

# **Annual Audit of Work Package 8: RF Systems and Work Package 17: Power Converters**

**September 12, 2014 9:00 – 12:00**

Attendees: A. Johansson, C. Martins, P. Bosland, A. Jansson, M. Lindross, D. McGinnis, C. Darve, E. Tanke, W. Hees, A. Sunesson, M. Jensen, R. Zeng, C. Marrelli, A. Ponton, F. Jensen, M. Conlon, J. G. Weisend II (Chair)

## **1) General Comments**

Significant activity has taken place in WP8 during the past year. Prototype modulators and IOTs have been ordered and the invitation to tender for the first prototype klystrons has been released. A significant amount of design work on RF distribution and other systems has been completed. Major progress has also been made at Lunds University on the low level RF system. Staff working on WP8 has helped to develop requirements for the Klystron Galley building, power and cooling.

The increase in potential in-kind-contributions is particularly striking. This work package has gone from one in which most of the content was expected to be procured by cash to one in which up to 80% of the content may be provided by in-kind-contributors.

Staffing levels (an issue identified at last years audit) has greatly improved with 5 new employees added in the last year.

Increased staffing and a better understanding of the work, has recently led to the creation of a new work package; Power Converters (WP17) which contains elements of WP8 and WP6 (HEBT & Magnets). This new work package, led by C. Martins is reviewed this year as part of the WP8 audit but will be reviewed in a separate audit next year.

Risks for the Work Package include: potential schedule slip due to protracted procurements, retention of staff and communication issues with partner labs. Mitigations are under way for all these risks including improvements in the ESS Procurement Dept. and development of a single point of contact with the work package for partner labs.

Procurement delays in the klystrons and IOTS have put the some of the project milestones at risk but the WP8 team is working with the schedulers to speed up intermediate activities so that ESS project milestones are met. There remains an issue with the RF power amplifier supplier for Uppsala. This could affect the schedule.

## **2) Response to Charge**

- Has the work package reached a level of technical maturity consistent with its current status on the schedule?

*Yes, though there is still the issue of the regulation accuracy requirements for the low level RF. This still needs to be settled between Beam Physics, RF and the Lead Engineers.*

- Are there any technical concerns regarding the work package?

*No*

- Is any additional development or testing required for the work package to meet its goals?

*Extensive testing of prototypes is already planned. A new desire is to test first articles in addition to prototypes at Test Stand 1. This may extend the required lifetime of Test Stand 1.*

- Are the requirements for the work package well understood and documented?

*Yes, with the exception of the low level RF requirements mentioned above.*

- Specifically, will the requirements needed to support procurement of production hardware be ready in time to allow the procurements to keep the schedule?

*Work remains to be done but should not affect procurement of production hardware. For example:*

*L4 requirements not yet finalized – this means L5 not finalized, may sometimes go to specification directly*

*We are talking to in-kind partners – difficult to provide complete specifications or requirements or SOW due to resource issues.*

*Interface requirements not finalized*

- Are all the interfaces between the work packages and other work packages and products properly defined, understood and agreed upon?

*Yes, though further details are required.*

- Have all safety issues in the work package been properly identified and dealt with?

*Yes*

- Are there sufficient resources (funding, staff) assigned to the work package to allow the goals of the work package to be met?

*Staffing issues have gotten much better since the last review. However, there are still gaps and the use of some staff on accelerator integration work requires additional staff. Additionally, the change from mostly procurement to mostly in kind work affects the type of staff required. This will be adjusted over the coming year.*

- Are there decisions that need to be made in order to allow the work package to meet scope, cost and schedule?

*Yes, the clarification of MPS and PSS responsibilities and the finalization of In kind agreements.*

- Are there any outstanding procurements or personnel actions that are limiting the progress on the Work Package?

*No*

- Is the Work Package on track to meeting its milestones?

*Generally yes. A new strategy regarding Klystron procurement will be needed to meet the project schedule. This appears to be possible and the details are being investigated.*

- Are there any adjustments to the schedule and milestones that should be made?

*Replanning to account for the additional in kind work and procurement slips is underway*

- Are there any changes to the work package scope that should be made?

*No*

- Have PDR and CDR reviews been scheduled to allow reviews of components or systems in time to keep to procurement schedules? Describe any schedule developed.

*These reviews have no yet been scheduled. The planning for them is underway*

### **3) Recommendations**

1. Bring Elettra and Uppsala together to work on the Spoke RF power amplifier development and production as quickly as possible
2. Optimize the staffing in RF group to ensure sufficient capability to manage the IKC in RF. Include in this analysis the potential use staff of Uppsala.
3. Change procurement of modulators for medium beta cryomodules so that arrival of last unit occurs earlier than April of 2019.
4. Investigate impact of the desire to test first articles in Test Stand #1 on the expected lifetime and cost of this test stand. If first article testing is chosen, alter the schedule for TS#1 to reflect this change.
5. Manage the development of software code by engineers in the WP 8 team to ensure this work is done in accordance with procedures used by ICS, and to ensure that developed code is stored and managed in databases / repositories authorized by ICS
6. Monitor the issue regarding Uppsala and the RF amplifier supplier closely.
7. Finalize LLRF regulation requirements.

#### **4) Status of the Last Review's Recommendations**

1. Assign additional staff to the WP8 efforts. In the near term, this can be done by reassigning existing staff from other work packages. At the same time, the staff plan for 2014 and beyond should be adjusted to bring more staff into the work package sooner.

*This is close to complete. Staffing levels have greatly improved over the last year. Some additional staff is required in 2015 and the nature of new staff needs to be adjusted to fit the increased In Kind Contributions.*

2. Place more resources in the radiation shielding analysis of the gallery and stubbs to quickly ensure that a design can be created (perhaps with local shielding) that meets ACCSYS needs and the desired radiation dose limits.

*This is complete*

3. Review any changes to the gallery or stubb design in response to cost pressures to ensure that the reduced space doesn't adversely affect reliability or operations.

*This is complete*

4. Review the use tetrodes to power the spoke cavities to ensure this approach is the best from a cost, performance and risk basis.

*This has been done and tetrodes remain the base line choice*

5. Determine which work package is responsible for the in situ (i.e. in cryomodule) conditioning of the power couplers.

*This has been done. The responsible work packages are 4 and 5.*

6. Assign responsibility for ensuring that the hot water associated with the klystron cooling is contained within a safe system to WP15.

*This has been done. Though the water cooling WP is now WP16.*

7. Monitor MicroTCA development activities to ensure that project risk remains low.

*This is ongoing. MicroTCA remains the baseline choice.*