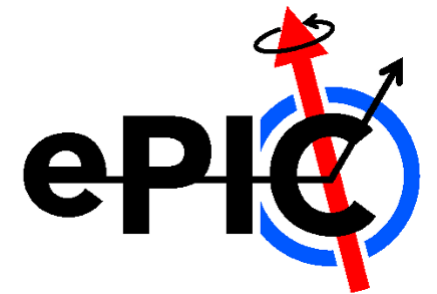


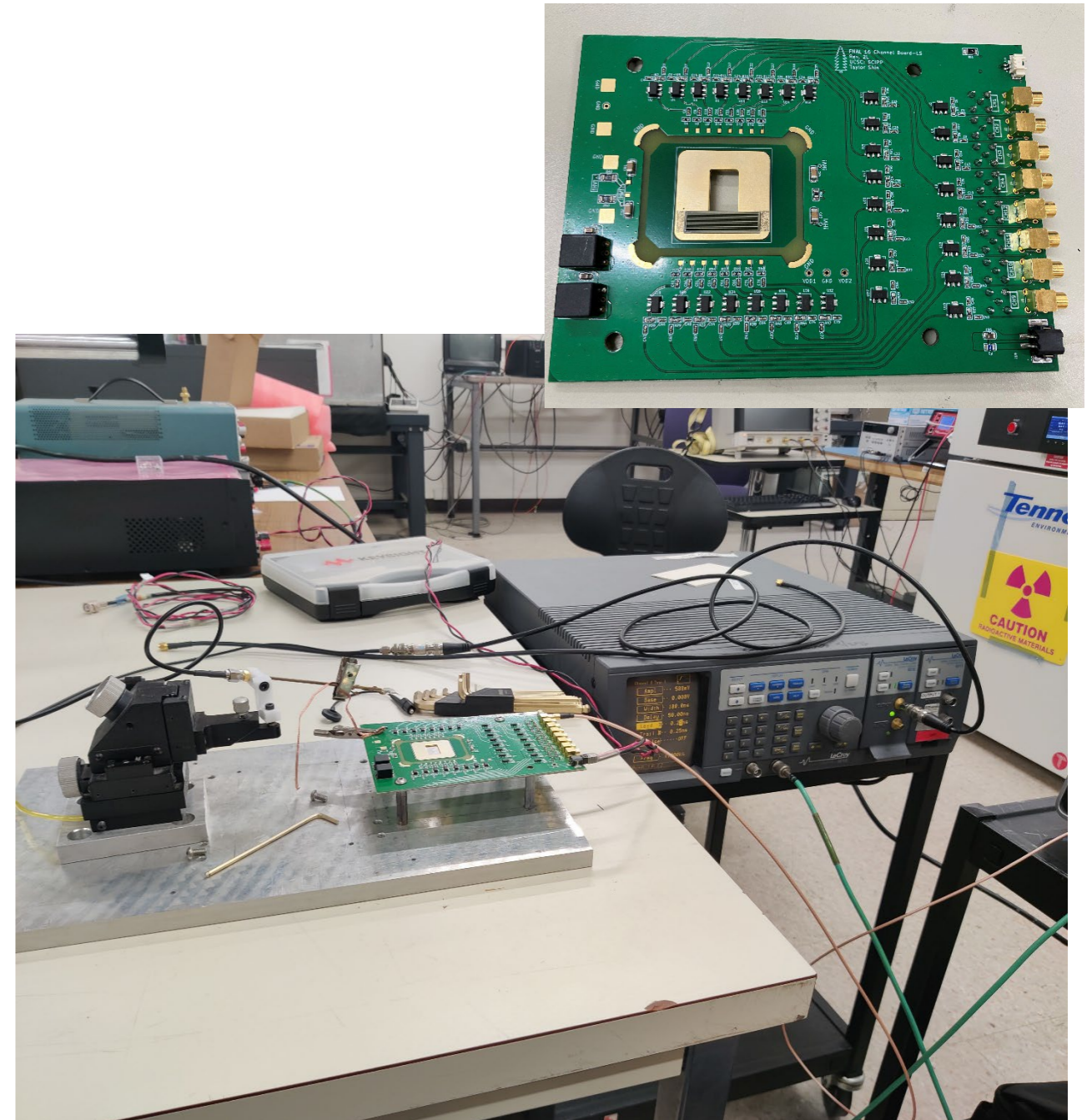
ePIC full prototype boards

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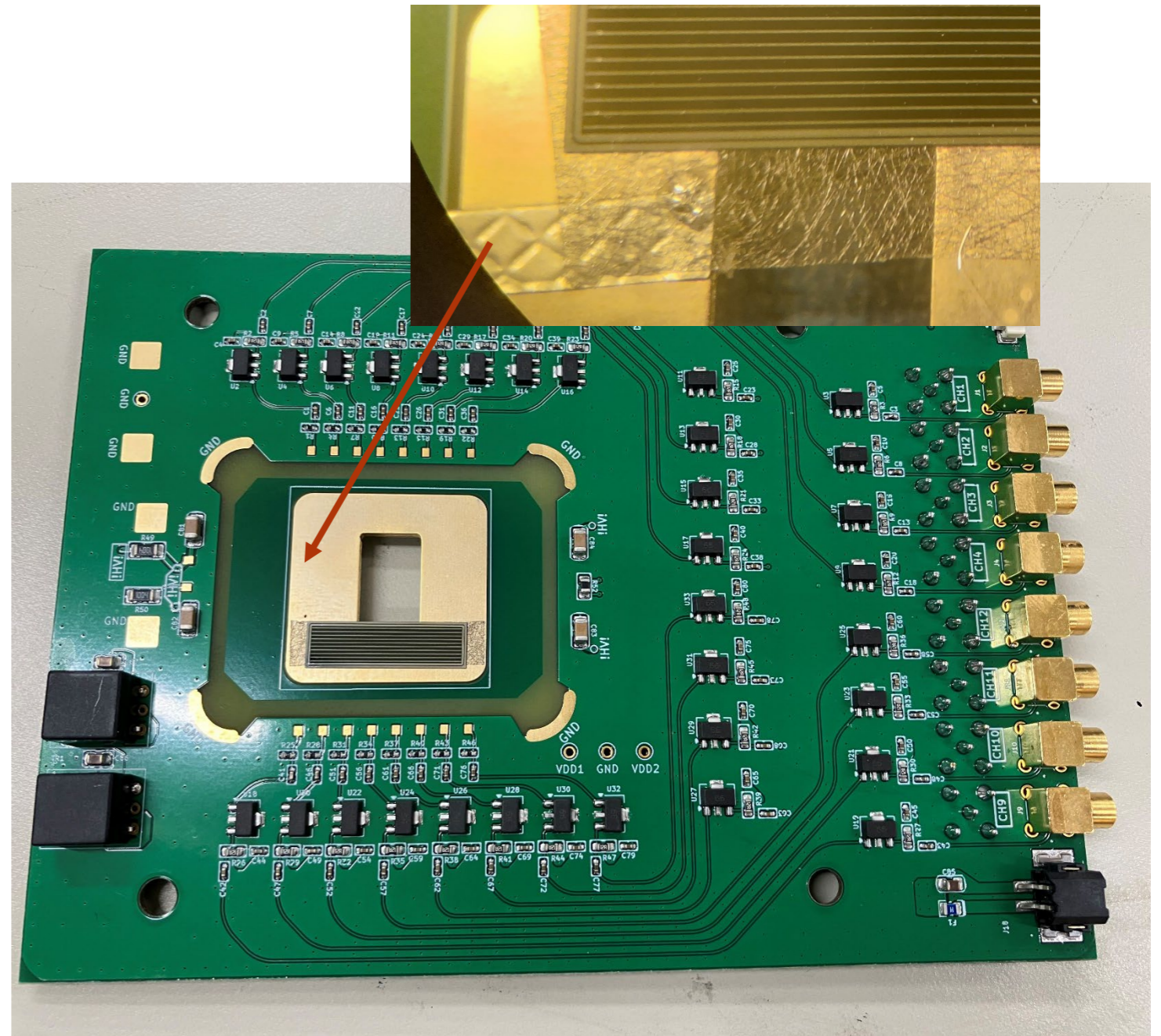
ePIC new boards

- New 16 channel board arrived
- Based off FNAL 16ch boards
 - Two stage Gali-66
- Increased sensor mount pad for new large HPK prototypes
- 4 boards received, 10 more awaiting assembly
- Tested RMS of all channels
- Tested all channels with needle pulse injection
- One sensor mounted (still to be tested)



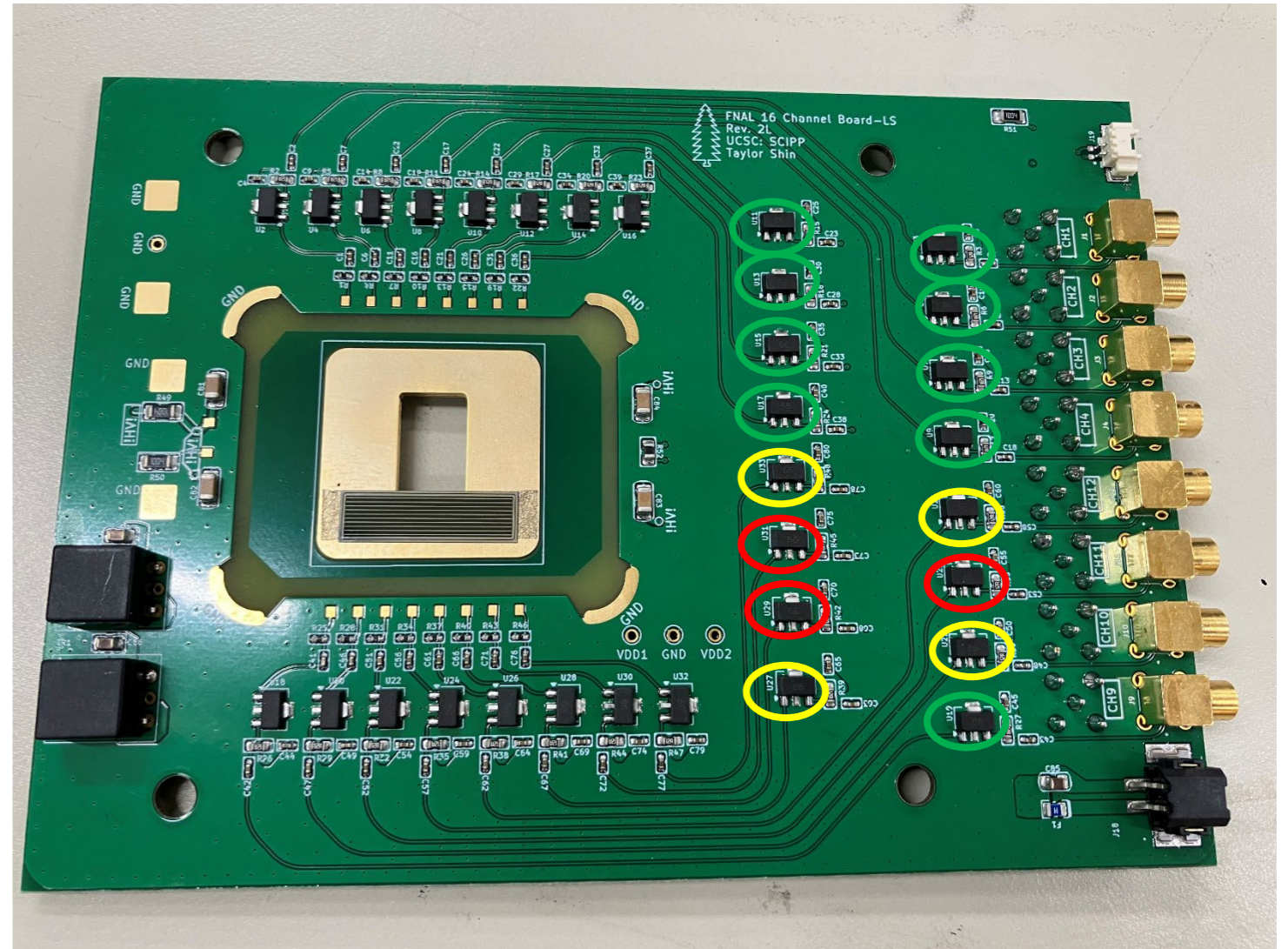
Issues

- HV pad is not fully metalized
 - Not a huge issue, sensors can still be biased
- HV pad NOT connected to high voltage
 - Need external connection (wire bond or soldered connection)
 - Might be an issue once we mount large prototypes
- HV with large hole (not in the design)
 - Not an issue with larger devices, might be an issue with current prototypes
- Not sure if this was a design flaw or design history and communication issues



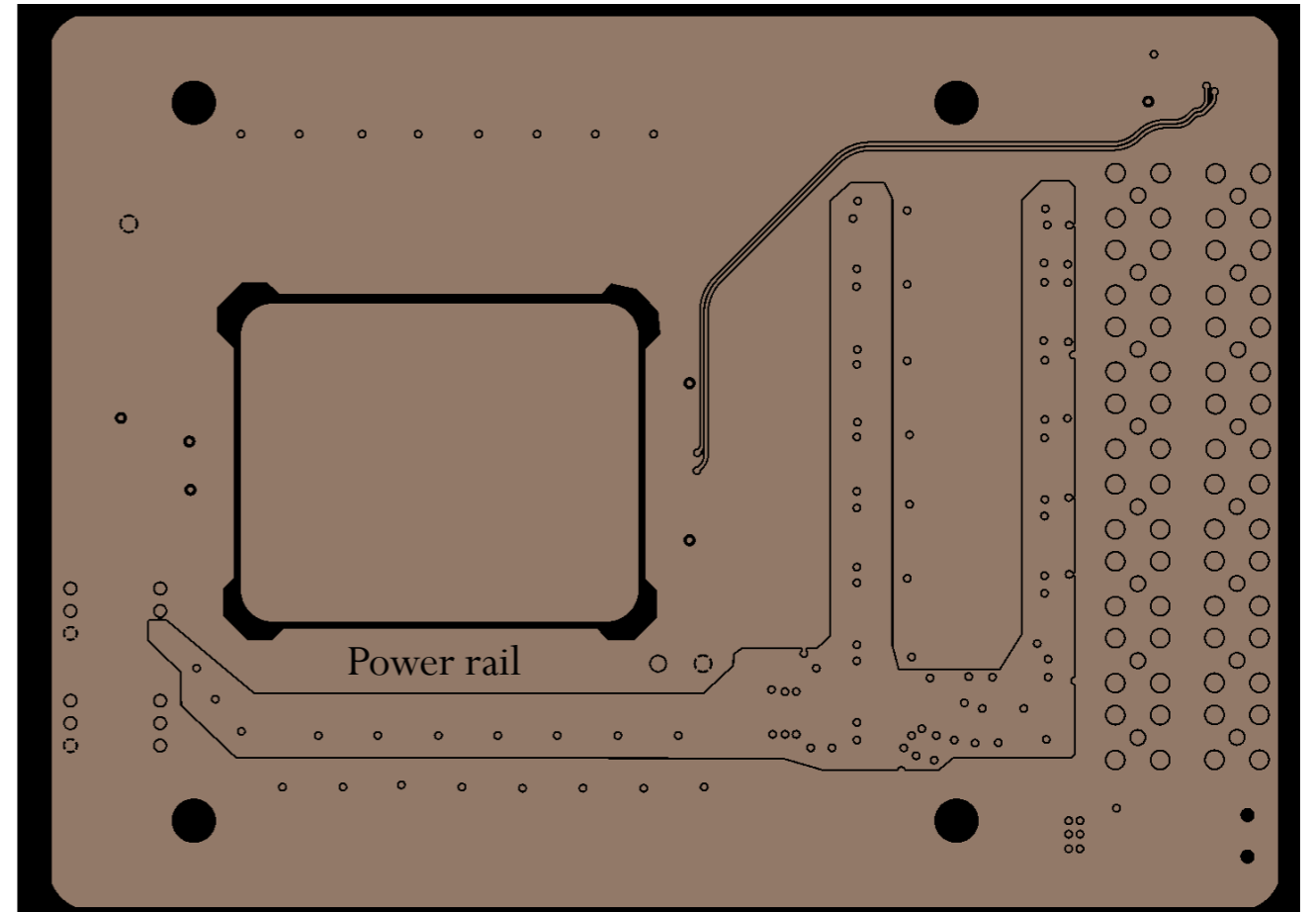
Issues

- First stage amplifier work properly and show correct input bias V
- Biggest issues are the preamplifier, in particular some second stages
 - The amplifiers in red always show very large (100s mV) GHz oscillations, making them unusable
 - They have a reduced input bias V
 - This induce bad cross-talk also in the yellow amplifiers
- All 4 boards tested have issues on the same three amplifiers
 - Tried to replace the amplifiers and the issue is still there
 - **If the red amplifiers are removed the rest of the board works correctly**



Cause?

- It's a puzzle why 3 second stage amplifiers show a reduced input voltage that probably cause the oscillations
 - The power rail is the same for all second stage amplifiers
- All the rest of the channels show normal behavior and RMS noise
- There might be design or production issues with signal lines between 1st and 2nd stage amplifiers for these three amplifiers
 - At first look it doesn't seem to be an issue in the design, maybe a defect on the mask for the production



Options

- Top 8 channels of the board work fine + other 4-5 channels at the bottom. The board is partly working OK
 - **Will test with an HPK sensor this week to verify performance**
- **Option 1:** accept these boards but tell them not to load the faulty amplifiers, we'll receive them ~1 month and they'll work as 12 channel boards. Redo new improved boards with FY25 funds.
 - Pro: receive boards soon, no extra costs
 - Cons: only 12 channels, come other design flaws (external HV connection needed)
- **Option 2:** we spend time to find what is the design/production flaw, tell them to hold off on the loading and keep parts (parts and loading is the most expensive part). Re-do the PCB production and load those.
 - Pro: fix small design issue, full 16ch boards.
 - Cons: Unknown delay (need to find issue first + 1 month PCB production), need funds (1-2000\$).
- Preferences?

Raw data

Board 1

| Board # | Channel # | Amplifier 1 Input (V) | Amplifier 1 Output (V) | Amplifier 2 Input (V) | Amplifier 2 Output (V) | Rms (mV) |
|---------|-----------|-----------------------|------------------------|-----------------------|------------------------|-------------|
| 1 | 1 | 2.6 | 3.5 | 2.6 | 3.5 | 1.5 |
| | 2 | 2.6 | 3.5 | 2.6 | 3.5 | 1.5 |
| | 3 | 2.6 | 3.5 | 2.6 | 3.5 | 1.5 |
| | 4 | 2.6 | 3.5 | 2.6 | 3.5 | 1.5 |
| | 5 | 2.6 | 3.5 | 2.6 | 3.5 | 1.5 |
| | 6 | 2.6 | 3.5 | 2.6 | 3.5 | 1.5 |
| | 7 | 2.6 | 3.5 | 2.6 | 3.5 | 1.5 |
| | 8 | 2.6 | 3.5 | 2.6 | 3.5 | 1.6 |
| | 9 | 2.56 | 3.4 | 2.4 | 3.2 | 1.8 |
| | 10 | 2.6 | 3.5 | 2.57 | 3.4 | 1.3 |
| | 11 | 2.6 | 3.5 | | | 500 μ V |
| | 12 | 2.6 | 3.5 | 2.6 | 3.5 | 1.6 |
| | 13 | 2.6 | 3.5 | 2.6 | 3.5 | 1.6 |
| | 14 | 2.6 | 3.5 | | | 500 μ V |
| | 15 | 2.4 | 3.2 | | | 500 μ V |
| | 16 | 2.6 | 3.5 | 2.47 | 3.3 | 1.3 |

Board 2

| Board # | Channel # | Amplifier 1 Input (V) | Amplifier 1 Output (V) | Amplifier 2 Input (V) | Amplifier 2 Output (V) | Rms (mV) | |
|---------|-----------|-----------------------|------------------------|-----------------------|------------------------|----------|-------------|
| | 2 | 1 | 2.6 | 3.5 | 2.6 | 3.5 | 1.6 |
| | | 2 | 2.6 | 3.5 | 2.6 | 3.5 | 1.6 |
| | | 3 | 2.6 | 3.5 | 2.6 | 3.5 | 1.6 |
| | | 4 | 2.6 | 3.5 | 2.6 | 3.5 | 1.6 |
| | | 5 | 2.6 | 3.5 | 2.6 | 3.5 | 1.7 |
| | | 6 | 2.6 | 3.5 | 2.6 | 3.5 | 1.7 |
| | | 7 | 2.6 | 3.5 | 2.6 | 3.5 | 1.7 |
| | | 8 | 2.6 | 3.5 | 2.6 | 3.5 | 1.7 |
| | | 9 | 2.56 | 3.4 | 2.5 | 3.3 | 13 |
| | | 10 | 2.6 | 3.5 | 2.59 | 3.4 | 5 |
| | | 11 | 2.6 | 3.5 | | | 3 |
| | | 12 | 2.6 | 3.5 | 2.6 | 3.5 | 4 |
| | | 13 | 2.6 | 3.5 | 2.6 | 3.5 | 24 |
| | | 14 | 2.6 | 3.5 | | | 1 |
| | | 15 | 2.4 | 3.2 | | | 4 |
| | | 16 | 2.6 | 3.5 | 2.5 | 3.3 | 700 μ V |

Board 3

| Board # | Channel # | Amplifier 1 Input (V) | Amplifier 1 Output (V) | Amplifier 2 Input (V) | Amplifier 2 Output (V) | Rms (mV) |
|---------|-----------|-----------------------|------------------------|-----------------------|------------------------|----------|
| 3 | 1 | 2.6 | 3.45 | 2.6 | 3.45 | 1.7 |
| | 2 | 2.6 | 3.45 | 2.6 | 3.46 | 1.8 |
| | 3 | 2.6 | 3.45 | 2.6 | 3.45 | 4.5 |
| | 4 | 2.6 | 3.45 | 2.6 | 3.46 | 1.5 |
| | 5 | 2.6 | 3.45 | 2.6 | 3.46 | 1.6 |
| | 6 | 2.6 | 3.45 | 2.6 | 3.45 | 1.6 |
| | 7 | 2.6 | 3.45 | 2.6 | 3.45 | 1.5 |
| | 8 | 2.6 | 3.45 | 2.6 | 3.45 | 1.5 |
| | 9 | 2.56 | 3.4 | 2.46 | 3.23 | N/A |
| | 10 | 2.59 | 3.44 | 2.56 | 3.32 | N/A |
| | 11 | 2.6 | 3.45 | 2.57 | 3.36 | N/A |
| | 12 | 2.56 | 3.45 | 2.58 | 3.36 | N/A |
| | 13 | 2.56 | 3.45 | 2.57 | 3.41 | N/A |
| | 14 | 2.51 | 3.35 | 2.17 | 3.17 | N/A |
| | 15 | 2.52 | 3.35 | 2.29 | 3.11 | N/A |
| | 16 | 2.6 | 3.45 | 2.55 | 3.37 | N/A |