Week 27

Multi-bunch injection scheme for LHC (T. Bohl at al.)

2010-07-08:

Four single bunches were injected into the SPS 2.4s apart, bunch spacing was 2us. Bunch intensity was about 1e11 at injection and about 10% less at extraction (see BCT screen shot). The cycle used was LHC_4inj_FB7260_FT835_Ext15815_2010_V1 with the standard LHC beam ramp.

The controlled long. emittance blow-up was optimised for this cycle. At flat top, with 7.0MV, bunch lengths between 1.3ns and 1.85ns corresponding to longitudinal emittances between 0.40eVs and 0.75eVs were obtained in a controlled way. It was not tried to obtain too large emittance values (typical values for LHC filling are 0.50eVs to 0.65eVs). Enclosed plot shows an example of bunch length distribution over more than a synchrotron period (blue trace): mean bunch length 1.58ns with max. spread of +/- 0.1ns. Red trace shows distribution of mean of 4 bunches per acquisition: 1.58ns +/- 0.03ns, this means that the beam is stable at flat top. To obtain stable bunches and a small spread of bunch length (long. emittance) the use of the TWC 800 MHz is required (this is a new operational requirement). BCT data show losses during the front porch and up to 36GeV/c. Only part of those losses are capture losses. The rest needs further studies probably also in the transverse plane. It was tried to increase the bunch intensity in the injectors to obtain 1e11 measured at flat top. This was not any more possible within the available time.

Figures:

- bunch length distribution of all acquisitions at flat top prior to extraction and distribution of the bunch length mean per acquisition (should be narrow for a stable beam)
- BCT

2010-07-11

Same beam as of 2010-07-08. Several non-RF related issues prevented the injection of the beam into LHC. No RF tuning.

2010-07-12

Same beam as of 2010-07-08. Transverse setting-up of cycle continued. Loss at 36GeV/c disappeared. Slight tuning of RF noise.

Conclusions: Longitudinal beam parameters should be good enough for injection into LHC (until further notice)

Outstanding:

- optimisation of capture
- fine tuning of noise
- feedback about bunch parameters needed from LHC

Week 28

Preparation of the LHC50 in the PSB/PS (A. Findlay, H. Damerau, S. Hancock)

The intensity of the LHC50 can be safely increased in the PSB (by increasing the number of injcted turns from 2.4 to 3.3) up to ~235e12 p per ring (Rings 2, 3&4) keeping the longitudinal properties unchanged and blowing the transverse normalized emittances to a total of ~7um (ex + ey).

The preparation of the high intensity LHC50ns (700e12 ppp -> ~1.9e11 ppb) seems to be well advanced now. With an average bunch length at extraction of ~4 ns and a longitudinal emittance slightly above 0.35 eVs, things look not so bad (see attached plot of a 'good' cycle). We still observe some small 'ears' of the bunch distribution during rotation, but those are in fact already present with nominal intensity (somewhat less pronounced). Also as expected, the bunch-to-bunch intensity variation (mainly at the head of the batch) becomes worse when increasing intensity. Intensity can be set directly in the PSB and, if you stay within the range of nominal and 1.9 10^11 ppb, the beam should go through the PS with only minor fine adjustments. The transverse emittances have not been checked yet.

High intensity single bunch into the SPS (G. Rumolo, J. Tan, H. Damerau, W. Höfle, B. Salvant)

Individual bunches with intensities between 1.5 and 3.5e11 have been produced at the PSB with a longitudinal emittance of 0.3eVs and transverse normalized emittances with a total of below 3um (measured 1.5 and 1.2um in x and y, respectively, for the highest intensities). These bunches have gone through the PS (nominal longitudinal parameters @extraction) and injected into the SPS. Before injecting into the SPS, the MOPOS had to be disconnected in the three sextants in which the BPMs are not equipped with attenuators, because of the incoming high peak signal. It was attempted to have a better match of the incoming batch into the SPS bucket (changing the voltage at injection) and losses at injection were observed for bunches down to 1.5e11 ppb.

150 ns beams in the PSB/PS/SPS (see talks in this MSWG)

Week 29 (Long MD)

B field fluctuations (S. Gilardoni, OP)

Measurements of MRP were taken on the SFTPRO user preceded by a different user (EAST/AD/CNGS/TOF), with all the PFW+F8L, disconnecting all of them, reconnecting the circuits one by one. Preliminary result: it seems that the MRP depends on the magnetic cycle of the user preceding the SFTPRO but it does not depend on the PFW or F8L.

Injection losses in the PS (S. Aumon et al.)

The goal of the MD was to use the new LHC BLMs for losses measurements at injection and study the losses of the incoming beam from the BTP line. OASIS was not used, we measured with an oscilloscope the analogical signals taken directly from the BLMs close to central building.

From Tuesday afternoon to Thursday, setting up of the LHC BLMs. The BI group manages to provide us an electronics allowing the use of new LHC BLMs in the PS. However, an oscillating signal appears on the LHC BLM placed in ss42 which was initially believed to be the losses of the incoming beam into the PS. It turned out that this was an artefact and not a loss.

The following days:

- Comparison of the signal given by LHC BLM 42 mounted on the MU42 and the old BLM in SS42, the so-called ACEM42. The time resolution of the new BLMs is much worse than the old BLMs (300ns versus 10ns, to be confirmed from the specifications). On the ACEM signals, we are able to see the 8 bunches whereas the signal of the LHC BLMs is much slower.
- First measurements of turn by turn losses at injection up to 500μs after injection on TOF, for example. Those measurements were done with the old BLM system because the LHC BLMs do not see the turn by turn losses of the circulating beam in SS42.
- Finally we used the ACEM BLMs for the measurements, because the time resolution is much better on the ACEM than the LHC one and also because we do not see the losses turn by turn, with the condition to measure the analogical signal, not via OASIS.
- Losses turn by turn on CNGS-SFTPRO beam like but it was not measured on how many turns.
- On Friday, measurement of the losses in ss42 of the incoming beam by changing the steering at the end of the BTP line and scan in angle to identify a better position and angle with less losses than we have currently. This experiment shows that **the current setting might be optimal**.

Conclusion of the MD:

We confirmed by measurements that we have losses turn by turn on the BLM42 and also on the 43, this latter measuring less than the 42. We find out that the new LHC BLMs might not be optimal to measure this type of losses. The new system is also much slower and less sensitive. The measurements have been done with an oscilloscope since even with the ACEM, it was not clear from OASIS that we have turn by turn losses. The signal is integrated and somehow filtered. It would be very useful to observe the non-integrated signal. Now, we are investigating on the possible candidates responsible for those turn by turn losses. Since the losses of the incoming beam in SS42 come from a horizontal aperture restriction at the septum, a scan in x and x' was made at the beginning of the septum with respect the losses measured on the BLM42 (ACEM). No better solution could be found. Scans with smaller step in x and x' can be attempted. We would like also to measure losses with a large enough constant emittance and vary the intensity. This can be easily done in parallel.

Collimation studies with the new collimator prototype installed in the SPS with integrated BPMs (R. Assmann et al.)

No report submitted yet

UA9 (W. Scandale et al.)

The results of last year were rapidly reproduced and the channeling with crystal 1 obtained in a few minutes. All the new hardware was tested and was performing as expected. The IHEP goniometer was working perfectly well, with an angular resolution of 10 murad. The quasi-mosaic crystal 3 was easily producing channeling with a simultaneous reduction of the nuclear background by a factor of 5. The collimator and the Cherenkov in the dispersive area downstream of the crystal collimation area were producing a first set of very interesting results. Some effort is still to be devoted to the control software in order to make it a bit more user friendly and at the same time to allow more remote action in BB5. In addition, the collected data have to be fully analyzed in the following weeks, on time to give the right guidance during the next very challenging run at the end of August.

Electron cloud measurements with 25ns LHC beams (M. Taborelli, E. Métral, G. Rumolo, et al.)

Up to 4 batches of 25ns spaced LHC beams were injected into the SPS. They could not be fully accelerated because of the pressure becoming too high at the location of the dipole exchanged during the technical stop. However, the pipe got rapidly scrubbed and we could accelerate the 4 batches closer to the end of the ramp. The electron cloud signal could only be observed on the two already previously installed a-C samples, as the StSt and the half coated C samples inserted during the technical stop had to be eventually taken out of the SPS before the start up, due to excessive outgassing. We then increased the intensity per bunch in two steps (+20% and +40%). We observed higher dynamic pressures with the more intense LHC beams (almost a linear dependence on the bunch intensity)