Response to ATAC 10 Committee Recommendations

Editor: David McGinnis
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ATAC 10 Review Information

- Indico Site (key=TAC10)
- Confluence Site

ARR-1 WP Update Summary Presentation

- **Description**
  - Slide 8 Recommendations Bullet: Sub-Bullet 1 in report
  - Next aTAC address the progress of different WP's in order to get a better overview of the general schedule, with special attention to the first systems needed for commissioning (as RFQ and DTL)
- **Response**
  - Author: Mats Lindroos ACCSYS Project Manager
  - Status: **Resolved**
  - Will present ACCSYS Work Package Status report from the last ACCSYS technical board (ACCSYS TB 12 use TB12 as key) as the starting point of the ACCSYS Project talk.

ARR-3 ATAC Membership

- **Description**
  - Slide 8 Recommendations Bullet: Sub-Bullet 2 in report
  - Include in new aTAC composition an IKC expert from XFEL
- **Response**
  - Author: Roland Garoby - ESS Machine Coordinator
  - Status: **Resolved**
  - ESS Machine Coordinator has appointed Hans Weise as new member of TAC

ARR-4 System Definition for Civil Construction

- **Description**
  - Slide 8 Recommendations Bullet: Sub-Bullet 3 in report.
  - Complete the sooner the definition of all systems which may need revision in order to fit with the civil construction constraints
- **Response**
  - Author: David McGinnis - AD Chief Engineer
  - Status: **Resolved**
  - *Conventional Facilities Requirements.*
    - The current set of specifications for conventional facilities is at: DOORs
      - (use Train1, DOORStr1 to view)
      - Navigate to ESS Technical Requirements ->Accelerator Technical Requirements->00_ACC–Interface Requirements ->ACC-SI Interface requirements
  - *Accelerator Division Physical Plant Working Group (AD-PPWG)*
    - The definition of the systems with respect to the civil construction constraints is reviewed weekly at the Accelerator Division Physical Plant Working Group (AD-PPWG). The group meets every Friday at 9am. The meeting minutes can be found at AD-PPWG. At the meeting, the following topics are discussed:
      - Cabling
      - Conventional Facilities
      - Cryo & Test Stands
      - Gallery Status
      - Management
      - Power
      - Tunnel Status
      - Protection Systems
      - Radiation Calculations
      - System Engineering
      - Water Cooling
    - Issues are tracked with a JIRA task system at: AD-PPWG JIRA Board
  - *Accelerator Integration Group Internal Vertical Design Reviews (AIG-IVDR)*
    - The AIG is responsible for the integration of the ESS-Linac which includes the integration of systems into the conventional facilities. The AIG uses a hierarchical set of specifications to describe. Starting in May AIG will begin monthly set of internal design reviews that will focus on the Engineering discipline specifications for a particular section of the linac. The description of the reviews can be found at: AIG-IVDR

ARR-5 In-Kind Commissioning

- **Description**
  - Slide 8 Recommendations Bullet: Sub-Bullet 4 in report.
  - The in-kind contributions should include the commissioning of the systems at ESS and ESS should also encourage the transfer of staff from the in-kind contributor to ESS when the equipment is delivered.
- **Response**
  - Author: Håkan Danared - AD Deputy Division Head
  - Status: **Resolved**
  - It is agreed that in-kind contributions if possible should include commissioning of the contributed equipment on-site in Lund, and this has been and will be brought forward in negotiations with partners. ESS Accelerator also supports transfer of staff from in-kind contributors to the extent allowed by the ESS AD staff plan. Obvious cases could be PhD students or postdocs who have worked on an in-kind project at a partner lab and who are willing move to ESS in Lund together with the equipment delivered.

ARR-6 Staffing of the RF Group

- **Description**
  - Slide 8 Recommendations Bullet: Sub-Bullet 5 in report.
  - Make the staff increase in the RF group a priority, since even though the RF system is the biggest cost factor for the ESS linac, the RF group today consists of only 10 people.
- **Response**
  - Author: Mats Lindroos ACCSYS Project Manager
  - Status: **To-Do**
  - ACCSYS Project Manager is working on the staff plan for the division and is seeing all the group leaders in the coming weeks. The RF group is a priority.

ARR-7 Commissioning of the Technical Systems

- **Description**
  - Slide 12 Recommendations Bullet: Sub-Bullet 1.
  - Commissioning of the technical systems, coordinated with the IK partners, is to be addressed together or even in advance to beam commissioning.
- **Response**
  - Author: John Weisend II ACCSYS Deputy Project Manager
  - Status: **In-Progress**
  - All components whether from IK Partners or Vendors will undergo site acceptance tests (SAT) as appropriate. These tests are part of work package scope and most are explicitly listed in the project schedule. Examples of this include: the Elliptical Cryomodule testing at ESS (WP10 in collaboration with WP8 and WP5), Spoke Cavity Cryomodule testing (carried out at Uppsala University as part of WP10- in this case, the testing at Uppsala constituents the SAT for the Spoke cryomodules),testing of klystrons upon installation and final testing of the installed Accelerator cryoplant and the installed cryogenic distribution lines. The SAT plans for other systems such as the Normal Conducting Front End components are still under development
  - There is strong agreement in general that IK partner staff will participate in the planning, carrying out and analysis of the SATs for their components. The specific details of their participation will vary from case to case and will be covered in the final In-Kind Agreement
  - Plans for testing groups of components from different subsystems in an integrated way will be covered as part of the installation and commissioning plan currently under development
  - This work is an ongoing effort and will continue in progress until installation is complete (2019) agreements with individual IK partners will be fixed once the final IK agreements are signed.

ARR-8 Collimation in the MEBT

- **Description**
  - Slide 10 Recommendations Bullet: Sub-Bullet 1 in report
  - The option of collimating the beam in the MEBT should be pursued.
- **Response**
  - Author: Aurélien Ponton - AD Lead Engineer for MEBT
  - Status: **Resolved**
  - Beam Physics: R. Miyamoto has studied the effects of collimation in the MEBT it has been shown that it reduces significantly the halo in the rest of the linac thus reducing potential hazardous losses in the linac. Three collimators should be placed in the MEBT at specific z location along the beam line.
    - See http://accelconf.web.cern.ch/AccelConf/HB2012/papers/weo3a02.pdf.
  - Thermo-mechanical studies: ESS Bilbao has written a technical document "Basic Scrapper Beam Design analysis (Oct. 2014)".
    - See smb://fileserver01.esss.lu.se/Share/Machines Directorate/Acceleratordivision/PublicReadWrite/WP3/MEBT/MEBT_Basic_Scrapper_Beam_Design_analysis.pdf.
    - In the report thermo-mechanical analysis is made to evaluate the temperature increase and stresses on a blade of the scraper system with respect to different penetration inside the beam (in terms of sigma) and beam sizes. To me the conclusions were unclear and the calculations and assumptions might need some clarifications and corrections. A conceptual design should be produced and the above mentioned document should be revised including for example other material than tungsten (carbon for example).
  - Radiations: Radiations studies are still missing for this part and will depend strongly on the choice of material.

ARR-9 Collimation System

- **Description**
  - Slide 10 Recommendations Bullet: Sub-Bullet 1 in report
  - Maintain the space available in case the full power beam will need collimation system, but ensure to define what are the radiation related issues to installing a collimator in a region that could have been heavily radiated during commissioning.
- **Response**
  - Author: Inigo Alonso - AD Lead Engineer for High Energy Beam Transport
  - Status: **Resolved**
  - The space for a collimation system in the High Energy Beam Transport (HEBT) region, right after the the end of the Superconducting linac, has been reserved in the integration model.
  - The HEBT region will not be radiated during commissioning beyond the effects from the maximum 1 W/m beam losses consistent with the ESS-SYR-ACC-090 requirement. This requirement establishes a limit for the beam losses that will be maintained by only allowing the beam power level to produce losses beneath the limit (during both commissioning and normal operation). Beam losses will be monitored by Beam Loss Monitors (BLM), also connected to the Machine Protection System (MPS). Installation thus will not be impacted in any way by a the environment activation.

ARR-10 Definition of Reliability

- **Description**
  - Slide 13 Recommendations bullet: Sub-Bullet 1 in report
  - Define staged levels of reliability over the start-up years, using as comparison the original specifications for availability at SNS with todays performance.
- **Response**
  - Author: Enric Bargallo - AD Lead Engineer for Reliability and Availability
  - Status: **In-Progress**
  - Reliability and availability evolution over the start-up years is very difficult to estimate since there is a lot of uncertainty for the different components and systems. It is foreseen that the number of unexpected events will decrease in time when early failures of components disappear, when we have better knowledge about the systems and when weak points of the machine have been fixed. Therefore, it is expected that the overall availability will be improved until steady-state operation has been reached. Comparisons with SNS were done and a similar curve was obtained for ESS. However, that curve was only useful to see one possible scenario.
  - What was done in the document ESS-0011768 (Updated report on operations, Chapter 4) was to define the priorities and the minimum values through the start-up years for the main ESS parameters. Since the performance of the machine is unknown, it is important to know which is the minimum value for each parameter that has to be reached in order to meet the goals of each phase. Moreover, the priorities describe the importance and focus that need to be put in place in order to reach better values for each parameter in each phase. It will be very difficult to improve all parameters at the same time and it will be important to properly allocate manpower and machine development time in order to reach the nominal values. The values included in tables 3 and 4 of this document will be reviewed for next versions of the document.

ARR-11 Reliability User Community

- **Description**
  - Slide 13 Recommendations Bullet: Sub -Bullet 2 in report
  - Consult user community on reliability and availability.
- **Response**
  - Author: Enric Bargallo - AD Lead Engineer for Reliability and Availability
  - Status: **Resolved**
  - The document ESS-0017709 was done by ESS science directorate with inputs from experts in neutron source facilities and with the people at ESS responsible of the interface with the user community. We think that this recommendation is completed since the document includes a broad representation of the user community. We don't expect that any further consultation would have an impact to the current requirements. Such consultation to the user community would require an important effort that we cannot afford at this moment.

ARR-12 Spoke Cryomodule Prototype Unexpected Technical Problems

- **Description**
  - Slide 16 Recommendations Bullet: Sub-Bullet 1 in report
  - As it applies also to other WP's, the risk of unexpected technical problems in the prototype phase must be taken into account.
- **Response**
  - Author: Christine Darve - AD Work Package 4 (Spoke Cryomodule) Leader
  - Status: **In-Progress**
  - We will use the on-going technical risk analysis initiated between the ESS series SRF component stakeholders (incl. What-if analysis, RAMI analysis, FMEA, Maximum Credible Incident, etc..). An adapted version is being defined in collaboration with CNRS for the Spoke technology demonstrator and with CEA for the elliptical technology demonstrator.
  - Plus, for practical matters, prototype fabrication from different suppliers limits the final risk (e.g. 3 cavities produced by 2 suppliers, 4 power-couplers produced by 2 suppliers).
  - Also, in case of delay or technical issues for the Uppsala test stands, IPNO has the capacity to complete the cryomodule test in accordance with the current ESS schedule and requirements.

ARR-13 Spoke Cryomodule Prototype Effort

- **Description**
  - Slide 16 Recommendations Bullet: Sub-Bullet 2
  - Increase the effort to save time during the prototyping with the goal to allocate some time contingency in the WP.
- **Response**
  - Author: Christine Darve - AD Work Package 4 (Spoke Cryomodule) Leader
  - Status: **In-Progress**
  - Time saving during prototyping is nearly impossible, w/o raising important risks.
  - Still, time duration has been limited between prototype (technology demonstrator) cryomodule test results and the launching of the series production, but we have planned a staged series production, which will permit to monitor the quality of the series production: i.e. vertical cryostat tests before ordering Nb and test in horizontal cryostat before ordering cavities. This staged approach has permitted us to gain 6 months to the series production phase.
  - Also, we will limit the prototyping phase duration by applying an effective QA/QC policy, by developing an industrialization plan and by building the proper communication tools.

ARR-14 Spoke Cryomodule Prototype Procurement

- **Description**
  - Slide 16 Recommendations Bullet: Sub Bullet 3 in report
  - Procure the materials and be ready for an iteration on the couplers before going into series production.
- **Response**
  - Author: Christine Darve - AD Work Package 4 (Spoke Cryomodule) Leader
  - Status: **In-Progress**
  - An iteration is possible after the first 4 power-coupler test campaign. Indeed, the prototype test is expected to be completed this summer and the Series production will not start before May 2016. Provision for ceramic production (long lead items) has also been anticipated.

ARR-15 Lund Coupler Test Facility

- **Description**
  - Lund Coupler Test Facility
  - Slide 16 Recommendations Bullet: Sub-Bullet 4 in report
- **Response**
  - Author: Christine Darve - AD Work Package 4 (Spoke Cryomodule) Leader
  - Status: **Rejected**
  - Concerning the Spoke power-coupler, then only 2 for the Technology Demonstrator power-couplers will be conditioned in Saclay, and the Series power-couplers will be fully conditioned in IPNO. There is no expected time issue on this end.
  - Concerning the Elliptical power-couplers, then the Saclay power-coupler test stand is available for the complete duration of the testing phase of the medium-beta and high-beta power-couplers. All power-couplers must be tested and conditioned in Saclay before being installed into the cryomodules.

ARR-16 Spoke Cryomodule Tests in Uppsala

- **Description**
  - Slide 16 Recommendations Bullet: Sub-Bullet 5 in report
  - ESS staff should be involved in the cryomodule tests at Uppsala in order to gain operating experience for later linac commissioning.
- **Response**
  - Author: Christine Darve - AD Work Package 4 (Spoke Cryomodule) Leader
  - Status: **In-Progress**
  - Uppsala cryomodule testing team is now gaining and sharing experience with IPNO. Four persons attended the SRF test campaign for the spoke cavity in order to learn and test the spoke in UU. ESS personnel is following up the testing phases in UU and acquire lessons learned from CEA and CNRS. Nuno Elias will attend the next test campaign in UU and has visited IPNO and CEA.

ARR-17 Spoke RF System Back-up plan

- **Description**
  - Slide 17 Recommendations Bullet: Sub-Bullet 1 in report
  - A decision point is needed when to apply the back up plans for the Uppsala RF system in case plan A fails.
- **Response**
  - Author: Anders Sunesson - AD Work Package 8 (RF Systems) Leader
  - Status: **Resolved**
  - The first back-up plan (Plan B), ordering a second tetrode-based power station, has already been activated. In December 2014 Uppsala University awarded a contract for a 352 MHz power station to DB Elettronica. Planned delivery end May - begin June 2015.
  - The company that won the original tender has in the meantime restarted operations and the plan is to deliver that power station end May - beg June 2015.
  - The second back-up plan (Plan C) has not yet been activated since Uppsala is on plan B. The developments that are mentioned are still being carried out by Siemens and Uppsala University. Uppsala University has also borrowed a 60 kW power source from CERN. This is already in Uppsala.

ARR-18 Spoke RF System Schedule Impact

- **Description**
  - Slide 17 Recommendations Bullet: Sub-Bullet 2 in report
  - The schedule impact for the back-up plans should be elaborated.Including realistic time for testing, debugging and commissioning the new systems, which can take several months.
- **Response**
  - Author: Anders Sunesson - AD Work Package 8 (RF Systems) Leader
  - Status: **In-Progress**
  - We know the schedule for the back-up solution that was chosen (delivery May 31 2015). To get enough test data for the serial production of power stations for the Spoke linac our in-kind partner Elettra has been kept in the loop on the contract. Elettra has proposed a schedule based on getting data from the prototype power source, and the need to fabricate a first unit based on their own design considerations (discussed with ESS Lund). This schedule is compatible with the ESS master schedule.
  - This will be clearer when data from the Uppsala contract prototypes is available, during summer 2015.

ARR-19 Spoke RF System Regulation

- **Description**
  - Slide 17 Recommendations Bullet: Sub-Bullet 3 in report
  - The parameter choice for the stability of the RF system (0.1deg,0.1%) should be documented in an ESS report.
- **Response**
  - Author: Anders Sunesson - AD Work Package 8 (RF Systems) Leader
  - Status: **In-Progress**
  - We interpret the recommendation the following way: TAC wants to know if RF believes the 0.1/0.1 requirements are feasible.
  - The actions above are planned and Beam Physics and LLRF team are planning a workshop at the end of April dedicated to the regulation issue.
  - The expected time when this is ready should be mid June 2015

ARR-20 Modulator Vendor Monitoring

- **Description**
  - Slide 20 Recommendations Bullet: Sub-Bullet 1
  - Quarterly reports and regular visits at the vendors are recommended to make sure that the 2 companies deliver in time.
- **Response**
  - Author: Carlos Martins - AD Work Package 17 (Power Systems) Leader
  - Status: **Resolved**
  - Contract #1 for 330kVA modulator (Ampegon):
    - Several meetings/communications have been held with this company since the contract has been signed:
    - Contract signed on June 26th 2014;
    - Kick off meeting held on July 4th 2014. At this meeting, it was agreed to extend the date for delivery of the Technical Design Report (TDR) to 17th October 2014. The TDR was sent to ESS for approval on this date. Minutes of the meeting available on request;
    - A TDR discussion meeting was held in Lund on 10th November 2014. The TDR was found technically not complete and not detailed enough, raising serious doubts regarding the compliance with some keypoints of the Technical Specifications. Therefore, this version of the TDR was not approved by ESS. A list of technical points to be reviewed and/or completed in the TDR was formulated. Ampegon has agreed to respond effectively to these actions and send a new TDR version to ESS for approval. Minutes of the meeting available on request;
    - A meeting was held in Turgi, Switzerland, on December 18th 2014 in order to discuss on the advancements of the new TDR preparation. Some progress has been observed and a considerable number of points had been answered effectively. However, some other critical points still remained open (type of capacitors of the main capacitor bank, lifetime

estimations of semiconductors and capacitors, regulation principle, etc.). Delivery time of the new TDR version was agreed to be end January. Minutes of the meeting available on request.

- Several communications have been made by E-mail in order to urge the company sending the new TDR for approval. Ampegon has informed that the TDR would be delivered end March 2015. The impact on the project schedule is still to be determined.

- CEA Saclay contract for 330kVA modulator demonstrator (DTI+SigmaPhi)
  - This contract has been managed by CEA Saclay partners.
  - A kick off meeting was held in Paris on 24th October 2014;
  - No more news have been given. ESS has requested for a status update in mid March 2015;
- 660kVA SML type modulator procurement
  - Different contacts have been made with several companies in order to check their interest in a future tender where the topology and many technical details of the design will be imposed.
  - Five companies have expressed their interest in participating into such an Invitation To Tender:
  - One American/French consortium;
  - Four European companies (3 have manufactured High Voltage power converters; 1 is new in the field of High Voltage but experimented with low voltage power supplies);
  - Other candidates are still under investigation.

ARR-21 Lund RF Test Stand

- **Description**
  - Slide 20 Recommendations Bullet: Sub-Bullet 2 in report
  - The vendor-contributed modulators are intended to go to Uppsala versus Lund. This is a missed opportunity for training staff at the Lund site. So called “soaked runs” for long term testing will be required before full acceptance and before making the decision of which design to pursue for manufacture. The opportunity for staff training is ideal for increasing the Lund technical staff and should not be missed. At least one modulator/RF station (if not more) should be setup in Lund.
- **Response**
  - Author: Wolfgang Hees - AD Work Package 11 (Test Stands) Leader
  - Status: **Resolved**
  - ACCSYS WP10 has been tasked by PL to install an RF Lab in Lund. This is an ongoing effort. Progress can be monitored here:
    - https://ess-ics.atlassian.net/wiki/display/ATS/RF+Lab+Lund
  - The facility is being realised in two stages:
    - Stage 1: To be located in the southern machine hall of LTH's M house, making use of the limited electrical power and installing an external atmospheric water cooler and a dedicated de-ionised water circuit. This part will be done in collaboration with LTH.
    - Stage 2: To be located in an industrial building at Scheelevägen, in the vicinity of Medicon Village, making use of the sufficiently available power and district cooling, installing a dedicated de-ionised water circuit.