MBHSP106 Test results 06/02/2018 – 20/02/2018

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11T Dipole Task Force Meeting – 21/02/2018

Tests done since last meeting

- Quench heater studies
- AC losses
  - Standard cycles, cryostat loss, special cycles
- High quench integral studies
  - Increasing by 0.5 MA^2s until degradation

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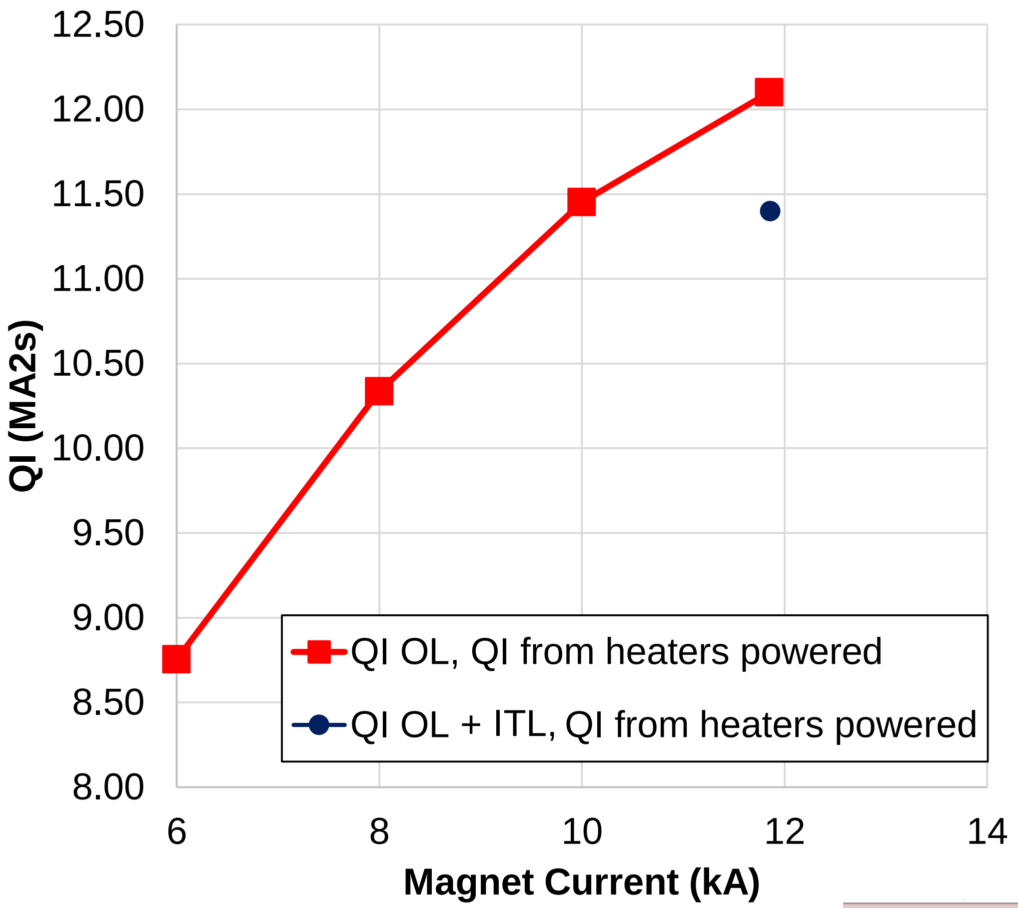
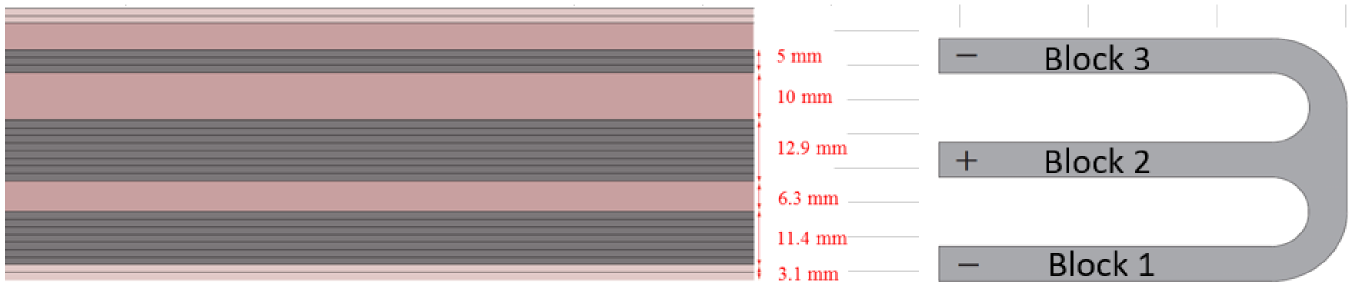
- Quench heater studies
- AC losses
  - Standard cycles, cryostat loss, special cycles
- High quench integral studies
  - Increasing by 0.5 MA^2s until degradation
  - Unexpected: no degradation; improvement (+500 A)
- Verification
  - Endurance, V-I curves, (quenches at 4.5 K)

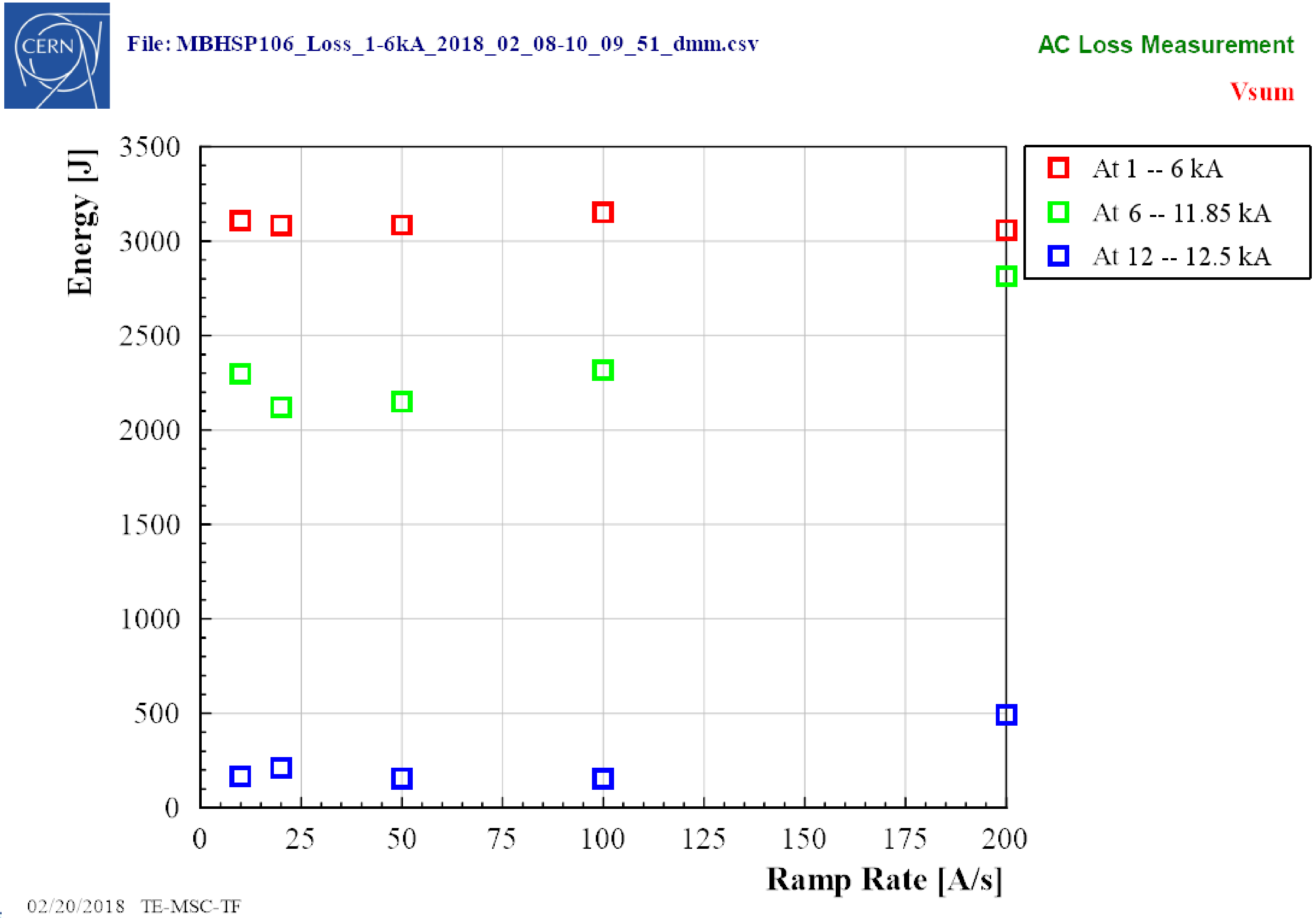
Quench heater studies



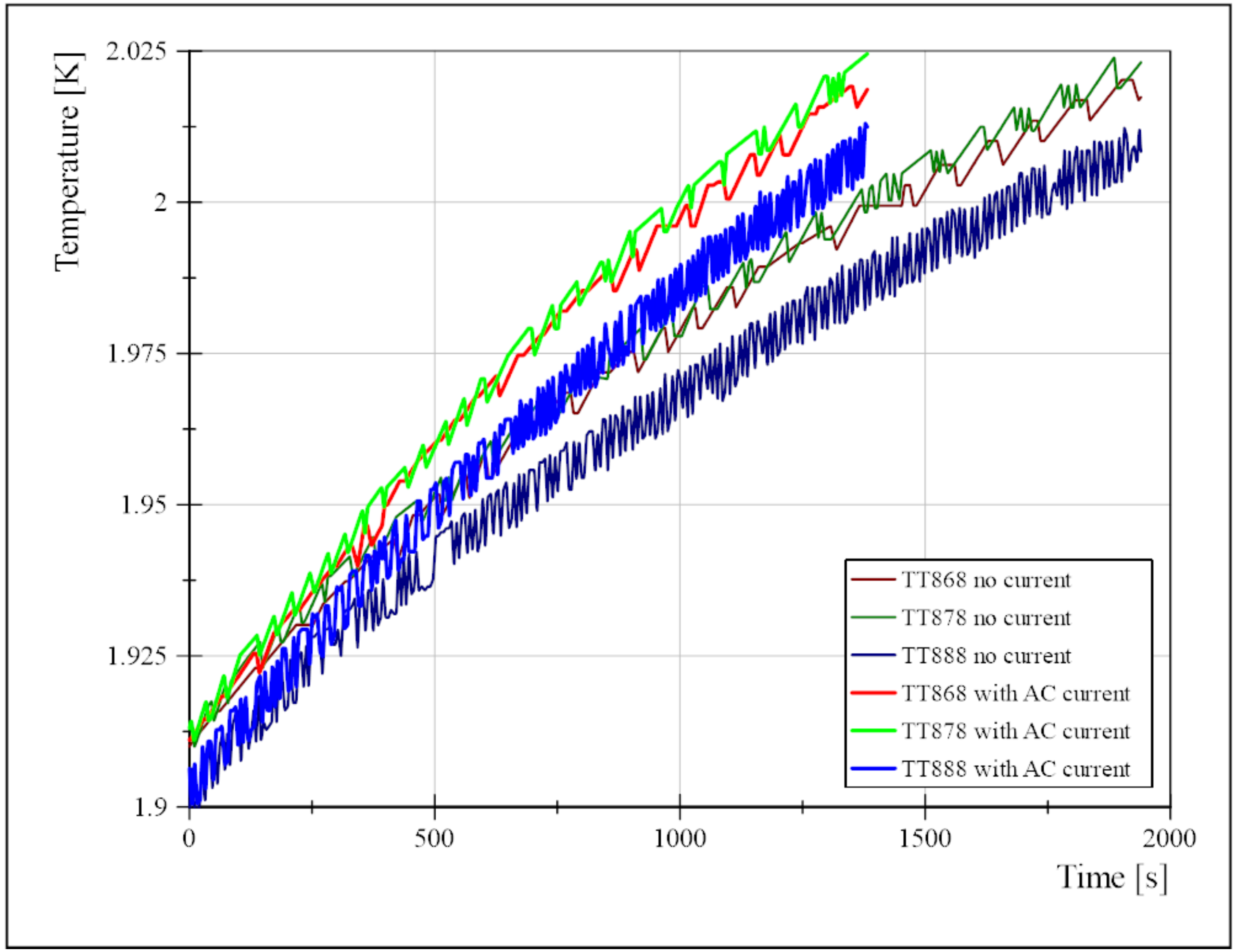
- One interlayer (ITL) quench heater lost after the second cooldown of the magnet
- Nominal power (88 A) discharge at nominal: ITL + OL QH reduce the quench integral by 0.7 MA^2s compared to just OL QH
- Another ITL QH lost after increasing the ITL QH power to 125 A
  - QH circuit resistance doubled: consistent with loss of Block #1



AC losses – standard cycles



AC losses – cryostat loss

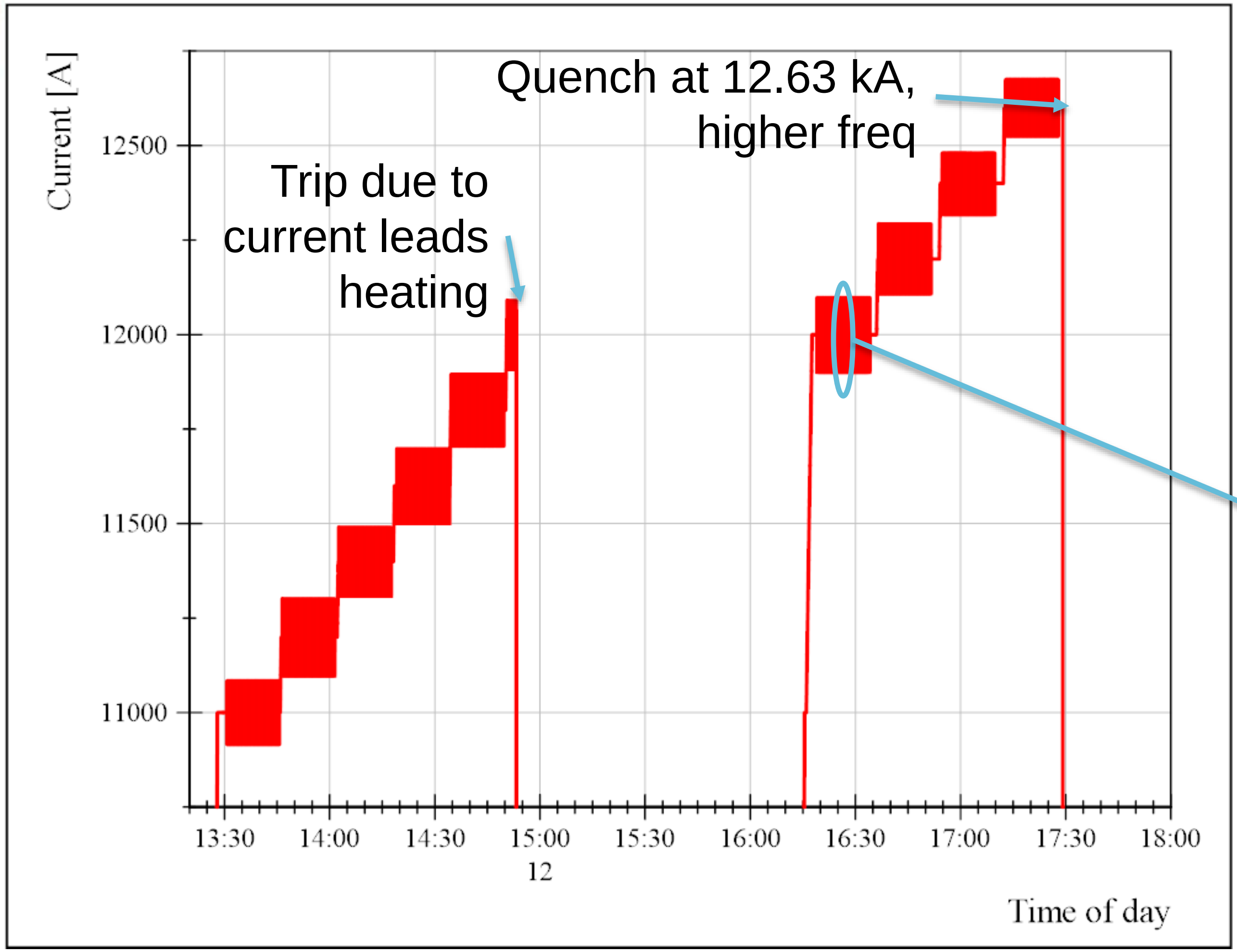


Two tests:

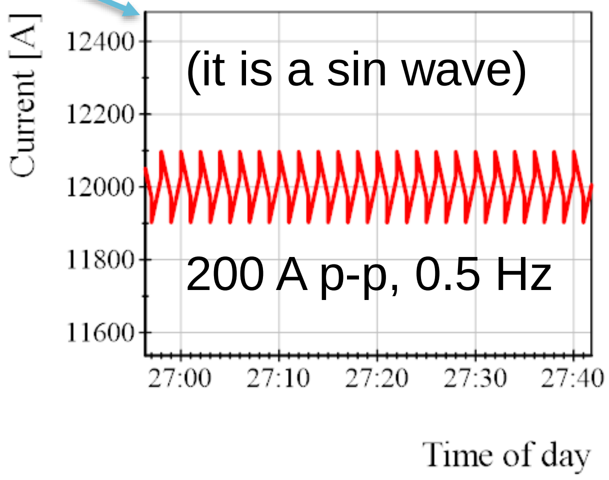
1. Stop 1.9 K pumping, measure temperature drift (dark curves)
2. Stop 1.9 K pumping and have a AC current in the magnet (light curves)

With current the magnet heats about 40% faster

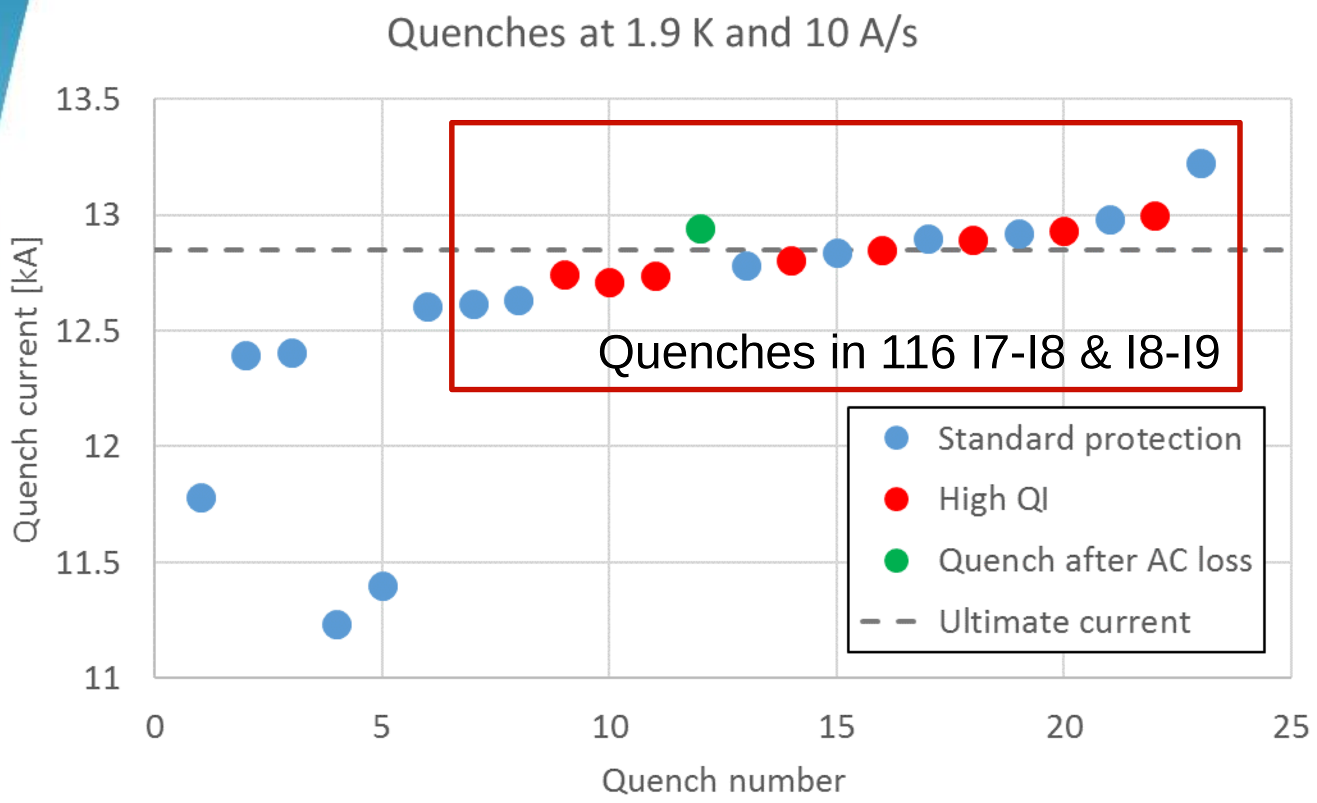
AC losses – special cycle

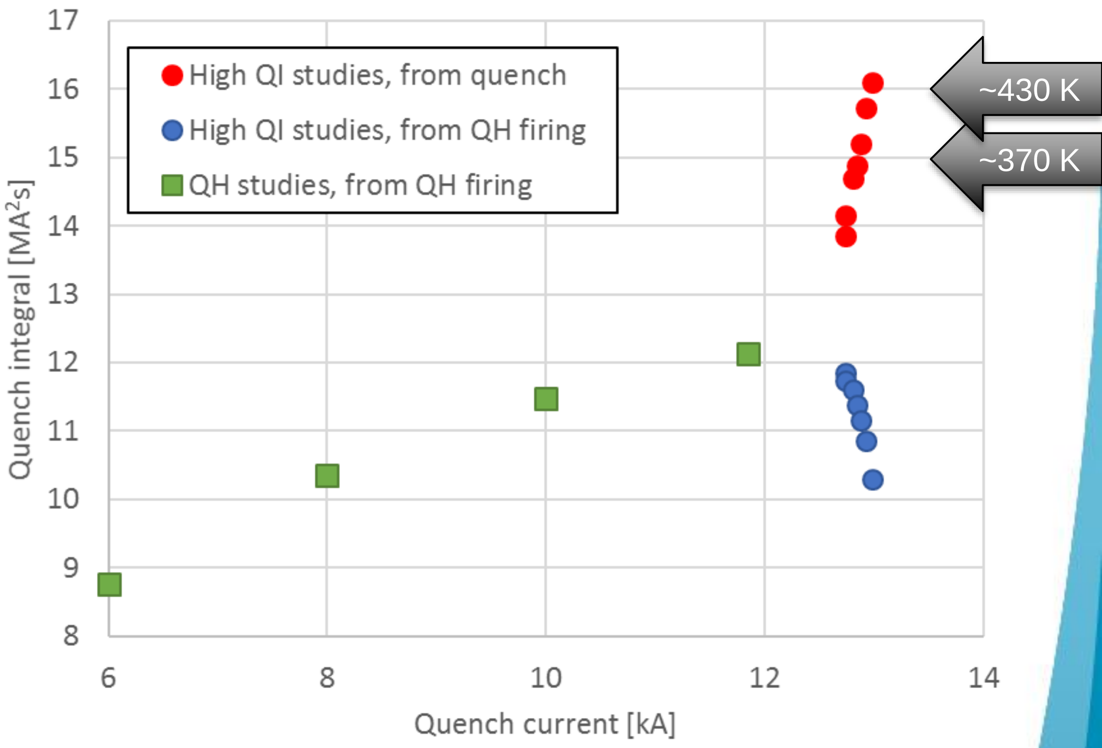


- 15 min of AC cycles at different levels of current, from 11 to 12.6 kA.
- As the expected quench current was 12.74 kA, after the last step we increased the frequency to 2 Hz, which provoked a quench as 12.63 kA



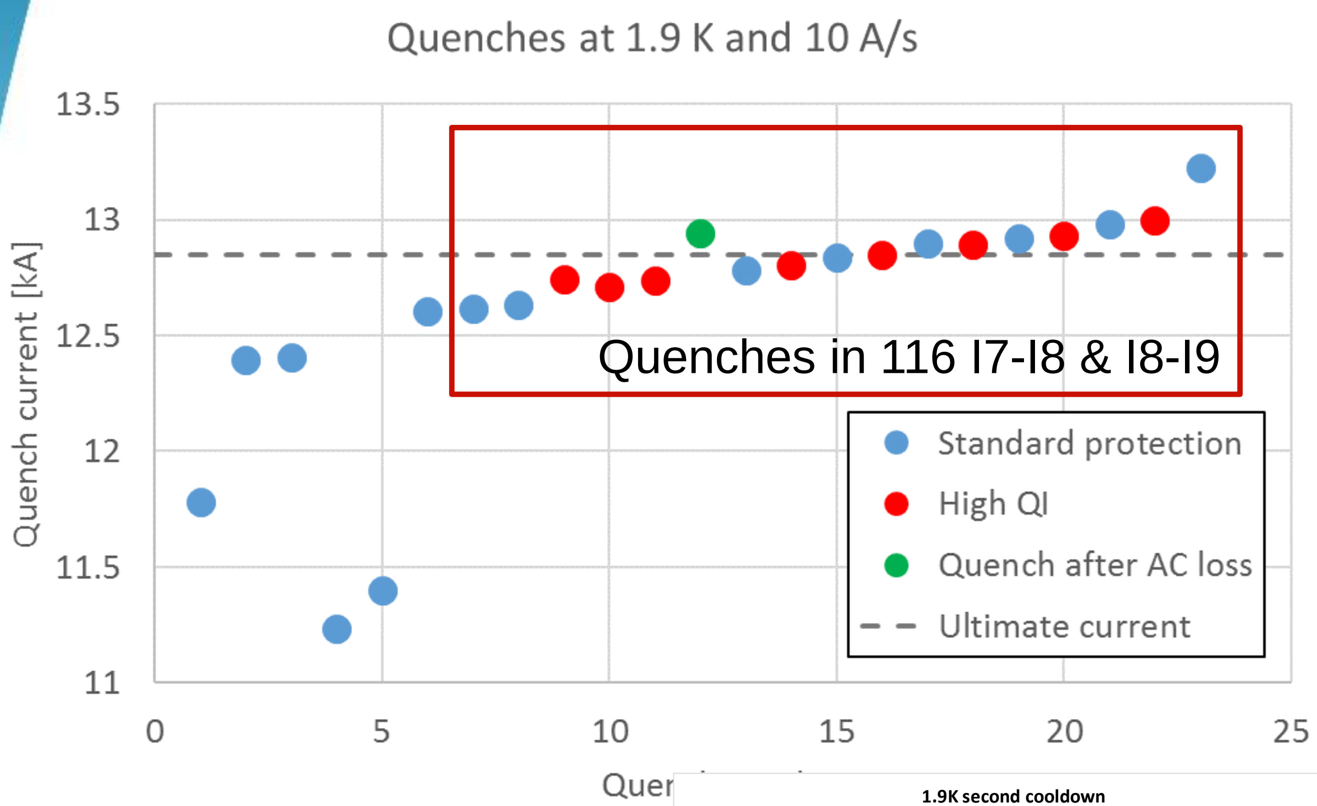
High QI studies



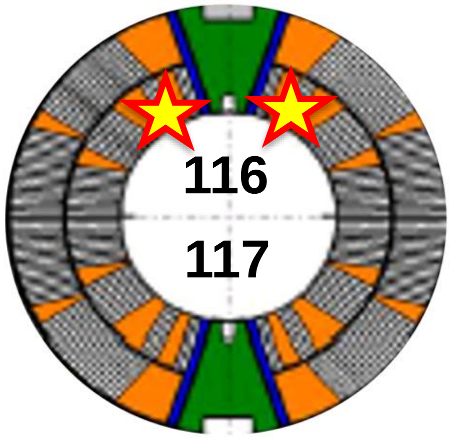


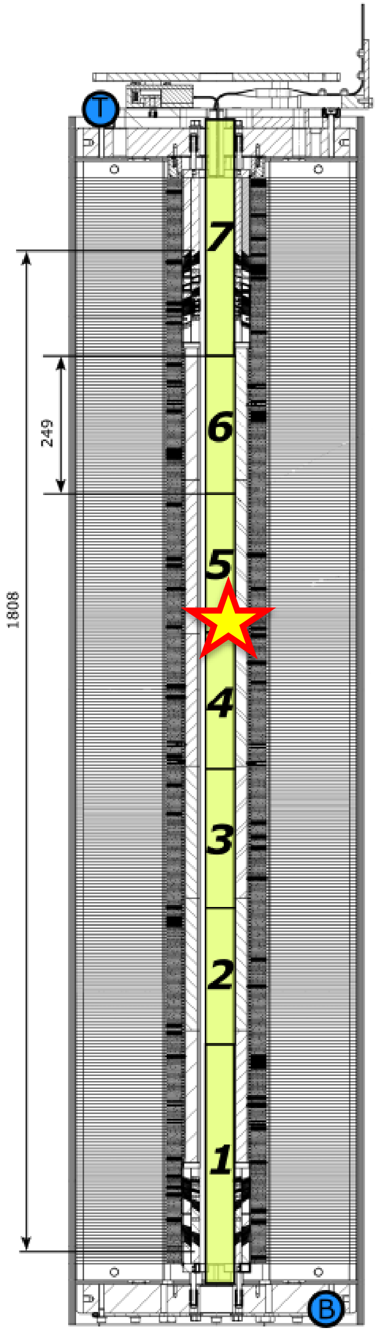
- After all the high QI quenches (except the first one), the quench current increases
- We have reached a maximum quench current of 13.23 kA
- All the high QI & verification quenches were in the same location

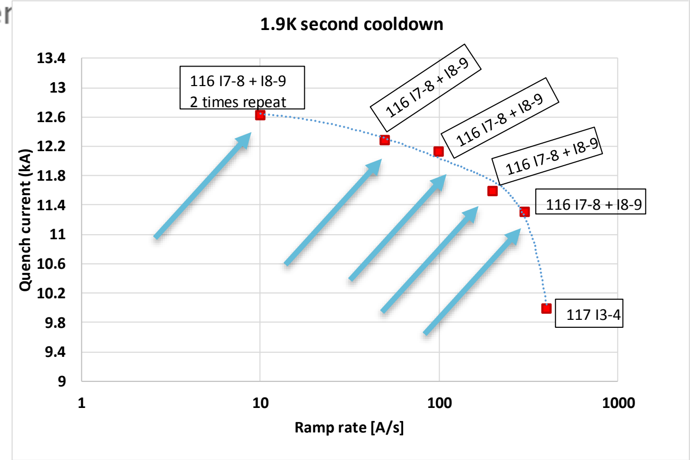
High QI studies – location

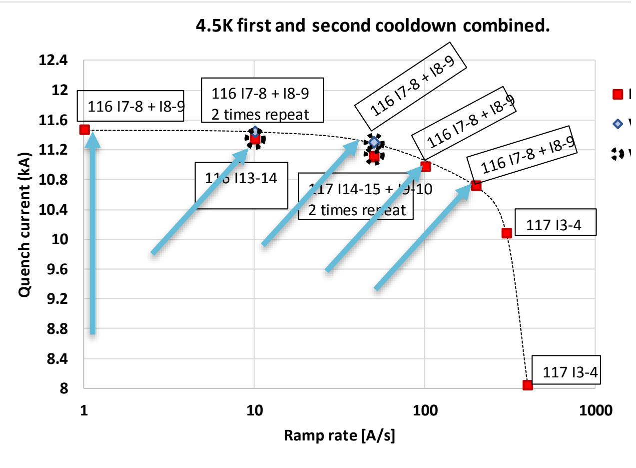


The quench location is the same Gerard mentioned last meeting

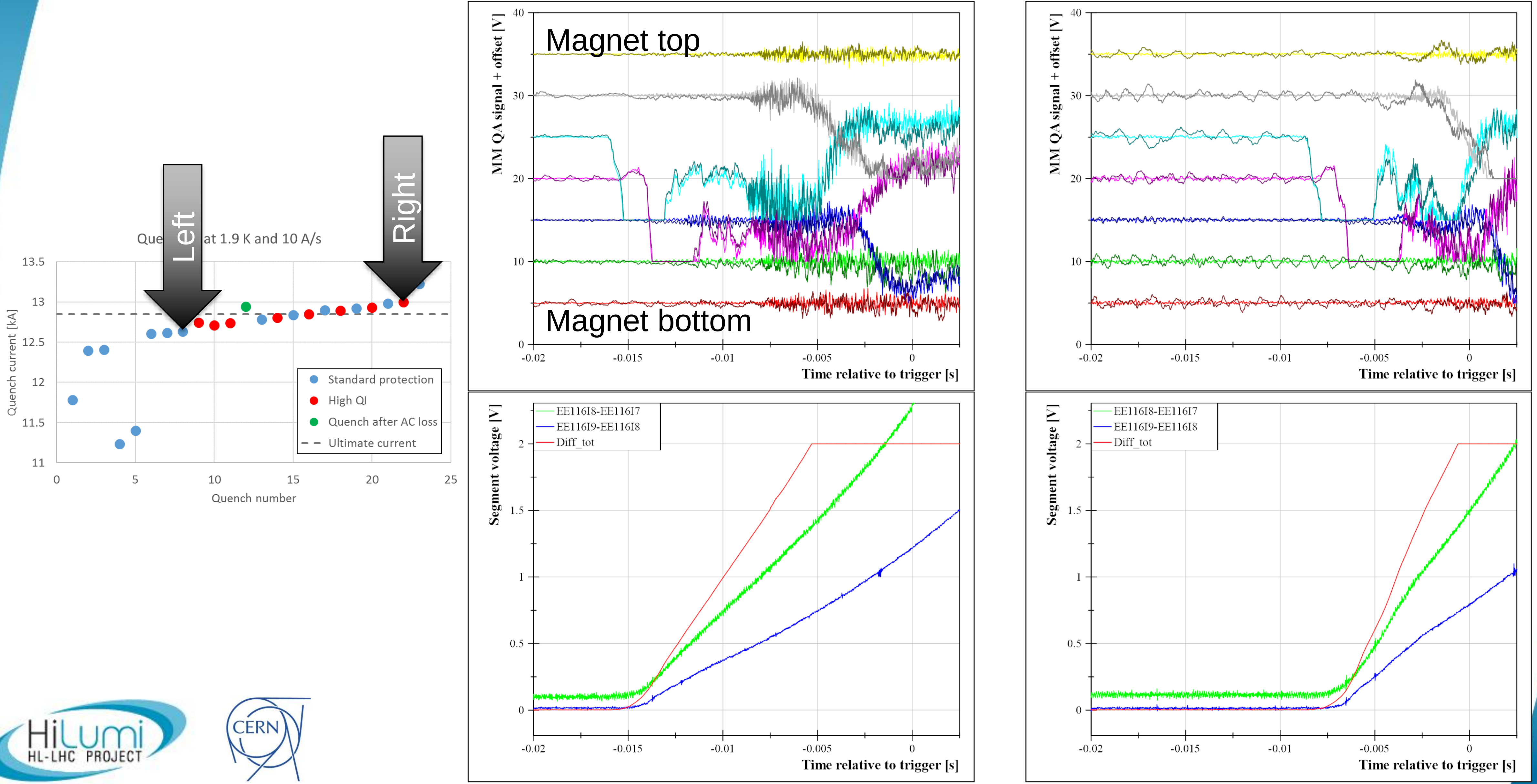








High QI studies – before and after



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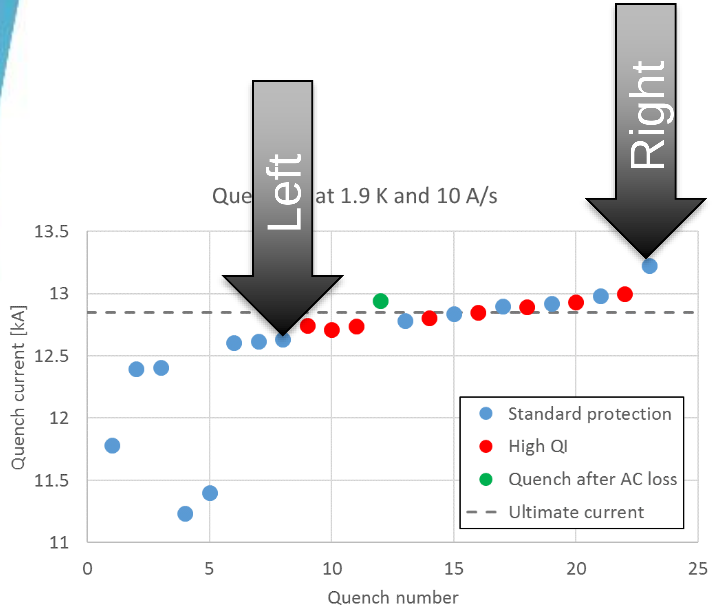
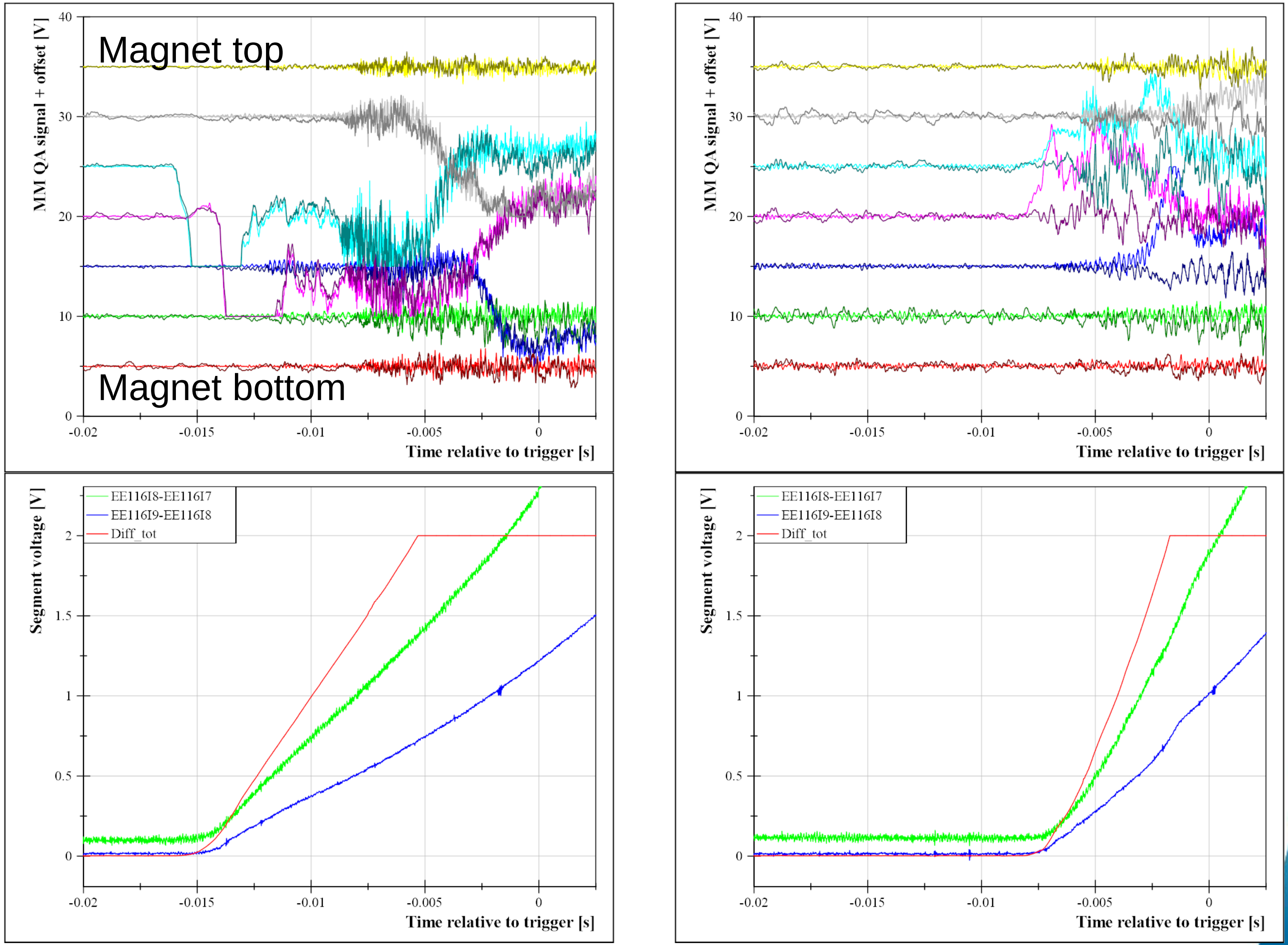
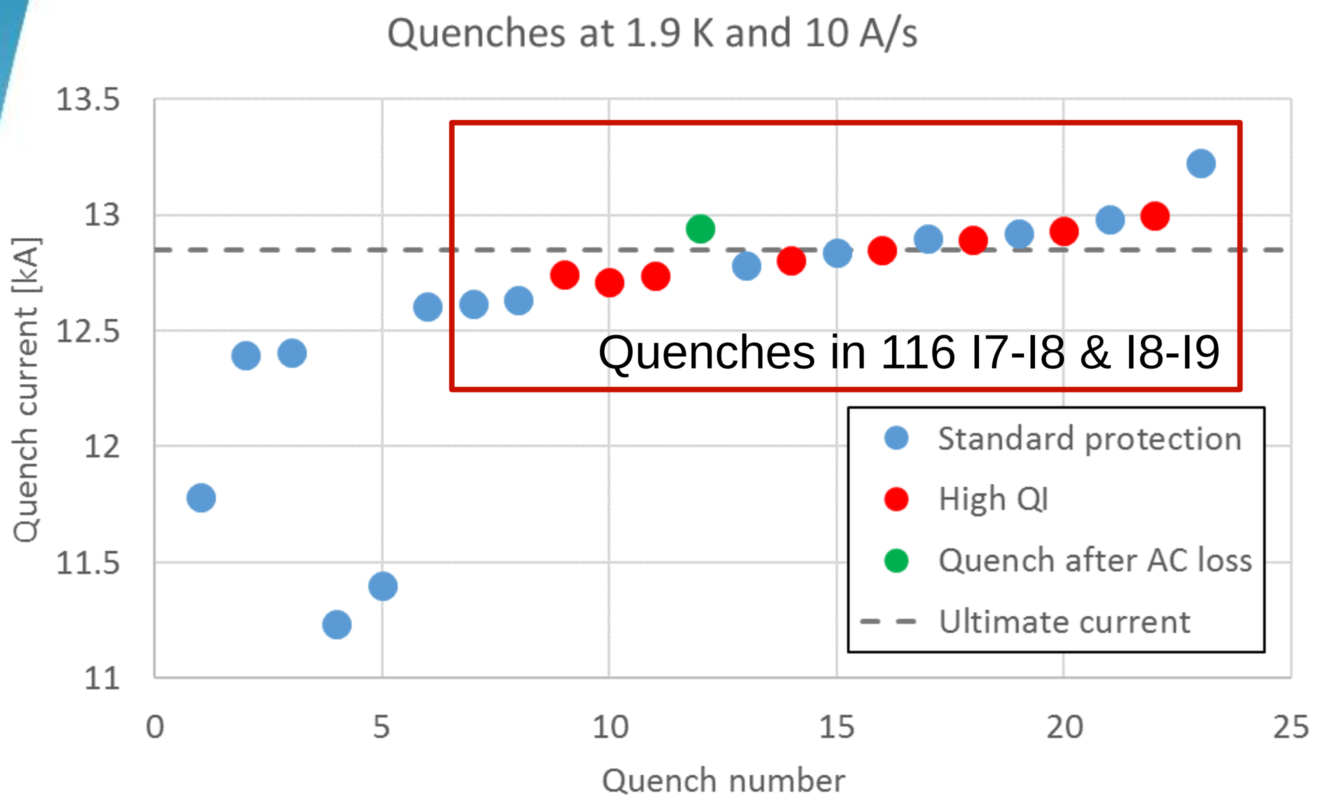




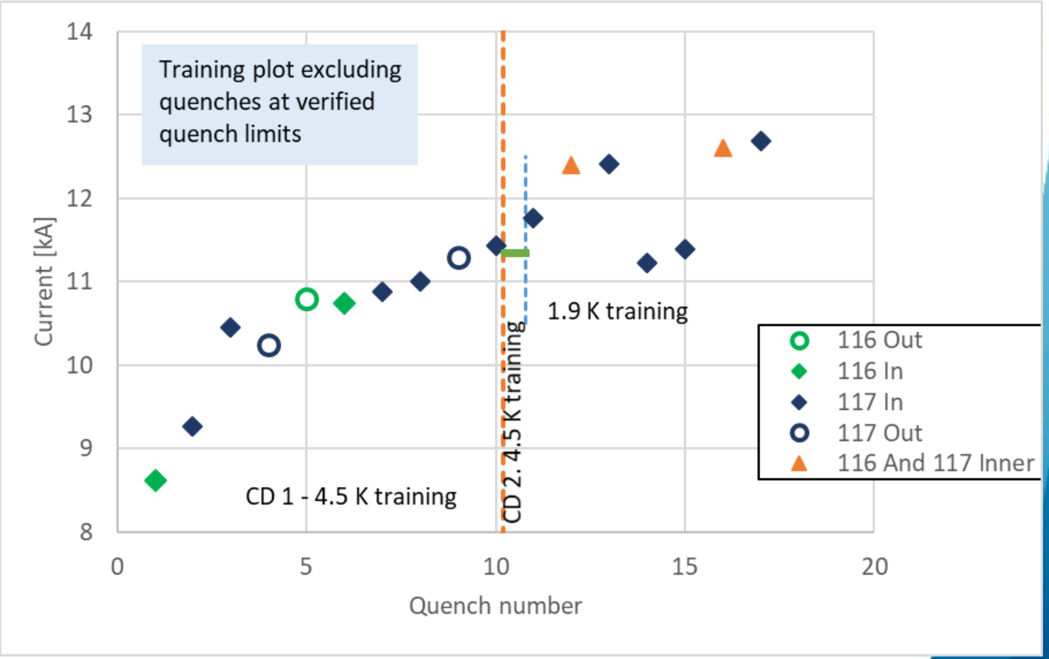
High QI studies – effect on training



After all these quenches we don't:

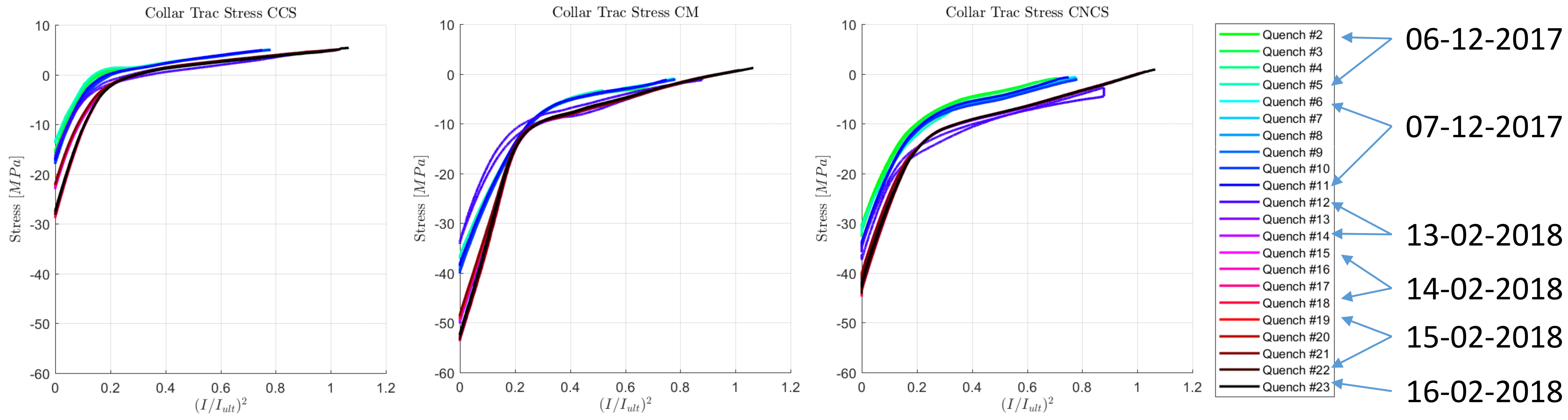
- Have any mechanically induced quench (training)
- Have any detraining

Mechanical motion induced quenches (training)

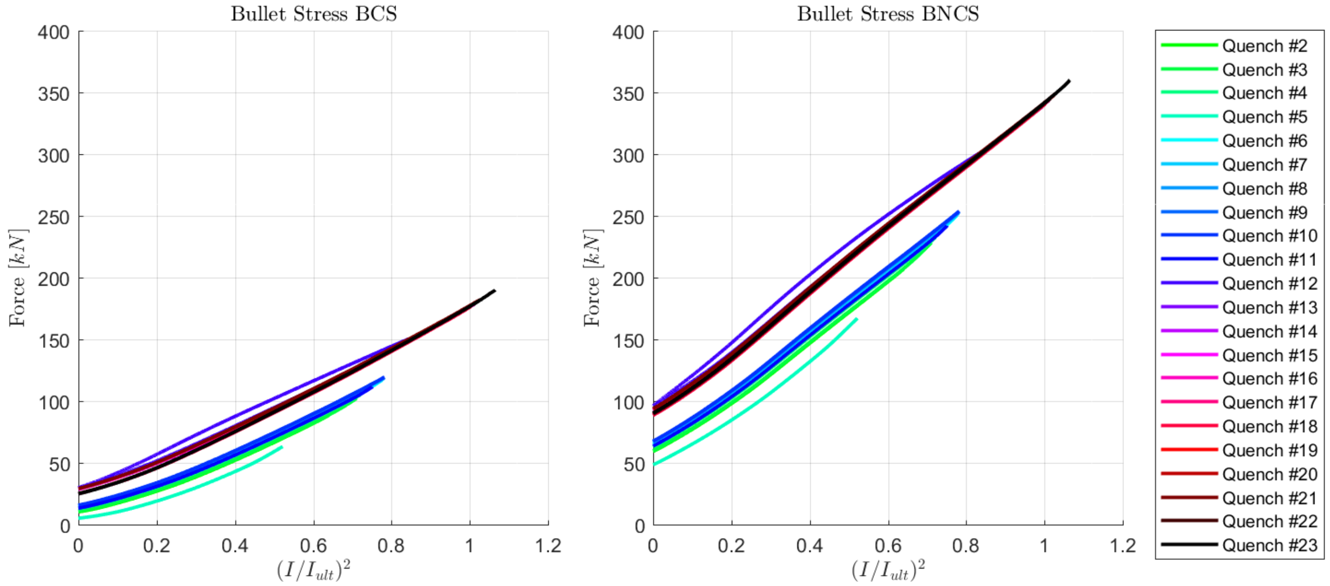


By Christian Löffler, data by Philippe Grosclaude

Collar nose compression - average per instrumented collar-pack / kN



Total bullet gauge compression / kN

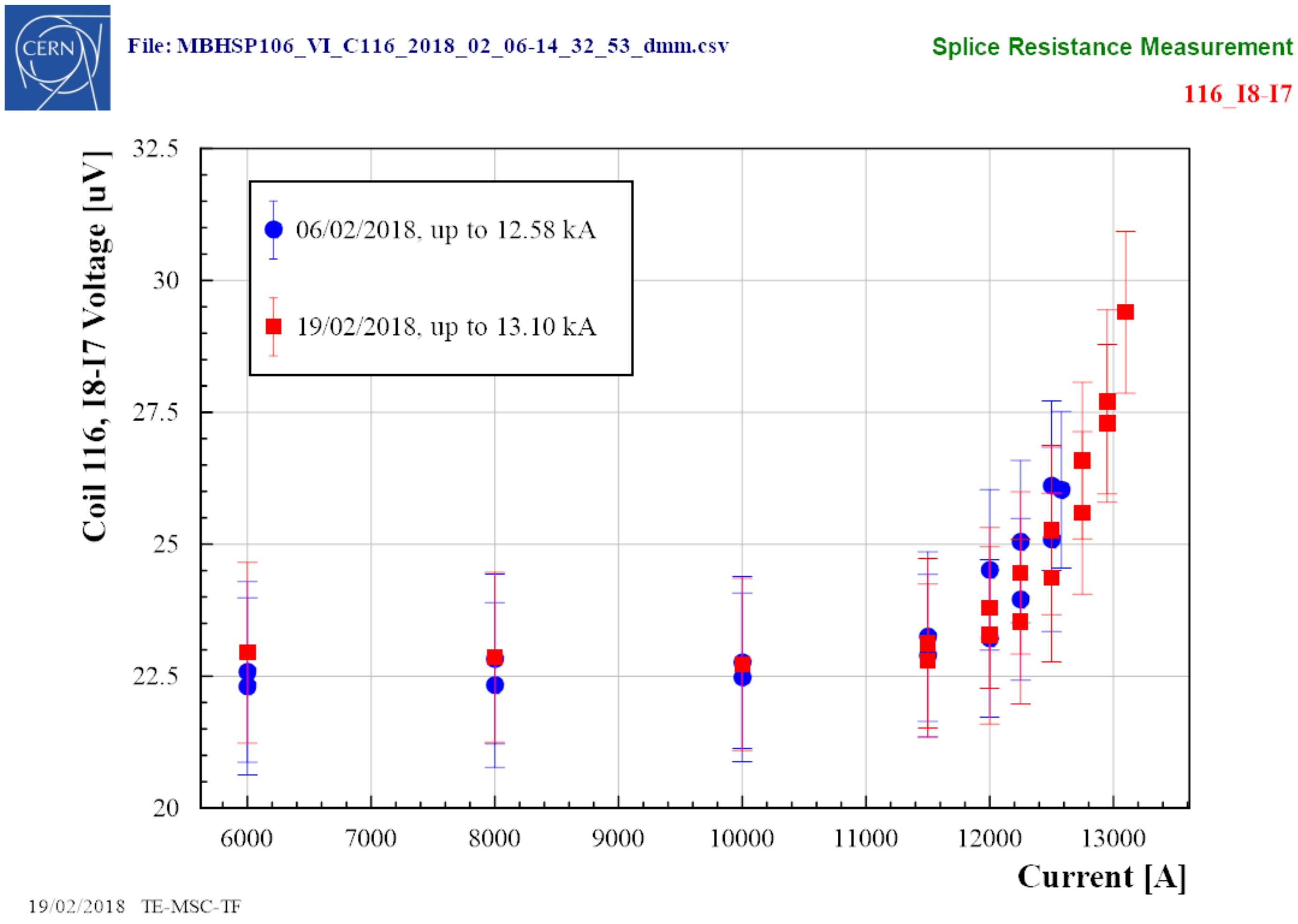


- Collar Nose
  - Kink occurs at 6 kA; bi-linear unloading
  - Very low measured pre-stress (100 MPa on the nose necessary to prevent “unloading”)
  - 5 MPa offset in NCS pack after new year
- Bullet Gauges
  - Standard settling behavior of the extremities
  - CS force comparable to previous models
  - NCS 30% higher than previous models

Verification – endurance

- Magnet held ultimate current (12.85 kA) at 1.9 K for two hours
- Magnet held 13.10 kA at 1.9 K for two minutes (during the V-I measurement cycle)

Verification – VI curves



- The segments that quenched:
  - Segment 116 I7-I8 shows a transition, very similar to the measured before the high QI studies
    - "n" value ~ 20-25
  - Segment 116 I8-I9 does not show a superconducting transition
- Midplane segments
  - 116 II-I1, I2-I3 and 117 II-I1, I2-I3 do not show a superconducting transition

Verification – 4.5 K

- The magnet has not yet reached a uniform 4.5 K
  - To be done later today

Next steps after thermal cycle

- Training at 4.5 K
- Ramp rate studies at 4.5 K
- Training at 1.9 K
- Ramp rate studies at 1.9 K
- V-I curve measurements
- AC-loss measurements