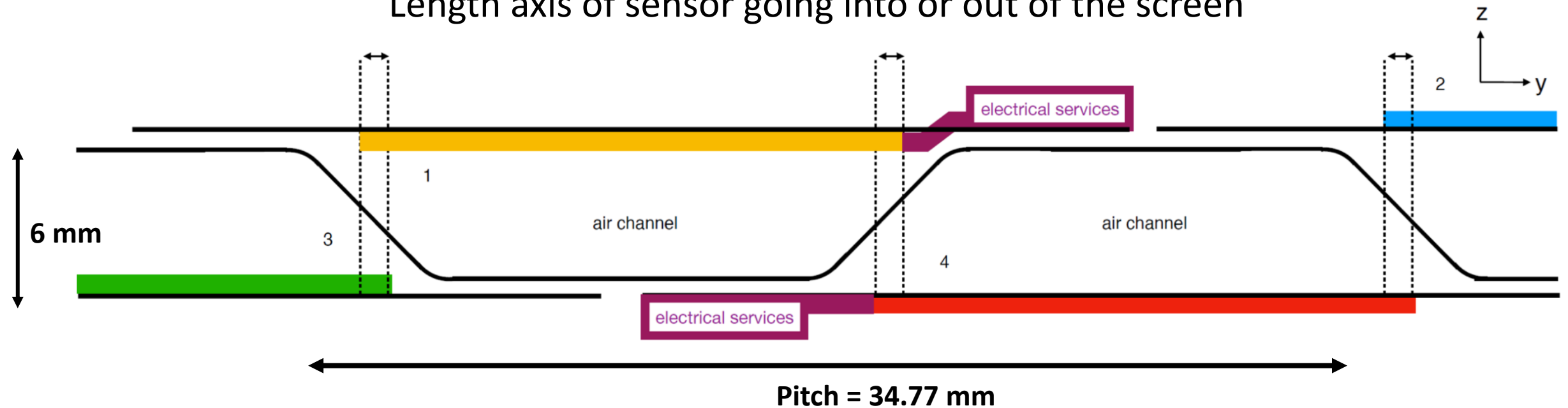


Disc design/prototyping

Nikki Apadula

Reminder: Corrugated core

Length axis of sensor going into or out of the screen

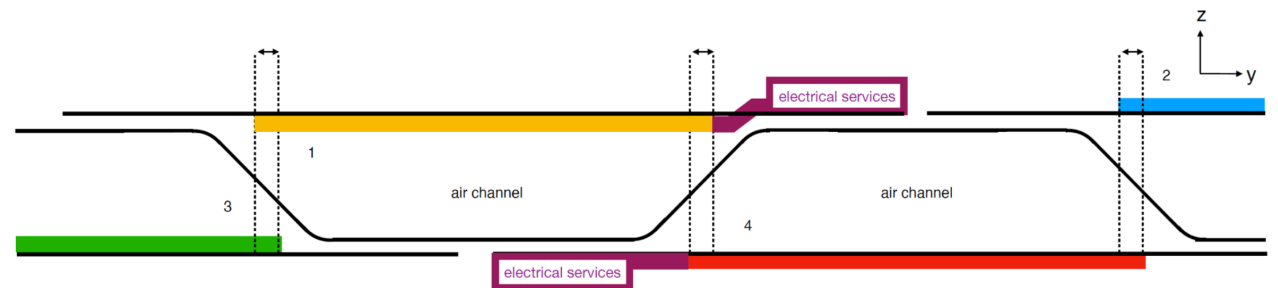
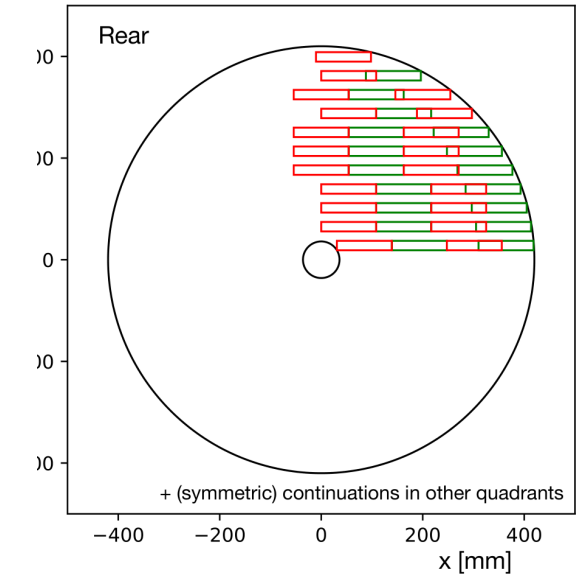
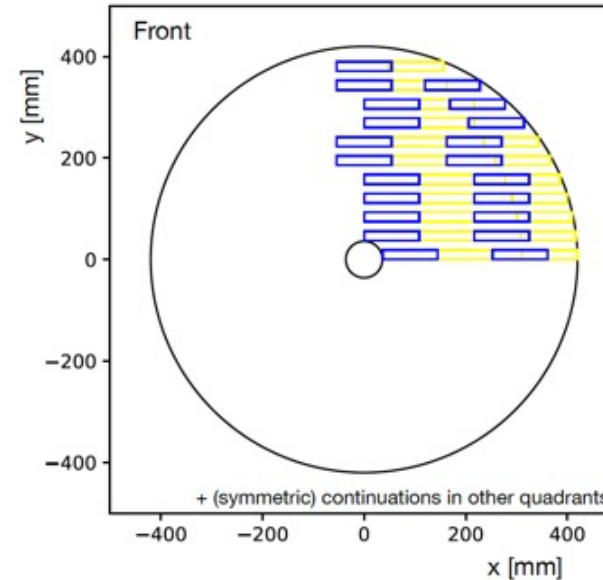


Overlap along the length axis by alternation

Corrugation pitch and height determine overlap along the short axis → Optimization ongoing

Reminder: Corrugated disc design

- Face sheet constructed out of modules
- Two module types:
 - **Belly up** (sensor facing outward from corrugation)
 - **Belly down** (sensor facing inward to corrugation)

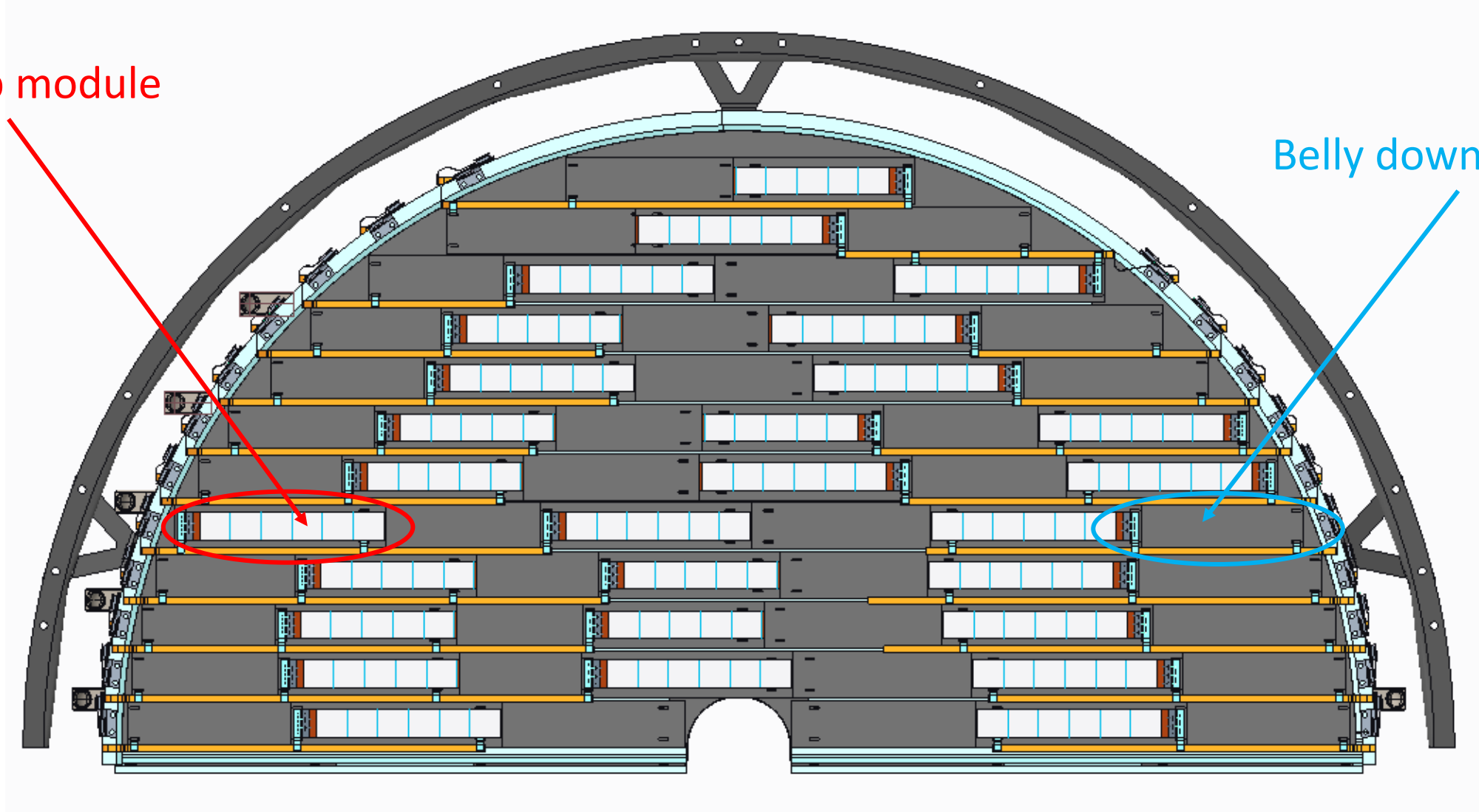


Sensor layout

"Front" face of disc (facing in towards interaction region)

Belly up module

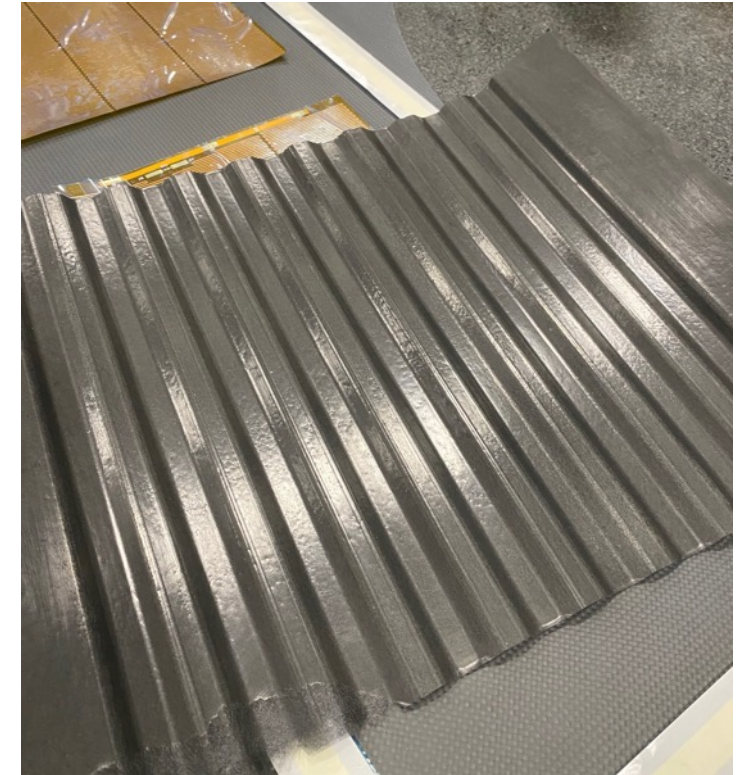
Belly down module



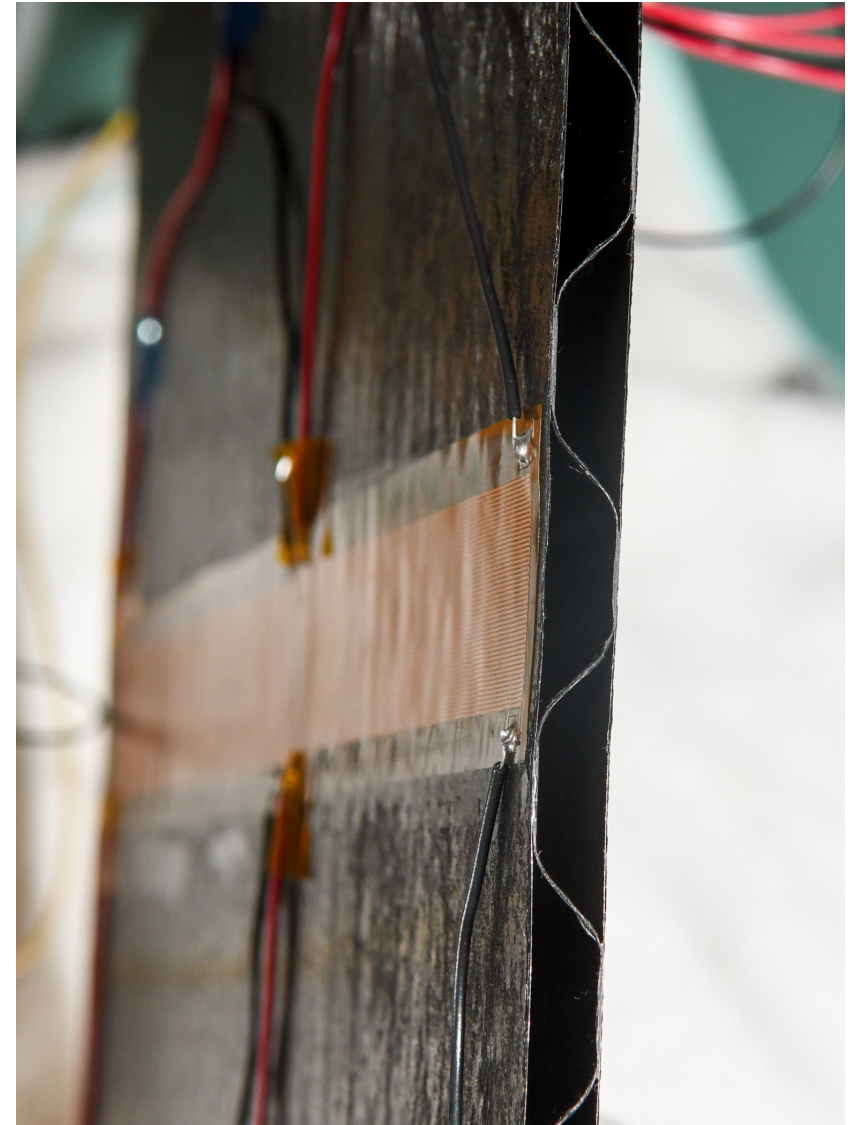
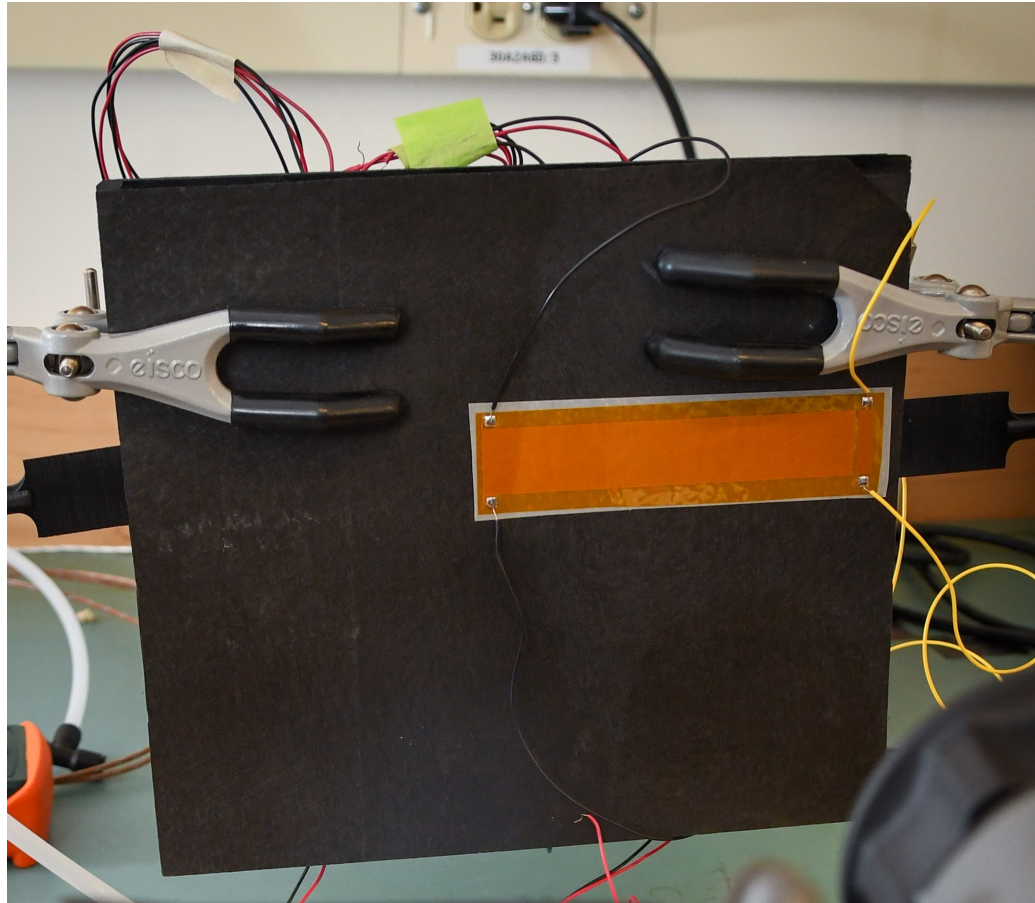
Prototyping campaign

First prototype test piece

- 2 layers 34 gsm veil & 5 layers 10 gsm resin
- Face sheet glued with 9309 adhesive in 5 mm strips
- Final size of prototype test piece = 22.4 cm x 20.2 cm
- Final weight of prototype test piece = 22.5 g
- Density = 497 gsm \rightarrow $\sim 0.12\%$ X/X_0

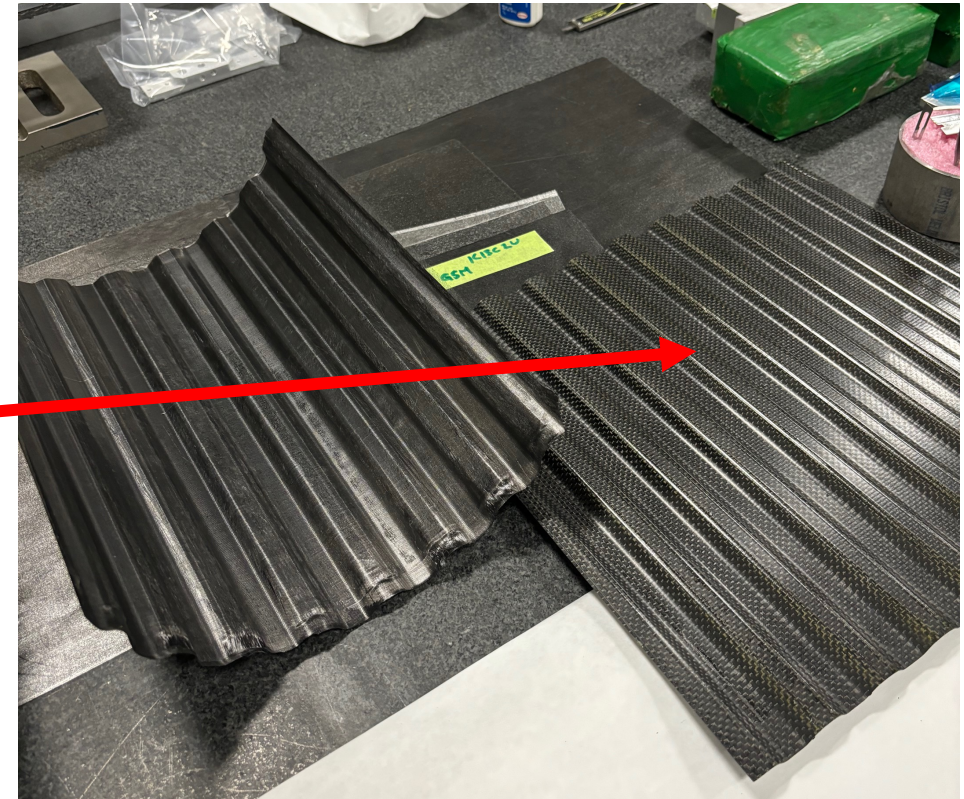


First prototype test piece



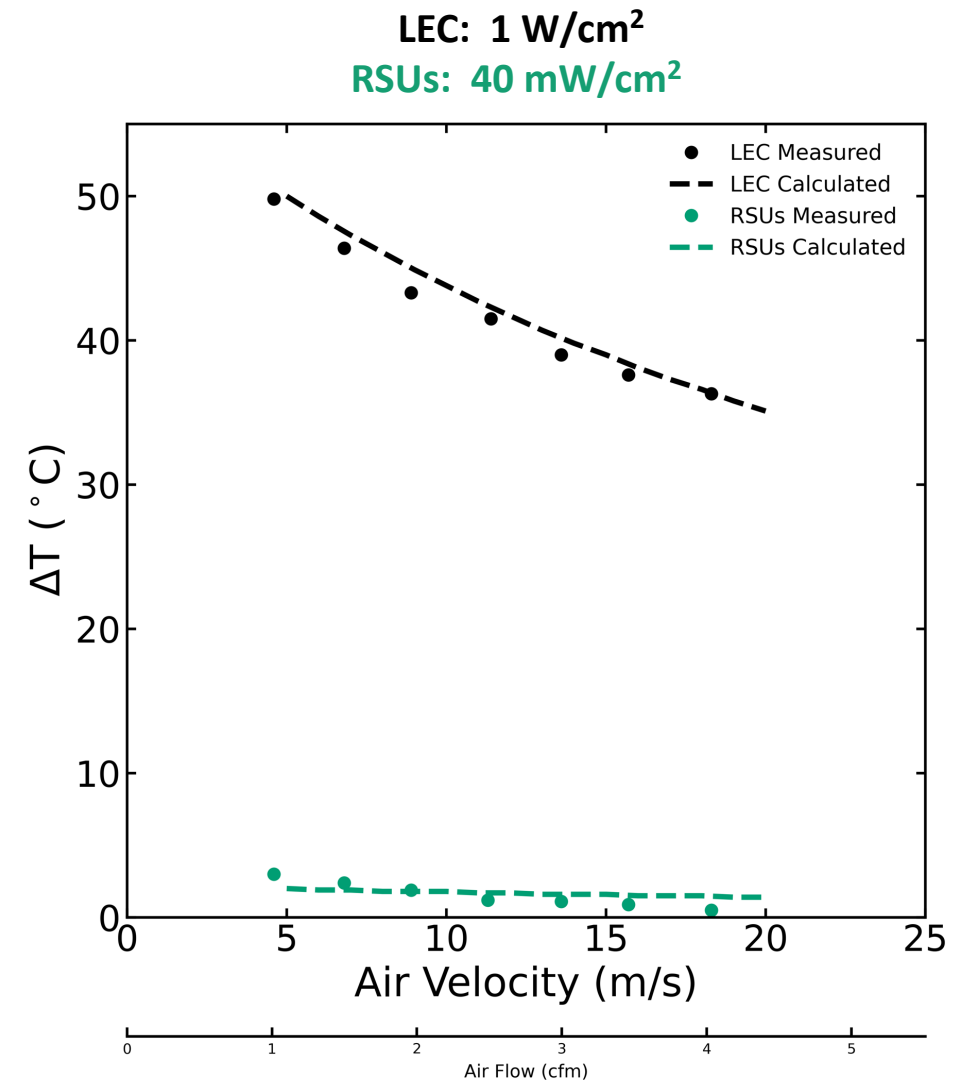
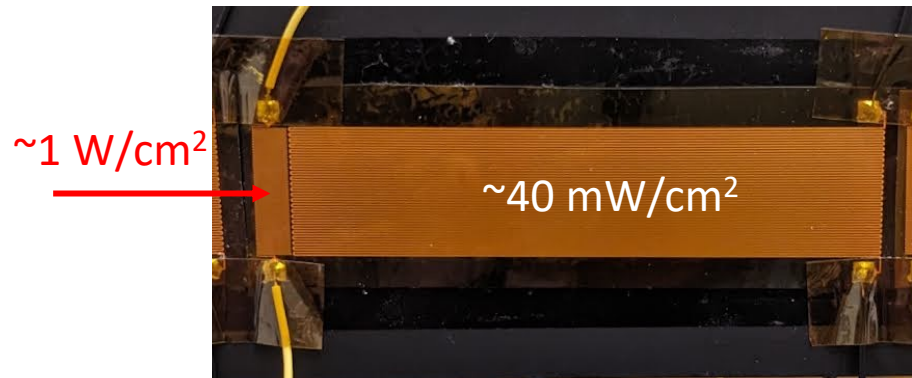
Next layups/prototypes

- Using K13 45 gsm unidirectional & 2 gsm glass veil in varying configurations
- Testing layups for both the corrugation & the module face sheets
- Rigid piece used as a top during curing
 1. Define satisfactory layup (reasonable X/X0, reproducible)
 2. Conduct bend test (with face sheet)
 3. Use in FEA and re-evaluate as necessary
 4. Vibration test in wind tunnel



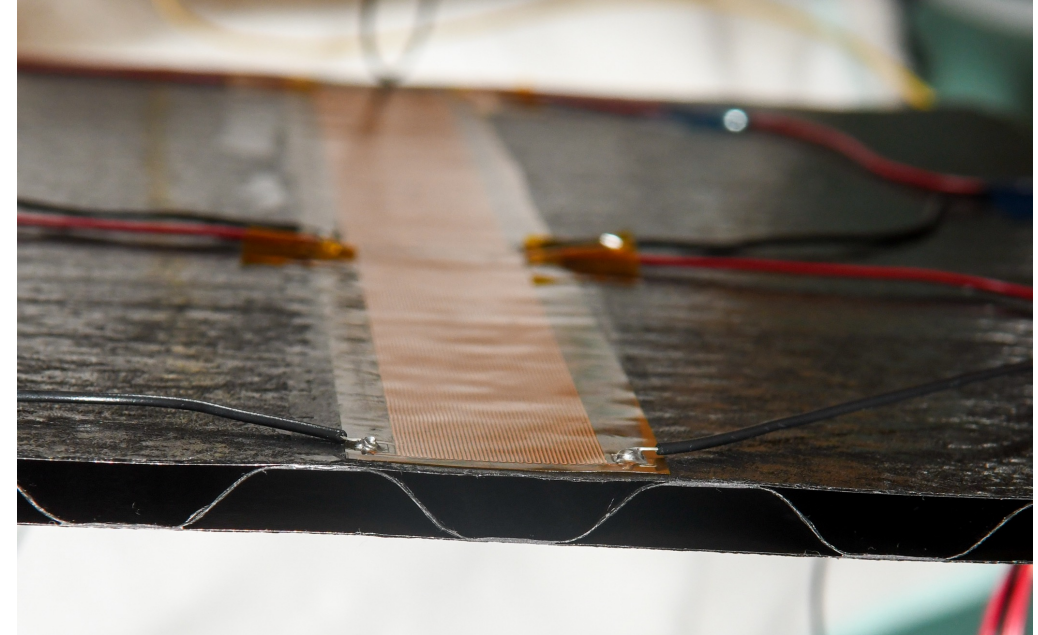
Thermal tests

- $\Delta T = T_{\text{Heater}} - T_{\text{Inlet Air}}$
- Air cooling sufficient for **RSUs**
- **LEC** trending in the right direction



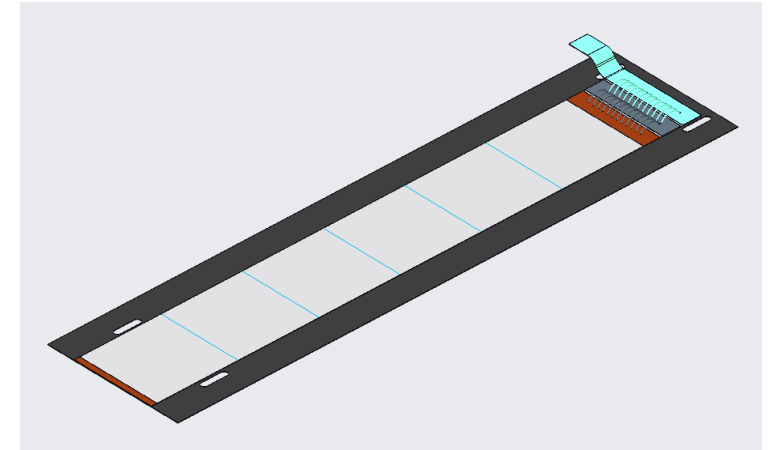
Upcoming thermal tests

- Add heating element to mimic AncASIC
 - Test air with both belly-up and belly-down modules
 - Explore options for K9 foam under LEC & AncASIC
 - Use thermo-mechanical dummies
1. Tests with current prototype
 2. Varying placement of AncASIC heater
 3. Tests with new layup



Tooling

- Tooling design is slower than hoped
- For the summer campaign we will use what is available from MVTX and ITS2 work & work on new design in parallel
- Carbon fiber, 3D printed pieces, & corrugated aluminum tooling can be used for holding corrugation and testing gluing of modules



Prototyping campaign: caveats

- Very similar to the OB ([SVT meeting 6/25/24](#))
- Thermo-mechanical dummies
 - Two power regions only → LEC & average RSU
- AncASIC to be represented separately with resistive heaters in various sizes/shapes
- No FPC or wire bonding
- Current plan: power brought in by wires

Prototyping campaign: small scale

- Layup finalizations
 - Corrugation and face sheets
 - Testing weight, strength, and handleability
- Assembly of 4 modules (using 4 dummy LAS)
 - Handling and gluing on carbon fiber face sheet
- Then assembly of one corrugated channel (4 modules)
 - Testing belly-down and belly-up assembly
 - Help facilitate tooling design
- Thermo-mechanical models to be used on a similar piece

Prototyping campaign: large scale

- Based on what is learned from small scale, move on to $\frac{1}{4}$ disc
- With current tooling, $\frac{1}{4}$ disc is possible. Will explore new tooling after layup/bending tests are complete
- 1st $\frac{1}{4}$ disc
 - Assemble first face and then opposite face with dummy modules
 - Use or develop new tooling
 - Vibration tests using wind tunnel & capacitive sensors
- Thermal tests
 - Test air inlet design, air re-use, foam
 - Pressure drop, deformation, vibrations

Future prototypes

- Updated corrugation tooling based on any changes to height/pitch
- Larger tooling to make a full half-disc
- Make support ring & interfaces to the support cylinder
- Make more realistic modules & test wire bonding

Dummy Silicon order

- 8 wafers of each layout (4 layouts total)
 - L0: 40 (8 full)
 - L1: 16 (8 full)
 - L2: 24 (16 full)
 - 5 RSUs: 80 (64 full)
 - 6 RSUs: 80 (64 full)
- Arrived last week & will be shipped out this week
 - Selection of Si to have heaters attached and encapsulated and made into thermo-mechanical dummies

