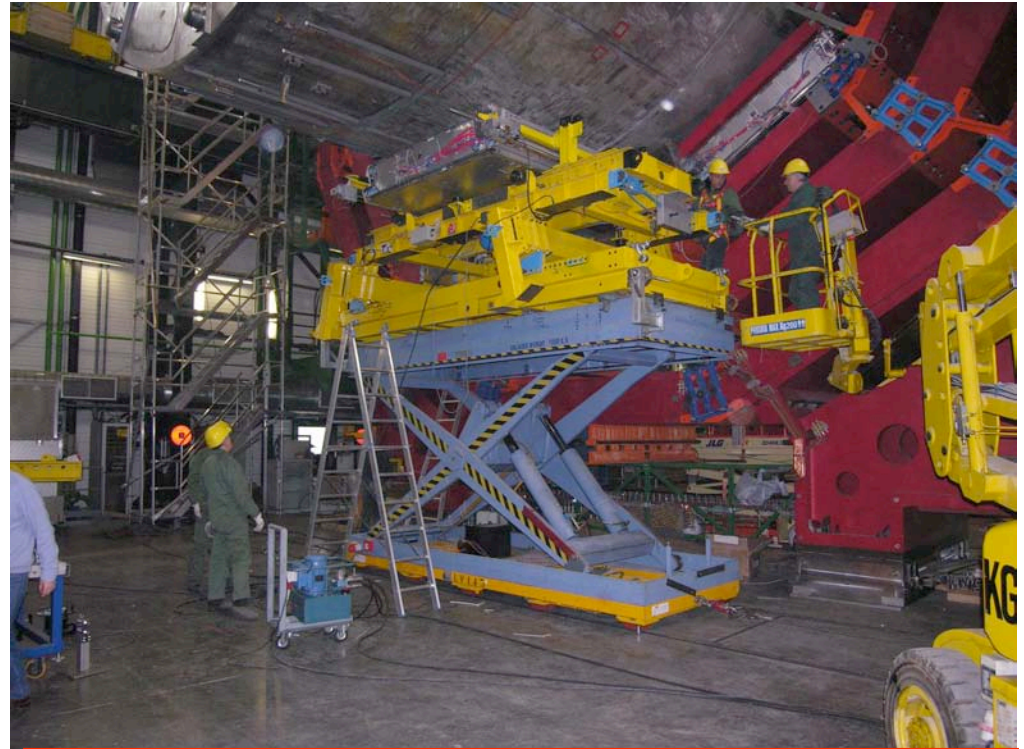
For most of YB+0 installation, crane usage in the staging area was in conflict with CSC and ME11 work due to proximity limitations of the two cranes. We all suffered some delays

Installation Under the Cryostat (YB+0)



After testing, the chamber is put on the table and pushed under the tower to the YB0 side.

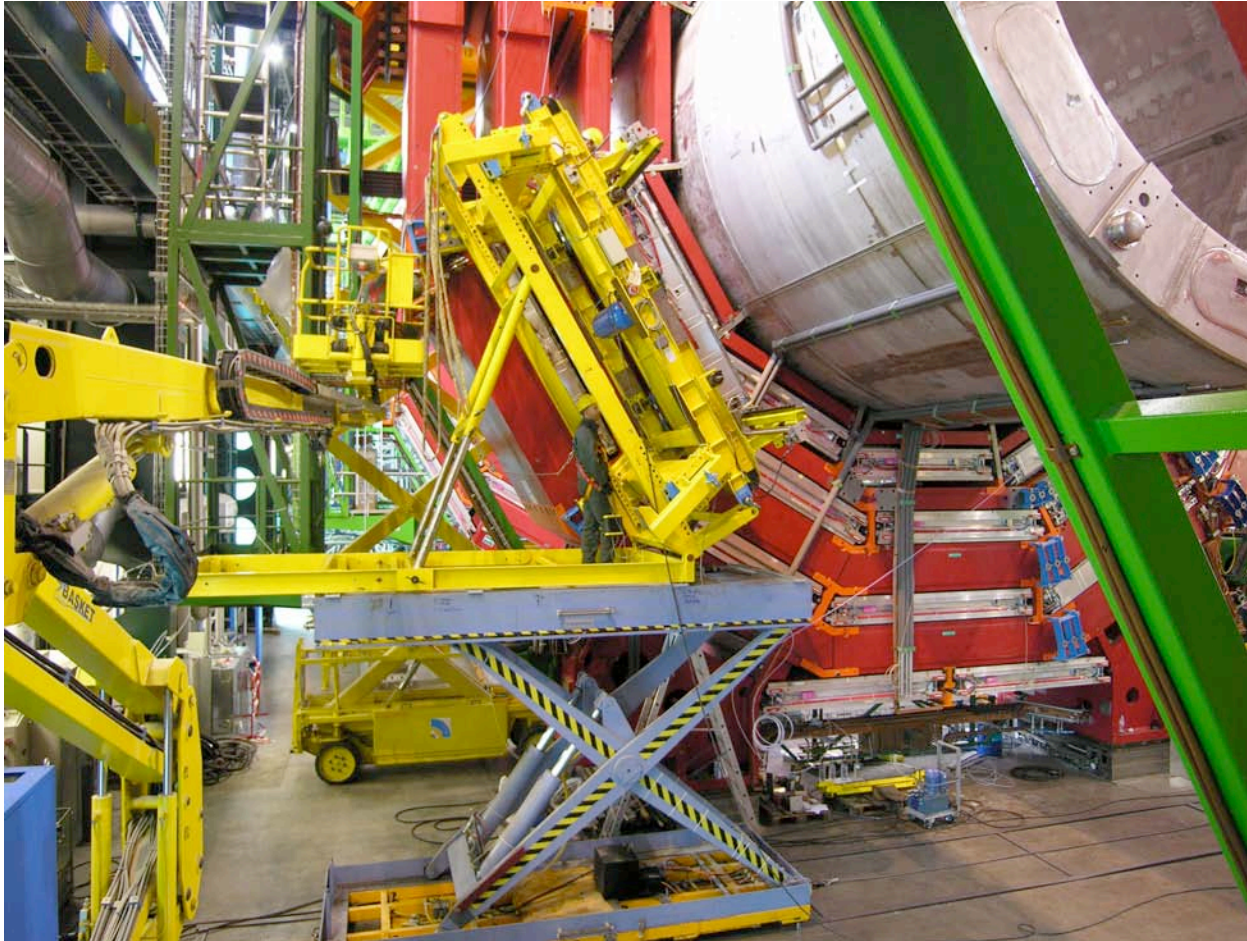
The platform is moved under S01 or S07 where the crane clears the cryostat



The platform is moved in position with the hydraulic hoist. Fine adjustment wrt the iron is done with a screwing mechanism.

Handling of the cradle with the crane was very difficult due to the scaffolding on the left and the cryostat.

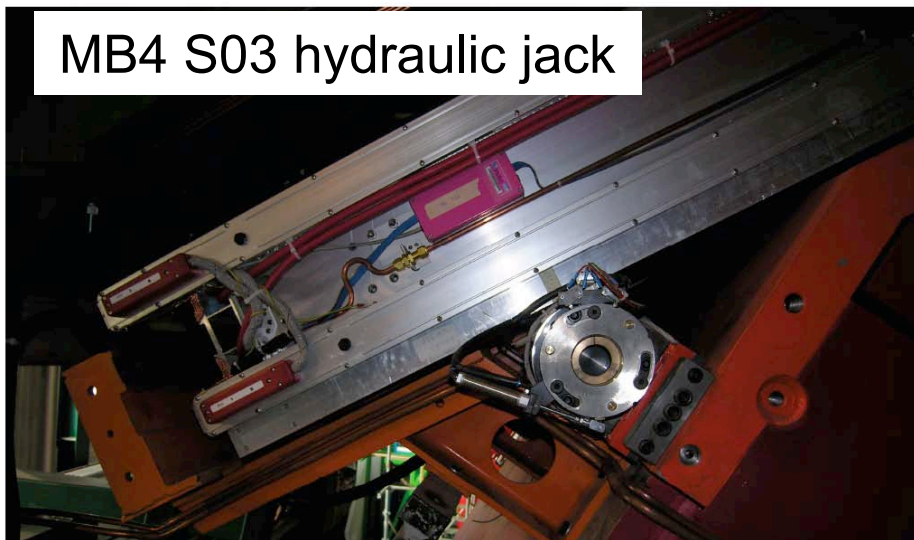
Installation Under the Cryostat (YB-0)



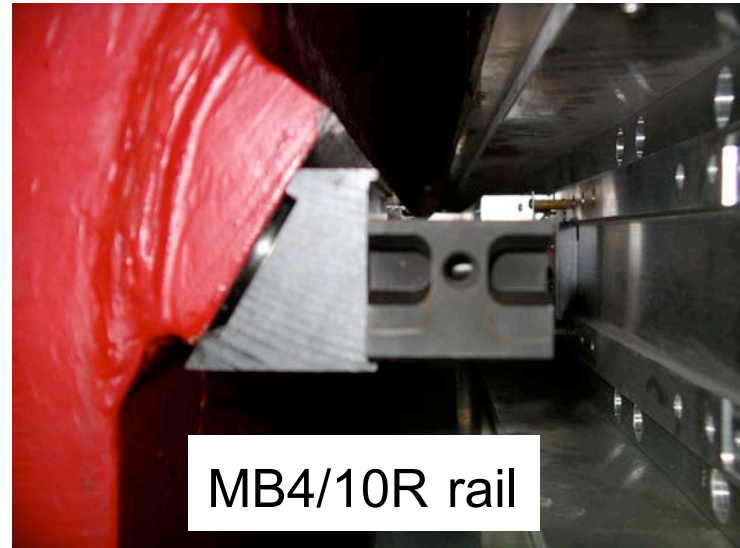
Moving the platform from S08 to S12 required a lot of time and patience due to flimsy rails and necessarily slow pace

MB4 installation in S08 and S12 was the most difficult for YB-0 since the cradle does not fit on the platform and, with the crane, it barely clears the cryostat.

Some Interferences



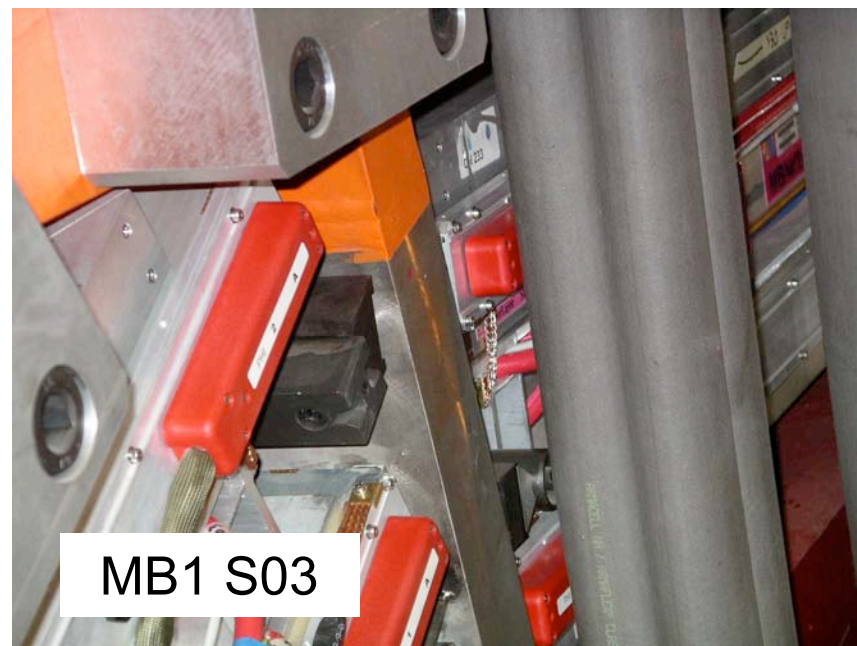
MB4 S03 hydraulic jack



MB4/10R rail



MB1 S02



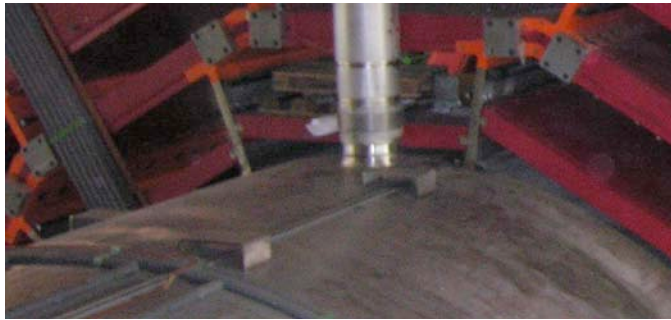
MB1 S03

Some Interferences

- **Not enough clearance to install MB4/10 Right.** The iron is out of specs and volume reduced for YB by reinforcements in feet area. Rectangular bar milled 10mm => **lost 4 hours** Similar problem in MB4 S08, bar milled ahead of time
- Interference with MB1 S03 HV connector and alignment passage with fixed pipes. **The chamber cannot be fully inserted until the pipes are modified.**
- MB1S02 gas connector in hard contact with foam protection but chamber at nominal position
- Hydraulic jacks in several locations had to be dismantled in order to insert the chamber
- Z-stops interfere in several positions with RPC cooling and/or HV connector

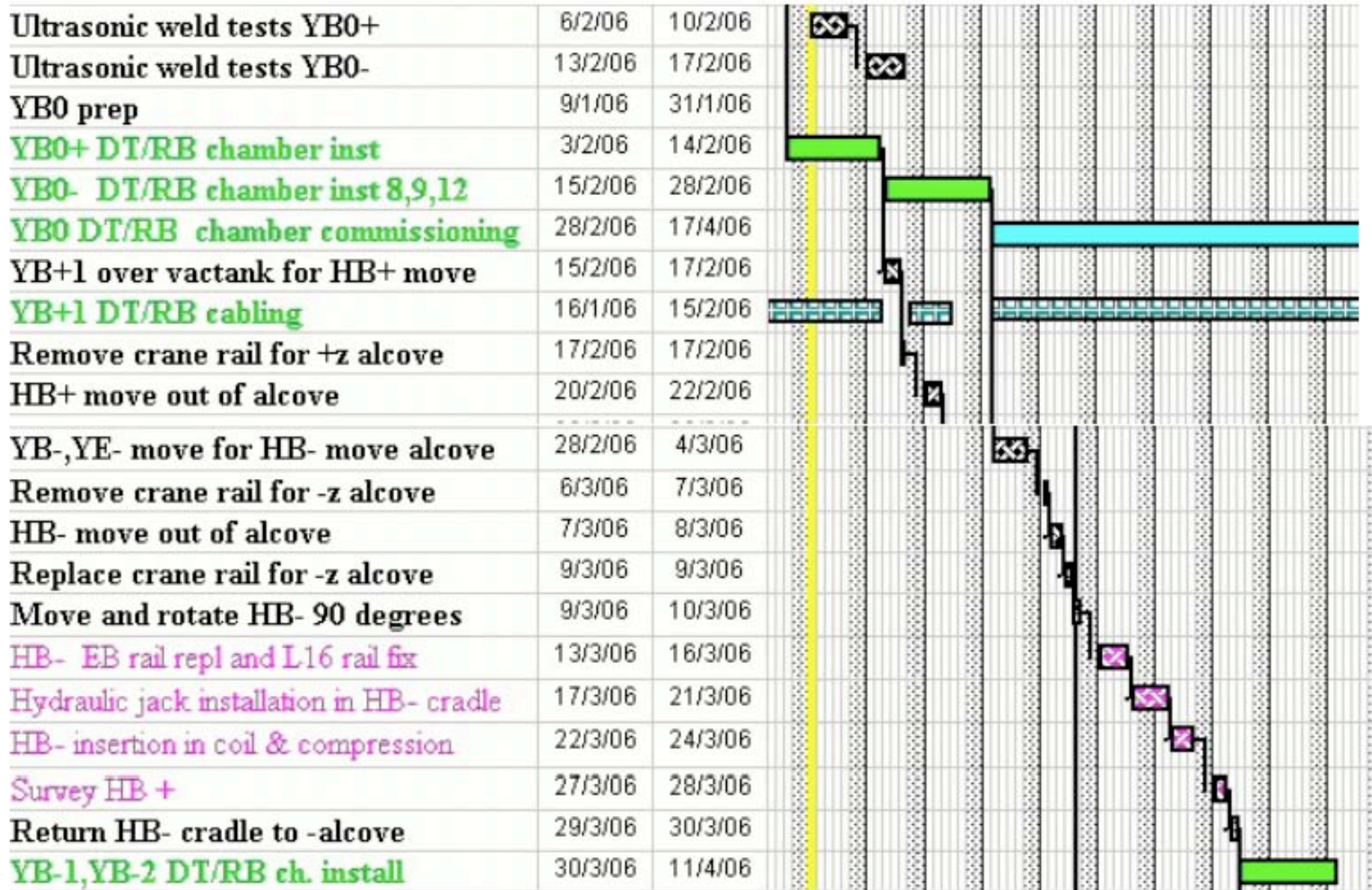
Some Problems

Last minute grinding of covers on the cryostat without adequate protection



- Assorted debris to be cleared from the iron pockets in YB0 S03, S08.
- **Two hours were lost** on February 22nd due to a faulty crane interlock.
- **TIS blocked the cranes operation at SX5 from 13:00 to 17:30** on February 23rd due to concerns with the building stability after the removal of the crane rail to move HB+. Chambers could not be delivered from ISR
- One transport had to be rescheduled on February 27th
- Another SX5 schedule optimization....

MTCC Schedule 07/02/06



YB-1, YB-2 Installation



- YB-2 was moved towards the end caps leaving a space that was barely sufficient for 2 transport frames, the test stand and unloading the frame from the truck
- In YB-2 the chambers were installed “front-end side” first. The RPC HV connector cover had to be removed to go through the iron pocket
- Last minute discovery: ZEC had not tested the cooling pipes in YB-2

In Addition

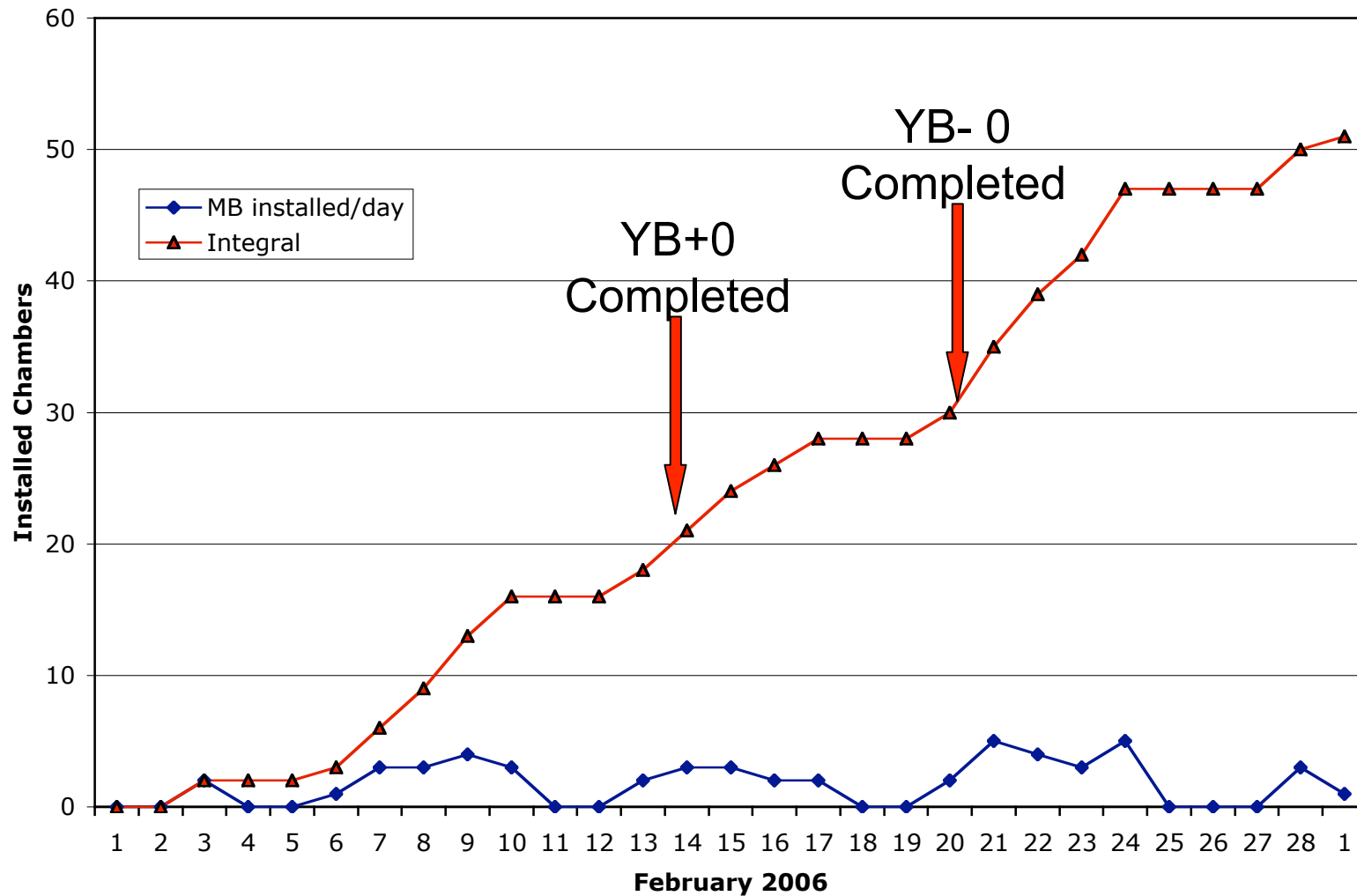
3 chambers were removed to change RPCs and then re-installed:

- MB2 in YB+1 S05 on February 1st
- MB1 in YB+1 S06 on February 3rd
- MB3 in YB+2 S12 on March 1st

For MB1, the cradle was rotated with the chamber, an operation that is required for chamber installation in S01, S07. This avoided several time consuming operations:

- extract the chamber from the cradle
- add the support pieces and rotate
- replace the RPC
- rotate and remove the supports
- insert on the cradle again

February 2006 Installation Summary



- YB+0 installation was completed on February 14th
- YB-0 was completed on February 20th
- YB-1, YB-2 was completed on March 1st

51 + 3 + 3 chambers

Sector 1 Installation Test

On March 1st we carried out an installation test in YB-2 S01 with a bare MB2 (MB2P01) that had already been used in other installation tests.

The procedure for installation in S01 and S07 is the following:

- 1) The chamber is attached to the cradle by sliding the cradle over the chamber.
- 2) The cradle is posed on the ground and released from the motorized balance beam.
- 3) The rotation is done by lifting the cradle with the crane from one extremity while holding it with a forklift at the other side
- 4) Once the cradle is in the vertical position it is released from the forklift.
- 5) The cradle is moved to the interface pads and its position is adjusted with two hoists
- 6) Once the cradle is bolted to the interface pads the insertion follows the usual procedure.

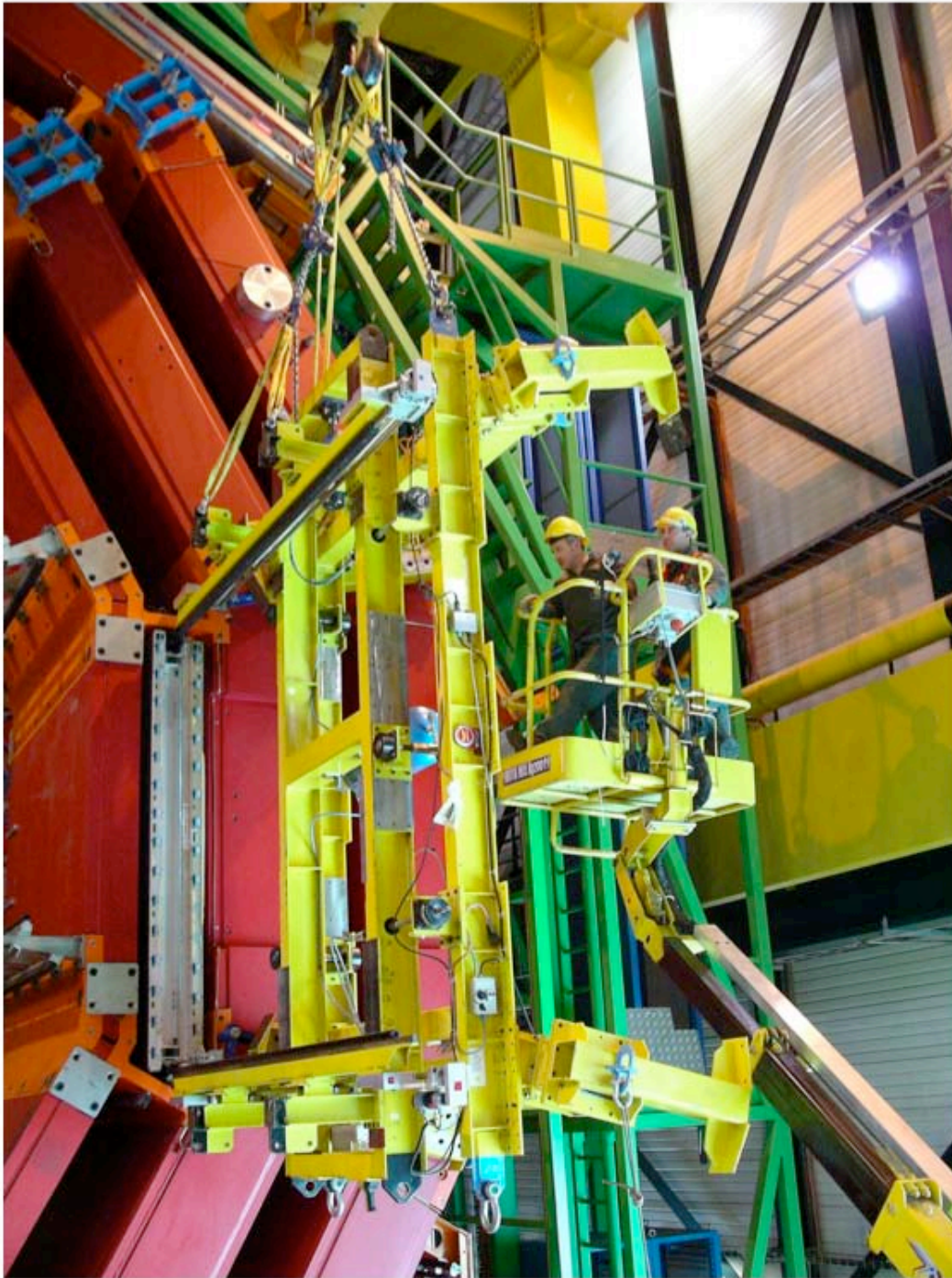


Cradle rotation with forklift



Portable crane used to rotate the cradle with MB2 in the installation test.

It works but it is not as smooth as with the forklift (must be electric for UX)



Sector 1 Installation Test

Hoisting the chamber and the final adjustment on the interface pads can be streamlined by using a dedicated balance beam and two electric hoists with remote control.

With these improvements and adequate manpower we expect to install 2 to 3 chambers/day in UX5

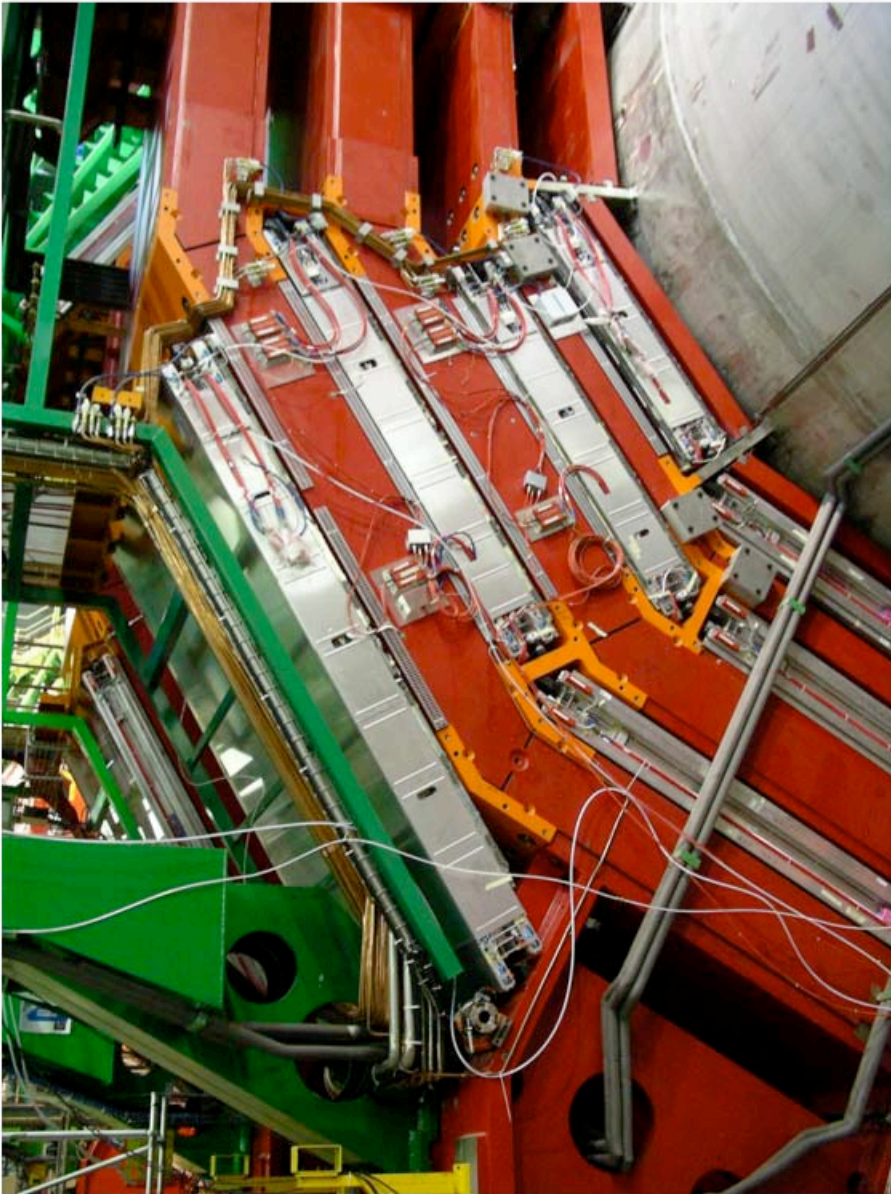
Feedback from this installation period

- The most important item is to have a large buffer of ready to install chambers before the beginning of the installation period. At present the buffer is limited to 28 chambers primarily by storage space at the ISR. The recommendation is to acquire support pieces for additional 6 chambers and more space at the ISR.
- It is very important to have a staging area large enough to accommodate 2 transport frames. This allows to minimize the impact of chambers deliveries to SX5 on the installation.
- At present we have interface pads for half of a wheel. In order to decouple the installation in SX5 and UX5, we should acquire additional interface pads for S01 and S07. These additional pieces would also streamline considerably the first installation phase after the Magnet Test

Feedback from this installation period

- The new electric hoist provided by Alain was a great help. However to get the full benefit it should be equipped with a remote control. At present, most of the adjustments must be done controlling the hoist from a cherry picker or scissor lift.
- The insertion tool provided by CIEMAT is essential for a fast installation rate. It is important that the safety switches are activated on the manual controls in order to avoid accidents during the operation.
- Spare parts should be acquired for the cradles in order to minimize the impact of failures during operation. The electric hoist should be overhauled before the next installation campaign.

Preparation for Commissioning



- YB0 is ready: cooling and gas connected (Gerd will finish the test this week), 10 chambers connected to HV
- Access to YB+0 depends on HB+ installation. **OK up to March 21st**
- Rails for MB1 HV patch panels are in the wrong position for YB_0 and YB-1. Special plates to be done this week
- Support bar for MB4/10 HV, LV to be installed this week
- Chambers positioned and z-stops locked for YB0 and YB-1
- Support plates for HV/LV PP installed on YB-1

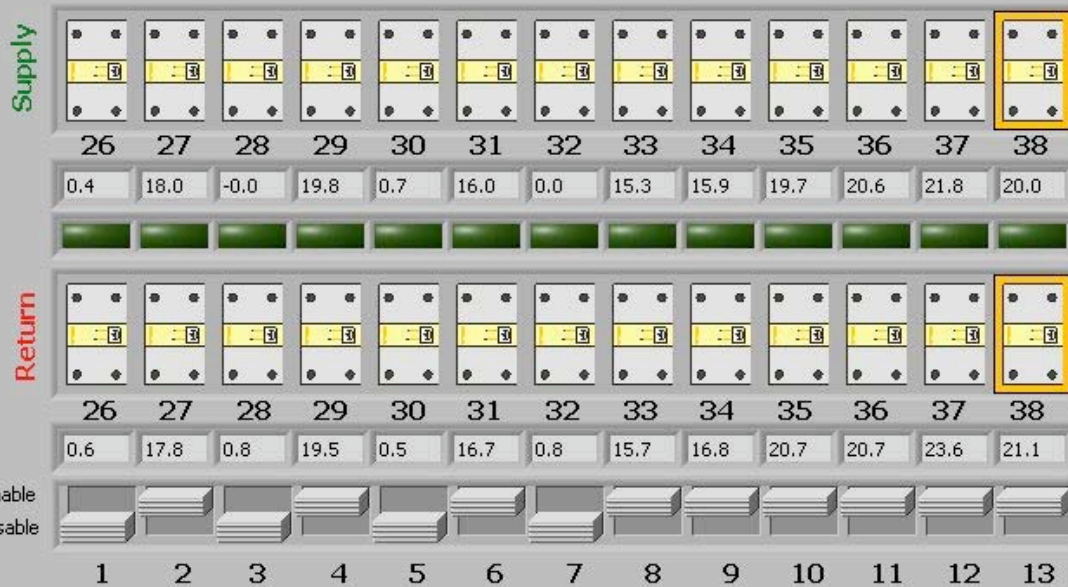
SX5 Gas Monitoring

ELMB-SuperScan Control (CMS DT MB+1) Manifolds E,F,G,H

NodeID 1 # of scans1

 System message 1

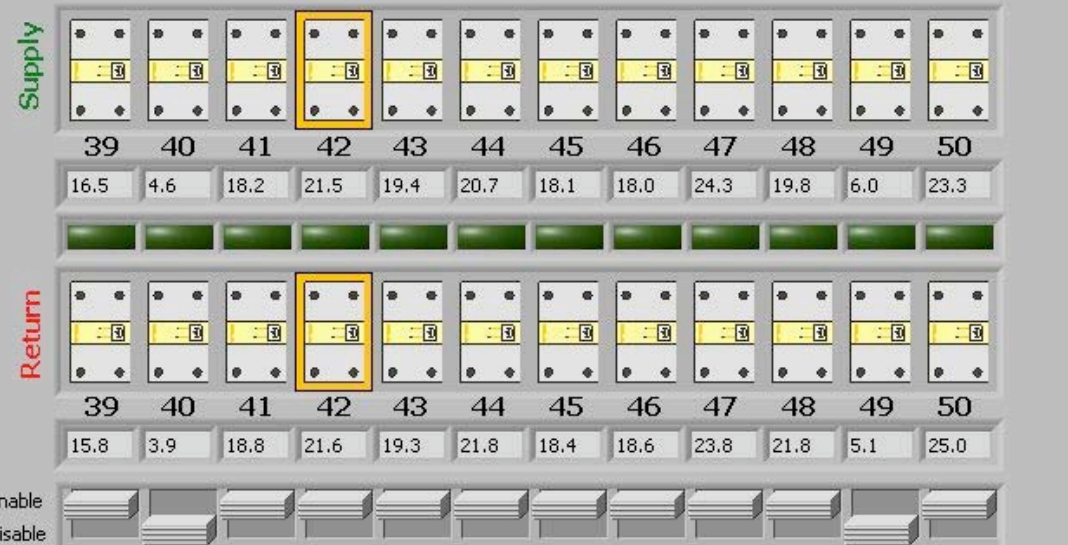
Manifolds E & F



NodeID 2 # of scans2

 System message 2

Manifolds G & H



SX5 Gas System

- Gas monitoring system operational since a couple of weeks.
- Debugged (crossed connections) and flows adjusted by Gerd.
- Gas flow to YB+1 will be disconnected apart for S10
- Gas flow on YB0 will be with temporary tubing until it is in UX
- Another gas mixture problem due to low Ar pressure (empty battery). Before the gas shuts off, the mixture is mostly Ar. This caused HV trips on the YB0 chambers.
- Shut off valve needed to close gas mix when Ar pressure is too low

Installation After the Magnet Test

Preferred Installation Sequence (115 Chambers):

- 1) YB-0 S04, S05: 9 +2 chambers
- 2) YB-1 ~8 Sectors: 29 +2 chambers
- 3) YB+2, YB+1, YB0 S01 S07: 16 chambers (UX)
- 4) YB-2 ~8 Sectors YB0 S01 S07: 39 +2 chambers
- 5) YB-1, YB-2 S01,S07: 16 chambers (UX installation

The chambers for the first 3 points (58) must be ready by the end of the Magnet Test.

Access time to YB0 can be minimized by commissioning (and cabling) YB+0 and YB-0 in parallel with two dedicated teams.

Schedule After the MT (educated guess)

Ingredients:

- Duration of MT (start closing to start opening magnet)
18 weeks from Austin's schedule end of December 2005
- Opening sequence and duration from Lucien's schedule in July 2005:
 - 1 day/item apart for HB cradle (3 days)
 - start opening with YE+3 to EB+
 - continue from YE-3 to EB-
- Best current estimate for closing the magnet: May 29th
- Moving an item to SX5 takes 1 week

Comments and Caveats

- Commissioning of YB0 installed chambers should be ~completed before MTCC
- S10/S11 in YB-1, YB-2 are ready for commissioning
- Installation team at SX5 as YB-2 opens to prepare YB-1 and YB-0 for installation (mount interface pieces, staging area preparation...)
- Two teams to cover 7am to 7pm installation
- One lifting platform, 1 cherry picker and priority use of the crane
- Adequate staging area between YB-1 and YB-2
- Buffer of ready to install chambers (28 to 34)
- YB-1 , YB-0 installation is done in the same period
- YB0 cabling starts as soon as YB+0 is accessible (no interference from EB installation)

Comments and Caveats

- Cabling and MC testing is still the most critical item. It also includes RPC cables
- YB-1 installation does not delay the lowering of YB+2, YB+1 in the cavern. But the installation sequence must be frozen now because we want to couple RPC and DTs
- Lowering YB0 could be interchanged with YB-2 installation depending on EB- readiness and end of the year shutdown

Activity Name	Start Date	Finish Date	Oct 06				Nov 06				Dec 06				Jan 07				Feb 07				Mar 07									
			17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	4	11	18	25	4	11	18			
YB Opens	5/29/06	9/25/06																														
YB0 Installation Sectors - 4,5 (9 Chambers) + 2 MB4/9-11	10/13/06 10/24/06	10/19/06 10/30/06																														
YB0 + Commissioning	10/2/06	10/13/06																														
YB-0 Commissioning S04,S05	10/27/06	11/6/06																														
YB-0, YB+0 Cabling in parallel	10/9/06	11/13/06																														
UX YB+2, YB+1 Sectors 1,7 (16 Chambers)	11/13/06	12/1/06																														
UX YB+ 2,+1 Functionality Test	11/23/06	12/15/06																														
UX YB+2 , +1 Cabling	12/4/06	12/22/06																														
YB-1 Installation , 8 sectors (29 +2 chambers)	10/20/06 12/11/06	11/9/06 12/15/06																														
YB-1 Commissioning	11/13/06	12/1/06																														
YB-1 Cabling	11/27/06	12/29/06																														
UX5 YB0 Installation and Cabling																																
UX YB0 Sectors 1,7 (8 Chambers)	1/8/07	1/16/07																														
UX YB0 Connections HV, LV, Cooling	1/15/07	1/23/07																														
UX YB0 Functionality Test	1/17/07	1/26/07																														
UX YB0 Cabling	1/24/07	2/6/07																														
YB-2 Installation , 8 sectors (30 +2)	12/4/06 1/30/07	12/22/06 2/5/07																														
YB-2 Commissioning	1/8/07	1/26/07																														
YB-2 Cabling	1/22/07	2/16/07																														
UX5 YB-1,YB-2 Installation and Cabling																																
UX YB-1, YB-2 Sectors 1,7 (16 Chambers)	1/29/07 2/26/07	2/6/07 3/6/07																														
UX YB-1, YB-2 Functionality Test	2/12/07 3/8/07	2/19/07 3/15/07																														
UX YB-1, YB-2 Cabling	2/19/07 3/12/07	3/5/07 3/19/07																														

Depends on HB/EB+ and vacations



Required Installation Windows (Minimum)

Activity Name	Start Date	Finish Date	Oct 06					Nov 06					Dec 06					Jan 07				Feb 07								
			17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	4	11	18	25	4			
YB Opens	5/29/06	9/25/06																												
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UX YB+2, YB+1 Sectors 1,7 (16 Chambers)	11/13/06	12/1/06																												
YB-1 Installation , 8 sectors (29 +2 chambers)	10/20/06 12/11/06	11/9/06 12/15/06																												
UX5 YB0 Installation and Cabling																														
UX YB0 Sectors 1,7 (8 Chambers)	1/8/07	1/16/07																												
YB-2 Installation , 8 sectors (30 +2)	12/4/06 1/30/07	12/22/06 2/5/07																												
UX5 YB-1,YB-2 Installation and Cabling																														
UX YB-1, YB-2 Sectors 1,7 (16 Chambers)	1/29/07 2/26/07	2/6/07 3/6/07																												

First Installation Period:
58 Chambers in 7 weeks

Second Installation Period:
57 chambers in 6 weeks

- with priority use of crane and access to wheels (7am to 7pm) and adequate manpower (**no experience with UX installation**)
- Installation windows are educated guesses not cleared with TC

Comments and Caveats V2

I have modified the installation schedule taking into account the latest Austin's estimate for the opening of the detector.

The main changes are:

- interleave YB0 and YB-2 installation. This requires additional interface pads
- chamber certification is more critical than ever, ~100 chambers ready at the beginning of November
- YB-2 cabling across end of the year shut down

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			20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	4	11	18	
YB Opens	5/29/06	8/28/06																												
YB0 Installation Sectors - 4,5 (9 Chambers) + 2 MB4/9-11	9/15/06 9/26/06	9/21/06 10/2/06																												
YB0 + Commissioning	9/4/06	9/15/06																												
YB-0 Commissioning S04,S05	9/29/06	10/9/06																												
YB-0, YB+0 Cabling in parallel	9/11/06	10/16/06																												
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UX YB+ 2,+1 Functionality Test	10/26/06	11/17/06																												
UX YB+2 , +1 Cabling	11/6/06	11/24/06																												
YB-1 Installation , 8 sectors (29 +2 chambers)	9/22/06 11/13/06	10/12/06 11/17/06																												
YB-1 Commissioning	10/16/06	11/3/06																												
YB-1 Cabling	10/30/06	12/1/06																												
UX5 YB0 Installation and Cabling																														
UX YB0 Sectors 1,7 (8 Chambers)	11/13/06	11/21/06																												
UX YB0 Functionality Test	11/22/06	12/1/06																												
UX YB0 Cabling	11/29/06	12/12/06																												
YB-2 Installation , 8 sectors (30 +2)	1/8/07 11/6/06	1/12/07 12/1/06																												
YB-2 Commissioning	11/27/06	12/15/06																												
YB-2 Cabling	12/11/06	1/19/07																												
UX5 YB-1,YB-2 Installation and Cabling																														
UX YB-1, YB-2 Sectors 1,7 (16 Chambers)	12/11/06 1/29/07	12/19/06 2/6/07																												
UX YB-1, YB-2 Functionality Test	1/8/07 2/8/07	1/15/07 2/15/07																												
UX YB-1, YB-2 Cabling	1/15/07 2/12/07	1/29/07 2/19/07																												

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UX YB-1, YB-2 Sectors 1,7 (16 Chambers)	12/11/06 1/29/07	12/19/06 2/6/07																											
			20	27	3	10	17	24	1	8	15	22	29	5	12	19	26	3	10	17	24	31	7	14	21	28	4	11	18

Summary

- Chamber installation before the Magnet Test is completed apart for YB+1 feet chambers. In total we have installed 54% of the chambers
- Most important we have finished (apart for the feet chambers) the installation under the cryostat, by far the most challenging operation.
- The additional tooling: transport frame, supports and hoist were very useful in streamlining the installation
- The buffer of ready to install chambers is a crucial item, we can install faster than coupling RPC/DT. Also RPC problems are seen ahead of time
- The installation team was a bit undermanned but ,on the positive side, new people from RPC groups and Torino participated.
- The insertion test was successful, no special problem are expected with UX installation
- Cabling (and testing) is still a critical item in the schedule
- Chamber certification at the ISR is still the major bottleneck