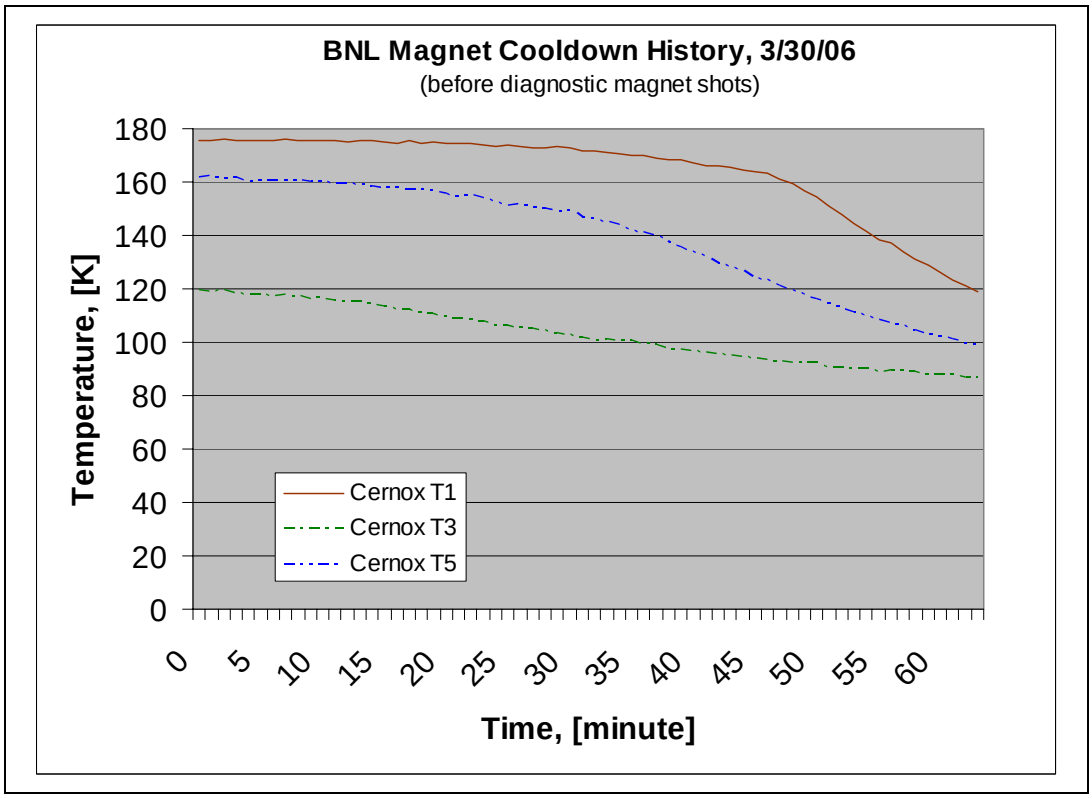
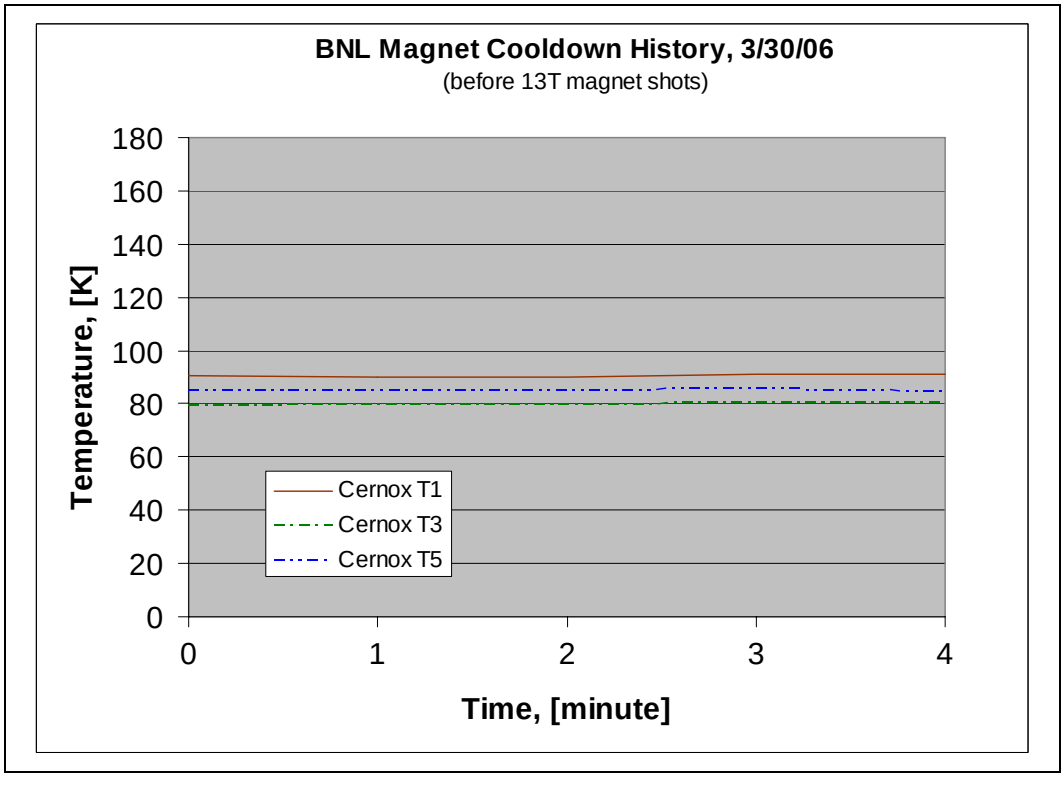
MERIT VRVS May 10 2006
P.H. Titus
Temperature Evaluation of the 15T shot

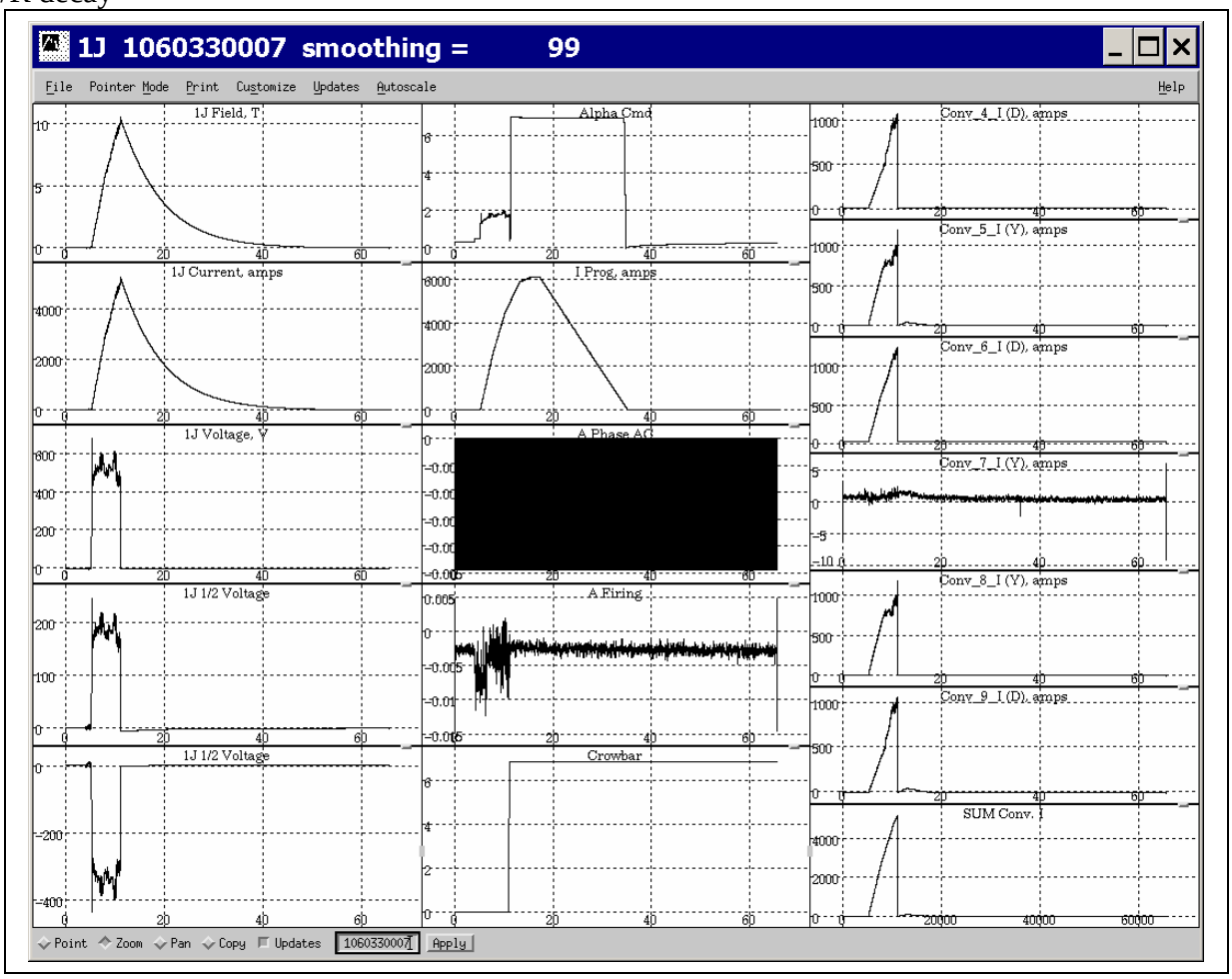
Thursday March 30 2006

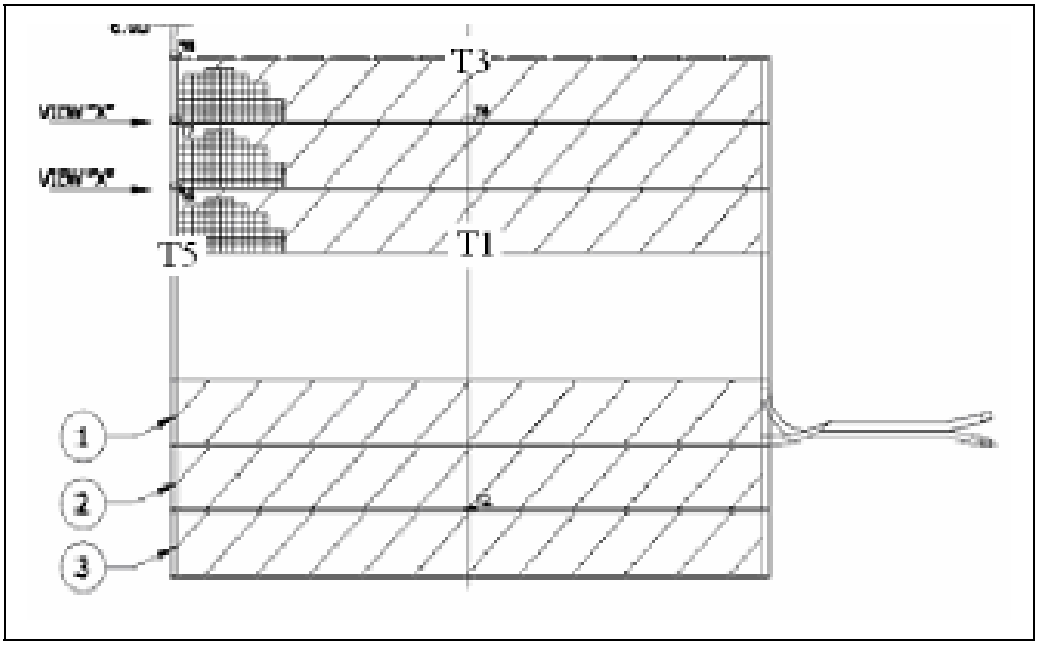


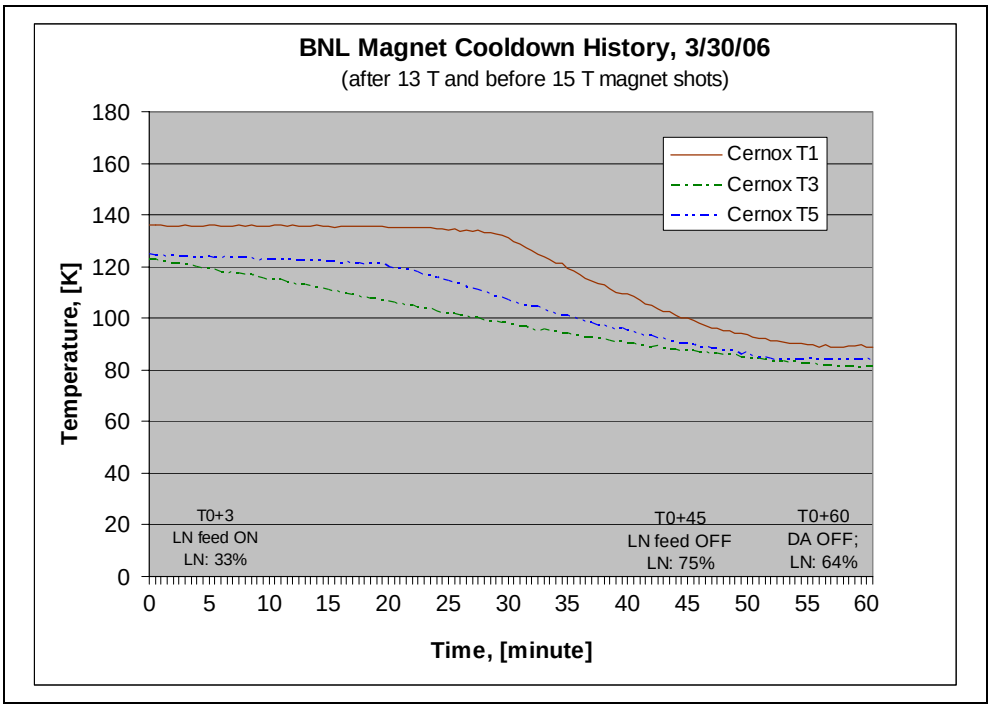


13T (Actual 10.5T) Pulse, March 30 2006

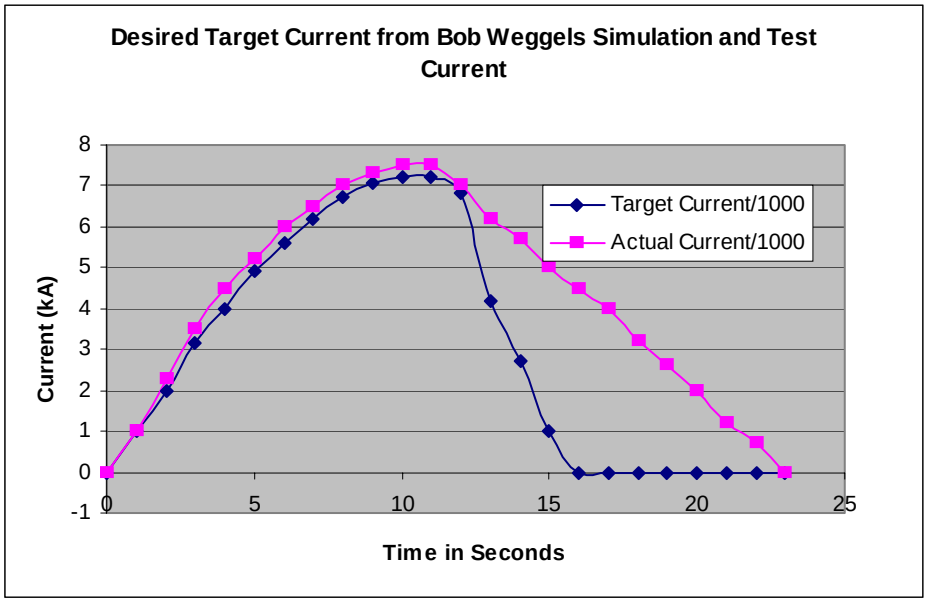
Intended as a 13T shot. It ended on a control fault at 10.5T – Interesting because of the L/R decay

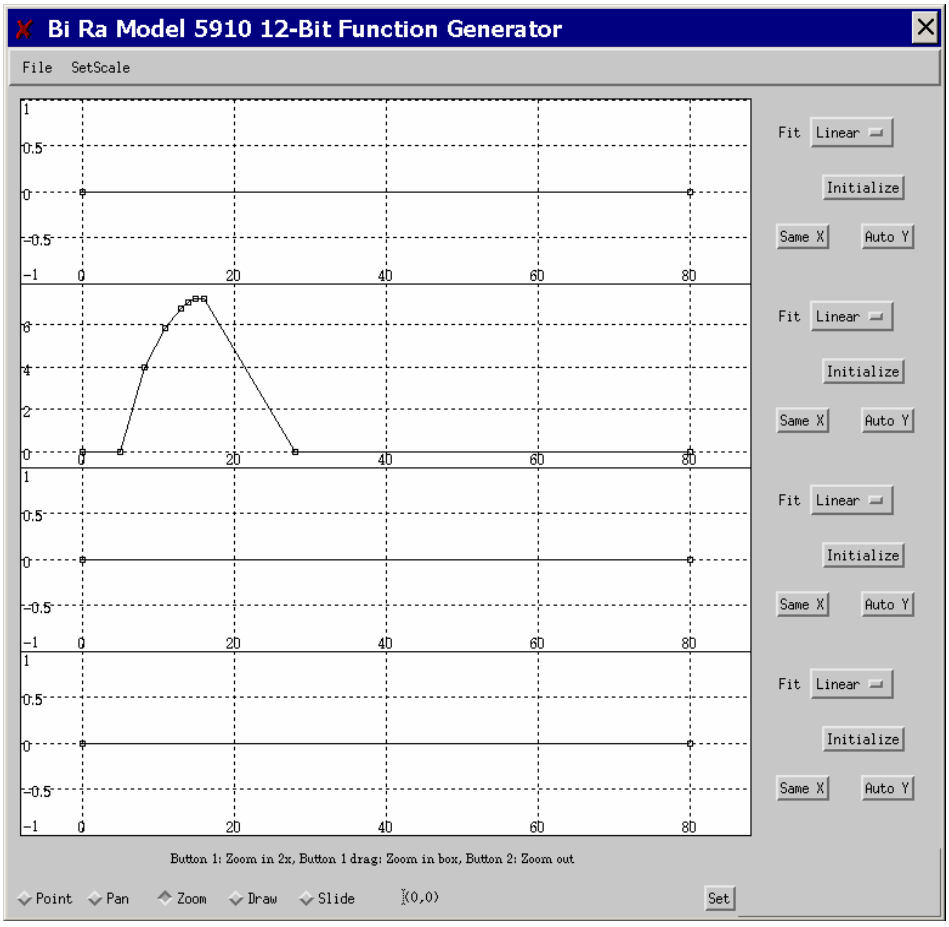



T3
T5
T1
1
2
3


BNL Magnet Cooldown History, 3/30/06
(after 13 T and before 15 T magnet shots)
Temperature, [K]
Time, [minute]
Cernox T1
Cernox T3
Cernox T5
T0+3
LN feed ON
LN: 33%
T0+45
LN feed OFF
LN: 75%
T0+60
DA OFF;
LN: 64%
0
20
40
60
80
100
120
140
160
180
0
5
10
15
20
25
30
35
40
45
50
55
60

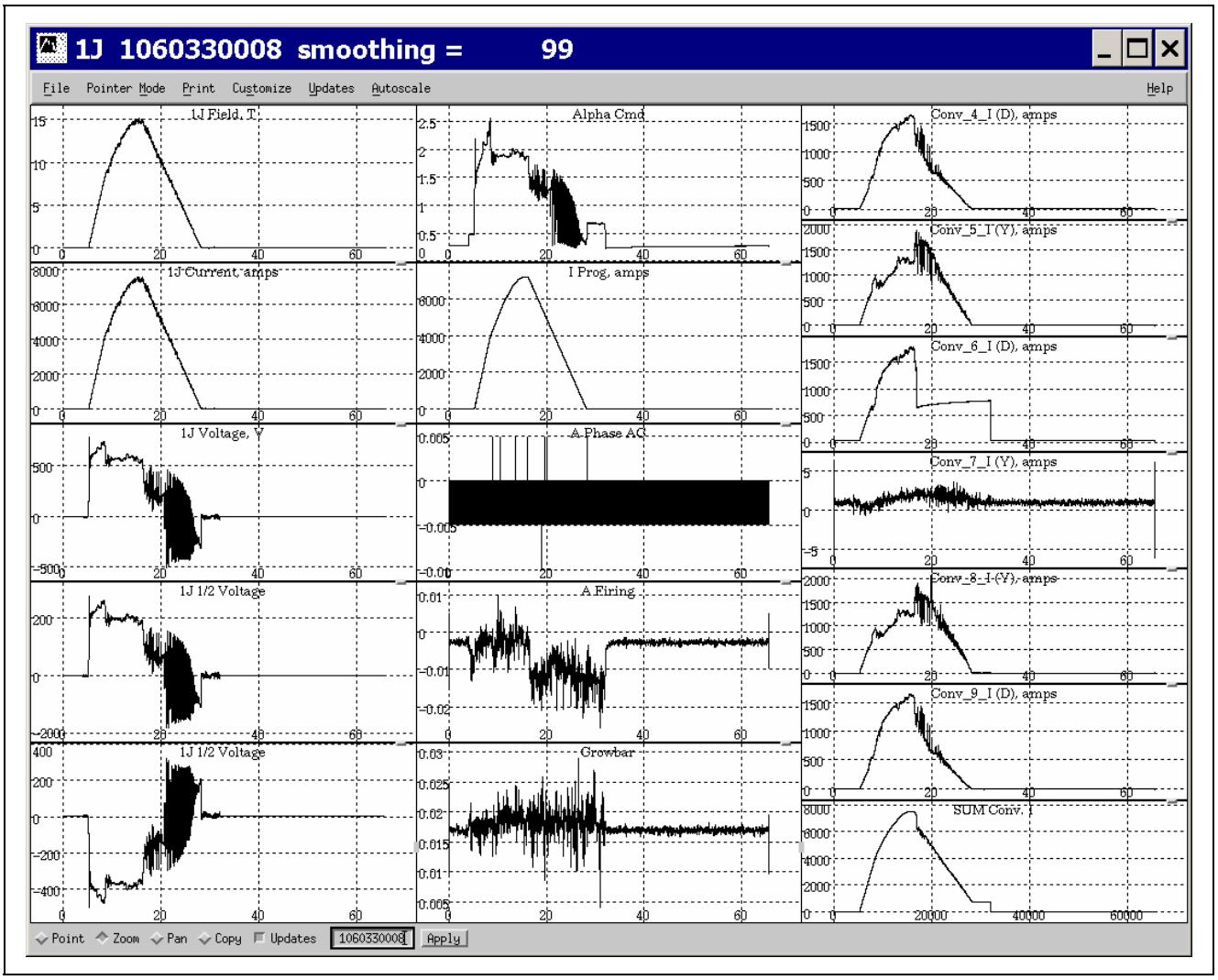
The actual current profile had more j^2*t than intended.



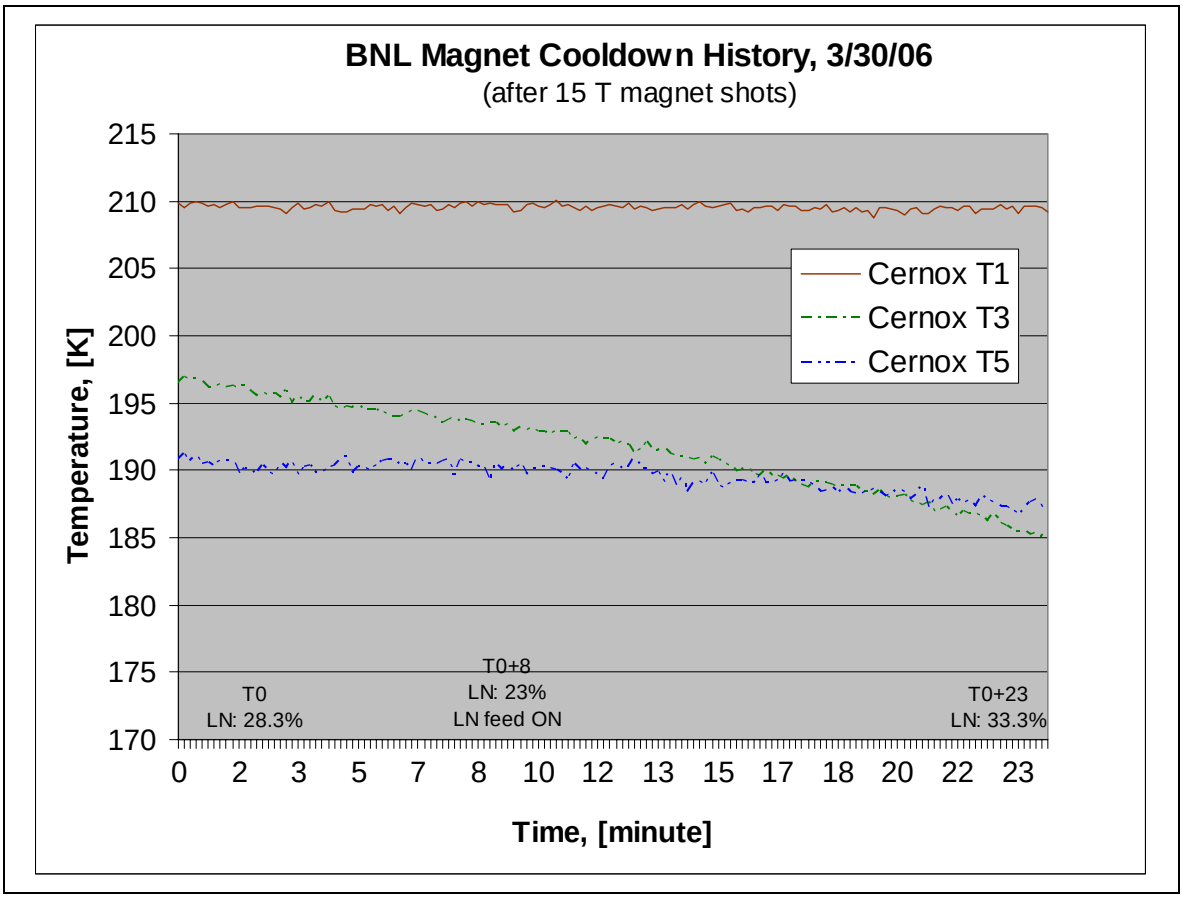


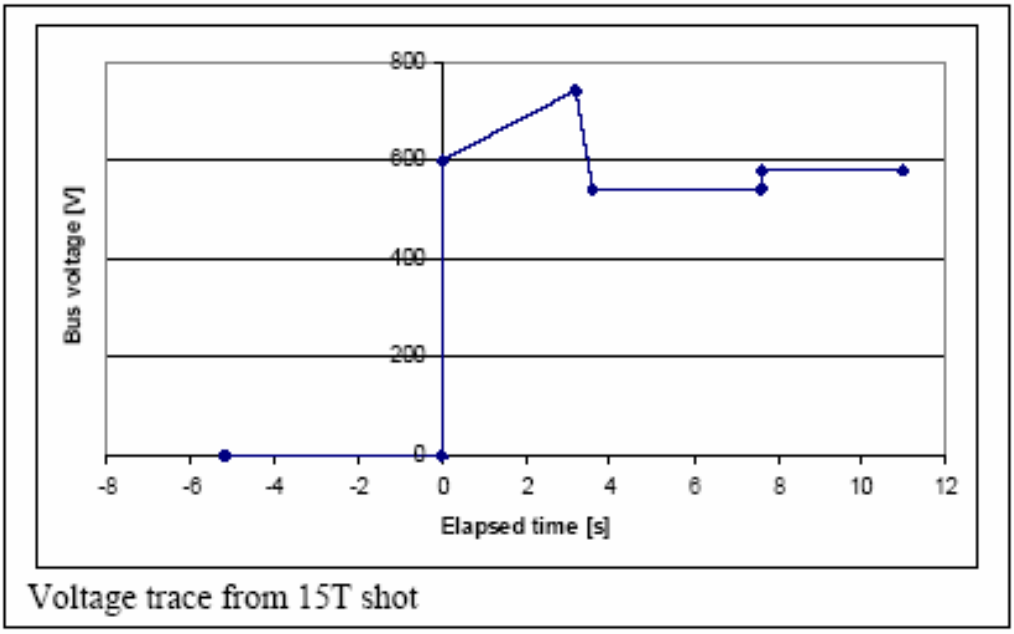
Actual Current Programmed by Phil Michael

15T Pulse, March 30 2006



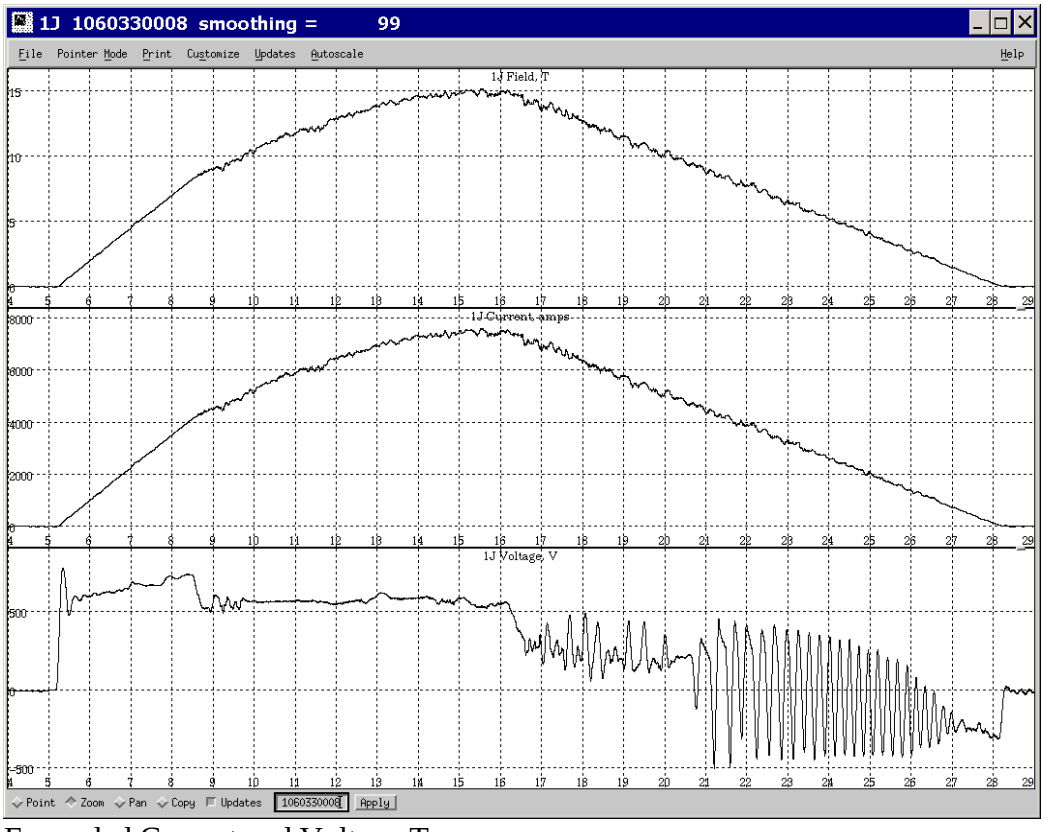
The 15T shot produced higher temperatures at the completion of the pulse, than anticipated.





Voltage trace from 15T shot

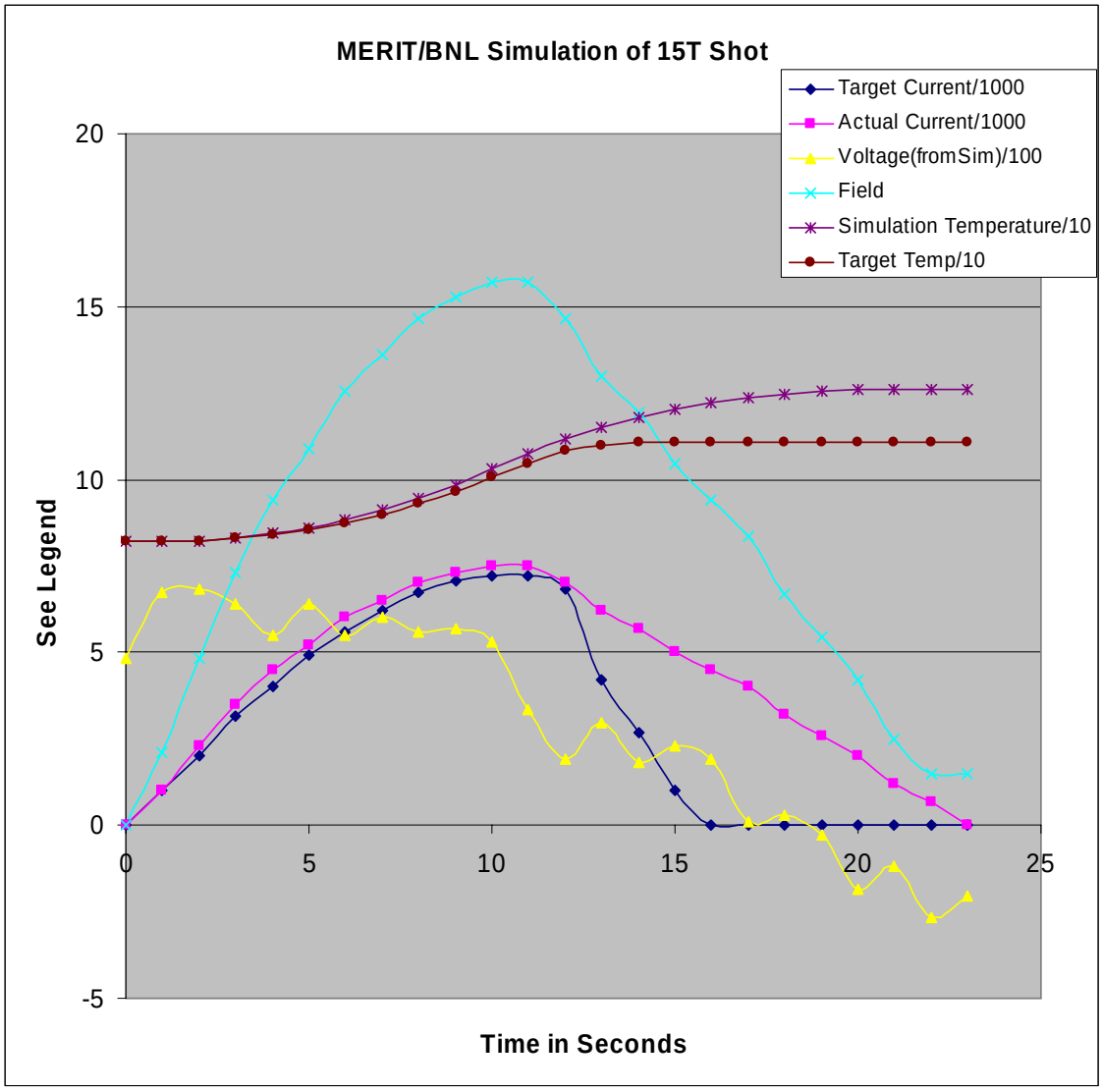
This is a partial voltage trace provided by Phil.



Expanded Current and Voltage Trace

Simulations based on applied current and applied voltage

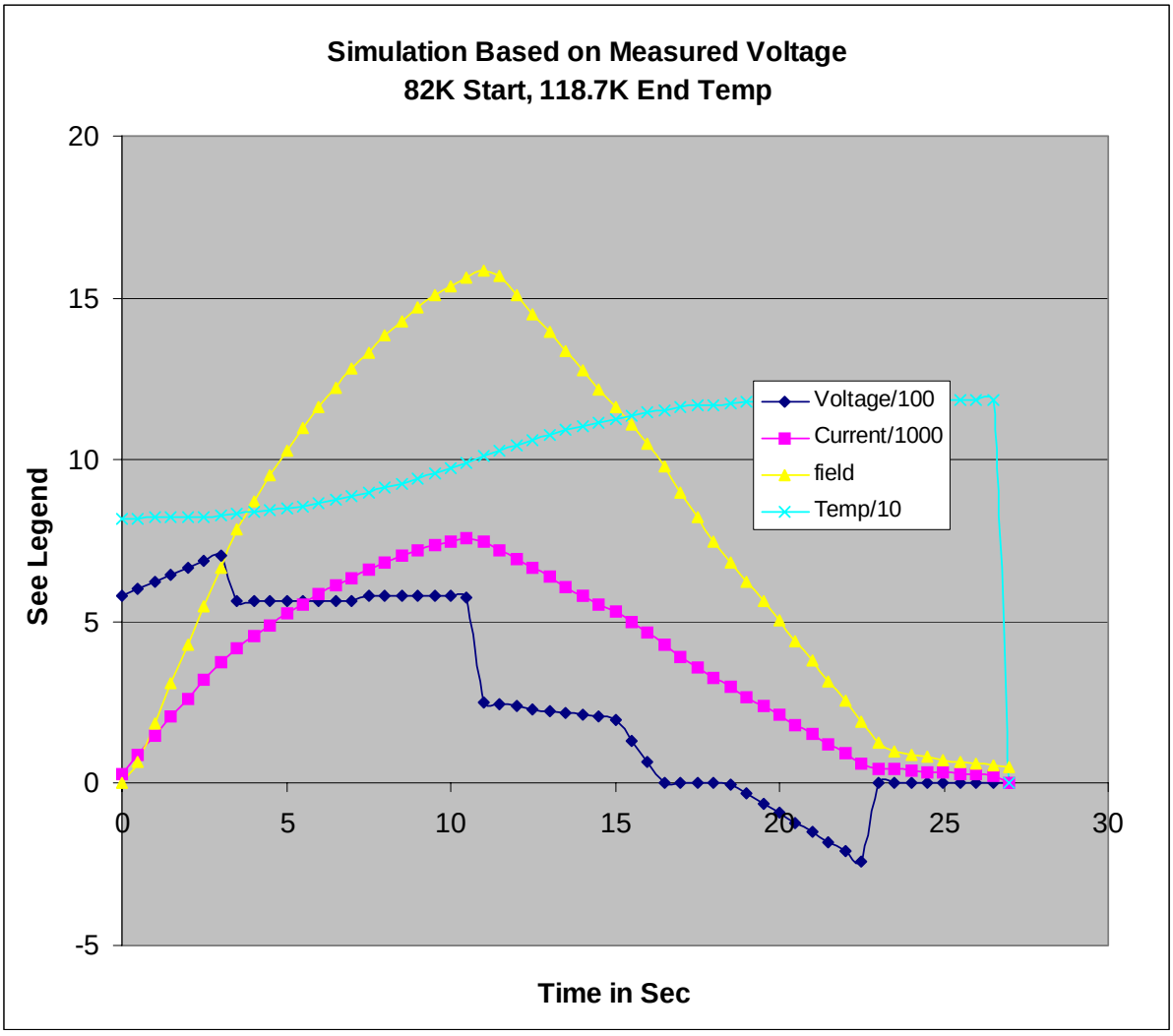
First, the current based simulation:



The target current profile has an 82K start and goes to 110.8K
The Simulation of the actual test current starts at 82 K goes to 126K
Temperatures of 190K were measured after the test pulse.

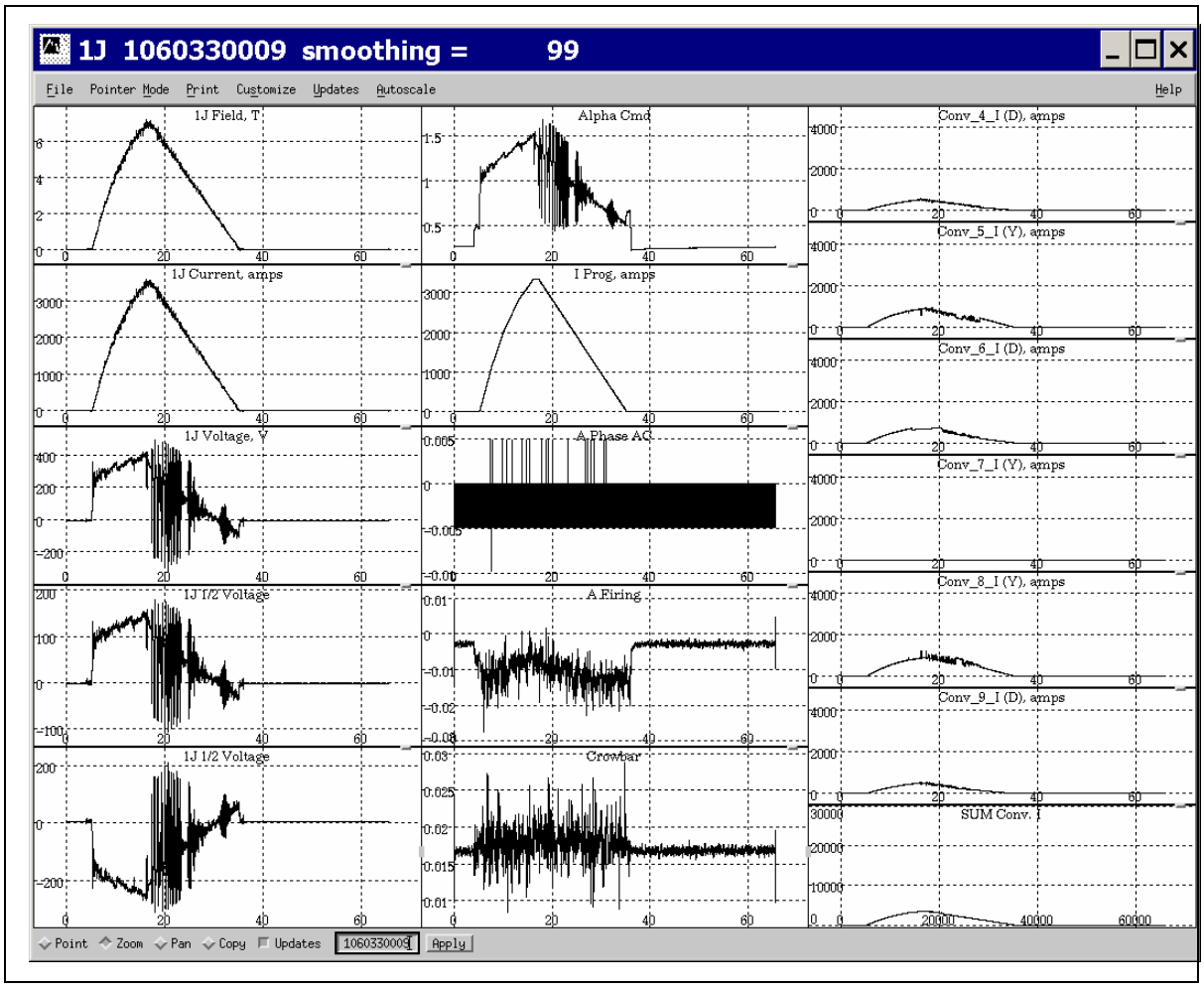
Next, the voltage based simulation:

Note that the average voltage is used rather than the voltage imposed by the control system oscillation.



The Simulation based on voltage starts at 82K and goes to 119K.
The Simulation of the actual test current starts at 82 K goes to 126K
The expected temperature range for the desired current profile is 82K to 110.8K
Temperatures of 190K were measured after the test pulse

After the 15T shot, the 7 Tesla shot that followed, used about 330 volts during the ramp up. The simulation would require about a 106K start temperature to get to 7 Tesla with 330 volts.



Conclusions:

The actual temperatures measured after the 15T shot were 80K higher than expected.

The higher programmed current and slower rampdown account for about 20K of the 80K , based on both current and voltage based simulations.

Control system voltage oscillations are large, but produce only a small variation in net current.

Could the voltage oscillations be producing some eddies or current oscillations inside the magnet that are not being seen outside the magnet?