

# Broaching Standoffs Cryocycling & Load Tests

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**ArgonCube Engineering Meeting | July 17<sup>th</sup> 2020**

# Press-fit broaching standoffs

Main support for charge and light readout assembly in SingleCube

Replaces original pixel standoffs

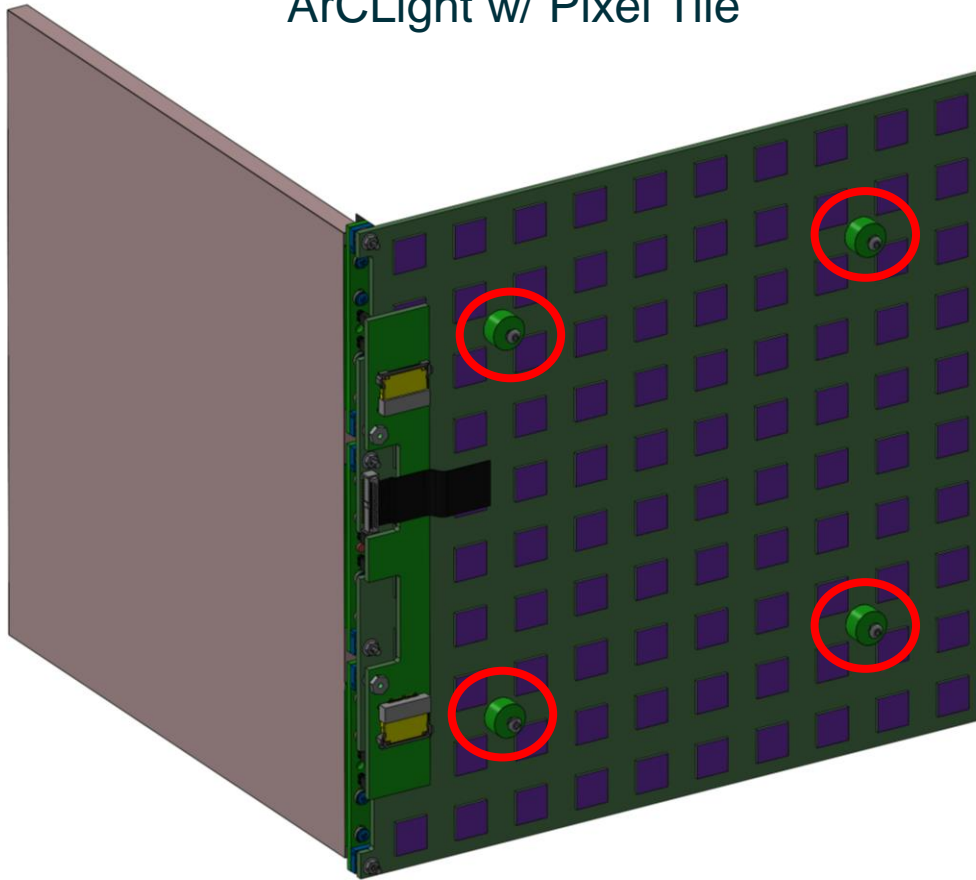
- Same location and thread
- Installed by commercial vendor

*\*\*\*Cryogenic and load qualification discussed here\*\*\**

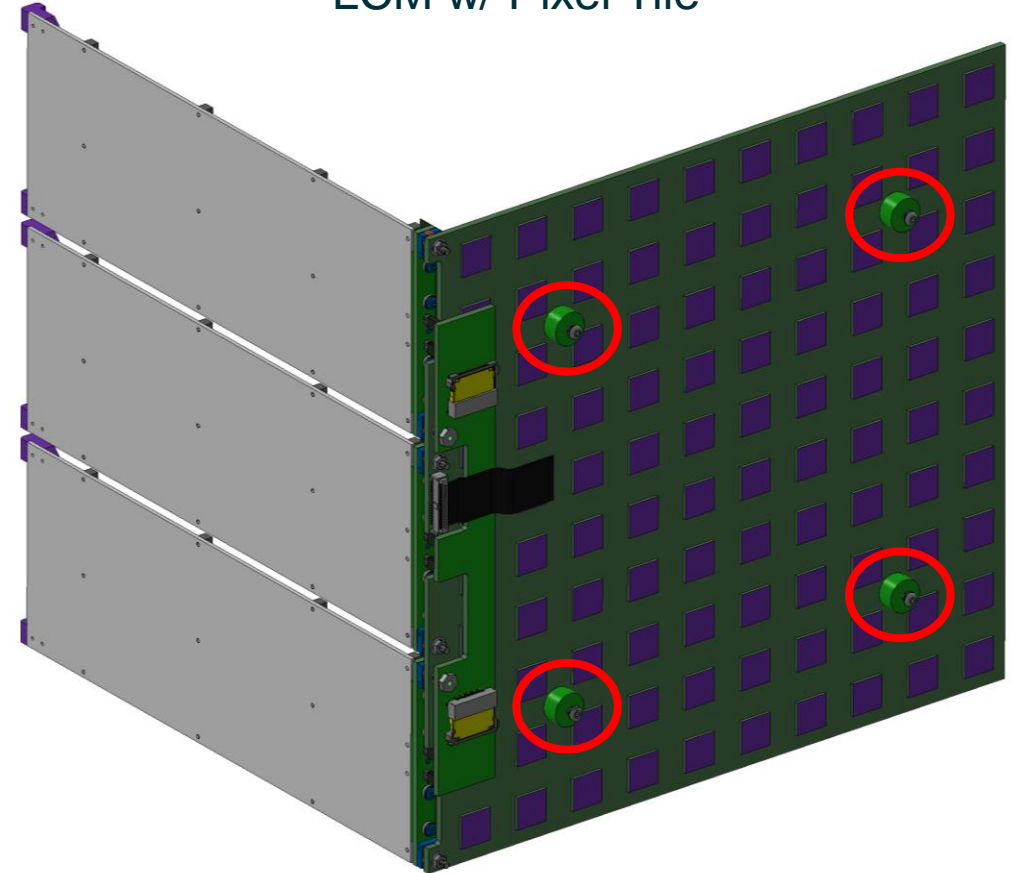
If successful, employed for Module 0 and 2x2

# Broaching standoffs to support pixel tile and light readout assemblies

ArCLight w/ Pixel Tile



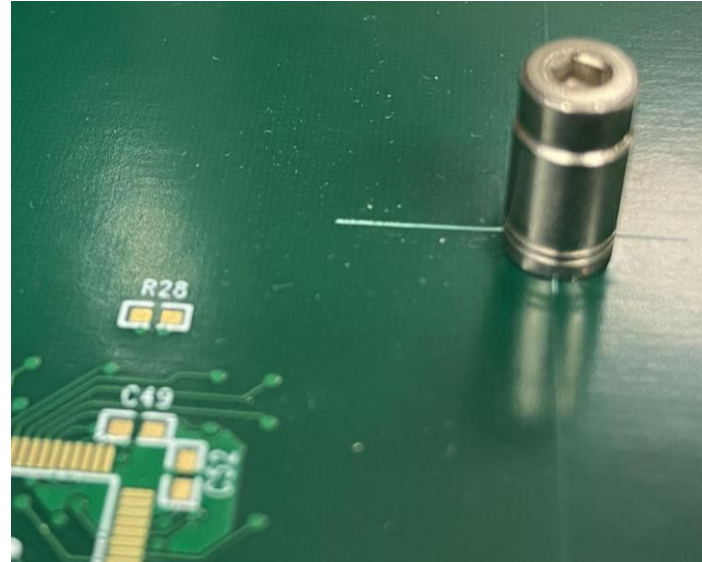
LCM w/ Pixel Tile



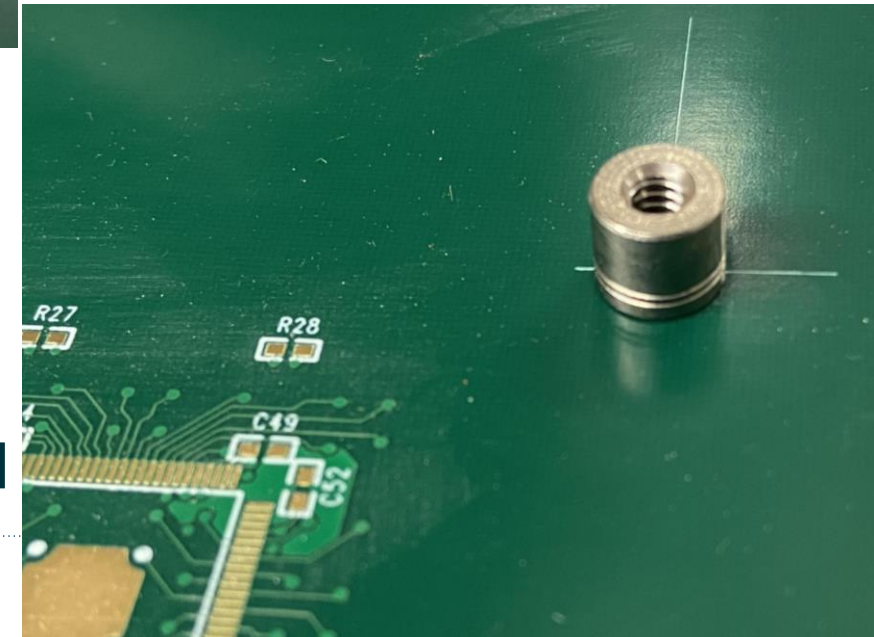
\*Figures courtesy of A. Lambert

# Two standoff types for testing

*Metric* – tall and thin



*Imperial* – short and broad



# Cryocycling & Load Test Procedure

1. Hold PCB with standoffs in cold vapor just above  $\text{LN}_2$  surface (1 minute before initial submerge; 30 seconds before subsequent submerges)
2. Slowly submerge entire PCB into  $\text{LN}_2$  (20 seconds initial submerge time; 5 seconds subsequent submerge time)
3. PCB totally submerged in  $\text{LN}_2$  for 30 seconds
4. Slowly raise PCB out of  $\text{LN}_2$  (5 seconds removal time)
5. Place PCB on bench top
6. Attach weights on bench top
7. Load test at room temperature

↑  
\*steps 1-4 repeated 4 times  
↓

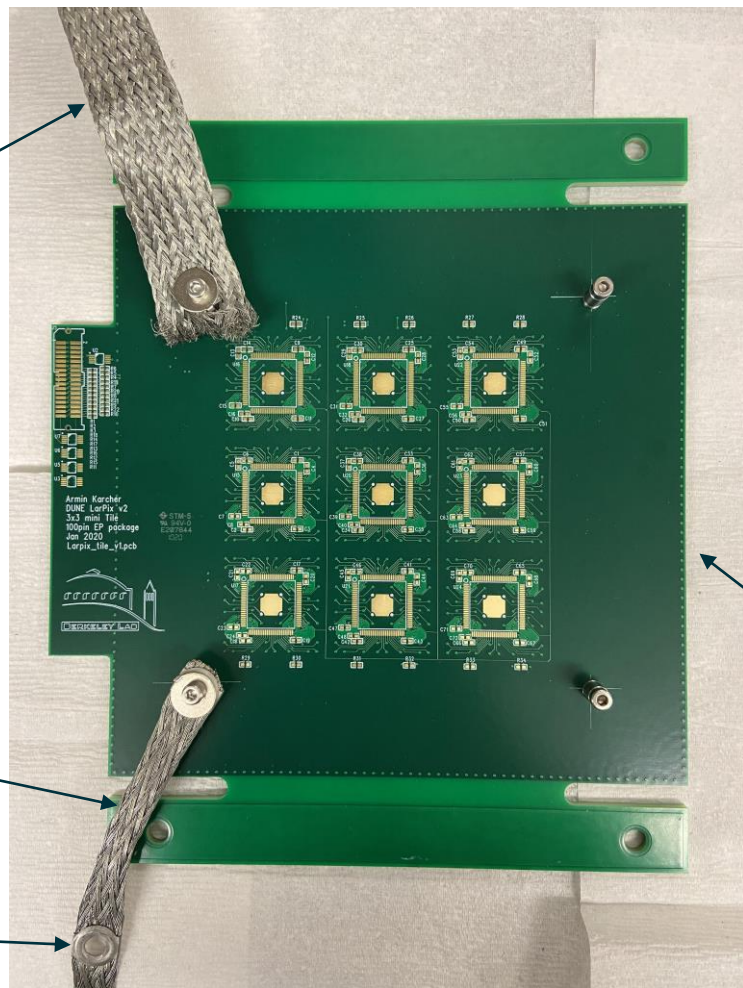


# Ancillary equipment for quick testing

- Tin-plated copper grounding braid:
- (1) insertion/removal from LN<sub>2</sub>
  - (2) hold point for load test

Tin-plated copper grounding braid for load test

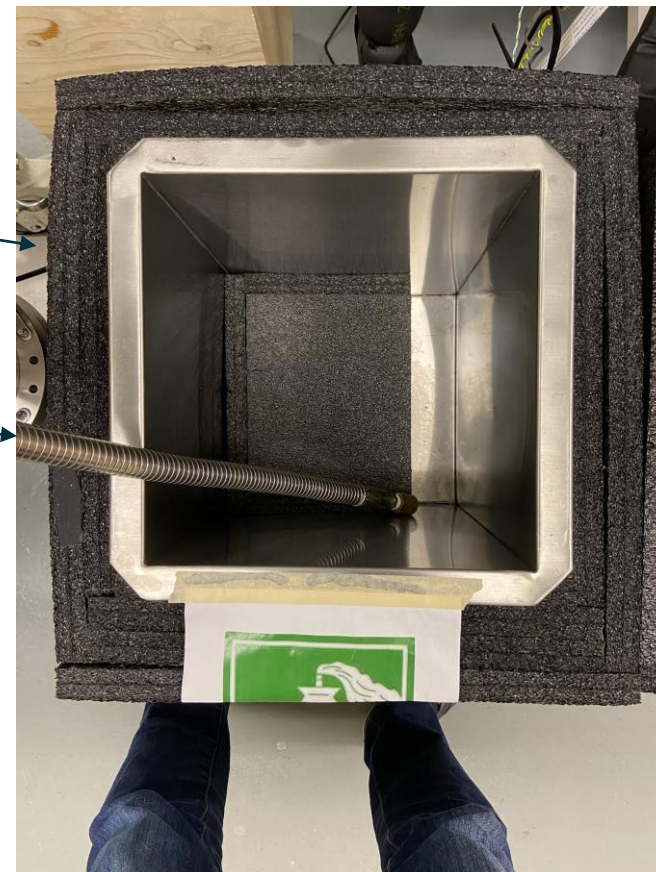
Eyelets to attach weights



Aluminum box with foam insulation

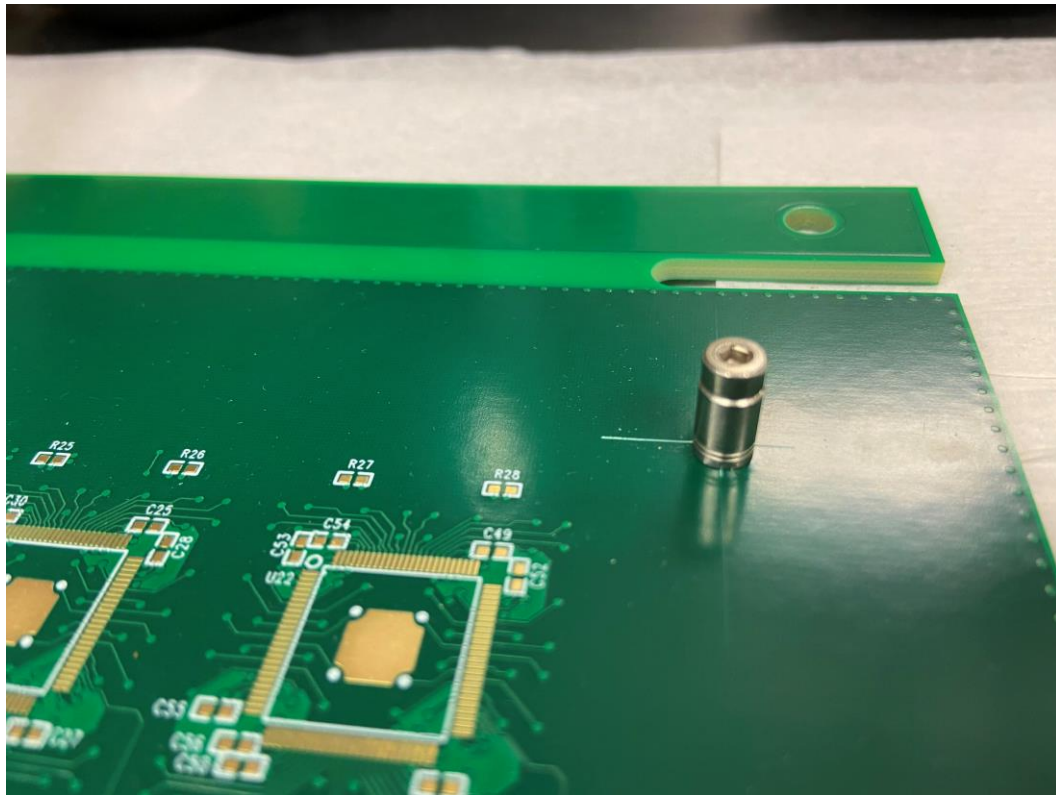
LN<sub>2</sub> fill line

First generation mini tile 3x3 pixel board (v1 rev1) – pixel pads on back-facing side

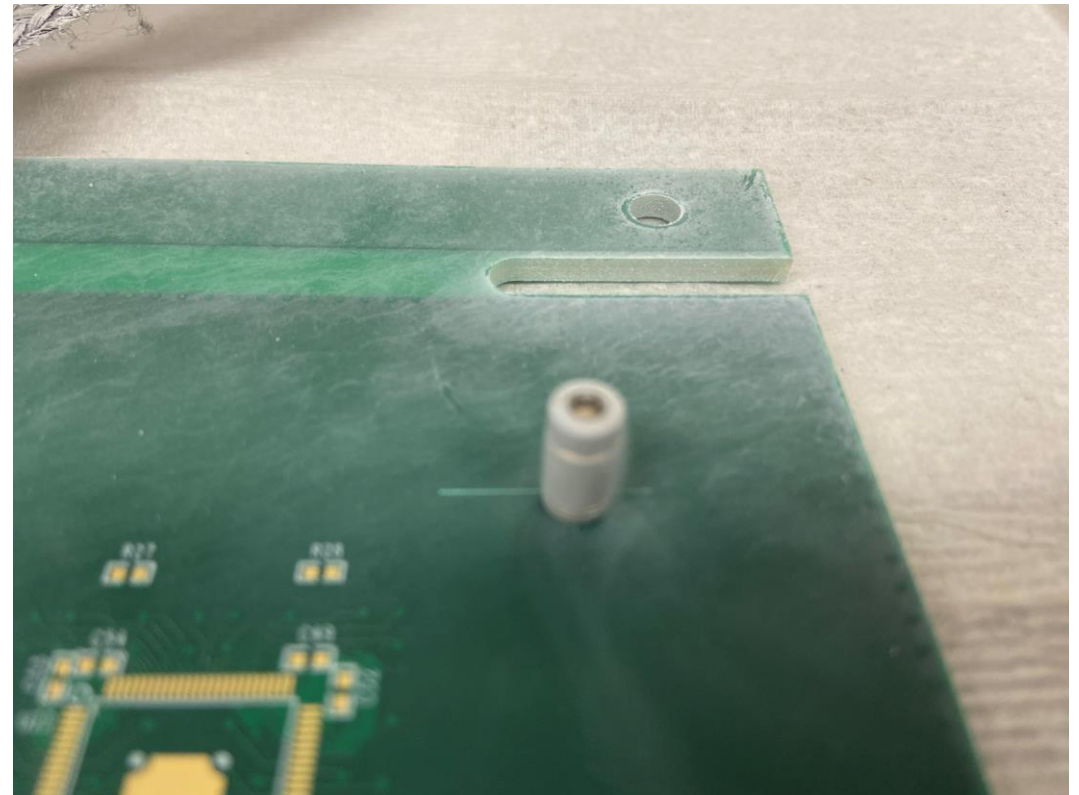


# Top right corner – *metric standoffs*

Before cryocycling



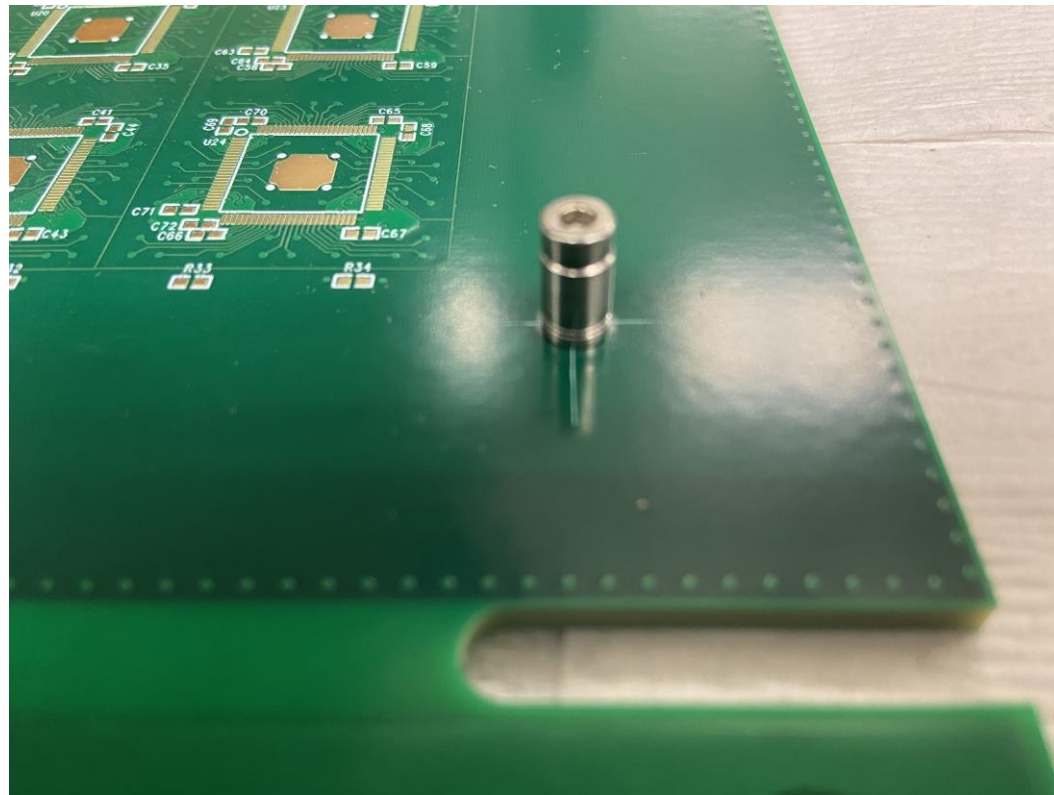
After cryocycling



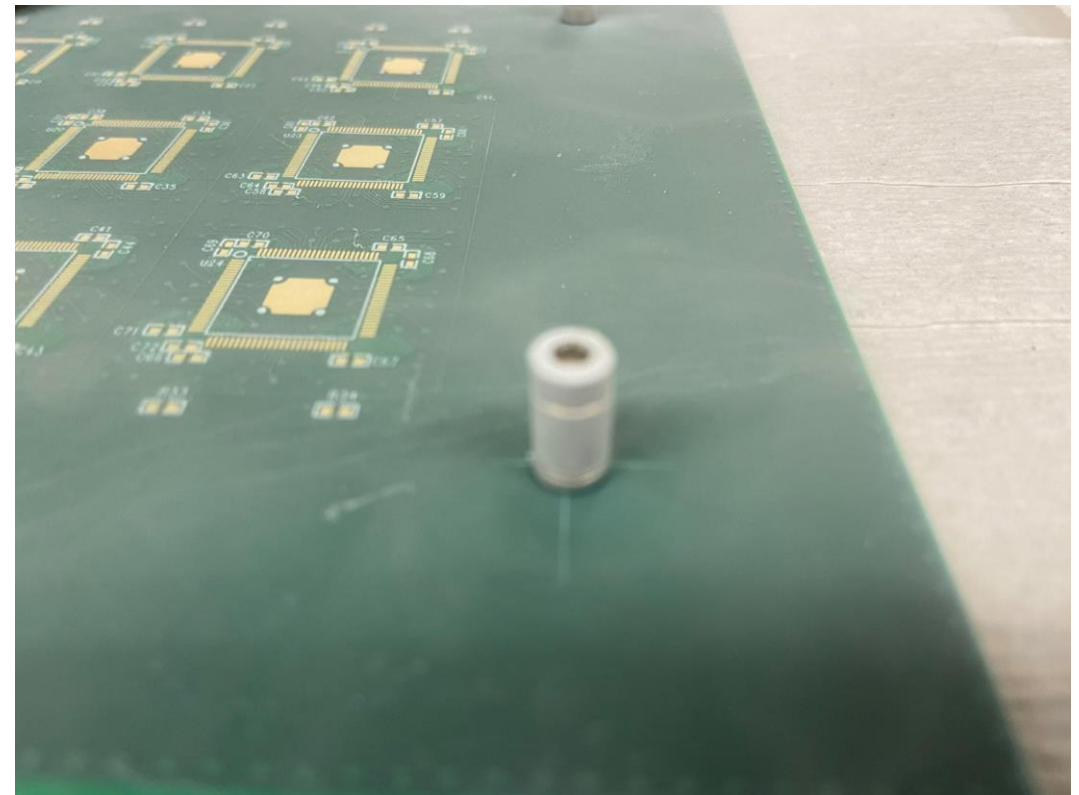


# Bottom right corner – *metric standoffs*

Before cryocycling



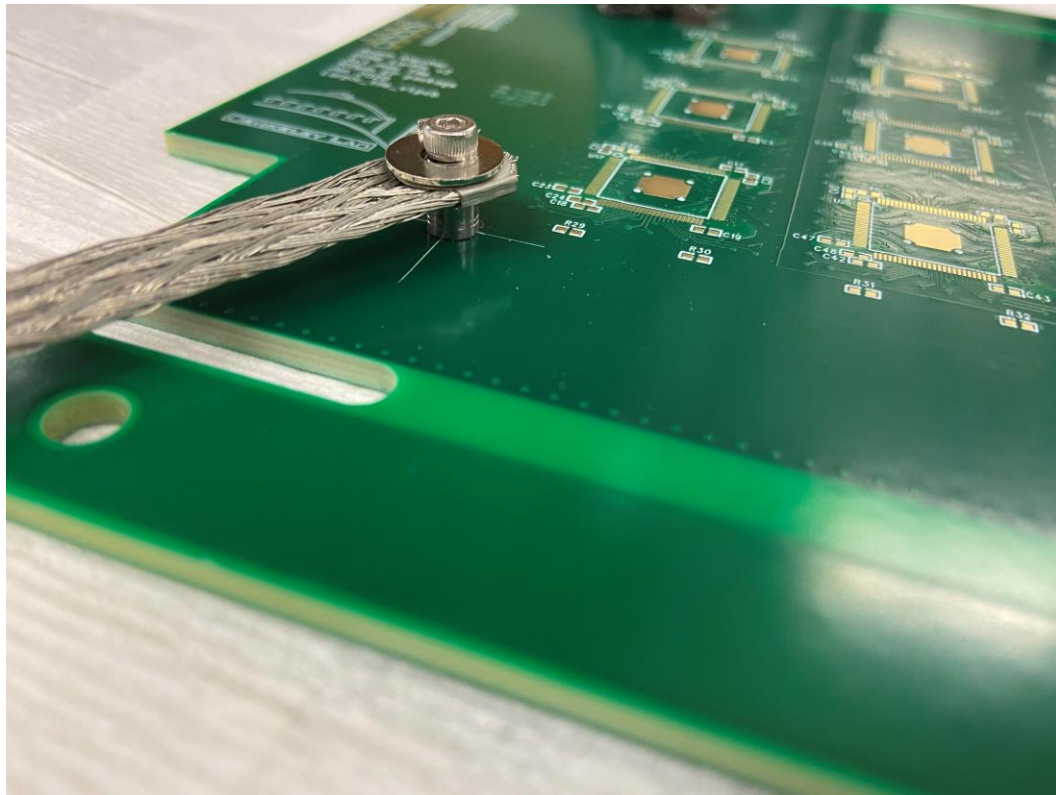
After cryocycling



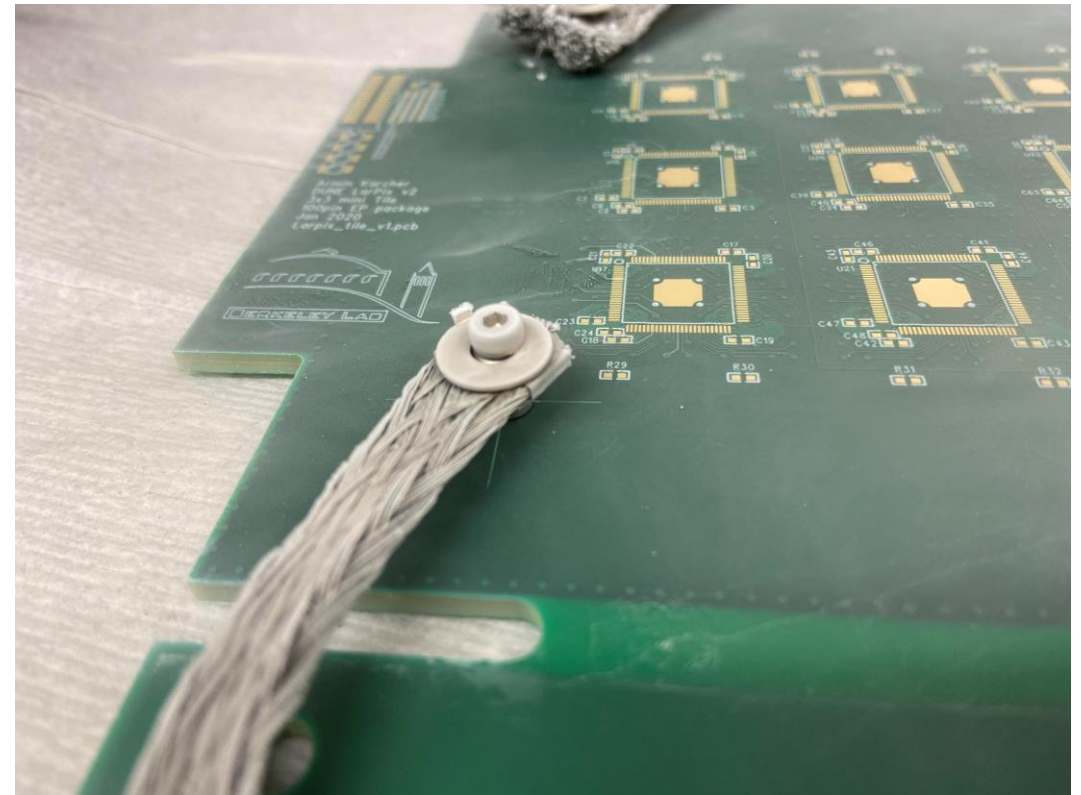


# Bottom left corner – *metric* standoffs

Before cryocycling

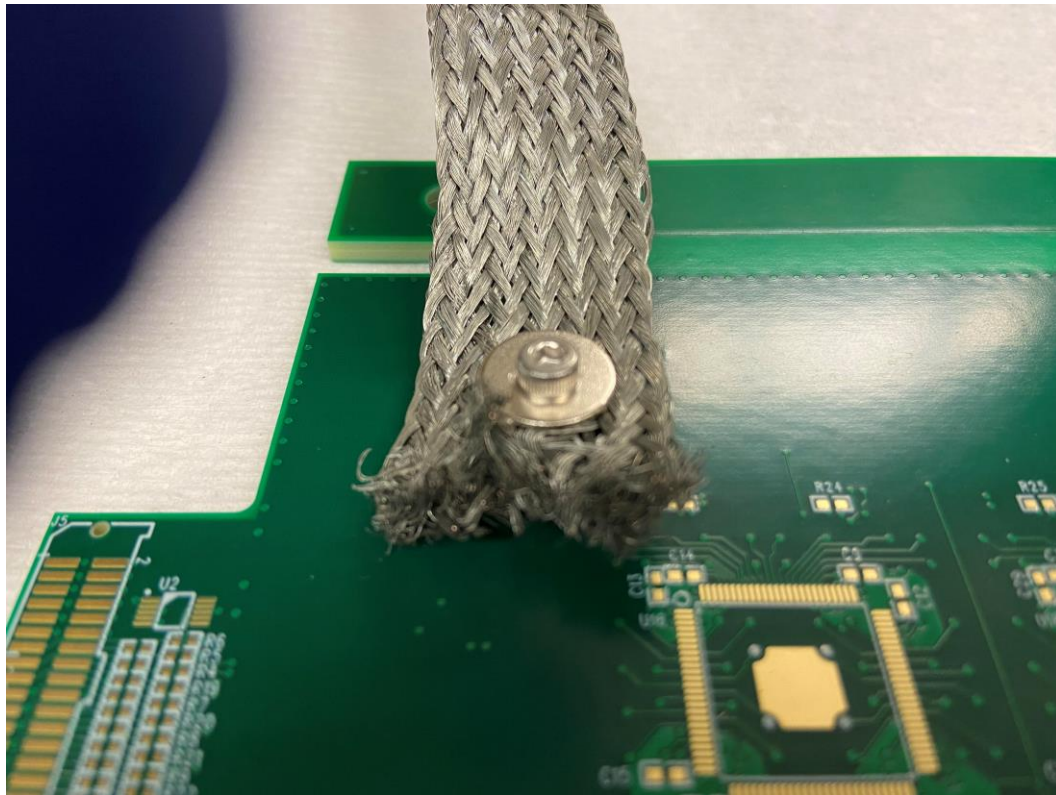


After cryocycling

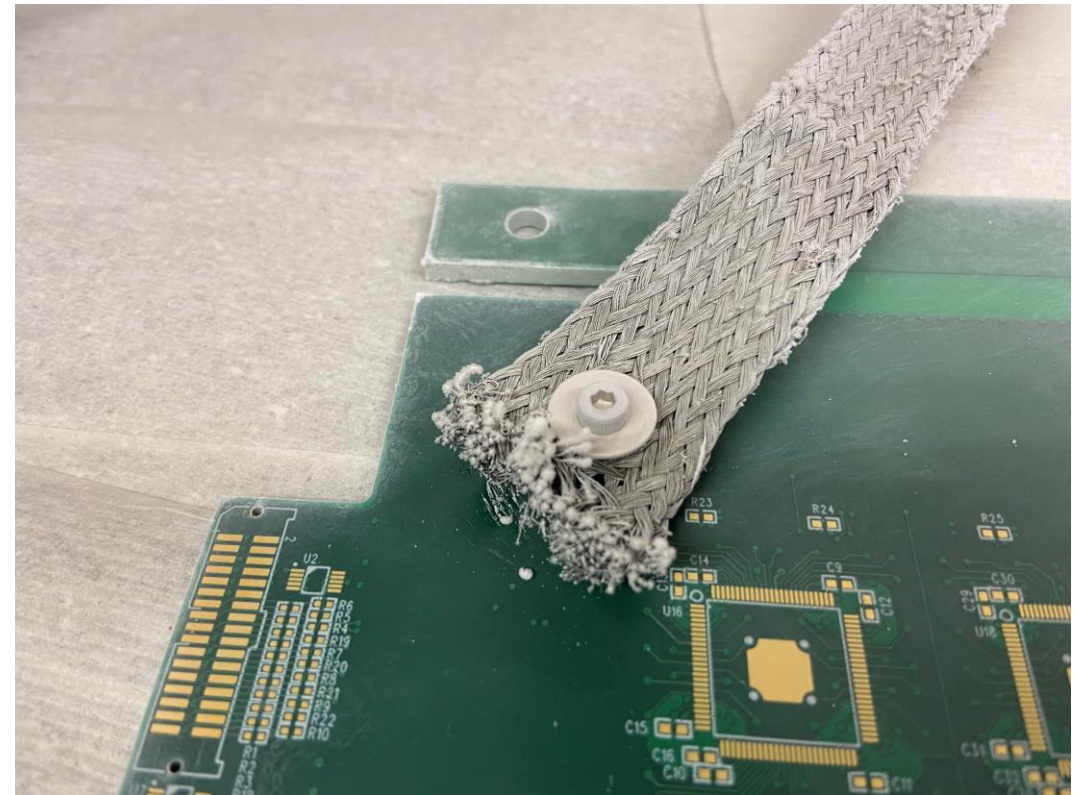


# Top left corner – *metric standoffs*

Before cryocycling



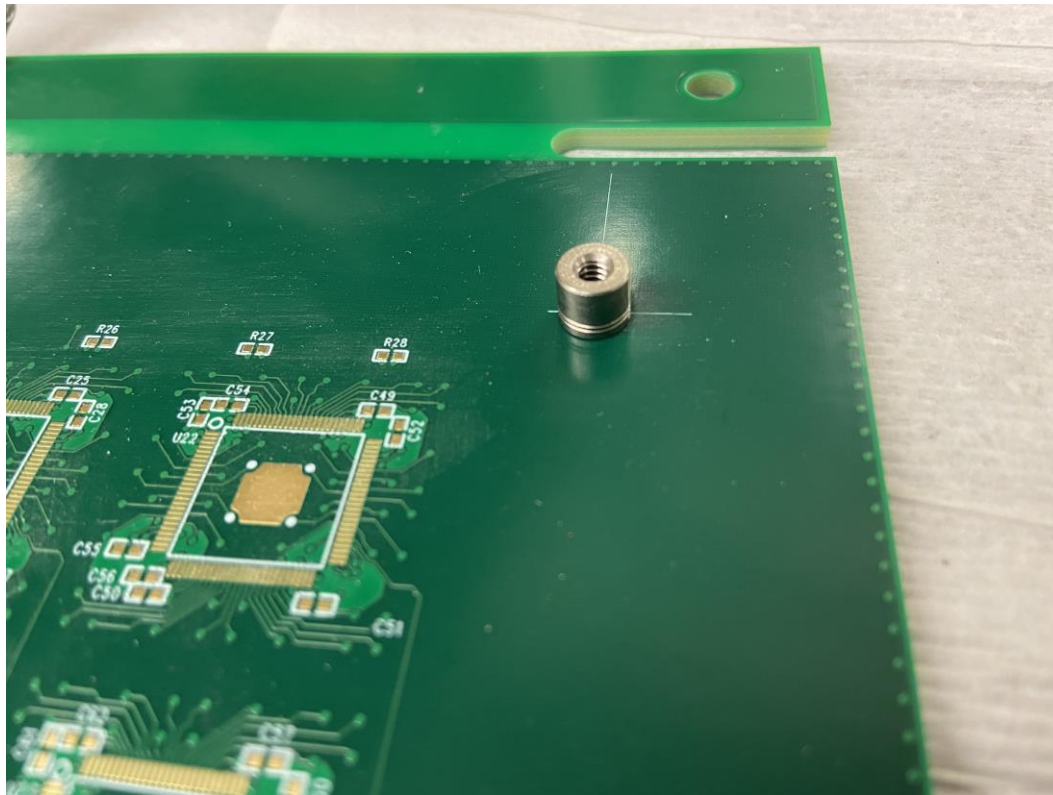
After cryocycling



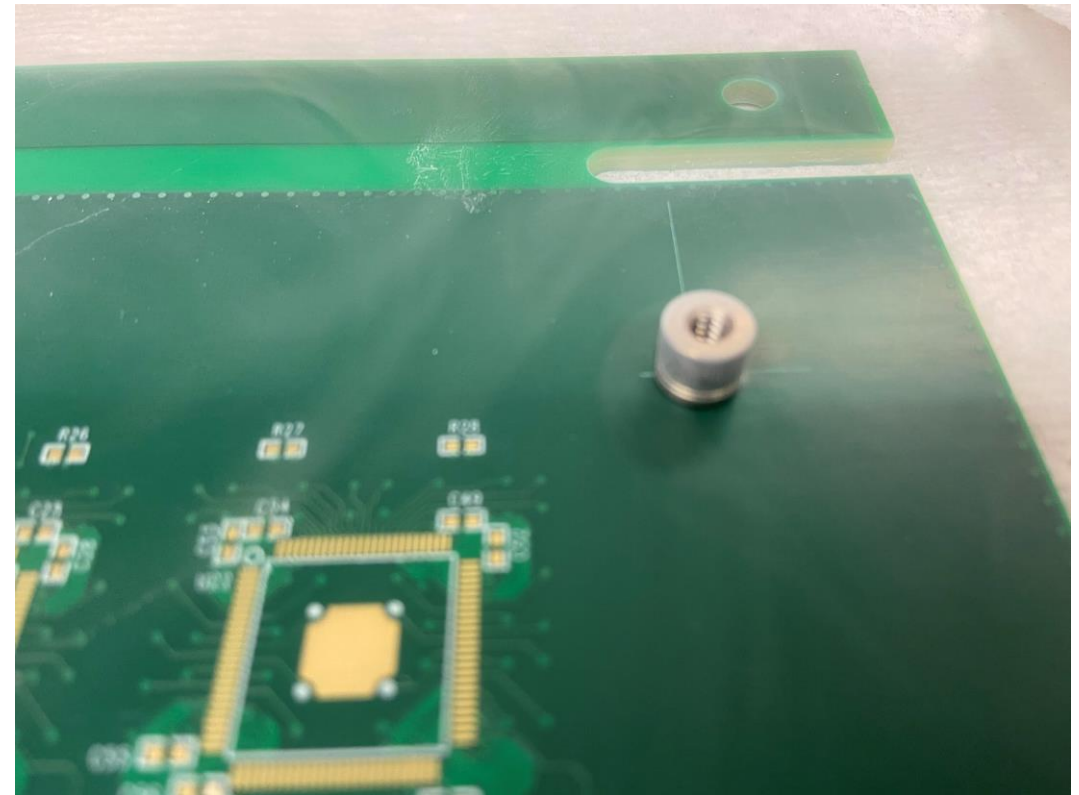


# Top right corner – *imperial standoffs*

Before cryocycling

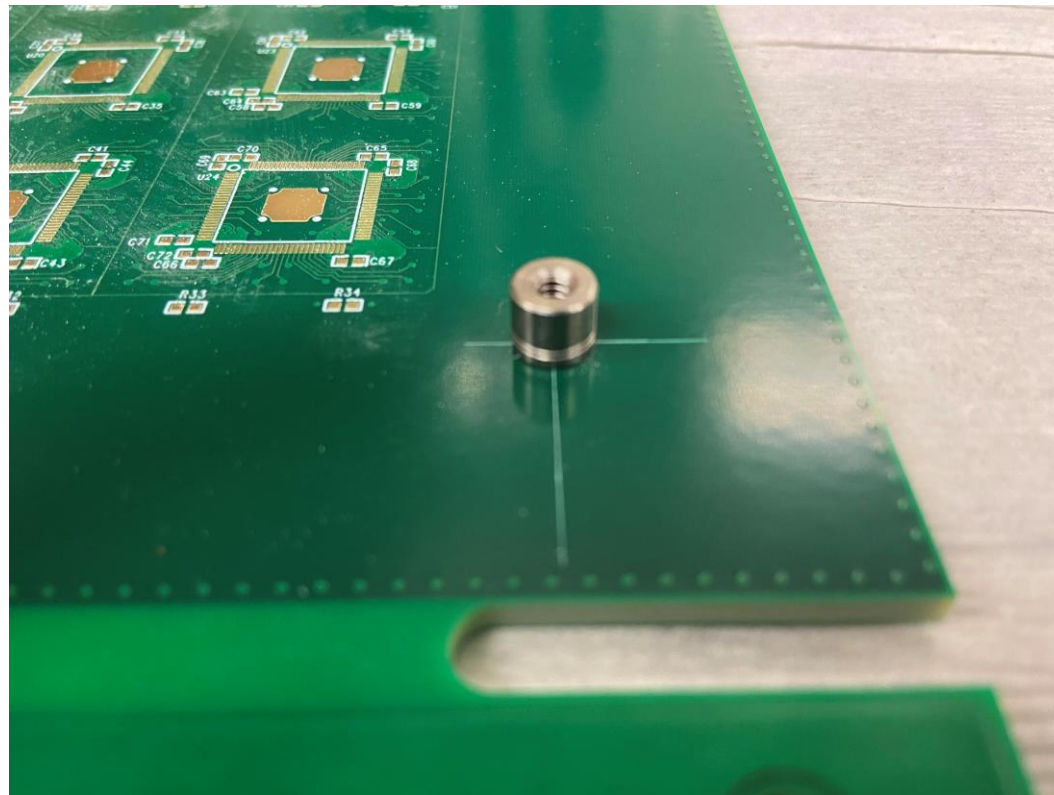


After cryocycling

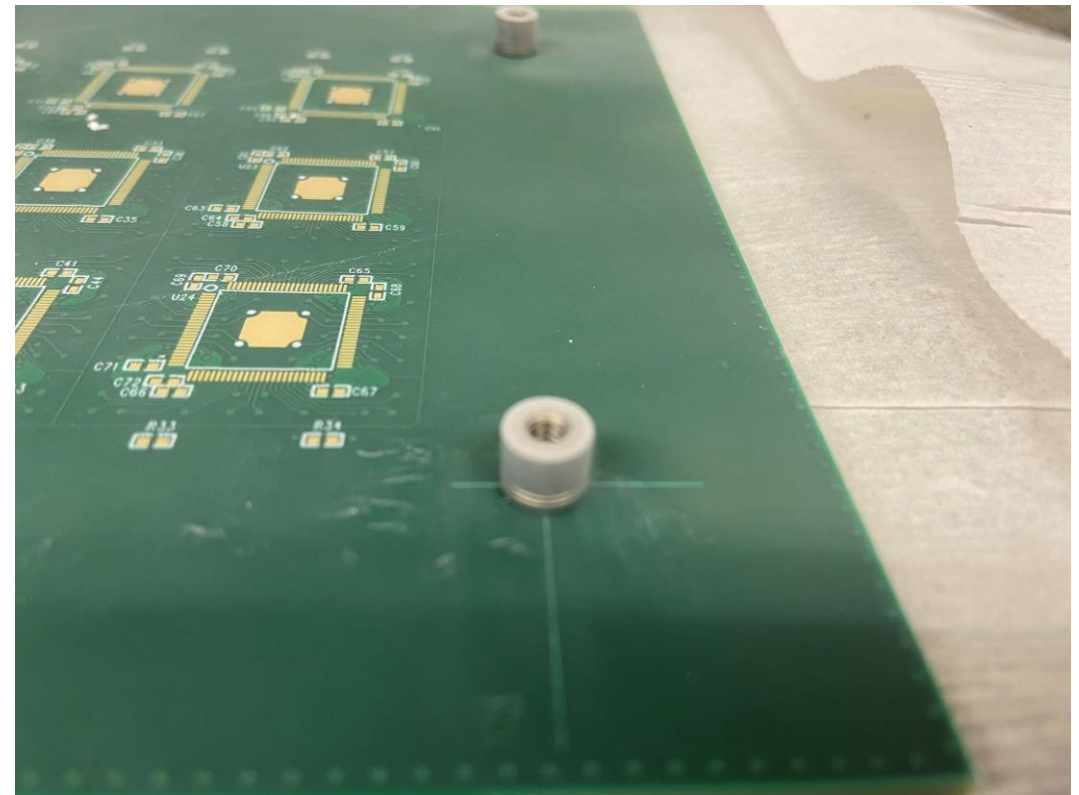


# Bottom right corner – *imperial standoffs*

Before cryocycling



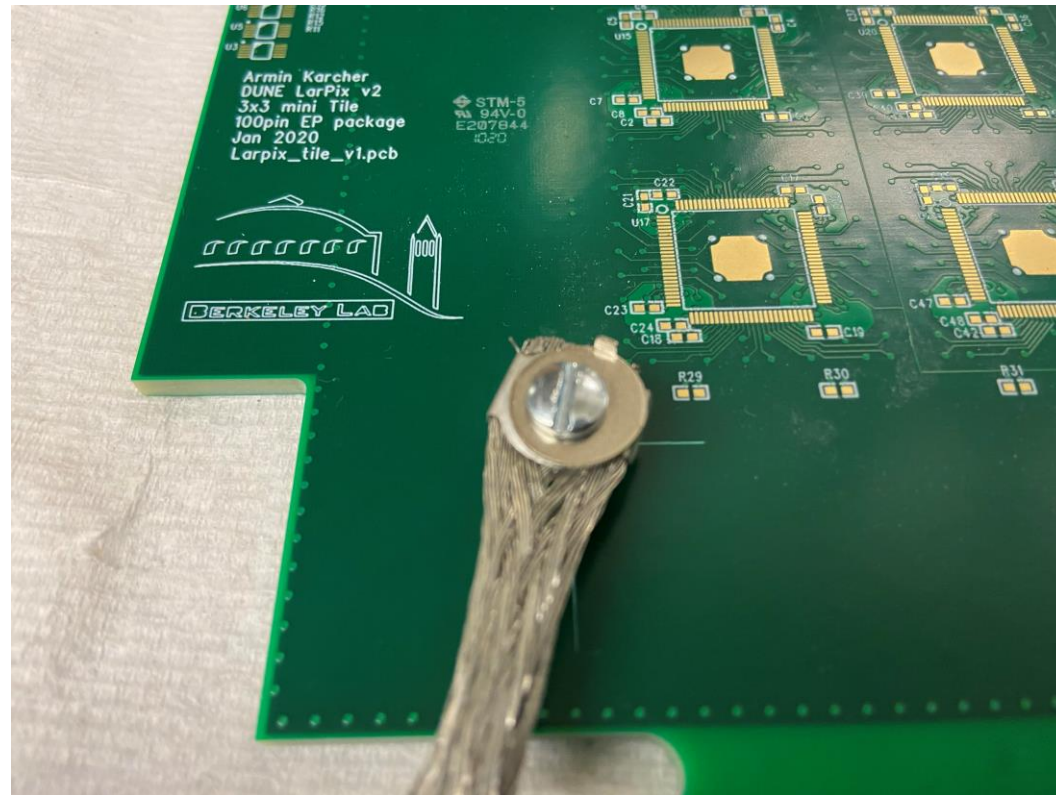
After cryocycling



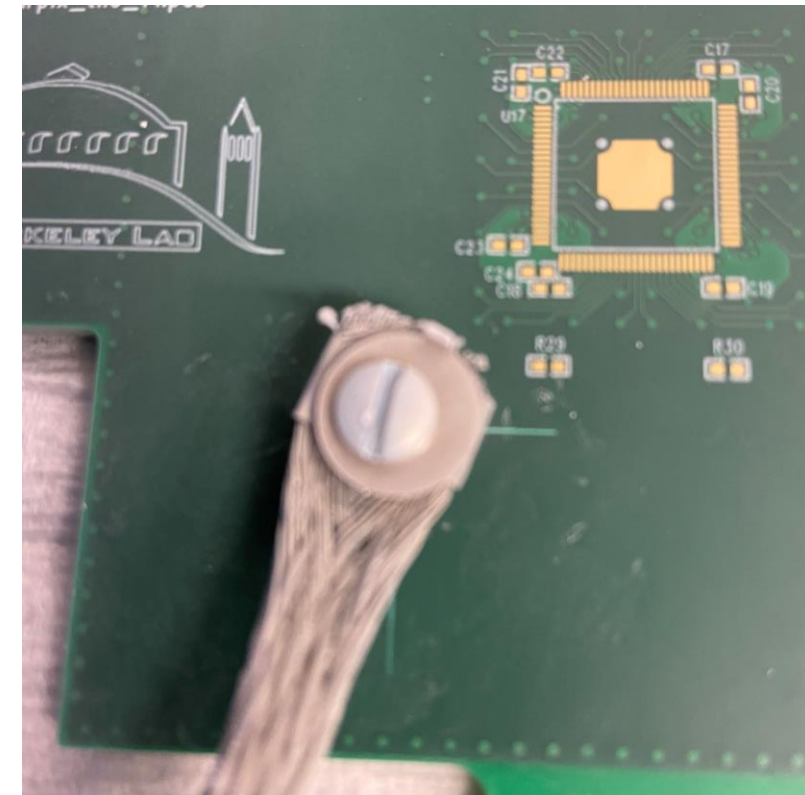


# Bottom left corner – *imperial standoffs*

Before cryocycling

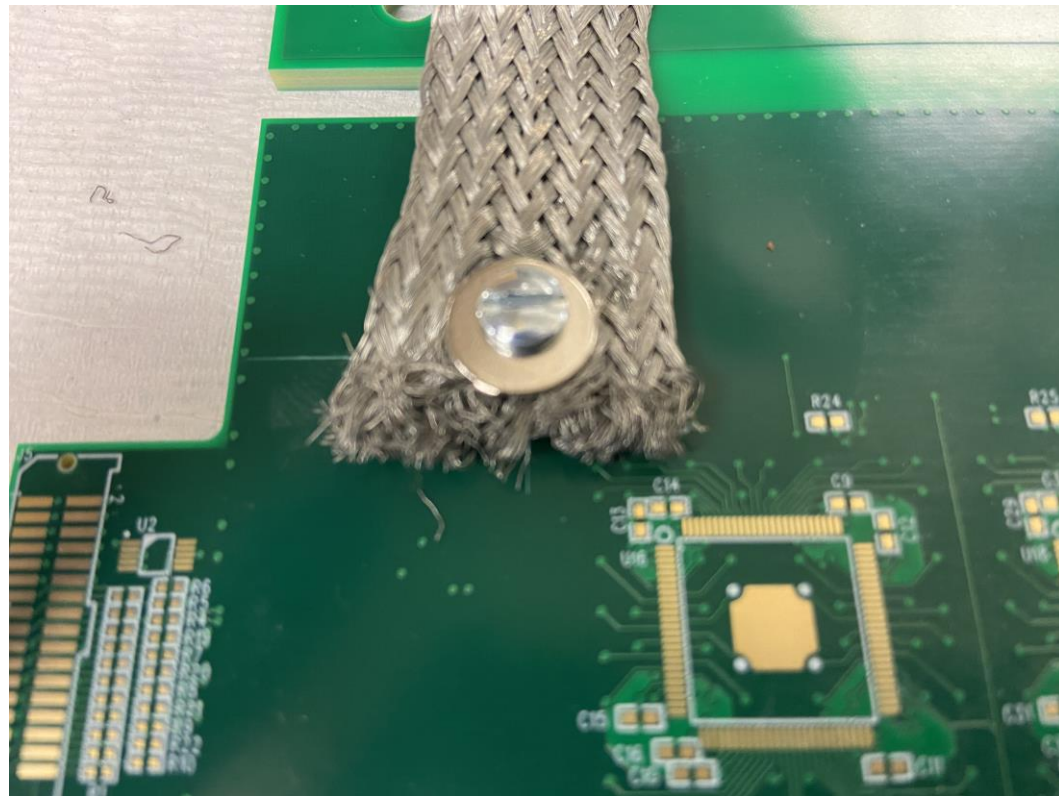


After cryocycling

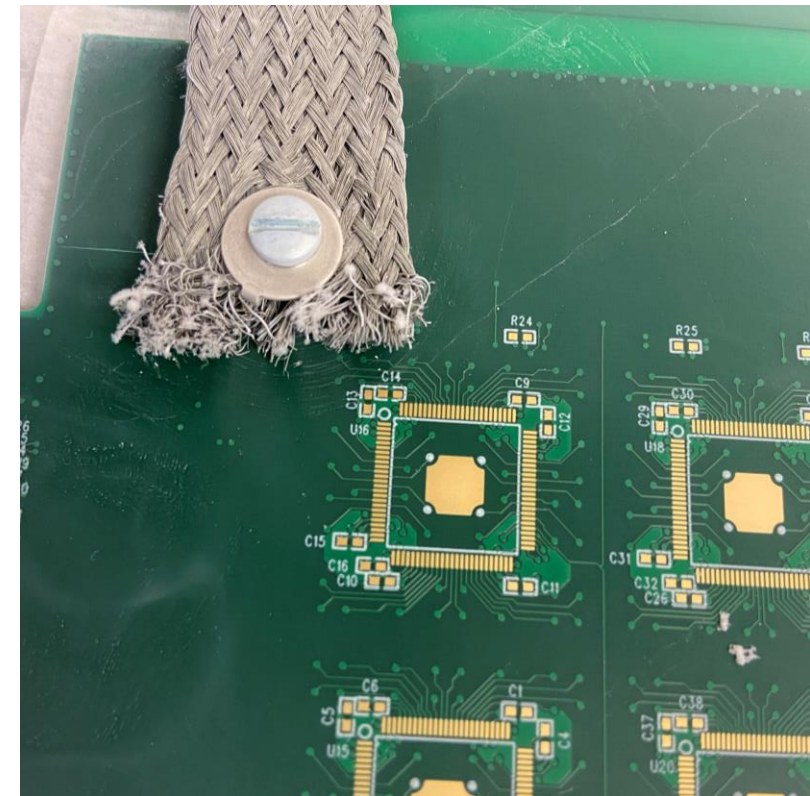


# Top left corner – *imperial standoffs*

Before cryocycling



After cryocycling



# Load test

100-chip pixel tile: ~740g

ArCLight: ~980g

Maximum load tested: 2024g

Load tested single attachment point  
(single standoff) for both type of  
broaching standoffs

Neither standoff type failed under load  
exceeding ArCLight plus 100-chip  
pixel tile mass



Test load equivalent to  
pixel PCB



Test load ~115% mass of  
ArCLight plus pixel PCB



# Summary

Upon visual inspection, no cracking or damage to pixel tile PCB was observed after multiple cryocycles

Neither standoff type failed at cold with load exceeding 100-chip pixel tile + ArCLight mass

**Either broaching standoff is suitable for SingleCube**



