

MBHDP301b – Intermediate test result discussion

16 May 2024

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With thanks to Carmen Abad Cabrera, Susana Izquierdo Bermudez, Diego Perini

Test plan: <https://edms.cern.ch/document/2906660/0.1>

Test report: <https://edms.cern.ch/document/2911072/1>

Recap MBHDP301 tests in 2023

Aperture 1 – Quench heater failure. No powering tests.

- Coil 108, was used before in SP102 and DP101
- Coil 214, new coil

Aperture 2 – Powering during two cool downs.

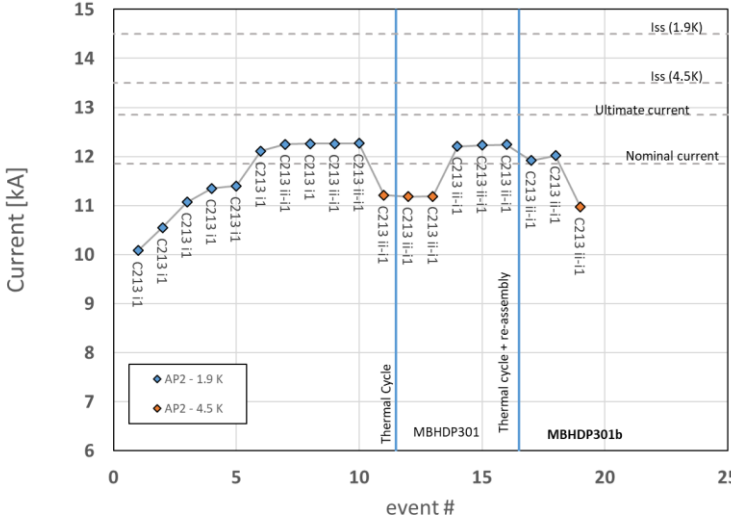
- Coil 212 part of aperture 2 in DP201
- Coil 213 part of aperture 2 in DP201

Test results MBHDP301 first and second cool down in

<https://indico.cern.ch/event/1309024/>

Powering results Aperture 2

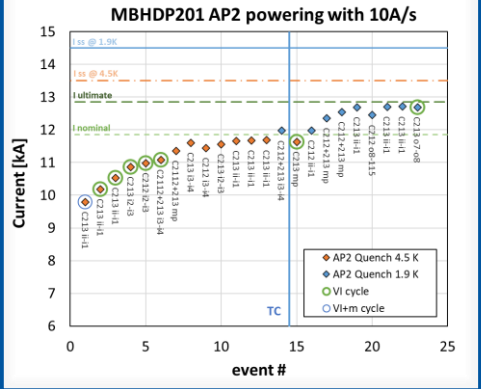
MBHDP301 AP2 powering with 10A/s

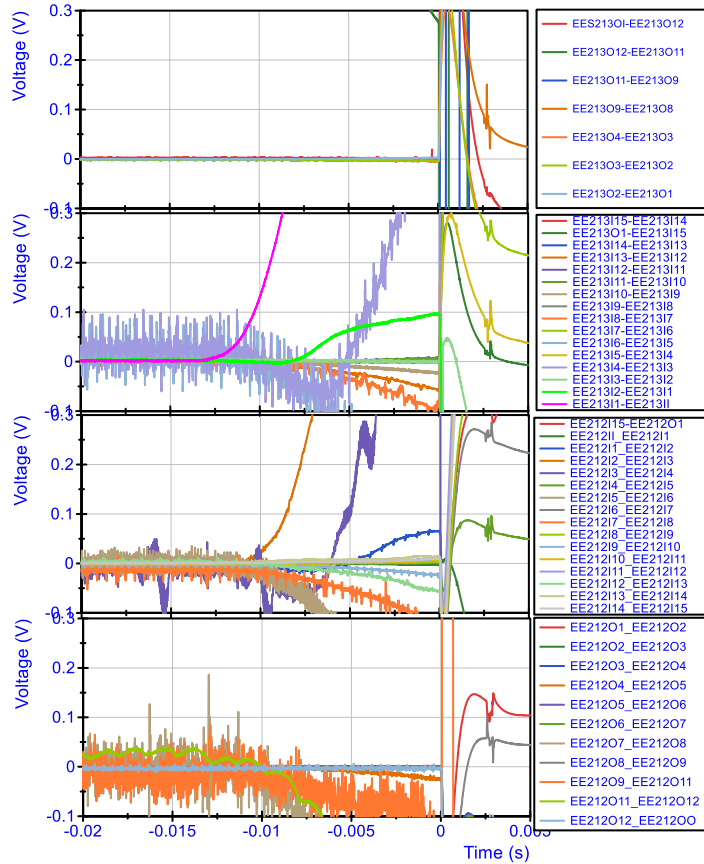
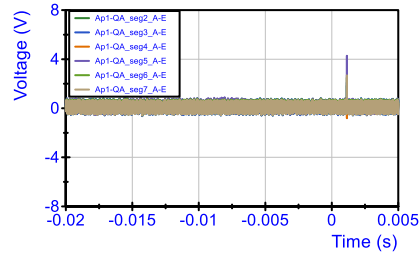
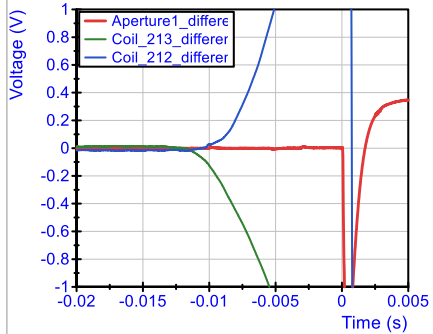
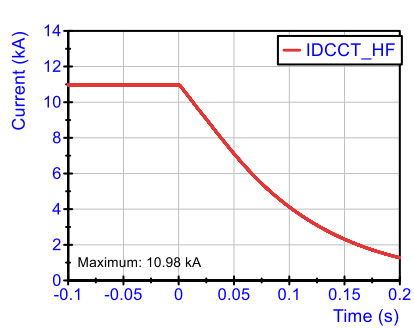


Coils 212-213 with end cage

- No training quenches in MBHDP301b
- Lost ~ 200 A compared to MBHDP301, both at 1.9 K and at 4.5 K.
- V-I measurements are ongoing this morning.
- Same quenching segment

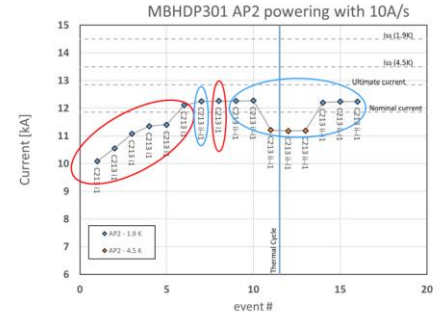
For reference: coil 212-213 as aperture 2 in MBHDP201



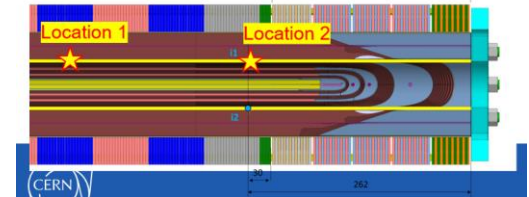


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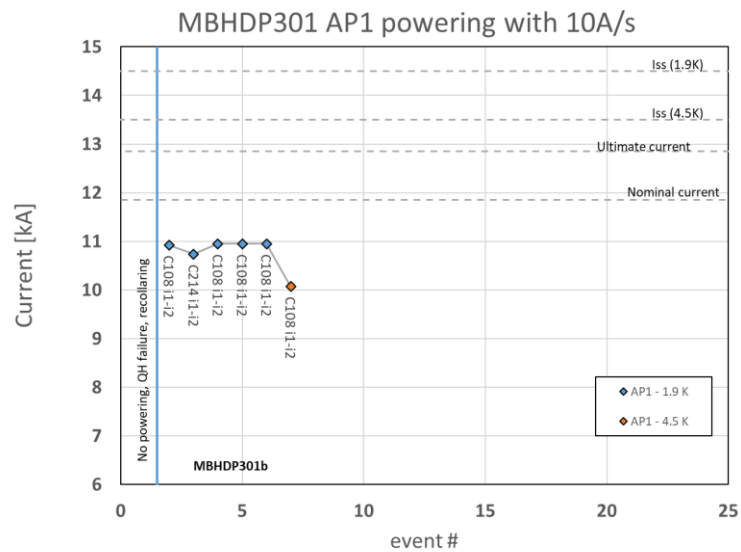
Voltages during quench for the 4.5 K quench of aperture 2. (this morning at 7h57). This is quench location 1, which we also saw last year.



In blue ovals are quenches in location 1
In red ovals are quenches in location 2



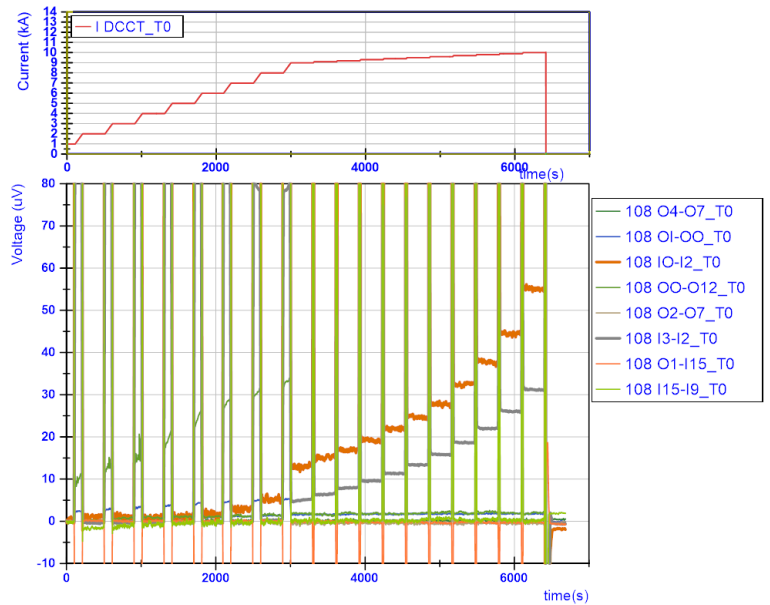
Powering results Aperture 1



Coils 108-214 (no end cage)

- At 1.9 K limited at 10.95 kA in coil 108. This is the lowest value recorded for 11T coils.
- Segment i1-i2 is in the head of the magnet.
- At 4.5 K it reached 10.07 kA.

Powering results Aperture 1 – VI at 4.5 K



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Coils 108

- At 10 kA we see 55 uV in segment IO-I2 (includes II-I1 and I1-I2. We could not measure them separately due to issues in wiring.)
- At 10 kA we see 31 uV in segment i2-i3 (straight midplane segment).

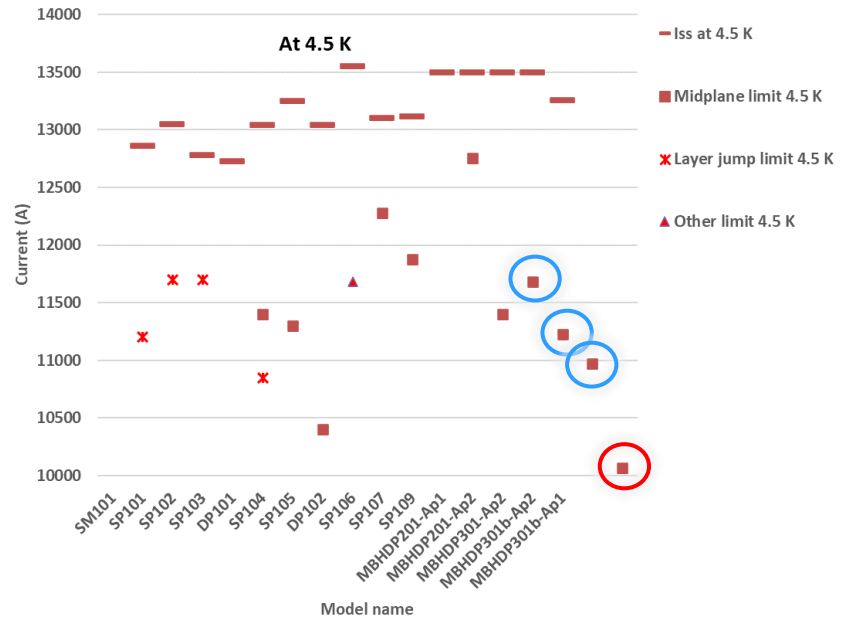
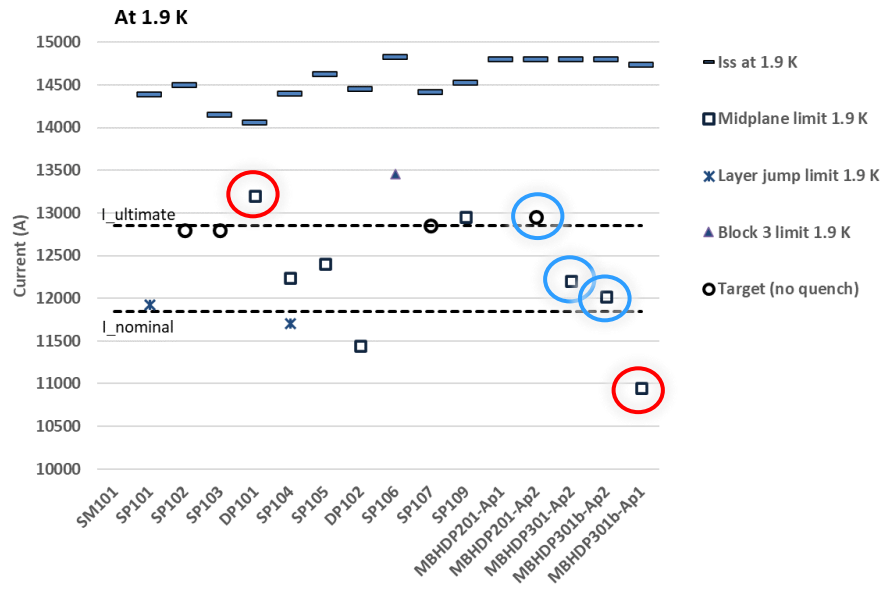
Coil 214

- Measured, but no voltage build up to 10 kA.

I have never seen more than ~24 uV in a segment (and that was at a higher current), so this is quite a dramatic result.



Overview performance limits 11T model coils

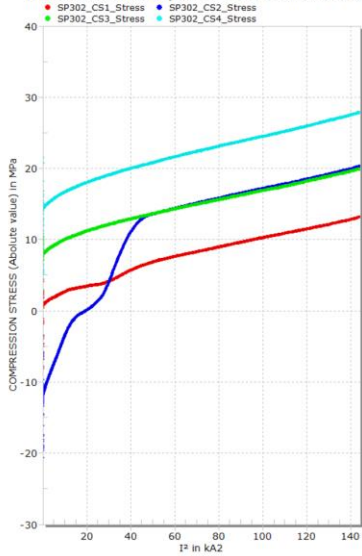


In red circle coil 108
 In blue circle coil 212-213

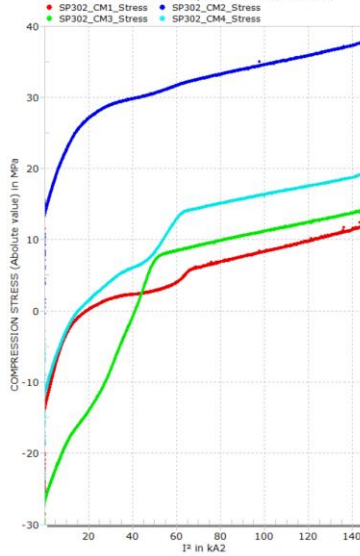


Mechanical measurements – Sylvain Mugnier

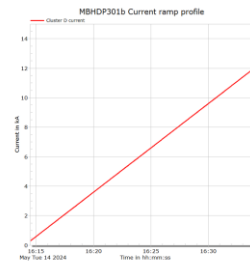
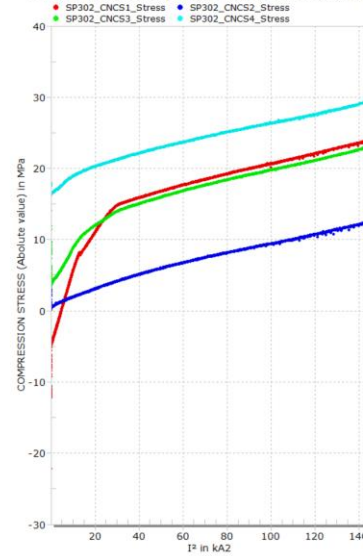
MBHDP301b Collars Comp. stress - SP302 Connection side



MBHDP301b Collars Comp. stress - SP302 Middle



MBHDP301b Collars Comp. stress - SP302 Non connection side



| SM18 Event | 14/05/2024 at 16h30 |
|--------------------|---------------------|
| I_{max} | 12,017 kA |
| Aperture powered | SP302 |
| Magnet temperature | 1.9 K |

Dear all,

You will find below the collar plots during the current ramp measured on the aperture SP302 with an $I_{max} = 12.017$ kA at 1.9 K. The mechanical behaviour of the collars on this aperture is similar to that observed during the powering of thermal cycle no. 2 of the MBHDP301a.

For information, during the tests carried out with only one single aperture powered (SP302), the measurements taken by the bullet gauges and the end-cage tie rods are also similar to those previously observed on MBHDP301a. A detailed analysis will be provided later.

Cheers,

Sylvain



Summary

Conclusive results on aperture 2: Similar quench location, 200 A lower than in 2023

Conclusive results on aperture 1: major degradation on midplane segments of coil 108

Mechanical measurements were performed too.

Following tests

Today:

- Aperture 2 quench at 4.5 K done.
- V-I measurements at 4.5 K this morning.

Friday:

- Combined powering tests for mechanical measurements.
- 4 cycles at 1.9 K below quench limit (up to 10.5 kA)
- One ramp to quench.
- Launch warm up.

Note:

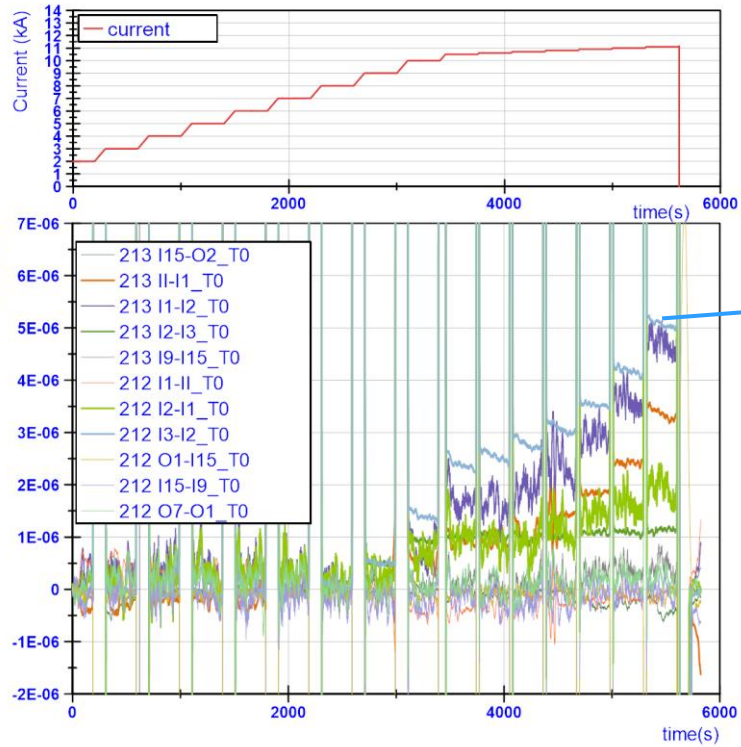
- Next week all magnet test stations will be in stand by for a valve installation on bench B2.
- Next week the cold box will be regenerated, allowing proper testing of Q2 and Q3 in June.
- Including having other priorities on cluster D and conclusive test results for MBHDP301b, warmup needs to start on Friday.



Two slides added after the meeting to complete the information here:

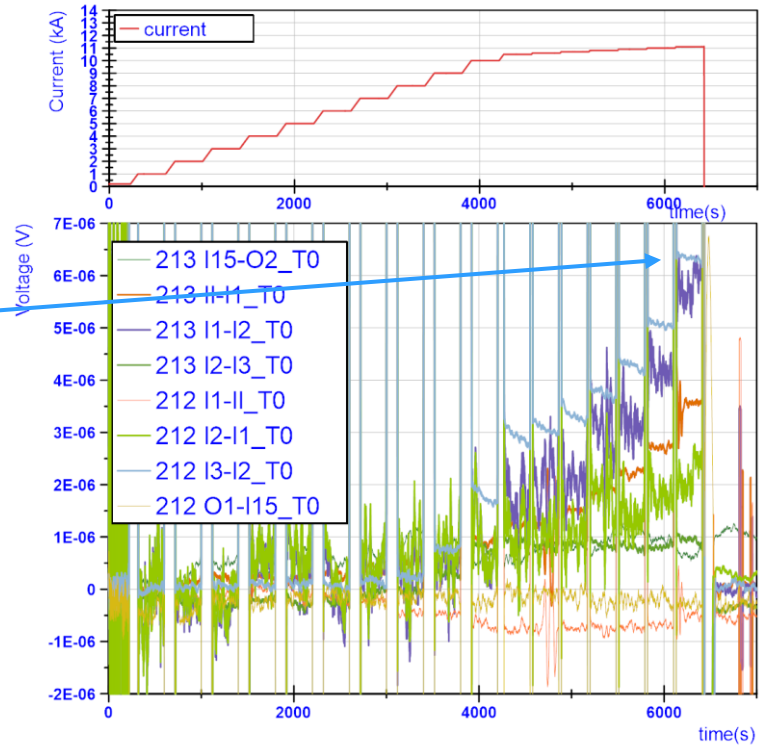
V-I measurements CD 1 vs CD 2 for MBHDP301 AP2

MBHDP301 AP2 at 4.5 K – CD1



212 I2-I3 at 5 uV at 11.1 kA
 212 II-I1 at 3.2 uV at 11.1 kA

MBHDP301 AP2 at 4.5 K – CD2

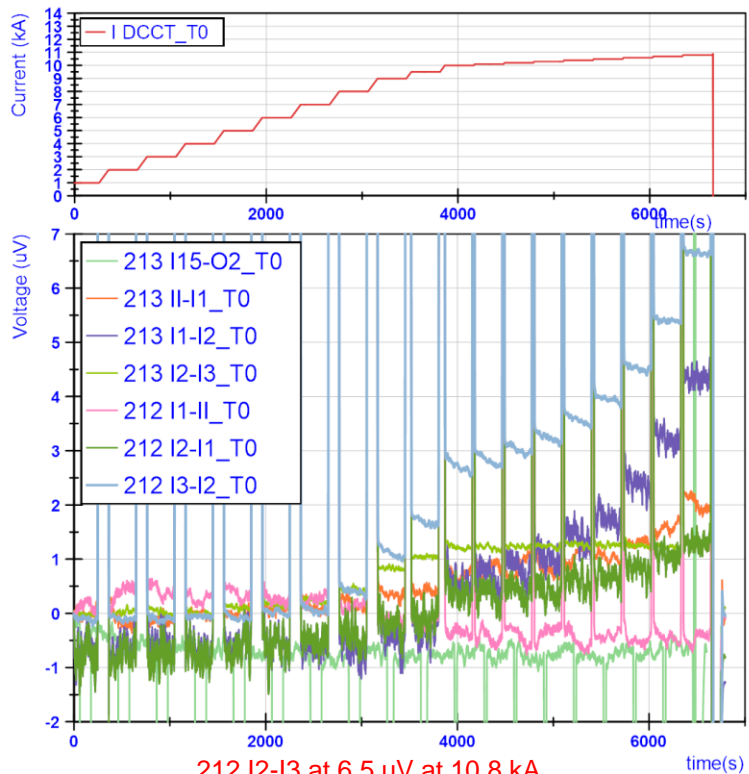


212 I2-I3 at 6 uV at 11.1 kA
 213 II-I1 at 3.5 uV at 11.1 kA

1 μ V increase for 213i1-i2 and 212 i2-i3
 Others don't have a significant change.



V-I measurements 301b AP2



212 I2-I3 at 6.5 uV at 10.8 kA
 213 II-I1 at 2.0 uV at 10.8 kA

At 11.1 kA

| | 301 CD1 | 301 CD2 | 301b CD1 |
|-----------|---------|---------|----------|
| 212 i2-I3 | 5 uV | 6 uV | - |
| 213 II-I1 | 3.2 uV | 3.5 uV | - |

At 10.8 kA

| | 301 CD1 | 301 CD2 | 301b CD1 |
|-----------|---------|---------|----------|
| 212 i2-I3 | 3.0 uV | 3.8 uV | 6.7 uV |
| 213 II-I1 | 1.5 uV | 1.9 uV | 2.0 uV |

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Additional slides

Full quench table MBHDP301b until 16 May 8h.

| MBHDP301b | | | | | | | | | |
|-----------|-----|----|---|-----|-------|-----|--------------------|--|-----|
| a005 | 1.9 | | 2 | 10 | 10.92 | 108 | 108_j1-i2 | | Ap1 |
| a007 | 1.9 | | 3 | 10 | 10.74 | 214 | 214_j1-i2 | | Ap1 |
| a008 | 1.9 | | 4 | 10 | 10.95 | 108 | 108_j1-i2 | | Ap1 |
| a010 | 1.9 | | 5 | 10 | 10.95 | 108 | 108_j1-i2 | | Ap1 |
| a011 | 1.9 | | 6 | 10 | 10.95 | 108 | 108_j1-i2 | | Ap1 |
| a012 | 1.9 | | | 50 | 10.88 | 108 | 108_j1-i2 | | Ap1 |
| a015 | 1.9 | | | 100 | 10.81 | 108 | 108_j1-i2 | | Ap1 |
| ta043 | 1.9 | 17 | | 10 | 11.92 | 213 | 213_ji-i1 -> i1-i2 | | Ap2 |
| a016 | 1.9 | 18 | | 10 | 12.02 | 213 | 213_ji-i1 -> i1-i2 | | Ap2 |
| na002 | 4.5 | | 7 | 10 | 10.07 | 108 | 108_j1-i2 | | Ap1 |
| na006 | 4.5 | 19 | | | 10.97 | 213 | 213_ji-i1 | | Ap2 |

