Meeting Minutes

Document Number: ESS-1087593

Date: November 06, 2018

Revision: 0

State: Preliminary

---

9th SRF Collaboration Meeting @ ESS on November 06-07, 2018

Meeting Date: 06 November 2018 (and 07)

Location: ESS - Lund

Time: 09:00 – 18:00

Chairman: Paolo Pierini and Christine Darve

Secretary: Christine Darve

Attendees:

Christine Darve (ESS) - Vincent Hennion (CEA)
Nuno Elias (ESS) - Thierry Trublet (VC) - CEA
Roland Garoby (ESS) - Guillaume Olry (IPNO)
Fredrik Hankansson (ESS) - Veronique Poux (VC) - IPNO
Wolfgang Hees (ESS) - Lars Hemansson (VC) - UU
Karol Kasprzak (ESS) - Han Li - UU
Cecilia Maiano (ESS) - Rocío Santiago Kern (VC) - UU
Mats Lindroos (ESS) - Andrea Bignami (INFN)
Paolo Pierini (ESS) - Paolo Michelato - INFN
Saeid Pirani (ESS) - Laura Monaco (VC) - INFN
Felix Schlander (ESS) - Rocco Paparella (VC) - INFN
John Weisend (ESS) - Daniele Sertore (VC) - INFN
Florence Ardelier (VC) - Mike Ellis - STFC
Pierre Bosland (CEA) - Peter McIntosch - STFC
Enrico Cenni (VC) - Mark Pendleton - STFC
Christelle Cloue (CEA) - Paul Smith - STFC

Web link available at: https://confluence.esss.lu.se/pages/viewpage.action?pageId=283050131

Agenda: November 6th, SRF Collaboration Meeting

09:00-09:05  (5') Welcome Conference room
09:05-09:15  (10') Minutes of 8th SRF Collaboration Meeting
Christine Darve
09:15-09:45  (30') Status of CEA Activities on the SRF Cavities and Cryomodules
Pierre Bosland
09:45-10:05  (20') LASA - Status for Medium-beta cavity fabrication & testing and open issues
Paolo Michelato
10:05-10:25  (20') STFC - Status for High-beta cavity fabrication & testing and open issues
Mike Ellis
10:25-11:05  (40') Coffee break
11:05-11:20  (15') ESS - Overall time schedule of SRF activities and open issues
Nuno Elias
11:20-11:40  (20') UU/CEA/ESS – Results of HB cavity package RF measurement in HNOSS
Han Li
11:40-12:00  (20') IPNO - First results of the Spoke cavity series
Guillaume Olry
12:00-12:20  (20') Discussion Synergy – Testing lessons learned from Spoke and Elliptical
All
12:20-13:25  Lunch (and buffer..)
13:25-13:45  (20') ESS - SRF frequency data flow
Cecilia Maiano
13:45-14:05  (20') ESS - Criteria for Freq. acceptance/handover checks
Paolo Pierini
14:05-14:25  (20') LASA- Status of Cavity outgoing inspection, NCR - Test case of LG
Laura Monaco / Andrea Bignami
14:25-14:45  (20') CEA - Flow of doc., NCR, Change Requests, etc - Data Management
Christelle Cloue
14:45-15:05  (20') ESS - Installation Binder / IRR – an example
Fredrik Håkansson
15:05-15:25  (20') Break
Fredrik Håkansson
15:55-16:55  (60') Discussion session (Flow of Documentation, DoC, etc)

November 7th, Workshop based on 9th SRF Collaboration Meeting and ESS Visit

DoC: Documentation for declaration of conformity - Fredrik
Technical - SRF info needed for the module tests at ESS (calibration data, performances) - Karol and Cecilia
QA/QC: Documentation flow and tracking and Non-Conformity Management: set flow process - ESS
Visit of TS2 in the afternoon (starting at 13:00) - Felix

---

1(5)
Minutes

1 Welcome (R. Garoby)

Roland Garoby welcomed the guests to the 9th SRF Collaboration Meeting in ESS-Lund.

2 Minutes of 8th SRF Collaboration Meeting (C. Darve)

Most SRF action items are continuously addressed during the weekly SRF collaboration meetings, held via Vidyo conference every Fridays at 10:00 ESS/SRF Collaboration.

Minutes of the 7th SRF Collaboration Meeting (10/04/2018) and new action items were reported.

**Action 1**: ESS to decide if the M1 series medium-beta cryomodule assembly, should start before the end of the assembly of the H-ECCTD, which would permit to gain 2 week-time → closed

**Action 2**: Paolo to organize an expert meeting to collect expected frequencies → closed

**Action 3**: Plan a test case based on LASA sub-folder structure → closed

**Action 4**: STFC (Jeanne/Mark) to use INFN info. to create their database using "Iso-Tracker" → closed

**Action 5**: Re-evaluate/relax the criteria for the cavity insulating vacuum acceptable leak-rate of 1e-7 mbar.l/sec. Use the outgassing test results from MP03 → closed

**Action 6**: Add STFC and LASA as reviewers of ESS-Interface Doc., Cavity and Cryomodule → closed

**Action 7**: CEA to manufacture the flange adaptation tools/pieces for cavity in dish-washers → closed

**Action 8**: Investigate the common denominators between the Spoke and Elliptical QC process in order to simplify the ESS data management → closed

**Action 9**: Plan the possible shipment of 2 more elliptical cavities (HP01+BNL 700 MHz) → closed

**Action 10**: Fredrik to update the list of documents ESS-0190962 applicable to WP04 and WP05 → closed

3 Status of the CEA Activities and open issues (P. Bosland)

Pierre gave the preliminary test results of the re-testing of the M-ECCTD and emphasized the differences between the first and second cryomodule assembly/test; e.g. cavity string assembled under N2 atmosphere at atmospheric pressure, instead of under vacuum (for the first assy). CEA is now confident that the series cavity string can be assembled while at atmospheric pressure.

Alignment was still complex, but a better control of steps has permitted a successful assembly. More tuning and procedure modifications are foreseen for the series cryomodule assembly. Michel/CEA will send the list of tuning and procedures for alignment measurements to Fabien.

The first cool-down was started on September 14, 2018. 2 rupture disks broke and were replaced in less than one hour on Sept. 26. The root causes for the rupture of the disks have been investigated and a meeting is planned with ESS on 2018-11-13/15: Cryogenics Interface Meeting @ CEA.

The RF conditioning has been successfully processed (w/ CEA system). The LFD piezo compensation were achieved at nominal gradient. The cavity #2 in position 4 (by the bunker entrance) passed the barrier, but Field Emission was observed.

The second cooldown of the cryomodule, M-ECCTD, could not start on November 5th (rupture disk and moisture issues), but is expected that week, with 2 weeks of operation.

The High-beta prototype cavity are being prepared in RI.

The Hb cavity package high power test in Uppsala has been reported by Han Li (see below).

The series production is progressing with the first 6 pre-series power-couplers RF conditioned. The Kick-off meeting with the B&S assembly team was passed and B&S staff starts to join CEA.

**Action item**:
1. CEA to send the list of tooling and procedures to complete the alignment measurements.

4 LASA-Status for Medium-beta cavity fabrication & testing and open issues (P. Michelato)

Paolo M. summarized the status of the Mb cavities fabrication: 36 cavities were produced in one year. The Nb material has been ordered for 38 cavities. First BCP was completed end of October, and the second on Nov. 5th, 2018. Since the furnace at EZ is not operational, LASA is investigating the possibility to complete the heat treatment for the first series cavities in CERN, RI, or IPNO.
The first cavity is available at DESY for the vertical test. DESY vertical test new insert has been validated using the LASA large grain cavity and a dummy cavity. The cold test of P05 has been completed on week of Nov. 6th. Radiation measurement could be completed using PM and scintillators could be available.

The geometrical Non-Conformities (NC) on the fabricated series cavities are being investigated with EZ and will be mitigated in collaboration with CEA (recommendation) and ESS (decision).

**Action item:**
2. LASA to limit the delay in cavity production due to Zanon (EZ) furnace non-availability

5 **STFC - Status for High-beta cavity fab. & testing and open issues** (Mike Ellis)

Mike presented the progress for the high-beta Nb sheets delivery and the cavity test-stand infrastructure preparation.

The vertical test stand is now ready for operation. The LLRF has been validated using a coaxial resonator. The first cool-down has been initiated and temperatures read 7 K. Measurements are planned by the end of November, including the operation with UHV and RGA.

Series cavity production is progressing although slight 2 weeks delay, due to reshaping of the first 2 cavities. BCP pre-test planned in 4 stages, then the release on the 1st cavity etching (40’), using the 1:1:2. The throughput of 8 cavities per month is expected.

Possible issues with 1) flange size for the In high power rising; 2) Change Request by In for the installation of the antenna on the CF100 to limit leak; and 3) valve orientation for the insertion in the vertical test cryostat.

The RF power shall be limited to 150 W due to the risk of burned cable/antenna.

Data storage based on SharePoint under commissioning.

**Action item:**
3. Solve the insertion of the valve orientation in the vertical cryostat.

6 **ESS - Overall time schedule of SRF activities and open issues** (Nuno Elias)

Nuno showed the updated schedule from the 8th SRF collaboration meeting, as tracked at Bi-Weekly Fridays meeting - Activities Plan. The tracking of delays and identified issues after the 8th SRF collaboration meeting have been underlined, as alarms for our ESS master schedule.

Possible mitigations by investigating preparation/installation scenarios were presented in order to gain up to 2 months in the ESS installation schedule.

7 **UU/CEA/ESS – Results of HB cavity package RF measurement in HNOSS** (Han Li)

Han summarized the test of the prototype high-beta cavity package in the HNOSS multipurpose cryostat. The fundamental power coupler was conditioned for 10 hr versus 4 hr at CEA (with different configuration or more outgazing). NB: CEA added an additional valve to increase the pumping capacity. It reached 1 MW at 500 msec and 300 kW if more than 500 msec.

The initial cool-down rate was 1 K/min then it was raised to 7 K/min, but temperature measurements may be unreliable.

The LLRF team from Poland and Lund University performed validation tests of their equipment ability and performance. CTS estimated sensitivity of 173 kHz / mm and cavity 37 Hz / mbar .

A cavity multi-pacting barrier was observed at 10 MV/m and easily processed.

The different results for the Qext measurement and accelerating gradient still need to be understood. The gradient discrepancy is 18 MV/m to 13 MV/m using the 2 methods. CEA could plan a possible test to verify the antenna installation before disassembly the power-coupler.

**Action item:**
4. Understand the discrepancy in HNOSS measurements.
8 IPNO - First results of the Spoke cavity series (Guillaume Olry)

Guillaume presented the tracking of the frequencies during the fabrication of the series Spoke cavities at EZ and the preparation of the first 4 double spoke cavities at IPNO vertical pit. For instance, frequency shifts of 48 and 140 kHz were estimated during the pumping and the TIG welding, respectively. The expected sum of frequency shift, is estimated to -265 kHz during cavity fabrication, up to -110 kHz (BCP), and -25 kHz during heat treatment.

29 double spoke cavities are under fabrication at EZ.

The installation of the Spoke valve box for Uppsala test stand has beginning in week 40. The valve box will be validated separately by installing a LHe tank end cap on the jumper connection.

9 ESS - SRF frequency data flow (Cecilia Maiano)

Cecilia summarized the different frequency data flow and expected frequencies shift for the elliptical cavities. The inspection criteria and the definition of the frequency measurements were described for the 18 different steps for each cavity.

The document, ESS-0343220, “Frequency acceptance and handover criteria for the elliptical cavities”, was discussed. The measurement method reference permitted to track 2 bad measurements. Automatic measurement should be preferred.

10 ESS - Criteria for Freq. acceptance/handover checks (Paolo Pierini)

Paolo described the need for a frequency acceptance strategy, and frequency acceptance flow. No show-stopper would be set by ESS, but all non-conformities on the frequency should be tracked. An acceptance range is to be defined after the first 6 cavities are produced. The mean square error (MSE) is proposed to be capped to 10 kHz by LASA.

The modification of company fabrication sequences, based on the reported NC, should be followed-up in an effective and fast way.

11 LASA - Status of Cavity outgoing inspection, NCR - Test case of LG (Andrea Bignami)

Andrea described the outgoing inspection for the first series medium-beta cavities, M001 and M002. He described also the flow of NCR. One half cell had to be rejected because it was misprinted.

This work has been supported by the Brightness effort, from EZ, LASA. Then, NC are stored on Alfresco. Different levels are available from Al1 (cavity fabrication) till Al5 (cavity accepted to string assembly).

Laura suggested that the data shall be transferred while the cavities are in DESY, i.e. Al3. NB that the expected test using data from the large grain cavity, could not be completed (SFR8 Action item# 3), because of the complexity of the file structure. We will implement directly the expected document for the series cryomodules. The installation structure should be copied/paste to our CHESS structure.

12 CEA - Flow of documentation, NCR, Change Requests, etc - Data Management (Christelle Cloue)

Christelle summarized the flow of documentation from level 1 to level 3. The impact shall be assessed at every level and mitigation decided by ESS for level 3. 92 change requests have been recorded in the CEA register so far, including 70 of them that are closed. 5 rework were possible.

Level 3 infers actions implemented after CEA and ESS approval, hence preventive and corrective actions shall be decided and implemented by ESS. Example from XFEL are based on the vacuum level, transportation, frequency measurement and shock loggers.

A template of the NC was developed based on the ESS template and shared to our SRF collaboration team.
13 **ESS - Installation Binder / IRR – an example** (Felix Schlander)

Felix listed the different documents that are expected to compose the Installation binder. There are not so many documents needed and no show-stoppers were identified. In-Kind partners are now informed on what they should provide.

14 **ESS - Cryomodule and Cavity Documentation - Declaration of conformity recall** (Fredrik Hakansson)

Fredrik presented the list of documentation needed for the ESS installation, commissioning, declaration of conformity/legislation. He introduced the step-by-step approach to compliance.

The ESS data management, permit a versatility and flexibility. The example of the documentation requested from the IK serves an example.

**November 7th, SRF Workshop based the 9th SRF Collaboration meeting presentations**

15 **DoC: Documentation for declaration of conformity - Fredrik – Paolo Michelato**

The CE marking and Declaration of Conformity (DoC) have been put on-hold at ESS, due to the lack of personnel to support materials preparation. Those activities and standards shall be provided “on a voluntary basis”. Planned preventive maintenance shall be addressed and listed.

In the framework of our SRF Collaboration, we will prepare all documents that we consider relevant for a possible need of DoC. E.g. Risk assessment shall be provided.

Few components have been identified with the support of a new ESS consultant (Maurice Looft) to comply with, e.g.:

- Machine directory: what could happen if piezo charged during transportation → mitigation: install a capacitance to prevent arcing to users;
- Bias system uses up to 10 kV → mitigation show on design that PEEK materials provides a proper insulation and electrical connector are CE marked.
- Use of helium guard or welded connection to prevent contamination of sub-atmospheric cryogenic circuits.

In addition, a specific meeting between IPNO & ESS was held on 181105 – MoM Fredrik Hakansson:

1. Prepare technical differences between prototype and series – by Guillaume
2. Establish: Technical File, Marking-, PMA and DoC template – by ESS
3. Check if current risk analysis is sufficient or need to be updated – by ESS
4. Explain EMC, ROHS and CLP directive further regarding implementation – by ESS
5. Prepare pre-inspection in Uppsala – By ESS
6. Decide language on documents outside the Technical File. In the TF French is ok but for other docs not used in operation ESS will check if this need to be in English or French is ok by ESS

16 **Technical - SRF info needed for the module tests at ESS (calibration data, performances) – Cecilia, Karol and Paolo**

The second group gathered technical personnel to discuss the frequency criteria and the tracking.

17 **QA/QC: Documentation flow and tracking and Non-Conformity Management: set flow process – ESS**

Description and examples of application were discussed between the In-Kind partners.

18 **Visit of TS2 in the afternoon (starting at 1300) - Felix**

The persons interested by the ESS visit have tour the installation, which is now