

Modifications to the Nab Detector Electronics System

Andrew Hagemeyer

University of Virginia

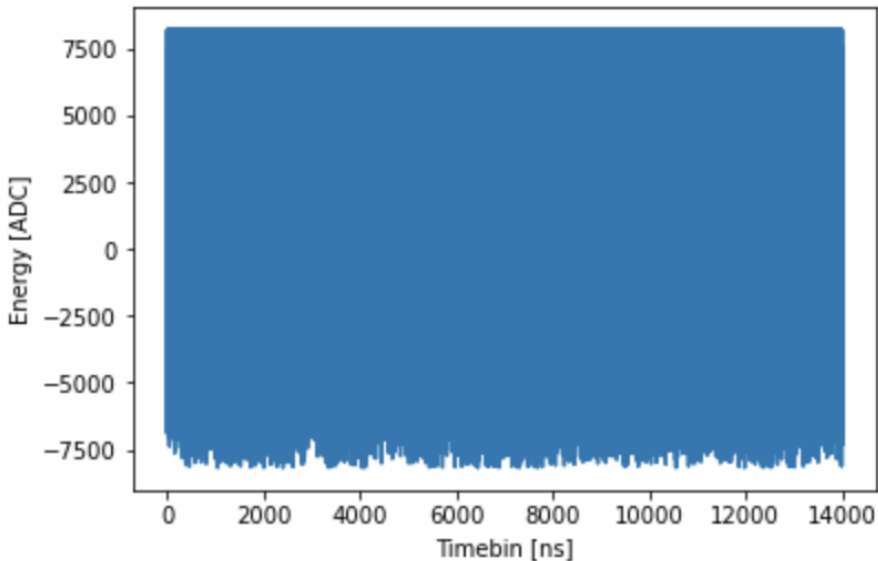
ACNS Conference, June 26, 2024



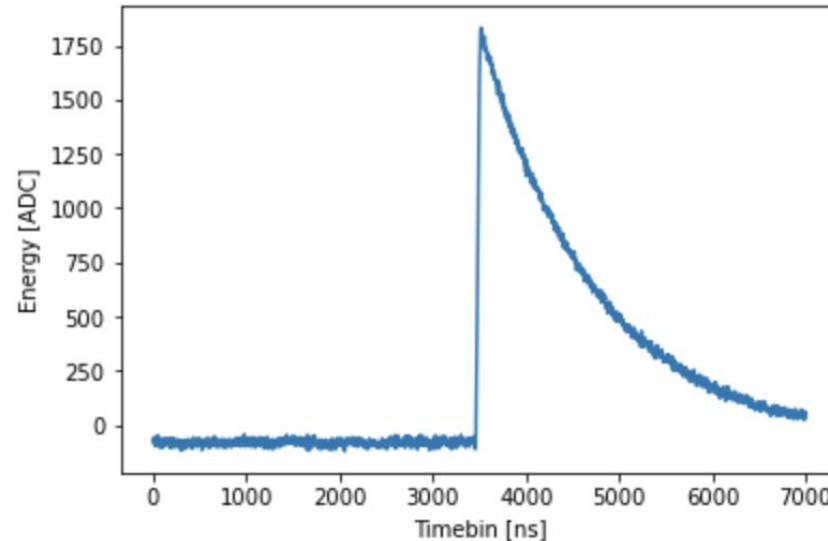
Nab Electronics

- Stability
 - Too many preamps plugged in leads to system oscillations
 - Preamps too cold leads to oscillations
 - Damage can lead to loss of pixel or instability

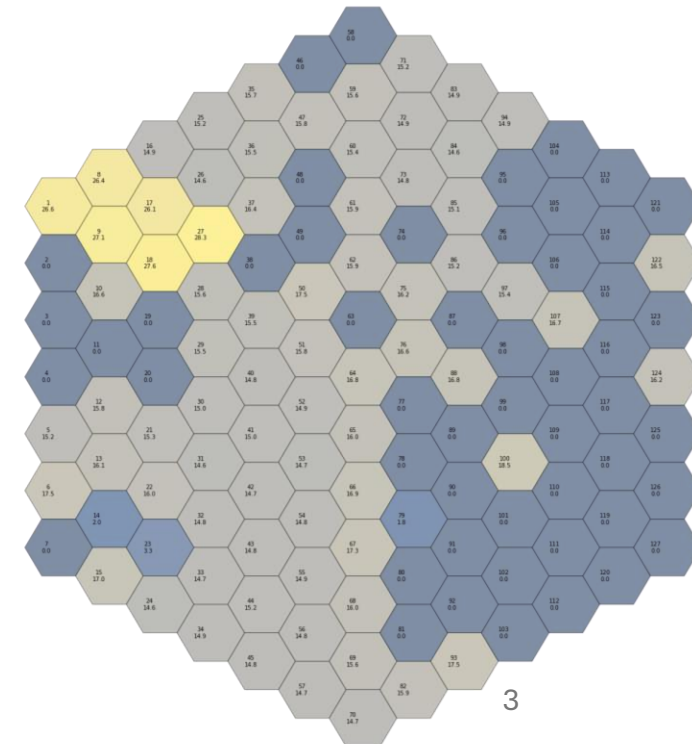
Oscillating Preamps Waveform



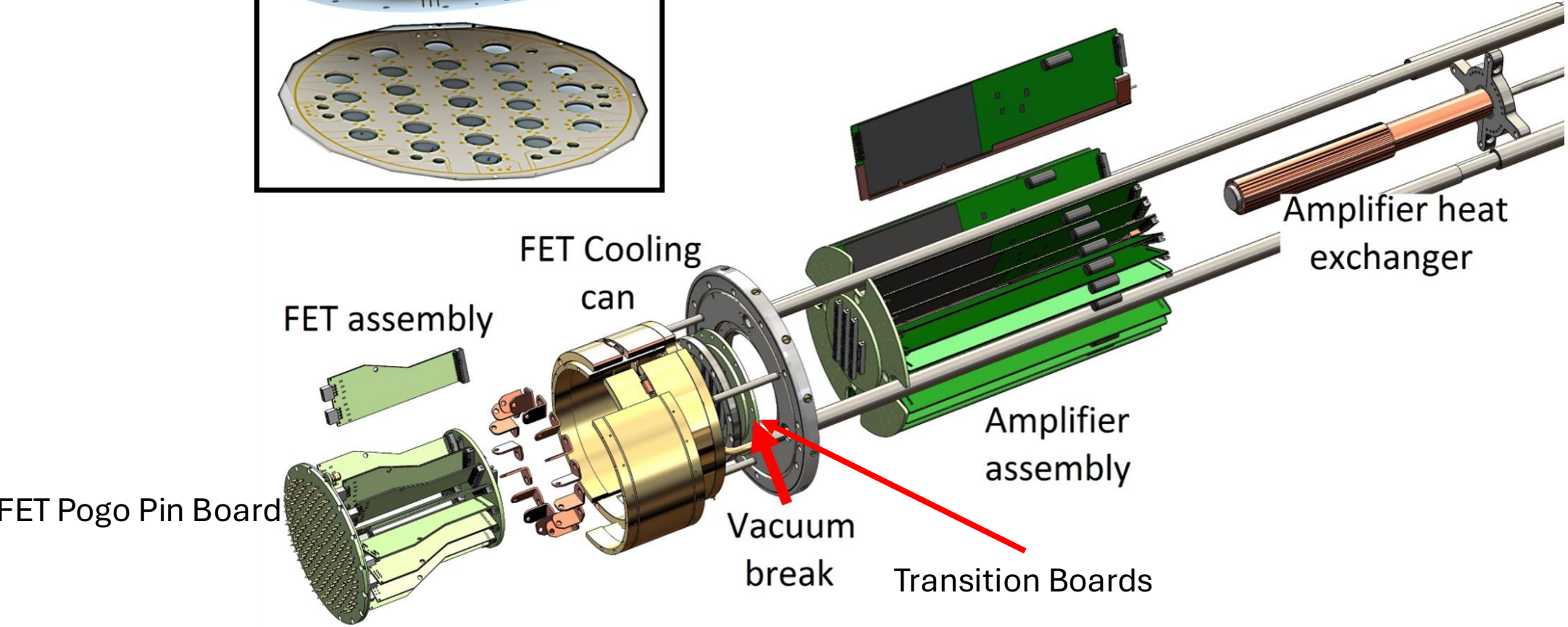
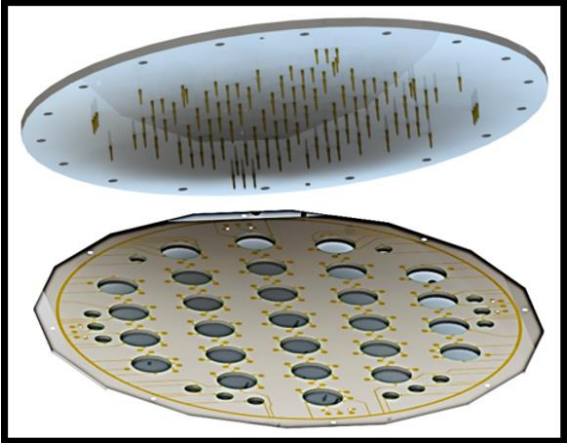
Electron Waveform



Upper Detector Pixel
Gain Summer 2023

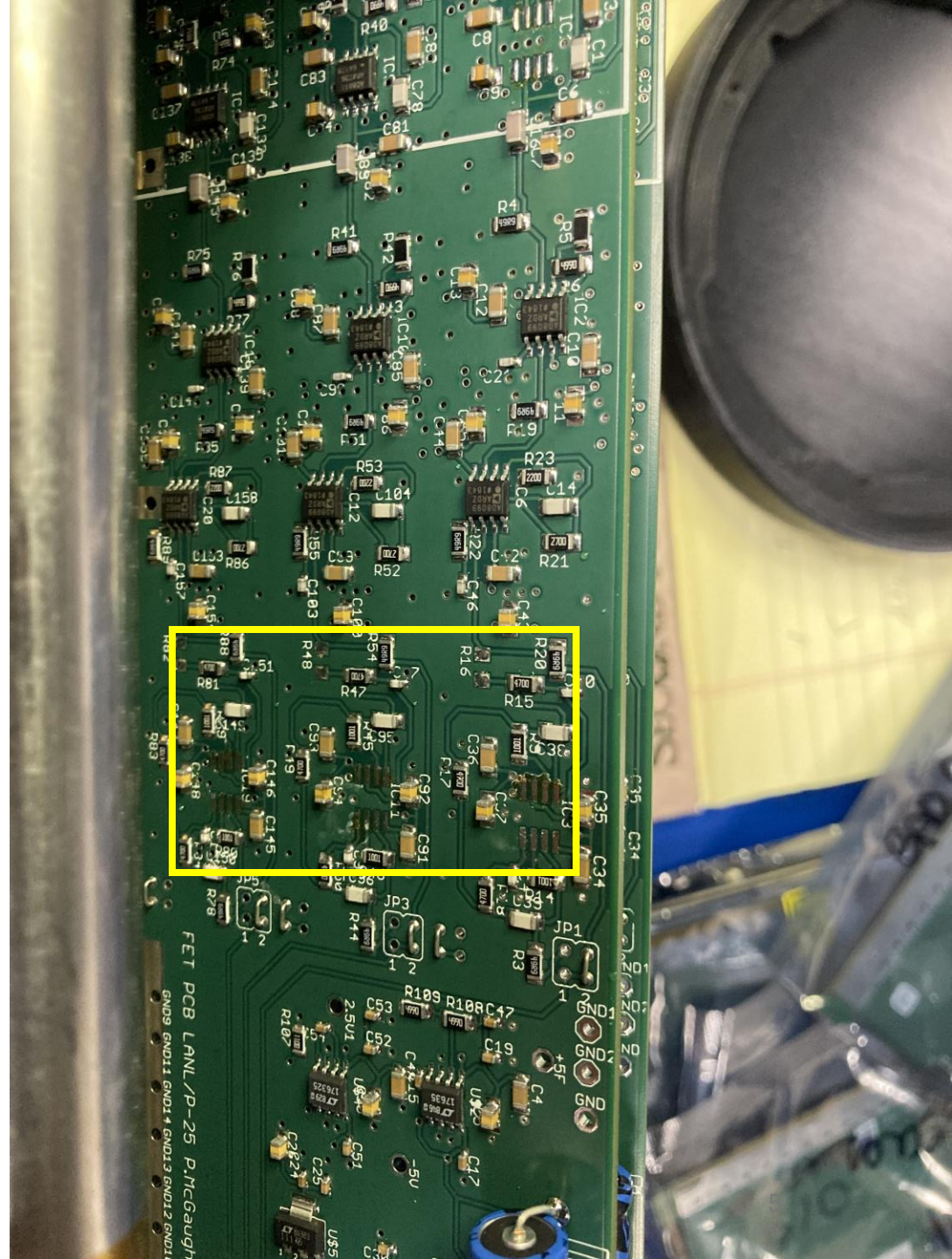


Nab Electronics



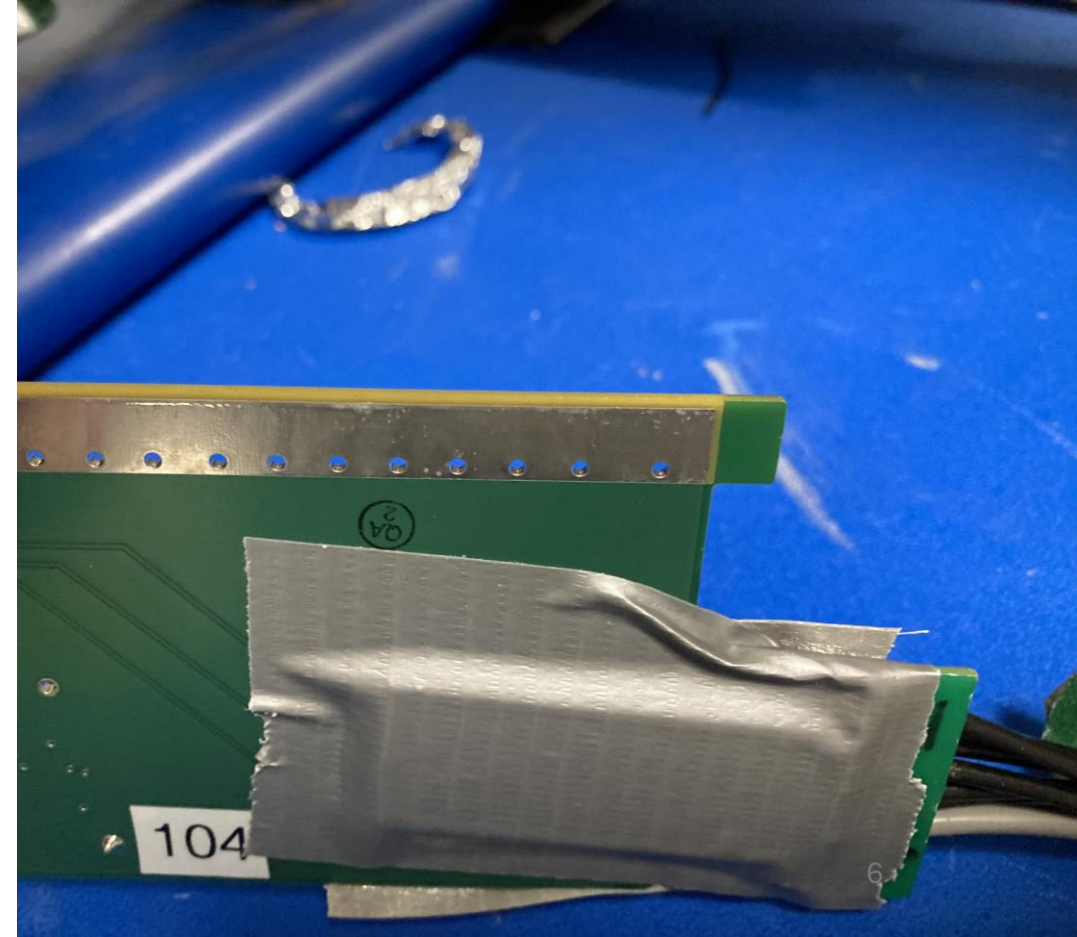
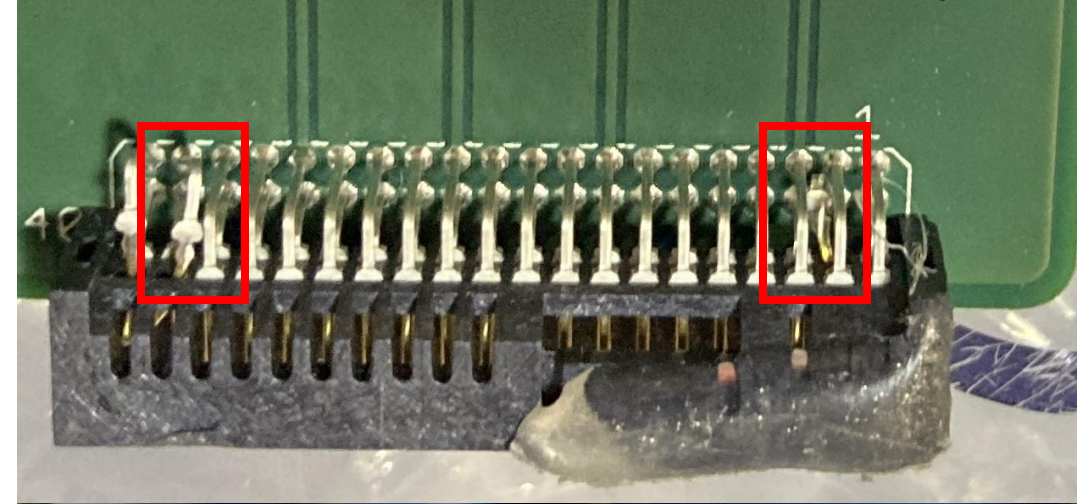
Shaper Circuit Removed

- Shaper Circuit Removed
 - Not in currently used
 - Preamplifier board power draw reduced by 1/3
 - Before
 - +7V : 295 mA
 - -7V : 271 mA
 - After
 - +7V : 211 mA
 - -7V : 186 mA
 - Stability Test
 - All preamps powered, system did not oscillate on bench for 2 hours

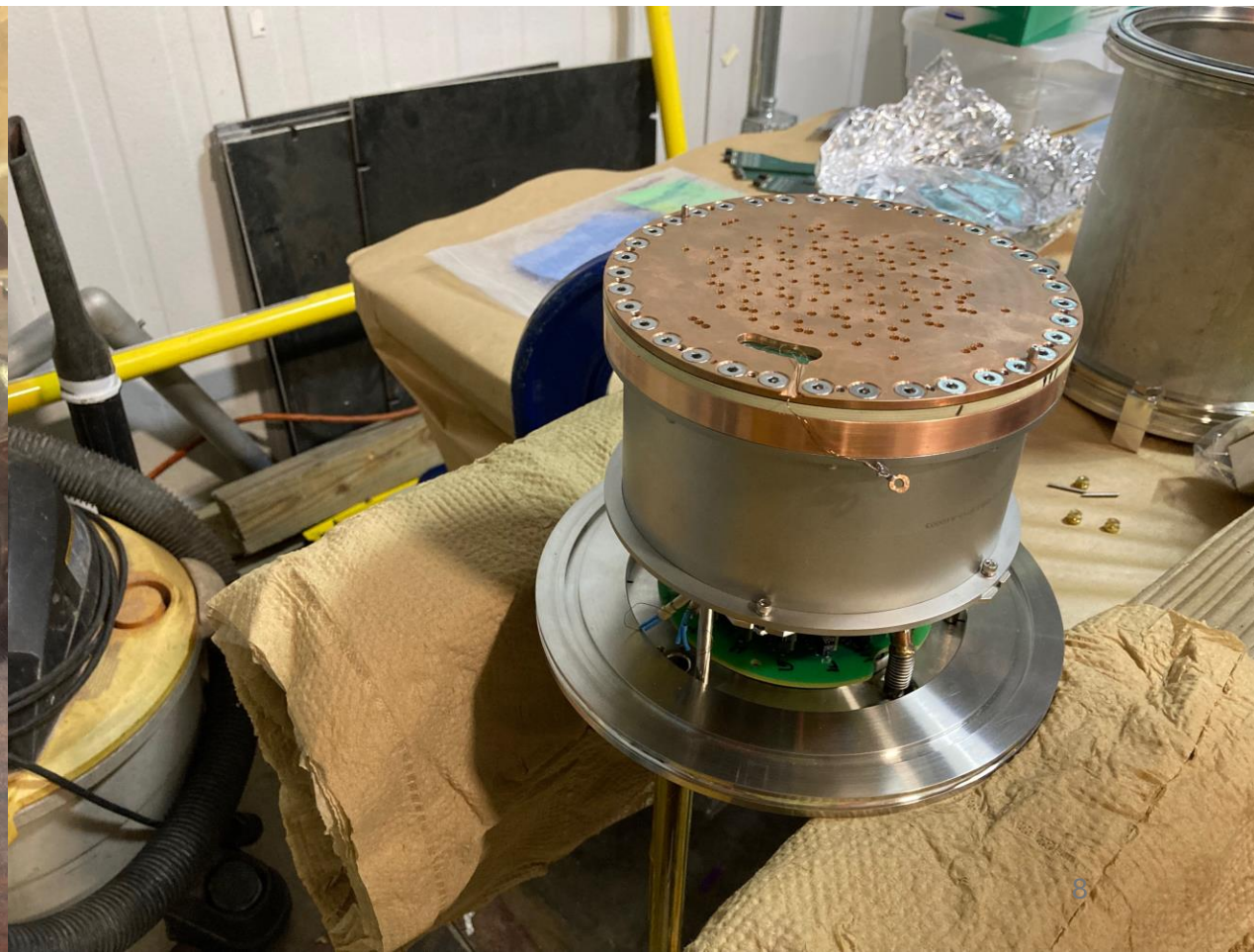
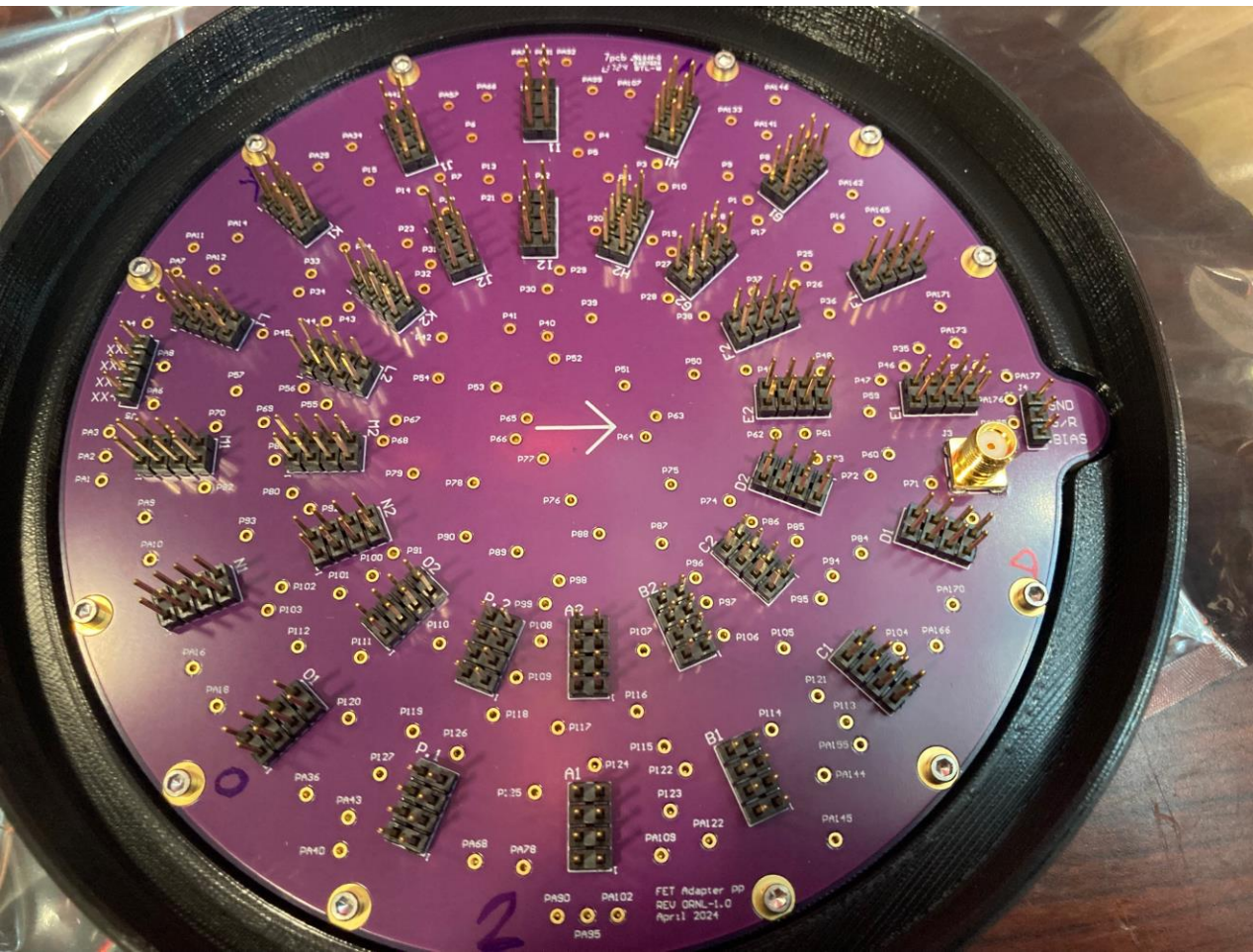


Connector Issues

- Connector Damage
 - Movement of Pins
 - Touching other Pins, not Pushed in
 - Connectors disengage easily
 - Tabs taped to connectors, holding them together
 - Repair Difficulty
 - No thermals on ground pins makes replacement effectively impossible

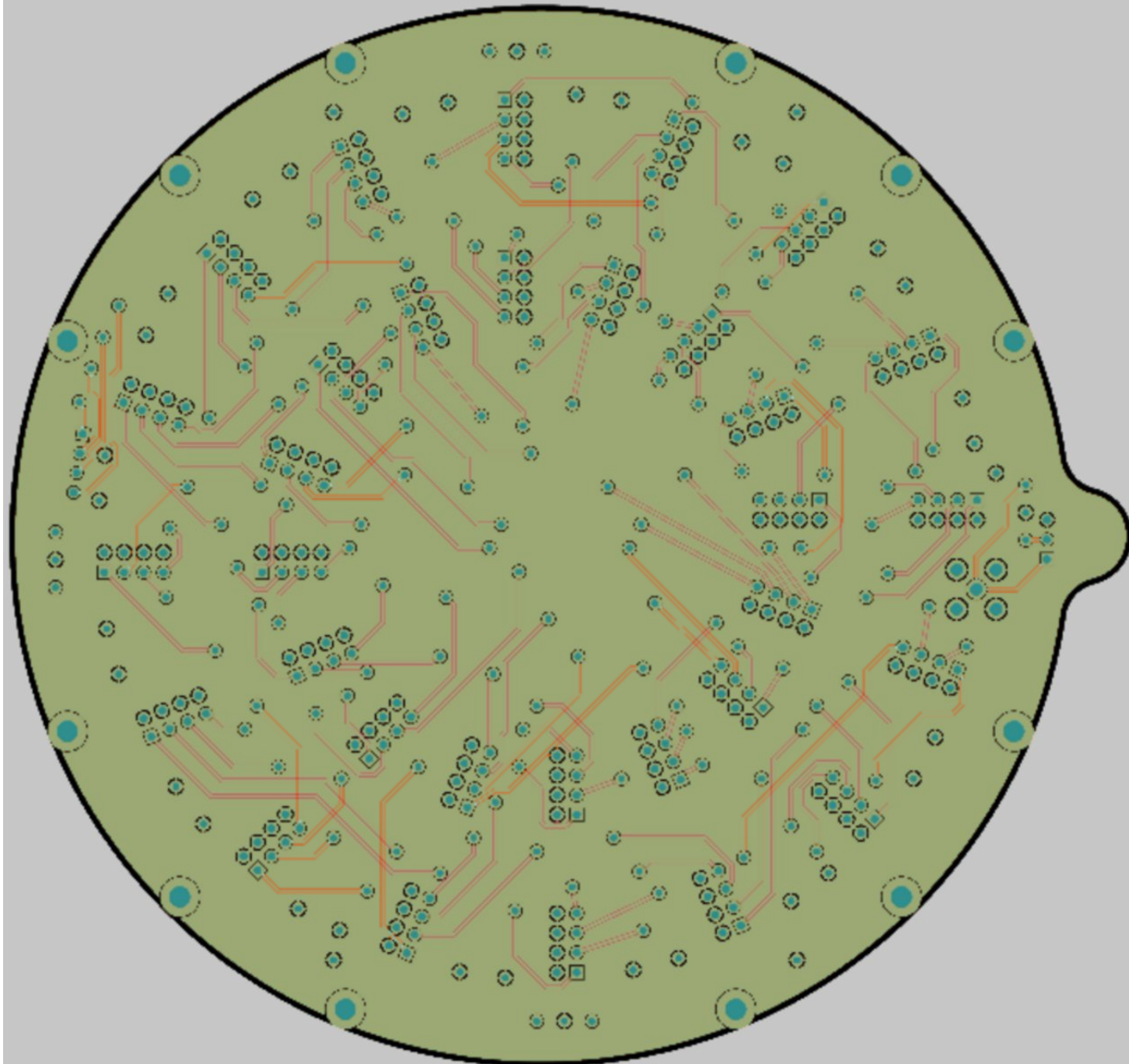


Cold Tests of New FET Pogo Pin Board



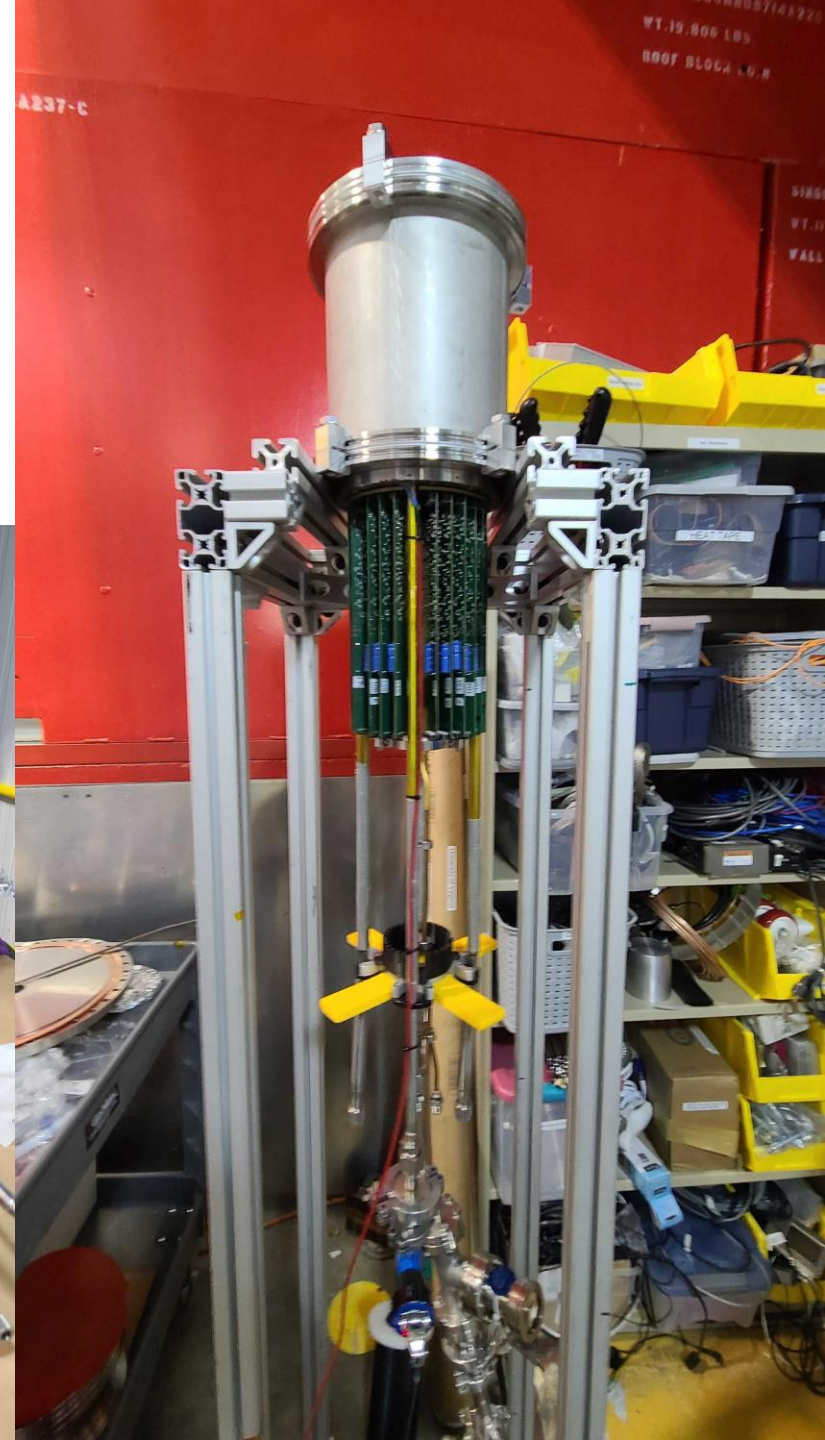
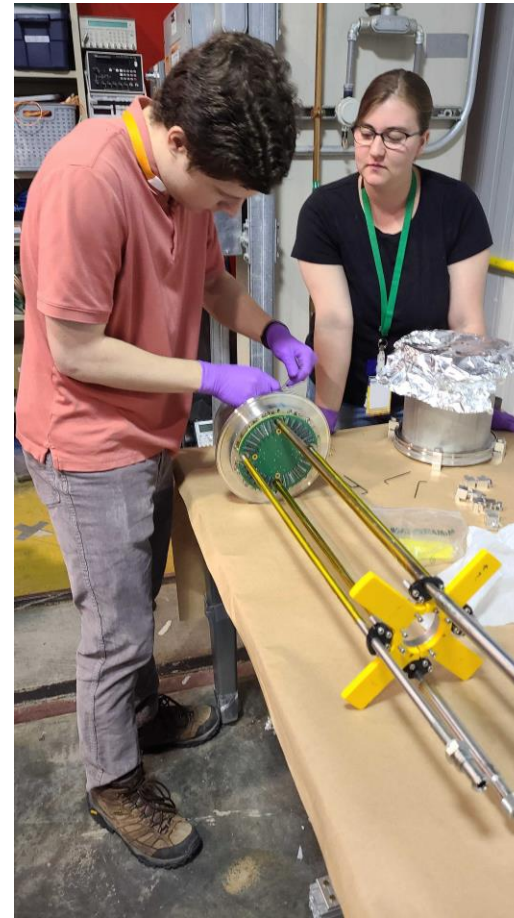
FET Pogo Pin Board Cross Talk Bench Test

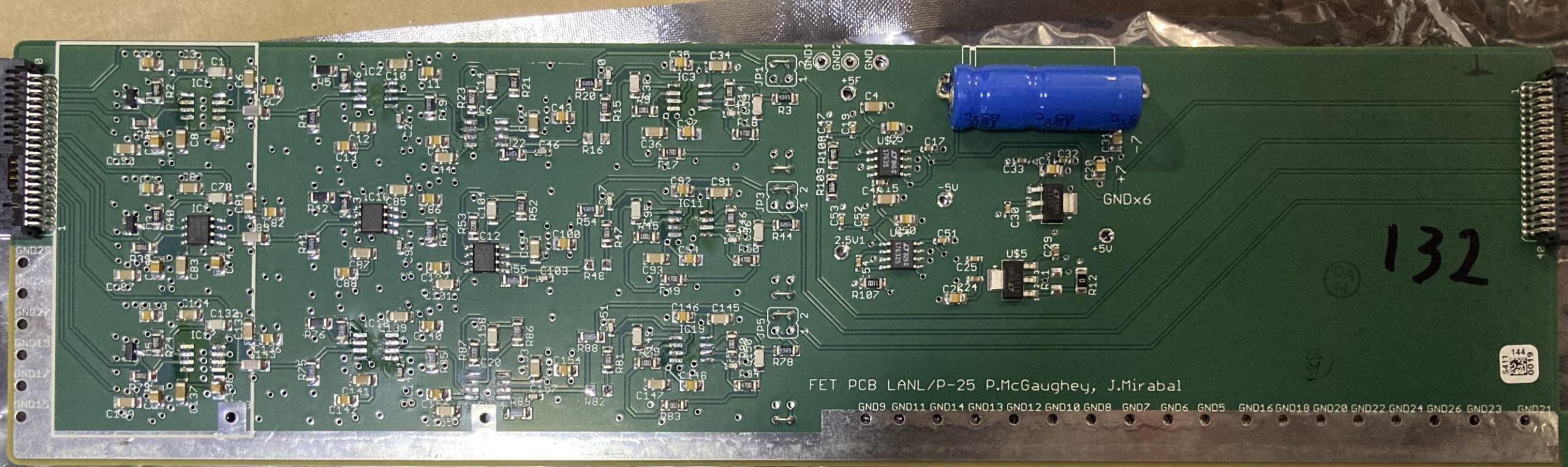
- Tested Overlapping Traces looking for crosstalk
 - 1 V output signal saw less than 10 mV crosstalk



Mini Chamber

- Tests of Electronics Changes
- Testing for new Lower Detector
- Testing of New Transition Boards

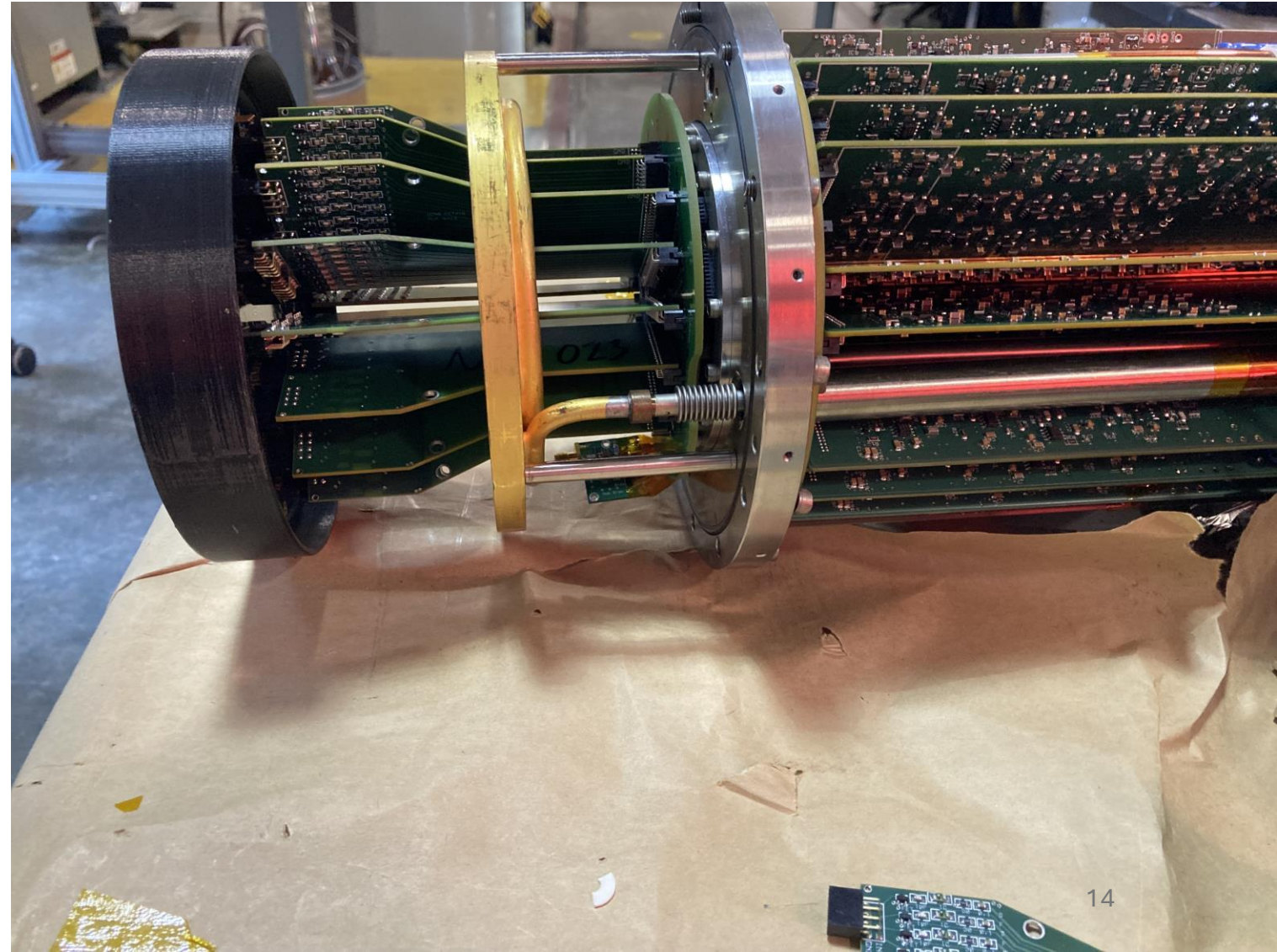




Electronics Modification Stability Test

FET Card Removal Bench Test

- Removed four FET cards (32 channels) from Electronics system to test stability



Removed Channels

- Modified Preamps:
 - A,B,D,G,I,J,L,M,P,R,T
 - 25 Channels removed
- Power up Test
 - Current Draws

Preamp	A	B	D	G	I	J	L	M	P	R	T
+7 (mA)	149	150	147	118	146	200	145	118	145	118	147
-7 (mA)	120	220	120	90	118	120	118	89	125	88	119
+12 (mA)	76	76	71	79	77	76	77	77	76	77	72
Ch. removed	2	2	2	3	2	2	2	3	2	3	2

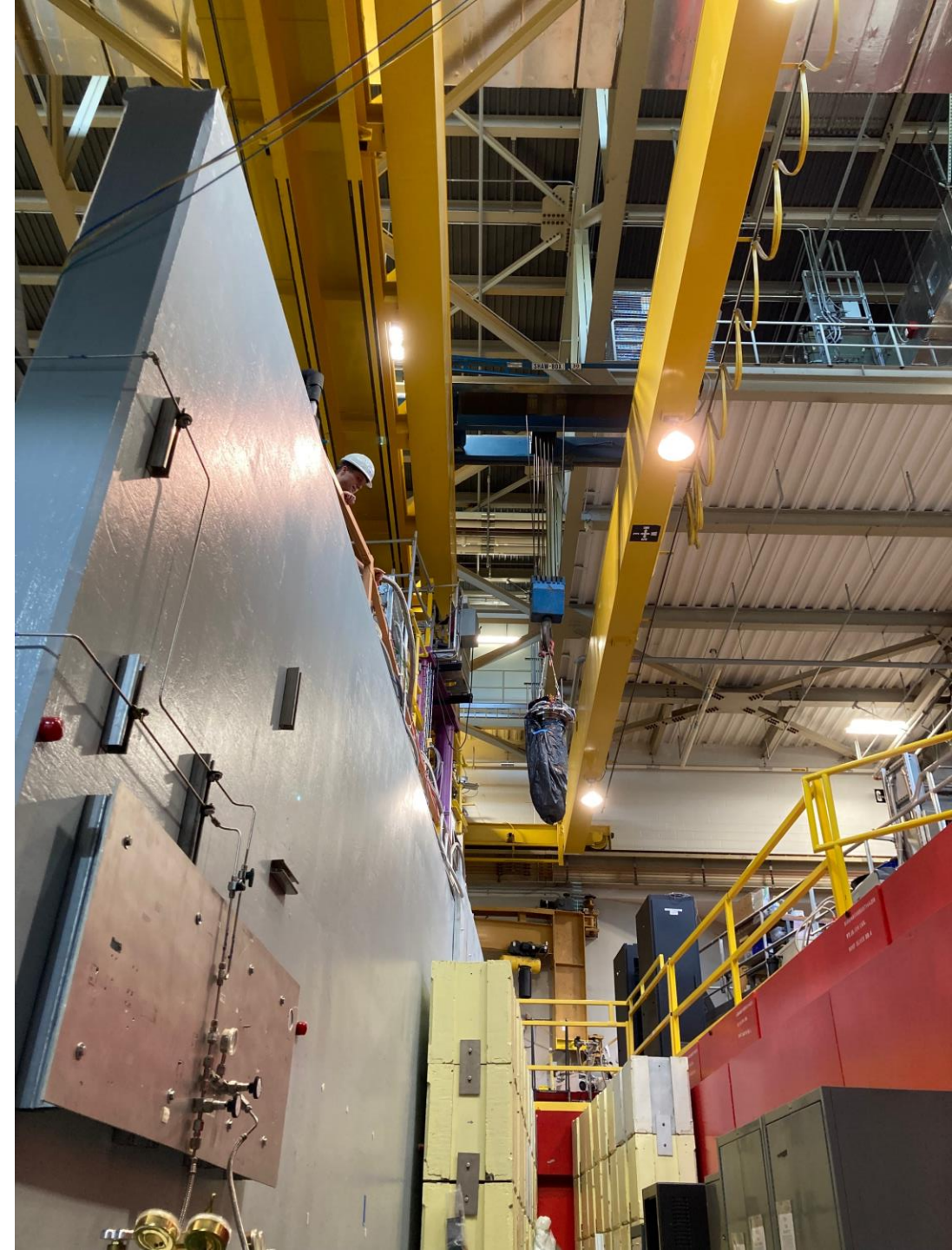
Test Results

- FET removal test:
 - System oscillated 4 times in 90 minutes
- Op-Amp removal test:
 - System oscillated once in 24 hours
- Bench Test,
 - No Detector
 - FETs not cooled



Future Work

- Tests of new transition boards
 - Continuity test
 - Vacuum Test
- Cold test 2nd new FET pogo pin
- Cold Test of manual outer pixel removal
- Install modifications for use in the upcoming beam cycle



The Nab Collaboration



NC STATE UNIVERSITY



Main project funding:

