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RF surface resistance measurements on planar samples

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12th IFAST WP9 Meeting
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The Cockcroft Institute of Accelerator Science and Technology

Lancaster University

University of Liverpool

iFAST

Agenda

1. Overview
2. Nb/Cu
3. Nb_3Sn /Cu
4. Nb_3Sn/Nb/Cu
5. Future plans

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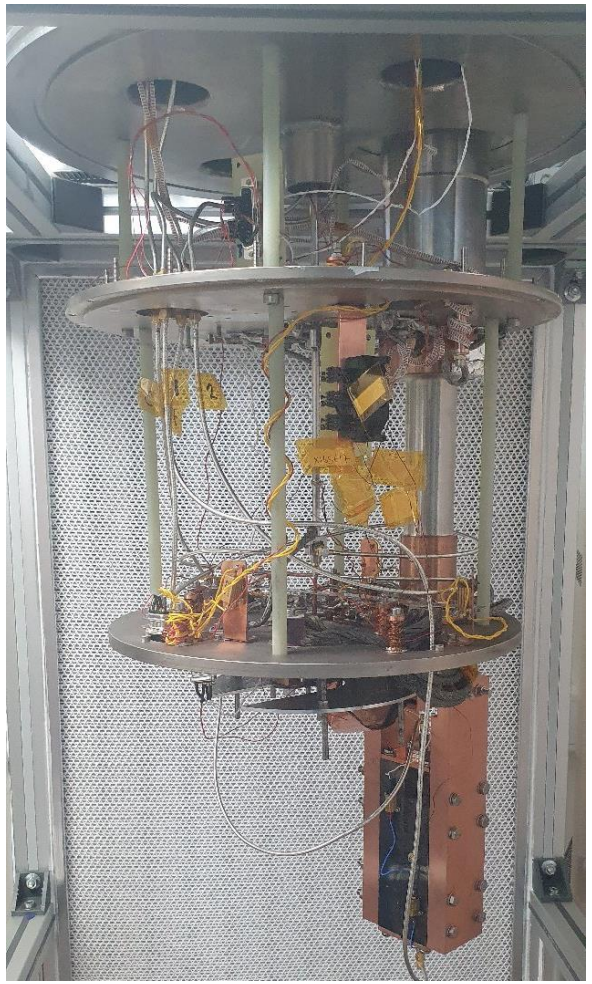
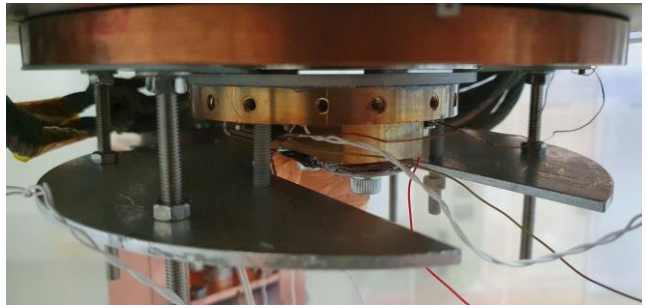
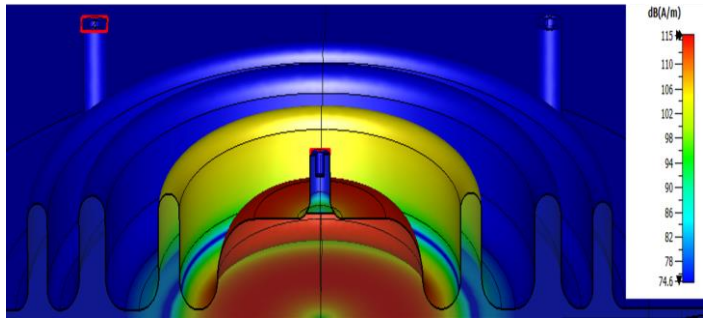
1. Overview

Sample tests with choke cavity

- **Nb/Cu** – effect of deposition temperature
- **Nb_3Sn/Cu** – effect of magnetron power & deposition method
- **Nb_3Sn/Nb/Cu** – effect of multilayer







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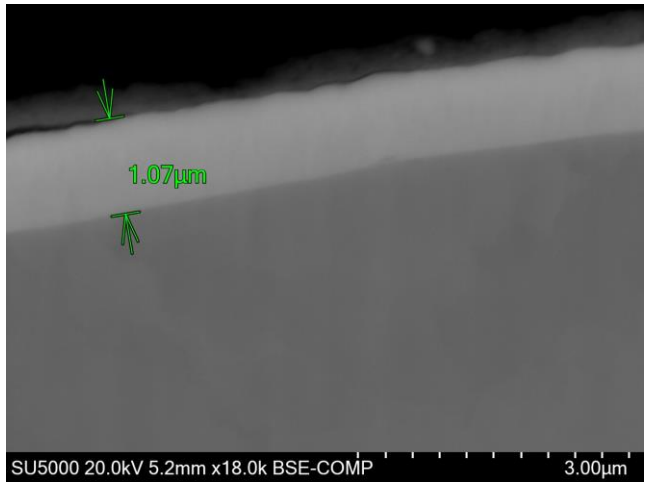
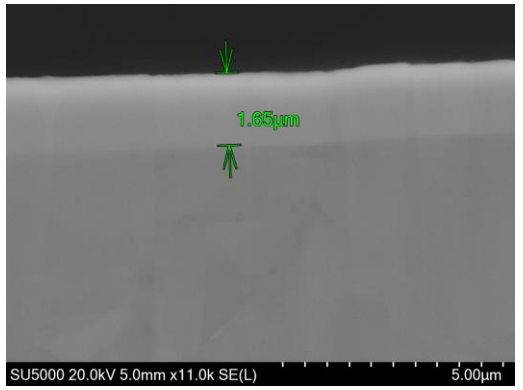
2. Nb/Cu Measurements

Nb/Cu samples

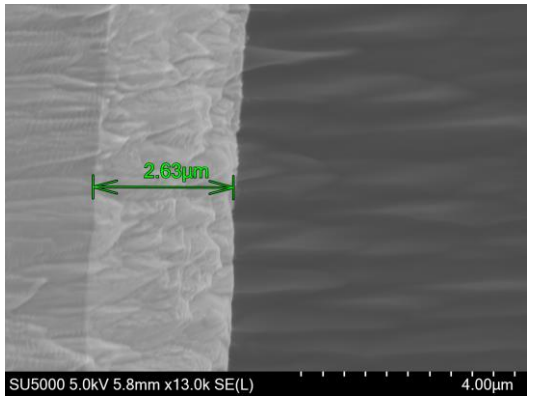
- **Study of effect of deposition temperature**
  - ❑ Room temperature to 615 °C
  - ❑ HiPIMS: P_{ave} = 400 W
  - ❑ All samples polishing: diamond turned (no chemical treatments)
  - ❑ 4.5 hr & 10 hr depositions
  - ❑ Used 2 Nb targets



Target 1 – thickness ~ 1 µm

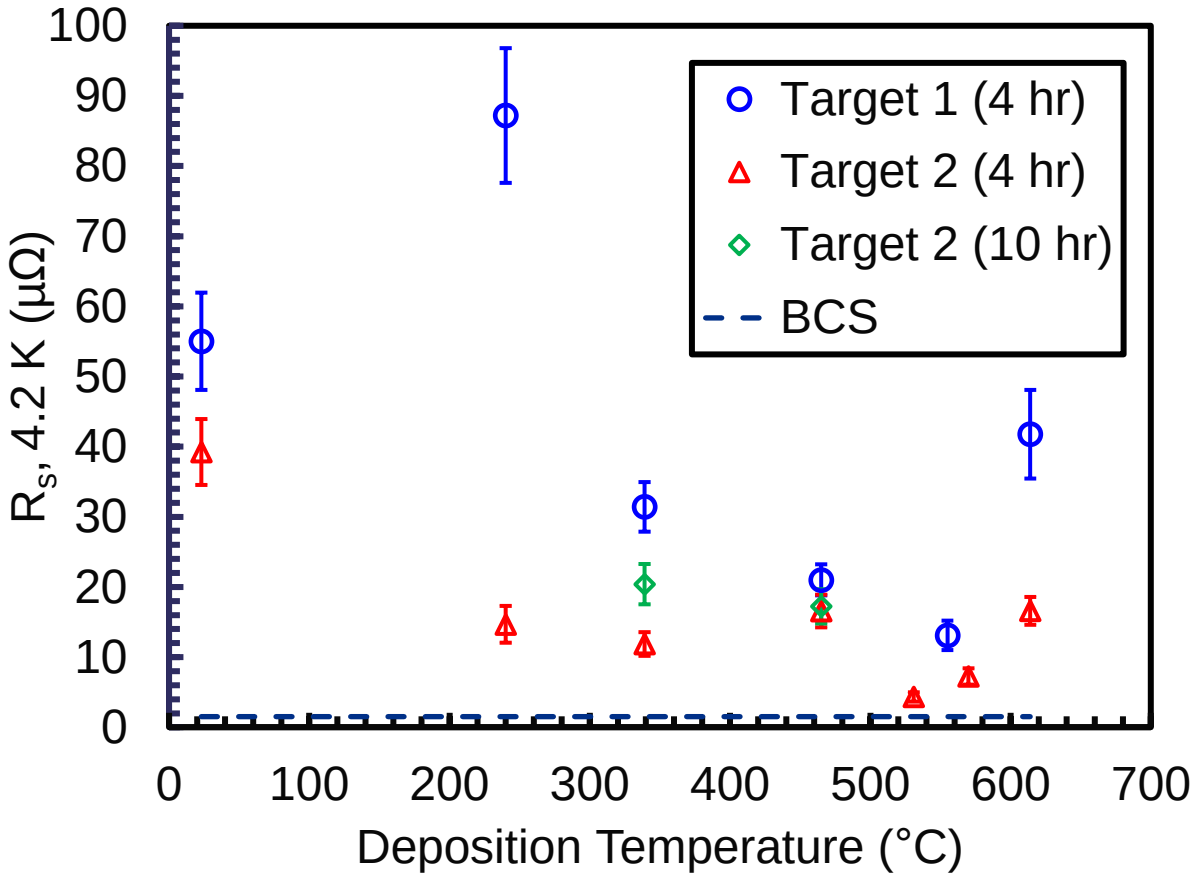


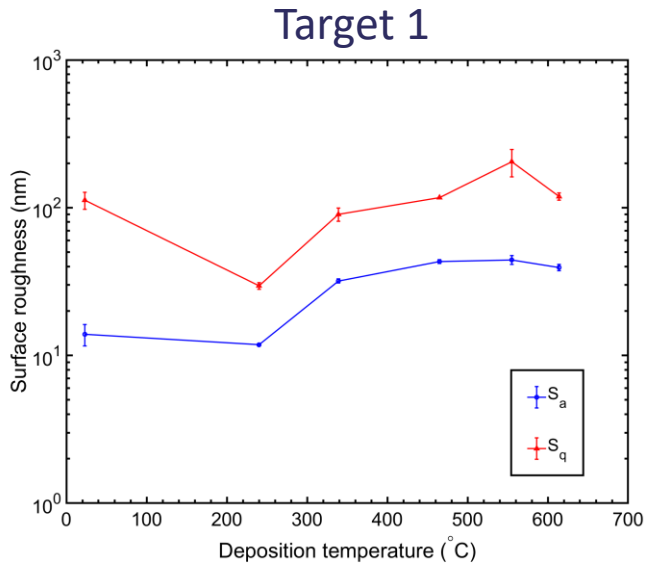
Target 2 (4.5 hr) – thickness ~ 1.7 µm

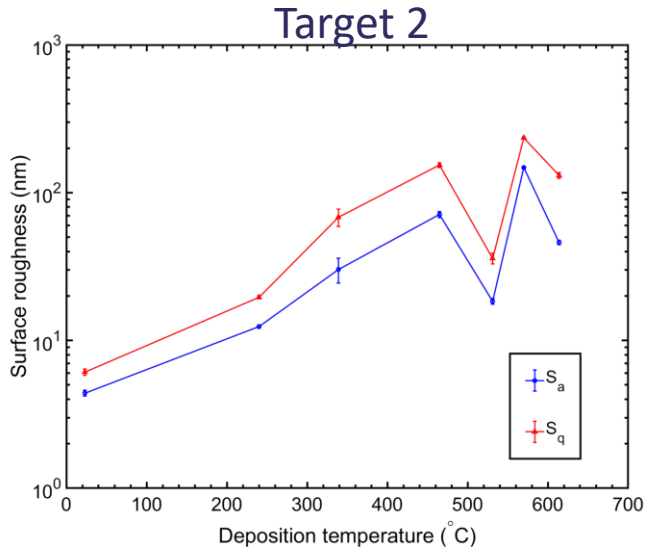


Target 2 (10 hr) – thickness ~ 2.6 µm

Nb: effect of deposition temperature on R_s



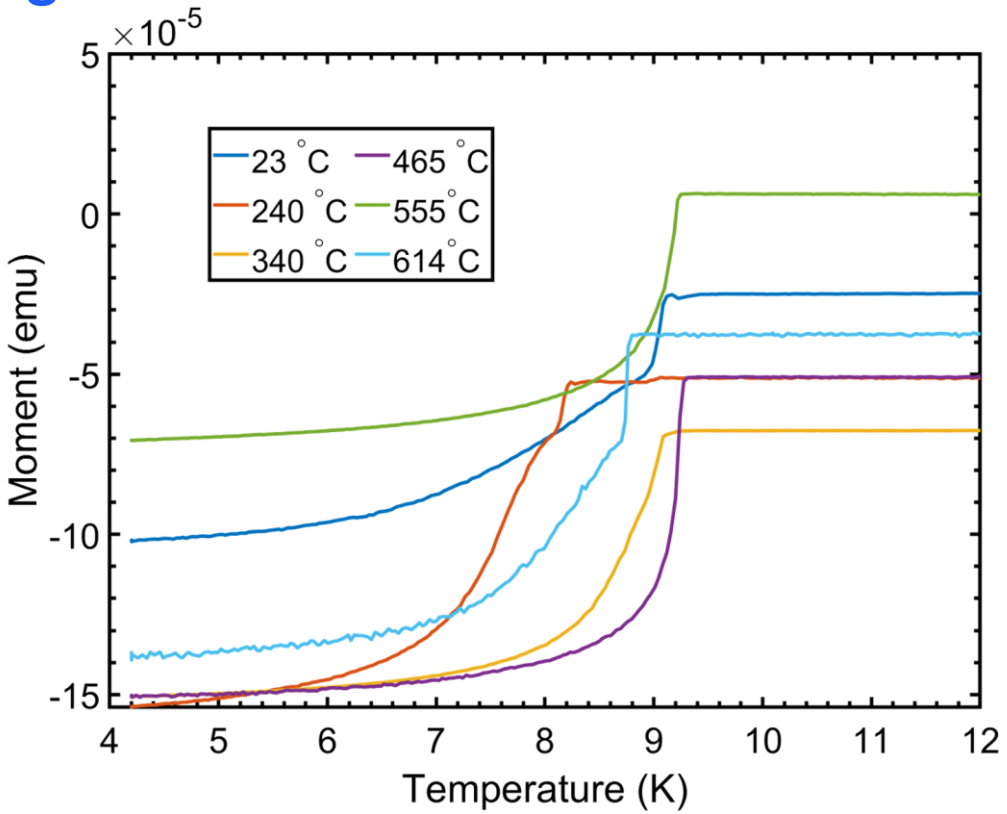


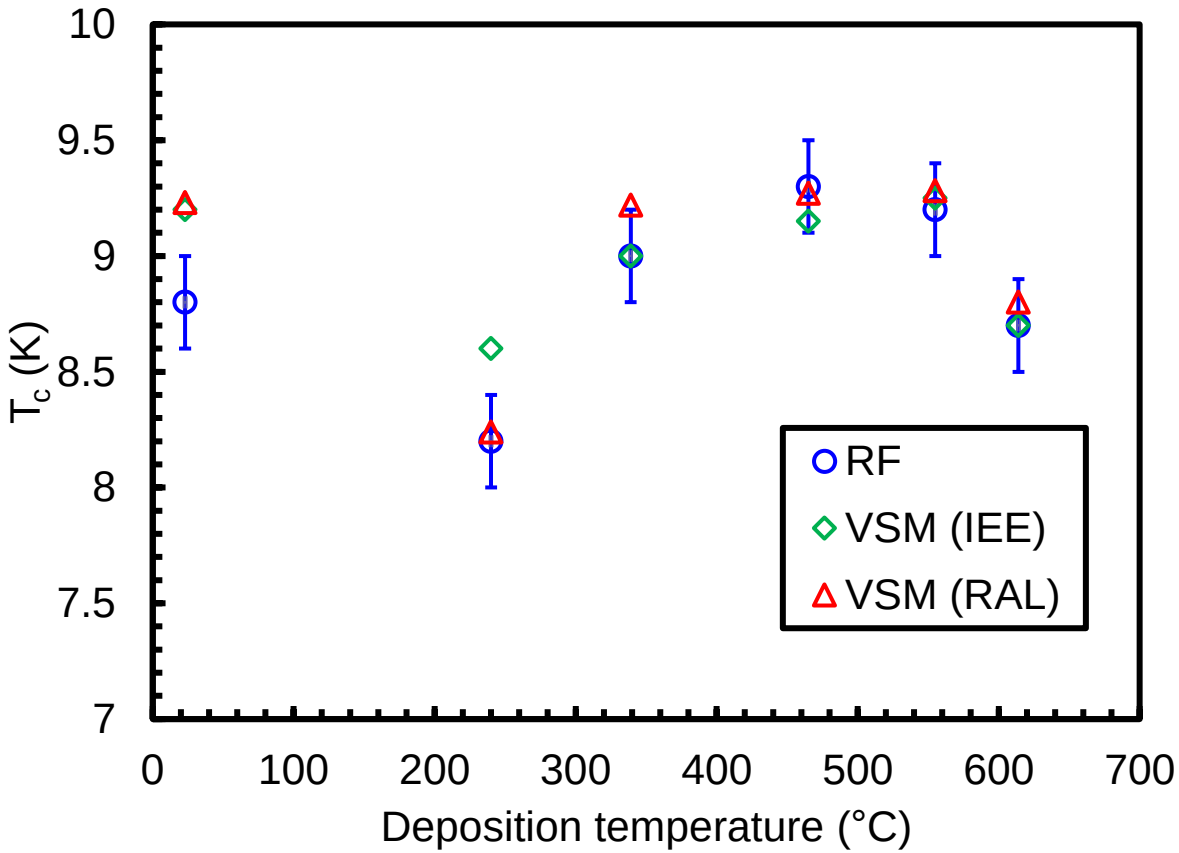


* Further surface analysis ongoing

EXP 900 – VSM Measurements

- **Target 1**

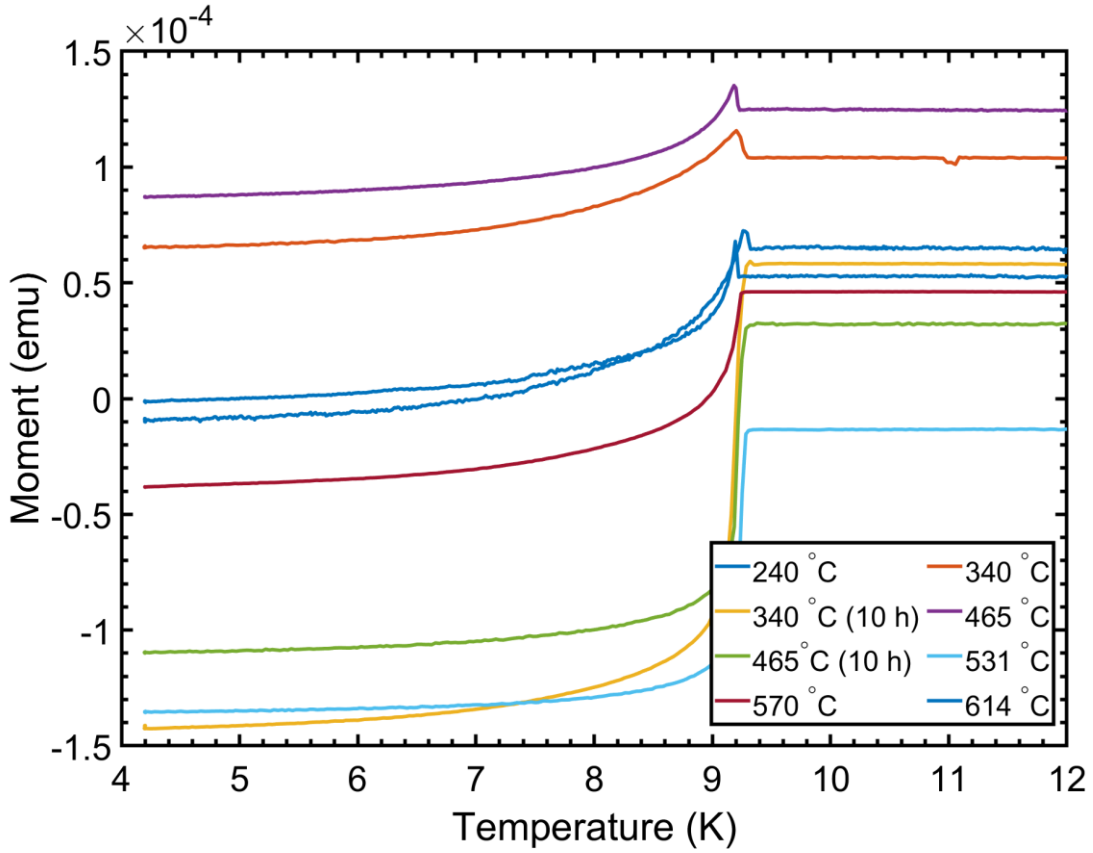




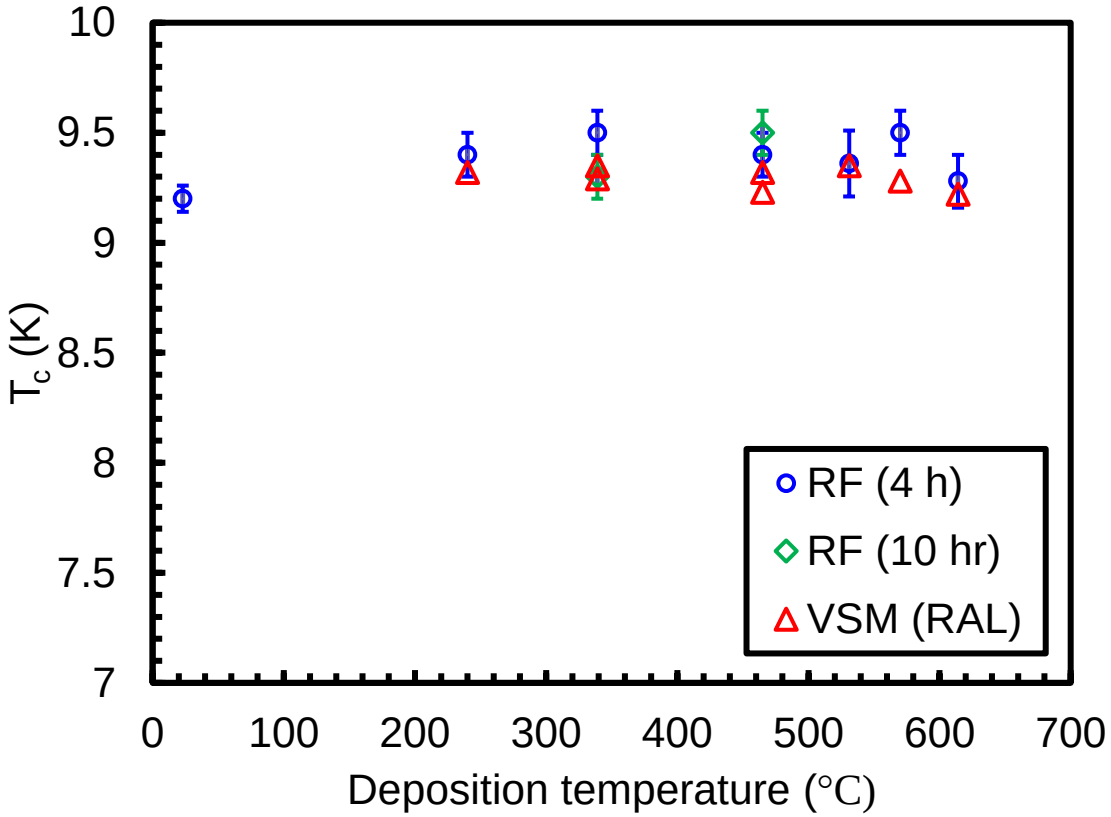
- B = 5 mT
- Samples 4 x 4 mm^2, 3 mm thickness
- Deposition time 4.5 h
- Larger variation in T_c

EXP 900 – VSM Measurements

- **Target 2**



- Cause of bumps at start of transition?



- B = 5 mT
- Samples 4 x 4 mm^2, 2-3 mm thickness
- Deposition time 4.5 h or 10 h
- T_c all as expected

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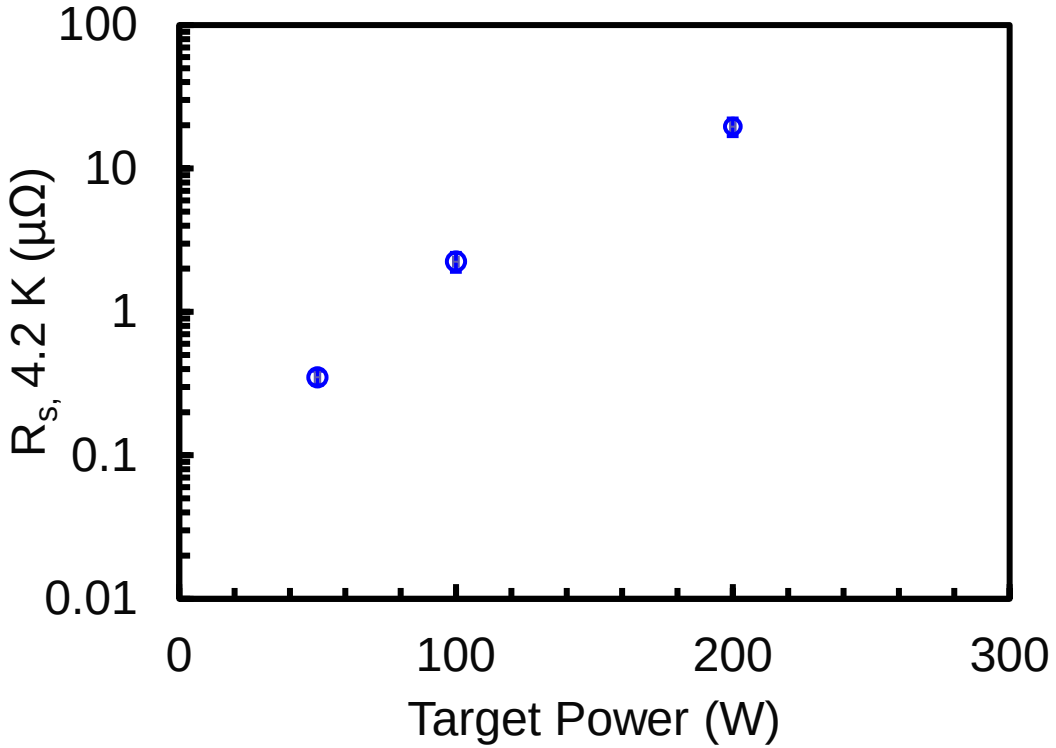
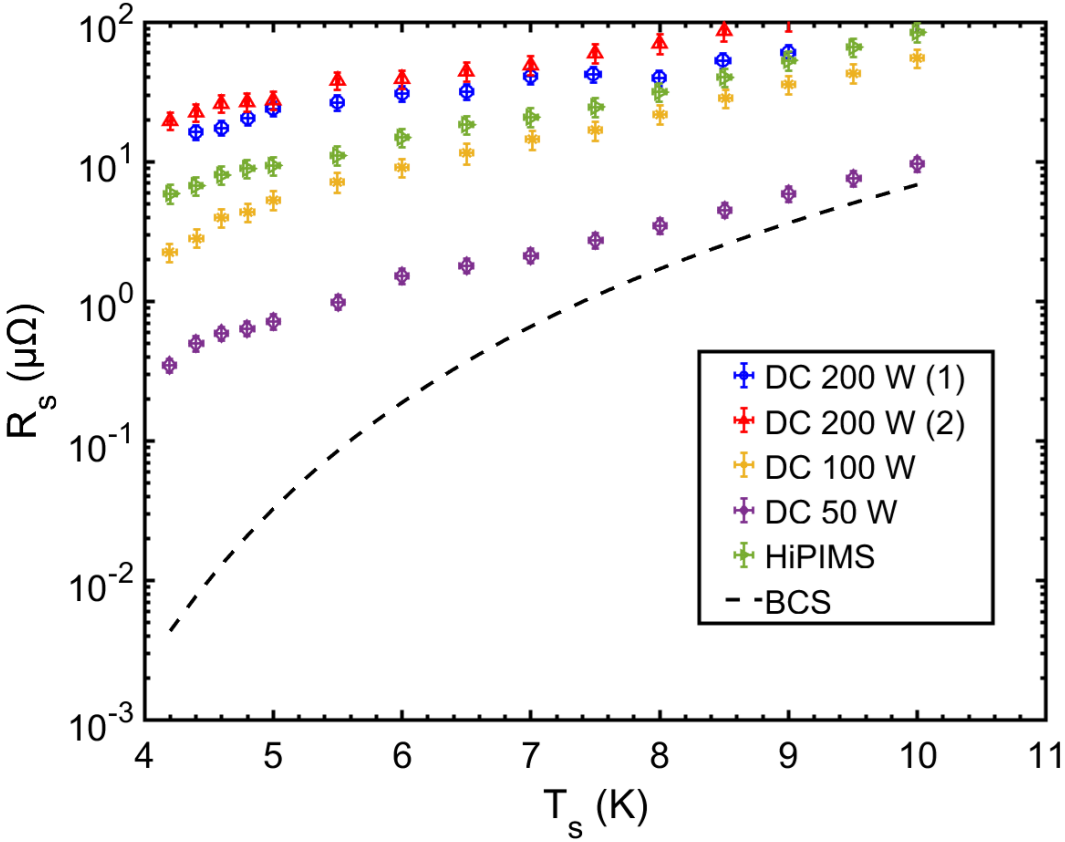
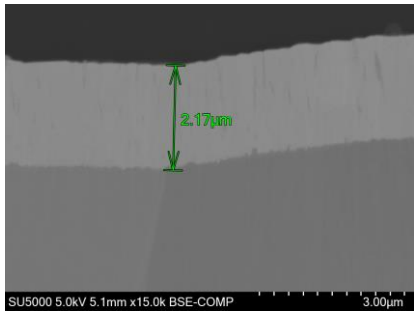
3. Nb_3Sn/Cu samples

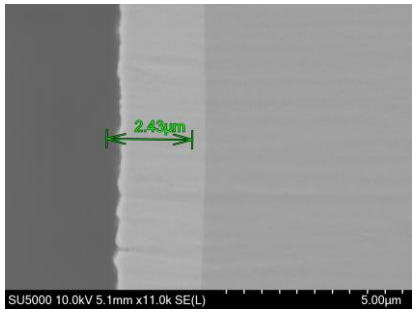
Nb_3Sn: effect of magnetron power on R_s



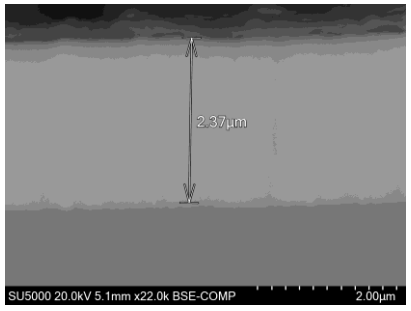




50 W DC ~ 2.2 μm



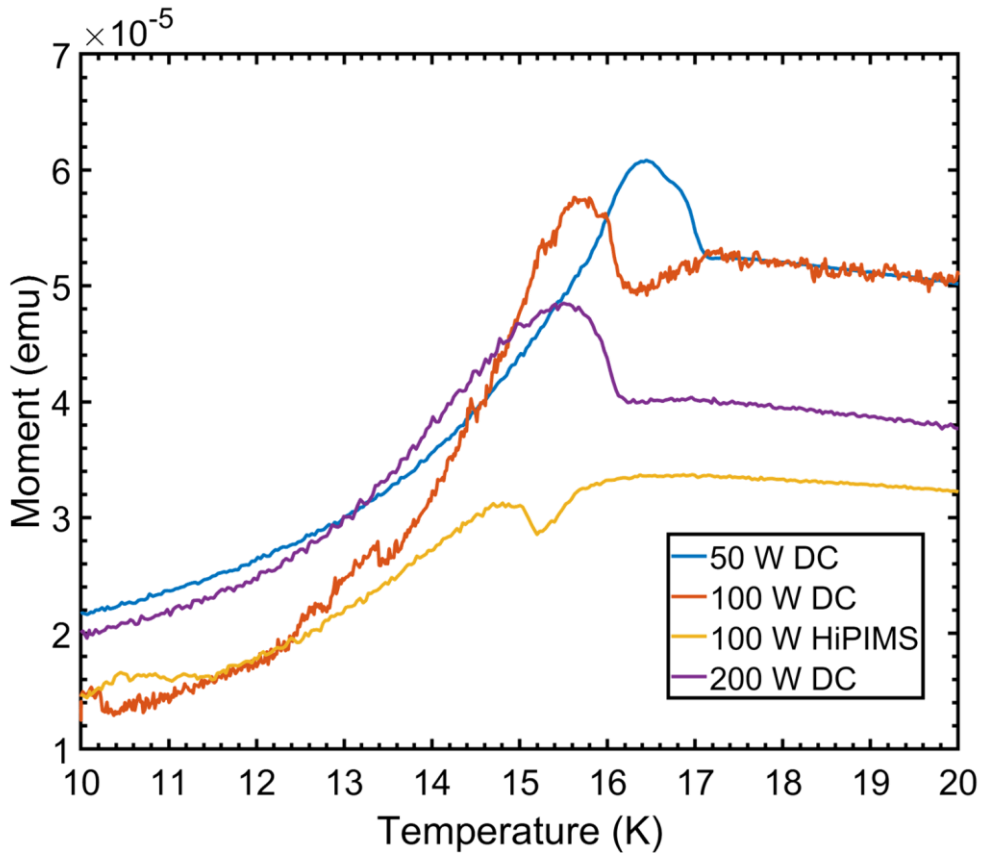
100 W DC~ 2.4 μm



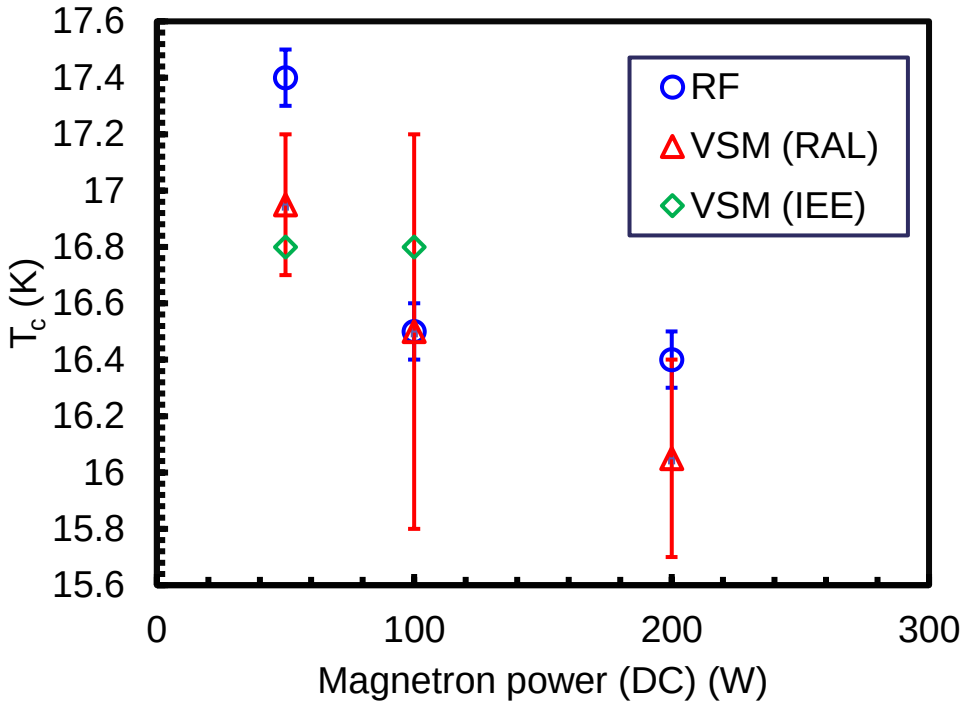
100 W HiPIMS ~ 2.4 μm

- Substrate temperature ~ 615 °C
- DC: P = 200 W, 100 W, 50 W
- HiPIMS: P_{ave} = 100 W

Nb_3Sn: effect of magnetron power on T_c



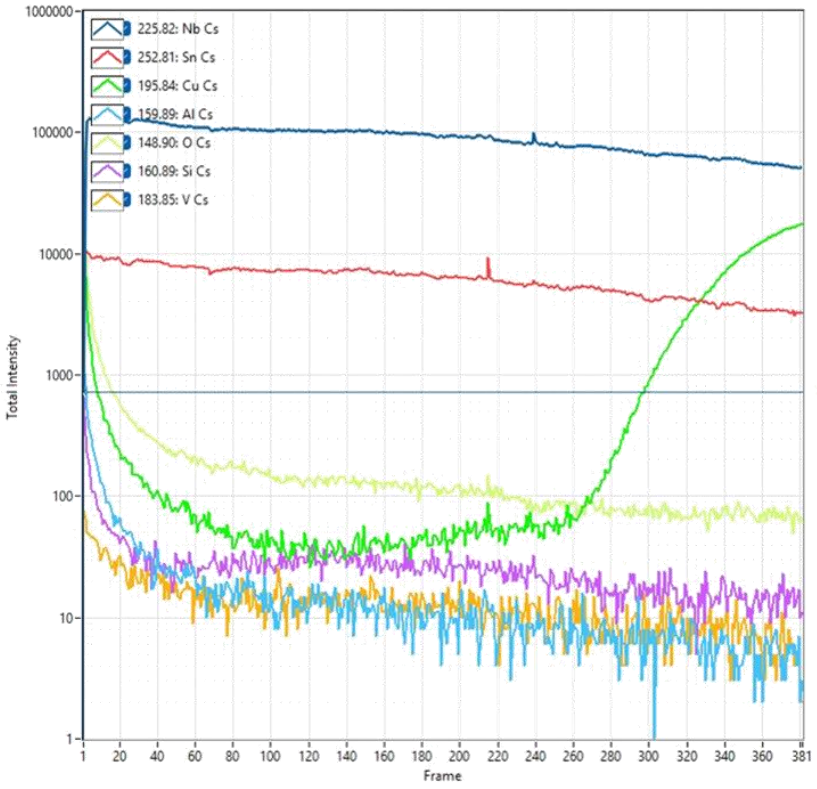
- B = 5 mT
- Deposition time 4 h, 10 h, 20 h
- Cause of the bumps?



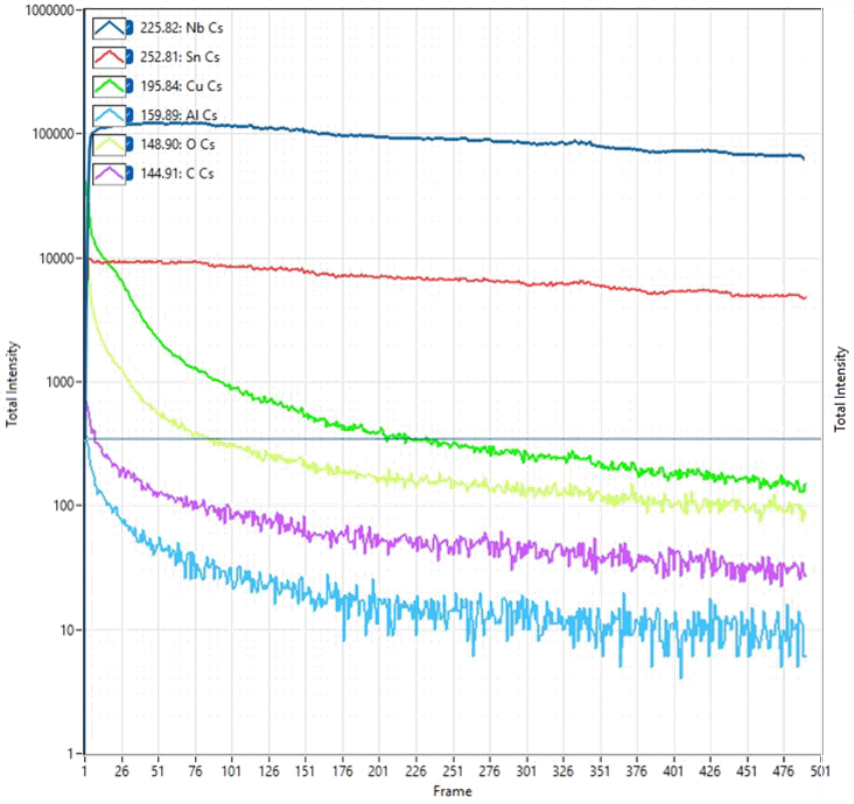
- T_c = 16 K (measured at IEE) for 100 W HiPIMS
- Further HiPIMS samples required

Power (W)	B_{en} (Oe)
50, DC	740
100, DC	610
100, HiPIMS	580

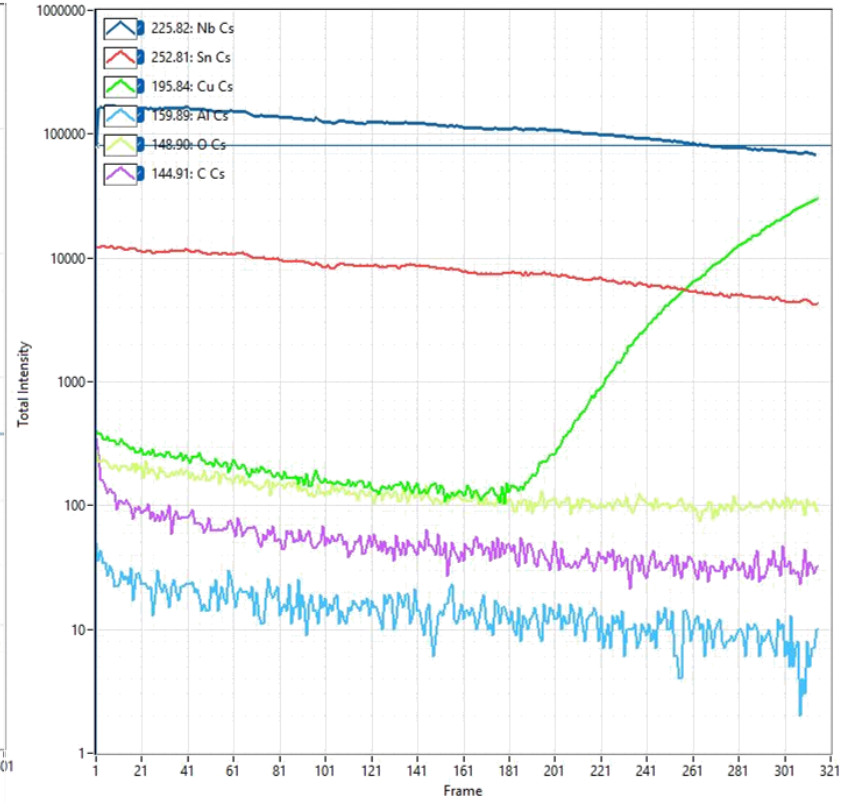
Nb_3Sn: SIMS analysis



50 W DC



100 W DC



100 W HiPIMS

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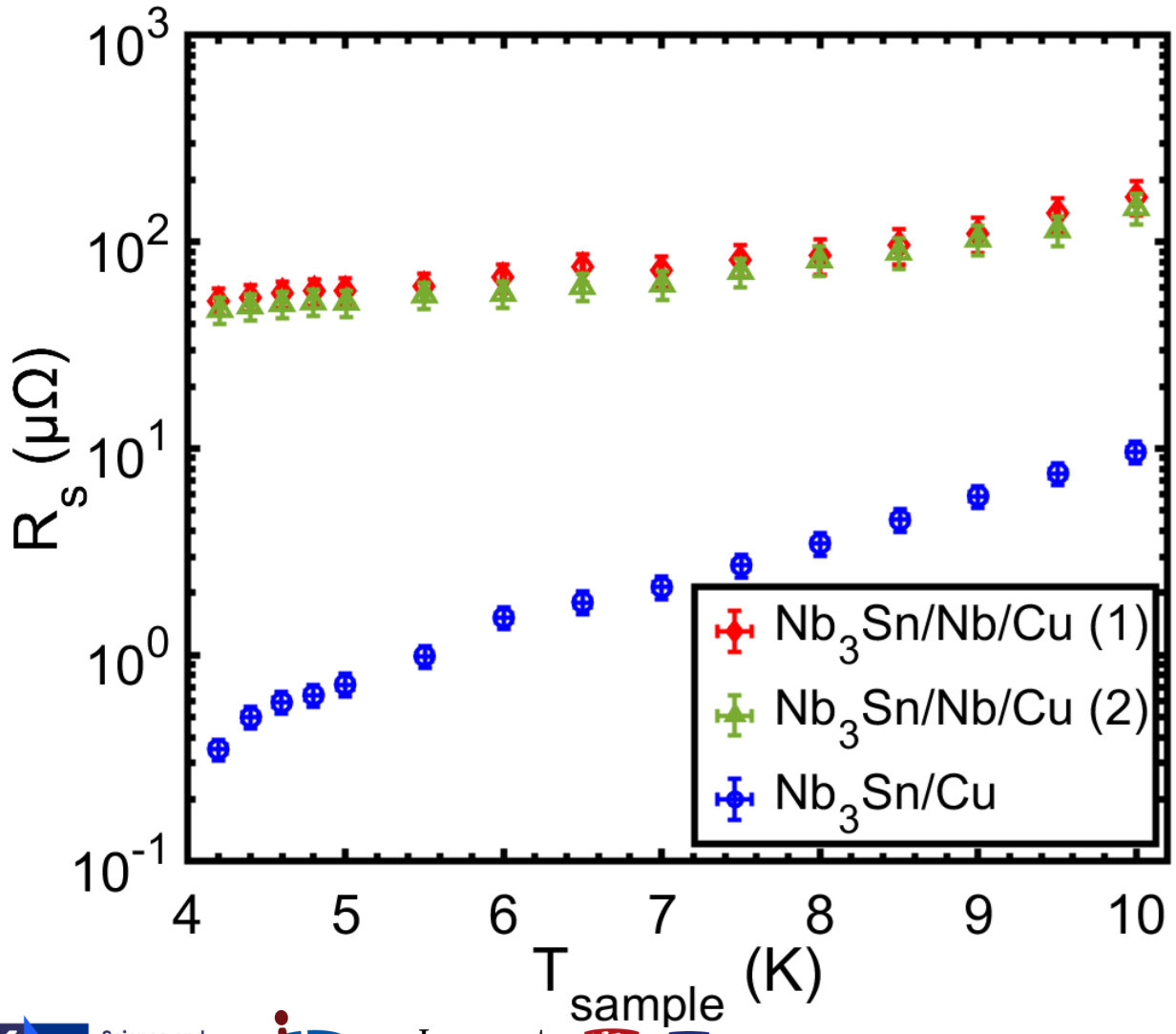
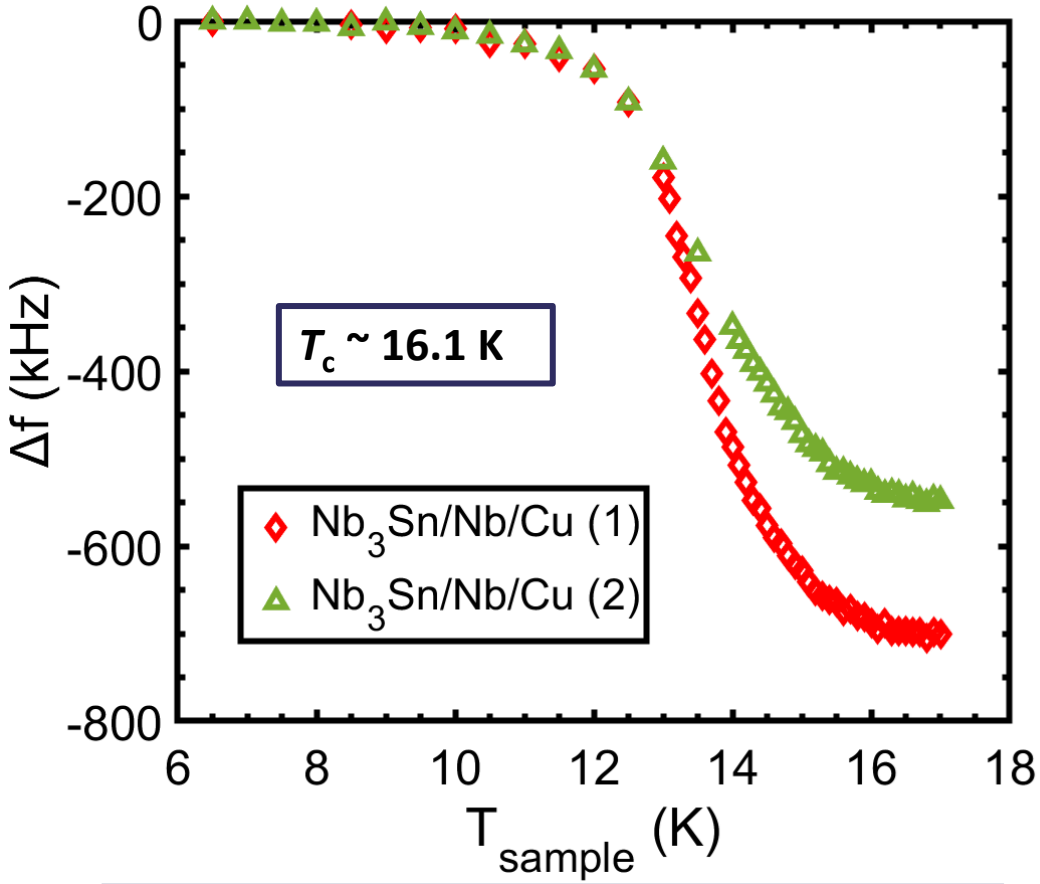
4. Nb_3Sn/Nb/Cu samples

Nb_3Sn/Nb/Cu samples





Deposition parameters:

- **Sample 1**
  - **Nb:** 400 W DC, 5.5 h
  - **Nb_3Sn:** 50 W DC, 9.5 h
- **Sample 2**
  - **Nb:** 400 W HiPIMS
  - **Nb_3Sn:** 50 W DC

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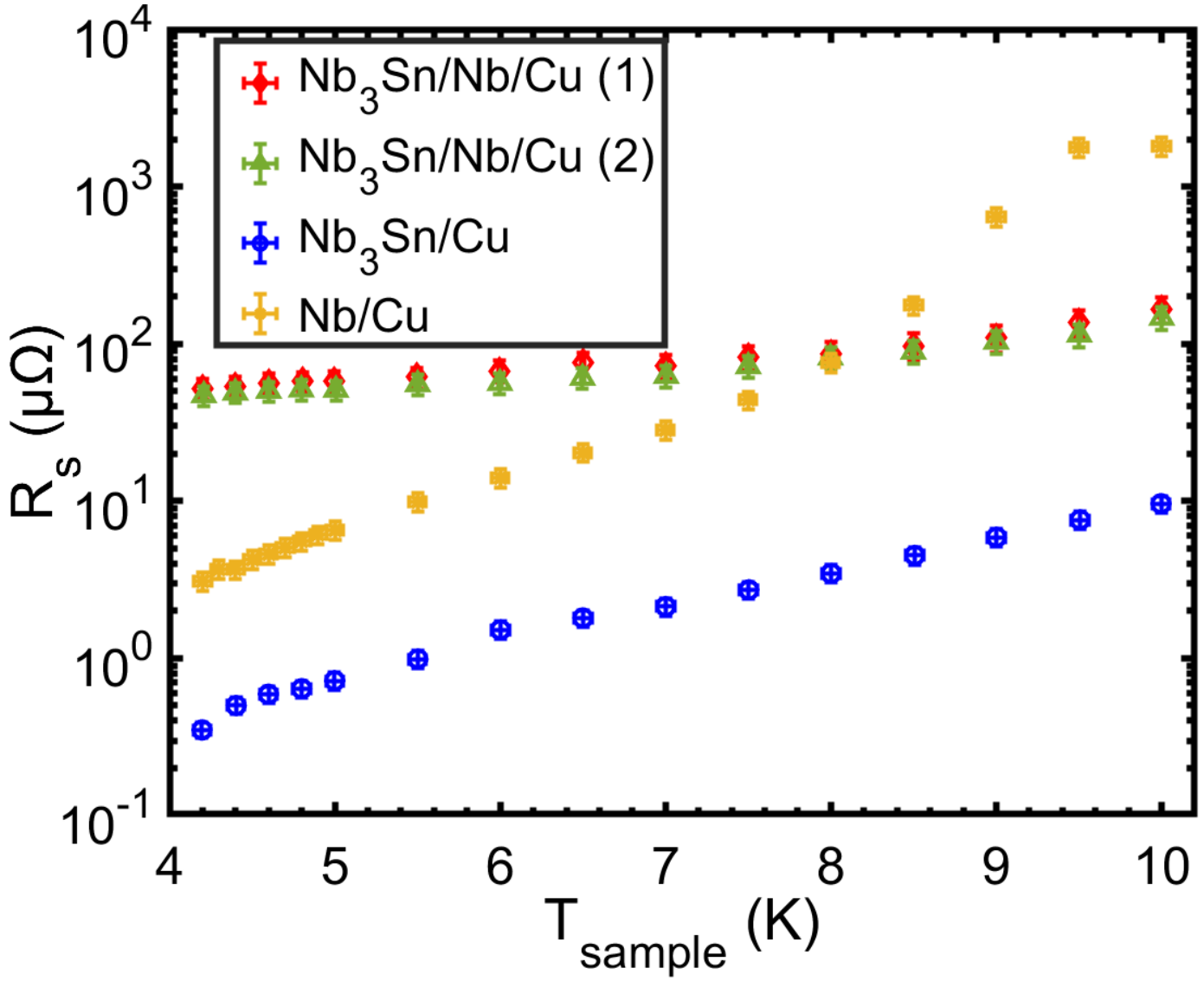
Nb_3Sn/Nb/Cu samples



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5. Future plans

Future plans

- **Focus on Nb_3Sn samples**
  - ❑ Single layers
  - ❑ Multilayers
- **Obtaining more bulk Nb discs for direct comparisons with QPR depositions**
- **Test samples without cutting in MFP facility for high DC field analysis**

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Questions?

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Thank you

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