Harmonics Measurements of DS0308 using the Mole

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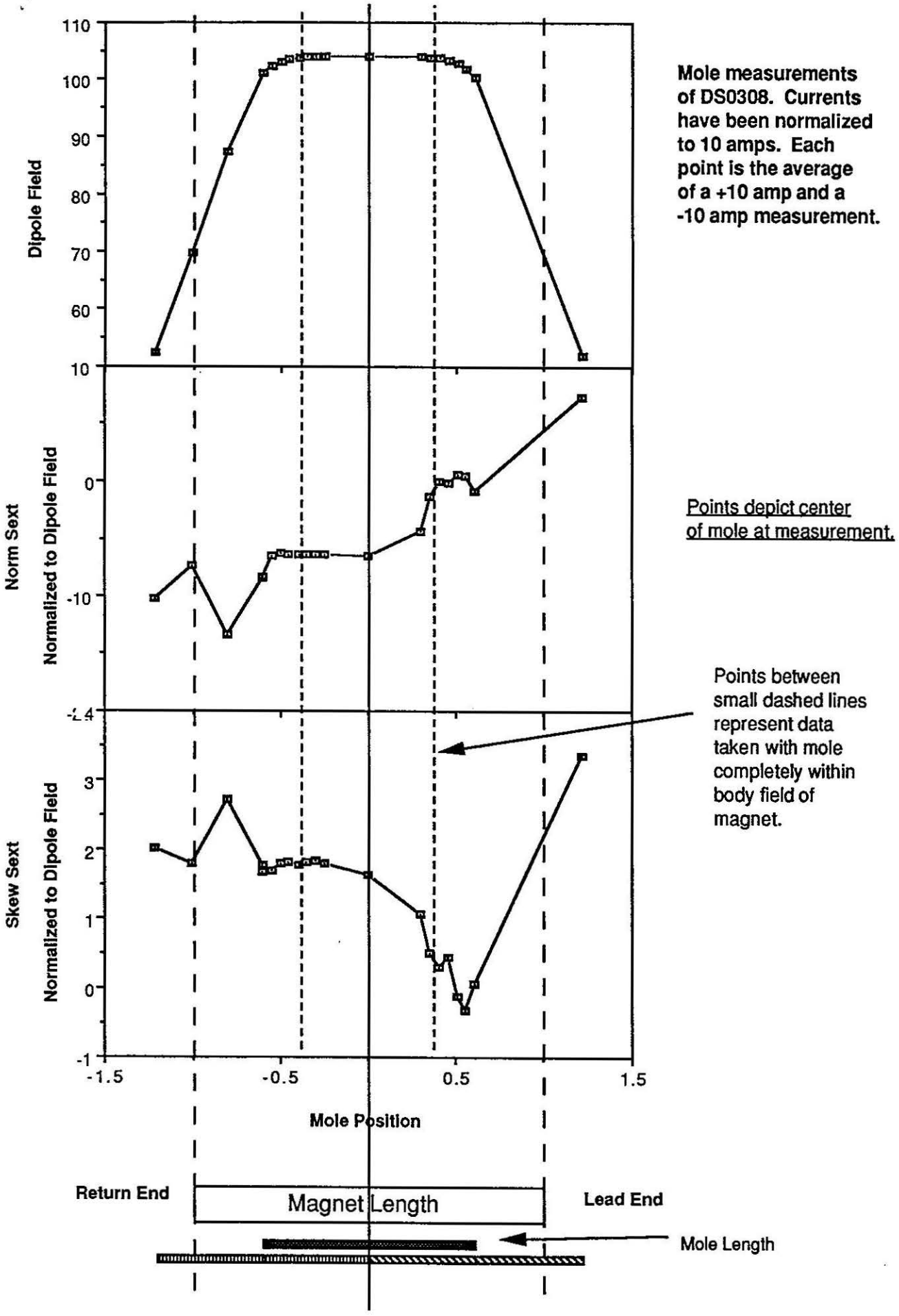
4/2/90

A series of harmonics measurements of DS0308 using the mole were made on 3/28 and 3/29/90. The magnetic length of DS0308 is one meter or 39.37" and the length of the mole is 24" so a body field measurement can be be which is free of distortion from end effects. The magnetic center of the DS0308 was obtained by measuring the fields in the end of the magnet, where they are linearly dropping off, as a function of mole position, and extrapolating to the center. A cloth tape attached to the mole is used to determine its position inside the magnet. In this reference frame the magnet center is at 6'11'. Two measurments were made at every position: one at +10 amps and one at -10 amps. The strength of the dipole field in the center of the magnet was 105 G. Since the sextupole field is uncontanminated by feed down from higher order harmonics, its value, normalized to the dipole field, can be immediately obtained from the online data aquisition and analysis program. The normal sextupole value was -6.555 and the skew sextupole value was 1.643 at the center of the magnet. A series of measurements were made near the ends of the magnet, by stepping the mole in 1 inch increments over a range of approximately 7 inches. This provided data covering a range in which about 4 inches of the mole was out of the body field to the mole being within the body field by about 3 inches. This data is shown in the the figure, where the position is in units scaled such that the magnetic length of DS0308 is 2 units. Note that the values for the normalized sextupole differ significantly at the lead end of the magnet. The reason for this is not understood. The raw data for the dipole, quadrupole and sextupoles can be found in the accompanying table.



Mole measurements of DS0308. Currents have been normalized to 10 amps. Each point is the average of a +10 amp and a -10 amp measurement.

Points depict center of mole at measurement.

Points between small dashed lines represent data taken with mole completely within body field of magnet.

Mole Harm Data

	A	B	C	D	E	F	G	H
1	Magnet Current	Magnet Position	Dipole Field	Norm Quad	Skew Quad	Norm Sext	Skew Sext	
2				Normalized to	Normalized to	Normalized to	Normalized to	
3				Dipole Field	Dipole Field	Dipole Field	Dipole Field	
4			C	b'	a'	b'	a'	
5	10.074	8.92	52.92	-3.977	-2.508	-10.752	1.022	
6	-10.079	8.92	52.9	-3.98	5.202	9.802	-3.038	
7	10.075	7.92	101.86	0.459	0.042	-8.235	1.824	
8	-10.075	7.92	101.86	-1.055	1.135	8.728	-1.756	
9	10.07	6.92	104.71	0.156	1.477	-6.335	1.605	
10	-10.072	6.92	104.78	-1.624	0.161	6.775	-1.681	
11	10.076	5.92	101.17	-1078	2.344	-0.751	0.086	
12	-10.081	5.92	101.235	0.234	-1.552	0.924	-0.048	
13	10.077	4.92	52.23	7.914	-3.465	6.505	3.832	
14	-10.08	4.92	52.33	-7.578	0.431	-8.336	-2.939	
15	10.077	6	102.61	0.803	1.382	0.55	-0.244	
16	-10.081	6	102.65	-0.525	-0.218	-0.465	0.382	
17	10.076	6.08	103.5	-0.264	0.818	0.676	-0.062	
18	-10.08	6.08	103.47	-0.995	-0.005	-0.519	0.176	
19	10.081	6.17	104	-0.149	1.433	-0.02	0.475	
20	-10.076	6.17	104.03	-1.27	0.045	0.168	-0.441	
21	10.077	6.25	104.41	-0.293	0.967	0.017	0.322	
22	-10.078	6.25	104.44	-1.559	0.325	-0.05	-0.295	
23	10.075	6.33	104.605	-0.155	1.143	-1.265	0.55	
24	-10.076	6.33	104.65	-1.914	0.115	1.437	-0.485	
25	10.075	6.42	104.71	0.166	2.105	-4.295	1.056	
26	-10.076	6.42	104.76	-2.066	0.153	4.538	-1.088	
27	10.064	7.92	101.79	0.148	0.267	-8.163	1.645	
28	-10.072	7.92	101.79	-0.783	1.405	8.671	-1.71	
29	10.061	7.83	102.94	0.329	0.771	-6.229	1.671	
30	-10.07	7.83	103.01	-0.911	1.043	6.791	-1.716	
31	10.066	7.75	103.71	0.3	1.251	-6.043	1.815	
32	-10.078	7.75	103.75	-0.798	-0.117	6.586	-1.781	
33	10.065	7.67	104.23	0.37	1.374	-6.251	1.823	

	A	B	C	D	E	F	G	H
34	-10.074	7.67	104.28	-1.137	-0.127	6.63	-1.822	
35	10.068	7.58	104.5	0.595	1.588	-6.172	1.734	
36	-10.065	7.58	104.56	-0.983	-0.107	6.634	-1.84	
37	10.064	7.5	104.65	0.657	2.352	-6.184	1.82	
38	-10.073	7.5	104.72	-1.082	-0.538	6.607	-1.816	
39	10.069	7.42	104.72	0.856	1.796	-6.317	1.82	
40	-10.079	7.42	104.73	-1.265	-0.259	6.47	-1.873	
41	10.067	7.33	104.73	0.899	1.791	-6.206	1.814	
42	-10.074	7.33	104.73	-1.034	0.108	6.625	-1.791	
43	10.067	8.58	70.33	-2.122	-0.259	-7.527	1.29	
44	-10.079	8.58	70.32	-3.272	4.68	7.323	-2.329	
45	10.07	8.25	87.94	0.493	-0.746	-13.249	2.722	
46	-10.073	8.25	88.02	-1.86	2.403	13.714	-2.748	

	I	J	K	L	M	N
1	MOLE pos. as fract	Dipole Field Ave	{Field(cur) - Field(-cur)}/2			
2	of mag length	over + and - current	Normalized to 10 Amps			
3	Center of magnet	Normalized to 10 amps				
4	is 0 position		Norm Sext (b')	Skew Sext (a')		
5	-1.2192	52.50831711	-10.1990954	2.014340335		
6						
7	-0.6096	101.101737	-8.418362283	1.776674938		
8						
9	0	104.006551	-6.508765981	1.631413209		
10						
11	0.6096	100.4142463	-0.830955594	0.066482827		
12						
13	1.2192	51.8727923	7.362567752	3.359196833		
14						
15	0.560832	101.825578	0.503530562	-0.310533109		
16						
17	0.512064	102.6840713	0.592891052	-0.118067764		
18						
19	0.4572	103.204852	-0.093286066	0.454428547		
20						
21	0.408432	103.6219296	0.033241559	0.306128177		
22						
23	0.359664	103.8434809	-1.340872151	0.513623755		
24						
25	0.3048	103.9501752	-4.383399317	1.063966263		
26						
27	-0.6096	101.1025189	-8.360052061	1.666157482		
28						
29	-0.554736	102.3049078	-6.467513461	1.6824701		
30						
31	-0.505968	102.9885076	-6.269202249	1.78515763		
32						
33	-0.4572	103.5354384	-6.395964646	1.809921632		

	I	J	K	L	M	N
34						
35	-0.402336	103.8394743	-6.360735671	1.775202838		
36						
37	-0.353568	103.9727916	-6.351896261	1.805632673		
38						
39	-0.3048	103.9557508	-6.34649951	1.832923667		
40						
41	-0.249936	103.996835	-6.370515827	1.789885522		
42						
43	-1.011936	69.81537569	-7.371253242	1.796079818		
44						
45	-0.810768	87.35540485	-13.38575751	2.715581715		
46						