

# ATB'S COMMITMENTS AND MAJOR ISSUES FOR THE LHC

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## Abstract

This paper states ATB's responsibility and organisation for LHC collimation, dumps, stoppers and masks. In particular, it will address the strategy during the collimator production to assure the system functionality and performance expected for the different operation stages and the procedures and tests to be put in place to reach these objectives. Finally, current major issues (i.e. uncovered requirements) and possible 'Plan B' are presented.

## DUMPS AND STOPPERS

- TED : External dumps for the transfer lines and TBSE : Stoppers

The dumps (TED) and safety stoppers (TBSE) in the transfer lines (between SPS and LHC, including CNGS) have all been produced and installed, except the TED to be installed in 2007 in TI2. All equipments have been tested and partially been used during the 2004 runs.

- TDE : LHC beam dumps (point 6)

The LHC beam dumps in point 6 will be installed as scheduled in two phases, the first installation will be in March 2006, the second campaign will be in December 2006 and includes also the spare dumps in UD 62 and UD 68.

- TDI : Injection dumps (point 8 and 2)

The TDI production is close to completion. The installation of the TDI in point 8 is scheduled for May 2006. Planning is very tight, but all efforts will be undertaken to reach the installation date.

## MASKS

- TCDD : Injection protection masks (point 8 / 2)

A new energy deposition study is deemed necessary to decide on cooling. In the meantime replacement chambers or a fixed aperture mask TCDDM will be produced and installed in point 8 according to the installation schedule. In point 2 a mobile device (collimator type) is foreseen, its new design will be based on the Collimator design (TCS type) and on the transfer line mask design (TCDIM). The schedule depends on the outcome of the new study (June 2006) and will result in a late installation of the TCDD.

- TCDIM : Transfer line masks (TI2 and TI8)

The design for the transfer line masks has been finalized. The production will be outsourced. Installation according to schedule is expected.

- TCLIM : Masks in point 6

The design for the masks in point 6 (together with TCDQM) started in January. The experience from the TCDIM types will reduce the design effort. A planning for

production and installation is not available at the moment. A start-up without these masks is possible.

## COLLIMATORS

### ATB Responsibilities and organization

The work packages for the LHC collimators concerning ATB are shown in the following table

Table 1: Work packages under ATB responsibility. There are similar descriptions used for other packages in other groups and departments.

| WP #     | Description                                 | ATB section |
|----------|---|-------------|
| AB/ATB1  | Phase 1 R&D, prototyping, tests             | TD-EET      |
| AB/ATB8  | FLUKA simulations                           | EET         |
| AB/ATB2  | Collimation Infrastructure                  | LPE-TD      |
| AB/ATB3  | Motor and Local Control                     | LPE         |
| AB/ATB4  | Sensors and calibration                     | LPE         |
| AB/ATB5  | Position Readout and Survey system          | LPE         |
| AB/ATB6  | Production support, control and calibration | TD-EET      |
| AB/ATB7  | CERN reception, testing and assembly        | TD          |
| AB/ATB6b | Collimator installation                     | TD-EET      |
| AB/ATB9  | Phase 2 engineering                         | TD-LPE      |
| AB/ATB10 | Commissioning                               | All         |

### Strategy for collimator installation

Following the analysis of the mismatch of the installation schedule to industrial production, reception assembly and test plannings illustrated in fig. 2, the following points and agreed upon (LTC 29th June):

- All standard Phase One collimators installed for LHC start-up
- Phase Two locations prepared for quick installation (infrastructure and base support)
- Vacuum chambers collimator replacement ordered

#### Installation campaigns:

- Most important collimators to be installed during the standard LHC installation campaign (April 2006 – February 2007).
- Special installation campaign for delayed collimators (late spring 2007)
- Third installation campaign during the shutdown 2007/2008. Production for special design collimators listed in table 2.

Table 2: location of special collimators

|     |               |     |               |
|-----|---------------|-----|---------------|
| IR1 | 2 TCLP        | IR5 | 2 TCLP        |
| IR2 | 1 TCLI, 2 TCT | IR7 | 4 TCHS        |
| IR3 | 4 TCHS        | IR8 | 1 TCLI, 2 TCT |

### Availability vs. installation

The figure 2 shows the planning of the collimator production in industry including the time required for assembly, testing and transport at CERN with respect to the installation planning (Dec. 2005). Delays will increase the backlog by 10 collimators /month that will have to be installed in the second phase.

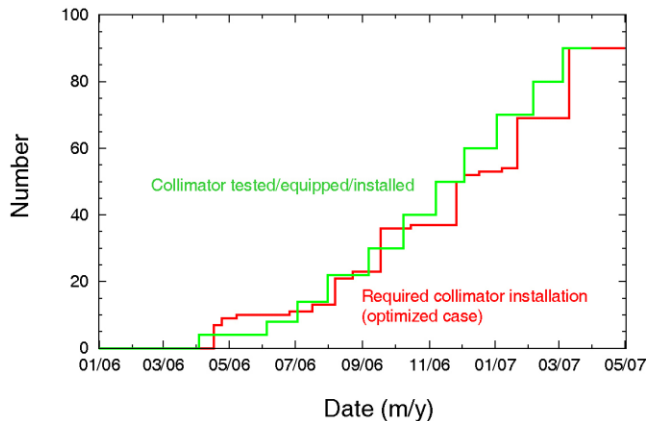


Figure 2: Collimator availability (Dec-05) vs. installation schedule

### Status of the production in Industry

(with reference to the last updated planning in Dec.):

- Production of TCDI: Following a problems on the beams machining, a delay of several weeks is announced. Installation date in May is jeopardized. The problem is now solved and a second subcontractor has been launched to speed up the machining.
- TCS beams for qualification: The brazing samples are under investigation. New samples will be produced. After their acceptance, the assembly and delivery of TCS collimators can go ahead (brazing accepted by CERN Feb. 10<sup>th</sup>).

### Availability of the collimator components

#### Base supports:

Delivery end of Feb. 2006 at CERN. The assembly at CERN is compatible with the installation schedule. The base support guides are designed to act as support for replacement vacuum chambers. The base supports will be installed on schedule in the tunnel for Phase one and two.

#### Upper supports:

The upper supports will be pre-assembled, depending on type, angle on production schedule. The plug-in and the 5<sup>th</sup> axis parts will be delivered to CERN in March, on schedule.

### Reception, assembly, tests and calibration

The time estimates below are based on the experience from the prototyping at CERN. The detailed procedures for commissioning will be published in a specific EDMS document. The timing based on prototyping work (man-

Weeks /collimators) will be optimized with the experience of the first batch of collimators qualified at CERN.

#### Mechanics: 10 man-Weeks

- Reception test: for leak test, cooling circuit, mechanical functionality and precisions.
- Base support assembly.
- Upper support assembly.
- Collimator assembly: Prepare orientation/type. Assemble the cooling system. Installation of motors and LVDTs. Test auto-retraction, positions and gaps.
- Alignment: Positioning of alignment targets.

**Electronics:** 4 man-Weeks Cabling, calibration of position sensors and motorization.

**Bake-out:** 3 collimators in parallel / week (AT-VAC).

**Staff:** 4 teams in parallel, for mechanics and 3 teams for electronics, 10 FSU + 9 staff/associates are currently available.

### Installation of first collimators

- **TCDI:** 6 transfer line collimators have to be installed in May. Actually only 4 collimators are in production. Delays for installation are expected.
- **TCT:** The installation in LSS8 (L/R) and LSS1L is scheduled in May, however, the April delivery falls short for full testing. A delay of a few weeks is expected.
- **TCS:** Installation in June in point 6: Production matches the installation planning.

### Installation of infrastructure

Cabling and cooling: The cables are pulled in P3, P1, P8, TI2 and TI8, and to be pulled in P2, P5, P7 on schedule.

The bake-out in the tunnel is disturbed by the presence of cooling water; the design has to be finalized.

Tracing (TS/SU) and drilling (TS/IC) are ready for base support installation in time.

Base support installation (TS/IC): The base supports arrive at CERN by end of Feb. 2006. They will be assembled in time for installation.

Traceability: The labeling of position, type, angle and phase will be stored in a data base.

Base support: The local cooling system, connection of water and cables will be mounted on time.

The alignment of the base support will be done by TS/SU.

### Installation of electronics

- Motors and drivers: Assembly in the tunnel must be avoided.
- LVDT's: The calibration in the Laboratory is mandatory. The tendering is completed and the offers received. Some of the bidders are able to deliver LVDT's 4 weeks after signature of the contract.
- After installation of the base, all connections and coupling will be checked.

- Low level control: Ready for commissioning in 2007. For the sector test, a pre-series will be organized.

### *Commissioning*

The document on commissioning is under finalization. The work estimation is of 2 x 200 man days (LPE/EA/IF) in the tunnel. Dry runs on the first delivered collimators will be performed during summer 2006.

### **MAJOR ISSUES**

The planning for the production and installation is very tight, there are no margins.

The different types give some flexibility during production to optimize the distribution between installation phases 1 and 2.

The sectors cannot be completed during the original installation schedule due to special design, collimators. Additional work for vacuum, alignment and transport is expected.