

# TTC challenges and upgrade for the LHC

*Friday 16 September 2005 11:05 (25 minutes)*

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## Summary

The TTC (Timing, Trigger and Control) system broadcasts the timing signals from the LHC machine to the experiments. At the detector level, it integrates the trigger information and local synchronous commands with these signals, for transmission via optical fibres to several thousands of destinations. If the support of the TTC system at the level of the detectors is well in hand, the main network between the machine and the experiments will require re-development to ensure its easy maintenance.

The functional specification of the TTC has changed during the last 5 years: three different types of 40.079 MHz clocks, as well as their respective orbits have been now defined to be transmitted by the TTC from the machine up to the experiments. Their availability during the various machine modes is not guaranteed by the machine outside the flat tops of LHC runs. The TTC has then to be able to supply these signals if they are not transmitted by the LHC. Moreover, the channel B, defined for control and command transmission, is not used at the LHC level, but only at the level of the detectors. A simplification of the TTC at the CERN Control Centre could then be made.

The need to simplify the first level of the system is also made necessary by the fact that the electronics at the CERN Control Centre is now becoming obsolescent as well as at the reception level in the detectors. As the number of timing signals to be transmitted has now increased, the need in term of infrastructure also augmented. The number of available receiver crates is not sufficient to receive the 3 various Bunch Clocks and Orbits. Spares are also missing, and there is no way to replace faulty modules.

Finally, at present, the system can neither be remotely controlled, nor monitored, which makes the on-call support and the maintainability difficult.

A status of the present TTC system will be presented (available infrastructure, production status, comparison with the BST system), as well as the challenges it has to cope with (latest problems solved, new test benches) and the necessary upgrade which will be needed in the near future to make it operational for LHC start in 2007:

- New solutions for the timing signal transmission, from the machine to the experiments
- New hardware proposal to replace the TTCmi crates
  - o Clock and orbit reception
  - o Missing Clock compensation
  - o Phase adjustment control
  - o Remote monitoring module and solutions for the support
  - o Signals distribution

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**Session Classification:** Plenary session P9