NuMu Collaboration Friday Meeting, August 4th 2006

MERIT (n-ToF-11) 15T Pulsed Magnet for Mercury Target Development

Neutrino Factory and Muon Collider Collaboration

MERIT/BNL Pulsed Magnet –Vacuum Pump Installed Prior to tests

MIT-PSFC Pre-Operational Testing Results

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Thursday March 30 2006 After successful 15T test

Heat Leak Measurements

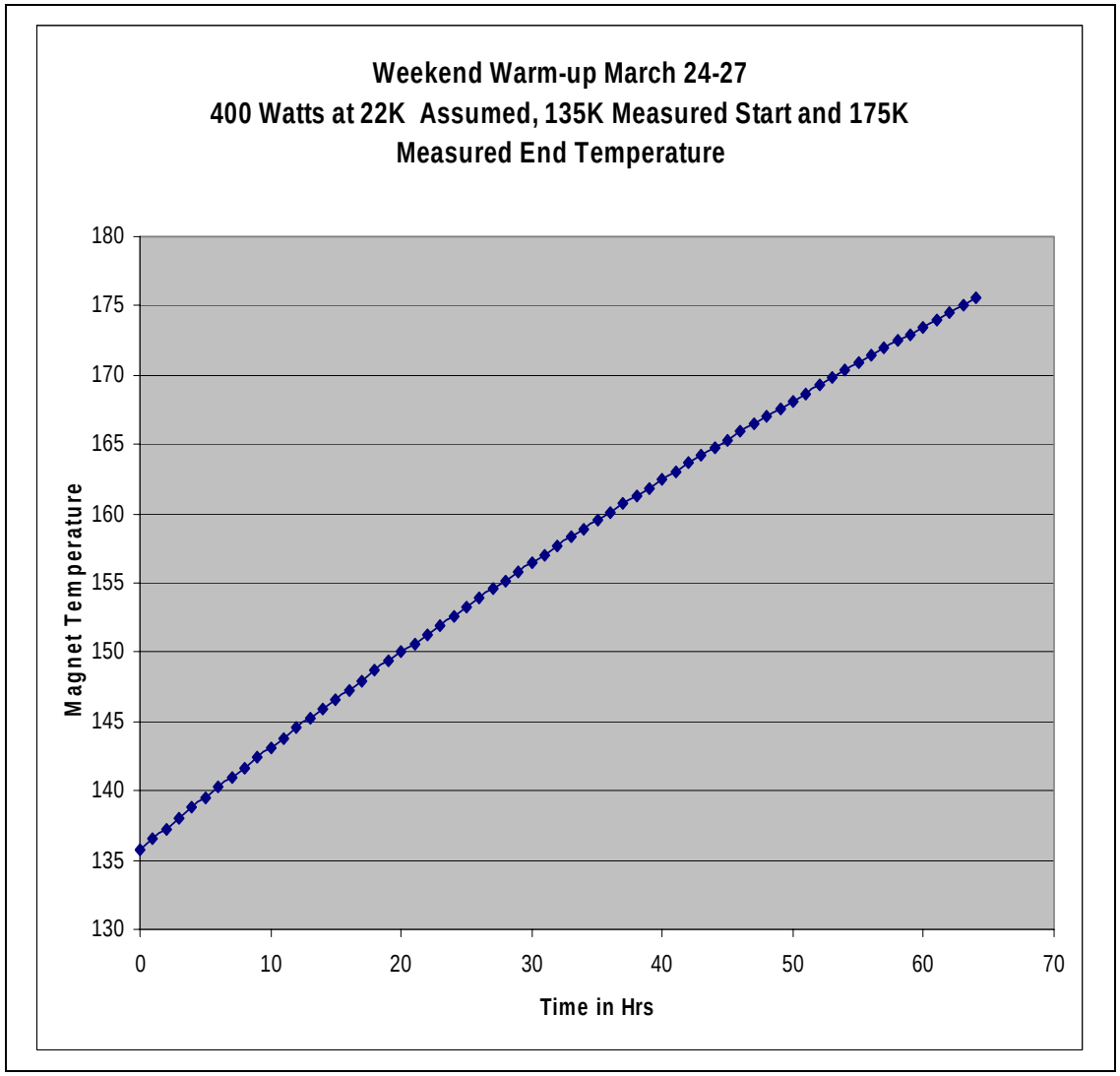
Helium service calculations predicted 220 watts – but anchored the leads at LN2 and neglected the heat leak from RT to 80 K at the leads

A simulation of a measured weekend warm-up used the global heat transfer coefficient for the helium service, and scaled it until the correct temperature change was obtained.

A 400 Watt heat leak for Helium service had to be assumed to obtain the measured temperatures. – this would include the leads, which are a big contributor – So the original spec of 220 watts for Helium was met.

This would correspond to 314 watts at 80K or LN2 service.

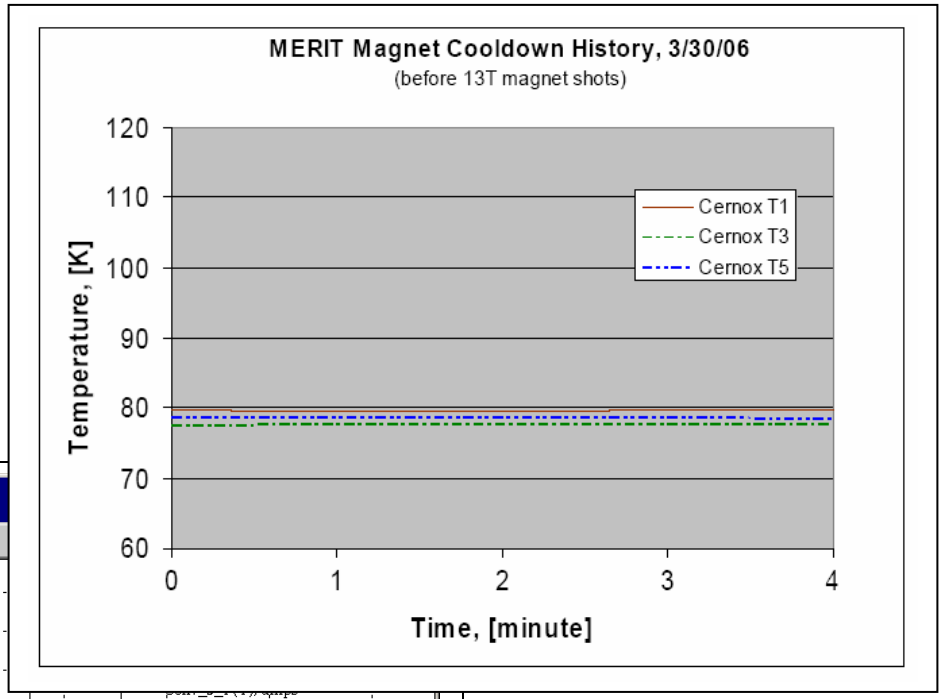
The 150 watt bore heater was run at about 40% during the tests in which the bore remained ice free. 60 watts would then be attributable to the bore vacuum and as well as conduction.

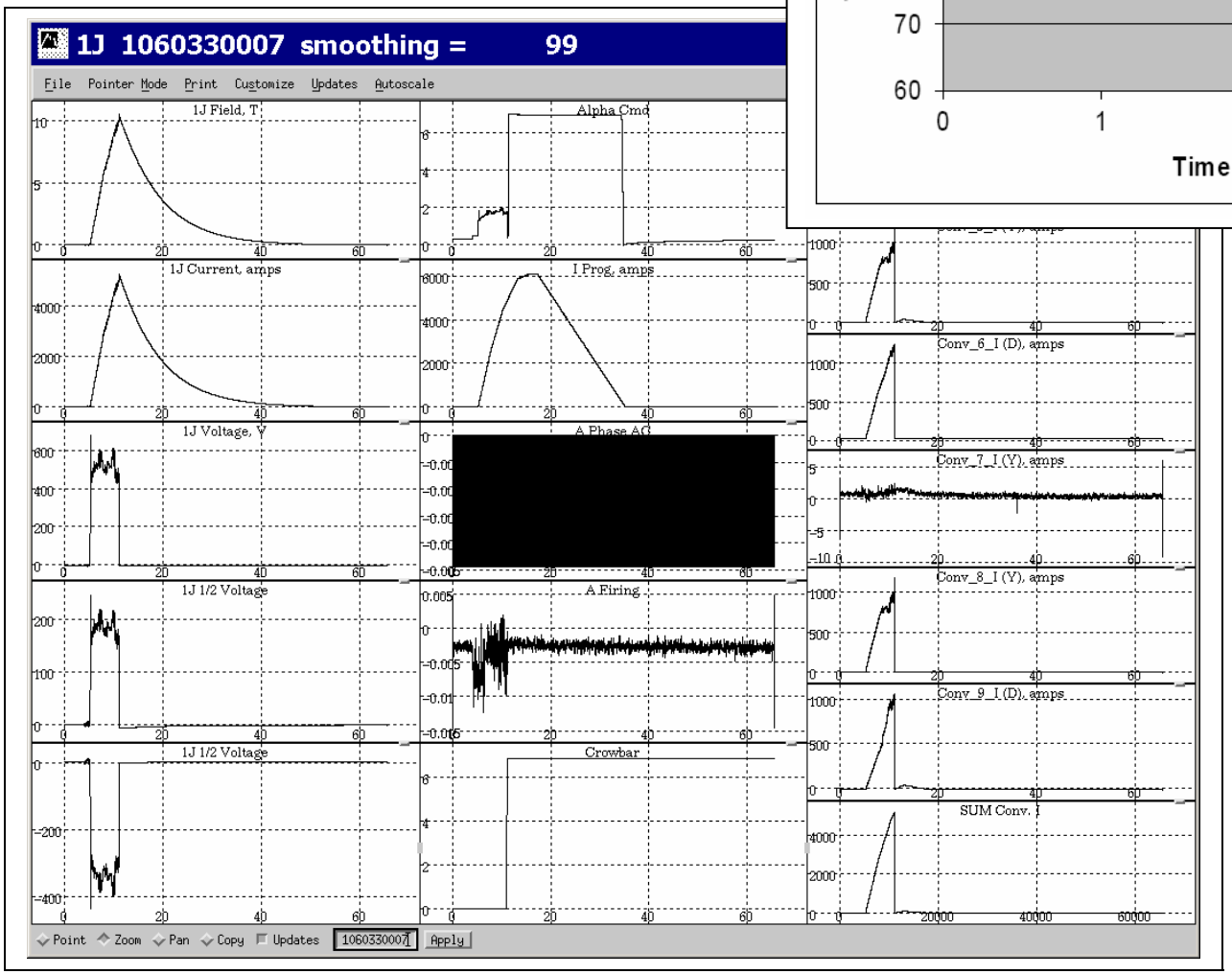


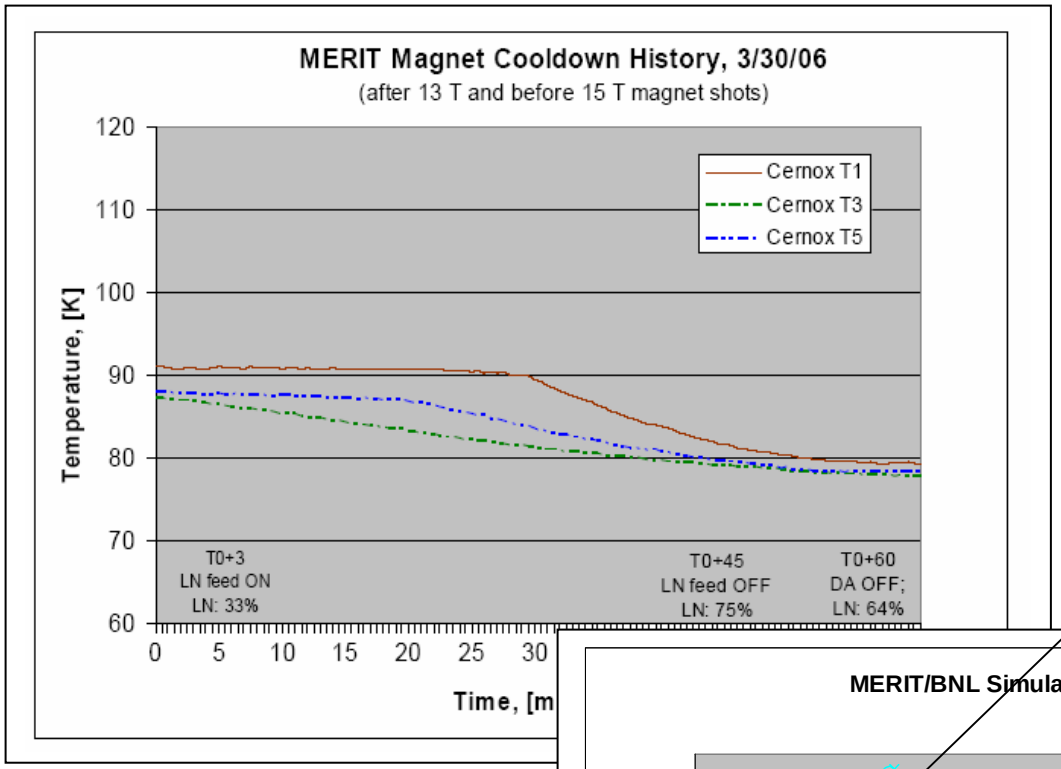
Shot Summary

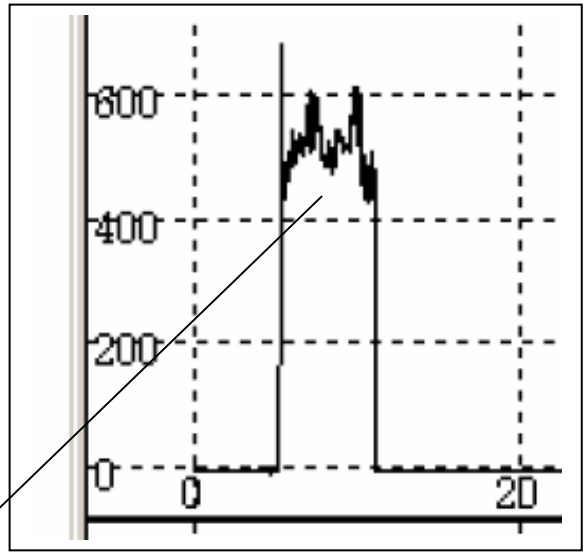
Date	Shot Number	Start Temp	End Temp	Peak Field	
March 9 2006	**1060309005**	**292**	**292**	**.6T**	**Before re-tap to higher voltage, 300 Amp Intended not to set off smoke detector.**
March 28 06	**1060328006**	**80K**		**.6T**	
March 28 06	**1060328006**	**80K**		**.6T**	
March 29 06	**1060329001**	**82**	**83**	**3.0T**	
March 29 06	**1060329002**	**85**	**94**	**7.0T**	
March 29 06	**1060329003**			**NA**	**Failed Shot (Interlocks still set ?)**
March 29 06	**1060329004**		**81 -91**	**7T**	**End temp measured before 2nd 7T shot of the day**
March 29 06	**1060329005**		**88-89**	**7T**	**Temp measured after series of 3 and 7 T shots**
March 29 06	**1060330001-2**				**Morning diagnostic shots, after disconnect of over current convertor**
March 30 06	**1060330003**	**80-85**		**3T**	**Tripped with L/R decay**
March 30 06	**1060330004**			**3T**	
March 30 06	**1060330005**			**3T**	
March 30 06	**1060330006**			**3T**	
March 30 06	**1060330007**	**77**	**90**	**10**	**Was to have been 13T but tripped at 10T with an L/R decay**
March 30 06	**1060330008**	**78**	**112-115**	**15.6T**	**Successful Full Field Test. Temperatures of 190 K were measured originally. Lower temperature results from calibration correction.**
March 30 06	**1060330009**	**115**	**129**	**7T**	**Was to have been the second 15T shot, Erroneous high temperature readings caused a 7T shot to be selected instead. Start and end temperatures are from analysis**

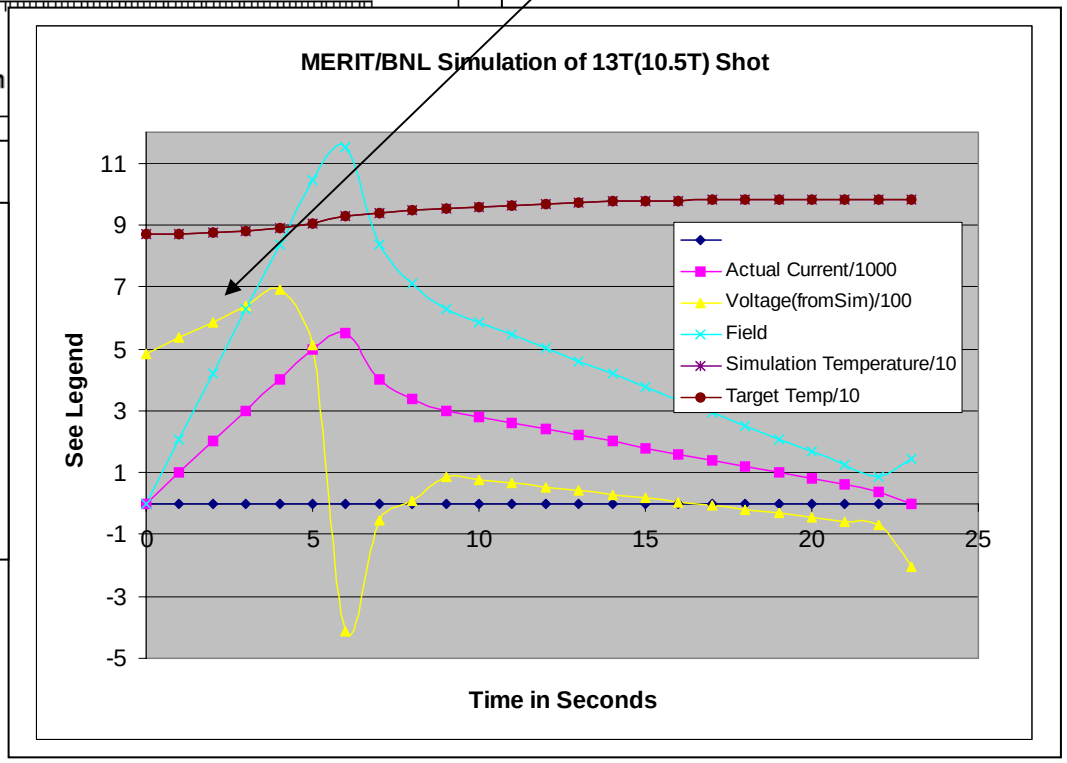
10T, Planned as a 13T Shot , 3/30/06











- **Current was input to the simulation**
- **The voltage is about right.**
- **The Current Input could have been more precise**

15T Test, Thursday March 30

7200 amps was programmed into the power supply. Based on Bob Weggels (and P.Titus)
calculations, this should be 15T

~7500 amps was reached by the power supply as reported by the power supply instrumentation. Based on the calculated magnet constant this would be 15.625T

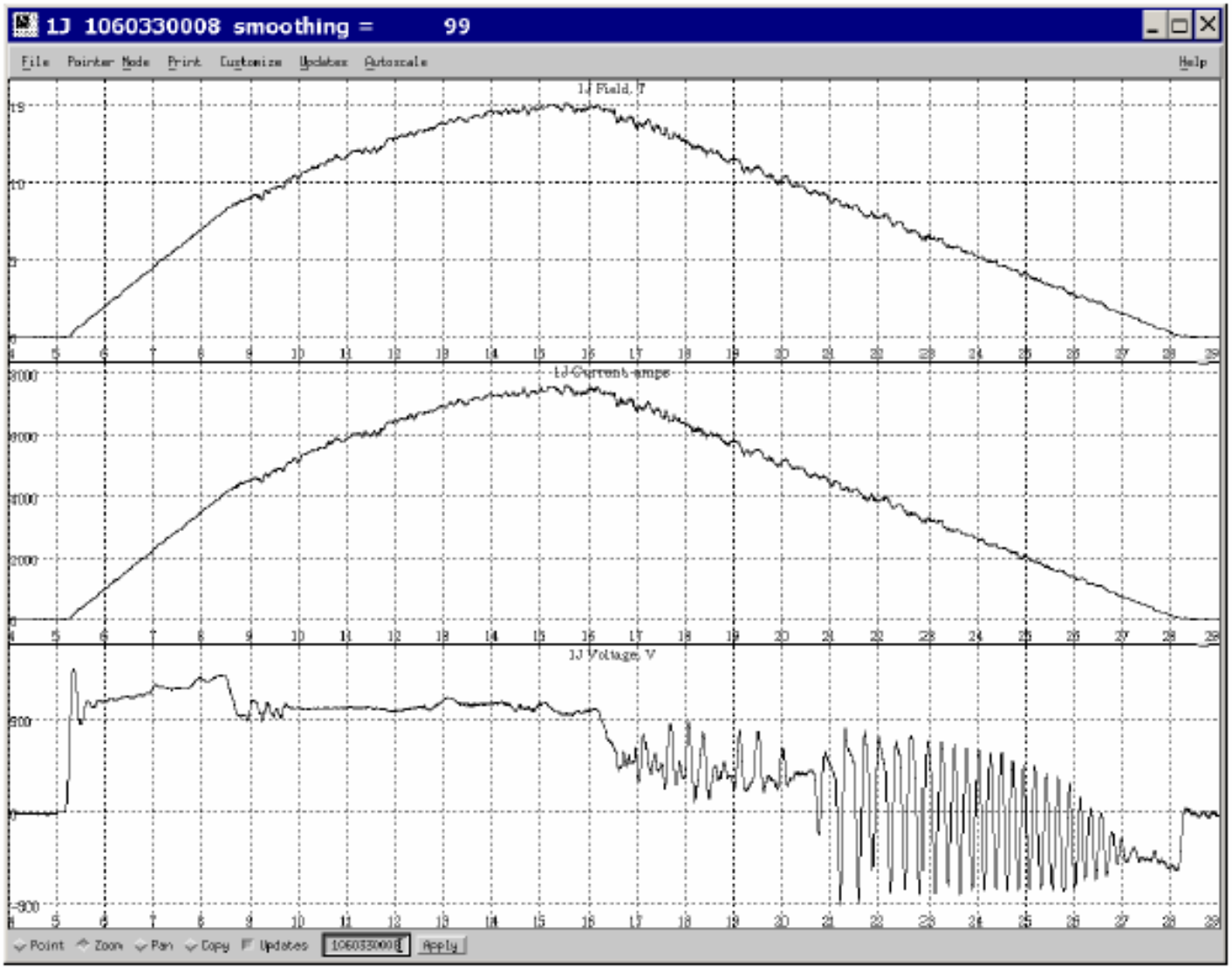
Based on gauss meter and small power supply current shunt, the magnet constant is:
`0.16T/79A = 0.0020253 T/A`
7200amps would be 14.58T
7500amps would be 15.19T

Movies of this pulse were taken and there was no visible motion of the bus bars and jumper cables.

Modifications to the Jumper Connections made Wednesday March 29 and installed the Morning of March 30

Stray Field Measurements were made by the MIT Safety Officer outside the test cell. These scaled well with the calculations.

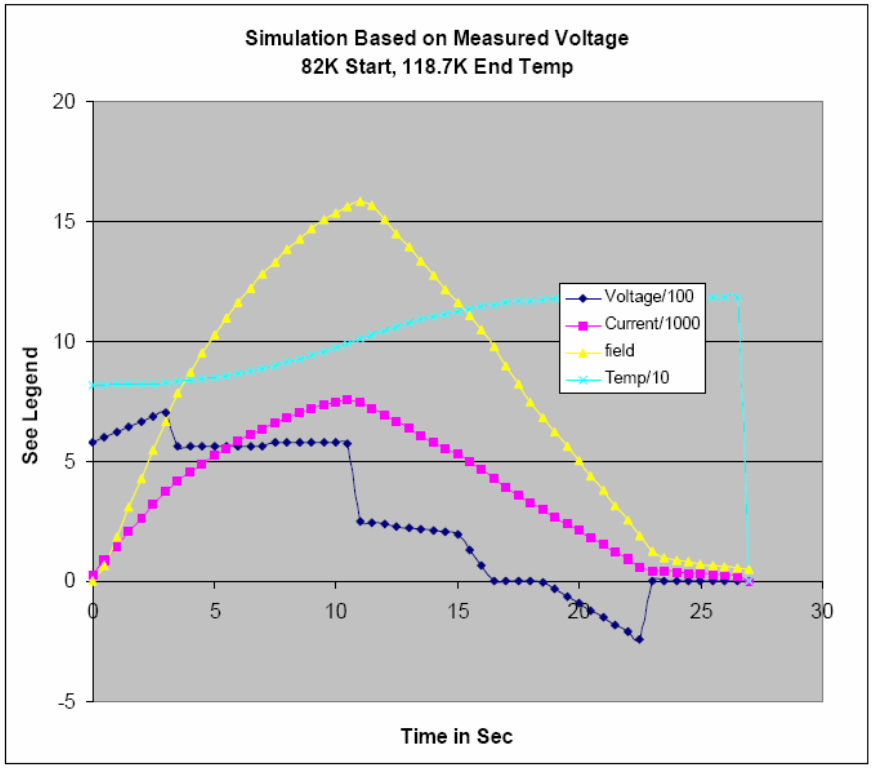
15T Test, Thursday March 30 – Expanded Current Traces



Expanded Current and Voltage Trace

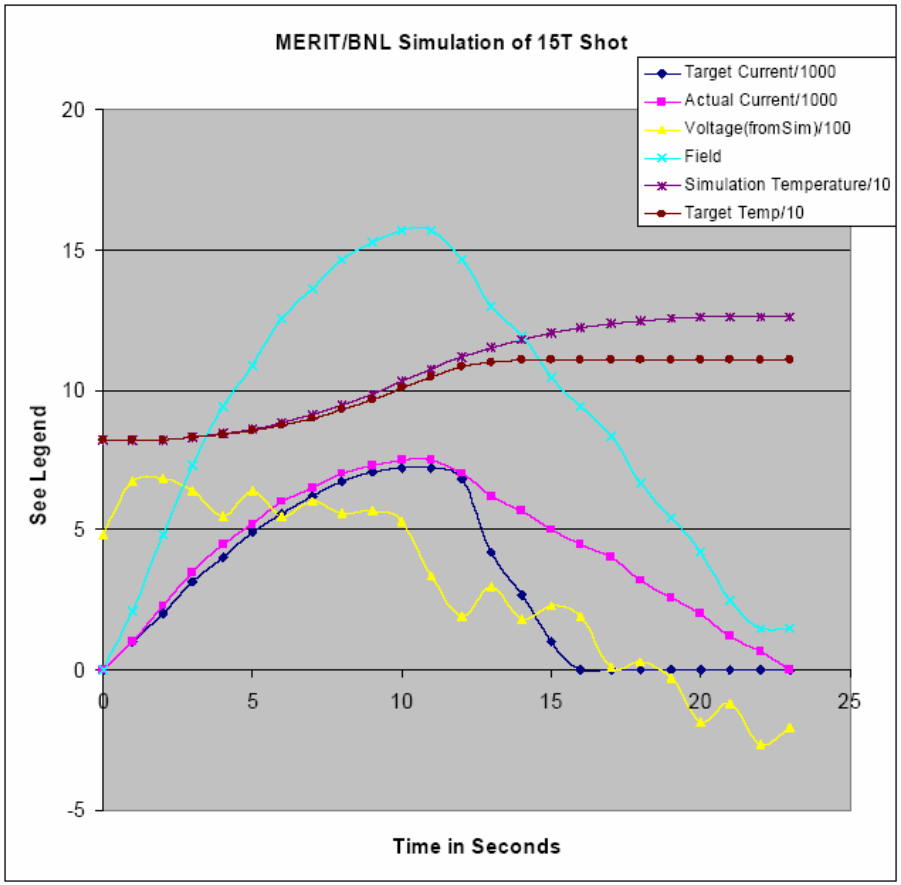
15T Shot Simulations based on applied current and applied voltage
The Expected Temperature Range from Weggel's 15T Simulation is 82K to 110.8K

Current based simulation

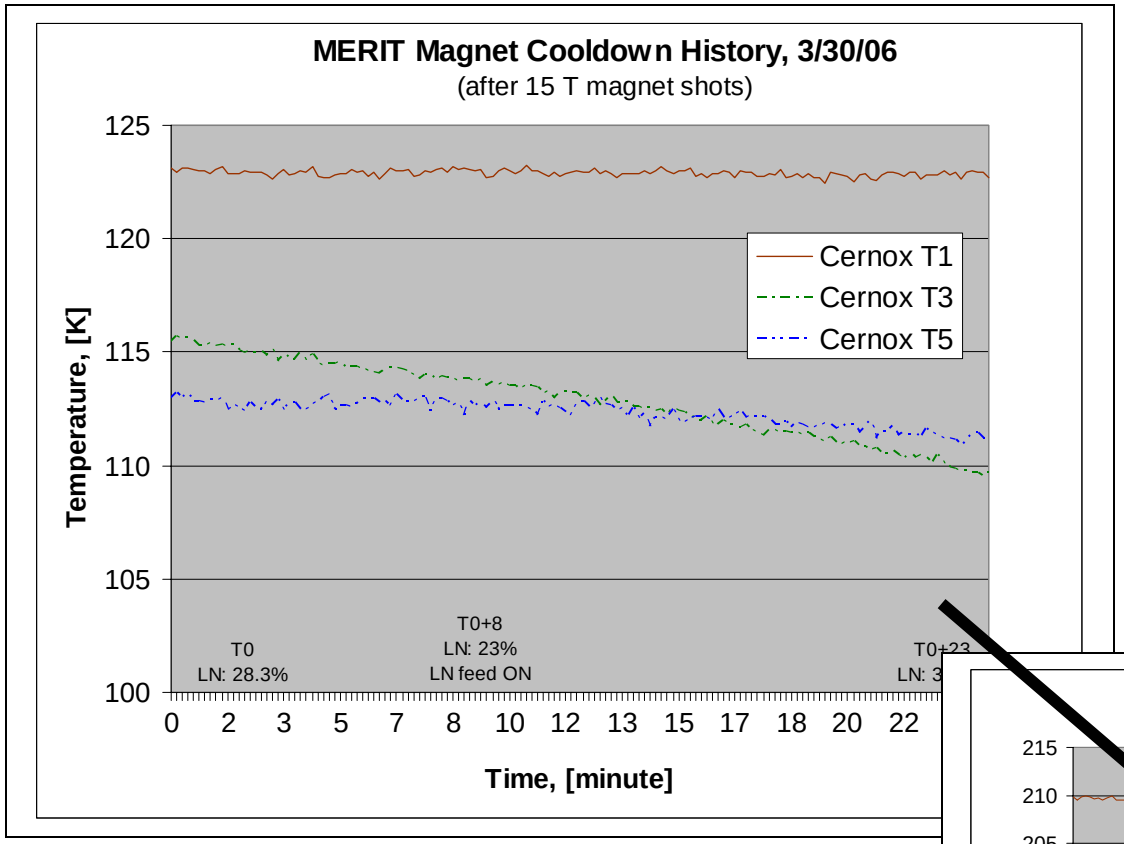


The Simulation based on voltage starts at 82K and goes to 119K.
Temperatures of 113 to 123K were measured after the test pulse

Voltage based simulation:



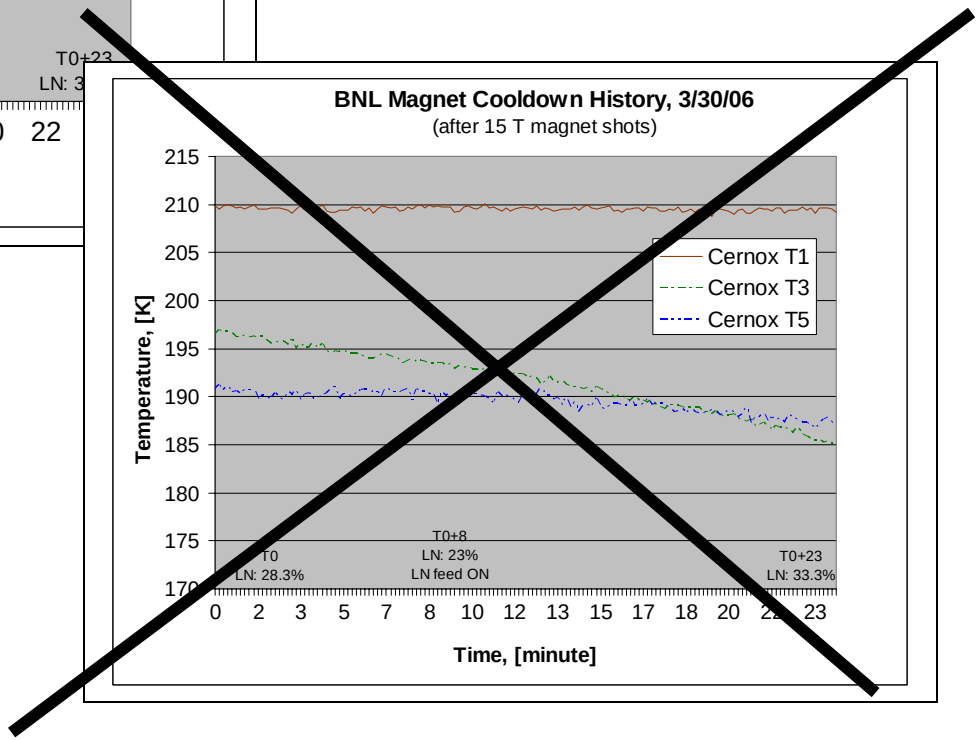
The target current profile has an 82K start and goes to 110.8K
The Simulation of the actual test current starts at 82 K goes to 126K
Temperatures of 113 to 123K were measured after the test pulse.



The original calibration of the CERNOX used a linear interpolation between 80K and RT.

It should have been a Log-Linear interpolation.

The belief that we had higher end temperatures led to specifying 7T for the last shot rather than 15T

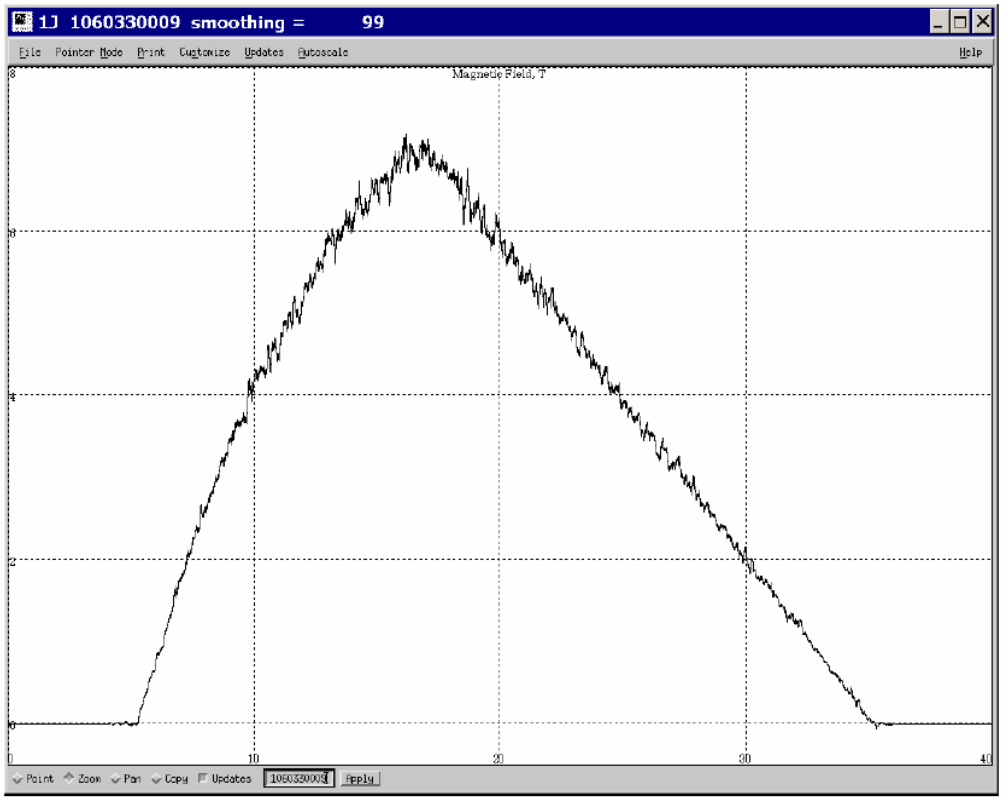


Last 7T Shot (Planned as the Second 15T Test) Thursday March 30

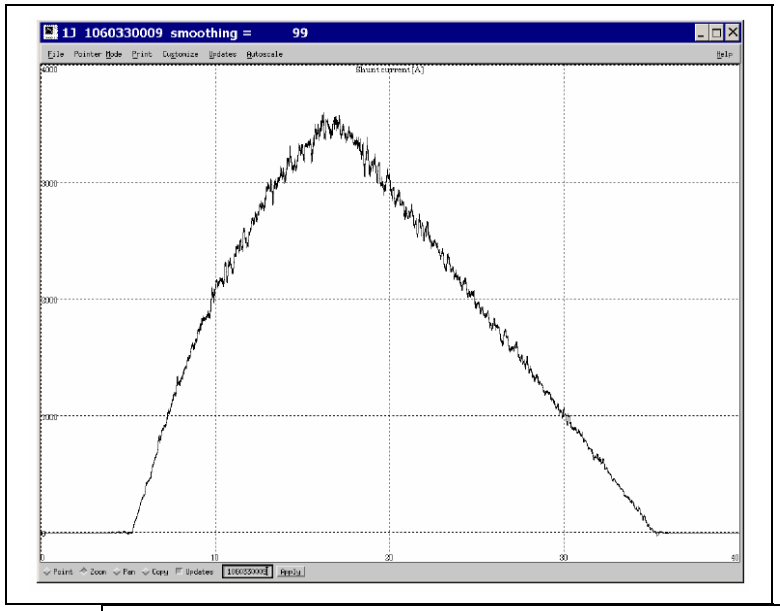
The second planned 15T shot was changed to a 7T shot because of the unexpectedly higher temperatures from the first 15T shot.

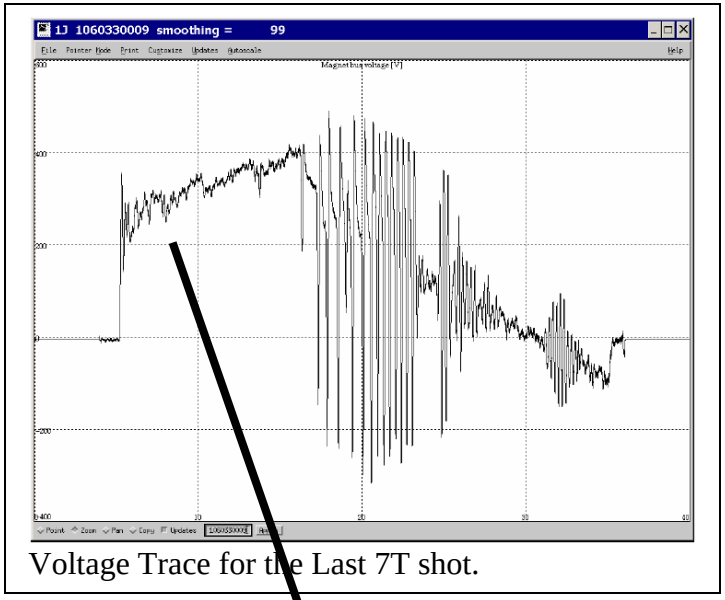
This required some investigation after the test run to diagnose the difficulty.

A simulation of the last 7T shot was performed. To Confirm that the end temperature of the 15T shot was closer to 115K than 190K. Start Temperatures were assumed until the voltage matched.

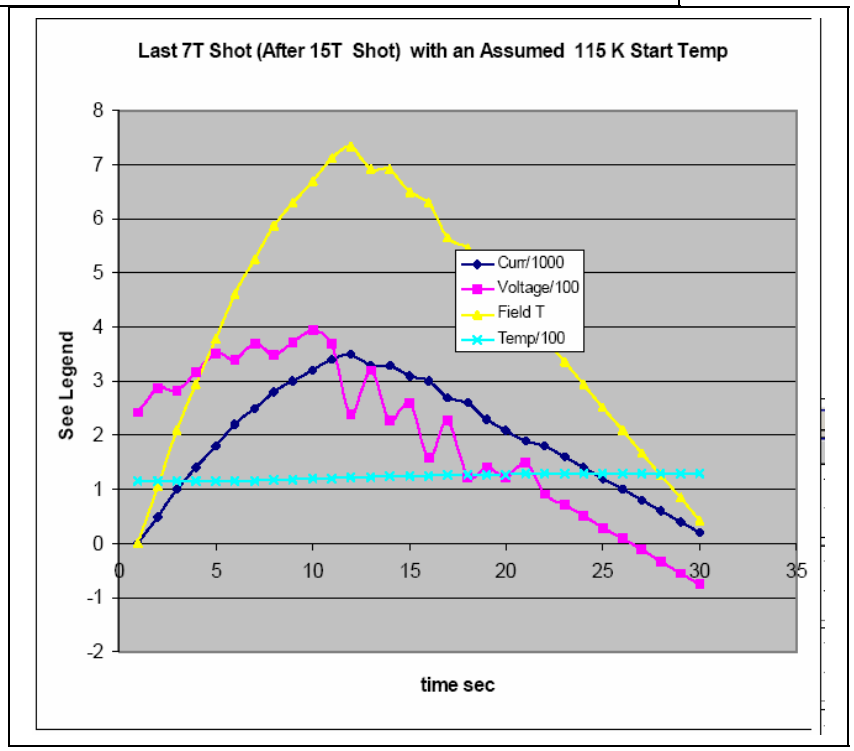


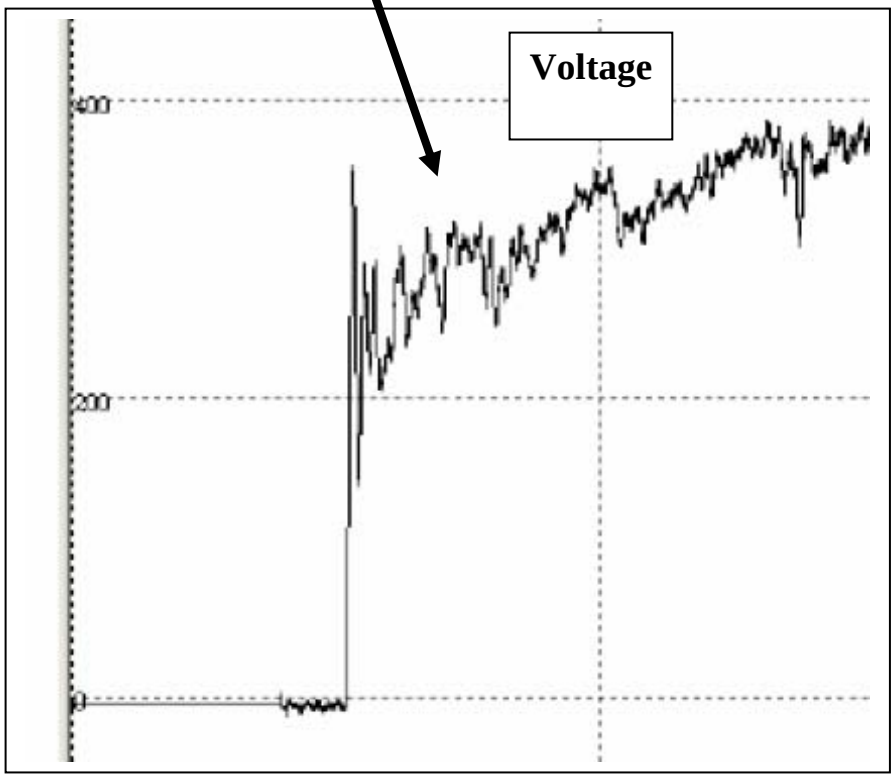
7T Shot – The Last Shot of the Campaign.

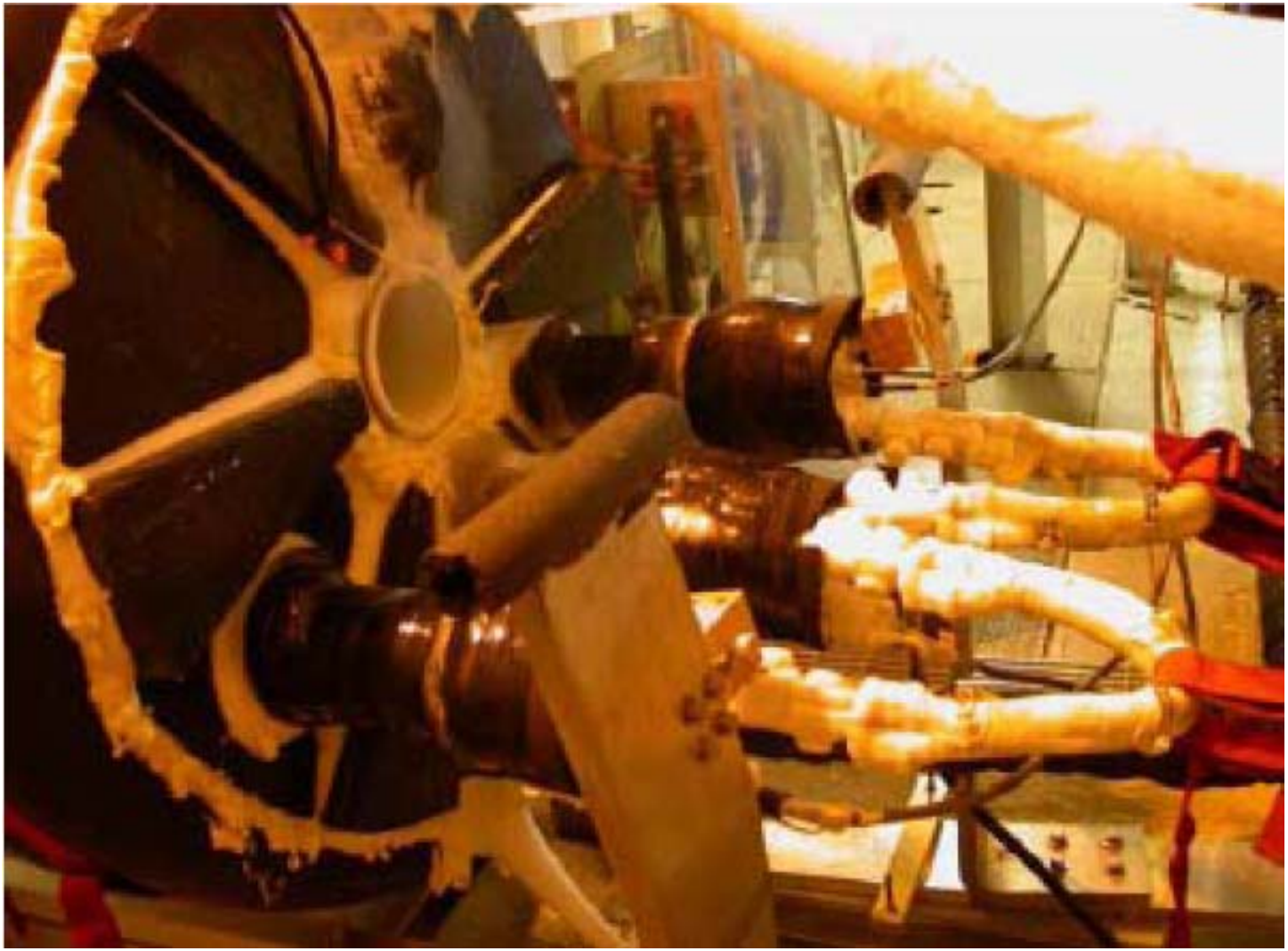




Voltage Trace for the Last 7T shot.







Thursday, March 30 2006 The cold end of the magnet. We had the bore heater off. Jumpers were not insulated.

Present Status:

All magnet performance issues have been resolved.

Power supply control system needs to be improved – Adjustments are still needed to impreove voltage noise.

Power supplies have been re-tapped to the lower voltage, and will need to be reconnected for higher voltage service.

Small items need attention – leaky gland nut needs to be fixed.

Field measurements at the bore will be revisited. At present the jet begins near the bore centerline where the field is very uniform (solenoidal)

Test Report and Plan are still being cleaned up. The latest version is on my web site *http://www.psfc.mit.edu/people/titus*

Contract for testing in the Fall is in place. This will allow:

- **Modifications to the PTF test stand to clear the "pit" for the Mercury system common base plate.**

- **Update of the cryogenic system for blow-down operation.**