

## Minutes of the 32th meeting of the SPS Upgrade Study Team on 17 November 2009

**Present:** J. Bauche, S. Calatroni, P. Chiggiato, P. Costa Pinto, W. Hofle, G. Rumolo, E. Shaposhnikova, M. Taborelli

**Excused:** G. Arduini, F. Caspers, R. Garoby, C. Yin Vallgren

### • **Transverse FB to cure e-cloud induced single bunch vertical instability and TMC-instability in the SPS. Progress 2008-2009 - W. Hofle**

The team of 17 people from different labs around the world participating in these studies was introduced together with an overview of their activities from 2007. Main efforts went into the improvement of the observation system as well as beam measurements and simulations.

The measurement of instability spectra and growth rates should allow the required FB frequency range and gain to be determined. The interpretation of signals includes de-convolution from cable (corrugated) and (4 slightly different) exponential couplers response. In 2009 the experimental set-up was improved (re-cabling and new connection).

Measurements with RF off show different behaviour for the spectra of sum and delta signals. The spectrum above 1.6 GHz seems to be due to propagating modes above the PU cut-off frequency. With RF on a single bunch with low chromaticity has unstable spectra in the range 0-2 GHz. For the LHC beam the e-cloud instability signal (0-1.5 GHz) increases for shorter bunches (during longitudinal quadrupole oscillations due to the voltage mismatch at injection).

In simulations performed with Headtail the unstable bunch spectrum extends up to 1 GHz. The WARP Postint simulations show also the splitting of vertical tune between the head and tail inside the bunch. Similar tune behaviour was observed in the SPS MD in June 2009.

It is planned to measure the beam transfer function starting with a single bunch.

→ All studies were done at the SPS injection energy or on a 55 GeV plateau while the e-cloud effect seems to be stronger at higher energies as follows from the dynamic pressure and e-cloud monitor data.

→ Reliable beam diagnostics is a key element for further progress.

### • **Results from MD week 45 - M. Taborelli**

Before the last MD the a-C coated RF shields were installed between the two coated MBB magnets however no significant change in the dynamic pressure behaviour was observed with LHC beam during the MD. The pressure between the coated magnets in general is still slightly higher, but the amplitude of change is smaller. With acceleration to 450 GeV an additional spike appears in the pressure curve for coated magnets. Detailed investigation of the shape of the recovery curves for coated and uncoated magnets suggests that the difference cannot be explained by a different pumping speed.

For 3 batches with 25 ns bunch spacing (strong e-cloud effect) the pressure in the coated magnets was slightly lower than in the uncoated magnets. It became higher for beams with 50 ns and 75 ns bunch spacing (no e-cloud).

As shown by experience with the first coated liner, the visual inspection from the outside is not sufficient to see the quality of the coating. More reliable diagnostics should be used in future, especially for magnets.

The RF shield extracted from the ring has a clear 5 mm e-cloud trace in the center, in good agreement with ECM measurements at low B-field (20 Gauss).

→ Understanding of degassing (precise measurements) together with optimisation of the coating process have now the highest priority for the project.

• **Vacuum characterisation of magnetron-sputtered amorphous carbon films - P. Chigiato**

The summary of results presented on 9.11.2009 at AVS 56th, San Jose, was given.

For e-cloud mitigation the amorphous carbon films have many excellent features for both bakeable and un-bakeable vacuum chambers. To be implemented on a large scale in the ring, vacuum properties of amorphous carbon should also satisfy strict requirements. Measurements performed in the lab on a 0.5 m long sample tube show that outgassing rates of unbaked amorphous carbon are less than for StSt for all components except water vapor. Indeed after 100 h of pumping the water vapor outgassing rate of a-C was still 20 times higher than for StSt. When baked to temperatures higher than 120 deg, the ESD yields of a-C are much lower than that of StSt (even for CO<sub>2</sub> and CO). Photon stimulated desorption yield is lower for unbaked a-C than for both baked and unbaked StSt.

Further optimisation of the coating process is mandatory. For example a decrease of water vapor outgassing can be achieved by reducing the discharge gas (e.g. Ne) pressure during the coating process. This leads however to a significant increase of the Ne outgassing rate (otherwise negligible).

• **AOB**

(1) The effect of fast conditioning at low B-field observed with ECM in the MD week 33 was analysed and will be presented at the next meeting (C. Yin Vallgren).

(2) Magnetic field between MBBs - J. Bauche will look for the possibility of performing preliminary (rough) measurements.

- The next meeting will be on **15th December 2009** at 15:30.

Preliminary agenda:

Beam diagnostics for future SPS beams (20') - J.-J. Gras

More results from the SPS MD week 45:

- ECM (20') - C. Yin Vallgren

- mw measurements (20') - S. Federmann

Elena Shaposhnikova, 19.11.2009