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RF Characterization Techniques of 1.3 GHz Cavities

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Among the bases that substantiate the feasibility of the FCC, the RF characterization of scaled versions of accelerating cavities becomes one of the major milestones within the project timeline. In particular, niobium thin film cavity deposition is regarded as the main alternative to the bulk (for example, this is the technology used in the HIE-ISOLDE QWRs at CERN), leveraging the heat transfer efficiency of copper as substrate, among many other advantages of this technology. Keeping that in mind, the R&D procedure for the coating optimization may be summarized as follows: (i) as first step, the evaluation of the sputtered niobium on copper flat samples is carried out by using a quadrupole resonator (QPR). The QPR allows for a controlled test of the thermally isolated sample exposed to RF fields. This test is based on a precise calorimetric compensation applied to a relatively simple geometry so that the possible uncertainties during both the sample manufacturing and testing are greatly reduced; (ii) then, the recipe used for the sample preparation is repeated to produce the coated cavities; and (iii) in order to push the cavity performance and overcome the mid- and high-field Q-slope, the current strategy attempts to optimize the substrate for the film deposition. In this sense, two different prototypes of seamless substrates: one made of copper electroformed on a mandrel and another one machined from the bulk; are successively tested at the *cryolab* to master the preparation technique. In parallel, a thermal mapping system for coated cavities, based on contact thermometry, is under development to pinpoint the mechanisms responsible of performance degradation.

Primary authors: BIANCHI, Antonio (CERN); VEGA CID, Lorena (CERN); VIDAL GARCIA, Pablo (Centro de Investigaciones Energéti cas Medioambientales y Tecno); VENTURINI DELSOLARO, Walter (CERN)

Presenter: VIDAL GARCIA, Pablo (Centro de Investigaciones Energéti cas Medioambientales y Tecno)

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