Minutes of the 27th meeting of the SPS Upgrade Study Team on 30 June 2009

Present: P. Chiggiato, K. Cornelis, P. Costa Pinto, S. Federmann, R. Garoby, E. Mahner, R. de Maria, G. Rumolo, D. Seebacher, E. Shaposhnikova, G. Vandoni, C. Yin Vallgren

Excused: G. Arduini, S. Calatroni, E. Metral, M. Taborelli

• Electron cloud measurements - S. Federmann, D. Seebacher, F. Caspers, E. Mahner

The microwave transmission method should allow us to compare the integrated e-cloud density in coated and uncoated dipole magnets from the difference in phase modulation of the transmitted wave. The expected phase difference is very small ($\sim 2.3 \times 10^{-3}$ rad or 0.13 deg). 10 loops and 2 button pick-ups (at uncoated magnet) were used totally in 6 locations around 4 magnets (two pairs). Their position and orientation were optimised using field calculations. These antennae were produced at CERN. New filters were also produced at CERN (in parallel to the outside order) after transmission frequency optimisation.

Practically no difference has been seen between coated and uncoated magnets except for the signal decay time at the beginning of the MD (was not seen later). Tests conducted after this MD have shown that the useful signal was contaminated by the beam induced signal at 43.4 kHz (the SPS revolution frequency) passing through the DC bypass (supply voltage for amplifiers) and creating inter-modulation of the microwave signal. The problem will be fixed during the next SPS access. The new set-up will be tested during the next SPS MD in W.29 (13-16 July).

• Studies with carbon coatings in the SPS - MD run, week 25 - C. Yin Vallgren

Measurements took place during 3 "scrubbing" sessions (3 nights) with 3 batches of 48 bunches on the flat bottom in the first period, 1-2 batches of 72 bunches during the second one and then first 1-2 batches of 72 bunches accelerated to 450 GeV/c and then 3-4 batches accelerated to 120 GeV during the third period. The e-cloud signal was recorded for 4 different liners in ECMs: new reference StSt, new a-C on Zr (rough surface, $\delta_{max} = 0.96$), new a-C with 4 cm wide coating ($\delta_{max} = 0.92$), and the old a-C (CNe13) sample vented during last shutdown.

Clear scrubbing effect can be seen on the StSt liner during the first session and at the end of the second one. During the first session the e-cloud signals in all carbon liners, being 100 times smaller than in the StSt one, were growing in accordance with RF voltage (flat bottom) increase of 100 kV each hour. Some e-cloud activity could be seen right at the border of the 4 cm wide strip at the end of flat bottom and during acceleration. At the end of this MD, the e-cloud signal (normalised to beam intensity) was reduced by 30% in the StSt liner, by a factor of 2 in the a-C strip and 10 in the a-C on Zr liner. The signal in the CNe13 sample was already 4 times smaller than in new carbon coatings at the start of measurements and practically vanished at the end.

During the first session, with 3x48 bunches in the ring, the pressure increase in coated magnets was twice higher than in uncoated. The situation has changed with 72 bunches, especially with acceleration, when during the cycle the pressure increase in coated magnets became twice less than

in uncoated.

• **E-cloud instability growth rates and spectra - R. De Maria**

The main aim of these studies is an evaluation of the feasibility of the e-cloud feedback system. Since the last MD in 2008 beam instrumentation has been improved and the exponential pick-up was used for time domain measurements. The MD took place on 16.06, measurements were done with two batches of 72 bunches on the flat bottom. This single bunch instability could be provoked by vertical chromaticity bumps ($0.05 \rightarrow 0$ during a few tens of ms), it sometimes caused beam loss and was mainly observed in the middle of the 2nd batch. The instability has a growth time (time to saturation) between 20 and 100 turns and a broad spectrum up to 1 GHz (also pick-up bandwidth). Data analysis is underway.

• **SPS vacuum modification - G. Vandoni**

Future modifications to the SPS vacuum system required for carbon coated magnets were discussed. They are mainly determined by the need to minimise ageing of coating due to air exposure of magnets which happens during shutdown work and interventions. Existing practice with parallel work in several sectors, transportation in tunnel, disconnected or removed equipment, magnet's interchangeability, alignment procedure - all should be reconsidered from this point of view. Storage and transport of magnets will be done under vacuum or in N_2. On the other hand there is no necessity to refine sectorisation, delicate equipment is already protected.

The list of required studies includes many issues (such as shutdown work-flow, installation procedures, monitoring, mobile pumping...) and should be prioritised.

→ The question to answer (by simulations): is it necessary to coat the SPS quadrupoles? - G. Rumulo

→ Study possible pumping port modifications (standardisation) - TE/VSC

• The next meeting will be on **4th August 2009** at 15:30 in the JBA room (bld. 864-2B14).

Preliminary agenda:
Update on SPS beam dump studies - Y. Kadi
Results from the SPS long MD week 29 - M. Taborelli, F. Caspers
Planning of the next MD (W33, 10-12 August) - E. Shaposhnikova

Elena Shaposhnikova, 6.07.2009