

SUMMARY: THE MINIMUM WORKABLE LHC – PROVIDERS' COMMITMENTS

JJ. Gras, S. Bart Pedersen, CERN, Geneva, Switzerland

RESPONSIBILITIES AND RESOURCES

After 2003 major re-structuration, the AB department refined this year its organisation. The resulting responsibility dispatching is basically the following:

Equipment groups are responsible for:

- The equipments
- The front end electronics
- The front end software and corresponding expert application whenever necessary

Controls group is in charge of:

- The control services (timing, DB, Alarms, Operating systems, FESA...)
- The software above front end servers necessary to operate the machine (operational GUIs, real time feedback, BPM, BLM concentrators...). This work is done in close collaboration with OP.

The equipment groups which contributed to the session (i.e. ATB, BI and RF) are all heavily loaded but should be able to fulfil their commitments with their available resources. CO on its side claims still missing several competent java programmers to complete the necessary developments. Project associate with the right skills seems difficult to find and this could eventually lead to a de-facto 'regulation by saturation' of the development instead of a planned regulation. Another big concern in this domain are the 24/365 necessary piquet services (like for Alarms for instance). CO is currently not able to provide them

ATB COMMITMENTS AND MAJOR ISSUES

O. Aberle

The AB/ATB group is responsible for the LHC dumps (TED, TBSE, TDE, TDI), masks (TCDD, TCLIM, TCDIM) and collimators (TCP, TCS, TCT, TCLA, TCLP...).

All screens and dump should be ready for Stage I (some equipments may be late for the sector test). ATB however has significant delays on collimators production.

In order to cope with this delays, ATB will install the collimators in two major phases. Phase I will provide the collimators necessary to run the machine up to 40% of the nominal intensity. The Phase II upgrade will add the necessary collimators to reach the nominal intensity. Unfortunately, the current delays and uncertainties (brazing issues) on production are not compatible with the installation planning. It has been proposed and accepted last year that the collimator Phase I installation will be spitted in two campaigns. Available collimators will follow the installation planning and a second campaign

will be organized later (late Spring 2007) to install the missing collimators.

This staging strategy should allow ATB to provide all standard Phase I collimators for the LHC start-up with Phase II locations prepared for an efficient installation.

BI COMMITMENTS AND MAJOR ISSUES

B. Holzer – R. Jones

AB-BI is currently working in close collaboration with TS/MME for the production of the different instruments which represents a huge activity. The production of these different monitors is currently on schedule with respect to the installation planning under discussion but most of these items are on the 'just in time' path.

The expected performance of the different instruments with respect to the proposed scenario is summarized below.

BPM

The Beam Position Monitors are expected to be fully functional for the LHC start-up. According to the LHC planning stages, the commissioning of the BPM systems will be progressive. The only concern is the ability to measure beam intensity via the BPMs which may not be ready for the start-up. The importance of the measurement has been confirmed during the session and BI will to its best to cover this need.

BLM

The Beam Loss Monitors with threshold tables as a function of quench level and energy will be ready for the LHC start-up and connected to the machine protection system. Some issues on the definition and handling of these threshold are still under discussion but the implemented strategy should be decided soon. The BLM will be extensively tested during the sector test and the logging and the post-mortem infrastructure will be used for their commissioning.

BOB

The beam synchronous timing system will be available for the LHC start-up. The final version that covers the requested needs is currently being tested. The BOB system will be commissioned for the SPS in 2006 and assessed during the LHC sector test.

Beam current and lifetime measurement

The LHC will be equipped with two DCCTs per ring, two fast beam current transformers per ring and two fast BCTs for the dump lines. The layout for these monitors has been finalized and the construction is ongoing. Only a minimal integration of machine protection requirements based on a software implementation will be available for

Stage I/II. The complete integration is only foreseen for later stages.

Tune, chromaticity and coupling measurement

A 3 stage approach for Q, Q' and coupling measurement has been proposed and accepted.

1. classical FFT analysis
2. then with PLL tune tracking
3. finally with full PLL based feedbacks.

The speed of the sequence will depend on experience with beam but for operational beams, the Base Band Tune (BBQ) measurement system seems to give excellent results.

Beam size measurement

To measure beam size, the base-line instruments are:

- 1) Wire scanners (BWS)
- 2) Synchrotron light monitors (BSRT)
- 3) Rest gas ionization monitors (BGI)
- 4) Optical transition radiation monitors (BTV) (only for inject&dump modes)

The LHC wire scanners, which are mainly intended for calibration, will not meet their nominal specifications for Stage I/II (reduced accuracy and lower intensity limit due to low speed) but they'll cover Stage I/II requirements. New electronics for the motorization system will be installed and commissioned for Stage III, allowing the full specifications to be met.

The LHC synchrotron light monitor (BSRT) will be used at start-up with a limited electronic installation only providing average beam sizes at 10Hz. The fast camera for bunch to bunch measurements will only be installed for Stage III.

With the SPS experience, the rest gas ionization monitor (BGI) is expected to be made operational very soon after initial start-up.

The BSRT and BGI will require dedicated commissioning time to calibrate them with respect to both beam intensity and energy.

The BTV systems are already used operationally in LTI and will be ready for start-up but the matching functionality will not be provided before Stage III.

Abort gap monitoring

The abort gap monitor (BSRA) tests have confirmed that the detection levels required for protons can be reached at all energies. For ions, however, no solution currently exists. A long term solution, possibly for Phase II, would mean replacing the current undulator with a shorter period undulator.

RF COMMITMENTS AND MAJOR ISSUES

E. Ciapala

Equipment under the responsibility of the AB-RF group, i.e. the ACS 400 MHz accelerating system, the ADT transverse damping systems and the APW wideband

longitudinal pick-ups are all in the final stages of assembly.

The LHC RF is in 'good shape' but time scales and resources are tight for some items, notably completion of all four SC modules and the low level RF systems since almost everything has already to be commissioned during the hardware commissioning.

The RF group will try to implement the final LHC timing and synchronization equipment for the sector test, rather than improvised additions to the SPS timing but RF is still lacking clear definitions of the initial timing scenarios for first beam and hope they will be formalized soon.

Operation with first beams should bring no major problems. All requested measurement equipment will be available for first beams but some work still has to be done for higher intensities mainly on safe injection schemes, e.g. to prevent injection in the wrong buckets, and power system transient studies, some protection systems may be needed there for high intensity operation.

COMMITMENTS AND MAJOR ISSUES ON CONTROL SERVICES

H. Schmickler – E. Hatziangeli

The AB-CO group has just recently been restructured in order to meet the requirements of the LHC. The new group structure has been finalised and most projects now have a technical responsible. However, CO is currently fighting against a lack of resources that makes the covering of activities critical.

The AB-CO group nevertheless aim to deliver the requested functionalities in time. A new software policy that combines complex but flexible versioning should guarantee the long term stability. The LHC sector test with beam would allow major validation tests on scalability issues linked to the control system.

The large number of requested LHC applications will be mainly written in JAVA, LabVIEW and UNICOS. The software production will rely on a common architecture already tested and deployed on other machines (LEIR, SPS, LTI).

Most of the applications to control the different equipments will be ready for the start up but some technical responsible people are still missing. Only the critical instruments have a delivery date defined and a responsible assigned. For the others, it will be done during the second half of the year 2006.

Finally, a strategy on security issues for equipment access is still missing and has to be formalized soon.

ACTIONS

This session and the following discussions raised the need of several actions summarized here:

Actions on Controls Requirements

Somebody or some working group should be mandated to publish:

- the LHC setting management interface and security strategy before the end of March for immediate implementation in controls frameworks
- the General Machine Timing behaviour and interface before the end of March for immediate implementation in controls framework
- Application and front end SW release test and deployment procedures before sector test
- the BLM threshold management (remote settings yes/no, function of energy yes/no, limited set of integration times yes/no...) before the end of the year

Actions on Commitments

In order to avoid 'Regulation by Saturation' on LHC applications:

- OP should be mandated to decide when a piece of software reached an acceptable state, allowing the re-deployment of resources on other subjects until everything becomes acceptable.
- LSA team should make a list of applications that could be covered by equipment groups or ABP Expert GUIs as a first stage and to discuss it with the groups concerned.

Early dry runs and controls infrastructure scalability and performance tests should be organized in addition to Sector Test and integrated into the planning.

The necessary Piquet Services (Alarms, timing, network, equipment front ends...) should be described and organized. This activity is already in progress.

There seems to be a consensus that ions will not be injected into LHC before Q4 2008. This statement would allow equipment providers to refine their commitments.

Actions on Layout and Installation

It is felt by several key actors that the following actions would be beneficial to the overall efficiency of the installation process:

- Define the minimum acceptable for the configuration of the machine
- Freeze around April the layout of this machine to be initially installed and ask AT/VAC to foresee vacuum chambers to replace the equipments that may not be ready and are not strictly necessary.
- Trace, drill and install the corresponding machine in good conditions, solving production delays issues by planning or vacuum pipes based on previous definition.