

LHC RF Meeting

20th October 2006

Participants: Luca Arnaudon, Thomas Bohl, Olivier Brunner, Philippe Baudrenghien, Andy Butterworth, Edmond Ciapala, Pierre Maesen, John Molendijk, Eric Montesinos, Daniel Valuch.

1. UX45/RUX45 installation (Olivier et al.)

✚ **Cabling and cable testing** remain major activities:

- Cabling around the ACS modules: Controls cables are mostly in place for all four modules; only two cavities remain to be completed. HOM cables are connected for the inner (Beam 2) modules but cable cutting and connector fitting still has to be done for the HOMs of the outer (Beam 1) modules. These cables are at the back where space is tight and they are very difficult to access. The 7/8 inch (blue) antenna cables still have to be done on all four modules.

- Klystron zone: Work on connecting the HV cables to the klystron HV boxes is ongoing. Additional supports are being added where needed, since cable slack has to be left to allow some movement of the klystrons. Flexwell cables in the trenches taking RF signals to the Faraday cages are also being connected. Other RF cables (e.g. to the ACS racks) are passed via the upper cable trays. Space is also very tight around the klystron, circulator and controls racks.

Four klystrons and circulators are now in place, fully connected with the waveguides also in place.

- Cabling between Faraday cages: Around 50 cables linking the cages still have to be put in place.

- Manpower: The cabling teams will probably leave the area before all cables are connected and tested. We will therefore have to manage remaining work on our own - we will train FSU personnel in connector mounting.

- Cable testing: J-C Perrier has started the testing of all coax cables (~500 in total) with a network analyser, checking for reflections produced by defects. Anomalies have been found in some ADT cables, in addition to the known damaged cables. (Note also that 3/8 inch flexwell cables for the reflected cavity power for the Faraday cages need to be spliced and re-routed to the waveguides on the platform.)

✚ **Waveguides:** Four waveguides will be taken out to make holes for the arc detectors (omitted)

✚ **Alignment:** We are still waiting on the survey team to do the ADTs and APWs.

✚ **Vacuum chambers:** Some bellows and interconnects are late, hence installation will not be finished before mid-November. Pumping will start in November.

✚ **HV Bunker installation:** Equipment for the third HV bunker is now being installed.

✚ **HOMs and transport zone:** TS have advised us to put additional protection around the ACS HOM domes of the beam 1 modules, which reach into the transport zone. **(Action: Pierre, Olivier)**

✚ **ACS rack equipment:** Installation in the ACS racks has progressed well with most of the PLCs, I/Os, interlocks and other equipment already in place. Cables are now being connected. RF signal distribution crates and HOM panels are also all in place and connection of RF cables for multiplexers, power meters and HOM systems is ongoing

✚ **Water cooling:** A pressure test will be done before the system is made operational. We do not have an exact date. Flexible pipes still have to be installed in any case for the klystrons and loads.

✚ **Telephones in Faraday cages:** We will use a single Sub-D 9 pin connector to bring the two lines into the cages

2. ACS couplers and cavities: (Eric, Pierre)

🔧 **Coupler assembly:** MCs 132 and 133 have been assembled and leak tested. They are now being baked. If all goes well they will be fitted to the SA2 test cavity next week. Couplers MC131 and 134 are being prepared next.

🔧 **Single cavity module and coupler:** Coupler MC125 was fitted. The leak rate is good, $<1.0 \times 10^{-9}$ mb l/s, better in fact than that measured after bakeout of the coupler. The cavity tuning drive system remains to be completed, then the cryostat will be closed by the end of week 44. With two weeks needed for installation in the bunker and cool-down it would be ready for first RF tests and conditioning by the third week in November.

🔧 **Module 4 (Europa):** Tuning compensation springs and tuner bellows will be fitted before the end of the year. The module will go in the bunker in January, probably without couplers, to do He level measurement tests. (See AoB below on Hardware commissioning – RF & Cryo)

3. ADT (Eric, Wolfgang)

🔧 **Dubna amplifiers:** An amplifier has been received from Dubna and will be tested next week. We still aim to have all amplifiers delivered as soon as possible in order to have final assembly and testing completed by the end of the year, with the Dubna team.

4. Controls (Luca)

🔧 **Testing:** In addition to the installation work (above) for ACS, testing with 220 V power switched on has also started, e.g. wall conditioning units and blowers.

🔧 **Vacuum equipment:** Crates for insulation vacuum control and readout and coupler vacuum will have to be modified by AT-VAC to fit with the layout as originally specified and agreed.

🔧 **Terminal server:** The bridge allowing access from the general network to the technical (machine) network has been installed. It will allow access (e.g. remote desktop) to the tunnel equipment and be operational in mid-November. Administrators are Luca, Andy and Frode.

5. LLRF (Philippe, John)

🔧 **Conditioning DDS:** Three prototype V1 cards have been assembled and programmed and are under various tests with the experts. While the set-up and control of the DDS is now fully working, a problem with sudden unexpected change in DDS amplitude after a long period of operation was discovered and will be investigated (John). With roughly one month before real test in SM18, there is sufficient time to set up and test all the software. Eric will provide information on normal operating levels for the conditioning loop. We may do the very first conditioning of the test cavity coupler with the original system, to check all other systems are OK.

🔧 **Switch and Protection Module:** There may not be sufficient time to fully debug the saturation hardware before the SM18 test. We can however use the existing switch and driver module for the first conditioning tests then install and test the new module later.

🔧 **Setpoint module:** Final checks are being done on the layout, after which a proto will be launched.

🔧 **RF Modulator:** Will be given to the design office next week.

🔧 **Crates:** The ATOS representative will visit next week to discuss crate mechanics delivery dates. We now have all other material needed to construct a first series, i.e. VME and RF backplanes, power supplies, etc.

🔧 **Preparation for series production:** The inventory of existing material is being prepared. This will be given to TS-DEM who will then organise procurement of remaining material.

✚ **RF distribution systems:** Once the installation is completed a full set of measurements and calibrations will be done on all the different chains.

6. AoB

✚ **Hardware Commissioning – RF and Cryo:** Following the last LSS HWC meeting, another meeting was held with the hardware commissioning team, together with Luigi Serio (AT-CR) to follow up on the issues of “co-activity” between RF and cryo during the hardware commissioning phases. **Some main points**, including three actions on our side:

- Pressure Stability: Cryo have been concerned that they would not be able to maintain our specified ± 3 mb pressure stability during cool-down and powering tests. We have confirmed that for initial tests and conditioning a much wider band can be tolerated. – up to ± 50 to ± 100 mb. They believe they can provide this from around the middle of the cool-down period, and right through the powering test period. We have been asked to provide the acceptable limits of level and pressure for this situation. **(Action 1)**

- Trips due to magnet quenches: If, during power tests, five or fewer cells quench the cryo recovery time is a few hours. However during this time the cavity cooling will still operate, and indeed may be even more stable than when magnets are being powered....

- Instrumentation check-out: This has been a concern since no time appeared to be allocated in the planning for crucial instrumentation, control and safety valve tests. We now understand that this work is done during the “Interconnection, Closure and Consolidation” periods (~5-6 weeks) which precede the power tests. It would therefore start in January according to the present planning....

- SM18 tests for He levels: Luigi reminded us of the planned SM18 test on level gauge readings, since cryo maintain that regulation will be impossible if there is variation in the individual cavity levels. We need to establish if the problem is simply due to the gauges and reading the values, or more fundamentally a problem with the He flow in the module. The use of delta P (pressure) measurement - used finally in LEP - should also be looked at and cryo will prepare the instrumentation needed for a test. **(Action 2)**

- Safety valves: We must provide the final specs for the safety valves. **(Action 3)**

✚ **Budgets:** An overall look at CET for LHC budget codes from Annabel Cobas shows that overall our spending is not too far from the estimates to Finance earlier this year. The installation budget appears to be very much underspent, but this needs to be checked further.

Next Meeting: Friday 27th October at 08:45 in the JBA room.

E. Ciapala, 20th October 2006.