Week 35 (long MD)

Set up of the multi-bunch beam on the coastable 270 GeV/c cycle + set up of the coastable 270 GeV/c cycle with Q20 optics (S. Cettour-Cave, T. Bohl et al.)

Both the multi-bunch beam (up to 48 bunches with 25ns spacing) on nominal optics and the single bunch (low intensity, ~3e10 ppb) on Q20 optics were set up on the 55-270 GeV/c cycle, and ready to be coasted at 270 GeV/c. The set up took longer than foreseen, which left very little time for the subsequent studies of emittance growth with the Q20 optics.

TT20 steering tests and validation of simulations (O. Berrig, D. Manglunki, S. Massot)

The MD on the TT20 line consisted of three tasks:

1) Measurement of the emittance with Gianluigi's and Serge's methods

2) Kick/response. One kick/response measurement consists of changing the strength of one corrector, and measuring the resulting position changes of the beam.

3) Focusing the beam on the T2 target. Done with the KNOB: T2BEAM/T2-LONG.DISPLACEMENT

→ 1) The analysis of the dispersion measurements are here:

\\cern.ch\dfs\Websites\o\OEBerrig\TT20_NA61_optics\MD_29Aug_2011\Dispersion analysis.xlsx

Unfortunately, the theoretical and measured dispersions does not match. Neither does the dispersion measurements from the two methods match.

Most probably, we used a too small momentum change for the dispersion measurements 0.6 GeV/c (out of 400 GeV/c) i.e. 0.15 %. and the noise in the position measurements dominated.

We will therefore need to repeat the dispersion measurements in the following MD.

Since the change of momentum needs to be increased, maybe to 1% or more, this cannot be done in the SPS ring, because the extraction would not work with such a large momentum change. To be confirmed. In that case, we can only use Serge's method, where we change the momentum of the TT20 line itself.

During analysis was found that the steering program does not save the positions correctly. It either saves two versions of the horizontal positions or two versions of the vertical positions e.g.

\\cern.ch\dfs\Websites\o\OEBerrig\TT20_NA61_optics\MD_29Aug_2011\T2Transfer_PLUS0_6GeV.csv

This needs to be corrected before the next MD.

→ 2) The kick/response measurements, with quite big changes to the correctors (about 10%).

The analysis is done in collaboration with B. Mikulec and V. Reginel. It is not a normal kick/response analysis, because we also want to determine any change of position of the quadrupoles, correctors or pickups. A "normal" kick/response analysis gives the calibration factor between current and strength of a quadrupole.

→ 3) The focusing test showed that we were already focused on the T2 target. There is no change in width by moving the focus.

http://elogbook.cern.ch/eLogbook/attach_viewer.jsp;jsessionid=B67F2E6897B6E3C522041DD736C05B51?attach_id=1191561 ß Original optics

http://elogbook.cern.ch/eLogbook/attach_viewer.jsp;jsessionid=B67F2E6897B6E3C522041DD736C05B51?attach_id=1191563 ß Focus moved 10cm downstream

http://elogbook.cern.ch/eLogbook/attach_viewer.jsp;jsessionid=B67F2E6897B6E3C522041DD736C05B51?attach_id=1191564 ß Focus moved 10cm upstream

Additional results:

In our last MD (3 August 2011) we found that the KNOB: T2BEAM/T2-P2IONv1 did not work correctly. It had two errors:

KQTLD2103 = -0.00216824 (It was -0.00067221)

KQNLF2104 = -0.00067221 (It was not implemented at all)

By correcting the strengths, the veritical size became slightly reduced.

The scan in the 3 August MD:

http://elogbook.cern.ch/eLogbook/attach_viewer.jsp?attach_id=1184426

The scan in this MD (29 August):

http://elogbook.cern.ch/eLogbook/attach_viewer.jsp;jsessionid=B67F2E6897B6E3C522041DD736C05B51?attach_id=1191561

It is however strange that there is a floor of values outside the spectrum.

25ns beam on Q20 and Q26 optics (H. Bartosik, Y. Papaphilippou)

During the MD on 2nd of September, 2 long LHC cycles with 25 ns beams were executed in parallel, one with the nominal and the other with the Q20 optics.

Despite some problems in the pre-injectors related to synchronization, injection kickers and the breakdown of POPS, the setup of the 25ns beam in the Q26 optics was done successfully with up to 4 batches. After some optimization of the RF, the beam was in principle ready for measurements of the e-cloud team.

As the cycle with the Q20 optics was present for the first time, all the basic adjustments had to be done which took quite some time. At the beginning, the transverse damper functions were purely copied from the Q26 optics, which caused heavy particle loss. During the day, the settings were corrected and the RF setup was done, including the voltage programs for the 200 MHz and 800 MHz systems and the gain of the RF phase loop. Finally, acceptable beam conditions were achieved with acceleration up to top energy in the late evening. Up to this point, only single batches of 72 bunches were injected due to lack of time. For half an hour, the longitudinal behaviour of these single batches was studied with the SPS BQM. Apart from a few bad shots, the nominal BQM checks were passed repeatedly and the beam was found stable up to flat top. It should be emphasized, that these observations were made without the controlled longitudinal emittance blow up, usually required for the same beam in the nominal optics.

25ns beam on Q20 and Q26 optics: electron cloud measurements (H. Neupert, M. Driss Mensi)

After the full day down because of the POPS problems, in the evening it was finally possible to measure the electron cloud with:

LHCMD1, Q26 optics, 2 batches 72 bunches, 25ns and

LHCMD1, Q26 optics, 3 batches 72 bunches, 25ns,

The magnetic field was scanned from 0A to 25A in 5A steps and data were saved for benchmark with the build up simulations and validation of the models.

After midnight the SPS was kept running with

LHCMD1, Q26 optics, 3 batches 72 bunches, 25ns

This run lasted 6,5h to measure the conditioning effects on the different samples.

Week 36 (parallel) + Week 37 (parallel)

Set up of the ions on 1-injection cycle (T. Bohl, D. Manglunki, et al.)

I-LHC longitudinal plane using Early Beam (in short)

- one bunch captured and accelerated to flat top
- length of flat top 2011: about 1s, was about 2s in 2010

- radial to synchro loop switch over did not work at first because of shorter flat top and conflict with East/West extraction bumps; problem now solved with help of Karel and Stephane
- re-phasing at flat top: ok at first sight, detailed measurements to qualify error have to be made
- a lot of things still missing for Early Beam, like controlled long. emittance blow-up with new hardware, e.g.

The two bunch "intermediate" beam is available from the PS; 1.7E8 ions/bunch (140% of design), transverse normalised rms emittances 0.8um (80% of design).

The single bunch beam is being routinely injected in the SPS; we now use only kicker modules, allowing a rise time shorter than 200ns. This will permit regular bunch patterns with 24 bunches and 200ns bunch spacing.

Once RF is advanced enough, some work will have to take place on the SPS transverse settings

Note that for various reasons (other MDs, source refill, LHC priority, PS 80MHz cavities...), the available parallel MD time has been much shorter than anticipated. It is quite fortunate that 8 weeks were budgeted to set up the SPS

Impedance localization measurements (N. Biancacci, et al.)

On Friday 09/09 we had MD time on SPS from 9h00 to 19h00. We planned an intensity scan using the Q26 optics with an LHCIndiv beam in order to localize impedance sources on transverse plane. The beam was available after LHC was filled at 11h00. Until 15h00 the beam was set up and chromaticty measured. The LHC dump interrupted the measurements. Since problems on LHC took longer then foreseen our MD time was restored. Around 16h00 PS had a fault on RF cavities but this seemed to not corrupt our beam quality (Ex Ey around 1-2um). Around 18h30 a problem in RF attenuator was detected and an access was needed. Measurements ended on 19h00 before the new LHC refill. Few data between 8e10-10e10 beam intensity were collected for both planes. Continuation is foreseen for Friday 16/09.

Week 38 (UA9 + floating)

Collimator studies + vacuum degassing measurements of jaws movements (D. Wollmann + collimator team, G. Bregliozzi + Vacuum team)

Out of the scheduled 12h with beam we had about 10h in coasting due to a refill of the LHC. We used a maximum of 4 nominal LHC bunches (indiv) at 120GeV.

We performed:

1) Scans with a 4c orbit bump (to max. +-3.5mm) at the TCSM.51934. There we aligned the collimator with the BPM and compared the results to our standard alignment with the BLM based (buy touching the halo).

2) We performed scans to measure the nonlinearity of the BPM-buttons (scan the jaws at a constant gap around the beam).

3) We studied the desorption yield of the unbaked collimator by scraping different amounts of beam. We used maximum 4 nominal LHC.

4) We performed another measurement with a 4c orbit bump at the TCSM.51943 from -1mm to +1mm in steps of 0.5mm.

Preliminary results:

The agreement of the beam centres between the BPM and BLM method was in general around 50um. A maximum discrepancy of ~100um was found.

Taking into account the 50um steps size for the BLM based alignment and the not calibrated BPM electronics this is in the expected range of accuracy. The expected amplitude of the orbit bump was nicely reproduced with the alignments (taking into account the ~10% accuracy of the bump in the SPS).