# LHC RF Meeting 7<sup>th</sup> February 2006

Participants: Luca Arnaudon, Philippe Baudrenghien, Thomas Bohl, Olivier Brunner, Andy Butterworth, Edmond Ciapala, Heiko Damerau, Wolfgang Höfle, Janna Holma, Trevor Linnecar, Pierre Maesen, John Molendijk, Eric Montesinos, Ragnar Olsen, Volker Rödel, Tony Rohlev.

### 1. UX45/RUX45 Installation (Olivier)

**QRL work:** Sector 3-4 is to be pressure tested in one week's time. Sector 4-5 still has problems with leaks in one sub-sector and tests are going on. Connection of the final section to the QUI in UX45 has still to be done for sector 3-4. (missing parts). For sector 3-4 this connection is already in place. All cryo work between the shielding walls should be finished by the beginning of March. Connections for the RF cryo line on the RUX45 roof are already fitted to the QRLs on both sides.

**Cabling:** Layout of able trays in the zone between the walls will need to be re-done. Cable pulling can only be done when the cryo work is finished. RF and other cabling work in this area are planned for completion by the end of June.

**Waveguide installation:** Installation in UX45 has now begun. Some of the long vertical sections through the platform are already suspended on the sector 3-4 side of the cavern.

**Cooling and ventilation:** Ventilation units will be installed from March through to July. Part of the tunnel roof will have to be put in place first.

**Upper UX45 Access:** Cages and doors to restrict access to the upper part of the UX45 cavern have been put in place. There is one for each side of the cavern, both near the PZ45 lift. They will be connected locally to the ACS HV interlocks. Access to the crane must also be blocked. On Monday 6<sup>th</sup> February the area was visited by RP, machine access and safety specialists - including D. Forkel-Wirth (SC-RP), G. Roy (AB-SU) and P. Ninin (TS-CES). The arrangement proposed was accepted. RF group will be responsible for doing a search in the upper area before closing the zone. It was also agreed not to restrict access to the cryo side (from US45). This will be reviewed as soon as beam is injected, with close follow up of radiation levels by SC-RP. We have agreed to write a brief summary of what has been agreed.

# (Action: Ed/Olivier)

# 2. ACS Couplers (Eric)

**Couplers 126 and 127:** SA2 conditioning is progressing well and is now at 2 ms pulsing with full power. Conditioning should therefore be complete in two weeks.

# 3. ACS Modules and SM18

**When tuning bellows:** Cycling tests are still ongoing.

**4** Module 5: The couplers have been fitted in the clean room then baked. A small leak has developed on the coupler of cavity C, in the region of the second polarization ceramic. We are concerned that bake-out temperature may have been higher than normal and we are checking vacuum data. It seems likely that we will have to clean room fit another coupler, probably one of those finishing conditioning in SA2.

**Klystron:** Interlocks and arc detectors are being prepared. Power will be applied next week (firstly with the waveguide short in place)

# 4. ADT Equipment (Eric)

**Kickers:** Bakeout of the first kicker in B113 has now been done. Wee are waiting for official acceptance from the vacuum group. (M. Jimenez). The tank will be opened later (end plates only) and the plates checked and measured for any distortion, with the help of the survey group.

**Amplifiers:** We have received four modified resistors; these have been sent to Dubna.

**Drivers:** Following Thales' explanation that an internal grounding problem may be the cause of the re-programming difficulties, one has been repaired. Five others are ready to be shipped.

**Ig2 supplies:** A problem with unreliable readback of the status was discussed with the manufacturer but they are unable to reproduce the fault.

**Power interlock module:** the prototype is being tested.

**Cabling and layout:** Cutting of cables and fitting of connectors cannot be done till this is finalized for the RF diagnostics and the power interlock systems. For RF diagnostics the multiplexing configuration has first to be decided. (Action: Wolfgang)

# 5. APW Equipment (Eric/Thomas)

**PU 01 Bakeout:** Bakeout of APW 01 resulted in leaks in four feedthroughs. The feedthroughs themselves had been tested to 250 °C (APW bakeout is 200 to 220 °C). We will look at the use of SPS APWL feedthroughs or else do bakeout at lower temperature (but over a longer period)

### 6. Special Topic: Cavity Controller Simulations, by J.K. Holma

Janne presented results on simulation of the klystron cavity feedback loops, based on Matlab and Simulink. <u>See Slides</u>. The non-linear klystron characteristic is modelled by introducing amplitude dependent functions into the amplitude and phase response characteristics. The functions are taken as closest fit approximations to measurements obtained on the real klystron. Equivalent In phase and Quadrature (IQ) component responses are therefore interdependent and have to be expressed in matrix form. Similar expressions are taken for the cavity response, based on an RLC circuit, with the detuning as parameter. Here the response is assumed linear. Other elements, such as delays, are included in the loop. Nyquist and bode plots of the response were simulated. Characteristics and simulated step responses obtained agree well with those measured in SM18 last year. However, in some cases, output transients appear with sign inversions between simulated and real. Since inverting the phase characteristic of the cavity corrects these it is suspected there may be a sign error in the cavity model. Future work will include the addition of other loops, such as the digital feedback loop and the klystron polar loop, and the effects of operating off-tune and the effect of the tuning loop.

#### **7.** AoB

**Underground material inventory:** The RF inventory was requested at the last TCC. It has now been given to SC.

Next Meeting: Friday 17<sup>th</sup> February at 08:45 in the JBA room.

# Agenda:

- 1) UX45 RUX45 Installation planning Olivier
- 2) Equipment status review

E. Ciapala, 15<sup>th</sup> February 2006.