

GLOBAL HARDWARE STATUS FOR THE LHC SECTOR TEST

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Abstract

Starting from the TI 8 dump (TED) up to the end of the continuous cryostat in IR7, the availability in the tunnel of all components in the beam line e.g. the vacuum, cryogenic, collimation, protection devices, beam instrumentation and magnet systems are reviewed.

INTRODUCTION

In this paper, the hardware availability date is defined as the transport date as specified in the schedule for the LHC Sector test. This scenario assumes that all equipments are ready for transportation (magnets, DFBs, beam instrumentation...) and that the vacuum acceptance tests for components on the beam vacuum lines are completed before their transportation to the tunnel.

This review will not address the status of the about 320 items of the database but will only address the critical equipment or equipment which availability was questioned.

The Sector test is part of the overall LHC installation i.e. the layout shall be identical to the one required in 2007 for the start up. All equipment expected to be available after the Sector test is considered as being on the critical path.

Prior to checking the hardware availabilities, the status of the 3D integration is shown.

LAYOUTS & MAJOR SYSTEMS

TI 8 downstream line - Last 120 m

At the end of the TI8 transfer line, the injected beam will arrive in the LHC main ring tunnel (IR8R – right side of IR8) and will pass very close to the DFBA, to the circulating beam vacuum chambers and to the Q6R8 quadrupole cryostat (Fig.1). Fig.2 shows examples of integration studies at the position of the collimators in TI 8 and near the Q6R8 quadrupole magnet.

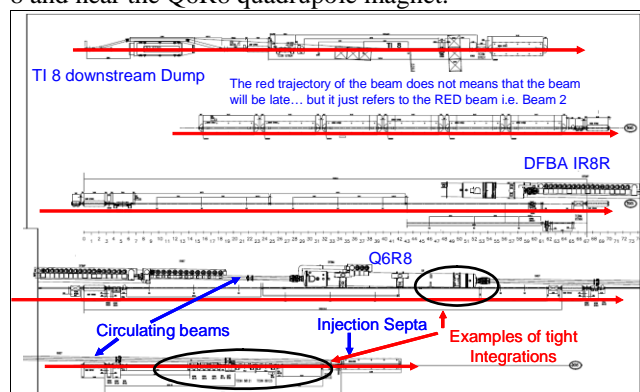


Fig.1: Layout of the last 120 metres of the TI 8 injection transfer line downstream the TI 8 dump.

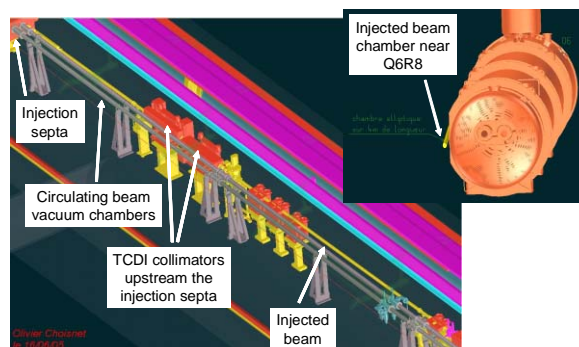


Fig.2: Example of the tight integration required in the TI 8 downstream part.

IR8R&L and IR7R

After travelling in the TI 8 SPS to LHC transfer line, the beam will be injected into the LHC between Q6R8 and Q5R8 quadrupoles, in the injection Septa (MSI). The last 40 meters of the TI 8 line downstream the TCDI collimators will be baked for vacuum compatibility with the ultra-high vacuum of the circulating beam.

The beams will pass through the Q5 cold quadrupole before being kicked to their final orbit by the injection kickers. Fig.3, 4 and 5 show the major equipments required for the room temperature parts, for the cryogenic system and for the cold magnets respectively from the injection into the LHC to the temporary beam dump to be installed in IR7R.

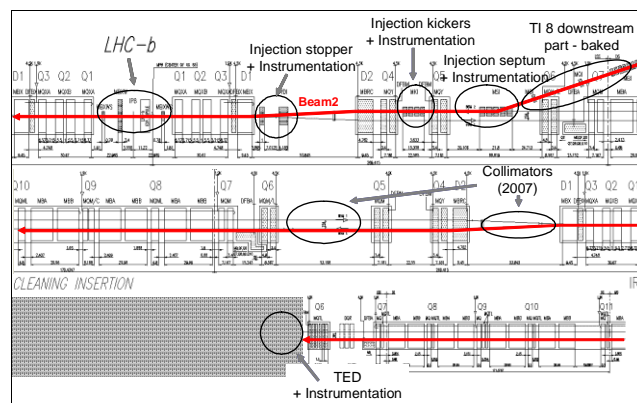


Fig.3: Major equipments in the room temperature part of the Sector test (i.e. IR8L&R + IR7R).

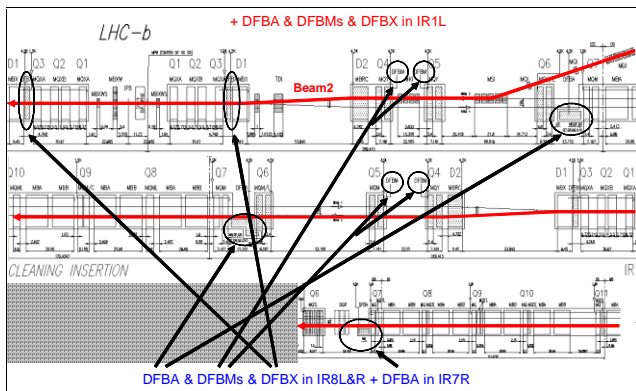


Fig.4: DFBs components required for the Sector test (i.e. IR8L&R + IR7R) to ensure the mechanical integrity of the cryogenic system.

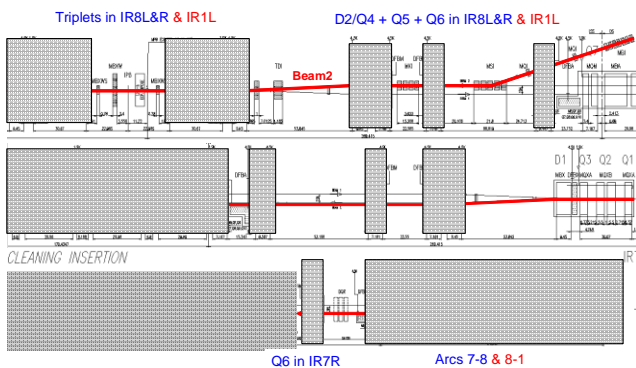


Fig.5: Cold magnets required for the Sector test (i.e. IR8L&R + IR7R). The magnets in IR1L are required to ensure the mechanical integrity of the cryogenic system

3D INTEGRATION & HARDWARE AVAILABILITY

TI 8 downstream line – Last 120 m

The 3D integration of the downstream part of the TI 8 line has been completed except for:

- The TCDIM mask for which the design is being completed. About one week will be required to complete the integration after receiving the final drawings.
- The differential pumping tank between the TI 8 and LHC circulating beam vacuums. The 3D re-integration will be completed by mid-February.

Most of the hardware is already available like magnets, beam instrumentations, vacuum bellows and pumping ports. The vacuum chambers are being re-manufactured.

Both the TCDIM mask and the differential pumping are expected by May'06 for an installation in May'06 and therefore need to be followed up. The injection collimators (TCDI) are already on the critical path, since expected in June'06 (Fig.6).

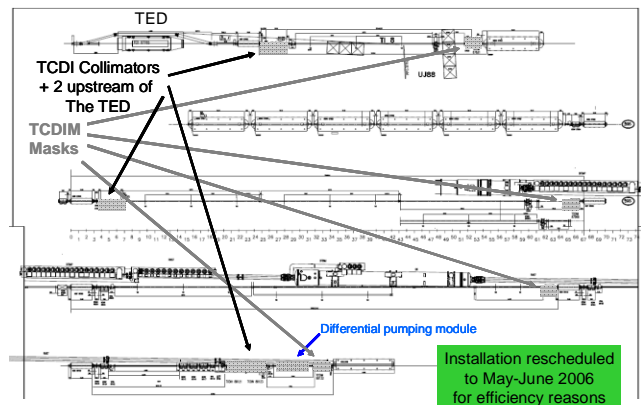


Fig.6: Position of the critical equipment in the last 120 metres of the TI 8 line.

Long Straight Section in IR8R

The 3D integration of the right side of IR8 has been completed except for:

- The DFBMs on Q4, Q5 and Q6 which integration shall be completed by March'06,
- The DFBA on Q7 which integration shall be completed by May'06,
- The TCDDM, TCTH mask or collimator which integrations will require 1 week after receiving the 3D models.

The DFBXs are all available at CERN and their installation in the tunnel shall follow the schedule.

However, several items have been identified as critical for the Sector test. The equipment to be followed up are:

- The septum chambers and pumping ports,
- The beam instrumentation (BTVSS, BTVSI, BPTX, BPMWB, BTVST, BPMSX, BPMSW),
- The injection collimator (TDI) which is delayed by 5 weeks (CERN workshop priorities),
- The injection kickers (MKI), the beam screen problems are being solved,
- The TCTH collimator which design is completed and is in production,
- The DFBMs.

Two components are on the critical path: the DFBAs due to manufacturing delays and the TCDDM masks which design is being completed.

Long Straight Section in IR8L

The 3D integration of the left side of IR8 has been completed except for the TCLIA, TCLIB, TCLIM and TCTH collimator. Their integration will require one week after receiving the 3D models.

The availability of the installation drawings is also a major issue and the IR8 installation vacuum drawings are expected to be completed by March'06.

The Q6L8 cold quadrupole magnet will be available for installation in March'06. Several items have been identified as critical for the Sector test. The equipments to be followed up are:

- The beam instrumentation: BPMWB, BPMSX, BPMSW,
- The DFBMs and DFBA.

The collimators TCLIA, TCLIB and TCTV are all on the critical path even if they are all at a different design stage, completed for the TCLIB and being completed for the TCLIA and TCTV. The TCLIB is already launched in production.

The TCLIA and TCTV are not yet launched for manufacturing and these collimators could be pushed to the Phase 2.

Arc sector 8-7

The 3D integration of the 8-7 arc is fully completed and no problems are expected with the dipole magnets. Some items need to be followed up:

- The QRL 7-8, the leak detections shall be completed,
- Some quadrupoles need to be followed up: Q7R7, Q8R7, Q9R7 and Q10R7. These magnets are expected to be available between week 10 and week 14.

Long Straight Section in IR7R

The 3D integration of the right side of IR7 is half made in particular for the DFBA. This integration will be completed by March'06.

Some equipments need to be followed up:

- The Q6R7 cold quadrupole magnet,
- The BTVSI monitor (beam instrumentation),
- The DFBA.

CONCLUSIONS

A huge amount of work has been made to provide the require equipment. However, to stay within the schedule, the installation must continue straight forward, all integration problems must have been solved not later than April'06. This strategy implies that the LHC baseline is fully consolidated. This consolidation requires the contribution of the equipment owners both at the stage of the first entry of the equipment parameters but also for the verification of the entered data.

Pressure shall be kept to complete the 3D integrations and the installation drawings required in particular by the Vacuum group for the detailed integration of the instrumentation ports and vacuum chambers.

The availability of the cold magnets, DFBMs and DFBA in IR1L for the Sector test shall be studied in detail and delayed equipments shall be confirmed as soon as possible to TS/IC in order to adapt whenever possible the installation schedule.

ACKNOWLEDGEMENTS

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