



# Fermilab

## PERFORMANCE TESTING OF SUPER "Fe" MAGNET

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### INTRODUCTION

The following report is a summary of the data obtained during the testing of a "proof of principle" iron-dominated low field and cost, high efficiency dipole. The magnet was tested for performance with the design field of 2.0T. See TM-1122 by Joe Heim for construction details.

### EXPERIMENTAL PROCEDURE

The magnet was vertically mounted in a boiling liquid helium cryostat with the electrical test circuit shown in Figure 1. All of the voltages were displayed on an eight channel recorder as a function of time. The magnet had its energy extracted via SCR switch dump-resistor circuit which was activated by a difference signal between coil halves. The cross-over joint (coil half to coil half connection) was monitored as a function of current.

### RESULTS

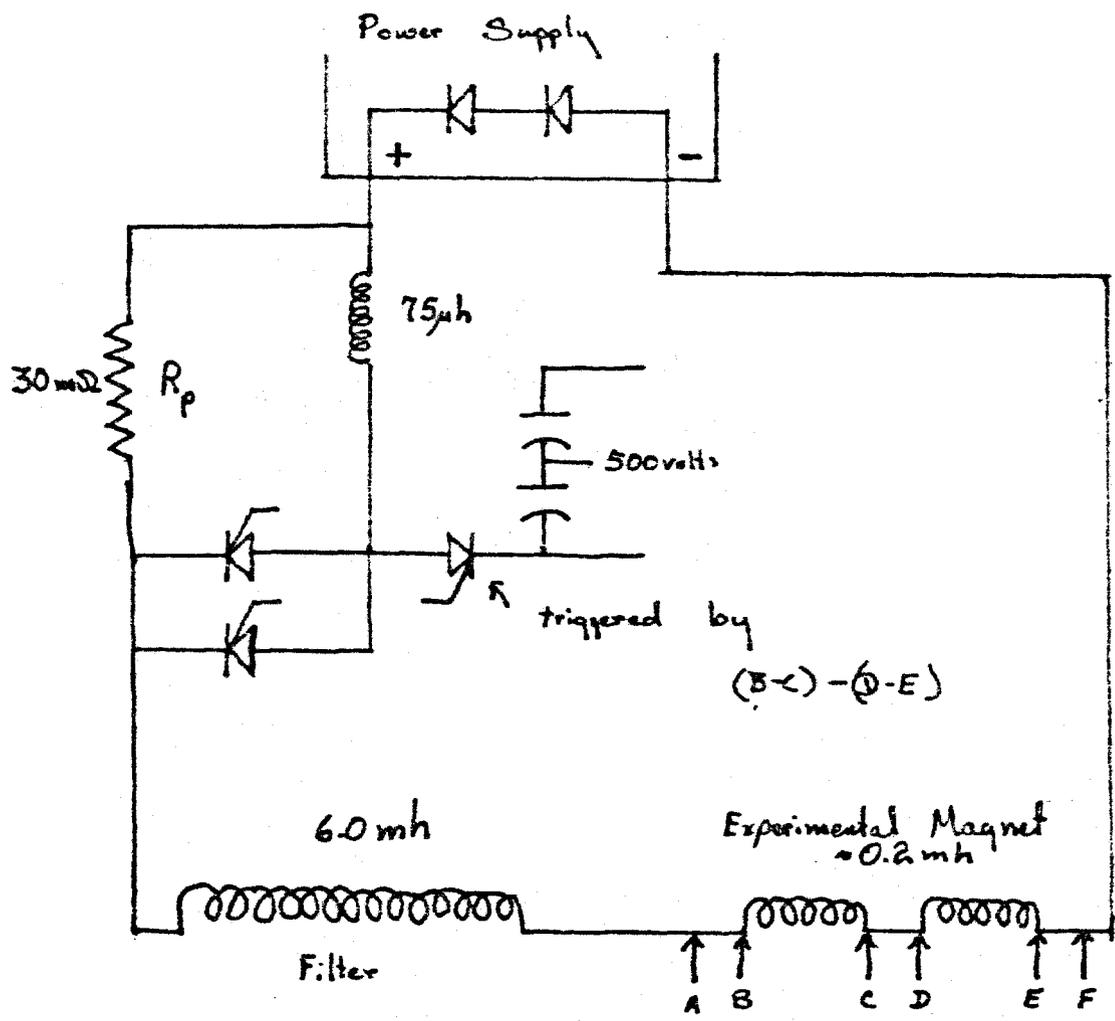
The magnet was quenched 14 times as shown in Figure 2. The magnetic field was monitored by a rotating probe inserted into the bore of the coil. The load line measured is shown in Figure 3. Both coil halves were monitored, therefore it was possible to reconstruct the resistance of the quenching coil half as a function of time for any given quench. The data given in Figure 4 were derived from the fourth quench of the magnet.

The effective joint resistance for the coil-to-coil connection at a transport current greater than 5000 A was  $1.5 \times 10^{-9} \Omega$  or 1.5 nano-ohms. The measured and computed inductance of the magnet was 0.2 millihenries. One of the sides quenched three times more often than the other. All of the quenches were done at ramp rates between 50 A/sec and 300 A/sec with the optimum ramp rate being around 250 A/sec.



SUBJECT  
Superconducting Magnet Test Circuit

NAME  
A.D. McInturff  
DATE  
June 24, 1982  
REVISION DATE  
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- A-F Vapor Cooled Lead to Lead
- B-E Superconducting Magnet
- B-C, or D-E " " half
- C-D Cross over joint or splice

Figure #1



SUBJECT

Quench History "Super Fe" Magnet

NAME

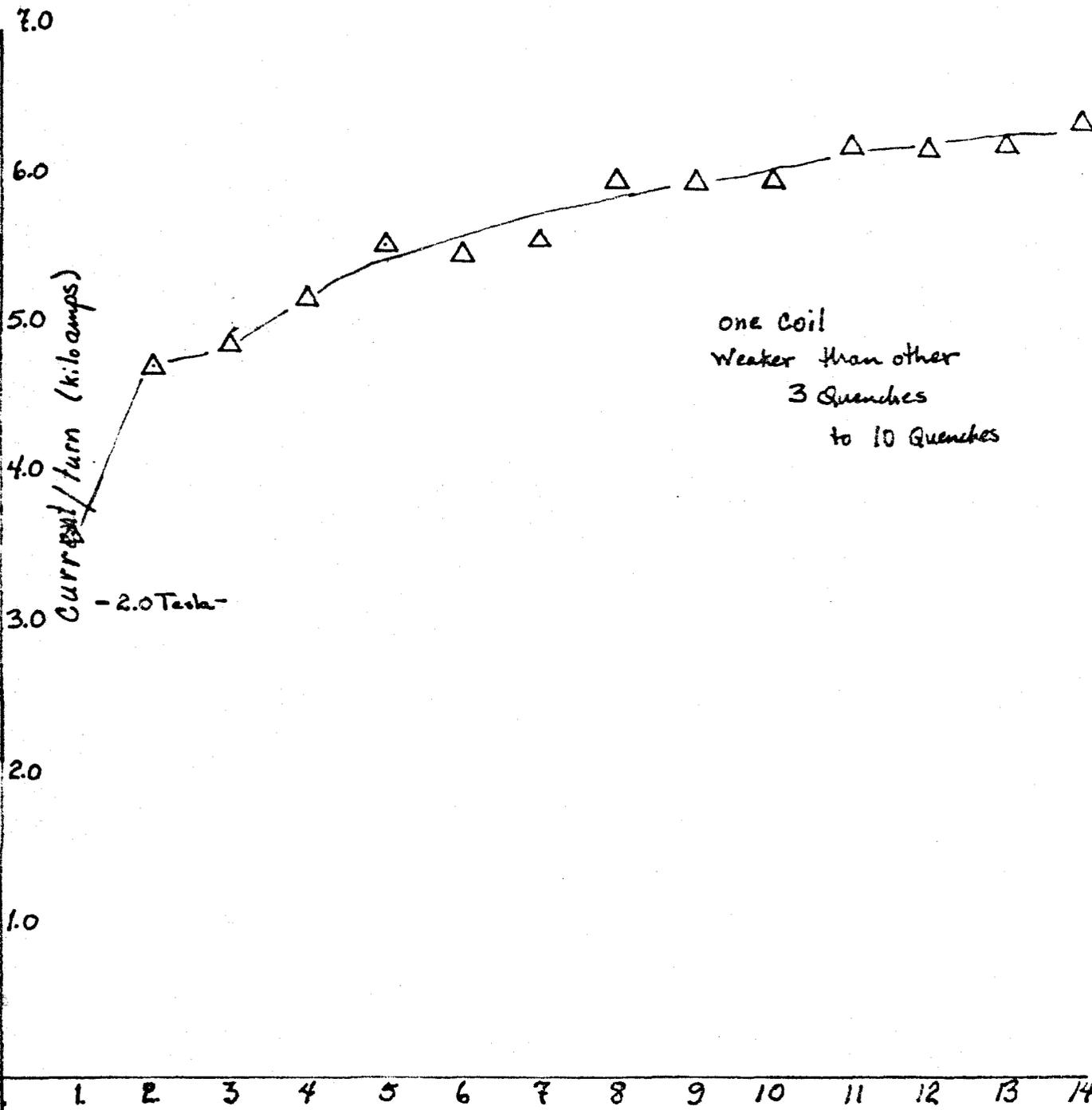
A. D. McInturff

DATE

6/24/82

REVISION DATE

6/30/82



one coil  
 weaker than other  
 3 quenches  
 to 10 quenches

-2.0 Tesla-

Quench Number

Figure #2



SUBJECT

Super "Fe" Magnet Lead Line

NAME

A.D. McInturff

DATE

6/24/82

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6/30/82

TM-1121

1 foot Dipole

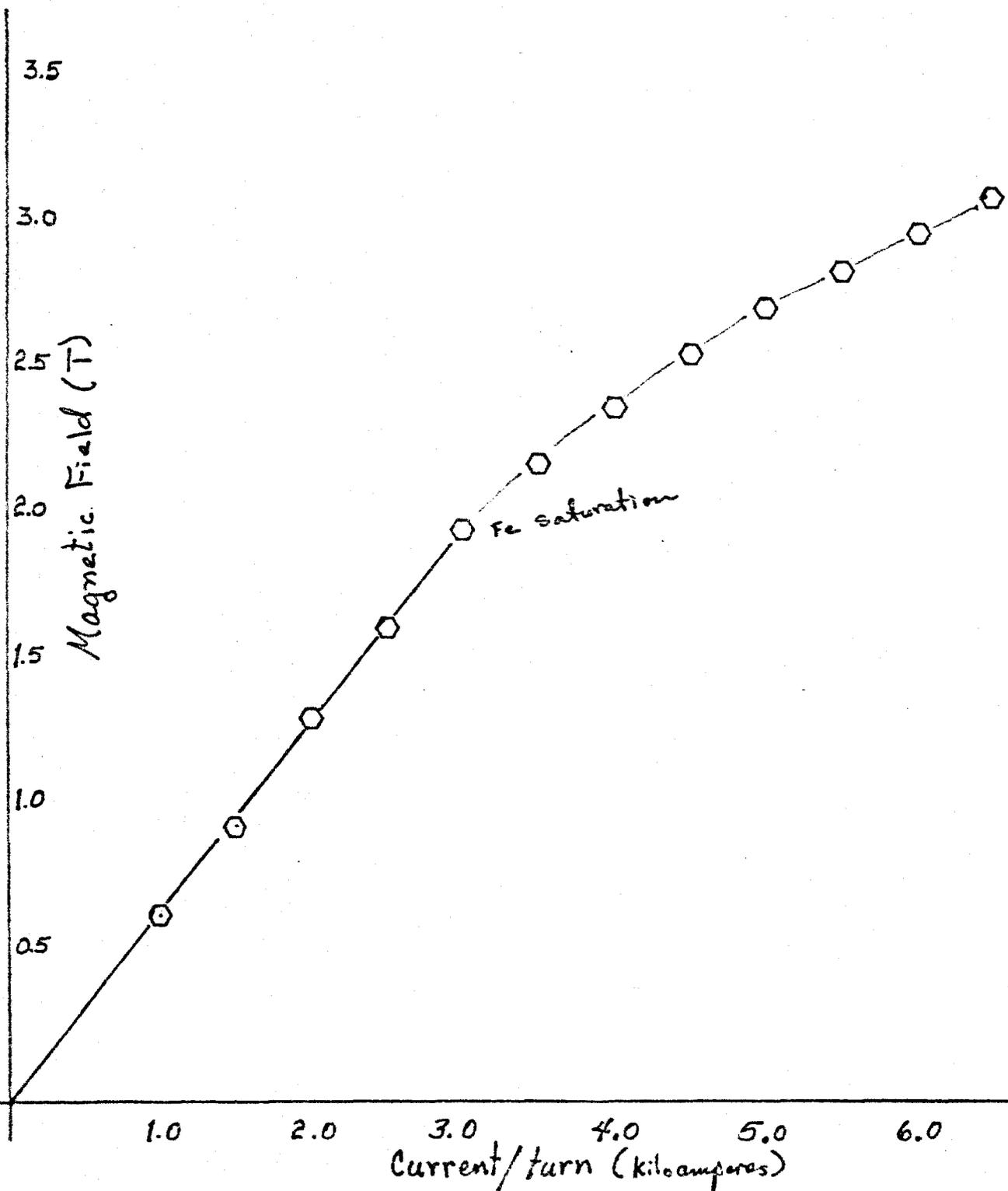


Figure #3



SUBJECT

Rate of Internal Resistance "Super Fe"

NAME

A. D. McIntosh

DATE

4/24/82

REVISION DATE

5/30/82

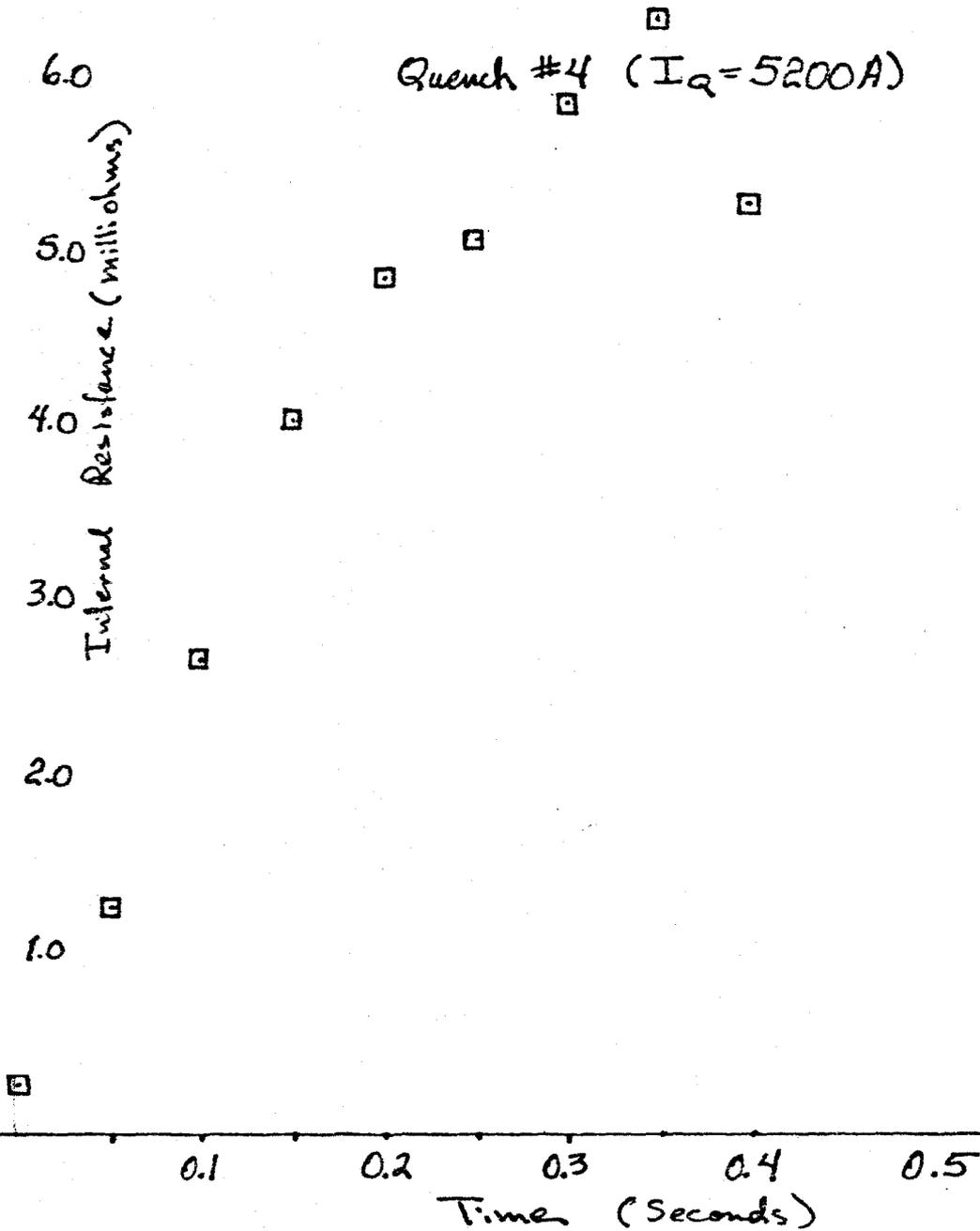
Total MITS =  $3 \times 10^6 \text{ Amp}^2\text{-sec}$ 

Figure #4

Trip  
Current  
fired