# LHC RF Meeting

11th October 2007

**Participants:** Luca Arnaudon, Olivier Brunner, AndyButterworth, Edmond Ciapala, Trevor Linnecar, Pierre Maesen, Eric Montesinos, Frode Weierud.

## 1. P4 & RF Planning

- **General P4 planning:** Cool-down of sector 4-5 has restarted in week 41. Sector 3-4 has been pressure tested. There is now a planning for sector 4-5 cool-down. We expect to reach 80 K by the end of next week (week 42). Note that while cool-down is in progress there are special access procedures to be followed. 4.5 K will be reached at the earliest by start of week 46. We have estimated a two week period. i.e. weeks 47 and 48, for filling the cavities and doing the low power tests on the ACS modules. This means that conditioning and other tests could start in the third week of November, giving one month of tests before the end of the year.

## 2. Equipment status in tunnel RUX 45

- **Cryo tests on modules in Sector 4-5:** After many weeks of requests to AT-ACR, tests on input output valves and purging of the cavities He circuits have now finally all been done, just before resumption of sector 4-5 cool-down. Problems at the level of the control application for the valves were discovered at the last minute but could be resolved in time by AT-ACR. The purging of the cavities has also permitted verification of the correct operation of the critical non-return valve in D (outlet) line. The automatic fail-safe system for closure of the control valve on overpressure on the D-line was also successfully checked. (The working pressures however needed to be reset correctly.)

- **Vacuum in module M2.B2:** (*LHC 5-Oceania*). A moderate beam vacuum pressure rise has occurred simultaneously in all cavities of this module. A fast increase from around 2.0E-9 to 2.0E-8 was observed on the vacuum logging system on the 25th September at 14:35. These increased levels are confirmed by the readings on all four main-coupler vacuum gauges. Recovery appears very slow. A quick test was made with the vacuum group (J-C Billy), the vacuum pumps were cut for about 1 hour, both on this module and on the neighbouring module, and vacuum recovery monitored. Both modules rose by a factor 10 and returned to the same starting values in the same time. The conclusions are therefore that some out-gassing had suddenly appeared or a small leak has occurred somewhere. Couplers, HOMCs, vacuum equipment are all possibilities. Interventions for waveguide fitting and on the Warm Recovery Line were going on at the time of the incident.

  We will therefore follow this up with vacuum experts (M. Jimenez). We will wait one week to see how the vacuum pressure evolves, and prepare for leak testing on the module. This would best be carried out in one to two weeks, once access restrictions in LSS4 are relaxed.

- **Pressure tests in 3-4:** The testing of sector 3-4 has been completed. Note that the pressure testis for all four RF modules (He circuits) were all done together earlier this year at the time of the Sector 4-5 tests.

## 3. UX45 work (Olivier):

- **False floors** in the ADT racks and ACS enclosures are now completely installed.

- **RUX45 Roof barriers:** The barrier along the cryo side on top of the RUX45 tunnel roof is complete.

## 4. Klystrons in UX45

- **Klystron boiler replacement:** The modified boilers for the eight klystrons on the sector 3-4 side have been delivered and have already been fitted.

- **Klystron power tests:** Measurements to obtain the optimum heater current for each klystron have been completed on the sector 4-5 klystrons. The four klystrons of Module 1.B2 have all been calibrated successfully, with the RF power measurements checked using calorimetric measurements of collector power dissipation, with and without RF. (Agreement to within 5-10 %). Saturation curves are now being measured on these klystrons.
- **Klystron Power Converters:** The klystron power converters are at present set to work at ½ capacity, this is to avoid any risk of overvoltage being applied to the klystrons. This causes some

operational difficulties with the converters. As soon as the overvoltage protection circuits are operational (in a few weeks) the converters will be returned to their normal configuration.

## 5. ADT systems

- **Power tests:** All eight anode converters have been run at 10 kV 5A/amplifier and will continue towards 12 kV 6A. Tests with pulsed RF will also be done.
- **Resistors:** For the moment we have no spares, but these are on order.

## 6. APWL

- **Alignment:** Survey group have discovered tilt errors in the alignment of various pieces of equipment in the machine, mainly BPMs etc. For RF, the only element is APWL B2 B5L4 (or APWL 2.B2). Since the error is small we have decided that the monitor should not be re-aligned.

## 7. LLRF

- **RF testing in UX45 - Klystrons Module 1.B2**: The remaining cabling for allowing the LLRF to drive the klystrons, using the conditioning DDS, was completed last week. Some minor modifications have been made to in the DDS on-board firmware to facilitate introducing remote software 'knobs' for drive level and frequency setting. At the same time modifications are also being done to introduce a calibration constant to ensure that the actual set value is always exactly the same as the knob value, irrespective of gain variations from board to board.
- **Klystrons Module 2.B1:** Before the same tests can be done on these klystrons, installation of the patch cables and four more Switch and Protection modules needs to be completed in Faraday cage B. The clock frequency references also have to be cabled. This work is ongoing and powering should start next week.
- **LLRF module status:** The series feedback modules (40) have now been received.

## 8. SM18 and B112:

- **Cryo operation and planning:** A discussion was held to review the situation of the cryoplant in SM18 and to agree on priories of running for various RF and magnet activities, with Serge Claudet and Lionel Herblin (AT-ACR) and Louis Walckiers (AT-MTM). The conclusions were kindly summarized by Serge Claudet. There is some hope of getting better LHe production (by increasing pressure), improving the chances for co-activity. Magnet (tracking tests) will continue till mid-November. From then till mid-November RF has priority for module 21, with conditioning of the cavity and its repaired coupler, and LLRF feedback loop tests. In 2008 start up will be in Week 7 with conditioning of our spare module, with low consumption magnet test bench activities as second priorities. With this arrangement we should be in a good position to complete our high priority tests.
- **Module 4:** With the conditioning of couplers MC131 & 134 recently completed in H112, and with the two previously completed, a set of four are now available for fitting on Module 4 (Europe). The clean room fitting is planned for next week.
- **New Couplers**: Couplers 135 and 136 (Spares) have been successfully assembled and will be baked out next week.

## 9. AoB

- **Safety for Hardware comissioning**

Following two 'near miss' situations, a one day workshop to review "SAFETY DURING HARDWARE COMMISSIONING" will take place on Thursday 18th October in the AT Auditorium.
See http://indico.cern.ch/conferenceTimeTable.py?confId=22150
Registration: http://indico.cern.ch/confRegistrationFormDisplay.py/display?confId=22150

**Next Meeting: Thursday 18th October** at 08:45 in the JBA room.

E. Ciapala, 16th October 2007.