Status of the machine studies

APC meeting, 26/10/07

1) Test new BLM set-up (B. Holzer, 17/10)

- Preliminary analysis says that the test was successful. We think we know how to improve the LHC BLM system.
- Next steps: Need another access and afterwards ASAP the same kind of MD as this week in order to determine the final layout for the LHC BLM system.
- New requirements: After an access to the SPS, ASAP ~30 minutes of protons injected in the SPS and the collimator in. Maybe can be done during beam set-up?

2) Electron cloud in the PS for different filling patterns: 12, 24, ... 72 bunches and for double step rotation (48 bunches only) (T. Kroyer and E. Mahner, 18/10)

- Generally, for less bunches the electron effect is less pronounced. Going from 72 to 48 bunches the effect kicks off later in the cycle (27 vs 33 ms before ejection) and the electron signal levels are smaller. Only during the last ~3 ms the maximum electron cloud signal for 48 bunches approaches that for 72 bunches. For 24 bunches the electron cloud appears only during the last few 100 microseconds, for 12 bunches no measurable effect was found. Using a double step rotation for the final bunch compression reduces the electron cloud effect during the last 5 ms for 48 and for 72 bunches; not checked for other beams.

3) Ions (Django and J. Jowett, 16-17/10)

- The working point (Qh, Qv) was increased to ~ (26.20, 26.25) and it seems that the losses reduced on the injection flat-bottom. However, it seems also that then we lose more at capture
- Acceleration done until top energy. Chromaticity measured and corrected.
- 3 injections done. The number of particles at top energy is however ~ the same as with only 1 injection!
- It was not possible to acquire orbit data in the latter part of the ramp.
- Continuing beam losses observed at the start of the ramp.
- Building on the work done in previous hours, we measured the tune dependence on momentum through most of the ramp with the help of the radial loop. Using these data we defined and applied chromaticity trims throughout the ramp. Injection of further bunches at the end suggest that maybe only one bunch is being captured at injection (or there is some limit on total current which seems unlikely).
- Next steps: Measurements of individual bunch currents with fast BCT, efforts to understand losses at start of ramp. Verify that all bunches are seeing the correct RF voltage and phase. Establish ramp to 270 Z GeV/c for collimation and loss map studies.

4) Ions (Django, 24-25/10)

- Almost nominal intensity on the EARLY beam during this MD.
- LEIR sends 1.2E10 charges to PS, where 0.9E10 charges (Pb54+) are injected and 0.6E10 charges Pb54+ are present at PS extraction. Finally there are 0.9E10charges of Pb82+ in TT2, which are injected in the SPS (for the first bunch).
- The subsequent injections are less efficient as the particles outside the buckets are removed from the machine.
- Measurements of beam lifetime and efficiencies in the PS are in general difficult to measure due to the noise on the BCT.
- The transverse emittances at the exit of the PS (measured in TT2 with the SEM-grids) are smaller than the nominal values (~ 0.7 μm normalised at 1σ instead of ~ 1 μm required). This value of transverse emittance is consistent with the one obtained from the IPMV in the SPS (~ 0.7 μm normalised at 1σ after 1st injection, ~ 0.7 μm after 2nd injection and ~ 0.8 μm after 3rd injection). The (preliminary) value of the vertical emittance at high energy measured with the IPMV is ~ 2 μm normalised at 1σ, whereas the BWS gives less than 1 μm => To be analysed in detail.

5) Comparison of filling schemes 4x72 or 5x48 bunches (E. Metral, 17-18/10)

- No major differences as the 4x72 bunch scheme was already well adjusted (~ 10% lower intensity at top energy). With this intensity the transverse emittances were measured below 3 μm at top energy.
- Then we increased the intensity by 10% to have the nominal bunch intensity at top energy on the 5x48 bunch scheme (only! We had then a pb and could do the same on the 4x72 bunch scheme) and the transverse emittances at top energy were measured to be 3.2 μm in H and 3.4 μm in V.

6) Study of the 75 ns beam (G. Arduini, 18/10)

- The offset (between the 25 ns and 75 ns beams) disappeared in Sextants 3, 4 and 6 (with attenuators), so it seems better. However, we lost 20 dB of signal and it has more noise.

7) IPMs in the SPS (J. Koopman, 22&24/10)

- Vertical profiles measured along the cycle with the IPMV on both SFTPRO1 on 22/10 and LHCION on 24/10.
- The IPMH is also available but one has to find first the values for the H correctors.
- Values obtained for the LHCION beam are discussed in 5).

8) Setting up of acceleration up to 450 GeV/c/u on dedicated ION cycle (T. Bohl, 16/10)

- Low level RF set-up for acceleration - optimisation of transition crossing - acceleration of beam up to Q*450 GeV/c - installation of an RF power amplifier protection system - studies to improve capture (data being analysed)
- Next steps: Acceleration of several bunches - study beam loss mechanism

9) Studies in the longitudinal plane for the nominal LHC beam (T. Bohl, 17/10)

- Intensity limit due to outgassing of beam dump kicker and beam dump - FesaSharedServer down on cfv-ba3-ctsrf3
- A lot of data concerning effect of longitudinal emittance blow-up and beam quality was acquired, analysis is ongoing

10) Acceleration of up to 3 bunches to 270GeV/c/u on dedicated ION cycle (T. Bohl, 24/10)

- Commissioning of new cycle - commissioning of going into coast without beam - injection conditions optimised for multiple injections - optimisation of transition - studies to understand beam losses by changing RF voltage programme, distance between injected bunches, suppressing fcav change, and noise measurements (data needs to be analysed in detail) - at first sight whatever voltage programme is used the loss at the beginning of the ramp stays constant (30% +/- 5%) for one bunch - 2nd and 3rd bunch are different from 1st bunch (as could be expected) - commission going into coast at Q*270 GeV/c with beam, first impression is good RF lifetime
- Next steps: Several low level h/w changes for consolidation and concerning synchro loop.