Flux jumps

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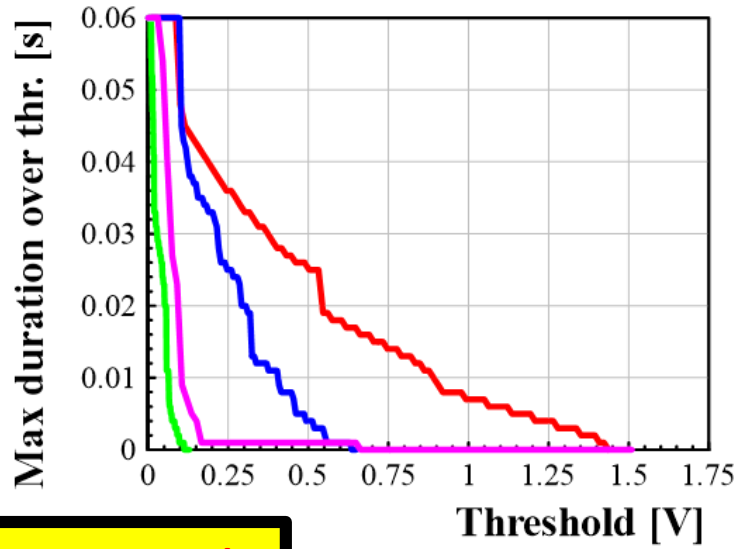
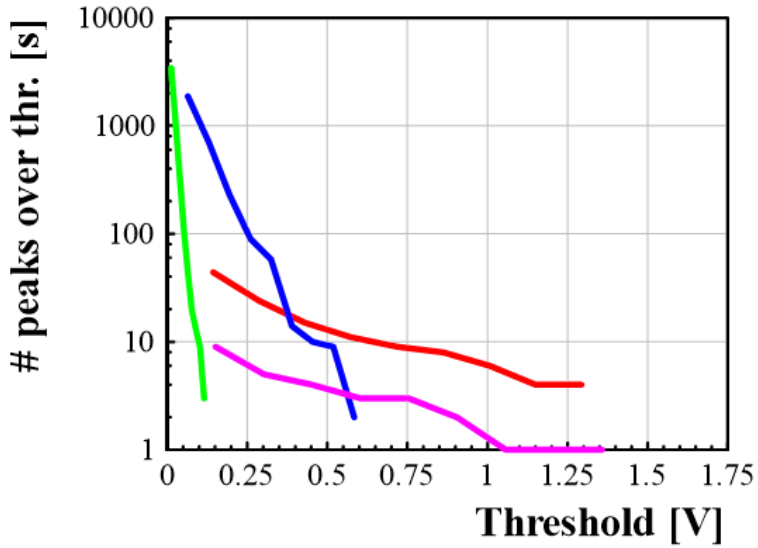
2018-05-15

File: CRMHFRA001_CR000003_2__O1804261124_I006(0)

Signal: Diff_tot

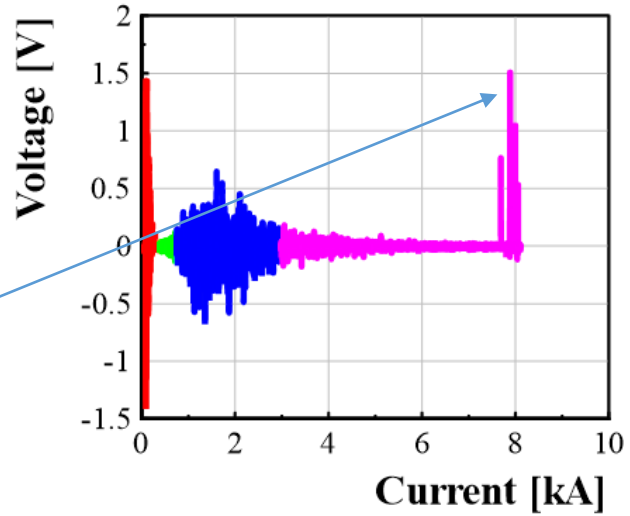
Spikes Statistics



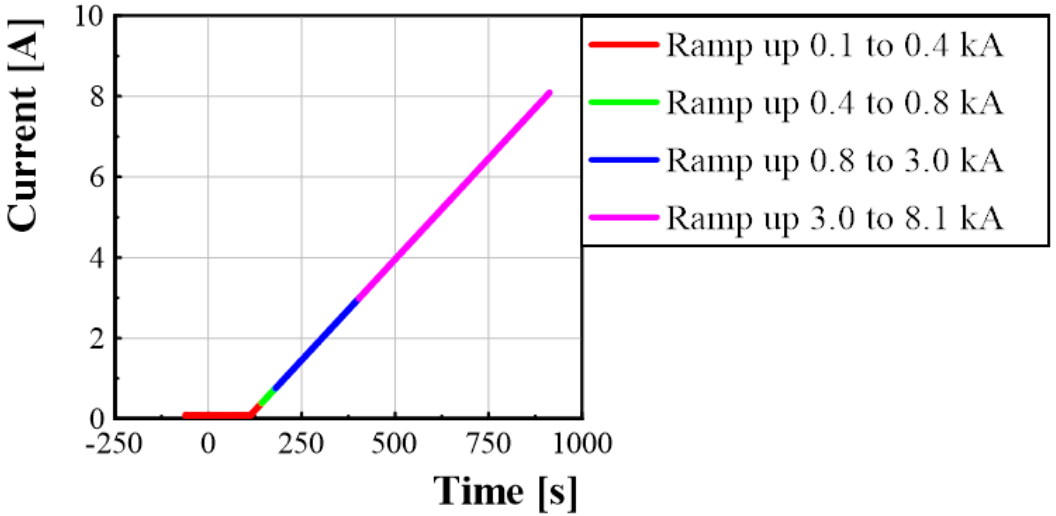


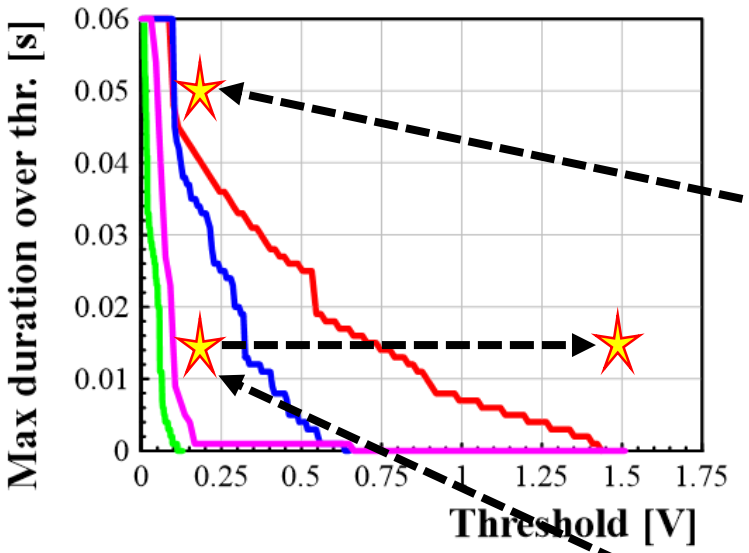
FRESCA2 1.9K at 10 A/s

Using differential voltage



Vibrations, not flux jumps





Choice of protection threshold:

Low current:

- Slow voltage buildup, threshold must be low
- Large margin in time

Threshold 150 mV, validation time 50 ms

Fixed threshold card for all currents

High current:

- Fast voltage buildup
- Small margin in time
- Important to detect quench early:

Threshold 200 mV, validation time 15 ms

Variable threshold cards, so at low currents

Threshold 1.5 V , validation time 10 ms (at low currents to avoid trips)

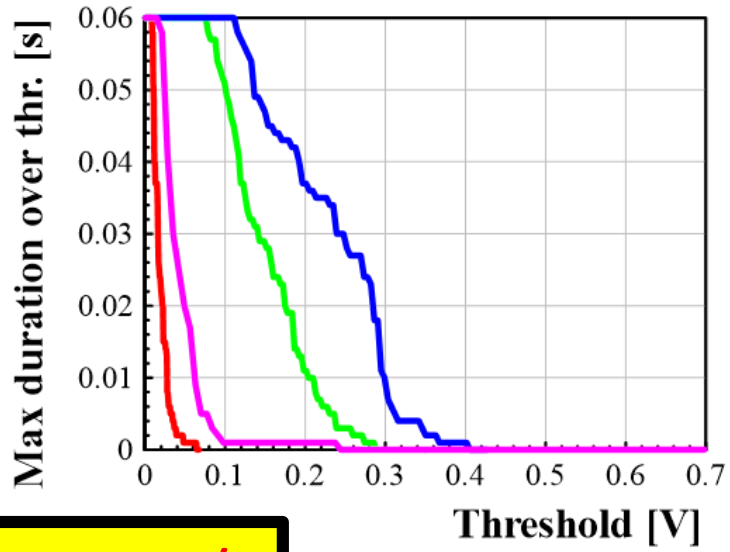
Some examples:

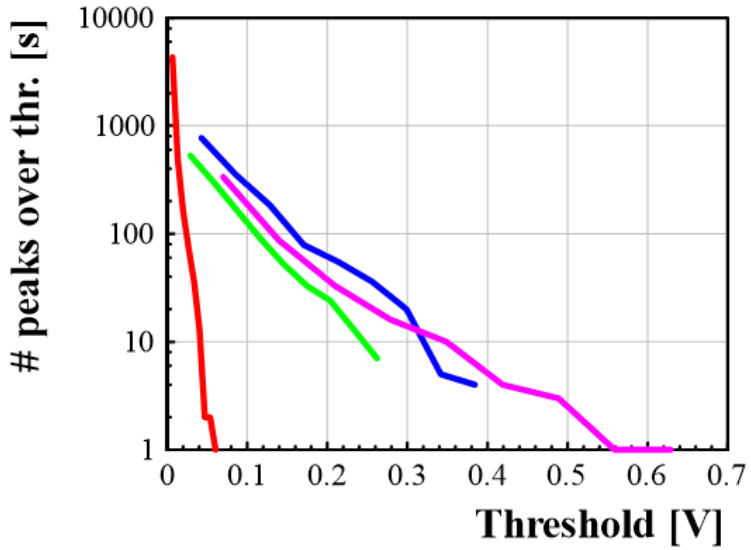
- FRESCA2 at 1.9 K
- FRESCA2 at 4.5 K
- MBHSP106 at 1.9 K

File: CRMHFRA001_CR000003_2__O1805071805_I033(0)

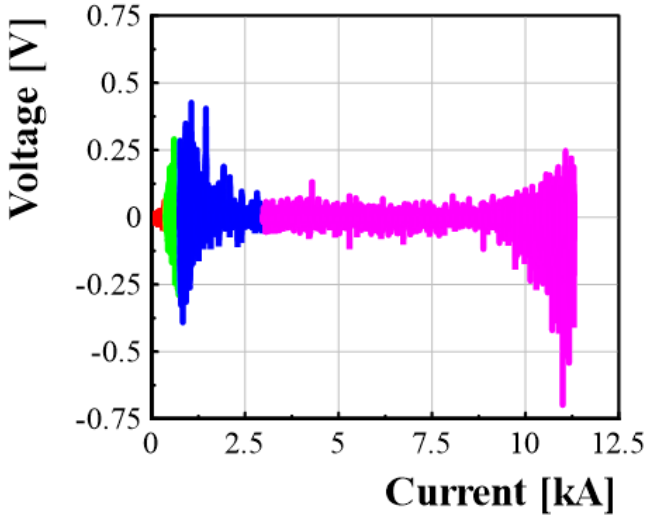
Signal: Diff_tot

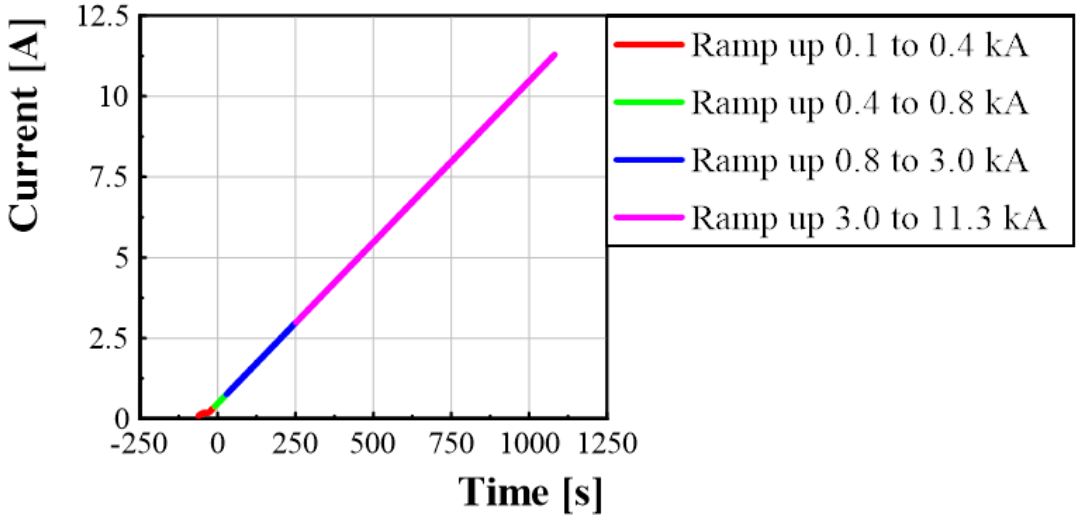
Spikes Statistics



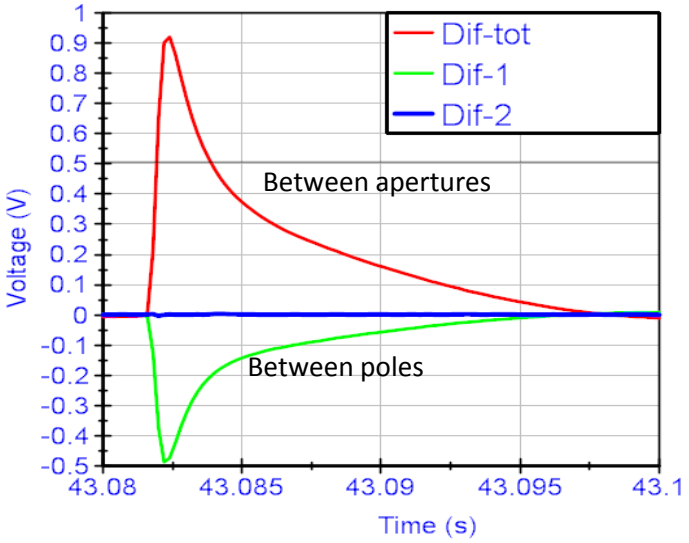


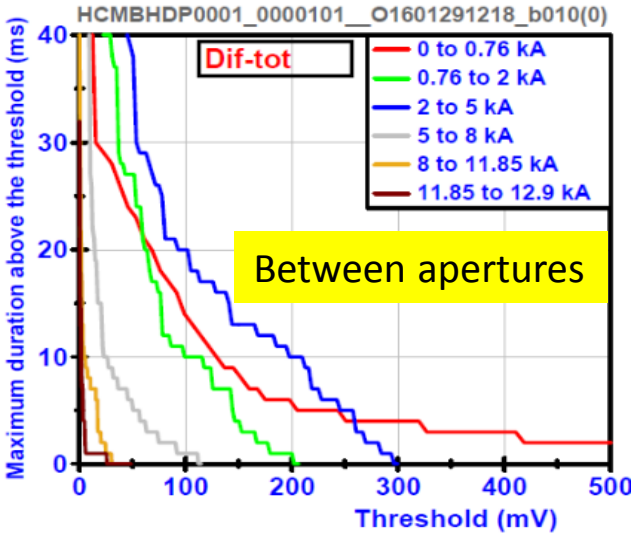
FRESCA2 4.5K at 10 A/s

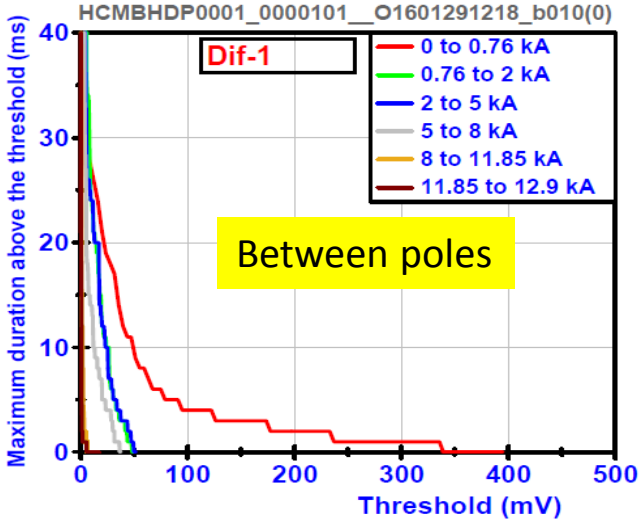


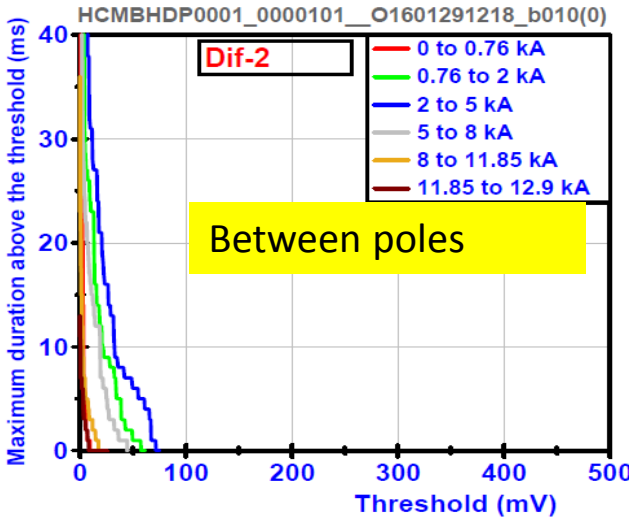


MBHDP101

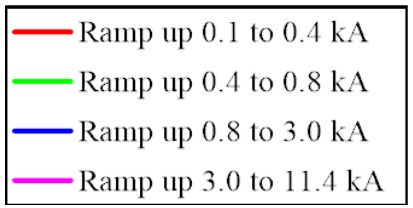

Dif-tot
Dif-1
Dif-2
Between apertures
Between poles
Voltage (V)
Time (s)


HCMBHDP0001_0000101__O1601291218_b010(0)
Dif-tot
0 to 0.76 kA
0.76 to 2 kA
2 to 5 kA
5 to 8 kA
8 to 11.85 kA
11.85 to 12.9 kA
Between apertures
Maximum duration above the threshold (ms)
Threshold (mV)

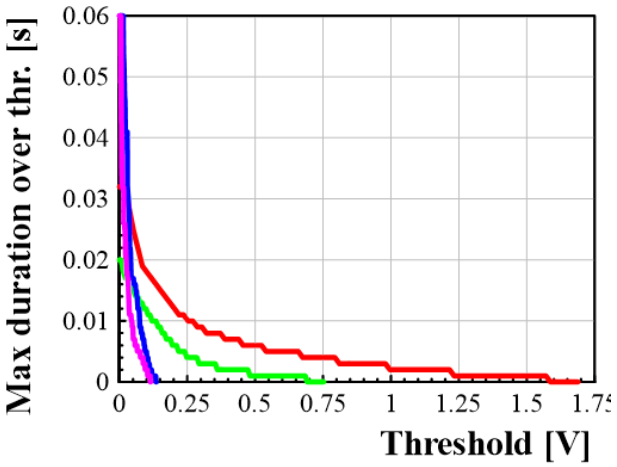

HCMBHDP0001_0000101__O1601291218_b010(0)
Dif-1
0 to 0.76 kA
0.76 to 2 kA
2 to 5 kA
5 to 8 kA
8 to 11.85 kA
11.85 to 12.9 kA
Between poles
Maximum duration above the threshold (ms)
Threshold (mV)

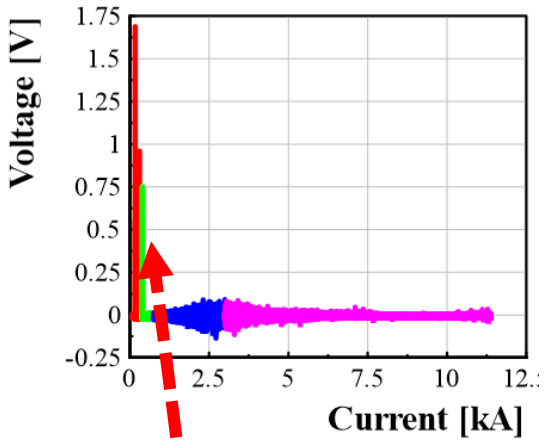

HCMBHDP0001_0000101__O1601291218_b010(0)
Dif-2
0 to 0.76 kA
0.76 to 2 kA
2 to 5 kA
5 to 8 kA
8 to 11.85 kA
11.85 to 12.9 kA
Between poles
Maximum duration above the threshold (ms)
Threshold (mV)

MBHDP102

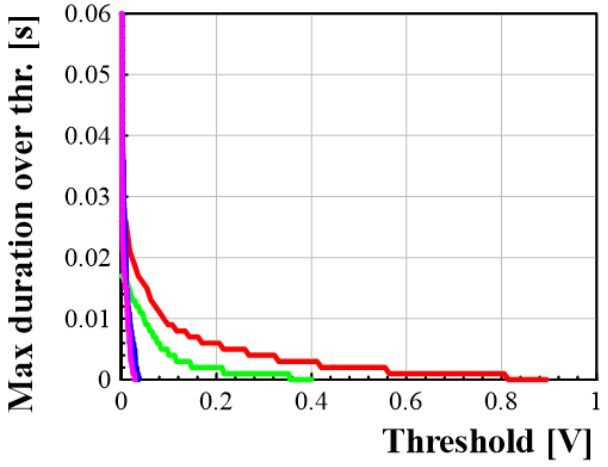


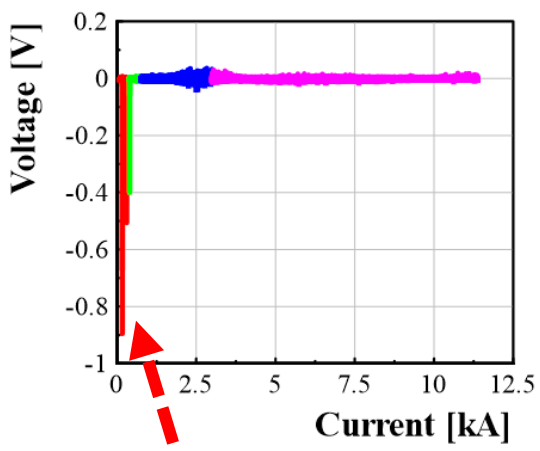
Signal: Diff_tot



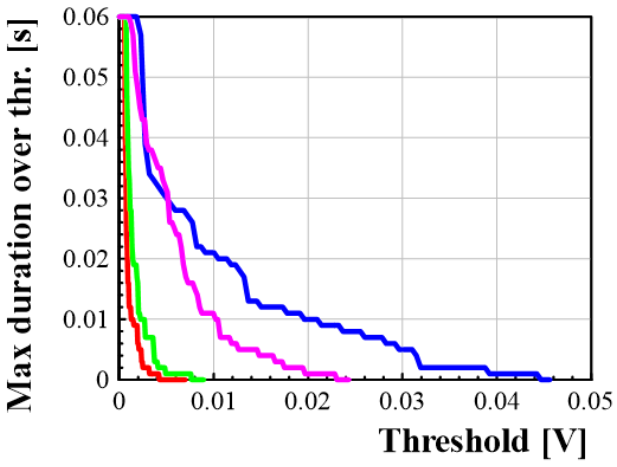


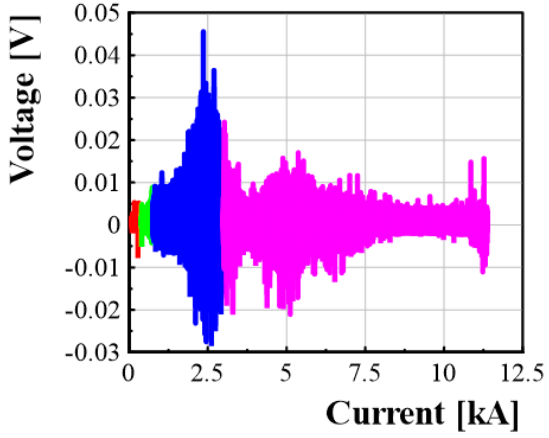
Signal: Diff Ap1





Signal: Diff Ap2

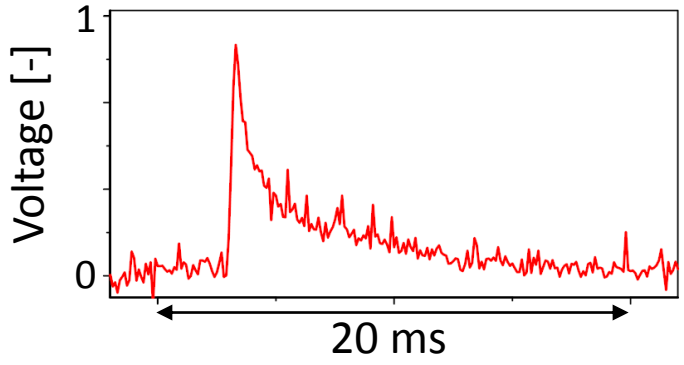




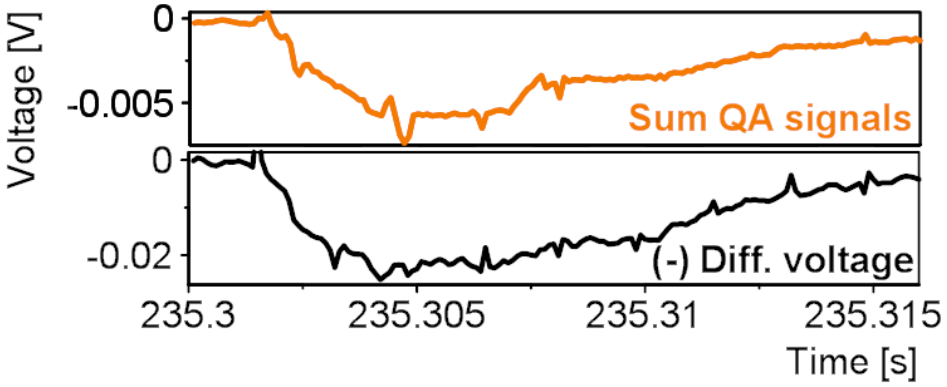
Large low current flux jumps in one coil only (only 1 aperture, only negative sign, coil 109).

Overview of Flux Jumps

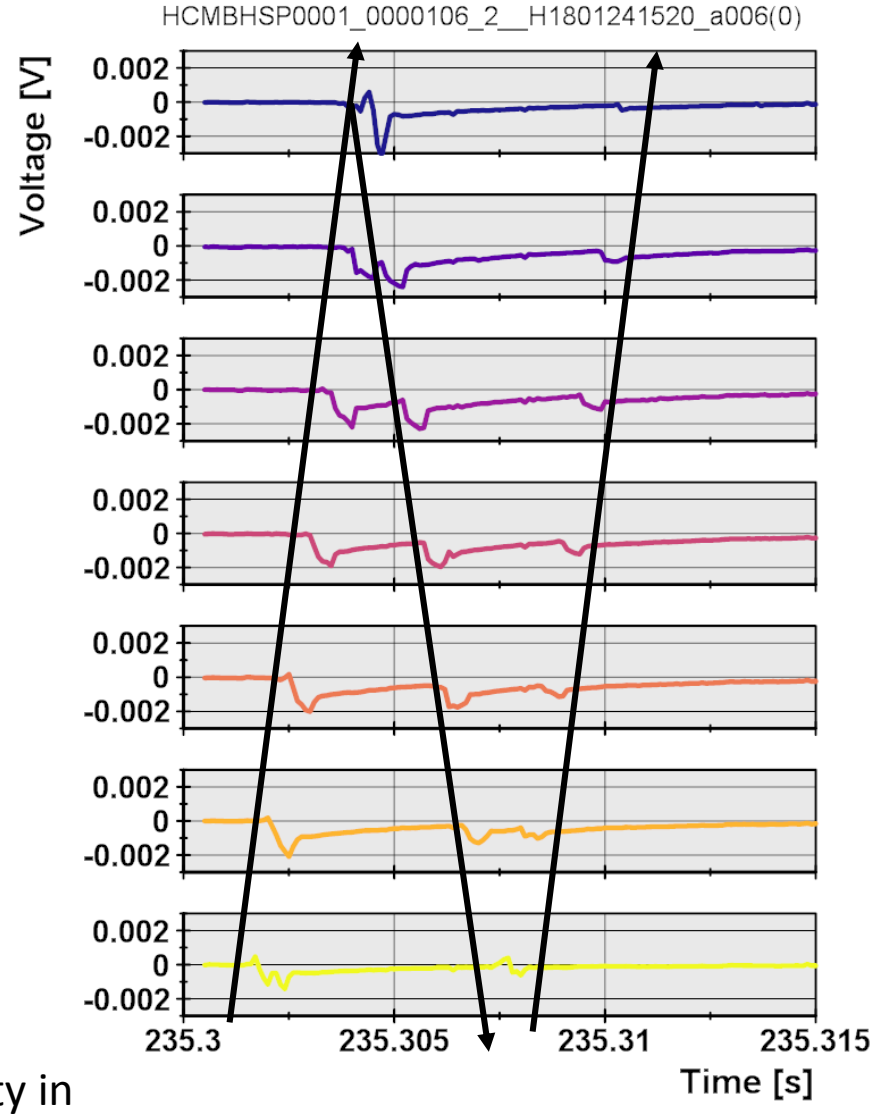
Example of flux jump in QA:

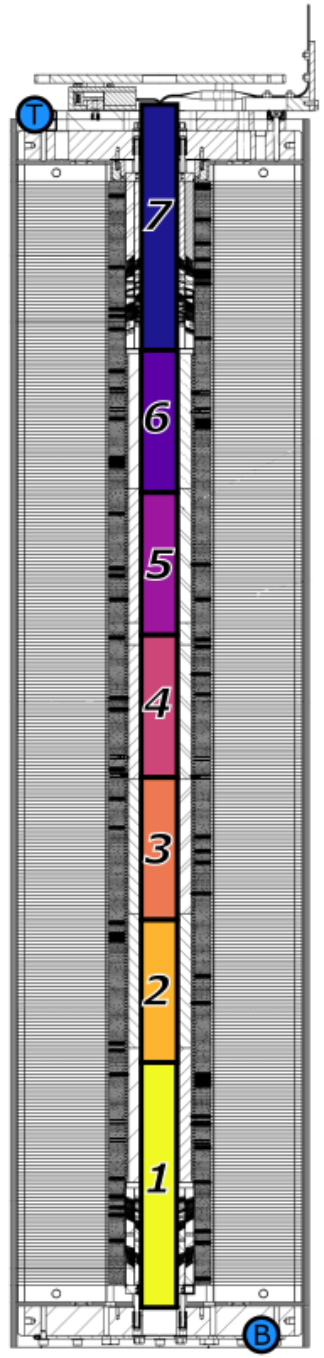


The sum of QA signals is similar to what is picked up by the differential voltage:



Flux jumps can be seen to propagate with velocities between 500 – 1000 m/s:

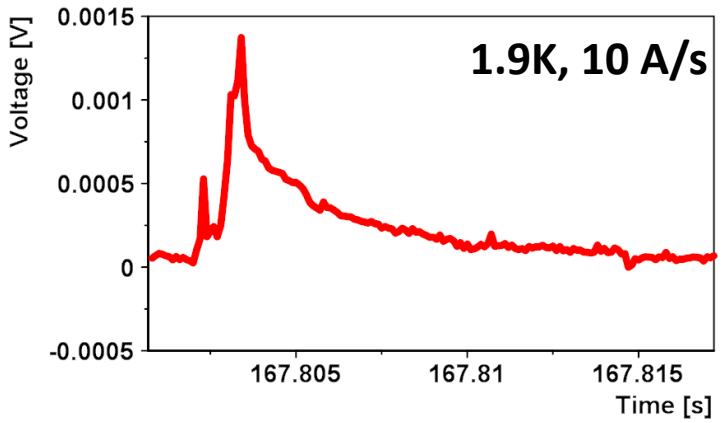


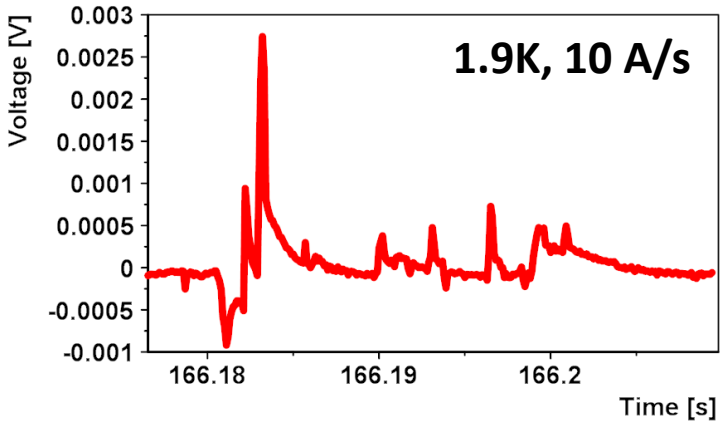


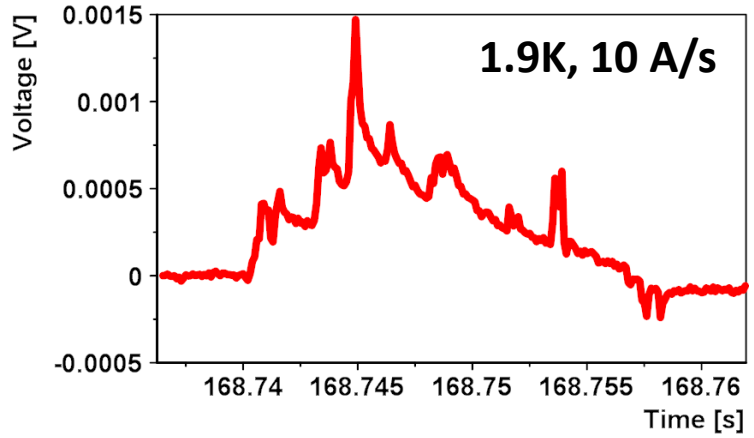
Fluxjump propagation already shown before with similar velocity in

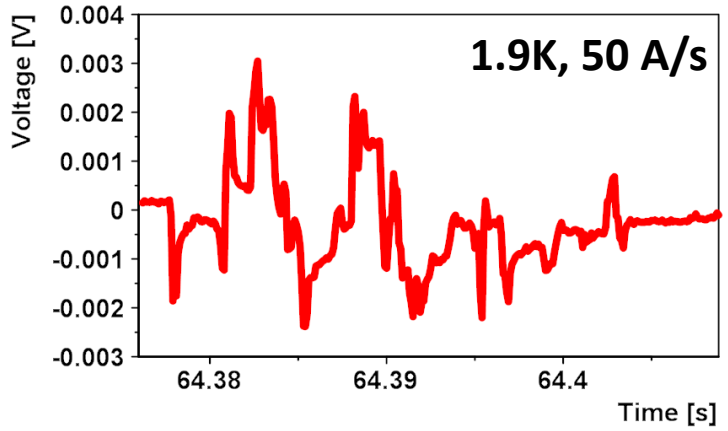
Maxim Marchevsky et al., "Axial-Field Magnetic Quench Antenna for the Superconducting Accelerator Magnets" IEEE Trans. Appl. Supercond., Vol. 25, No. 3, 2015, 9500605

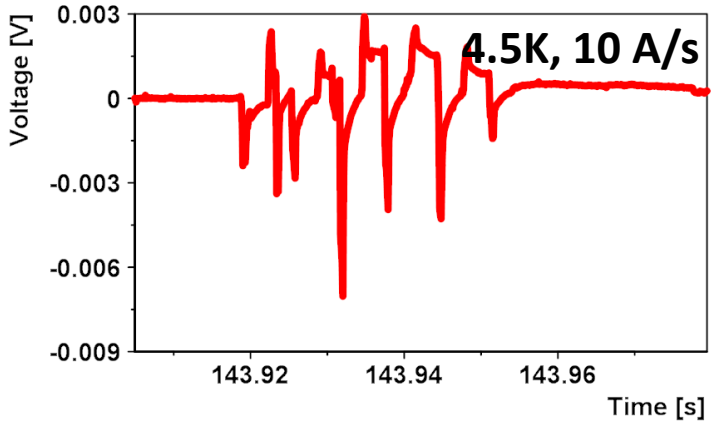
Examples of flux jumps

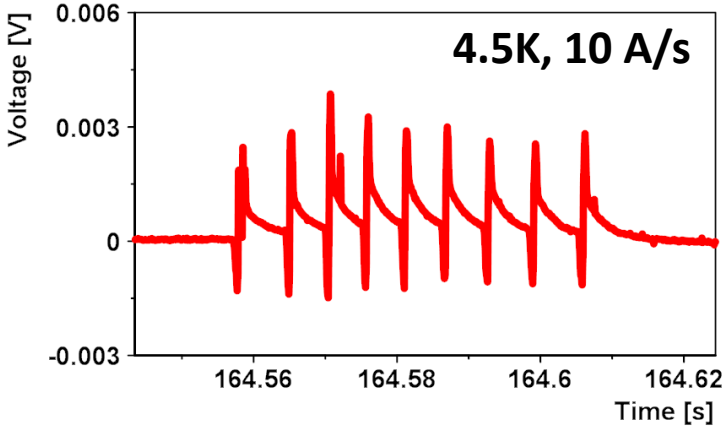












Note: this is a random example to show that flux jump perturbations appear in a large varyity of forms.