



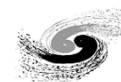
苏州八匹马超导科技有限公司

Status of CCT corrector construction and test

Yingzhe Wang



Progress of series production



苏州超导科技有限公司

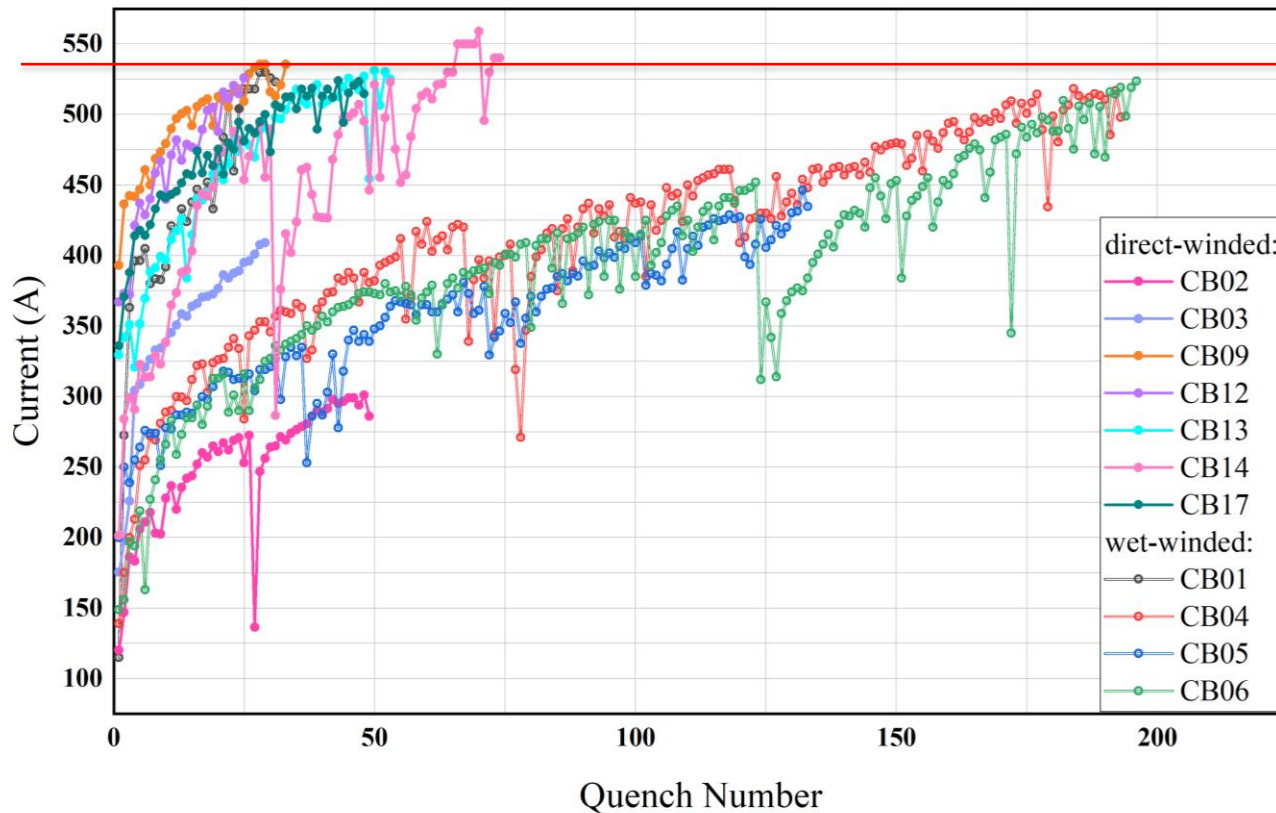
	Coil name	Winding method	Location	Coil stand-alone performance (4.2 K)	Magnet performance at 4.2 K
MCBRD01	MCBRD_CB01	Wet wind	CERN	530 A	Both apertures reached ultimate current 422 A, and passed 4-hour stability test
	MCBRD_CB03	Direct wind		410 A (training stopped due to the availability of the test station)	
	MCBRD_CB02	Direct wind	CERN	Failed to reach the design current	
MCBRD02	MCBRD_CB04	Wet wind	CERN	422 A (training stopped due to the availability of the test station)	Both apertures reached ultimate current 422 A, and passed 4*1 hour stability test
	MCBRD_CB06	Wet wind		530 A	
MCBRD03	MCBRD_CB09	Direct wind with new channel size	CERN	530 A	Both apertures reached ultimate current 422 A, and passed stability test
	MCBRD_CB12	Direct wind with new channel size		526 A (25 quenches)	
	MCBRD_CB14	Direct wind with new channel size	BAMA	530 A (30+34 quenches), put in quarantine	
MCBRD04	MCBRD_CB13	Direct wind with new channel size	IMP	530 A (20+33 quenches)	Both apertures reached ultimate current 422 A, and other tests will be implemented in the middle of Oct.
	MCBRD_CB17	Direct wind with new channel size		524 A (47 quenches)	
<u>MCBRD05</u>	MCBRD_CB18	Direct wind with new channel size	IHEP	<i>The stand-alone test of CB18 and CB19 will be implemented in the middle of Oct.</i>	-
	MCBRD_CB19	Direct wind with new channel size	IHEP		-
	MCBRD_CB20	Direct wind with new channel size	BAMA	<i>Ready for VPI</i>	
MCBRD_CB10, 11, 15, 16		Shipped to CERN for fabrication			

Stand-alone test results of all Apertures



苏州八匹马超导科技有限公司

Training History of the HL-LHC CCT Coils



530A

Manufacture of CB14



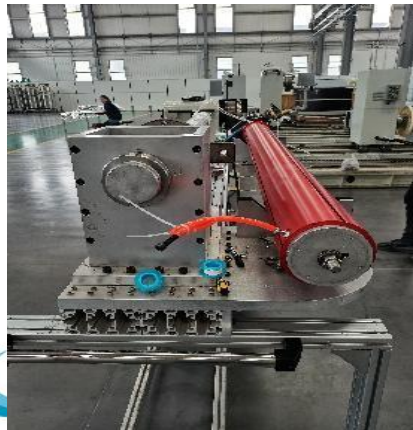
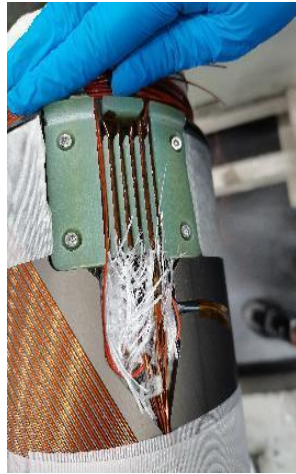
苏州八匹马超导科技有限公司



Manufacture of CB14



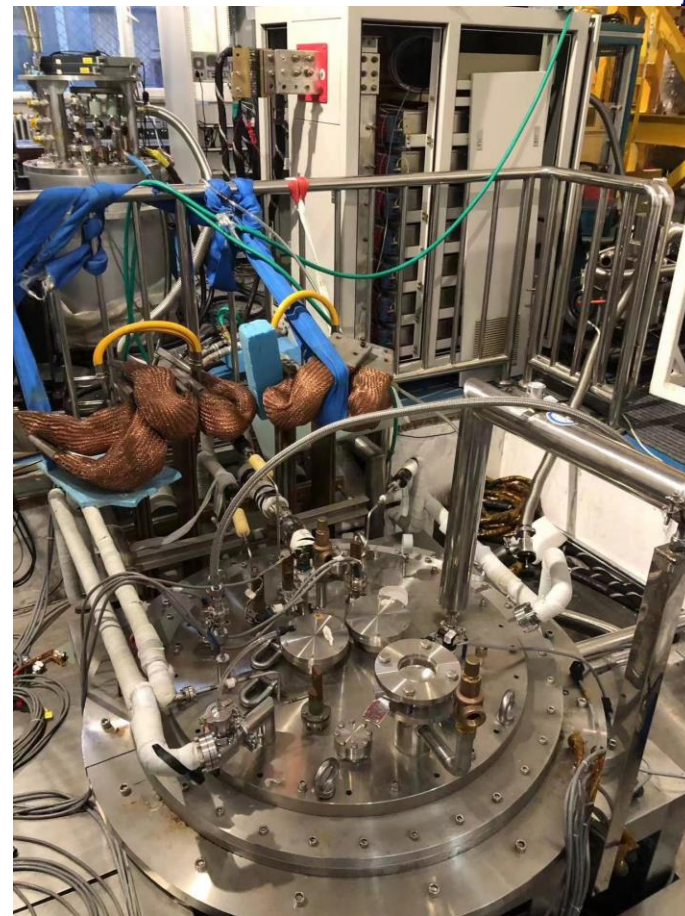
苏州八匹马超导科技有限公司



Stand-alone test of CB14 at IHEP



苏州八匹马超导科技有限公司

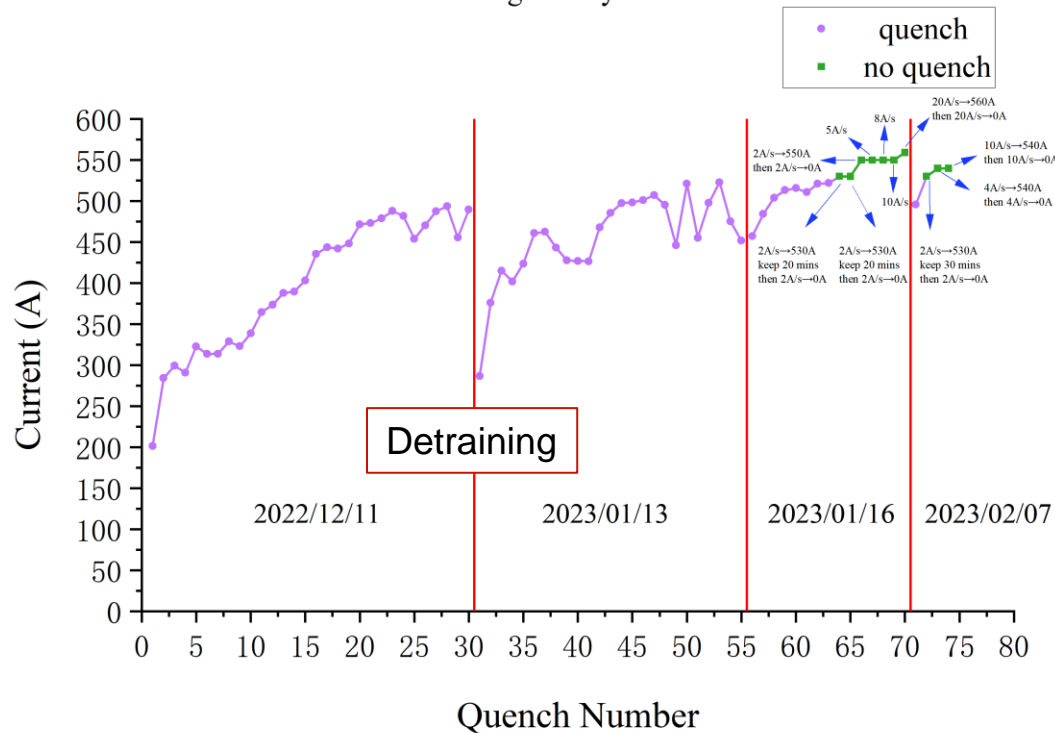


Stand-alone test of CB14



苏州八匹马超导科技有限公司

Traning history of CB14

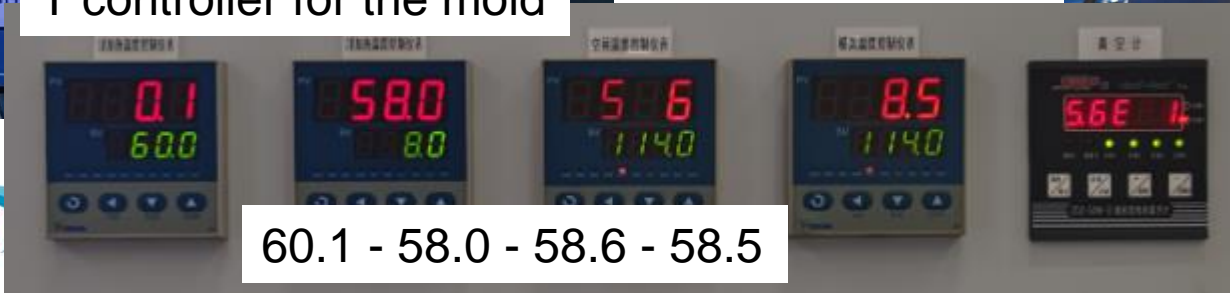
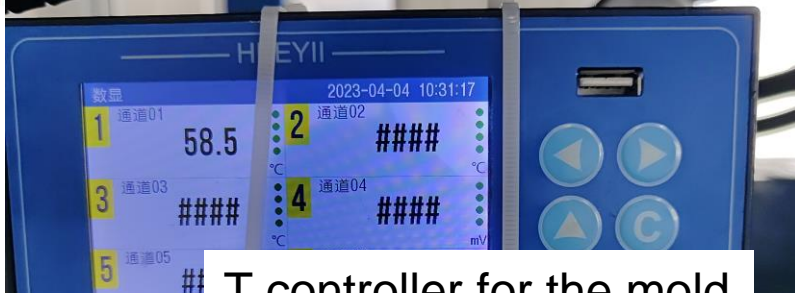
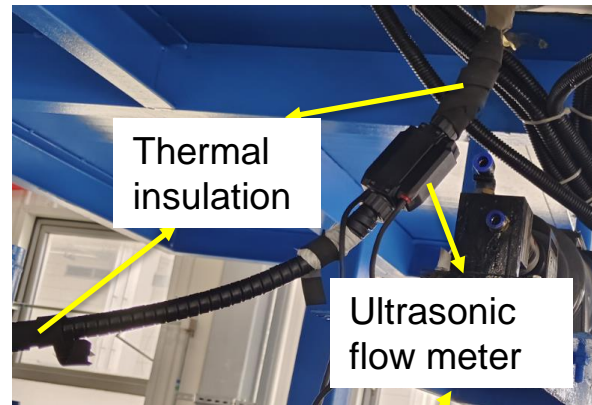
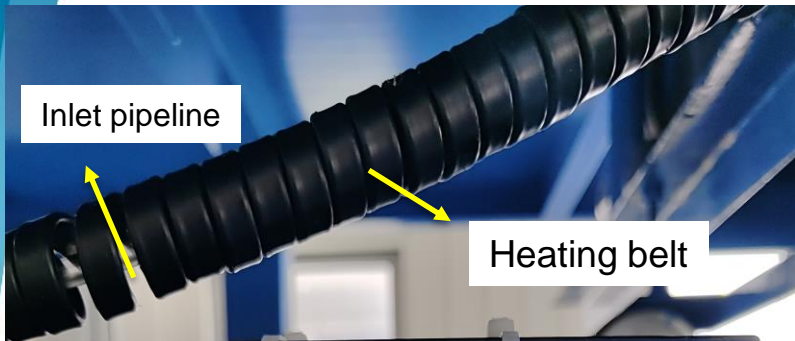


Changes:

- Changes of the operators.
- **The inlet pipeline between mix tank and impregnation furnace (exposed in the air ~10°C) didn't use any thermal insulation.**
- It takes a longer time (6~7h) of injection compared with CB09 ~ CB13 (3~4h).



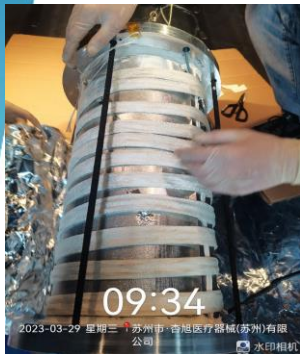
Corrective action of the VPI station



Qualification of the VPI system



苏州八匹马超导科技有限公司

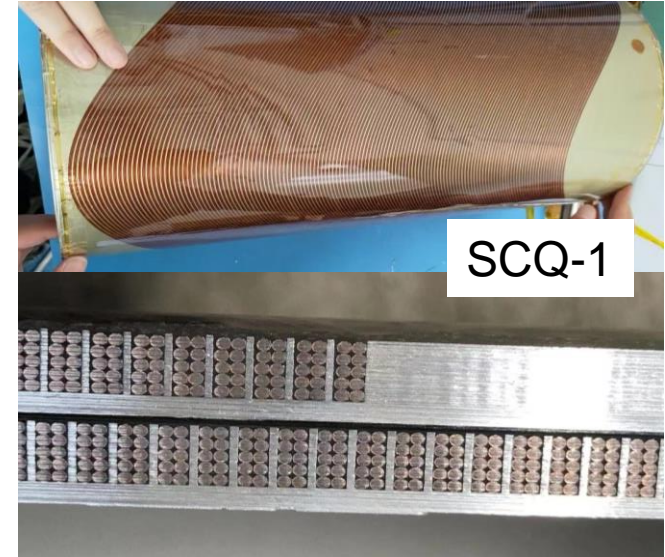
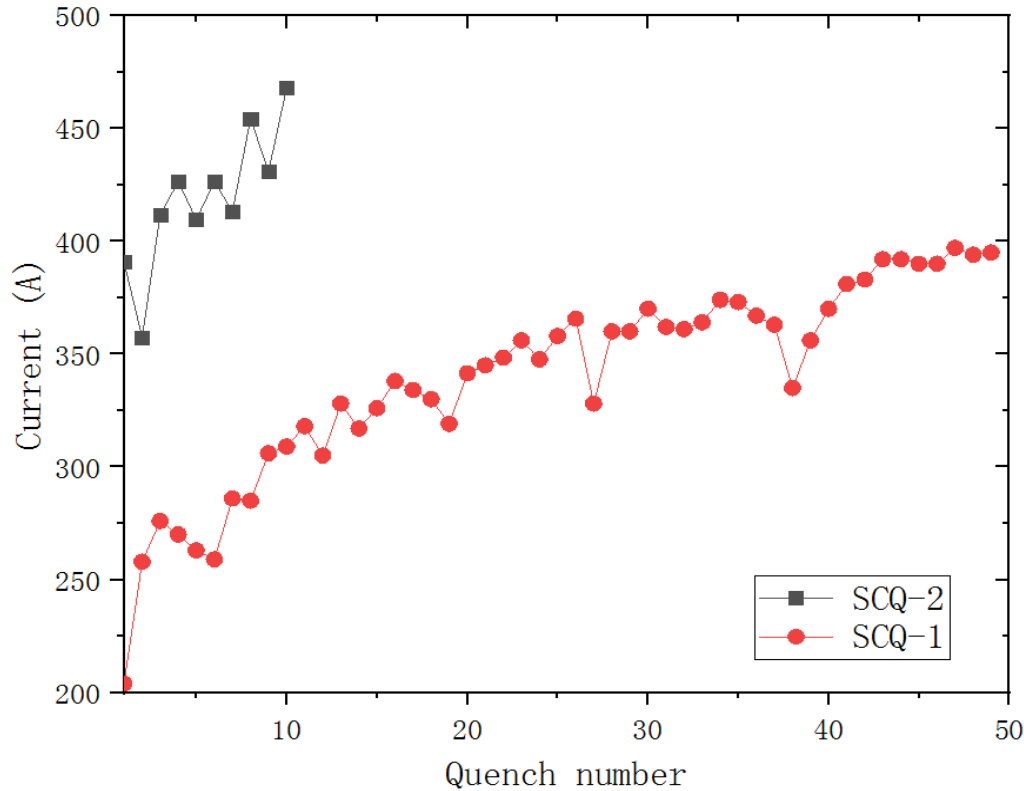


Set the curing procedure.
设定固化程序。

60°C → 30min → 80°C → 1440min → 80°C → 60min → 135°C → 180min → 135°C → 20°C

- We use a 0.5m quadrupole CCT magnet as a qualification of the VPI system after applying the corrective actions.
- This magnet will be tested this week.

Performance of SCQ-CCT coils

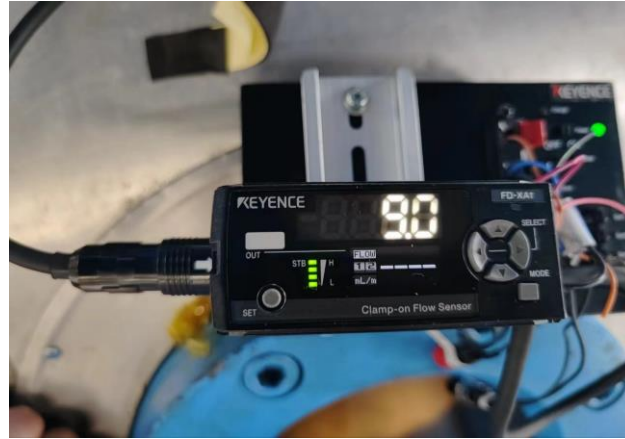
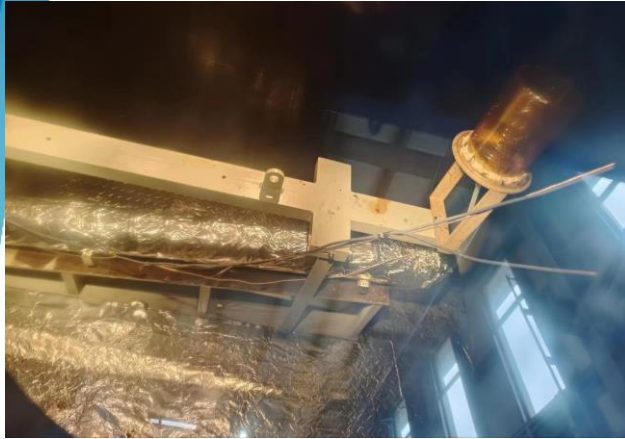


- Well impregnated magnet SCQ-1 experienced long training
- With the modified channel size, the training performance of SCQ-2 significantly improved.

VPI for CB17



苏州八匹马超导科技有限公司



Equipment	Object	Function	Voltage/ Current	Test Time	Resistance
Megger MIT 525	Coil to ext. tube	IR	512V/5.82nA	30 s	88.0 GΩ
	Coil to ext. tube	IR	1026V/10.4nA	30 s	98.4 GΩ
	Coil to ext. tube	IR	1544V/16.5nA	30 s	93.8 GΩ
	Coil to ext. tube	IR	2052V/22.3nA	30 s	92.2 GΩ
	Coil to ext. tube	IR	2557V/20.8nA	30 s	123.2 GΩ
	Coil to ext. tube	IR	3267V/32.1nA	30 s	101.9 GΩ



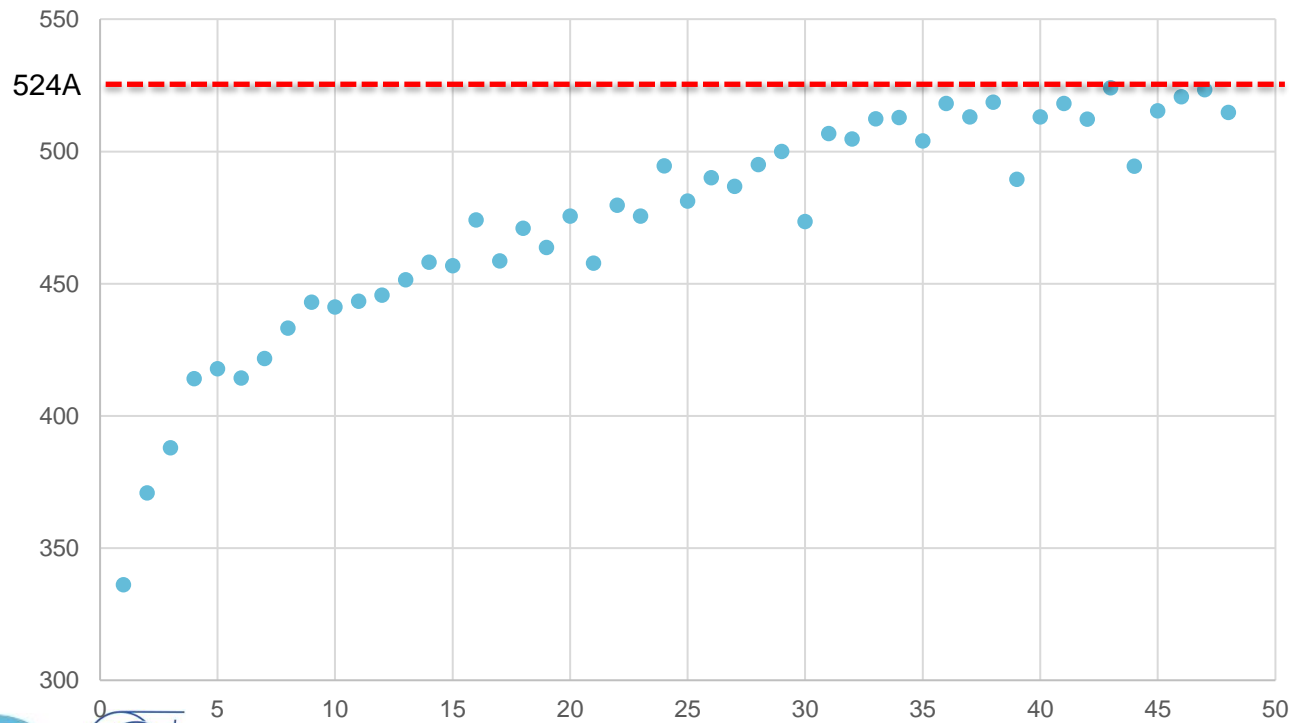
2023-06-05 星期一 苏州八匹马超导科技有限公司 水印相机

Stand-alone training of CB17



苏州八匹马超导科技有限公司

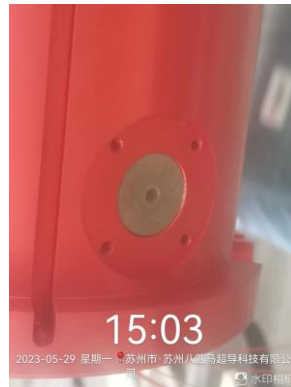
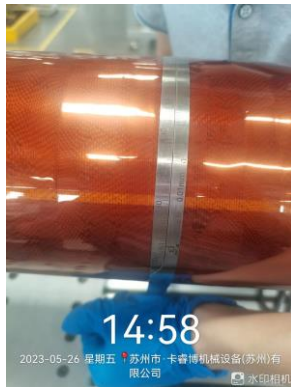
Training history of CB017



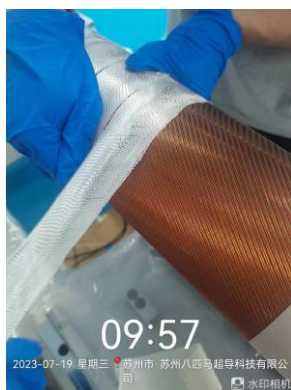
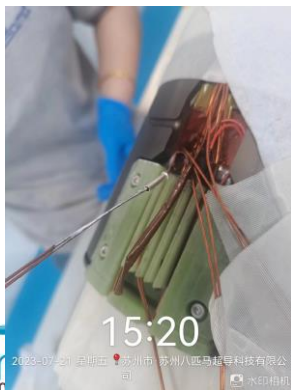
Manufacture of CB18



苏州八匹马超导科技有限公司



Manufacture of CB19



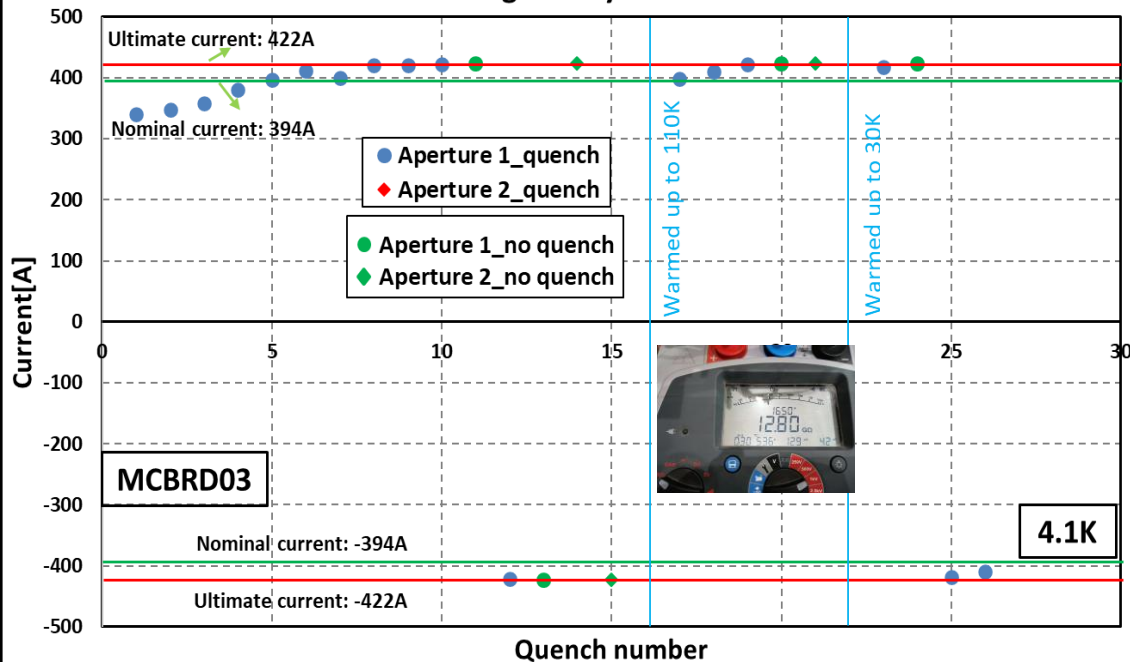
Training history of MCBRD03 (1st test)



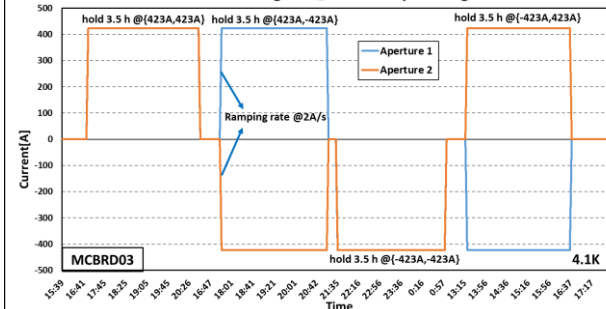
苏州八匹马超导科技有限公司

- AP1(CB12, 25 quenches 526A) reached $\pm 422\text{A}$ after **11 quenches**.
- AP2(CB09, 33 quenches 530A; after thermal cycle > 500A) reached $\pm 422\text{A}$ **without any quenches**.

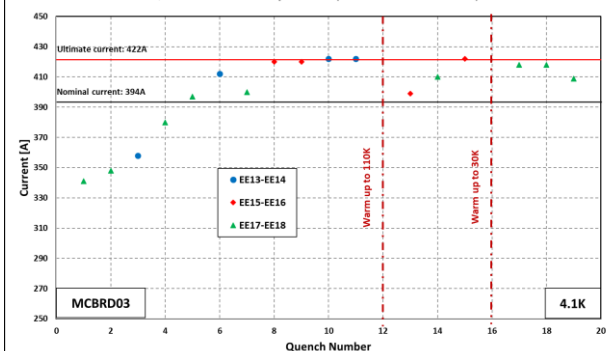
The training history of MCBRD03



The 3.5 h holding test @combined powering



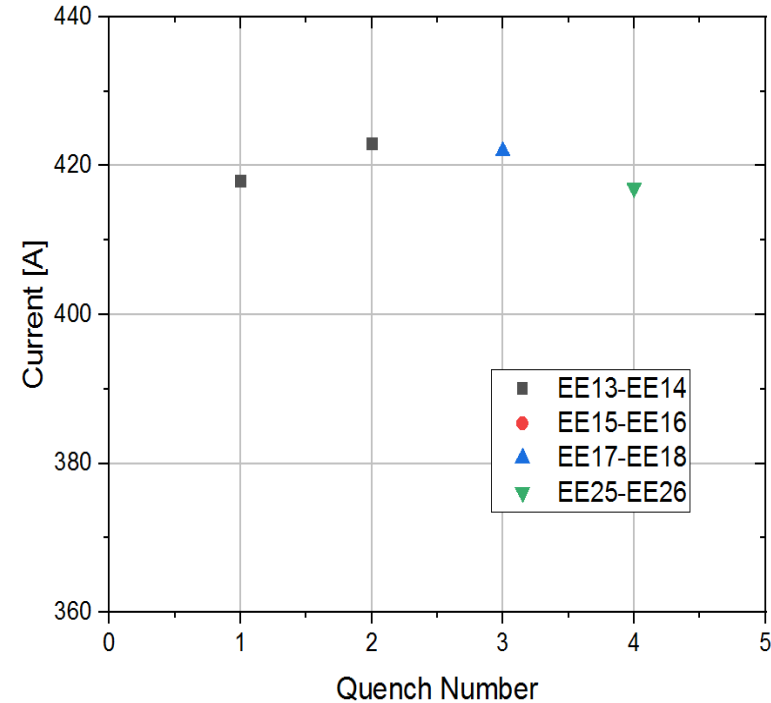
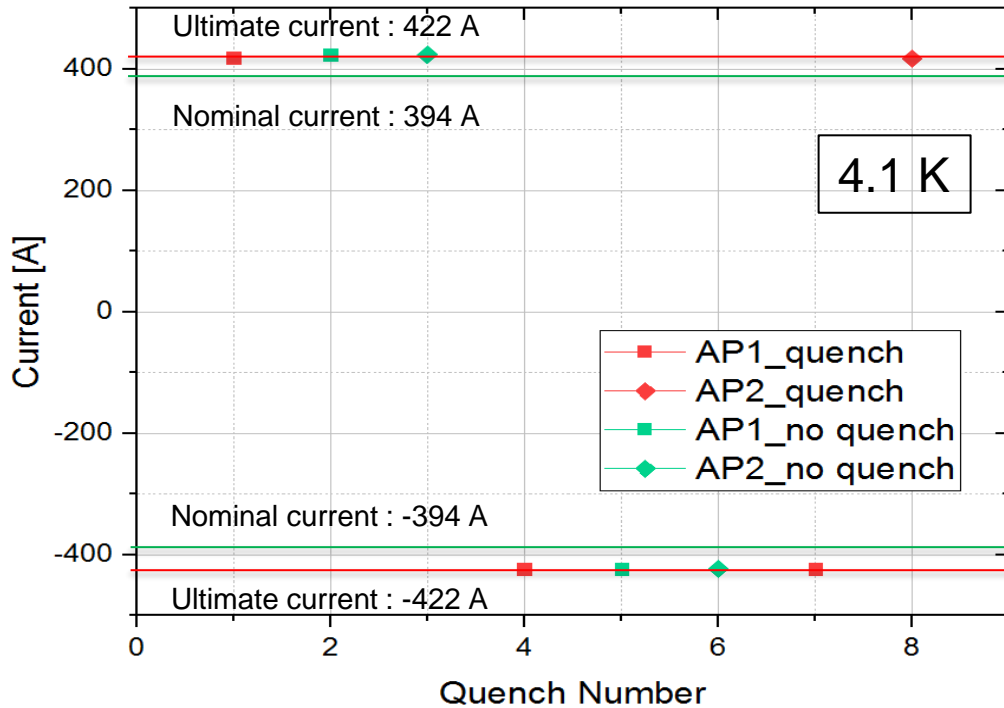
Quench locations of Aperture 1 (take the absolute value)



Training history of MCBRD03 (2nd test)

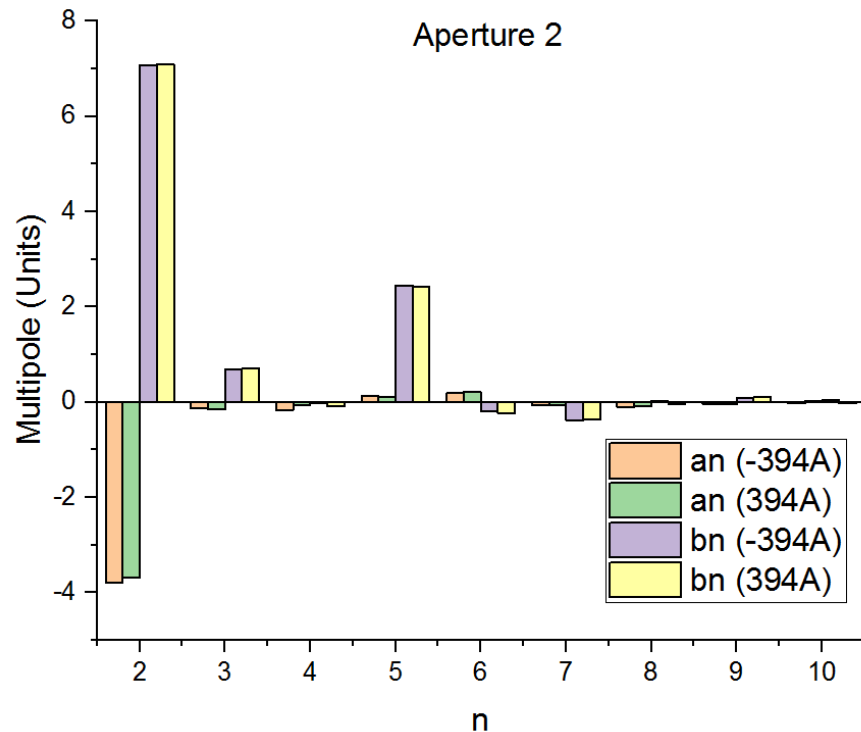
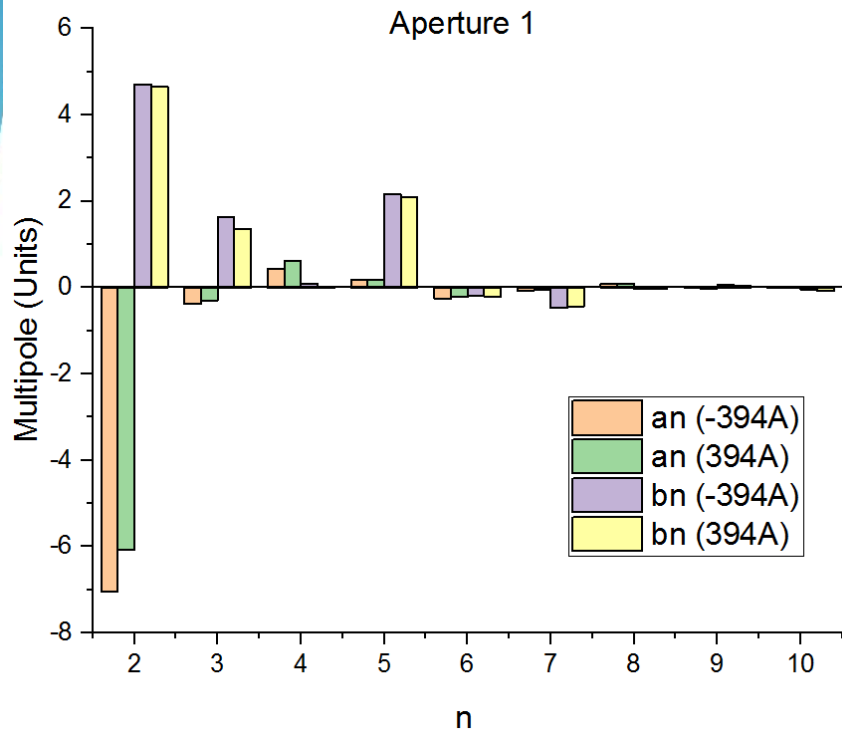


- Both Apertures reached the nominal current **without any quenches** after thermal cycle.



Field Quality of MCBRD03

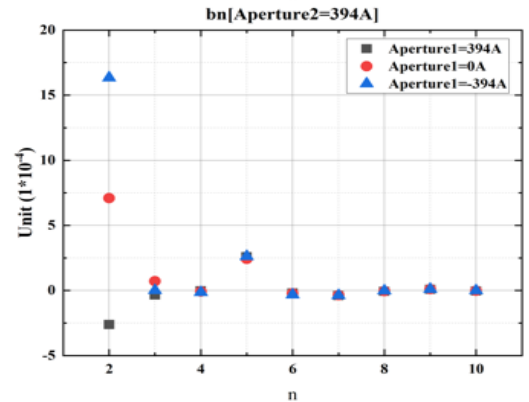
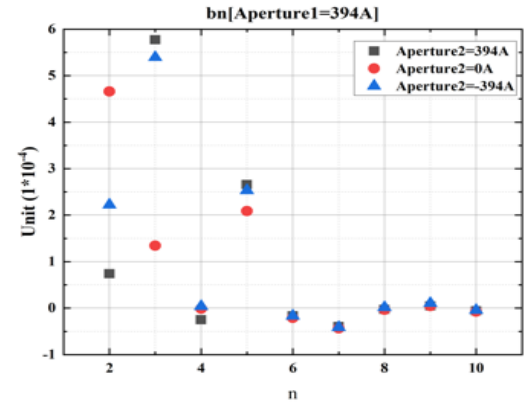
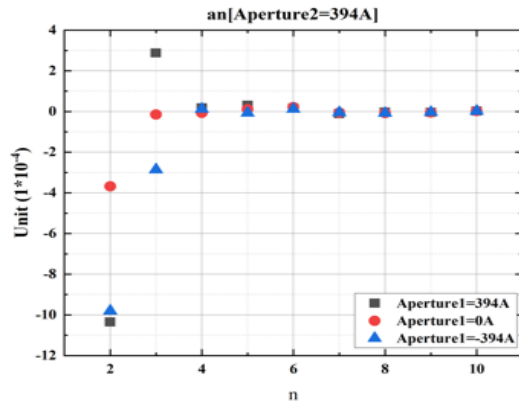
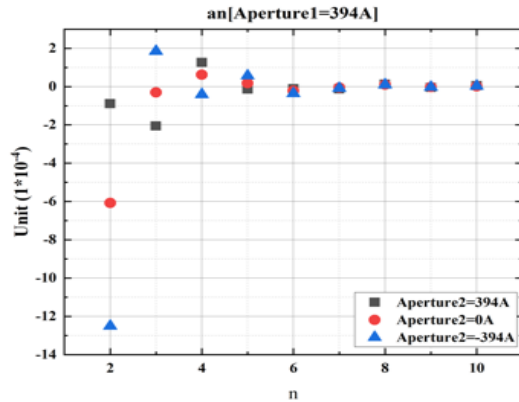
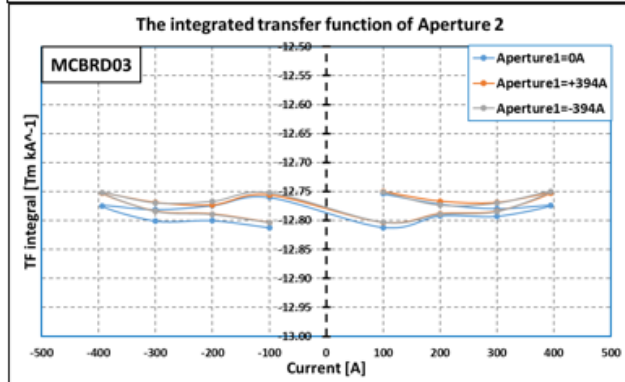
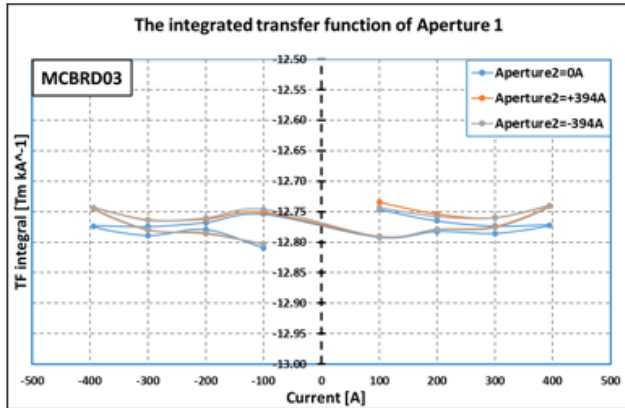
Multipoles (individual powering)



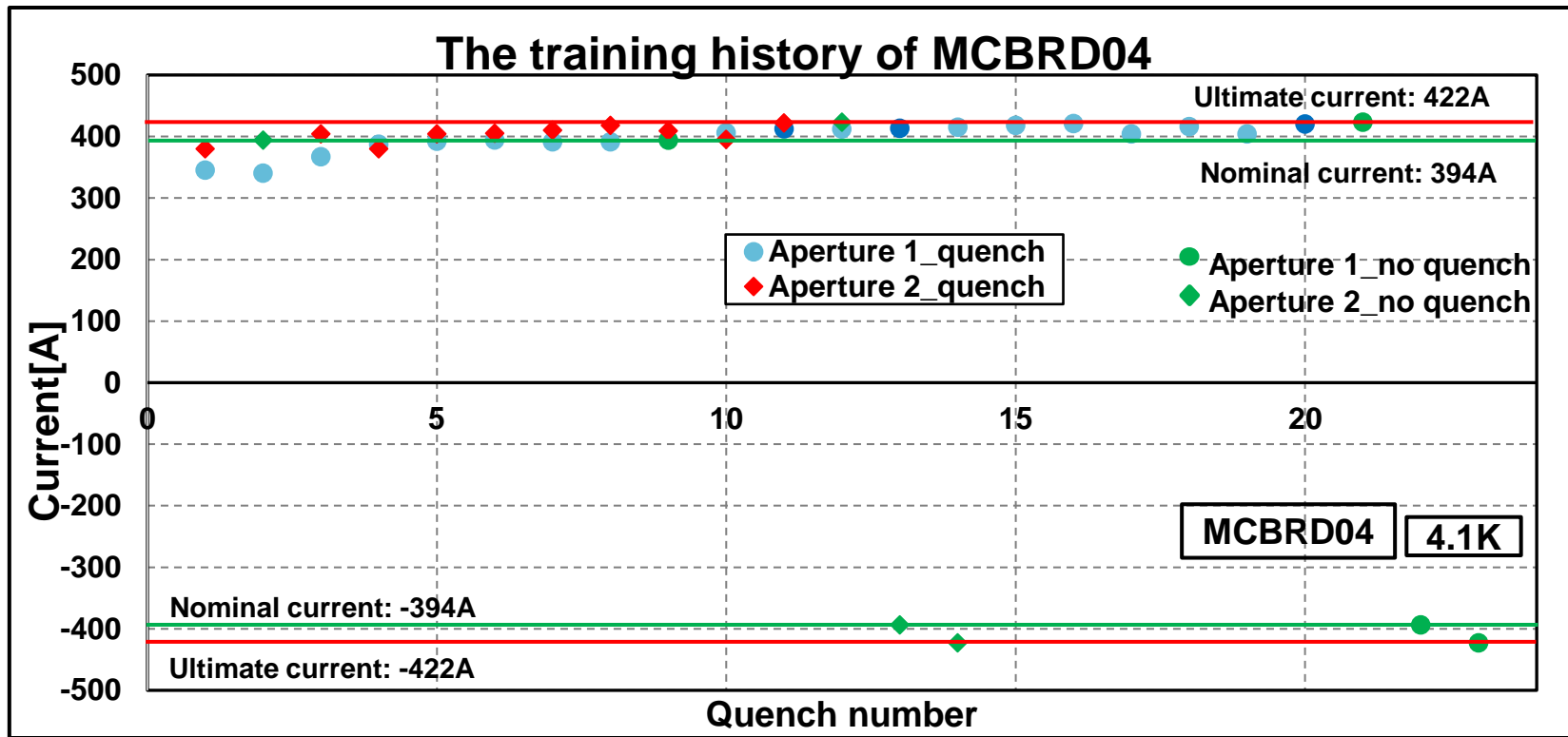
Field Quality of MCBRD03

Crosstalk-transfer function (combined powering)

Crosstalk- Multipoles (combined powering)



Training history of MCBRD04 (1st test)



- AP1(CB17, 47 quenches 524A) reached $\pm 422\text{A}$ after 15 quenches.
- AP2(CB13, 53 quenches 530A) reached $\pm 422\text{A}$ with 10 quenches.

Summary



- 4 series CCT magnets have been fabricated. All of them reached the ultimate current and passed the field quality test. The 5th magnet is under fabrication.
- The 4th magnet to be delivered in late Oct or early Nov. The 5th magnet to be assembled in Nov, tested and delivered in late Dec 2023 or early Jan 2024
- Production rate for the rest of series magnets: every 3 month per magnet
- Components for 2 CCT magnets have been shipped to CERN from IHEP, to verify the performance with components from China and CERN fabrication process.



Thanks for your attention

