CRP6 BDE Updates

CRP Consortium Meeting 4/24/2024

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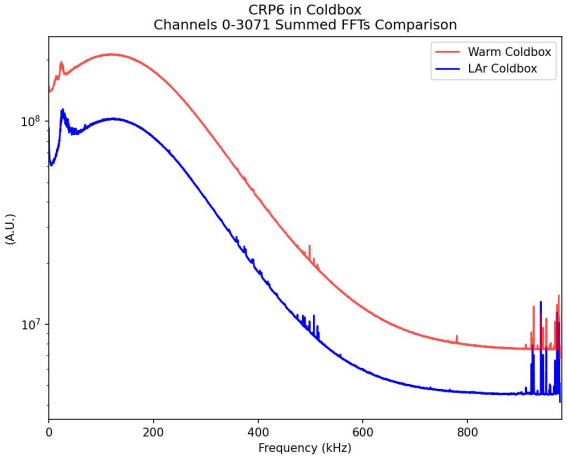
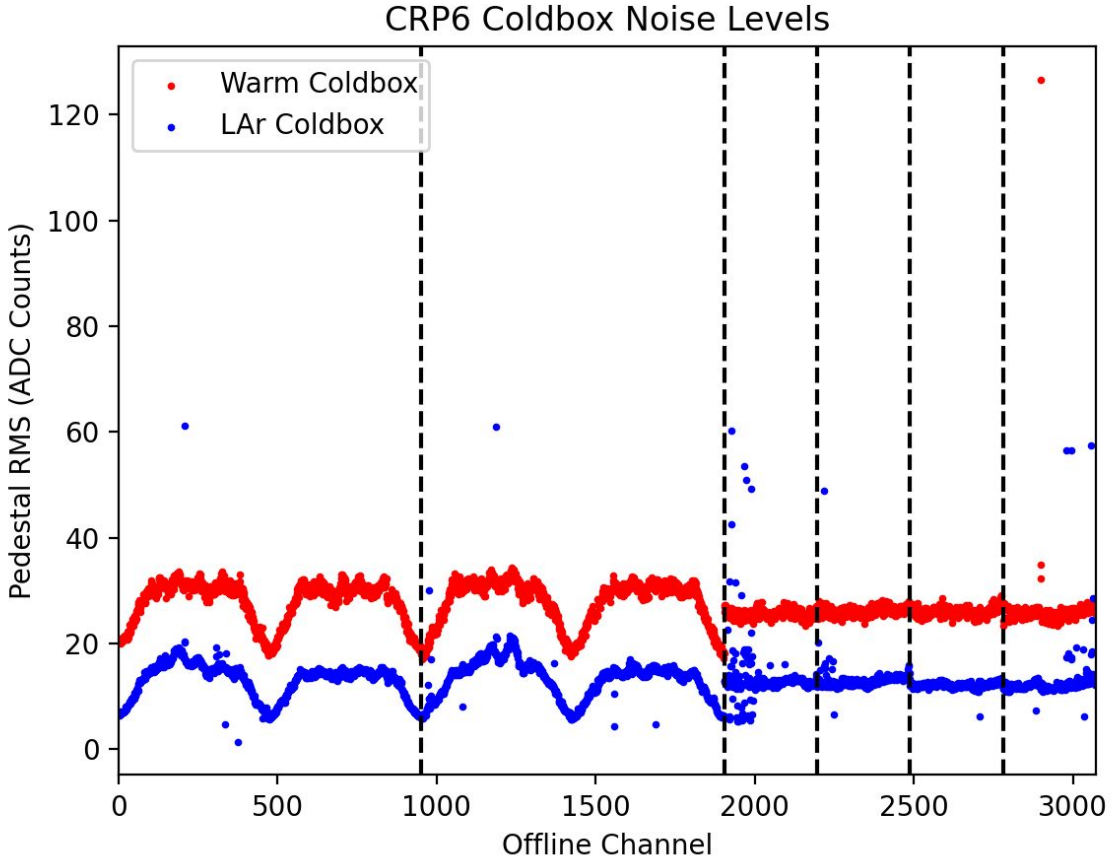
CRP6 BDE-related Changes

- Reminder: a second coldbox test of CRP6 was run in January, after CRP team restored the copper sheet grounding on both sides and added shield plates underneath the cables on B-side
  - Overall noise improved everywhere
  - Localized pickup on collection channels mostly went away on B-side, but remained on A-side, **suggesting shielding the power cables helped**
- Afterwards, CRP team made a number of additional improvements/changes:
  - A new ground plane on the A-side
  - Replacing one adapter board on A-side, where there had been many disconnected channels at cold
  - Replaced shield and 1st induction anodes on A-side
  - Soldered grounding braids on both sides

CRP6 Cooldown

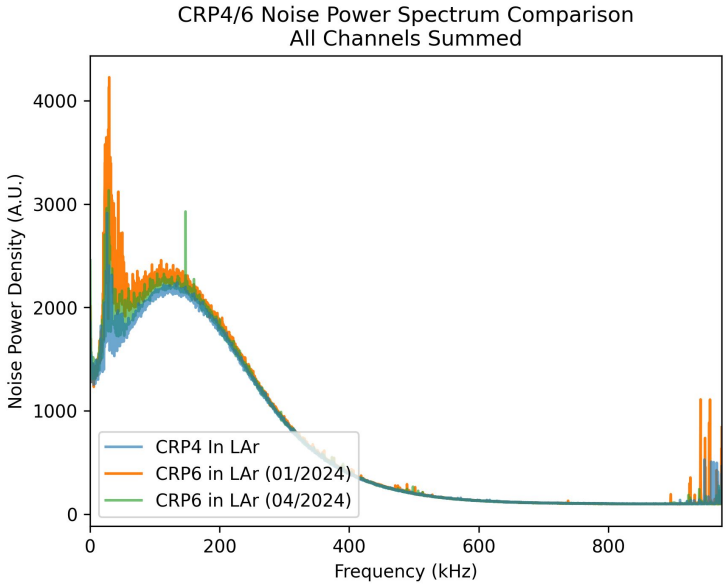
- CRP6 cooldown saw the loss of several channel connections, in particular in one corner of B-side X plane
  - Like last time, these started appearing while still in gas

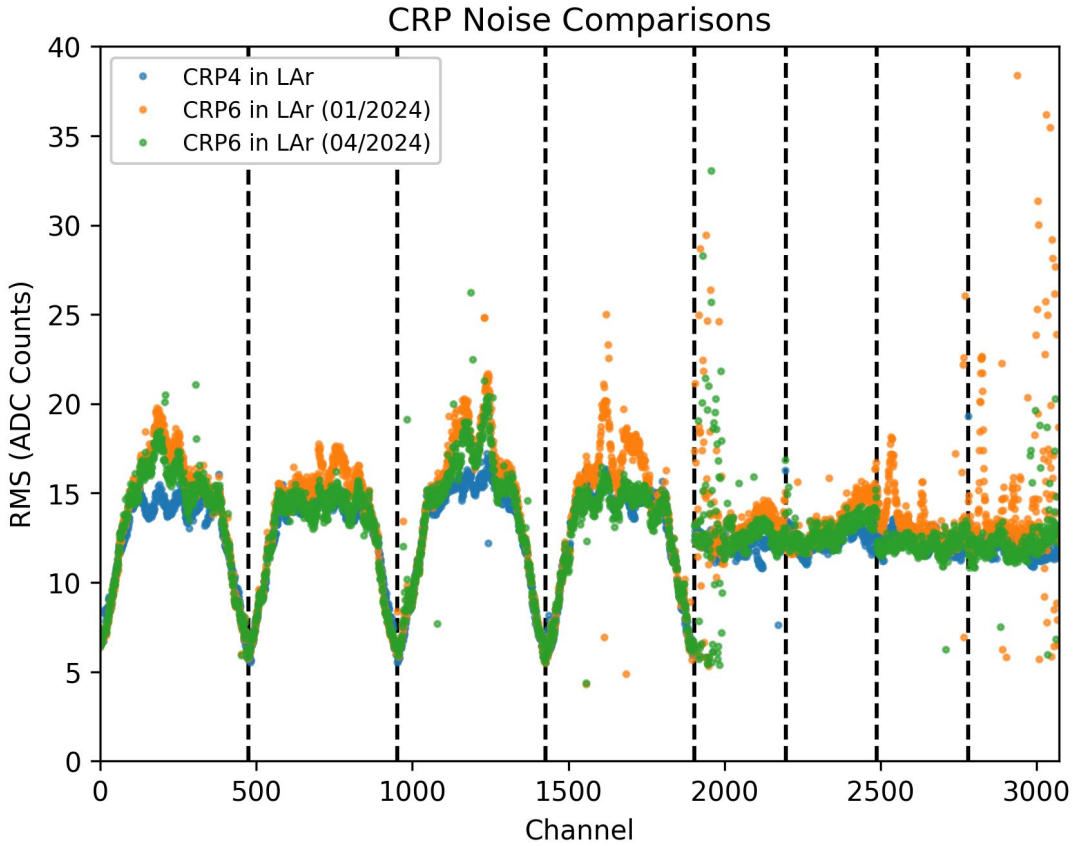




Comparison to Previous Runs

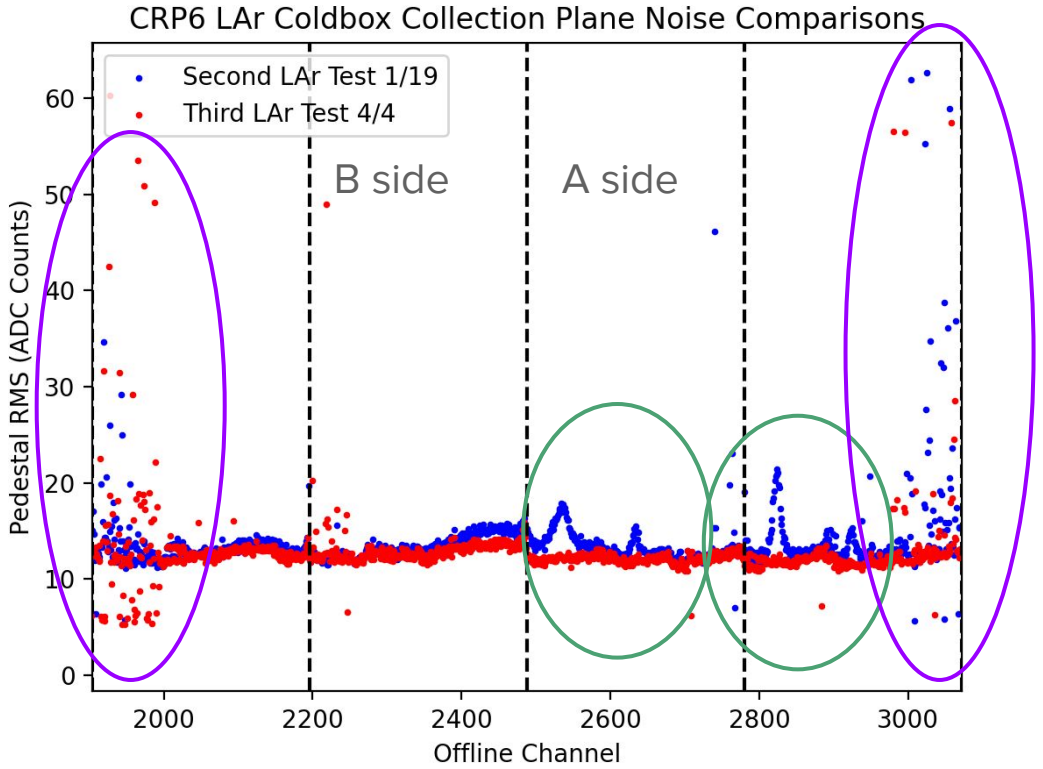
- Noise level on A-side is now comparable to best levels achieved in CRP4
  - This is the side where the new grounding plane was added





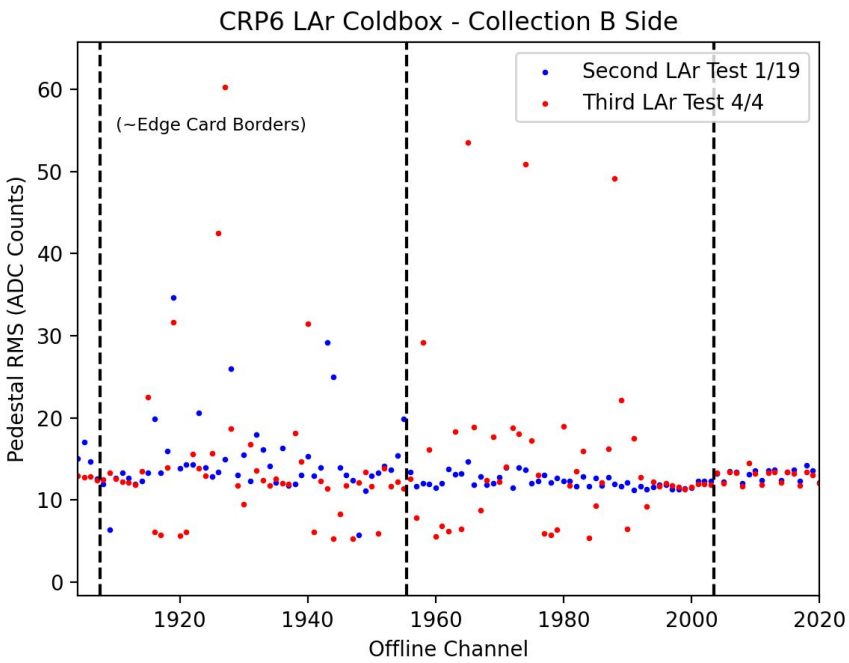
Collection Plane Behavior

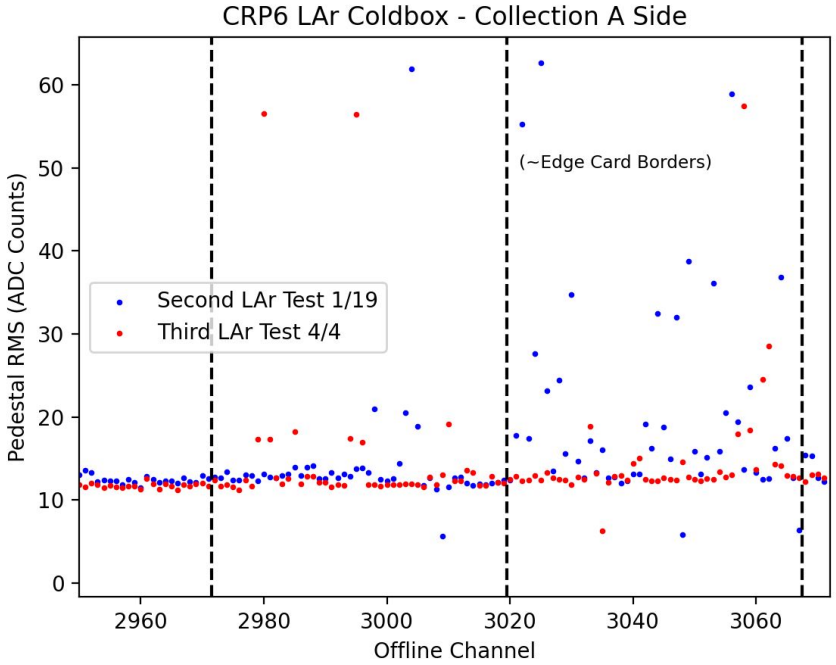
- Noise peaks on A-side that were believed to be pickup from power cables running over them are now gone
  - Recall that some shielding was placed beneath the B-side cables prior to the January coldbox test already
- Scattered high/low noise channels in CRP corners are still present, appearing only at cold



High/Low Noise Collection Channels

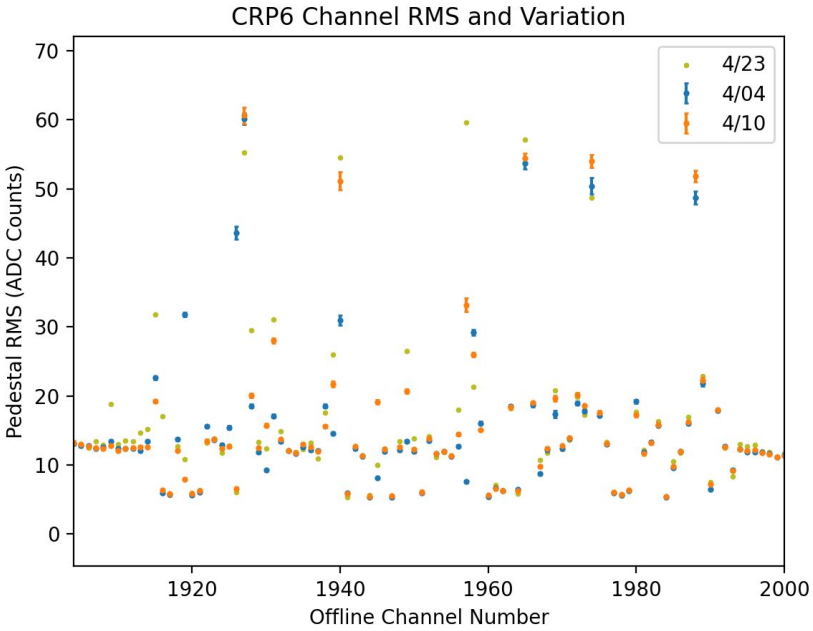
- The random high/low noise channels seem unrelated to any electronics settings, and appear only at cold
- The problem seems worse on B-side and less severe on A-side during this cooldown

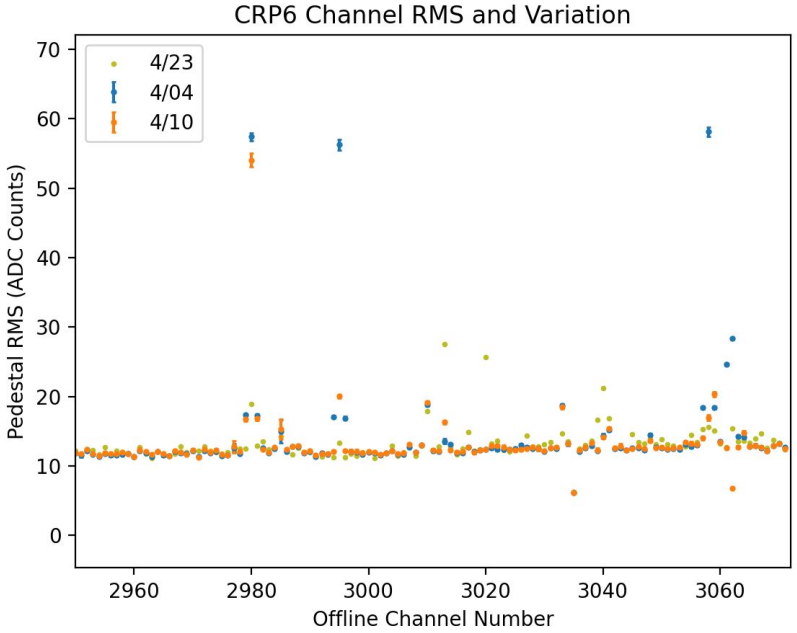




High/Low Noise Channel Stability

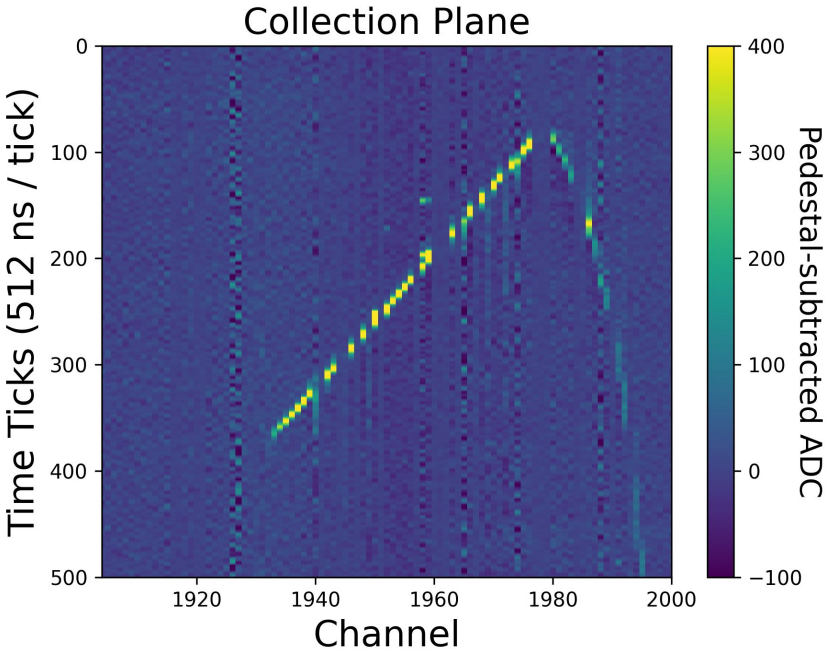
- The set of channels with abnormal behavior is fairly stable over time
  - Note: 4/23 dataset has cathode/CRP bias on

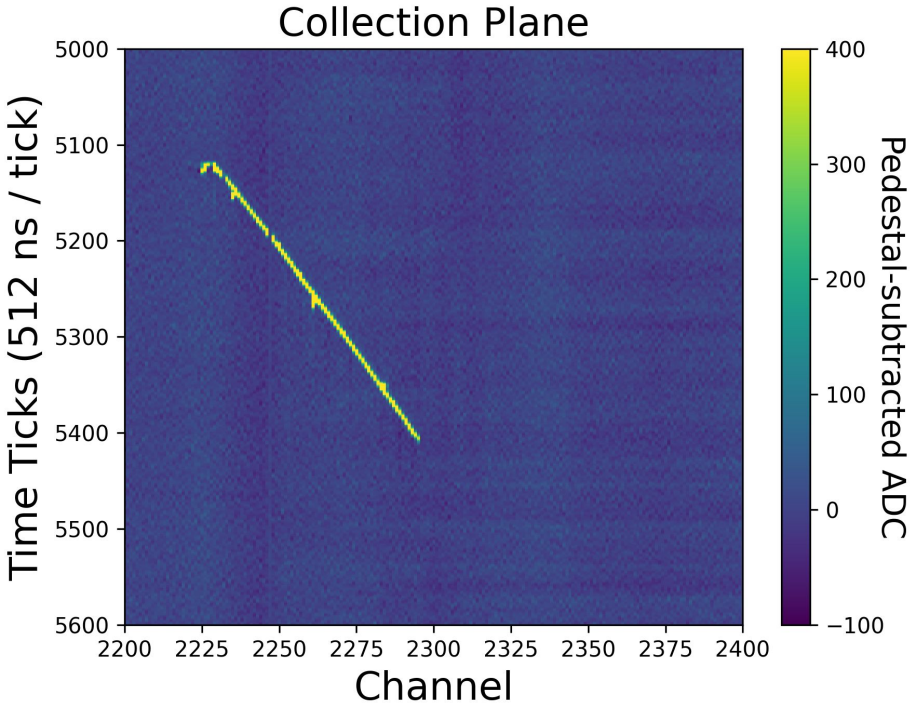




Broken Tracks

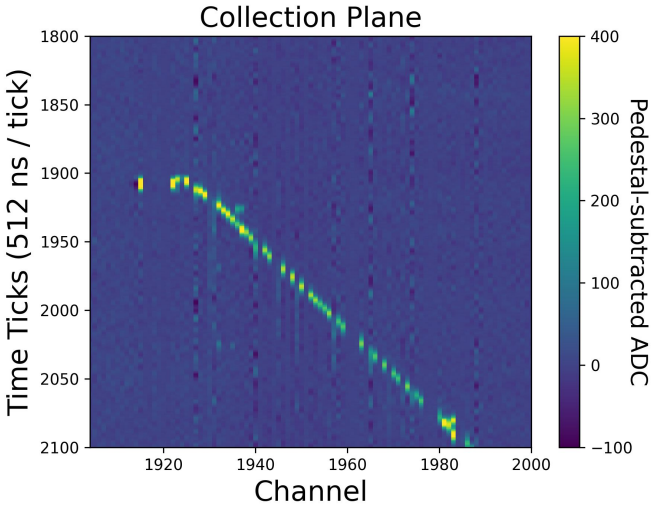
- Effect of the open collection channels clearly visible in tracks passing through the afflicted regions

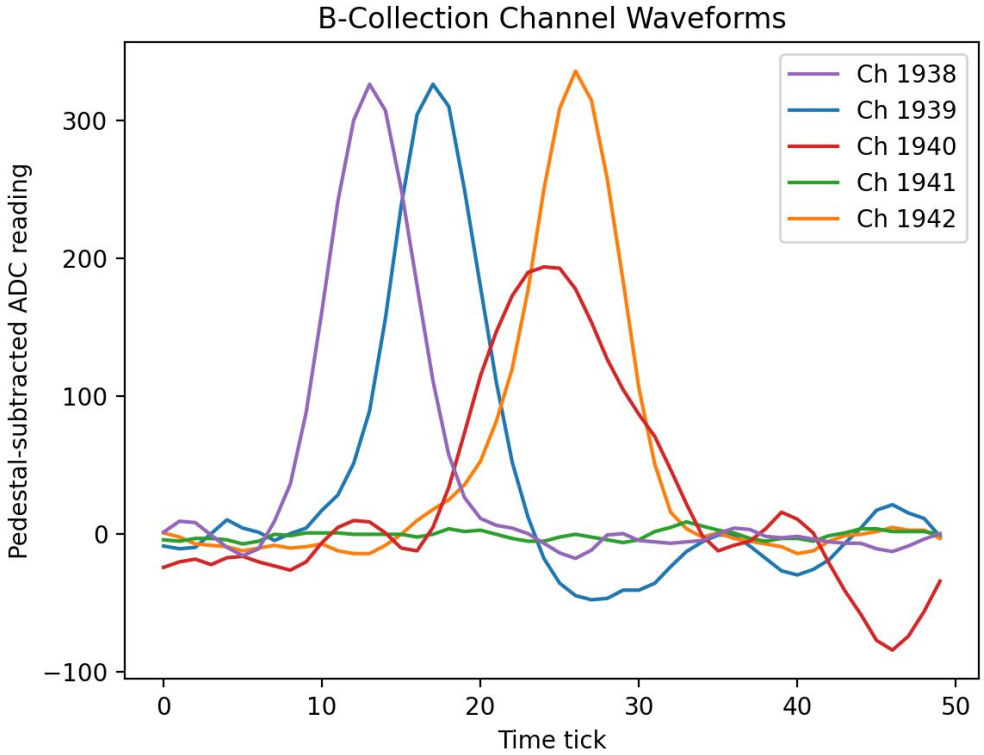




Charge on High/Low Noise Collection Channels

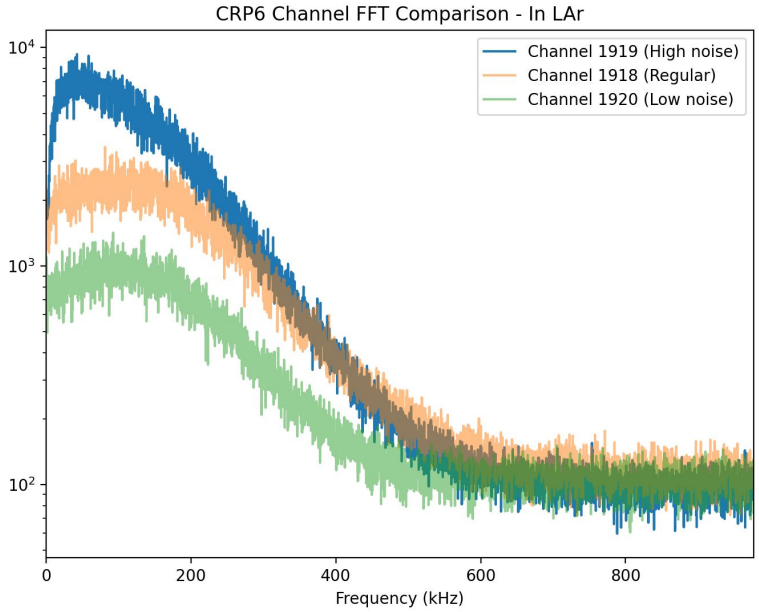
- Most (not all) high-noise collection channels still collect charge, but the timing and pulse shape are distorted
  - Not obvious that this can be explained just by noise effects

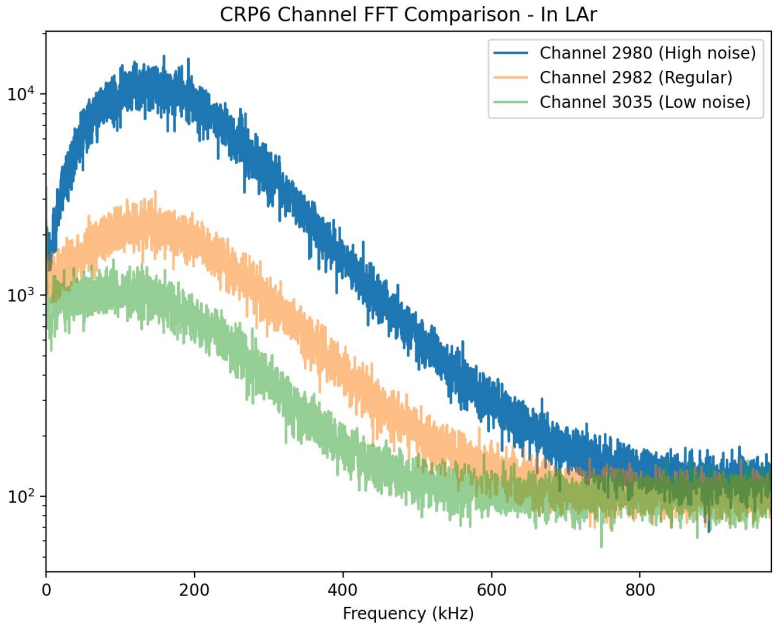




High/Low Noise Collection Channels

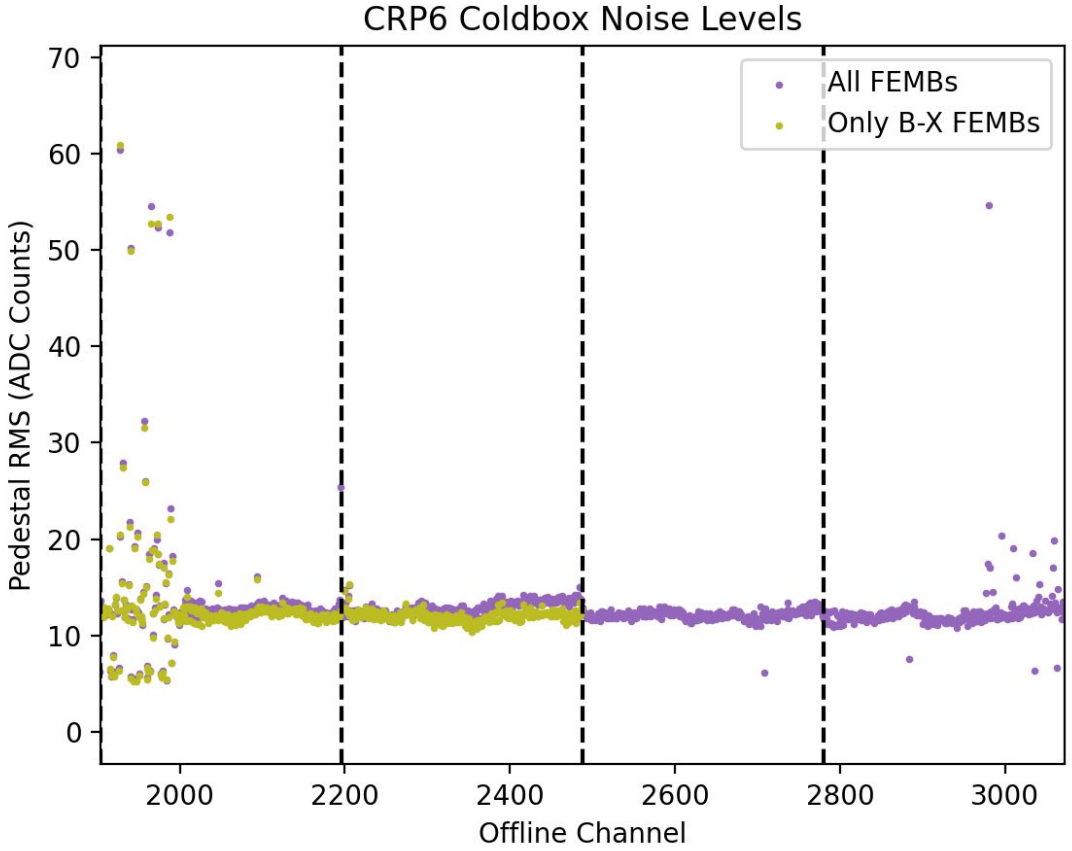
- The scattered high/low noise channels on the collection plane show no distinctive features in their noise power spectra
  - Consistent with being respectively improperly shorted to something and simply disconnected





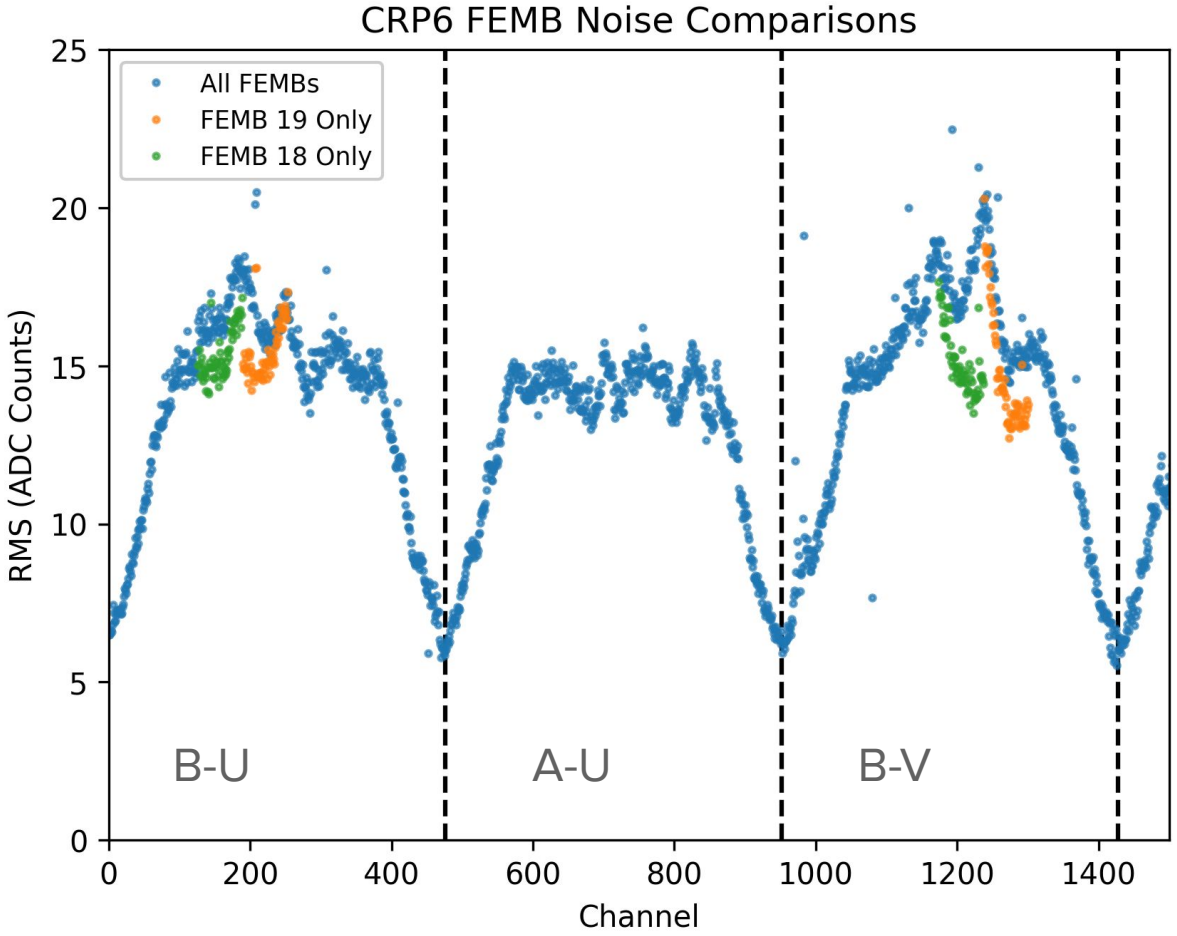
High/Low Noise Collection Channels

- The behavior of these scattered channels does not change with any electronics settings we have tried, including:
  - Powering only a subset of FEMBs
  - Differential/SE mode
  - Increasing LArASIC leakage current
  - Power settings



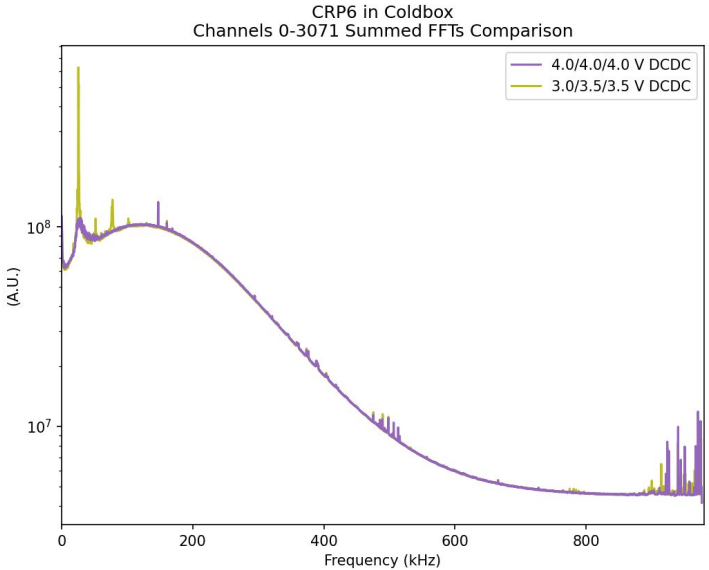
Single-FEMB Tests

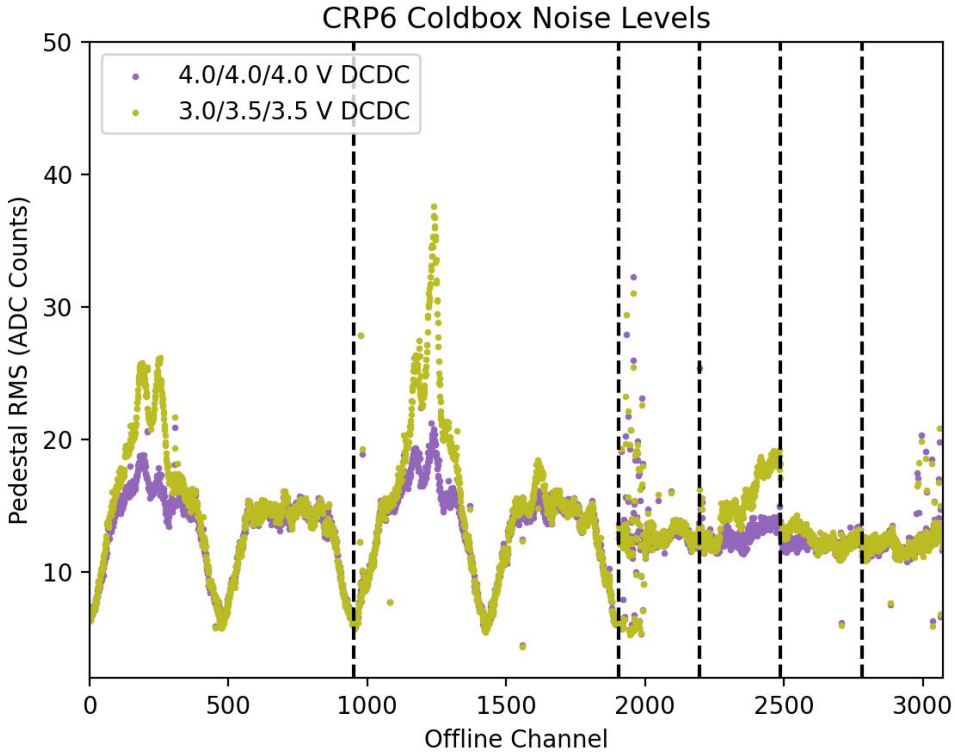
- Powering only a single FEMB at a time suppresses noises in the regions with highest pickup
- But it does not eliminate the excess noise entirely



Effect of Power Settings

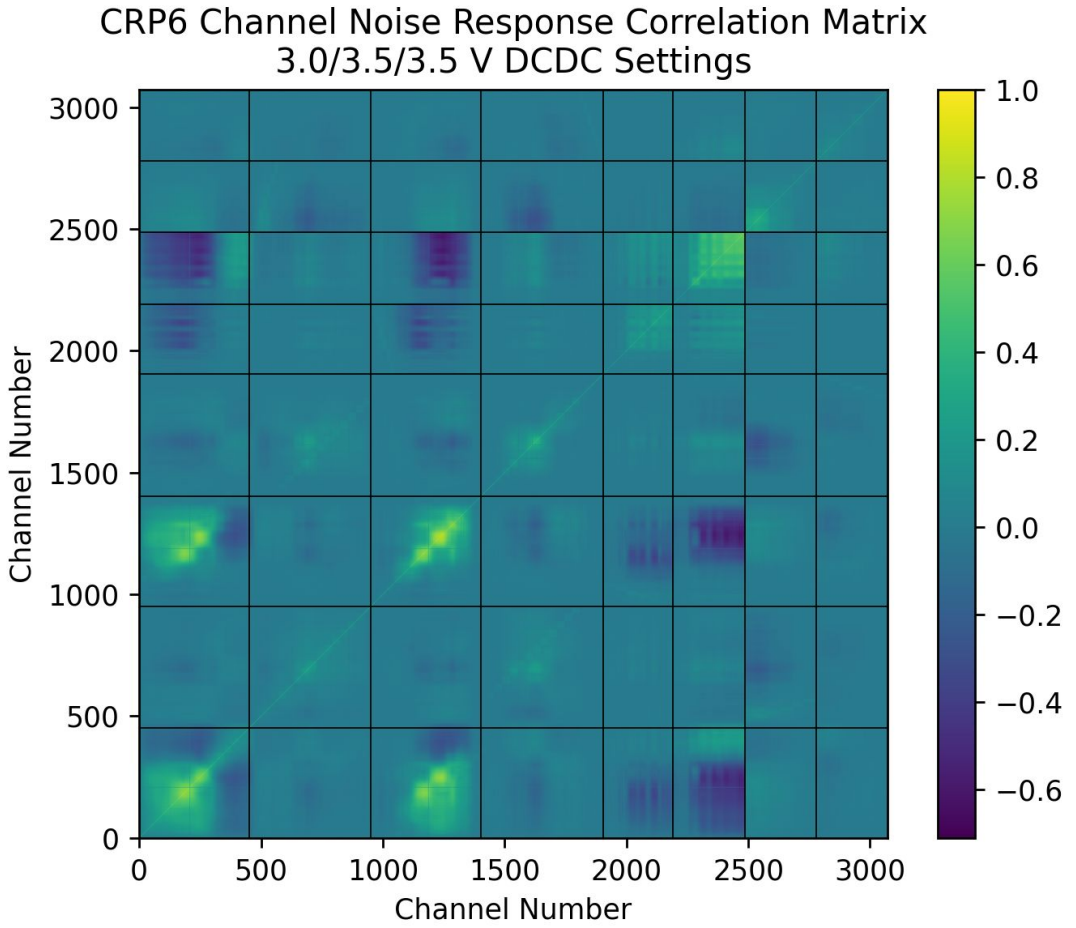
- Decreasing DC/DC power settings on the WIBs shows the usual effect of amplifying coherent noise
  - Note: little effect on A-side, where there was little pickup in the first place





Noise Correlations

- **Correlation matrix of raw channel waveforms**
  - Note: at “nominal” DCDC settings, the shape is the same, but less intense
- Notable features:
  - Small positive-correlation squares corresponding to ASIC divisions
  - Large blocks of positive correlation on the high-noise B-side induction channels
  - Large anticorrelations between induction and collection noise on B-side



Summary

- Recent improvements to the A-side of CRP6 have brought noise down to levels of CRP4/5 tests
  - B-side noise remains a bit higher, but the same changes have not been made on that side
- Issues with anomalous channel responses appearing at cold in CRP6 persist, but the source is unclear
  - The A-side seems improved but not entirely fixed on this matter - could it be related to the adapter board and edge card replacements made there, or is it just random?
- Tracking CRP6 noise, pulser, and both cosmics/PNS runs in this spreadsheet