# ESS replies to TAC13 recommendation for accelerator:

(also available at <https://ess-ics.atlassian.net/secure/RapidBoard.jspa?rapidView=230&quickFilter=708>)

U: tac

P: tac14

**AD Staff Plan**

1) Have ESS central team staff spend more time at IK facilities (especially during

key demonstrations) to be able to take ownership of these components

ESS AD has started an IK intern program with two senior staff members helping out for longer periods at IK partners. They will in the coming year spend time in Catania for ion source ad in Legnaro for the DTL. AD is also encouraging younger staff from the division to spend time at IK partners and presently this happens for the ion source, for SRF linac and for the LWU. It remains challenging for many staff members to be away from home for longer periods but all show a willingness to spend some time at IK partners.

2) Trained technicians will be required – have people spend extended time at IK

labs (> 3 weeks)

We now have technicians at AD and we encourage them to spend time at IK partners for training.

Example for the vacuum team: For the LWU the vacuum group at ESS will send **eight technicians** to the IK partner STFC-Darebsury site in order for the staff to be trained in handling and assembling particle free chambers. It is ESS’ preference to that the staff is **split into teams of 2 to 4 people** and each team should spend a training period of a **maximum of 4 weeks at the Partner’s Daresbury location** during the build phase (i.e. **between the time period April 17 and October 19 2017**, subject to agreement by the Parties). The Partner will supply all equipment and all other required supplies to enable ESS personnel to undertake and complete the aforementioned training at the Partner’s site. ESS will cover the living expenses of these staff.

Examples of exchange of staff with IK partners for RF systems:

* ATM Atomki spent long time here in Lund with 1-2 persons, collaborating with ESS personnel to contribute and to learn about system design.
* ESS Bilbao has had one person work with the LLRF people at LU for 1-2 weeks, to facilitate knowledge transfer
* LU personnel working with LLRF have spent 1-4 weeks in Uppsals working with the FREIA people
* Warsaw University will have people in Lund making measurements on our phase reference line prototype during October 2016
* Carlos Martins of WP 17 has spent a lot of time at ESS Bilbao to discuss and work on the modulator design

3) Assign to a cental ESS team individual reponsibility for each linac system

(source, DTL, spokes,…) – including IK oversight, integration, beam

commissioning planning,…

The installation organisation which will be presented at the Tac meeting includes system responsible for each installation area. The R2A2 for the system responsible is now being agreed and it is likely to cover the areas mentioned above.

**Accelerator structures: RFQ**

1) Start RFQ LLRF/Resonance control modeling

– The mixing valve for the water tuning system should be installed as close to the RFQ as possible (i.e. 1-2 meters) to reduce system delay and allow for increased closed-loop gain

This is the plan. Discussions have taken place with the responsible for the installation of the cooling system and no problem detected.

– Personnel responsible for the LLRF and resonance control (water) should be very tightly coupled

There are plans to test the cooling system in CEA replicating the system that will be used at ESS (length of pipe run and number of bends, etc.). It is planned to involve the responsible experts from ESS LLRF team in the preparation and execution of these tests.

– CEA should execute a system model of the RFQ to predict thermal tuning constants of Hz/degree C. Both common-mode and differential (loop-to-body) thermal frequency and time constants are desirable. The LLRF/resonance control team will use this estimate in their modeling of the control loops for optimum performance.

The request has been submitted to CEA and discussions have started.

2) Ensure the movable RFQ tuning system meets vacuum requirements

There are no movable tuners included in the RFQ design. The tuners are adjustable by hand to tune the field flatness. These have been reviewed during the CDR2 held last December and approved by the ESS vacuum group.

**Accelerator structures: MEBT**

1) Define a minimally acceptable baseline MEBT (possibly w/o chopper) to meet the beam test requirements for 2018

A minimalist MEBT has previously been simulated with unconvincing results. Rather, a relatively complete MEBT is needed to measure the beam parameters before injecting to the DTL and further to the SCL. A temporary diagnostics device is not a viable alternative due to schedule constraints. See also response to recommendation about diagnostics plates.

2) Clarify the specifications and function of the chopper

The specifications are defined in the requirements in DOORS. The clarification of the chopper functionality is within the requirements.

– Do not use the chopper as a required machine protection device

The MEBT chopper is in fact one of the devices of the MPS actuation system used to turn the beam off. The actuation system comprises 3 devices: the ion source magnetron, the LEBT chopper and the MEBT chopper. The trigger is sent to the three devices in case the linac needs to be turned off. In the scenario where the LEBT chopper fails, the MEBT chopper is required to dump the 100 µs transient from the source.

**Accelerator structures: DTL**

1) Find means to reduce the tendering period and concentrate on companies which are known to have experience with the fabrication of similar cavities. This will come at a price but it will reduce long qualification periods

A meeting has taken place the 29th and 30th of June where the schedule of the DTL was detailed and updated. During this meeting the possibilities to shorten the tender process have been discussed. A follow-up meeting took place September 7th and 8th to further work on possible ways to reduce the duration of parts of the schedule. The bottle neck is the PMQ production and by changing the assembly order of the tanks, adding space in the clean area at ESS for parallel final assembly of the tanks and adjusting the installation schedule the RFI dates can be maintained. A key thing is now to not lose any time in administrative delays for the tenders.

2) The use of temporary diagnostics plates is suggested by INFN to aid the beam

commissioning process but needs to be agreed to by ESS. This suggestion should be based on a commissioning plan.

It is difficult to install separate diagnostics plates due to schedule and space constraints. It would be possible to install one behind tank 1, but there is no time in the schedule to act on potential findings from it. If, for instance, the emittance would be found to be slightly higher than expected, there is no time to open the tank and try to fix it. Instead we would have to transport such a beam, perhaps at low intensity, to the end of the linac in order to produce first neutrons. Any further investigations would have to be postponed to a later time.

**Accelerator structures: Spoke Cavity / Cryo-modules**

1) The reason for the failure with the conditioning of the first pair of couplers?

It was a human mistake. All securities of the interlock system were deactivated unintentionally from the supervision interface during a ramp-up phase of the power.

It was the first RF conditioning of the coupler pairs and the supervision interface was in a debugging phase in which all commands (ON/OFF) related to the interlocks were "accessible" from the supervision interface.

Moreover, the computer session was not logged-off during the absence of the person is charge of the RF conditioning process.

2) How to prevent this risk to happen in the future ?

Actions decided:

1/ Session log-off in case of absence of the responsible.

2/ During the debugging phase which occured in June: double check (software/hardware) in case of an activation of an alarm seen on the supervision interface.

This risk does not exist anymore because the debugging phase is finished. The supervision interface is fully operational and the second RF conditioning process were OK from the supervision interface point of view.

**Accelerator structures: Medium-beta Cavities**

1) Pursuing the large-grain Nb for ESS applications appears too risky

WP05 confirms that the development on-going with the large-grain will not be pursued for the ESS application. Since the schedule for this LG is relaxed, that extra cavity could be used as a prototype to test different fabrication procedures, e.g. influence of baking the cavity, comparative studies w/ fine grain.

**Accelerator structures: High-beta**

1) The niobium procurement for the elliptical cavities should be started as soon as possible. As proposed, all upcoming CFTs related to the elliptical cavities / modules should be prepared now. Use the SRF community’s expertise by inviting selected experts to the specification reviews.

STFC has now launched the Nb material call-for-tender. The specification is modeled after the INFN's specification, which is adapted from the XFEL experience.