FEB2 Status Update

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on behalf of the LAr HL-LHC FEB2 group

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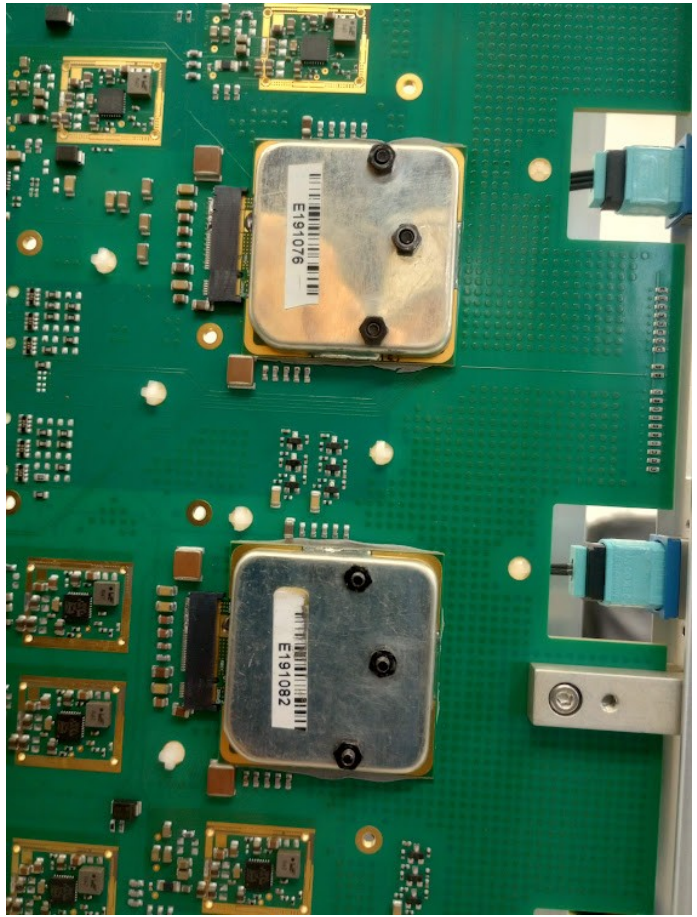
Overview

(Last update given by John on Nov 13th; see indico)

- Initial power and noise measurements with “new” Small Mezzanines
- Updates on FEC power bus issues
  - Measurements of AC filtering capacitors and GND-PGND connections
- Thermal images with “new” Small Mezzanines

New Small Mezzanines

- Small Mezzanines (SM) convert high voltage 48V input down to 12V using CERN bPOL48V chips
- Received 8 new SM tested by INFN Milano at Nevis on Nov 19th
- Installed on all 4 FEB2 v2.5 boards
  - So far, only thoroughly tested 1 v2.5 board



Power Measurements

- Initial power measurements on v2.5 show small increase in power draw of 0.5W without LSB2 attached

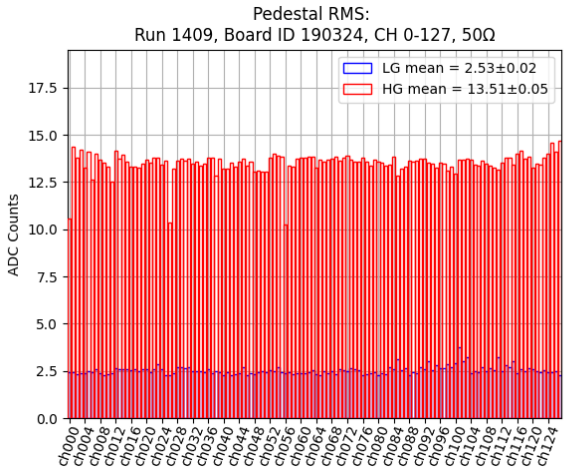
Board	PS power draw [W]
190324 + “old” SM + no LSB2	125.0
190324 + “new” SM + no LSB2	125.5

- “New” SM don’t have integrated heat sink
  - Need to investigate if increased 0.5W draw could be due to temperature differences
- Only thoroughly tested one v2.5, measurements across multiple boards still to come

Noise Performance

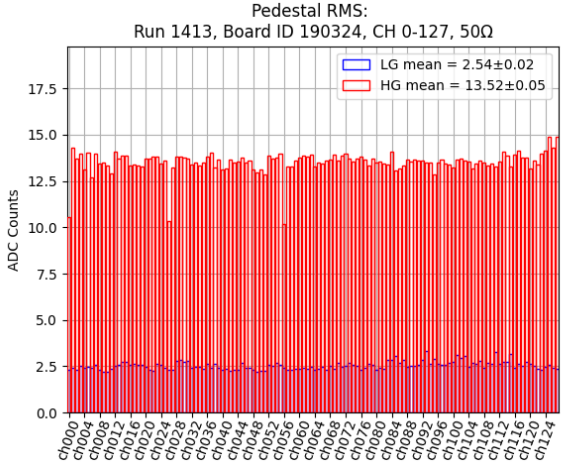
- Initial noise measurements show slightly increased noise
  - 14.7 counts with “old” SM vs 14.9 counts with “new” SM on channel 127
  - Most noticeable on channels closest to input power connector (right of graph)

Old Mezzanines



Run 1409

New Mezzanines

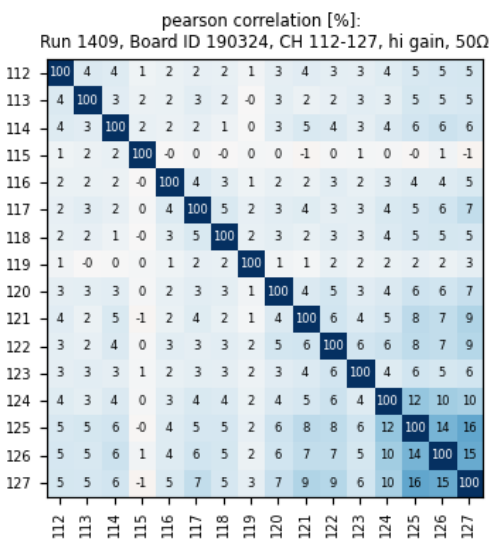


Run 1413

Noise Performance cont.

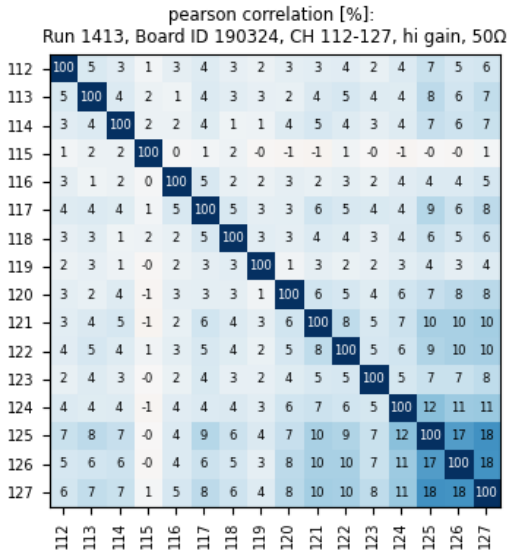
- Correlated noise near input connector, between channel 126 and channel 127, increases from 15% to 18%

Old Mezzanines



Run 1409

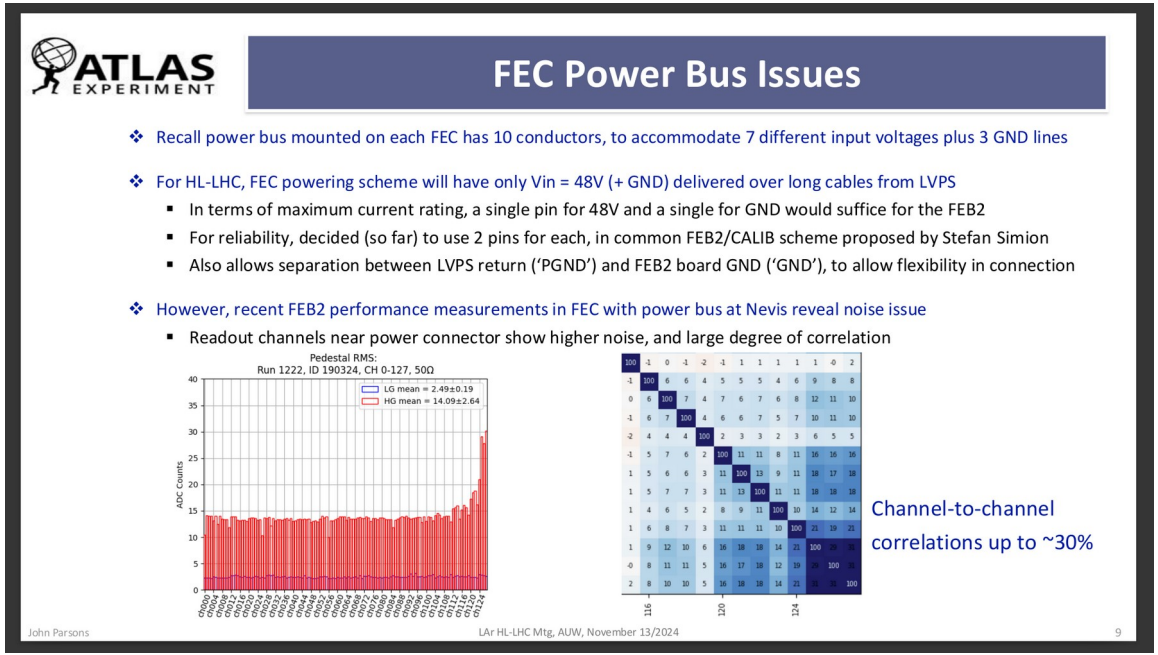
New Mezzanines



Run 1413

Power Bus Issues

- Performing tests to mitigate increased noise near input connector while using FEC power bus



See John's Nov 13th AUW talk for more details

AC Filtering

- Added 1nF capacitor on 48V and GND power bus bars for filtering
  - Significantly reduces noise near input power connector

Board	Configuration	Channel 126-127 Correlation [%]	Channel 127 High Gain RMS [Counts]
190324	“old” SM + No AC filtering	13.0	14.4
190324	“old” SM + 1nF cap added on 48V and PGND pins	8.0	14.0

Note: measurements done with “old” SM

- Tested various resistor and capacitor values with current setup showing best results
  - Further tests required to determine “optimal” value

GND-PGND Connections

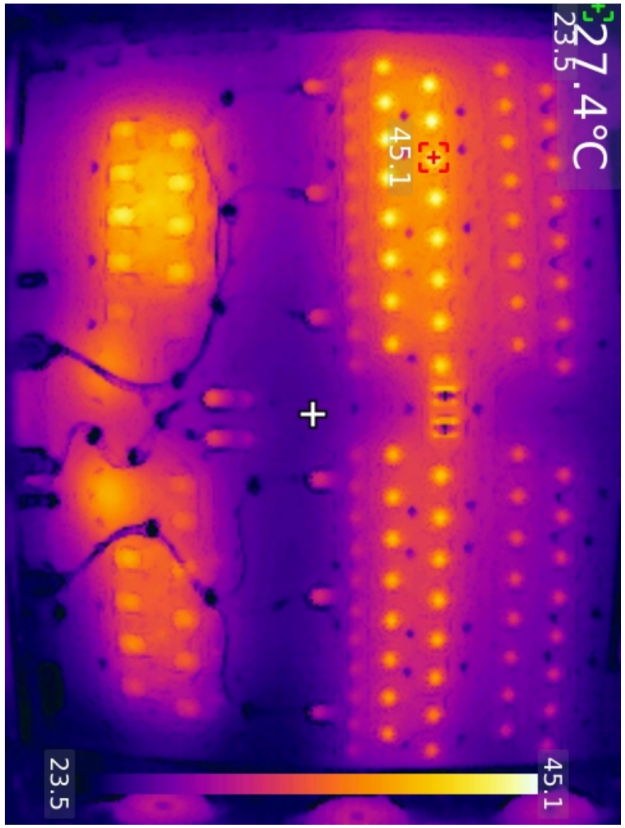
- Adding additional connection between GND and PGND significantly decreases noise
  - Tested two connections, including on-board PGND-GND connection and between PGND and GND on input power connector

Board	Configuration	Channel 126-127 Correlation [%]	Channel 127 High Gain RMS [Counts]
190324	AC Filtering + “new” SM	17.6	14.9
190324	AC Filtering + “new” SM + on-board connection	9.3	14.2
190324	AC Filtering + “new” SM + on-board connection + PGND-GND connection	7.4	14.0

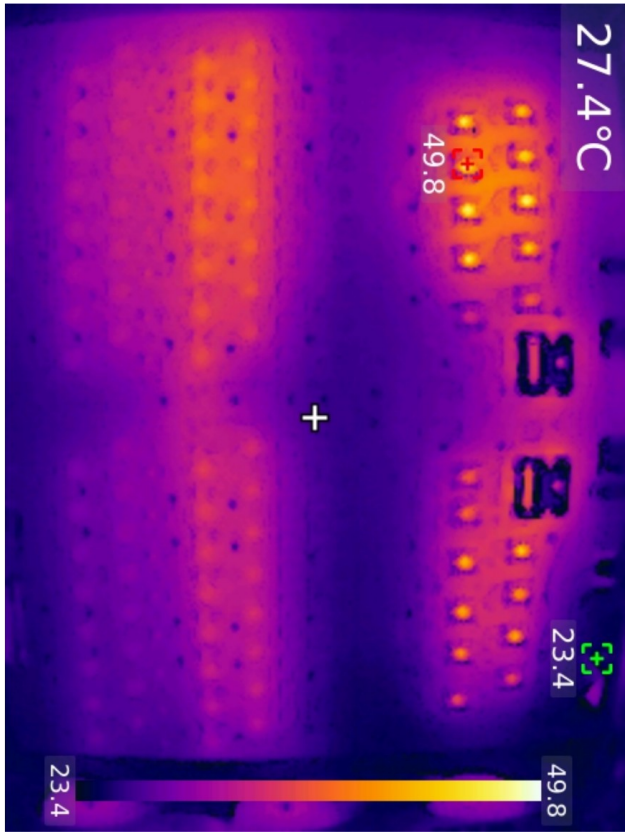
Thermal Images

Note: Air cooling from bottom of image

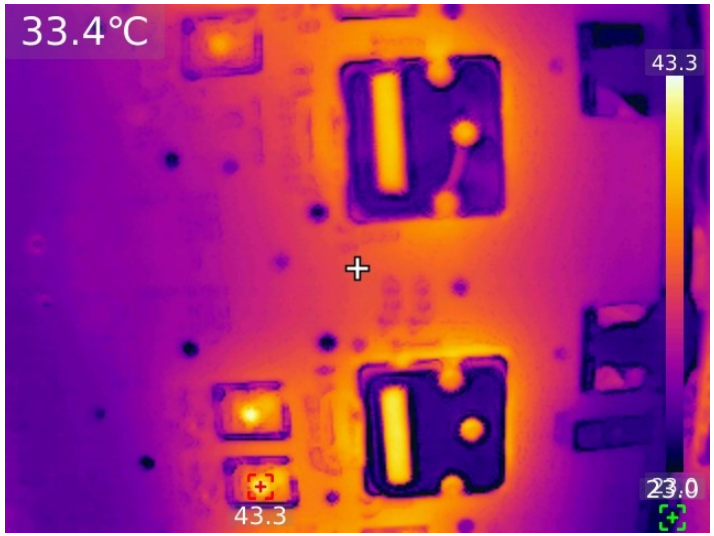
Top of FEB2



Bottom of FEB2



Close up of SM on back side of FEB2 v2.5

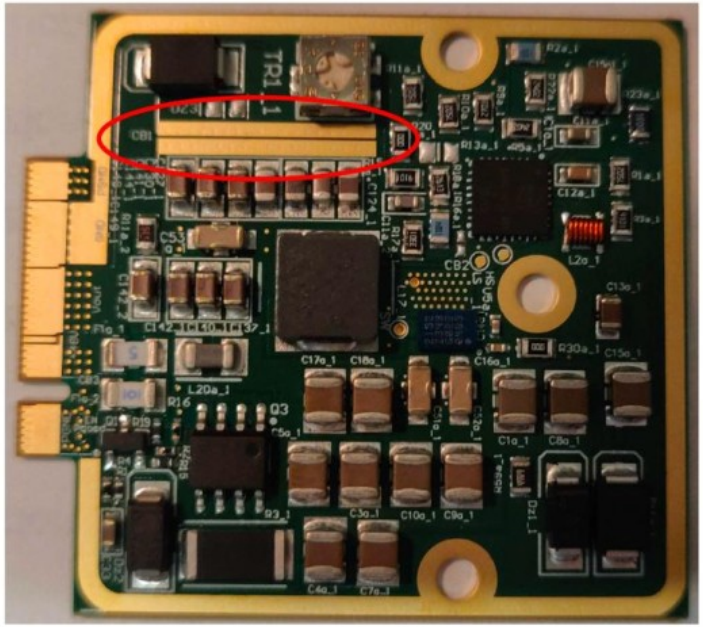


Conclusion

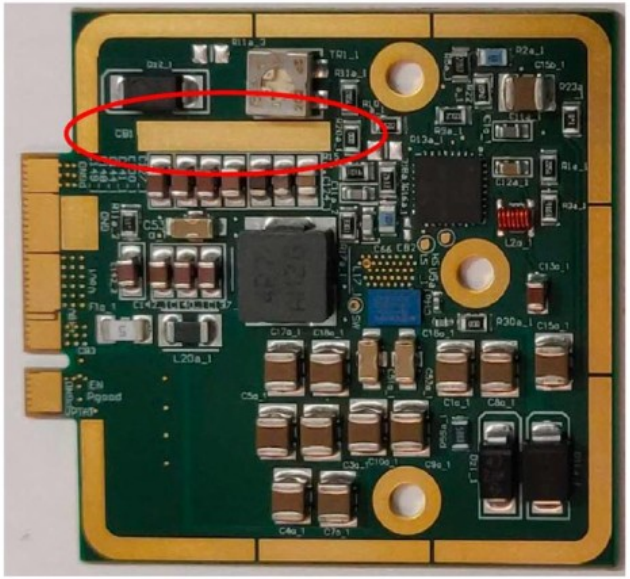
- Nevis received 8 “new” Small Mezzanines on Nov. 19th
  - Testing across all 4 v2.5 boards is underway. Aiming for more complete tests in time for upcoming LAr week
- New SM work on v2.5 FEB2, though initial measurements show slight increase in both power and noise
- Further testing is underway to reduce noise from FEC power bus near input connector
  - Addition of filtering capacitors and more connections between GND-PGND significantly reduce noise
- Proceeding with assembly of additional 6 v2.5 FEB2 boards, including 2 using HPS for HEC

Backup

SM Without Heat Spreader



Old SM



New SM