Agenda MPWG 5 May 2006

Agenda

- Issues around the 'Cryo OK' signal (R. Denz)
- Progress on the Abort Gap Monitor for the LHC (S. Hutchins)
- Follow up from the LHC workshop @ Divonne - commissioning organization (R. Schmidt)

AOB

Follow up from the LHC workshop @ Divonne - commissioning organization -

Presentation to trigger further discussion

Objectives

- define what needs to be done (related to MP)
- define who does what (e.g. who coordinates what)
- discuss in LHCCWG
- later proposal to LTC

Input

- Follow-up from Chamonix@Divonne
- Discussions with several colleagues (from MP systems, operation, management)
- Future topics for MPWG that are alredy in the pipeline
- “MyMaps” – some ideas on what should be done, inside and outside MPWG

Chamonix@Divonne and future work of MPWG

other Divonne conclusions

- Operation of the LHC will be strongly confined by machine protection issues. Therefore integration of **commissioning for Machine Protection Systems into general beam operation is required, by close collaboration between machine protection experts and operation / commissioning team**.
- Today, commissioning is mainly discussed in two working groups, LHC-OP (now LHCCWG - R.Bailey / M.Lamont / F.Zimmermann) and MPWG, both reporting to LTC. **The organisation of LHC beam commissioning should be revisited**, aiming at an improved integration of machine protection commissioning and general LHC commissioning.
- How to integrate Machine Protection Issues into LHC Commissioning?
- How to interface MPWG to LHCCWG?
  - Option 1: stay as it is
  - Option 2: stop MPWG, and LHCCWG takes over
  - Option 3: topics related to commissioning to be discussed in LHCCWG (in common with MP experts), and other topics to be discussed in MPWG
- The **creation of a Machine Protection** Coordination **Team is proposed**. Do we agree that such team would be useful, and what would be the mandate?

Topics from Chamonix@Divonne I

- Management of Critical Settings has been highlighted as important topic. **Specification has been approved**. What next? Presentation to LTC is planned
- A strategy for accessing equipment via the network, from inside and outside CERN, is required. **Proposal for CO strategy on secured equipment access (P.Charrue)**

.... to be better understood what is covered by which system and by whom (who?)

- Machine protection systems will be required for the different operational stages. Not everything is required for day one, but most systems should become available when accelerating 156 bunches per beam. **A follow-up should ensure that the protection systems are ready when they are required** (who?)
- Operation of the Beam Dumping System requires other systems to be operational, such as beam monitors (BPMs, Screens, BLMs), collimators (TCDQ & TCS in IR6, other collimators). **It is important that everyone is aware and understands the implications for the Beam Dumping System**. Colleagues from several groups are concerned, RF, BI, CO, ATB, etc. (who?)

Topics from Chamonix@Divonne II

- **Operation of the beam cleaning system requires a powerful controls system. Collimator positions are critical and must be managed accordingly** (CollTeam+ ...)
- **For each operational stage, operational settings are known, maximum allowed settings of collimators for machine protection need to be worked out in detail** (CollTeam+ ...)
- The Beam Loss Monitor System (detectors, electronics etc.) is expected to be operational before beam. **The commissioning and operational scenarios must be further developed** (LHCCWG+...)
- **Formalised procedures, documented and approved, for machine protection systems are required for different stages**. This is successfully being done for Hardware Commissioning, but it is important that this approach for beam commissioning is agreed upon and taken seriously (LHCCWG+...)
- Operating conditions for the different commissioning stages have to be defined. **Each system will be commissioned for the current operating conditions. A move to the next commissioning stage must be authorized.** Testing and acceptance procedures and required state for the next stage (LHCCWG+...)

Future topics on Machine Protection I

- Failures of the grid (e.g. thunderstorms) and their consequences (MPWG)
  - What is the reliability of UPS systems?
  - MP systems that are connected to UPS - what happens in case of failure? (Beam dumping system, Beam interlock system, Quench protection system, Beam Loss Monitor System, ...)

- Movable objects and interlocking – others than collimators (MPWG)
  - BTVs, wires scanners, vacuum valves, experimental detectors, ...
  - Presentation to LTC and/or LHCCWG before summer

- Beam instrumentation and interlocking – others than BLMs (MPWG?)
  - BPM in IR6, to prevent orbit excursions beyond 3mm, and to provide a fast interlock signal in case of fast orbit changes
  - BCT and interlocks

Future topics on Machine Protection II

- Beam interlocks and experiments: TOTEM, LHCb VELO, etc. (LEADE+...)
- Safe Machine Parameters - LHC and SPS (MPWG+...)
  - SPS safe beam flags, LHC flags
  - commissioning (LHCCWG+...)
- BLM thresholds – how to modify the thresholds?
  - Strategy: LHCCWG+...
  - Technique: MPWG+...
- Interlock reference and tolerances ?
- Software interlock system (MPWG?)
- SPS and transfer line / CNGS beam interlock system (partial) for 2006 (MPWG)
- Closed orbit and machine protection (LHCCWG)
  - how to avoid closed orbit bumps?
  - hos to safely measure the aperture?

“myMAPS”

- Define what machine protection systems are required at what time with what level of performance taking into account the operational scenarios for LHC and SPS (incl. transfer lines and CNGS) (who?)
- Ensure that the LHC Machine Protection systems will be available when required (be aware of development, construction and installation of Machine Protection systems and propose alternative solutions in case of problems with the delivery of MP systems) (who?)
- Preparation of the LHC Machine Protection commissioning (beam related) (LHCCWG plus MP experts)
  - Define roles of MP experts, OP, equipment experts, etc.
  - Integrate preparation of MP commissioning into general preparation of LHC commissioning
  - Write test procedures for MP systems
  - Develop proposals for automation of test procedures

“myMAPS”

- Study redundancy of the LHC MP systems (MPWG)
  - Study beam response for failure scenarios, estimate beam losses and the response of the various interlock systems. What interlock channels are redundant for what failures? What to do if a system does not work as specified?
  - Extend the reliability model to systems that have not yet been included. What is the impact on safety and availability if interlock channels are disabled?
  - Identify common mode failures. Develop methods to identify such failures
  - Double failures, eg. TDI position & inj. kicker error, Beam dump & TDCQ
- Work out worst case failures and consequences for the LHC (MPWG)
  - What happens if the beam dumping system does not extract the beam? Estimate damage level in such case. What could be done to minimise such damage and to limit repair times?
  - What happens if the energy extraction does not work for the dipole magnets?
  - Suggest procurement of spare material

“myMAPS”

- Create a competent team of specialists on Machine Protection to demonstrate the correct functioning of the MP systems during operation
- Prepare tools to optimise the system parameters during (early) LHC operation - team up with Post Mortem project

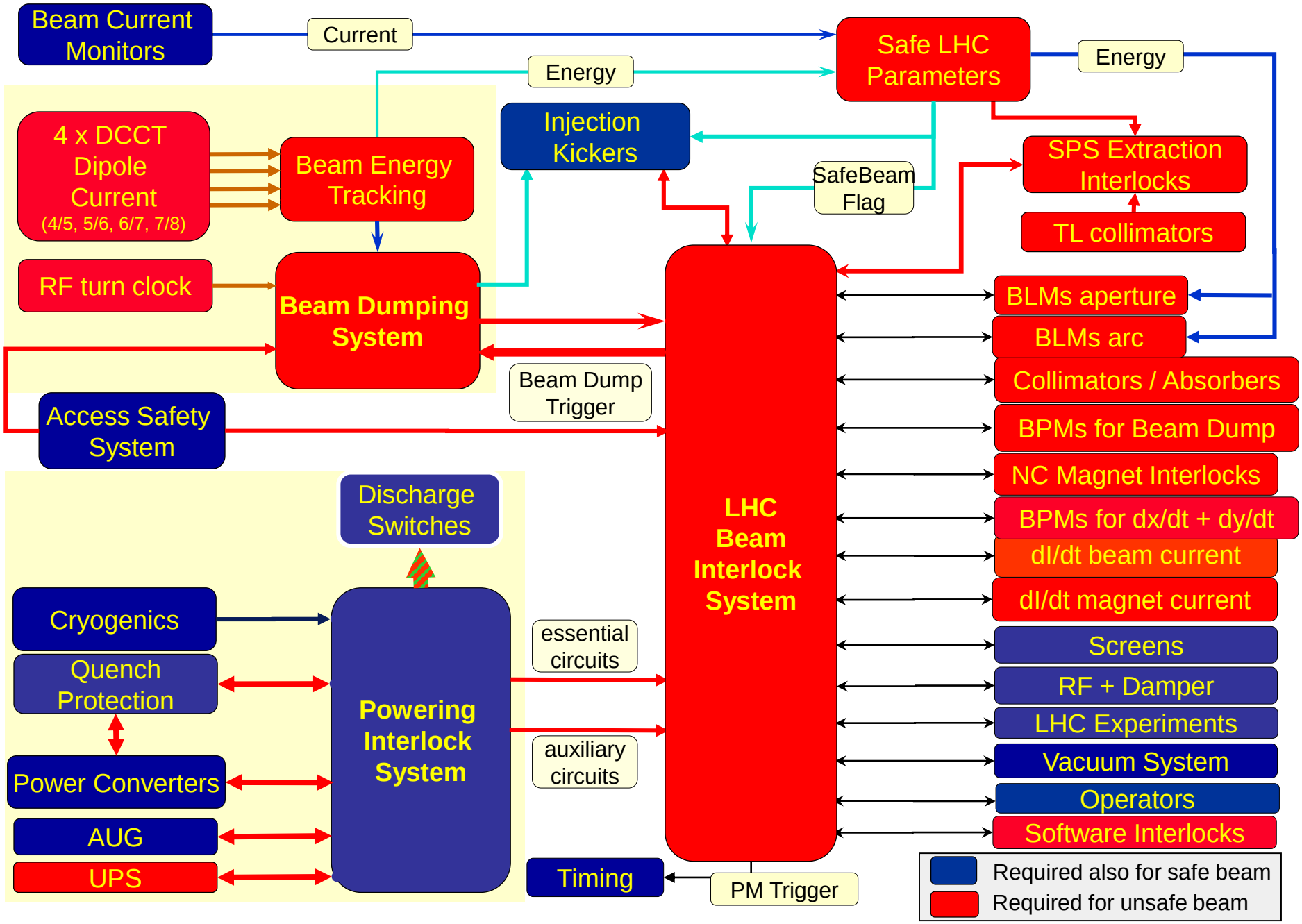
This includes training of newly recruited EICs.

Proposal for MP commissioning

- Break down MP commissioning into “digestable pieces” (MP experts)
- Suggest roadmap for writing procedures related to MP systems
  - procedures for what system(s), for which operational phase
  - propose names to work on these procedures – MP experts plus EIC
- Present such proposal to LHCCWG (within ~6 weeks)
  - iteration with MP experts, either informally, or via MPWG
  - discuss role of MP experts during operation (“MP team”)
- Finally, present common proposal LHCCWG & MP experts to LTC

End

Machine Protection Systems and connected equipment



MP systems break-down – individual systems

- Beam interlock system
  - LHC
  - SPS to LHC and CNGS
  - Safe Machine Parameter generation and distribution
- Beam dumping system
- Beam loss monitor system
- Quench protection system
- Powering interlock system (normal conducting and superconducting)
- Fast Magnet Current change monitors
- dIBeam/dt interlock
- dx/dt – dy/dt interlocks
- Collimation and cleaning

MP – questions

- Where is the responsibility for the controls of TCQD/TCS and the TDI/TCDD - in BDS or in collimation system?

... assuming a limited availabilty of machine protection systems

- What is the maximum beam intensity that can be transferred from SPS to LHC?
- What is the maximum beam intensity that can be stored at 450 GeV in LHC?
- What is the maximum beam intenstity that can be ramped to top energy?

- What systems have to be commissioned for operating with this intensity?
  - Who works this out?
  - Who writes the procedures for commissioning of MP systems?
  - Who carries out the procedures?
  - How to decide that LHC operation is safe for this beam intensity?

- What is required to declare the LHC safe for injection after a beam dump?
  - for a planned beam dump
  - for a beam dump after a failure
  - similar to beam injection

MP – questions

- The protection systems have a high level of redundancy.
  - How to ensure that the redundancy is available?
  - How to decide if the LHC can still be operated with some loss of redundancy?
- How to analyse the data from the PM systems? How to ensure that the data is analysed and correct conclusions are made?
- What to do in case of missing equipment?
  - collimator jaw stuck
  - BLM not working
  - others
- How to decide if interlocks should be disabled?
- How to optimise overall availability?
  - more interlocks? less interlocks?