

# ArgonCube TPC High Voltage System

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on behalf of the SLAC DUNE group

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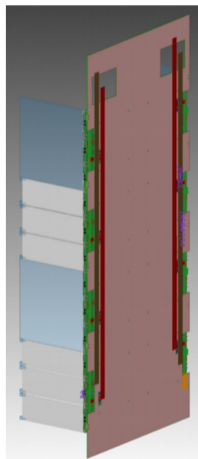
September 3, 2020

### Module components:

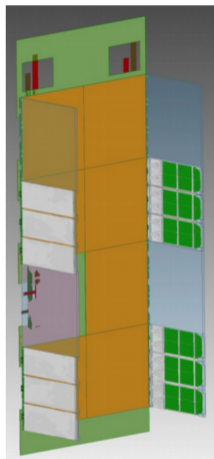
- Pixel sensors
- Light collection
- Cryogenics
- **High voltage FT**
- **Resistive sheet field cage**

### SLAC's involvements:

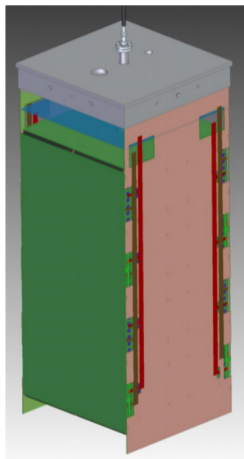
1. ND module design (*Skarpaas*)
2. High voltage system
3. Local cryostat (*Itay*)



Readout plane (pink)  
and light sensors (gray/blue)  
from "outside"



Readout plane (pink)  
and light sensors (gray/blue)  
from "inside"



"Naked" module with field  
cage (green)

Status reported at the last update (07/31):

- Laminator ready, small scale Mylar+epoxy tests completed

**Week 1:**

- Large scale Mylar tests inconclusive with suction table
- Changed procedure to laminate on jig plate, switched to a softer rubber roller (week 3)
- Large scale Mylar+epoxy test successful

**Week 2:**

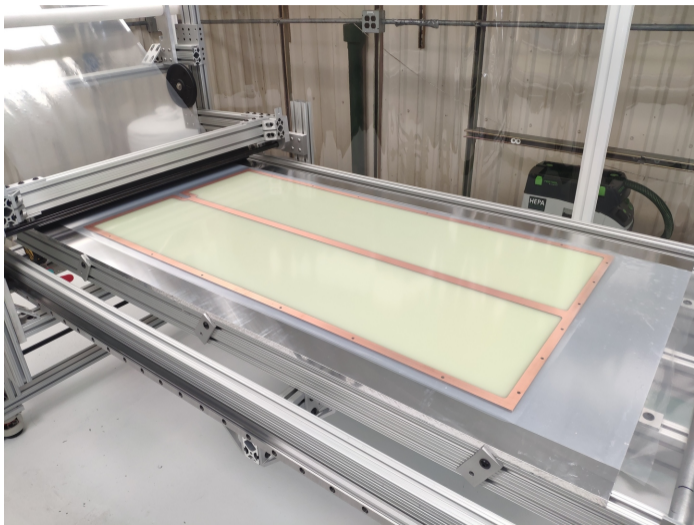
- Laminated both sides of the cathode with XC

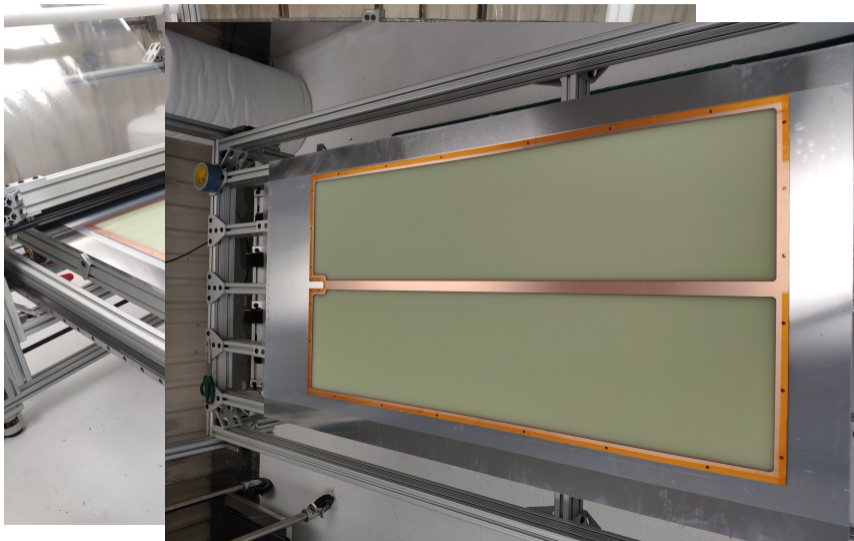
**Week 3**

- Laminated the top, bottom and first side panels

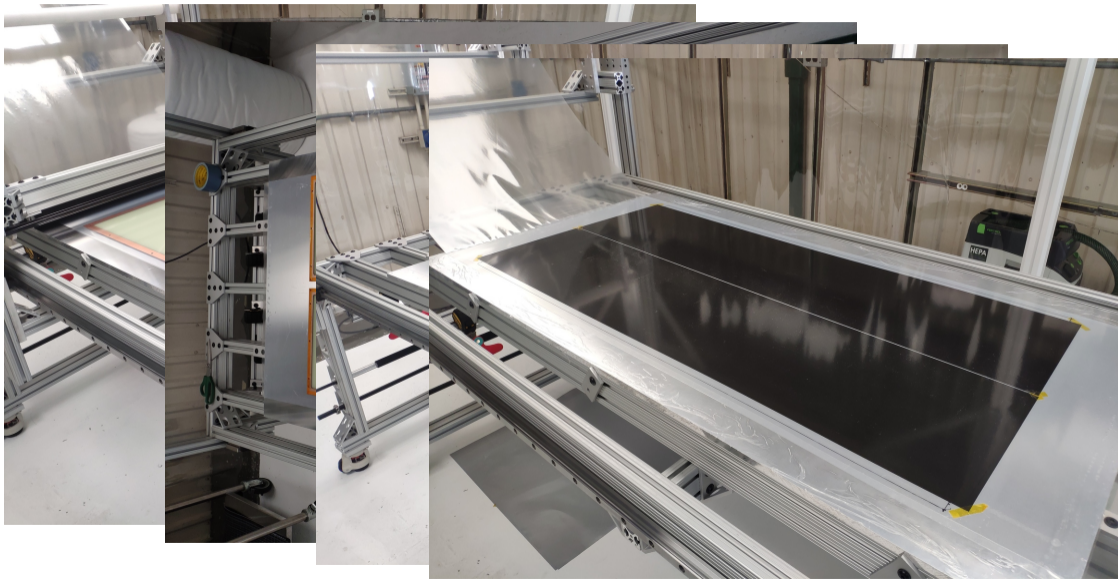
**Week 4**

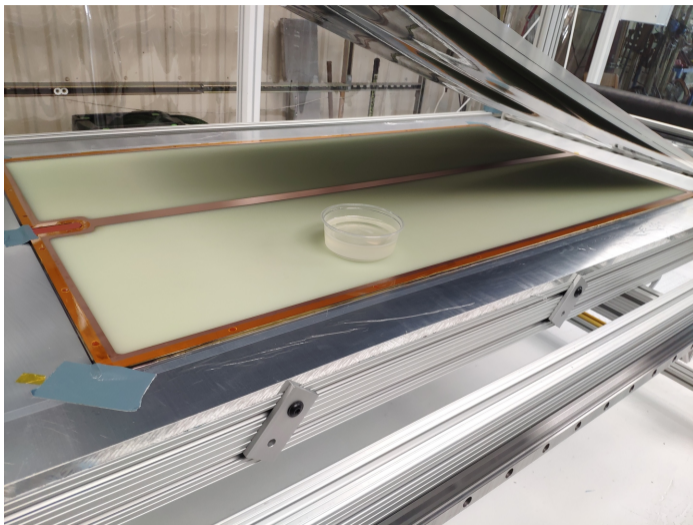
- Laminated second side panel
- Assembled the full field cage, preliminary electrical tests



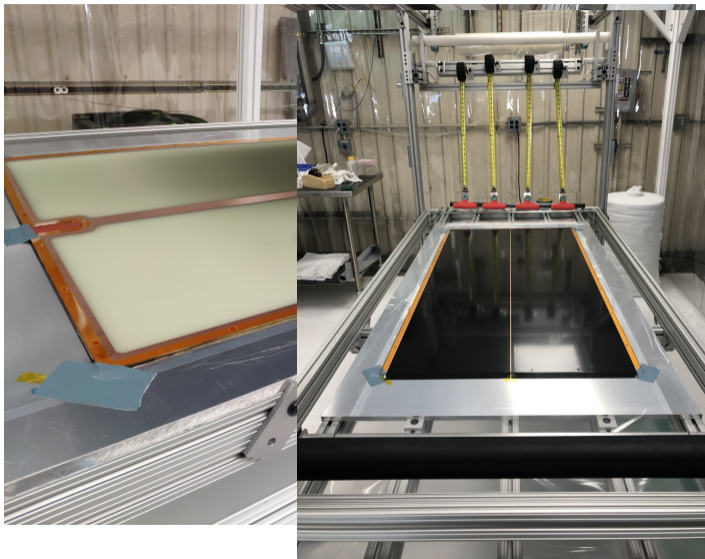


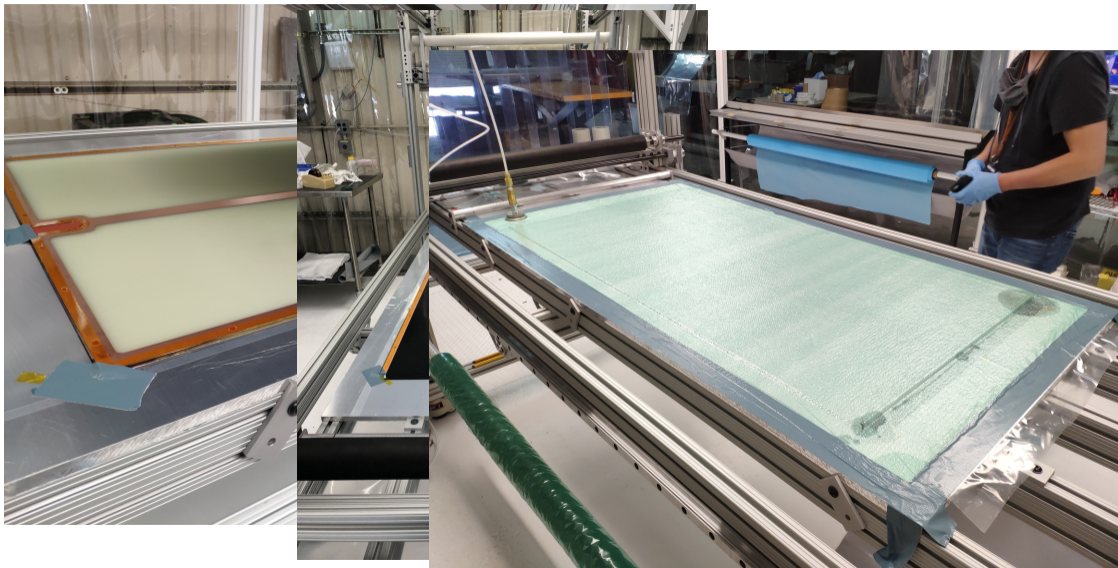






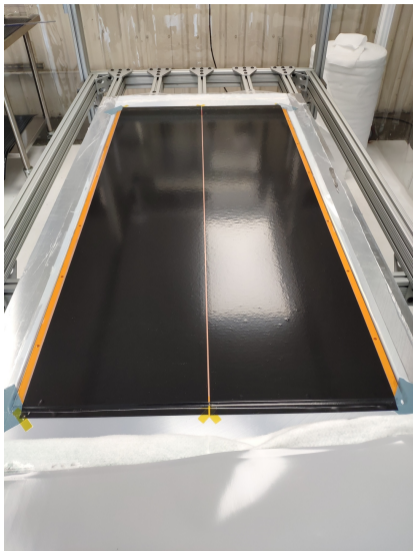






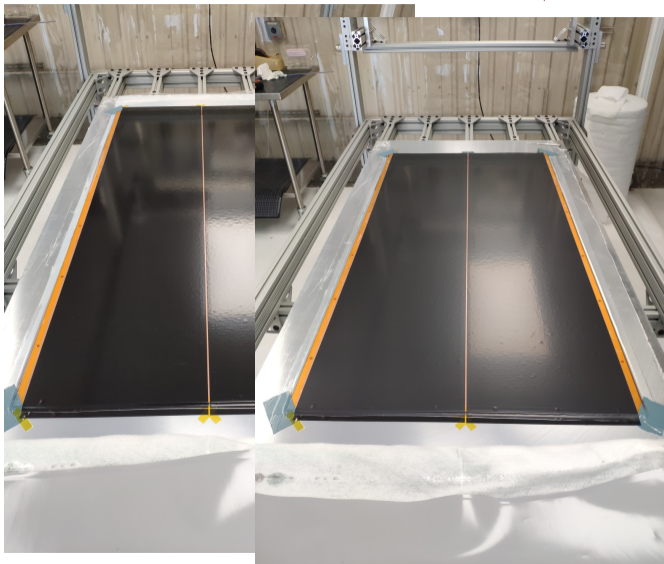
# Cathode laminations

FR4+XC+epoxy



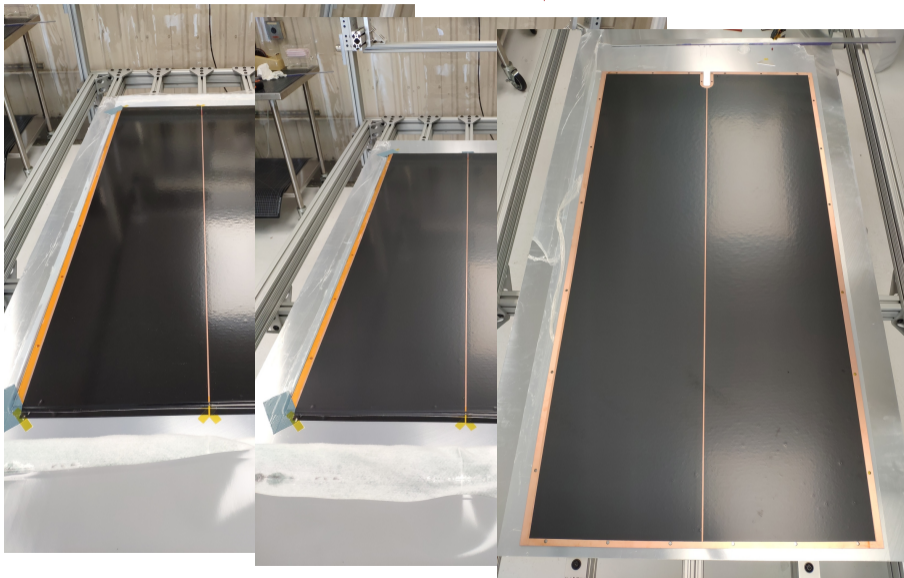
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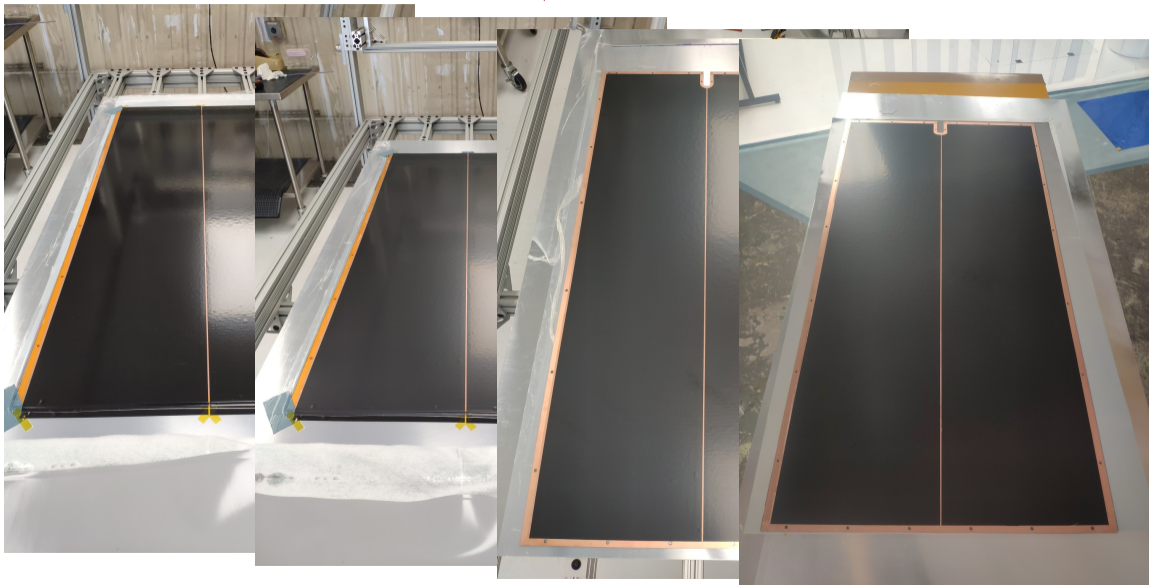
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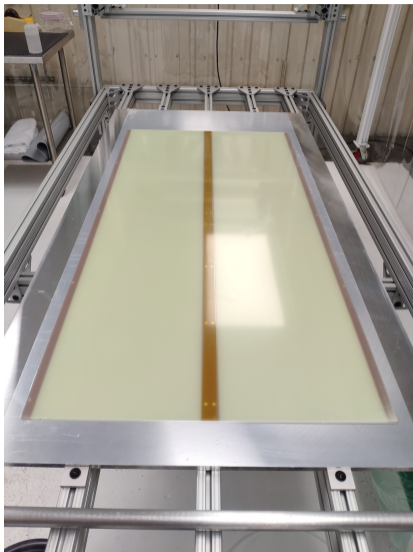
# Cathode laminations

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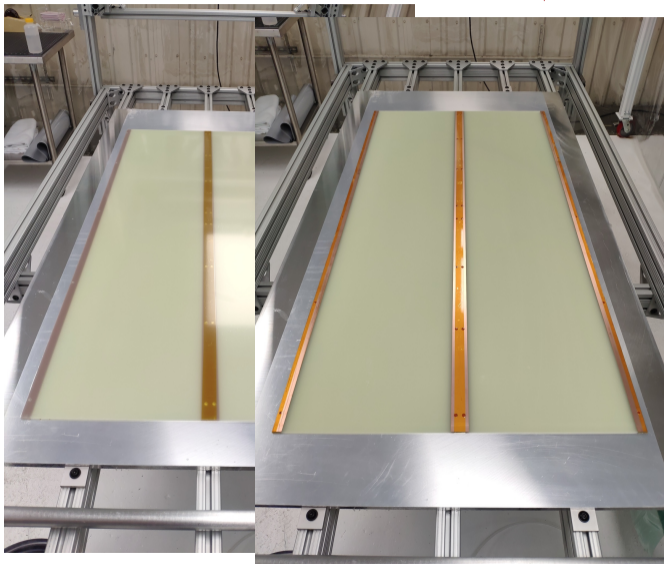
# Field shell laminations

FR4+DR8+epoxy



# Field shell laminations

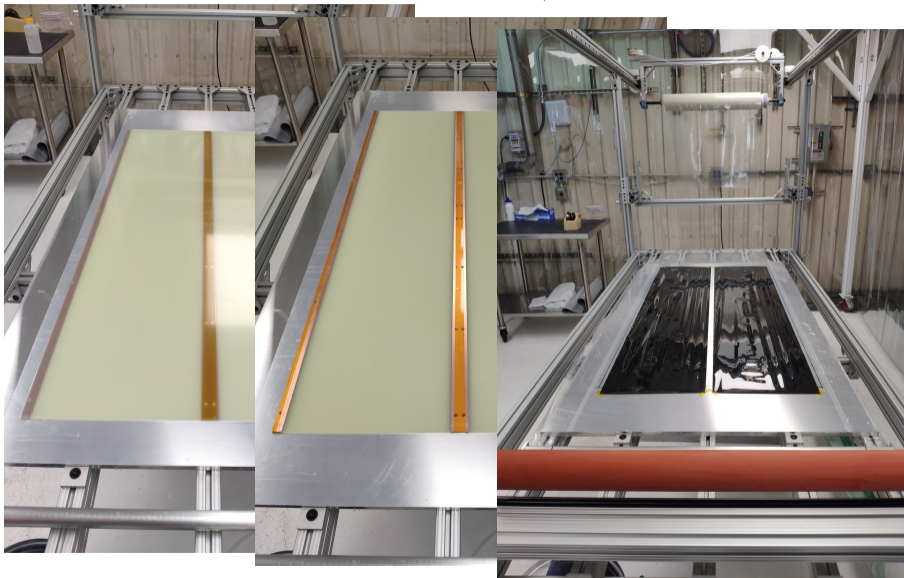
FR4+DR8+epoxy





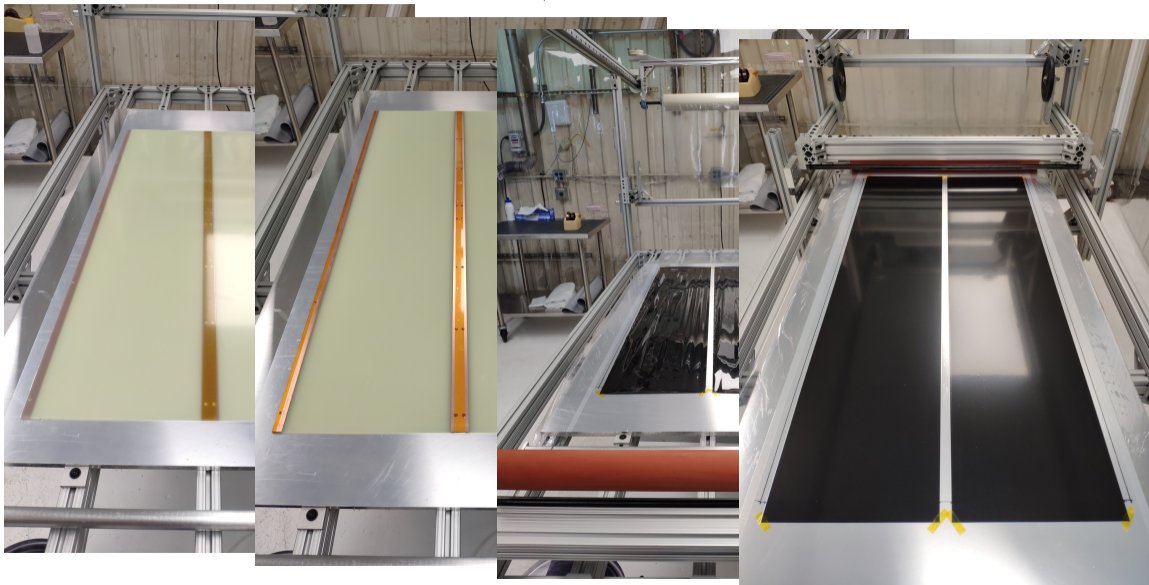
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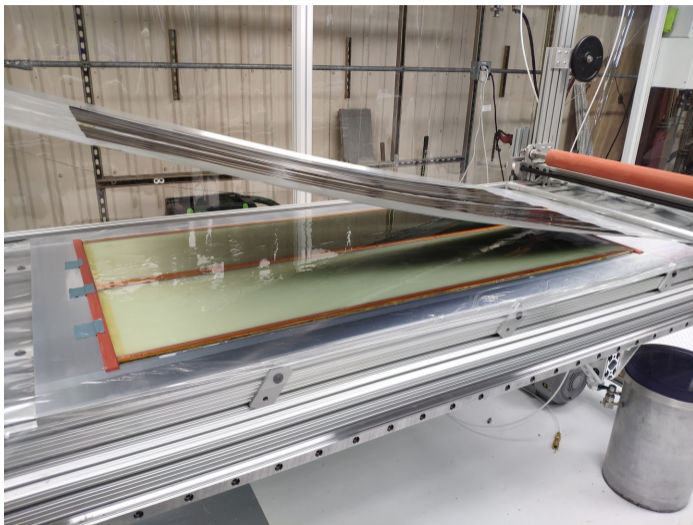
FR4+DR8+epoxy

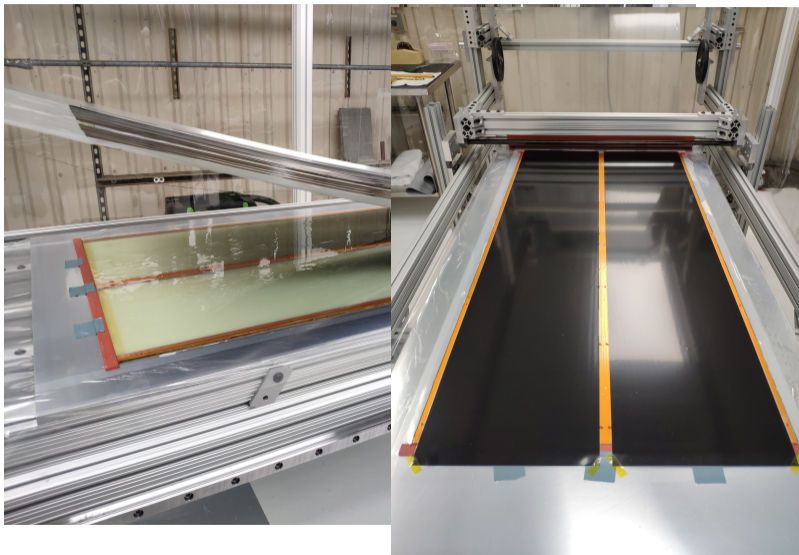


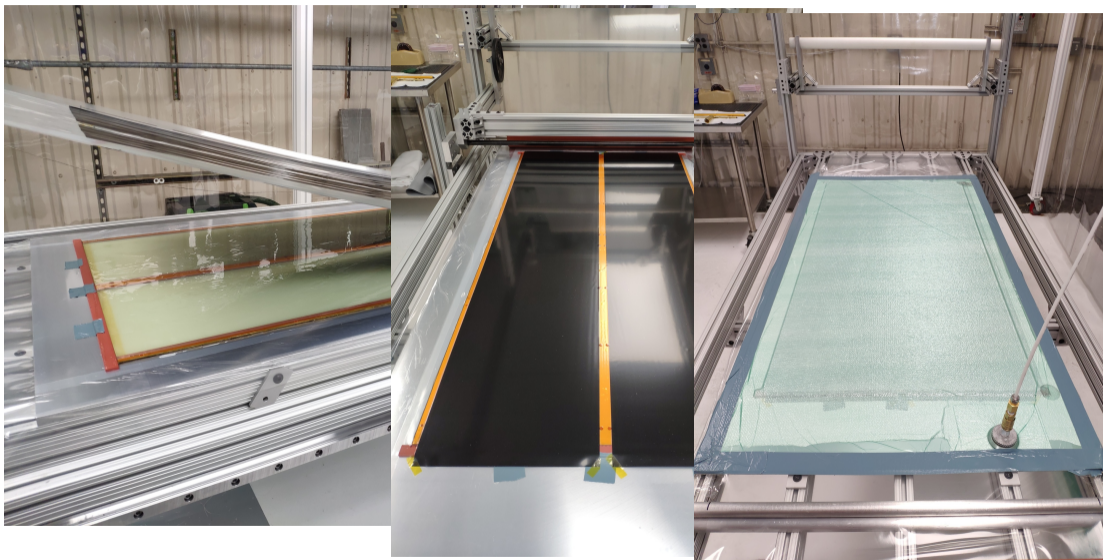
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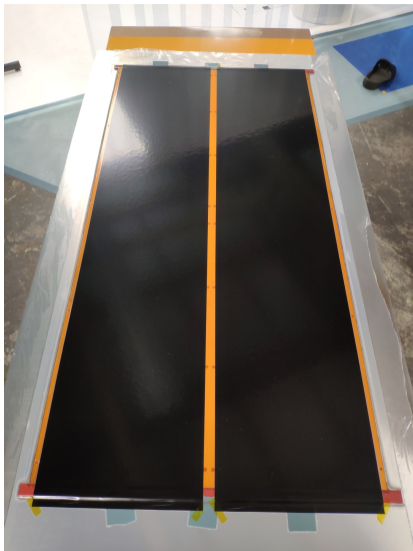


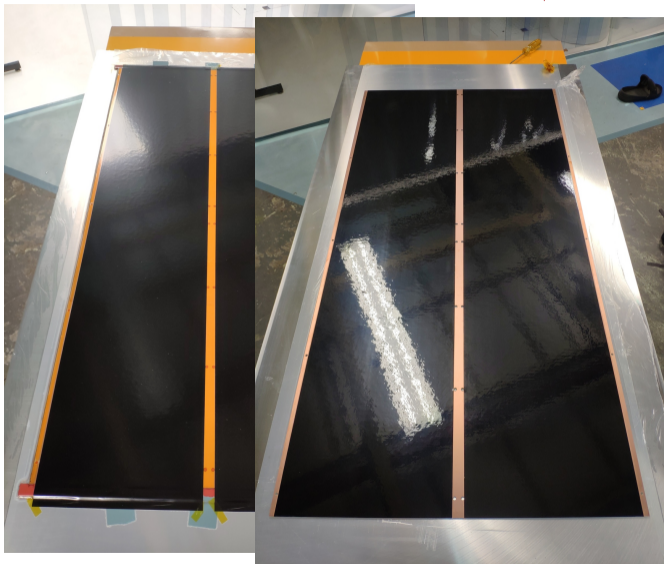




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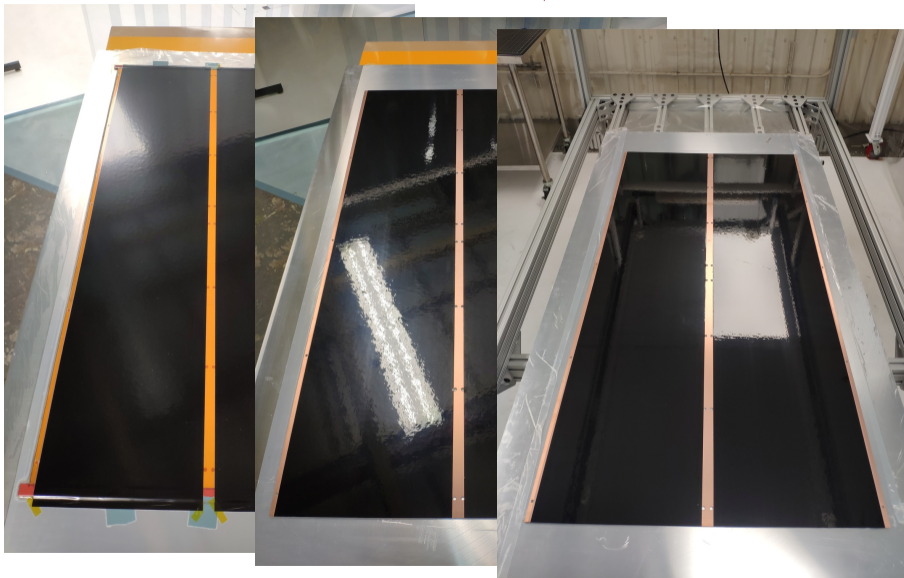
FR4+DR8+epoxy



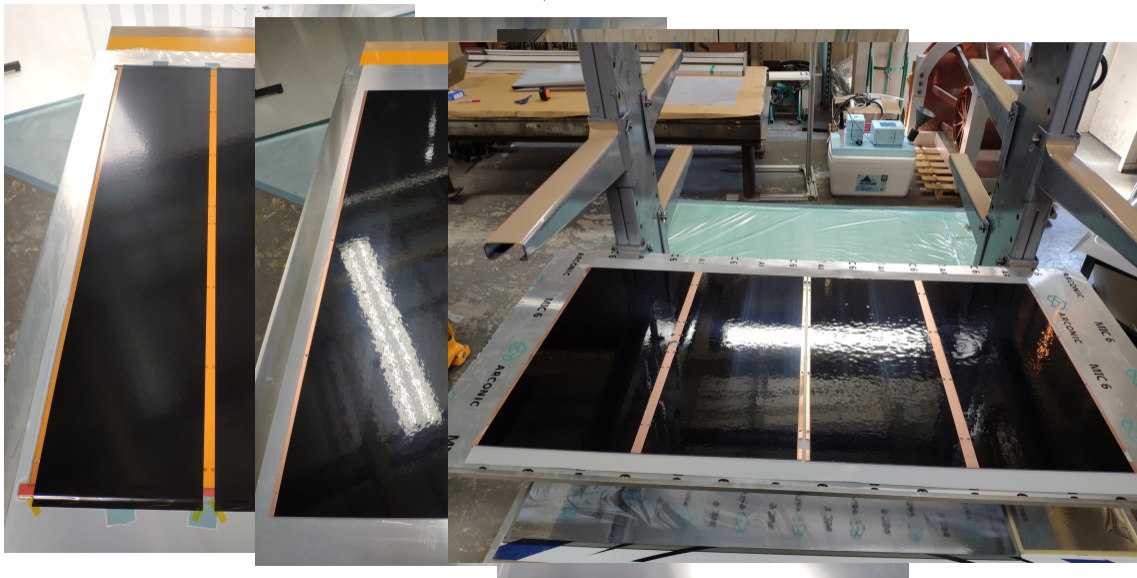


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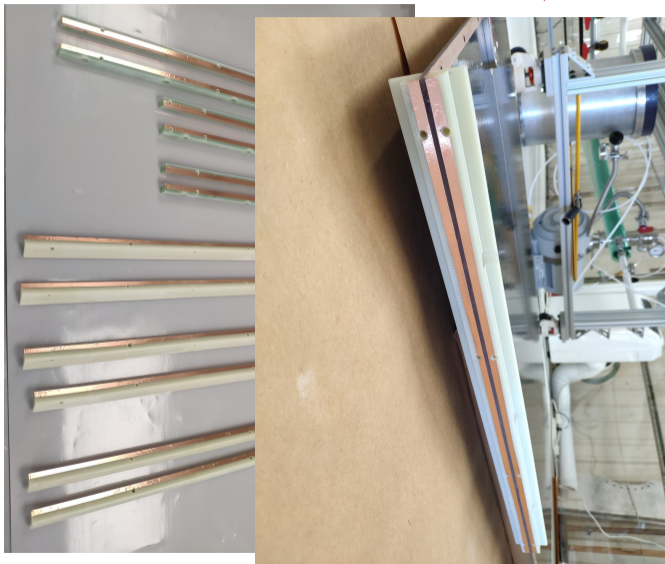
FR4+DR8+epoxy

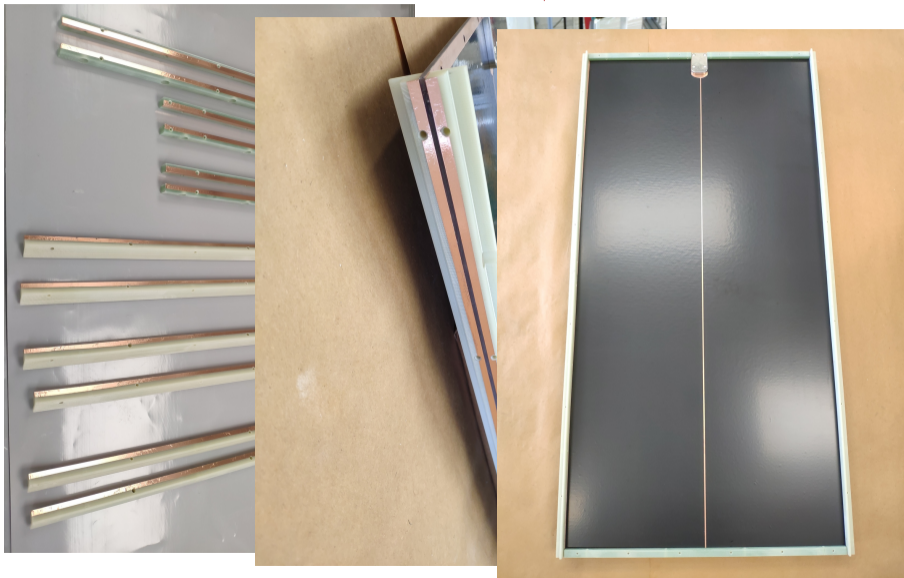








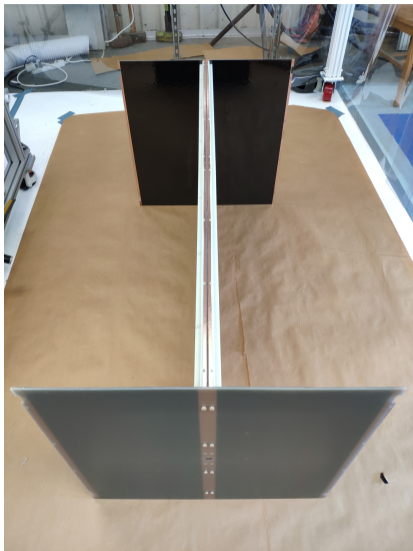




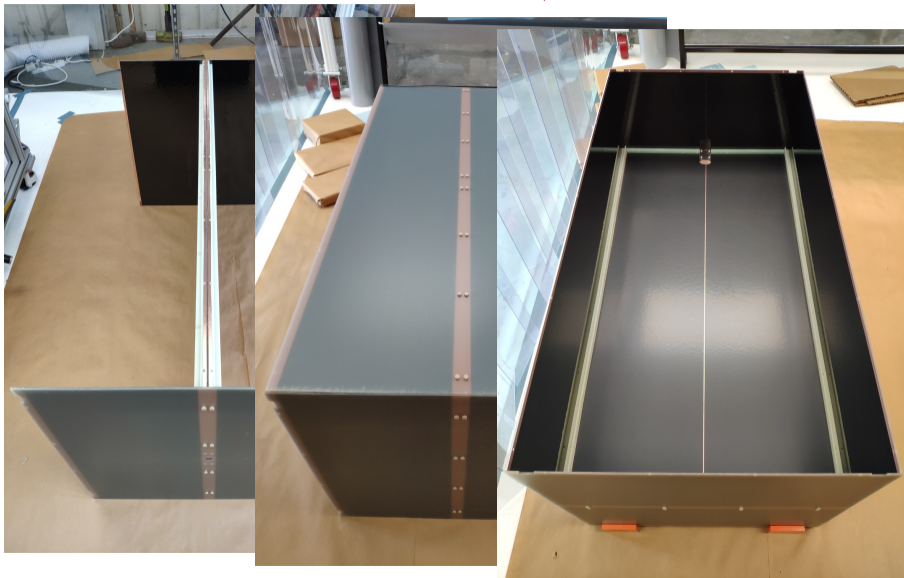


## Module-0 Field-Cage

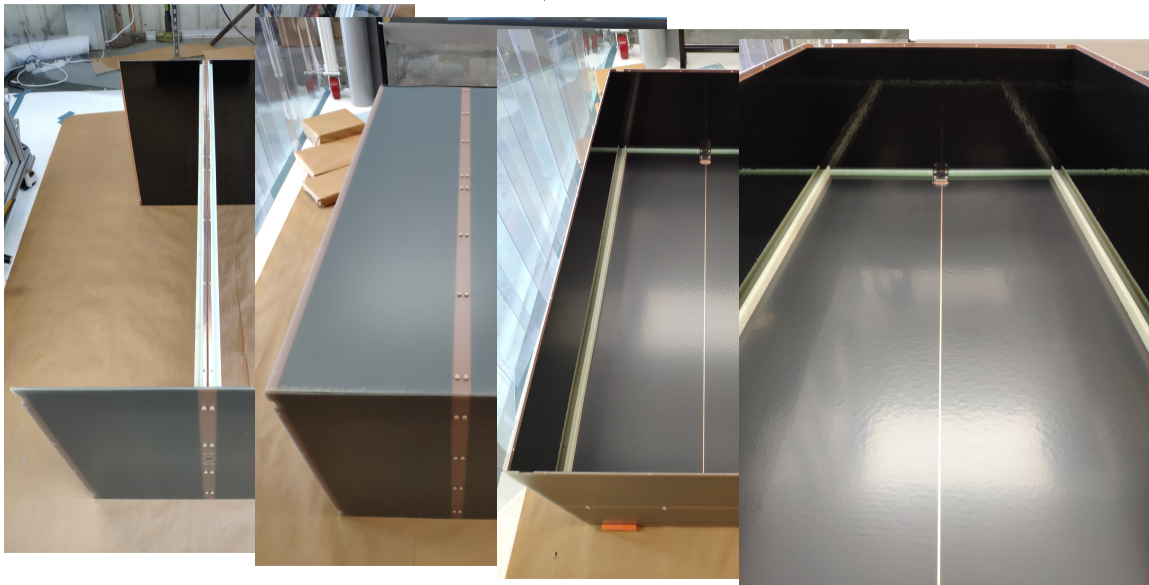
Test-fit

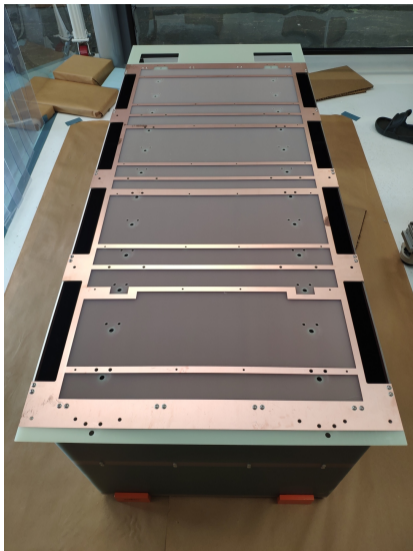


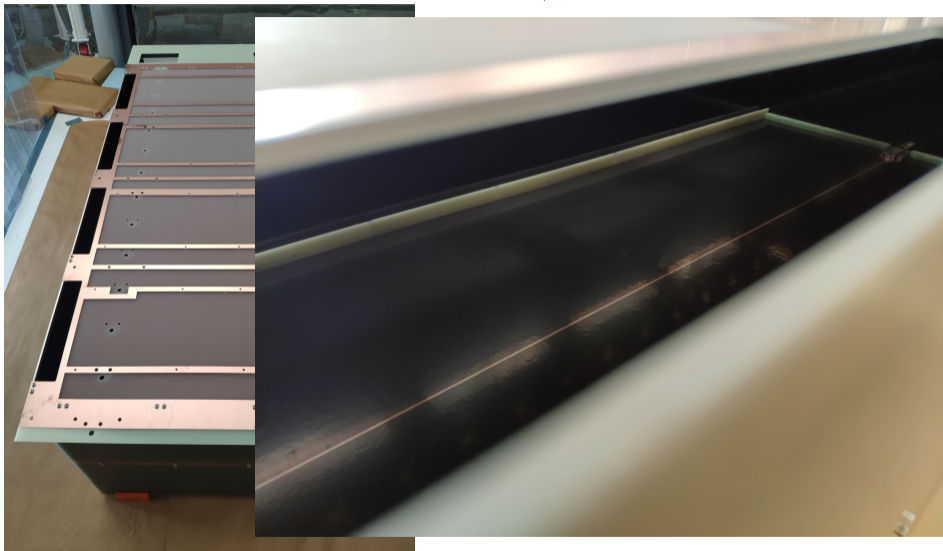


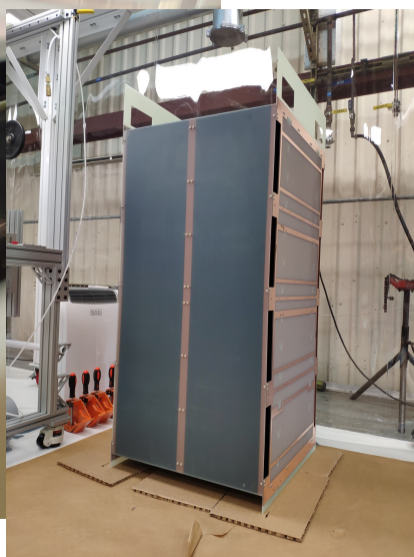
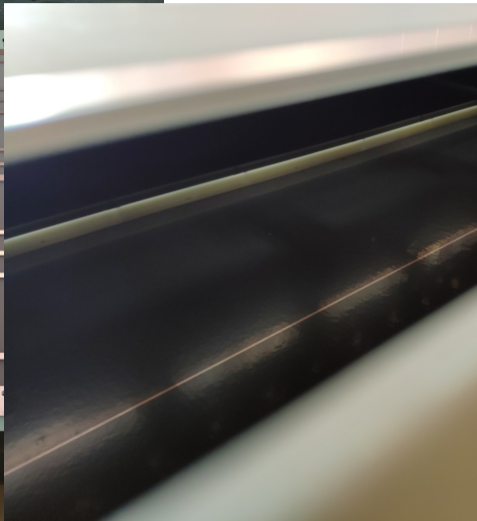
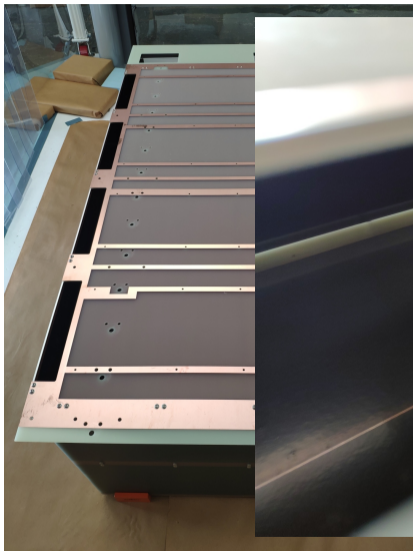






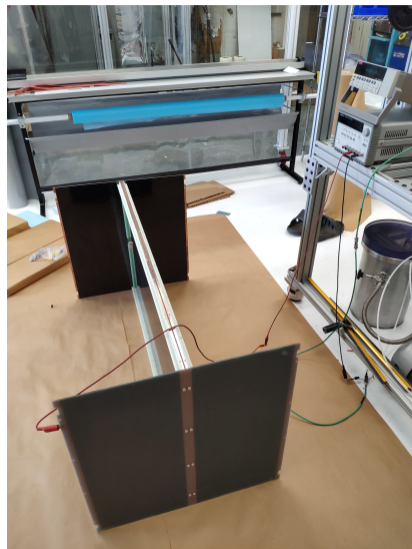






Measured the current going through each panel (both sides) at 50 V with picoammeter

| Panel       | Side  | Current [nA] | $R_s$ [ $G\Omega/\square$ ] |
|-------------|-------|--------------|-----------------------------|
| Bottom      | Left  | 193          | 0.57                        |
|             | Right | 230          | 0.56                        |
| Top         | Left  | 230          | 0.48                        |
|             | Right | 250          | 0.44                        |
| Side 1      | Left  | 373          | 0.58                        |
|             | Right | 430          | 0.50                        |
| Side 2      | Left  | 310          | 0.69                        |
|             | Right | 350          | 0.61                        |
| <b>Full</b> | A     | 1277         | 0.51                        |
|             | B     | 1170         | 0.56                        |



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|             | B     | 1170         | 0.56                        |

Ready to be shipped next week!



### Activities in small LAr Dewar:

- Resolved discharge issue in the system (spent DR8 strip)
- Resumed HV cable testing
- Modified system to accommodate  $15 \times 15$  cm laminated samples

Study an alternative to DR8: resistive PVC mentioned by Neil Spooner and studied by Kentaro Miuchi at Kobe U. for the SR $\mu$ -TPC R&D ([paper](#))

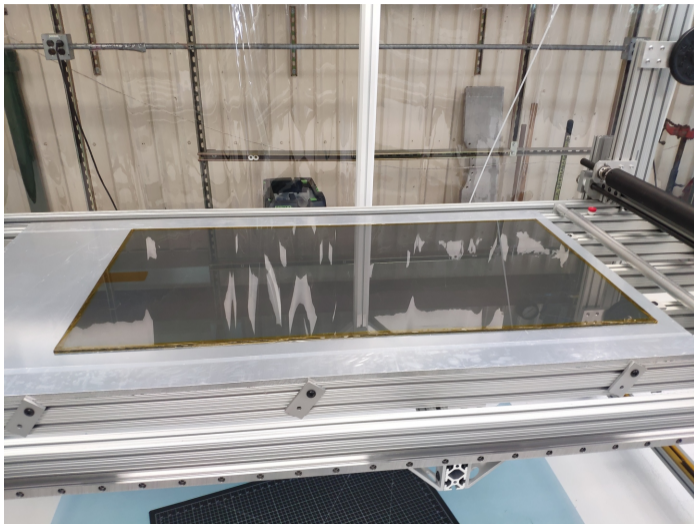
- Checked expected sheet resistance: as expected ( $\mathcal{O}(10^{10})\Omega/\square$ )
- Dunked it in LN2, became stiff but not brittle, came back to normal at room temperature
- Laminated a  $15 \times 15$  cm sample on a copper-clad board, will cryo/HV test next week

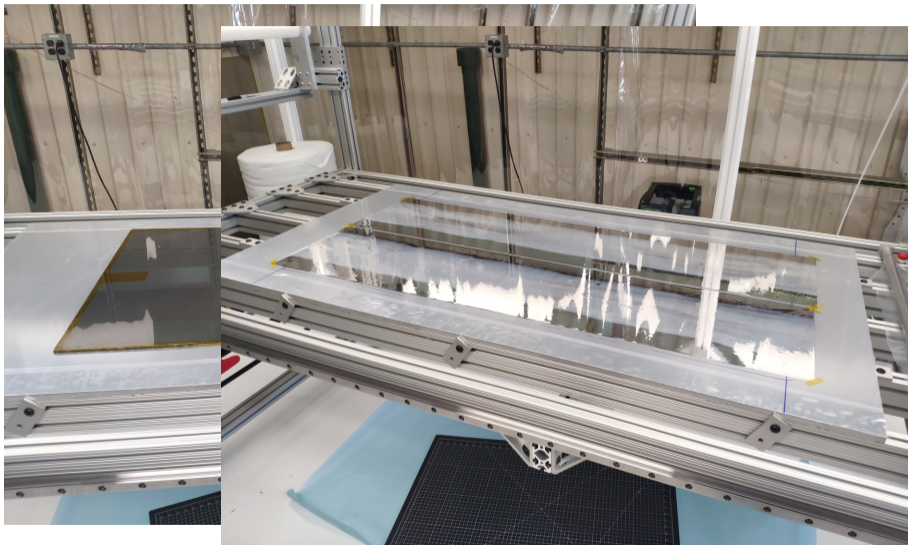
Checked robustness of PEEK screws when cryo cooled

- Tried varying levels of torque, did not see any failure when dunked in LN2

Back-up slides

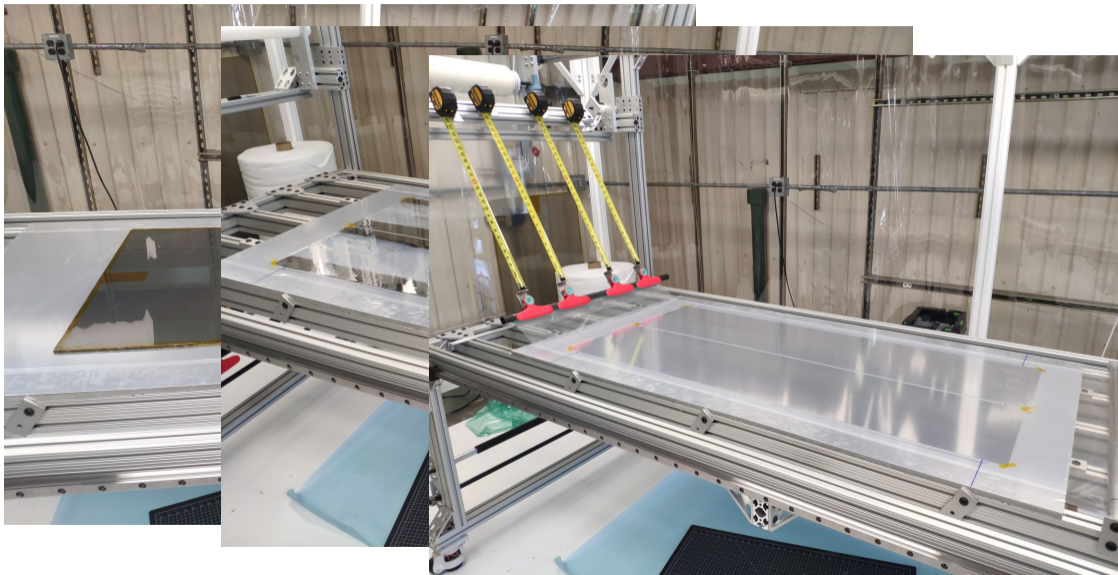


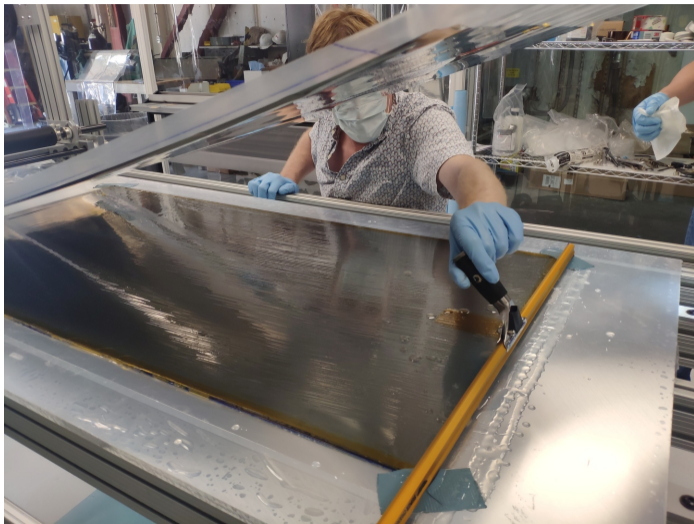


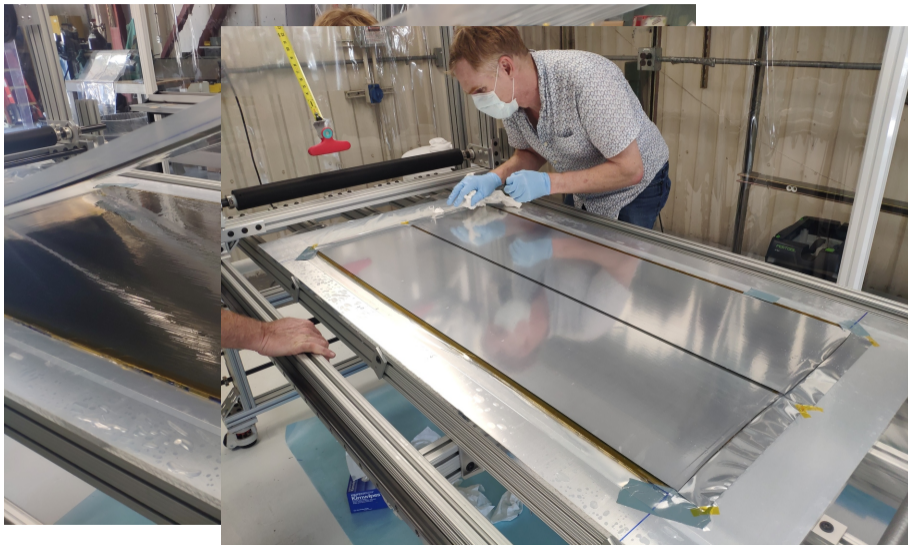


# Large scale preliminary test

Polycarb+Mylar+epoxy **SLAC** NATIONAL ACCELERATOR LABORATORY

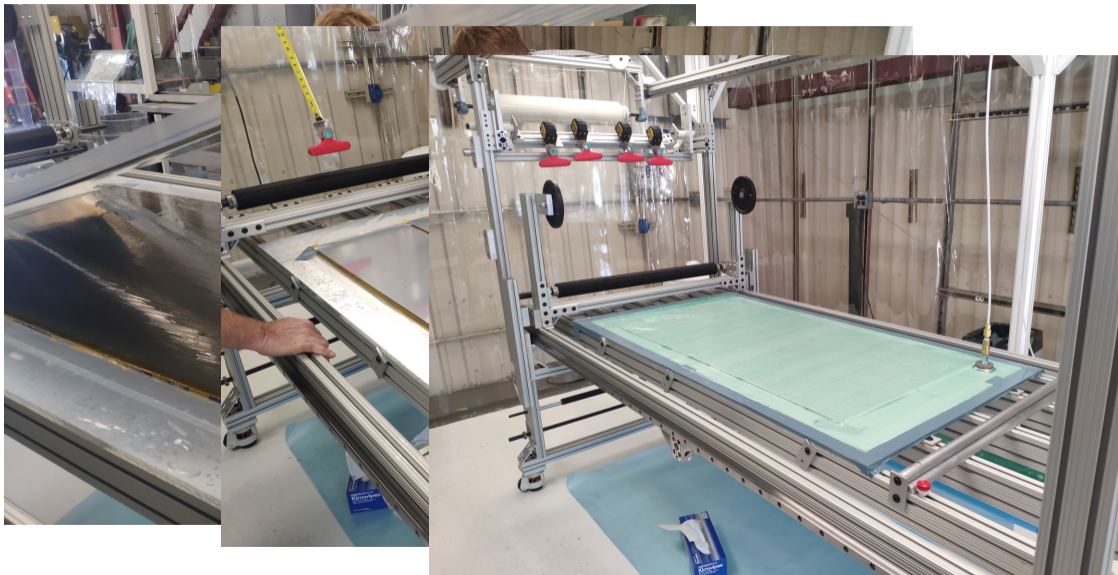


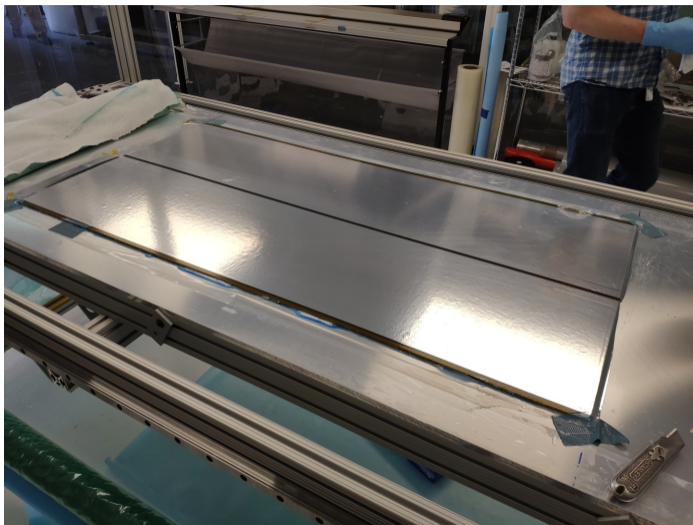


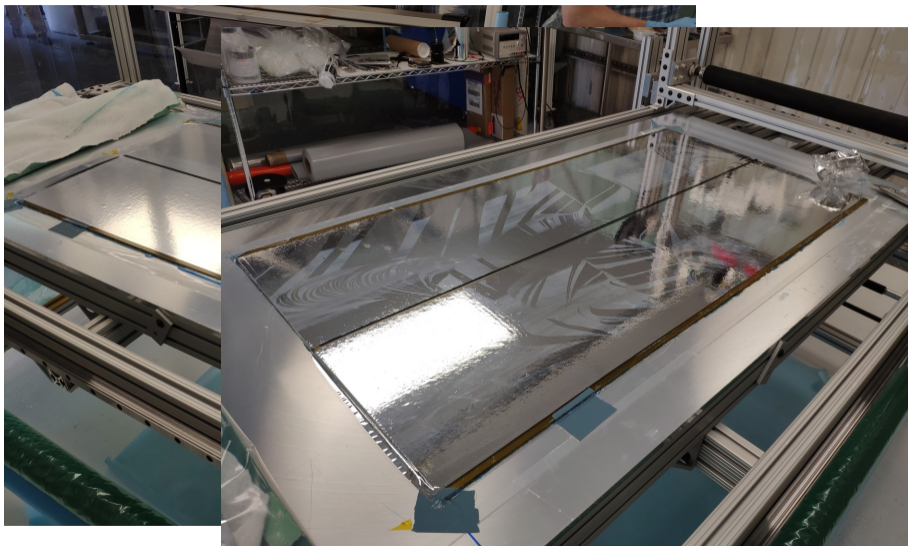


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