Advanced surface coating techniques for superconducting radiofrequency cavities

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ESR 10  
Supervisor: Cristian Pira  
FCC Week / Amsterdam, 9-13 April 2018
Outline

Motivation
Objective
Work Plan
Status
Challenges and risks
Objectives

Work Plan

Status

Challenges and risks

Motivation

Theoretical limit!

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Why Nb/Cu cavities?

Motivation

Objectives
- High $Q_0$
- Thermal stability
- Insensibility of Earth’s magnetic field
- Cost reduction

Work Plan

Status

Challenges and risks

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Q-slope problem

\[ Q_0 = \frac{\omega_0 U}{P_d} \]

\( Q_0 \) = Quality factor
\( \omega_0 \) = Resonant frequency
\( U \) = Stored energy
\( P_d \) = Dissipated power

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• Develop a novel coating technique for Niobium coated Copper cavities

• Derive correlations of radiofrequency performances of film cavities to the parameters of the sputtering process.

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**Objectives**

- **Nb thin film**
- **Nb thick film**

**Palmieri-Vaglio Model:** thermal boundary resistance

**Palmieri et al.**
*The way of thick films toward a flat Q-curve in sputtered cavities*

*18th International Conference on RF Superconductivity*

**Tuesday talk:** Cristian Pira
*Coating studies on 6 GHz seamless cavities*

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**FCC Week**
Amsterdam 9-13 April 2018
**Nb Thick Films on 6 GHz cavities**

**Objectives**

- Increase rf performances
- Increase reproducibility
- Derive a correlation between RF performances and deposition parameters

**Work Plan**

**Status**

**Motivation**

**Challenges and risks**

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Working on the existing protocol

**Objectives**

- Cavity Fabrication
- Mechanical Finishing
- Chemical Polishing
- PVD process
- RF Characterization

**Work Plan**

- Collaboration with I-Cube (ESR-09)
- Improve spinning process
- Insert 6 GHz tumbling
- Study effects of different sputtering parameters
- Collaboration with CERN (ESR-01) and HZB (ESR-08)

**Status**

- Motivation
- Challenges and risks

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Objectives

- Learning phase (...)
- Familiarity with existing protocol

Work Plan

- Organizing database

Status

Motivation

Objectives

Work Plan

Challenges and risks

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Objectives

Work Plan

Status

Challenges and risks

Availability of partners

Team schedule

Laboratory re-organization

Motivation

Availability of partners

Team schedule

Laboratory re-organization

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Vincenzo Palmieri
Thank you!