**Minutes from the Working Group for XFEL Linac RF Operations meeting**

**Thursday Nov. 17th 2011**

**Participants:** Wolf-Dietrich Moeller, Holger Schlarb, Julien Branlard, Tobias Schnautz, Lutz Lijle, Bernd Petersen

**Opening remarks:**

* An indico webpage has been set up for this meeting series, where minutes and presentations are kept: https://indico.desy.de/categoryDisplay.py?categId=256
* We had a discussion about who should chair the meeting; it was decided to keep Holger Schlarb as chair, assisted by Julien Branlard.
* Elmar Vogel should be informed about these meetings. There is however no primary overlap between the scope of these meetings and his responsibilities to the string assembly and module ownership.
* The schedule for future talks was presented and reviewed by attendees:
  + Nov. 17th 2011: **Cryogenic system**
  + Dec. 1st 2011 : **High level RF**
  + Dec. 15th 2011 : no meeting
  + Dec. 29th 2011 : no meeting
  + ~~Jan. 12~~~~th~~ ~~2012~~ : Jan 19th 2012: **Personal interlock systems**
  + Jan. 26th 2012 : **Couplers / Technical interlock**
  + Feb. 9th 2012 : **LLRF**
  + Feb. 23rd 2012 : **Vacuum**
  + Mar. 8th 2012: **Controls**
  + Mar. 22nd 2012: **Utilities**

**Presentation from Bernd Petersen on Cryogenic operations XFEL**

* The installation sequence is well defined and already covered in another meeting: *General installation meeting*, chaired by Thomas Hott and Markus Hoffmann
* Notes on the mains differences between FLASH and XFEL
  + FLASH cooling consumption is about 1kW while Hera’s cooling requirements are 8kW (2.5MW), resulting in a very large and fault-tolerant cooling buffer for FLASH.
  + FLASH has a very robust warm pumping system with a x8 overcapacity
  + The XFEL cooling system won’t have such a pump but will rely on cold compressors to regain energy. This system is sensitive to mass flow changes (10% difference in mass flow change is critical)
  + One should expect the restarting of the cold compressor stage to take about 10h.
  + Based on LHC experience, there is a steep learning curve for cryogenics recovery time. One can expect up to 50 hours recovery time at the beginning if the mass flow experiences uncontrolled changes.
  + AMTF is equipped with warm pumps (with 40g/s capacity). There, the static load can be compensated for.
* Note on cavity quenches:
  + The pressure is specified to be at 31mbar +/- 0.3mbar
  + Each cavity will be equipped with a temperature sensor which detects a temperature rise if a cavity quenches but the time scale doesn’t allow to rely on this indicator to take action before it is too late for the cryogenic system.
  + The typical mass flow is on the order of 50 g/s. Based on FLASH experience, a cavity quenching for a long time results in a 5 g/s mass flow
  + The pressure increase is massively delayed due to the 300mm cryogenic pipe. Reacting on the pressure signal is also too slow to avoid down time.
  + It was brought up that online cavity tuning monitoring can be a good indication to detect a quench. The future automatic quench server implementation includes monitoring of the cavity tuning and reflected power, as well as sudden Ql changes as an indication of a quench. 🡺 Typical values are +-35Hz detuning => +/-0.7mbar
* Notes on heat load fluctuations during RF operations
  + The cryo refrigerator needs about 0.5h before full RF operation. This has RF implications for startup and recovery sequences.
  + CEBAF has a heater at each cryo module
  + HERA has heater at each cavity
  + For the XFEL, heaters are foreseen at each feed end cap with Helium reservoirs. They are designed such that they can heat more than the dynamic loads.
  + These heaters are operated during standard operations.
* Cryogenic requirements
  + A main requirement coming from this discussion is the need for a direct connection between the control system and the cryogenic system. Feed forward waveforms should be provided to cryo to allow for active heat load compensation using the heaters.
  + Furthermore, the RF interlock system should avoid sudden interruptions of the RF drive (in case of quench or a cavity gradient limit reached for example). The preferable action (from a cryogenic point of view) is to lower the operating gradient locally and broadcast the information to neighboring cryomodules to compensate for the gradient drop.

The next meeting is scheduled for December 1st 2011. The topic of discussion will be High level RF.