

Summary Notes: 7th Meeting of Sub Working Group on the Commissioning of the Machine Protection System, Wednesday 20th June 2007

Present:, Brennan Goddard, Pierre Dahlon, Jeremie Fleuret, Magali Gruwe, Verena Kain, Alick Macpherson, Luis Martinez, Ivan Romera, Rudiger Schmidt, Benjamin Todd, Jan Uythoven, Jorg Wenninger, Markus Zerlauth,

CC: Ralph Assmann, Roger Bailey, Reyes Alemany Fernandez, Eva Barbara Holzer, Mike Lamont, Blanca Perea Solano, Laurette Ponce, Bruno Puccio, Stefano Redaelli, Walter Venturini

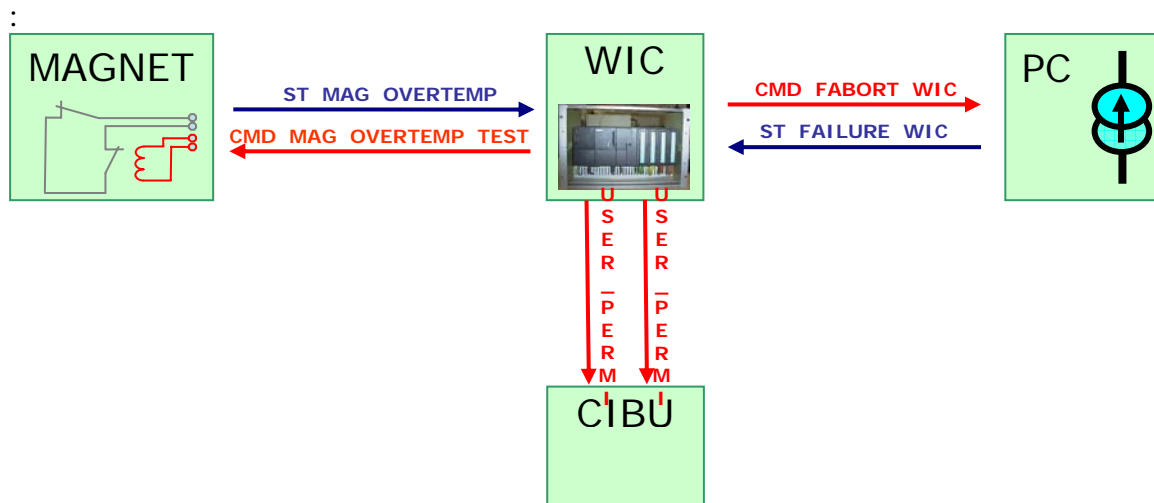
General

- Jan's talk at the LHCMAC; no action list or issues raised
- Alick Macpherson introduced as new scientific secretary
- Alick to assist in completion of procedures documentation.
 - Start with vacuum system and then the PIC commissioning procedures

MPS Aspects of Warm Magnet Interlock Controller (WIC) – Ivan Romera Ramirez

Protection system for warm magnets

- Protects against over heating of the magnet ($T > 65\text{ }^{\circ}\text{C}$)
 - Monitoring via PLC. Reaction time $> 1\text{ms}$
- Protects against failure of power converter
 - Fast monitoring \Rightarrow response time $\sim 1\mu\text{s}$
 - Power converter shutdown has fixed delay ($O(\text{sec})$) after power failure to ensure WIC-MPS functionality
- 8 WICs, 144 warm magnets, 40 power converters in the LHC



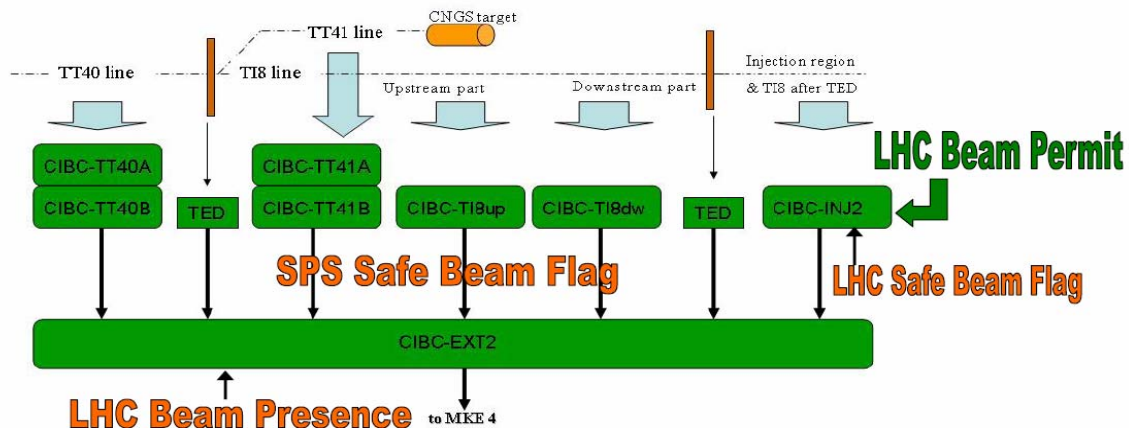
- **Need to trigger and test failure modes and correct setting of flags to WIC.**
 - Triggering of test failures is done by:
 - CMD_FABORT_WIC and CMD_MAG_OVERTEMP_TEST flags generated in the WIC
- **Redundancy of WIC input to BIC**
 - Input from power converters goes to CIBU via both a PLC and a Boolean processor (FM-352)
- **WIC Commissioning**
 - General commissioning
 - Interlock, logging, and post-mortem systems to be tested
 - Tests done without beam and magnets at zero current, but power converter fully operational
 - WICs where there are no FMCMs
 - Commissioning tests done without beam. All circuits to be tested
 - WICs where there are also FMCMs
 - Commissioning tests done without beam. All circuits to be tested. Additional tests to be done with beam
 - Additional tests:
 - Assess response time of the WIC relative to FMCM, so to determine if there is redundancy in protection for magnets with FMCM and WIC systems.
 - Requires simulating generating a “controlled” power failure.
 - Example: test on D1 power converters
 - This test should also be done with beam. For the tests with beam, could use partially squeezed, depending on the circuit to be tested. List of tests need with beam needs to be clarified
 - GUIs: Have been developed and ready for commissioning tests
- **Documentation:** WIC Commissioning Procedure document in preparation.
 - System tested without Beam: see LHC-MW-HCP-002

Action/Request List

- Finalise first draft of Commissioning Procedure
- Test WIC in relation to FMCM to assess MPS redundancy
- For critical magnets plan for tests of WIC system with partially squeezed beam.

Commissioning: Injection Protection System – Verena Kain

Verena addressed the issues for the Injection Protection system, but stressed that this was a work in progress, and one that involves 3 different Beam Interlock Controllers: the SPS extraction BIS, the LHC Injection BIS and the LHC circulating beam BIS. (see figure)



LHC Beam Presence to MKE 4

- **Individual Tests: Injection BIC**
 - Assumes injection permit commissioned without beam
 - Assumes individual systems complete and ready for interlock testing.
 - Needs injection region closed in LHC
 - Assumes needs
 - LHC_BEAM_PERMIT
 - Collimator Motor control
 - Collimator Environment Parameters
 - Functional MKI
 - Also needs the vacuum system for the transfer line
 - Eg the injection line interlocks from TI8 down to the TED
 - MKI
 - BIC input includes energy tracking and input from LBDS
 - Must ensure that don't inject into abort gap
 - Also requires RF synchronisation between LBDS and injection
 - Also need to test recovery mode in case of failure
 - Re-triggering in case of kicker failures
 - Passive protection
 - Assumes collimator motor control
 - Testing TDI, TCDI, TCDD, and TCLI thresholds – all done at the same time.
 - LHC_BEAM_PERMIT
 - Needs an RF(orbit) frequency lock similar to the LBDS to detect the correctly locate within the orbit ie so that there is no injection into the abort gap
 - For injection tests the SIS INJECTION_INHIBIT has to be masked
- **Global Tests: SPS Master BIC**
 - Test of global interlock: Proposal is to keep the SPS running without beam for this test.
 - => needs to be scheduled for end of this year's SPS running
- **Global Tests: Verification of protection settings**
 - Requirements on SPS
 - Needs SPS safe beam flag
 - Nominally scheduled for only 1 shift for testing (without SPS users) this was felt to be optimistically short
 - Requirements on LHC

- Needs to be done with fake LHC_BEAM_PERMIT signals (both A and B channels) and fake LHC_BEAM PRESENCE flags
 - Follow-up discussion on this with Bruno Puccio and Ben Todd scheduled for 22nd June)
 - Ben Todd to formulate a list of reasonable tests
 - Needs injection regions closed
 - It was noted that otherwise the MSI/MBIAH interlocks from the access system need to be masked
- Strategy: Global test to be a two stage test of the logic of the master BICs
 - Test done without, then with the LHC beam
 - Second stage must be part of LHC Beam Commissioning
 - Defines protection settings
 - Procedures included in LHC Beam Commissioning procedures A1 to A5
 - Clarification is needed as to possibility/procedure in case of β mismatch at injection such that the injection beam size is much larger than the circulating beam
 - Statement: It is OK within reasonable tolerances, but what is considered reasonable?
 - Clarification is needed as to possibility/procedure in case of dirty injection scenarios
 - Example: if BLMs on TDIs register a dirty injection, is it mandatory to remove the LHC_BEAM_PERMIT?
 - Question: Should the TDI BLMs stay on the ring BIC or move to the SPS BIC?
 - How do we trigger studies of the injection in this case?
 - Response. This is foreseen in the sequencer
 - Details (Jorg)?
- **Issues**
 - Toggling the LHC Safe Beam flag to allow injection
 - To be discussed with Bruno Puccio and Ben Todd on 22nd June.
 - Different operational scenarios (eg polarity changes for LHCb etc)
 - To be dealt with at a later date
 - Outline of tests for injection protection system
 - Still some clarification needed on full set of tests and procedures that need to be done
 - Full list of activities and timeline need to be presented.

Actions/Request List

- Schedule global tests for SPS Master BIC at end of SPS run: done, in accelerator schedule V5.0 (<http://ab-div.web.cern.ch/ab-div/Schedules/schedule2007.pdf>)
- Address issues of fake LHC_BEAM_PERMIT and LHC_BEAM_PRESENCE flags, and list of reasonable tests that can be made with them [Ben Todd]
- Clarify on which master BIC the BLMs on the TDIs are connected to.
- Write procedures for the commissioning of the MPS aspect of the Injection System

AOB

- Safe beam flag.
 - After the workshop with the experiments, questions have arisen regarding the level of the safe beam flag threshold. I.e. the expts would prefer 2×10^{11} instead of 10^{12} . Jorg proposed that we keep the Safe beam flag as is, but define a second flag for safe transfer to the LHC. This second flag would:
 - Be maskable and have an adjustable threshold
 - Input into the master BIC
 - Would avoid unnecessary changes on the form and functionality of the present Safe beam flag, so that it stays useful to both SPS and CNGS.
- Bernd Dehning has raised the point from the workshop with the expts MP, namely that the issue of how to test, commission and set thresholds for the Experiments BCMs (Beam Conditions Monitors) needs to be addressed.
 - Bernd suggests that we check to see if a MTF procedure is needed, ie set the conditions that have to be met before the experiments activate their inputs into the BICs
- Next meeting
 - **Date: 11th July**
 - **Time: 10:00 - 12:00**
 - **Room: 865-1-D17**
 - **Topics to date**
 - Protection aspects of the LBDS – Brennan Goddard