

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 Hermansson (VC)	UU
Karol Kasprzak	ESS	Han Li	UU
Cecilia Maiano	ESS	Rocio 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)	CEA	Mike Ellis	STFC
Pierre Bosland	CEA	Peter McIntosh	STFC
Enrico Cenni (VC)	CEA	Mark Pendleton	STFC
Christelle Cloué	CEA	Paul Smith	STFC
		Alan Wheelhouse	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 8h 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 Cloué
14:45-15:05 (20')	ESS - Installation Binder / IRR – an example	
15:05-15:25 (20')	Break	
15:25-15:55 (20')	ESS – Cryomodule and Cavity Documentation – Declaration of conformity	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

Minutes

1 Welcome (R. Garoby)

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

2 Minutes of 8h 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 (Pierre 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 tooling and procedure modifications are foreseen for the series cryomodule assembly. Michel/CEA will send the list of tooling 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 RI high power rising; 2) Change Request by RI 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 BCP process temperature varies between 8 and 18 degrees, with a rate of ~0.4 um / min. The heat treatment plateaux are 300 C, 500C and 650C.

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 AI1 (cavity fabrication) till AI5 (cavity accepted to string assembly).

Laura suggested that the data shall be transferred while the cavities are in DESY, i.e. AI3. 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 a examples.

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 hold 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 habe tour the installation, which s now