

Status of the machine studies

MSWG meeting, 20/11/09

1) SPS FBCT calibration problems during the last dedicated MDs of week 45 (E. Metral and L. Jensen)

- As already mentioned in the previous MD report, during the last dedicated MD we took the LHC 50 ns beam and obtained the results mentioned in the SPS Elogbook on Tuesday 03/11 at 18:28. Deducing the intensity / bunch from the BCT yields $\sim 1.2E11$ p/b, whereas from the FBCT we have ~ 2 times less. Lars Jensen was contacted to check whether there could be a calibration problem.
- We did not succeed to meet (yet) but according to him, the problem *could* be linked to calibration but the most likely cause, is a wrong setting of the 40MHz phase which can be controlled (empirically) from Markus' application. I still have to check this with him at some point...

2) Calibration of the SPS BWS (S. Cettour Cave)

- The wire scanners (BWSV41420, BWSH41677, BWSV41677, BWSH51995, BWSV51995, BWSH52171 and BWSV52171) have been calibrated with orbit bumps (<http://emetral.web.cern.ch/emetral/SPSmachine/Instrumentation/BWS/Wire%20scan%20calibration.xlsx>).

3) Coupled-bunch feedback with C11 in the PS (H. Damerau)

- Monday 16/11 (08:00 - 18:00).
- The spare cavity C11 has been operated as a feedback kicker on harmonics h19/20 (cavity coarse tuning at h=19.5) to damp coupled-bunch oscillations during acceleration. C11 thus replaced C86/C96 being normally used as feedback kickers. As the dominant coupled-bunch modes on the flat-top are different (RF harmonic still h21), the feedback was also tested successfully at h13/14 (C11 tuned to h=13.5). This mode of operation is not possible with C86/96, since they cannot generate any signal at h13/14 when tuned to h21 (for the normal RF harmonic).

4) New PU configuration for the PS radial loop (H. Damerau)

- Tuesday 03/11 (13:00-20:00).
- As recommended by the MSWG, the PUs used for the radial loop have been changed from PU22/51/96 to the new configuration PU22/36/76/96. Measurements have been taken before and after the switch-over for AD, CNGS, SFTPRO, TOF, MD1 (MTE). LHC-type beams are not critical, they have been delivered to the SPS in parallel. Since the MD, the new PU configuration is operational. A first look on the measurements shows that beams are now better centered as observed by the mean radial position from the CODD.

5) SPS scraper (E. Veyrunes and E. Metral)

- Reminder (P. Collier wants to know the situation with the SPS scraper: https://ab-mgt-md-users.web.cern.ch/ab-mgt-md-users/2009/CommentsAtIEFC_17-04-09.htm): The goal was to arrive at specifications at the end of the run as R. Losito confirmed that the present scraper is not adapted for high-intensity operation.
- On 01/09/09, the scraper was tested (in //) and seemed to work without perturbing high-intensity beams. Some delays were observed, it seems that different scraping positions were also found from one week to the next, etc.
- On 12/10/09 the scraper was also tested on LHCFAST2 (using the scraper expert application) and some references were put in the Elogbook.
- Meeting on 12/11/2009 with Roberto Losito, Eric, Elias and several other people:
 - The first objective (from R. Losito) was to understand what is needed (i.e. what are the requests/specifications) for next year. Then take a decision to put a new control system, which they know well, or to keep the old one. The 2nd objective is to decide if we keep the copper blocks or if we replace them by graphite.
 - Francesco Cerutti (EN/STI) used ICOSIM and FLUKA to perform some (preliminary) simulations, which seem to confirm the first analytical estimates with a copper thickness of 3 cm. The peak is too high wrt to the fusion point. Considering graphite and reducing the length (1 cm), the value was still quite high. Preliminary conclusion: Even with 1 cm it is not sure that it will work for high intensity. A smaller value than 1 cm would be better (to have a longer energy deposition) but then we have other (mechanical etc.) problems => We start for the moment with 1 cm.
 - It was reminded that $1 \sigma = 0.6$ mm at this location and that the precision of emittance meas. is ~ 10 -20%, therefore the precision on the sigma is ~ 5 -10%.
 - It was said that next year we will certainly use only the 50 ns beam and not the 25 ns beam.

- Reminder from Roberto: The first 3 weeks of January might be in shutdown (still to be confirmed) => We could change the copper blocks by graphite blocks. In 2 weeks we will have final simulations results. But can we do a new control system? We should profit from the small shutdown to see if we have cables to put etc.
- Question raised: Which speed do we need?
- It was mentioned that during previous MDs it seems that there were more re-populated tails in H than in V.
- Reminder: With the actual copper blocks, if the full intensity LHC beam goes on it then the limit is at 1% (for 3 sigmas).
- Concerning the actual situation with the current scraper, Eric emphasised that it cannot be given to OP like this. Another question was raised: Do we need additional LHC BLM to measure correctly? It seems that with the current SPS BLMs it should be OK.
- Meeting on 18/11/2009 with Eric, Elias, Mathieu Donze (EN/STI), Jorg, Alessandro Masi (EN/STI):
 - Concerning the scraper specifications discussed in the past, I sent to the participants a paper prepared by G. Arduini and H. Burkhardt (which was never published): https://edms.cern.ch/file/772782/1/scrappers_v7.doc.
 - It was said that the new CO (new electronics etc.) should be ready for maximum March 2010. The existing one will not be touched and could be used meanwhile.
 - Currently it is linked to the injection timing, i.e. it is the beam IN. For us it is the easiest to put a delay wrt to it. Furthermore, the 200 (or 400) ms delays measured during the previous tests seem to be constant and in this case this is not so much a problem and can be compensated.
 - There are many FESA classes in the old application which might not be necessary and it seems that some clean-up would not be a bad idea.
 - In the new application, it should be very simple, i.e. only few FESA classes should be used: Settings, Acquisitions, etc. We need to have a return message telling us what was done (if it scraped or not, etc.). This is not the case at the moment and we can only deduce some scraper activity from measurements on the BLMs or BCT, if beam losses have been generated.
 - For the moment, the idea is to scrape once per cycle. The parking position should not be ppm but all the rest could/should be ppm (the scraping time should be ppm).
 - We need to know the speed of the slow and the fast motors.
 - A. Masi mentioned that we could apply the same philosophy as for the collimators. We change the settings in the FESA classes and then we arm and play these settings for many cycles.
 - Eric is preparing a note "Scraper Controller Configuration", for the scraper class specifications, based on S. Redaelli's request for the crystal studies.

6) Instability in double RF system for SPS and LHC (E. Chapiro)

- We had 4 MD sessions during this year devoted to these studies. All measurements finally were done at 26 GeV/c. During the first three we were measuring single bunch instability threshold as a function of intensity for different amplitude and phase of the 4th harmonic RF system as well as the amplitude of the main RF system. At the end of the 3rd MD (at high intensity) we found that chromaticity was negative and after correction to positive value we did not have much time left to restart our measurements. During the fourth session we scanned the phase at two (low and high) intensities only, again for different voltages. Low intensity was always used for calibration of phase between the two RF systems. Unfortunately analysis of data shows that results obtained before ion run (2 first MDs) could not be reproduced later (some hardware was modified for ions). We are investigating the reasons for it. Otherwise basic results are that bunch-lengthening mode is much more unstable than bunch-shortening and even single RF system, but bunch-shortening mode has also its own application limits which we were studying. Two MD Notes are in preparation.

7) YASP validation with beam on PS high energy orbit correction TT2 new FE correction (M. Gourber)

- Several MDs during the last few weeks.
- Problems encountered: some BI unavailability.
- Current results: overall validation completed at 70%.
- Next steps: completion of validation.

8) Low-intensity variants of the single-batch LHC50ns in the PS (H. Damerau)

- Wednesday 18/11 (08:00 - 18:00).
- A first test with a low-intensity LHC-type beam with 50 ns bunch spacing (single batch) and 20% of its nominal intensity per bunch has been performed successfully (from the longitudinal point of view) in PSB and

PS. At PS extraction, 12 (PSB ring 3 only) and 36 bunches have been produced. The parameters requiring readjustment in the PS beam control after the intensity changes were as expected (all PPM and remote).

- Next steps: Setting-up time needed to fine tune this beam.

9) Dedicated MD request (S. Gilardoni)

- There is still the hot topic of the losses in the injection region (causing the closure of the Route Goward), which Simone would like to perform before the end of the 2009 run. This year they had already some dedicated MDs on the subjects, but few of them were in fact used to re-commission the instrumentation. They would need a short dedicated time slot, 4-6 h, to conclude the measurements: test a new optics for the high intensity beams and, since the line is not ppm, this can be done only in dedicated mode. A proposition from Simone (it was already discussed/agreed with the FOM) could be to take these measurements immediately after the end of the run for the LHC (on December 16th).

10) Important question still to be answered by the PS: Is the LHC25 ns beam still more unstable than in the past? (E. Metral)

- It was mentioned during the 1st MSWG meeting held on 27/03/09 that the "Nominal 25 ns LHC beam is right at the limit of stability" (H. Damerau). The MSWG recommended to check in 2009 whether the LHC25 still suffers from the longitudinal coupled bunch instability that was observed in 2008. Is the LHC25 ns beam still more unstable than in the past? If yes, do we know why? It was mentioned to Heiko and Steve that in fact MKE kickers were installed during the shutdown 2007-2008 (<http://ps-impedance.web.cern.ch/ps-impedance/>). It was predicted that the BB impedance contributions should have small effects on the thresholds for instabilities (<http://cdsweb.cern.ch/record/971884/files/ab-2006-051.pdf>). However the small resonances measured at low frequency on the kickers could drive some coupled bunch instabilities (http://ps-impedance.web.cern.ch/ps-impedance/MTE_Kickers/MTEKickerResonances_03-04-09.ppt). Concerning these resonances, Luc Sermeus told us that the kicker magnets on which impedance measurements were made had a "bricolage" representing the transition pieces. Therefore, we could perhaps expect that these resonances are smaller on the installed MTE kickers...