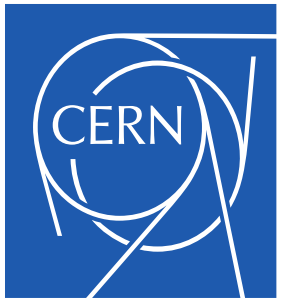
“HIGHEST”
High-Temperature High-Gradient Superconductors



2024 – 02 – 31 Bellaterra

Agenda for today

- **9:30 AM → 9:50 AM Welcome and introduction**
  Speaker: Dr Joffre Gutierrez Royo (ICMAB - CSIC)
- **9:50 AM → 10:10 AM Status of experiments at SLAC and new ideas**
  Speaker: Jessica Golm (CERN)
- **10:10 AM → 10:30 AM Discussion on next steps of the collaboration**
- **10:30 AM → 11:30 AM Laboratory visit**
- **13:00 → 14:30 Lunch**
- **15:00 → 16:00 REBCO Coatings for High-Gradient RF Applications**
  Speaker: Sergio Calatroni (CERN)

Outline

1 – Quick project overview

2 – D-Nano 40 mm-wide CC tape “batch #1” initial results

3 – Possibility of measuring high-RF powers in CCs lab samples

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HIGHEST Background and aim

Sustainability of particle accelerators will benefit from a wider use of HTS technology.

- High-Temperature Superconductors (HTS) can fill the operating window between normal conducting RF and traditional low-temperature superconducting RF for high power applications
- Investment in RF hardware and operational energy costs could be lowered in comparison to present-day technologies by operating at liquid-nitrogen temperature

We have already demonstrated:

- Successfully applying 2D HTS tapes in 3D geometries
- Measuring a higher quality factor of these HTS coated RF cavities at low power

Aim:

- We aim at demonstrating that HTS can be used for high power RF applications
- We want to develop and optimize a 3D coating technology and demonstrate its scalability to make practical RF high power devices

WP3 plan and risk mitigation

WP3 (CSIC-ICMAB)					
2D coating on discs and segmented cavities for benchmarking			D1		
Measurement of superconducting properties of 3D HTS coatings					D2
SLAC supporting partner					
RF high power characterization of 3D coated HTS discs in their mushroom cavity					

Risk	**Mitigation**
Segmented test cavity delayed	HTS optimization studies to be performed with older “RADES” cavities
Quality of 3D coatings on discs	Measurement of superconducting (non-RF) properties at ICMAB will help in optimization work
High power characterization at SLAC delayed	Preliminary low-power characterization is possible with standard laboratory devices

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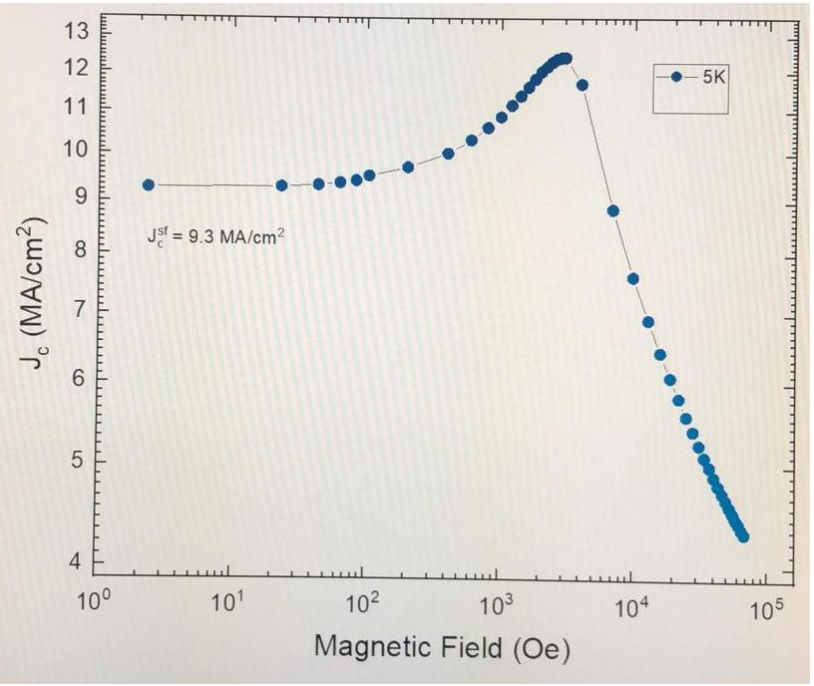
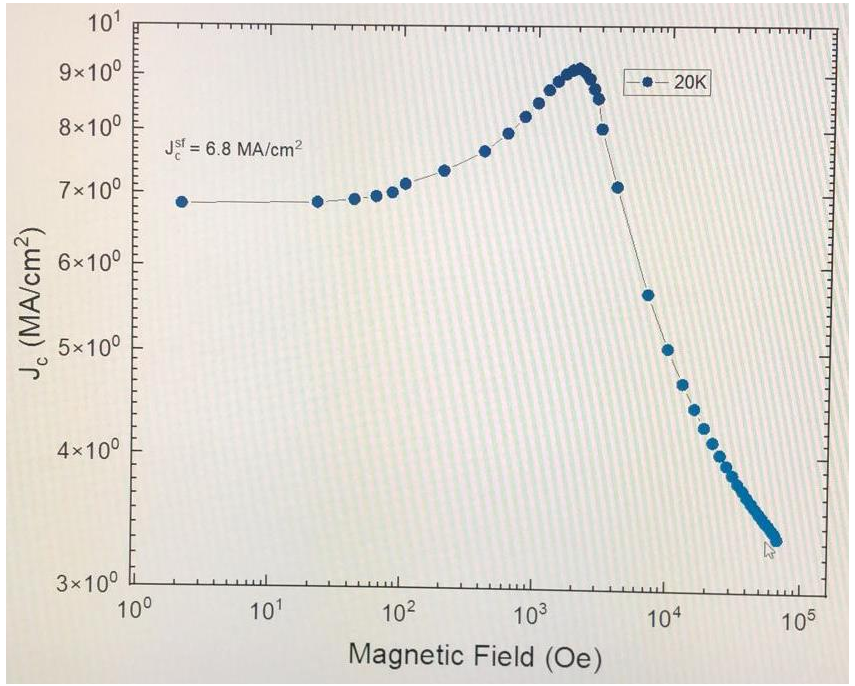
3D HTS coatings will benefit from having wider tapes





40mm-wide D-Nano tape from batch #1 shows rather low J_c values

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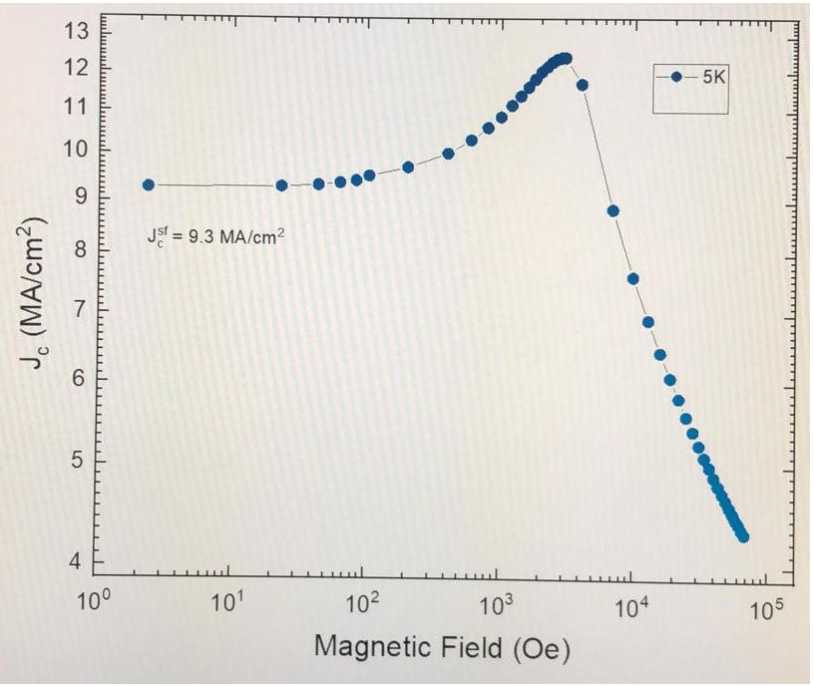

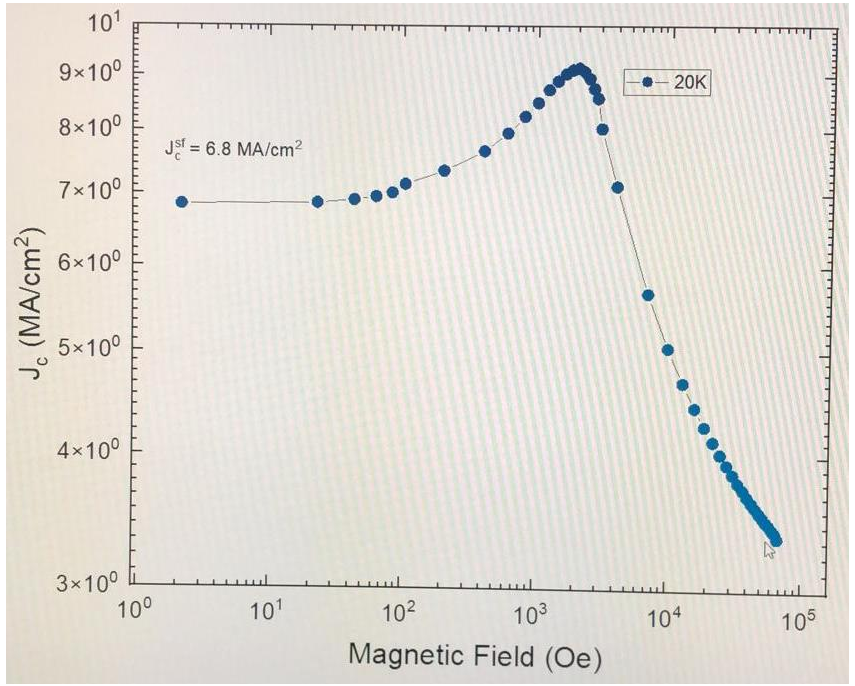

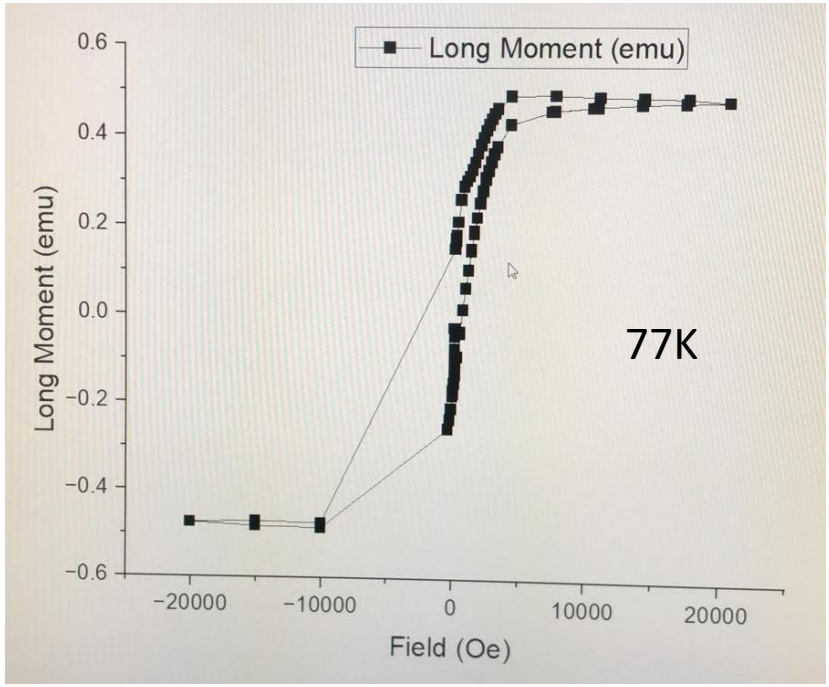

Main signal coming from the RABiTS substrate

40mm-wide D-Nano tape from batch #1 shows rather low J_c values, particularly at liquid nitrogen temperatures.

Z_s characterization remains to be performed

Karlsruher Institut für Technologie

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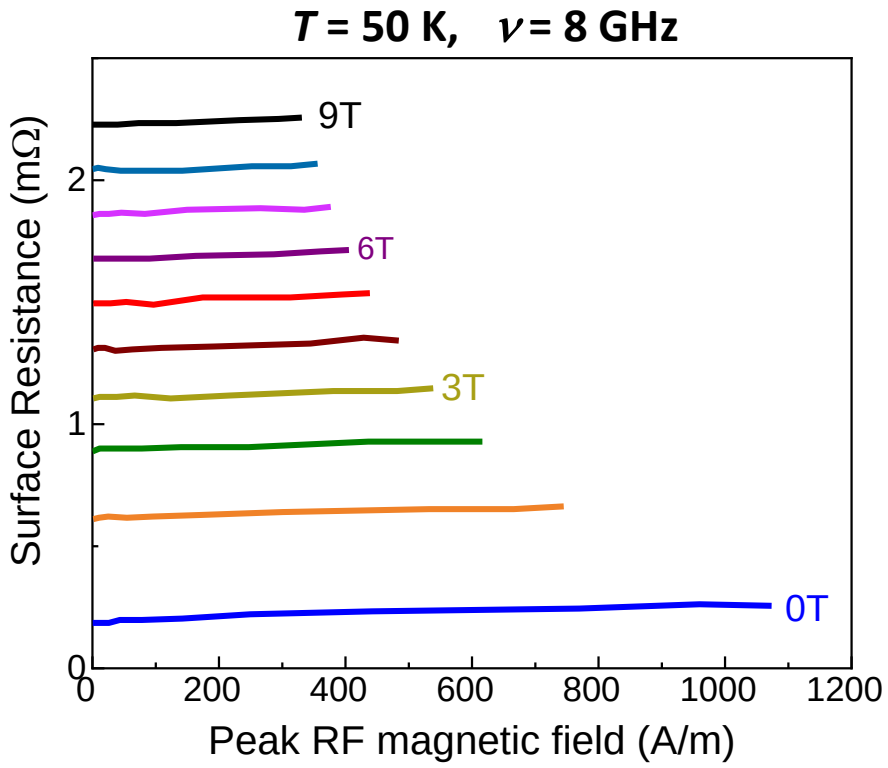
Initial study shows that CCs have a weak dependence with the RF power



***P. Krkotic**, et al. Supercond. Sci. Technol.* **35** (2022)

Far from high-gradient accelerator requirements

H_{Rf} ***= 575.000 A/m***

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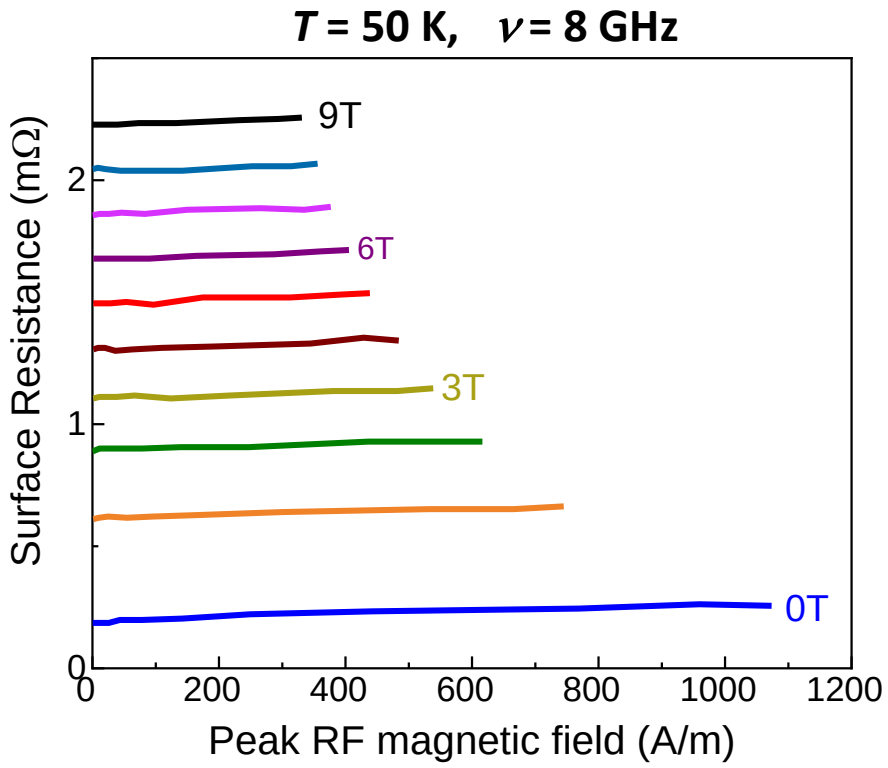

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Far from high-gradient accelerator requirements
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Higher Rf powers, in the order of high-gradient accelerators requirements, are achievable using a (μ-)stripe resonator technique

There is very limited and "old" data on REBCO RF-power dependence

Transferring a REBCO CC to a flexible low-loss dielectric substrate

To use strip resonator techniques we have to get rid of the metallic (Ag & Cu) substrate of our REBCO samples

1st - Delamination

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20 μm thick low-RF loss Kapton
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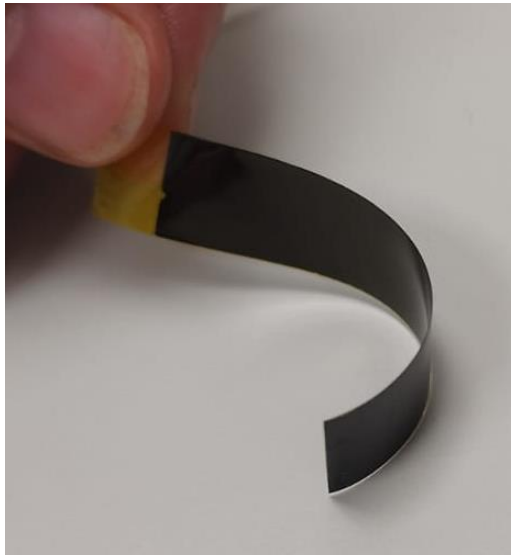

3rd – Etching of Ag & Cu

This allows to "print" REBCO circuits compatible with a (μ-)stripe resonator geometry to study $Z_S(H,T,H_{RF},f)$