B-Mapping Project: Measurement Requirements

Study Impact of Mid-T Heat Treatments on Magnetic Flux Expulsion Behavior

amount of trapped magnetic flux determined by:

fixed during measurement:

- heat treatment (here mid-T)
- cavity geometry
- niobium grain size
- niobium grain orientation

adjustable during measurement:

- cooldown velocity
- temperature gradient along the cavity surface
- magnetic flux density meanwhile T_c transition

goal: study independently impact of each parameter → hold other parameters constant meanwhile!

Heater-Project

Define a Controlled Temperature Gradient along Cavity Surface

Linear Cooldown:

- solution developed by Juergen
- recommissioning ongoing by cryo-colleagues

Temperature Gradient:

- four heaters (arranged in groups of two) used to define temperature gradient
- located at upper and lower drift tube
- controlled by PI(D)-loop



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- four heaters (arranged in groups of two) used to define temperature gradient
- located at upper and lower drift tube
- controlled by PI(D)-loop
- control parameters were stepwise manually adjusted until satisfactory results were achieved
 - \rightarrow low overshoot
 - \rightarrow no ringing
 - \rightarrow low approaching time to target value





- tuning of vacuum valve (cryo plant) PI control loop ongoing
- temperature gradient constant at 0 K (red curve T1(upper iris) covered by black curve T3(lower iris)

06.3.23 22:00:00

□ XATC2TTC1001_temp K □ XATC2TTC1003_temp K □ XATC2TTC1002_temp K

06.3.23 20:00:00

07.3.23 00:(









Plotting Data



Scheduled Measurements - Baseline Series - 1DE26

Mid-T Heat Treatment: Before After Comparison

→ separately investigate performance impact / flux expulsion behavior of "assumed technical extrema"

date [KW]	cooldown velocity [K/h]	temperature gradient [K]	mag. flux density [uT]
10	-3	0	10
10	-3	6	10
11	-3	0	0*
11	-3	6	0*
11	-30	0	10
11	-30	6	10
12	-30	0	0*
12	-30	6	0*

after each cooldown:
2 x Q-E curve @ 2 K
→ identify possible
additional trapped flux by
quench

(one time) 1 x Q-E curve @ 1.5 K to approximate R_{BCS}

* only residual mag. flux – no active cancelation for a potential comparison with performance after usual vert. test

DESY. | Presentation Title | Name Surname, Date (Edit by "Insert > Header and Footer")

Scheduled Measurements

Potential Improvements

- replace measurements @ 0 uT by a single one with active flux cancelation to exclude impact of Rflux
- investigate temperature induced "threshold flux" [Felix et al.] by an independent test series
- investigate impact of cooldown velocity by an independent test series

