238th Machine Protection Panel Meeting (LHC)

Friday 14 July 2023 (Zoom)

Indico

Participants

C. Bernius (EP-UAT), R. Bruce (BE-ABP), V. Coco (EP-LBD), Y. Dutheil (SY-ABT), C. Hernalsteens (TE-MPE), M. Hostettler (BE-OP), D. Lazic (EP-UCM), F. Moortgat (EP-CMG), D. Nisbet (SY-EPC), A. Radeva Poncet (BE-CSS), M. Saccani (SY-BI), R. Secondo (TE-MPE), M. Solfaroli Camillocci (BE-OP), G. Trad (BE-OP), J. Uythoven (TE-MPE), C. Wiesner (TE-MPE), D. Wollmann (TE-MPE)

Minutes from previous LHC MPP meetings (D. Wollmann)

No comment was raised regarding the minutes of previous MPP LHC meetings. Therefore, the circulated minutes are considered approved and all items discussed have been implemented.

F. Moortgat will check with the ALFA team for the outcome of the re-adjustment of the anti-collisions switches in view of a future report to the MPP.

LHC BLM firmware update during TS1 (M. Saccani)

M. Saccani presented the firmware updates to the BLM LHC system performed during TS1. He started by reminding the BLM system optical link architecture and how the redundant acquisition electronics in the tunnel and the processing electronics in the surface work.

A series of spurious interlocks have been observed in 2023 run. After careful investigation, these were partially solved by decreasing the operational temperature of the BLM racks to $16℃$ (after an increase to $23℃$ during LS2).

Further investigations revealed that the source of the issue is in the way the interlock is calculated at the FPGA level. A combination of high temperature and weak tunnel transmitter link makes the algorithm unstable and trigger an interlock sporadically.

An updated version of the firmware with a fix for this issue has been deployed during TS1 and no spurious dump has been observed since then.

Discussion

D. Nisbet asked about the performance of the FPGA since M. Saccani mentioned that the memory is 99% full. M. Saccani explained that indeed it is difficult to touch any part of the FPGA firmware without introducing bugs or performance issues. Careful testing of any changes is the only mitigation measure until the new design will be deployed.

Faster beta* levelling at the start of Stable Beams (M. Hostettler)

M. Hostettler presented a proposal for a faster beta* levelling procedure. Since the LHC is currently operated at 1.6e11 ppb intensity (and not 1.8e11 ppb as planned), IP1 and IP5 desired luminosity is reached in ~45 minutes (which corresponds to a beta* matchpoint in the order of 60cm). In this context, reducing the time to reach the desired luminosity could be beneficial (especially for shorter fills dumped prematurely) for integrated luminosity gain (in the order of ~5%).

The proposal is to skip intermediate beta* matchpoints and go directly from 120cm to a beta* value closer to the target luminosity.

The software is already able to perform this operation, but driving collimator limits poses the problem of Machine Critical Setting (MCS) signatures. These signatures are generated by collimator experts as steps between each beta* matchpoint and will not cover more than one step. The technical proposal to overcome this issue is to produce cumulative MCS signatures from 120cm to any other beta* matchpoint so that it is possible to execute a step from 120cm to any other matchpoint directly.

The risk of this proposal is to decide to perform a step to a matchpoint that would exceed the target luminosity of IP1 and IP5 and possibly be problematic for the cryo heatload on the triplets. In order to reduce this risk, it was decided to not generate cumulative MCS signatures to go below 60cm in one step from 120cm.

A test of the new functionality with setup beam (2 nominal bunches per beam) was performed successfully. The further commissioning proposal is to start skipping beta* steps incrementally fill by fill (i.e jumping 2, 4, 6, … matchpoints).

Discussion

J. Uythoven asked based on what the operator chooses which cumulative step to apply. M. Hostettler answered that the operation will be carried out in the lumi server and the operator will have to manually choose where to go. This will be automated in the future. M. Hostettler proposes to have a setting in LSA that represents the beta* to which the lumi server will go as an initial step. D. Wollmann and J. Uythoven agreed that this is a good way to proceed as the setting in LSA makes it easy to follow the future slow increase of bunch intensity.

J. Uythoven commented that it is important that the collimator limit functions are monotonous to avoid unsafe scenarios. M. Hostettler reassured that this proposal does not change in any way the limits, as it just adds signatures. Collimator limits are monotonous functions.

D. Nisbet asked for clarification on how the new segment signatures are generated with respect to the already present ones. As a follow-up of the discussions, it was decided to play the cumulative segments during the current beam stop and ask the collimation team to check the limits functions from 120cm to all the matchpoints up to 60cm (**Action** for R. Bruce and collimation team).

Actions

- Validate all the collimator segments from 120cm to 60cm (and all the matchpoints in between) to ensure safe fast beta* levelling to 60cm (R. Bruce and collimation team)