ECAL Heater Controls
Heater Design Change

Marc McMullen
and the Detector Support Group
February 23, 2023

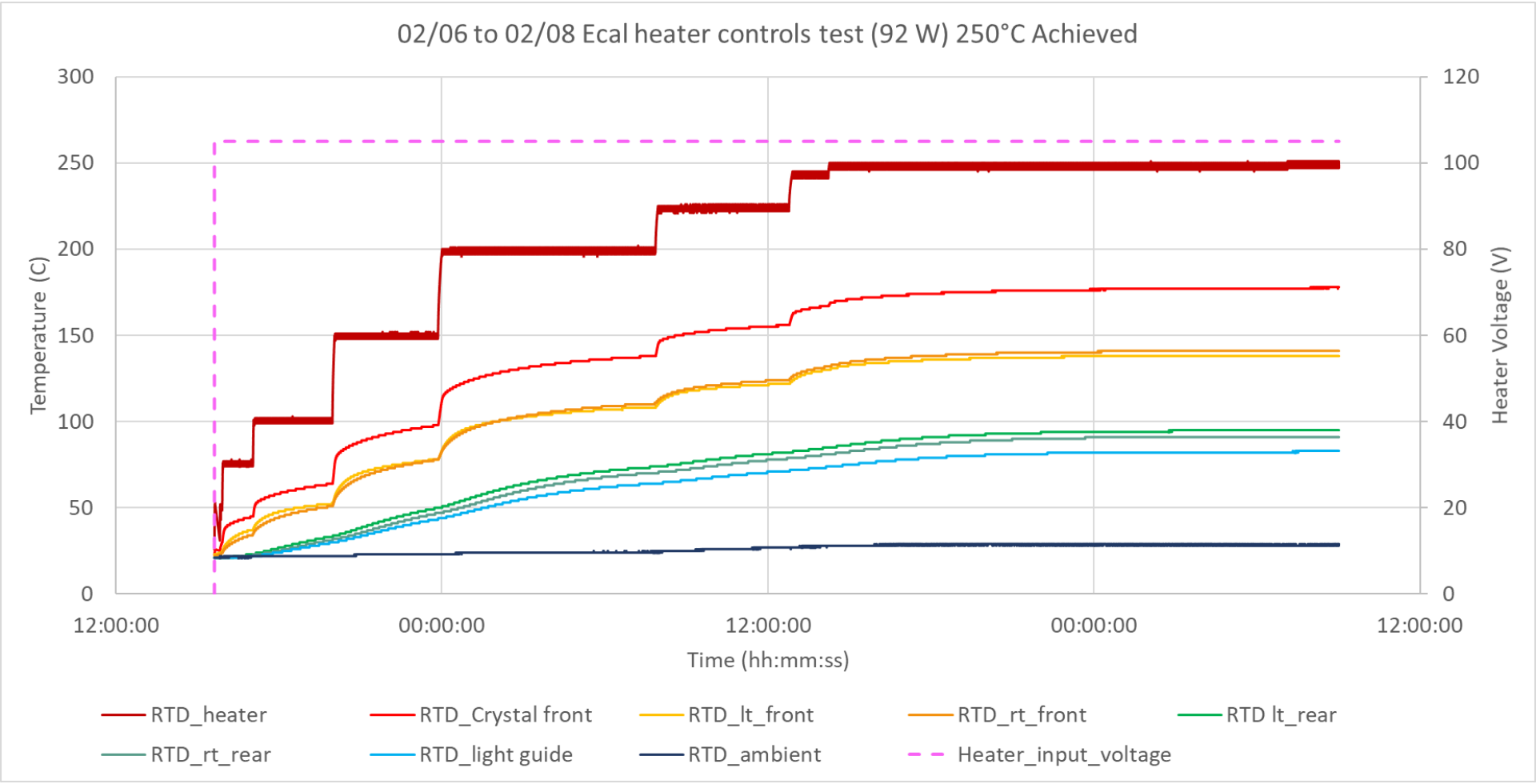
Contents

- Objective
- Test results at 92 W
- Mechanical design change
- Circuit calculation
- Circuit simulation
- Project progress
- Conclusion

Objective

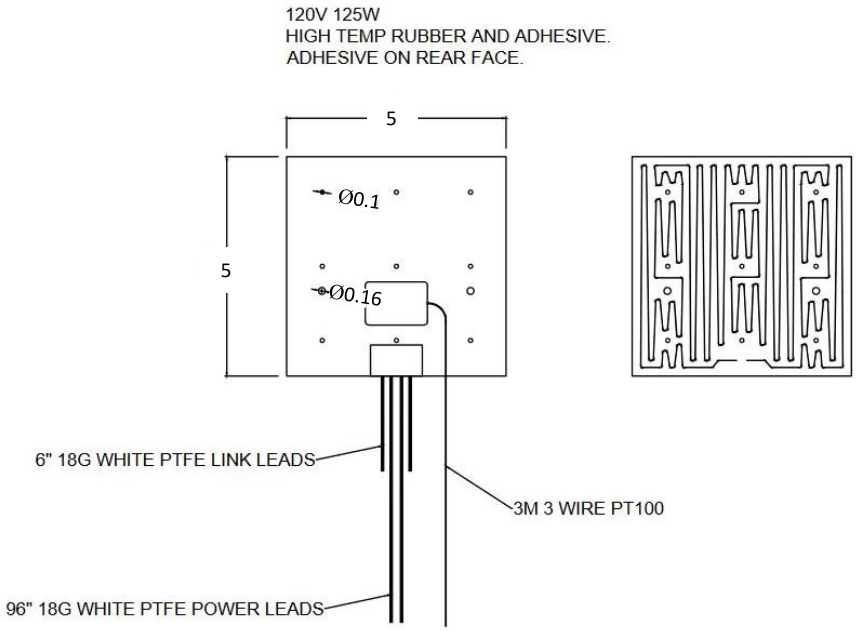
- Improve the mechanical fit of the custom heater
- Optimize the heater specification
- Confirm the heater specification through circuit simulation

Test Results @ 92 Watts

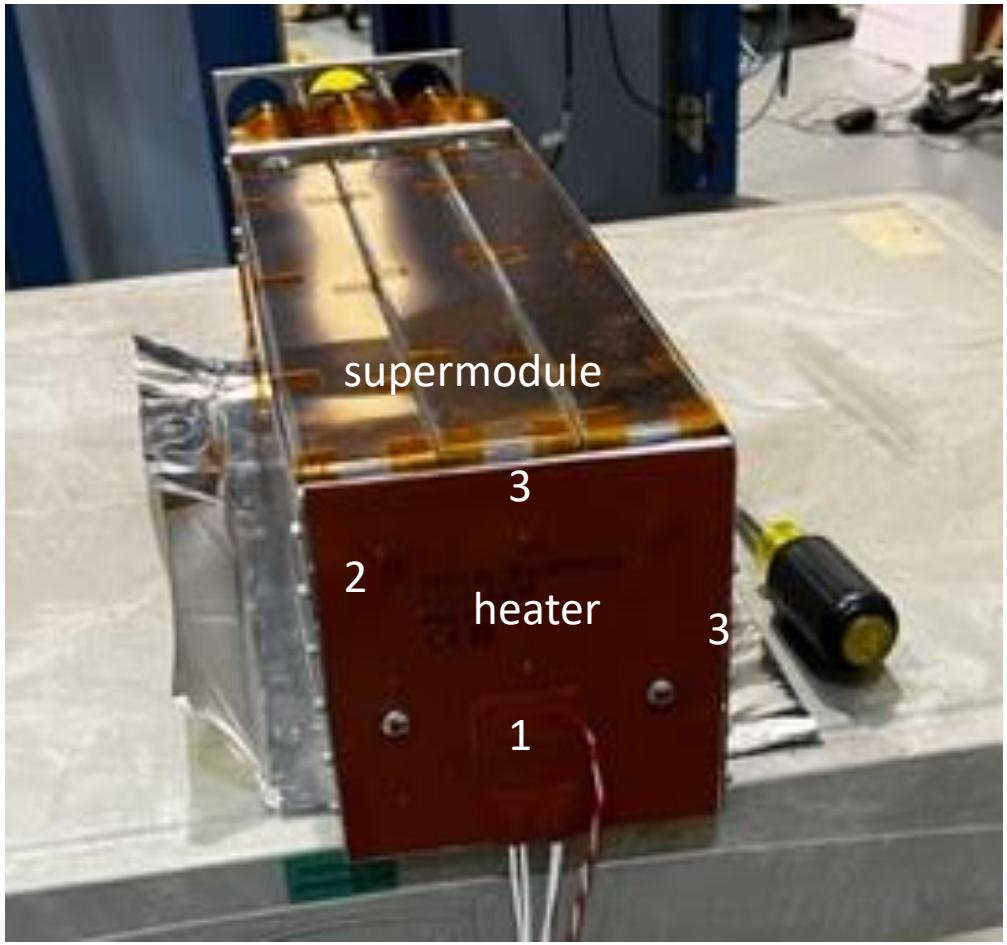


92W was produced by the heater to achieve the target temperature of 250 degrees Celsius

Mechanical Design Changes (Prototype)

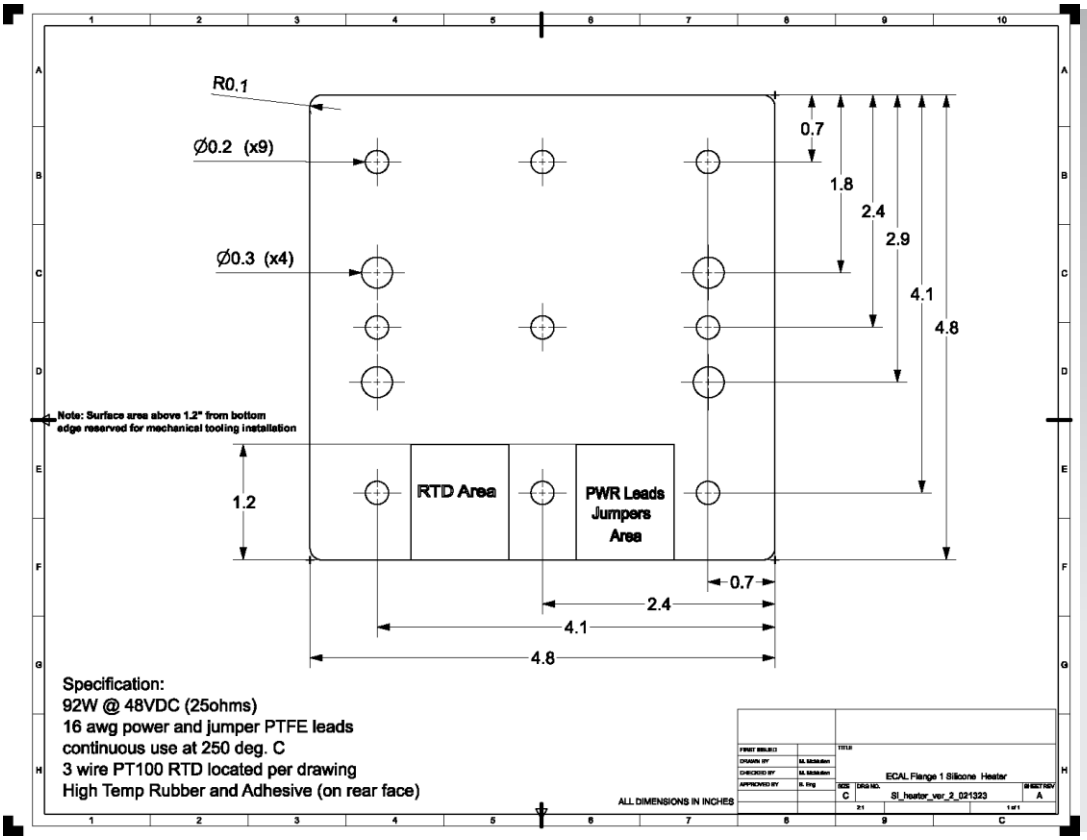


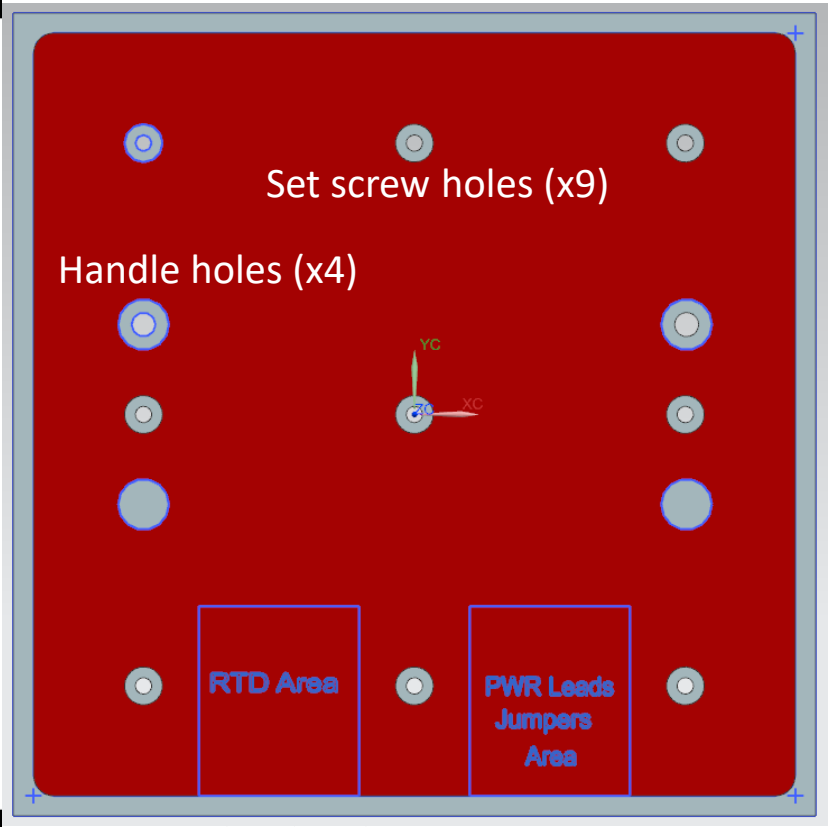
CHR heater prototype design in inches



1. RTD is in-line with handle attachment hardware – tooling fit issue
2. Set screw holes too small – alignment issue
3. Size equals flange dimensions – alignment issue

Mechanical Design Changes (version 2)





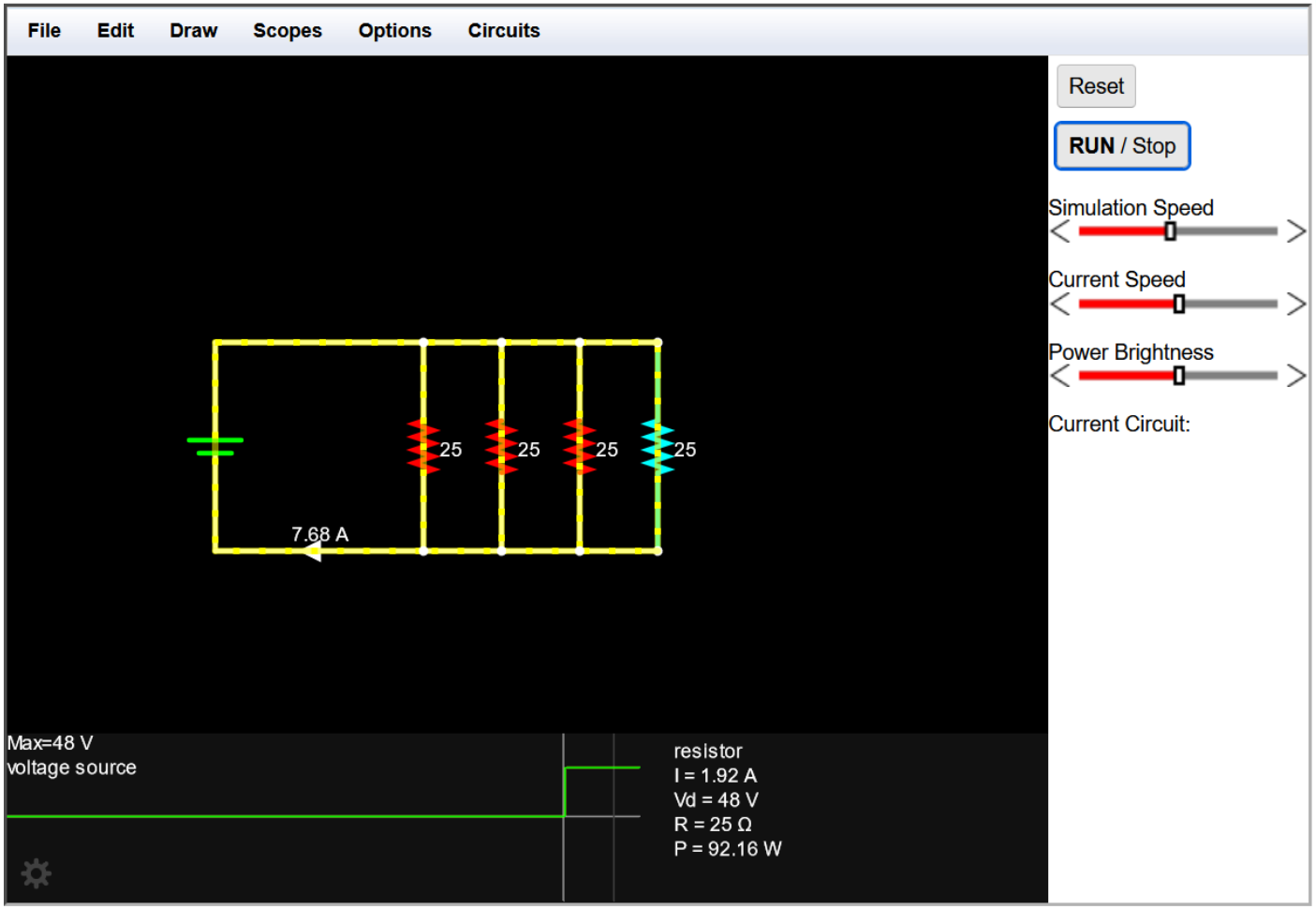
NX12 model of the front flange with the new heater design

- Reduced the overall heater by ¼” in length and width ~23” squared – improved alignment
- Increased all hole size – improved alignment
- Relocated the RTD and power leads – removes mounting obstruction
- Added extra handle tooling holes – eliminate the need to install the heater upside down

Circuit Calculation

- Test results confirm that 92 W is more than adequate to achieve the target temperature of 250^{o}C at the heater on the front flange
- 48 VDC supplies are available
- 48 V * 1.92 A = 92 W (per heater)
- A distribution of four supermodule heaters per channel would require ~7.7 A per power supply
- Custom Heaters and Research is currently working on a quote for 220 units specified at 92W at 48 V
  - 12 units for approval testing

Circuit Simulation



- Simulated four heater in parallel using Falstad.com simulator to confirm calculations for channel power requirements
- 25 ohm resistors were used to provide 92 W per heater at 48 V

Project Progress

- ✓ Insulated heating test – completed 02/08/23
- System segmentation of 188 total supermodules
  - 47 channels to power 4 supermodules in parallel per channel
    - ✓ **Power requirement calculation – completed 02/15/23**
  - Full system temperature readback from 188 heater RTDs
    - **Readback channel multiplexing**
- ✓ Design changes to heater – completed 02/15/23
  - 5” x 5” needs to be reduced by ¼” in height and width
  - All holes need to be increased for easier alignment application
  - Customize resistance to accommodate system power requirement
- Develop 2 channel controls system for the 6 supermodule test in March

Conclusion

- 92W is more than adequate to reach the target temperature of 250^{o}C at the front flange
- Simulation of the heater circuit with the design changes are complete
- The prototype heater design changes have been made and have been sent for quote with the specification of 92W at 48V
  - Design will be reviewed by DSG

The End