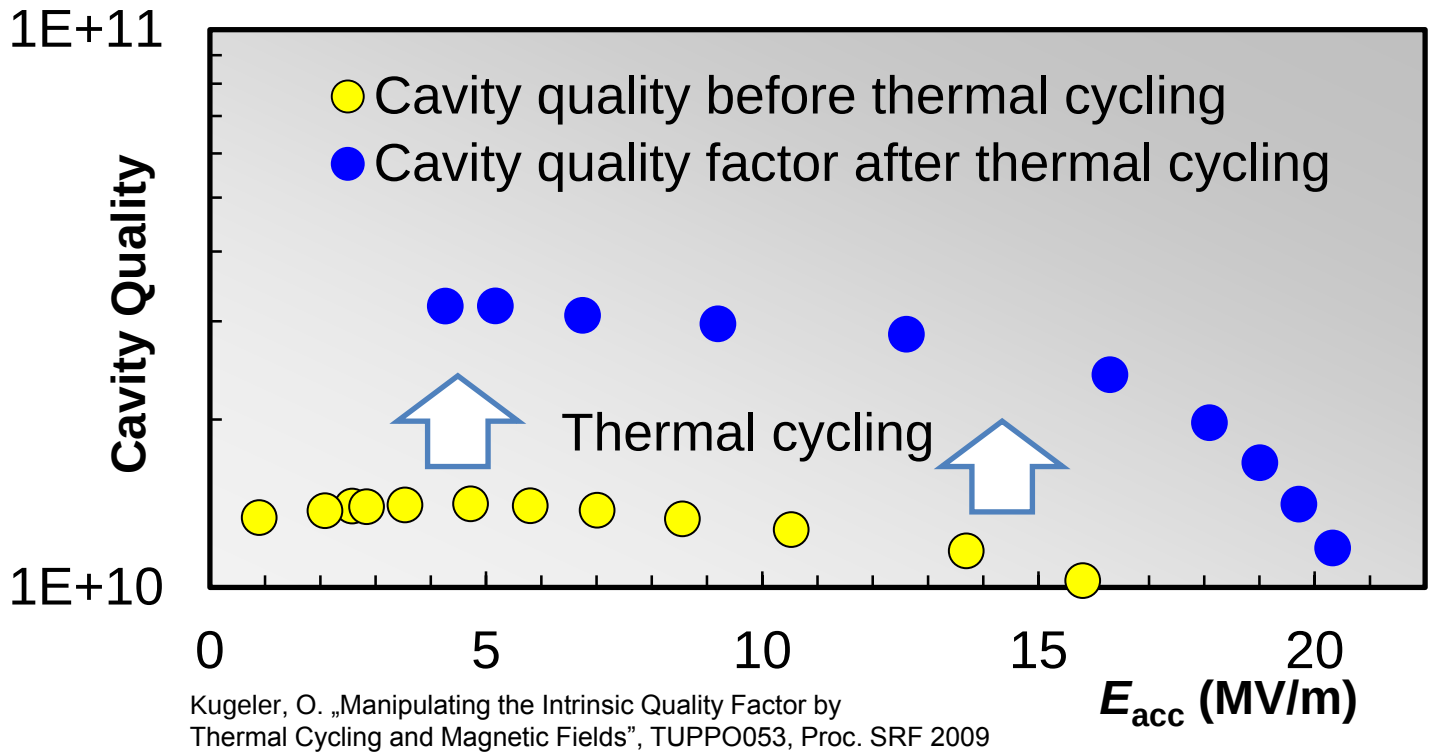
Thermal cycling @HZB

Julia Vogt, HZB

THERMAL CYCLING

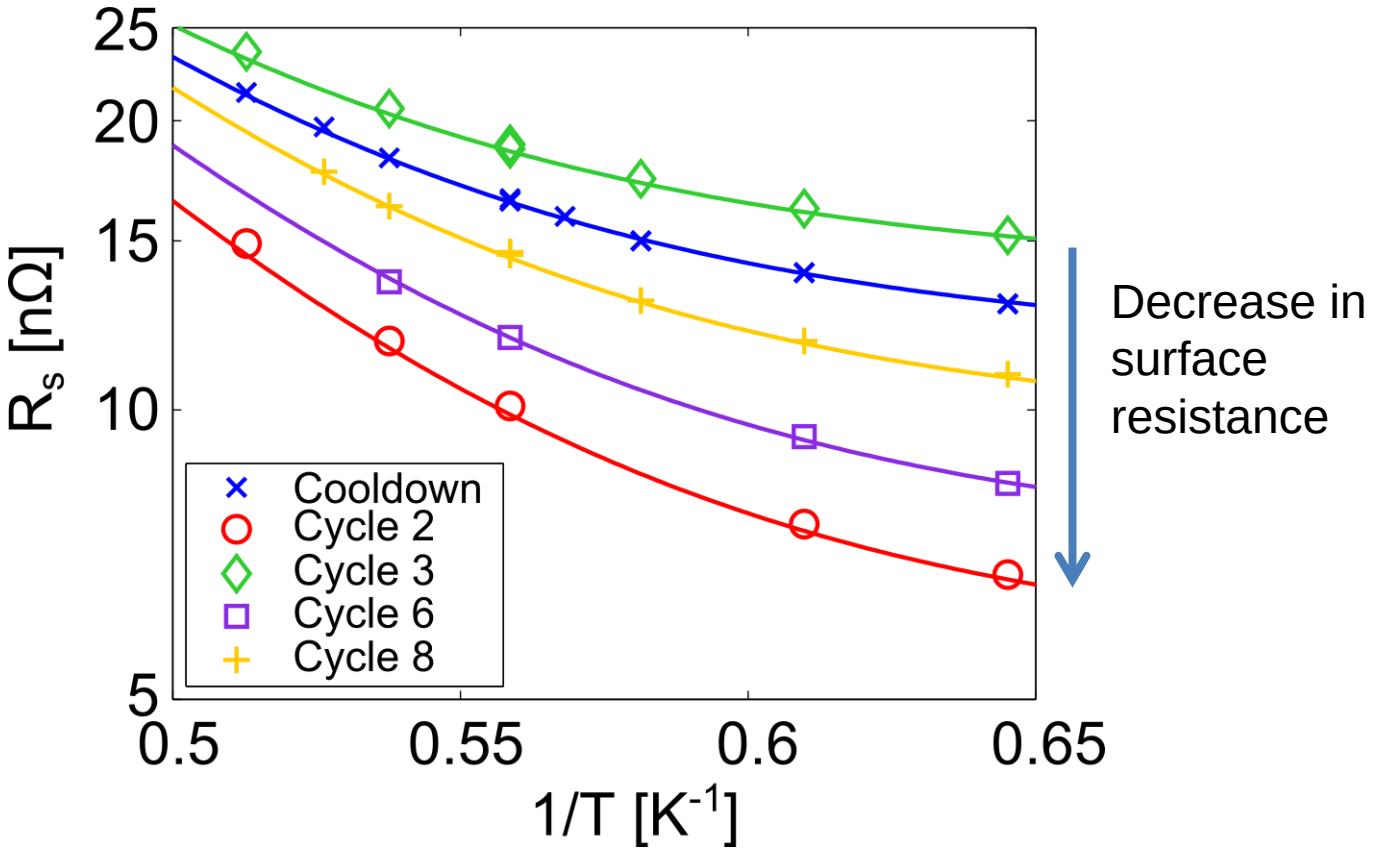
Where we started: “Thermal cycling” @SRF2009
(TESLA cavity in HTS)



Kugeler, O. „Manipulating the Intrinsic Quality Factor by Thermal Cycling and Magnetic Fields”, TUPPO053, Proc. SRF 2009

THERMAL CYCLING

Systematic study → Cooling conditions influence quality factor in HTS (Cavity in tank) significantly



Kugeler, O. SRF 2013

THERMAL CYCLING

What we learned:

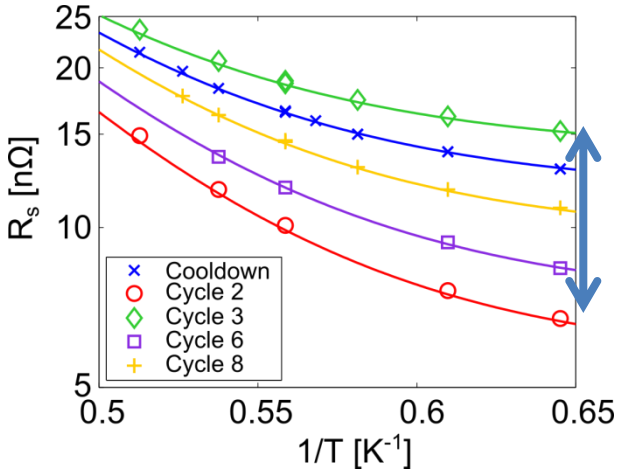
- Same cavity, same run, same setup…
- No change in any other parameter

$$G/Q_0 = R_{surface} = R_{BCS}(f,T) + R_{residual}(?)$$

- Change is due to trapped magnetic flux
- Dynamics close to transition temperature are most important

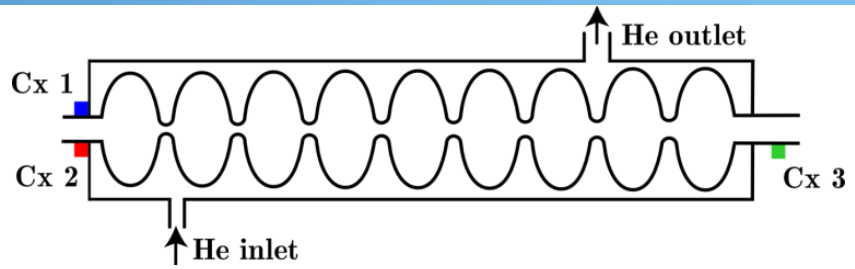
What we still need to understand in detail in basic R&D:

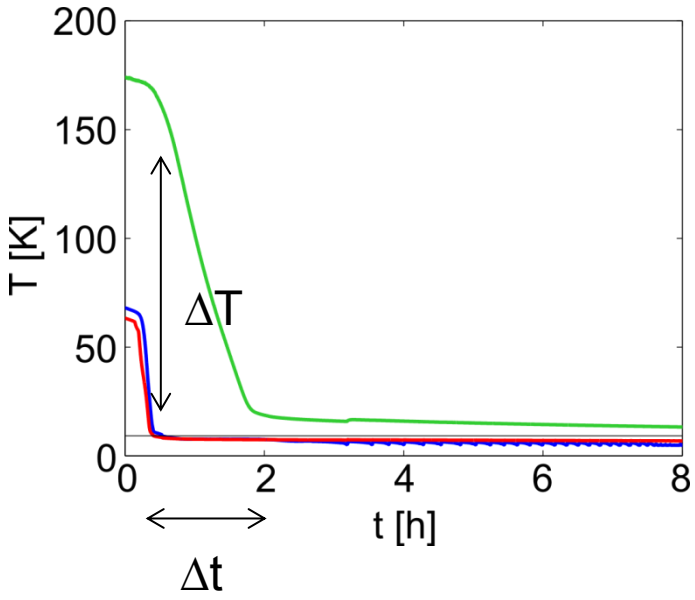
- Where does the flux originate from?
- What are the dynamics of the trapping? Phasefront vs. nucleation
- Which gradients are relevant? Temporal? Spatial?

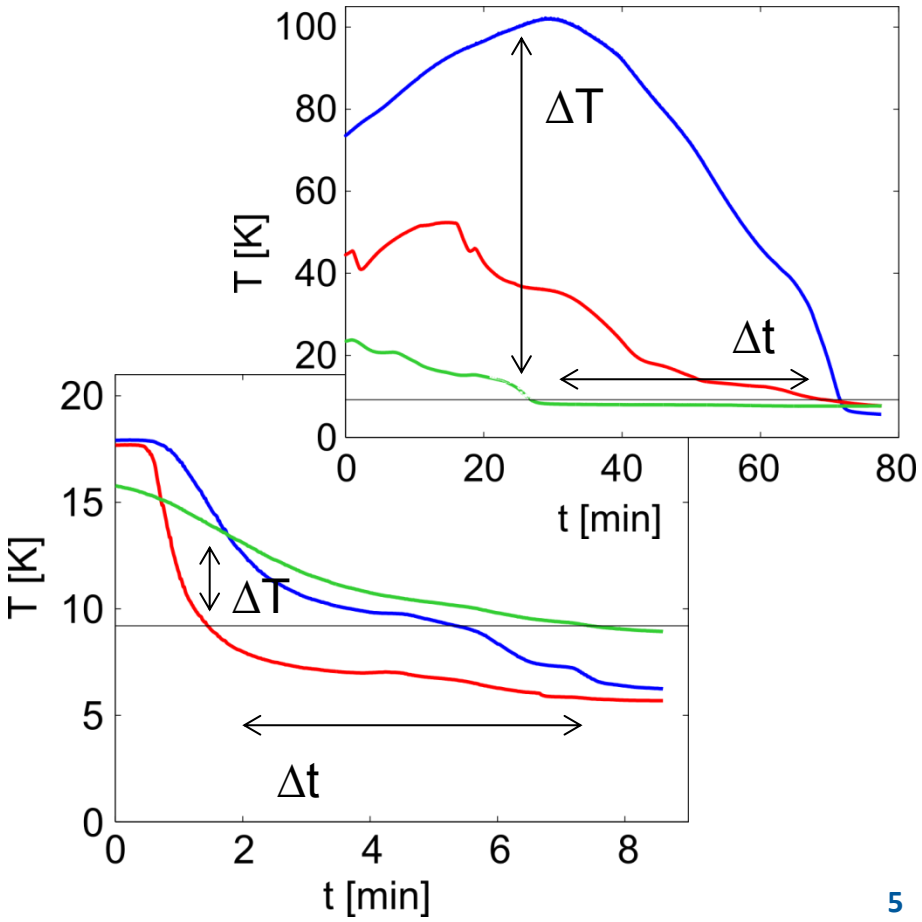


THERMAL CYCLING

About gradients and distributions:







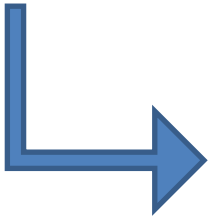
- Spatial gradient ΔT
- Temporal gradient Δt
- Temporal change of spatial gradient ΔT/ Δt
- Linked in HTS!

THERMAL CYCLING

Results at
- FNAL
- Cornell
- DESY
- CEBAF
- …

Basic R&D in VTS/HTS and…

… data from recent modul tests



Basic R&D questions:

- *Where does the flux originate from?*
- *What are the dynamics of the trapping? Phasefront vs. nucleation*
- *Which gradients are relevant? Temporal? Spatial?*

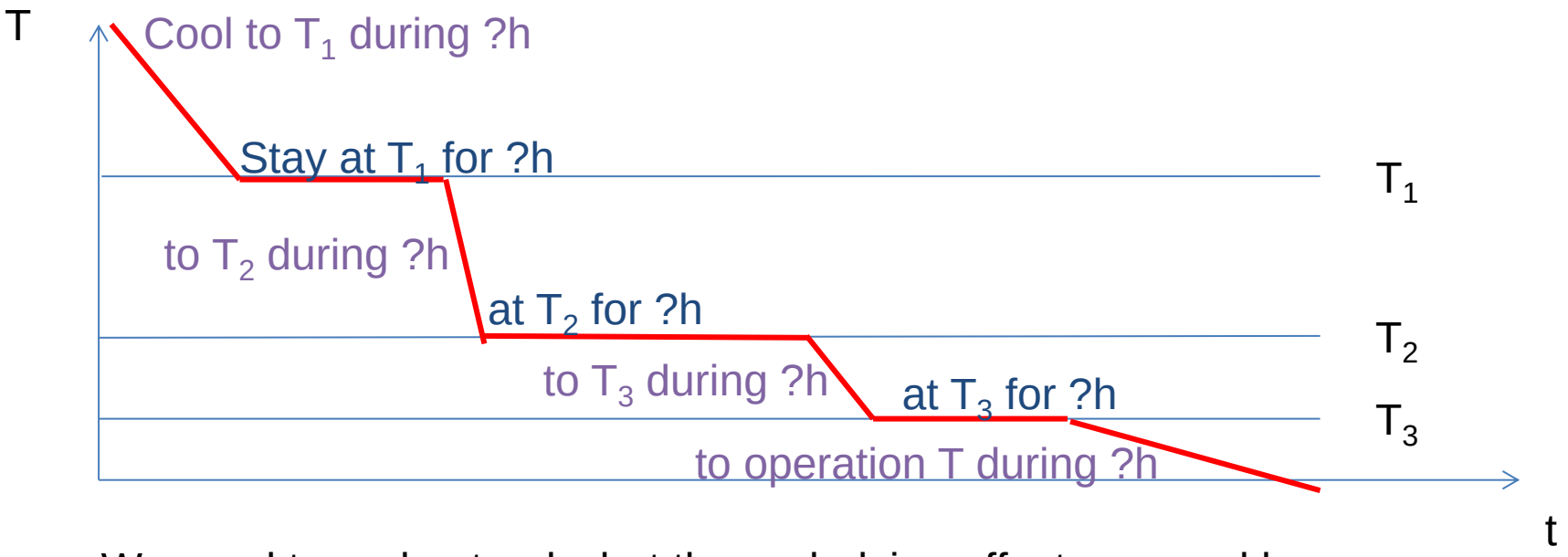
Next steps: R&D in samples, HTS, VTS, modules with diagnostics:
- Temperature sensors close to where the physics is going on
- Magnetic field probes
- …

THERMAL CYCLING

What does that mean when considering module testing?

Thermal Cycling → Controlling cooling conditions

What does the operator need?



We need to understand what the underlying effects are and how we can translate them into a cooling scheme.