Minutes of the 24th meeting of the SPS Upgrade Study Team on 24 March 2009

Present: G. Arduini, F. Caspers, P. Chiggiato, K. Cornelis, P. Costa Pinto, R. Garoby, E. Shaposhnikova, D. Seebacher, M. Taborelli, C. Yin Vallgren

Excused: S. Calatroni, E. Metral, F. Zimmermann

• SPS dipole prototype coating - P. Costa Pinto et al.

The design of the coating system for the SPS magnets (MBA), begun in August 2008, was completed with the successful coating of 3 MBB magnets in March 2009. Taking into account that the magnet type was changed in the meantime and the initial coating configuration with parallel fields and cylindrical rods did not work, this result required a lot of effort from many people on a very short time scale. On the way, many difficulties were overcome during 4 test runs (unstable plasma, current leak through ceramic isolation, thermal deformation of anodes, non-uniform dipole field...). During the SPS magnet coating the first surprise came from the surface "cleanness". With additional surface treatment it was possible to remove silicon traces, but not white spots (hydrocarbons).

The time required to coat one magnet was around 34 hours. A thickness of 50 nm is sufficient for SEY reduction, 200-300 nm was obtained in the center and 1.5 μm at the edge (near cathodes). An SEY of 1 was measured (on small samples placed inside the magnet) after coating and in the tunnel just before pumping down. Magnets were kept for 2-3 days in air before final installation. The coating quality check with an endoscope was done on only one dipole - MB096 and everything was fine. However some small (~ 1 cm^2) peel-off was observed (1.8 m inside the magnet) on MB085 during the installation in the tunnel.

A lot of modifications which can significantly improve the performance of the coating system have been identified and will be implemented. The way to remove the Carbon coating is under study, it can probably be burnt off with Oxygen plasma.

$\Rightarrow$ It will be interesting to have a liner coated by the present coating system to be installed in the ECM in the SPS.

$\rightarrow$ A possibility to coat a wider region should be investigated (65 mm now).

The magnet coating team is congratulated by all SPSU members for their remarkable achievements on such a tight schedule.

The first test μwave measurements have been done by Fritz and Edgar after the magnet and RF hardware installation.

New SPS liners: the 2009 spring collection - M. Taborelli

For the 2009 test, the places for 4 liners (48 channels each) are used in the following way.

1. XSD1: new StSt.

2. XSD2: old (2008) liner with a-C coating (CNe13).

3. EcEx: new a-C coating on rough layer (CNe/Zr10). A roughness of CNe/Zr10 is smaller than that of the previous, smaller size, samples (as CNe9Zr). The measured SEY is around 0.95 (0.85 for CNe9Zr).

4. SDneg: 4 cm stripe of a-C coating with SEY of 0.94, (55 mm were scrubbed on the StSt sample in the SPS)

The C-magnet will be used for the sample CNe14 kept for 2 months in air and 5 months in vacuum. A drift of SEY from 1.1 to 1.15 was observed on this sample after 5 months in vacuum of 10^{-3} mbar.

• **Results of the measurements of electromagnetic properties of NEG and Carbon coatings in the microwave range - D. Seebacher**

Transmission measurements with the glass rod installed in the center of the resonator at the maximum electrical field (for odd modes) were performed in the 2-4 GHz frequency band. The measurements of the quality factor and detuning give qualitative (metal or dielectric) and quantitative information about the layer properties.

For the NEG coated glass rod the resonant peaks were damped and shifted down in frequency, indicating the behaviour of a conductor. This is close to the behaviour of a brass rod and is also confirmed by simulations.

Unlike the NEG, the Carbon coating causes a very small perturbation to the empty resonator structure (amplitude reduction of odd peaks). The behaviour corresponds to a bad conductor with conductivity 10^5 less than that of copper, close to measurements at DC. For the SPS the relevant frequency range is below 4 GHz, much lower than for electron rings with very short bunches.

• **e-cloud MDs in 2009 - E. Shaposhnikova**

In 2009 the structure of the MD periods will be similar to 2008 with 6 blocks of 72 hours each, separated by 3 week periods. We (SPSU WG) are the main users of the LHC nominal beam accelerated to 450 GeV and 16-24 hours are foreseen each MD block for our e-cloud measurements. The rest of the MD time will be used for coasts (most probably at 120 GeV). The first MD, planned for 15-17 June, will be used as a scrubbing run, with different (increasing) number of batches.

• The next meeting will be on **21 April 2009** at 15:30 in the JBA room (bld. 864).

Preliminary agenda:

Progress report on coatings - M. Taborelli

Elena Shaposhnikova, 26.03.2009