Calibration of a Custom Built Cernox Thermometer in Pulsed Magnetic Fields

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Introduction
A custom designed Lakeshore Cernox™ 1030BC thermometer to be used as the platform thermometer and sputtered heater on a heat capacity stage was calibrated at temperatures from 15K down to 1.4K in magnetic fields up to 45T using the mid-pulse magnet in cell 1 at the NHMFL in Los Alamos, NM. The resulting calibration will be used to measure the heat capacity in the 33 T resistive and at the NHMFL of ultra clean YBCO. As the specific heat is calculated from the temperature difference of an applied heat pulse, knowing the calibration is essential for determination of the electronic contribution of the specific heat.

Experimental
The Cernox™ thermometer was mounted with the excitation current perpendicular to the magnetic field. Using the NHMFL Los Alamos digital lock-in amplifier the thermometer was excited with a current of 4 $\mu$A at a frequency of 10 kHz. Data was taken at a rate of 1 MHz as the magnet was pulsed to 45T. The short time of the magnetic field pulse (around 50 ms) ensures that the thermometer under test remains isothermal while the data is taken. Data is taken for two magnetic field pulses at each temperature the first the 10T and the second to 33T. Overlaying the resulting data ensures that there is no magnetically induced heating effect during the pulse.

![Figure 1: Low temperature field sweeps of a Cernox thermometer. The data are plotted in a Labview Runtime 8.5 program that creates a matrix converted the data from R(B) at fixed T into R(T) at fixed B.](image)

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