76th Meeting of the Machine Protection Panel

Participants: N. Bacchetta, R. Bruce, V. Chetvertkova, B. Dehning, M. Deile, A. Di Mauro, M. Hempel, E.B. Holzer, S. Jackson, R. Jacobsson, M. Jonker, A. Lechner, E. Nebot, M. Nemcic, S. Redaelli, C. Roderick, B. Salvachua, M. Sapinski, O. Stein, J. Wenninger, D. Wollmann, M. Zerlauth.

1 Presentations

The slides of all presentations can be found on the website of the LHC and SPS Machine Protection Panel:
http://lhc-mpwg.web.cern.ch/lhc-mpwg/

1.1 Calculation of abort thresholds for the beam loss monitoring system of the Large Hadron Collider at CERN (M. Nemcic, E. Nebot Del Busto).

- So far the BLM dump thresholds have been calculated in an offline C++/Root tool. The thresholds were then checked and loaded into the BLM crates. The problems with this approach are:
  - Change management: the threshold changes (when, who, why) are not automatically tracked.
  - Storage: No central place to store the threshold files.
  - Testing: The thresholds cannot be verified in the calculation tool directly.
  - Security: The calculation tool is not protected against usage and changes by non-authorized users (RBAC).
  - Usability: To use the tool knowledge of C++ and root are required.
- The new automated database approach within LSA is presented (LHC/BLM threshold generator).
  - Advantages: Data security and consistency, tracking changes in thresholds, calculating thresholds (GUI), testing the thresholds, security of the system (RBAC), separated implementation and calculation of the thresholds;
  - Features of the threshold generator:

        - Parameterization: View/plot algorithm parameters; add/edit/remove corrections; commit changes; create new monitor families from an existing one; set monitor factors.
        - Testing / Verification: Plotting of master threshold and applied threshold; comparison of monitor families.
        - Change history: Summary of threshold changes in each family; history of changes in algorithm parameter.
        - Generating reports.
        - Committing thresholds to final.
    - Limitations (security):
        - Flexibility: user actions are limited.
        - Only database administrator can delete/edit algorithm parameters.

Questions and comments:

- Jorg and Barbara discuss whether history logs should be graphs or tables.
    - Martin: - Both are available.
- Jorg asks: What's the reason for giving the responsibility for changing the parameters to the database administrator instead of giving this right to the BI expert?
    - Martin: - The parameters will be provided by the BI expert and will then be imported by the database administrator. The parameters for the main algorithms (not the corrections) haven't been changed for more than 1.5 years.
- Markus asks: A lot of the vital functionalities for the threshold generation have been re-implemented, how certain are you that the old and the new approaches are equal? Are they benchmarked against each other?
    - Martin: - Not everything is re-implemented yet. They will be benchmarked after fully being implemented.
- Markus asks: What are the differences in committing the changes in two approaches?

- Martin: - In the new approach there are different types of databases: Stage and Final. They have different security levels. From Final the changes are pushed to the Master. The monitor factor is applied in Master. Master is launched by another application.

- Markus asks: The idea is to migrate to the new tool at the end of LS1? Before doing this the results of the new tool should be benchmarked against the old tool, e.g. compare newly calculated thresholds to the old thresholds.
  - Martin: The algorithm changed a while ago, but not all thresholds have been re-calculated with the new algorithm. Thus, the implemented threshold values will not be exactly the same as the newly calculated for some monitors.
  - Eduardo: - Actually the discrepancies are due to a different approach of implementing the corrections for the electronics. Some of the implemented thresholds haven't been adjusted with this change. Therefore the comparison should be done directly with C++/Root threshold computation.
  - Daniel: The new corrections are already implemented in the current C++/Root tool, but it is not implemented in some of the actual thresholds.
- Markus asks: How the work will proceed? Who will be the responsible from BI for the BLM thresholds generation in the future?
  - Barbara: It is planned to get a new fellow in 2014, who will work on that. In addition the new threshold generator will help us to be less dependent on the main person, as it eases the creation of new thresholds. Still the baseline will be that at least two independent people prepare/verify any changes of thresholds.
- Bernd comments: Thresholds change with energy. The magnet people should be responsible for defining the quench limits of the magnets.

- Eduardo comments: we have the corrections, but we could not predict the quench level. The final goal is to find the proper quench level.
    - Barbara: For the future we want to use QP3 for defining the quench limit.
        - Jorg: Quench limit depends on the loss scenario
        - Mariusz: need the numbers for quench limits which should come out of the ongoing analysis of the quench test results
- Daniel: If the quench limit from QP3 is obtained, at which point in the generator will it be integrated?
    - Eduardo: The new quench limit table can be integrated by monitor family into the database.
- Jorg: The ECR (engineering change request) for the change of the BLM positions (moving one of the 3 BLMs per quad in the arc to the downstream dipole) is still pending. **Action: Bernd**
- Anton comments: the BLM positions were optimized using the results of the FLUKA simulations for the cases that never occurred: losses due to an orbital bump.
- Bernd: It is clear, that if one monitor is taken away, this reduces the redundancy.
- Anton asks about the position of the BLM at the dipole– horizontal or vertical?
    - These BLMs will be installed above the interconnect MB-MB (i.e. vertical position).

Technical specification: Calculation of abort thresholds for the beam loss monitoring system of the Large Hadron Collider

1.2 MPP Workshop 2013 Executive summary (M. Zerlauth, D. Wollmann)

- Markus presents the follow-up from the machine protection workshop to be presented at LMC on the 24.04.2013 (The presentation can be found here).

Questions and comments:

MPS experience and outlook:

- Jorg comments:
    - Organization of LBOC is to be discussed with Gianluigi.
    - The operational scenarios (beta*, combined ramp and squeeze, vert. crossing in IP8, pile up, luminosity leveling etc.) are intertwined and therefore need to be discussed as a complex together with the optics team, the experiments etc. The most probable scenarios should be developed before autumn 2013. This is clearly in the scope of LBOC.

Injection and LBDS:

- Markus says: The new redundant link from the BIS to the LBDS retriggering line requires high dependability, as the number of unnecessary asynchronous beam dumps should not be increased significantly by this link. Work is ongoing and the goal is to come up with a hardware proposal soon. A student is working in MPE on the dependability analysis of this link.
    - Daniel comments that the hardware needs to be ready for installation and tests in the LHC at the beginning of 2014.
- Jorg asks if the TCDQ is going to be changed during LS1?
    - Yes, it is going to be longer: 9m instead of 6m. Besides that the hardware remains unchanged.
- **Action: Jorg** will prepare the specifications for the interlocking of the TCDIs with a virtual beta* in the SIS via SMP timing.

Movable devices:

- Stefano comments that the absolute beam position in the collimator can only be calculated when the jaw-position and the gap size are known.

- Jorg adds that the beam position in the button collimators needs to be available as UDP package to use it in the orbit feedback.

AOB:

1.3 Installation of the fast shutter valves in IR4 during LS1 (MPP, A. Lechner et al).

- Markus shows that the idea to install fast shutter valves to protect the cavities in IR4 from contamination originates in the LHC project report 1168. This idea was picked-up in several Chamonix presentations in the last years.
- Markus summarizes the current state of the design, development and hardware test of the fast vacuum valves (EDMS 1093346 (R. Veness)).
- Preliminary FLUKA simulations from Anton show that already the first 100 bunches of the impacting beam will vaporize the blade of the valve in case of spurious and undetected closure of the valve. The resulting showers would then reach ½ the damage limits of the superconducting magnets downstream.
- Markus concludes that from an MPP point of view the installation of these fast vacuum valves in LS1 cannot be endorsed at this moment in time due to the missing development of a dependable trigger and interlocking strategy and implementation.

Discussion:

- Richard: even if the material survives the beam doesn't survive more than 3 turns?
    - Markus: the problem is to protect the cavities and downstream equipment; if the valves are molten they contaminate the area and the cavities. The valve moves too fast to dump the beam by BLMs (as it will take at least 3 full turns to remove the beam from the

machine) before the damage threshold of the blade and downstream elements are reached.

Jorg comments that the mechanics of the valves is very well advanced.

- MPP proposes:

  1. Perform the needed preparations during LS1, but do not install the devices.
  2. Re-asses the requirements for such fast shutters.
  3. Start and finalize the design of the controls, interlocking and triggering for the fast shutters.

- Richard comments to re-shuffle the order of the proposal: 3, 2, 1.

  Action Markus: Trigger a meeting with VAC, RF and OP colleagues to agree on strategy to be adopted.