

## Minutes of the meeting of the SPS Upgrade Study Group on 16 December 2010

**Present:** T. Argyropoulos, H. Bartosik, C. Bhat, S. Calatroni, F. Caspers, K. Cornelis, S. Ferdemann, W. Hofle, Y. Papaphilippou, B. Salvant, M. Taborelli, G. Rumolo, E. Shaposhnikova

**Excused:** J. Bauche, R. Garoby, B. Goddard, E. Metral, C. Yin Vallgren

• **Plan for the winter intervention in SPS. New coatings - M. Taborelli**

• Magnets:

- no MBA (difficulties in coating due to small aperture), another possible slot for installation is in week 12
- QD chamber is ready for installation
- 4-6 a-C coated shields 50 cm long (0.7 mm thickness) will be inserted in the SPS at a position having sufficient aperture margin for ageing studies (probably only sector 5 will be open)

• Mobile samples:

- extract StSt for measurements in the lab
- insert a-c CNe57

• ECMs

- extract DLC
- insert grooves or a clearing electrode (more urgent!)

Measurements of TiN received from Oak Ridge show maximum SEY in the range 1.15-1.2 - a very low number in comparison what has been measured in the past, most probably due to a very rough surface (also observed).

Good results were obtained (SEY of 0.97) for coating using a 30 cm prototype permanent magnet inside the MBB. No change after storage in air for 1 month.

Feasibility studies continue for clearing electrodes materials. Most promising seems to be plasma spray alumina, but it has 50 times higher outgassing than copper (measured at KEK) and very high resistivity in vacuum. Reminder: Fritz' enamel electrodes were removed from the ring (replaced by coated pipes for pressure measurements in the ECM region).

→ Tests with beam in a high magnetic field are necessary to identify working parameter space for clearing electrodes in the SPS (voltage, polarity).

Re-insertion of old coated magnets is under discussion (e-mail exchange). Due to work load (J. Bauche) these MBBs will not be installed during this shutdown, probably it is possible during

the TS of week 12. For Mauro this has lower priority than insertion of the coated shields, easier to monitor.

• **Evaluation of electron cloud measurements with microwave transmission method of the MD runs in week 39 and 42 - S. Federmann, F. Caspers, E. Mahner**

The new experimental set-up has many advantages with the electronics removed from the tunnel and increased measurement sensitivity due to removal of pumping port shields.

Recording time of the VSA is too short (8 s) and covers only three beam injections (3.6 s apart). The PM and AM signals at 42 kHz were used for calibration purpose.

During the MD in week 35 an increase in PM signal of  $\sim 5$  dB was observed at each injection of 25 ns nominal batch in incoated section. No signal was observed in coated sections in most cases, some small signal was observed in 4 out of 20 cycles recorded, with a larger increase in signal after the third injection. The AM signal is still quite strong, but not correlated with PM anymore.

During the MD in week 42 the PM signal in uncoated section was observed only for 2 batches (and not for 3 or 4). Results could be different due to the different carrier frequency used in this MD for transmission measurements. Acquired data is usually analysed off-line after the MD and this phenomenon was noticed during the MD. Analysis of other beam data (such as bunch length) did not help to explain this observation.

• **MD results from Nov. 20 on low transition energy in the SPS and studies for 2011 - H. Bartosik, Y. Papaphilippou, B. Salvant, T. Argyropoulos**

For a lower transition energy the expected increase in threshold of different instabilities (TMCI, longitudinal coupled-bunch) is proportional to the slippage factor  $\eta$ . However for the same longitudinal parameters the voltage also scales as  $\eta$ .

In this MD losses during the first 10 ms after injection were measured as a function of RF voltage. For nominal bunch intensities around  $1 \times 10^{11}$  losses are small (2-4%) and don't seem to depend on RF voltage. For higher intensities ( $\sim 2.5 \times 10^{11}$ ) losses are around 5% for voltages above 2.5 MV and are higher for lower voltages. 10% losses were measured for 1.8 MV. For very high voltages slow losses are observed along the flat bottom, possibly due to the increased space charge for shorter bunch length.

An extensive list of required MD studies and simulations was presented for the next year.

• **MDs for 2011. RF issues for low transition gamma - E. Shaposhnikova**

The list of MD subjects important for the SPS upgrade was presented. Low transition gamma is one of the most important among them. Optics studies can be done on parallel cycles. After the optics has been optimised acceleration of the nominal LHC beam should be tried. The most critical question is what, smaller, emittance is required for longitudinal beam stability on the flat top. The hope is that this smaller emittance will give the same bunch length in the new optics as with the present optics.

In case of difficulties in the longitudinal plane with this optics, an intermediate value of transition energy could also be considered.

• **e-cloud simulation in the SPS (update) - G. Rumolo, C. Octavio Dominguez, F. Zimmermann**

Simulations of e-cloud build-up were done for different values of transverse emittance and two values of magnetic field ( $B= 0.117$  T and  $B = 2.025$  T) for SEY of 1.6 and 1.7 (the SPS value after the scrubbing). Very small difference in build-up was observed for high field but a significantly stronger effect for a small transverse emittance (1.5 mm mrad) at low field (even with a SEY of 1.6). This interesting result could explain difficulties observed in the past in the SPS with a 50 ns spaced beam with small emittances (production scheme with two batch injection in the PS).

- The next meeting will be on **20 January 2011** at 15:30.

Preliminary agenda:

- Transverse emittance in the SPS after upgrades (preparation for Chamonix) - E. Shaposhnikova
- Single bunch longitudinal instability - T. Argyropoulos (tbc)
- MD planning for 2011 - G. Rumolo

Elena Shaposhnikova, 5.01.2011