

TS-MME WORKPACKAGES

Presented by V. Vuillemin/TS-MME .

Abstract

TS-MME holds two main workpackages in collaboration with the AB Department:

- Beam Instrumentation
- Collimators

BEAM INSTRUMENTATION

The beam instrumentation workpackage (WP) concerns the beam diagnostics elements required for the first LHC beam operations.

This WP comprises:

- Design studies.
- Manufacturing drawings.
- Construction and some assembly work of the beam instrumentation elements, except for some BPM's and the BLM's (CECOM/BINP), either directly in the main assembly workshop or by outsourcing some mechanical construction to external industries.

The coordination managed by TS-IC of the installation in the tunnel of the elements (except for BLM's) is also included in this global WP.

The Table 1 describes the overall organisation of the WP.

Table 1

| WP ORGANIZATION: | | | | | | | | | | | | | | | |
|---|---|------------------------|-----|----------------------------|-----|---------------------------------|--------|-----------------------|--------|--------------------|-----|------------------------------|-----|---|--|
| Project Leader: | C.Fischer / AB-BDI | | | | | | | | | | | | | | |
| Coordination between Departments: | R.Garoby / AB-BDI, V.Vuillemin / TS-MME | | | | | | | | | | | | | | |
| Design: | WP owners C.Menot, A.Bouzoud / TS-MME + 11 designers Design studies and manufacturing drawings for the | | | | | | | | | | | | | | |
| >>Monitors: | <table border="0"> <tr> <td>Beam Position Monitors</td> <td>BPM</td> </tr> <tr> <td>Profile TV Screen Monitors</td> <td>BTV</td> </tr> <tr> <td>Profile Gas Ionization Monitors</td> <td>BGIH/V</td> </tr> <tr> <td>Profile Wire Scanners</td> <td>BWSH/V</td> </tr> <tr> <td>Beam Loss Monitors</td> <td>BLM</td> </tr> <tr> <td>Current Transformer Monitors</td> <td>BCT</td> </tr> <tr> <td colspan="2">[BSRT, BGIH/V, BTV: 600 blueprints realized]</td> </tr> </table> | Beam Position Monitors | BPM | Profile TV Screen Monitors | BTV | Profile Gas Ionization Monitors | BGIH/V | Profile Wire Scanners | BWSH/V | Beam Loss Monitors | BLM | Current Transformer Monitors | BCT | [BSRT, BGIH/V, BTV: 600 blueprints realized] | |
| Beam Position Monitors | BPM | | | | | | | | | | | | | | |
| Profile TV Screen Monitors | BTV | | | | | | | | | | | | | | |
| Profile Gas Ionization Monitors | BGIH/V | | | | | | | | | | | | | | |
| Profile Wire Scanners | BWSH/V | | | | | | | | | | | | | | |
| Beam Loss Monitors | BLM | | | | | | | | | | | | | | |
| Current Transformer Monitors | BCT | | | | | | | | | | | | | | |
| [BSRT, BGIH/V, BTV: 600 blueprints realized] | | | | | | | | | | | | | | | |
| >>Profile Synchrotron Radiation Telescopes | BSRT | | | | | | | | | | | | | | |
| Manufacture: | WP owners J.P.Bacher, M.Polini / TS-MME Estimated at least 3500 hours internal until mid-March, not total All except some BPM's and BLM's | | | | | | | | | | | | | | |
| Installation: | TS-IC. All except BLM's | | | | | | | | | | | | | | |

Essentially all design work is either finished or nearly finished, except for the BQK and two BSRT elements, for which the design work has been scheduled later. Manufacturing drawings are well advanced and some designs have been already forwarded to the main CERN workshop for construction

The Table 2 below summarizes the status of the design activities at the time of the Chamonix XV workshop.

Table 2

| Elements | N(models) | DESIGN | | | |
|---|-------------------------|------------------------|---------|--------------|--------------|
| | | Study | Details | Construction | Assembly |
| BPM(Beam Position Monitors) | | | | | |
| Old BPMs | 144 | 100% | 99% | Cecom/ BINP | TS-MME |
| New BPMs | 24 | 100% | 99% | Cecom/ BINP | TS-MME |
| BFLX | 2 | 100% | 60% | | |
| BFLHV | 12 | 100% | 60% | | |
| BPAWT | 2 | 100% | 60% | | |
| BCK | 4 | 0%(start février 2006) | 0% | | |
| Support BPM | 6 | 100% | 80% | Outsourced | |
| BLM(Beam Loss Monitors) | | | | | |
| BLM | | 100% | 100% | Russia | |
| BCT (Current transformer monitors) | | | | | |
| BCT (ring point 4) | 2 lignes/4 trans/ ligne | 100% | 100% | TS-MME | ABBD, AT-VAC |
| BCT(dump point 6) | 2 lignes/2 trans/ ligne | 100% | 70% | TS-MME | ABBD, AT-VAC |
| BSRT (Profile Synchrotron Radiation Telescope) | | | | | |
| BSRT (General study) | | 85% | 85% | TS-MME | ABBD |
| BSRTA M S | 3 | 100% | 100% | TS-MME | ABBD |
| BSRTL | 1 | 0%(start sept 2006) | 0% | TS-MME | ABBD |
| BSRTT | 1 | 0%(start sept 2006) | 0% | TS-MME | ABBD |
| BWS (Profile Wire Scanners) | | | | | |
| BWSHV | 1 | 100% | 80% | TS-MME | ABBD |
| BGI (Profile Gas Ionisation Monitors) | | | | | |
| BGIHV | 4 | 100% | 100% | TS-MME | ABBD |
| BTV (Profile TV screen Monitors) | | | | | |
| BTVS | 1 | 100% | 100% | Russia | |
| BTVSSIT_SE | 3 | 100% | 100% | TS-MME | ABBD |
| BTVD | 1 | 100% | 100% | TS-MME | ABBD |
| BTVDD | 1 | 60% | 0% | TS-MME | ABBD |

Below are shown interesting examples of the designs of the beam instrumentation elements:

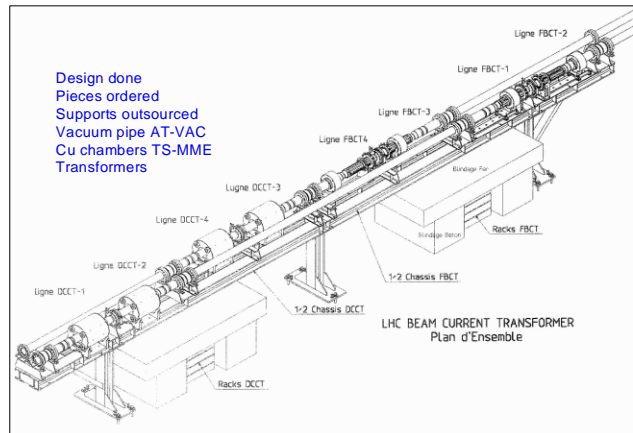


Figure 1: Beam Current Transformer

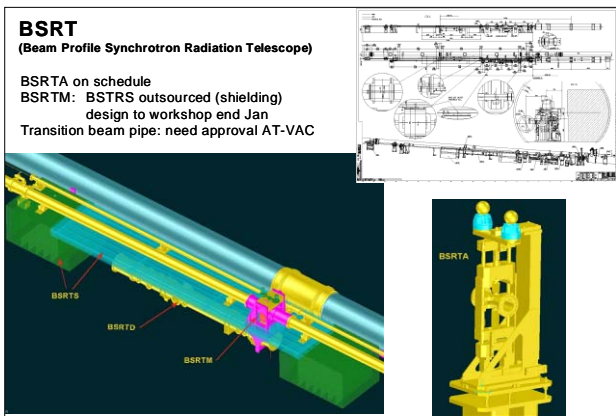


Figure 2: Beam Profile Synchrotron Radiation Telescope

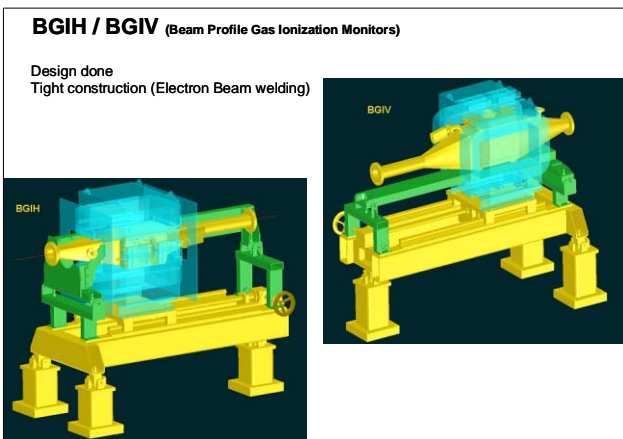


Figure 3: Beam Profile Gas Ionization Monitor (H = horizontal, V = Vertical)

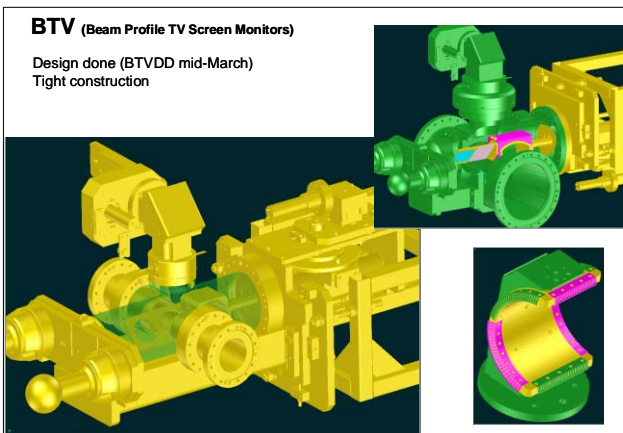


Figure 4: Beam Profile TV screen Monitors

The construction of several elements is on a very tight schedule. The priority in construction will be given to those parts of the elements that are connected to the LHC vacuum. Presently, up to mid-march 2006 (the WP is not yet complete) 3500 hours of construction and assembly have been scheduled in the main workshop, following the main LHC installation schedule. The most critical point is due to the fact that TS-MME has only one large folding

press, with one expert technician. The press will have to work more than 8 hours/day in order to meet the production schedule.

Table 3 below describes the present schedule in terms of construction, assembly and installation.

A more precise scenario concerning the installation of the elements will be discussed in the beginning of 2006.

Table 3

| ELEMENT | TASK | Jan | | Feb | | Mar | | Apr | | May | | Jun | | Jul | | Aug | | Sep | | Oct | | Nov | | Dec | |
|-------------|--------------------|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|-----|---|
| | | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 | 1 | 2 |
| BSRT | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assembly | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end A43 | | | | | | | | | | | | | | | | | | | | | | | | |
| BSRV | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assembly | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end | | | | | | | | | | | | | | | | | | | | | | | | |
| BSRS | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assembly | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end | | | | | | | | | | | | | | | | | | | | | | | | |
| BSRSV | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assembly | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end | | | | | | | | | | | | | | | | | | | | | | | | |
| BSVD | Design drawing | | | | | | | | | | | | | | | | | | | | | | | | |
| | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end | | | | | | | | | | | | | | | | | | | | | | | | |
| BSVDV | Design drawing | | | | | | | | | | | | | | | | | | | | | | | | |
| | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end | | | | | | | | | | | | | | | | | | | | | | | | |
| BGIH/V | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assembly | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end A43 | | | | | | | | | | | | | | | | | | | | | | | | |
| BSWH/V | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assembly | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end A43 | | | | | | | | | | | | | | | | | | | | | | | | |
| BCT | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assembly | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end A43 | | | | | | | | | | | | | | | | | | | | | | | | |
| BPM | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assembly | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end A43 | | | | | | | | | | | | | | | | | | | | | | | | |
| BPM special | Construction | | | | | | | | | | | | | | | | | | | | | | | | |
| | Assembly | | | | | | | | | | | | | | | | | | | | | | | | |
| | Install at end A43 | | | | | | | | | | | | | | | | | | | | | | | | |

COLLIMATORS

The TS-MME WP owners are: A. Bertarelli, M. Mayer and R. Perret. This WP was defined already when the EST Division existed:

"The EST provided output will be the required number of prototype collimators within the required schedule and drawings for the series production",

namely the technical specification, the thermo-mechanical calculations, the design and drawings for series production as well as the production of 2 prototypes, including some testing.

As the years have passed, the original requirements have gone through an evolution and the number of collimators/masks required have increased compared to what was defined at the beginning of the project. Including the prototypes, more than 1000 drawings have been realized in 2 years for 30 different variants and geometrical configurations, test benches and paloniers.

The Table 4 summarizes the list of the collimators, masks and absorbers.

All design work for the primary and secondary collimators (TCP and TCS) are finished and the production drawings have been delivered on time. The work on the masks has started with additional designers allocated to this task.

Table 4

| Name | code | description | where | numbers |
|----------------------------|-----------------|--|--------|---------|
| Main collimators | TCP | Primary collimator | LHC | 8 |
| | TCSG | Secondary collimator | LHC | 32 |
| | TCTA | Tertiary collimator 1 beam | LHC | 12 |
| | TCDI | Collimator in Transfer tunnel | TL | 14 |
| | TCDD | Collimator absorber block for Q4 Protection (IR6) 6 m length | LHC | 2 |
| | TCLIA | Injection collimator 2 beams "2in1" | LHC | 2 |
| | TCLP | Absorber for physics debris - as TCSG but with Cu - 0.5m | LHC | 8 |
| | TCTB | Tertiary collimator 2 beam | LHC | 4 |
| | TCDD | Secondary collimator for TCDD (mobile) 2 beams | LHC | 1 |
| | TCLIB | Injection protection 1 beam phase 2 | LHC | 6 |
| | TCSM | Secondary collimators phase 2 | LHC | 33 |
| | TCION ? | Ion primary collimator (only space reservation for Alice+LHCb) | LHC | |
| Masks transfer line | TCDIM-B | Mask for bending magnet 1 beam | TL | 2 |
| | TCDIM-QF | Mask for focussing quadrupole magnet 1 beam | TL | 3 |
| | TCDIM-QD | Mask for defocussing bending magnet 1beam | TL | 4 |
| | TCDIM-S | Mask for septum magnet 1 beam | TL | 2 |
| Masks Injection | TCDDM | Mask fixe for TCDD 2 beams | LHC | 1 |
| Masks tunnel | TCDDM | Mask absorber block for Q4 Protection (IR6) 2 beams | LHC | 2 |
| | TCLIM | Mask after the TCLI 2 beams | LHC | 2 |
| Active absorbers | TCLA | as TCSG (mobile) but with W/Cu instead of CFC | LHC | 20 |
| Passive absorbers | TCLAP | Fixe 2 beams | LHC | 10 |
| | TDE | main extraction beam dump in cavern (650m downstream) | cavern | 2 |
| | TCDS | "Diluter" to protect the extraction septum magnet MSD | LHC | 2 |
| Scrapers | TCHSV | Motorized scrapers Vertical | LHC | 2 |
| | TCHSS | Motorized scrapers Scrow | LHC | 2 |
| | TCHSH | Motorized scrapers Horizontal | LHC | 4 |

In addition to the tasks originally defined in the WP, TS-MME has accepted the responsibility to write the technical specifications and order the components or the series production for the water couplings, the high precision Carbon jaws, the water hoses, the supply of Glicop and the supports for the collimators.

A new Research and Development WP for the Phase 2 LCH collimators has been accepted by TS-MME. Its aim is to develop a new secondary collimator concept and manufacture one or two full size prototypes in 2007-2008. However the present WP will cover only the development stage, namely:

- Mechanical engineering, preliminary studies, thermal and mechanical calculations, new material research.
- Test of materials, coatings, optimisation of vacuum, heat conductance coating.
- Design and manufacture of test devices.
- Functional tests.

After the completion of the development stage, a prototype stage will follow to cover the detailed design for a prototype production, the handling of radioactive collimators and their new integration.

CONCLUSION

A large number of persons from the TS-MME group is working in an integrated way on these two WP's: 17-19 designers, 6-7 persons in the assembly workshop, as well as the project coordinators and engineers. All the specific technologies and know-how required for thin-film coating, brazing, welding, surface treatment and analysis as well as materials expertise and metrology, are provided by the TS-MME Group to complete successfully these two challenging LHC WP's..



Figure 5: supports of collimators