A Preliminary Report on Strength of ½ of a 3Q120

Bruce Brown

A Preliminary Report on Strength of 1/2 of a 3Q120

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Attached please find some data taken on the dates shown at MTF on a 3Q120A magnet by utilizing a Morgan Coil for determining the strength of the quadrupole component. The probe was inserted approximately 1/2 the distance through the magnet (accuracy of longitudinal placement about .25 inch) and was rotated to record the flux change at constant current. The data are listed twice: once in time order and once sorted by current. It should be noted that these measurements were begun when the magnet had not ever been powered and the initial flux was very small. The remanent after a 400 A excitation is also available in these results. As a guide to the activity planned for each measurement, Table 3 lists with each run the title created by the measurer. These results are plotted in Figures 1-3. This magnet is marked as #4 and to match the MTF VAX measurement system conventions, it was labeled as QQQ004 in our data.

The analysis of strength is based on a nominal probe radius determined from shop drawings. The amplitude of the quadrupole component is converted to Tesla-m/m of strength in the regular data reduction program. It is reported in the frame in which the skew quadrupole component is zero. The data is taken with the current measured at the Transductor. This is known to be an inferior method of current measurement below about 50 A. I have not corrected the data, but a special calibration against the shunt was carried out, see table 4.

Table 1

Some measurements of strength of QQQ004 at various currents.

Sorted by Current

MH MAGNET ID	MH RUN DATE TIME	MH CURRENT	MH_REF_AMPLTD(TESLA)	TESLA/AMP
QQQ004	9-Apr-1985 14:50:53.85	2.1871E+00	2.0776E-01	9.4991E-02
QQQ004	8-Apr-1985 11:50:14.91	2.1881E+00	2.0619E-03	9.4233E-04
QQQ004	9-Apr-1985 14:17:07.03	2.1909E+00	2.0794E-01	9.4909E-02
QQQ004	10-Apr-1985 13:11:24.08	2.1909E+00	2.1450E-01	9.7905E-02
QQQ004	8-Apr-1985 11:37:53.82	2.1909E+00	2.9344E-03	1.3393E-03
QQQ004	8-Apr-1985 11:44:12.86	2.1919E+00	1.2721E-03	5.8037E-04
QQQ004	10-Apr-1985 13:50:28.07	2.1957E+00	2.1974E-01	1.0008E-01
QQQ004	10-Apr-1985 07:27:40.13	1.4916E+01	1.1423E+00	7.6582E-02
QQQ004	10-Apr-1985 08:10:06.28	1.4927E+01	1.1707E+00	7.8429E-02
QQQ004	10-Apr-1985 07:20:19.07	3.2247E+01	2.3320E+00	7.2317E-02
QQQ004	10-Apr-1985 08:37:03.67	3.2409E+01	2.2755E+00	7.0211E-02
QQQ004	10-Apr-1985 09:43:02.37	3.2505E+01	2.2872E+00	7.0362E-02
QQQ004	10-Apr-1985 10:20:17.67	3.2506E+01	2.2870E+00	7.0355E-02
QQQ004	10-Apr-1985 09:13:44.99	3.2509E+01	2.2895E+00	7.0427E-02
QQQ004	10-Apr-1985 11:24:34.85	5.2060E+01	3.6758E+00	7.0606E-02
QQQ004	10-Apr-1985 12:50:23.92	5.2066E+01	3.6739E+00	7.0562E-02
QQQ004	10-Apr-1985 12:40:38.28	5.2075E+01	3.6738E+00	7.0549E-02
QQQ004	10-Apr-1985 10:51:47.25	5.2083E+01	3.6761E+00	7.0581E-02
QQQ004	9-Apr-1985 13:44:51.54	4.0203E+02	2.7527E+01	6.8469E-02
QQQ004	9-Apr-1985 13:04:28.10	4.0205E+02	2.7526E+01	6.8463E-02

Table 2

Sorted by Time of Measurement

MH MAGNET ID	MH RUN DATE TIME	MH CURRENT	MH_REF_AMPLTD(TESLA)	TESLA/AMP
QQQ004	8-Apr-1985 11:37:53.82	2.1909E+00	2.9344E-03	1.3393E-03
QQQ004	8-Apr-1985 11:44:12.86	2.1919E+00	1.2721E-03	5.8037E-04
QQQ004	8-Apr-1985 11:50:14.91	2.1881E+00	2.0619E-03	9.4233E-04
QQQ004	9-Apr-1985 13:04:28.10	4.0205E+02	2.7526E+01	6.8463E-02
QQQ004	9-Apr-1985 13:44:51.54	4.0203E+02	2.7527E+01	6.8469E-02
QQQ004	9-Apr-1985 14:17:07.03	2.1909E+00	2.0794E-01	9.4909E-02
QQQ004	9-Apr-1985 14:50:53.85	2.1871E+00	2.0776E-01	9.4991E-02
QQQ004	10-Apr-1985 07:20:19.07	3.2247E+01	2.3320E+00	7.2317E-02
QQQ004	10-Apr-1985 07:27:40.13	1.4916E+01	1.1423E+00	7.6582E-02
QQQ004	10-Apr-1985 08:10:06.28	1.4927E+01	1.1707E+00	7.8429E-02
QQQ004	10-Apr-1985 08:37:03.67	3.2409E+01	2.2755E+00	7.0211E-02
QQQ004	10-Apr-1985 09:13:44.99	3.2509E+01	2.2895E+00	7.0427E-02
QQQ004	10-Apr-1985 09:43:02.37	3.2505E+01	2.2872E+00	7.0362E-02
QQQ004	10-Apr-1985 10:20:17.67	3.2506E+01	2.2870E+00	7.0355E-02
QQQ004	10-Apr-1985 10:51:47.25	5.2083E+01	3.6761E+00	7.0581E-02
QQQ004	10-Apr-1985 11:24:34.85	5.2060E+01	3.6758E+00	7.0606E-02
QQQ004	10-Apr-1985 12:40:38.28	5.2075E+01	3.6738E+00	7.0549E-02
QQQ004	10-Apr-1985 12:50:23.92	5.2066E+01	3.6739E+00	7.0562E-02
QQQ004	10-Apr-1985 13:11:24.08	2.1909E+00	2.1450E-01	9.7905E-02
QQQ004	10-Apr-1985 13:50:28.07	2.1957E+00	2.1974E-01	1.0008E-01

Table 3

Run comments attached to each of the runs in Tables 1,2

MH MAGNET ID	MH RUN DATE TIME	MH RUN DESCRIPTION
QQQ004	8-Apr-1985 11:37:53.82	
ZERO AMP.	RUN, BEFORE P.S. WAS TURNED ON	PROBE EXTENDS 1/2 THE LENGTH OF MAGNET.
QQQ004	8-Apr-1985 11:44:12.86	
ZERO AMP.	RUN, BEFORE P.S. WAS TURNED ON	PROBE EXTENDS 1/2 THE LENGTH OF MAGNET.
QQQ004	8-Apr-1985 11:50:14.91	
ZERO AMP.	6P RUN BEFORE P.S.	TURNED ON PROBE EXTENDS 1/2 THE LENGTH OF MAGNET.
QQQ004	9-Apr-1985 13:04:28.10	
RUN # 1	3Q120 (G. DUGAN)	400 AMPS
QQQ004	9-Apr-1985 13:44:51.54	
RUN # 8	3Q120 (G. DUGAN)	400 AMPS
QQQ004	9-Apr-1985 14:17:07.03	
RUN # 1	3Q120 (G. DUGAN)	0.0 AMPS
QQQ004	9-Apr-1985 14:50:53.85	
RUN # 8	3Q120 (G. DUGAN)	0.0 AMPS
QQQ004	10-Apr-1985 07:20:19.07	
RUN # 1	3Q120 (G. DUGAN)	15 AMPS
QQQ004	10-Apr-1985 07:27:40.13	
RUN # 1	3Q120 (G. DUGAN)	15 AMPS
QQQ004	10-Apr-1985 08:10:06.28	
RUN # 8	3Q120 (G. DUGAN)	15 AMPS
QQQ004	10-Apr-1985 08:37:03.67	
RUN # 1	3Q120 (G. DUGAN)	30 AMPS
QQQ004	10-Apr-1985 09:13:44.99	
RUN # 1	3Q120 (G. DUGAN)	30 AMPS
QQQ004	10-Apr-1985 09:43:02.37	
RUN # 1		30 AMPS
QQQ004	10-Apr-1985 10:20:17.67	
RUN # 8		30 AMPS
QQQ004	10-Apr-1985 10:51:47.25	
RUN # 1		50 AMPS
QQQ004	10-Apr-1985 11:24:34.85	
RUN # 8		50 AMPS
QQQ004	10-Apr-1985 12:40:38.28	
RUN # 1		50 AMPS
QQQ004	10-Apr-1985 12:50:23.92	
RUN # 3		50 AMPS
QQQ004	10-Apr-1985 13:11:24.08	
RUN # 1		0 AMPS
QQQ004	10-Apr-1985 13:50:28.07	
RUN # 8		0 AMPS

ANALYSIS OF MTF STAND A/ STATION A1 CURRENT READOUT

Following the measurements for the 3Q120 Quad, it was realized that the measurements were taken in a region of the transductor where it provides VERY poor response and in which the current calibration (a linear fit with offset) which is suitable at hi currents (working current normally 1200 A) is totally unsuited. In order to understand the measurements, it is useful to look instead at the corresponding shunt voltage and calculate the current in that way. The first three columns of the attached table contains a calibration of the power supply system. DAC lists the voltage from the 3159 Power supply controler; TDR lists the voltage from the transductor; SHUNT gives the voltage from the shunt. The ratio of transductor voltage to shunt voltage is listed in TDR/SH to give a feeling for the nature of the problem. In the TDR AMPS column, the same conversion of Transductor voltage to current used by the measurement program is applied (the calibration numbers at the top are taken from the CALIBration database). The SH AMP column is analyzed assuming that the shunt voltage is linear in current with an offset given from the value when the current is zero. This is an assumption without a more careful calibration, but I recomend it as a working assumption. The offset corresponds to about 300 mA.

CALIBRATION DATA 16-APRIL-1985
TDR CAL 0.269 OFFSET
399.883 LINEAR

DAC	TDR	SHUNT	TDR/SH	TDR AMPS	SH AMP LINEAR	COMMENT
mV	mV	mV		Amps	Amps	
-25.037	-0.053	-0.015	3.533	0.248	0.000	P.S. OFF
-25.058	-0.054	-0.015	3.600	0.247	0.000	P.S. ON
4.124	12.110	0.212	57.123	5.111	4.820	
13.872	25.665	0.470	54.606	10.532	10.298	
22.804	37.710	0.696	54.181	15.348	15.097	
34.685	53.370	0.992	53.800	21.610	21.382	
42.442	63.330	1.182	53.579	25.593	25.416	
50.603	73.850	1.379	53.553	29.800	29.599	
71.623	100.362	1.878	53.441	40.402	40.195	
92.759	126.910	2.376	53.413	51.018	50.769	
191.760	250.270	4.710	53.136	100.347	100.328	
392.120	501.000	9.436	53.095	200.610	200.676	
594.580	753.950	14.200	53.095	301.761	301.832	
792.460	1000.030	18.831	53.106	400.164	400.164	

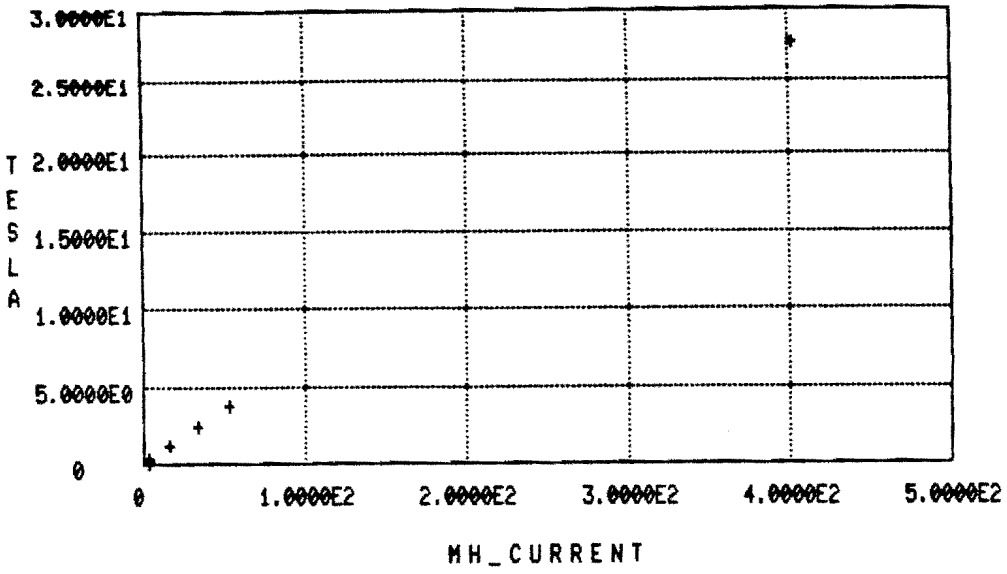

Figure 1
Excitation Curve QQQ004

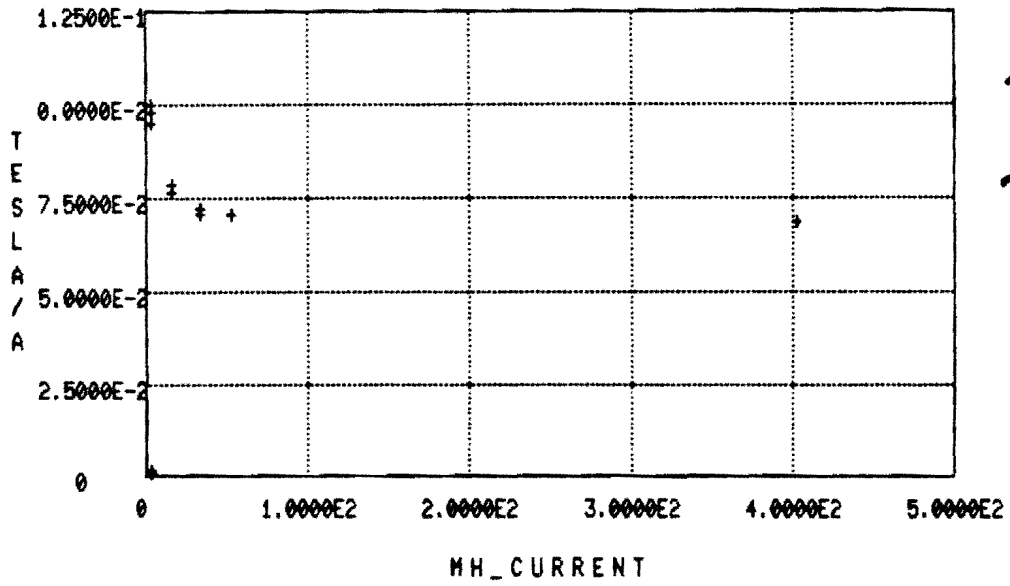

Figure 2
Tesla/Amp assuming no correction to Transductor Current

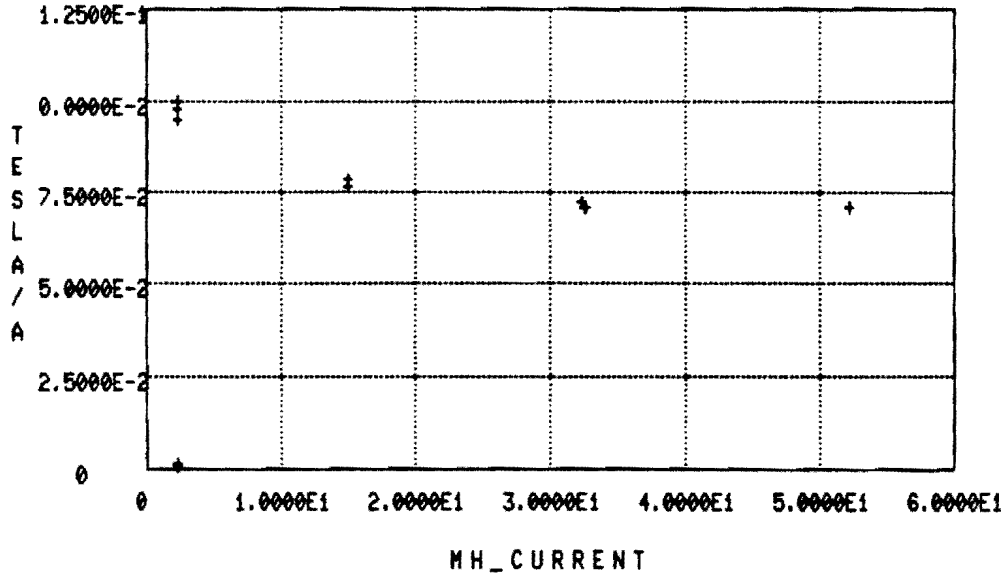

Fig 3
Same as Fig 2 but expanded to show low current points