national accelerator laboratory

TM-570
0621.000

10' Modified B1 Wide Gap

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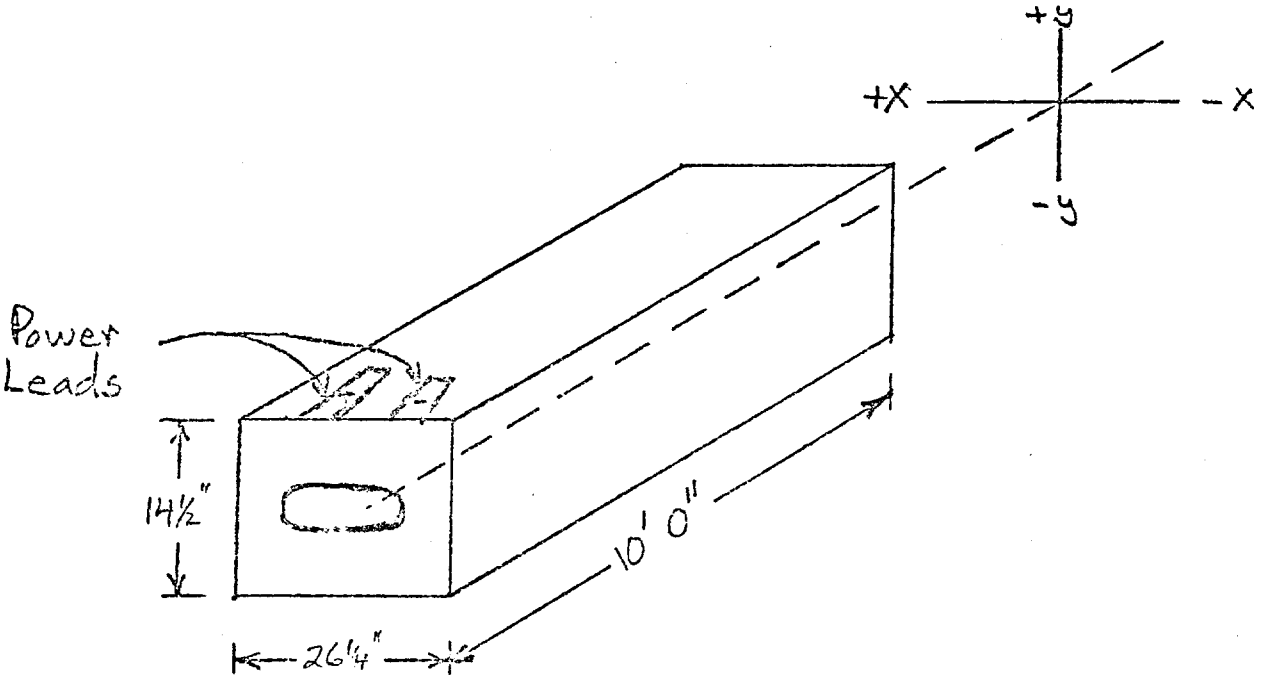
Modified B1 wide gap magnets were made using main-ring B1 laminations, widening gap height. Useful aperture is 7.4 inches wide and 2.3 inches high. Its turn number is 68. Several wide gap magnets for proton were measured between November 1974 and February 1975. The breakdown is as follows.

Wide Gap Magnet Number	Date Measured	Type of Measurement
#1	Nov. 21, 1974	Hand Measurement
#6	Jan. 26, 1975	Hand Measurement
#4	Feb. 7, 1975	Computer Measurement
#7	Feb. 11, 1975	Computer Measurement
#8	Feb. 13, 1975	Computer Measurement
#9	Feb. 13, 1975	Computer Measurement
#10	Feb. 28, 1975	Computer Measurement

Parameters

The probe consisted of one loop of 4 mil diameter tungsten wire stretched around two .49976" diameter crystals. A Philbrick integrator and a bucking coil were used. The integrated signal was fed to an A/D system interfaced with a computer.

R integrator = 30,130Ω (9949Ω for field shape)
C integrator = 1.0 μf (.1%)
R probe = 82Ω
R bucking coil = 2Ω



Magnet Orientation

10' Modified B1 Wide Gap Magnets

Excitation Values for excitation were obtained by flipping the probe 180° then back to 360°.

current I (Amp)	SB(x=0)dl WG#1 (kG-m)	SB(x=0)dl WG#6 (kG-m)	SB(x=0)dl WG#4 (kG-m)	SB(x=0)dl WG#7 (kG-m)	SB(x=0)dl WG#8 (kG-m)	SB(x=0)dl WG#9 (kG-m)	SB(x=0)dl WG#10 (kG-m)
0	.031	.032	.043	.029	.023	.029	.040
100	4.51	4.515	4.48	4.53	4.56	4.54	4.54
200	9.05	9.04	9.03	9.17	9.08	9.10	8.99
300	13.59	13.58	13.68	13.64	13.61	13.51	13.56
400	18.07	18.12	18.05	18.11	18.17	18.14	18.18
500	22.66	22.64	22.74	22.55	22.82	22.71	22.67
600	27.19	27.16	27.27	27.16	27.25	27.13	27.26
700	31.71	31.66	31.58	31.84	31.73	31.71	31.57
800	36.19	36.19	36.37	36.39	36.26	36.08	36.08
900	40.63	40.62	40.60	40.68	40.82	40.62	40.62
1000	44.91	44.89	44.54	44.98	45.04	44.84	44.95
1100	48.81	48.83	48.82	48.74	49.02	48.89	48.89
1200	52.27	52.28	52.26	52.24	52.33	52.25	52.33

All fields have been normalized to their nominal current. A plot of SBdl vs I for wide gap magnet #1 is shown in graph.

Field Shape

Values for field shape were found by moving the probe across the beam aperture and noting the change in voltage at different positions relative to the center. A bucking coil was used to compensate for power supply instability.

The field shape for wide gap magnets is extremely flat. Field shapes for wide gap magnet #4 at 600 and 1200 amperes are given below as a typical example.

X (inches)	% (at 600 amps)	% (at 1200 amps)
-2.0	.002	-.091
-1.5	-.004	-.046
-1.0	-.007	-.022
- .5	-.003	-.006
0.0	.000	.000
.5	-.005	-.008
1.0	-.012	-.025
1.5	-.014	-.046
2.0	-.007	-.084

Where % is defined as:

$$\% = \frac{\int B(X)dl - \int B(X=0)dl}{\int B(X=0)dl} \times 100$$

Although this magnet was measured using a computer and A/D system, it is generally true for all magnets that at 600 amperes the field is flat to within better than ±.00X% and flat to within ±.0XX% at 1200.

All field shape measurements were made at the midplane of the gap except for the hand measured magnet #1. The field shape of wide gap magnet #1 was measured at y = 0.0" and also at y = 0.75. With this magnet a bucking coil was not used.

Field Shape Wide Gap #1

y = 0"	I = 700 amps	I = 1132 amps
X	%	%
-2.0	.022	-.050
-1.5	.012	-.026
-1.0	.004	-.010
- .5	.004	.000
0	.000	.000
.5	.004	-.002
1.0	.000	-.014
1.5	.008	-.028
2.0	.018	.000

y = +.75"	I = 700 amps	I = 1132 amps
X	%	%
-2.0	-.037	-.068
-1.5	-.022	-.040
-1.0	-.077	-.014
- .5	.000	-.002
0	.000	.000
.5	.000	-.005
1.0	-.011	-.002
1.5	-.037	-.057
2.0	-.048	-.087

Inductance

		#1	#6	#4	#7	#8	#9	#10
50 H_z	L_s	66.6 mh	66.0 mh	66.5 mh	66.5 mh	66.8 mh	67.4 mh	66.7 mh
	Q	7.45	7.6	7.45	7.45	7.35	7.30	7.35
1 kHz	L_s	21.0 mh	21.1 mh	21.2 mh	21.2 mh	21.1 mh	21.2 mh	20.8 mh
	Q	1.07	1.08	1.09	1.08	1.07	1.08	1.07

All inductance measurements were made with a current of .68 amperes.
The corresponding driving voltages were: 15 volts for 50 Hz
125 volts for 1 kHz.

Water Flow

	#1	#6	#4	#7	#8	#9	#10
GPM	12.0	11.0	9.4	9.4	9.4	9.2	9.4
PSI	182.5	187.5	142.5	142.5	142.5	147.5	142.5

Equipment

Dana model 5500 D.V.M.	FNAL #2435
Dana model 5500 D.V.M.	FNAL #17541
Dana model 5900 D.V.M.	FNAL #12837
General Radio Inductance Bridge model 1633-A	Serial #826
Varian model 620i computer	FNAL #2448
Philbrick Integrator	

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