5th LHC OPERATIONS WORKSHOP, EVIAN2014 SUMMARY OF SESSION 3: HARDWARE STATUS AND COMMISSIONING PLANS

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Abstract

This paper summarizes the discussions that followed the presentations of the session 3 "Status and commissionin plans," at the 5th LHC Operations Workshop, Evian2014.

INTRODUCTION

The third session of 5th LHC Operations Workshop, Evian2014, was dedicated to the presentation of status and commissioning plans for some key accelerator systems. The session included the following five talks:

1) **RF system**, by Philippe Baudrenghien;
2) **Transverse beam damper**, by Daniel Valuch;
3) **Collimation system**, by Gianluca Valentino;
4) **Injection systems**, by Wolfgang Bartmann;
5) **Beam dumping system**, by Nicolas Magnin.

For each presentation of the session, summaries of the discussion that followed the presentations are given. A summary of the critical points and open actions is also given.

RF SYSTEM (PH. BAUDRENGHIEN)

J. Jowett recalled that with heavy ions beams synchrotron radiation damping is twice as strong. It is important that controlled blow up is available as it might help reducing the IBS growth in the transverse plane. *P. Baudrenghien* agreed, highlighting that the most difficult part is to figure out which noise distribution to use.

G. Arduini asked if there will be intensity limitations from RF for the doublet beams that can be injected in the LHC and what needs to be monitored at intermediate intensities for the intensity ramp-up of the doublet beam. *P. Baudrenghien* replied that this should not be the case as these beams will not be ramped. The HOM power should be monitored at the different cavities as with the different bunch spacing different harmonics might be intercepted. He also recalled that in Run 1, the HOM measured power was lower than expected.

S. Redaelli asked if the items listed in the MD request page are part of the commissioning or if they can be addressed in MD period after the intensity ramp up. *P. Baudrenghien* replied that the few ramps could come later, but not too late as the experiments would need the information rather early on, and prefer not to have changes on the luminous region length during the run.

J. Wenninger asked to clarify what is meant by "moderate intensity", if that corresponds to few bunches in early commissioning or more, so during intensity ramp-up. *P. Baudrenghien* and *E. Shaposhnikova* replied that it is important to foresee some RF dedicated measurements in the first two months of commissioning with single bunches. Measurements will have to continue during the intensity ramp-up, probably requiring negotiations with the MP panel. They added that the evolution of the bunch length is not yet known during physics, and that it will be interesting to look into what physics processes drive the evolution of the bunch length then.

TRANSVERSE BEAM DAMPER (D. VALUCH)

M. Lamont commented on the resource availability for the full implementation of the new observation features. *W. Höfle* replied that some prioritization will have to be made and reckoned that most of the work relies on support from their controls section (BE-RF-CS).

O. Brüning asked about the interface between the ADT observation box and Timber. *D. Valuch* replied that the two systems are complementary but they do not talk to each other. The new data from the ADT will not be stored in the logging database whereas the previously logged parameters will remain as in Run 1. For the observation box, different users will subscribe to different chunks of data, but buffers will write continuously removing the bottleneck of deadtime.

M. Lamont asked to comment on the FESA 3 migration. *D. Valuch* replied that at present the priority is on the injectors restart and that the teams are working hard on that. For the LHC, commissioning staging will be the way to go. This will start after summer. *A. Butterworth* added that indeed the workload is important. *W. Höfle* added that a choice based on priorities needs to be done. The importance of the SPS scrubbing beam development drove the changes on the SPS damper and made it a priority. Until the new SPS damper is not operational the LHC system will not be switched.

R. Schmidt inquired about the use of the non colliding bunches at IP1/5 to measure the tunes. *D. Valuch* recalled that an active Q measurement was demonstrated by kicking bunches, and that a passive one was demonstrated with massive number crunching to calculate the tune from the noise spectrum. He added that the ideas are alternative solutions to the BBQ. This is not part of the new data that will be made available by the observation box. *R. Jones* com-

mented that the BBQ cannot do bunch-by-bunch, but can do fast measurements e.g. for feedbacks, while the ADT measurements could be bunch-by-bunch but mostly offline. The two systems should be seen as complementary.

COLLIMATION SYSTEM (G. VALENTINO)

O. Brüning asked about the collimator setting problem mentioned by the speaker. Why was it not caught by loss maps? *S. Redaelli* replied that a setting error for the centre of one TCT in IR2 was put in at the beginning of the run so there was no correct reference loss maps to compare against. This case would be immediately caught by the new BPM collimators that measure the beam location inside the jaws.

O. Brüning also asked whether the new BPM feature will lessen the need for validation loss maps. *G. Valentino* replied that the settings validation will still rely on loss maps. The new BPMs feature will however be crucial for online orbit measurements and for faster alignment in the IR's. *S. Redaelli* emphasized that the added value is in the orbit monitoring that will allow online detection of potential setting problems in the collimator centring that is presently not easily validated.

G. Arduini asked to clarify whether the initial alignment will be done as in Run 1, with losses. *S. Redaelli* replied that after initial comparisons between the BLM and the BPM methods, only the BPM method will be used. He however recalled that only a small fraction of the system is equipped with BPMs so the majority of the collimators can only be aligned with the BLM technical. The TCT with BPMs will ensure an efficient setup in case of changes of IR configurations.

M. Pojer asked whether calculations were performed to address the impact on electronics in the RRs from the increased radiation due to the TCL6s. *M. Brugger* replied this is the case: simulations show that the radiation levels to electronics remain in the tolerance budget. *S. Redaelli* commented that we should foresee some measurements at startup to validate the simulations for different TCL configurations.

M. Lamont recalled that the experiments requested splashes on the TCTs and asked if this will remain feasible. *S. Redaelli* replied that they will be ok with the new TCTPs.

INJECTION SYSTEMS (W. BARTMANN)

O. Brüning asked about the 1.4 SEY threshold for the MKI. Is this acceptable for electron cloud? *G. Rumolo* replied that this value is similar to the ones of dipoles and is considered acceptable.

O. Brüning asked about the consequences of not coating the TDI. *B. Salvant* replied that the TDI will be equivalent to before LS1 from the impedance point of view. The coating would have greatly improved the impedance according to calculations performed by *N. Mounet*.

P.Baudrenghien commented that with 25 ns beams, the increased transient beam loading at the SPS is likely to cause more capture losses in the LHC. What are the plans to set the new sunglasses for the LIC BLM's? *W. Bartmann* stated that the sunglasses will in theory be possible after the LS1 upgrade of the system but a follow up with the MP panel is needed. *B. Dehning* clarified that it is a major decision with a potential impact on the whole BLM system (might have an effect on the other monitors also), thus a broader discussion is needed. There is also a manpower issue within the BLM team, but this can be overcome. *V. Kain* commented that at the end of Run 1 the problem had already been mitigated and was not limiting severely the performance. The feature might therefore not be needed anymore. *W. Bartmann* pointed out that the mitigation was primarily coming from the increased operational gaps for the transfer line collimators that were opened from 4.5 to 5 sigma. The final decision on the implementation of the sunglasses depends therefore also on the planned protection settings. *B. Goddard* agreed and re-iterated the need for a wider discussion.

R. Schmidt highlighted that the MSI current interlock is vital and worked well during Run 1. Why was it changed? Was a failure analysis performed concerning the implemented changes? *V. Kain* recalled that the MSI will adopt the LHC-type FGC power converter controls. An interlock on the settings will be needed, which is not there at the moment. *J. Wenninger* explained that the MSI had an SPS converter, which meant it could not be degaussed. The idea came to put it on an FGC, but that implied the loss of the fast interlock. He added that there are other dipoles in the transfer lines that are as dangerous as the MSI but are on SPS interlocks only. *J. Uythoven* stressed that it will be put in the BETS to make sure that it has the right settings. This should make it safer than the SPS interlock.

S. Redaelli asked about the radiation resistance and the robustness to beam impacts of the upgraded TDI featuring optical sensors. Considering the criticality of the device (that is hit a few times per year by important beam losses) is it not worth considering beam tests at HRM to address the robustness of the proposed solution? *R. Losito* replied that the measurement heads will be out of beam trajectories and he excludes problems from beam impacts.

B. Goddard hinted that quite a lot can be done in transfer line tests and sector tests for the commissioning steps proposed by the speaker. *W. Bartmann* agreed, adding that SPS extraction aperture tests should be repeated with proper SPS supercycles. He estimated the amount of time needed to 66 hours, or 4 shifts per transfer line.

BEAM DUMPING SYSTEM (N. MAGNIN)

R. Bruce asked a best guess of the number of asynchronous dumps per year after the LS1 changes. *J. Uythoven* replied that we should keep the assumption of one asynchronous dump per year per beam. Due to the

hardware changes, this is to be confirmed by the reliability run. *B. Goddard* stressed the importance of accumulating a couple months of operational data with the reliability run before confirming the yearly figures.

M. Zerlauth recalled the importance of the UPS powering test, stressing that the study of the LBDS response was one of the main motivations for the first test executed. However, the LBDS was not available for this first test. It will be available in its final configuration for the second UPS test.

B. Goddard asked about the need for beam tests of the direct dump BLMs. *B. Dehning* recalled that the BLM thresholds had to be reduced in previous tests to trigger a dump, and then increased back to the operational values. This procedure will likely have to be repeated.

P. Collier asked about the failure modes of the dilution kickers. Do we need all kickers per plane for a safe dump? *B. Goddard* replied that studies showed that one dilution kicker per plane is sufficient for a safe dump. The present implementation foresees a dump immediately if one of the dilution kicker fails. *N. Magnin* recalled that indeed in case of failure of a kicker, a synchronous beam dump will be pulled. *P. Collier* and *R. Schmidt* argued why to dump the beam in a non-optimal condition instead of trying to recover the kicker. *J. Uythoven* explained that this is better than risking additional failures that could generate unsafe conditions.