LHC RF Meeting 23rd September 2005

Present: Luca Arnaudon, Philippe Baudrenghien, Thomas Bohl, Andy Butterworth, Edmond Ciapala, Wolfgang Höfle, Trevor Linnecar, Pierre Maesen, Elena Shaposhnikova, Volker Rödel, Joachim Tückmantel, Daniel Valuch.

1. ACS Couplers (Pierre from Eric)

Coupler conditioning test stand: The test stand has been re-assembled and the cavity is under bake-out. The couplers will be fitted next week.

2. ACS Modules and SM18 (Pierre)

4 Module tests in bunker: Low level tests were continued on module 2 and a series of HOM measurements was also done (See below). Module 2 will stay in the bunker for another week, then module 5 - if assembly can be completed in time. (i.e. superinsulation, warm recovery dome, mechanical adjustments). Module 4 would go in for thermal cycling 3-4 weeks afterwards.

Warm recovery domes: These have been delivered; they need final welding before being fitted on the module. The first two will be fitted to modules 4 and 5.

4 HOM measurements: Following discussions with Joachim and Volker, a first series of measurements was performed on module 2 over a period of around two days. Pierre presented an overview and some results. In order to have appreciable signals, all HOM loads were disconnected for the tests. For each cavity the network analyser drive signal was applied to one wideband coupler and measured on the other. 50 ohm terminations were put on the cables connected to these couplers. (terminating one part of the 25 ohm line only) The widebands were used as input rather than the main coupler as the main coupler is designed for 400 Hz and showed notches at other frequencies (e.g. 600 MHz). The antenna signal was too low in intensity to be used as output, without amplifying the input signal. The narrowband (dipole) couplers have a strong response around 500 MHz. Frequency sweeps were made over several ranges. The loads were connected on the dipole couplers and damping of these modes verified for all cavities. For higher modes, which propagate across the cut-off tubes, damping was verified by measuring on wideband couplers across two neighbouring cavities, without then with loads on all HOM couplers. The results can be seen on the AB-RF home directory - See \\cern.ch\dfs\Departments\AB\Groups\RF\Machines\LHC\ACS\SM18TestStand\LHC\ACS\HOMs

From analysis of the data for the dipole modes (typically three were seen in each cavity) we should be able to estimate the Qext from the data for the undamped (without loads) and damped (with loads) cases to get an estimate of the impedances, using the calculated R/Qs for these modes. It would be useful to do better resolution measurements around the frequencies of the modes. For higher frequencies the damping appears less than might be expected, however the if Qext values are low this would not be a problem, again to be verified in greater detail.

Fundamental coupling between cavities: A short test was done on 26th August. See <u>results</u>. With RF applied normally to cavity A of module 2 the fields in cavities A and B were measured, with cavity B tuned for maximum signal. For 8 MV/m and 3.9 MV/m in cavity A the signal on cavity B was measured as 65 and 66 dB down, demonstrating a sufficiently small (fixed) level of fundamental coupling between the cavities. The main couplers on both cavities were fully retracted. A test with coupler A at 45 mm and 3.4 MV/m (188 kW) indicated a lower coupling of 69 dB down, independent of the tuner position of cavity B. This is not understood and the test will be repeated.

3. Low Level RF and tests in SM18 (Philippe)

Tuner module: All tests have been very successfully completed, including a verification of the half-detuning system. The card can go for series production as only minor modifications or additions are needed.

Feedback modules: Phase noise reduction was measured and corresponds to the gain of the loop, a factor of 20 is obtained for a cavity Qext of 20000 and 40 for 60000. The amplitude noise is more difficult to measure precisely but its reduction appears to be less. This will in any case be further

reduced by the klystron polar loop. While approaching saturation of the klystron the gain is reduced but there is no tendency towards instability. (We avoid working with the klystron having any region of negative small signal gain). Saturation of the klystron for short periods during the revolution period may be a problem with high intensity beam; however the basic feedback module is not designed to handle this.

Presentation: A presentation on the results achieved will be made when the present SM18 tests have been completed.

Series production of electronics modules (Wolfgang) A list of modules to be made for low level RF (in all machines) was discussed with TS-DEM, starting with 12 for the immediate future. This considerably increases the time and resources which they have to devote to us. Clearly, all modules and crates needed for LHC hardware commissioning will have to be fully produced by June 2006. This represents a considerable workload. Components will be ordered by TS-DEM, the EDH requests will be routed to us for verification, as an error in ordering of a long lead time component could have a major impact.

4. APW (Thomas)

Vacuum testing of the first pick-up will be done in mid-October, the impedance will be checked and heating of the ferrites with power will be measured. The tests have been planned by Eric with M. Jimenez (AT-VA)

5. ADT (Wolfgang)

Water cooled resistors: We will receive two modified resistors next week (with suitable reinforcing to prevent cracking of ceramics due to pressure in the steel cooling plates)

4 Amplifiers: The second amplifier has been successfully tested (Eric). However a fabrication problem has been found with a printed circuit board (Daniel). The card can be repaired, but JINR have been informed and asked to correct this for future amplifiers. Also some disc capacitors have been found to have been damaged, probably by over-tightening during mounting. Improved fixing (e.g. spring washers...) may be needed.

4 ADT Layout and Database: Drawings of the ADT twin kicker module elements 'Left' and 'Right', will be put in CDD (Julien Barral). Names and details, such as dimensions, positioning of fixing points and alignment markers, vacuum connections etc. can now be put into the database.

(Action: Olivier, Wolfgang with S. Chemli)

Tetrode sockets: 24 have been ordered from Thales; delivery is late but is not critical yet.

Drive amplifiers: There are problems with downloading corrected CPLD code into the last batch of amplifiers. This is being followed up with the manufacturer.

6. UX45 Planning and Installation (Olivier)

Cabling: There may be a need to give priority to cables passing through RB46, before QRL installation work. (starting 18th October) we should check that details of these cables are complete. While fitting connectors is the second phase of cabling and cables can initially be cut to maximum length in the first phase, there is still an urgency to complete the cabling lists, define patch panels and equipment rear panels, for all equipment. This will be followed up next week, with the aim of completion in two weeks. (Actions: Ed, Luca, Eric, Philippe)

<u>Note</u> that J.C Perrier is responsible for all coax cables, Luca for control and infrastructure, Olivier for ACS HV and Eric for ADT HV cables.

Electrical layout in UX45: We have to approve the electrical layout in UX45, approve switchgear specifications and provide other information to J. Gomez (TS-EL). CDD drawing LHCEY___4011, showing layout in UX45 concerning TS-EL, is in the approval process. This drawing shows the position of UPS supplies.

7. AoB

Stepping motor drive for ACS cavities (Luca) While micro-stepping is not possible with the existing stepping drive modules a compatible micro-stepping version is available. We should obtain a sample for test.

Materials inventory: We have been reminded that SC needs a materials inventory for underground equipment. Information has already been given to J-C Perrier, who should complete it and send to SC. (Action: J-C Perrier)

Next Meeting: Friday 30th September at 08:45 in the JBA Room 864-2-B14.

E. Ciapala, 27th September 2005.

Outstanding Actions (Reminders)