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LAWRENCE BERKELEY LABORATORY - UNIVERSITY OF CALIFORNIA
ENGINEERING NOTE

CODE	SERIAL	PAGE
MME Book No. 631	MT-293 TPC-LBL-81-3	1 of 54

AUTHOR	DEPARTMENT	LOCATION	DATE
M.I. Green D.H. Nelson	Electronics Engineering Magnetic Measurements Engr.	LBL	January 16, 1981

PROGRAM — PROJECT — JOB

TITLE

Time Projection Chamber (TPC) Solenoid Fault Location, Magnetic Studies

INTRODUCTION

On September 30, 1980, Phillipe Eberhard requested the assistance of Magnetic Measurements Engineering in locating faults in the Time Projection Chamber (TPC) solenoid with the aid of sensitive, magnetic-field detecting probes. This note reports on magnetic field maps that aided in localizing solenoid shorts and discontinuities. In addition, ten washers used in mounting the LN_2 transfer tube were found to be highly magnetic.

TPC SOLENOID AND FAULT DESCRIPTIONS

Figure 1A is a schematic representation of the TPC solenoid. The solenoid consists of three concentric coils. The inner coil is ultrapure aluminum (UPA) and the outer two coils are superconducting (SC) coils connected electrically in series (point C).

Suspected faults were: 1) a low resistance short to ground from the UPA coil, 2) a low resistance short between the inner SC coil and the UPA coil, and 3) a high resistance area in the inner SC coil.

SELECTION OF MEASUREMENTS SYSTEM

The preliminary test plan was to energize (at low current values) various combinations of the three coils and to measure resultant magnetic fields with a hand held probe. We found this procedure time consuming, and mechanical instabilities introduced significant scatter in the data.

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Magnetic Measurements Engineering (MME) recently implemented a "Data Logger" system, utilizing a Tektronix 4051 mini-computer as the controller. This system monitors, records and plots magnetic-field measurements in real time. Very slight program changes allowed the MME Data Logger to be used for the TPC Fault Search Program. A simple mechanical aid was devised to position and to locate the Hall probe.

INSTRUMENTATION

Figure 1B is a schematic diagram of the instrumentation used and Table 1 lists the specific equipment. Figure 2 describes the frame of reference and the means of positioning the Hall probe.

RESULTS

Table 2 is an index of the data runs made. This report tabulates only the data saved on tape files. These tape files are available for further data analysis and plotting.

Shorted turns between adjacent windings of the UPA coil are evident in Figures 4A and 4B in the vicinity of x = 9 cm. Variations of UPA coil winding density are noticeable in Figures 4A, 4C and 4D at x-positions of 150, 170 and 318 cm.

A short to ground from the UPA coil in the vicinity of x = 8 cm is evident in the data plots of Figures 7 and 8.

The data of Figure 14 indicates a short to ground from the SC coil in the vicinity of x = 10 cm.

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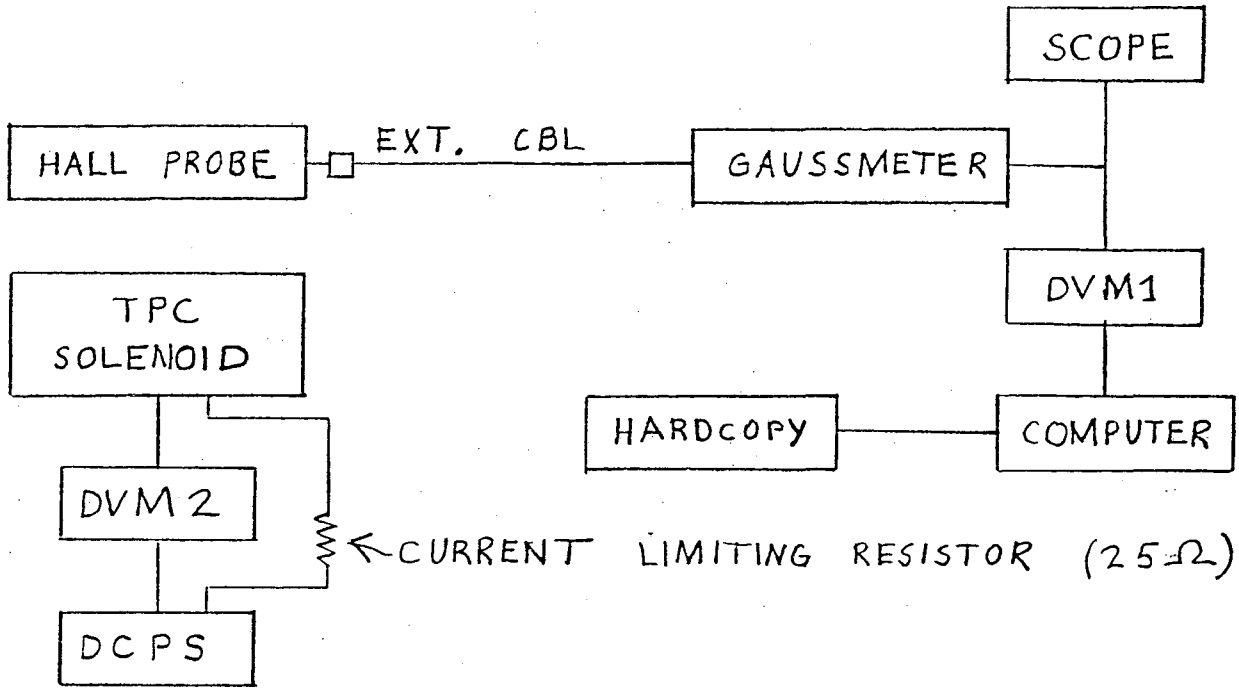

FIGURE 1B SCHEMATIC OF INSTRUMENTAITON

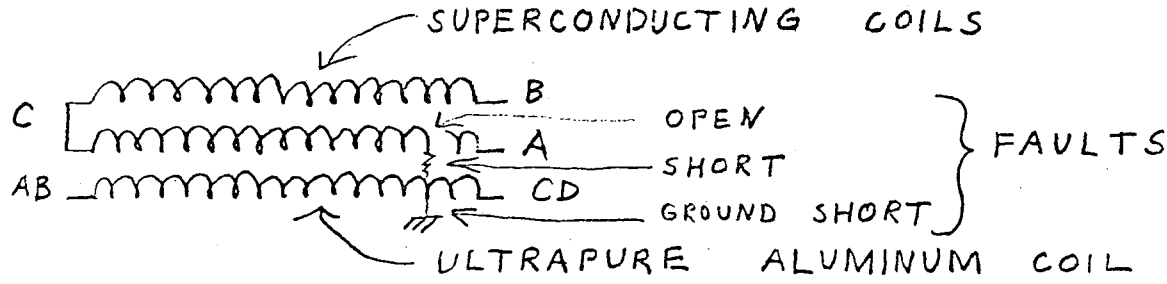

FIGURE 1A SCHEMATIC OF THE TPC SOLENOID INDICATING FAULTS.
THE "OPEN" FAULT WAS DISCOVERED DURING OUR INITIAL TESTS.

Hall Probe	F.W. Bell Axial Hall Probe Model HAB8-2508 S/N 107786 Cal = 0.7424 Used Cal = 7.424 x 1.0026 = 7.443
Ext. Cable	F.W. Bell Model XOVO-0025 S/N 139565
Gaussmeter	F.W. Bell Model 810 HR S/N 101199 ERDA 504143
	F.W. Bell Model 8860 S/N 99627
10/6/80 18:00	Gaussmeter changed to: F.W. Bell Model 810 R3 Channel 1 DOE 517835
DVM 1	Hewlett Packard Model 3455A S/N 1622A08417 DOE 517459
Scope	NLS Model MS-215 S/N 1973
Computer	Tektronix 4051 S/N B051568 ERDA 504556
Hardcopy	Tektronix 4631 S/N B094611 ERDA 504505
DCPS	Power Designs Inc. Model 5015 Transistorized Power Supply
DVM 2	Data Precision Model 258 S/N 4457

TABLE 1 INSTRUMENTATION LIST

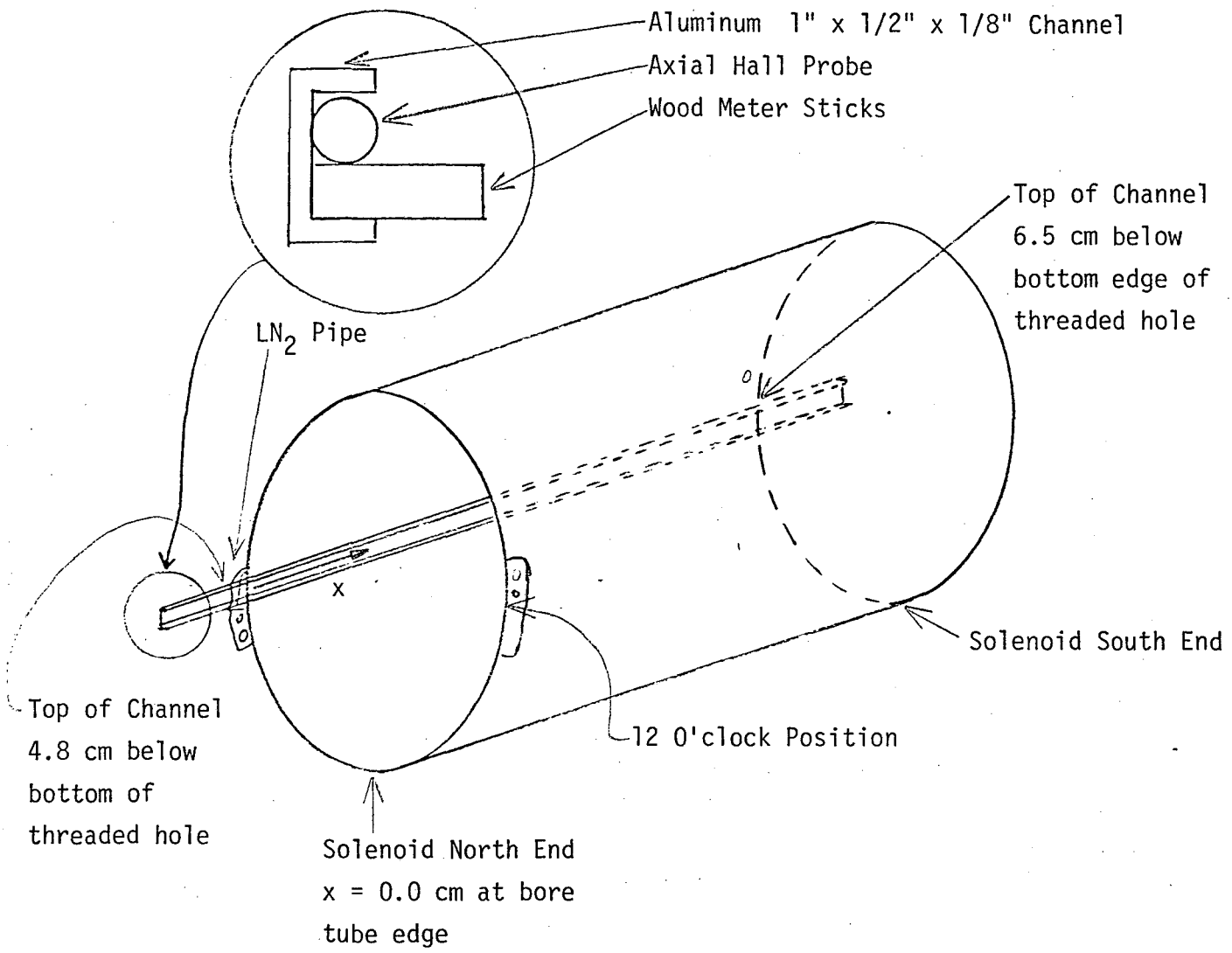

FIGURE 2 FRAME OF REFERENCE AND PROBE LOCATION. CHANNEL LOCATED AT THE 6 O'CLOCK POSITION.

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DISCUSSION

Short term fluctuations/drift (± tens of milligausses) were observed during the measurements. Replacing the Gaussmeter (on October 6, 1980 at 18:00 hours) did not significantly reduce the fluctuations/drift. Because the observed variations were slow compared to the time required for collecting data and because these drifts did not interfere with the information we were gathering, it was decided to continue with data acquisition rather than study and attempt to correct the drift problem.

In hindsight, the most probable cause of the drifts is the zero temperature stability of the Hall probe devices which is specified at under ±90 mG/°C.

As the probe was held and positioned by hand, probe temperature variations through finger contact could easily have been several degrees Celsius.

In each data run, there are noticeable drifts between adjacent data pairs every 30 or so data pairs. This drift is the result of time lapses which occured while the computer display was being refreshed. In some cases, data runs were repeated to ensure that this drift was not a real phenomena.

The data scatter seen in Figure 10 was the result of an inexperienced Hall probe positioner with hot variable fingers.

RECOMMENDATIONS (MIG)

If further studies of this type would be useful, I would suggest that we use our LSI-11/CAMAC/GPIB Data Acquisition System to automatically position the Hall probe by means of a stepping motor. I also would recommend that a temperature regulated Hall probe be used if very low magnetic fields are to be mapped in the future.

ACKNOWLEDGEMENTS

G. Gibson and R. Smits were extremely helpful in setting up the equipment. Most of the very tedious and accurate Hall probe positioning was accomplished by G. Gibson.

Distribution:
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M. Pripstein
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J.D. Taylor
L.J. Wagner
Electronics Engineering Master File
Magnetic Measurements Engineering (4)
TPC Representatives (9)
TPC Files (5)

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DEPARTMENT Electronics Engineering Magentic Measurements Engr.
LOCATION LBL

CODE MME Book No. 631
SERIAL MT-293 TPC-LBL-81-3
DATE January 16, 1981

DATE	TIME	TAPE FILE NO.	TABLE NO.	FIGURE NO.	COIL	I AMPS	TERMINAL POLARITY +	TERMINAL POLARITY -	X-RANGE (cm)	X-INCREMENT (cm)	REMARKS
10/3/80	11:13	3	3	3	-	0	-	-	-20 to +350	10	Background Run
10/3/80	13:46	-	-	-	UPA	0.500	CD	AB	-20 to + 18	0.5, 1	Overhead crane moved, Stopped and repeated
10/3/80	14:18	4	4	4A,B,C,D	UPA	0.500	CD	AB	-20 to +350	0.5, 1	∿-25 mG zero shift at end of run
10/3/80	15.58	5	5	5A,B	UPA	0.500	AB	CD	-20 to +350	0.5, 1	Polarity reversal of previous data set, +9 mG zero shift
10/6/80	14:10	-	-	-	UPA	0.500	AB CD	CD AB	200	0	Unsuccessful attempt at taking data by alternating polarity
10/6/80	14:26	-	-	-	UPA	0.500	AB	GND	-20 to + 30	0.5	Operator error - data not saved
10/6/80	14:49	6	6	6	UPA	0.500	AB	GND	-20 to +350	10	
10/6/80	15:24	7	7	7	UPA	0.500	GND	CD	-20 to + 30	0.5, 1	
10/6/80	18:08	8	8	8	UPA	0.500	GND	CD	0 to + 20	0.5	Repeat of previous run to check polarity, Gaussmeter changed
10/6/80	18:56	9	9	9	SC	0.500	B	C	-20 to +350	0.5, 1	∿-90 mG zero shift
10/6/80	20:29	10	10	10	SC	0.150	GND	C	-20 to +350	0.5, 1	Hall probe rotated between positions 25 and 30 cm
10/7/80	14:32	11	11	11	SC & UPA	0.100	C	CD	0 to + 30	0.5	
10/7/80	14:53	12	12	12	SC & UPA	0.100	CD	C	0 to + 30	0.5	
10/7/80	15:13	13	13	13	SC	0.100	C	GND	0 to + 30	0.5	
10/7/80	15:20	14	14	14	SC	0.100	GND	C	0 to + 30	0.5	
10/7/80	15:42	-	-	-	SC	0.100	GND	C	+15 to + 25	0.5	Repeat to determine if quantum jump is real, -55 mG zero shift
10/7/80	15:55	15	15	15	SC & UPA	0.100	C	AB	0 to + 30	0.5	
10/7/80	16:10	16	16	16	SC & UPA	0.100	AB	C	0 to + 30	0.5	

TABLE 2 INDEX OF DATA RUNS

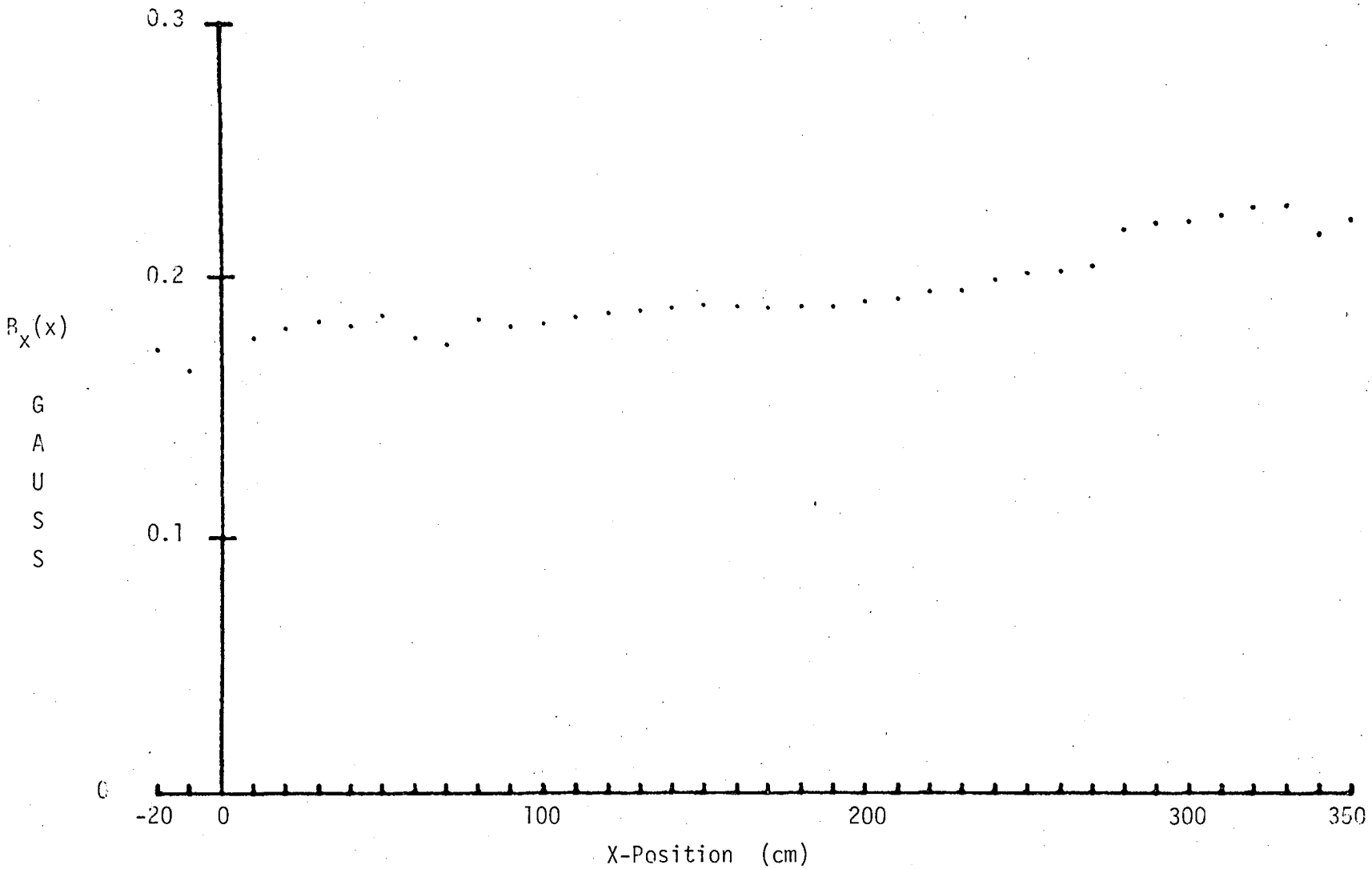

FIGURE 3
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--11:13
TPC SOLENOID-FAULT SEARCH- --- BACKGROUND RUN-- NO CURRENT
6 OCLOCK,AXIAL PROBE POINTING TOWARD NORTH END OF SOLENOID(BLDG WEST)

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
-20.0	0.172	230.0	0.195
-10.0	0.164	240.0	0.199
0.0	0.170	250.0	0.202
10.0	0.176	260.0	0.202
20.0	0.180	270.0	0.204
30.0	0.183	280.0	0.218
40.0	0.181	290.0	0.221
50.0	0.185	300.0	0.221
60.0	0.177	310.0	0.224
70.0	0.174	320.0	0.228
80.0	0.184	330.0	0.227
90.0	0.181	340.0	0.216
100.0	0.182	350.0	0.222
110.0	0.185		
120.0	0.186		
130.0	0.187		
140.0	0.189		
150.0	0.190		
160.0	0.189		
170.0	0.188		
180.0	0.189		
190.0	0.189		
200.0	0.191		
210.0	0.192		
220.0	0.195		

TABLE 3.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--11:13
TPC SOLENOID-FAULT SEARCH- --- BACKGROUND RUN-- NO CURRENT
6 OCLOCK,AXIAL PROBE POINTING TOWARD NORTH END OF SOLENOID(BLDG WEST)

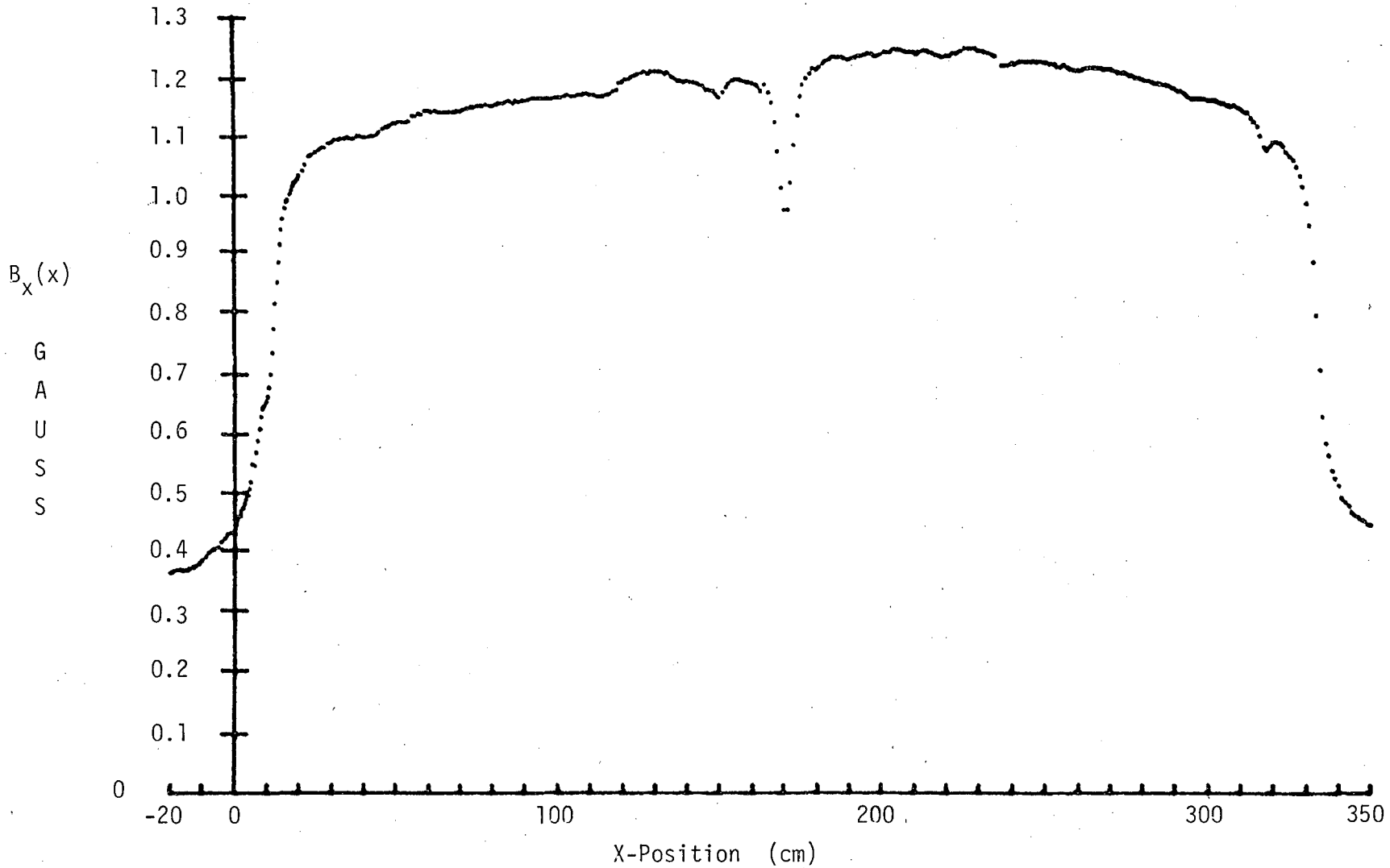

FIGURE 4A
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--14:18
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB-,CD+,8.67V,0.500A ---
POS=6 OCLOCK, AXIAL PROBE POINTING TOWARD SOLENOID NORTH

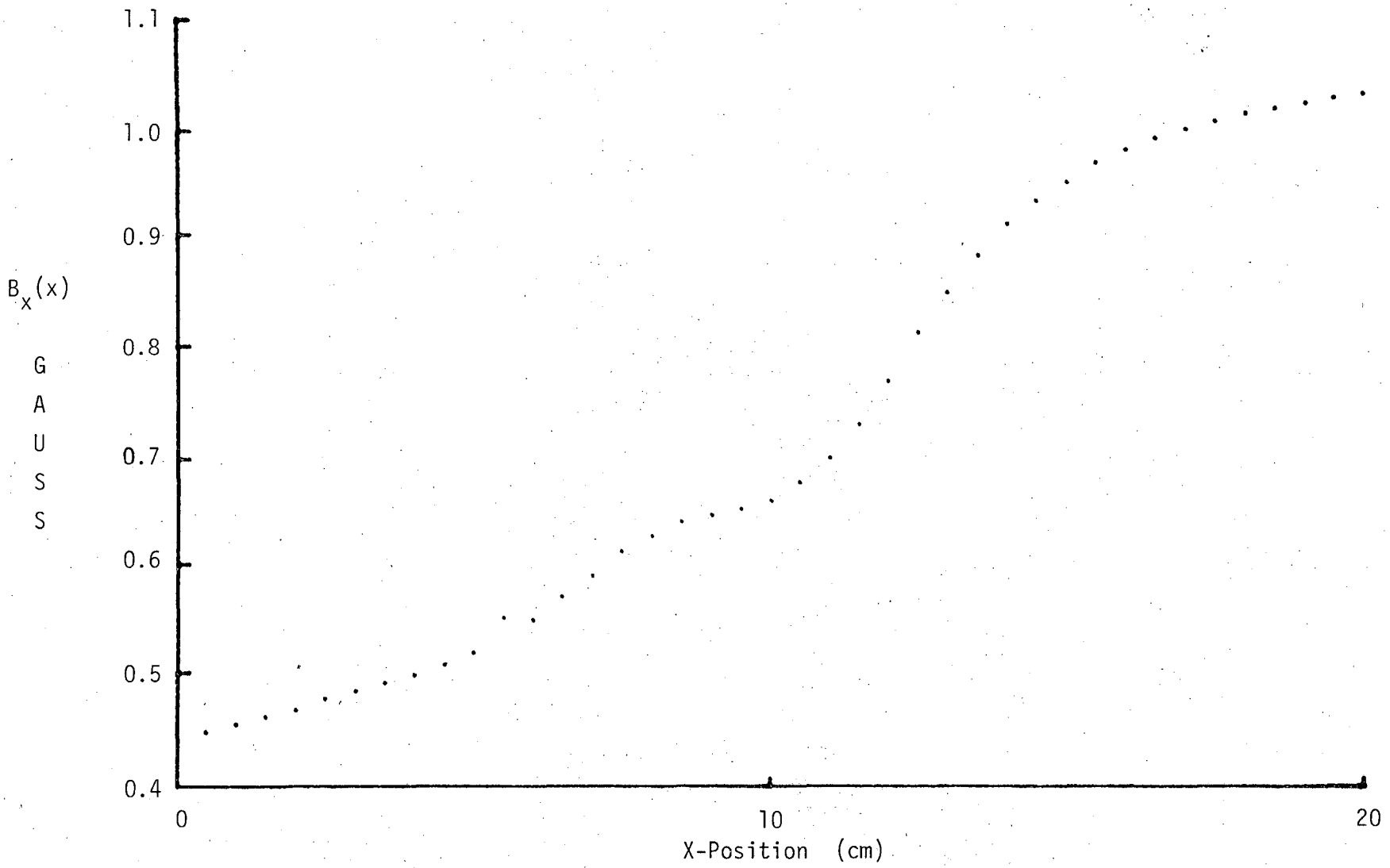

FIGURE 4B
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--14:18
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB-,CD+,8.67V,0.500A ---
POS=6 OCLOCK, AXIAL PROBE POINTING TOWARD SOLENOID NORTH

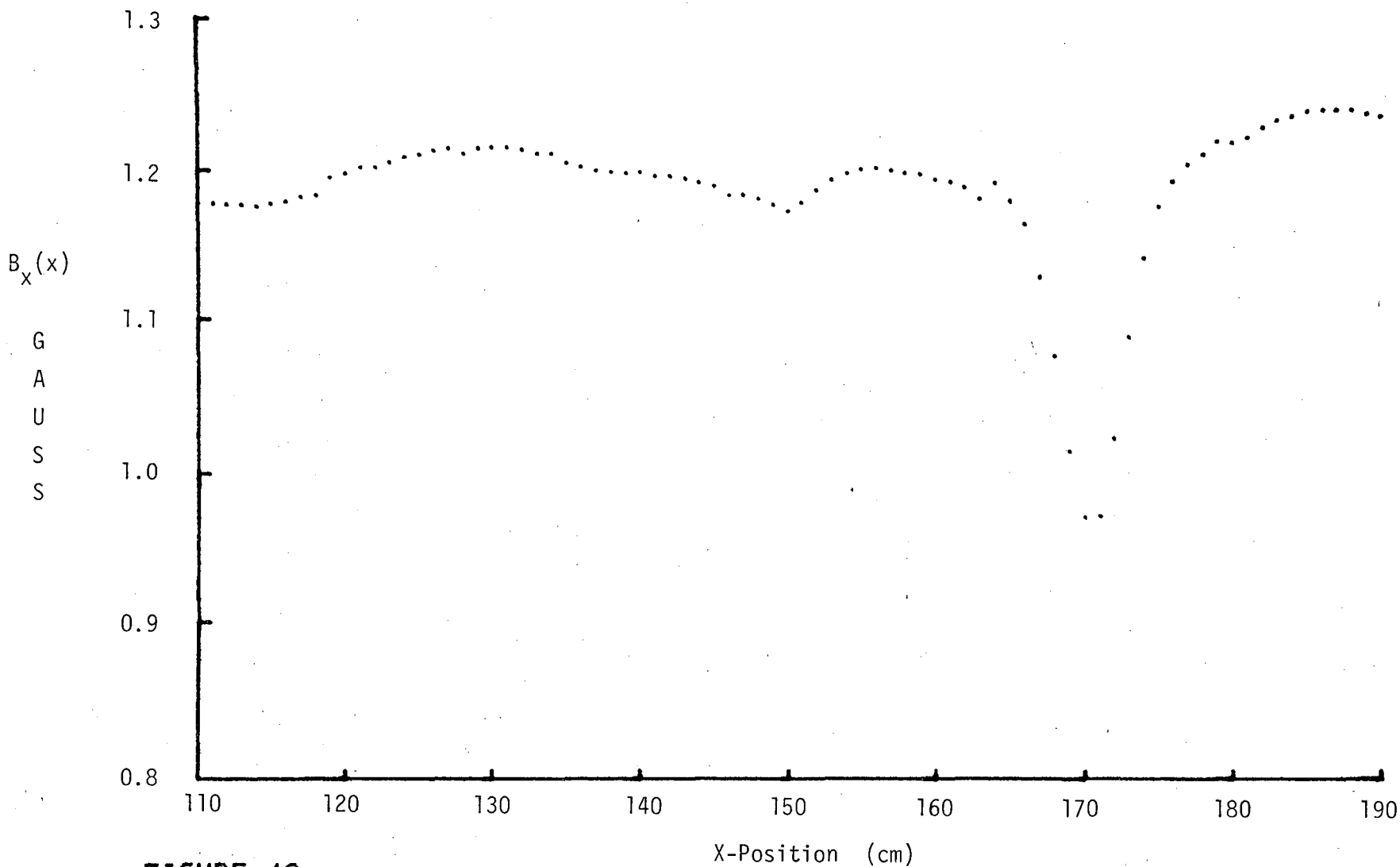

FIGURE 4C
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--14:18
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB-,CD+,8.67V,0.500A ---
POS=6 OCLOCK, AXIAL PROBE POINTING TOWARD SOLENOID NORTH

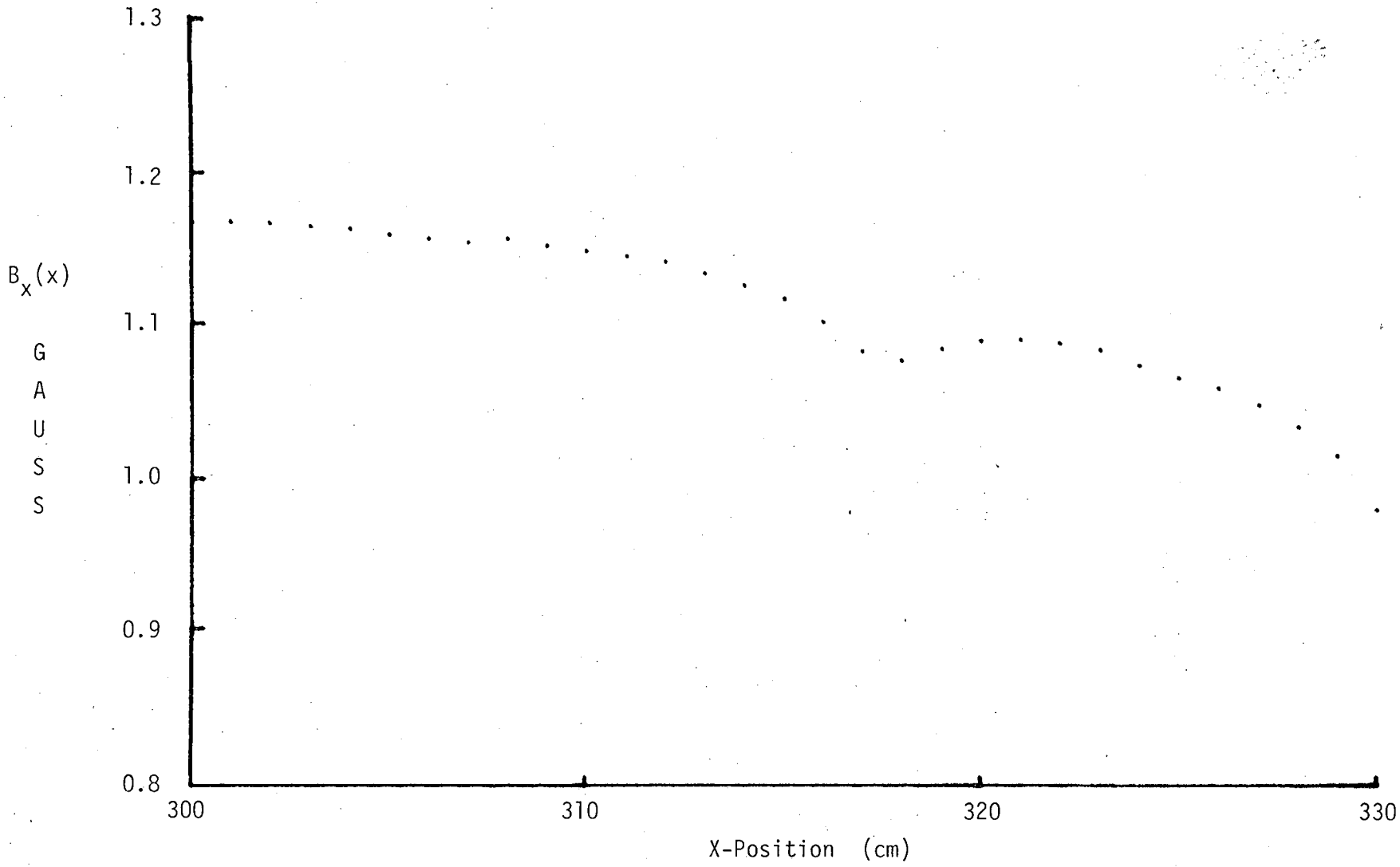

FIGURE 4D
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--14:18
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB-,CD+,8.67V,0.500A ---
POS=6 OCLOCK, AXIAL PROBE POINTING TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
-20.0	0.362	2.5	0.476	15.0	0.953	35.0	1.101
-19.0	0.363	3.0	0.483	15.5	0.971	36.0	1.098
-18.0	0.365	3.5	0.491	16.0	0.982	37.0	1.099
-17.0	0.365	4.0	0.498	16.5	0.993	38.0	1.103
-16.0	0.366	4.5	0.508	17.0	1.002	39.0	1.102
-15.0	0.366	5.0	0.518	17.5	1.010	40.0	1.100
-14.0	0.368	5.5	0.550	18.0	1.016	41.0	1.101
-13.0	0.371	6.0	0.549	18.5	1.021	42.0	1.103
-12.0	0.373	6.5	0.569	19.0	1.026	43.0	1.102
-11.0	0.378	7.0	0.589	19.5	1.030	44.0	1.106
-10.0	0.382	7.5	0.611	20.0	1.034	45.0	1.109
-9.0	0.389	8.0	0.629	21.0	1.044	46.0	1.115
-8.0	0.393	8.5	0.642	22.0	1.054	47.0	1.118
-7.0	0.398	9.0	0.649	23.0	1.067	48.0	1.119
-6.0	0.402	9.5	0.655	24.0	1.068	49.0	1.123
-5.0	0.405	10.0	0.662	25.0	1.073	50.0	1.125
-4.0	0.413	10.5	0.678	26.0	1.077	51.0	1.127
-3.0	0.425	11.0	0.701	27.0	1.081	52.0	1.127
-2.0	0.432	11.5	0.732	28.0	1.083	53.0	1.127
-1.0	0.435	12.0	0.772	29.0	1.088	54.0	1.130
0.0	0.443	12.5	0.813	30.0	1.091	55.0	1.138
0.5	0.449	13.0	0.849	31.0	1.095	56.0	1.137
1.0	0.456	13.5	0.883	32.0	1.097	57.0	1.143
1.5	0.463	14.0	0.911	33.0	1.099	58.0	1.141
2.0	0.470	14.5	0.936	34.0	1.098	59.0	1.146

TABLE 4.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--14:18
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB-,CD+,8.67V,0.500A ---
POS=6 OCLOCK, AXIAL PROBE POINTING TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
60.0	1.146	85.0	1.165	110.0	1.175	135.0	1.206
61.0	1.145	86.0	1.162	111.0	1.175	136.0	1.204
62.0	1.147	87.0	1.165	112.0	1.175	137.0	1.201
63.0	1.145	88.0	1.164	113.0	1.175	138.0	1.200
64.0	1.145	89.0	1.164	114.0	1.173	139.0	1.199
65.0	1.145	90.0	1.166	115.0	1.175	140.0	1.200
66.0	1.144	91.0	1.167	116.0	1.177	141.0	1.198
67.0	1.144	92.0	1.169	117.0	1.183	142.0	1.198
68.0	1.145	93.0	1.170	118.0	1.184	143.0	1.196
69.0	1.148	94.0	1.170	119.0	1.196	144.0	1.193
70.0	1.148	95.0	1.169	120.0	1.198	145.0	1.190
71.0	1.149	96.0	1.169	121.0	1.202	146.0	1.184
72.0	1.151	97.0	1.169	122.0	1.203	147.0	1.185
73.0	1.154	98.0	1.169	123.0	1.206	148.0	1.182
74.0	1.153	99.0	1.171	124.0	1.209	149.0	1.176
75.0	1.155	100.0	1.172	125.0	1.211	150.0	1.171
76.0	1.155	101.0	1.172	126.0	1.214	151.0	1.180
77.0	1.155	102.0	1.173	127.0	1.215	152.0	1.188
78.0	1.157	103.0	1.175	128.0	1.212	153.0	1.195
79.0	1.156	104.0	1.174	129.0	1.215	154.0	1.199
80.0	1.155	105.0	1.174	130.0	1.216	155.0	1.202
81.0	1.157	106.0	1.176	131.0	1.216	156.0	1.203
82.0	1.159	107.0	1.176	132.0	1.215	157.0	1.201
83.0	1.160	108.0	1.177	133.0	1.212	158.0	1.199
84.0	1.161	109.0	1.177	134.0	1.212	159.0	1.199

TABLE 4. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--14:18
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB-,CD+,8.67V,0.500A ---
POS=6 OCLOCK, AXIAL PROBE POINTING TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
160.0	1.196	185.0	1.241	210.0	1.248	235.0	1.242
161.0	1.194	186.0	1.241	211.0	1.245	1236.0	1.229
162.0	1.190	187.0	1.241	212.0	1.250	237.0	1.224
163.0	1.182	188.0	1.241	213.0	1.252	238.0	1.225
164.0	1.192	189.0	1.238	214.0	1.251	239.0	1.224
165.0	1.180	190.0	1.237	215.0	1.248	240.0	1.228
166.0	1.162	191.0	1.239	216.0	1.246	241.0	1.227
167.0	1.128	192.0	1.241	217.0	1.244	242.0	1.232
168.0	1.077	193.0	1.243	218.0	1.243	243.0	1.232
169.0	1.016	194.0	1.242	219.0	1.241	244.0	1.230
170.0	0.972	195.0	1.244	220.0	1.242	245.0	1.230
171.0	0.972	196.0	1.247	221.0	1.242	246.0	1.230
172.0	1.025	197.0	1.246	222.0	1.246	247.0	1.231
173.0	1.089	198.0	1.243	223.0	1.248	248.0	1.232
174.0	1.141	199.0	1.242	224.0	1.249	249.0	1.230
175.0	1.174	200.0	1.245	225.0	1.252	250.0	1.229
176.0	1.193	201.0	1.248	226.0	1.255	251.0	1.228
177.0	1.204	202.0	1.249	227.0	1.255	252.0	1.226
178.0	1.211	203.0	1.249	228.0	1.256	253.0	1.226
179.0	1.219	204.0	1.253	229.0	1.256	254.0	1.222
180.0	1.219	205.0	1.253	230.0	1.252	255.0	1.222
181.0	1.223	206.0	1.253	231.0	1.251	256.0	1.223
182.0	1.229	207.0	1.252	232.0	1.248	257.0	1.221
183.0	1.234	208.0	1.250	233.0	1.247	258.0	1.217
184.0	1.237	209.0	1.249	234.0	1.244	259.0	1.216

TABLE 4. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--14:18
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB-,CD+,8.67V,0.500A ---
POS=6 OCLOCK, AXIAL PROBE POINTING TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
260.0	1.215	285.0	1.194	310.0	1.148	335.0	0.630
261.0	1.216	286.0	1.191	311.0	1.145	336.0	0.587
262.0	1.218	287.0	1.191	312.0	1.141	337.0	0.565
263.0	1.219	288.0	1.188	313.0	1.134	338.0	0.540
264.0	1.219	289.0	1.186	314.0	1.126	339.0	0.525
265.0	1.221	290.0	1.184	315.0	1.117	340.0	0.511
266.0	1.221	291.0	1.181	316.0	1.102	341.0	0.492
267.0	1.219	292.0	1.181	317.0	1.083	342.0	0.486
268.0	1.217	293.0	1.176	318.0	1.078	343.0	0.479
269.0	1.217	294.0	1.171	319.0	1.085	344.0	0.468
270.0	1.218	295.0	1.168	320.0	1.090	345.0	0.464
271.0	1.216	296.0	1.167	321.0	1.091	346.0	0.461
272.0	1.214	297.0	1.166	322.0	1.089	347.0	0.456
273.0	1.212	298.0	1.166	323.0	1.084	348.0	0.453
274.0	1.210	299.0	1.167	324.0	1.074	349.0	0.448
275.0	1.210	300.0	1.166	325.0	1.067	350.0	0.447
276.0	1.207	301.0	1.166	326.0	1.060		
277.0	1.206	302.0	1.165	327.0	1.049		
278.0	1.203	303.0	1.163	328.0	1.035		
279.0	1.201	304.0	1.161	329.0	1.016		
280.0	1.200	305.0	1.158	330.0	0.980		
281.0	1.199	306.0	1.156	331.0	0.941		
282.0	1.198	307.0	1.153	332.0	0.882		
283.0	1.195	308.0	1.156	333.0	0.794		
284.0	1.194	309.0	1.152	334.0	0.702		

TABLE 4. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--14:18
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB-,CD+,8.67V,0.500A ---
POS=6 OCLOCK, AXIAL PROBE POINTING TOWARD SOLENOID NORTH

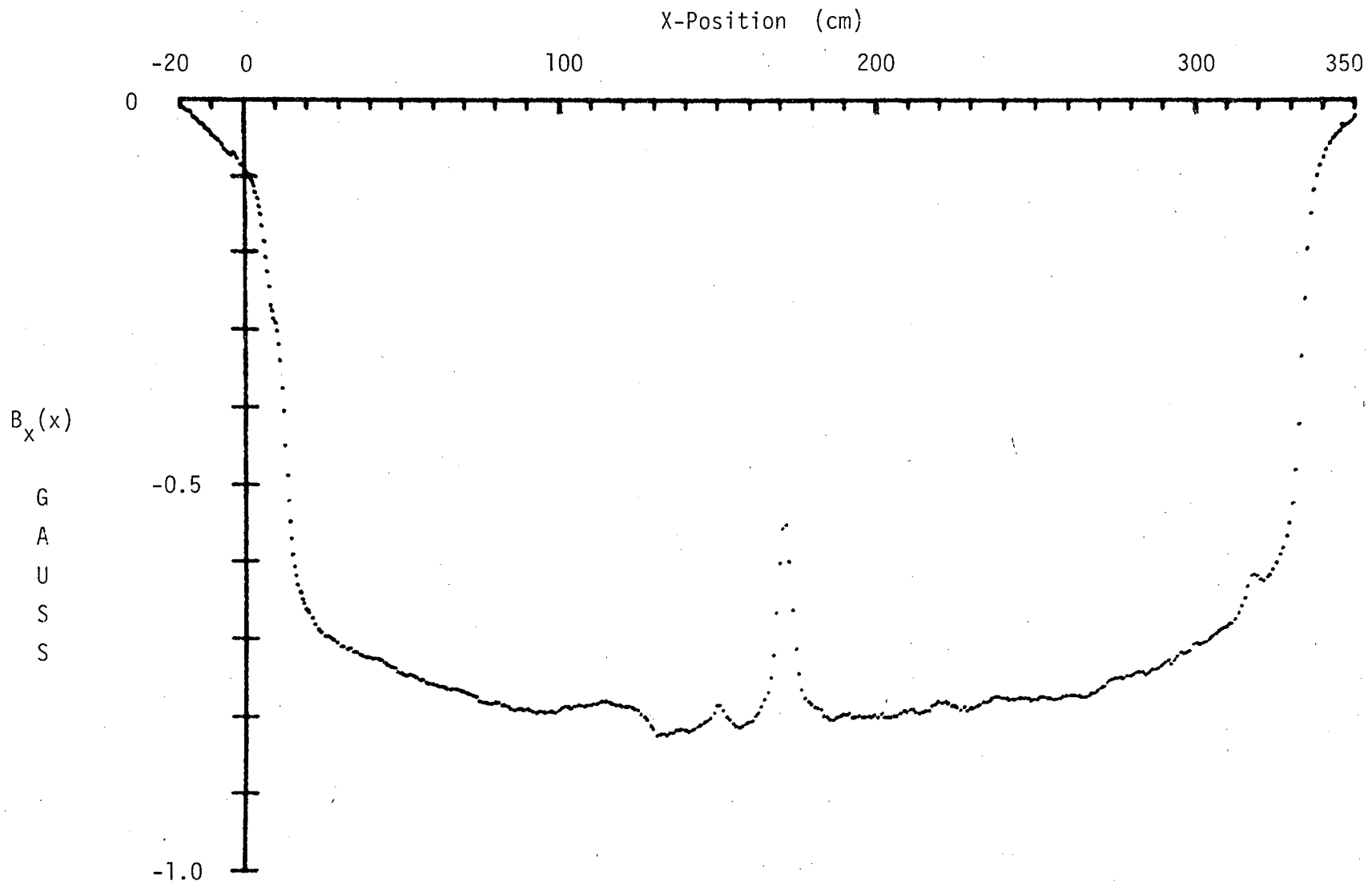

FIGURE 5A
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--15:58
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB+, CD-, 8.69V, 0.500A ---
POS=6 OCLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH

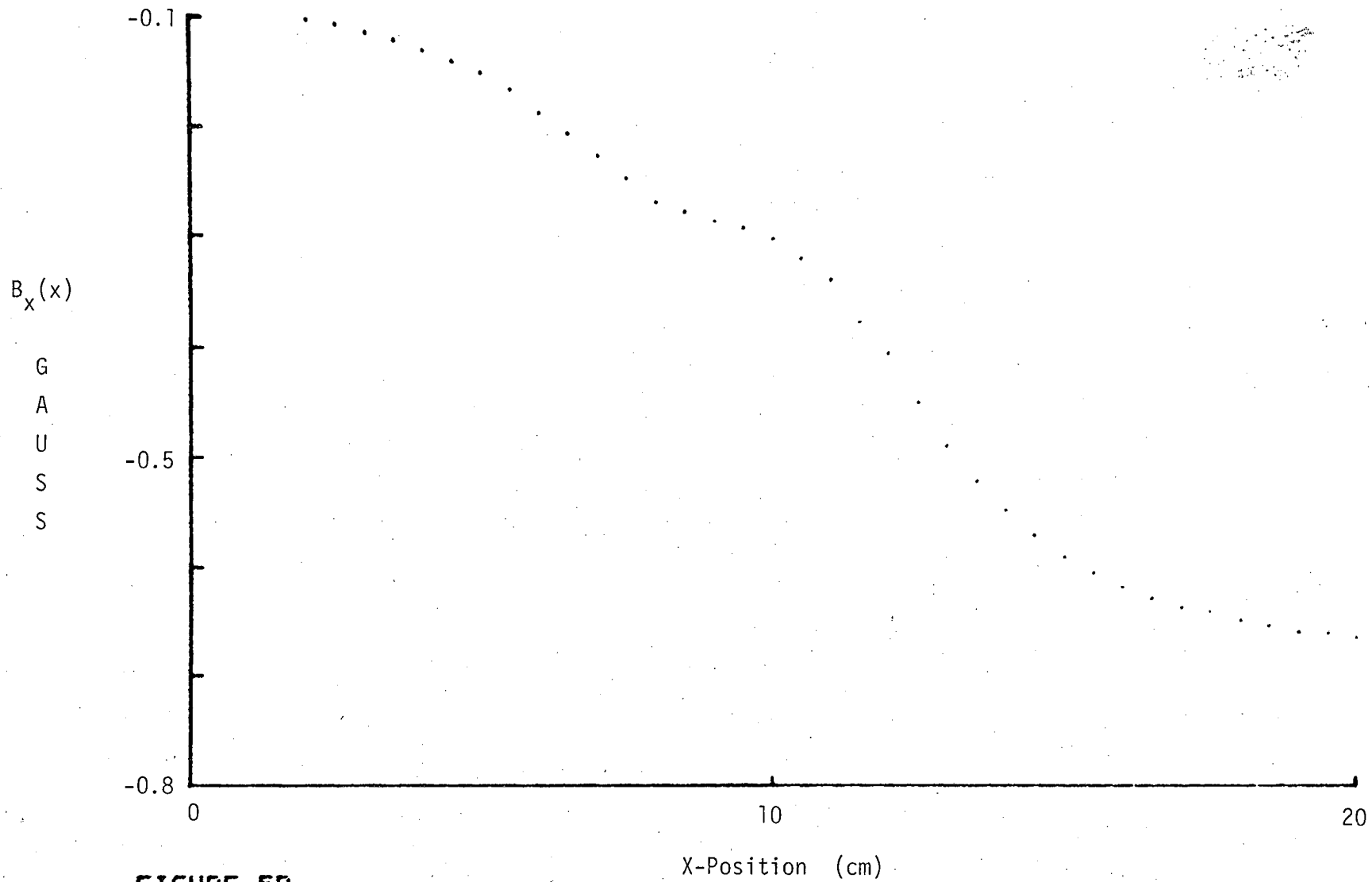

FIGURE 5B
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--15:58
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB+, CD-, 8.69V, 0.500A ---
POS=6 OCLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
-20.0	-0.005	2.5	-0.107	15.0	-0.591	35.0	-0.717
-19.0	-0.010	3.0	-0.113	15.5	-0.605	36.0	-0.720
-18.0	-0.014	3.5	-0.121	16.0	-0.619	37.0	-0.722
-17.0	-0.015	4.0	-0.130	16.5	-0.629	38.0	-0.724
-16.0	-0.022	4.5	-0.140	17.0	-0.638	39.0	-0.724
-15.0	-0.026	5.0	-0.150	17.5	-0.641	40.0	-0.726
-14.0	-0.030	5.5	-0.166	18.0	-0.649	41.0	-0.726
-13.0	-0.033	6.0	-0.187	18.5	-0.654	42.0	-0.726
-12.0	-0.037	6.5	-0.206	19.0	-0.660	43.0	-0.727
-11.0	-0.040	7.0	-0.226	19.5	-0.662	44.0	-0.731
-10.0	-0.047	7.5	-0.246	20.0	-0.665	45.0	-0.733
-9.0	-0.050	8.0	-0.269	21.0	-0.673	46.0	-0.736
-8.0	-0.052	8.5	-0.277	22.0	-0.682	47.0	-0.737
-7.0	-0.058	9.0	-0.286	23.0	-0.688	48.0	-0.742
-6.0	-0.065	9.5	-0.292	24.0	-0.691	49.0	-0.743
-5.0	-0.070	10.0	-0.302	25.0	-0.696	50.0	-0.745
-4.0	-0.073	10.5	-0.319	26.0	-0.696	51.0	-0.746
-3.0	-0.071	11.0	-0.339	27.0	-0.699	52.0	-0.746
-2.0	-0.077	11.5	-0.376	28.0	-0.701	53.0	-0.748
-1.0	-0.086	12.0	-0.405	29.0	-0.705	54.0	-0.750
0.0	-0.092	12.5	-0.450	30.0	-0.709	55.0	-0.753
0.5	-0.094	13.0	-0.489	31.0	-0.710	56.0	-0.753
1.0	-0.097	13.5	-0.521	32.0	-0.713	57.0	-0.756
1.5	-0.098	14.0	-0.548	33.0	-0.712	58.0	-0.758
2.0	-0.103	14.5	-0.570	34.0	-0.716	59.0	-0.759

TABLE 5.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--15:58
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB+, CD-, 8.69V, 0.500A ---
POS=6 OCLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
60.0	-0.759	85.0	-0.791	110.0	-0.784	135.0	-0.820
61.0	-0.762	86.0	-0.790	111.0	-0.783	136.0	-0.818
62.0	-0.762	87.0	-0.791	112.0	-0.781	137.0	-0.817
63.0	-0.763	88.0	-0.792	113.0	-0.780	138.0	-0.816
64.0	-0.764	89.0	-0.791	114.0	-0.781	139.0	-0.818
65.0	-0.764	90.0	-0.792	115.0	-0.782	140.0	-0.820
66.0	-0.764	91.0	-0.793	116.0	-0.783	141.0	-0.818
67.0	-0.764	92.0	-0.794	117.0	-0.786	142.0	-0.815
68.0	-0.766	93.0	-0.793	118.0	-0.784	143.0	-0.812
69.0	-0.767	94.0	-0.794	119.0	-0.787	144.0	-0.811
70.0	-0.769	95.0	-0.795	120.0	-0.786	145.0	-0.807
71.0	-0.771	96.0	-0.794	121.0	-0.787	146.0	-0.806
72.0	-0.773	97.0	-0.793	122.0	-0.788	147.0	-0.802
73.0	-0.776	98.0	-0.794	123.0	-0.790	148.0	-0.794
74.0	-0.780	99.0	-0.792	124.0	-0.792	149.0	-0.785
75.0	-0.781	100.0	-0.788	125.0	-0.797	150.0	-0.785
76.0	-0.782	101.0	-0.787	126.0	-0.801	151.0	-0.791
77.0	-0.784	102.0	-0.786	127.0	-0.804	152.0	-0.801
78.0	-0.783	103.0	-0.790	128.0	-0.813	153.0	-0.805
79.0	-0.782	104.0	-0.787	129.0	-0.816	154.0	-0.809
80.0	-0.782	105.0	-0.786	130.0	-0.824	155.0	-0.813
81.0	-0.785	106.0	-0.786	131.0	-0.822	156.0	-0.814
82.0	-0.786	107.0	-0.787	132.0	-0.822	157.0	-0.812
83.0	-0.786	108.0	-0.784	133.0	-0.824	158.0	-0.810
84.0	-0.790	109.0	-0.785	134.0	-0.821	159.0	-0.808

TABLE 5. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--15:58
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB+, CD-, 8.69V, 0.500A ---
POS=6 OCLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
160.0	-0.807	185.0	-0.803	210.0	-0.790	235.0	-0.778
161.0	-0.799	186.0	-0.804	211.0	-0.790	236.0	-0.775
162.0	-0.795	187.0	-0.801	212.0	-0.793	237.0	-0.773
163.0	-0.787	188.0	-0.799	213.0	-0.794	238.0	-0.773
164.0	-0.776	189.0	-0.797	214.0	-0.793	239.0	-0.775
165.0	-0.768	190.0	-0.798	215.0	-0.791	240.0	-0.775
166.0	-0.750	191.0	-0.795	216.0	-0.791	241.0	-0.776
167.0	-0.720	192.0	-0.800	217.0	-0.786	242.0	-0.777
168.0	-0.666	193.0	-0.800	218.0	-0.783	243.0	-0.777
169.0	-0.600	194.0	-0.799	219.0	-0.780	244.0	-0.775
170.0	-0.557	195.0	-0.801	220.0	-0.782	245.0	-0.774
171.0	-0.552	196.0	-0.800	221.0	-0.780	246.0	-0.775
172.0	-0.599	197.0	-0.799	222.0	-0.782	247.0	-0.775
173.0	-0.662	198.0	-0.799	223.0	-0.785	248.0	-0.778
174.0	-0.712	199.0	-0.797	224.0	-0.785	249.0	-0.777
175.0	-0.744	200.0	-0.799	225.0	-0.787	250.0	-0.777
176.0	-0.765	201.0	-0.796	226.0	-0.790	251.0	-0.773
177.0	-0.775	202.0	-0.800	227.0	-0.787	252.0	-0.773
178.0	-0.780	203.0	-0.800	228.0	-0.791	253.0	-0.776
179.0	-0.783	204.0	-0.800	229.0	-0.789	254.0	-0.774
180.0	-0.786	205.0	-0.799	230.0	-0.788	255.0	-0.776
181.0	-0.788	206.0	-0.798	231.0	-0.785	256.0	-0.777
182.0	-0.791	207.0	-0.794	232.0	-0.783	257.0	-0.775
183.0	-0.798	208.0	-0.792	233.0	-0.780	258.0	-0.773
184.0	-0.800	209.0	-0.793	234.0	-0.780	259.0	-0.771

TABLE 5. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--15:58
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB+, CD-, 8.69V, 0.500A ---
POS=6 OCLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
260.0	-0.771	285.0	-0.741	310.0	-0.679	335.0	-0.194
261.0	-0.772	286.0	-0.737	311.0	-0.678	336.0	-0.148
262.0	-0.772	287.0	-0.737	312.0	-0.673	337.0	-0.118
263.0	-0.770	288.0	-0.735	313.0	-0.664	338.0	-0.098
264.0	-0.773	289.0	-0.732	314.0	-0.656	339.0	-0.085
265.0	-0.774	290.0	-0.728	315.0	-0.645	340.0	-0.074
266.0	-0.771	291.0	-0.726	316.0	-0.630	341.0	-0.065
267.0	-0.768	292.0	-0.730	317.0	-0.616	342.0	-0.056
268.0	-0.768	293.0	-0.725	318.0	-0.614	343.0	-0.050
269.0	-0.764	294.0	-0.721	319.0	-0.617	344.0	-0.047
270.0	-0.762	295.0	-0.715	320.0	-0.621	345.0	-0.040
271.0	-0.759	296.0	-0.717	321.0	-0.623	346.0	-0.033
272.0	-0.755	297.0	-0.715	322.0	-0.619	347.0	-0.034
273.0	-0.752	298.0	-0.714	323.0	-0.614	348.0	-0.030
274.0	-0.750	299.0	-0.706	324.0	-0.608	349.0	-0.027
275.0	-0.749	300.0	-0.704	325.0	-0.600	350.0	-0.021
276.0	-0.748	301.0	-0.704	326.0	-0.589		
277.0	-0.749	302.0	-0.703	327.0	-0.579		
278.0	-0.746	303.0	-0.702	328.0	-0.566		
279.0	-0.746	304.0	-0.698	329.0	-0.549		
280.0	-0.743	305.0	-0.695	330.0	-0.521		
281.0	-0.741	306.0	-0.691	331.0	-0.480		
282.0	-0.741	307.0	-0.688	332.0	-0.420		
283.0	-0.741	308.0	-0.685	333.0	-0.333		
284.0	-0.743	309.0	-0.682	334.0	-0.258		

TABLE 5. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/03--15:58
TPC SOLENOID - FAULT SEARCH - UPA COIL, AB+, CD-, 8.69V, 0.500A ---
POS=6 OCLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH

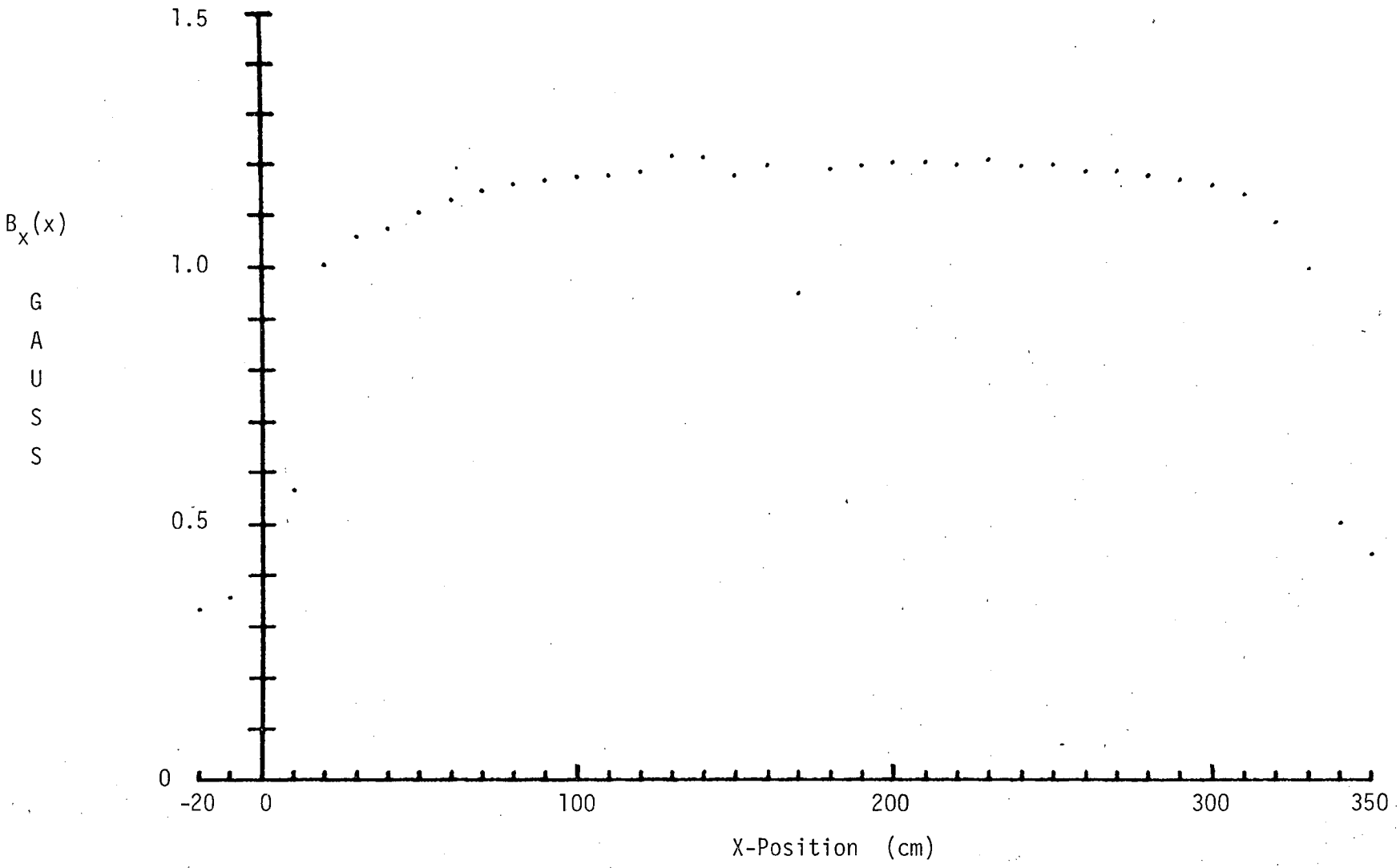

FIGURE 6
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--14:49
TPC SOLENOID - FAULT SEARCH - UPA COIL, CD+,GND-, .500A ---
POS=6 OCLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
-20.0	0.332	230.0	1.211
-10.0	0.356	240.0	1.197
0.0	0.405	250.0	1.201
10.0	0.566	260.0	1.189
20.0	1.005	270.0	1.187
30.0	1.058	280.0	1.178
40.0	1.076	280.0	1.177
50.0	1.107	280.0	1.180
60.0	1.131	290.0	1.170
70.0	1.148	300.0	1.160
80.0	1.161	310.0	1.142
90.0	1.170	320.0	1.087
100.0	1.176	330.0	0.999
110.0	1.180	340.0	0.501
120.0	1.188	350.0	0.441
130.0	1.218		
140.0	1.216		
150.0	1.179		
160.0	1.201		
170.0	0.951		
180.0	1.193		
190.0	1.201		
200.0	1.206		
210.0	1.205		
220.0	1.200		

TABLE 6.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--14:49
TPC SOLENOID - FAULT SEARCH - UPA COIL, CD+,GND-, .500A ---
POS=6 OCLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH

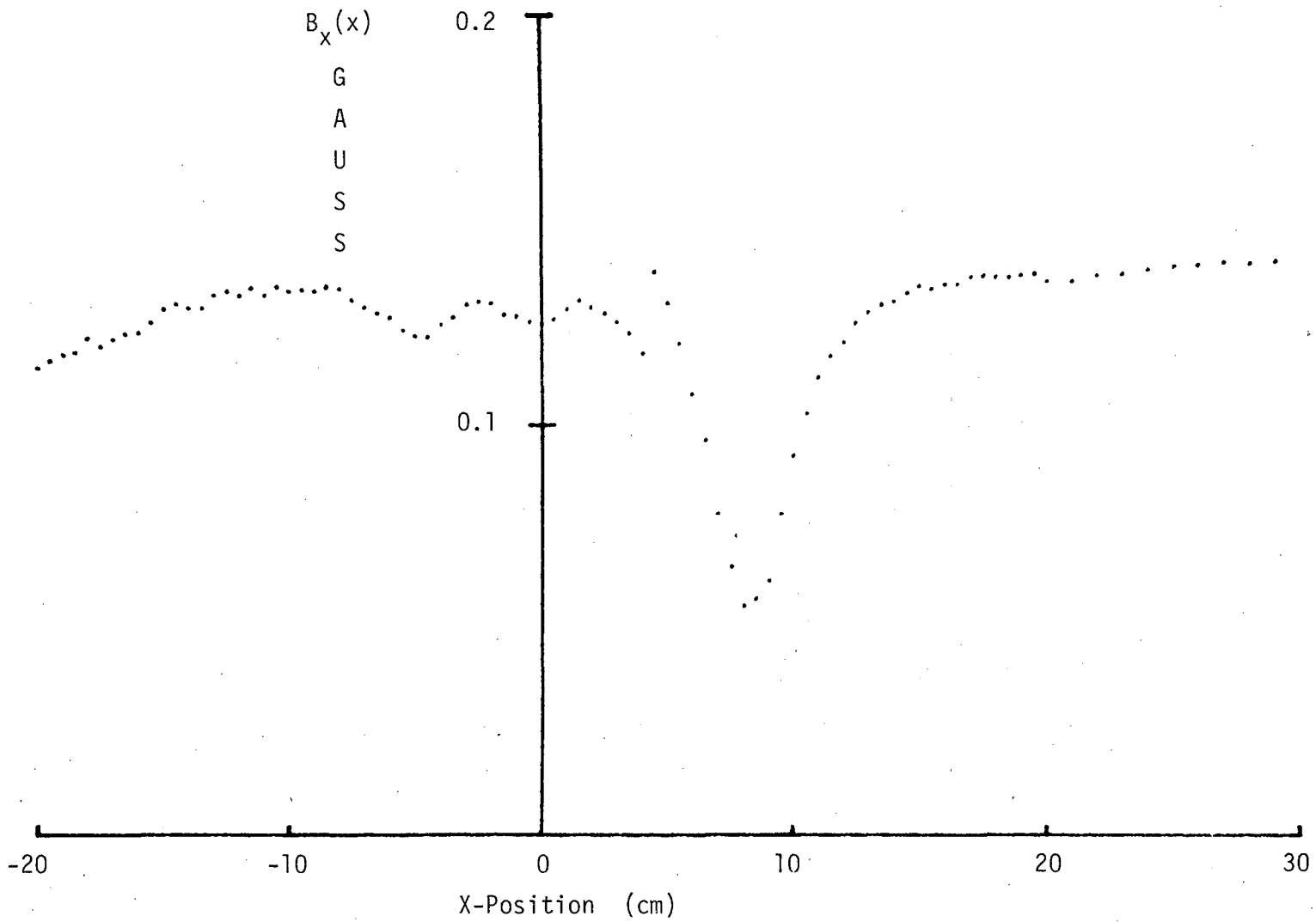

FIGURE 7
LBL MAGNETIC MEASUREMENTS ENGINEERING -- DHN--80/10/6--15:24
TPC SOLENOID - FAULT SEARCH - UPA COIL, CD-,GND+,0.500 A --- ---
POS = 6 O CLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH.

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
-20.0	0.114	-7.5	0.130	5.0	0.129	17.5	0.136
-19.5	0.116	-7.0	0.128	5.5	0.120	18.0	0.135
-19.0	0.117	-6.5	0.127	6.0	0.108	18.5	0.136
-18.5	0.118	-6.0	0.126	6.5	0.096	19.0	0.136
-18.0	0.121	-5.5	0.123	7.0	0.078	19.5	0.136
-17.5	0.119	-5.0	0.122	7.5	0.065	20.0	0.134
-17.0	0.121	-4.5	0.121	8.0	0.055	21.0	0.134
-16.5	0.122	-4.0	0.124	8.5	0.057	22.0	0.136
-16.0	0.122	-3.5	0.126	9.0	0.062	23.0	0.136
-15.5	0.124	-3.0	0.129	9.5	0.078	24.0	0.137
-15.0	0.128	-2.5	0.130	10.0	0.092	25.0	0.138
-14.5	0.129	-2.0	0.129	10.5	0.103	26.0	0.138
-14.0	0.128	-1.5	0.127	11.0	0.112	27.0	0.139
-13.5	0.128	-1.0	0.126	11.5	0.117	28.0	0.138
-13.0	0.131	-0.5	0.125	12.0	0.120	29.0	0.139
-12.5	0.132	0.0	0.125	12.5	0.125		
-12.0	0.131	0.5	0.126	13.0	0.127		
-11.5	0.133	1.0	0.128	13.5	0.129		
-11.0	0.131	1.5	0.130	14.0	0.130		
-10.5	0.133	2.0	0.128	14.5	0.132		
-10.0	0.132	2.5	0.127	15.0	0.134		
-9.5	0.132	3.0	0.125	15.5	0.133		
-9.0	0.132	3.5	0.122	16.0	0.134		
-8.5	0.133	4.0	0.117	16.5	0.134		
-8.0	0.133	4.5	0.137	17.0	0.135		

TABLE 7.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- DHN--80/10/6--15:24
TPC SOLENOID - FAULT SEARCH - UPA COIL, CD-,GND+,0.500 A --- ---
POS = 6 O CLOCK,AXIAL PROBE POINTING TOWARD SOLENOID NORTH.

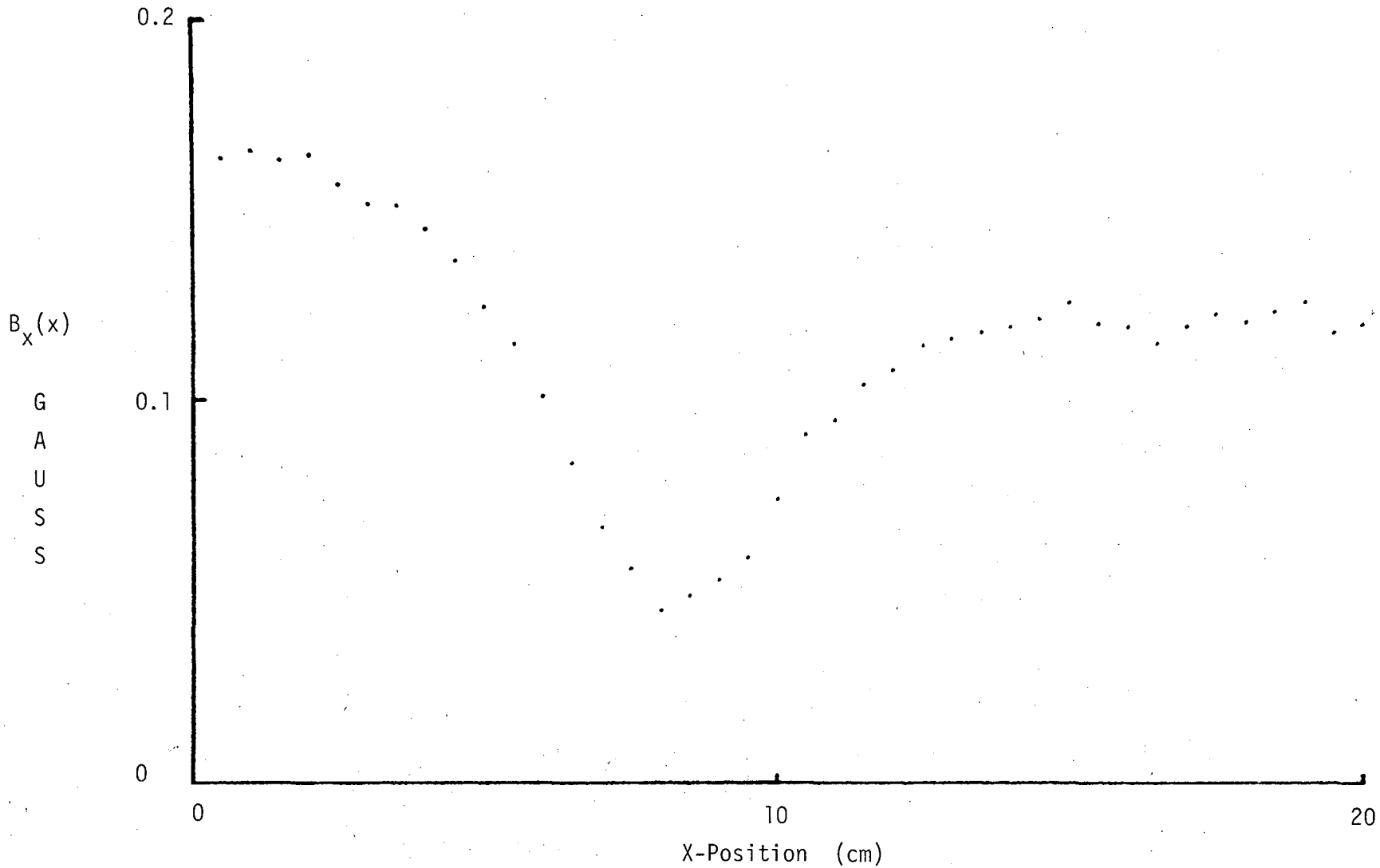

FIGURE 8
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--18:08
TPC SOLENOID - FAULT SEARCH - UPA COIL, CD-,GND+, 0.500A ---
POS=6OCLOCK,AX PR PTNG SOL NORTH, CHANGED GAUSSMETER

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
0.0	0.165	12.5	0.114
0.5	0.163	13.0	0.116
1.0	0.165	13.5	0.118
1.5	0.163	14.0	0.119
2.0	0.164	14.5	0.121
2.5	0.156	15.0	0.125
3.0	0.151	15.5	0.120
3.5	0.151	16.0	0.119
4.0	0.144	16.5	0.115
4.5	0.136	17.0	0.119
5.0	0.124	17.5	0.122
5.5	0.115	18.0	0.120
6.0	0.101	18.5	0.123
6.5	0.084	19.0	0.125
7.0	0.067	19.5	0.118
7.5	0.056	20.0	0.119
8.0	0.045		
8.5	0.049		
9.0	0.053		
9.5	0.059		
10.0	0.074		
10.5	0.091		
11.0	0.095		
11.5	0.104		
12.0	0.108		

TABLE 8.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--18:08
TPC SOLENOID - FAULT SEARCH - UPA COIL, CD-,GND+, 0.500A ---
POS=6OCLOCK,AX PR PTNG SOL NORTH, CHANGED GAUSSMETER

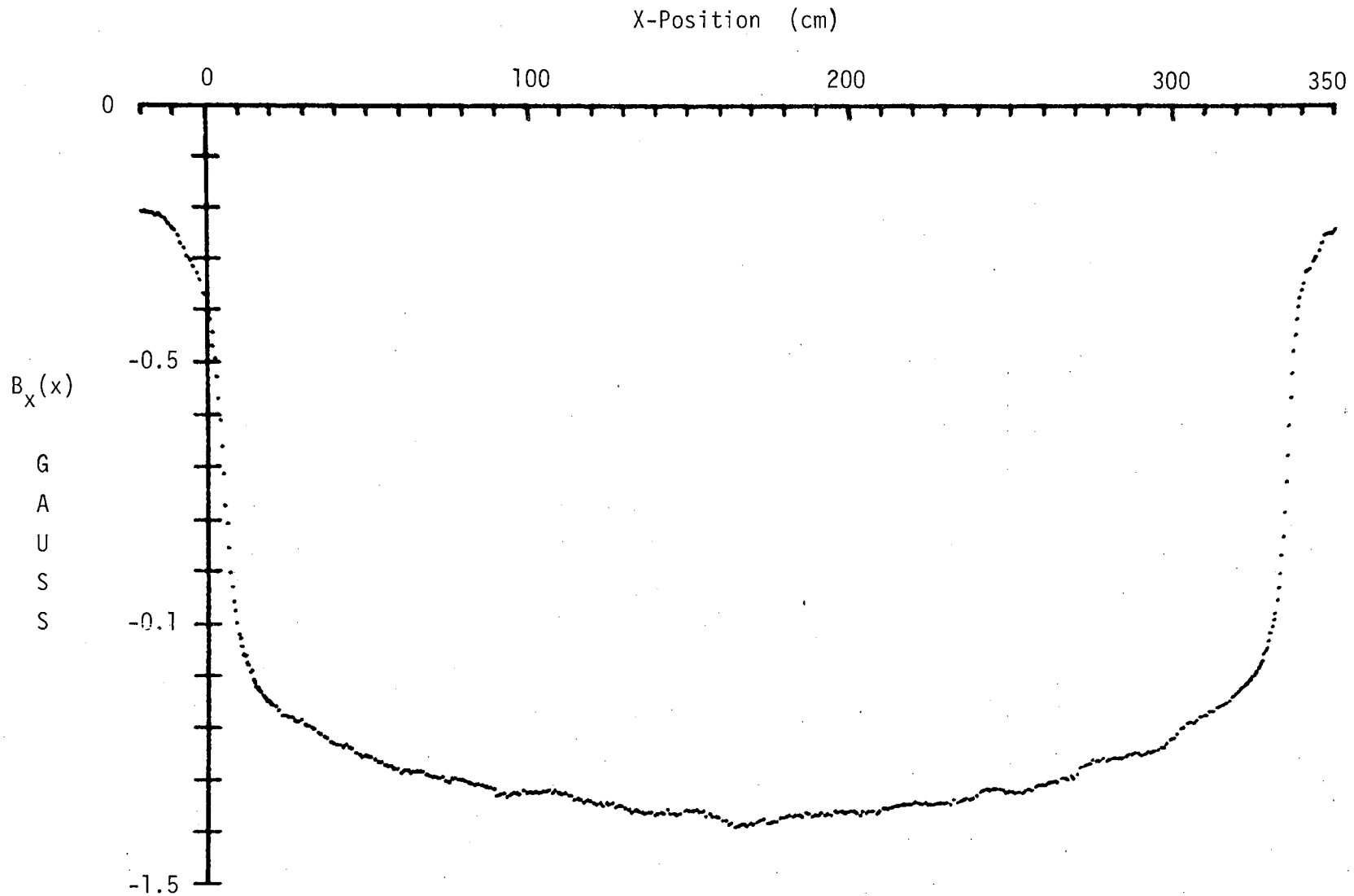

FIGURE 9
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--18:56
TPC SOLENOID - FAULT SEARCH - SC COIL, B+,C-, 0.500A,~39V ---
POS=6 OCLOCK, AXIAL PROBE PTNG SOL.NORTH,GM=810R3

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
-20.0	-0.207	2.5	-0.491	15.0	-1.122	35.0	-1.214
-19.0	-0.209	3.0	-0.528	15.5	-1.125	36.0	-1.218
-18.0	-0.211	3.5	-0.568	16.0	-1.130	37.0	-1.222
-17.0	-0.211	4.0	-0.610	16.5	-1.133	38.0	-1.229
-16.0	-0.216	4.5	-0.658	17.0	-1.138	39.0	-1.231
-15.0	-0.213	5.0	-0.712	17.5	-1.142	40.0	-1.234
-14.0	-0.217	5.5	-0.773	18.0	-1.145	41.0	-1.234
-13.0	-0.223	6.0	-0.808	18.5	-1.150	42.0	-1.239
-12.0	-0.230	6.5	-0.855	19.0	-1.150	43.0	-1.235
-11.0	-0.239	7.0	-0.901	19.5	-1.154	44.0	-1.238
-10.0	-0.244	7.5	-0.929	20.0	-1.157	45.0	-1.241
-9.0	-0.254	8.0	-0.957	21.0	-1.161	46.0	-1.251
-8.0	-0.270	8.5	-0.977	22.0	-1.168	47.0	-1.251
-7.0	-0.278	9.0	-0.999	23.0	-1.178	48.0	-1.258
-6.0	-0.294	9.5	-1.021	24.0	-1.177	49.0	-1.256
-5.0	-0.303	10.0	-1.028	25.0	-1.180	50.0	-1.256
-4.0	-0.315	10.5	-1.044	26.0	-1.179	51.0	-1.256
-3.0	-0.329	11.0	-1.061	27.0	-1.188	52.0	-1.261
-2.0	-0.341	11.5	-1.062	28.0	-1.189	53.0	-1.266
-1.0	-0.369	12.0	-1.076	29.0	-1.185	54.0	-1.268
0.0	-0.398	12.5	-1.080	30.0	-1.196	55.0	-1.273
0.5	-0.406	13.0	-1.094	31.0	-1.197	56.0	-1.274
1.0	-0.419	13.5	-1.092	32.0	-1.199	57.0	-1.275
1.5	-0.444	14.0	-1.108	33.0	-1.205	58.0	-1.280
2.0	-0.468	14.5	-1.114	34.0	-1.211	59.0	-1.281

TABLE 9.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--18:56
TPC SOLENOID - FAULT SEARCH - SC COIL, B+,C-, 0.500A,~39V ---
POS=6 OCLOCK, AXIAL PROBE PTNG SOL.NORTH,GM=810R3

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
60.0	-1.287	85.0	-1.311	110.0	-1.329	135.0	-1.364
61.0	-1.283	86.0	-1.314	111.0	-1.327	136.0	-1.368
62.0	-1.282	87.0	-1.317	112.0	-1.331	137.0	-1.366
63.0	-1.287	88.0	-1.315	113.0	-1.331	138.0	-1.366
64.0	-1.285	89.0	-1.317	114.0	-1.339	139.0	-1.369
65.0	-1.286	90.0	-1.330	115.0	-1.335	140.0	-1.369
66.0	-1.286	91.0	-1.328	116.0	-1.340	141.0	-1.366
67.0	-1.286	92.0	-1.325	117.0	-1.344	142.0	-1.367
68.0	-1.291	93.0	-1.333	118.0	-1.340	143.0	-1.360
69.0	-1.294	94.0	-1.329	119.0	-1.342	144.0	-1.368
70.0	-1.295	95.0	-1.326	120.0	-1.346	145.0	-1.369
71.0	-1.296	96.0	-1.327	121.0	-1.350	146.0	-1.369
72.0	-1.298	97.0	-1.328	122.0	-1.346	147.0	-1.367
73.0	-1.296	98.0	-1.321	123.0	-1.351	148.0	-1.364
74.0	-1.302	99.0	-1.326	124.0	-1.344	149.0	-1.360
75.0	-1.305	100.0	-1.323	125.0	-1.349	150.0	-1.362
76.0	-1.299	101.0	-1.325	126.0	-1.346	151.0	-1.361
77.0	-1.298	102.0	-1.325	127.0	-1.354	152.0	-1.359
78.0	-1.300	103.0	-1.325	128.0	-1.351	153.0	-1.366
79.0	-1.302	104.0	-1.323	129.0	-1.351	154.0	-1.363
80.0	-1.302	105.0	-1.323	130.0	-1.357	155.0	-1.372
81.0	-1.305	106.0	-1.320	131.0	-1.360	156.0	-1.368
82.0	-1.308	107.0	-1.326	132.0	-1.364	157.0	-1.372
83.0	-1.310	108.0	-1.321	133.0	-1.358	158.0	-1.372
84.0	-1.309	109.0	-1.327	134.0	-1.363	159.0	-1.375

TABLE 9. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--18:56
TPC SOLENOID - FAULT SEARCH - SC COIL, B+,C-, 0.500A,~39V ---
POS=6 OCLOCK, AXIAL PROBE PTNG SOL.NORTH,GM=810R3

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
160.0	-1.380	185.0	-1.373	210.0	-1.356	235.0	-1.339
161.0	-1.381	186.0	-1.365	211.0	-1.355	236.0	-1.336
162.0	-1.387	187.0	-1.368	212.0	-1.355	237.0	-1.339
163.0	-1.386	188.0	-1.371	213.0	-1.353	238.0	-1.336
164.0	-1.392	189.0	-1.369	214.0	-1.350	239.0	-1.332
165.0	-1.390	190.0	-1.370	215.0	-1.350	240.0	-1.325
166.0	-1.387	191.0	-1.365	216.0	-1.349	241.0	-1.322
167.0	-1.388	192.0	-1.371	217.0	-1.348	242.0	-1.318
168.0	-1.389	193.0	-1.367	218.0	-1.349	243.0	-1.321
169.0	-1.386	194.0	-1.370	219.0	-1.349	244.0	-1.319
170.0	-1.387	195.0	-1.363	220.0	-1.343	245.0	-1.319
171.0	-1.383	196.0	-1.366	221.0	-1.345	246.0	-1.319
172.0	-1.380	197.0	-1.363	222.0	-1.350	247.0	-1.320
173.0	-1.378	198.0	-1.365	223.0	-1.347	248.0	-1.327
174.0	-1.384	199.0	-1.365	224.0	-1.349	249.0	-1.324
175.0	-1.384	200.0	-1.364	225.0	-1.348	250.0	-1.324
176.0	-1.383	201.0	-1.363	226.0	-1.348	251.0	-1.326
177.0	-1.384	202.0	-1.366	227.0	-1.346	252.0	-1.325
178.0	-1.376	203.0	-1.369	228.0	-1.346	253.0	-1.325
179.0	-1.374	204.0	-1.363	229.0	-1.347	254.0	-1.320
180.0	-1.372	205.0	-1.365	230.0	-1.345	255.0	-1.317
181.0	-1.370	206.0	-1.361	231.0	-1.348	256.0	-1.320
182.0	-1.373	207.0	-1.362	232.0	-1.340	257.0	-1.314
183.0	-1.370	208.0	-1.368	233.0	-1.343	258.0	-1.311
184.0	-1.370	209.0	-1.362	234.0	-1.341	259.0	-1.312

TABLE 9. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--18:56
TPC SOLENOID - FAULT SEARCH - SC COIL, B+,C-, 0.500A,~39V ---
POS=6 OCLOCK, AXIAL PROBE PTNG SOL.NORTH,GM=810R3

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
260.0	-1.312	285.0	-1.257	310.0	-1.177	327.5	-1.061
261.0	-1.305	286.0	-1.251	311.0	-1.170	328.0	-1.053
262.0	-1.306	287.0	-1.253	312.0	-1.169	328.5	-1.047
263.0	-1.303	288.0	-1.250	313.0	-1.163	329.0	-1.034
264.0	-1.305	289.0	-1.249	314.0	-1.159	329.5	-1.020
265.0	-1.297	290.0	-1.255	315.0	-1.157	330.0	-1.007
266.0	-1.299	291.0	-1.251	316.0	-1.154	330.5	-0.994
267.0	-1.300	292.0	-1.248	317.0	-1.150	331.0	-0.979
268.0	-1.294	293.0	-1.249	318.0	-1.141	331.5	-0.955
269.0	-1.297	294.0	-1.246	319.0	-1.136	332.0	-0.932
270.0	-1.292	295.0	-1.246	320.0	-1.131	332.5	-0.904
271.0	-1.277	296.0	-1.240	320.5	-1.127	333.0	-0.867
272.0	-1.274	297.0	-1.238	321.0	-1.124	333.5	-0.831
273.0	-1.272	298.0	-1.231	321.5	-1.122	334.0	-0.785
274.0	-1.270	299.0	-1.224	322.0	-1.119	334.5	-0.728
275.0	-1.263	300.0	-1.223	322.5	-1.115	335.0	-0.675
276.0	-1.266	301.0	-1.214	323.0	-1.111	335.5	-0.619
277.0	-1.264	302.0	-1.203	323.5	-1.109	336.0	-0.565
278.0	-1.259	303.0	-1.201	324.0	-1.103	336.5	-0.519
279.0	-1.263	304.0	-1.194	324.5	-1.101	337.0	-0.480
280.0	-1.261	305.0	-1.190	325.0	-1.095	337.5	-0.448
281.0	-1.259	306.0	-1.192	325.5	-1.090	338.0	-0.418
282.0	-1.260	307.0	-1.187	326.0	-1.085	338.5	-0.395
283.0	-1.260	308.0	-1.179	326.5	-1.078	339.0	-0.376
284.0	-1.259	309.0	-1.177	327.0	-1.072	339.5	-0.360

TABLE 9. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--18:56
TPC SOLENOID - FAULT SEARCH - SC COIL, B+,C-, 0.500A,~39V ---
POS=6 OCLOCK, AXIAL PROBE PTNG SOL.NORTH,GM=810R3

X (CM)	B (GAUSS)
340.0	-0.349
341.0	-0.327
342.0	-0.322
343.0	-0.303
344.0	-0.297
345.0	-0.284
346.0	-0.268
347.0	-0.254
348.0	-0.251
349.0	-0.252
350.0	-0.243
351.0	-0.244

TABLE 9. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--18:56
TPC SOLENOID - FAULT SEARCH - SC COIL, B+,C-, 0.500A,~39V ---
POS=6 OCLOCK, AXIAL PROBE PTNG SOL.NORTH,GM=810R3

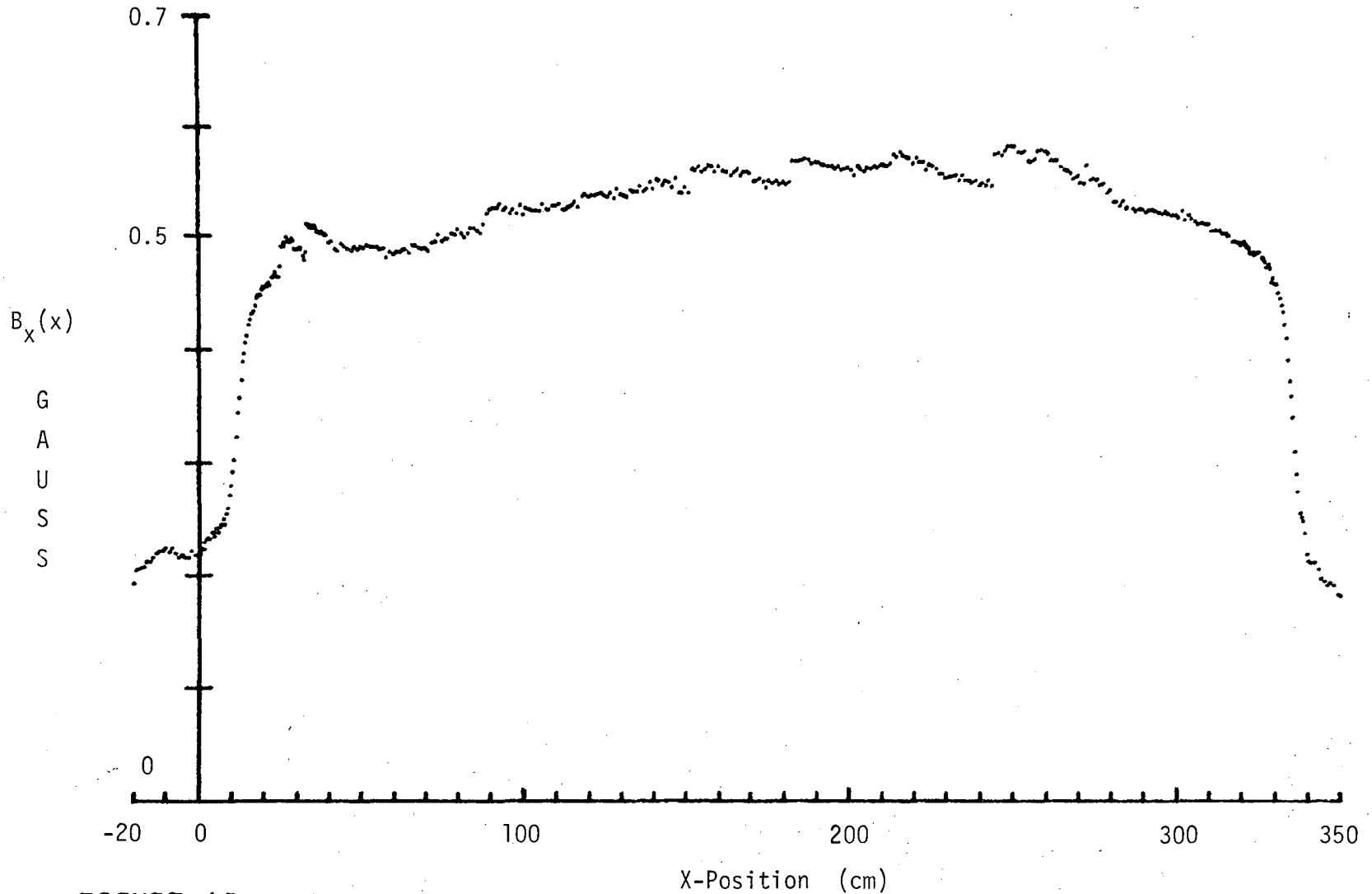

FIGURE 10
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--20:29
TPC SOLENOID - FAULT SEARCH - SC COIL,C-,GND+,0.150A,~20V ---
POS=6 OCLOCK, AXIAL PROBE PNTG TOWARD SOL. NORTH, S10R3#1

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
-20.0	0.193	2.5	0.233	15.0	0.412	27.5	0.496
-19.0	0.204	3.0	0.233	15.5	0.422	28.0	0.495
-18.0	0.206	3.5	0.231	16.0	0.427	28.5	0.499
-17.0	0.207	4.0	0.237	16.5	0.431	29.0	0.495
-16.0	0.212	4.5	0.238	17.0	0.434	29.5	0.488
-15.0	0.212	5.0	0.235	17.5	0.438	30.0	0.488
-14.0	0.214	5.5	0.241	18.0	0.446	30.5	0.489
-13.0	0.219	6.0	0.237	18.5	0.448	31.0	0.490
-12.0	0.221	6.5	0.243	19.0	0.448	31.5	0.488
-11.0	0.222	7.0	0.245	19.5	0.453	31.5	0.490
-10.0	0.223	7.5	0.249	20.0	0.455	32.0	0.483
-9.0	0.219	8.0	0.245	20.5	0.455	32.5	0.479
-8.0	0.223	8.5	0.255	21.0	0.456	33.0	0.486
-7.0	0.219	9.0	0.259	21.5	0.459	33.5	0.511
-6.0	0.215	9.5	0.271	22.0	0.456	34.0	0.508
-5.0	0.217	10.0	0.279	22.5	0.463	34.5	0.509
-4.0	0.214	10.5	0.292	23.0	0.465	35.0	0.508
-3.0	0.214	11.0	0.302	23.5	0.468	35.5	0.509
-2.0	0.221	11.5	0.322	24.0	0.465	36.0	0.507
-1.0	0.218	12.0	0.344	24.5	0.463	36.5	0.504
0.0	0.219	12.5	0.357	25.0	0.473	37.0	0.504
0.5	0.218	13.0	0.373	25.5	0.490	37.5	0.502
1.0	0.223	13.5	0.389	26.0	0.491	38.0	0.504
1.5	0.223	14.0	0.396	26.5	0.494	38.5	0.503
2.0	0.230	14.5	0.407	27.0	0.499	39.0	0.500

TABLE 10.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--20:29
TPC SOLENOID - FAULT SEARCH - SC COIL,C-,GND+,0.150A,~20V ---
POS=6 OCLOCK, AXIAL PROBE PNTG TOWARD SOL. NORTH, 810R3#1

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
39.5	0.501	64.0	0.489	89.0	0.521	114.0	0.527
40.0	0.495	65.0	0.485	90.0	0.524	115.0	0.527
41.0	0.495	66.0	0.492	91.0	0.526	116.0	0.532
42.0	0.489	67.0	0.492	92.0	0.525	117.0	0.527
43.0	0.487	68.0	0.489	93.0	0.529	118.0	0.536
44.0	0.493	69.0	0.489	94.0	0.523	119.0	0.538
45.0	0.491	70.0	0.490	95.0	0.526	120.0	0.537
46.0	0.488	71.0	0.487	96.0	0.520	121.0	0.537
47.0	0.487	72.0	0.494	97.0	0.525	122.0	0.538
48.0	0.491	73.0	0.496	98.0	0.521	123.0	0.538
49.0	0.489	74.0	0.501	99.0	0.528	124.0	0.540
50.0	0.491	75.0	0.496	100.0	0.520	125.0	0.538
51.0	0.490	76.0	0.499	101.0	0.526	126.0	0.537
52.0	0.492	77.0	0.499	102.0	0.525	127.0	0.540
53.0	0.491	78.0	0.502	103.0	0.524	128.0	0.535
54.0	0.491	79.0	0.502	104.0	0.523	129.0	0.543
55.0	0.491	80.0	0.506	105.0	0.523	130.0	0.538
56.0	0.488	81.0	0.503	106.0	0.529	131.0	0.537
57.0	0.489	82.0	0.499	107.0	0.524	132.0	0.536
58.0	0.481	83.0	0.503	108.0	0.525	133.0	0.542
59.0	0.486	84.0	0.507	109.0	0.528	134.0	0.541
60.0	0.484	85.0	0.507	110.0	0.528	135.0	0.541
61.0	0.486	86.0	0.506	111.0	0.529	136.0	0.545
62.0	0.487	87.0	0.503	112.0	0.524	137.0	0.542
63.0	0.488	88.0	0.511	113.0	0.524	138.0	0.543

TABLE 10. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--20:29
TPC SOLENOID - FAULT SEARCH - SC COIL,C-,GND+,0.150A,~20V ---
POS=6 OCLOCK, AXIAL PROBE PNTG TOWARD SOL. NORTH, 810R3#1

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
139.0	0.550	164.0	0.556	189.0	0.566	214.0	0.575
140.0	0.543	165.0	0.559	190.0	0.568	215.0	0.573
141.0	0.553	166.0	0.561	191.0	0.567	216.0	0.577
142.0	0.550	167.0	0.556	192.0	0.565	217.0	0.573
143.0	0.547	168.0	0.560	193.0	0.565	218.0	0.573
144.0	0.550	169.0	0.559	194.0	0.564	219.0	0.572
145.0	0.550	170.0	0.558	195.0	0.564	220.0	0.566
146.0	0.544	171.0	0.551	196.0	0.562	221.0	0.571
147.0	0.553	172.0	0.551	197.0	0.564	222.0	0.567
148.0	0.540	173.0	0.554	198.0	0.560	223.0	0.568
149.0	0.540	174.0	0.549	199.0	0.561	224.0	0.561
150.0	0.544	175.0	0.545	200.0	0.562	225.0	0.565
151.0	0.540	176.0	0.551	201.0	0.561	226.0	0.564
152.0	0.562	177.0	0.548	202.0	0.555	227.0	0.561
153.0	0.560	178.0	0.551	203.0	0.563	228.0	0.556
154.0	0.564	179.0	0.547	204.0	0.561	229.0	0.557
155.0	0.559	180.0	0.549	205.0	0.559	230.0	0.553
156.0	0.561	181.0	0.547	206.0	0.562	231.0	0.554
157.0	0.565	182.0	0.549	207.0	0.561	232.0	0.555
158.0	0.564	183.0	0.569	208.0	0.563	233.0	0.556
159.0	0.559	184.0	0.568	209.0	0.562	234.0	0.551
160.0	0.563	185.0	0.569	210.0	0.565	235.0	0.556
161.0	0.561	186.0	0.570	211.0	0.565	236.0	0.550
162.0	0.559	187.0	0.571	212.0	0.564	237.0	0.551
163.0	0.559	188.0	0.569	213.0	0.567	238.0	0.548

TABLE 10. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--20:29
TPC SOLENOID - FAULT SEARCH - SC COIL,C-,GND+,0.150A,~20V ---
POS=6 OCLOCK, AXIAL PROBE PNTG TOWARD SOL. NORTH, 810R3#1

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
239.0	0.551	264.0	0.568	289.0	0.525	314.0	0.501
240.0	0.546	265.0	0.562	290.0	0.524	315.0	0.501
241.0	0.548	266.0	0.560	291.0	0.521	316.0	0.499
242.0	0.545	267.0	0.559	292.0	0.524	317.0	0.495
243.0	0.550	268.0	0.557	293.0	0.523	318.0	0.494
244.0	0.546	269.0	0.552	294.0	0.523	319.0	0.494
245.0	0.575	270.0	0.554	295.0	0.521	320.0	0.490
246.0	0.576	271.0	0.548	296.0	0.520	320.5	0.495
247.0	0.573	272.0	0.547	297.0	0.521	321.0	0.493
248.0	0.579	273.0	0.563	298.0	0.520	321.5	0.490
249.0	0.582	274.0	0.551	299.0	0.518	322.0	0.489
250.0	0.582	275.0	0.552	300.0	0.518	322.5	0.485
251.0	0.581	276.0	0.551	301.0	0.516	323.0	0.484
252.0	0.577	277.0	0.545	302.0	0.522	323.5	0.485
253.0	0.575	278.0	0.547	303.0	0.514	324.0	0.483
254.0	0.577	279.0	0.539	304.0	0.519	324.5	0.485
255.0	0.568	280.0	0.540	305.0	0.515	325.0	0.485
256.0	0.568	281.0	0.530	306.0	0.513	325.5	0.486
257.0	0.570	282.0	0.530	307.0	0.510	326.0	0.481
258.0	0.577	283.0	0.527	308.0	0.511	326.5	0.479
259.0	0.578	284.0	0.531	309.0	0.510	327.0	0.476
260.0	0.577	285.0	0.526	310.0	0.510	327.5	0.472
261.0	0.575	285.0	0.524	311.0	0.504	328.0	0.473
262.0	0.568	287.0	0.524	312.0	0.504	328.5	0.470
263.0	0.568	288.0	0.522	313.0	0.504	329.0	0.459

TABLE 10. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--20:29
TPC SOLENOID - FAULT SEARCH - SC COIL,C-,GND+,0.150A,~20V ---
POS=6 OCLOCK, AXIAL PROBE PNTG TOWARD SOL. NORTH, 810R3#1

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
329.5	0.462	344.0	0.195
330.0	0.458	345.0	0.193
330.5	0.456	346.0	0.190
331.0	0.449	347.0	0.192
331.5	0.445	348.0	0.189
332.0	0.438	349.0	0.182
332.5	0.432	350.0	0.180
333.0	0.422		
333.5	0.409		
334.0	0.390		
334.5	0.372		
335.0	0.358		
335.5	0.339		
336.0	0.309		
336.5	0.289		
337.0	0.274		
337.5	0.254		
338.0	0.251		
338.5	0.247		
339.0	0.237		
339.5	0.218		
340.0	0.212		
341.0	0.210		
342.0	0.210		
343.0	0.204		

TABLE 10. (CONTINUED)
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/06--20:29
TPC SOLENOID - FAULT SEARCH - SC COIL,C-,GND+,0.150A,~20V ---
POS=6 OCLOCK, AXIAL PROBE PNTG TOWARD SOL. NORTH, 810R3#1

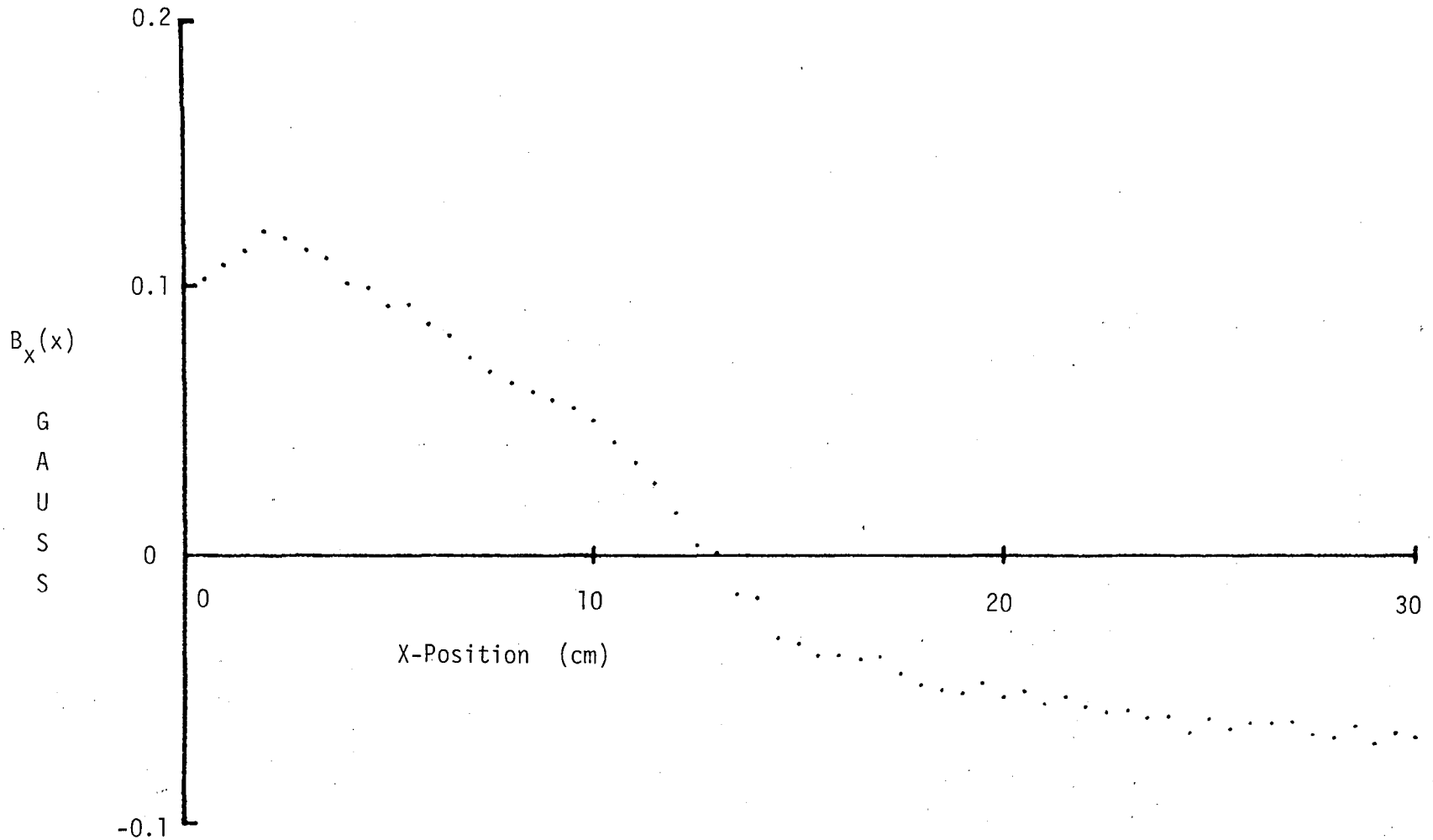

FIGURE 11
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--14:32
TPC SOLENOID - FAULT SEARCH - SC & UPA - C+,CD-,.1000A ---
POS=6 OCLOCK, AXIAL PROBE TOWARD SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
0.0	0.101	12.5	0.004	25.0	-0.061
0.5	0.103	13.0	0.001	25.5	-0.065
1.0	0.108	13.5	-0.014	26.0	-0.062
1.5	0.113	14.0	-0.016	26.5	-0.063
2.0	0.120	14.5	-0.031	27.0	-0.062
2.5	0.118	15.0	-0.033	27.5	-0.067
3.0	0.114	15.5	-0.038	28.0	-0.068
3.5	0.110	16.0	-0.037	28.5	-0.064
4.0	0.101	16.5	-0.039	29.0	-0.070
4.5	0.099	17.0	-0.038	29.5	-0.066
5.0	0.093	17.5	-0.044	30.0	-0.068
5.5	0.093	18.0	-0.048		
6.0	0.086	18.5	-0.050		
6.5	0.082	19.0	-0.051		
7.0	0.074	19.5	-0.048		
7.5	0.069	20.0	-0.053		
8.0	0.065	20.5	-0.051		
8.5	0.061	21.0	-0.055		
9.0	0.058	21.5	-0.053		
9.5	0.055	22.0	-0.056		
10.0	0.050	22.5	-0.059		
10.5	0.042	23.0	-0.058		
11.0	0.035	23.5	-0.060		
11.5	0.027	24.0	-0.060		
12.0	0.016	24.5	-0.066		

TABLE 11.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--14:32
TPC SOLENOID - FAULT SEARCH - SC & UPA - C+,CD-,.1000A ---
POS=6 OCLOCK, AXIAL PROBE TOWARD SOLENOID NORTH

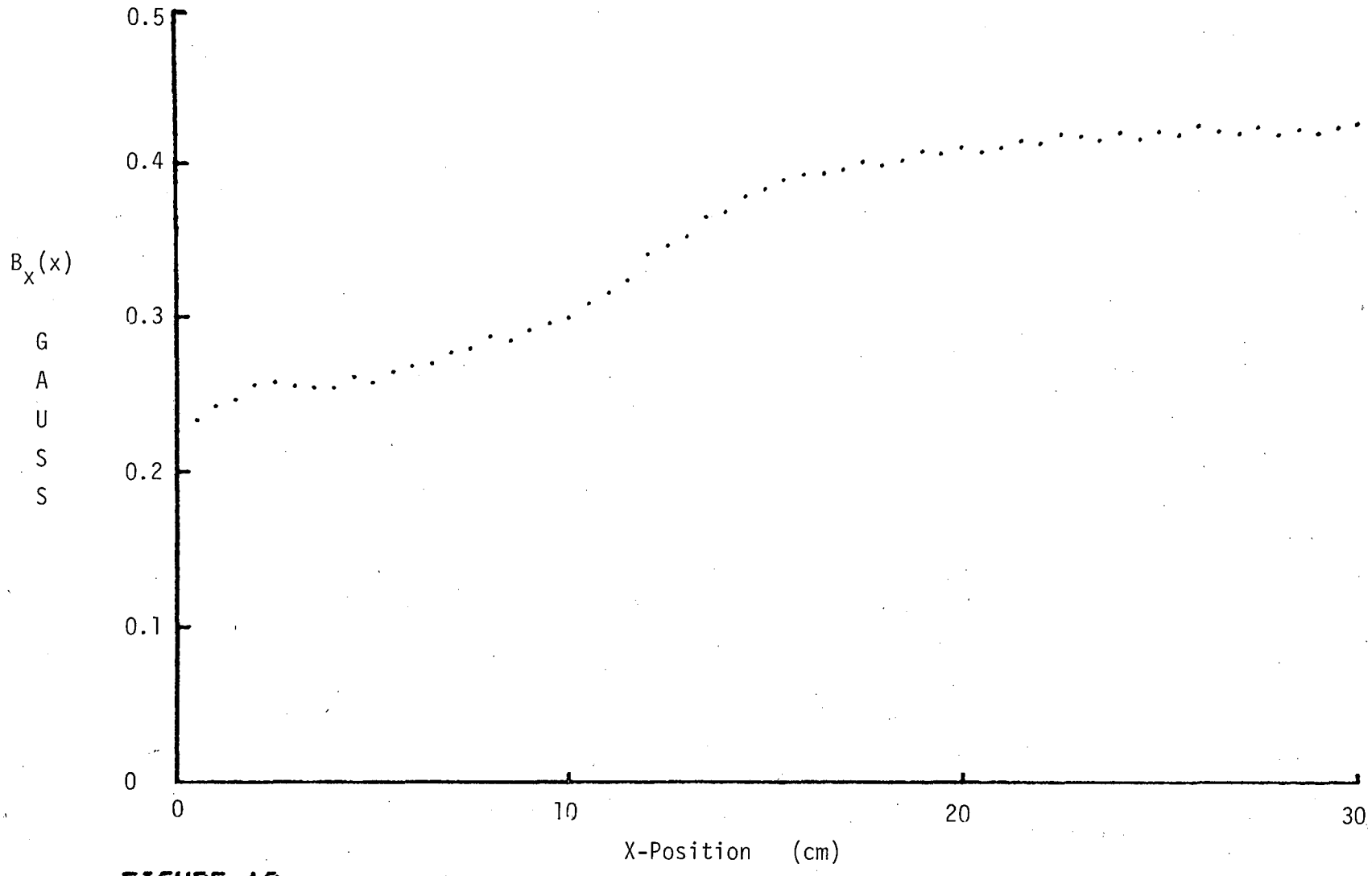

FIGURE 12
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--14:53
TPC SOLENOID - FAULT SEARCH - SC & UPA, C-,CD+, 0.1000A---
POS=6 OCLOCK, AX PR PTNG SOL NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
0.0	0.227	12.5	0.346	25.0	0.422
0.5	0.234	13.0	0.352	25.5	0.418
1.0	0.243	13.5	0.365	26.0	0.425
1.5	0.248	14.0	0.369	26.5	0.421
2.0	0.257	14.5	0.379	27.0	0.419
2.5	0.258	15.0	0.384	27.5	0.424
3.0	0.255	15.5	0.390	28.0	0.419
3.5	0.255	16.0	0.393	28.5	0.423
4.0	0.255	16.5	0.394	29.0	0.420
4.5	0.262	17.0	0.397	29.5	0.423
5.0	0.258	17.5	0.402	30.0	0.426
5.5	0.265	18.0	0.399		
6.0	0.269	18.5	0.403		
6.5	0.271	19.0	0.408		
7.0	0.278	19.5	0.407		
7.5	0.280	20.0	0.412		
8.0	0.288	20.5	0.408		
8.5	0.285	21.0	0.411		
9.0	0.293	21.5	0.416		
9.5	0.297	22.0	0.414		
10.0	0.300	22.5	0.419		
10.5	0.309	23.0	0.418		
11.0	0.316	23.5	0.415		
11.5	0.324	24.0	0.421		
12.0	0.341	24.5	0.416		

TABLE 12.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--14:53
TPC SOLENOID - FAULT SEARCH - SC & UPA, C-,CD+, 0.1000A---
POS=6 OCLOCK, AX PR PTNG SOL NORTH

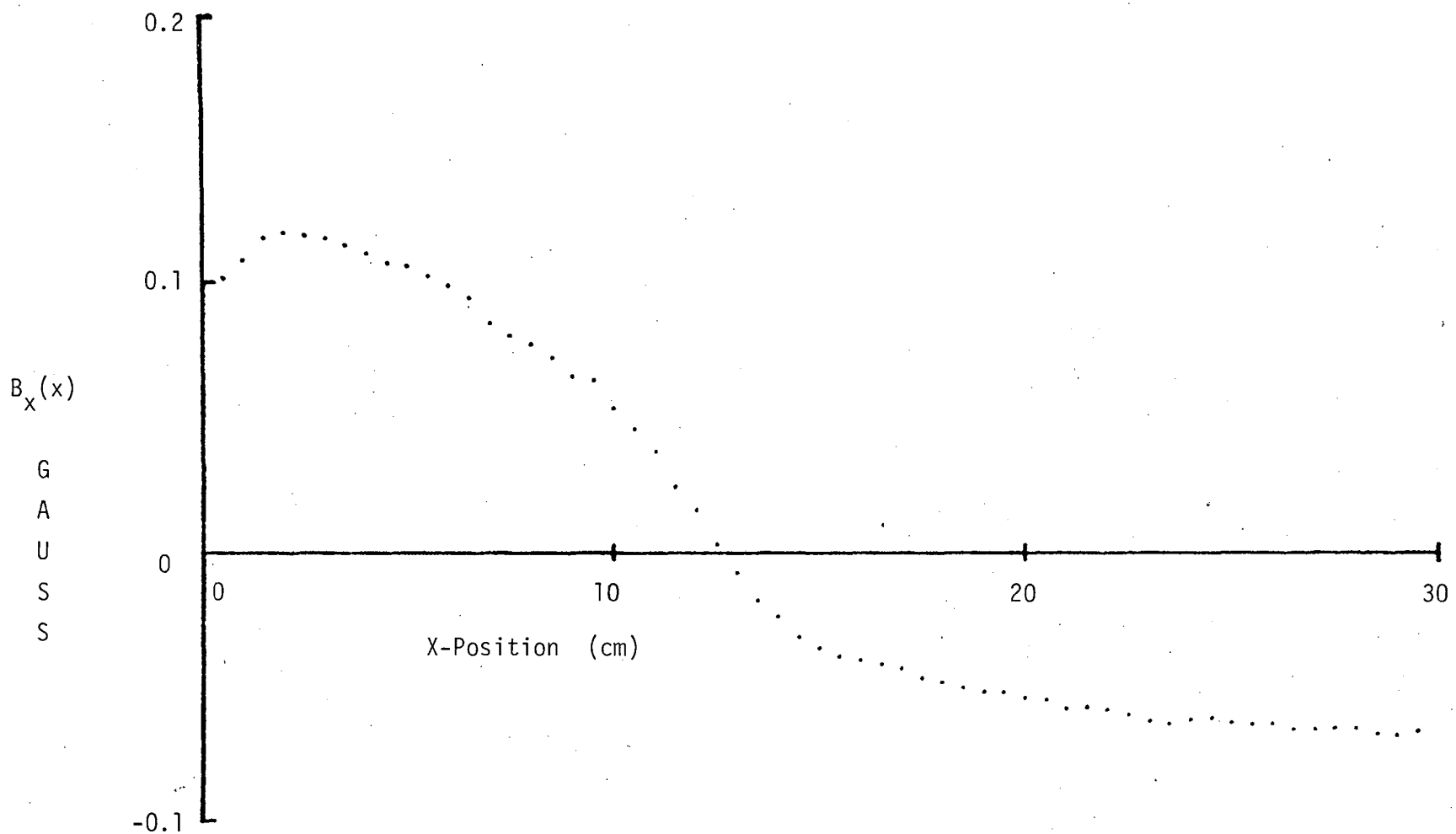

FIGURE 13
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--15:130
TPC SOLENOID - FAULT SEARCH - SC COIL - C+,GND-,0.1000A ---
POS=6 OCLOCK, AX PROBE PNTG SOLENOID NORTH

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
0.0	0.099	12.5	0.003	25.0	-0.064
0.5	0.102	13.0	-0.008	25.5	-0.064
1.0	0.108	13.5	-0.018	26.0	-0.064
1.5	0.117	14.0	-0.024	26.5	-0.066
2.0	0.118	14.5	-0.032	27.0	-0.066
2.5	0.118	15.0	-0.036	27.5	-0.066
3.0	0.117	15.5	-0.039	28.0	-0.066
3.5	0.114	16.0	-0.041	28.5	-0.068
4.0	0.111	16.5	-0.042	29.0	-0.068
4.5	0.107	17.0	-0.044	29.5	-0.067
5.0	0.106	17.5	-0.047	30.0	-0.003
5.5	0.103	18.0	-0.049		
6.0	0.099	18.5	-0.051		
6.5	0.094	19.0	-0.052		
7.0	0.085	19.5	-0.052		
7.5	0.081	20.0	-0.055		
8.0	0.077	20.5	-0.055		
8.5	0.073	21.0	-0.058		
9.0	0.066	21.5	-0.058		
9.5	0.064	22.0	-0.059		
10.0	0.054	22.5	-0.061		
10.5	0.046	23.0	-0.063		
11.0	0.038	23.5	-0.064		
11.5	0.025	24.0	-0.063		
12.0	0.015	24.5	-0.062		

TABLE 13.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--15:130
TPC SOLENOID - FAULT SEARCH - SC COIL - C+,GND-,0.1000A ---
POS=6 OCLOCK, AX PROBE PNTG SOLENOID NORTH

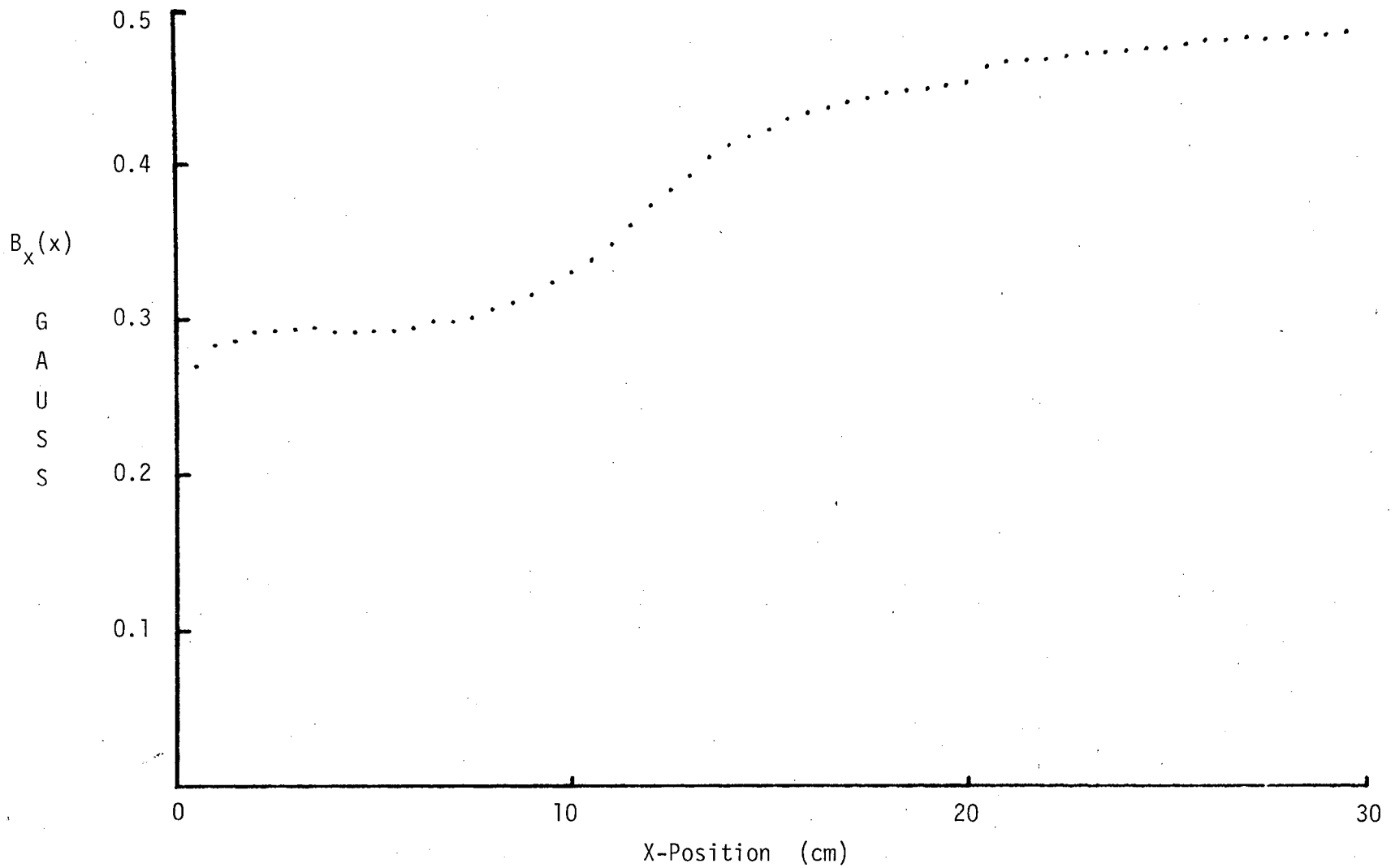

FIGURE 14
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--15:26
TPC SOLENOID - FAULT SEARCH - POS=6 OCLOCK,AX PRBE PTNG SOL N ---
SC COIL, C-,GND+, 0.1000A

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
0.0	0.266	12.5	0.384	25.0	0.476
0.5	0.270	13.0	0.394	25.5	0.478
1.0	0.284	13.5	0.405	26.0	0.481
1.5	0.286	14.0	0.413	26.5	0.481
2.0	0.292	14.5	0.418	27.0	0.483
2.5	0.294	15.0	0.424	27.5	0.482
3.0	0.295	15.5	0.430	28.0	0.483
3.5	0.295	16.0	0.435	28.5	0.485
4.0	0.293	16.5	0.438	29.0	0.485
4.5	0.292	17.0	0.441	29.5	0.486
5.0	0.294	17.5	0.443		
5.5	0.293	18.0	0.446		
6.0	0.295	18.5	0.449		
6.5	0.299	19.0	0.449		
7.0	0.299	19.5	0.452		
7.5	0.302	20.0	0.454		
8.0	0.307	20.5	0.464		
8.5	0.311	21.0	0.467		
9.0	0.317	21.5	0.469		
9.5	0.324	22.0	0.469		
10.0	0.331	22.5	0.471		
10.5	0.339	23.0	0.473		
11.0	0.349	23.5	0.474		
11.5	0.361	24.0	0.475		
12.0	0.374	24.5	0.476		

TABLE 14.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--15:26
TPC SOLENOID - FAULT SEARCH - POS=6 OCLOCK,AX PRBE PTNG SOL N ---
SC COIL, C-,GND+, 0.1000A

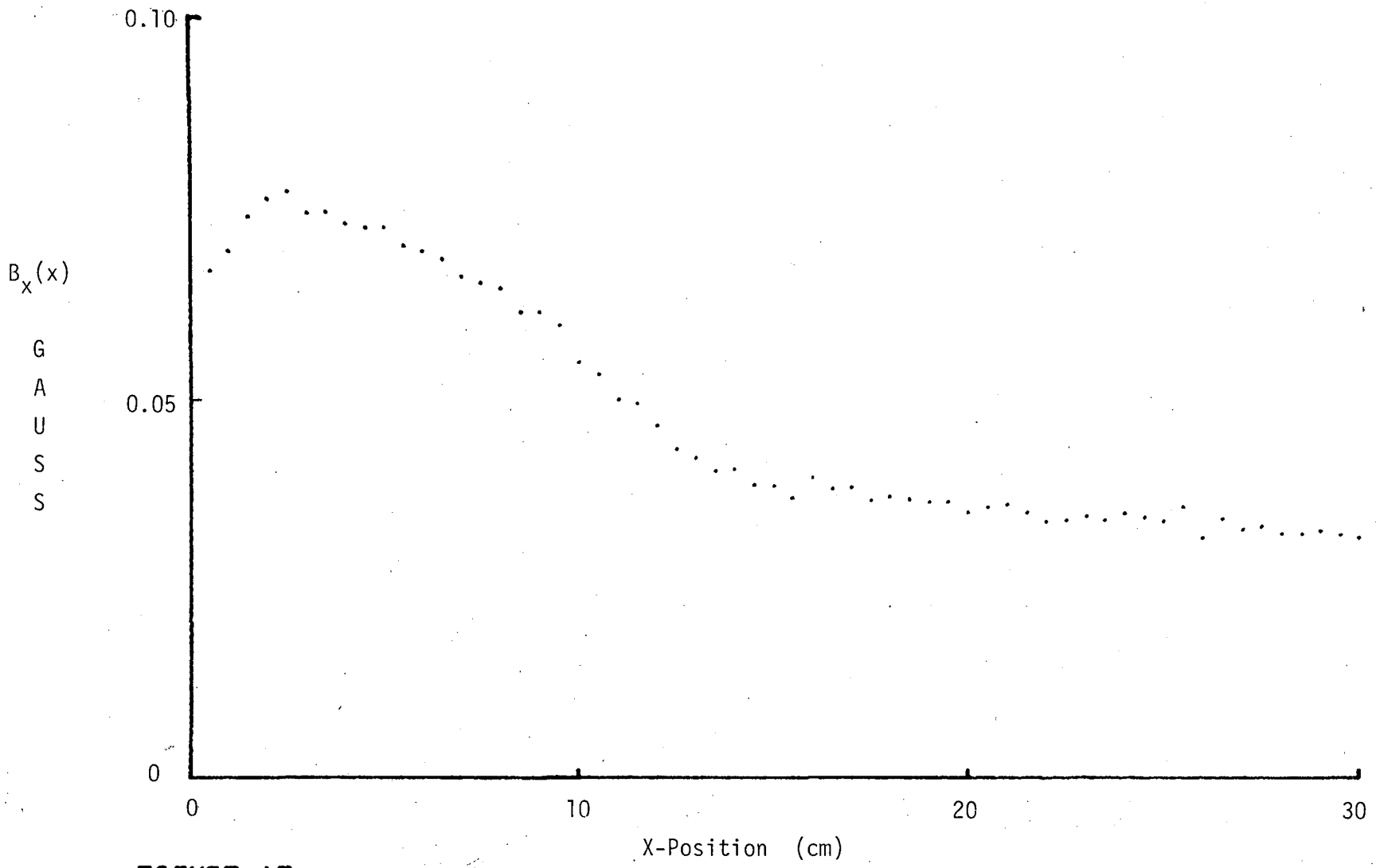

FIGURE 15
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--15:55
TPC SOLENOID - FAULT SEARCH - POS=6 OCLOCK,AX PRBE PTNG SOL N ---
SC & UPA (C+, AB-), 0.1000A

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
0.0	0.158	12.5	0.143	25.0	0.134
0.5	0.166	13.0	0.142	25.5	0.135
1.0	0.169	13.5	0.140	26.0	0.131
1.5	0.173	14.0	0.140	26.5	0.134
2.0	0.176	14.5	0.138	27.0	0.133
2.5	0.177	15.0	0.138	27.5	0.133
3.0	0.174	15.5	0.137	28.0	0.132
3.5	0.174	16.0	0.139	28.5	0.132
4.0	0.173	16.5	0.138	29.0	0.132
4.5	0.172	17.0	0.138	29.5	0.132
5.0	0.172	17.5	0.136	30.0	0.131
5.5	0.170	18.0	0.137		
6.0	0.169	18.5	0.137		
6.5	0.168	19.0	0.136		
7.0	0.166	19.5	0.136		
7.5	0.165	20.0	0.135		
8.0	0.164	20.5	0.135		
8.5	0.161	21.0	0.136		
9.0	0.161	21.5	0.135		
9.5	0.159	22.0	0.134		
10.0	0.155	22.5	0.134		
10.5	0.153	23.0	0.134		
11.0	0.150	23.5	0.134		
11.5	0.149	24.0	0.135		
12.0	0.146	24.5	0.134		

TABLE 15.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--15:55
TPC SOLENOID - FAULT SEARCH - POS=6 OCLOCK,AX PRBE PTNG SOL N ---
SC & UPA (C+, AB-), 0.1000A

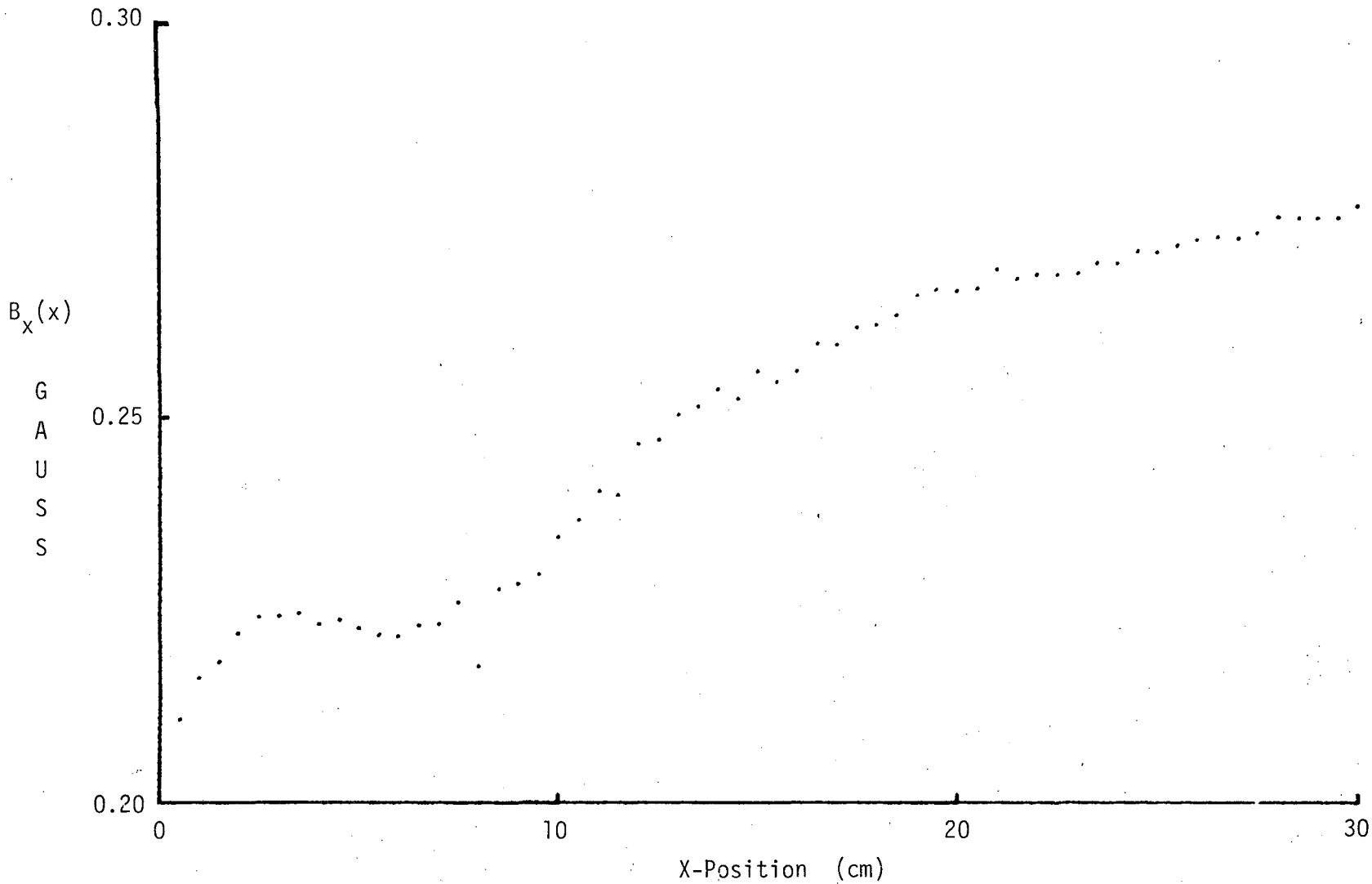

FIGURE 16
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--16:10
TPC SOLENOID - FAULT SEARCH - POS=6 OCLOCK,AX PRBE PTNG SOL N ---
SC &UPA (C-,,AB+), 0.1000A

X (CM)	B (GAUSS)	X (CM)	B (GAUSS)	X (CM)	B (GAUSS)
0.0	0.205	12.5	0.246	25.0	0.270
0.5	0.211	13.0	0.250	25.5	0.271
1.0	0.216	13.5	0.251	26.0	0.272
1.5	0.218	14.0	0.253	26.5	0.272
2.0	0.222	14.5	0.252	27.0	0.272
2.5	0.224	15.0	0.256	27.5	0.273
3.0	0.224	15.5	0.254	28.0	0.275
3.5	0.224	16.0	0.256	28.5	0.275
4.0	0.223	16.5	0.259	29.0	0.275
4.5	0.223	17.0	0.259	29.5	0.275
5.0	0.222	17.5	0.261	30.0	0.276
5.5	0.222	18.0	0.261		
6.0	0.221	18.5	0.262		
6.5	0.223	19.0	0.265		
7.0	0.223	19.5	0.266		
7.5	0.226	20.0	0.266		
8.0	0.218	20.5	0.266		
8.5	0.227	21.0	0.268		
9.0	0.228	21.5	0.267		
9.5	0.229	22.0	0.268		
10.0	0.234	22.5	0.268		
10.5	0.236	23.0	0.268		
11.0	0.240	23.5	0.269		
11.5	0.239	24.0	0.269		
12.0	0.246	24.5	0.270		

TABLE 16.
LBL MAGNETIC MEASUREMENTS ENGINEERING -- MIG--80/10/07--16:10
TPC SOLENOID - FAULT SEARCH - POS=6 OCLOCK,AX PRBE PTNG SOL N ---
SC &UPA (C-,,AB+), 0.1000A

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