



MBHSP109 test program discussion

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Test phases

Phase 0 at 4.5 K: low current preparation, dielectric strength test at 1 kV, verifying quench limit (2 quench maximum), performing V-I measurement (1 day)

Phase 1 at 1.9 K: test dielectric strength QH-coil during provoked quench. (most realistic conditions, discussed in <https://edms.cern.ch/document/2276098> and <https://edms.cern.ch/document/2277553>)

Phase 1b at 1.9 K: nominal test dielectric strength QH-coil without current to 3.3 kV

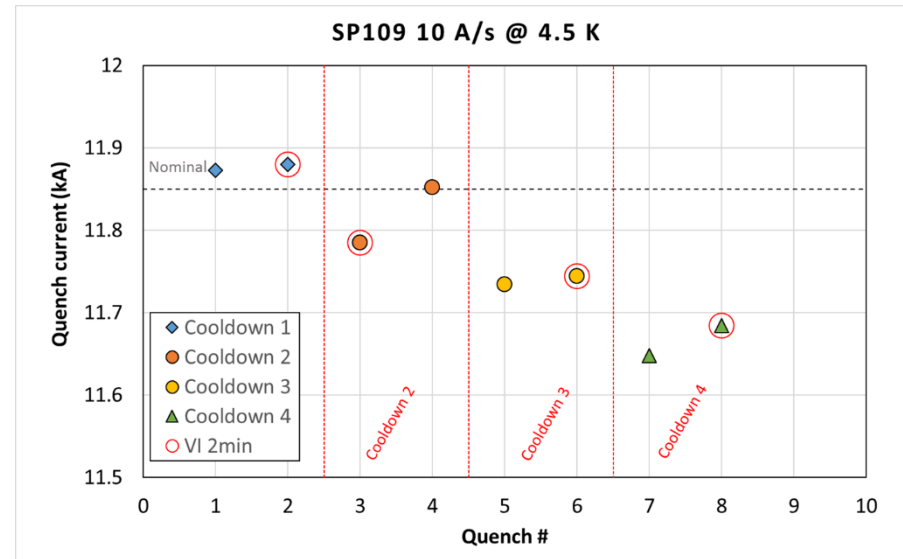
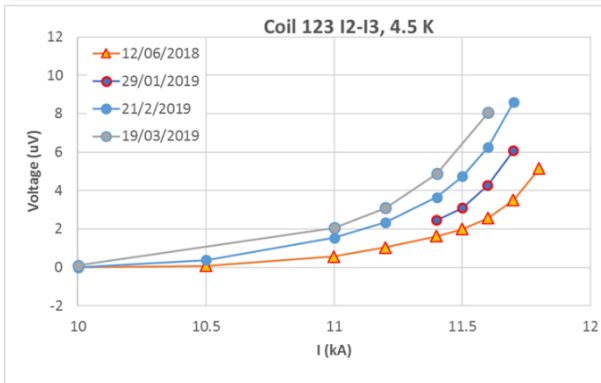
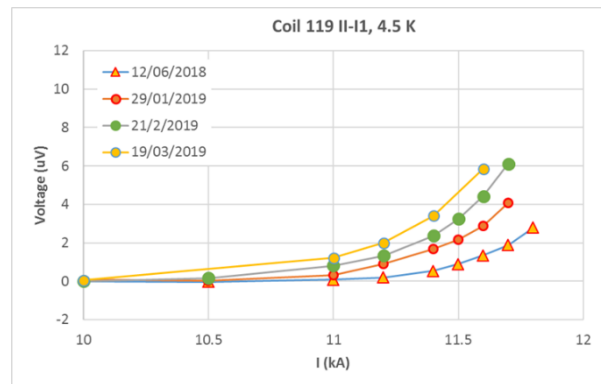
Phase 2 at 200 K: test dielectric strength QH-coil at various pressures

Phase 0 – preparation and performance check

Verify quench limit and V-I curve, to complete the following plots.

Goal is to have data, such that in a possible additional cool down we can find the impact of thermal cycle in HFM compared to Long test station.

Short test: 1 day.



Insulation check (in liquid) at 1 kV

Phase 1 – 1.9 K HV test during quench

1. At 1.9 K train the magnet to 12 kA minimum, and **include the energy extraction** for protection (12.55 kA was the limit for this magnet after high-QI tests).

2. Using the table below, use QH 119 left and QH 123 right for protection and use QH 123 left for the HV test. In the table the target for the voltage between QH and coil is given, starting with 1000 V.

The HV voltage source will set a voltage between ground and coil, the actual voltage will depend on the voltage imbalance/voltage distribution in the coil following provoked quench. A test run with a set test voltage of 500 V will be done first to verify the test system and quantify the voltages used.

Test	Current	Heater used for HV test	QH for protection	Voltage QH-ground	Target V_QH-coil	Measured V_QH-coil
1a	3 kA	QH123R	QH 123L, QH 119L	100 V		
1b	11.85 kA	QH123R	QH 123L, QH 119L	500 V		
1c	11.85 kA	QH123R	QH 123L, QH 119L		1000 V	
2	11.85 kA	QH123L	QH 123R, QH 119L		1000 V	
3a	11.85 kA	QH119L	QH 123L, QH 123L	500 V		
3b	11.85 kA	QH119L	QH 123L, QH 123L		1000 V	
4	11.85 kA	QH123R	QH 123L, QH 119L		1300 V	
5	11.85 kA	QH123L	QH 123R, QH 119L		1300 V	
6	11.85 kA	QH119L	QH 123L, QH 123L		1300 V	
7	11.85 kA	QH123R	QH 123L, QH 119L		1600 V	
8	11.85 kA	QH123L	QH 123R, QH 119L		1600 V	
9	11.85 kA	QH119L	QH 123L, QH 123L		1600 V	

Note: If we have a failure of more heaters, the magnet protection will be increasingly difficult. Therefore the magnet needs to be trained before this

Phase 2 – HV test at 200 K

Test results last test

Test	Temperature	pressure	HV Test level	Result
0	1.9 K	1.35 bar	3.3 kV	Failed for all heaters between 1.5 and 2.5 kV Spare connectors also failed between 2 and 2.4 kV. Reducing the helium level above lambda plate did not improve the measurements significantly.
1	80 K	1.9 bar	940 V	Passed
2	200 K	1.9 bar	940 V	Passed
3	200 K	1.35 bar	940 V	Passed
4	80 K	1.9 bar	1345 V	Passed
5	198 K	2.1 bar	1345 V	123 right passed 119 left passed 123 left failed at 1319 V, but passed in second test 119 right failed at 1291 V, then at 1143 V, then at 941 V and then the leakage current was so high that the test was aborted manually at 612 V
6	200 K	1.35 bar	1345 V	Breakdown in all 3 remaining QH circuits and dummy cables

Following the tests as described in <https://indico.cern.ch/event/862202/>

Test proposal

Test	Temperature	pressure	HV Test level
1	200 K	3 bar	1000 V
2	200 K	3 bar	1300 V
3	200 K	1.35 bar	1300 V
4	200 K	3 bar	1600 V