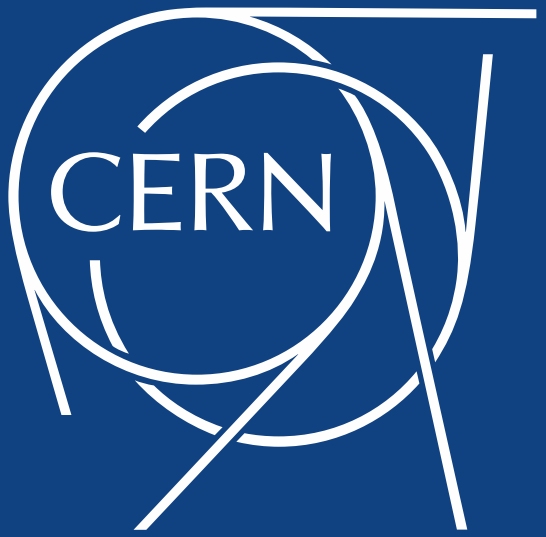
CERN

Kickoff Collaboration Meeting CERN-LNL-STFC: SRF cavity technology for the FCC

Scope of the meeting

CONSIDERING THAT:

- CERN is interested in promoting the application of the Nb/Cu sputter coating technology for future accelerator projects such as the proposed Future Circular Collider;

- INFN, for the purpose of its contribution to the collaboration contemplated by this Agreement represented by INFN-LNL, has the expertise required to further develop the Nb/Cu sputter coating technology and to manufacture seamless accelerator cavities;

- STFC is interested in acquiring Nb/Cu sputter coating know-how and to develop its analysis capabilities related to thin superconducting films,

THE PARTIES HAVE AGREED AS FOLLOWS:

ARTICLE 1
Purpose

1.1 The purpose of this Agreement is to establish a framework for scientific collaboration in Superconducting RF cavities technology, with such collaboration having as its aim to combine expertise to achieve scientific goals and to develop common specialised knowledge. Each Party shall use the results of the collaboration for peaceful purposes only.

Scope of the meeting

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

Agenda

https://indico.cern.ch/event/403142/

CERN-LNL-STFC collaboration kickoff meeting

chaired by Sergio Calatroni (CERN)

Tuesday, 23 June 2015 from **09:30** to **18:00** (Europe/Zurich)

CERN (112-R-028)

Manage

Description Meeting rooms:
morning 112/R-028
afternoon 112/R-034

Tuesday, 23 June 2015

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'*
- 11:00 **STFC presentation** *30'*
- 11:30 **SRF facilities at CERN** *15'*
  Speaker: Karl-Martin Schirm (CERN)
- 11:45 **Thin films and SRF at CERN** *15'*
  Speaker: Alban Rene Maurice Sublet (CERN)
- 12:00 **Discussion** *30'*

12:30 - 13:30 Lunch (Restaurant No.2 (build. 504)) → Tickets provided for visitors

13:30 - 15:00 Visit to the SRF and thin films facilities
Location: SM18 and build. 252 → Travel by car

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.
Location: 112-R-034

ARTICLE 2
Collaboration

2.1 It is intended that CERN's contribution to the collaboration shall include:

a) RF design of the 5-cell 800 MHz cavities.
b) The supply of the High Purity OFHC Copper material required for the cavity forming in the size required by INFN.
c) Development, commissioning and operation of the full infrastructure for the niobium sputter coating of 5-cell 800 MHz copper cavities: surface processing, coating bench and RF test facility as described in more detail in Annex 1.
d) A financial contribution as set out in Annex 2.

2.2 It is intended that INFN's contribution to the collaboration shall include:

a) The fabrication of four seamless 800 MHz 5-cell copper cavities, as described in more detail in Annex 1.
b) The development of surface processing and coating techniques on seamless 6 GHz cavities, in view of a possible application to 800 MHz cavities, as described in more detail in Annex 1.
c) For the achievement of these goals, INFN will be free to subcontract part of the work to Consorzio Futuro in Ricerca (CFR). CFR has been traditionally collaborating for years with INFN, through the support and coordination of students, scientific fellows, young researchers and foreign experts, that have contributed to the performance of R&D on superconducting cavities, in the framework of a Master Programme called "Surface Treatments for Industrial Applications" promoted by INFN and the University of Padua.

2.3 It is intended that STFC's contribution to the collaboration shall include:

Microscopic and surface characterization of samples produced by the other parties, representing either routine or innovative surface preparation processes or coating as described in more detail in Annex 1.

Scope of work: CERN

Tests, actions (CERN)

RF Design of 5-cell 800 MHz superconducting cavities.

Development of the full infrastructure for the niobium sputter-coating of 5-cell 800 MHz copper cavities:

a) The design, manufacturing and operation of a surface processing bench for the chemical and/or electropolishing of 5-cell 800 MHz copper cavities prior to coating.
b) The design, manufacturing and operation of a coating bench for such cavities, based on current the state of the art for magnetron niobium coatings of elliptical cavities.
c) The design, manufacturing and operation of a cryogenic RF test bench for such cavities.

To these purposes CERN will execute all relevant studies, material procurement and analyses, prototyping and tests as seen fit for the purpose.

Scope of work: LNL

Tests, actions (INFN)

a) The fabrication of 4 seamless 800 MHz 5-cell copper cavities.
b) The development of surface processing and coating techniques on seamless 6 GHz cavities, in view of a possible application to 800 MHz cavities, including: the role of the microstructure of niobium at the interface between copper and niobium, the effect of the high deposition temperatures on SRF properties of niobium, the study of improved deposition magnetron sources for the niobium deposition, and the study of thermal boundary resistance between copper and liquid helium.
c) INFN will also investigate the possible application of either spinning, back-extrusion or alternative seamless fabrication techniques for the production of a single-cell 400 MHz cavity. For these initial investigations the technical drawings of the LHC 400 MHz cavity will be provided by CERN. In collaboration with CERN an optimisation of the cavity design (HOM coupler, FPC, etc.) will be considered. These investigations should be summarised in a feasibility report including first estimates of tooling cost and providing the basis for prototyping activities

To the purpose of a), CERN will provide INFN with the cavity RF design and all relevant raw material needed for the manufacturing of prototypes and of production cavities.

To the purpose of b), CRF will carry out at least 32 coatings and RF characterisations on 6 GHz copper cavities. INFN will provide every six months a written report on its advances.

Scope of work: STFC

Tests, actions (STFC)

a) Microscopic and surface characterization of samples produced by the other parties, representing either routine or innovative surface preparation processes or coating.
b) Development of in-house 3D Nb/Cu coating capabilities.

To the purpose of a) CERN and INFN will provide STFC with test samples, in quantities (not greater than 40 samples) and at intervals to be mutually agreed case by case, for analyses aimed at confirming and complementing in-house analyses. These analyses will include at least: SEM, XPS, XRF, TEM, XRD, and AFM.

To the purpose of b) INFN and CERN will as well assist STFC in setting up their coating bench by verifying engineering drawings and procedures, and by onsite assistance if requested and upon mutual agreement.

Draft planning

		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
LHC	Operation/ Long Shutdown																	LS2			
Injectors	Operation/ Long Shutdown																				
LNL	6 GHz cavities test of units 1 to 15				M1		D1														
	6 GHz cavities test of units 16 to 28							M2			D2										
	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	RF design for 800 MHz cavities			M8																	
	Engineering design for 800 MHz cavities				M9																
	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 of first cavity														D14						

6 GHz
800 MHz
400 MHz
3D Nb/Cu

Milestones & Deliverables

Milestones	Title	Responsible	
M1	Interim report 1 on 6 GHz cavity studies	LNL	
M2	Interim report 2 on 6 GHz cavity studies	LNL	
M3	Interim report 3 on 6 GHz cavity studies	LNL	
M4	Report on 400 MHz cavity fabrication studies: interim	LNL	
M5	Annual report on sample analyses	STFC	
M6	Annual report on sample analyses	STFC	
M7	Annual report on sample analyses	STFC	
M8	Report on 800 MHz RF design	CERN	
M9	Report on 800 MHz engineering design	CERN	
Deliverables	**Title**	**Responsible**	
D1	Yearly status report on 6 GHz cavity studies	LNL	
D2	Yearly status report on 6 GHz cavity studies	LNL	
D3	Yearly status report on 6 GHz cavity studies	LNL	
D4	Production of tooling for 800 MHz cavity fabrication	LNL	
D5	Fabrication of first cavity	LNL	
D6	Fabrication of remaining cavities	LNL	
D7	Final report on 400 MHZ seamless fabrication feasibility	LNL	
D8	Engineering design of coating bench	STFC	
D9	Production of first coated cavity	STFC	
D10	Cu OFE supply to LNL for manufacturing of 4 cavities	CERN	
D11	Completion of surface treatments bench	CERN	
D12	Completion of coating bench	CERN	
D13	Completion of RF test bench	CERN	
D14	Coating of first cavity prototype	CERN	

Monitoring process

- Contractual committee:
  - Michael Benedikt – CERN
  - Enzo Palmieri – INFN-LNL
  - Peter McIntosh – ASTeC
- Review at least once a year (in person)

AOB

- Define technical linkperson for each Lab.
- Regular / on demand Internet meetings.