

Status of the machine studies

MSWG meeting, 03/07/09

1) Setting-up of the feedforwards in the SPS and of the TWC 800 MHz in view of the Long Injector MD of week 25 (T. Bohl)

- MDs done from Monday 08/06 (08:00 - 18:00) to Wednesday 10/06 (08:00 - 14:00).
- Did not have the required machine/beam conditions all the time.
- Problems encountered:
 - wrong LHCFast cycle was loaded,
 - TWC 800 MHz not available,
 - not possible to get 48 bunches of nom. intensity accelerated to flat top due to outgassing (MKDVI) and ion traps interlock,
 - bunches too long at injection,
 - Wednesday morning: no beam available from PS.
- Current results:
 - by Tuesday noon V. Rossi finished adjustment of feedforward as far as possible with the available beam; this means the setting-up could not be completed; therefore more setting-up time will be needed during long MD next week,
 - Tuesday afternoon beam was used by Giulia for BQM and by Wolfgang for transv. damper set-up.
- Summary: available time was useful although not everything which had been foreseen could be done.
- Next steps: finalise feedforward setting-up during long MD (as well as long. damper and TWC 800 MHz setting-up).

2) SPS ecloud studies during the 1st Long Injector MD

- The results were discussed in today's MSWG meeting:
 - MKDV outgassing and ZS vacuum issues (K. Cornelis)
 - E-cloud in liners and vacuum measurements (M. Taborelli / C. Yin Vallgren)
 - Summary and report on MW measurements and ecloud instability studies (E. Shaposhnikova)

3) SPS RF studies (T. Bohl)

- MD done on Wednesday 17/06 (10:00 - 18:00).
- Did not have the required machine/beam conditions all the time, but the available beam could be used in a useful way.
- Problems encountered:
 - beam not always available from injector,
 - no. of batches limited by ZS interlocks,
 - large variations of bunch intensity throughout the batch (irregular batch structure) for part of the MD time.
- Current results
 - a large amount of data was acquired in time domain and some in frequency domain,
 - data will be used for coupled bunch instability source determination.

4) Long LHC cycle in the PS during the 1st Long Injector MD (Y. Papaphillipou)

- On Wednesday morning and afternoon, we managed to re-establish the magnetic cycle of a CNGS/SFTPRO type of beam in case of failure of the rotating machine. This cycle is very similar to the normal SFTPRO cycle with slightly slower ramp, so that the voltage limit of the mains is not exceeded. We managed to accelerate and extract 700×10^{10} protons on MD3. The main problem we faced was that the timing of the internal dump was found at 600 ms, even if MD3 was a ppm copy of SFTPRO. The PFW were initialized using the polynomes. All high-energy timings were delayed by 30 ms.
 - New requirement: Work is still needed for optimisation of the working point and the extraction settings.
- On Thursday morning we re-established the 5 BP-long magnetic cycle of an LHC-type of beam using the new regulation. Just before the power cut around noon, we managed to accelerate 150×10^{10} . There was no time to adjust the longitudinal splittings and set-up the double injection, but we checked that we are no longer limited with timing max values as it was the case last year.
 - New requirement: We will need around 4-8h dedicated MD time to finalise the work on this cycle.

5) UA9 in the SPS during the 1st Long Injector MD (S. Redaelli) => This is the additional day we required to prepare the cycle and in particular test the coast

- We only had coasting beam for about 2 h. In this limited time we could:
 - verify all the agreed beam measurements with coasting cycle.
 - centre the LHC collimator jaw around the local beam orbit and set it to opening of about 6 sigmas (final values to be confirmed after detailed look at the measured data).
 - perform relative alignment of the TAL with respect to the 6 sigma beam envelope defined by the collimator. We found that the TAL got closer to the beam than at collimator at a position of +64.5mm from the out switches.
 - perform relative alignment of the CRYSTAL-1 with respect to the 6 sigma beam envelope defined by the collimator. We found that the cristal got close to the beam than the collimator at a position of 76.6 mm from the OUT switches.
 - perform a first angle scan of crystal-1 with crystal into the beam. This scan showed that the position of the cristal is strongly affected by the angle settings, which is obviously not good. This requires follow-up.
- Clearly the data quoted above are to be considered as preliminary and will have to be confirmed by careful analysis off-line of the measured data.
- It is also worth noticing that for all the devices moved we verified the correct functioning of the control applications, of the logging and of the private data acquisitions.

6) UA9 in the SPS

- MD done on June 30th, 2009.
- Problem encountered:
 - BLM on BA5 give false measurements
 - A white noise excitation from the transverse damper (with an application to control it) is needed and was not available yet.
- Current results (from the logbook):
 - Angular scan with crystal 1
 - Going 0.5 mm inside with the crystal. Losing more at the TAL than at the crystal... like a two stage collimation system.
 - starting angular scan: -100 murad, +500murad, going up to +1000 murad. Looking to the minimum of the losses at the crystal and max at the TAL.
 - Angular scan with crystal 2
 - Losses at the crystal go down. Channeling? ~-1300 umrad.
 - Scan on the other direction. Same reduction of losses at the BLM on the crystal. Indication of channeling!
 - Now we put in the Cherenkov detector and then repeat a scan of the crystal angle.
 - Crystal at up to 78 mm. Scan in amplitude start at 70 mm and then 1 mm step to go in. Start at 71.7 mm
 - Crystal at 79.628 mm, no large losses, different than before.
 - Losses at cherenkov seen at 78 mm but nothing on blms.
 - Opening the TAL then
 - Losses on BLMs seems 80.295 mm.
 - Moving TAL back by 1.5 mm.
 - Starting angular scan from -2000 to 0 in step of 30 murad/s.
 - Channeling and volume reflection seen at about -1300 murad
 - Scintillators + quartz
 - Nice channeling profile (01:33)
 - Now crystal further in, 81.250 and repeat the scan. Before crystal was at about 4.5 mm from the central orbit
 - Transverse damper was used up to 779,543 turns = 18 sec (= length of the pulsed cycle).
 - BLM on BA5 give false measurements.
 - More meas. with crystal 1
 - New coast. Aligning collimator, same coordinates as before: 2.8 mm left, -1.6 mm right, 3.5 sigma half gap
 - Aligning the TAL. Starting from 61 mm, 63 mm, 64 mm, 65 mm, 66 mm, 67 mm, 68 mm (losses). Leaving at 68 mm, opening the collimator.
 - Putting crystal 1 in. slowly... moving 10 by 10 mm.
 - Crystal alignment 78.4 mm.

- TAL moved to 66.5 mm.
- Several peaks of channeling observed => Secondary channeling peaks!
- Amorphous position to measure lifetime
- Putting the crystal in channeling and re-measuring the lifetime
- Next steps:
 - 1) Check that the BLMs in LSS5 work. For some time we observed that even without beam, some strange signals were observed on some BLMs of LSS5. This was also the case during the MD. Since then, the crate, as well as the acquisition cards, were changed. Jorg checked it: "We looked at it and it seemed really much much better. It is now similar to BA4 and BA3. For some reason BA1, BA2 and BA6 is still better in terms of noise than the other free crates. I check this by settings the gains up a lot and looking at the signals when there is NO beam. This reveals the (very) radiation areas in BA1 and BA2 (in the LSS's), while the rest if the monitors should read something very close to 0".
 - 2) A white noise excitation from the transverse damper (with an application to control it) is needed for the next Long Injector MD of week 29. Up to now, only the system to perform the controlled transverse emittance blow-up (as was done last year, exciting the 1st unstable betatron line) was used, but for the next time this will not be enough. E. Metral reminded W. Hofle, who confirmed that it should be available.

7) Losses at PS injection (S. Aumon)

- MD done on July 1st, 2009 (morning + afternoon).
- The MD was stopped because there was no signal on the SEMfil 48.
- Problems encountered: No signal on the SEMfil 48 in horizontal and vertical at some point. This SEM fil is necessary to reconstruct the beta function at injection. Ana Guerrero came in the CCC to cure the problem without success.
- New requirement: The measurements have to be done again when the SEM48 works.

8) Tests with the newly cabled radial loop pick-ups SS36 and SS76 in the PS (H. Damerau)

- MD foreseen to be done on July 1st, 2009 (afternoon).
- It was finally decided to continue the morning MD and postpone this one.
- Next requirement: ~ 8 h slot for this subject during the injector long MD of week 29 => Could be done in parallel when the SPS is only taking single (up to four) bunch (LHCINDIV, etc.) LHC-type beams.

9) Localization of SPS transverse impedance (R. Calaga)

- The beam was prepared in the PSB and PS as foreseen.
- The MD foreseen on July 3rd was cancelled, as the SPS was not available.
- Today's MD is taking place.

10) PS SEM-GRIDS SMH42 and injection (48, 52, 54) SEM-grids (R. Steerenberg)

- Check that it worked and could be used for the PS dedicated MD of July 1st on losses at PS injection.

11) LHC transfer line studies (M. Meddahi) => Summary from <https://lhc-commissioning.web.cern.ch/lhc-commissioning/meetings/20090623/LHC-BC-WG-Min23June09.pdf>

- Aims of the MD were to execute complete / nominal LHC injection sequences to ring 1/2 under LHC mastership, and bring all previously tested aspects together.
- Started with batches of 12 bunches of 1e10.
- Had to adjust MKE4 waveform to improve waveform and also adjust timing in MKE6 to extract correctly (now understood by ABT). Need to define the settings and store these!
- Some small problems which prevented full sequence as timing bug stopped first injection to the SPS if there is no beam in the SPS... only problem found. Also IQC result came too late for the next cycle – could not be studied as lost the LHC mastership when trying to do this. Apparently both issues have been fixed.
- Prepulse diagnostics can be seen in the BIS monitor – settings critical and need to see about MCS with kicker delays.
- Observed beam losses on TPSGs due to uncaptured beam – need to calibrate this – need some more MD time which can be combined with the setup of the TPSG and MST/E protection which needs to be done.
- Also seen spurious triggers on TL BPMs due to spurious bunches.
- Extracted onto TED with cooling water off – about 60 degrees expected for full intensity batch.
- Beam quality monitor in SPS will be critical.

12) Beta-beating in the SPS, and coupling and vertical dispersion correction (R. Tomas)

- MD took place on June 23.
- Problem encountered: We started with the LHC probe beam (as planned) however it was very hard to get the BPMs working at such low intensities. Thanks to the flexibility in the PS Booster we tried the LHCINDIV beam with higher intensities, however the synchronization bunch-BPM system (in turn-by-turn mode) was not stable enough for systematic measurements. Jorg proposed to change the beam to the LHC25 with 12 bunches. This worked very well and we took nice data from 6 pm to 9 pm with the permission of the coordinator. To summarize, single bunch and multi-turn data in the SPS seem to be incompatible (from today's experience). Next Thursday we will need the same beam (LHC25, 12 bunches) for the MD in collaboration with GSI colleagues, and not the LHC probe beam as it is presently planned.
- Comment from Jorg after the MD (on the problem encountered): The LHCINDIV beam was never used in the SPS before your MD, and in particular RF settings were incorrect. The beam was in the wrong position, and that generates a mess in many settings... I'm not yet convinced that single bunch and multi-turn are incompatible since nothing was changed in the system. I rather think that this must have to do with the settings (the switch over to LHCINDIV did not help) and the delay in the acquisition. To be checked another time.
- New requirement: More MD time to complete the measurements.

13) Test of reconstruction of localized sextupolar and octupolar errors, in collaboration with G. Franchetti (GSI) (R. Tomas)

- We had LHC25 beam and 12 bunches.
- BPMs worked perfectly since the beginning. We took orbit scans for 2 orbit corrector configurations with and without octupoles.
- Tune and BPM data were recorded satisfactorily.
- First estimates from model suggested agreement with measurements.

14) General information (E. Metral)

- MAL1001 is often a problem after supercycle changes => One can easily lose 10 min to ½ hour to restart it (locally when needed). May be one could think on how to improve it in the future.
- BWS521 (linear one, but at high dispersion: $D_x \sim 2.2$ m) should work again (BI, 11/06/09) => Still to be checked in detail. BI will now look in more detail to the BWS414 (rotational). The ideal linear one is BWS517, with a small dispersion of ~ -0.35 m, but it is still not working.
- The "scan now" knob in the BWS application works and was used to make measurements in coasts.