ECAL Heater Controls Test Stand

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This month I assembled a test stand to aid in the development of a system of controls for the ECAL supermodule heaters. The goal of the system is to maintain a target temperature at the front flange of the supermodule of 250^{o}C. The test stand consists of a single supermodule placed in an enclosure, a power supply, and a National Instruments 9045 cRIO as the data acquisition and controls.

The EEL building's industrial oven, Fig.1, was used as an enclosure for the test stand. The internal size of the oven (4’ wide, 3’ high, 2’ deep) is rated for 350^{o}C making it ideal for use as an enclosure. It also is vented outside the building, which will remove any unwanted outgassing during the test.

The cRIO uses four modules for monitoring temperatures and voltages, as well as controlling power to the heater. Temperature is monitored by two four-channel RTD modules. The RTDs are for the six positions on the supermodule, the heater, and the ambient air of the oven enclosure. The voltage applied to the heater was monitored by a channel of an analog input module. Due to the limits of the analog input module, a voltage divider was installed parallel to the heater, to allow only 10% of the heater voltage to be measured for voltage verification. Finally, power to the heater is controlled by a relay which is controlled via a digital output module channel.

Power to the heater and relay is provided by a four-channel Agilent N6700B power supply. Each channel can supply 50 VDC and 5 A. The heater is rated for 125 W at 120 V. To achieve enough voltage, three channels are configured in series. The fourth channel is used to power the relay coil that requires 12 VDC.

- Assembled the test stand
- Developed control and monitoring software for a single ECAL heater and software datalogging

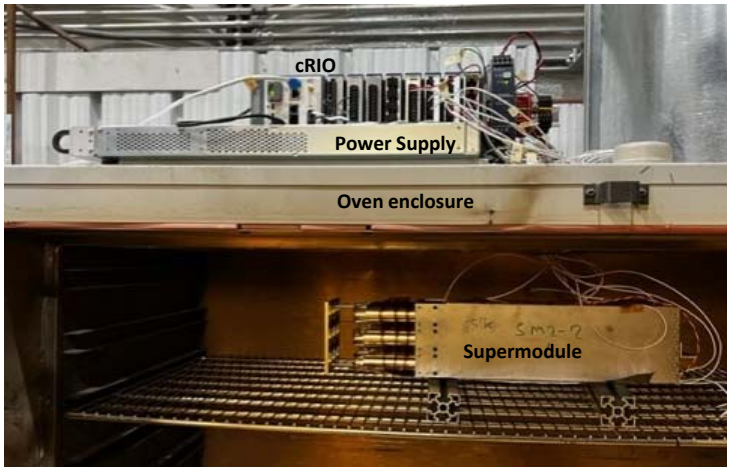

FIG.1 Supermodule in oven

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I wrote the controls software in LabVIEW using four sub-VIs in the main VI while loop. Each sub-VI is responsible for completing a task. The tasks are data acquisition of the RTDs and heater voltage, control of the power supply settings (set voltage, current limit, and output enable), temperature control, and datalogging.

ECAL heater controls main VI loop

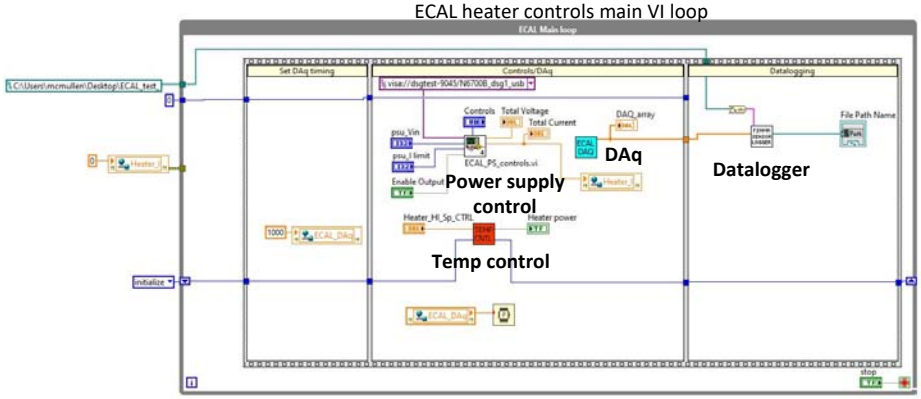

FIG.2 LabView controls software

In conclusion, I developed a test stand, Fig. 3, that will aid in the design of a control system for the ECAL supermodule heaters. The test stand uses National Instruments hardware and software to control the temperature of a custom-designed heater and monitor the temperature at multiple locations on an ECAL supermodule. These tests will confirm the power needed to reach a target temperature and the control elements needed to maintain this temperature.

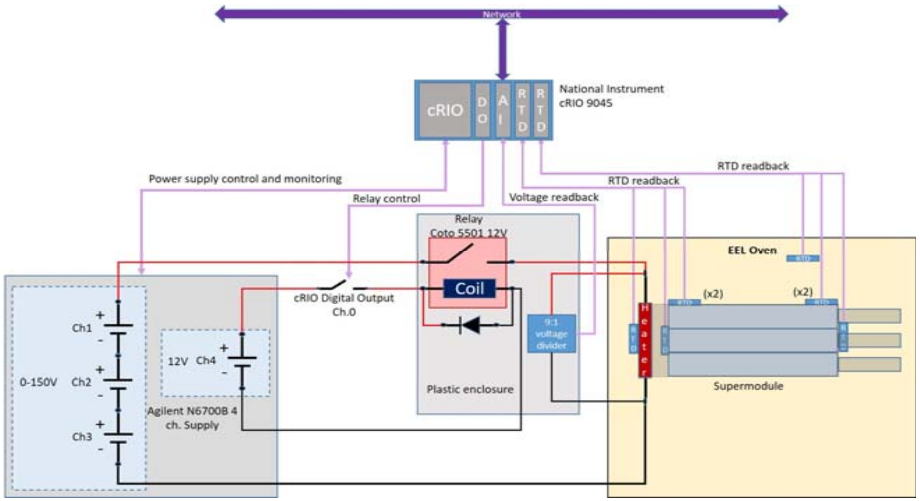

FIG .3. ECAL heater controls test stand