

# Investigation on Two Techniques for the Reduction of Screening Current-Induced Field Effects in REBCO HTS Coils

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## SCIF issue in REBCO magnets

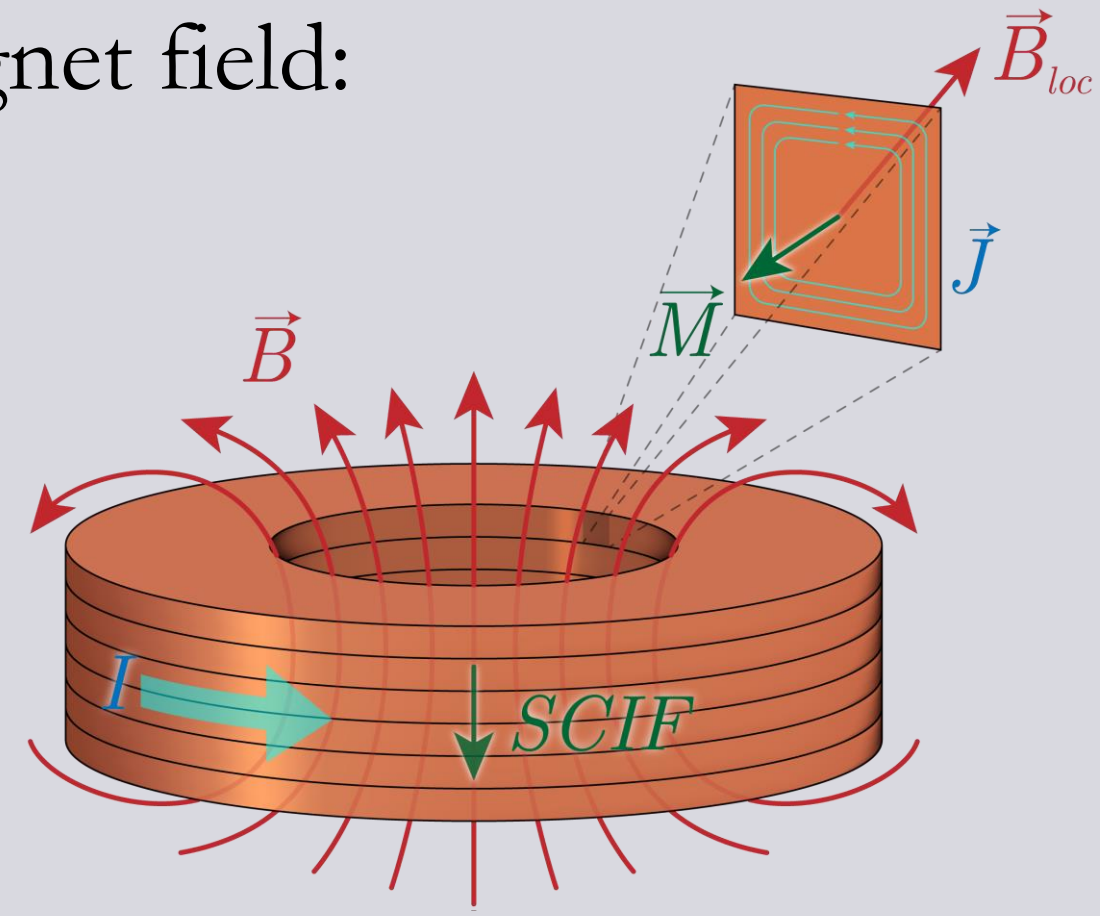
Screening Current-Induced Field Problem

REBCO c.c. are promising materials for high-field magnets. However, the Screening-Current Induced Field (SCIF) has problematic effects on the overall magnet field:

- Lowering of the amplitude
- Deterioration of the quality
- Slow time decay

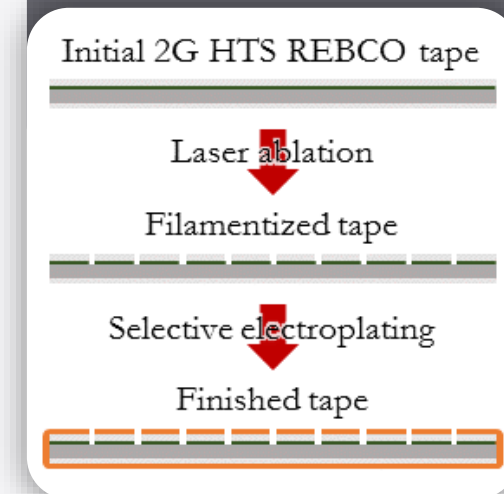
Which are incompatible with field quality standards in practical applications.

⇒ Techniques are required to suppress the perturbations caused by the SCIF in REBCO magnets

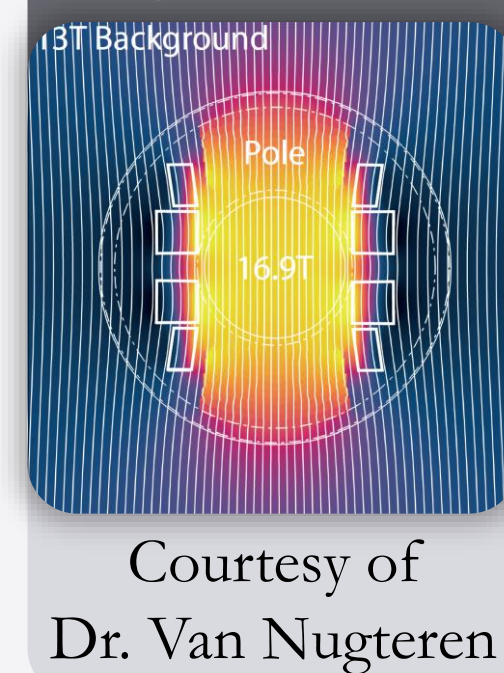


## SCIF reduction techniques

### Tape striation

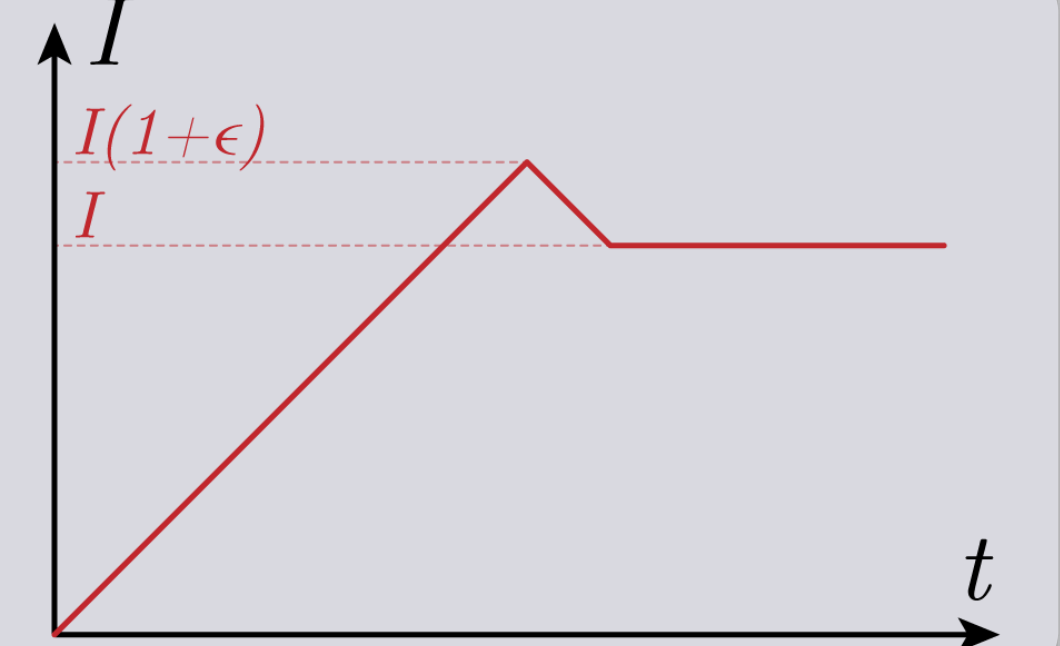


### Aligned tapes



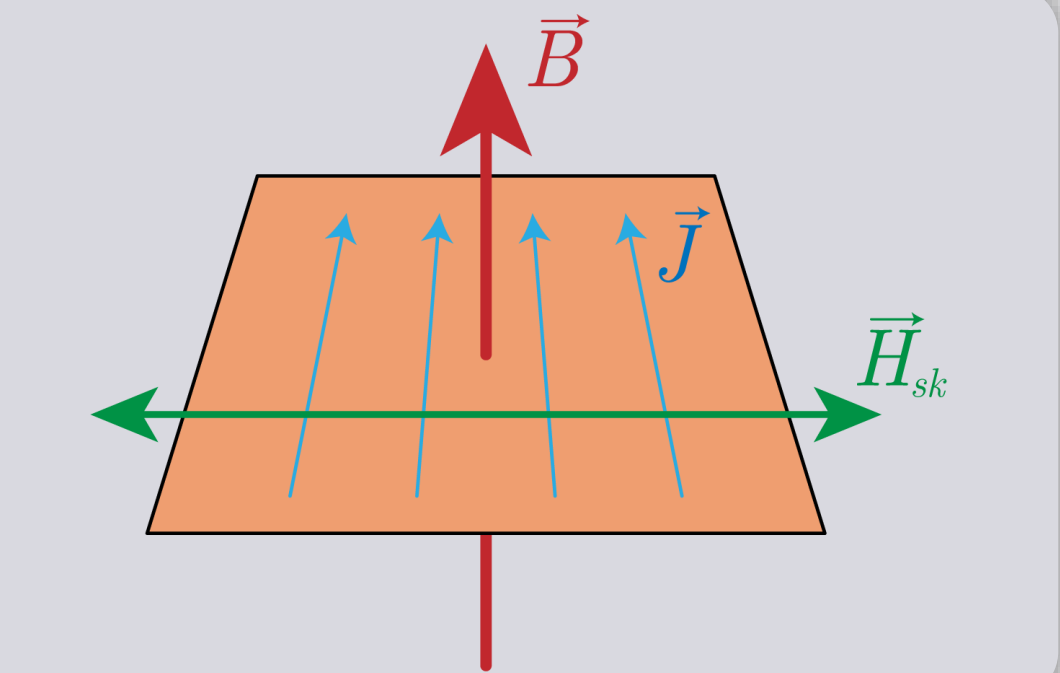
Current overshoot

The magnet current is raised to  $I$  with an overshoot  $\epsilon$  ( $\sim 0\%$ ), creating a favorable initial distribution of  $\vec{j}$ , thus limiting the SCIF drift.

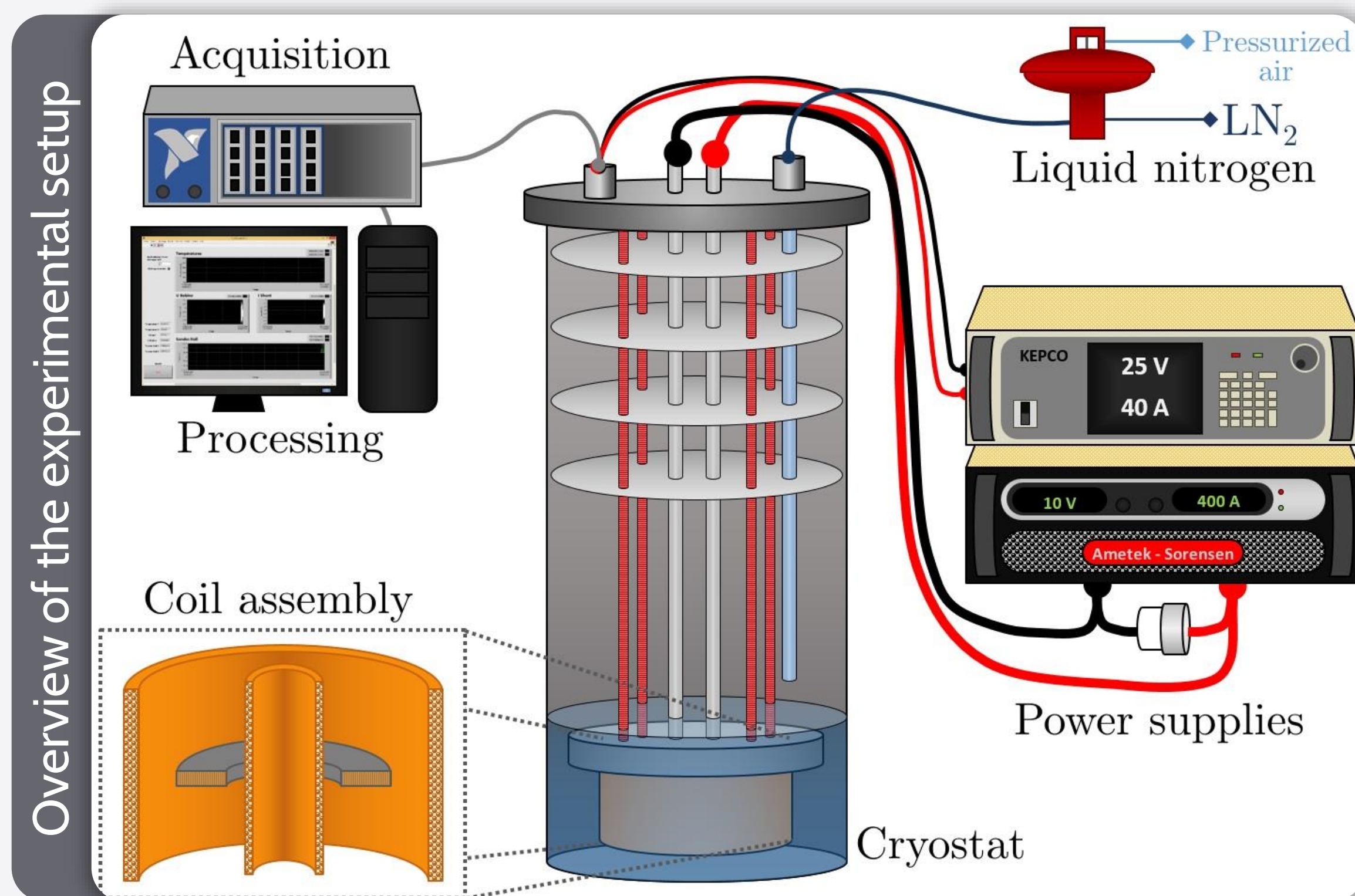


Vortex shaking

An external AC shaking field  $\vec{H}_{sk}$  of a small amplitude ( $\sim 100$  mT) and orthogonal to  $\vec{B}$  triggers the SCIF relaxation at an exponential rate.



## Experimental setup & protocols



Two single-pancake coils wound from SGS6050-AP SuperPower REBCO c.c.

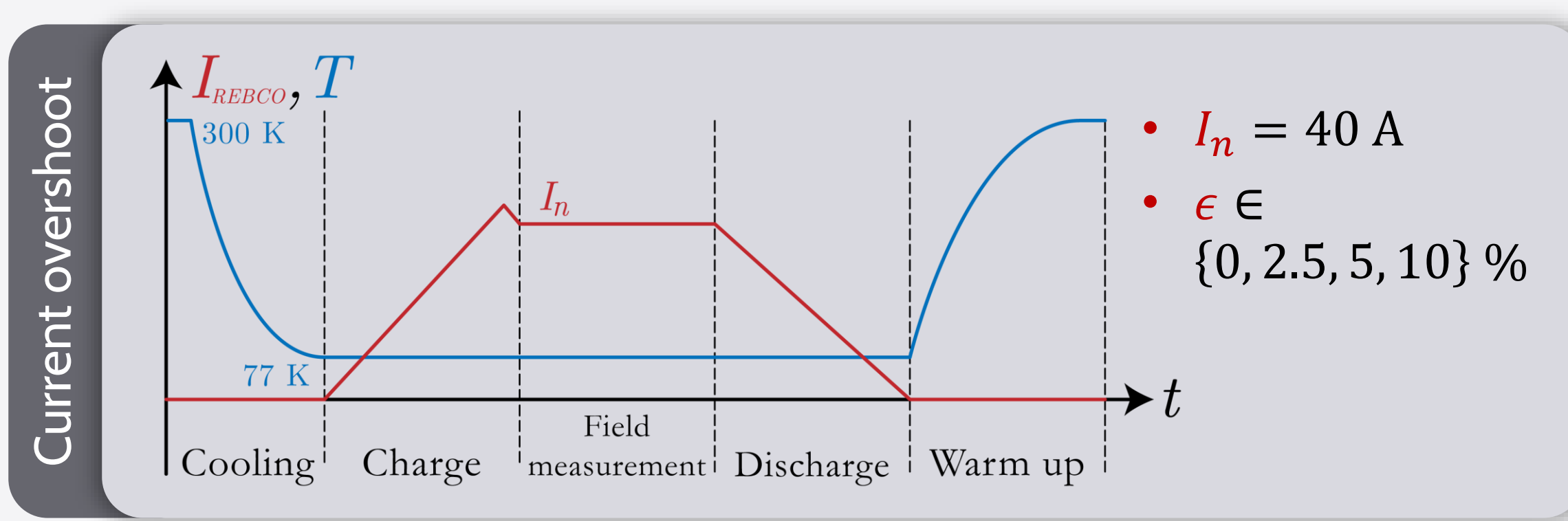
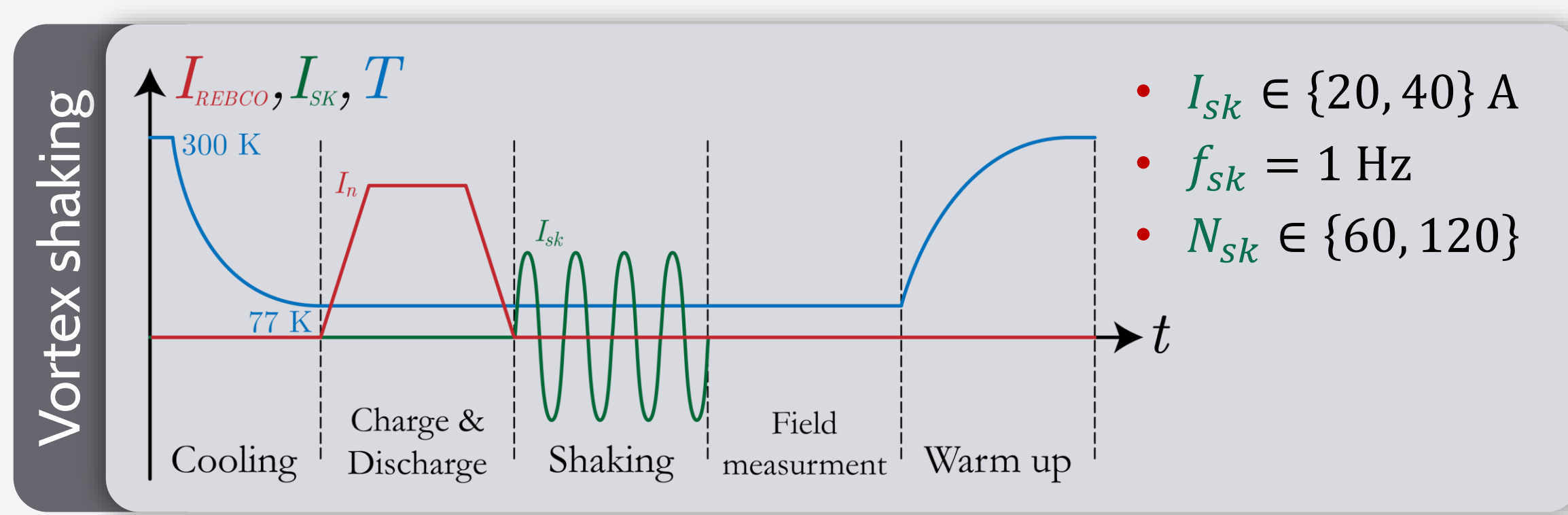
1. Insulated coil using 75  $\mu\text{m}$  inter-turn Kapton tape
2. MI coil using 30  $\mu\text{m}$ -thick stainless steel co-winding

Parameters	Ins. coil	MI coil
Nb. of turns	133.5	160.5
I.R. / O.R. [mm]	30 / 48.8	30 / 47
Height [mm]	6	6
Inductance [mH]	1.80	2.77
Coil cst. [mT/A]	2.06	2.56

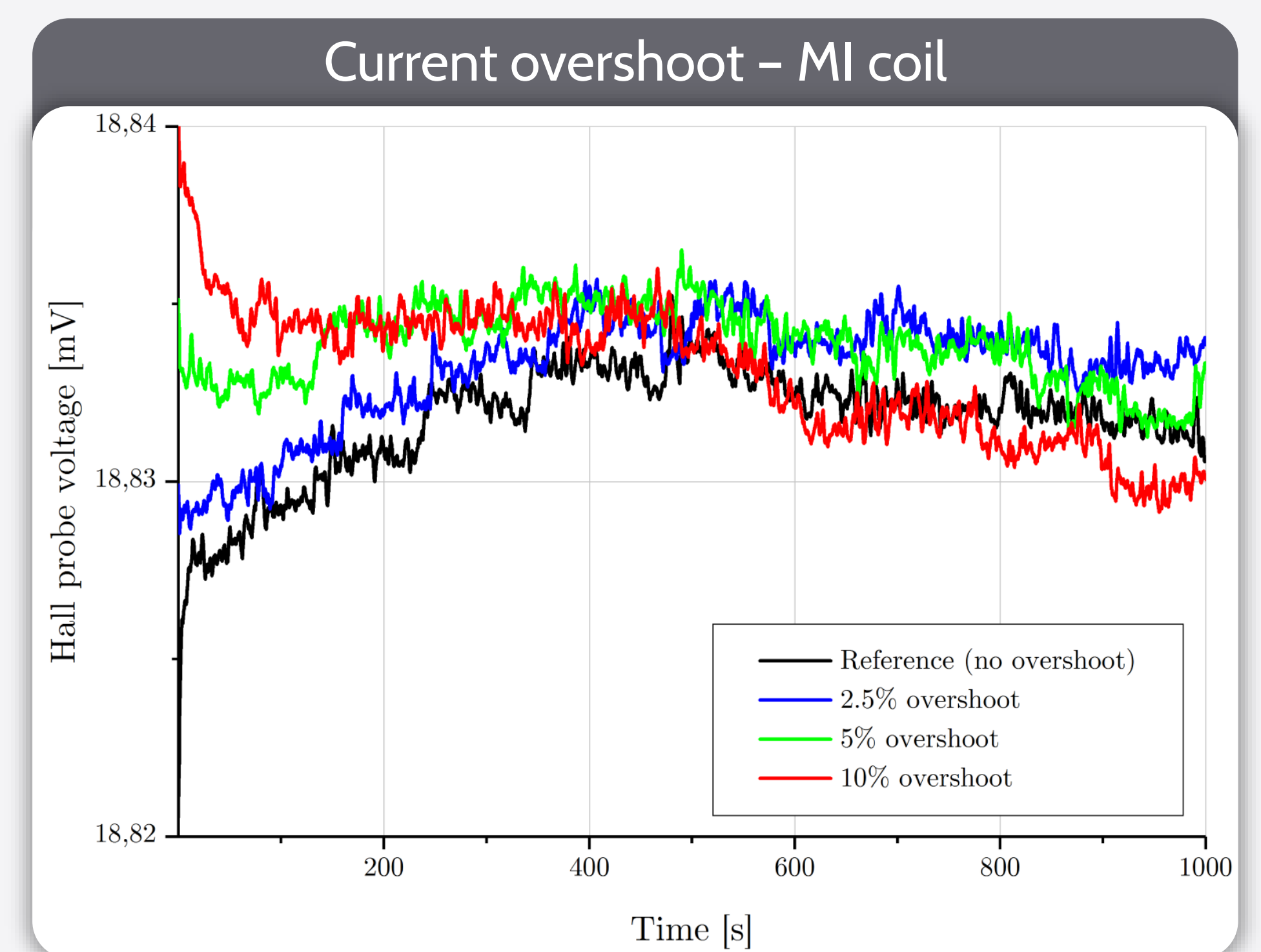
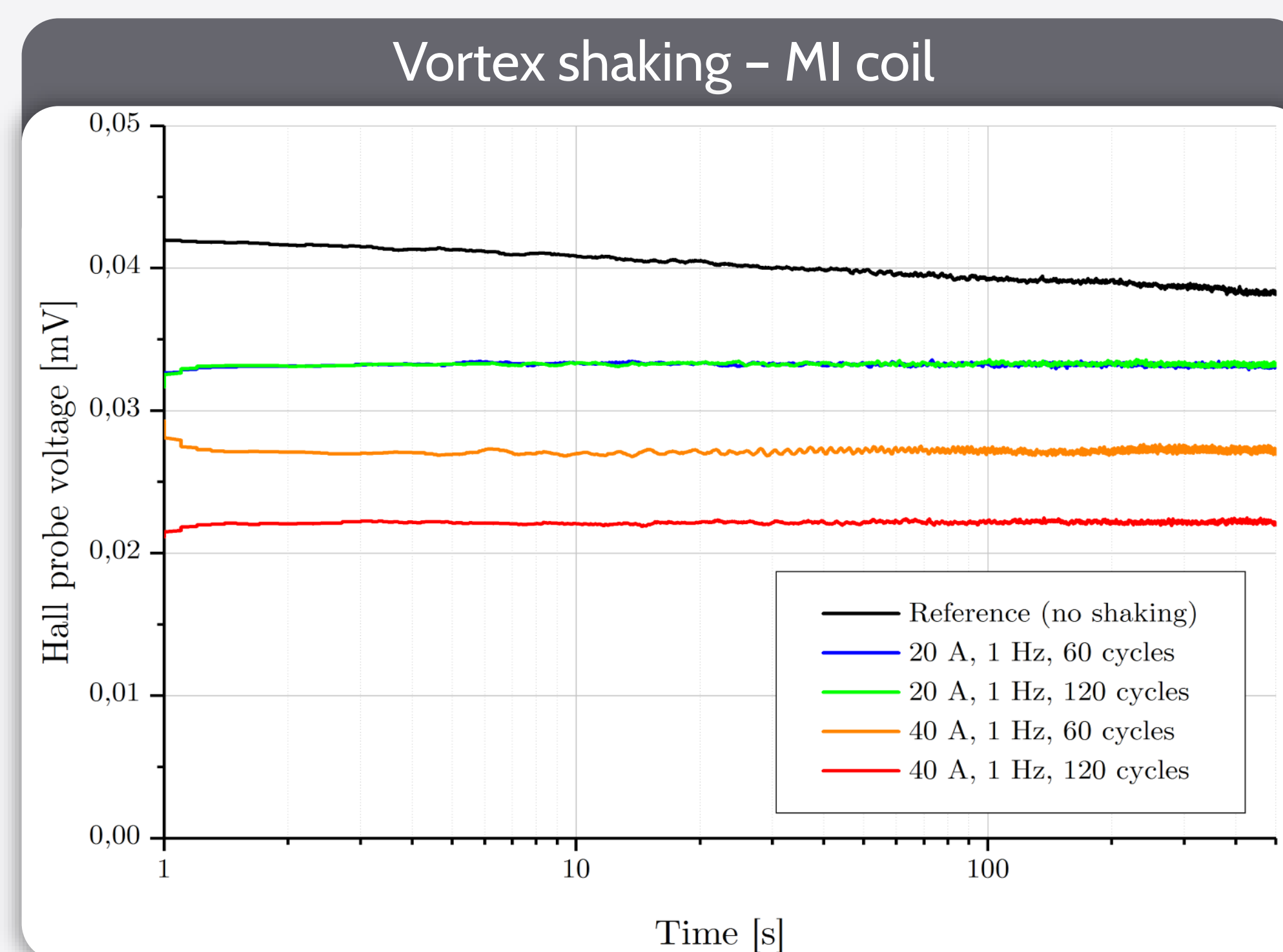
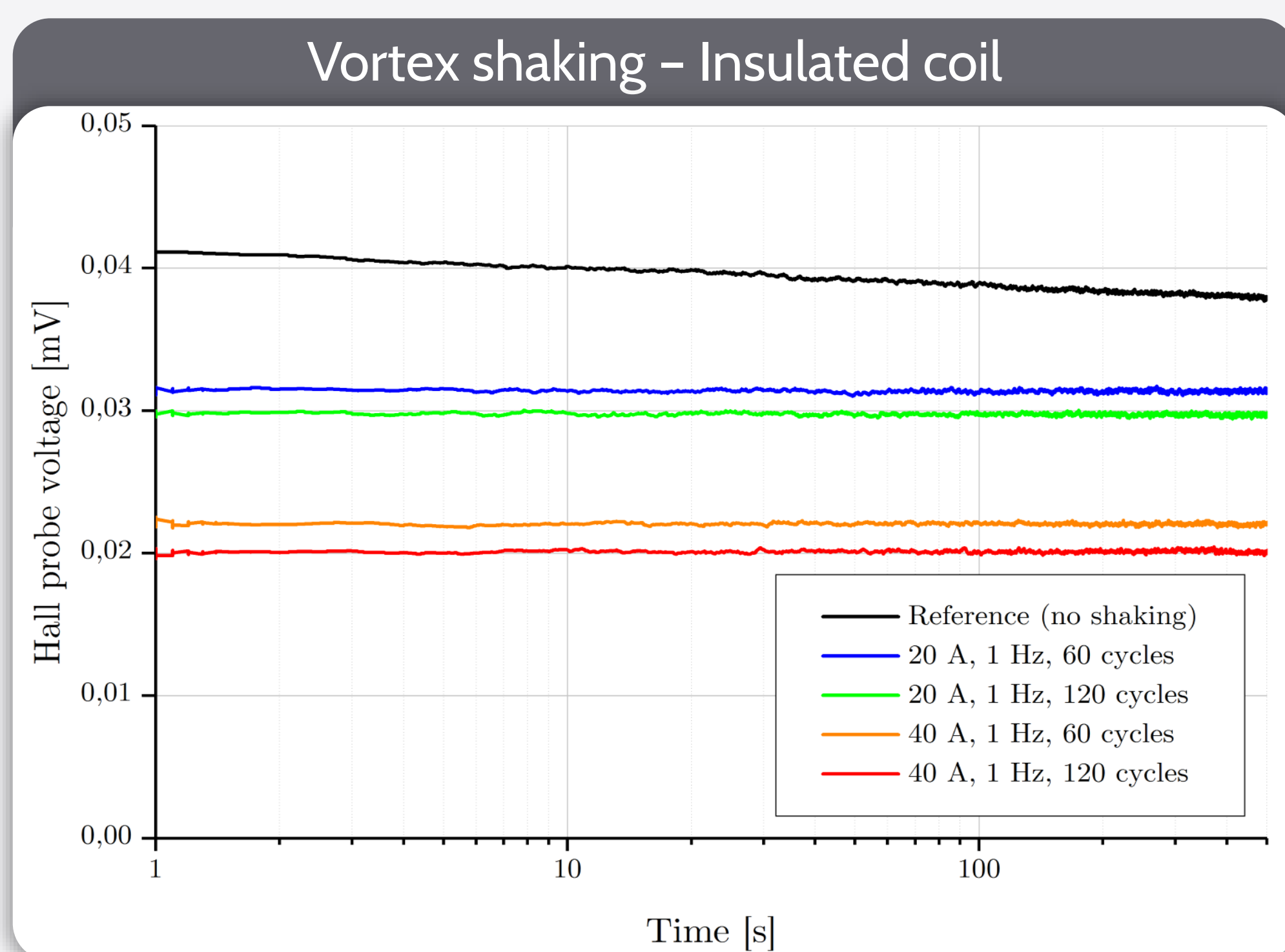
Shaker coils

Pair of copper solenoids connected in series, used to generate the axial AC field (max. amplitude 80 mT)

Parameters	Inner coil	Outer coil
Nb. of layers	2	4
Turns / layer		52
Inner radius [mm]	16.6	73.7
Outer radius	19.8	80.1
Height [mm]		83
Resistance [m $\Omega$ ]	14	117
Inductance [mH]	n/a	5.9



## Results



Conclusions

- Vortex shaking cancels the field drift caused by the SCIF and partially removes the trapped magnetization.
- Only partial SCIF suppression was observed, further tests will show whether increasing  $N_{sk}$  or  $I_{sk}$  enhances the effect.

- Current overshoot reduces the field drift caused by the SCIF.
- No way to determine a priori the optimal overshoot value  $\epsilon$ .