SPSU August 11th 2011

Present: Thomas Bohl, Mauro Taborelli, Elena Shaposhnikova, Theodoros Argyropoulos, Brennan Goddard, Gianluigi Arduini, Fritz Caspers, Elias Métral, Wolfgang Hoefle, Juan Esteban Mueller, Simone Gilardoni, Steven Hancock, Michael Holz, Chandra Bhat, Giovanni Rumolo.

**Transfer of LHC beams from PS to SPS (Heiko Damerau**)

Summary:

Joint PS-SPS studies were performed to see if increasing the 80 MHz voltage in the PS for the same longitudinal emittance helps for the PS-SPS transfer. Both PS and SPS are expected to benefit from less dense injected bunches. However, quick studies in 2010 were not very promising as higher emittance caused more losses during transfer. More thorough studies in 2011 using 2 and 3 RF 80 MHz cavities confirm that injecting shorter bunches in SPS yield no improvement if capture voltage is not changed. Next steps during the next MDs include capture voltage optimization in the SPS.

Discussions:

Thomas Bohl mentioned that increasing the voltage is beneficial, but not too much, as otherwise continuous losses could be increased on the flat bottom. In any case losses will occur, either at capture or ramp.

Q20 and Q26 settings were similar except for the dip (to 2MV) in capture voltage at injection.

Everyone agreed that it is now important to simulate the transfer including rotation and include intensity effects in SPS (scaling of beam loading with intensity).

Heiko Damerau stated that with the 3 RF 80 MHz cavities, there is enough margin for bunch rotation with intensities well beyond nominal.

From nominal to ultimate LHC beams, losses were observed to be twice - three times higher.

Heiko said that the losses are not less for the bunches that are shorter.

Thomas said that the longitudinal instability during the ramp (in absence of the controlled longitudinal emittance blow-up in the SPS) does not create losses and said that the losses are mainly capture losses.

Elias Métral said that good transmission was achieved some years ago thanks to the careful setting of the LL control (longitudinal damper). Thomas Bohl agreed but said it is difficult and time consuming to retune.

Gianluigi Arduini wondered whether losses are mostly longitudinal losses.

Heiko also said that the 3rd cavity is beneficial even with the 1 turn feedback.

Actions:

* Simulations of longitudinal dynamics of transfer from PS to SPS
* MDs with capture voltage scans in SPS (low gammaT is in trouble if we want to increase voltage accordingly…)
* Try tomography with the new WCM and the scope.

**Multipacting measurements in SM18 (Michael Holz)**

Summary:

High magnetic field tests were performed in the multipacting test stand, now set up in SM18. Currents from 1000 A to 5000 A were put in the magnets. First measurements showed that the multipacting maxima values are not monotonous with increasing magnetic field. More tests will be performed. Compared to multipacting in resonant conditions (11A), multipacting with any other current is much less pronounced. Finally, it was observed that the stray field is affecting the RGA.

Action:

* measure multipacting in the carbon coating magnet.
* Michael Holz is leaving CERN very soon. Need to organize the next steps.

**SPS impedance work in progress (Benoit Salvant)**

Summary:

* Updated HEADTAIL was used to simulate TMCI thresholds for Q20 and Q26 (no direct space charge was taken into account). The two mode coupling spectra are very similar and show two instability thresholds corresponding to two separate mode couplings. The second (main) instability for the Q20 optics should be within reach with the current parameters (~3e11 p/b), but a small positive chromaticity may push the threshold and make it hard to be observed. Besides this, an issue with the simulated intra-bunch signals was observed this morning and has to be understood before moving on.
* The TMCI threshold for Q20 could not be observed yet in MDs. Octupoles, linear coupling and longitudinal matching will be tuned in the next MD as with the Q26 to try to decrease the threshold.
* Measured tune shifts with intensity on MD1 cycle were obtained for Q20 and showed a good agreement with HEADTAIL predictions (actually closer prediction than for Q26). After the meeting, the bunch lengths for each super-cycles were used to obtain the slope ΔQ\*L=f(Nb) and the points turned out to be nicely aligned.
* Kicker simulations using the C-shape magnet and the MKP segmentation showed that the dipolar vertical impedance is significantly higher than that with the currently used model in ZBASE (Tsutsui model). Specific simulations for all kicker geometries will be performed accounting also for the internal and external circuits.
* Within assumptions used, the available 2D models indicate that NEG coating and carbon coating have an impact on the imaginary part of the longitudinal and transverse impedances in the frequency range of interest. Contrary to LHC, the effect at injection in the SPS is small (~1%). The effect at the SPS extraction will be addressed.

Discussion:

Alexey Burov said that the space charge tune shift is large and should strongly affect the mode shifting and coupling. However, the HEADTAIL model for space charge is very coarse and cannot be trusted yet. This is one of the tasks for the HDWG now.

Fritz Caspers asked if the peaks observed in the simulated MKP impedance have been corroborated by measurements. This was performed after the meeting and will be addressed at an upcoming meeting.

Fritz Caspers reiterated his objections against the 2D models used to obtain the impedance of cylindrical structures. He advised to use simple bench measurements to check these models and proposes to estimate by how much the electrical length of a device is increased by coatings and surface roughness.

Action:

* See if one should measure the electrical length of a coated coaxial line with Fritz Caspers.
* Compare MKP simulations with bench measurements
* Update ZBASE with more realistic kicker models

**Wolfgang Hofle**

Summary:

In 2010, attempts to excite the beam with the strip-line (with equipment on surface) were unsuccessful. This year the amplifiers are in the tunnel in a low radiation zone (below a quadrupole). First measurements with a frequency sweep on a single bunch with LARP colleagues (who came to CERN) indicate that we can excite and measure bunch oscillations (with both the BBQ and the BPW). Reduction of the closed orbit at the pickup location enabled to enhance the observed signal.

Discussion:

For feedback on many bunches, there will be strong need for more power and fast memory to store data for all these turns.

This way of exciting single modes may enable to measure individual modes, specific tune shifts, and even show that modes couple.

To develop in-house the hardware clocked at 3GHz will take time and requires correct experience.

**MD planning (Giovanni Rumolo)**

Floating MD:

It is planned to have 12 h for FB studies and 12 h with the same cycles as last time (50 ns beam to compare Q20 and Q26). Measurements with E-cloud monitor will be done (scan with magnetic field), but no one from the microwave measurements. A test with ZS will be also done. We need to retract ZS, or make an orbit bump?

Gianluigi said that it will be important to see if we can run with a low chromaticity on the Q20.

If time allows, it would be nice to check e-cloud for the 25 ns beam with Q20.

Separate users will be set for both cycles.