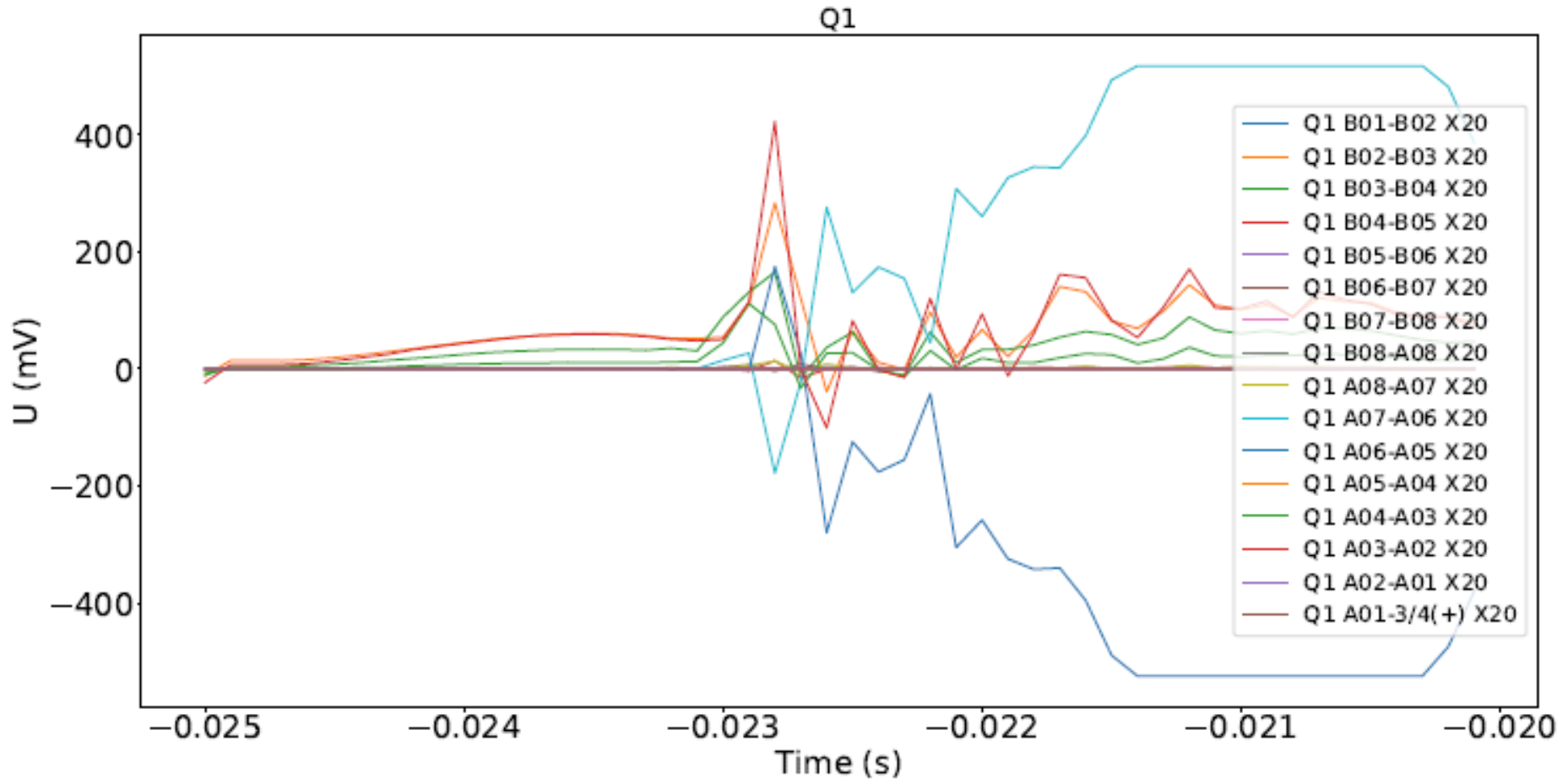- Beginning of training is associated with a pronounced spike in Vtap and QA signals at the onset of every quench. The most striking example is quench 5 where such spike also coincides with a loss of Vtap A06 in Q1. This points to the mechanical origin of the precursor spike.

- Post-spike "ringing" is seen in Vtap and antenna signals, and its frequency is fairly high (~4 kHz), suggesting the motion is associated with a coil or structural part that is not overly large or massive (as that would give rise to much lower frequencies of vibration)

- The antenna signals suggest that mechanical activity in quench 5 is well confined in the RE section below element 13 of the antenna

- The summary table of QA-based quench locations to quench initiation in-between element 14 and 16 for the majority of training quenches, independently of the quenching coil

- In the last OL quench #13 some weak antenna signals are observed in the LE for the first time; quench onset appears to be close to element 3.

Large mechanical event in quench 5 results in a loss of voltage tap A06 **which coincides with the onset** of the quench
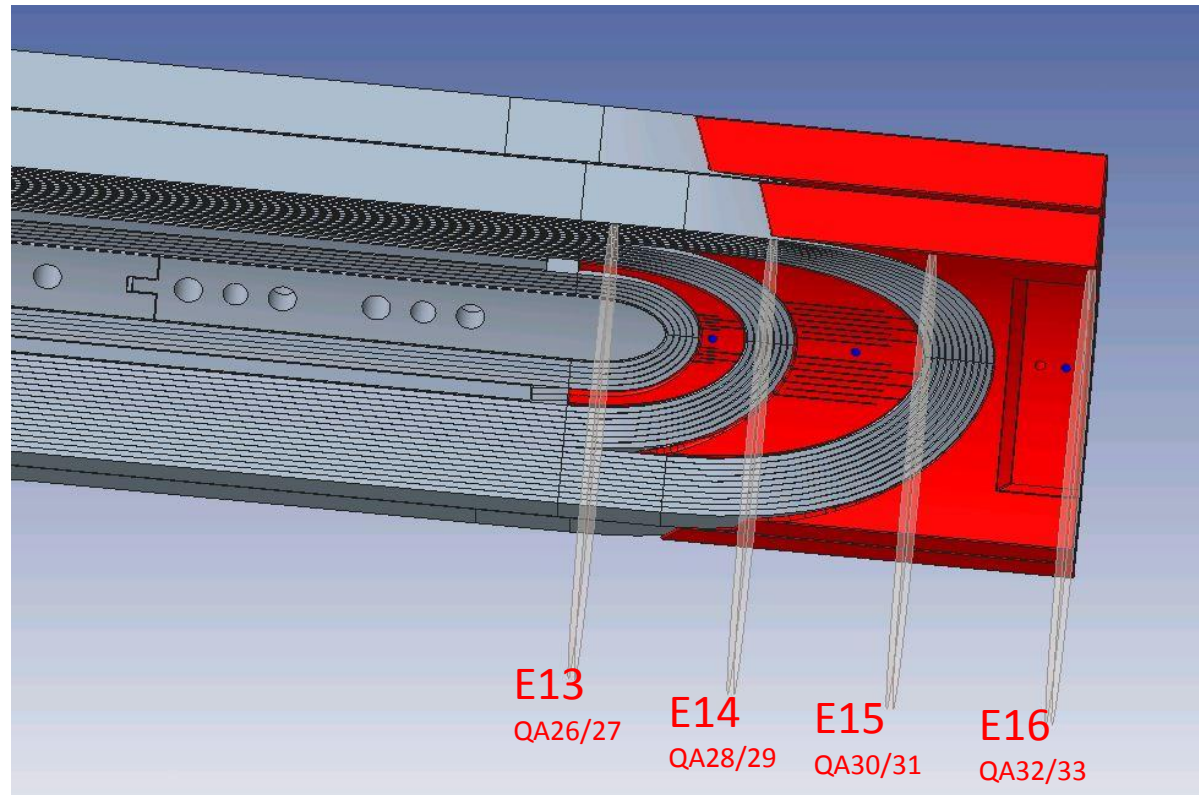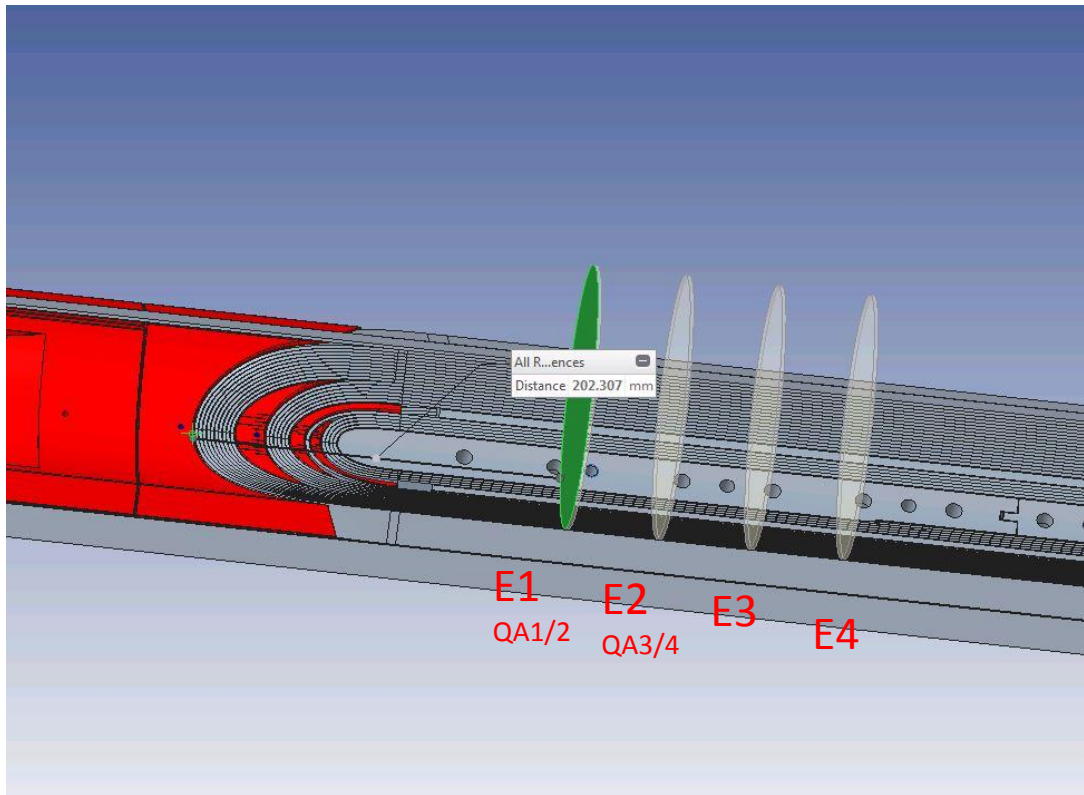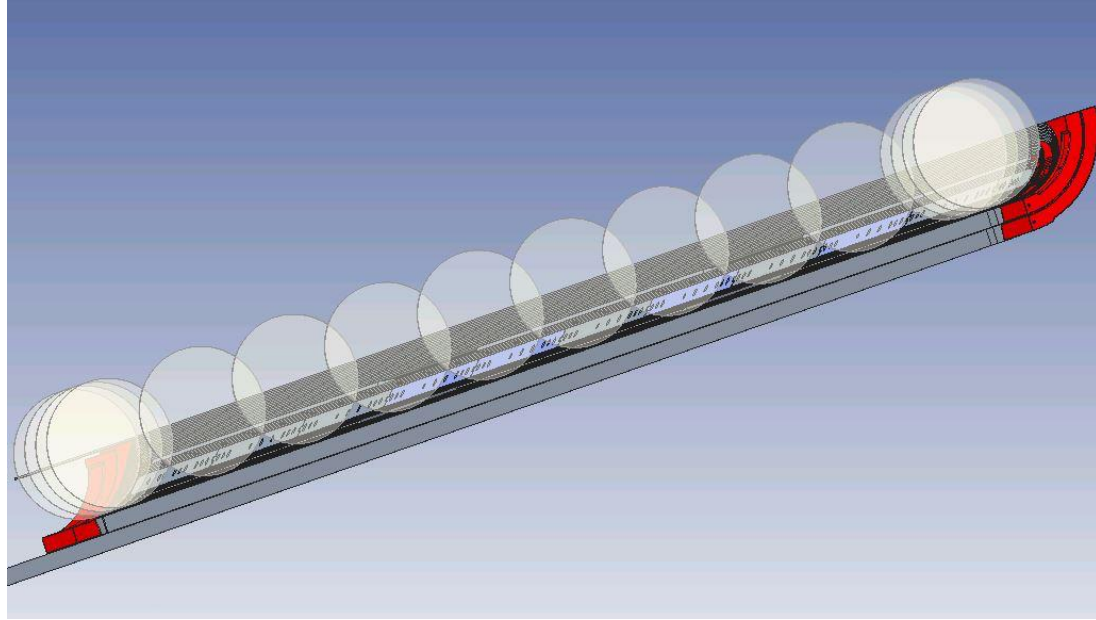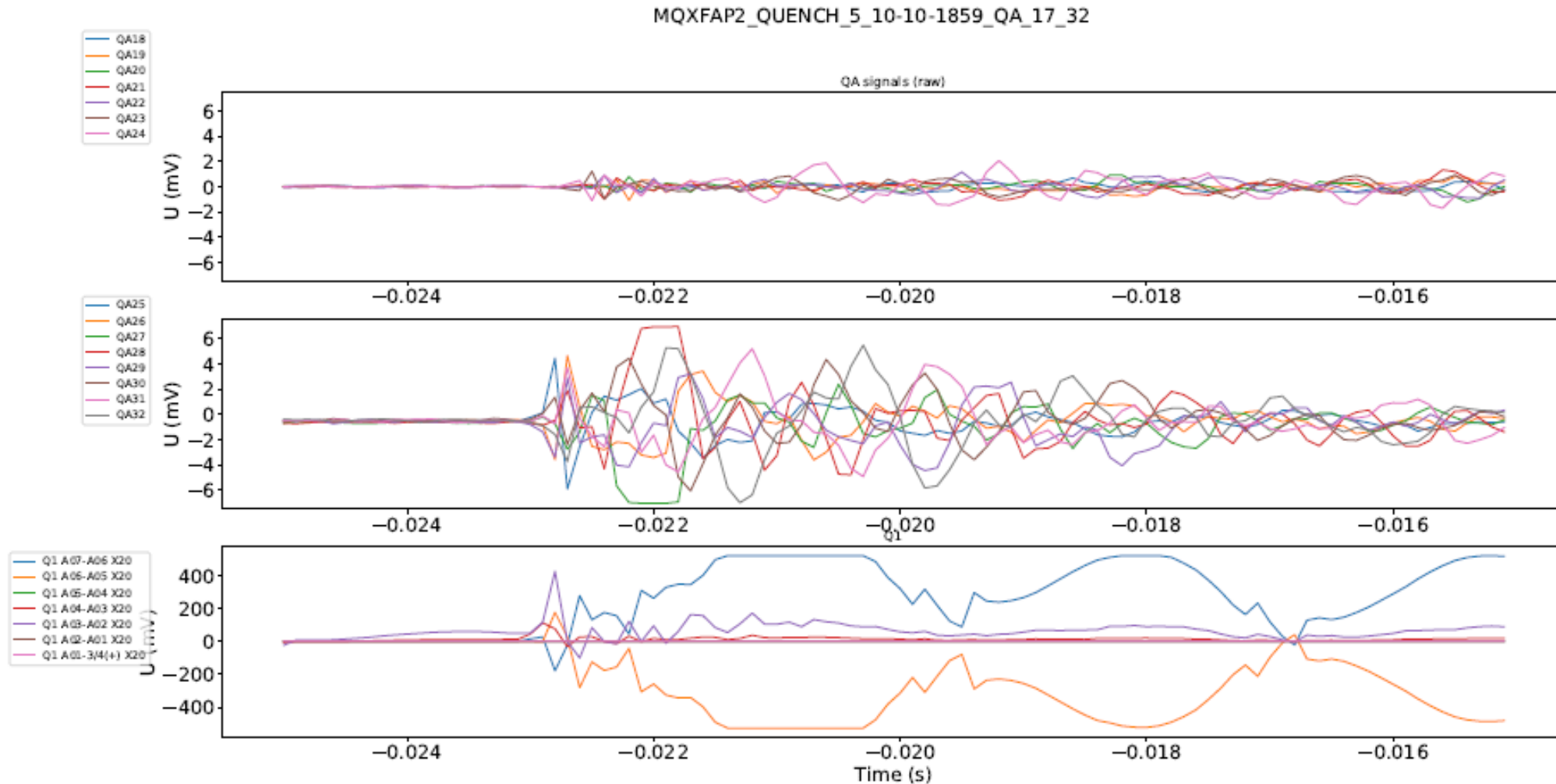

MQXFAP2_QUENCH_5_10-10-1859_Vtaps
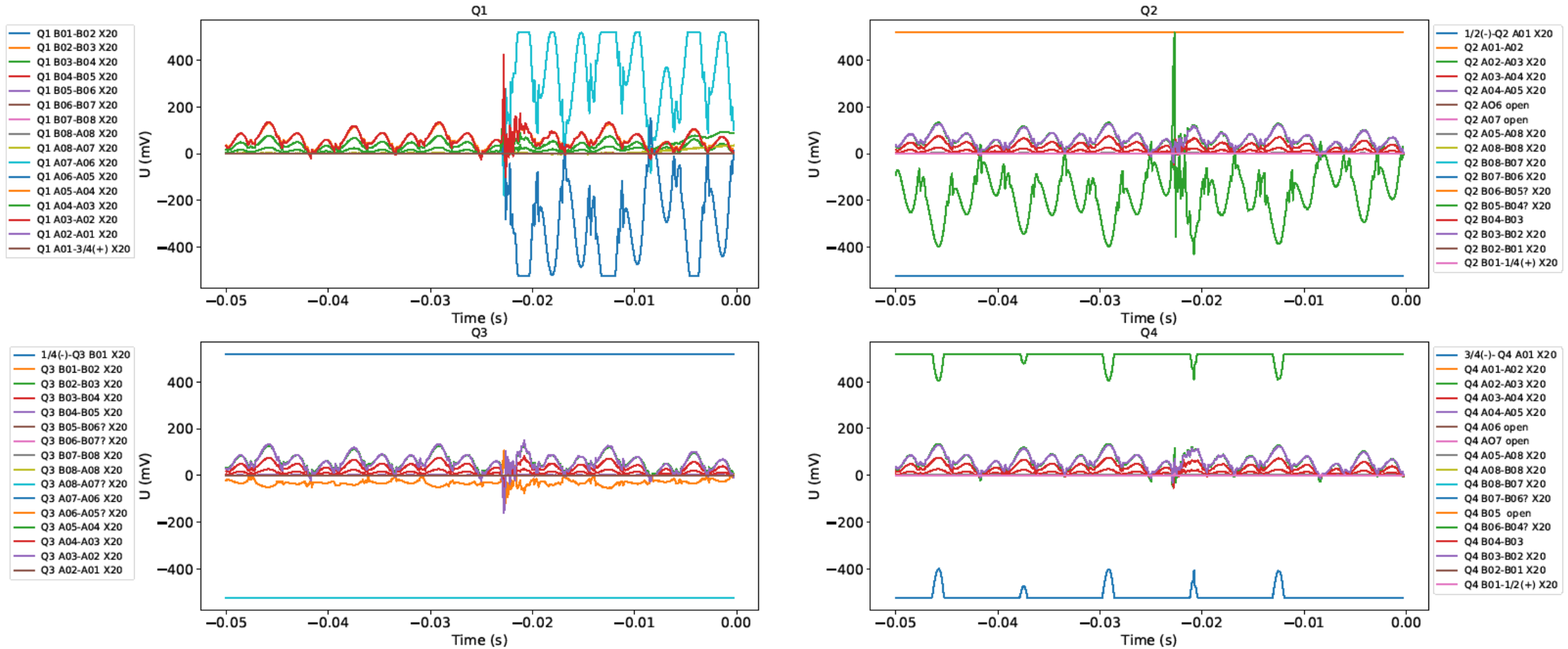
Frequency of post-spike voltage ringing is at least 4 kHz : not likely to be of entire coil or anything massive

- *Likely due to motion of a small-sized coil fraction or structural element*

All R...ences
Distance 202.307 mm

E1
QA1/2

E2
QA3/4

E3

E4

E13
QA26/27

E14
QA28/29

E15
QA30/31

E16
QA32/33

Quench antenna raw signals of quench 5

Quench is centered at the element 14 (QA 27/28) where largest signal amplitude is seen. Elements 15 and 16 (towards RE from element 14) are active as well, while elements towards LE (13, 12…) show very little or no activity. One can guess that Q1 coil motion was well confined to the RE region down from element 13.

Quench antenna localization summary

Quench #13:   QA6 (element 3, LE) - OL quench

Quench #12 : ?? (no discernible signals)   - OL quench

Quench #11 : QA30,QA31 -> QA29,QA28 (element 15 -> element 14, RE)

Quench #10 : QA26 -> QA28 (elements 13 -> element 14, RE)

Quench #9 : QA28 & QA30 (?, weak signals)

Quench #8 : QA28 (?, weak signals) (element 14, RE)

Quench #7 :   QA30 -> QA32; QA30 -> QA28 (element 15 -> elements 16 and 15 -> element14)
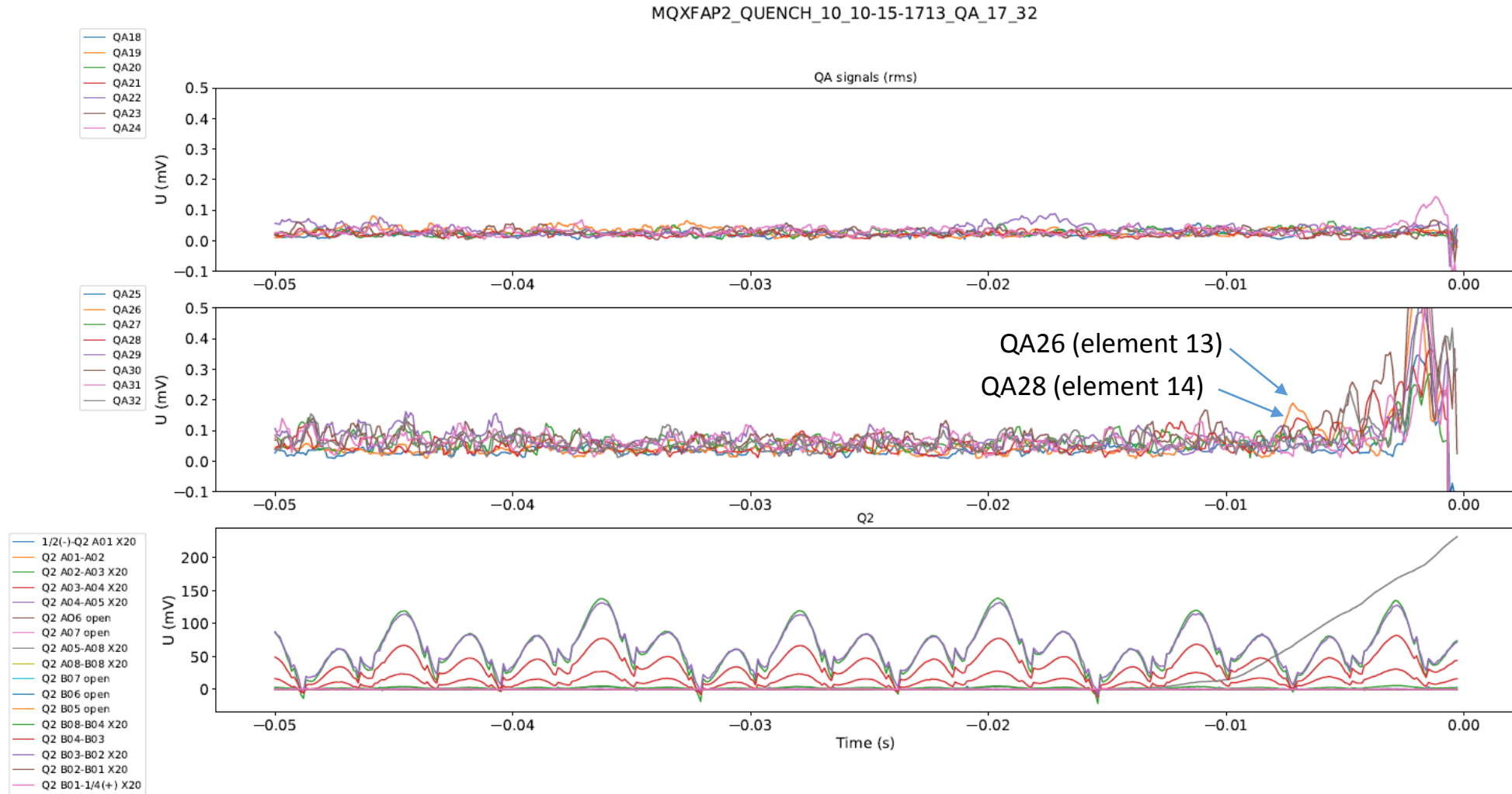
Quench #6 : ?? (no discernible signals)

Quench #5 : QA27/QA28 (element 14, RE)

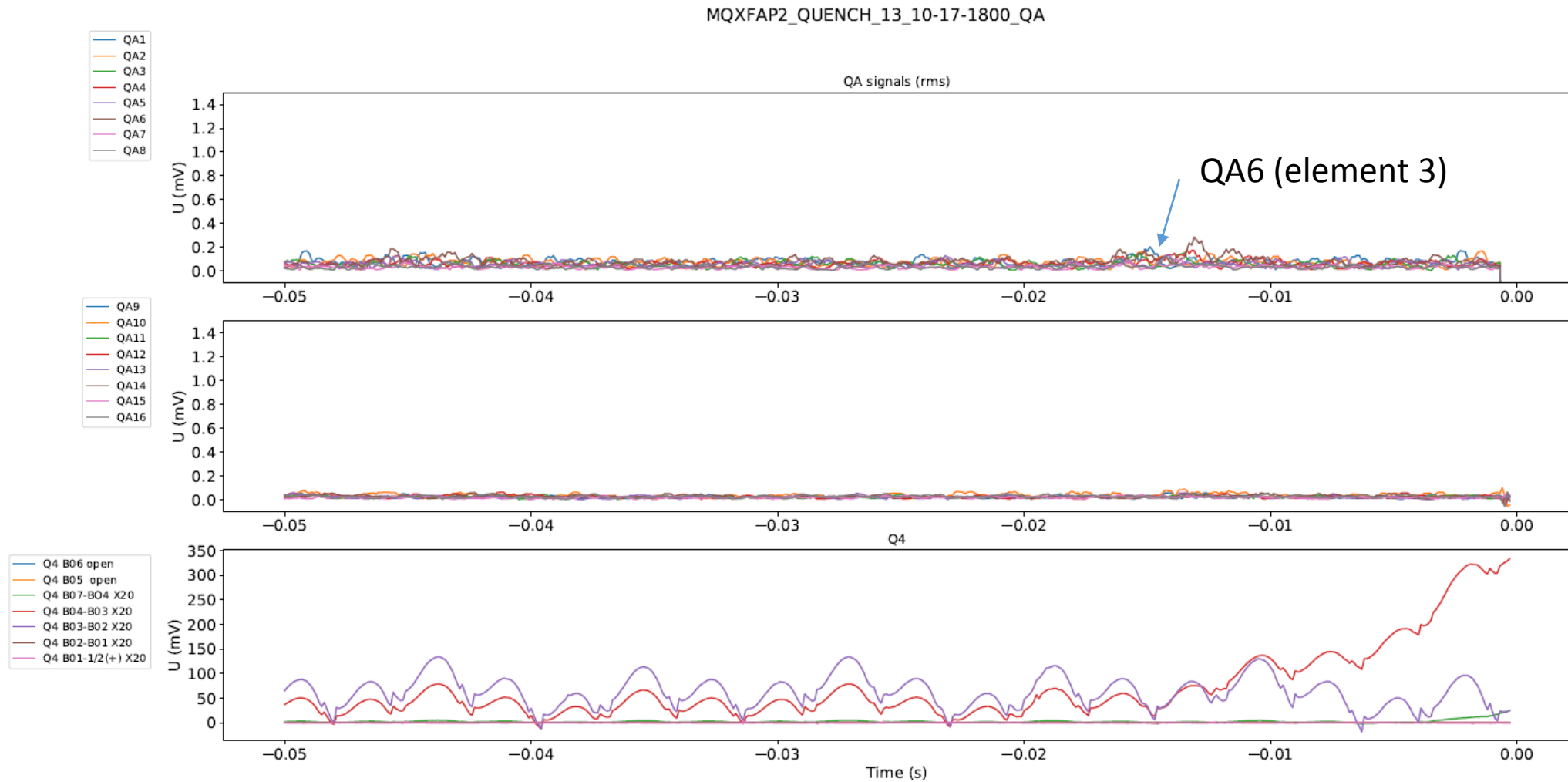Quench #4 : QA32 (element 16, RE)

Quench #3 : QA29 (element 14, RE)

Quench antenna signal example (quench 10)

MQXFAP2_QUENCH_10_10-15-1713_QA_17_32

Wavelet-filtered and rms (5-point) averaged antenna voltages are plotted to improve signal/noise

Quench antenna signal example (quench 13)

MQXFAP2_QUENCH_13_10-17-1800_QA

QA6 (element 3)

Wavelet-filtered and rms (5-point) averaged antenna voltages are plotted to improve signal/noise