

# MQXFA06 Quench Antenna Results

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14Oct2021

### Summary of quenches (from Joe Muratore/Anis Ben Yahia):

1.	$I_Q = 14528.57 \text{ A}$	Coil 119 (Q2) Inner Pole Turn	NT-SS	24.2 MIIts	4.5K
2.	$I_Q = 14819.88 \text{ A}$	Coil 119 (Q2) Inner Pole Turn	T-SS	24.2 MIIts	4.5K
3.	$I_Q = 14845.60 \text{ A}$	Coil 122 (Q1) Inner Pole Turn	T-SS	24.3 MIIts	4.5K
4.	$I_Q = 14884.65 \text{ A}$	Coil 119 (Q2) Inner Pole Turn	T-SS	24.0 MIIts	4.5K
5.	$I_Q = 14879.25 \text{ A}$	Coil 211 (Q3) Inner Pole Turn	NT-SS	24.0 MIIts	4.5K
6.	$I_Q = 15108.25 \text{ A}$	Coil 211 (Q3) Inner Pole Turn	NT-SS	24.5 MIIts	4.5K
7.	$I_Q = 15158.46 \text{ A}$	Coil 123 (Q4)		24.3 MIIts	4.5K
8.	$I_Q = 14970.79 \text{ A}$	Coil 123 (Q4)		24.2 MIIts	4.5K
9.	$I_Q = 15162.06 \text{ A}$	Coil 122 (Q1) Inner Pole Turn	T-SS	24.6 MIIts	4.5K
10.	$I_Q = 15136.86 \text{ A}$	Coil 211 (Q3) Inner Pole Turn	NT-SS	24.9 MIIts	4.5K
11.	$I_Q = 14985.25 \text{ A}$	Coil 122 (Q1) Inner Pole Turn	T-SS	24.3 MIIts	4.5K
12.	$I_Q = 15260.51 \text{ A}$	Coil 122 (Q1) Inner Pole Turn	T-SS	24.1 MIIts	4.5K
13.	$I_Q = 15173.83 \text{ A}$	Coil 122 (Q1) Inner Pole Turn	T-SS	25.3 MIIts	1.9K
14.	$I_Q = 15638.14 \text{ A}$	Coil 211 (Q3) Inner Pole Turn	NT-SS	25.6 MIIts	1.9K
15.	$I_Q = 15978.96 \text{ A}$	Coil 211 (Q3) Inner Pole Turn	T-SS	25.3 MIIts	1.9K
16.	$I_Q = 16298.32 \text{ A}$	Coil 122 (Q1) Ramp + outer pole turn		25.9 MIIts	1.9K
17.	$I_Q = 16275.21 \text{ A}$	Coil 211 (Q3) Inner Pole Turn	T-SS	25.6 MIIts	1.9K
18.	$I_Q = 16323.63 \text{ A}$	Coil 122 (Q1) Inner Pole Turn	T-SS+RE	26.7 MIIts	1.9K
19.	$I_Q = 16339.68 \text{ A}$	Coil 211 (Q3) Inner Pole Turn	NT-SS+LE	26.3 MIIts	1.9K
20.	$I_Q = 16457.56 \text{ A}$	Coil 211 (Q3) Inner Pole Turn	NT-SS+LE	26.0 MIIts	1.9K

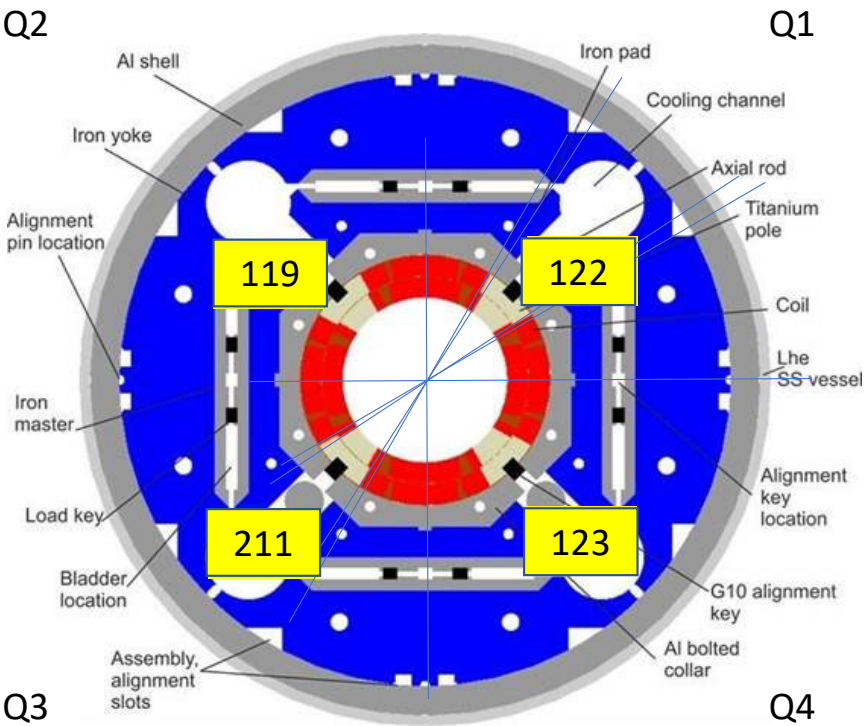


**Full length Z-coverage with 111, 50mm-long flex circuits.**  
Overlapping, dipole and quadrupole bucked (DQBuck) circuits, staggered so there are no 'dead zones' in Z

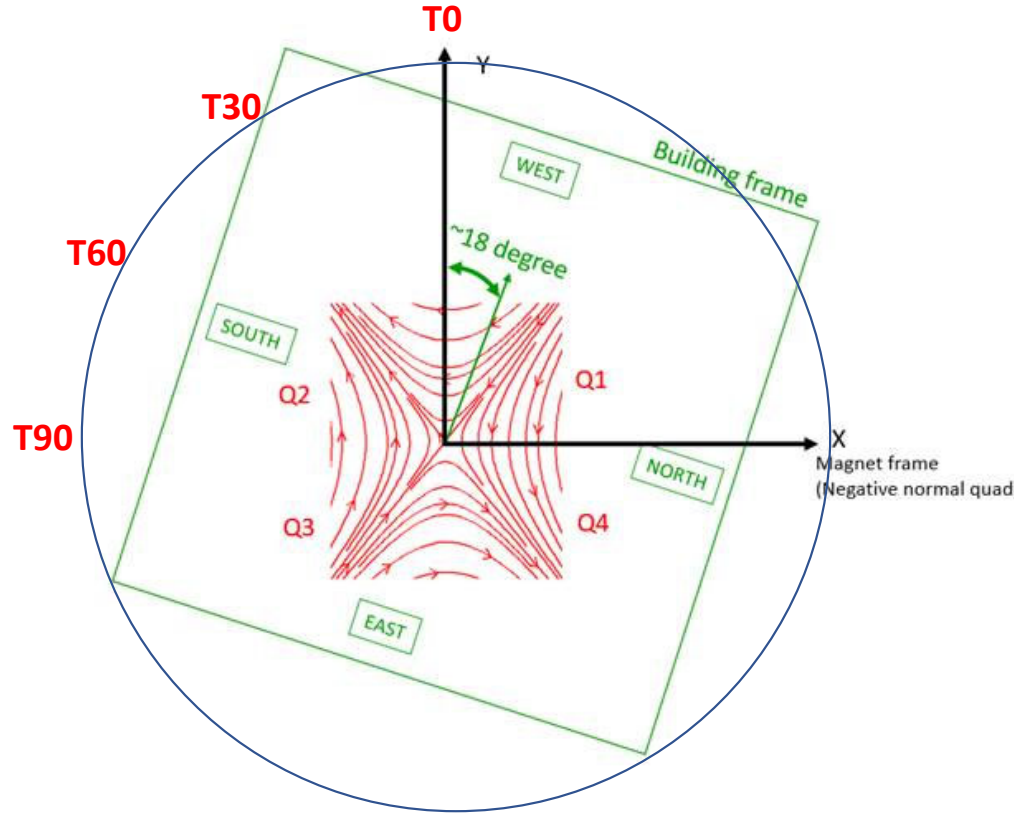
**Theta detection with 12, full-length DQBuck radial circuits**  
Positioned every 30 degrees.



# Theta Antennas



Quench Antenna T0 placed along Y-axis



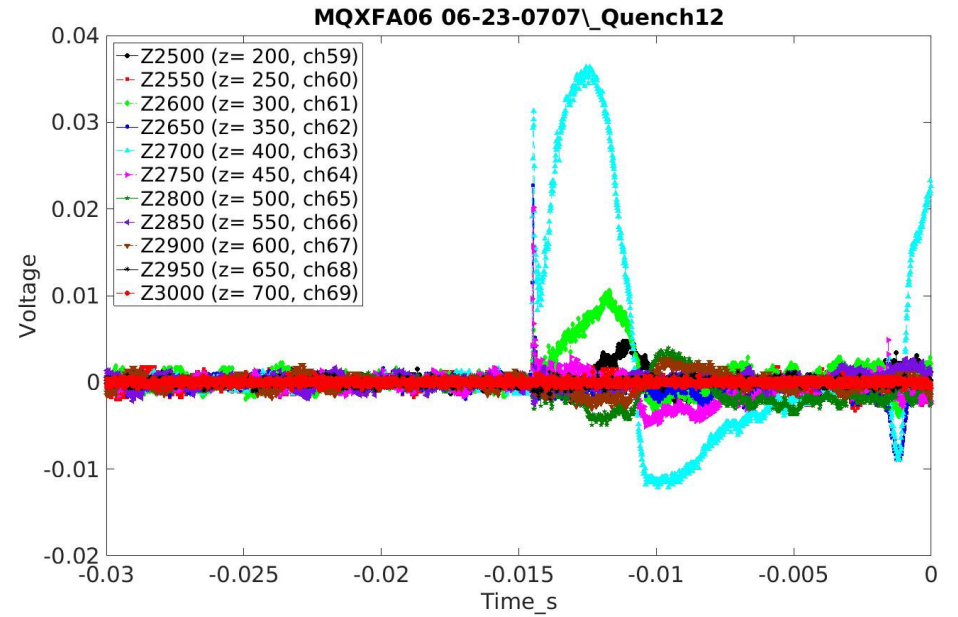
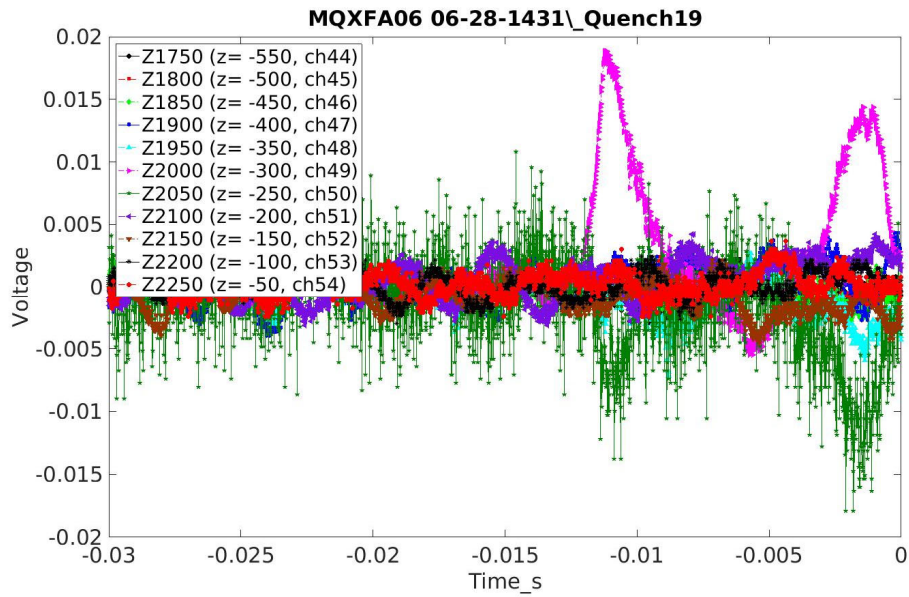




MQXFA06 QAnt Quench Location Summary  
millimeters wrt z=0 magnet center

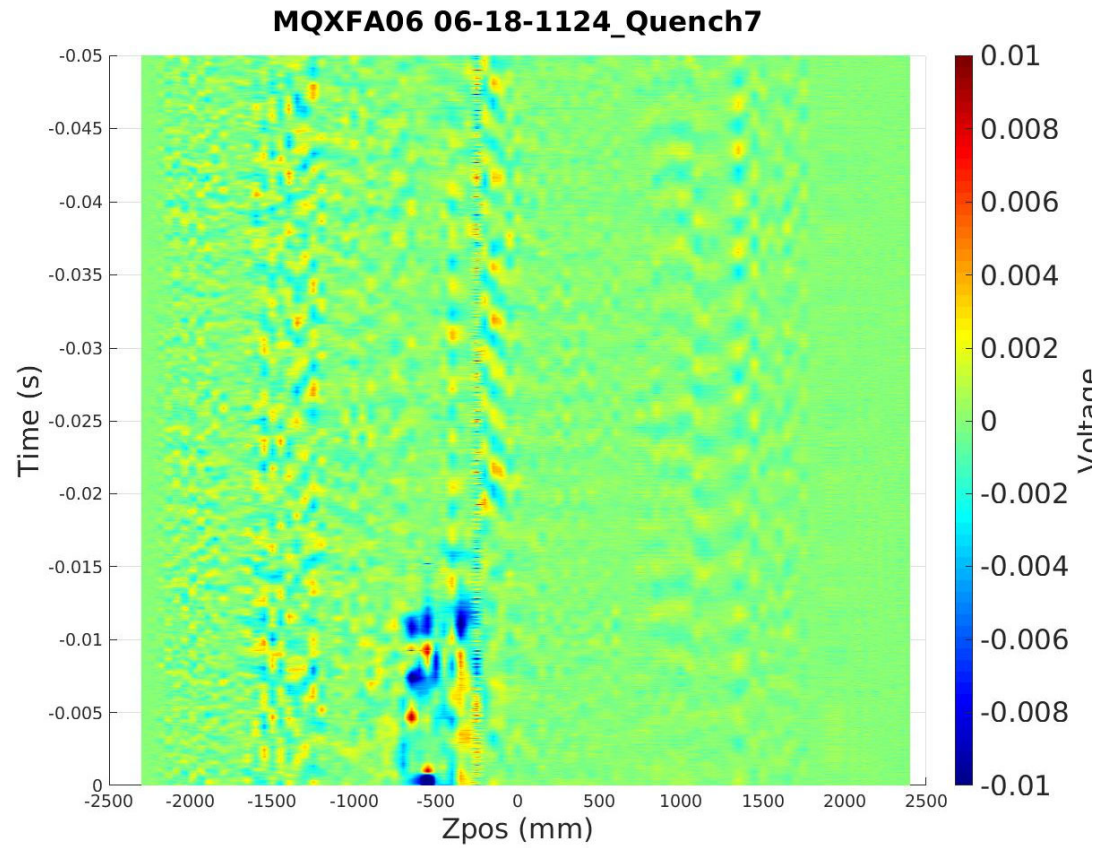
Quench Number	Quench Z-Location Signal	Quadrant
1	-1150	Q2
2	1350	Q2
3	650	Q1
4	1300	Q2
5	1250	Q3
6	-1300	Q3
7	-550, -350	Q4
8	-650, -350	Q4
9	650, 350	Q1
10	1250	Q3
11	600	Q1
12	400	Q1
13	400	Q1
14	500	Q3
15	-1400	Q3
16	600	Q1, Q2
17	-450	Q3
18	550	Q1
19	-300	Q3
20	-1800	Q3

About 75% of quenches had some level of spike event at start (presumably flux redistribution)



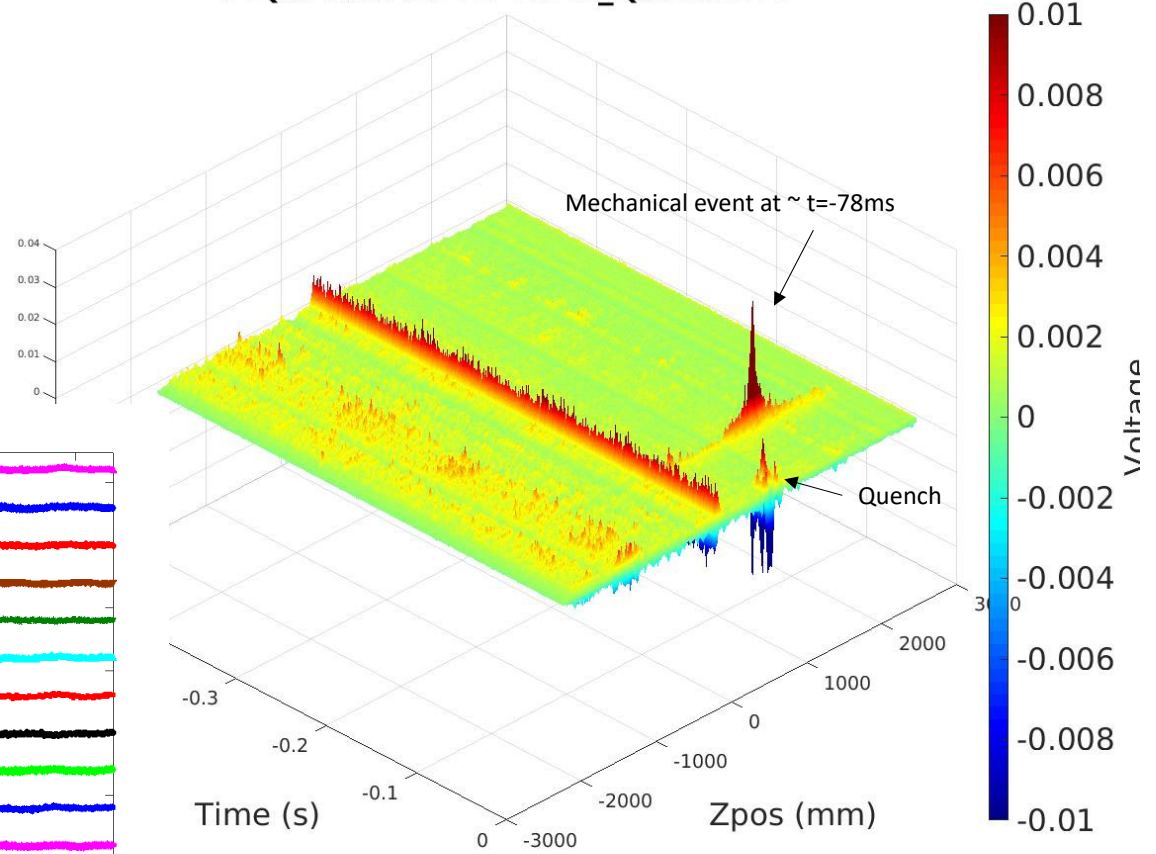
Some quenches had little spike activity

Example of antenna signals from apparent multiple quench starts near each other (within about 300mm)

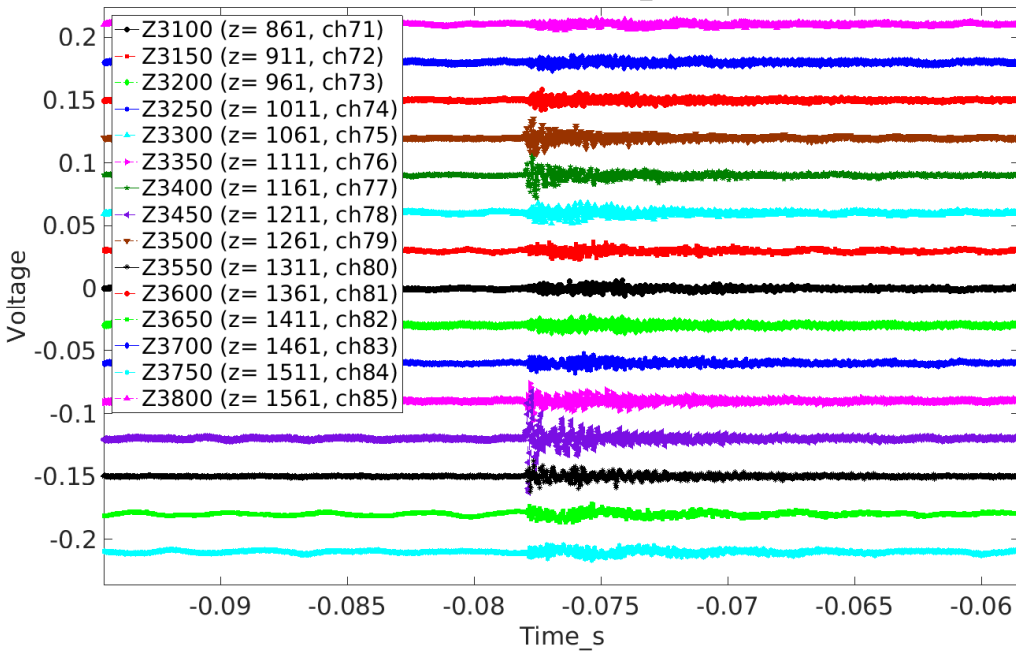


There are some mechanical events seen as well – some at different location than quench and before quench

### MQXFA06 06-23-1616\_Quench14

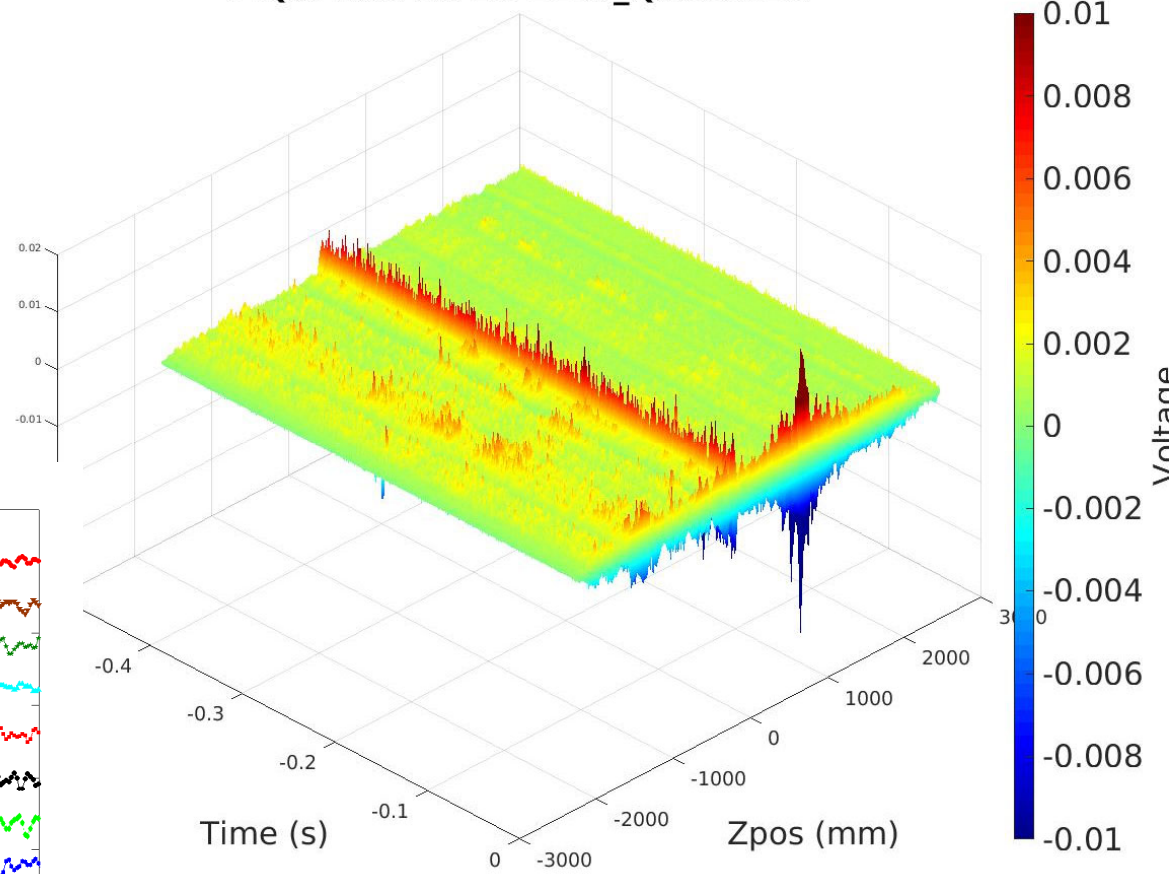


### MQXFA06 06-23-1616\_Quench14

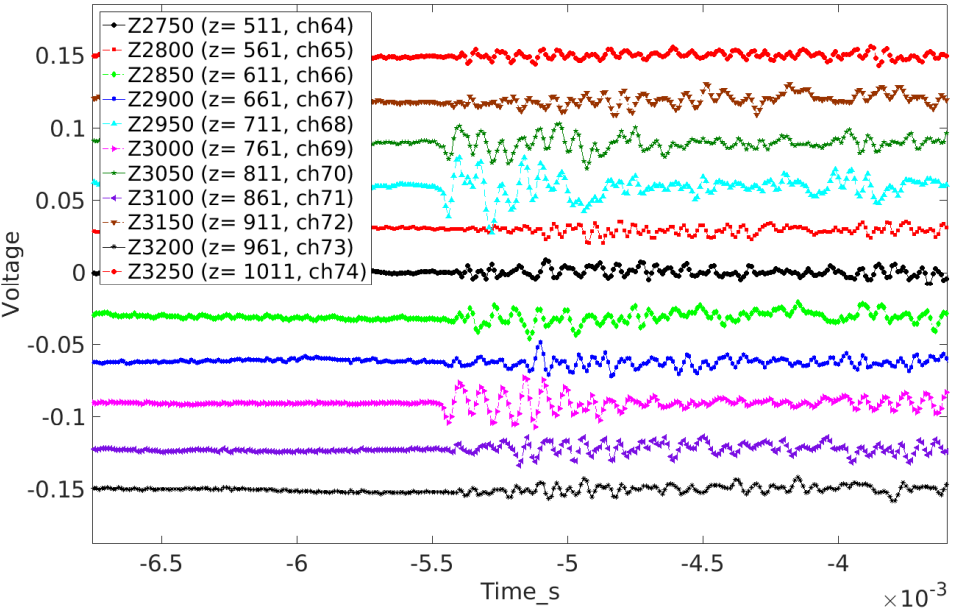


This was a mechanical event seen after quench centered on the quench location

MQXFA06 06-25-1157\_Quench16

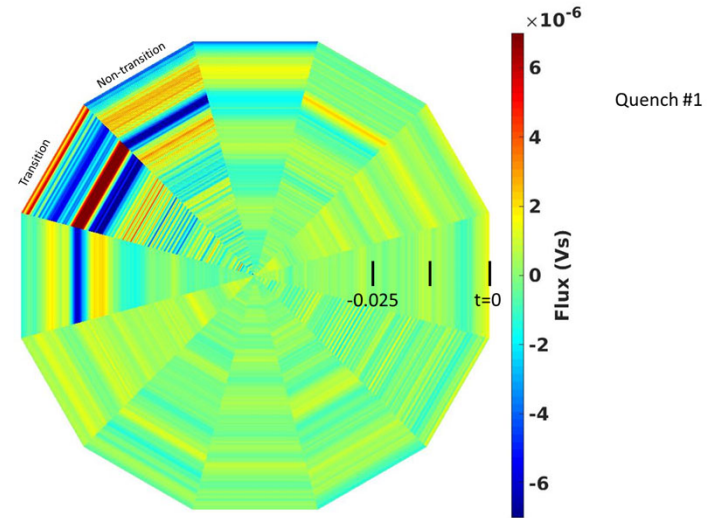
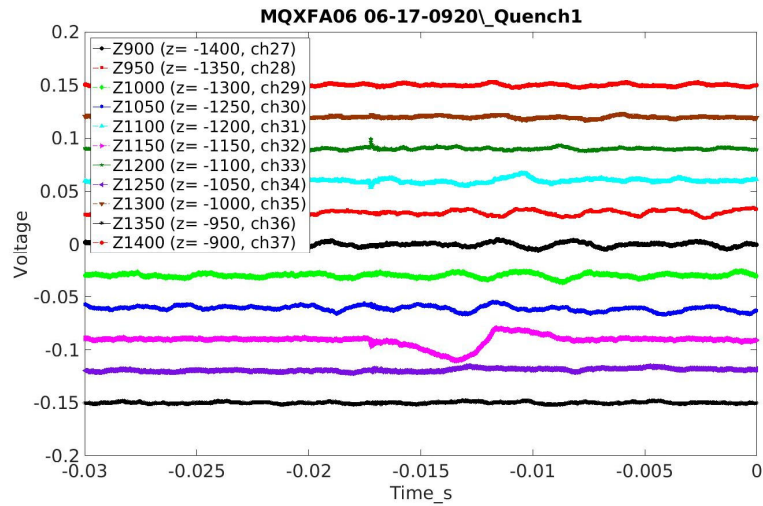
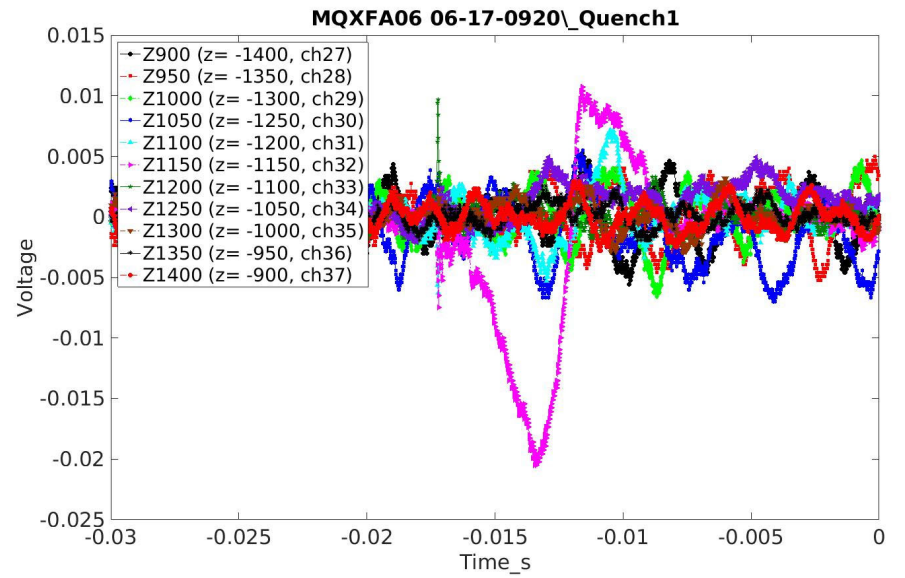
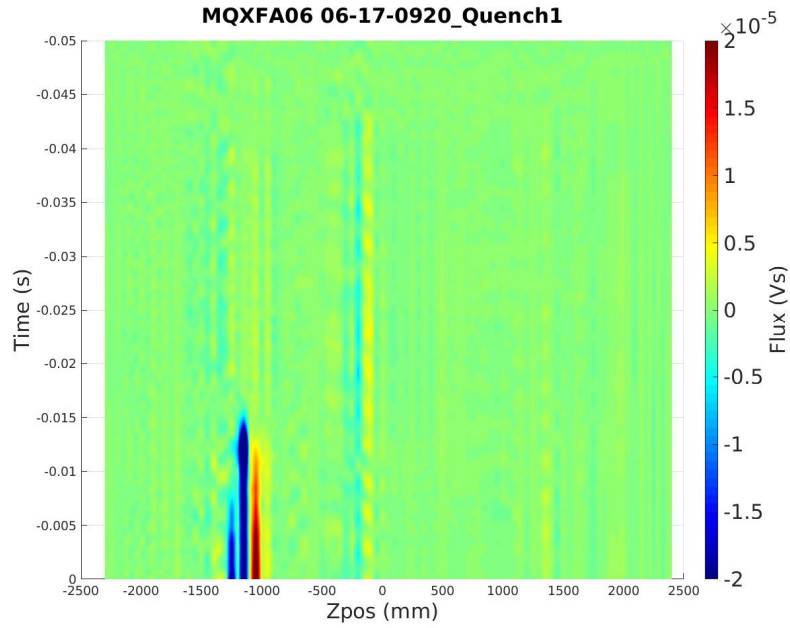


MQXFA06 06-25-1157\_Quench16





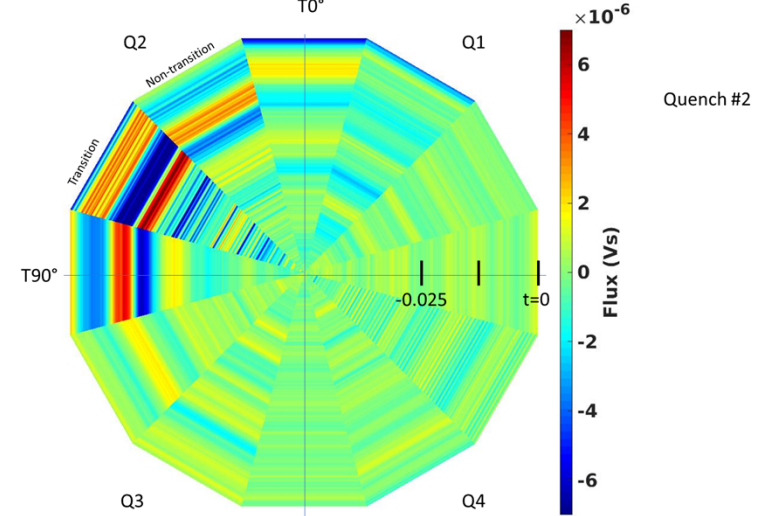
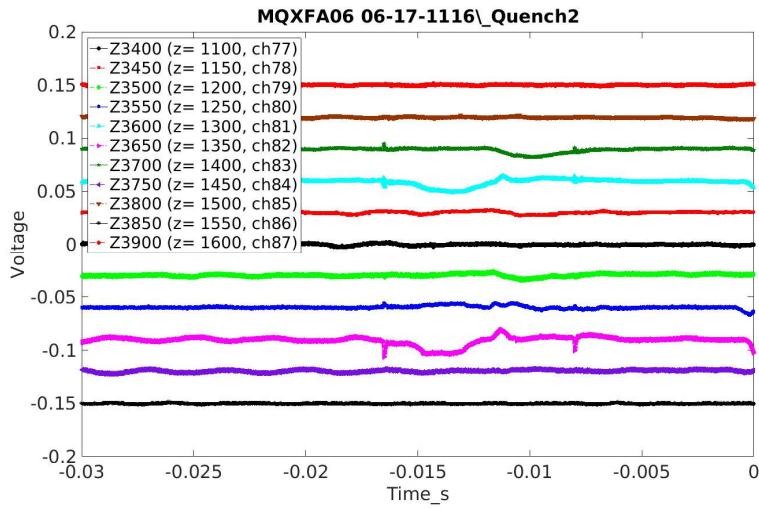
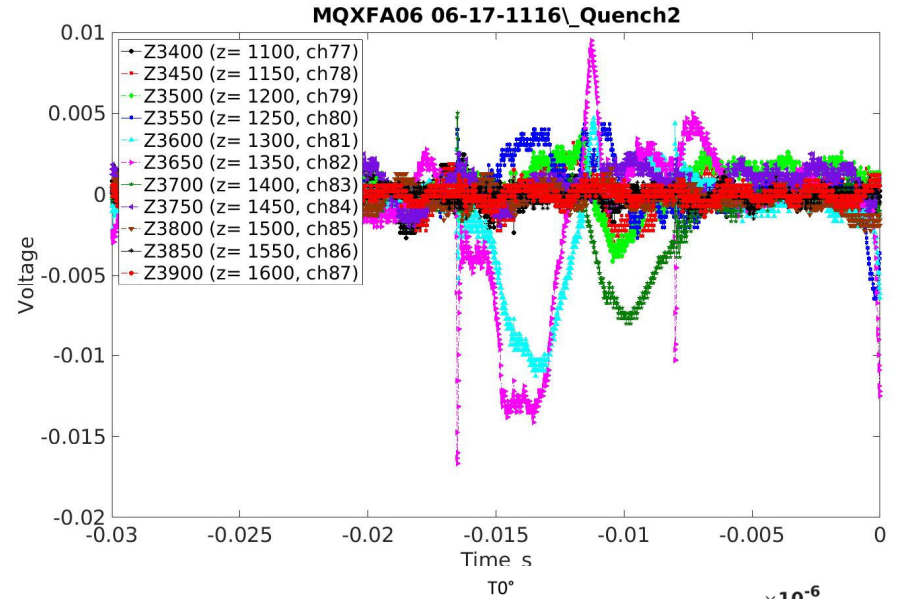
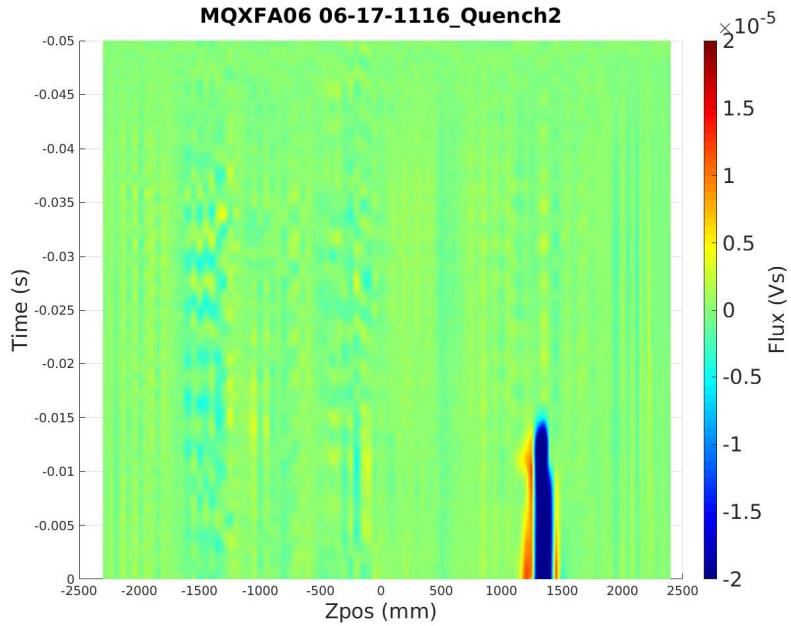
Q#1



1.  $I_Q = 14528.57$  A Coil 119 (Q2) Inner Pole Turn NT-SS

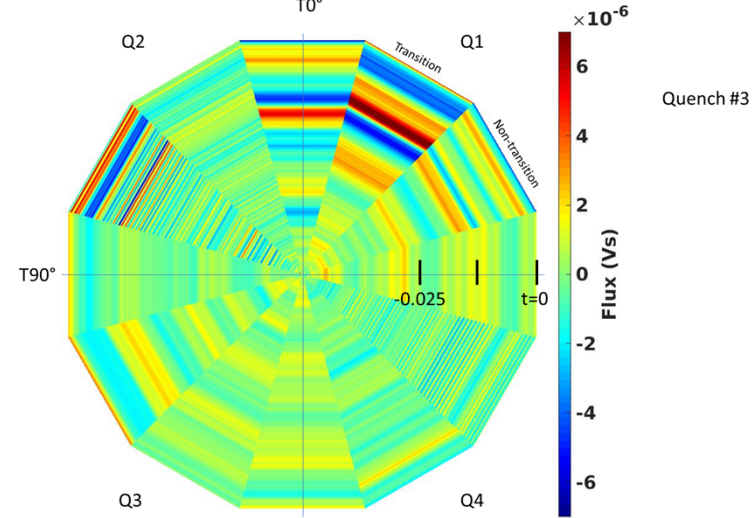
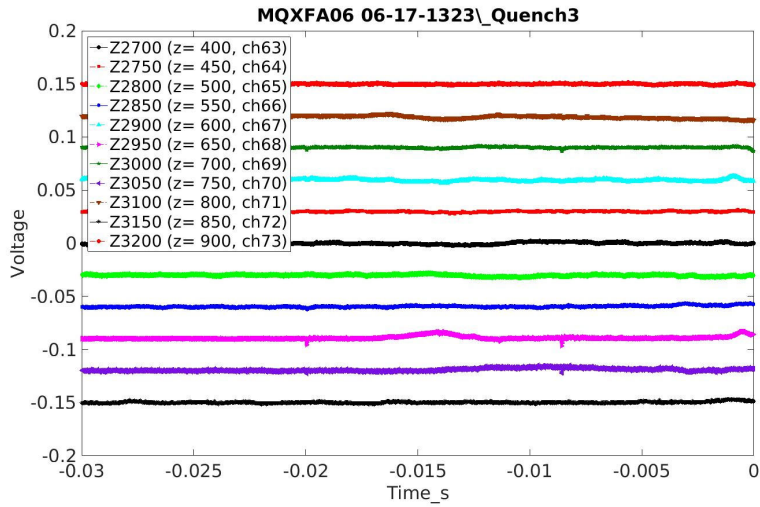
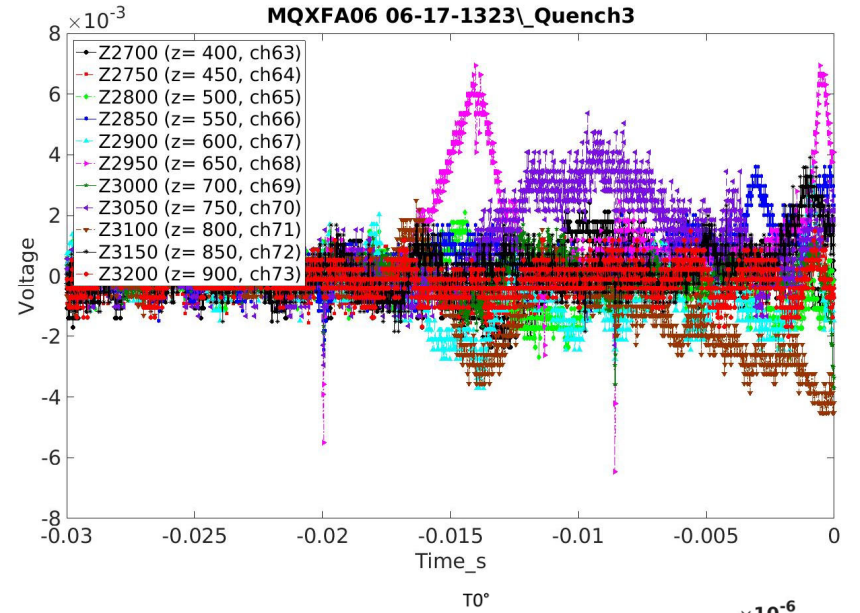
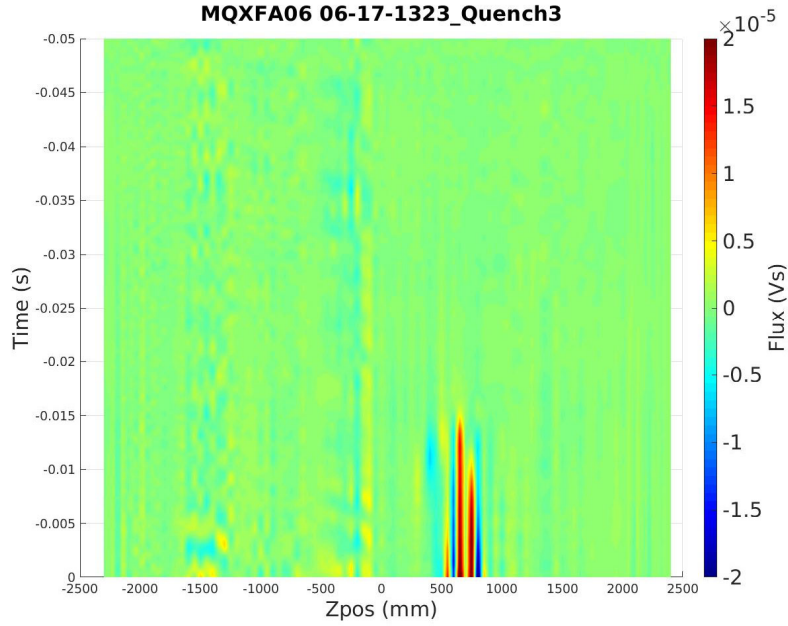
24.2 Milts 4.5K

Q#2



2.  $I_0 = 14819.88$  A Coil 119 (Q2) Inner Pole Turn T-S5

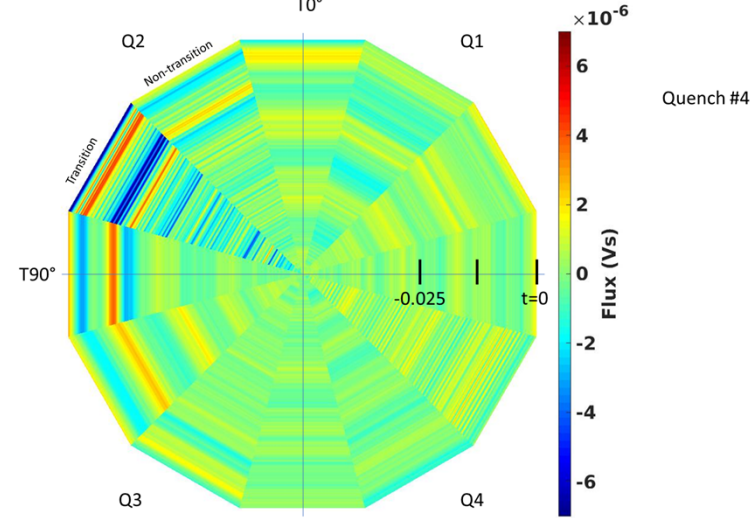
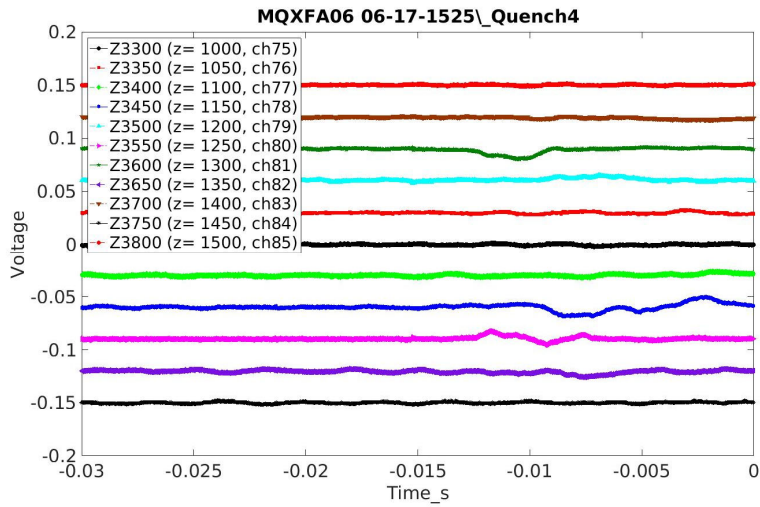
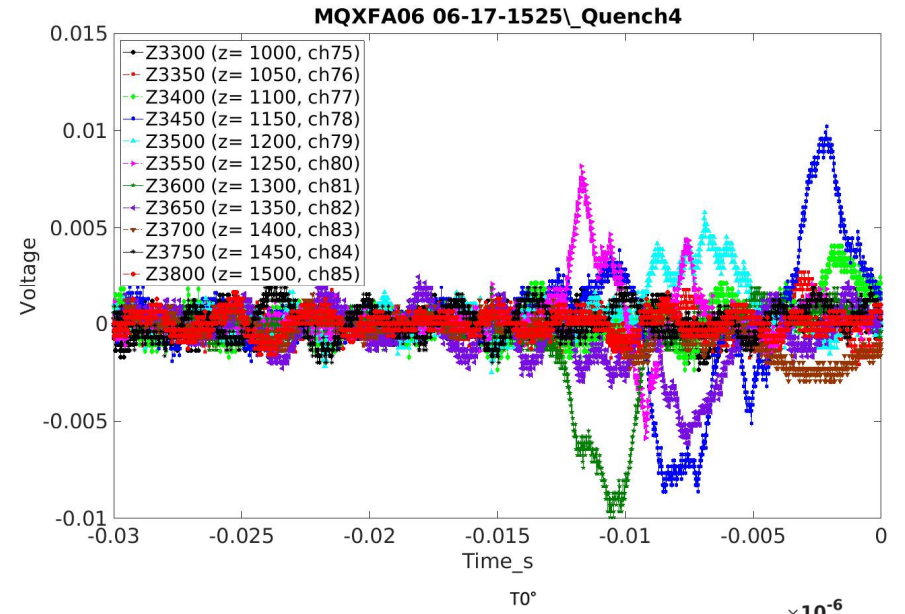
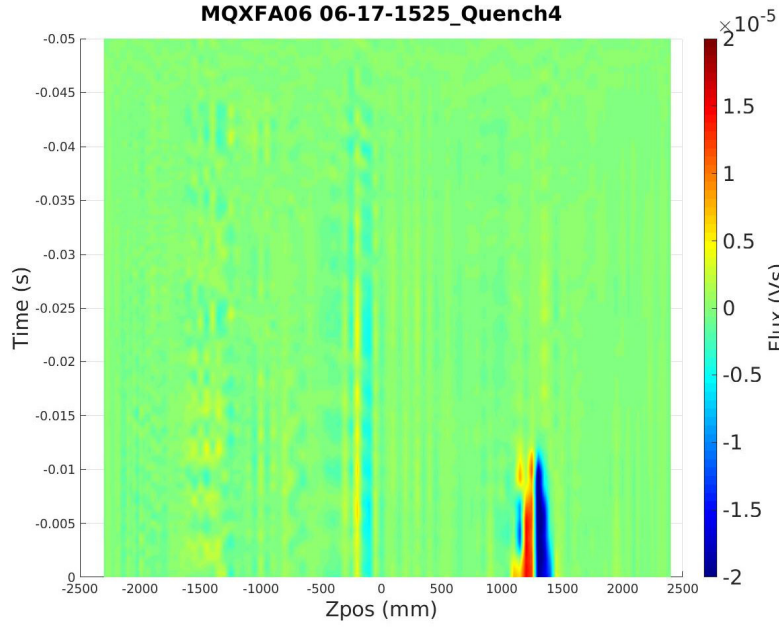
Q#3



3.  $I_q = 14845.60$  A Coil 122 (Q1) Inner Pole Turn T-SS

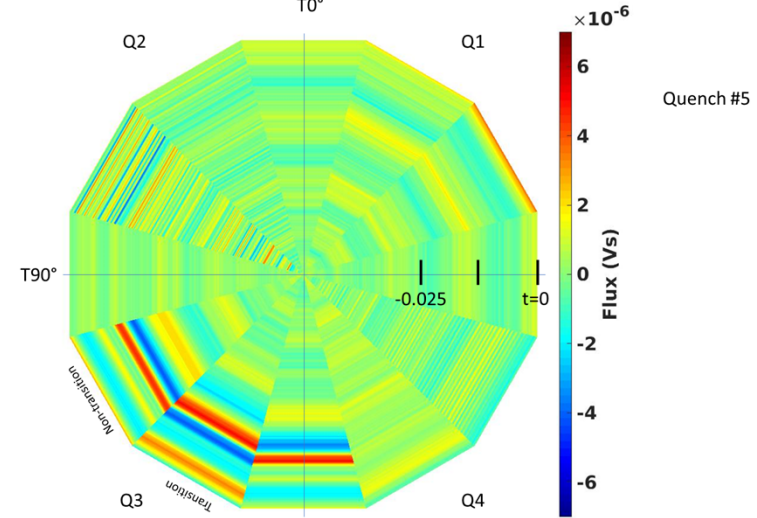
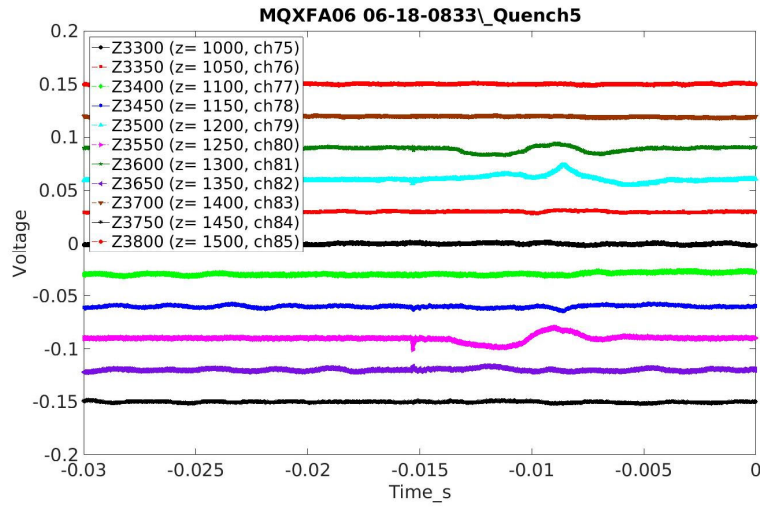
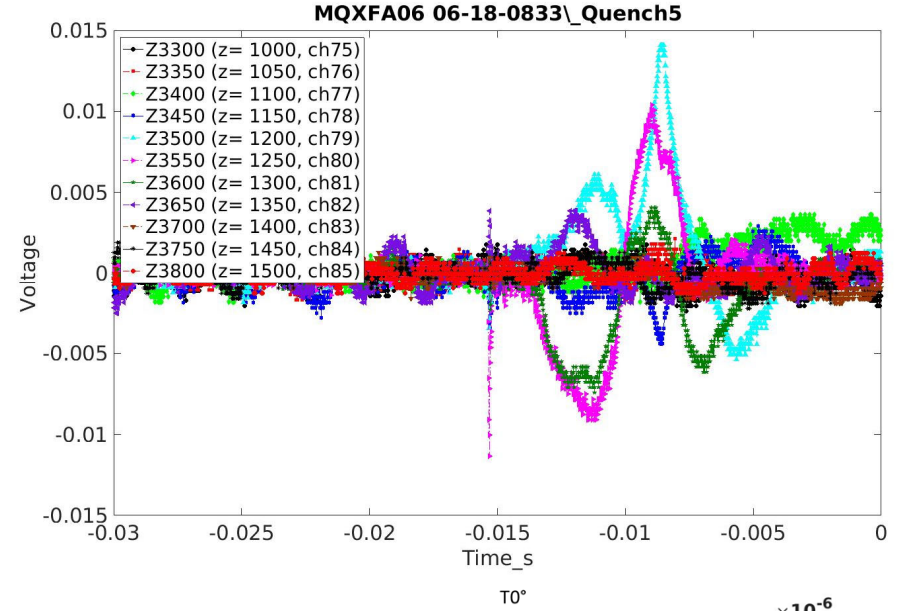
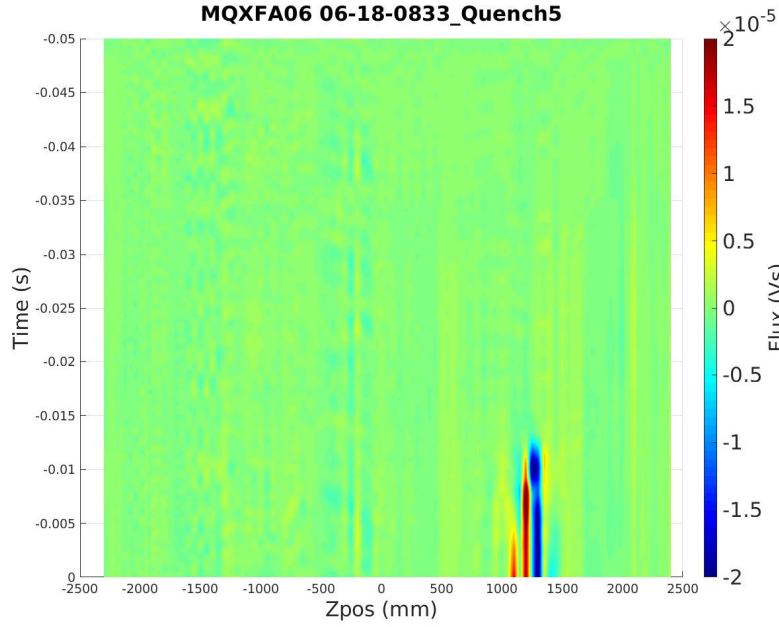


Q#4



4.  $I_q = 14884.65$  A Coil 119 (Q2) Inner Pole Turn T-SS

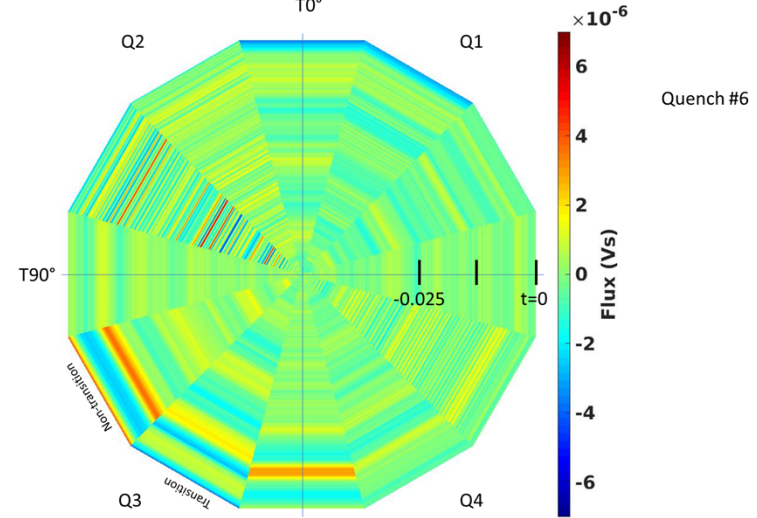
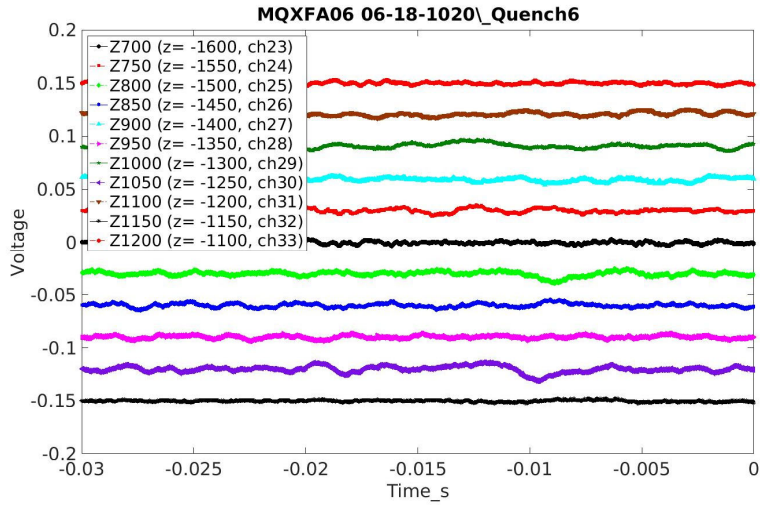
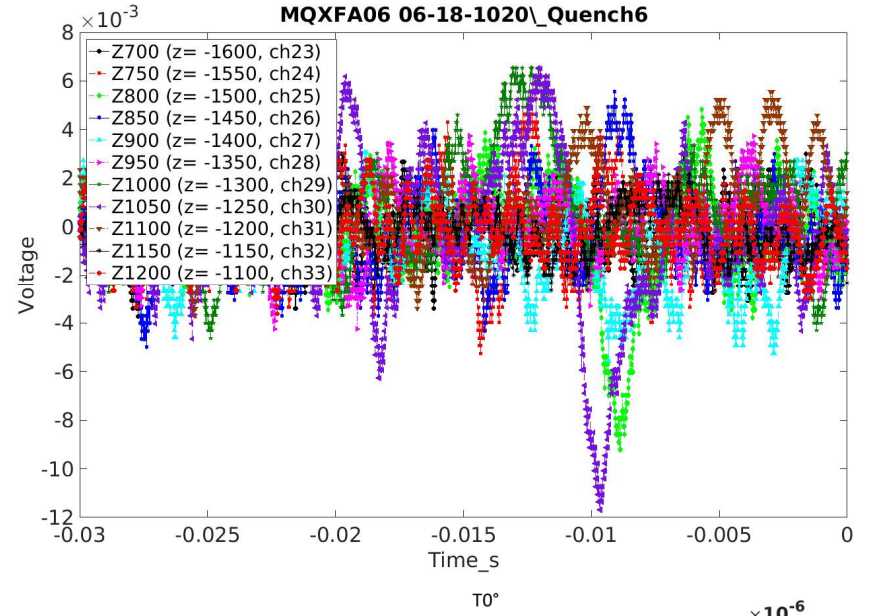
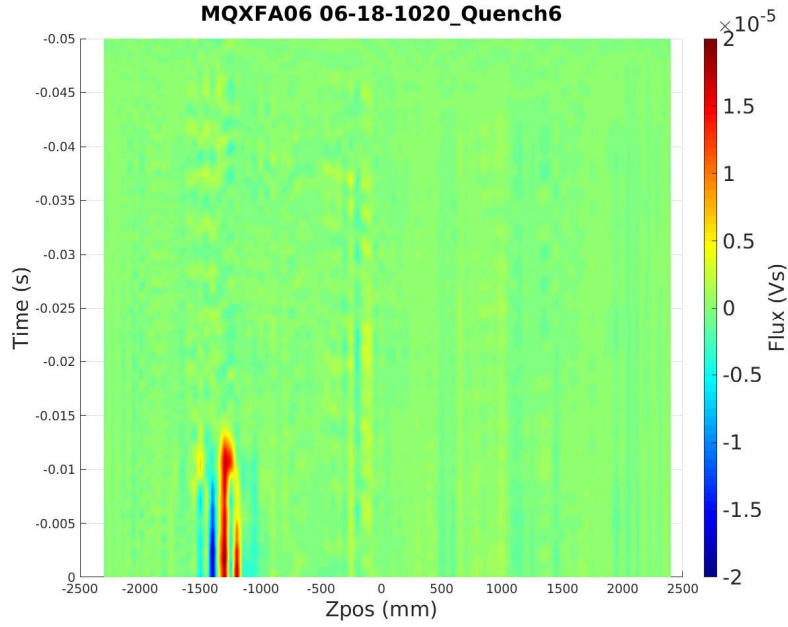
Q#5



5.  $I_Q = 14879.25$  A Coil 211 (Q3) Inner Pole Turn NT-SS



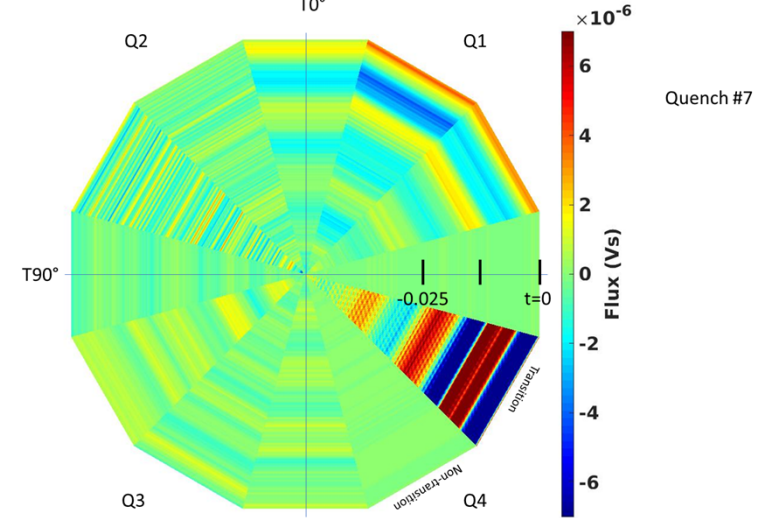
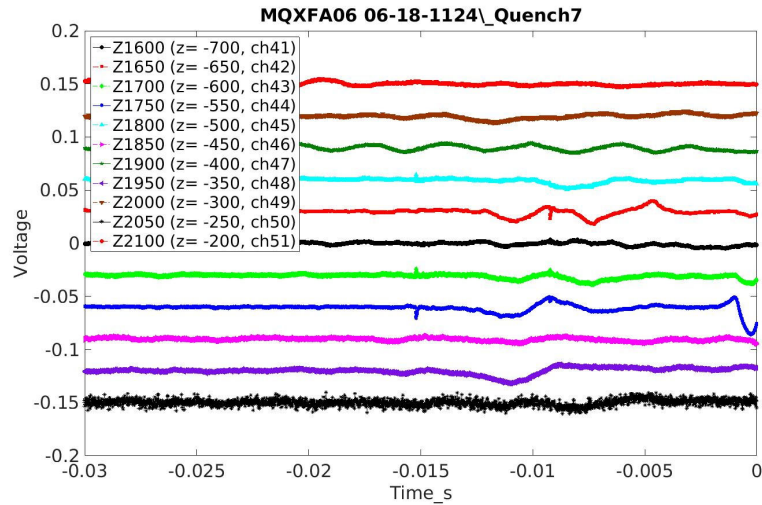
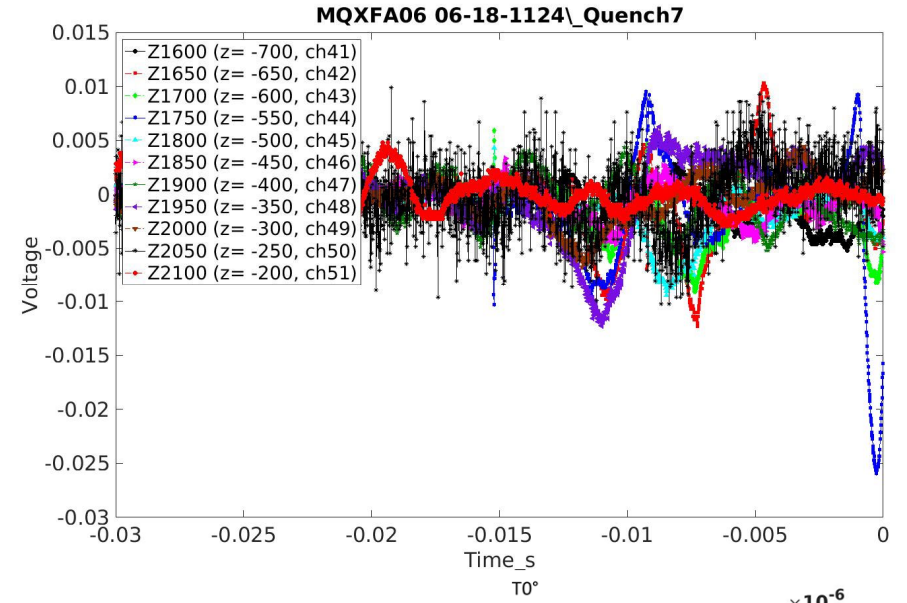
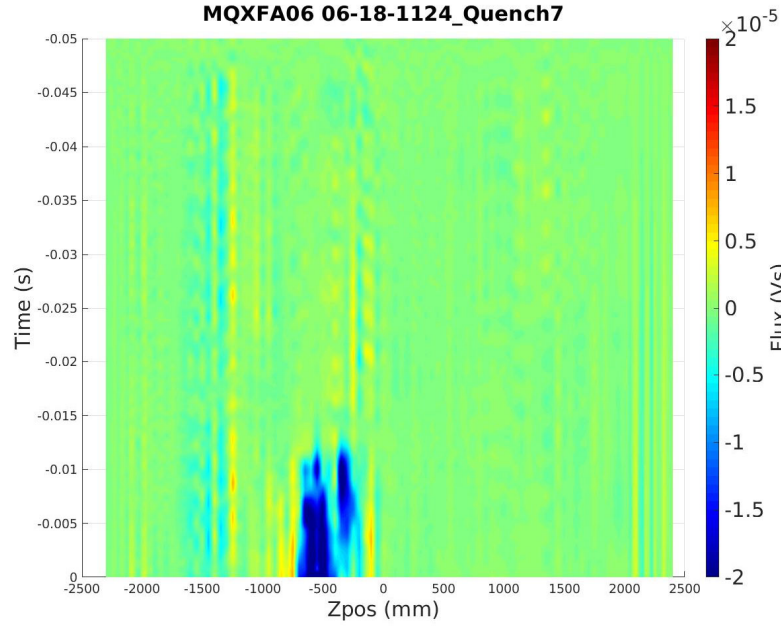
Q#6



6.  $I_q = 15108.25$  A Coil 211 (Q3) Inner Pole Turn NT-SS

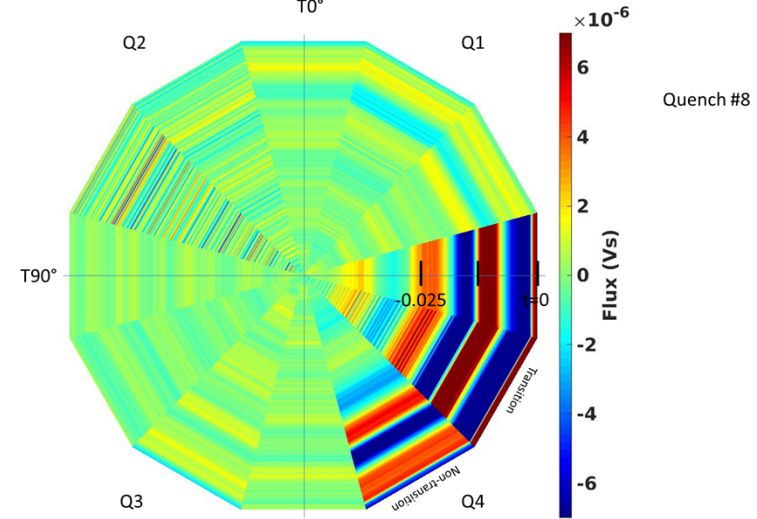
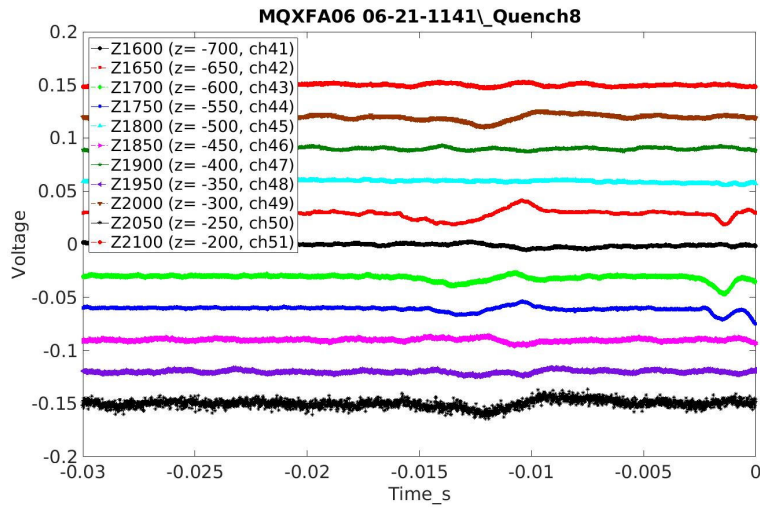
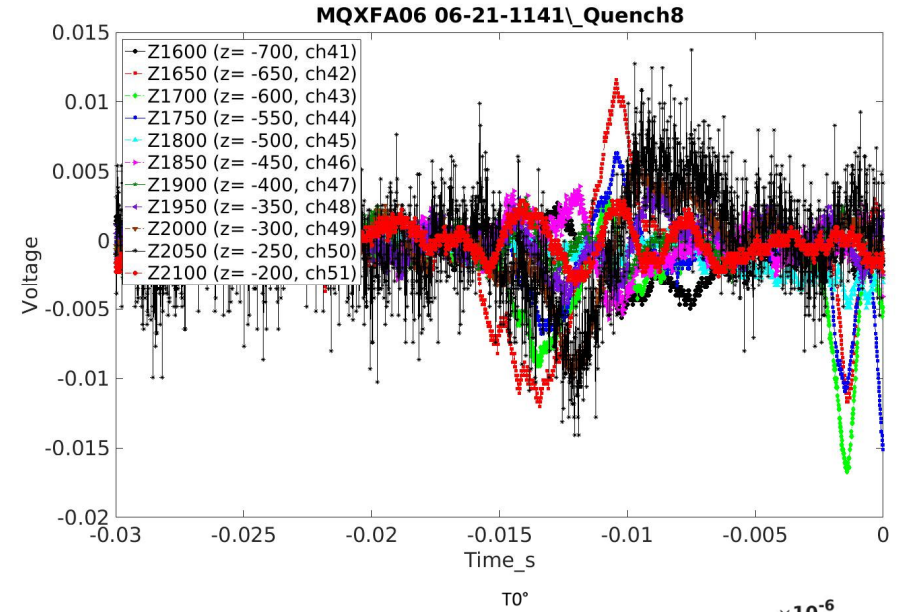
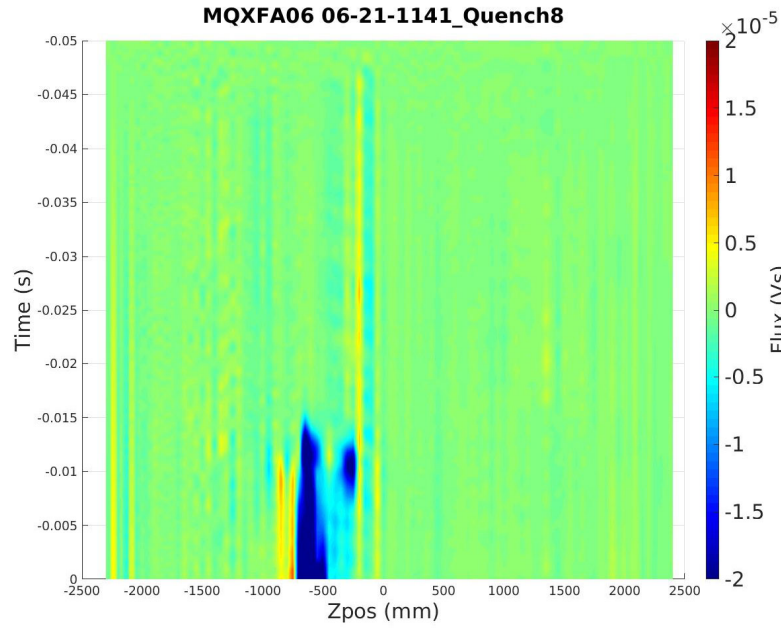


Q#7



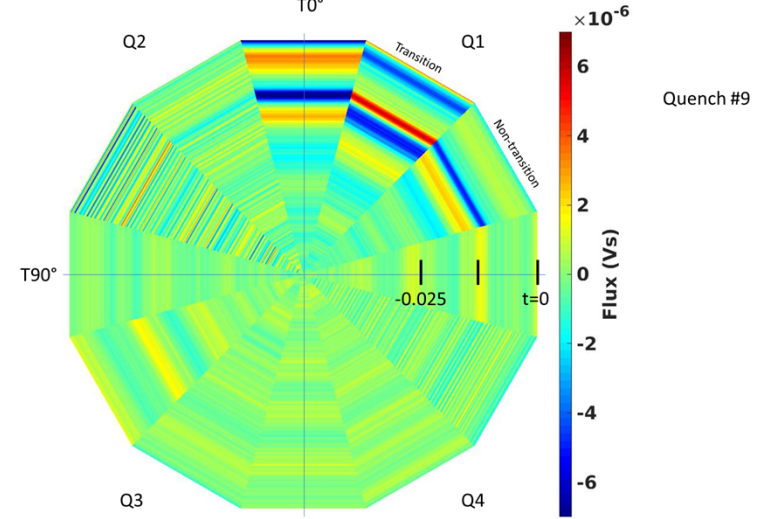
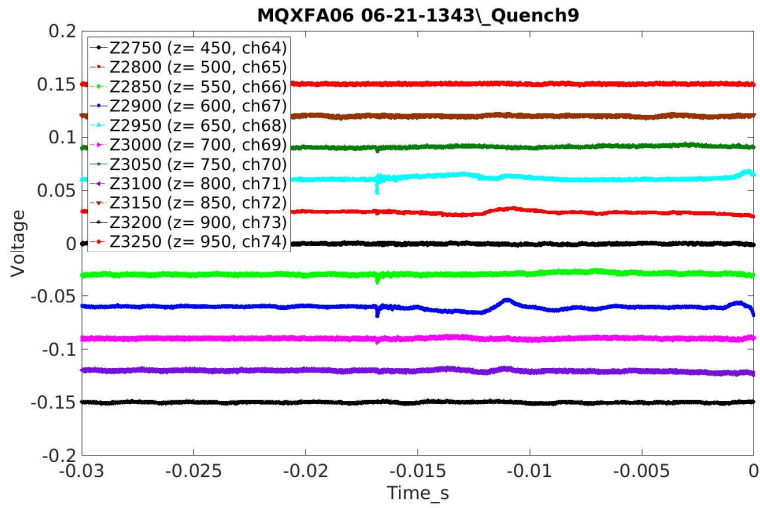
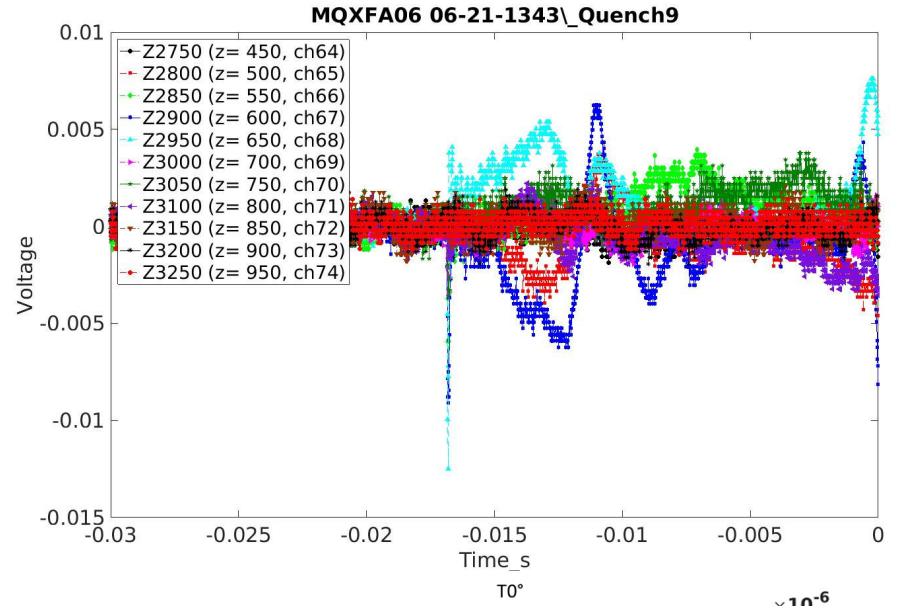
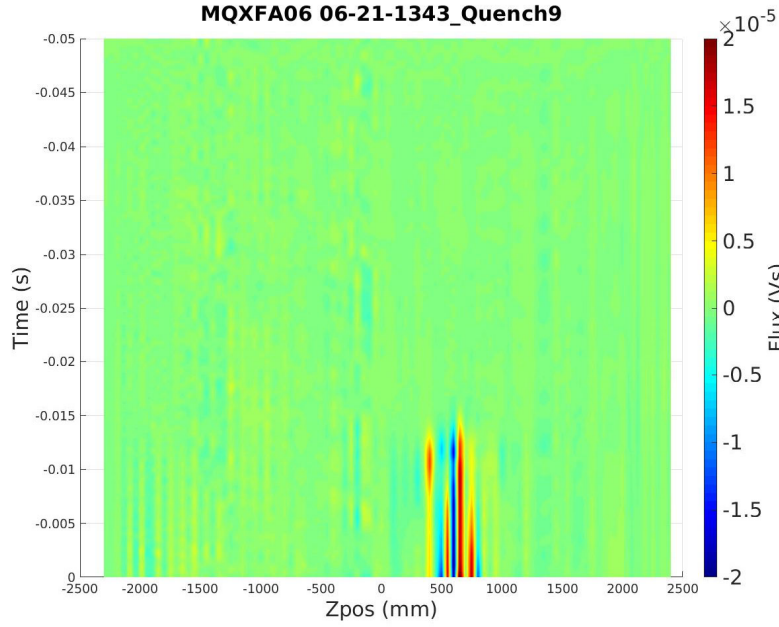
7.  $I_q = 15158.46$  A Coil 123 (Q4)

Q#8



8.  $I_Q = 14970.79$  A Coil 123 (Q4)

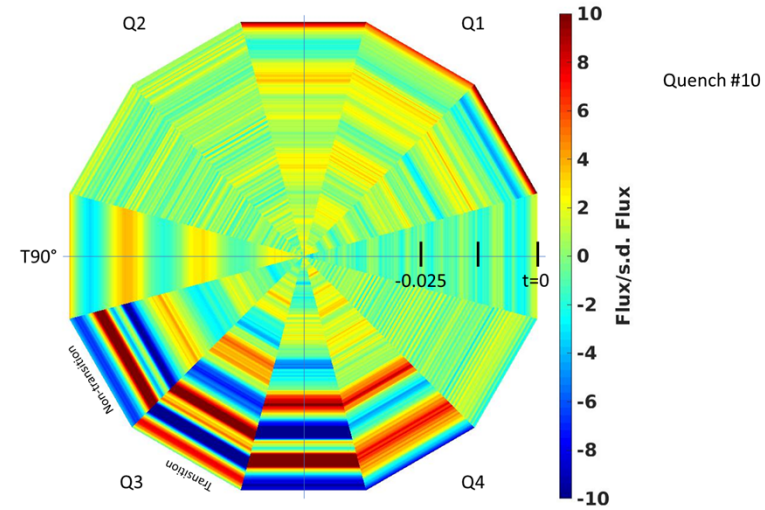
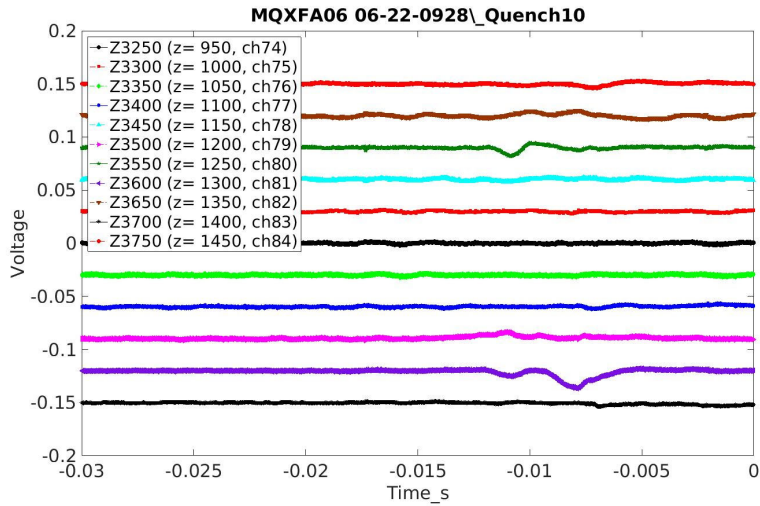
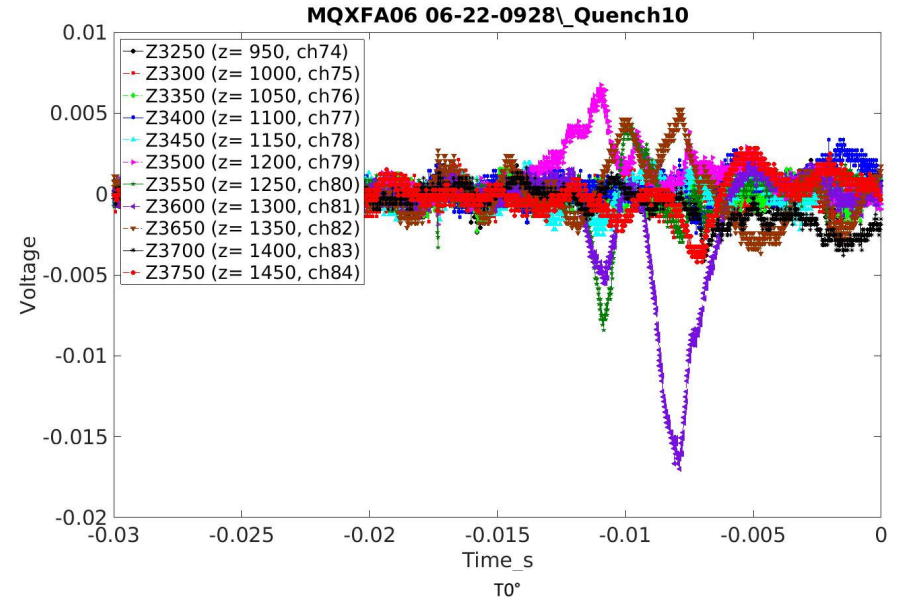
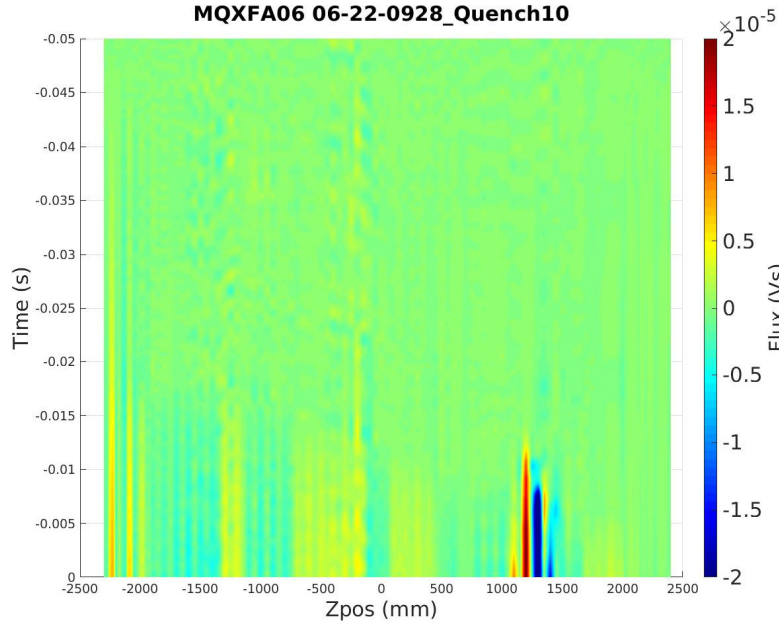
Q#9



9.  $I_Q = 15162.06$  A Coil 122 (Q1) Inner Pole Turn T-SS

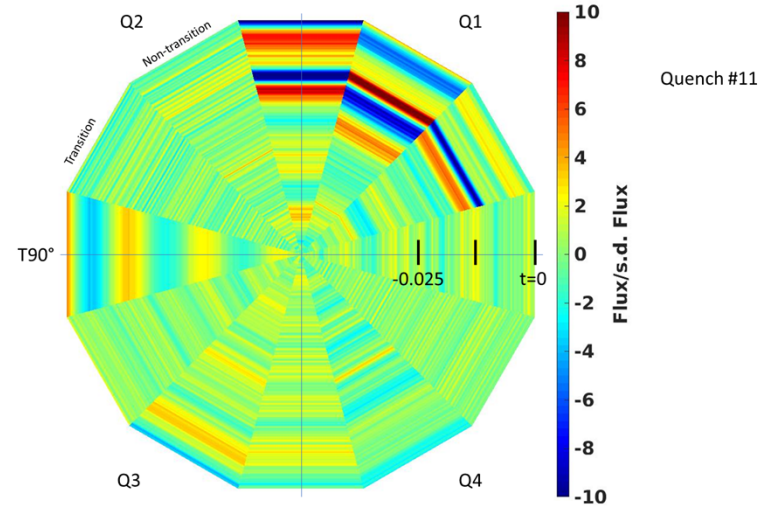
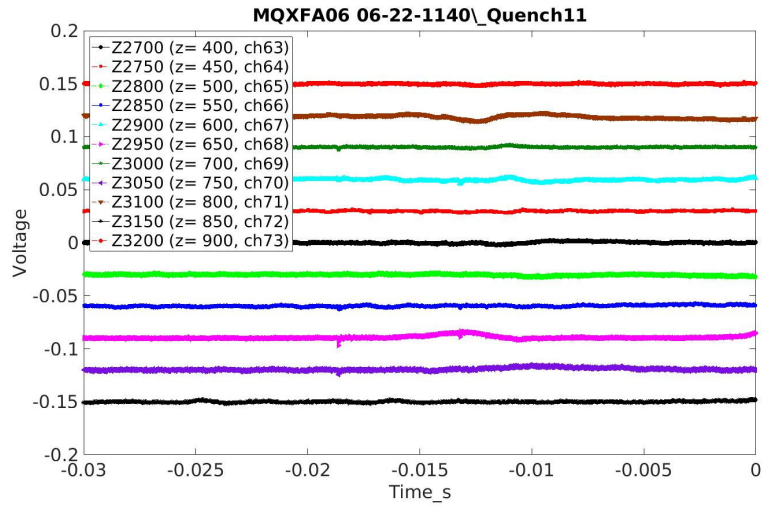
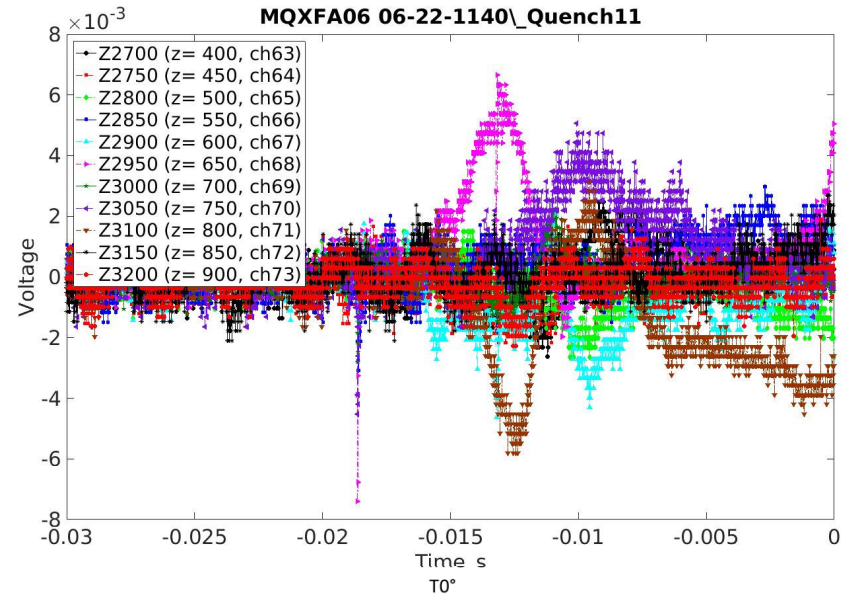
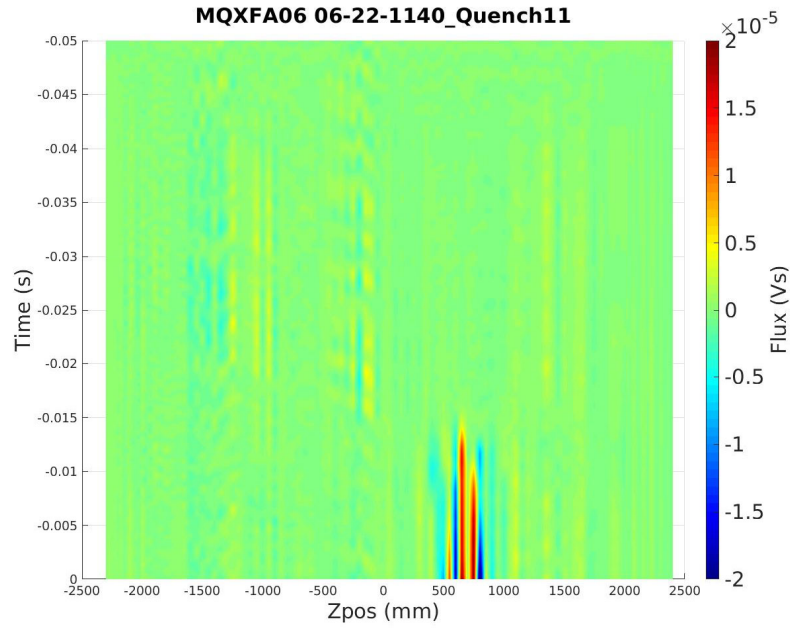


Q#10



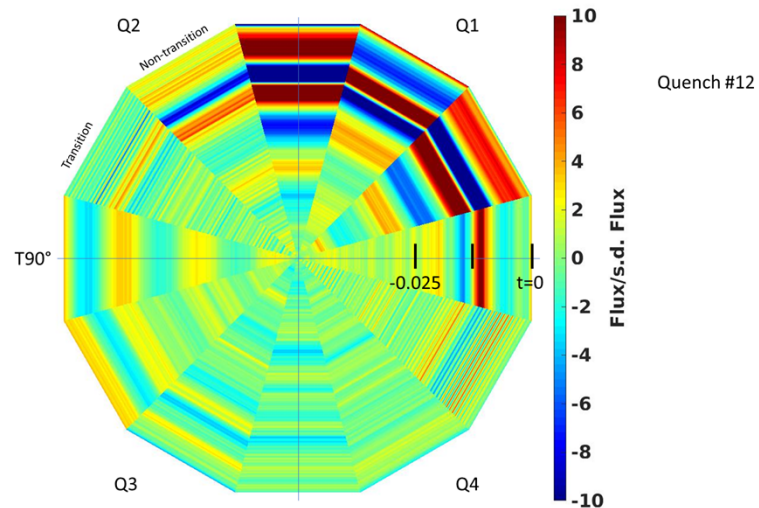
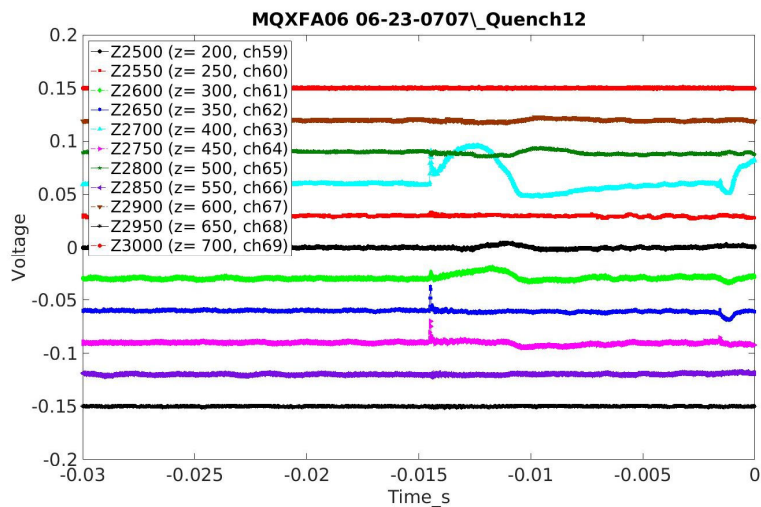
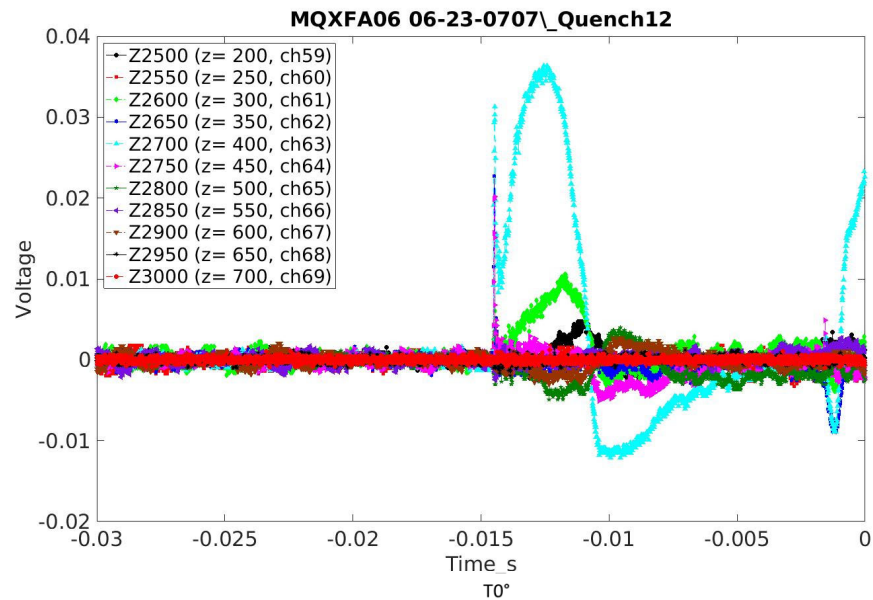
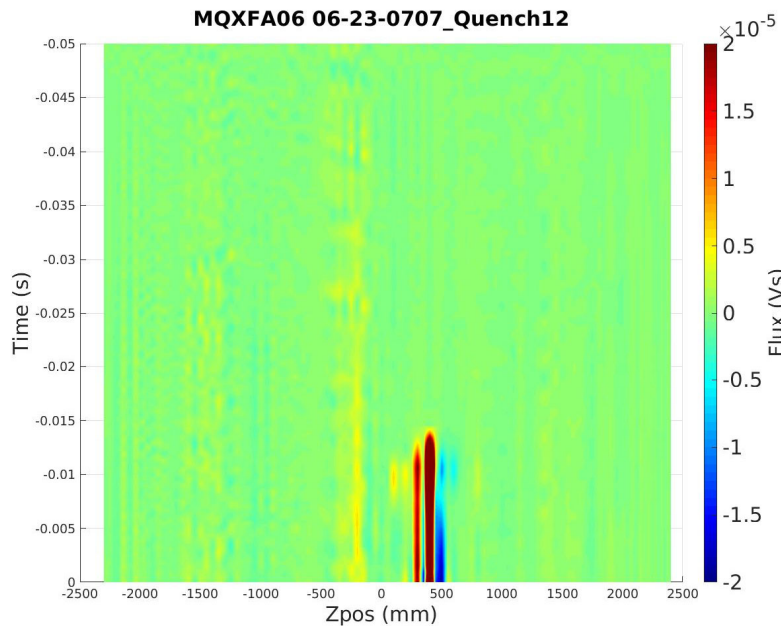
10.  $I_c = 15136.86 A$  Coil Z11 (Q3) Inner Pole Turn NT-55

Q#11



11.  $I_q = 14985.25$  A Coil 122 (Q1) Inner Pole Turn T-SS

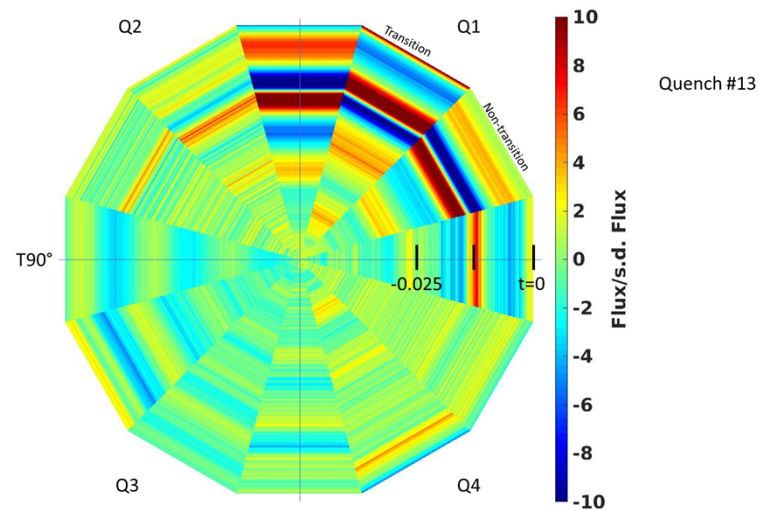
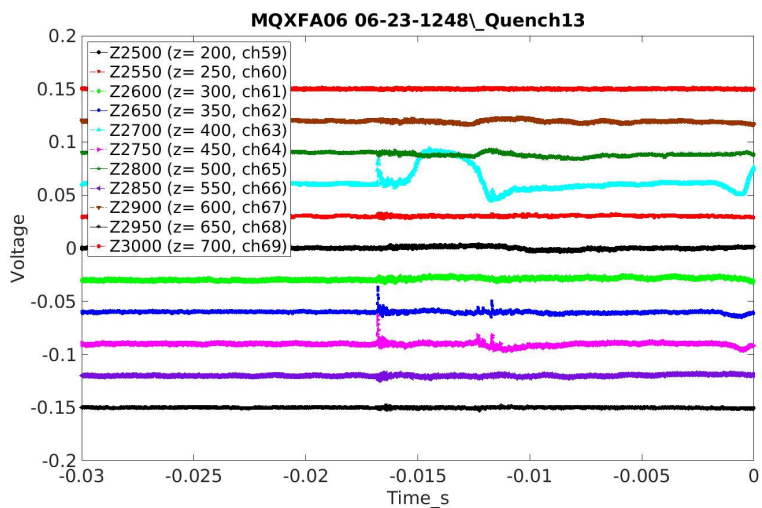
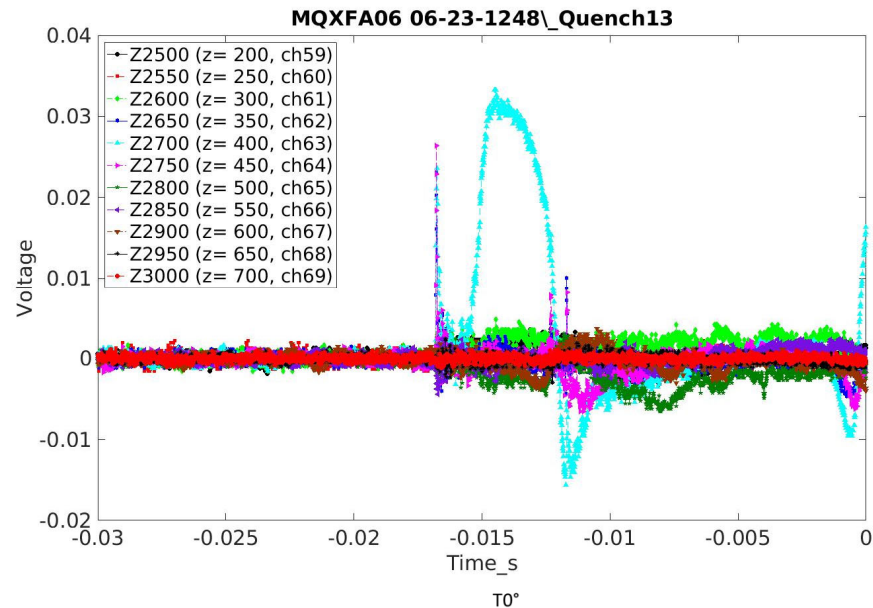
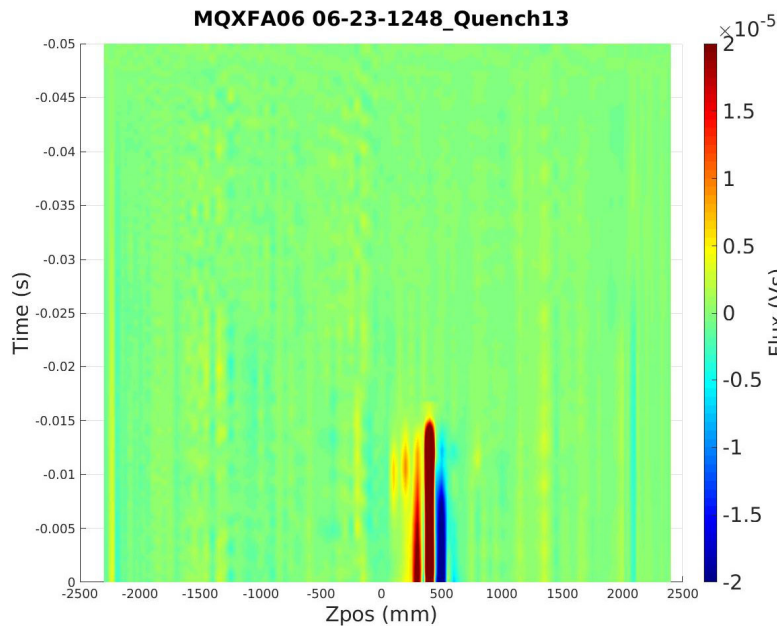
Q#12



12.  $I_c = 15260.51A$  Coil 122 (Q1) Inner Pole Turn T-SS

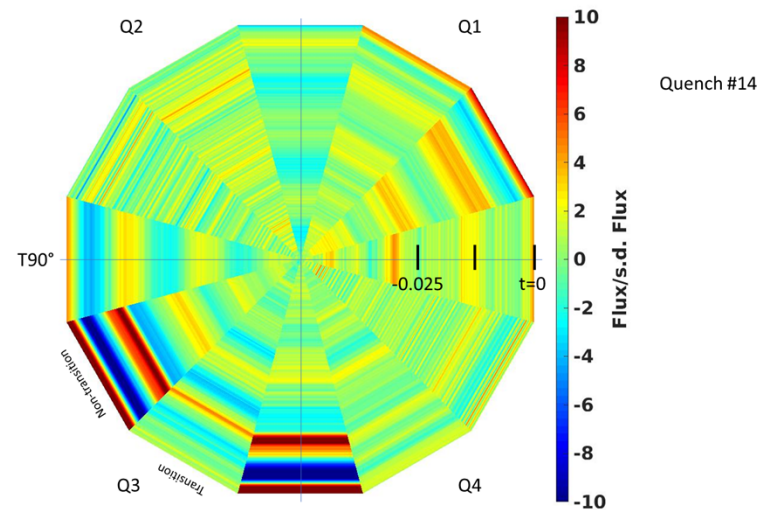
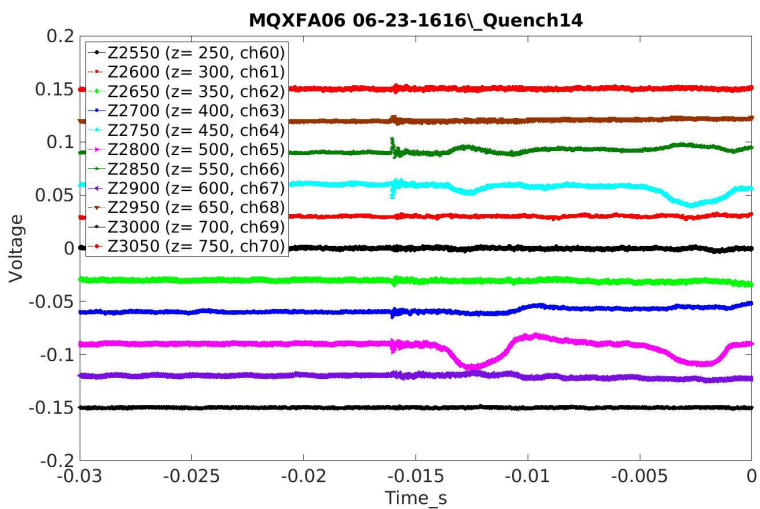
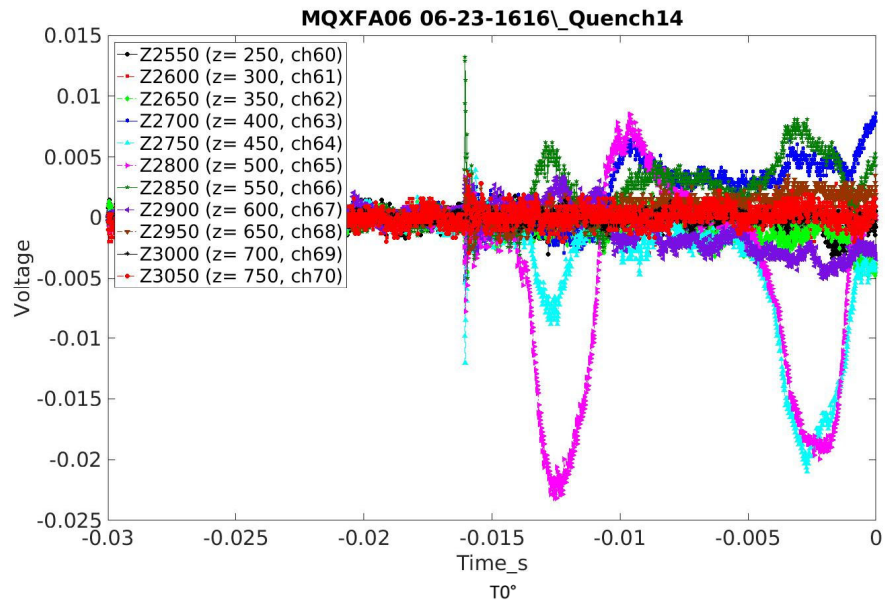
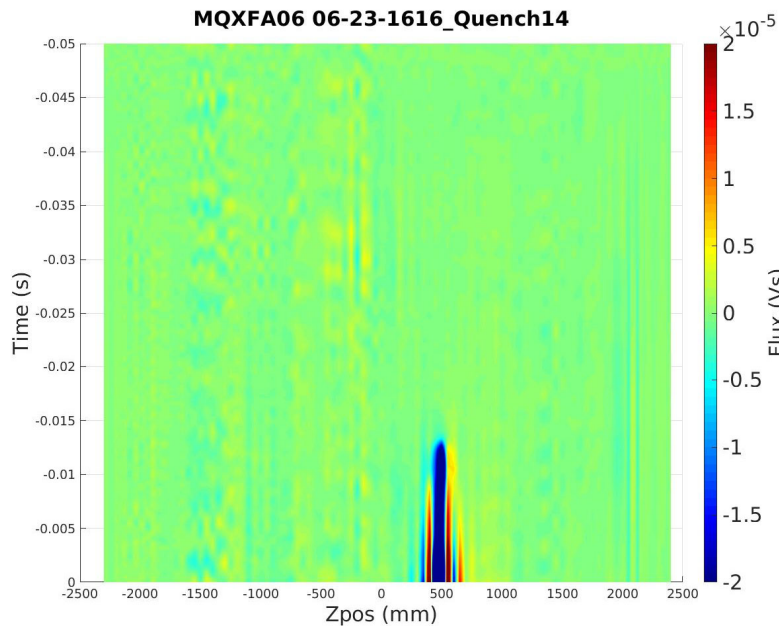


Q#13



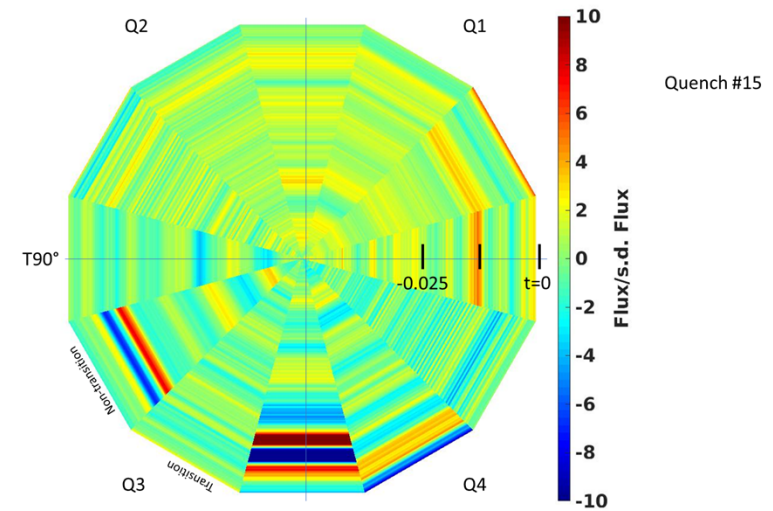
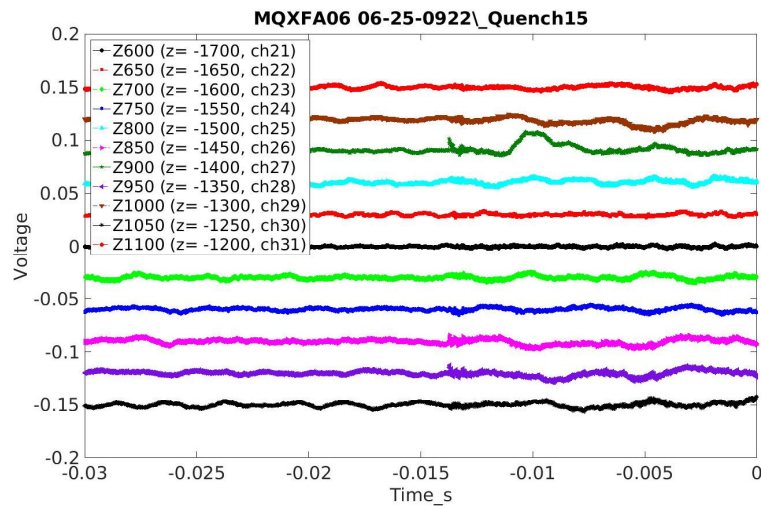
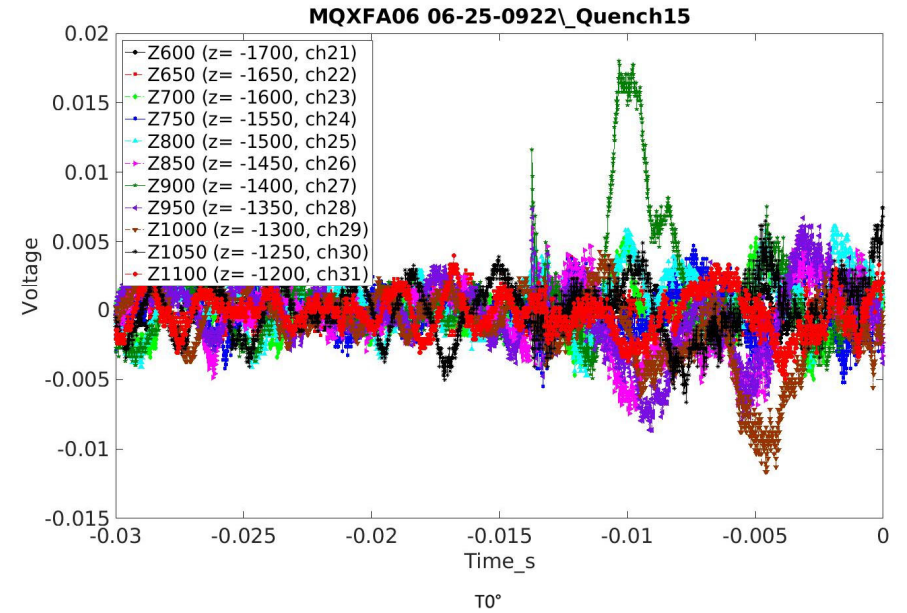
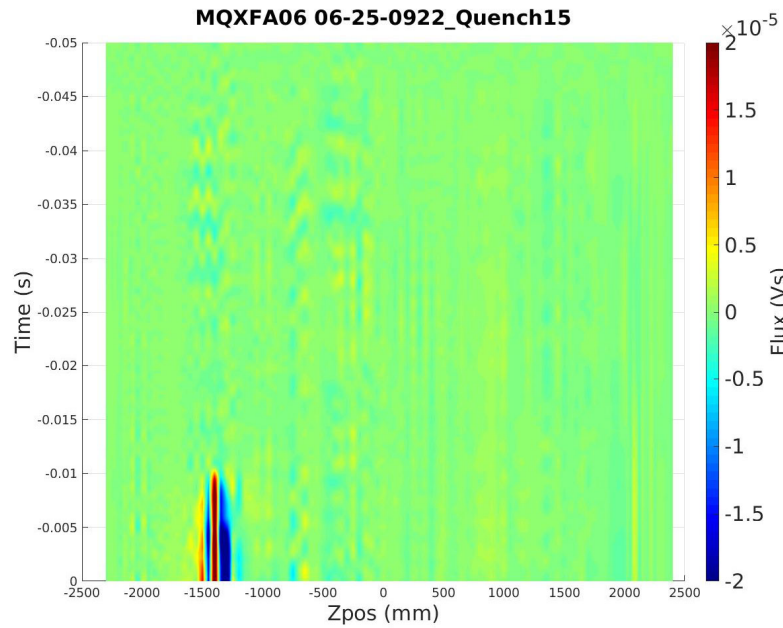
13.  $I_Q = 15173.83A$  Coil 122 (Q1) Inner Pole Turn T-SS

Q#14



14.  $I_c = 15638.14$  A Coil 211 (Q3) Inner Pole Turn NT-SS

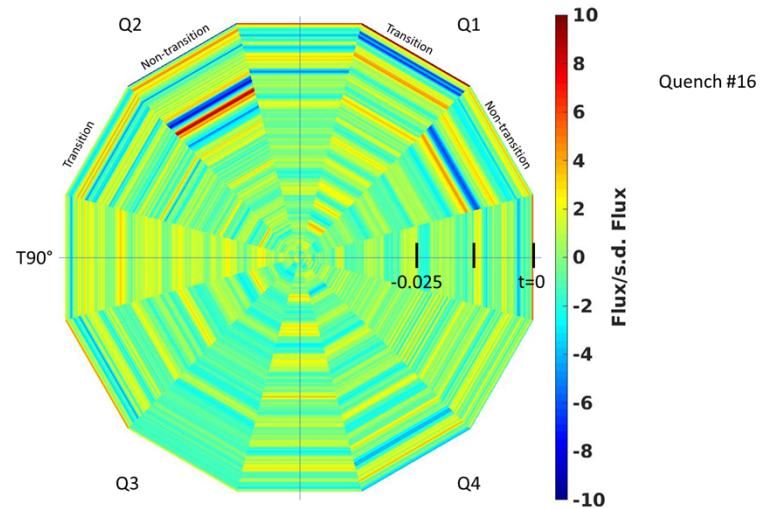
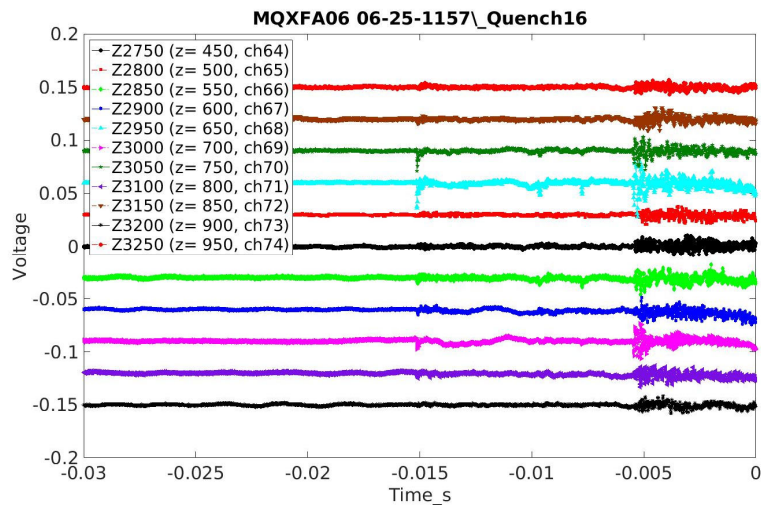
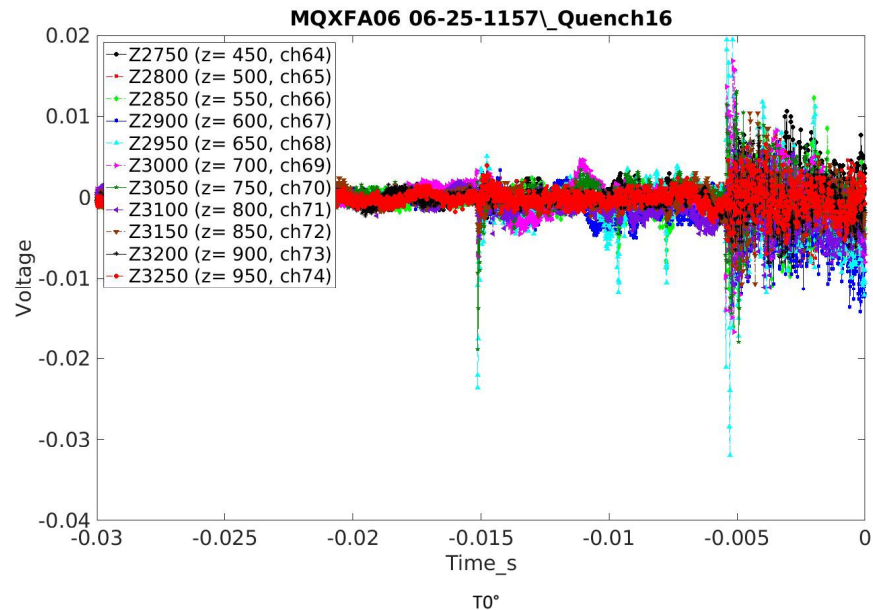
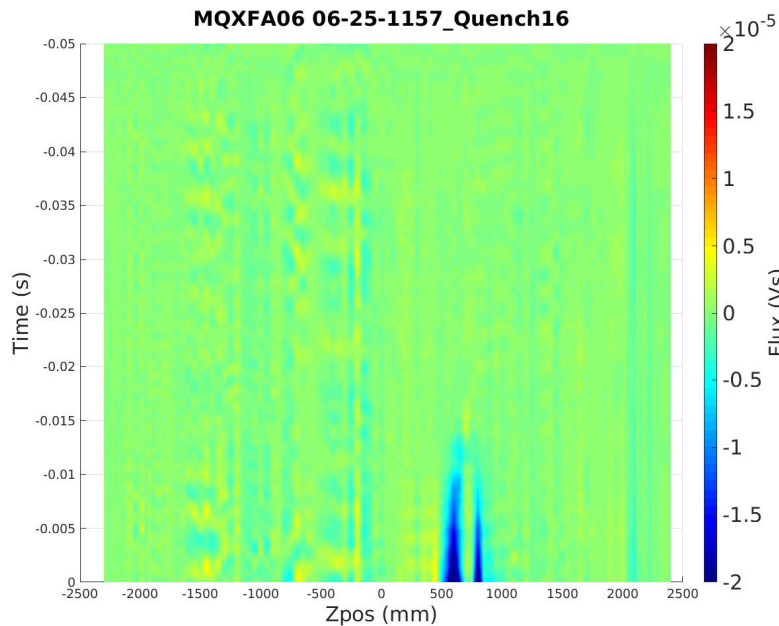
Q#15



15.  $I_q = 15978.96$  A Coil 211 (Q3) Inner Pole Turn T-55

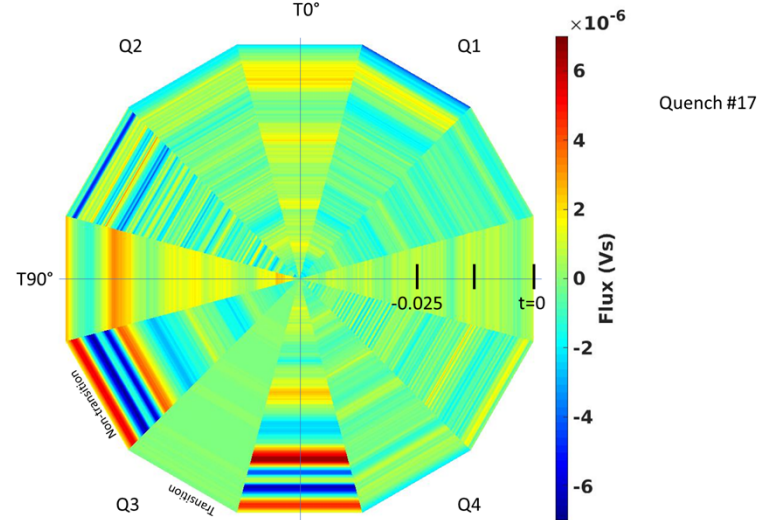
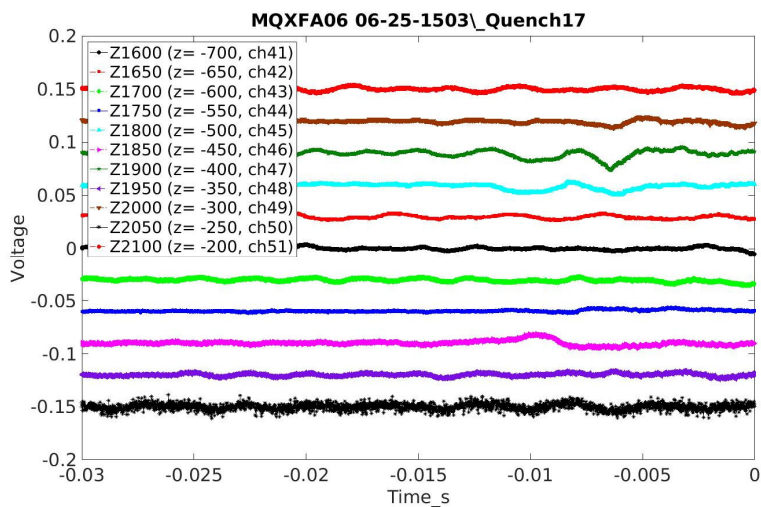
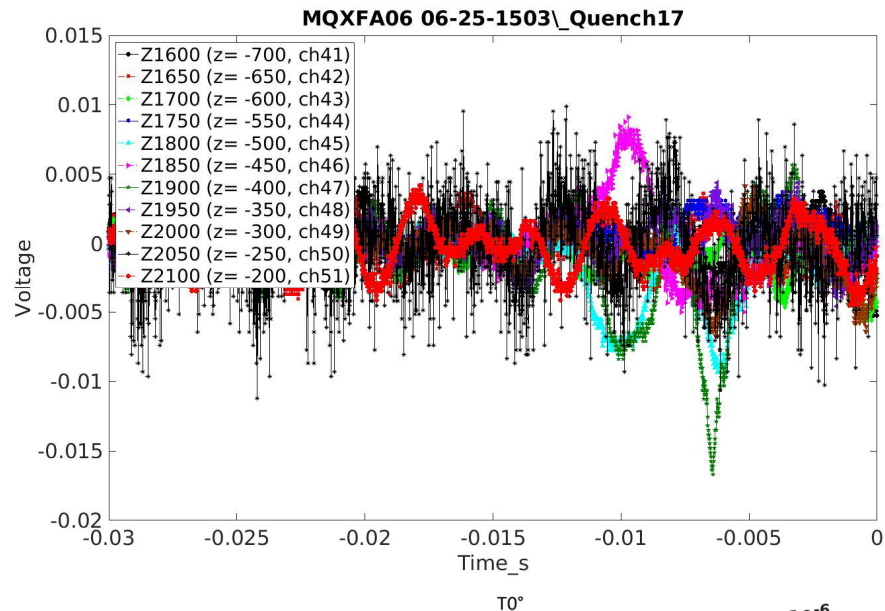
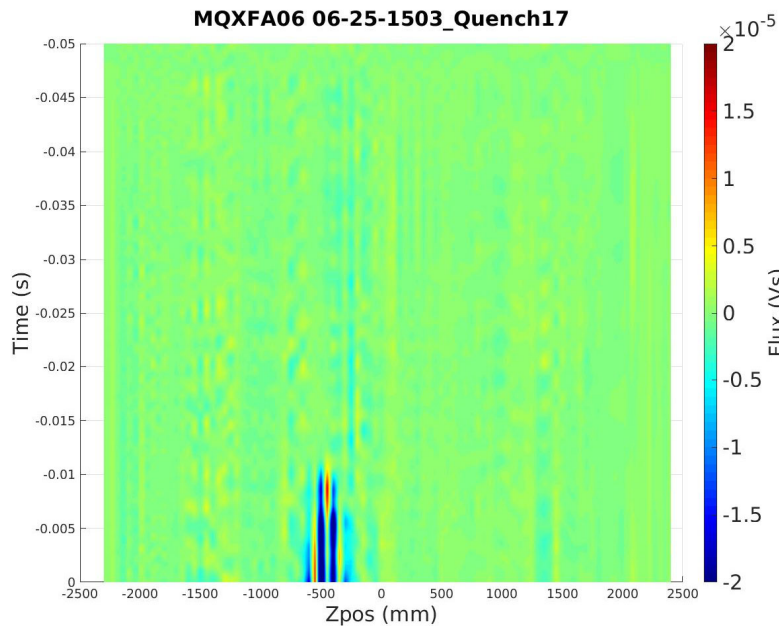


# Q#16



16.  $I_Q = 16298.32$  A Coil 122 (Q1) Ramp + outer pole turn

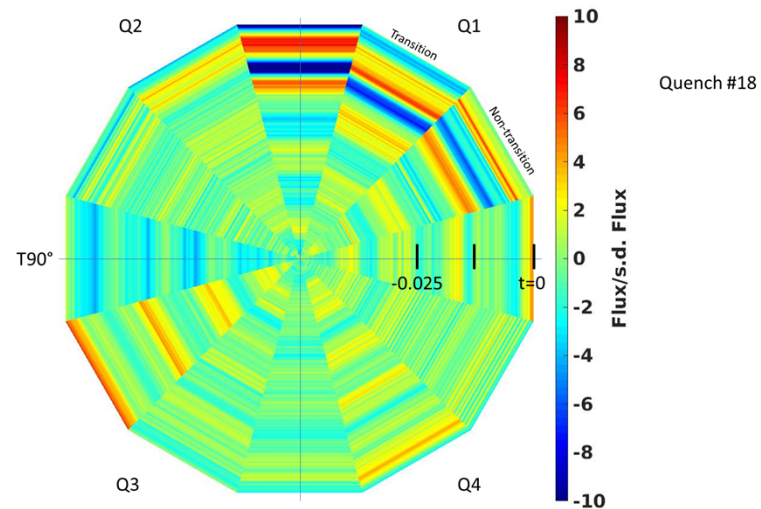
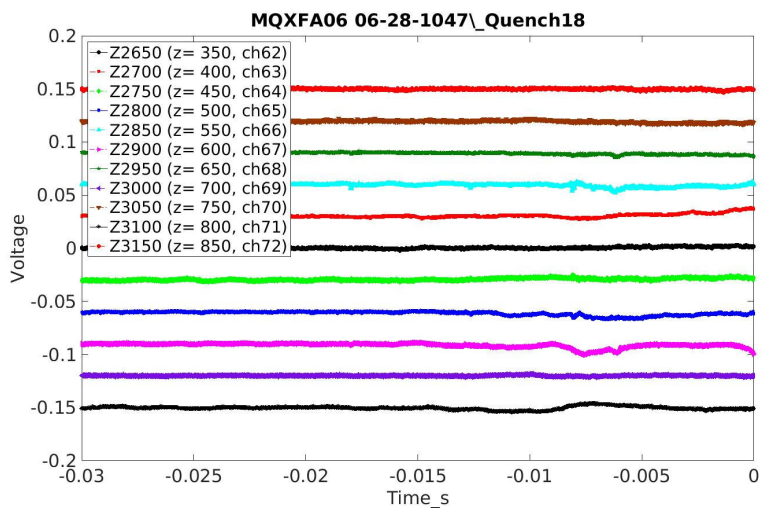
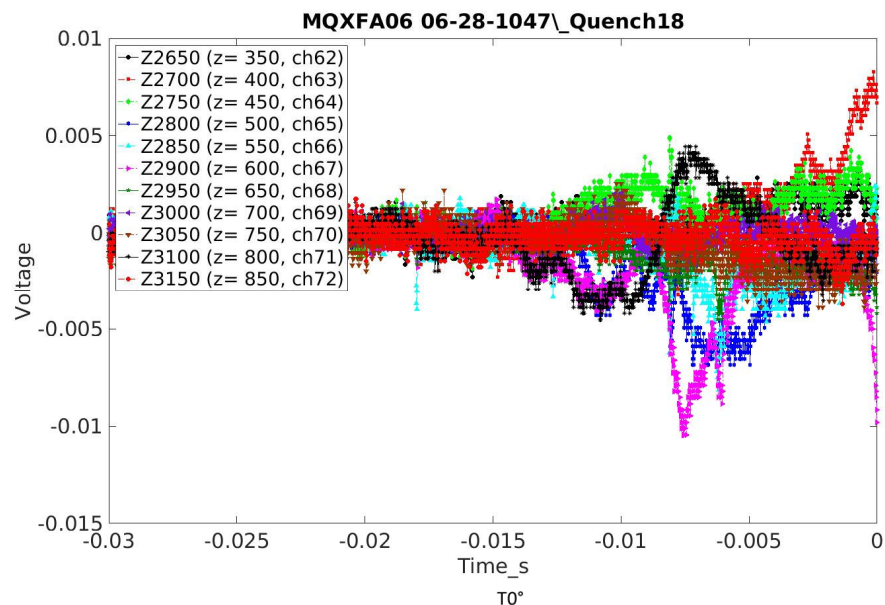
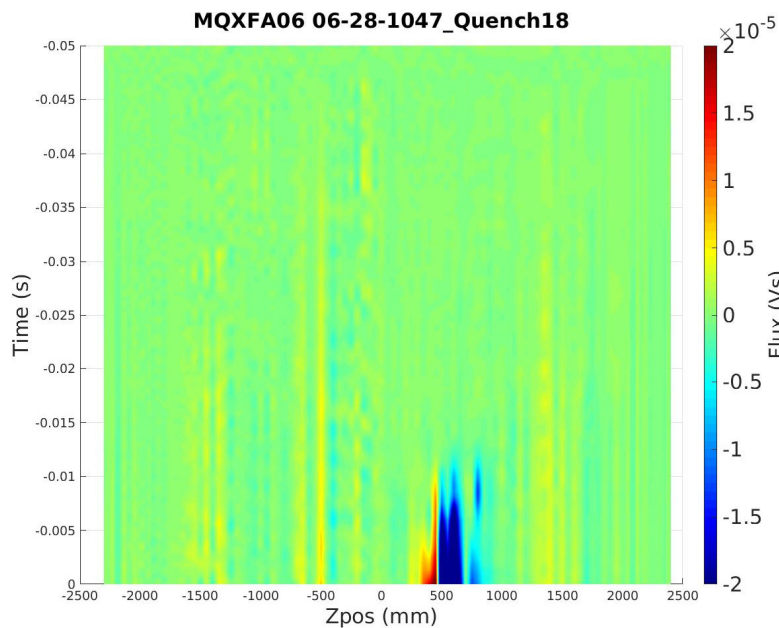
Q#17



17.  $I_q = 16275.21A$  Coil 211 (Q3) Inner Pole Turn T-SS



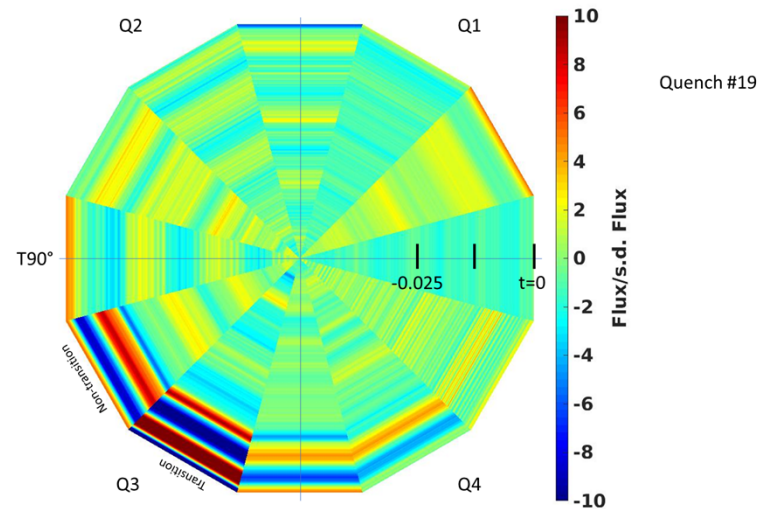
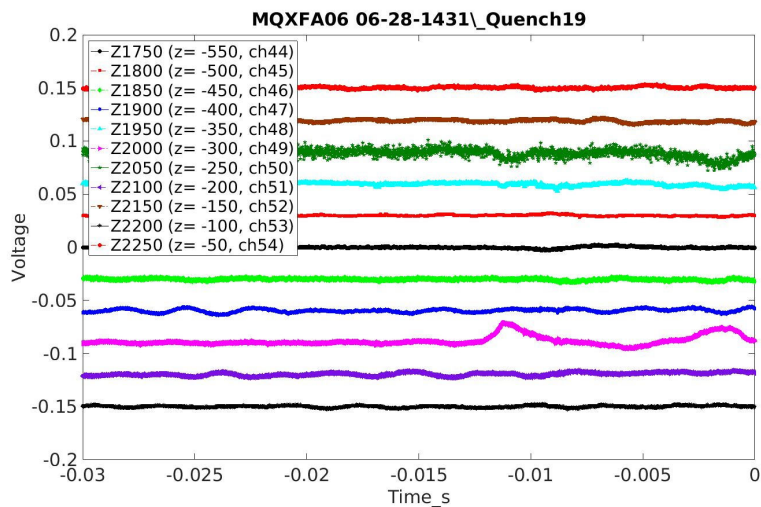
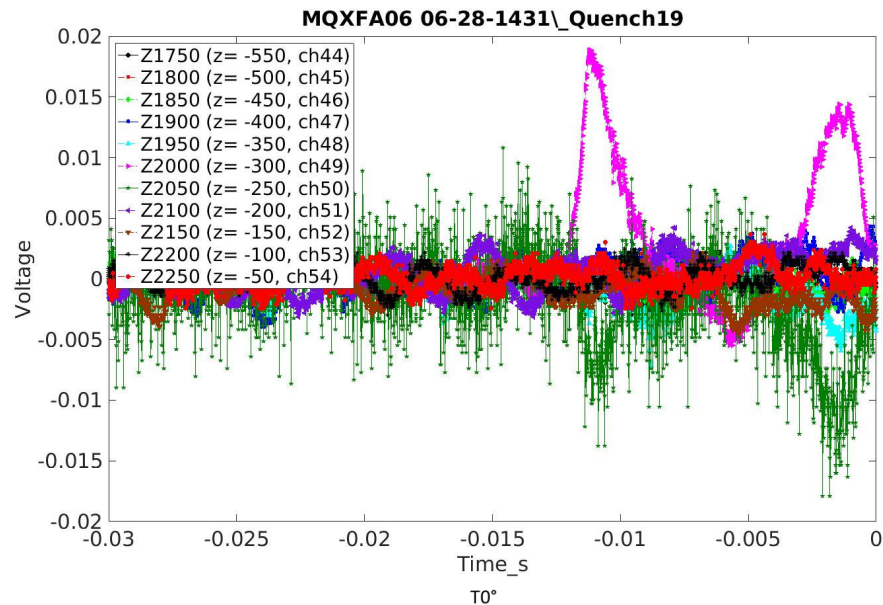
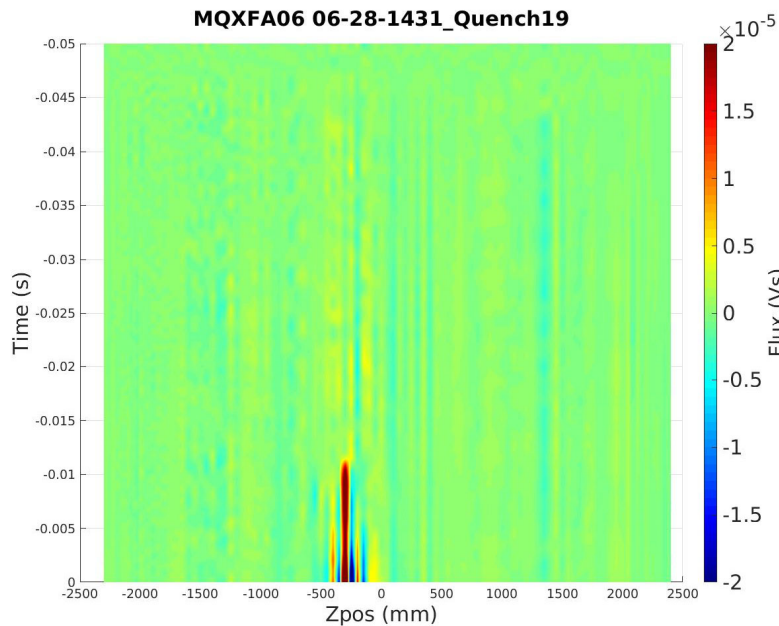
Q#18



18.  $I_q = 16323.63$  A Coil 122 (Q1) Inner Pole Turn T-SS+RE

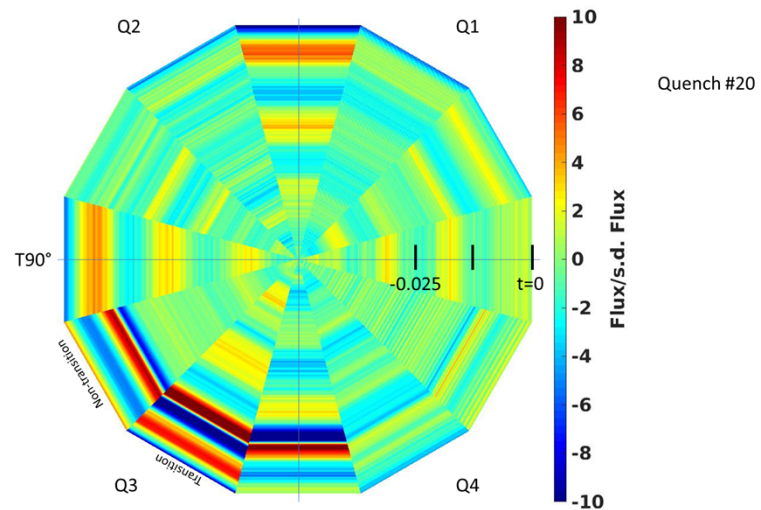
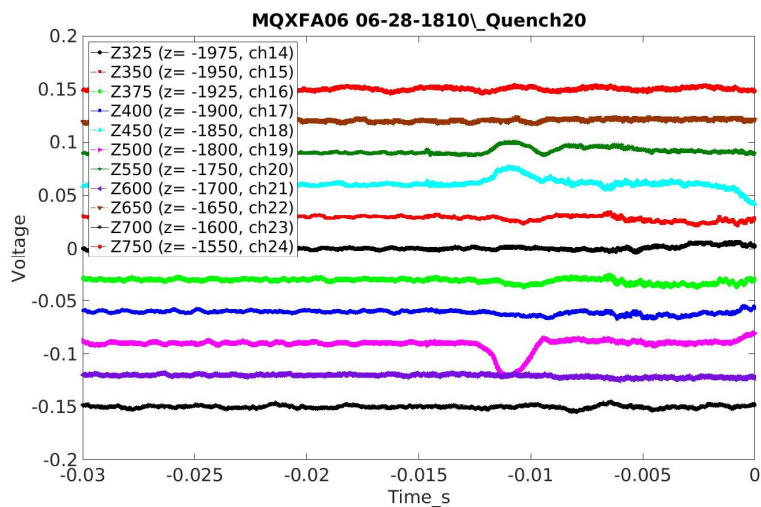
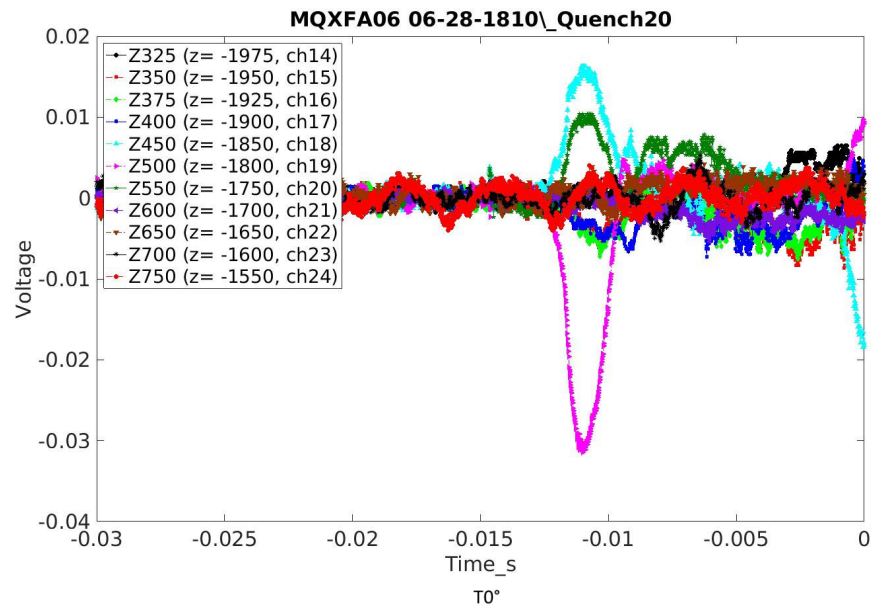
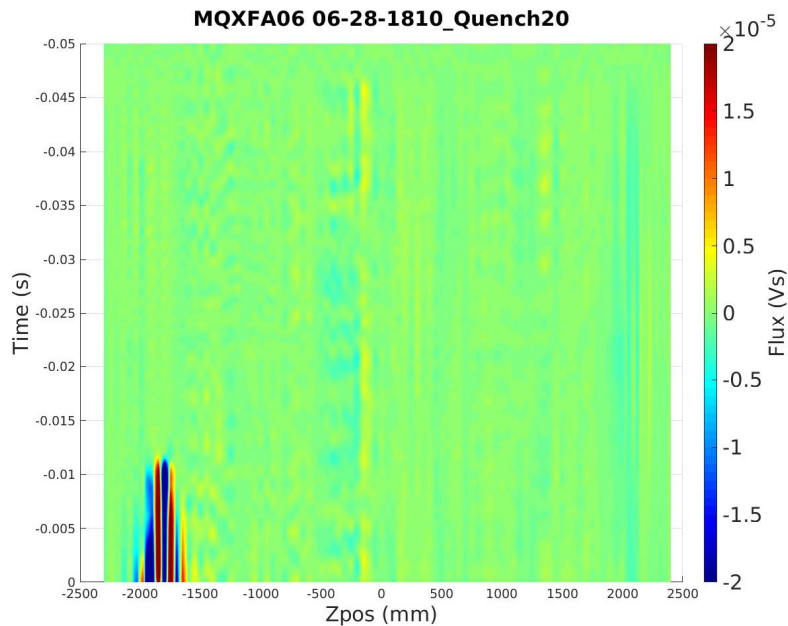


Q#19



19.  $I_q = 16339.68$  A Coil 211 (Q3) Inner Pole Turn NT-SS+LE

Q#20



20.  $I_q = 16457.56$  A Coil 211 (Q3) Inner Pole Turn NT-SS+LE

## Summary:

Quench antenna arrays located all quench in Z to within about 50mm, and in azimuth at least at the quadrant level.

Quenches in Q1 were all within +/- 200mm of Z position +500 mm.

Quenches in Q2 were within about +/- 200mm of Z = +1450 mm (except for the very first quench for the magnet at Z= -1150)

Quenches in Q3 were distributed throughout the magnet

Quenches in Q4 were within +/- 100mm of Z=-500 mm