

Minures of CERN-LNL-STFC kickoff meeting.

SRF cavity technology for the FCC

CERN, 23th June 2015

CERN: Sarah Aull, Michael Benedikt, Rama Calaga, Sergio Calatroni, Paolo Chiggiato, Gilles Favre, José Miguel Jimenez, Guillaume Rosaz, Karl Schirm, Alban Sublet, Mauro Taborelli, Giovanna Vandoni, Walter Venturini Delsolaro.

ASTeC, STFC Daresbury: Philippe Goudket, Joseph Herbert, Reza Valizadeh.

INFN - LNL: Daniel Franco, Vincenzo Palmieri, Vlada Pastushenko, Cristian Pira, Hanna Skliarova.

Goal of the meeting

The meeting started with a review of the purpose of the Collaboration Agreement, this defining the scope of the present meeting:

- Review the capabilities of the Laboratories within the needs of this Collaboration
- Define a consistent set of milestones and deliverables within a credible and agreed planning
- Discuss the monitoring process

The agenda of the day is as follows. All presentations are available through the Indico web site <https://indico.cern.ch/event/403142/>.

The screenshot shows the Indico event page for the "CERN-LNL-STFC collaboration kickoff meeting". The event is chaired by Sergio Calatroni (CERN) and is scheduled for Tuesday, 23 June 2015, from 09:30 to 18:00 (Europe/Zurich) at CERN (112-R-028). The description indicates meeting rooms for morning (112/R-028) and afternoon (112/R-034) sessions, with an agenda material link. The agenda for Tuesday, 23 June 2015, includes the following items:

- 09:30 - 10:00: Welcome coffee
- 10:00 - 10:10: Welcome 10' (Speaker: Jose Miguel Jimenez (CERN))
- 10:10 - 10:30: Introduction to the FCC Project and scope of the Collaboration 20' (Speaker: Michael Benedikt (CERN); Material: Slides)
- 10:30 - 12:30: Capabilities and infrastructures related to SRF and to the FCC collaboration
- 10:30: LNL presentation 30' (Speaker: Mr. Vincenzo Palmieri (LNL); Material: Slides)
- 11:00: STFC presentation 30' (Speaker: Reza Valizadeh (STFC); Material: Slides)
- 11:30: SRF facilities at CERN 15' (Speaker: Karl-Martin Schirm (CERN); Material: Slides)
- 11:45: Thin films and SRF at CERN 15' (Speaker: Alban Rene Maurice Sublet (CERN); Material: Slides)
- 12:00: Discussion 30' (Speaker: Sergio Calatroni (CERN); Material: list of actions)
- 12:30 - 13:30: Lunch (Restaurant No.2 (build. 504))
- 13:30 - 15:00: Visit to the SRF and thin films facilities (Location: SM18 and build. 252)
- 15:00 - 15:30: Coffee break (112-R-034)
- 15:30 - 17:30: Discussions (Focus on drafting a detailed planning of the collaboration, duly specifying milestones and deliverables; Convener: Sergio Calatroni (CERN); Location: 112-R-034)

Summary of the discussion

The discussion focused on a critical review of the scope of the work and the tests and actions as detailed in the Agreement and its Annex (available to the different Parties), to which reference is made here. The main points are mentioned in the following, divided according to the four main project lines: 800 MHz 5-cell cavities, 400 MHz single-cell cavities, 6 GHz cavities and 3D coating system in STFC.

800 MHz 5-cell cavities

RF design and specification drawing should be done by CERN, including evaluation of mechanical stability to define the minimum wall thickness. V. Palmieri underlines that he needs an approved drawing before starting the design of the tooling for production, according to the chosen fabrication technology (spinning from tube or blank, back-extrusion of tube or rolling-welding, etc.). It is suggested that the cut-offs should be without port for ancillaries. CERN will take care of welding of brazed flanges.

CERN will provide the drawing within two months (M8) leaving 10 months for the fabrication of the tooling (D4). V. Palmieri confirms that this delay is feasible.

CERN will provide raw material in adequate quality, quantity and form for the fabrication of production cavities according to LNL needs through a framework contract, for which there is considerable experience (K. Schirm). It is agreed that first fabrication tests in INFN may be done with Cu material supplied by INFN and not up to full specifications.

The goal is to have one 800MHz cavity coated and tested by the end of the Collaboration.

400 MHz single-cell cavities

The study will be for mono-cell, but scalability to multi-cell for real machines must be taken into account. CERN will provide to LNL the design of the LHC cavities to be used as a model for the feasibility study of seamless cavities. V. Palmieri mentions that LNL will explore a broad range of technologies including spinning, starting from tubes manufactured in different ways, and electroforming.

6 GHz studies

LNL proposes to focus at the beginning on the study of the parameters which might influence adhesion at the interface Nb/Cu through interlayers, deposition temperature, thermal cycling. P. Chiggiato insists that all studies should consider parameters which are scalable to 800MHz cavities.

Cu-OFE for manufacturing further 6GHz cavities should be supplied by CERN upon request of LNL, as local suppliers do not provide certified material. Copper sheet, with material certificate, in 2mm or 3mm thickness, is available from the CERN store.

RF characterisation will be done in LNL.

Sample characterization at ASTeC may be made by SEM+EBSD, TEM, XPS+Auger, SIMS, AFM, XRD, ... W. Venturini stressed the importance to characterize flux penetration. ASTeC may rely upon external

partners for this and other techniques which might not be available in-house, or consider acquisition.

STFC will deliver a basic report of test results with each sample. At each annual project meeting STFC will then deliver a more comprehensive Milestone report of the analysis carried out during the previous year

From a comment of Paolo Chiggiato, to avoid undue future proliferation of tests, LNL shall initiate a proposal for a table of characterization tests as well as the expected information. The proposal shall be circulated amongst the 3 partners, completed and approved.

3D Nb/Cu coating system in STFC

STFC would like to focus of the development and commissioning of a Nb/Cu coating system for 6 GHz cavities, including surface preparation. It is asked that STFC express in detail their plans and deliverables for this purpose. Their document will be joined to this minutes and will become an integral part of the collaboration upon approval.

Planning

The remarks made above are integrated into the annex planning, which include the relevant Milestones and Deliverables.

Documentation

Several remarks have been done on naming and traceability of the samples sent for analyses, and their follow-up. CERN will prepare an MTF-based (or similar) follow-up protocol for documentation.

Intellectual Property

The chapter of the Agreement on Intellectual Property is read entirely.

Communication and monitoring.

Direct communication among the different Parties, Partners and People is encouraged, in parallel with communication via the formal contact persons. A sharepoint or similar tool will be set up by CERN in order to trace and share all communication.

It has been decided, in accordance with the Collaboration agreement, to held monitoring meeting once a year in rotation in the different partner Laboratories. The Monitoring Committee is constituted by M. Benedikt, V. Palmieri, P. McIntosh

AOB

LNL warns that the Collaboration Agreement is not yet signed and thus they cannot officially hire or employ people to work on this. The starting date of this Collaboration is anyhow tentatively fixed for the 1.7.2015 for three years, and will be shifted accordingly in case there is major delay for the official signatures. CERN will make sure the signatures happen swiftly.

Actions

CERN

Launch a framework contract for the delivery of certified Cu-OFE up to a maximal value.

Supply Cu-OFE in 2mm or 3mm sheet to LNL for 6GHz cavities manufacturing.

Delivery of approved drawing of 800 MHz cavity to LNL (M8). **Deadline: 31.8.2015**

Work out a plan for production and testing follow-up and circulate. **Deadline: 31.8.2015**

Setup a tool for sharing of communication. **Deadline: 31.8.2015**

Ensure quick signature of Contract documents. **Deadline: 1.7.2015**

LNL

Provide a testing program, with relevant parameters, techniques, procedures, for 6GHz cavities, to circulate. **Deadline: 1.8.2015**

Provide a request for size, quantity and thickness, of certified Cu-OFE for 6GHz cavities, to CERN.
Deadline: 1.8.2015

ASTeC

Prepare a summary description of what the deliverables would be under 3D Nb/Cu Coating System.
Deadline: 3.7.2015

Annex: planning chart

		2015				2016				2017				2018				2019																																																															
		Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4	Q1	Q2	Q3	Q4																																																												
LNL	6 GHz cavities test of units 1 to 15			M1		D1				M2	D2																																																																						
	6 GHz cavities test of units 16 to 28																																																																																
	6 GHz cavities test of units 29 to 32											M3	D3																																																																				
	800 MHz cavities: toolings for production				D4																																																																												
	800 MHz cavities: production of first cavity								D5																																																																								
	800 MHz cavities: production of cavities 2 to 4												D6																																																																				
	400 MHz cavity seamless fabrication feasibility study: engineering									M4																																																																							
	400 MHz cavity seamless fabrication feasibility study: validation & cost												D7																																																																				
STFC	Samples analyses for 6 GHz cavity studies					M5				M6				M7																																																																			
	Samples analyses for 800 MHz cavity studies													M7																																																																			
	Development of 3D Nb/Cu coating: design & procurement									D8																																																																							
	Development of 3D Nb/Cu coating: construction and commissioning															D9																																																																	
CERN	Specification drawing for 800 MHz cavities		M8																																																																														
	Supply Cu OFE sheets for cavity manufacturing								D10																																																																								
	Design & manufacturing of surface treatments bench											D11																																																																					
	Design & manufacturing of coating bench											D12																																																																					
	Design & manufacturing of RF test bench											D13																																																																					
	Coating + RF test of first cavity																D14																																																																
	Specification drawing for 400 MHz LHC-type cavity			M9																																																																													
Milestones	Title	Responsible																				Contractual date																				Agreed date																				<div style="display: flex; justify-content: space-between; font-size: 8px;"> 6 GHz 800 MHz 400 MHz 3D Nb/Cu </div>																			
M1	Interim report 1 on 6 GHz cavity studies	LNL																				Q2																																																											
M2	Interim report 2 on 6 GHz cavity studies	LNL																				Q6																																																											
M3	Interim report 3 on 6 GHz cavity studies	LNL																				Q10																																																											
M4	Interim report on 400 MHz cavity fabrication studies	LNL																				Q8																																																											
M5	Annual report on sample analyses	STFC																				Q4																																																											
M6	Annual report on sample analyses	STFC																				Q8																																																											
M7	Annual report on sample analyses	STFC																				Q12																																																											
M8	Specification drawing for 800 MHz cavity	CERN																				Q1																				31.8.2015																																							
M9	Specification drawing for 400 MHz cavity	CERN																				Q1																				30.9.2015																																							
Deliverables	Title	Responsible																				Contractual date																				Agreed date																																							
D1	Yearly status report on 6 GHz cavity studies	LNL																				Q4																																																											
D2	Yearly status report on 6 GHz cavity studies	LNL																				Q8																																																											
D3	Yearly status report on 6 GHz cavity studies	LNL																				Q12																																																											
D4	Production of tooling for 800 MHz cavity fabrication	LNL																				Q4																																																											
D5	Fabrication of first cavity	LNL																				Q8																																																											
D6	Fabrication of remaining cavities	LNL																				Q12																																																											
D7	Final report on 400 MHz seamless fabrication feasibility	LNL																				Q12																																																											
D8	Engineering design of coating bench	STFC																				Q8																																																											
D9	Production of first coated cavity	STFC																				Q12																																																											
D10	Cu OFE supply to LNL for manufacturing of 4 cavities	CERN																				Q6																																																											
D11	Completion of surface treatments bench	CERN																				Q8																																																											
D12	Completion of coating bench	CERN																				Q8																																																											
D13	Completion of RF test bench	CERN																				Q8																																																											
D14	Coating of first cavity prototype	CERN																				Q12																																																											