



Magnetic Measurements on MCBXFBP2c

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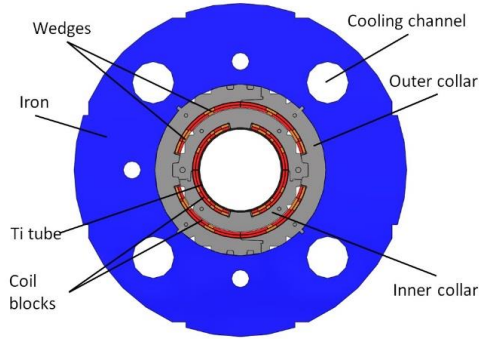


EDMSID: [2755934](#)

Outline

- Setup
- Measurement Cycles Overview
- Results
 - Standard Cycles
 - Diagonals and angles
 - Comparison to MCBXFB01
- Conclusions

Introduction



Vertical field from the inner coils:

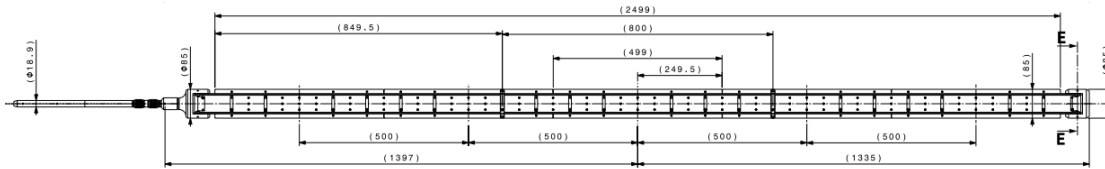
- main field B_1 (normal)

- first allowed b_3

Horizontal field from the outer coils:

- main field A_1 (skew)

- first allowed a_3

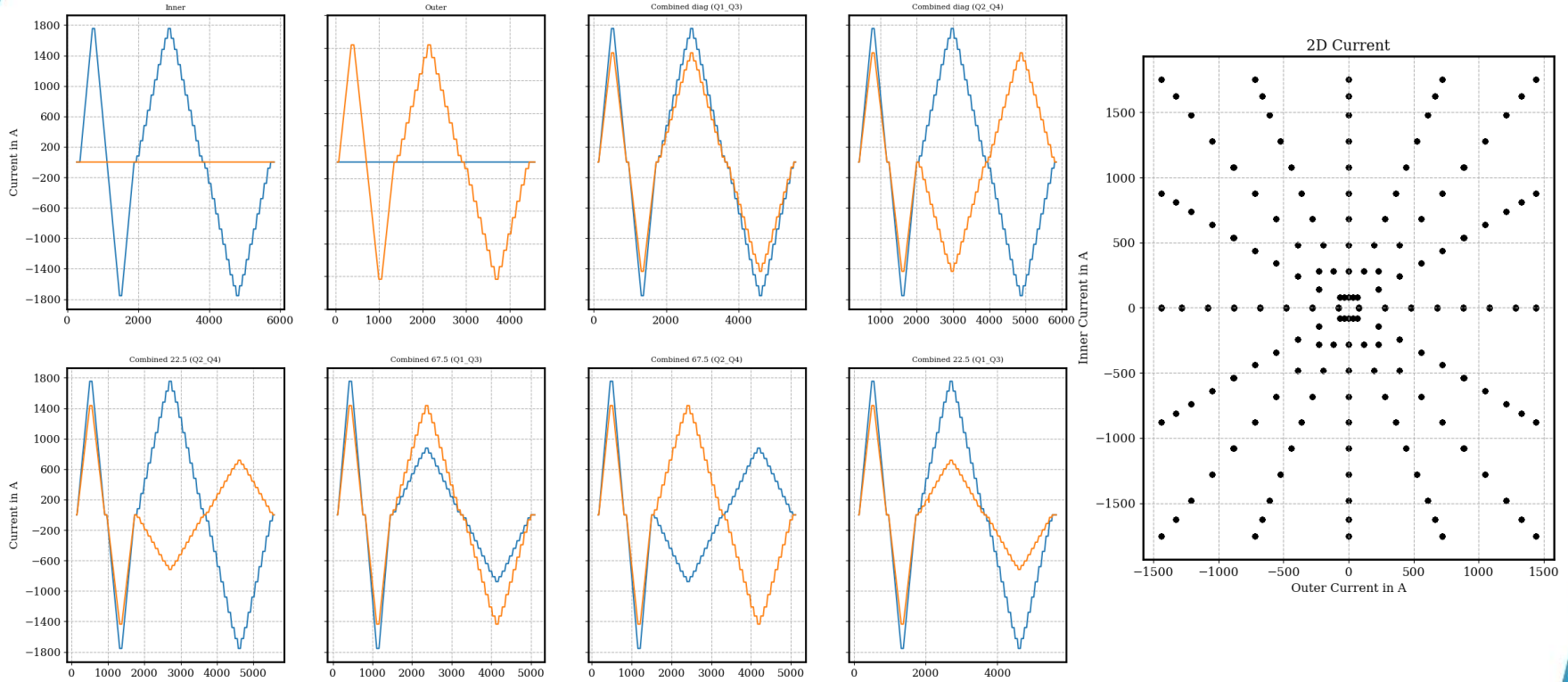


Rotating-coil in the helium bath of vertical cryostat ClusterD in SM18

- 5 segments (500 mm each, 2.5 m total)
- Centered around Segment 3

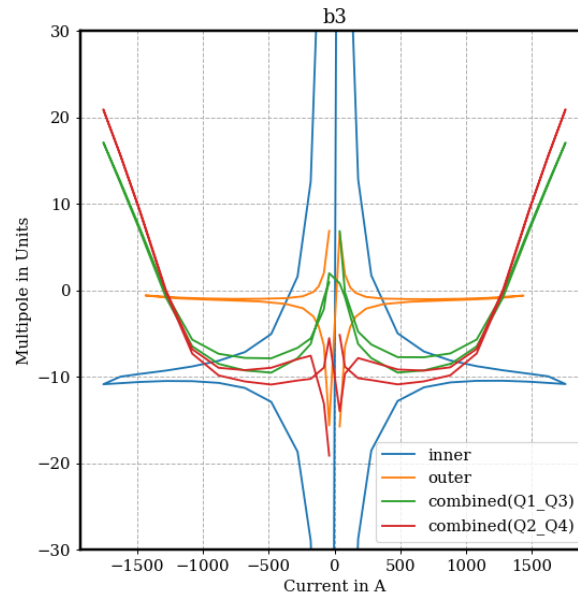
Reference radius 50 mm

Powering cycles



On Multipole Normalization

Normalize b_n on B field
Normalize a_n on A field



Standard Cycles

Integrated Field Strength

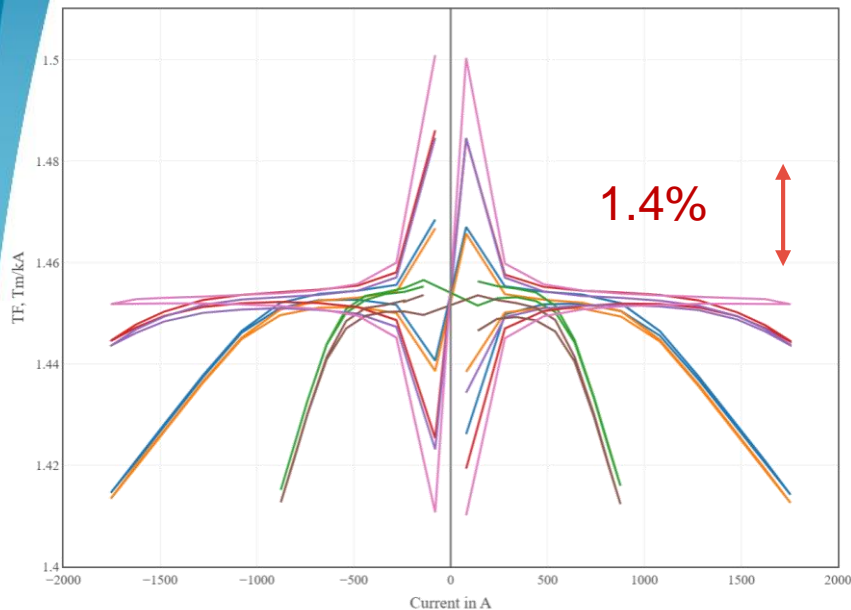
- Inner Plane at 1755 A
 - Individual Powering: 2.563 Tm
 - Combined Powering 45°: 2.495 Tm
 - Previous magnet MCBXFB01:
 - 2.569 Tm (individual)
 - 2.495 Tm (combined 45°)
- Outer Plane at 1435 A
 - Individual Powering: 2.563 Tm
 - Combined 45° Powering: 2.524 Tm
 - Previous magnet MCBXFB01:
 - 2.555 Tm (individual)
 - 2.506 Tm (combined 45°)

INNER
-20 Units
wrt. MCBXFB01

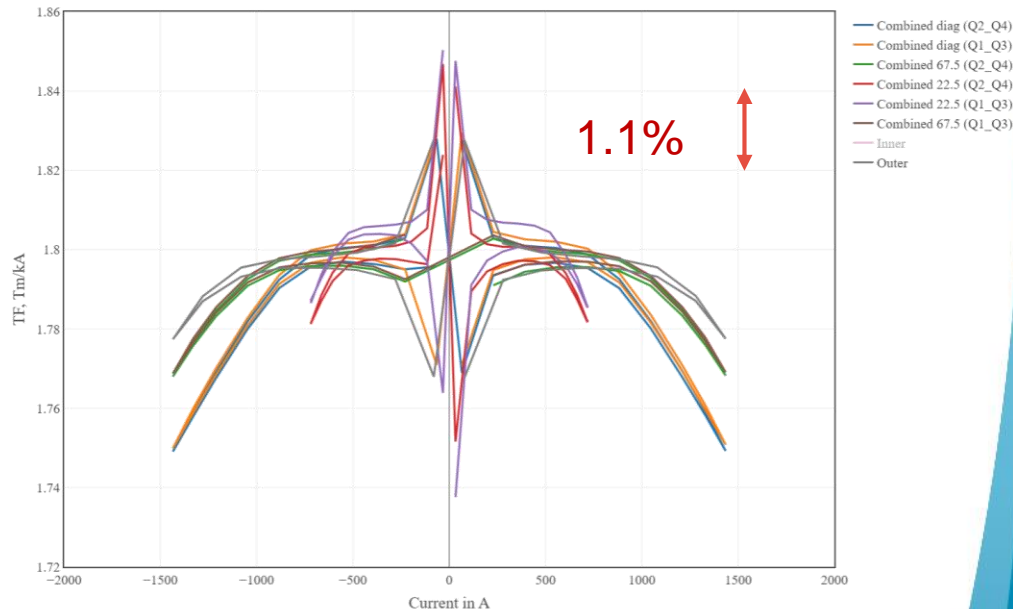
OUTER
+30 Units
wrt. MCBXFB01

Integral Transfer function

Normal Integral TF



Skew Integral TF



Individual powering:

Saturation on outer plane -1.0%

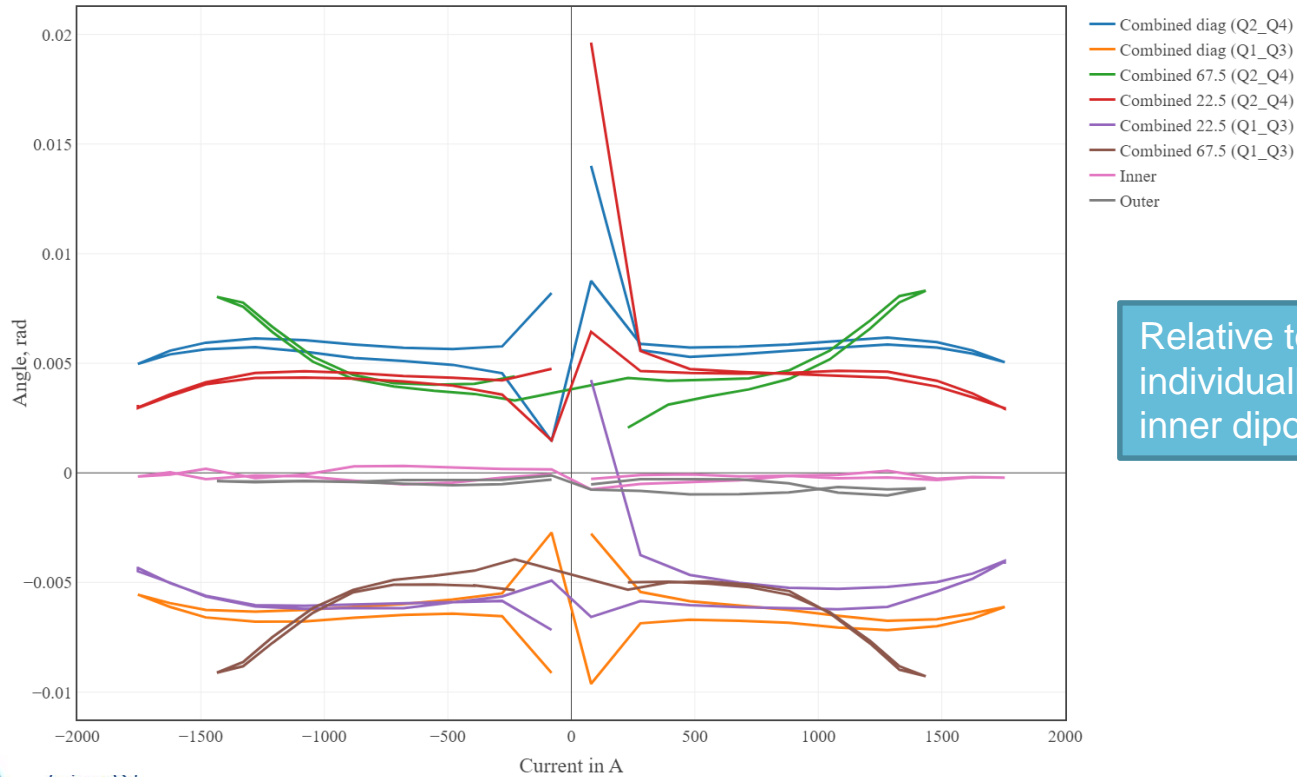
Combined 45°:

Saturation on inner plane -2.7%

Saturation on outer plane -2.8%

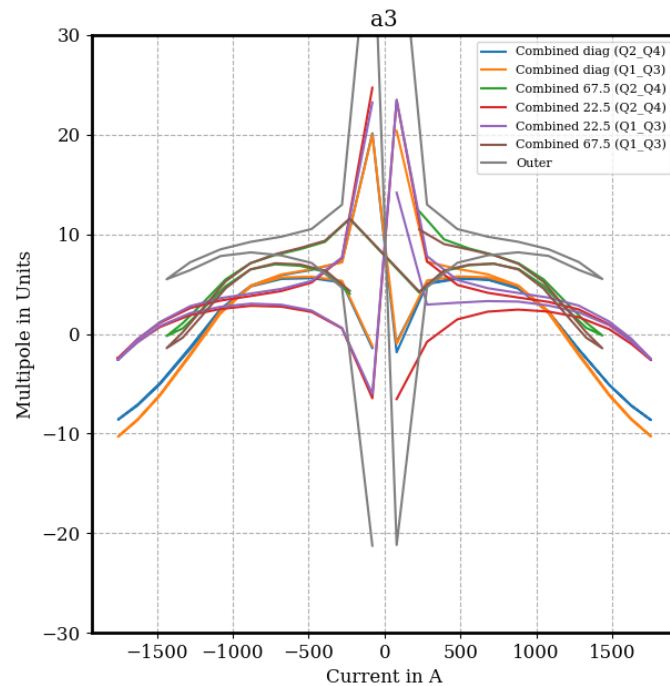
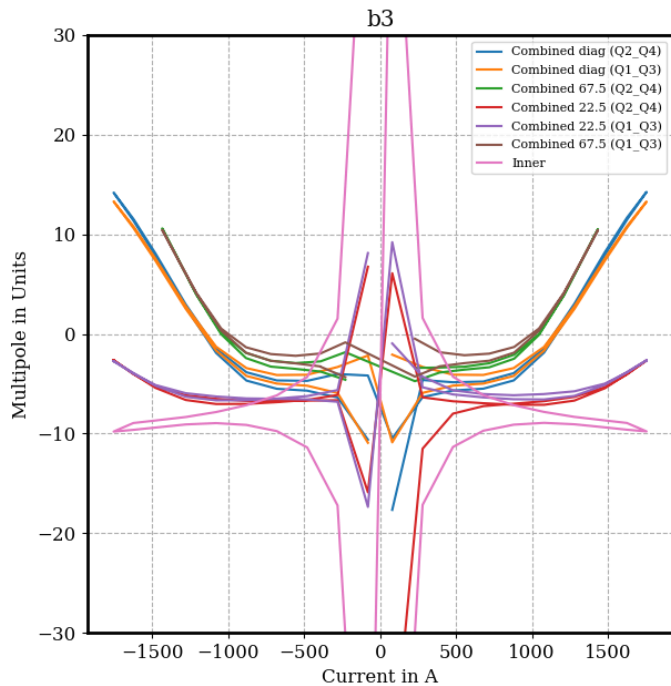
Integral Angle

Integral Angle



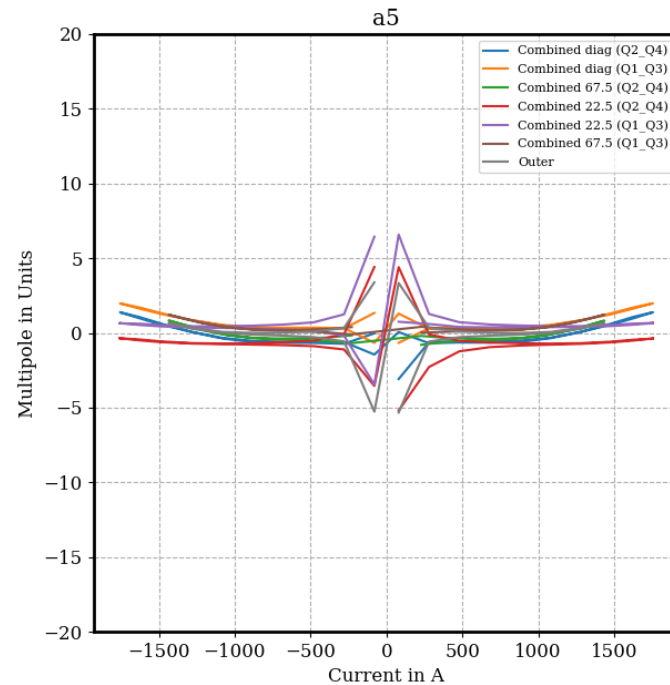
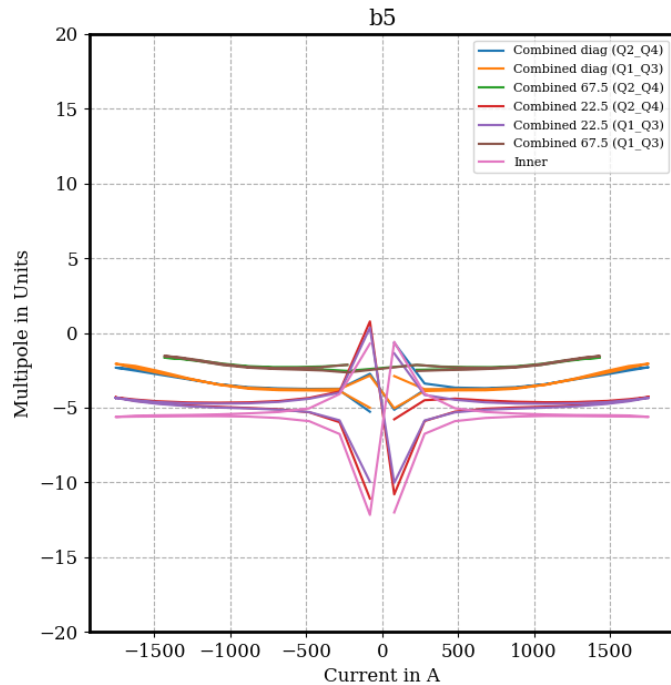
Relative to the individually powered inner dipole

Integral Multipoles b3 and a3



Requirement: +/- 20 units

Integral Multipoles b5 and a5



Requirement: +/- 7 units

Integral Field-quality table

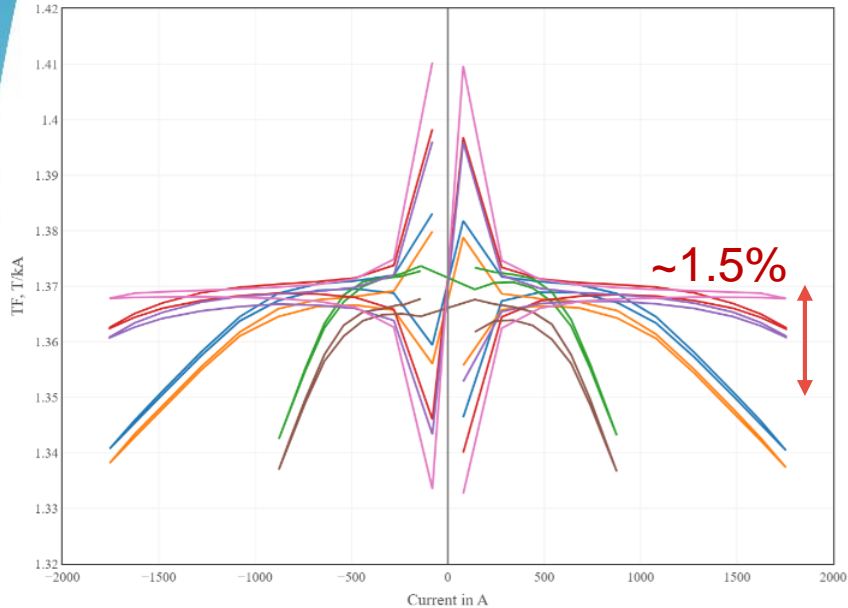
INNER at 1755A			INNER at 0A			INNER at 1755A			INNER at 1755A		
OUTER at 0A			OUTER at 1435A			OUTER at 1435A			OUTER at -1435A		
	Unit	Value		Unit	Value		Unit	Value		Unit	Value
Norm. TF	Tm/kA	-1.460	Norm. TF	Tm/kA	-	Norm. TF	Tm/kA	-1.421	Norm. TF	Tm/kA	-1.422
Norm. Int. Field	Tm	-2.563	Norm. Int. Field	Tm	0.002	Norm. Int. Field	Tm	-2.495	Norm. Int. Field	Tm	-2.497
Skew TF	Tm/kA	-	Skew TF	Tm/kA	1.787	Skew TF	Tm/kA	1.760	Skew TF	Tm/kA	1.758
Skew Int. Field	Tm	0.001	Skew Int. Field	Tm	2.563	Skew Int. Field	Tm	2.524	Skew Int. Field	Tm	-2.522
n	bn	an	n	bn	an	n	bn	an	n	bn	an
2	-0.84	0.27	2	-0.3	-0.19	2	0.44	-0.83	2	0.37	-0.92
3	-9.79	0.18	3	-0.22	5.52	3	13.28	-10.29	3	14.25	-8.65
4	-0.78	0.82	4	0.18	-0.1	4	-0.58	0.86	4	-0.46	-0.55
5	-5.62	0.6	5	-0.03	0.65	5	-2.06	1.98	5	-2.3	1.38
6	-0.53	0.88	6	0.11	-0.38	6	-0.53	0.45	6	-0.34	-1.14
7	-3.54	0.35	7	0.35	-2.43	7	-2.93	-1.72	7	-2.32	-2.25
8	0.23	-0.08	8	-0.13	-0.07	8	0.22	-0.09	8	0.09	0.09
9	-0.09	0.08	9	-0.43	-0.07	9	0.26	-0.01	9	-0.55	-0.09
10	0.48	-0.12	10	0.00	0.01	10	0.34	-0.11	10	0.39	0.17
11	1.60	-0.32	11	0.01	0.04	11	1.17	-0.35	11	1.23	0.22
12	-0.48	0.24	12	0.01	-0.01	12	-0.33	0.23	12	-0.36	-0.22
13	-1.53	0.35	13	0.01	0.00	13	-0.87	0.32	13	-0.95	-0.47
14	0.09	-0.04	14	0.04	-0.01	14	-0.03	0.08	14	0.10	0.07
15	0.05	-0.02	15	-0.01	-0.07	15	-0.17	-0.18	15	0.13	-0.01

Integral Field-quality table

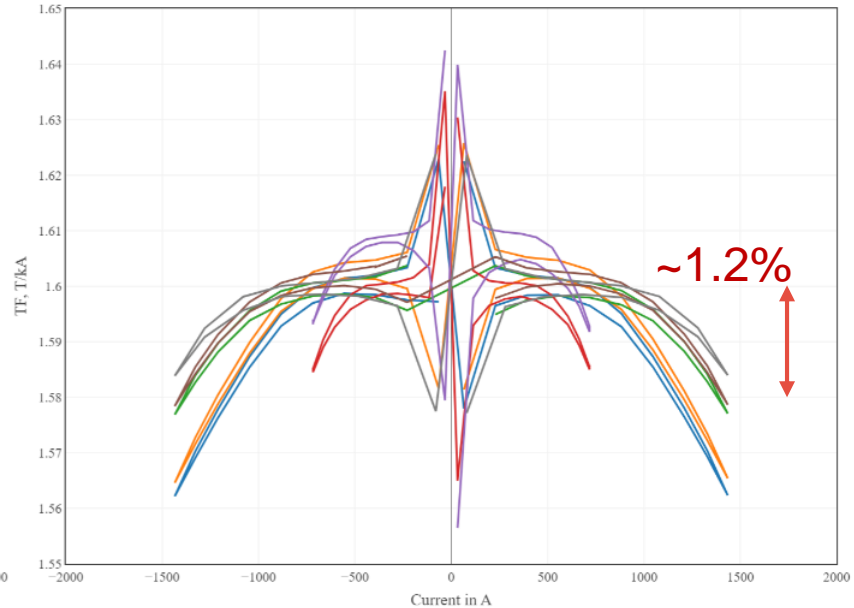
INNER at 1755A			INNER at 877A			INNER at -877A			INNER at 1755A		
OUTER at -717A			OUTER at 1435A			OUTER at 1435A			OUTER at 717A		
	Unit	Value		Unit	Value		Unit	Value		Unit	Value
Norm. TF	Tm/kA	-1.452	Norm. TF	Tm/kA	-1.420	Norm. TF	Tm/kA	-1.423	Norm. TF	Tm/kA	-1.452
Norm. Int. Field	Tm	-2.550	Norm. Int. Field	Tm	-1.246	Norm. Int. Field	Tm	1.249	Norm. Int. Field	Tm	-2.549
Skew TF	Tm/kA	1.792	Skew TF	Tm/kA	1.778	Skew TF	Tm/kA	1.777	Skew TF	Tm/kA	1.796
Skew Int. Field	Tm	-1.285	Skew Int. Field	Tm	2.551	Skew Int. Field	Tm	2.550	Skew Int. Field	Tm	1.288
n	bn	an	n	bn	an	n	bn	an	n	bn	an
2	-0.56	-0.61	2	0.50	-0.45	2	0.07	-0.49	2	-0.37	-0.08
3	-2.67	-2.61	3	10.43	-1.45	3	10.52	-0.16	3	-2.65	-2.52
4	-0.61	-0.87	4	-0.51	0.45	4	-0.24	-0.45	4	-0.78	0.78
5	-4.3	-0.38	5	-1.55	1.22	5	-1.66	0.82	5	-4.35	0.65
6	-0.42	-1.13	6	-0.37	0.15	6	-0.15	-0.83	6	-0.52	0.63
7	-2.99	-1.51	7	-1.96	-2.04	7	-1.29	-2.35	7	-3.28	-0.91
8	0.13	0.04	8	0.25	-0.12	8	0.02	0.01	8	0.28	-0.09
9	-0.33	-0.09	9	0.33	-0.01	9	-0.43	-0.11	9	0.12	0.03
10	0.44	0.17	10	0.21	-0.11	10	0.2	0.12	10	0.42	-0.06
11	1.47	0.36	11	0.73	-0.17	11	0.76	0.20	11	1.49	-0.23
12	-0.44	-0.26	12	-0.20	0.14	12	-0.21	-0.17	12	-0.50	0.16
13	-1.31	-0.45	13	-0.57	0.13	13	-0.57	-0.22	13	-1.32	0.22
14	0.08	0.02	14	0.03	0.06	14	0.07	-0.05	14	0.09	-0.01
15	0.06	0.01	15	-0.12	-0.03	15	-0.08	-0.05	15	0.10	0.05

Central Transfer function

Normal Central TF



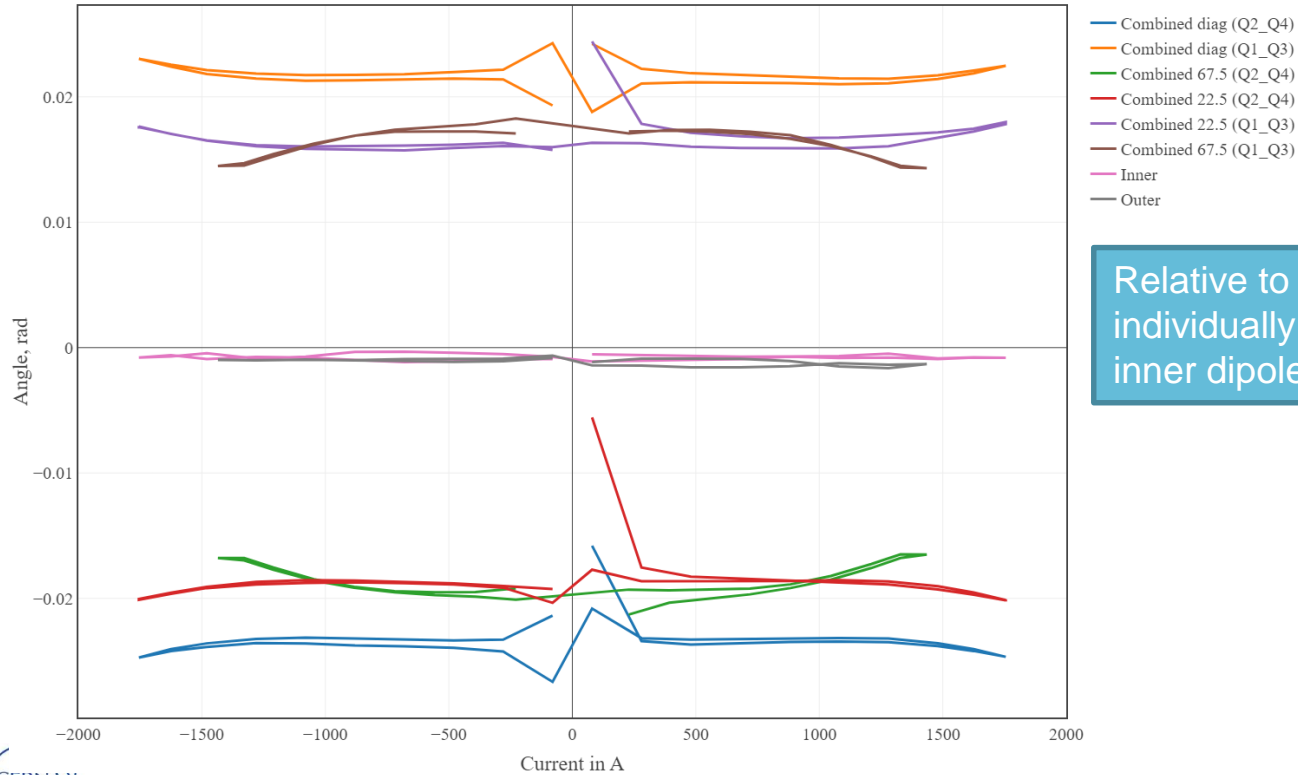
Skew Central TF



- Combined diag (Q2_Q4)
- Combined diag (Q1_Q3)
- Combined 67.5 (Q2_Q4)
- Combined 22.5 (Q2_Q4)
- Combined 22.5 (Q1_Q3)
- Combined 67.5 (Q1_Q3)
- Inner
- Outer

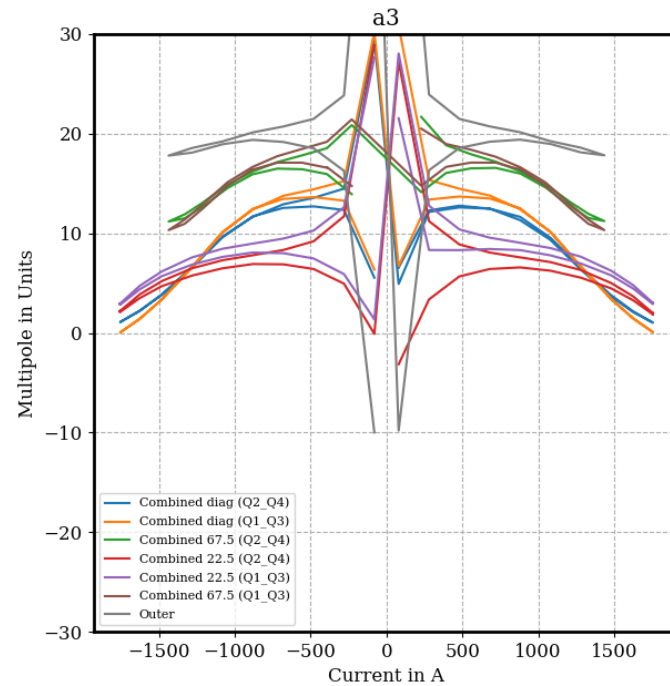
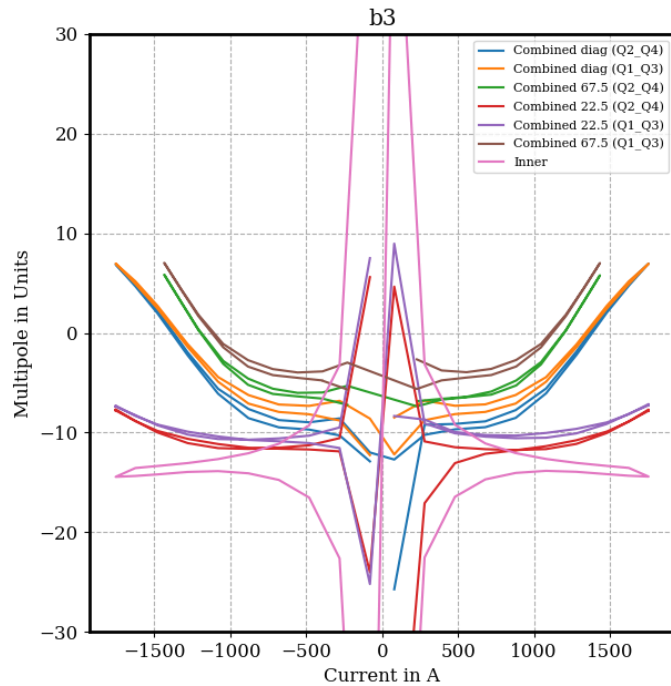
Central Angle

Central Angle

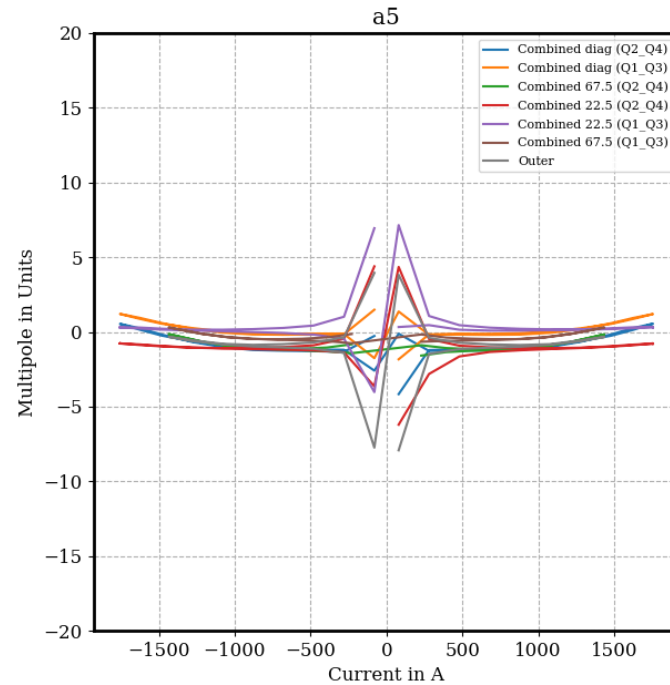
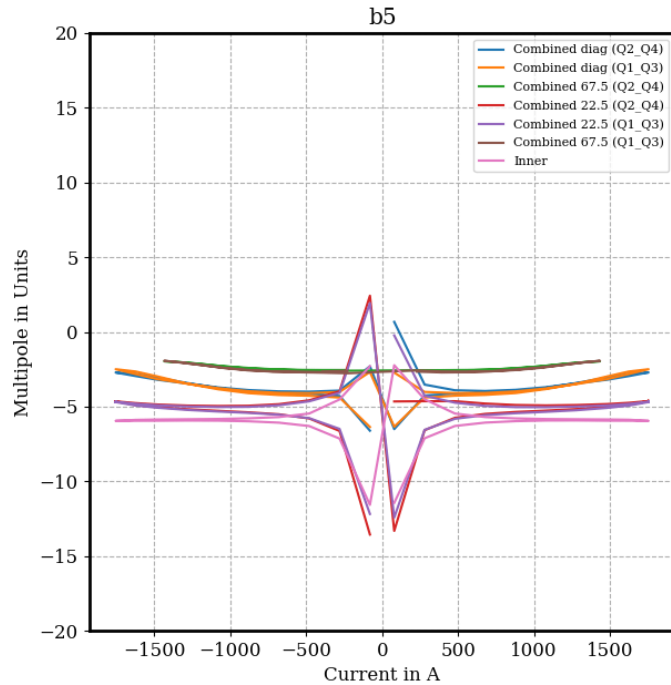


Relative to the individually powered inner dipole

Central Multipoles b3/a3



Central Multipoles b5/a5



Central Field-quality table

INNER at 1755A			INNER at 0A			INNER at 1755A			INNER at 1755A		
OUTER at 0A			OUTER at 1435A			OUTER at 1435A			OUTER at -1435A		
	Unit	Value		Unit	Value		Unit	Value		Unit	Value
Norm. TF	T/kA	-1.368	Norm. TF	T/kA	-	Norm. TF	-10 units with previous	-1.337	Norm. TF	T/kA	-1.340
Norm. Field	-5 units with previous	-2.402	Norm. Field	T	0.001	Norm. Field	T	-2.348	Norm. Field	T	-2.354
Skew TF	T/kA	-	Skew TF	-equal with previous	1.584	Skew TF	+20 units with previous	1.565	Skew TF	T/kA	1.562
Skew Field	T	0.001	Skew Field	T	2.272	Skew Field	T	2.245	Skew Field	T	-2.241
n	bn	an	n	bn	an	n	bn	an	n	bn	an
2	0.26	-1.83	2	0.35	1.85	2	0.67	-0.8	2	1.47	2.35
3	-14.43	0.73	3	-1	17.83	3	6.94	0.07	3	6.96	1.03
4	-0.7	0.41	4	0.13	-0.39	4	-0.49	0.25	4	-0.42	-0.39
5	-5.96	0.73	5	0.02	-0.34	5	-2.5	1.19	5	-2.71	0.55
6	-0.03	0.54	6	0.17	-0.47	6	-0.2	0.09	6	0.08	-0.83
7	0.4	-0.05	7	0.49	-3.22	7	-0.12	-2.4	7	0.62	-2.29
8	0.27	1.46	8	-0.17	-0.09	8	0.35	1.03	8	0.06	-1.14
9	0.19	0.22	9	-0.57	-0.12	9	0.7	0.06	9	-0.47	-0.27
10	0.69	-0.25	10	-0.02	0	10	0.49	-0.21	10	0.53	0.23
11	2.71	-0.7	11	-0.02	0.1	11	2	-0.5	11	2.09	0.55
12	-0.56	0.31	12	0.06	0.01	12	-0.44	0.21	12	-0.43	-0.29
13	-1.72	0.39	13	0.01	0.05	13	-1.11	0.35	13	-1.14	-0.41
14	0.16	-0.14	14	0.08	0.01	14	0.06	-0.05	14	0.12	0.07
15	0.18	-0.04	15	-0.01	-0.15	15	0.04	-0.19	15	0.13	0.04

Central Field-quality table

INNER at 1755A			INNER at 877A			INNER at -877A			INNER at 1755A		
OUTER at -717A			OUTER at 1435A			OUTER at 1435A			OUTER at 717A		
	Unit	Value		Unit	Value		Unit	Value		Unit	Value
Norm. TF	T/kA	-1.362	Norm. TF	T/kA	-1.337	Norm. TF	T/kA	-1.342	Norm. TF	T/kA	-1.361
Norm. Field	T	-2.393	Norm. Field	T	-1.173	Norm. Field	T	1.178	Norm. Field	T	-2.390
Skew TF	T/kA	1.585	Skew TF	T/kA	1.579	Skew TF	T/kA	1.577	Skew TF	T/kA	1.592
Skew Field	T	-1.137	Skew Field	T	2.264	Skew Field	T	2.262	Skew Field	T	1.142
n	bn	an	n	bn	an	n	bn	an	n	bn	an
2	0.77	2.27	2	0.32	0.42	2	1	2.44	2	0.26	-1.13
3	-7.79	1.94	3	7.01	10.32	3	5.78	11.23	3	-7.23	2.97
4	-0.55	-0.51	4	-0.43	-0.06	4	-0.25	-0.49	4	-0.64	0.17
5	-4.63	-0.78	5	-1.93	0.29	5	-1.97	-0.17	5	-4.69	0.32
6	0.05	-0.7	6	-0.2	-0.13	6	0.13	-0.7	6	-0.1	0.3
7	0.62	-1.28	7	-0.28	-2.88	7	0.63	-2.79	7	0.24	-1.38
8	0.12	-1.39	8	0.3	0.62	8	-0.02	-0.78	8	0.4	1.28
9	-0.15	-0.25	9	0.63	0.02	9	-0.48	-0.24	9	0.5	0.11
10	0.6	0.26	10	0.33	-0.14	10	0.31	0.15	10	0.68	-0.12
11	2.5	0.69	11	1.32	-0.24	11	1.27	0.42	11	2.51	-0.44
12	-0.48	-0.35	12	-0.33	0.17	12	-0.21	-0.17	12	-0.59	0.22
13	-1.46	-0.38	13	-0.73	0.22	13	-0.7	-0.23	13	-1.54	0.33
14	0.22	0.07	14	0.01	-0.02	14	0.1	0.02	14	0.06	-0.1
15	0.12	-0.02	15	-0.02	-0.18	15	0.03	-0.09	15	0.19	-0.08

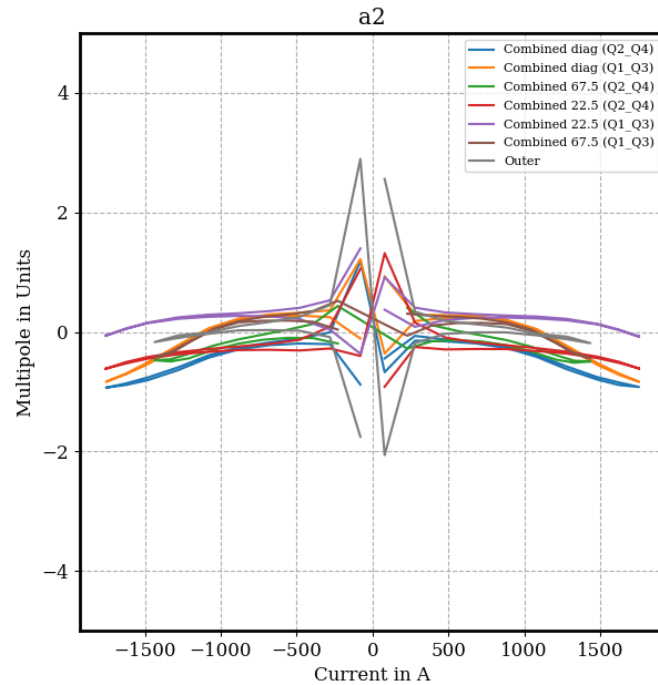
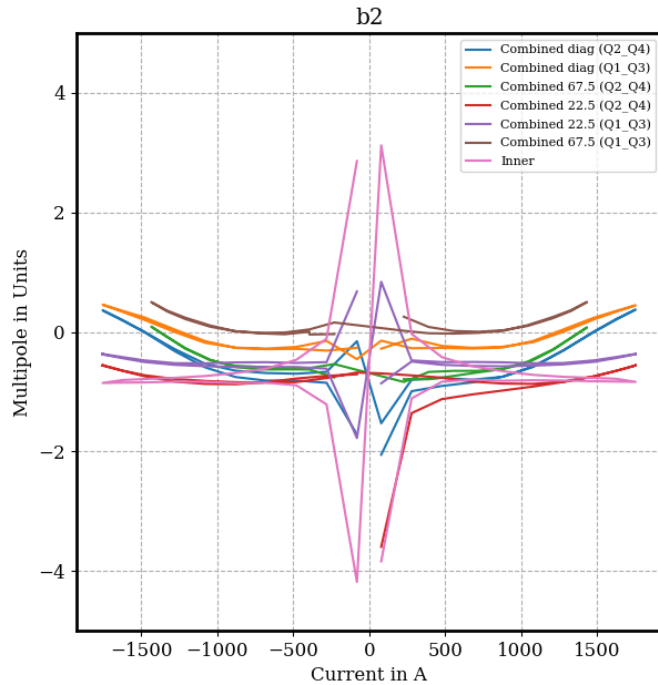
Conclusions

- Transfer function at nominal level
 - Individual powering
 - Inner plane: -2.563 Tm, Outer Plane: 2.563 Tm
 - Saturation on outer plane -1.0% with individual powering
 - Combined powering 45°
 - Inner plane: -2.495 Tm, Outer Plane: 2.524 Tm
 - Saturation: -2.7% on inner plane, -2.8% on outer plane
- Field quality at nominal level
 - Inner plane
 - b3 of -9.8 units (individual), 13.3 units (combined powering 45°)
 - b5 of -5.6 units (individual), -2.1 units (combined powering 45°)
 - Outer plane
 - a3 of 5.52 units (individual), -9.5 units (combined powering 45°)
 - a5 of 0.6 units (individual), 1.6 units (combined powering 45°)
- Field Quality and Transfer function for the other powering angles is comparable (usually better) to the individual and 45° combined powering
 - Measured values within magnet specification

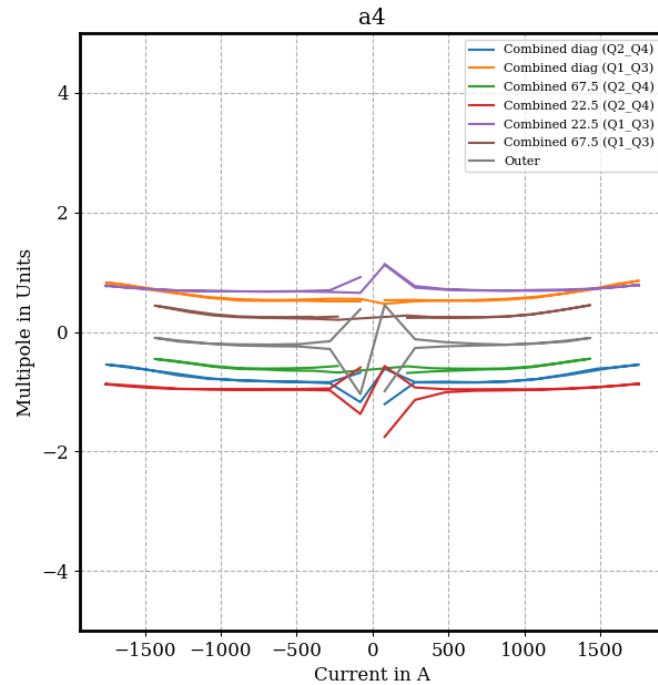
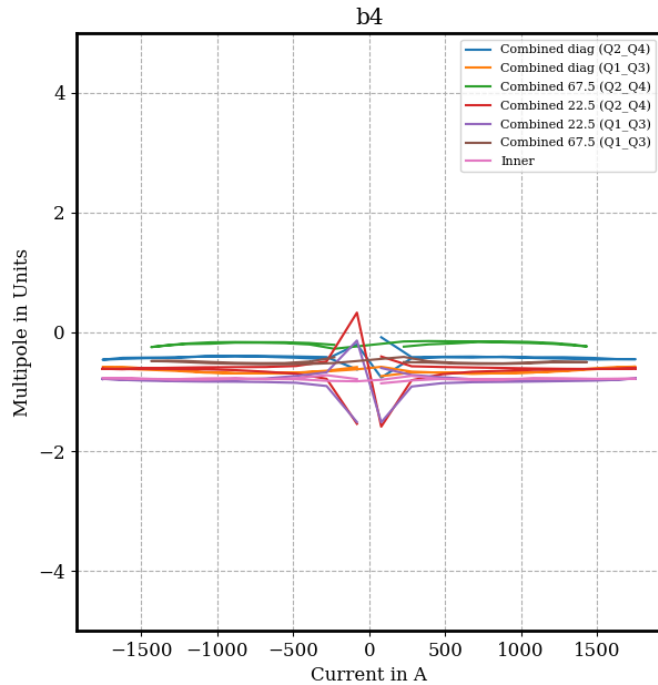
Additional slides



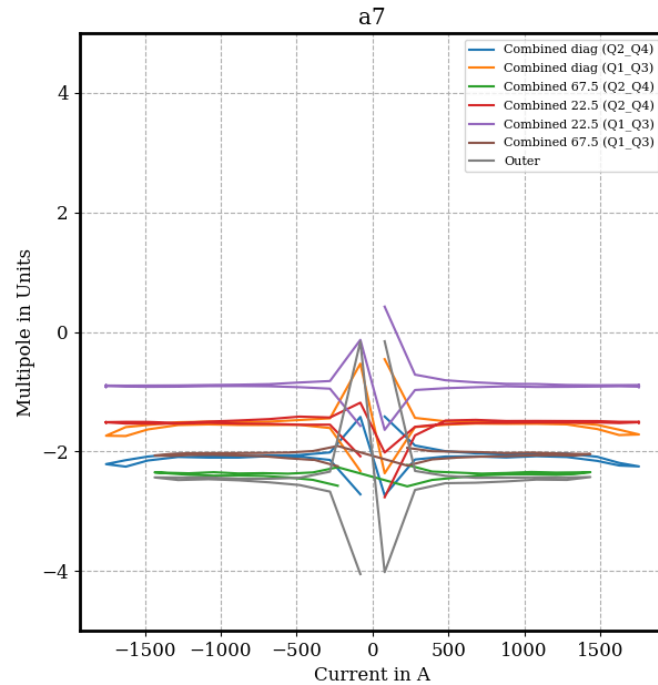
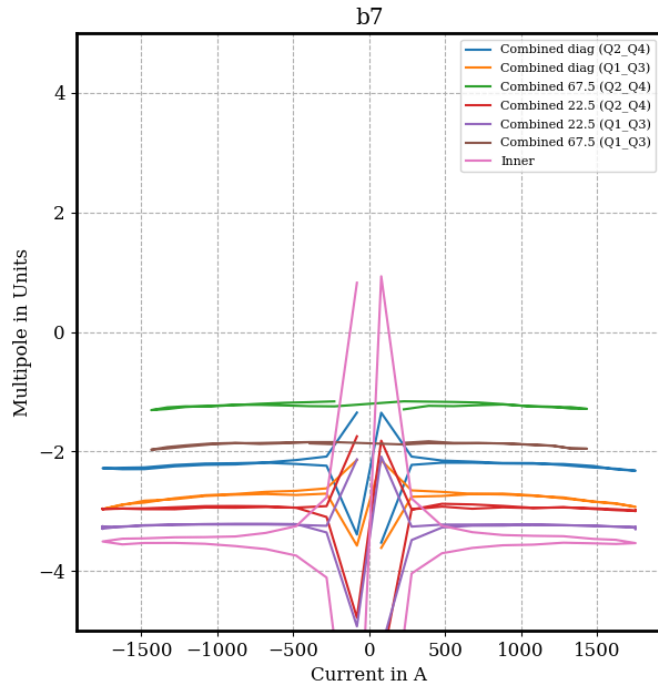
Integral Multipoles b2/a2



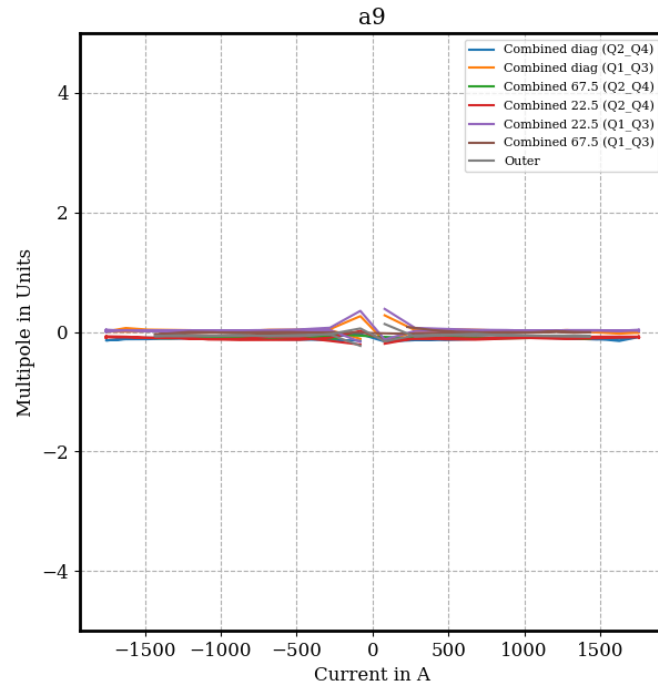
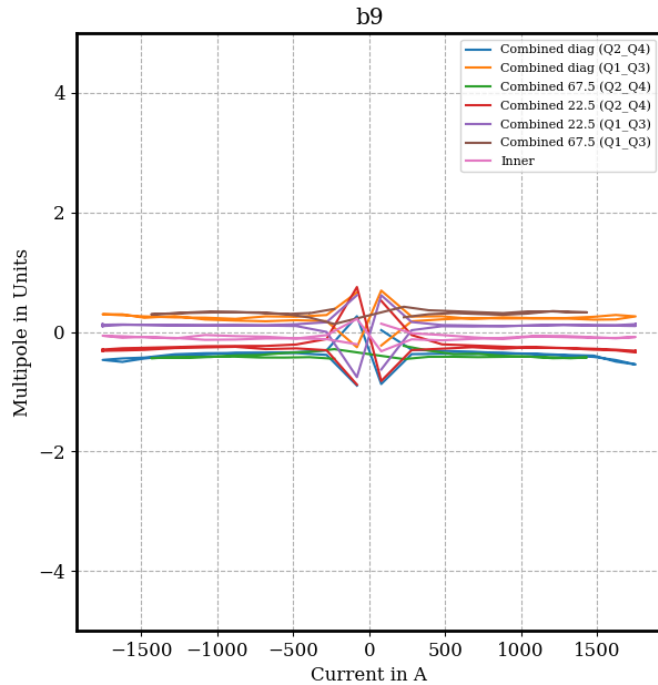
Integral Multipoles b4/a4



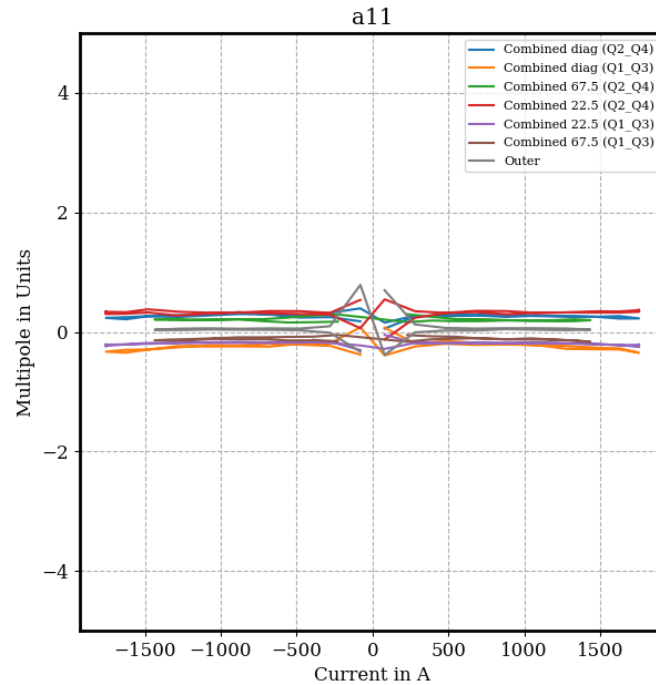
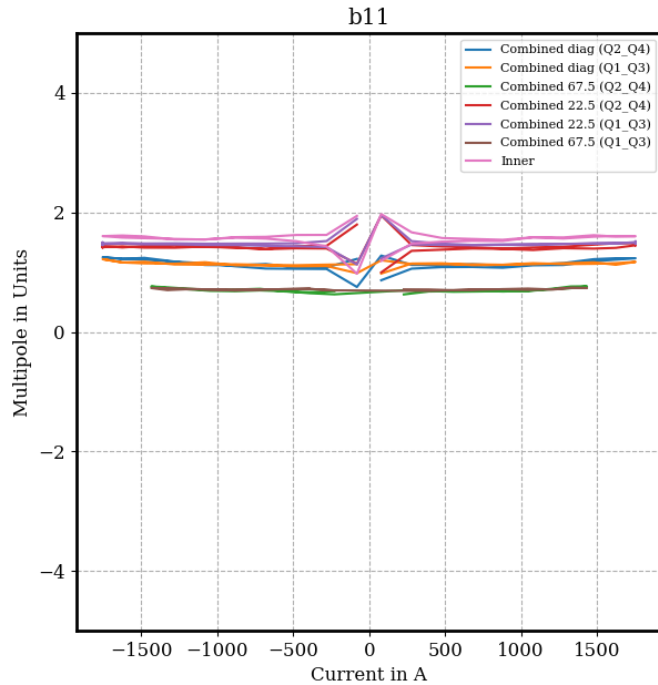
Integral Multipoles b7/a7



Integral Multipoles b9/a9



Integral Multipoles b11/a11



Integral Multipoles b13/a13

