

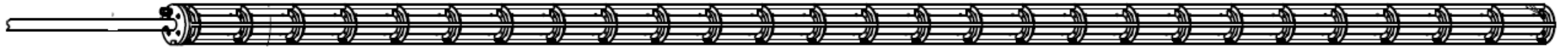


# Quench antenna results

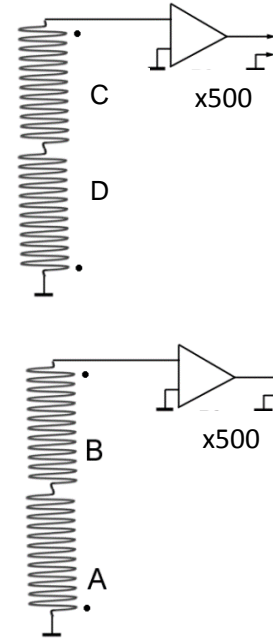
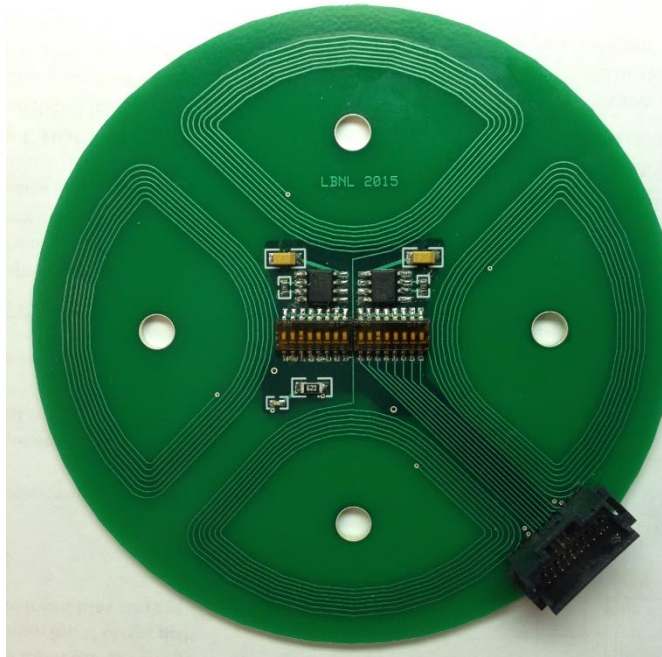
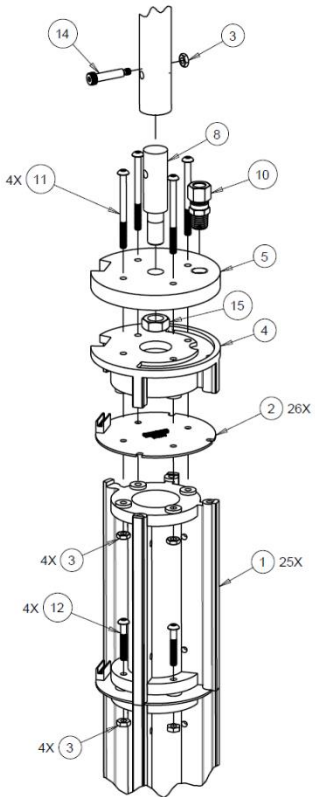
M. Marchevsky (LBNL)



# Quench antenna design and layout

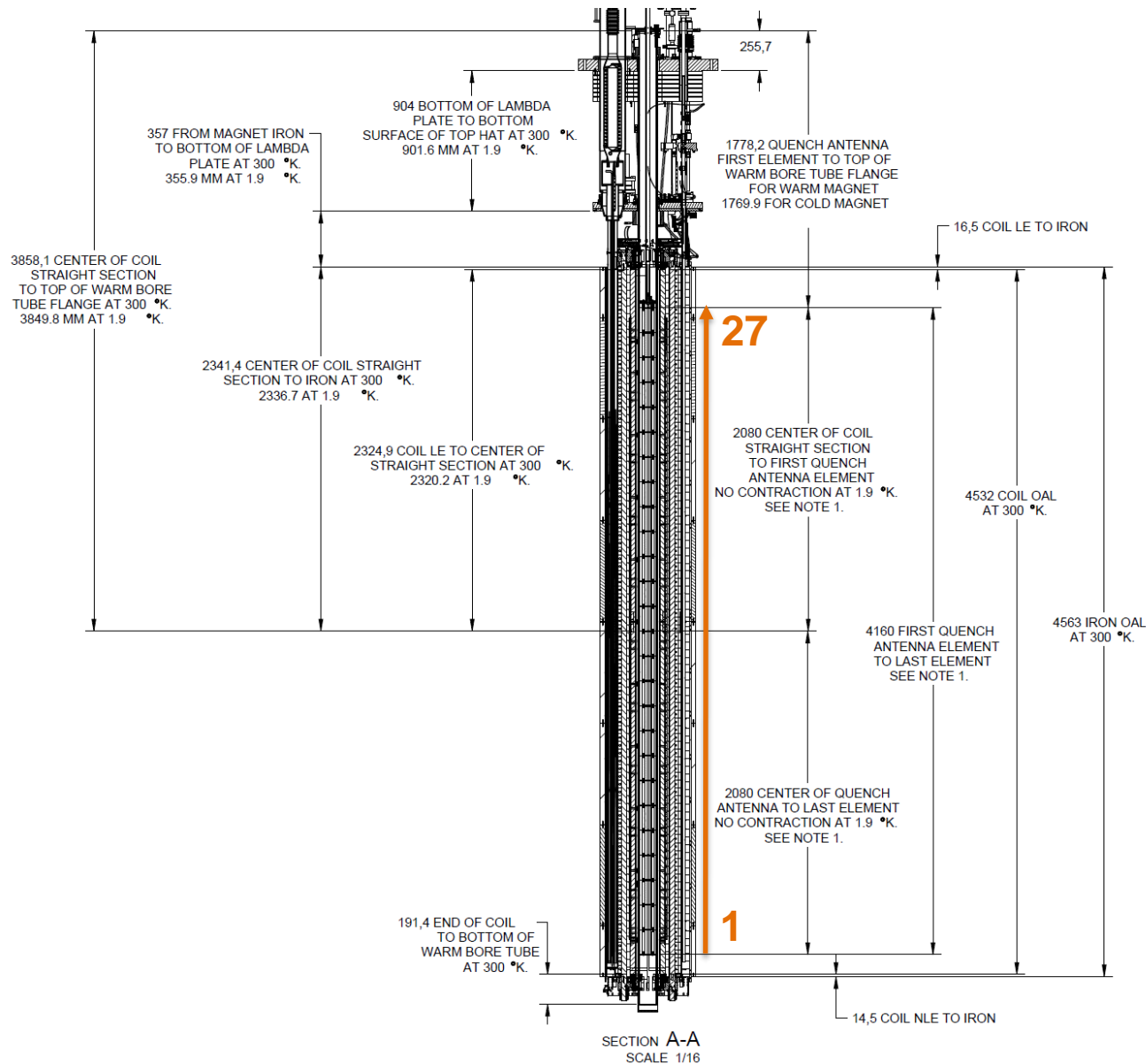


27 elements covering the entire magnet length, having uniform spacing of 160 mm between the elements



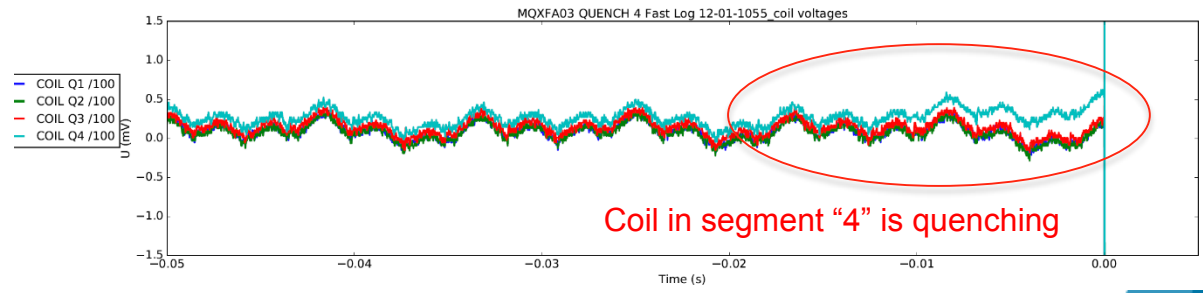
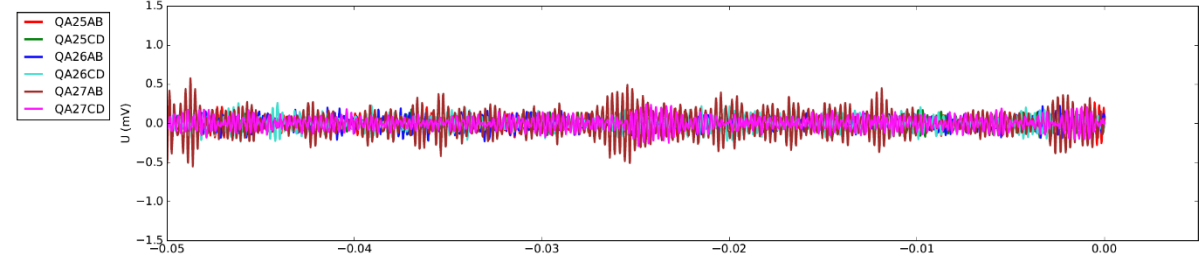
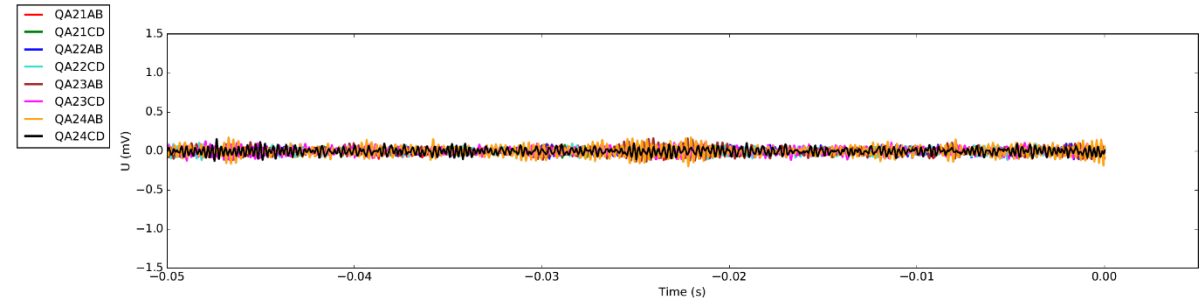
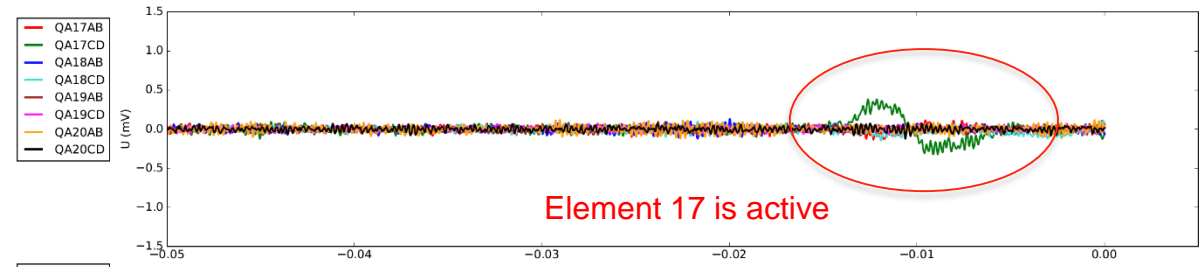
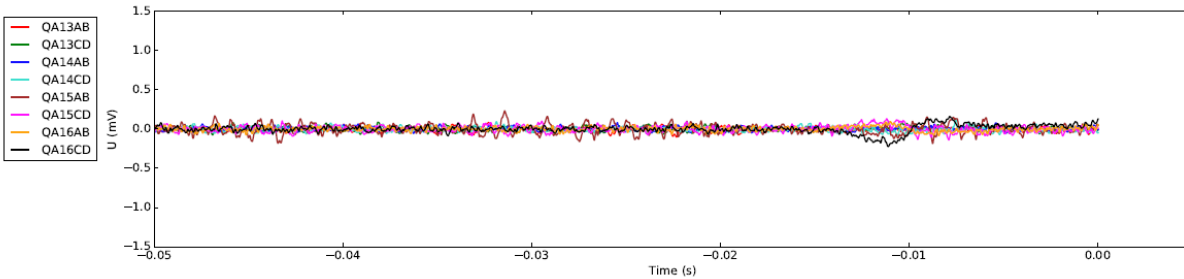
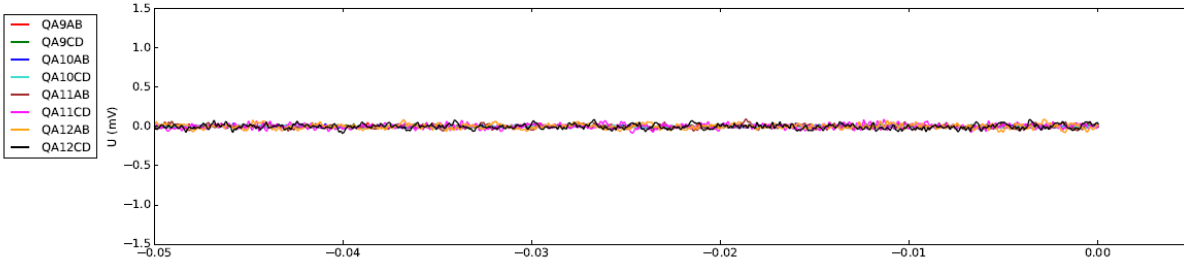
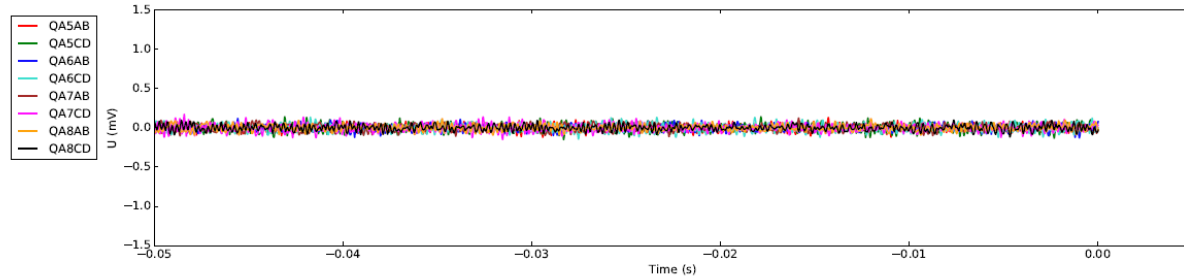
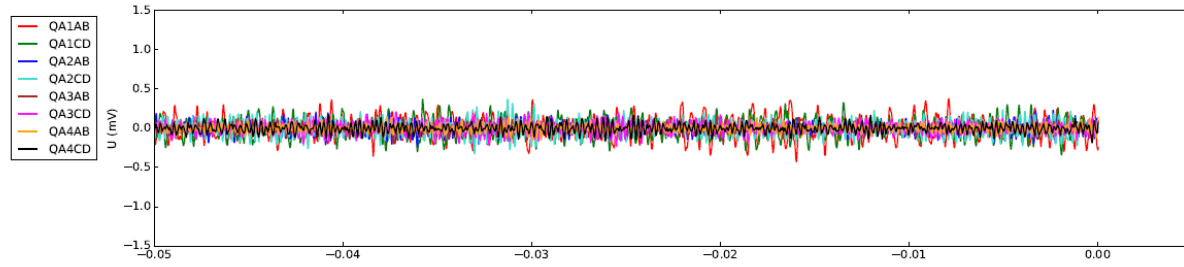
- The antenna has been developed at LBNL and consists of PCB elements with two orthogonal pairs of dipole-bucked coils in combination with a dual op-amp with a gain factor of 500
- It has been used in MQXFAP1 in the 16-element configuration.
- BNL has built new support structure and extended the antenna to 27 elements uniformly covering the coil length

# Quench antenna placement in the MQXFA03 magnet



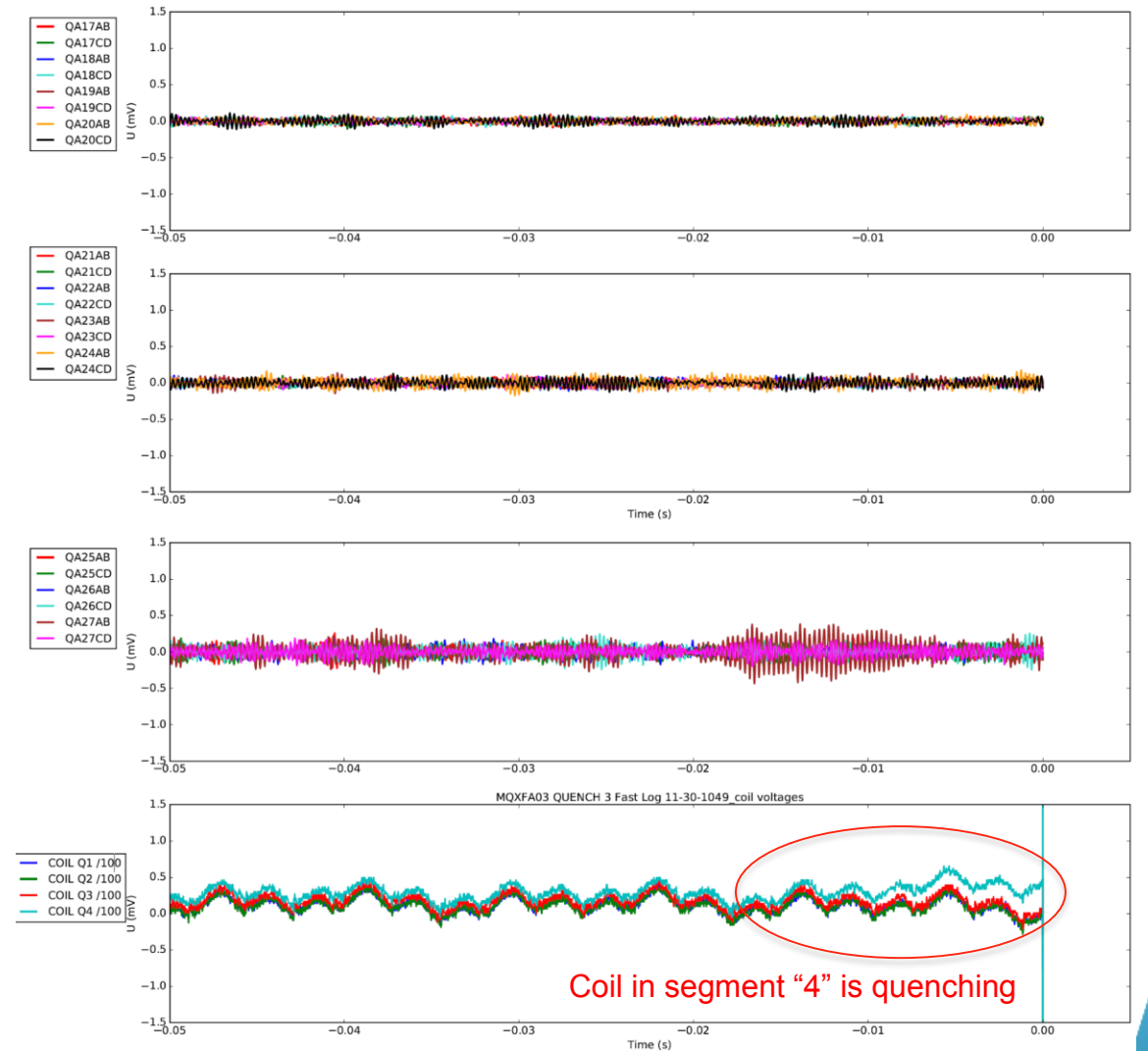
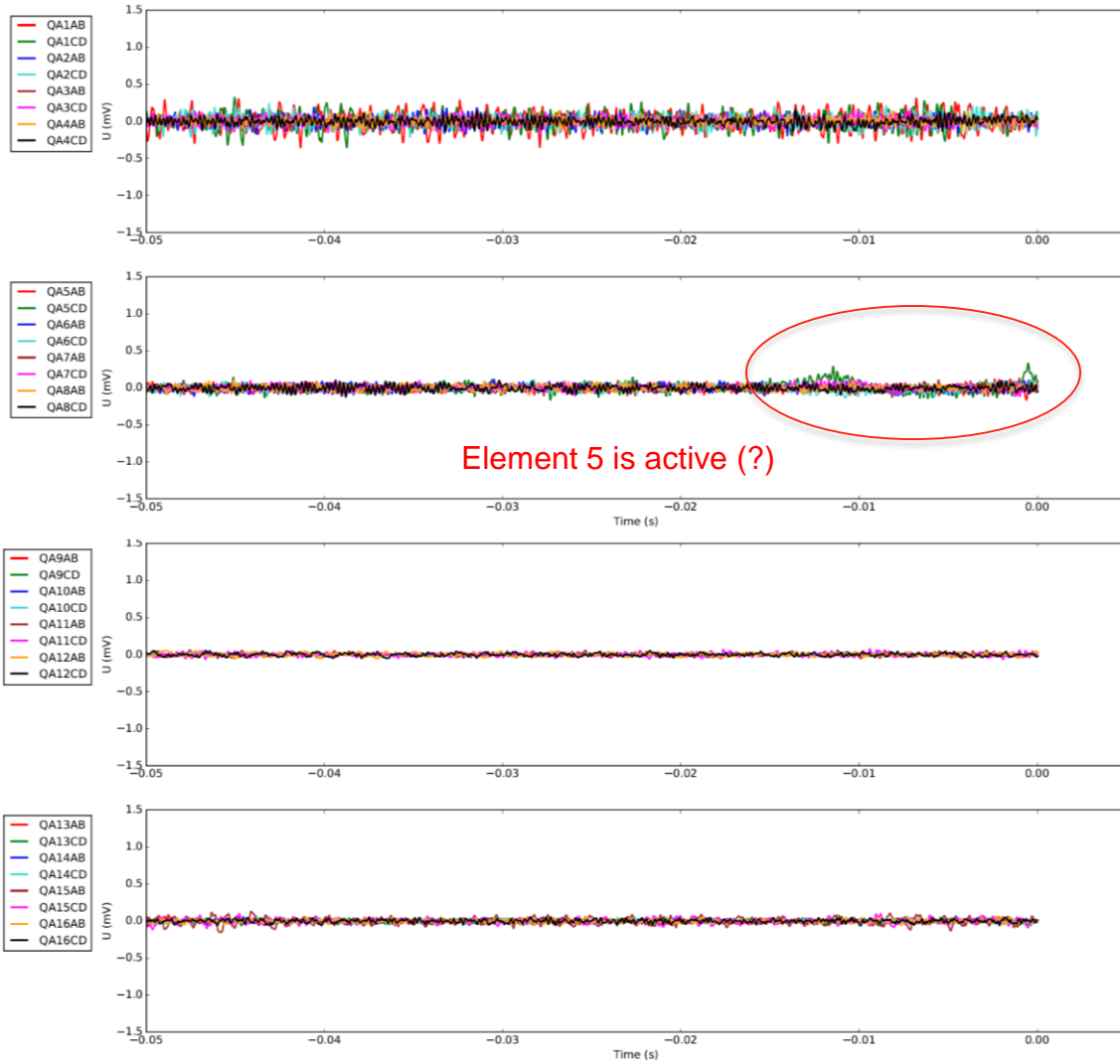
- QA was placed in the warm bore during training
- Signals were acquired at 100 kHz using NI ADC hardware
- Raw signals were plotted together with coil voltages to determine active element for each quench
- For some quenches active element signals were clear and easy to identify while for other they were near noise level (or below...). The reason for the latter is unclear, as presently antenna is covering the entire coil length with high density, and no “dead zones” due to sparse placing of the elements are expected

# Example of a “good” QA signal: quench #4

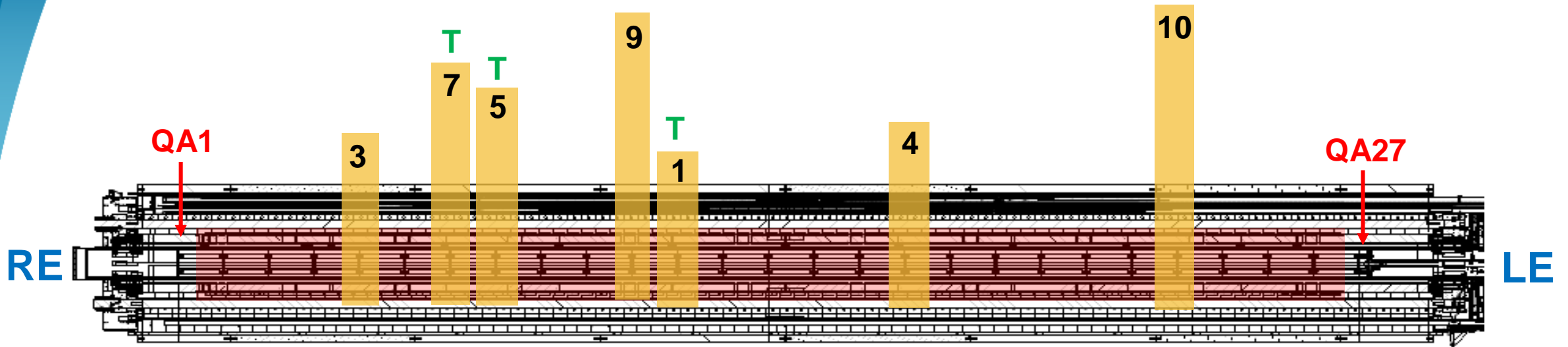




# Example of a “weak” QA signal: quench #3



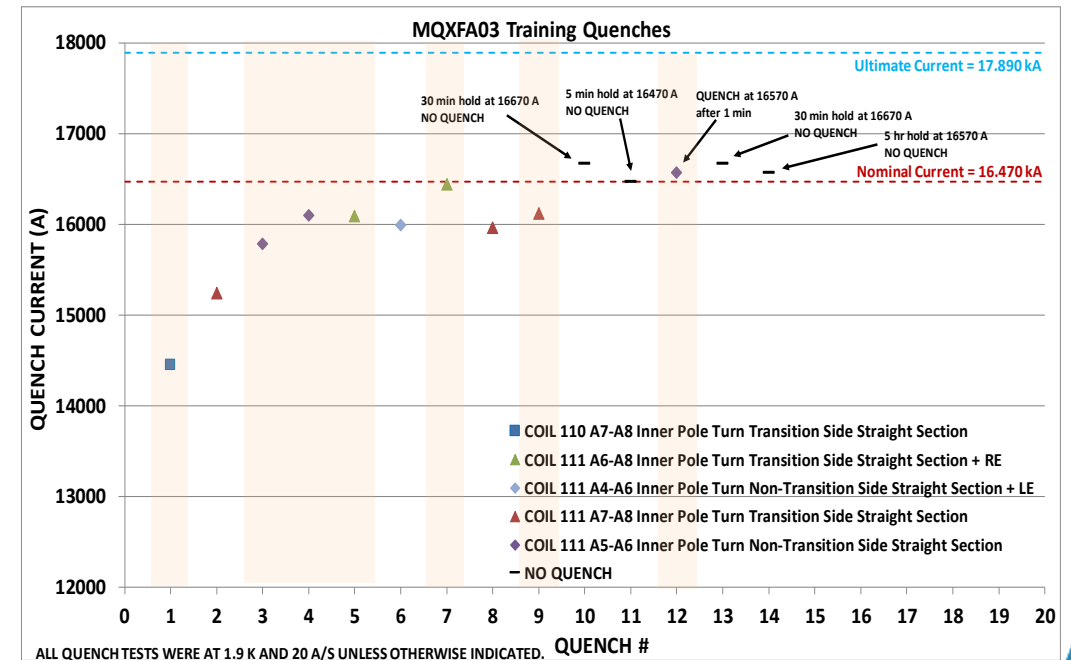
# Quench location distribution summary



## Active quench antenna elements for MQXFA3 quenches

- Quench 1 - QA12CD (?)
- Quench 2 - ? (no signal)
- Quench 3 - QA5CD (?)
- Quench 4 - QA17CD
- Quench 5 - QA8AB
- Quench 6 - ? (no signal)
- Quench 7 - QA7CD (?)
- Quench 8 - ? (no signal)
- Quench 9 - QA11AB
- Quench 10 - QA23CD

\*Question marks are for signals very low in amplitude



# Addendum: all QA signals for MQXFA3 training

# Active quench antenna elements for MQXFA3 quenches

Quench 1 - QA12CD (?)

Quench 2 - ? (no signal)

Quench 3 – QA5CD (?)

Quench 4 – QA17CD

Quench 5 – QA8AB

Quench 6 - ? (no signal)

Quench 7 – QA7CD (?)

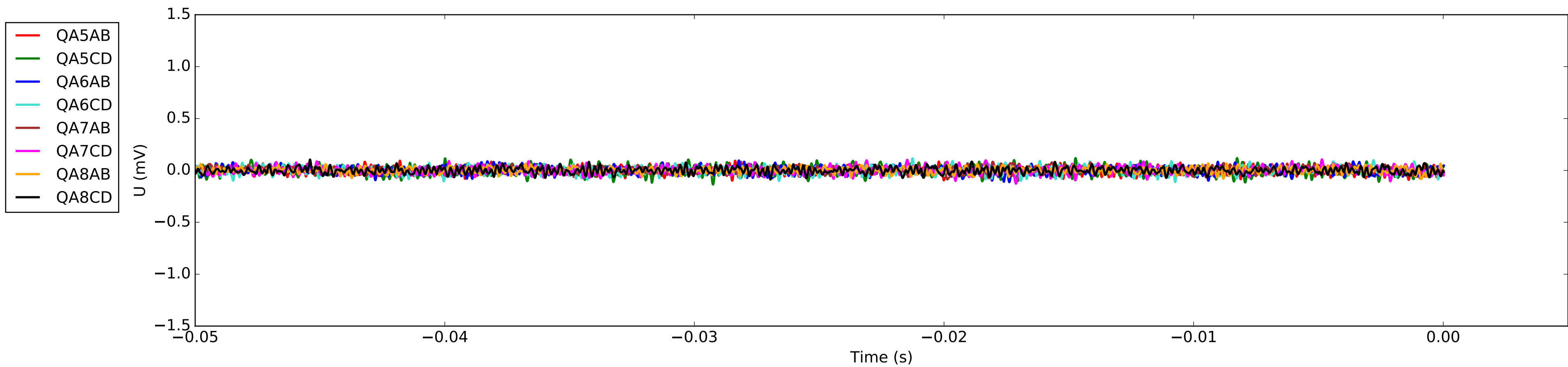
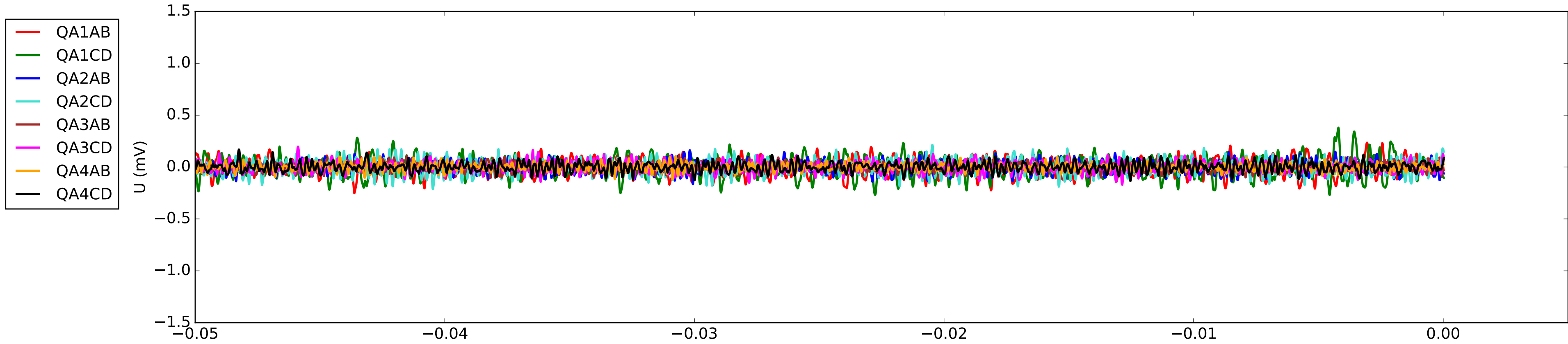
Quench 8 - ? (no signal)

Quench 9 – QA11AB

Quench 10- QA23CD

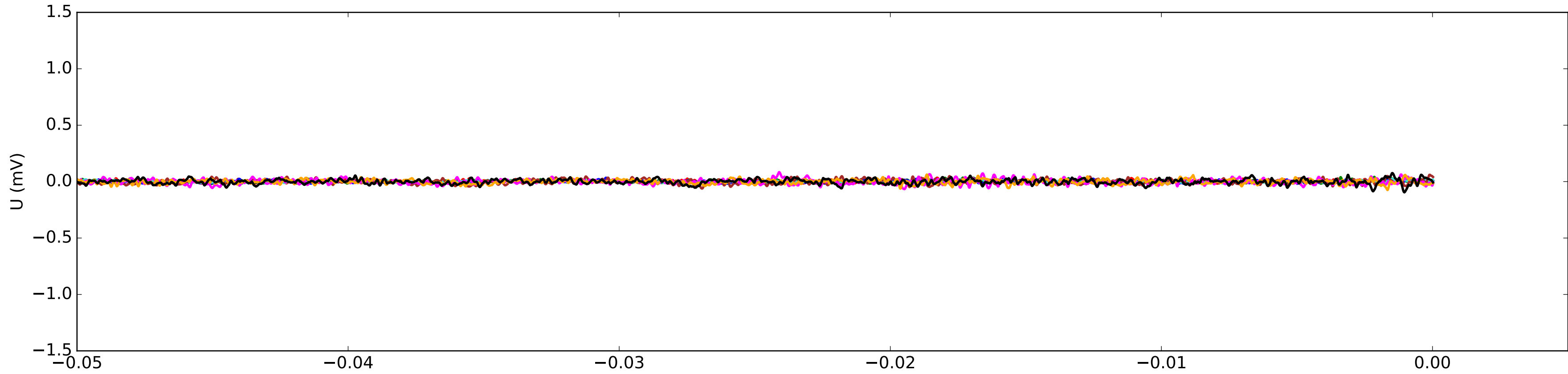
\*Question marks are for signals very low in amplitude

# QUENCH1\_QA

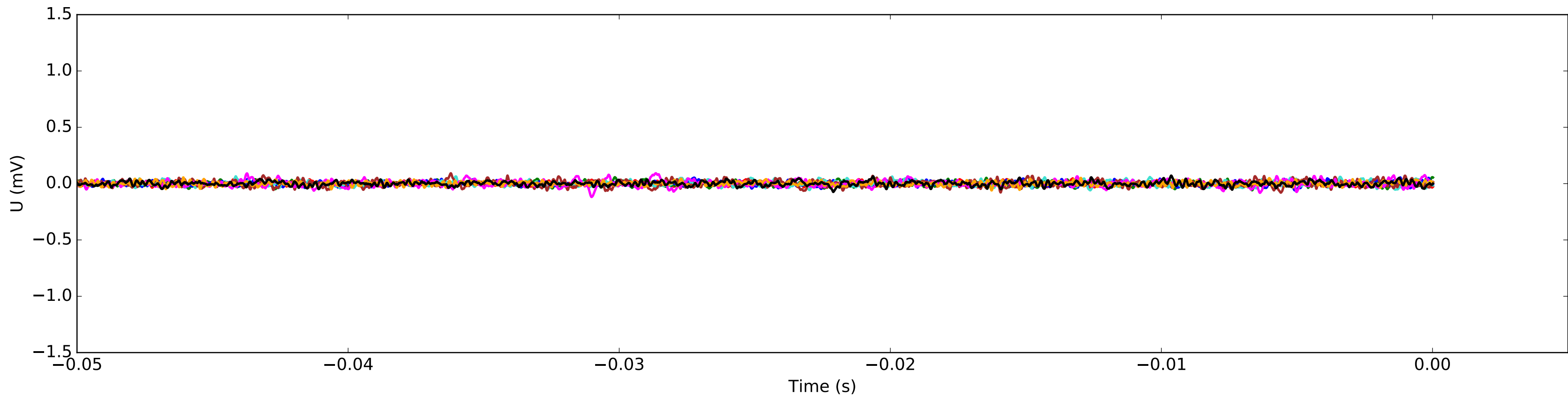


# QUENCH1\_QA

- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD



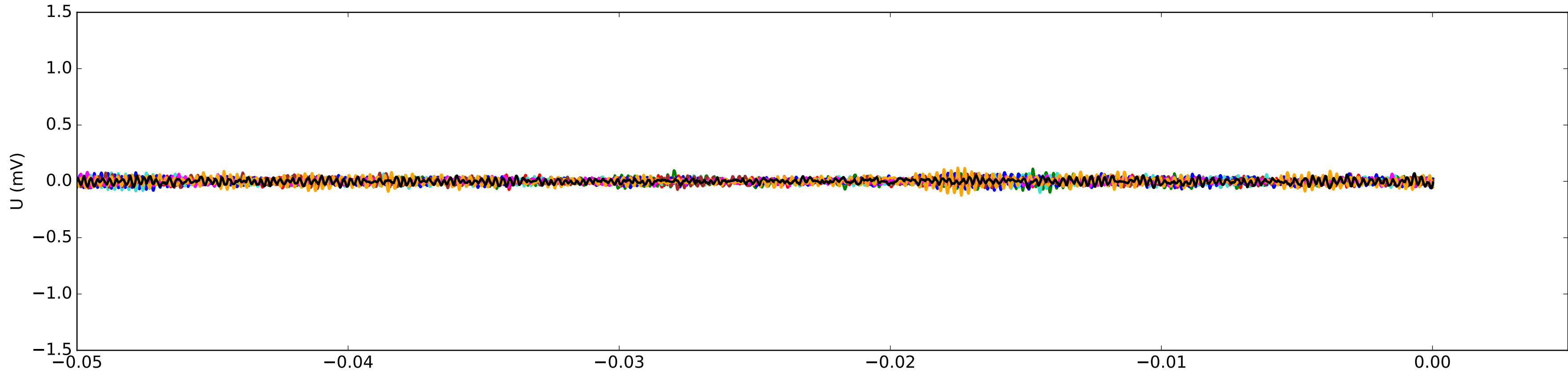
- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD



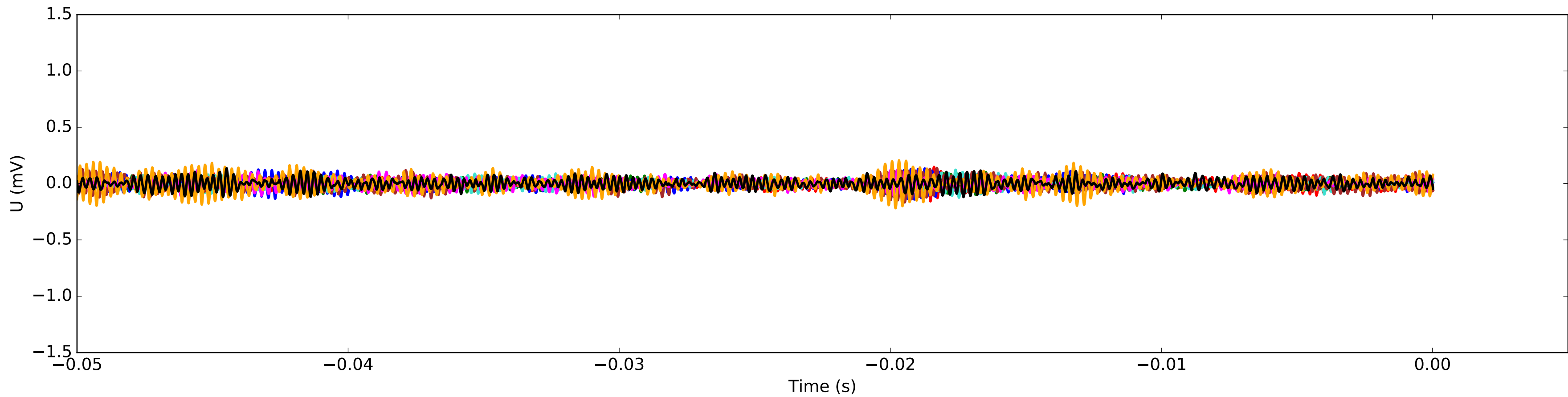


# QUENCH1\_QA

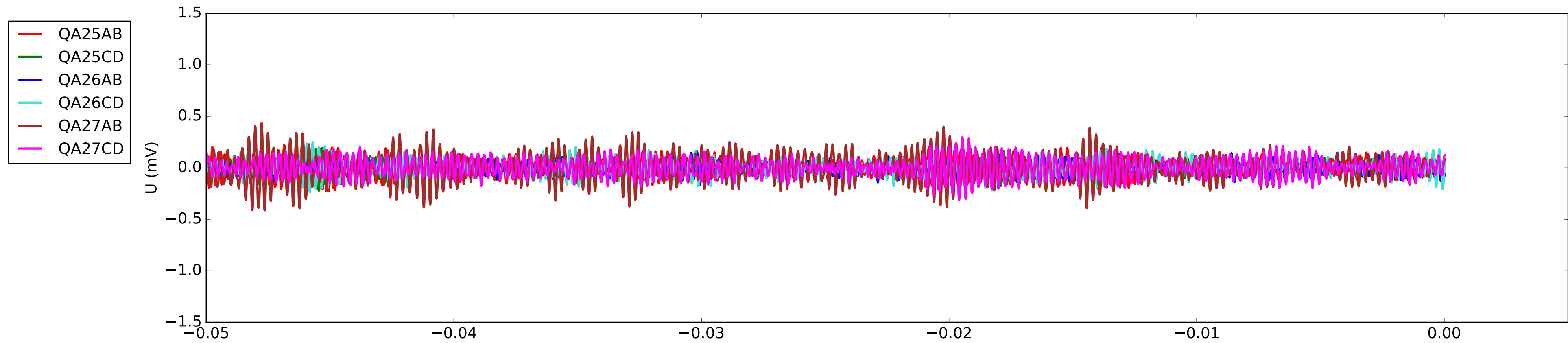
- QA17AB
- QA17CD
- QA18AB
- QA18CD
- QA19AB
- QA19CD
- QA20AB
- QA20CD



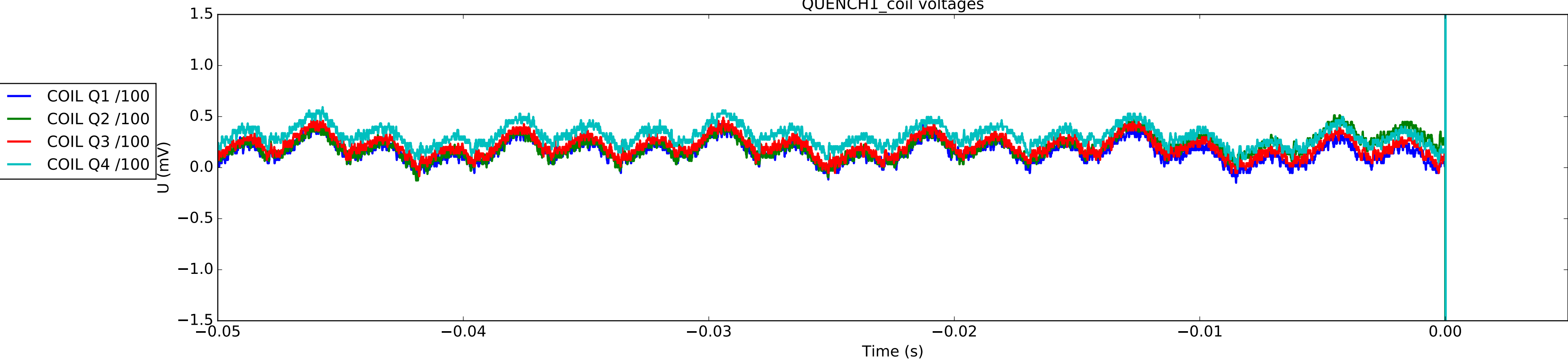
- QA21AB
- QA21CD
- QA22AB
- QA22CD
- QA23AB
- QA23CD
- QA24AB
- QA24CD



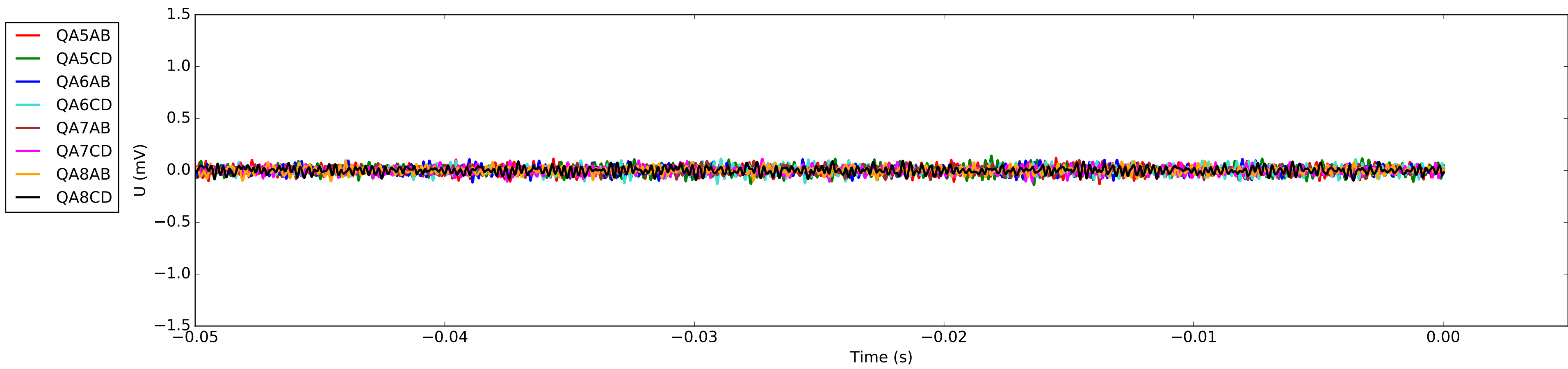
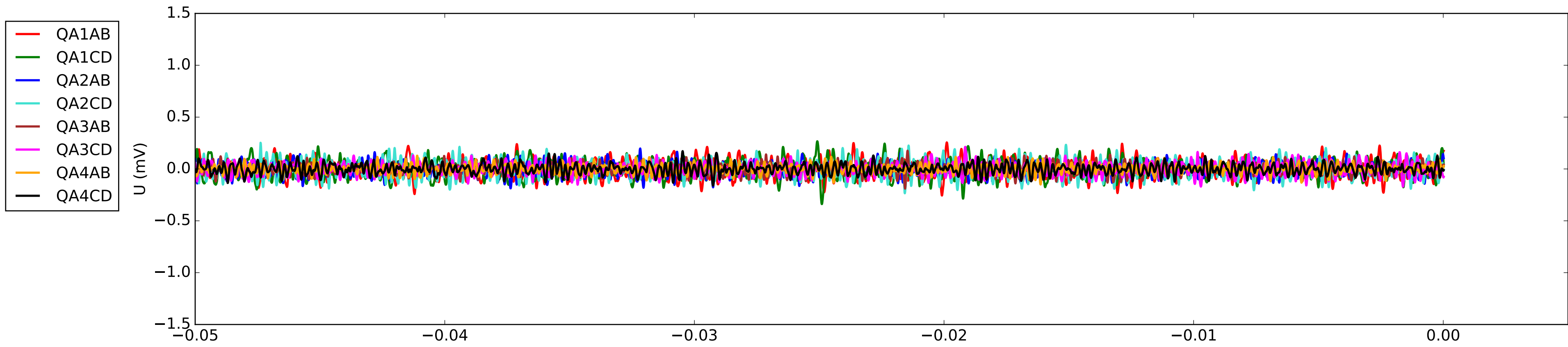
QUENCH1\_QA



QUENCH1\_coil voltages

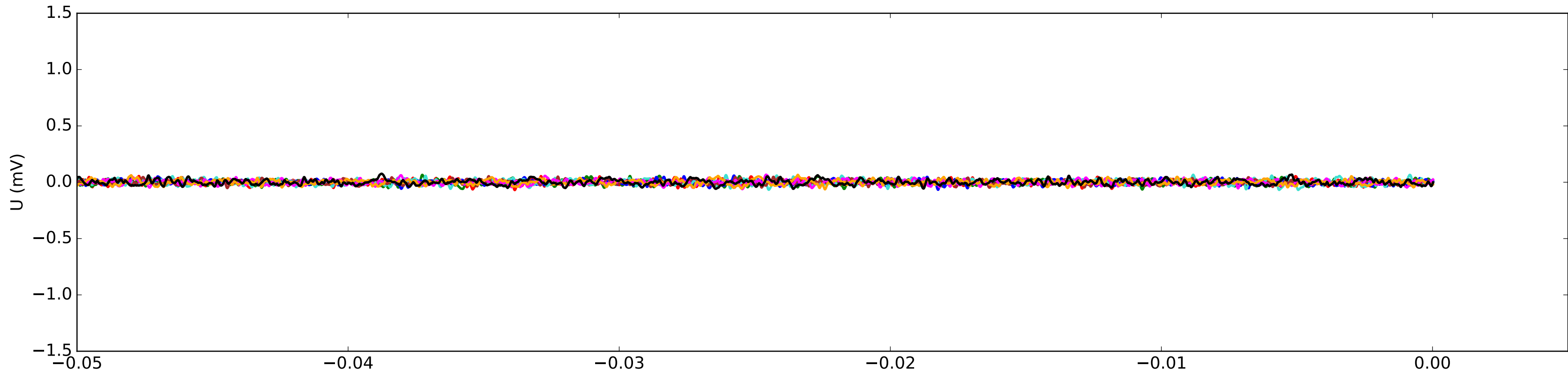


MQXFA03 QUENCH 2 Fast Log 11-29-1057\_QA

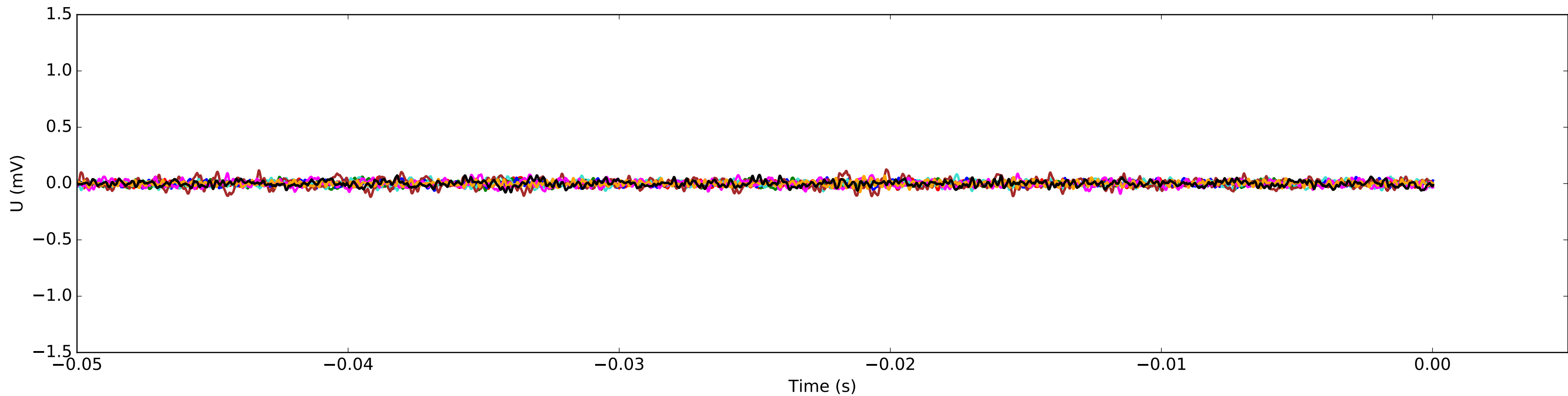


MQXFA03 QUENCH 2 Fast Log 11-29-1057\_QA

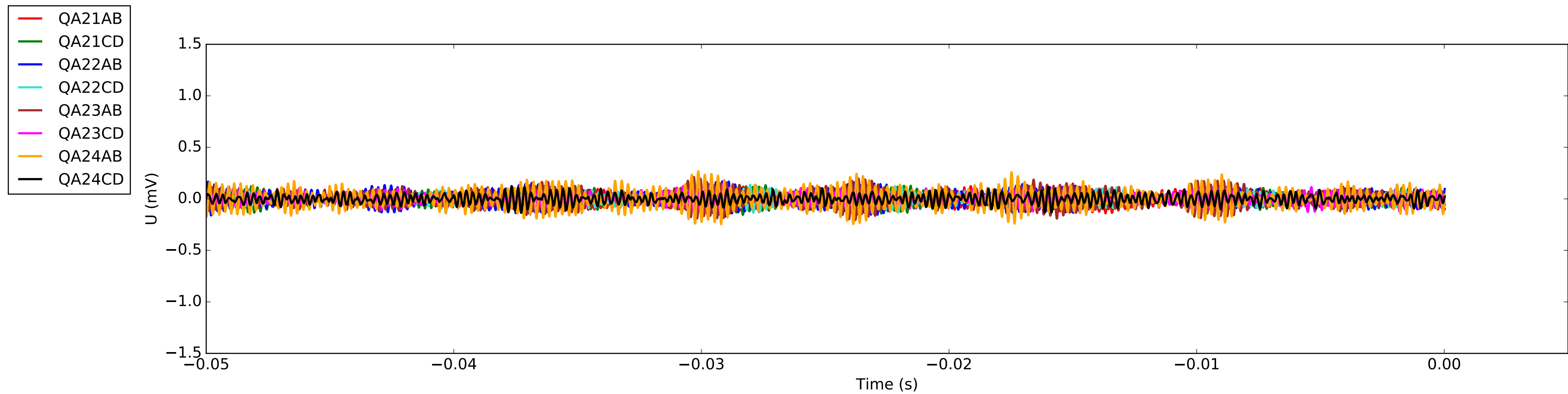
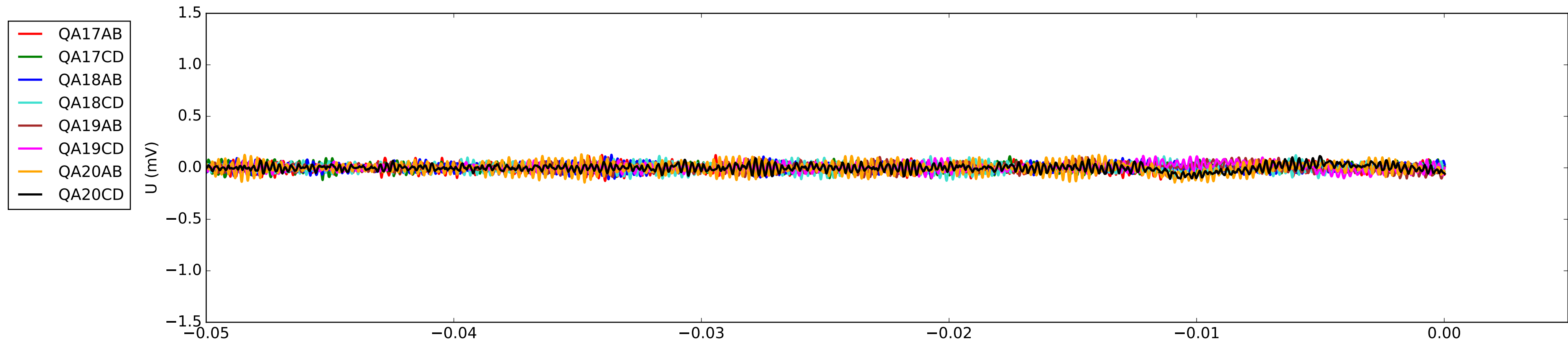
- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD



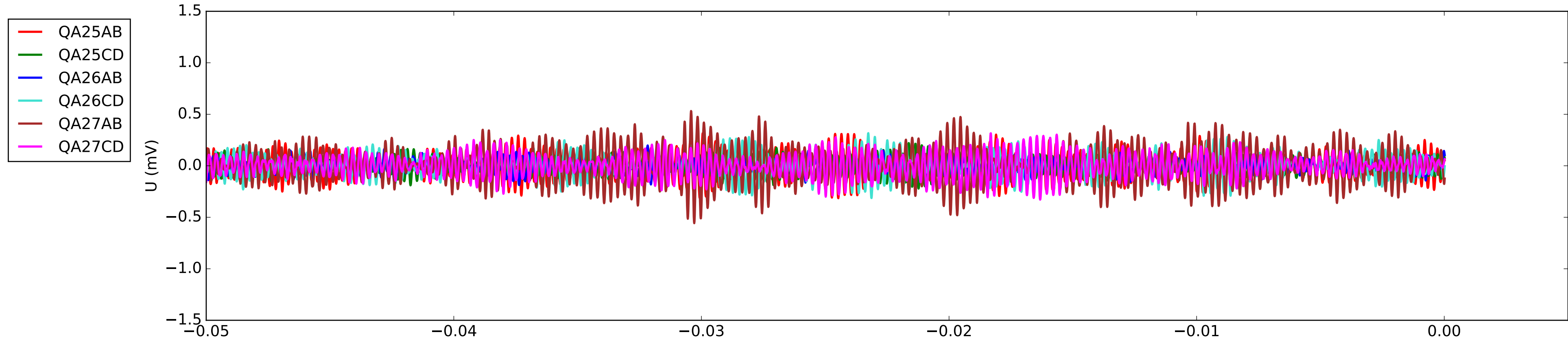
- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD



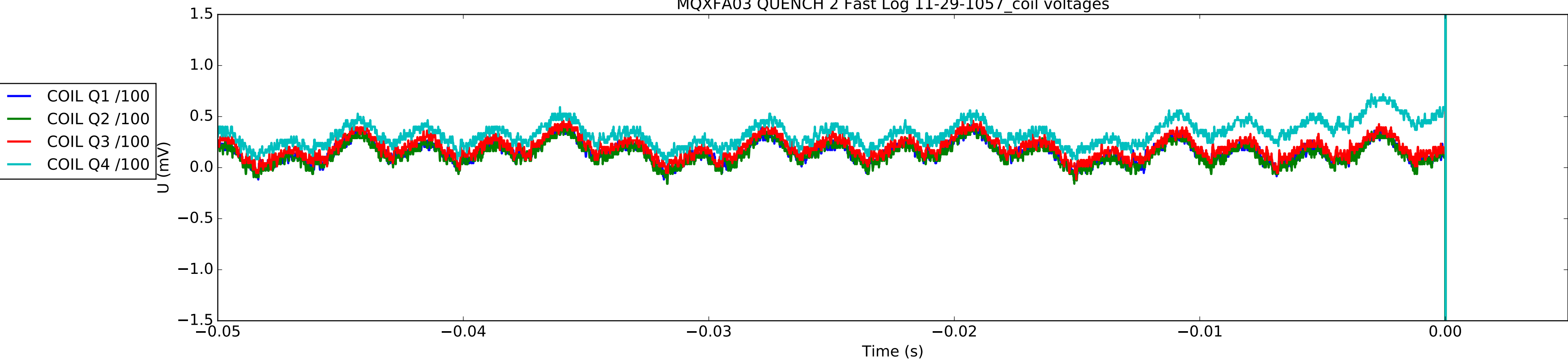
MQXFA03 QUENCH 2 Fast Log 11-29-1057\_QA



MQXFA03 QUENCH 2 Fast Log 11-29-1057\_QA

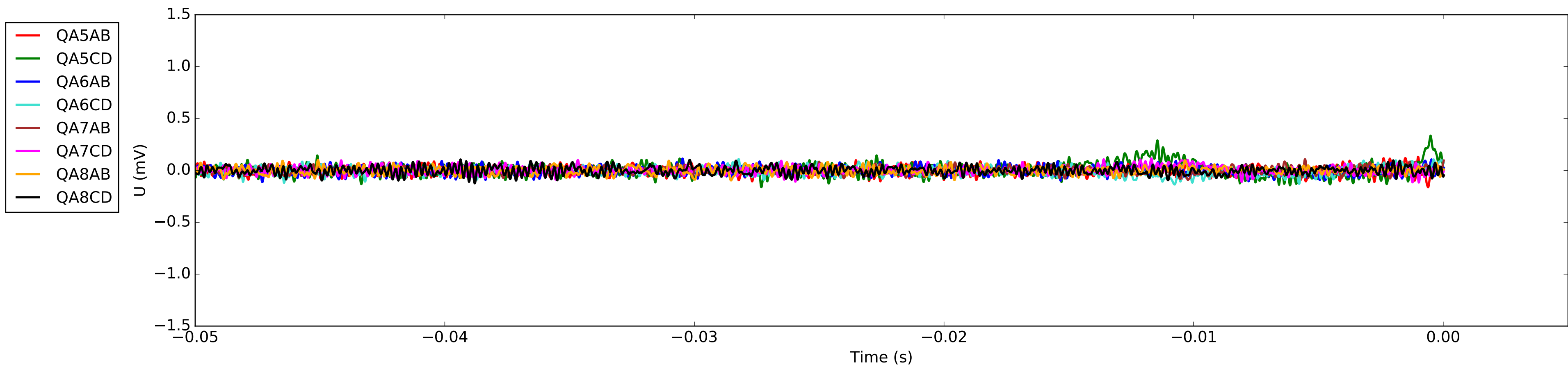
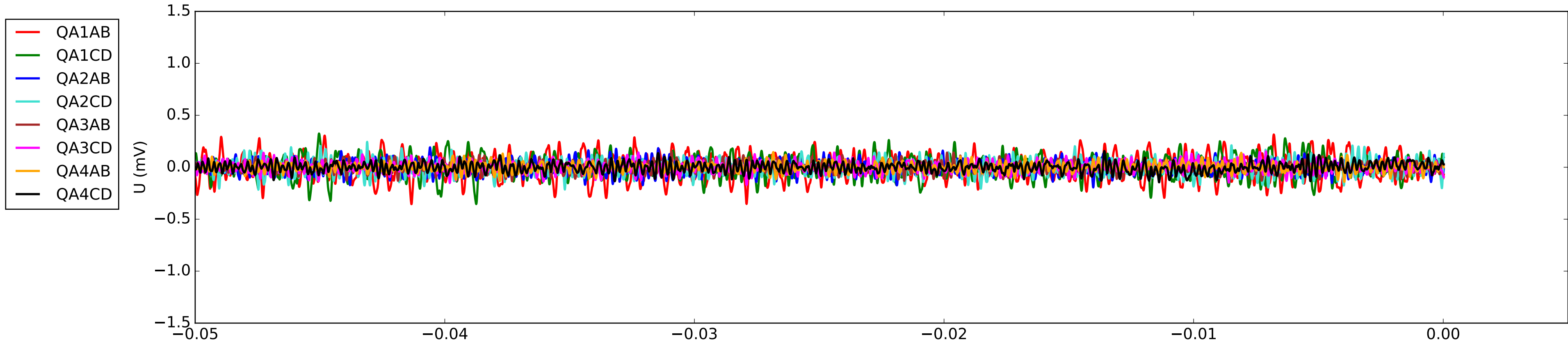


MQXFA03 QUENCH 2 Fast Log 11-29-1057\_coil voltages



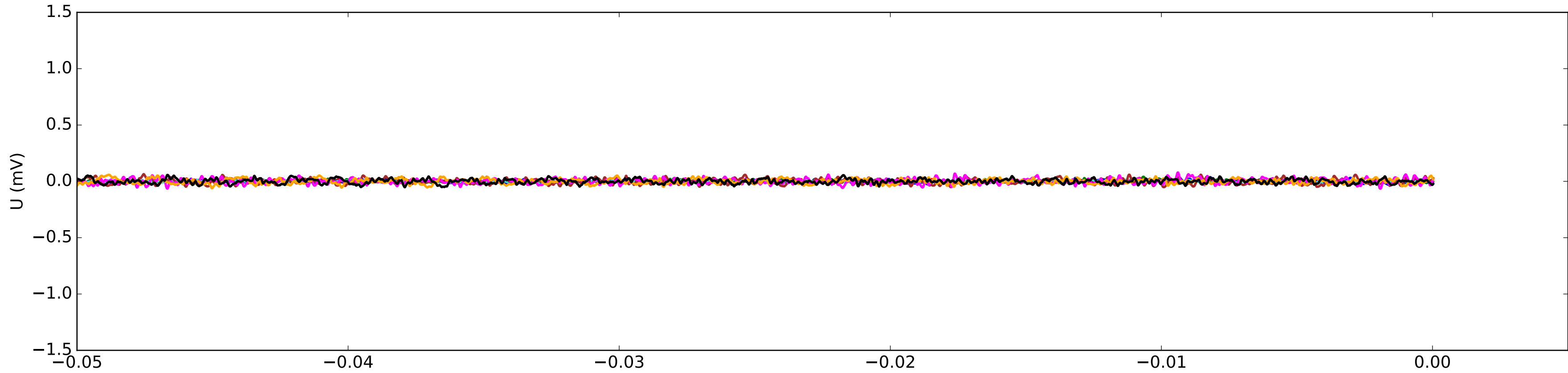


MQXFA03 QUENCH 3 Fast Log 11-30-1049\_QA

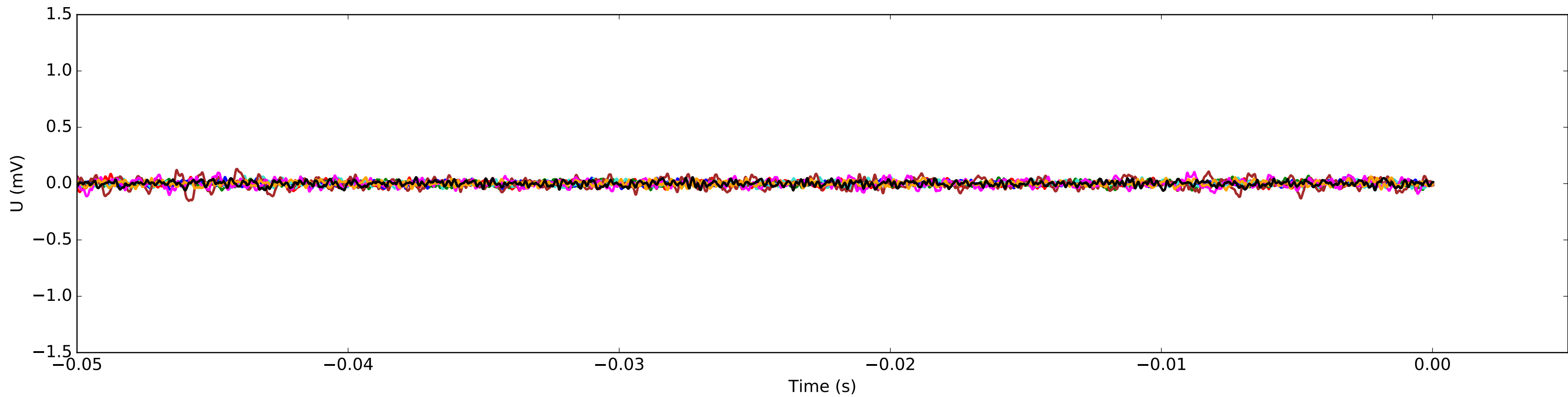


MQXFA03 QUENCH 3 Fast Log 11-30-1049\_QA

- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD



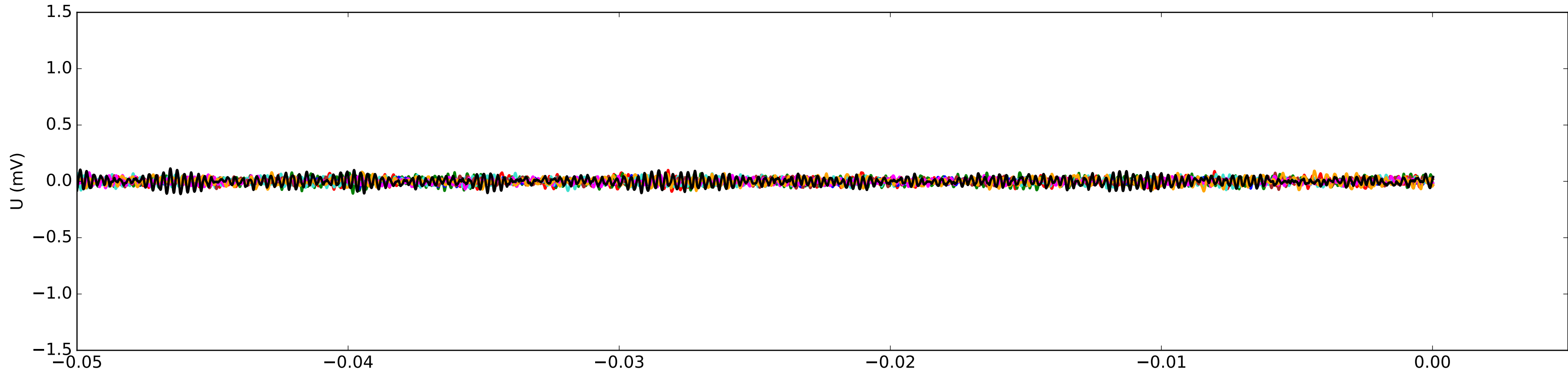
- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD



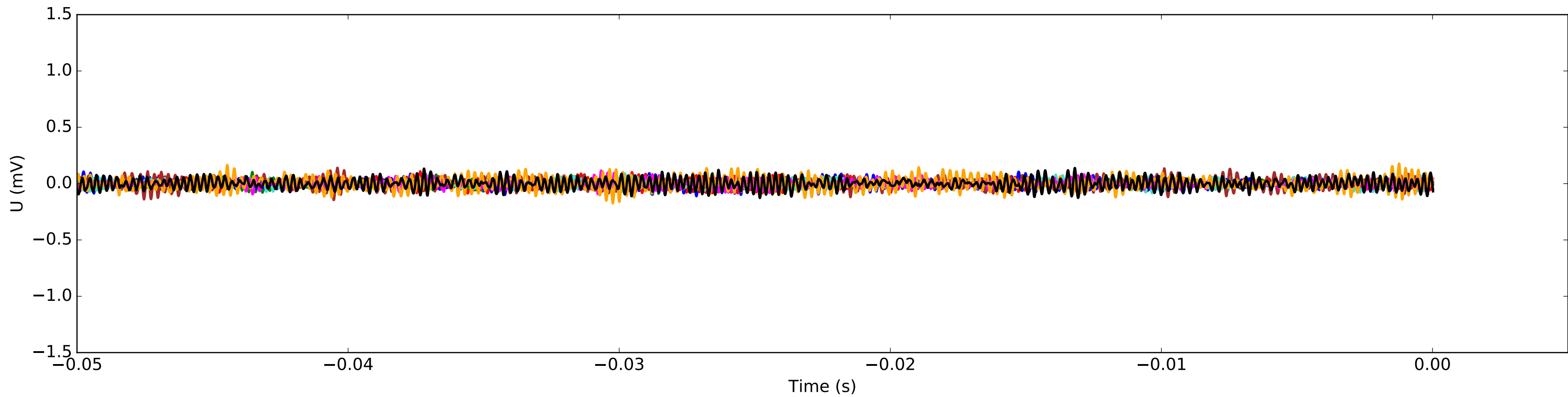
Time (s)

MQXFA03 QUENCH 3 Fast Log 11-30-1049\_QA

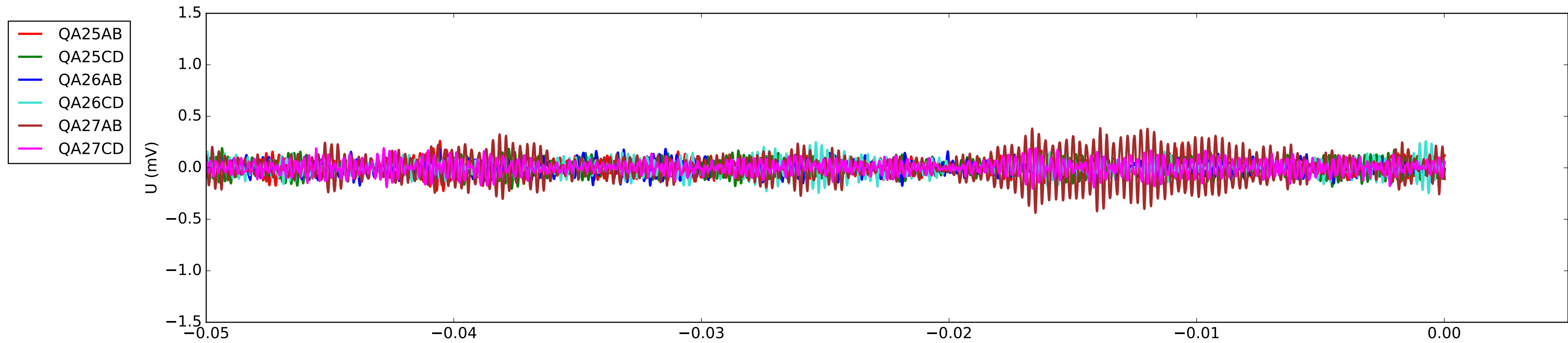
- QA17AB
- QA17CD
- QA18AB
- QA18CD
- QA19AB
- QA19CD
- QA20AB
- QA20CD



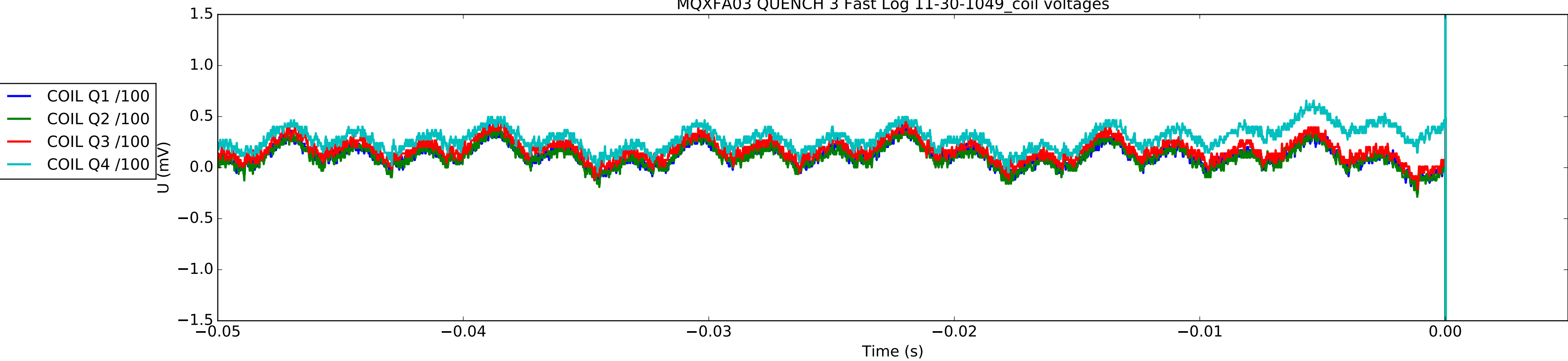
- QA21AB
- QA21CD
- QA22AB
- QA22CD
- QA23AB
- QA23CD
- QA24AB
- QA24CD



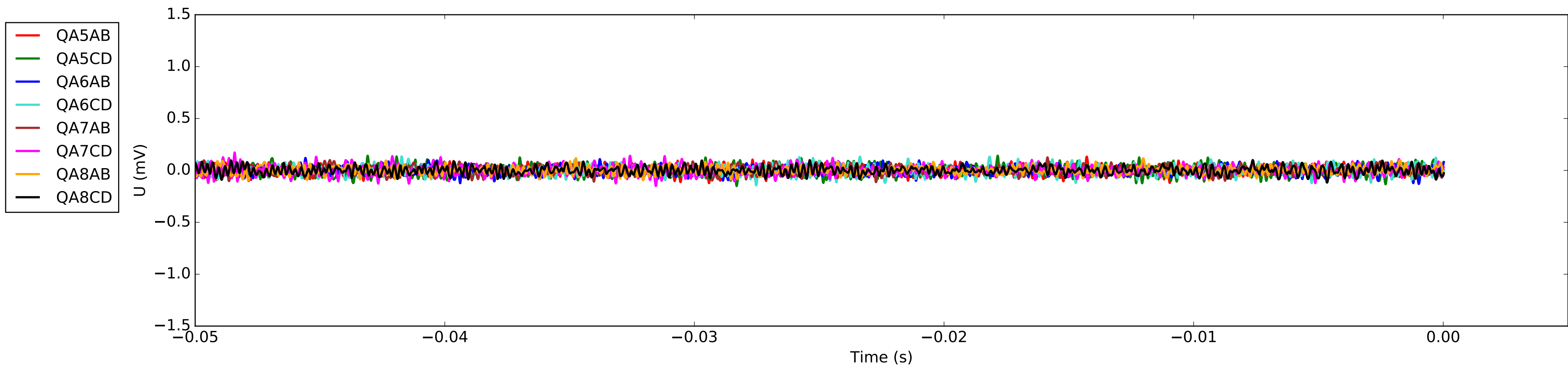
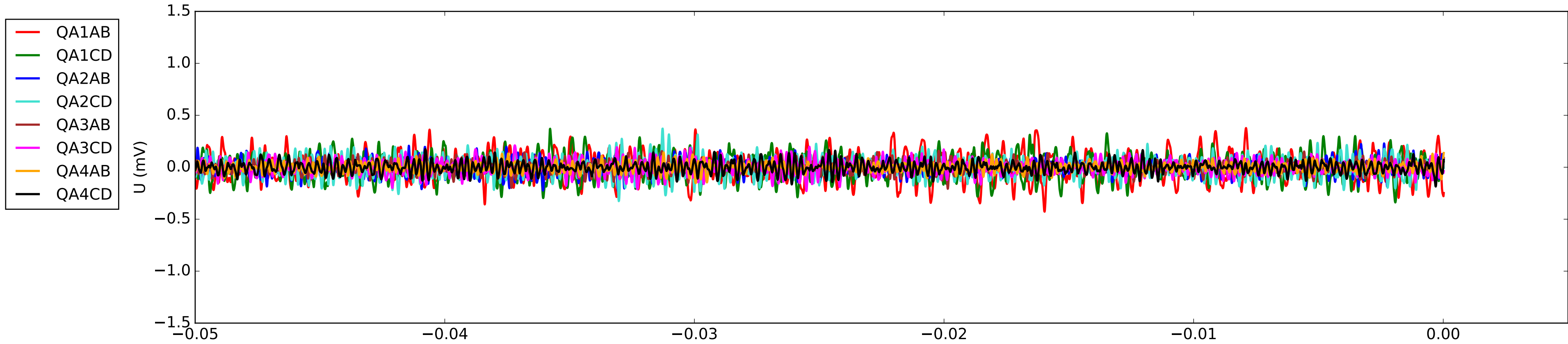
MQXFA03 QUENCH 3 Fast Log 11-30-1049\_QA



MQXFA03 QUENCH 3 Fast Log 11-30-1049\_coil voltages

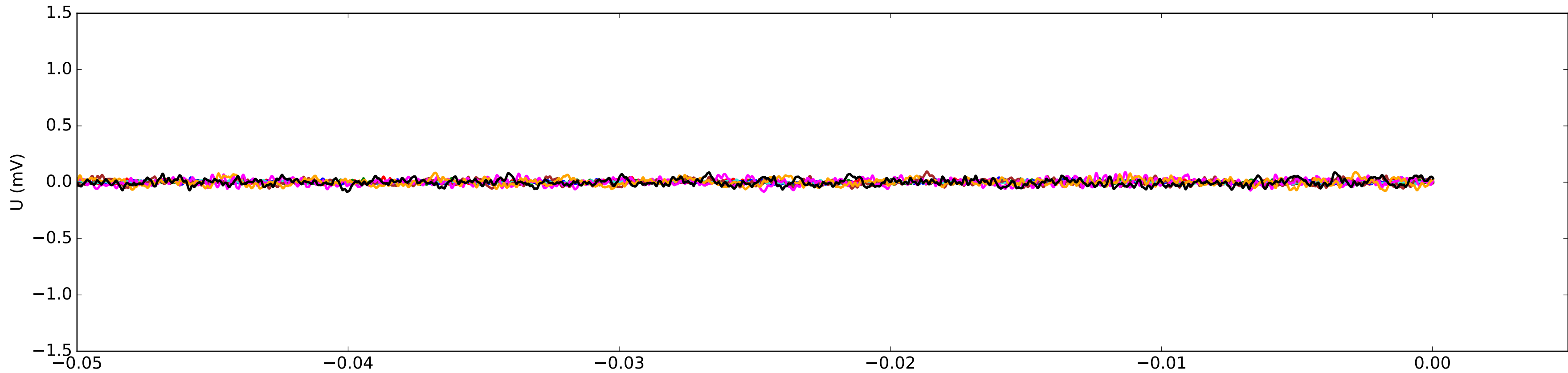


MQXFA03 QUENCH 4 Fast Log 12-01-1055\_QA

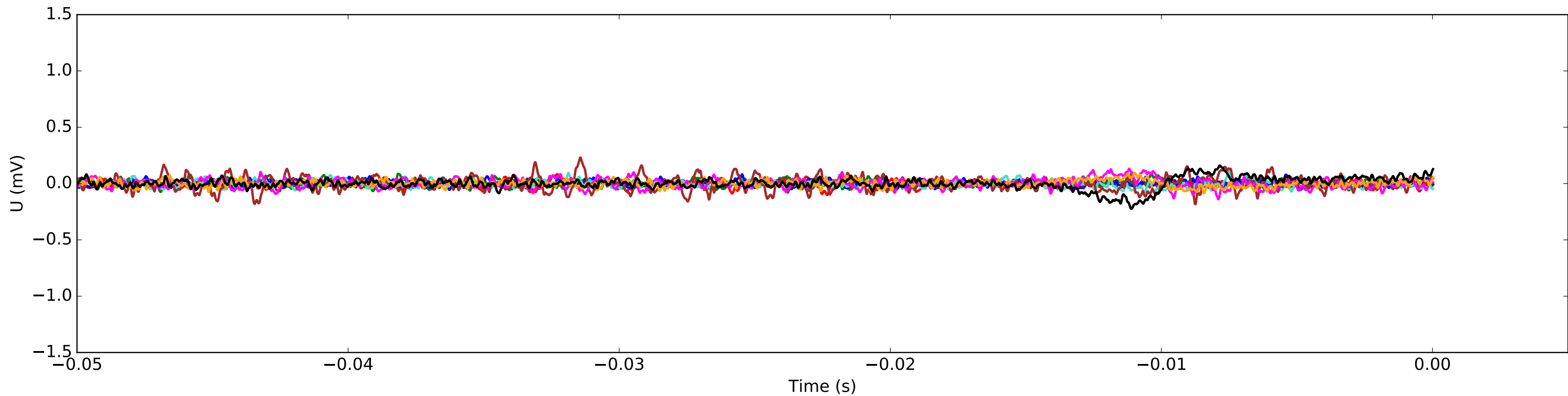


MQXFA03 QUENCH 4 Fast Log 12-01-1055\_QA

- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD



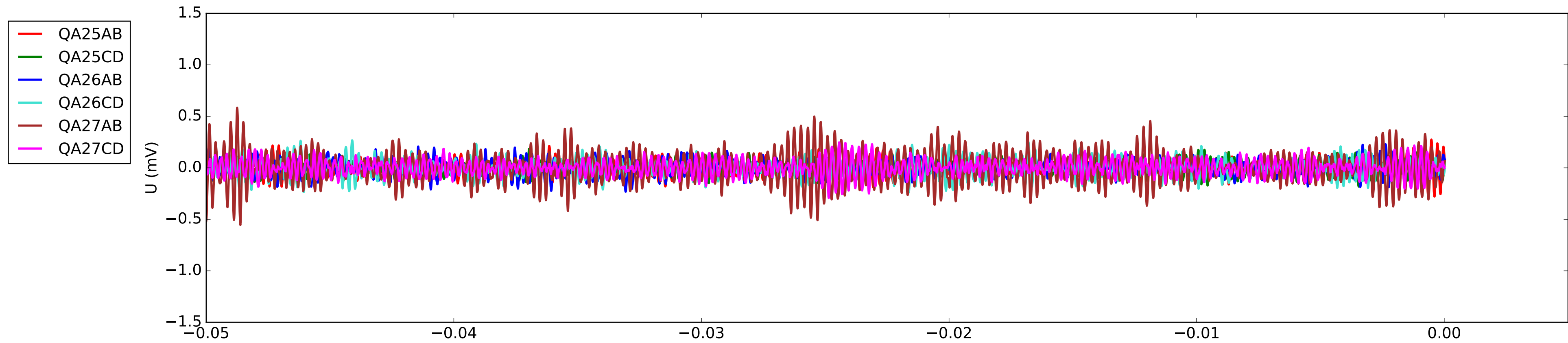
- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD



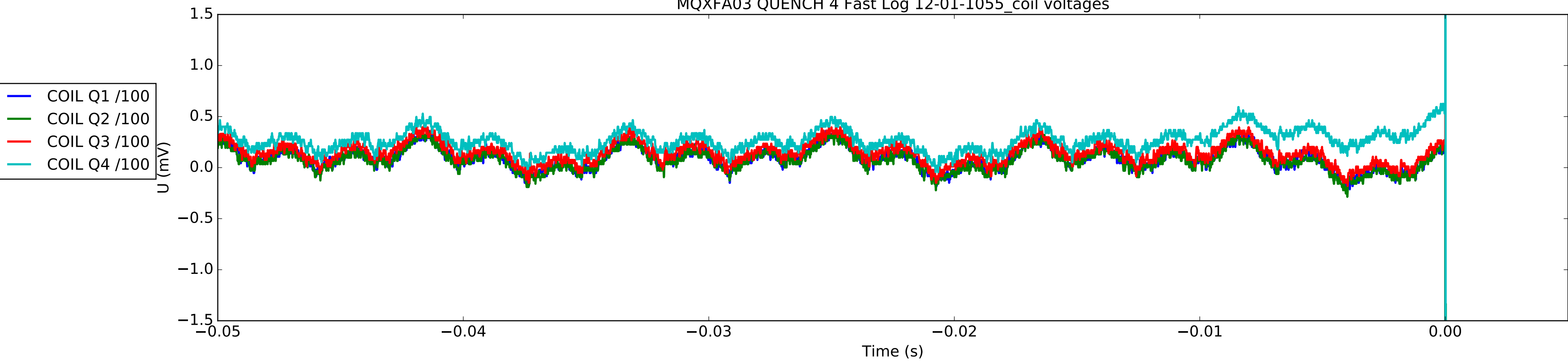




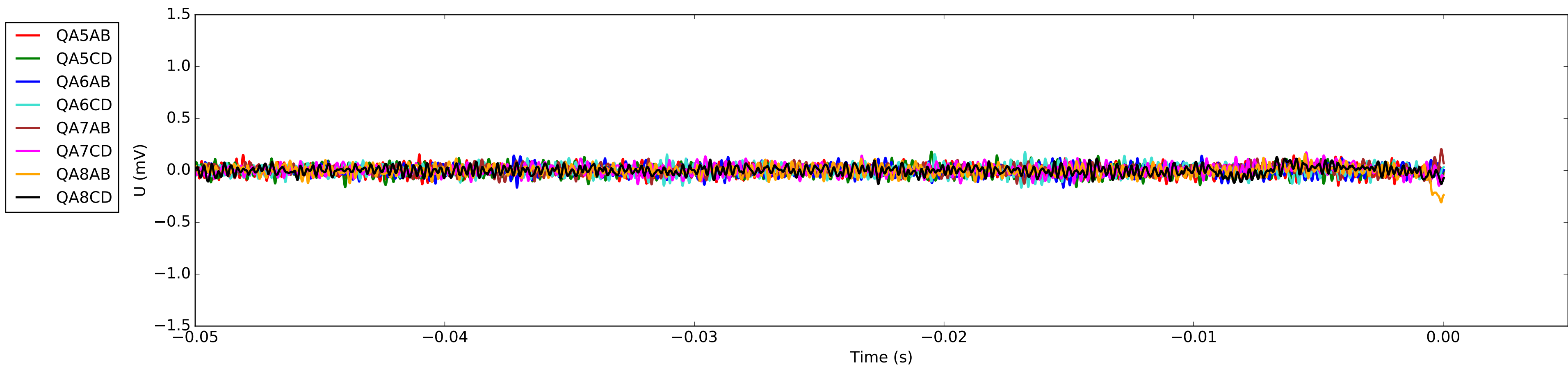
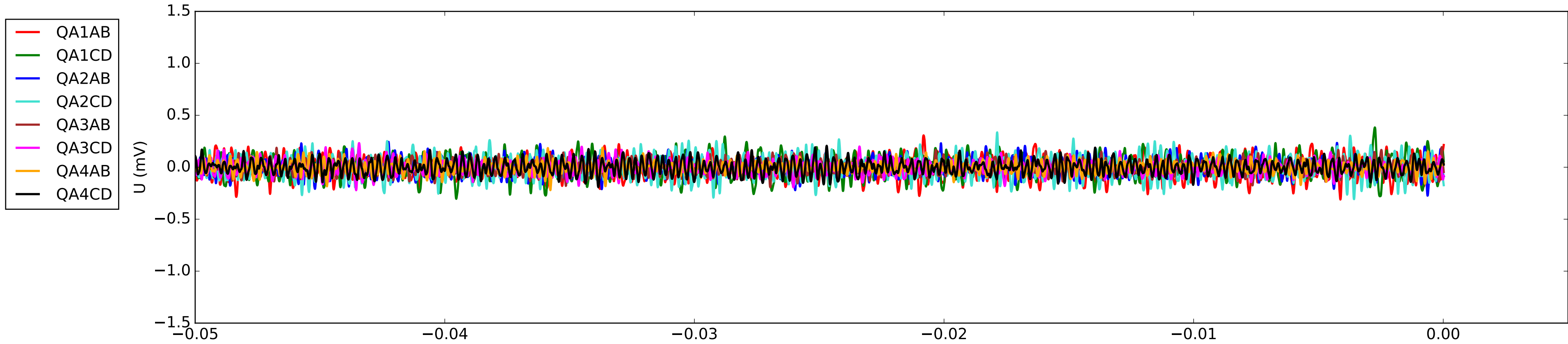
MQXFA03 QUENCH 4 Fast Log 12-01-1055\_QA



MQXFA03 QUENCH 4 Fast Log 12-01-1055\_coil voltages

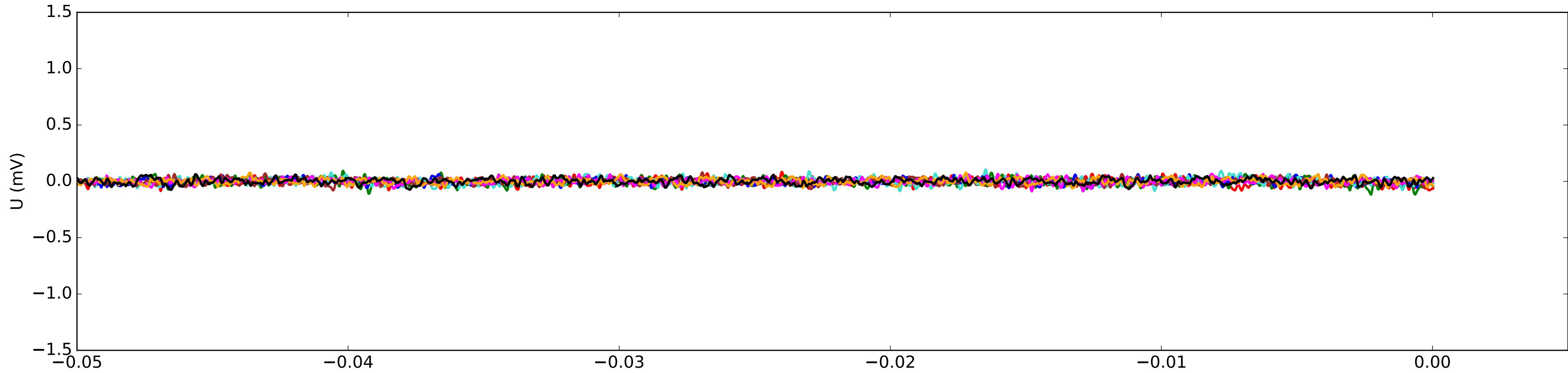


MQXFA03 QUENCH 5 Fast Log 12-02-1107\_QA

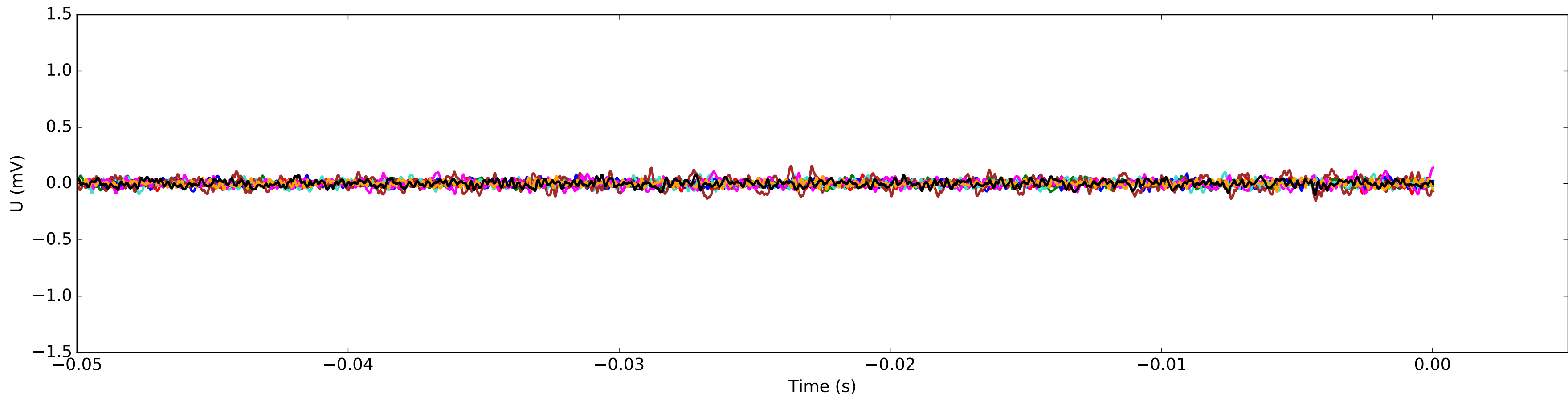


MQXFA03 QUENCH 5 Fast Log 12-02-1107\_QA

- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD

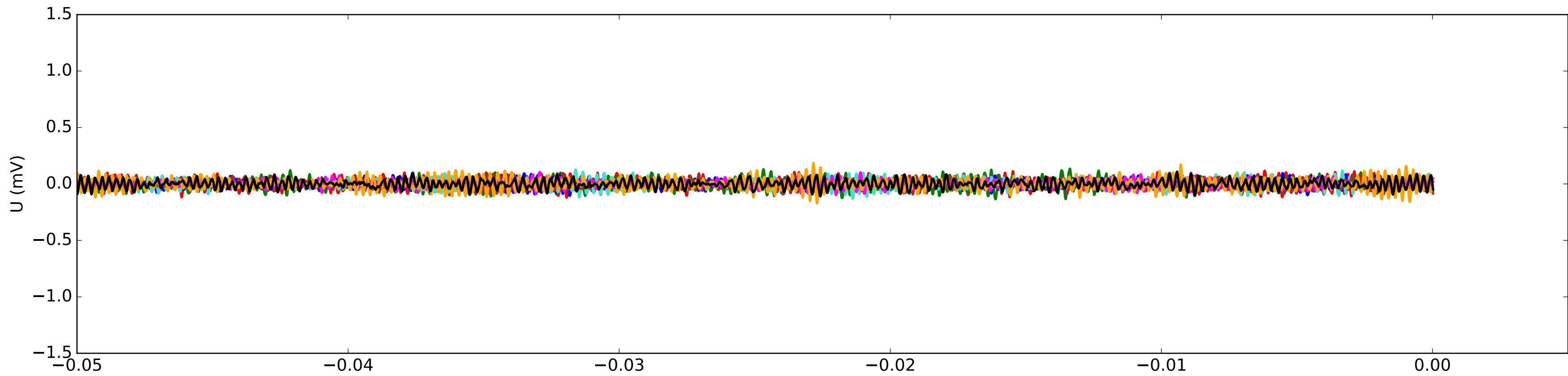


- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD

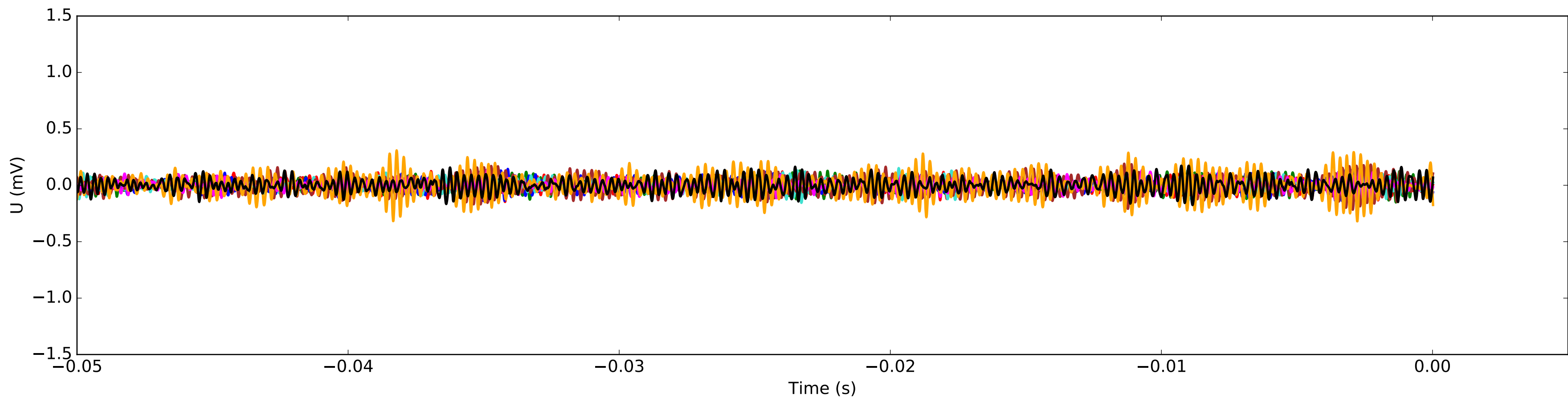


MQXFA03 QUENCH 5 Fast Log 12-02-1107\_QA

- QA17AB
- QA17CD
- QA18AB
- QA18CD
- QA19AB
- QA19CD
- QA20AB
- QA20CD

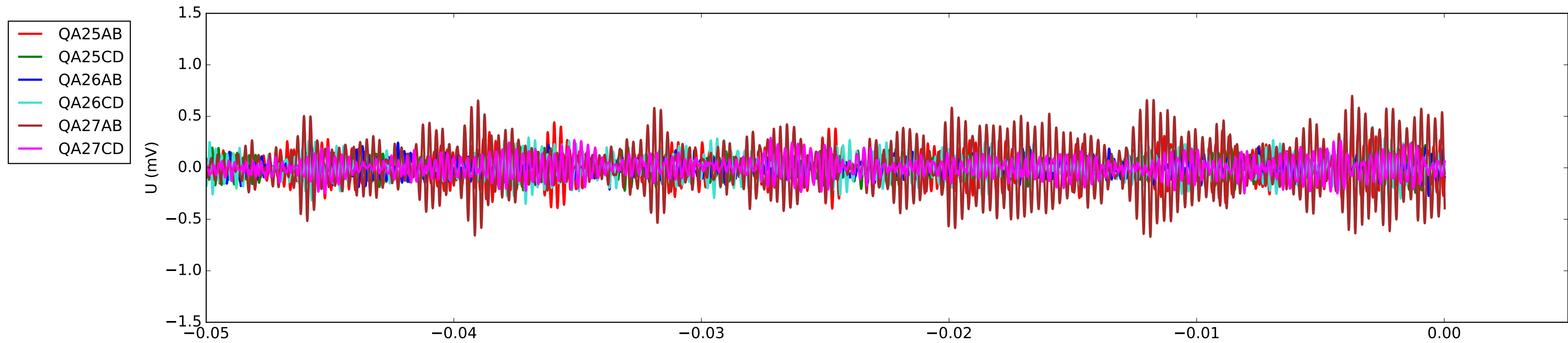


- QA21AB
- QA21CD
- QA22AB
- QA22CD
- QA23AB
- QA23CD
- QA24AB
- QA24CD

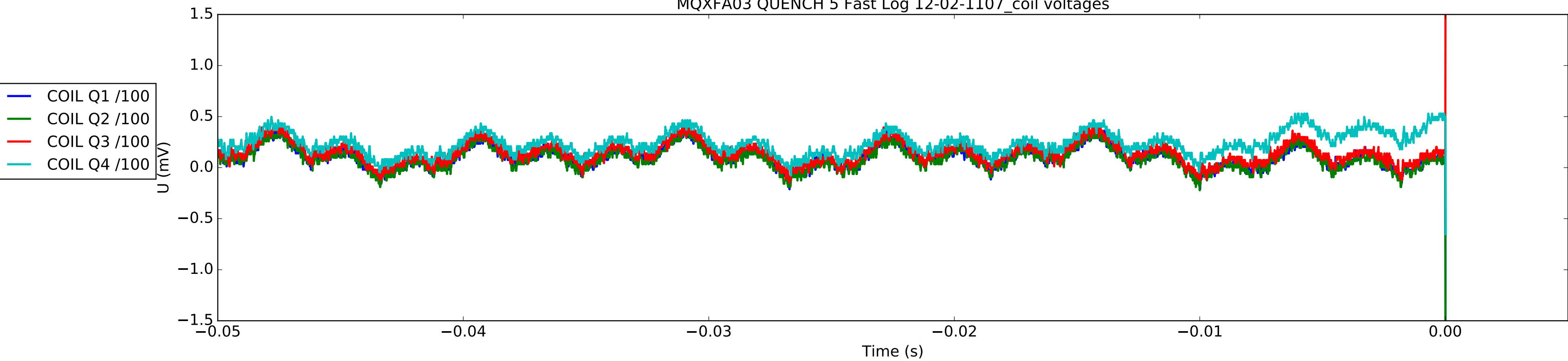


Time (s)

MQXFA03 QUENCH 5 Fast Log 12-02-1107\_QA

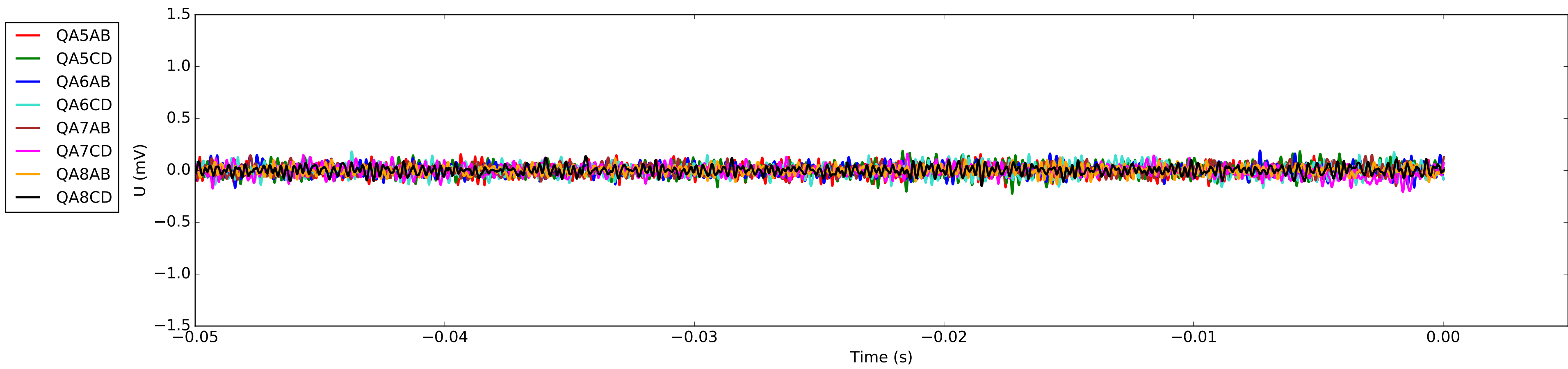
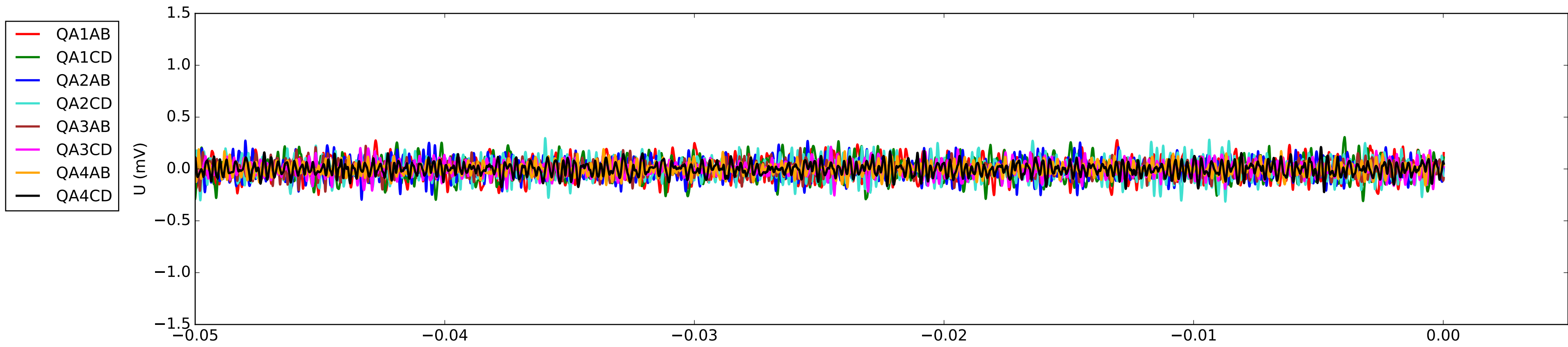


MQXFA03 QUENCH 5 Fast Log 12-02-1107\_coil voltages



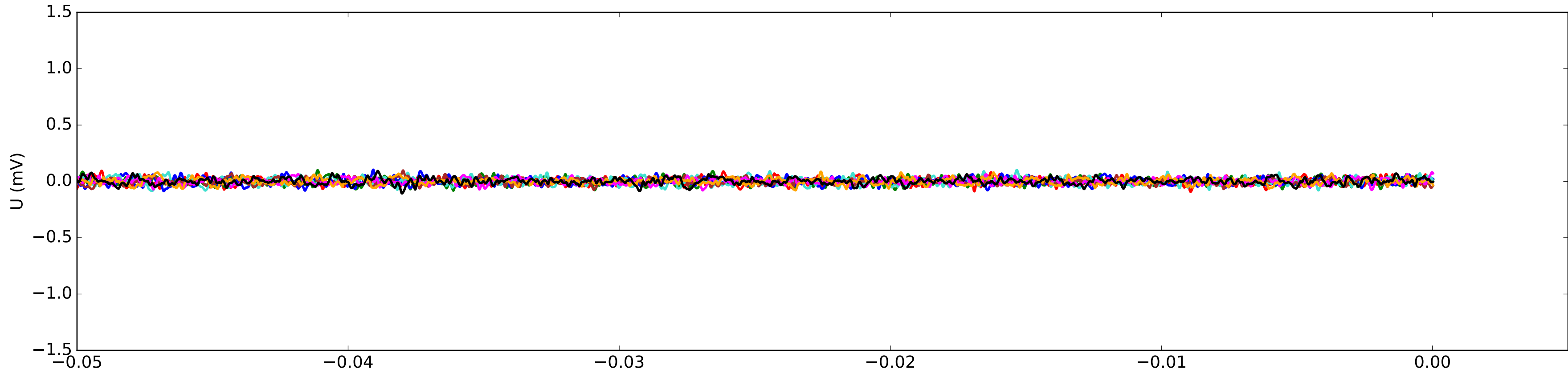


MQXFA03 QUENCH 6 Fast Log 12-03-1158\_QA

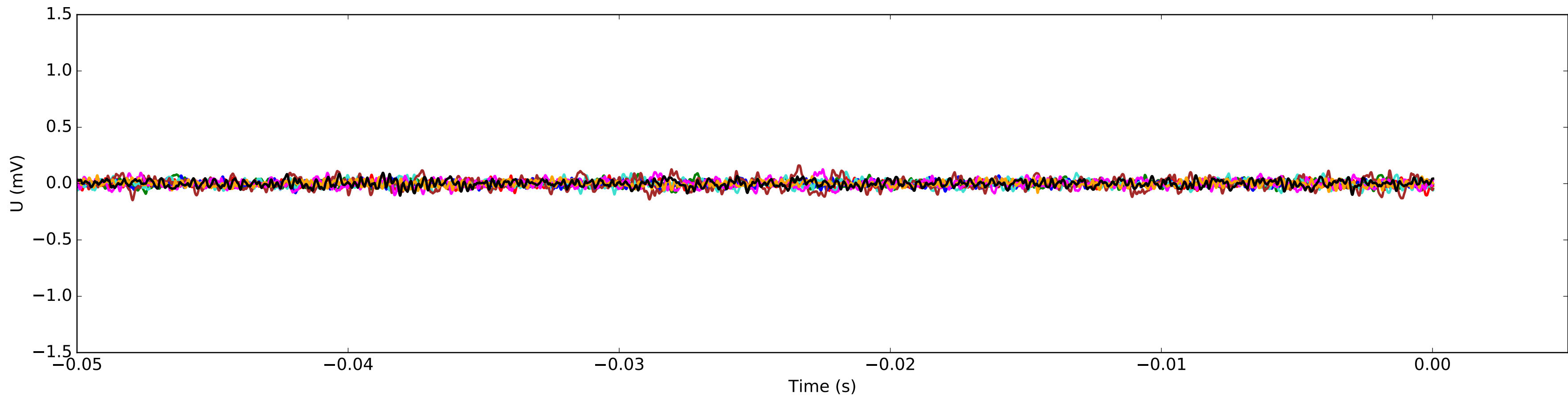


MQXFA03 QUENCH 6 Fast Log 12-03-1158\_QA

- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD

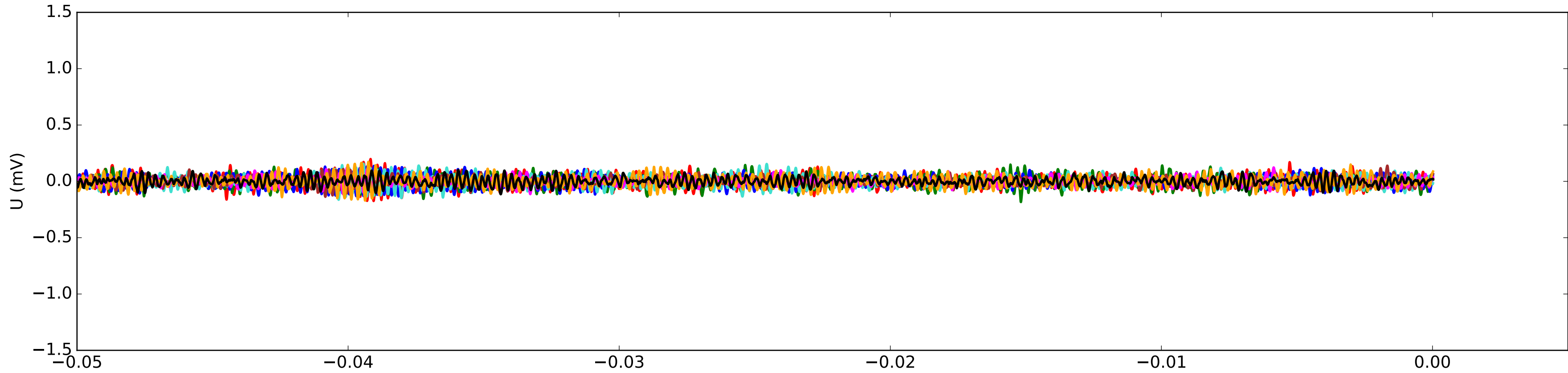


- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD

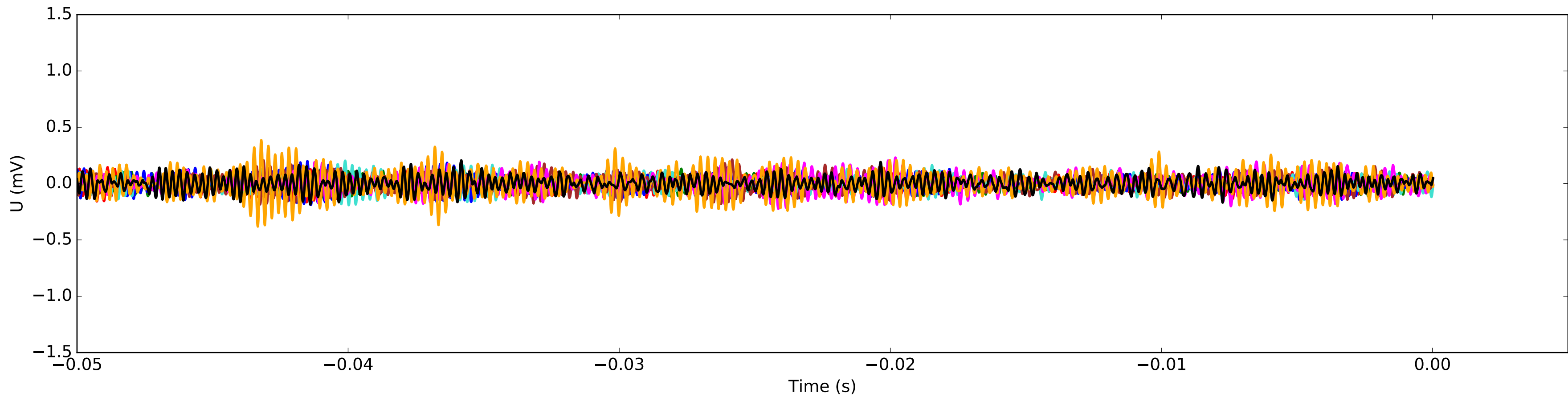


MQXFA03 QUENCH 6 Fast Log 12-03-1158\_QA

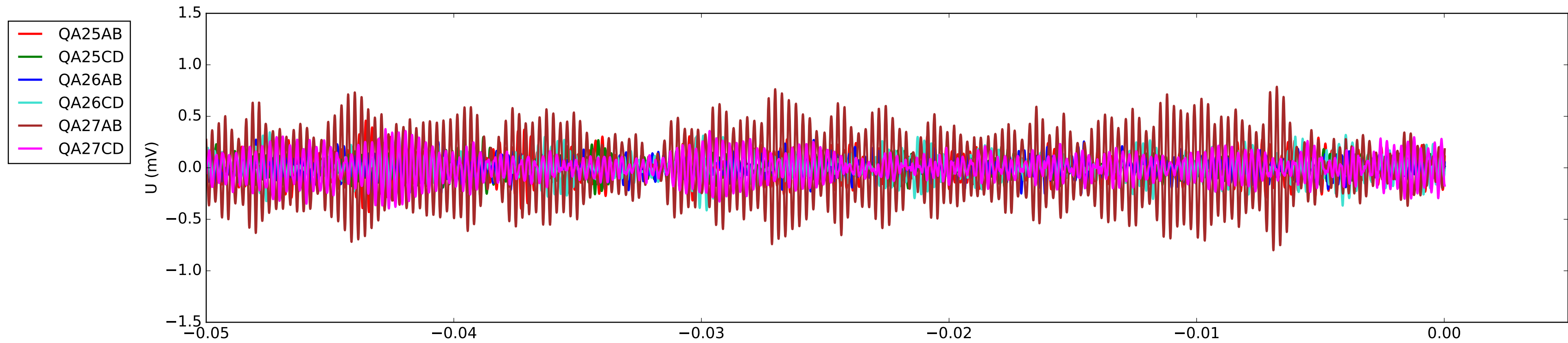
- QA17AB
- QA17CD
- QA18AB
- QA18CD
- QA19AB
- QA19CD
- QA20AB
- QA20CD



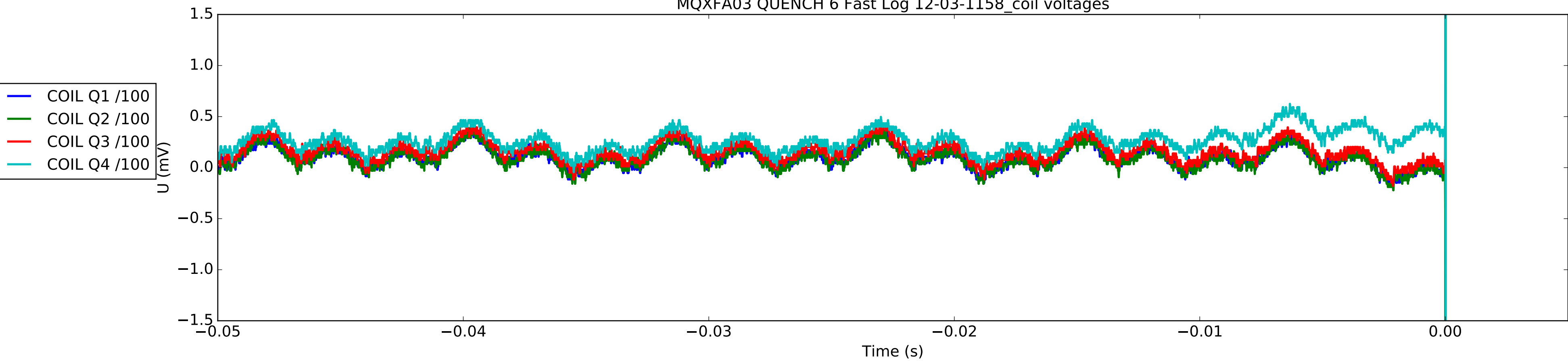
- QA21AB
- QA21CD
- QA22AB
- QA22CD
- QA23AB
- QA23CD
- QA24AB
- QA24CD



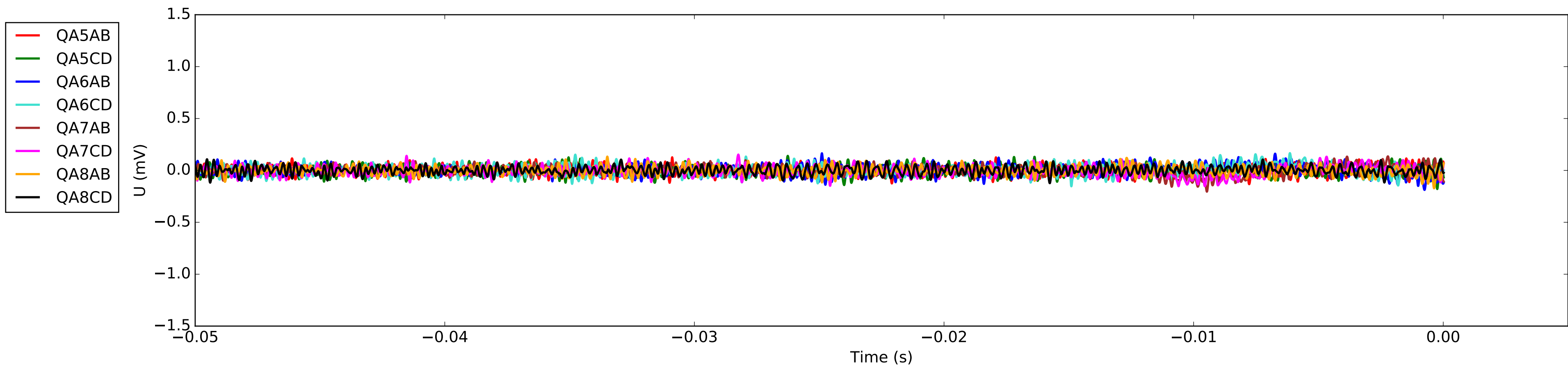
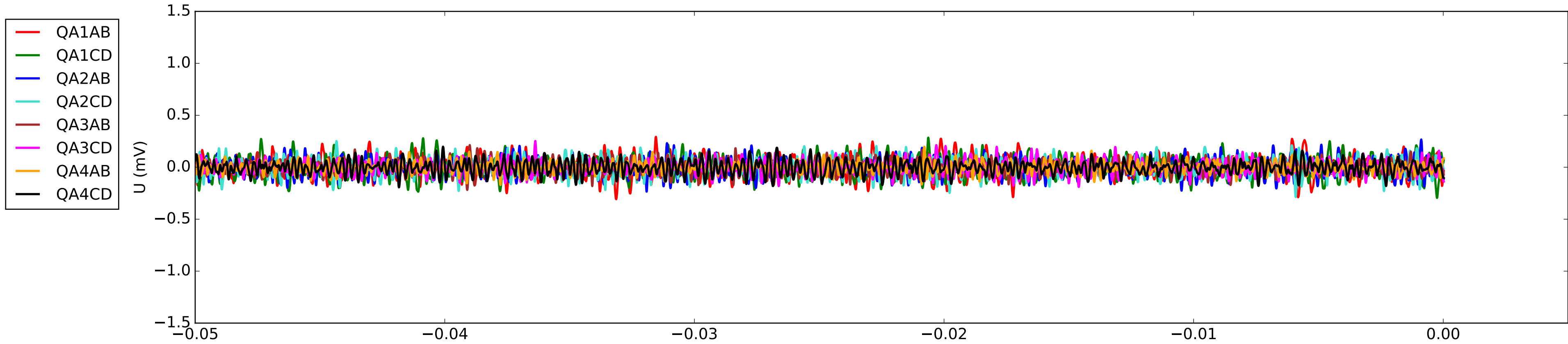
MQXFA03 QUENCH 6 Fast Log 12-03-1158\_QA



MQXFA03 QUENCH 6 Fast Log 12-03-1158\_coil voltages

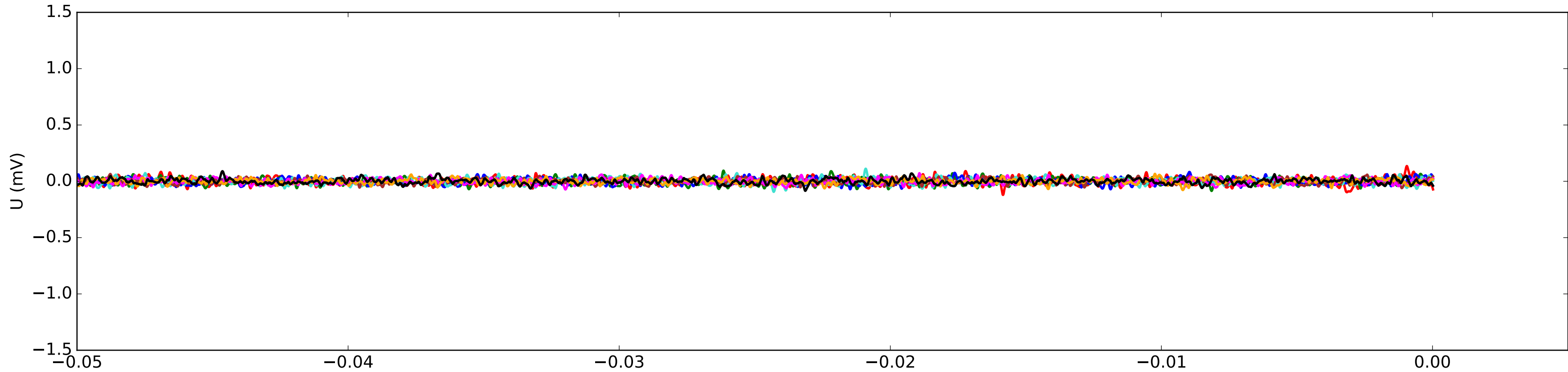


MQXFA03 QUENCH 7 Fast Log 12-03-1535\_QA

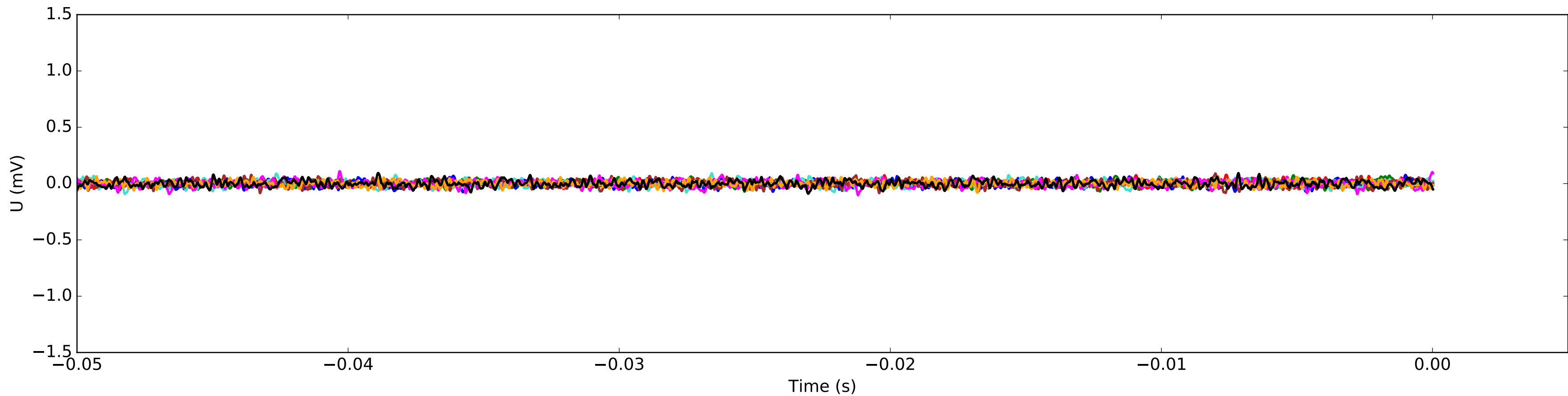


MQXFA03 QUENCH 7 Fast Log 12-03-1535\_QA

- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD



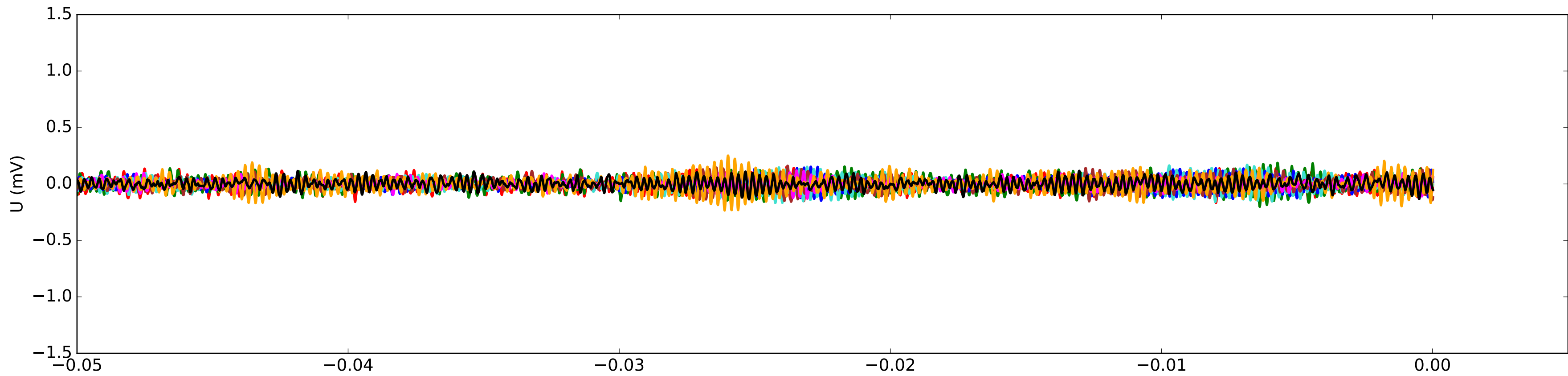
- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD



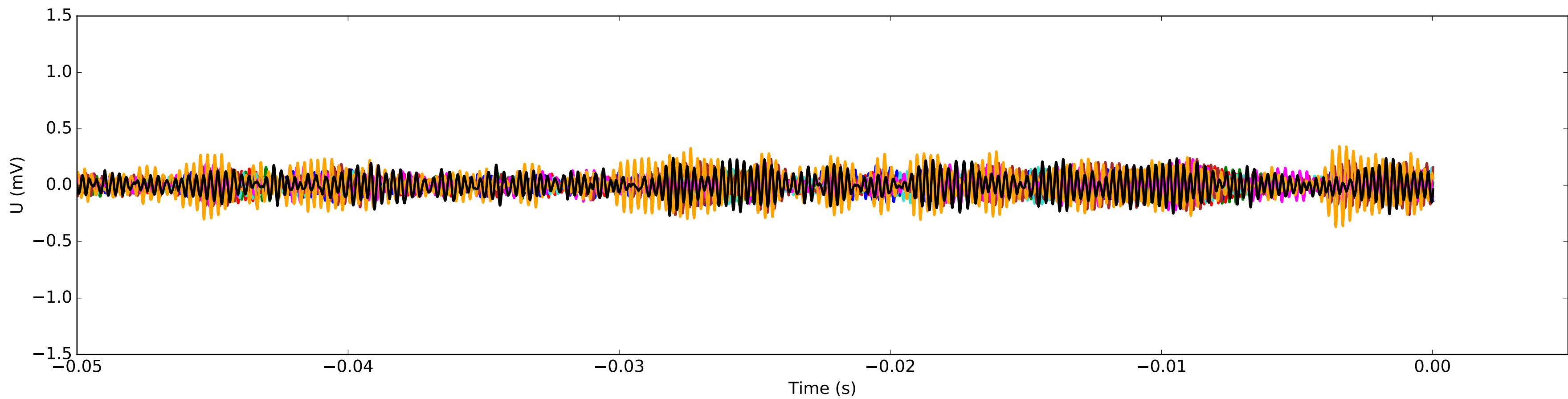


MQXFA03 QUENCH 7 Fast Log 12-03-1535\_QA

- QA17AB
- QA17CD
- QA18AB
- QA18CD
- QA19AB
- QA19CD
- QA20AB
- QA20CD

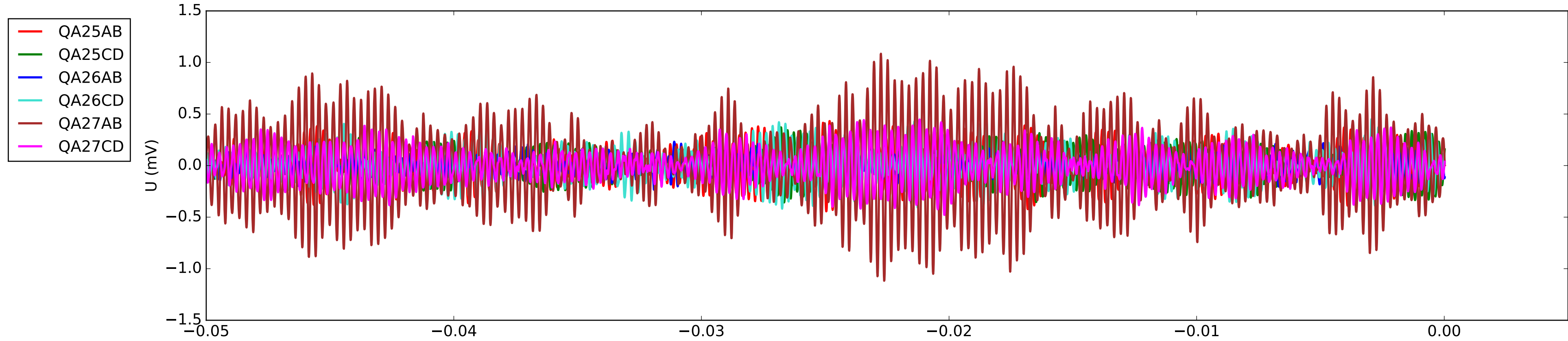


- QA21AB
- QA21CD
- QA22AB
- QA22CD
- QA23AB
- QA23CD
- QA24AB
- QA24CD

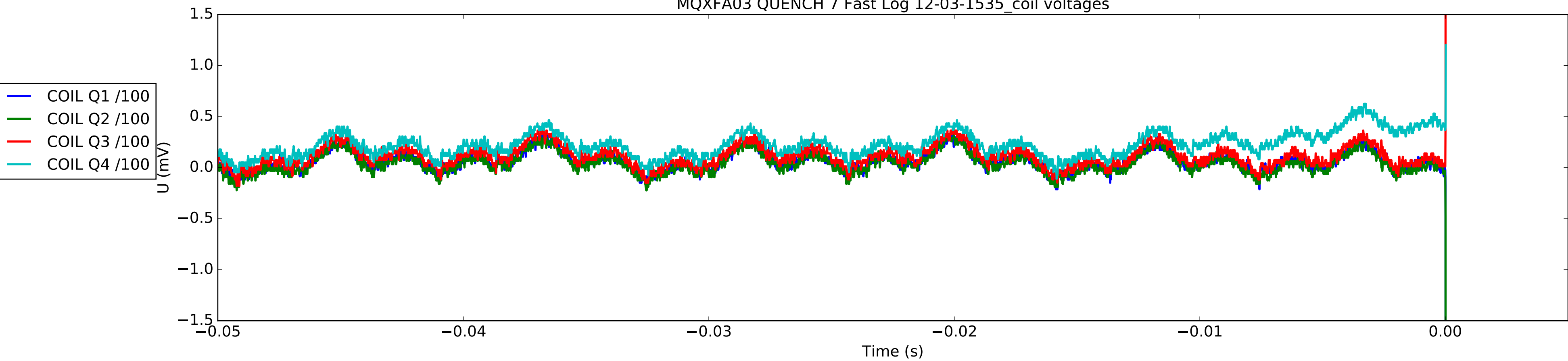




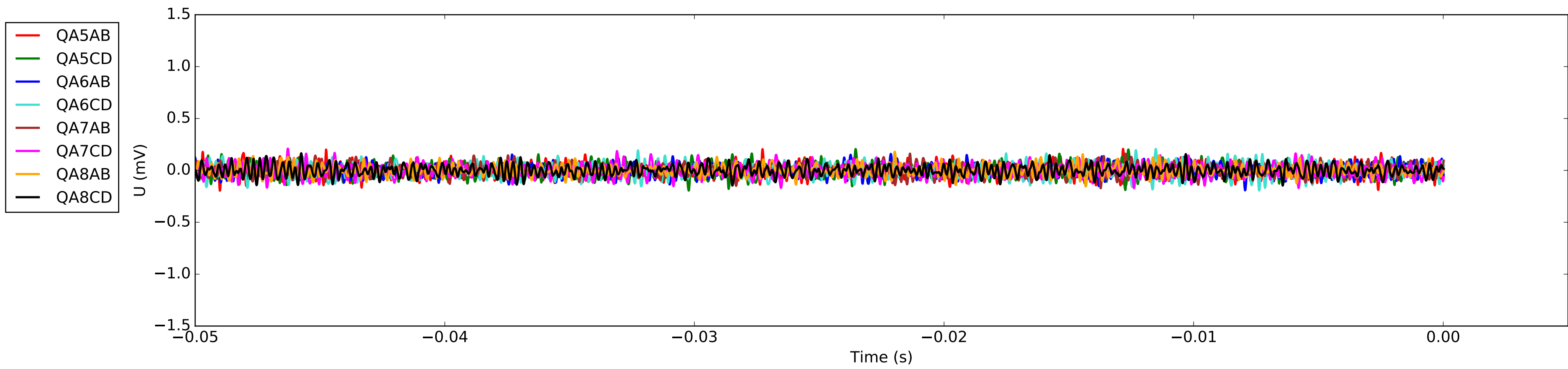
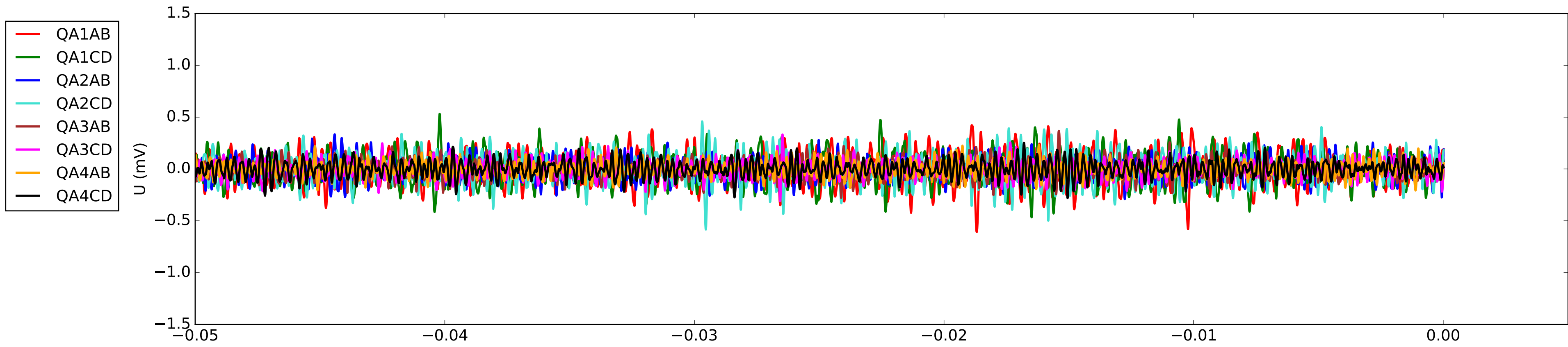
MQXFA03 QUENCH 7 Fast Log 12-03-1535\_QA



MQXFA03 QUENCH 7 Fast Log 12-03-1535\_coil voltages

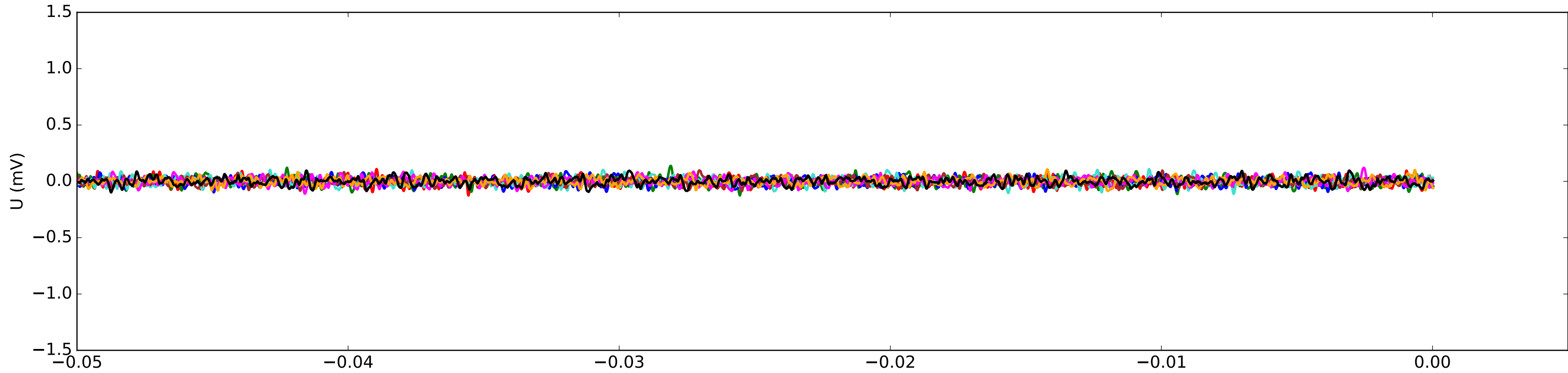


MQXFA03 QUENCH 8 Fast Log 12-04-1031\_QA

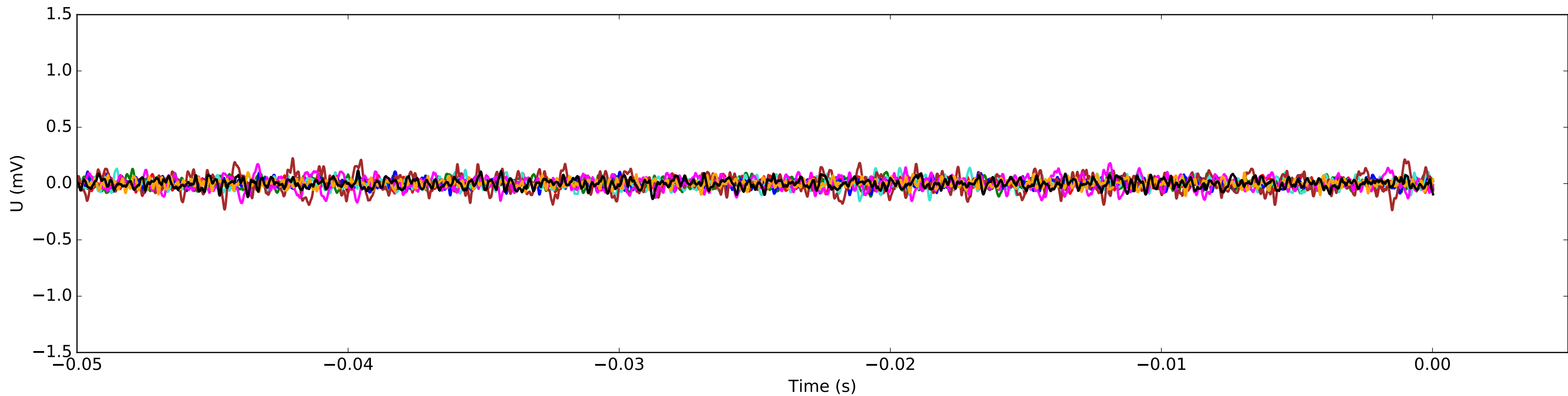


MQXFA03 QUENCH 8 Fast Log 12-04-1031\_QA

- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD

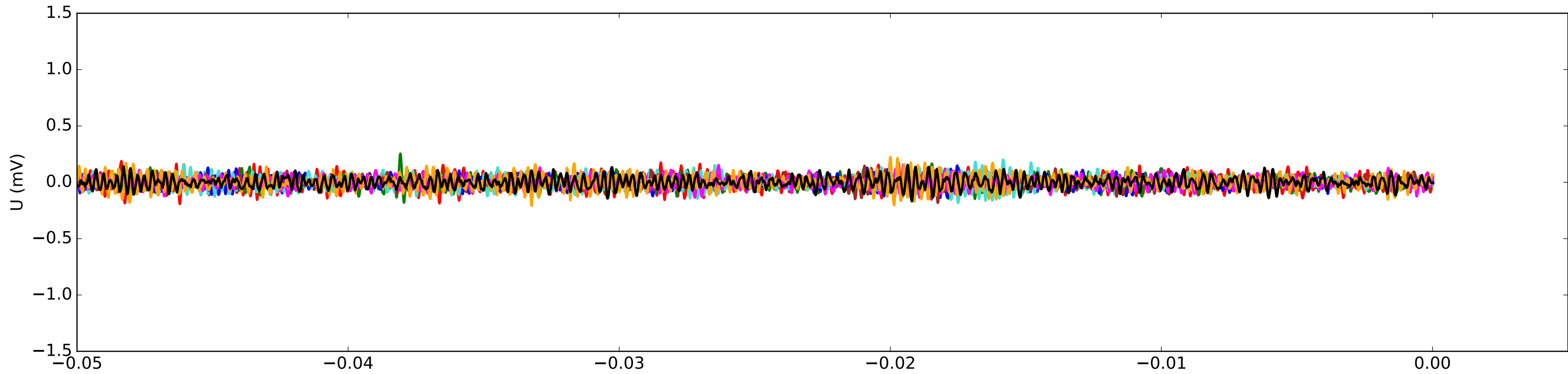


- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD

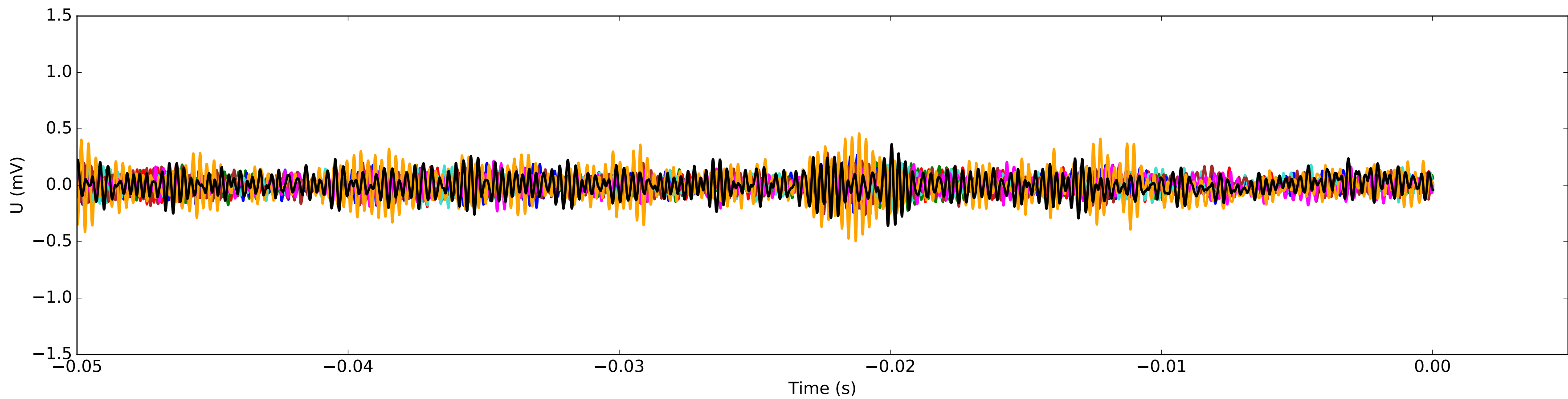


MQXFA03 QUENCH 8 Fast Log 12-04-1031\_QA

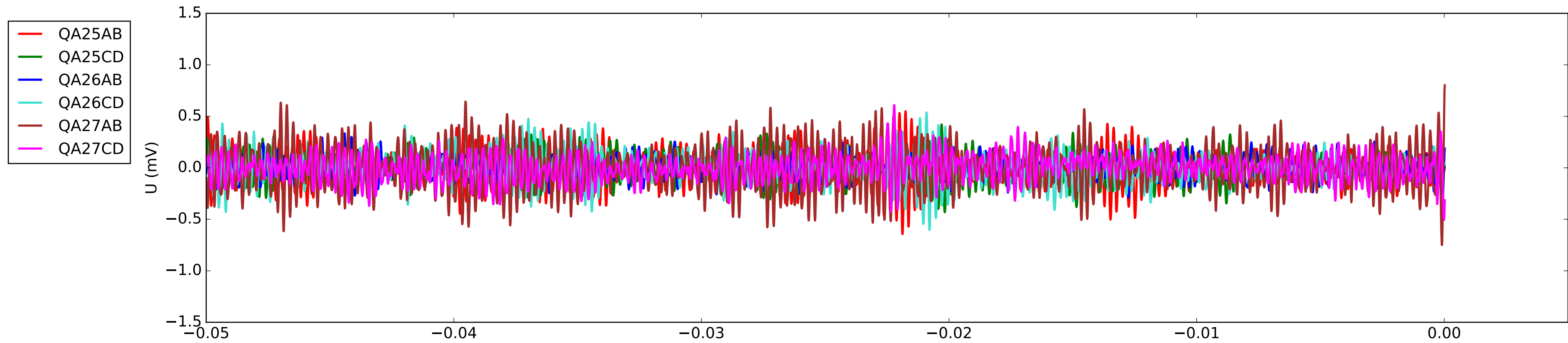
- QA17AB
- QA17CD
- QA18AB
- QA18CD
- QA19AB
- QA19CD
- QA20AB
- QA20CD



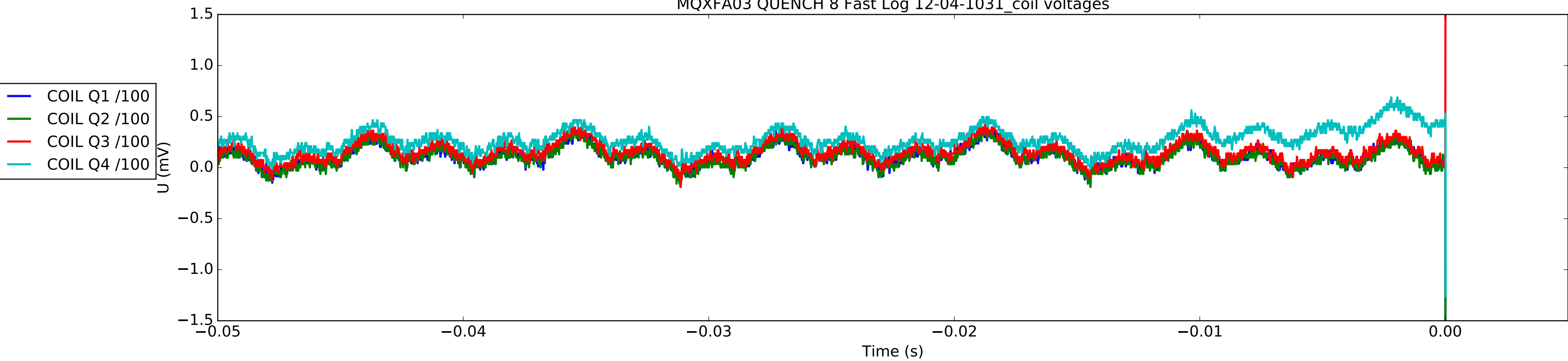
- QA21AB
- QA21CD
- QA22AB
- QA22CD
- QA23AB
- QA23CD
- QA24AB
- QA24CD



MQXFA03 QUENCH 8 Fast Log 12-04-1031\_QA



MQXFA03 QUENCH 8 Fast Log 12-04-1031\_coil voltages

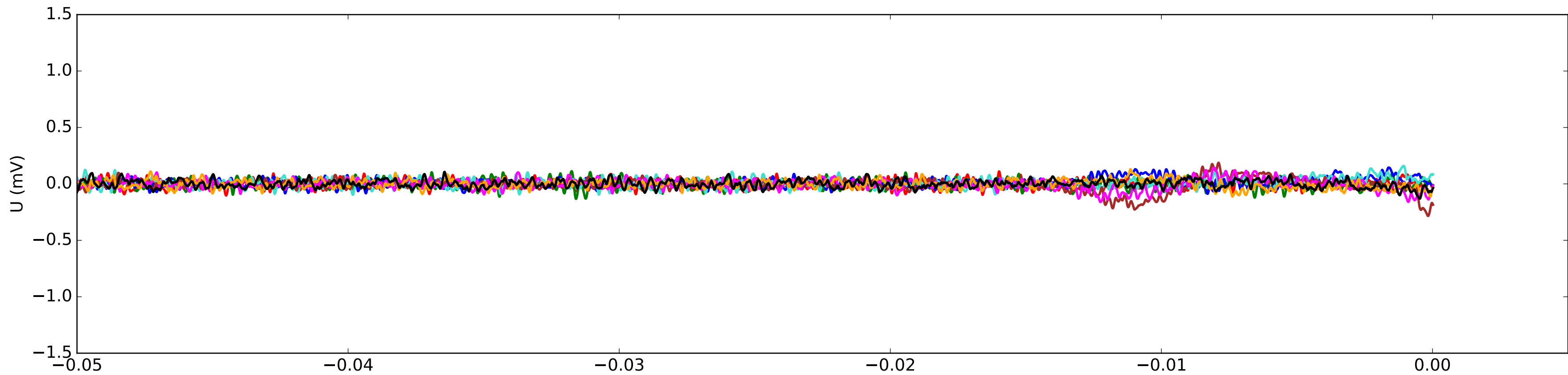




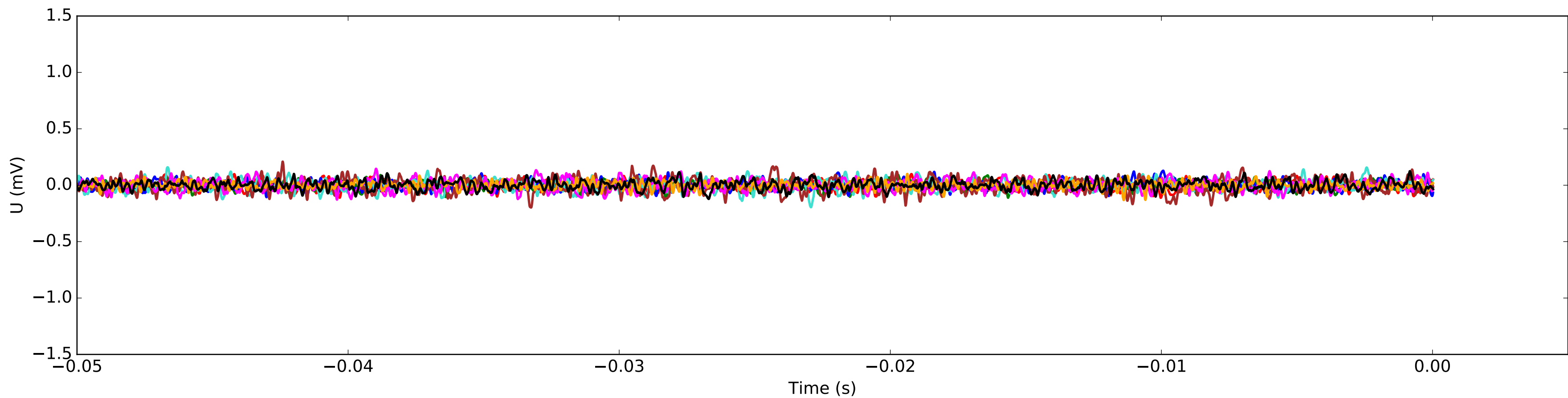


MQXFA03 QUENCH 9 Fast Log 12-04-1603\_QA

- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD



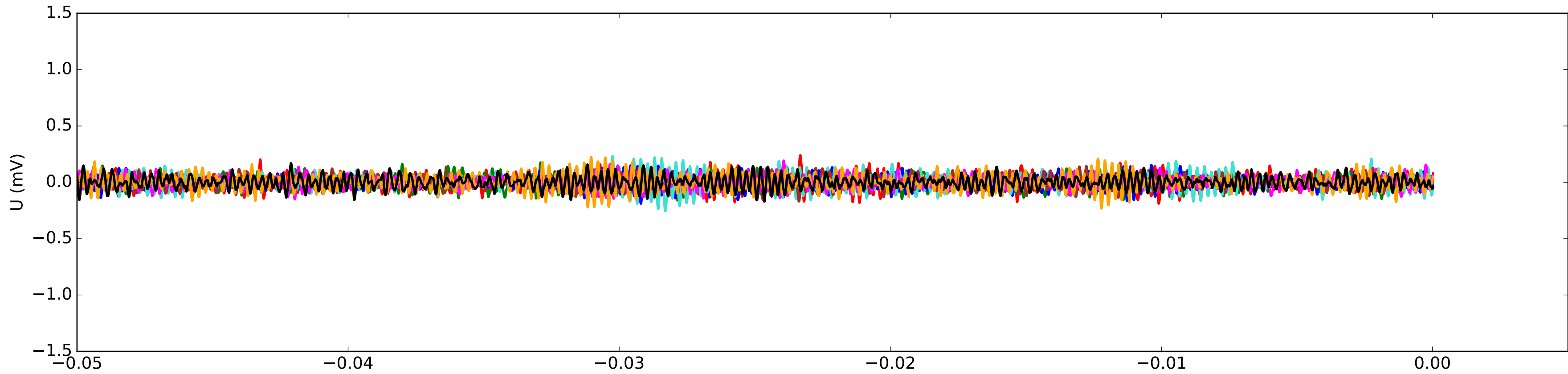
- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD



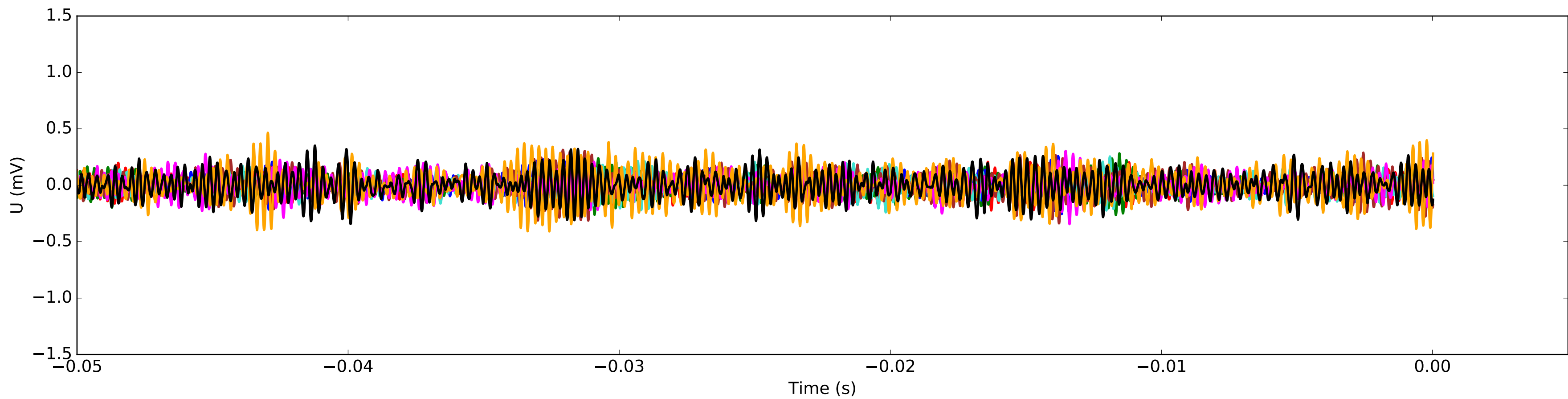


MQXFA03 QUENCH 9 Fast Log 12-04-1603\_QA

- QA17AB
- QA17CD
- QA18AB
- QA18CD
- QA19AB
- QA19CD
- QA20AB
- QA20CD

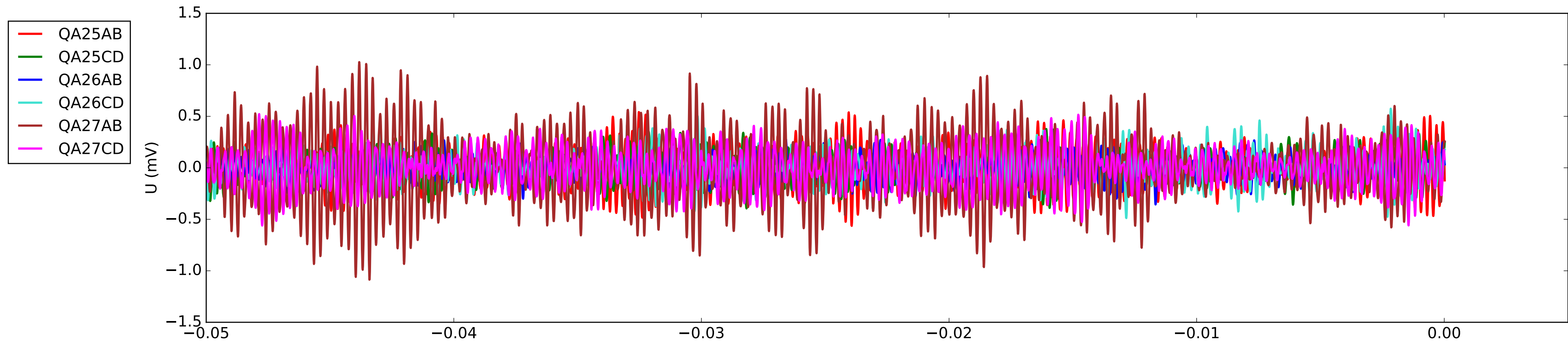


- QA21AB
- QA21CD
- QA22AB
- QA22CD
- QA23AB
- QA23CD
- QA24AB
- QA24CD

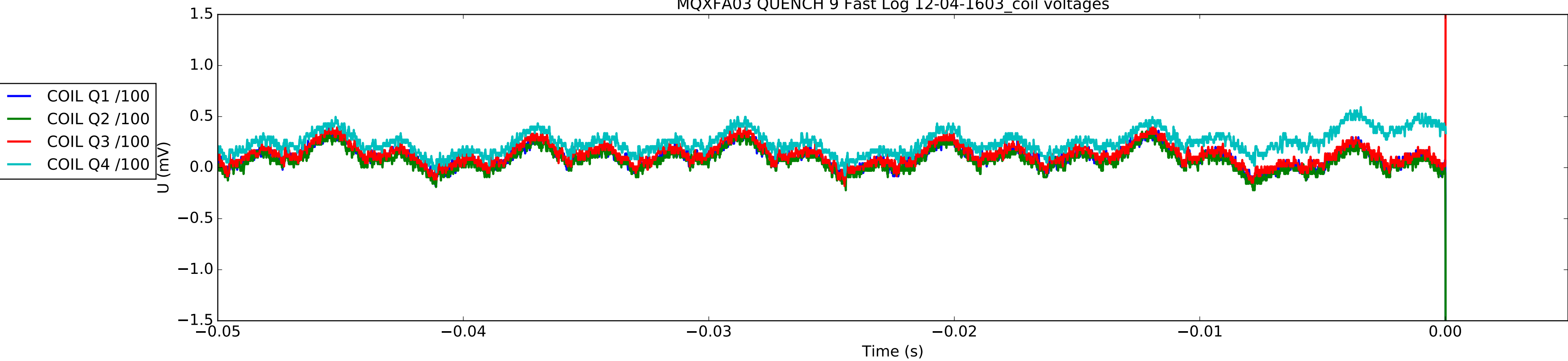


Time (s)

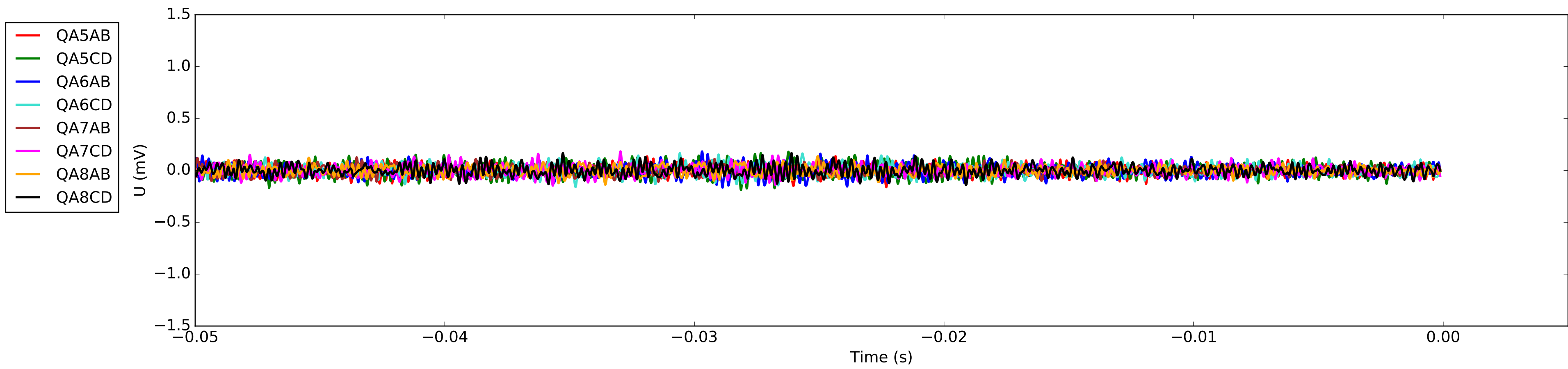
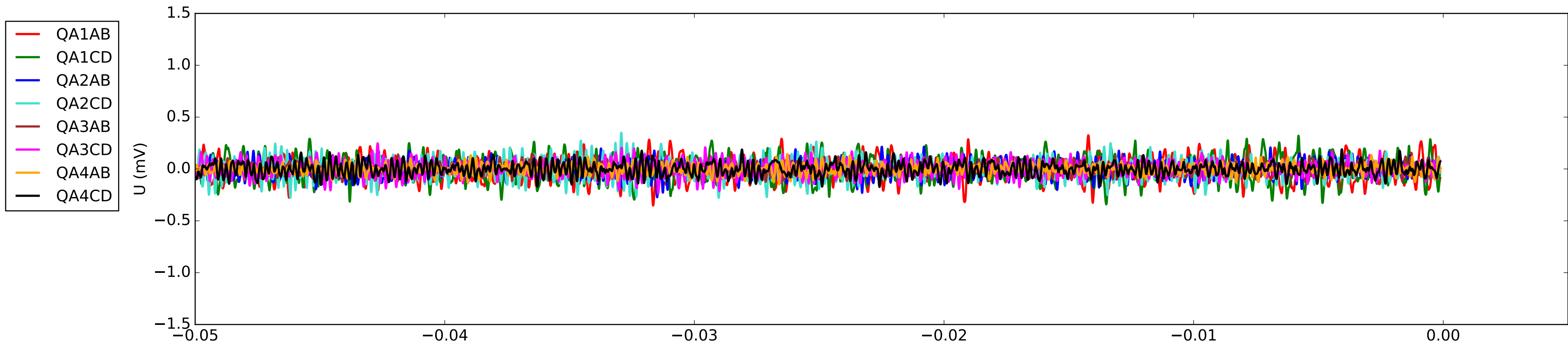
MQXFA03 QUENCH 9 Fast Log 12-04-1603\_QA



MQXFA03 QUENCH 9 Fast Log 12-04-1603\_coil voltages

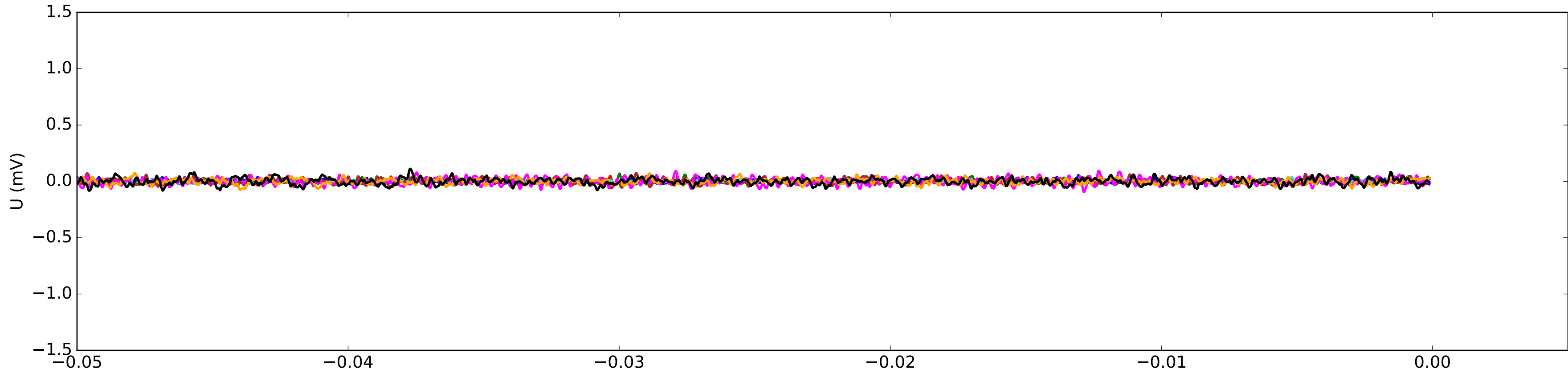


MQXFA03 QUENCH 10 Fast Log 12-05-1516\_QA

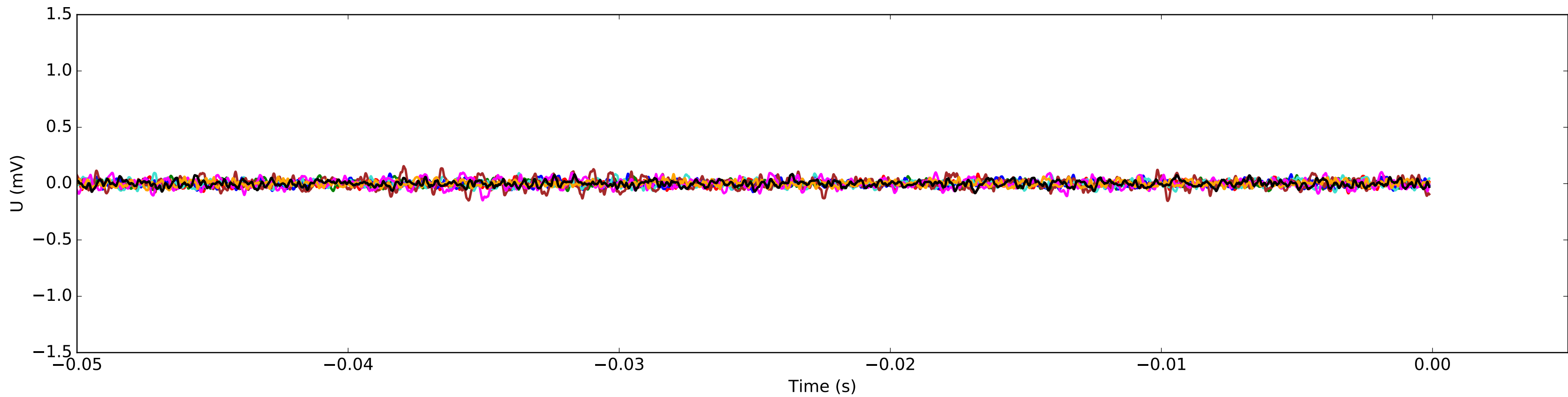


MQXFA03 QUENCH 10 Fast Log 12-05-1516\_QA

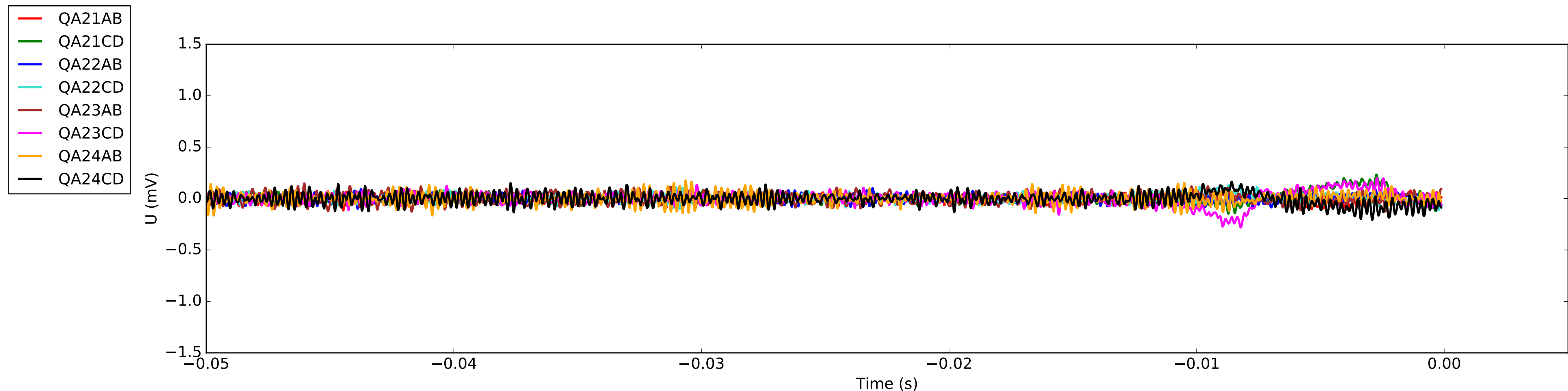
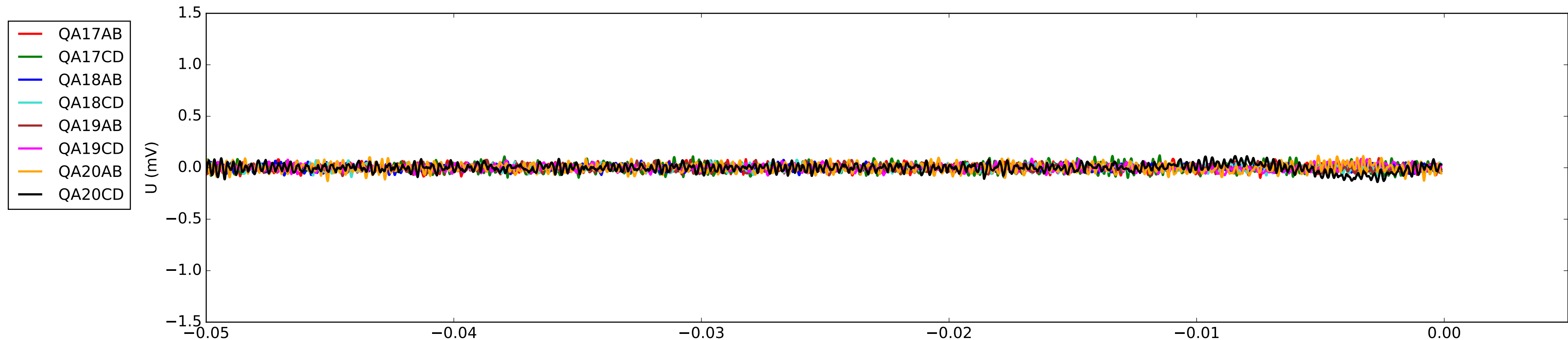
- QA9AB
- QA9CD
- QA10AB
- QA10CD
- QA11AB
- QA11CD
- QA12AB
- QA12CD



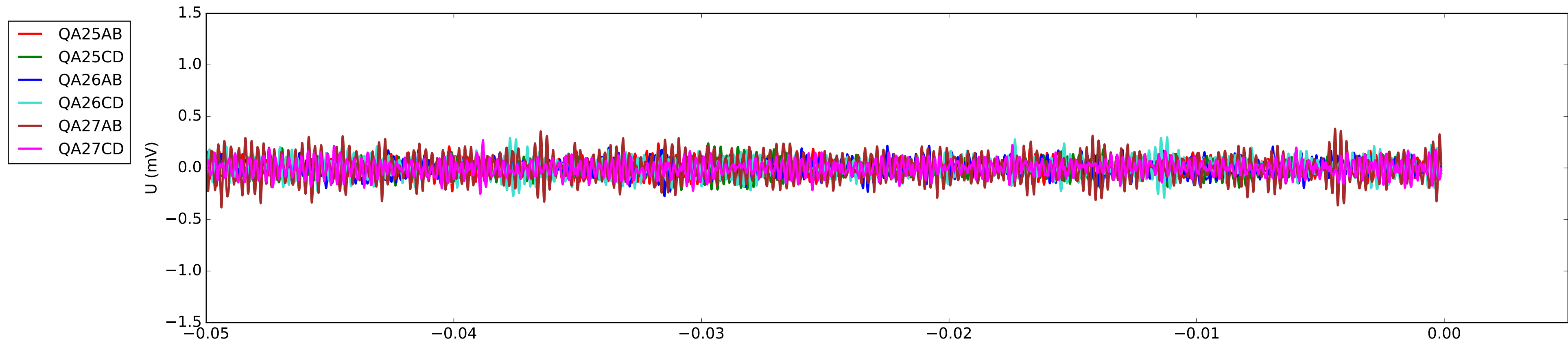
- QA13AB
- QA13CD
- QA14AB
- QA14CD
- QA15AB
- QA15CD
- QA16AB
- QA16CD



MQXFA03 QUENCH 10 Fast Log 12-05-1516\_QA



MQXFA03 QUENCH 10 Fast Log 12-05-1516\_QA



MQXFA03 QUENCH 10 Fast Log 12-05-1516\_coil voltages

