LHC RF Meeting

10th November 2006

Participants: Luca Arnaudon, Philippe Baudrenghien, Olivier Brunner, Andy Butterworth, Edmond Ciapala, Wolfgang Höfle, Trevor Linnecar, Pierre Maesen, John Molendijk, Eric Montesinos, Joachim Tückmantel, Daniel Valuch, Frode Weierud.

1. ACS Couplers and SM18

- **Couplers 131 and 134:** These have been successfully assembled and are leak-tight. (Note that MC134 is ex-MC130 which has had additional cleaning treatment and was successfully conditioned in SA2 but suffered a small leak when mounted on the spare cavity LHC 21)
- **Couplers 132 and 133:** Conditioning is progressing normally in SA2, and expected to be completed in mid-December. We suspect that some of the problems related to vacuum leaks after assembly may have been due to leaks between the niobium coating and the polarization ceramics, rather than the copper seals.
- **Spare cavity LHC21:** Mounting the tuner drive mechanism on the single cryostat proved difficult, (e.g. problems with faulty cables, adjustment of spacers etc.) but the cryostat is now closed and the insulation vacuum pumped down. The cavity will be installed in the bunker next week.

2. ADT (Eric/Wolfgang)

- **Amplifiers:** We are expecting the partially completed amplifiers from Dubna in the near future. The Dubna team will come as planned to finish construction and test. The drawings will also be updated. Series production of resistors is under way. We have all the tetrodes.
- **ADT and MAC:** Wolfgang has been asked give a presentation on the status of the ADT to the Machine Advisory Committee (MAC) in December. Damper noise is a subject of interest. A prototype of the analog front end electronics has been completed by Daniel. (Filtering, down conversion, IQ demodulation). Noise measurements will be made on this.
- **PIM crates:** The eight series Power and Interlock Monitor crates have been delivered

3. UX45/RUX45 installation (Olivier)

Pictures from last week's meeting (3rd Nov 06) can be seen here. Olivier presented some more pictures, illustrating some of the points below:

- **ACS modules: (Pierre):** The inversion of the insulation pumps on the outer modules (to allow better access for vacuum work) has been completed. The insulating vacuum has not been pumped for the moment. Blue antenna cables can be connected without difficulty, but additional supports will be made. Protective coverings for the Penning gauges have been prepared and will be put in place next week. Module end pieces to protect the HOM domes from passing transport vehicle damage have still to be made.
- **HV Bunkers and HV equipment:** Crowbar tests are being done with the HV generator. HV has been ramped to 60 kV on the first bunker. This will be held for 2 hours to test each of the klystrons. Triggering of the thyratron is checked, using a 25 kV spark gap. The diagnostics on the individual klystrons is also checked.
- **Klystron and circulator installation in UX45:** Now 10 klystrons and circulators are connected to their waveguides. Control racks remain to be put in place. However, to gain working space around the klystrons the two outside klystrons near the wall may be shifted nearer to the wall. This would mean changing one waveguide on each side.
- **Grounding:** We will arrange ground connection of equipment to the cable tray earth braids using a specially purchased too. Earth connection of the HV bunkers to the tunnel earthing system is being handled by TS-EL. They will also make the connection from the platform to this ground. The

question was raised as to whether a final check of the grounding system would be made by TS-EL and how would this be done. To follow up with TS-EL. **(Action: Olivier)**

- **Emergency stops:** The positioning and accessibility of the electrical distribution emergency stop buttons was raised. Inclusion of UPS in the emergency stop was also discussed. We should therefore see if there is a common policy for UPS and emergency stop buttons. Generally, safety considerations would take priority over machine operation and UPS should cut with the electrical distribution safety buttons, especially since we would not envisage separate emergency stop buttons for UPS. **(Action: Olivier+TS-EL)**

- **RF cables and connectors:** Two more FSU staff have now been trained on connector mounting, making us less dependent on ST-EL for certain jobs. The 16 waveguide reflected power signal cables which have been incorrectly routed to the quay will be cut at the shielding wall and connected to new cables going to the waveguides on the platform. Splicing material for 3/8 inch cable is not available. The cable sections left will be difficult to remove - they will be labelled and left in place. Use could eventually be made of them if additional cabling were needed to the quay.

- **Network Situation (Luca):** All the equipment is installed in the racks and the fibre ducts are in place. We are waiting for the fibres to be blown.

- **Electrical Distribution Boxes:** The boxes for the ADT (one on each side, with 12 cables) are fixed on the wall above the water distribution making access difficult. Either we re-site these or find a suitable means of access. To be followed up, possibly with TS-EL. We should keep these boxes away from cable trays carrying RF cables. **(Action: Olivier, Eric)**

- **Cryo WRL Heaters:** These are now planned to be put into place next February. Again this work will need to be closely supervised by us as the cryo team are not familiar with our equipment and the risks of causing damage.

- **SR4 Enclosure:** The order has gone out and it will be put in place by the supplier at the beginning of December. In the meantime the whole area urgently needs to be cleared and cleaned out. **(Action: J-C. Perrier)**

4. LLRF (Philippe, John)

- **Polar loop Simulations:** Janne Holma has now included the klystron polar loops (phase and amplitude) in the Matlab simulations. With correct gain settings these work correctly with the RF feedbacks (wideband RF and narrowband digital), giving overall 10E5 factor reduction in amplitude noise at 50 Hz and 10E4 at 600 Hz.. A technical note will be produced.

- **Cavity Controller Crates:** A set of three test cards is being made to test the RF backplanes. Visual inspection has shown problems on two out of 10 backplanes received from TS DEM. They will take the remaining 60+ back for detailed inspection.

  Local production of the crates has started. We need 10 before the end of the year for SM18 and lab use, then 32 more towards the end of January to equip the UX45 Faraday cages. We will increase FSU manpower accordingly.

- **Conditioning DDS:** Two problems have been identified recently, one concerned with clock phasing, cured by introducing a slew adjustment - and the previously described problem of output drift due to unequal frequency sweeping of the two DDS outputs, I and Q, before modulation. (See LHC RF meeting 27th Oct) This latter should be cured by exactly synchronising the sweeps of the two channels to the same clock pulses.

- **Set Point Module:** After a long period of test running with function generator hardware an abnormal situation occurred, with un-transferred packets continuously circulating in the transmission loop. This was traced to filling of address fields with zeros, probably as a result of a power glitch (The two systems running suffered this problem at the same time). This problem can be cured by the general solution of not transmitting packets with the same send and receive addresses.

- **Tuner front end:** Version 2 has now been fully tested and production of 25 has been launched. The calibration for 300 kW power may be changed from 60 % full scale to 50 % to allow up to 1.2 MW to be read (maximum transient reflection without beam)
- **VME Clock Distribution modules:** The full series of 75 (LHC and all other LLRF VME applications) has been launched.
- **NIM crates for Clock Distribution:** Ten have been recuperated from SPS and will be stored in SG4. Ten more are under construction. Around 140 NIM modules are needed to generate and distribute the various clock signals.
- **Handling of Calibration Data:** Many of the LLRF VME modules use calibration coefficients, determined during their test procedure. The values need to be stored such that they can be quickly reloaded if a crate or module has to be changed, to avoid long setting up procedures. This can be done in a central database if all modules have a unique identification number (being implemented by John). These can be loaded into the front end as needed, to be set into the hardware on power-up. The overall management of this is under study. (Andy, Frederic)

5. Software (Andy):

- **DDS Conditioning software:** Work is progressing well. All the various parameters for pulsing and envelope generation can be set up and tests of the conditioning loop have been done with simulated vacuum signals. An application program is being developed in LabVIEW. This will also display history data stored in the tuner control module.

6. AoB

- **Electronics Tools Support:** The resources for this are under discussion. We believe that this service is essential and the resources needed are not directly dependent on the amount of work going on at a particular time. It is clearly most efficient if organized on a CERN-wide basis. It is closely coupled with the work of TS-DEM.

Next Meeting: Friday **24th November** at 08:45 in the JBA room.

E. Ciapala, 14th November 2006.