Updates from the Lab: Cooling

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LBL EIC Meeting

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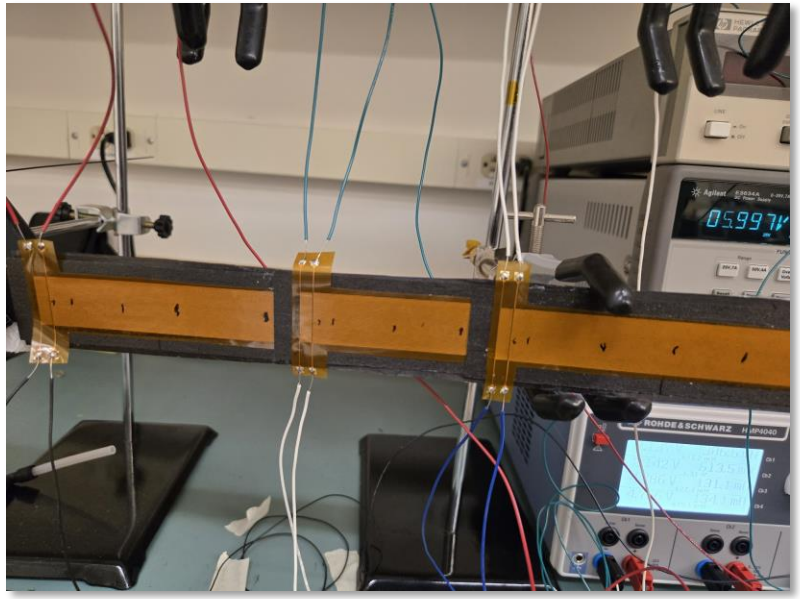
Single Row Corrugation Measurement

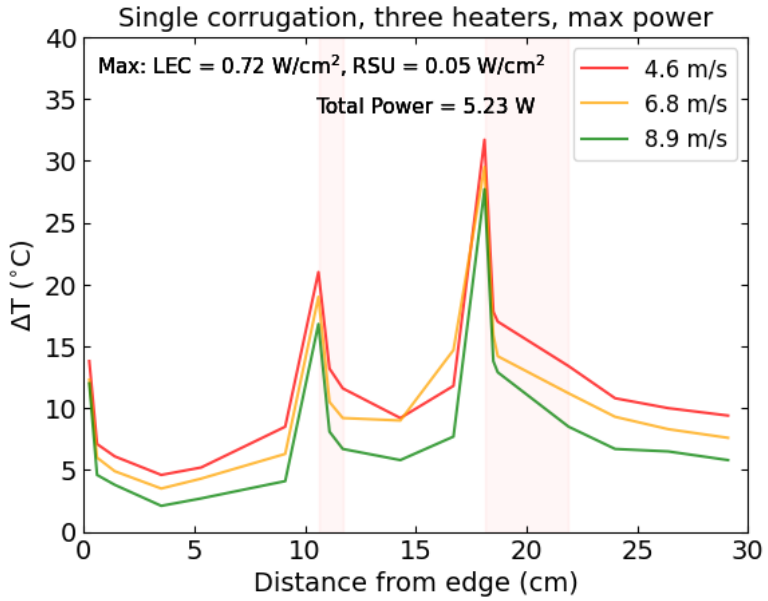
- 5-RSU EIC-LAS size
- Nominal
  - LEC: 0.48 W/cm^2, RSU: 0.03 W/cm^2
- Max
  - LEC: 0.72 W/cm^2, RSU: 0.05 W/cm^2
- Air speeds: 0, 4.6, 6.8, 8.9, 10.8 m/s
- Isolate natural convection & forced convection
- Minimize conduction through the corrugation
- Provide input to Nick's thermal model

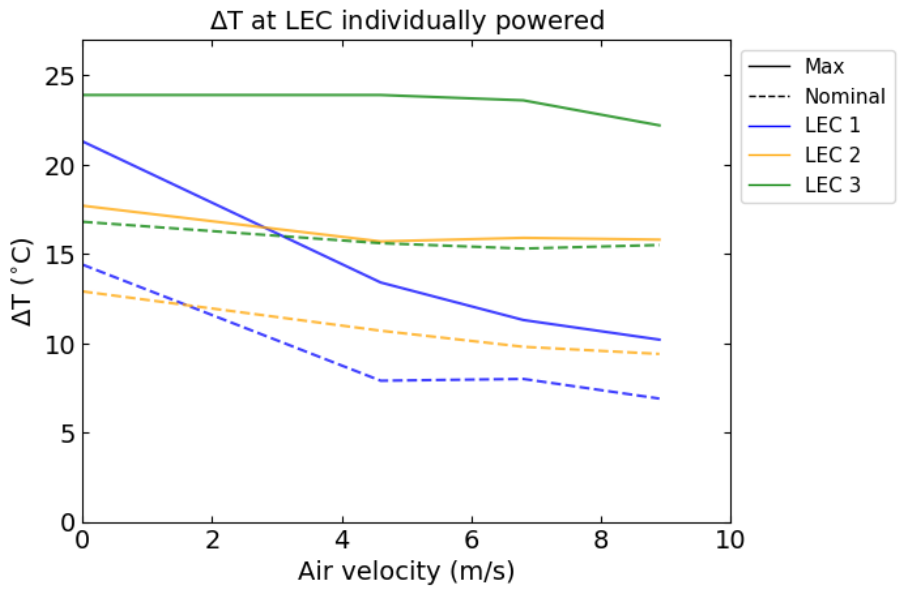
See Austin's slides from 4/15/25

From last time

- All outward facing heaters
- First time measuring LEC 3 directly
- ΔT of LEC 3 significantly higher than the rest
- LEC 2 & 3 are ~flat with air velocity when individually powered

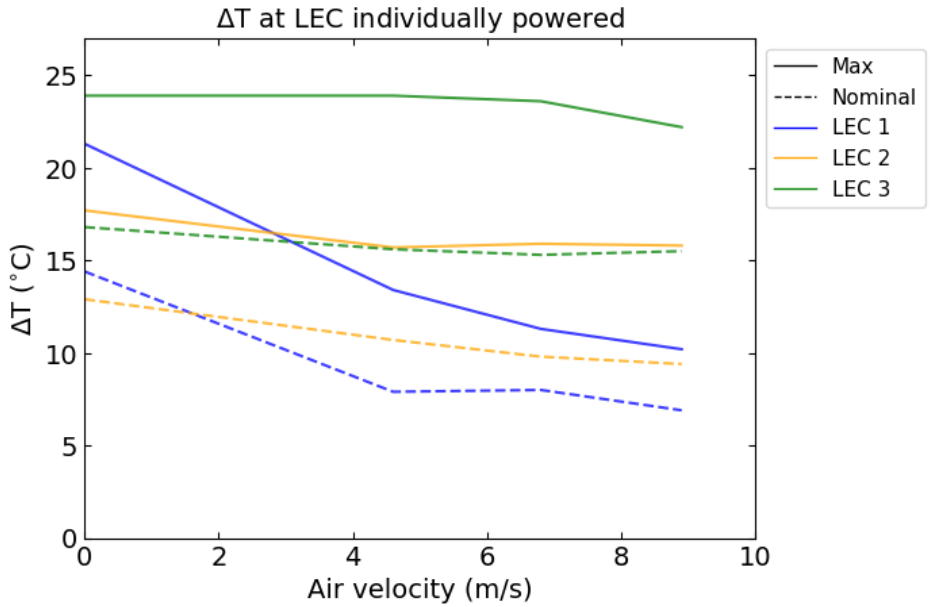


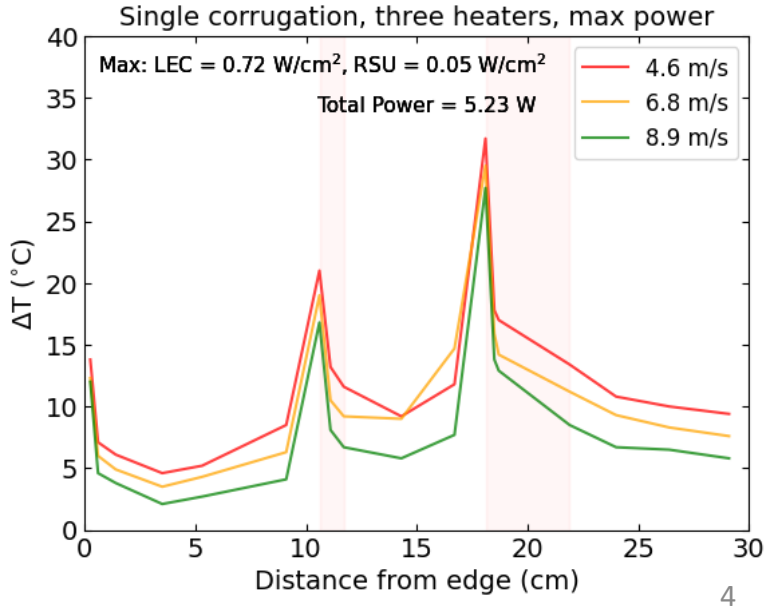




High ΔT investigation

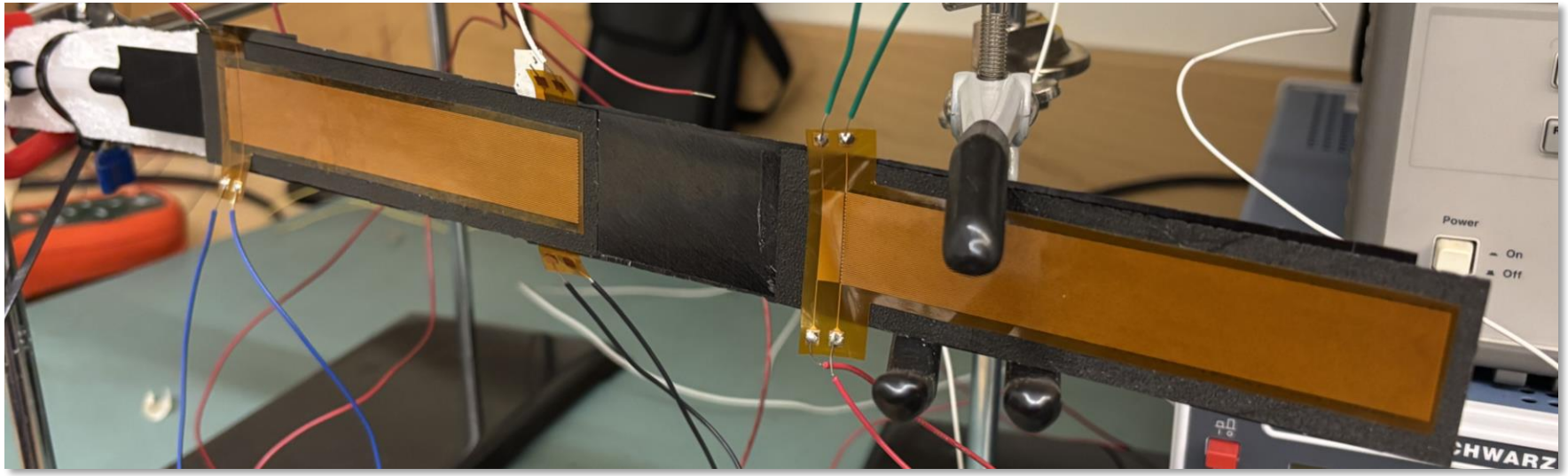
- Why is LEC 3 so much hotter than LEC 2?
- When individually powered, LEC 2 & 3 distributions should be the same
  - Both have overlap & are past the initial entrance zone region of the air flow
- However, LEC 3 is ~10°C greater
- Decided to investigate this setup in parallel to creating a new one



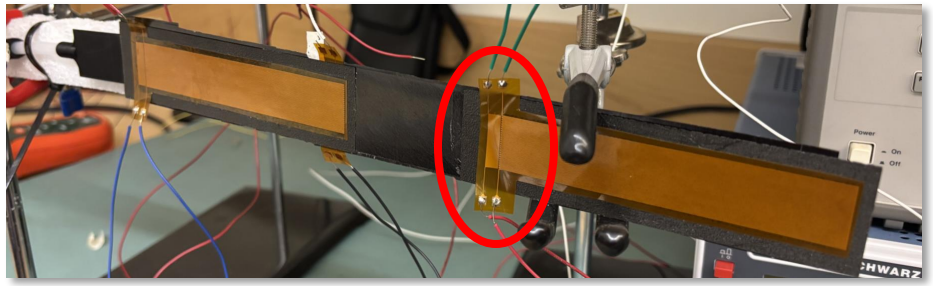


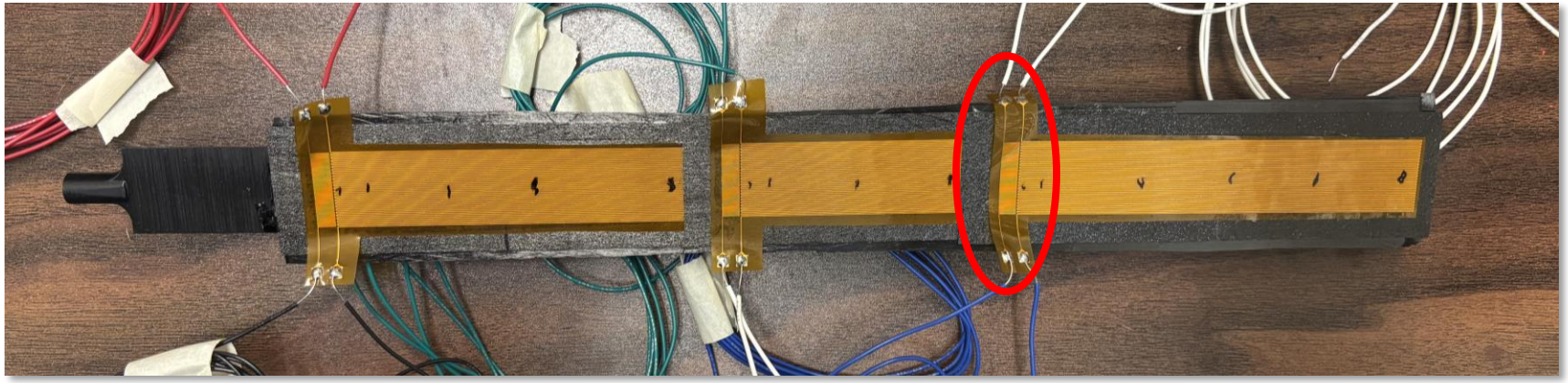
New setup

- Single corrugation with inward facing middle heater
- Thermal camera measurements only → cannot make direct measurements of the second heater
- Focusing on third heater



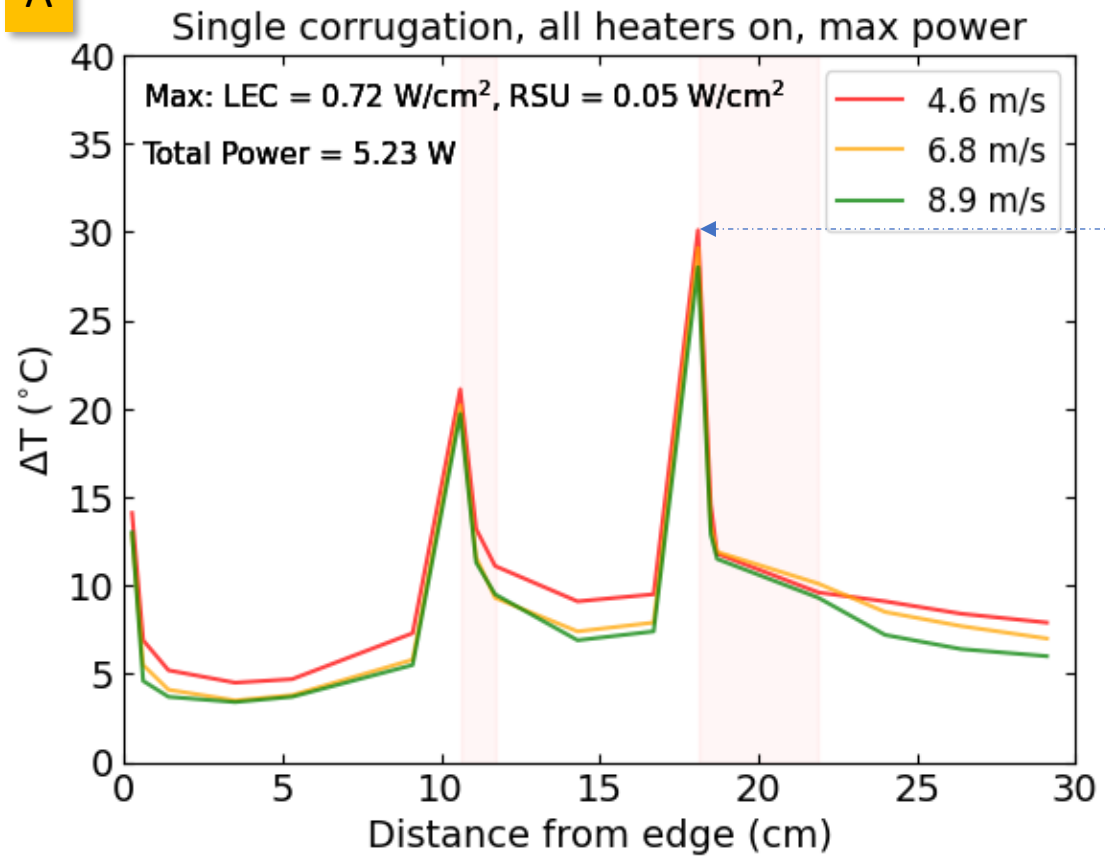
Heater adhesion





- Found that the heater was pulling up from the CF near the LEC → likely due in part to the solder points
- Without good adhesion, there is an air gap under the heater and we lose the benefit of the CF conduction and the forced convection

A



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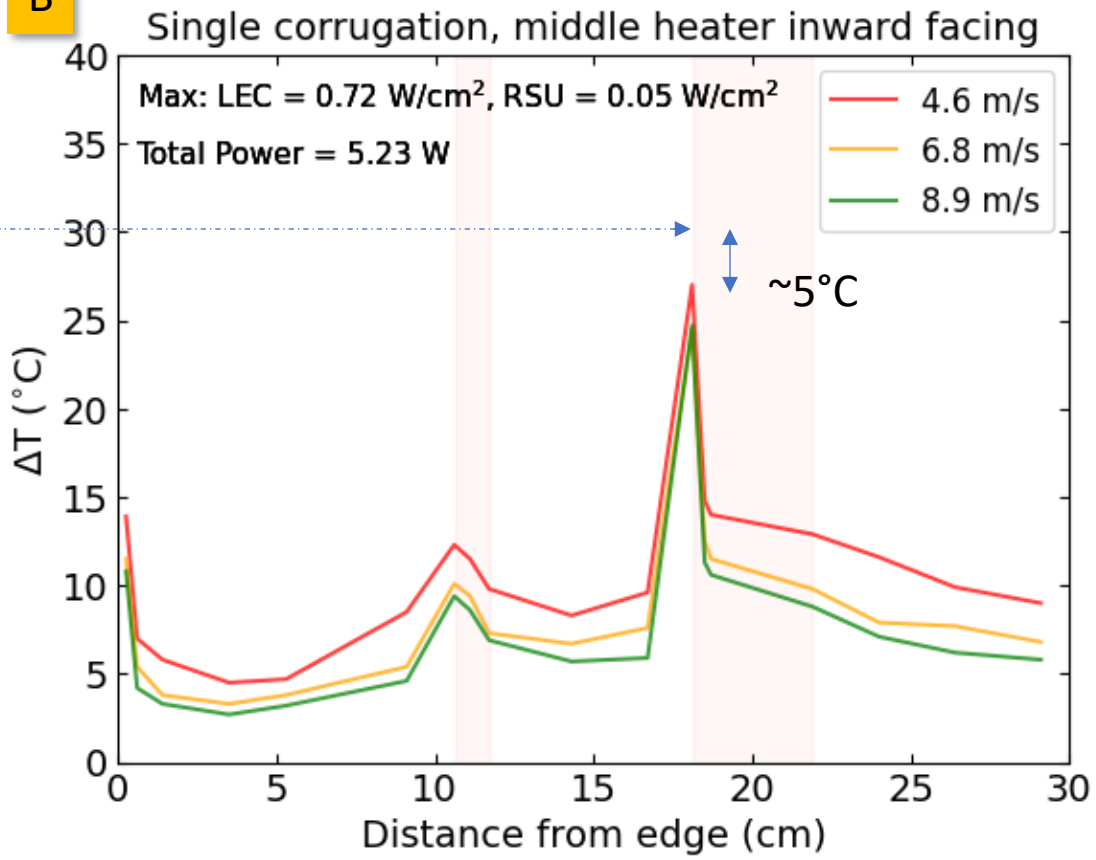
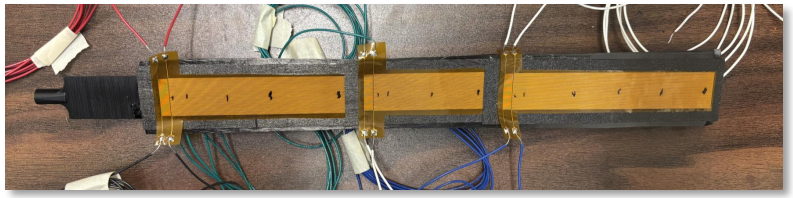
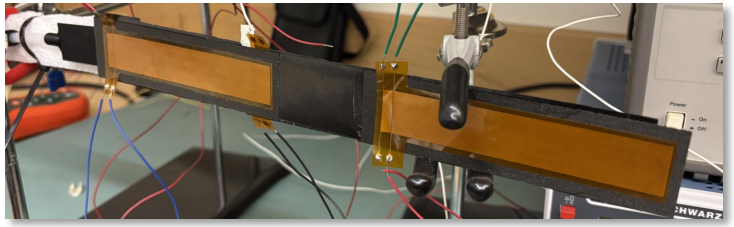


- all outward facing
- 3rd LEC pulling up

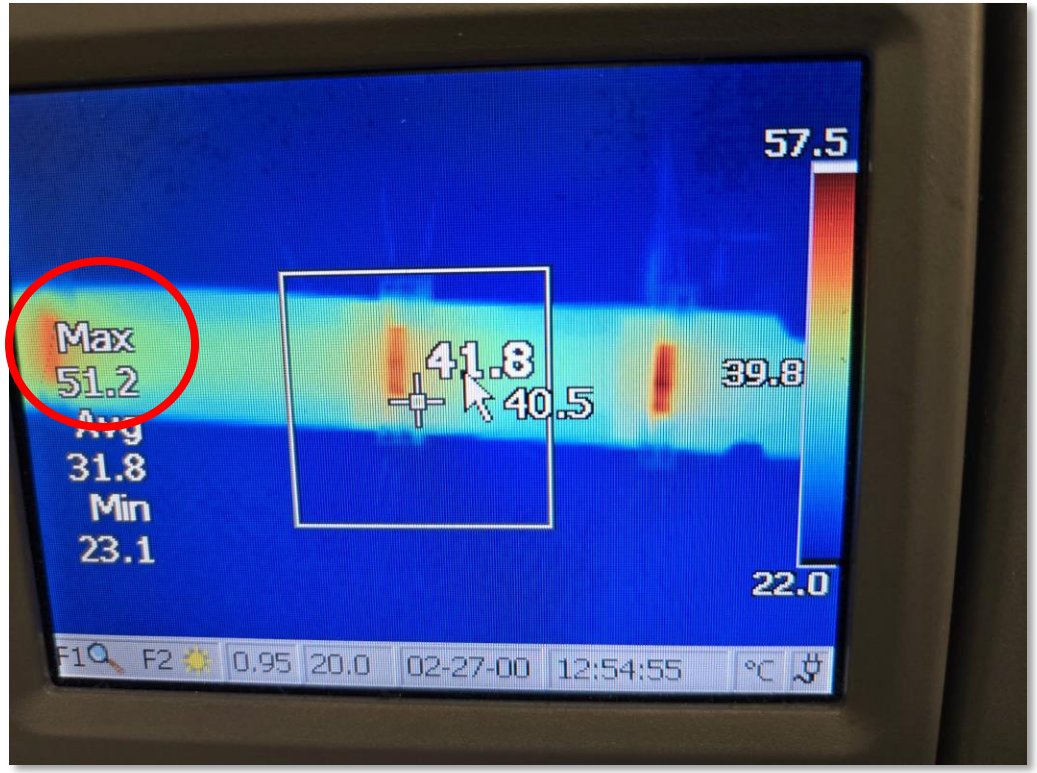


- inward facing middle heater
- fixed LEC adhesion



Thermal camera: Max function

- Previous (4/15) single corrugation results used Max function on the thermal camera
- Will always find hot spot and is not representative of the actual temperature
  - If hot spot is does not make contact with CF, it will never change with air velocity
- Solution: go back to taking an average temperature along width of LEC



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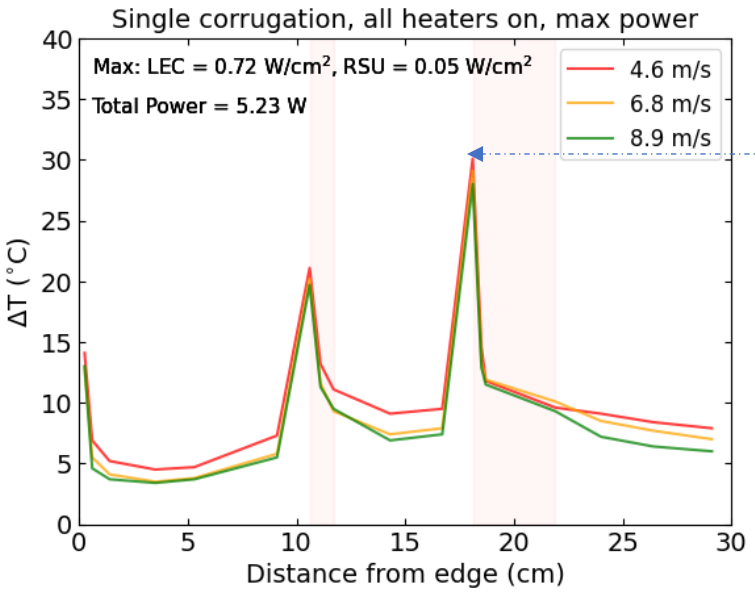
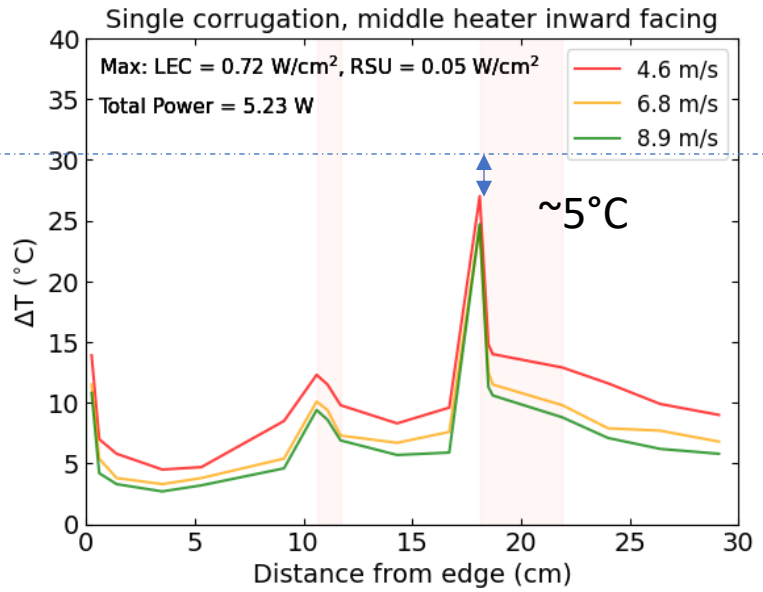


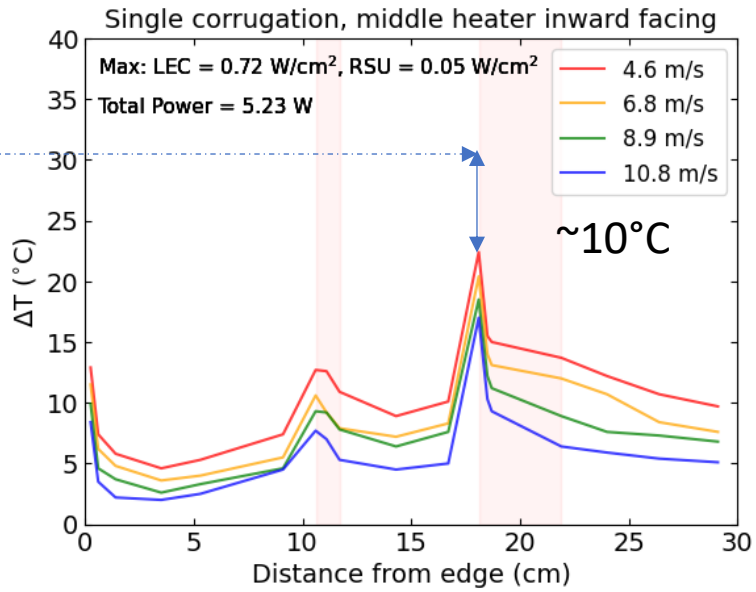
- all outward facing
- 3rd LEC pulling up

B

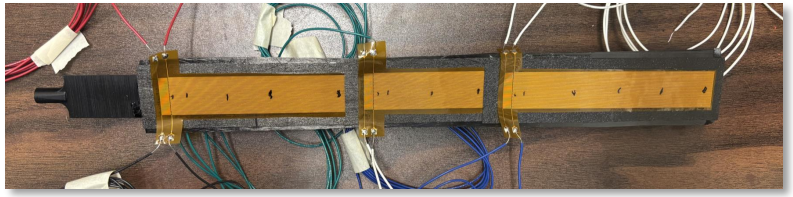


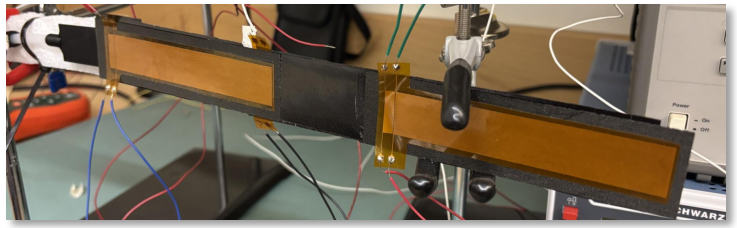
- inward facing middle heater
- **fixed LEC adhesion**

C



- inward facing middle heater
- **fixed LEC adhesion**
- **using thermal camera avg T**

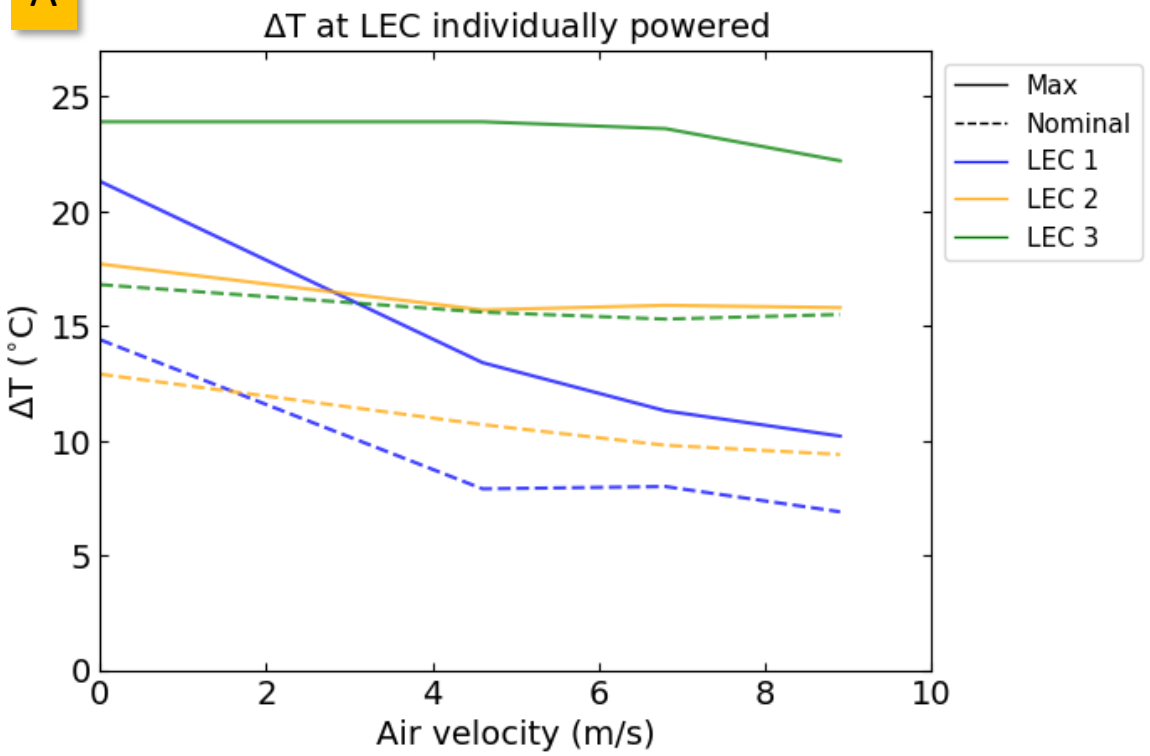




LEC vs Air velocity

*LEC 2 → cannot be directly measured and is therefore a measurement of the RSU with the LEC on behind it

A



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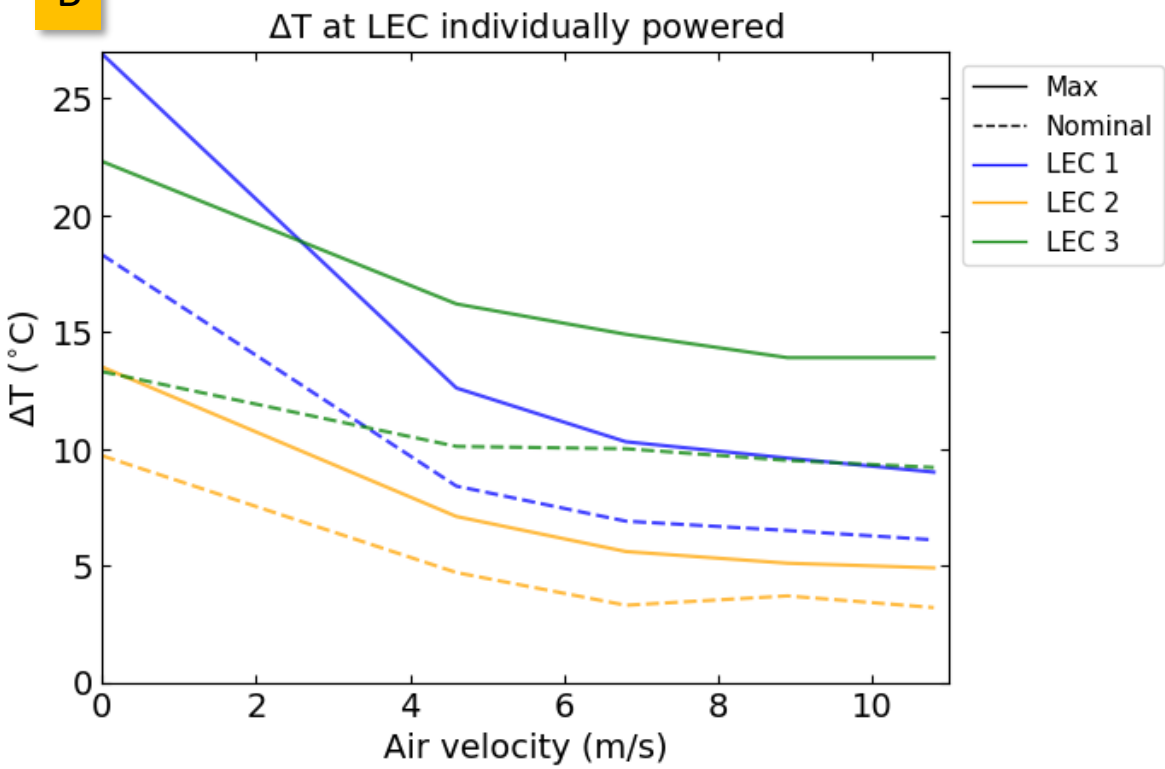
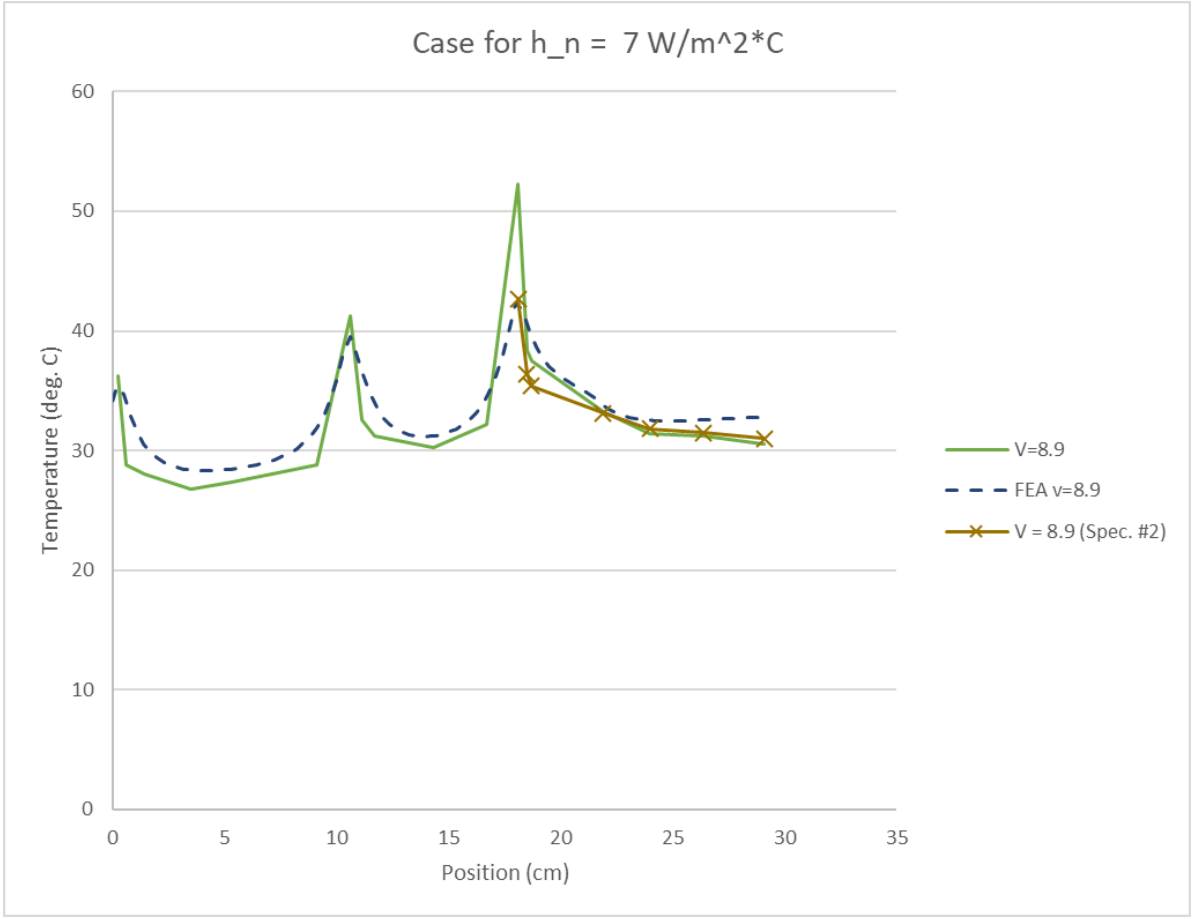


LEC 2 & 3 now drop as a function of air velocity → response to forced convection

See Nick's slides from 5/6/25

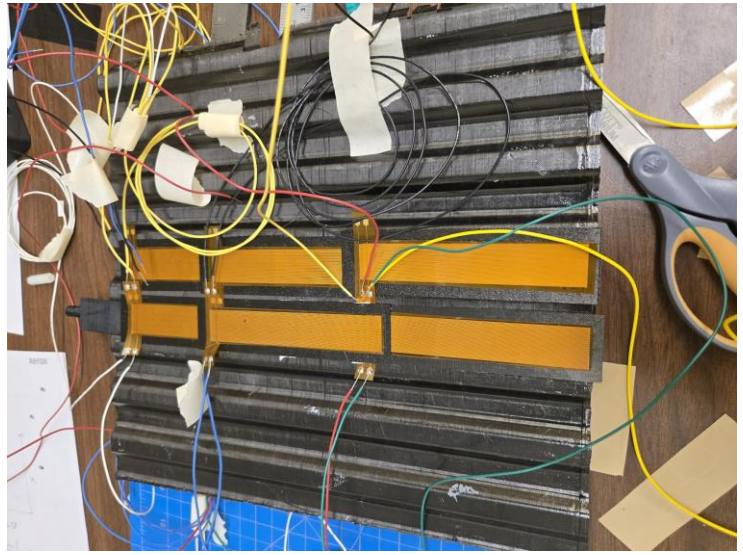
Model comparison



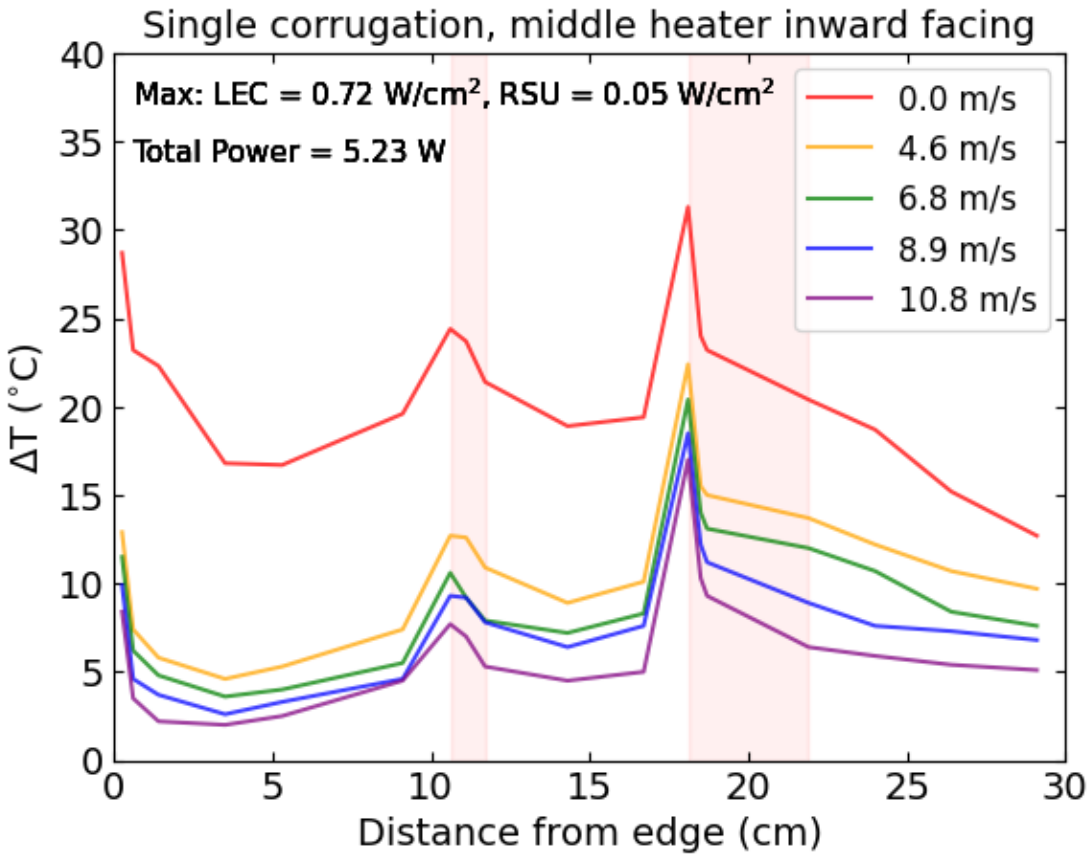
- New results (orange points) match Nick's model predictions

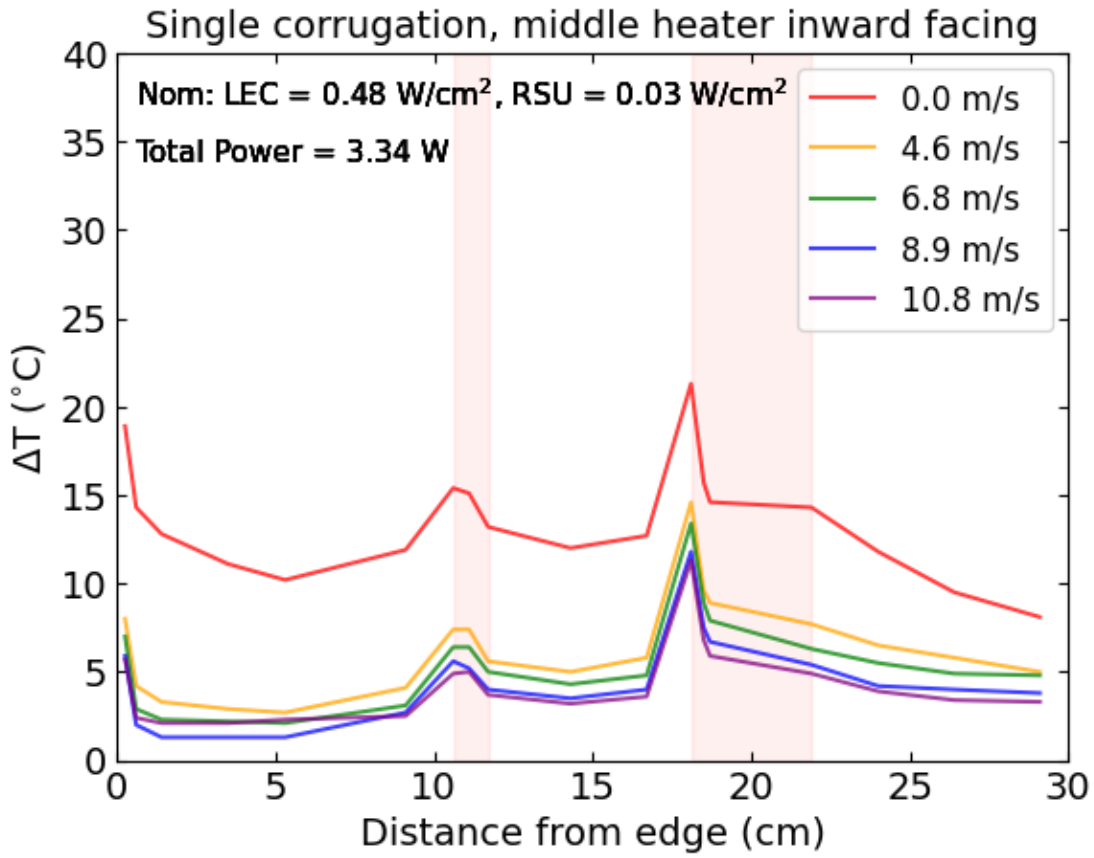
Upcoming/next steps

- Model predictions with 7 heaters
  - Max expected in single SVT disk row
- Larger test piece with 3 rows of heaters
  - Test proximity to neighboring heaters
- Incorporate AncASIC into test piece and model predictions



New Results





- With air velocity > 5 m/s, $\Delta T < 20$ C for all cases