PHASE CHANGE MATERIAL TRANSIENT HEATSINK FOR POWER SEMICONDUCTOR

Midterm Presentation I

Team 9:

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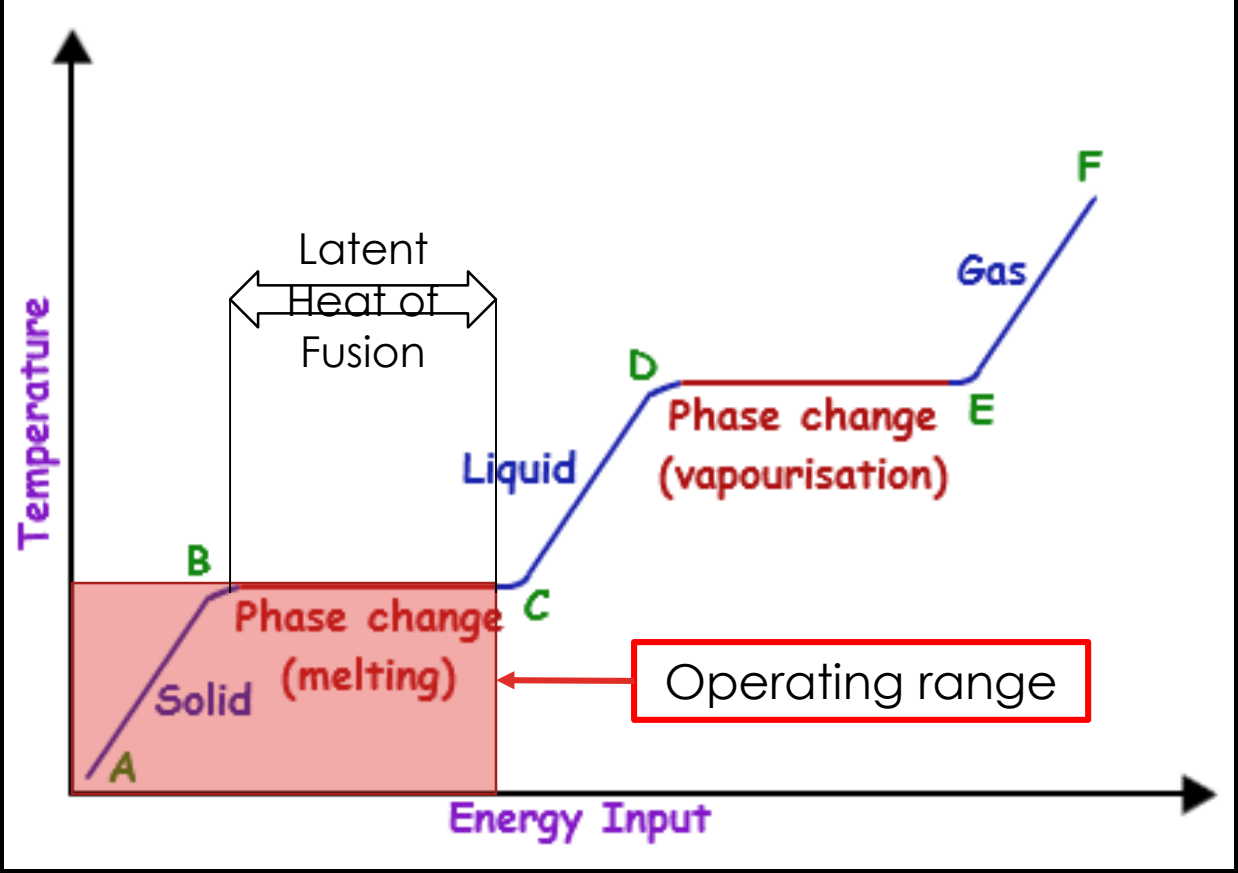
MOTIVATION

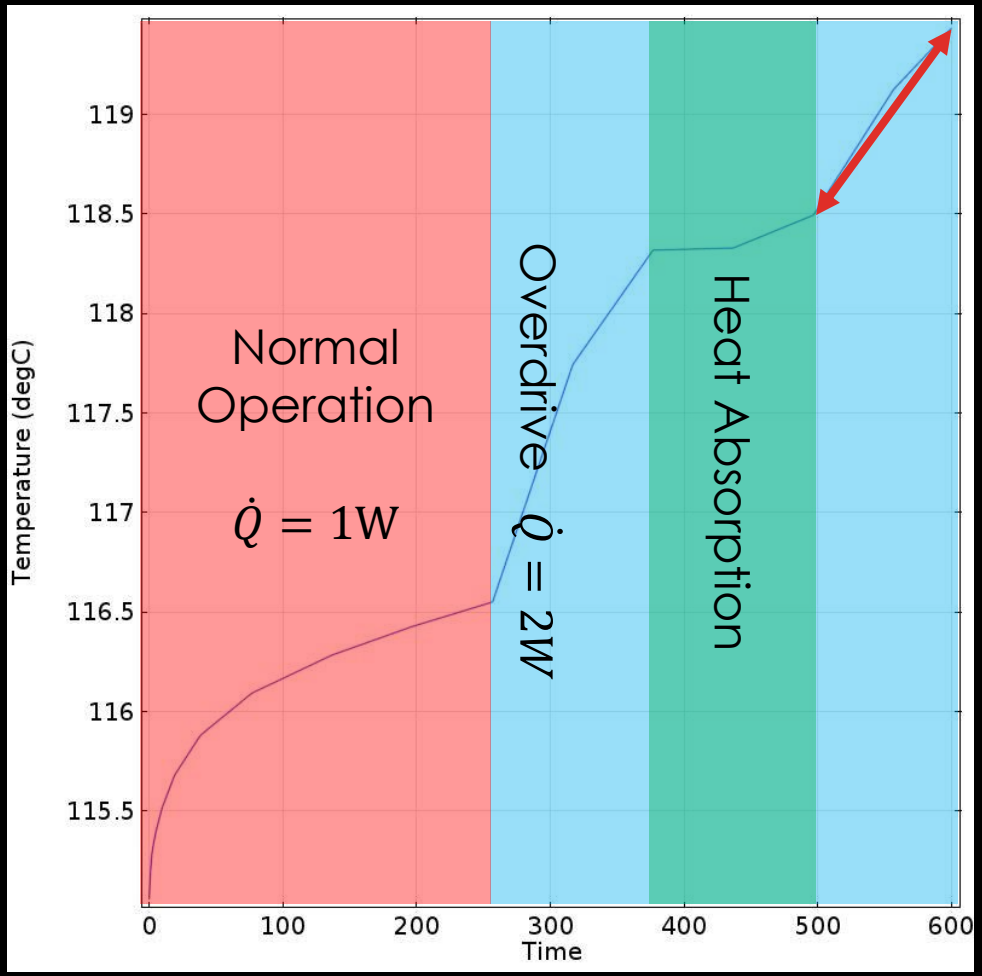
- New solutions for electronics cooling
- Power Semiconductors
  - Found in jet engine's ignition units and power regulators
  - Thermal management is critical
- Customer's need
  - A highly-reliable, low- weight heat dissipation solution for power semiconductors in jet engine systems

BACKGROUND


Temperature
Latent Heat of Fusion
A
B
C
D
E
F
Solid
Phase change (melting)
Liquid
Phase change (vapourisation)
Gas
Operating range
Energy Input

OBJECTIVES

- Identify ideal PCM for heatsink
  - Given operating temperature range 115-125°C
- Numerical model to test heatsink performance
  - Design parameters
  - Prototype geometry
- An experimental rig for validation of the model
  - Final design selection/design for manufacturing



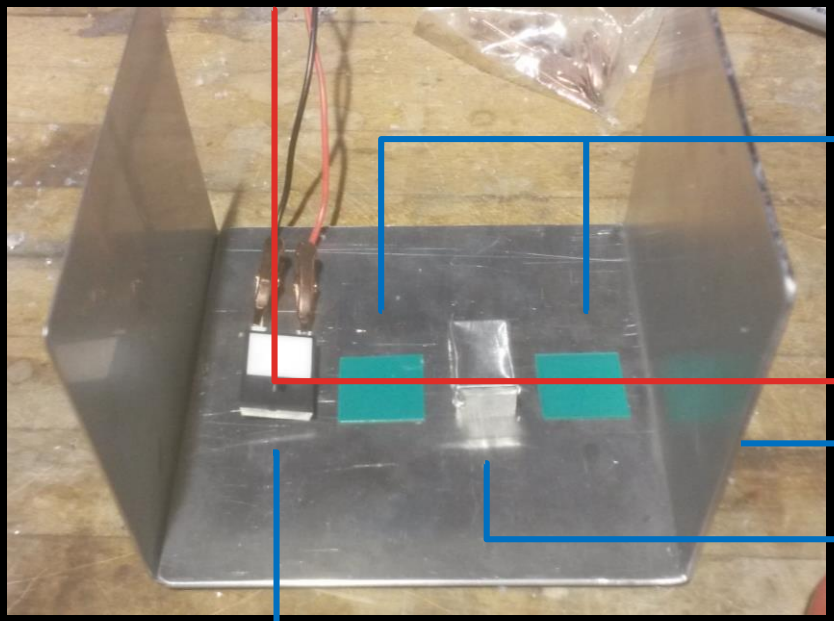
PROCUREMENT

Material/Equipment	Vendor	Amount	Unit Cost (USD)	Total Cost (USD)
MP9100 resistor	Digi-Key	1 pc.	10.90	10.90
52In-48Sn solder	IndiumCorp	3 ft	**265.00**	795.00
Aluminum tape	eBay	1 spool	40.00	40.00
Hi-Flow 300P*	Orion	1 pc.	48.00	48.00
NI 9211*	National Instruments	1 pc.	351.00	**351.00**
cDAQ 9174*	National Instruments	1 pc.	762.00	**762.00**
LabView Full	National Instruments	1 license	2699.00	**2699.00**
DC power supply*	Digi-Key	1 pc.	489.00	**489.00**
Lab oven*	Mellen	1 pc.	2499.99	**2499.99**
Type K thermocouple*	Omega	4 pcs.	30.00	120.00
Aluminum bar*	Various	26 cu. in.	5.00	5.00
Thermal contact tape*	eBay	1 spool	4.50	4.50
Machining*	N/A	2 hours	20.00	40.00
			Remaining Budget (including starred items):	**-5864.39**
			Remaining Budget (excluding starred items):	**1154.10**

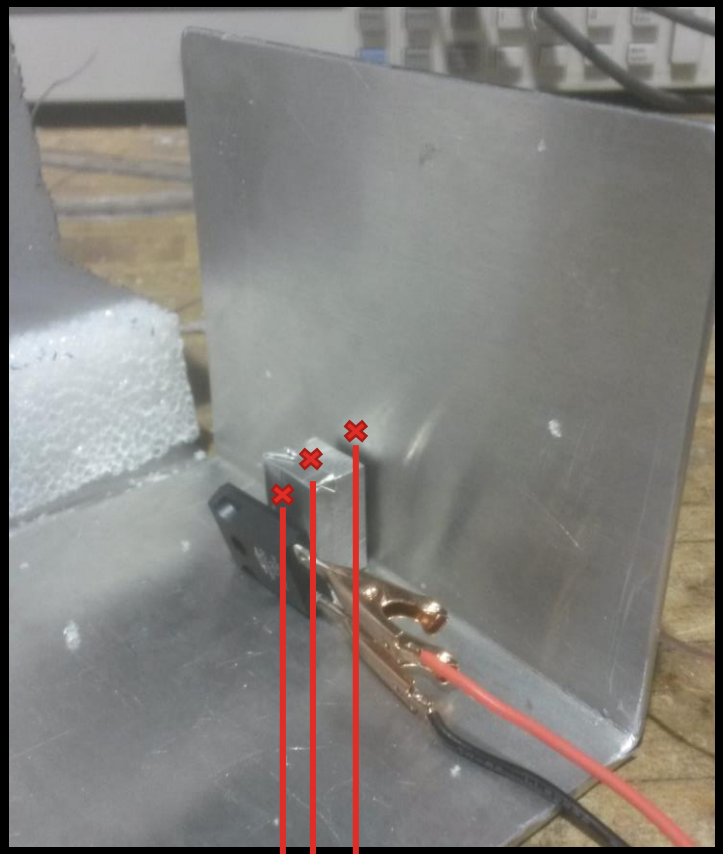
Starred items obtained at no cost

- Allocated budget was $2,000
  - Majority of cost would be incurred in purchasing testing equipment: One-time capital investments
  - Still well under-budget (excluding starred items) and do not anticipate any other major purchases

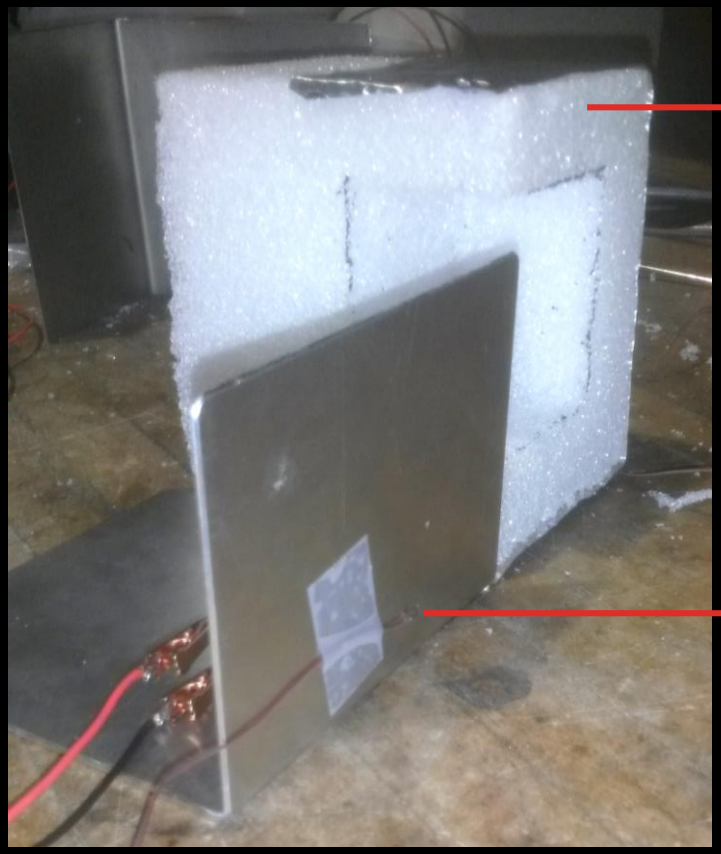
PROTOTYPE TESTING



PROTOTYPE TESTING



Thermocouple mount locations



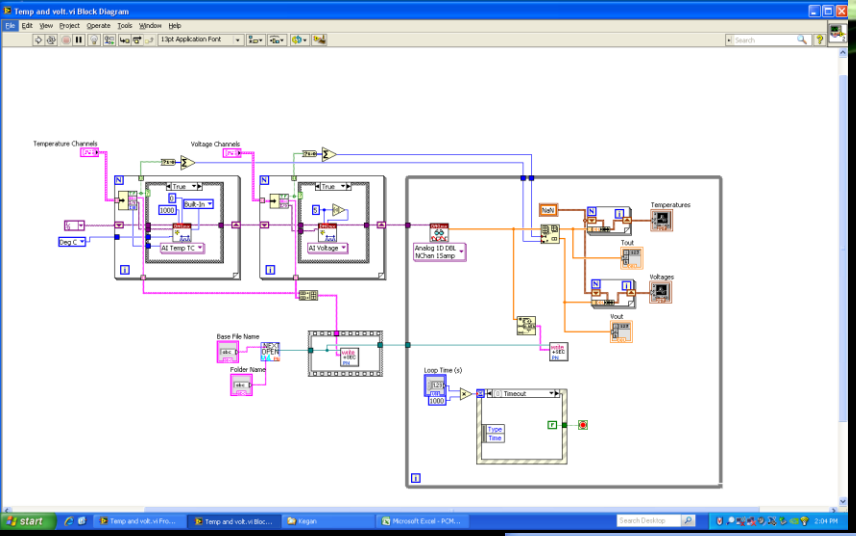
Styrofoam insulation

Type E thermocouple

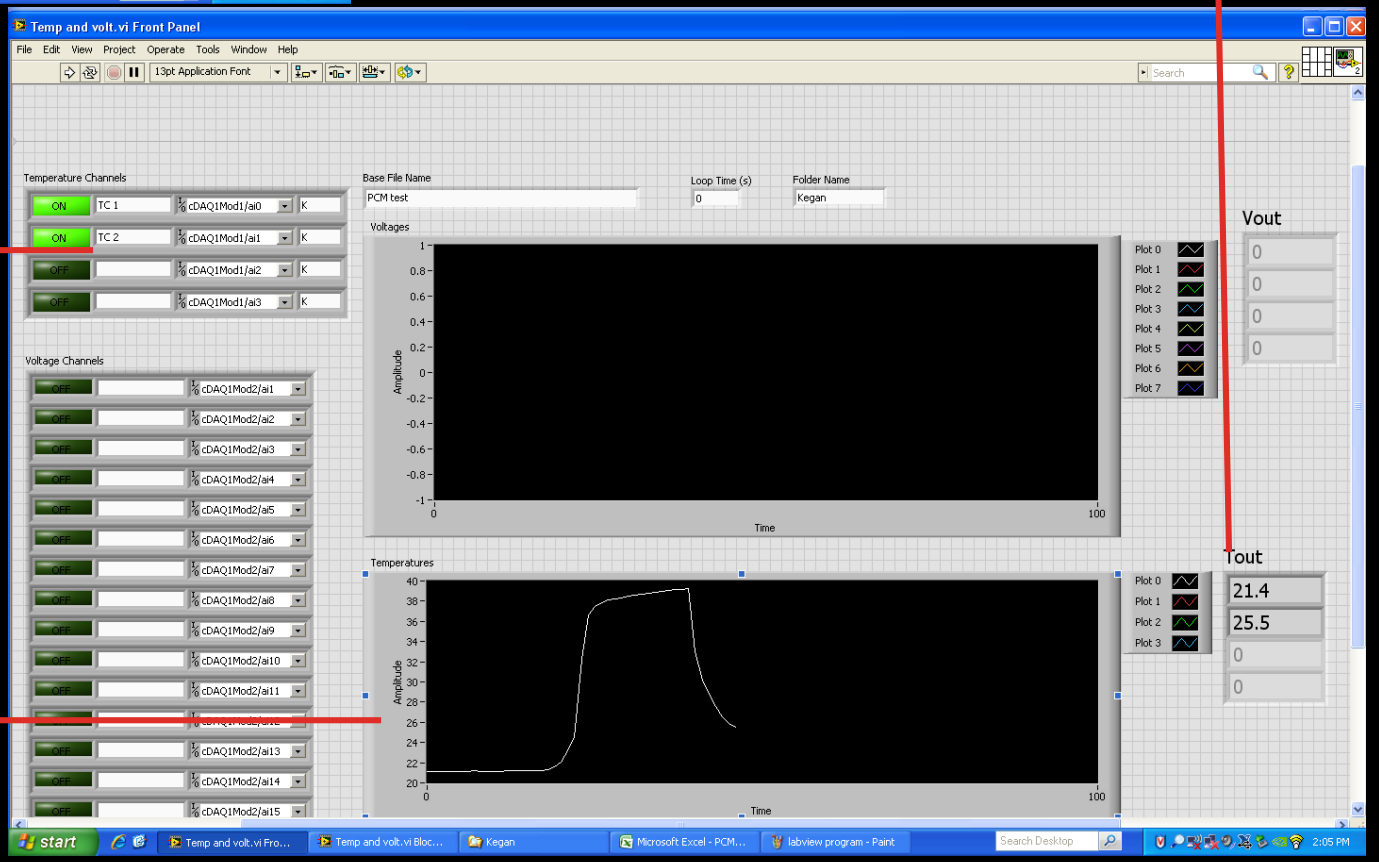
PROTOTYPE TESTING

DAQ

Real-time temperature



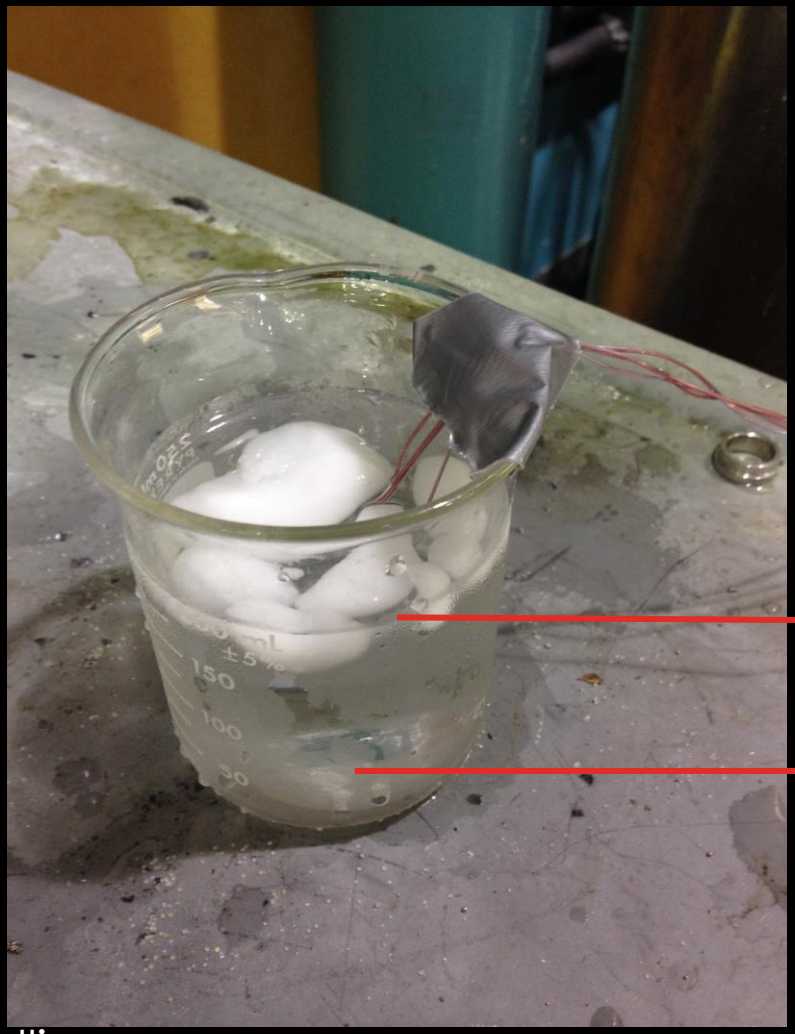
Thermocouple On/Off switch



Real-time temperature

Kegan Dellinger

CALIBRATION

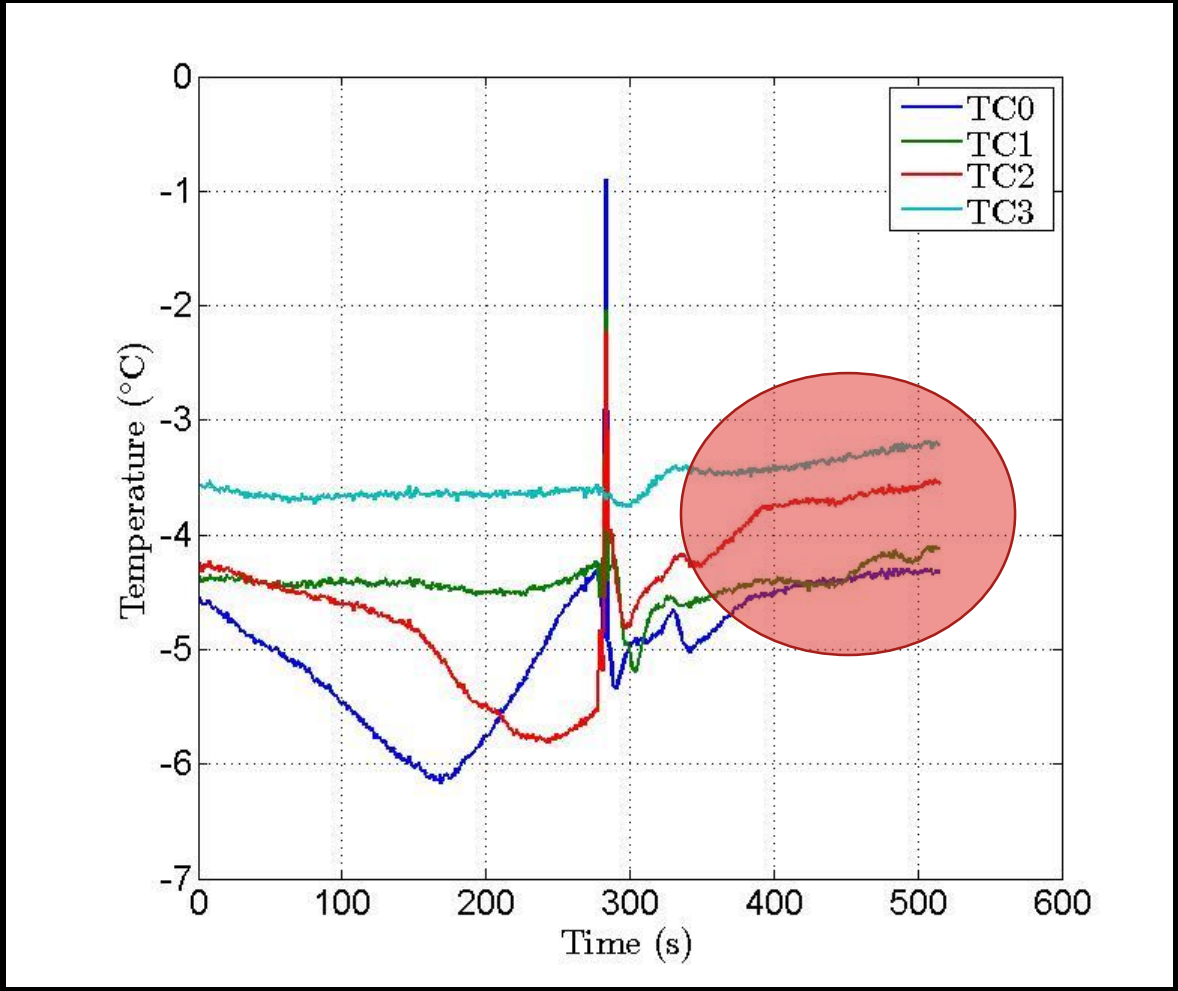


Thermocouple junction point

Ice Water

CALIBRATION

- To = -4.3651
- T1 = -4.2870
- T2 = -3.6437
- T3 = -3.2951



PERSONAL PROTECTION EQUIPMENT (PPE)

Safety Glasses

Long Sleeves

Thermally Insulated Gloves

FUTURE PLANS

- Finish prototyping
  - Setting up test rig, troubleshooting, executing validation
- Refine model - if necessary
- Determine manufacturing method

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- Bob Walsh - NHMFL
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QUESTIONS?