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A Hybrid REBaCuO-Cu Coating for the FCC-hh Beam Screen

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Inside the vacuum chamber of the FCC-hh, image currents will be induced in the beam screen due to its proximity to the particle beam. To ensure a stable beam trajectory, it is important that the surrounding material has very low surface resistance and that the magnetic field homogeneity is maintained in the central region of the vacuum chamber. To achieve this, our consortium explores the possibility of coating the beam screen with a highly conductive hybrid coating, made of alternating longitudinal segments of REBaCuO (RE = Rare Earth) and copper.
In this work, we use finite elements numerical analysis and a simulation model that accounts for superconducting properties of commercially available coated conductors to evaluate the field quality at the centre of the hybrid-coated vacuum chamber. We find a broad set of possible coating geometries that fulfil the field quality criterion, introducing field harmonics of the order of one unit or below, with or without an external correction of the dipole field. Samples of the hybrid coating are produced based on the geometries predicted by our model, showing lower than Cu surface resistance at close conditions to those found in the FCC-hh, confirming that this method can successfully generate a coating that complies with both field quality and surface resistance criteria. Finally, we analyse how field harmonics are affected by a misalignment of the beam screen.

Primary authors: TELLES, Guilherme; ROMANOV, Artur; LAMAS, Neil; KRKOTIC, Patrick; O'CALLAGHAN CASTELLA, Juan Manuel; PONT, Montse; CALATRONI, Sergio (CERN); PUIG, teresa (CSIC); GRANADOS, Xavier (ICMAB-CSIC); GUTIERREZ ROYO, Joffre (ICMAB - CSIC)

Presenter: TELLES, Guilherme

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