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RAMP SPLICE RESISTANCE MEASUREMENTS ON MAGNET DS0315

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The resistance of the upper ramp splice of magnet DS0315 was measured recently in LAB 2. The resistance was determined by measuring the voltage accross the ramp splice while the magnet current was ramped from 2000 to 6500 amps at various ramp rates. The voltage and current were measured using HP Model 3457A DVM's, which were read and controlled by a PC. The ramp rates used in this measuremnet varied from 50 to 200 A/sec, and the DVM was set to take readings at a rate of 38 Hz, using an integration time of 1 power-line cycle. Measurements were taken on both the "up" and "down" ramps, i.e., $dI/dt > 0$ and $dI/dt < 0$. The splice resistance was determined by performing a linear-least-squares fit to the voltage-current data. The table below summarizes the data.

TABLE I

"UP RAMPS"		"DOWN RAMPS"	
dI/dt (A/sec)	R (n-Ohms)	dI/dt (A/sec)	R (n-Ohms)
50.0	1.35	50.0	1.57
50.0	1.52	50.0	1.56
100.0	1.62	100.0	1.59
100.0	1.58	100.0	1.61
100.0	1.54	200.0	1.51
200.0	1.63	200.0	1.55
200.0	1.59		

A plot of Resistance as a function of ramp rate (dI/dt) is shown in Figure 1. From this graph we can deduce that there is essentially no ramp rate dependance, the voltage accross the splice being primarily resistive in nature. The average value of these resistance measurements is 1.56 n-Ohms, with a standard deviation of 0.07 n-Ohm.

The splice resistance was also measured in a "DC" fashion by ramping the magnet to a known current level, and then measuring the voltage accross the splice while the magnet was kept at constant current. This measurement was performed with the magnet current held at 2000, 3000, 4000, 5000, and 6000 Amps. The splice voltage is the average value of 200 readings taken by the DVM, with an integration time of 10 power-line cycles. The data from this set of measurements is summarized in Table II below.

TABLE II

Magnet Current (Amps)	Splice Voltage (uV)
2002.69	46.87 +/- 0.18
3000.43	49.39 +/- 0.21
4059.70	51.01 +/- 0.23
5027.54	52.62 +/- 0.18
6007.52	56.39 +/- 0.28

These data are plotted in Figure 2. A linear fit was performed on this V-I data, yielding a value for the splice resistance of 2.20 +/- 0.18 n-Ohms. This value is somewhat higher than that obtained from the ramped runs. The discrepancy may possibly be due to joule heating of the splice while the current remained at the higher values. This would tend to increase the value of the resitstance at higher currents.

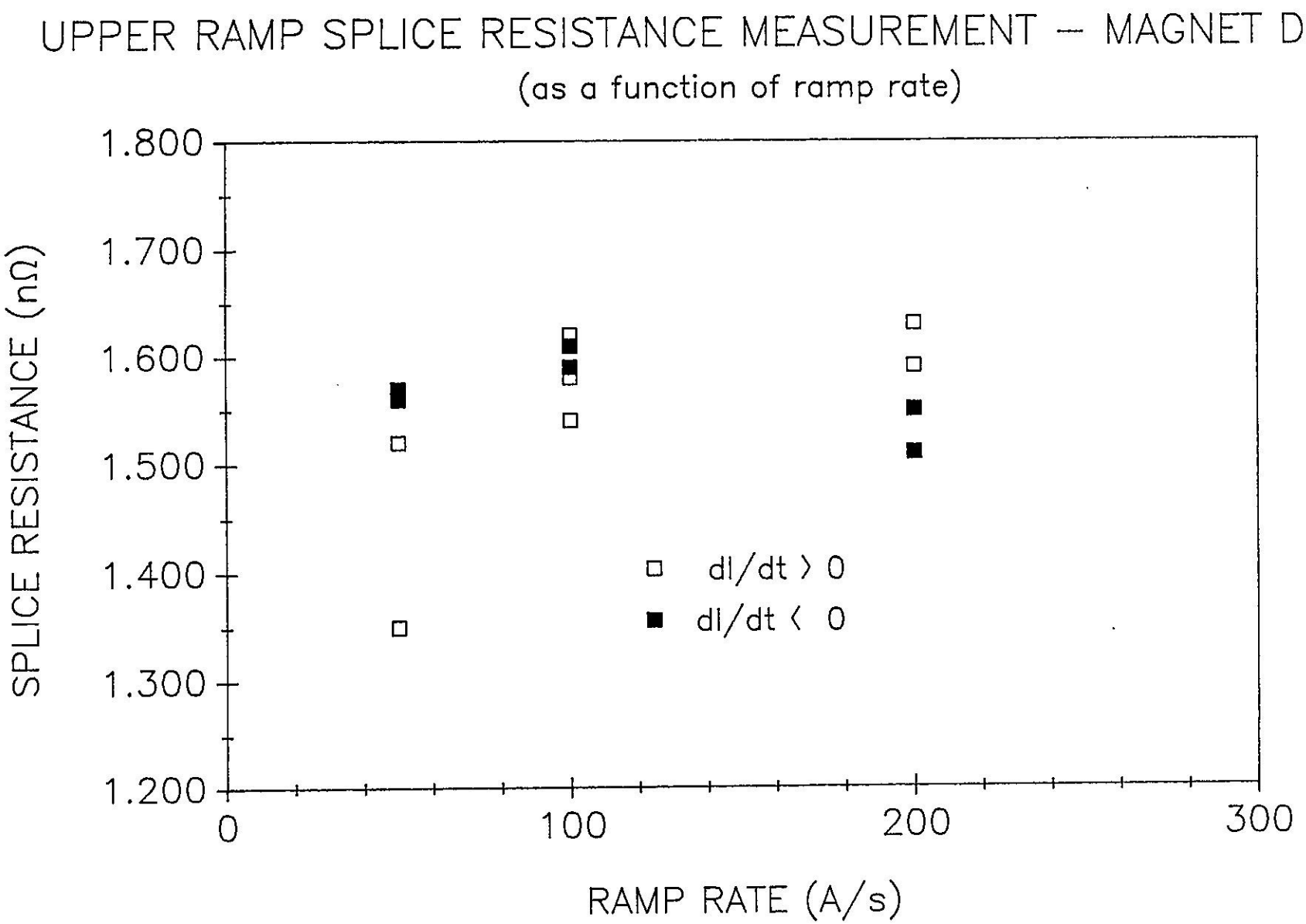
UPPER RAMP SPLICE RESISTANCE MEASUREMENT – MAGNET DS0315
(as a function of ramp rate)
SPLICE RESISTANCE (nΩ)
1.800
1.700
1.600
1.500
1.400
1.300
1.200
0
100
200
300
RAMP RATE (A/s)
dI/dt > 0
dI/dt < 0

FIG. 1

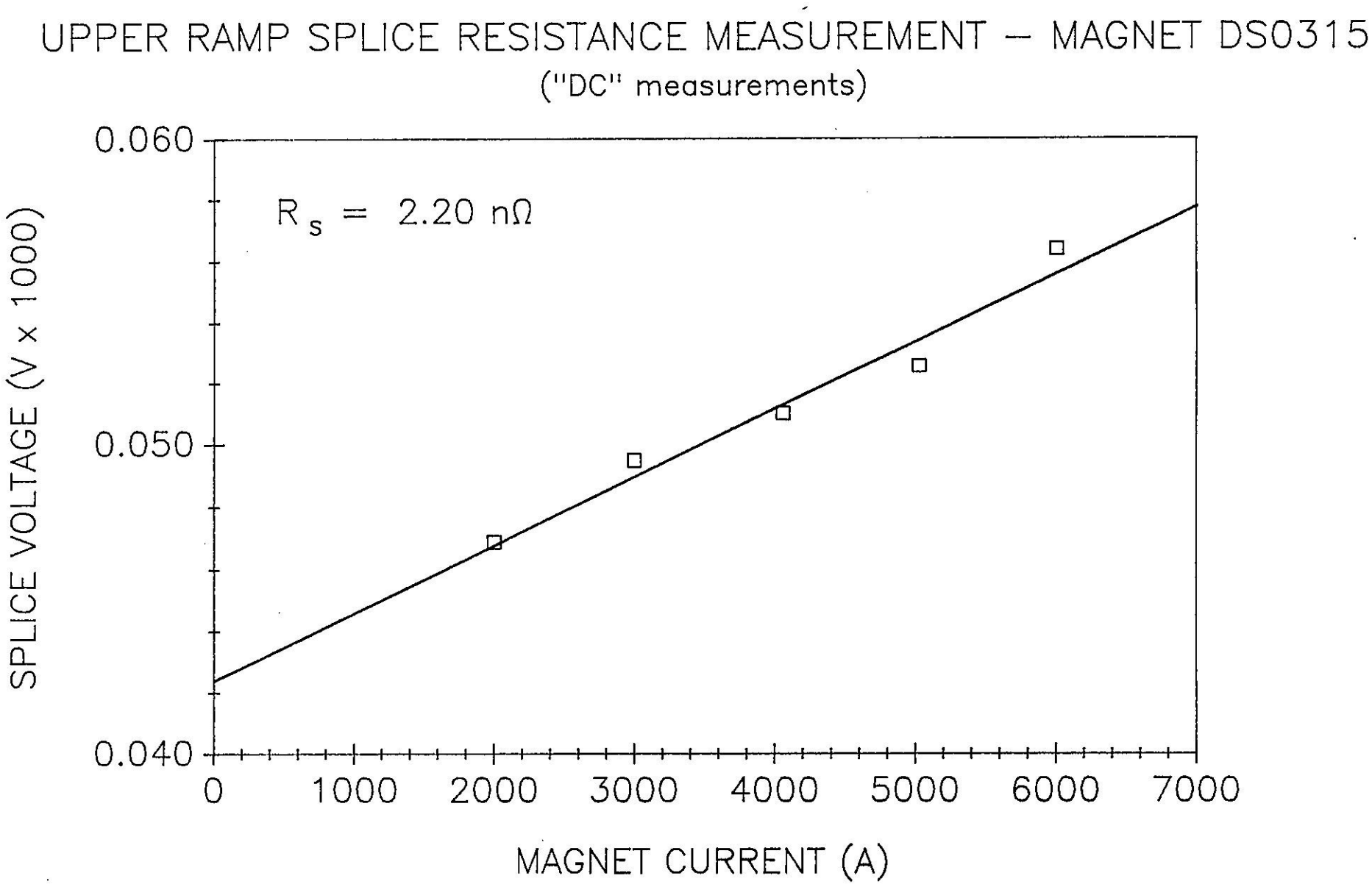
UPPER RAMP SPLICE RESISTANCE MEASUREMENT – MAGNET DS0315
("DC" measurements)
R_s = 2.20 nΩ
SPLICE VOLTAGE (V x 1000)
0.060
0.050
0.040
0
1000
2000
3000
4000
5000
6000
7000
MAGNET CURRENT (A)

Fig. 2