# APA-7 Cold Electronics Testing in ColdBox

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Activities of the Past Weeks

- Started cooling down the cold box on 29-October at a rate of <10K/hour. The new cryogenic system works very well. Took about a day to cool to the target temperature
- On CE side we took noise data through out the entire cool down
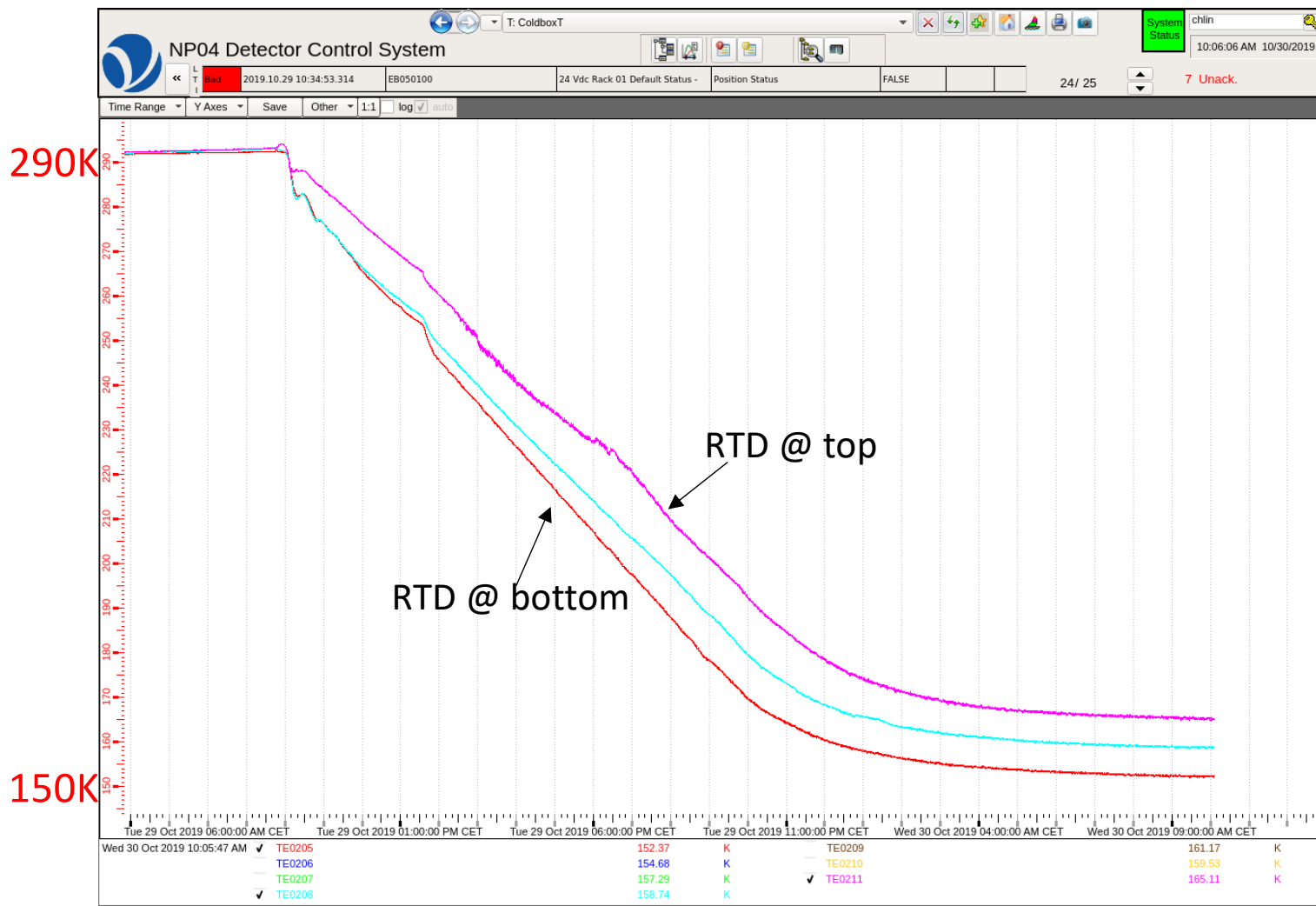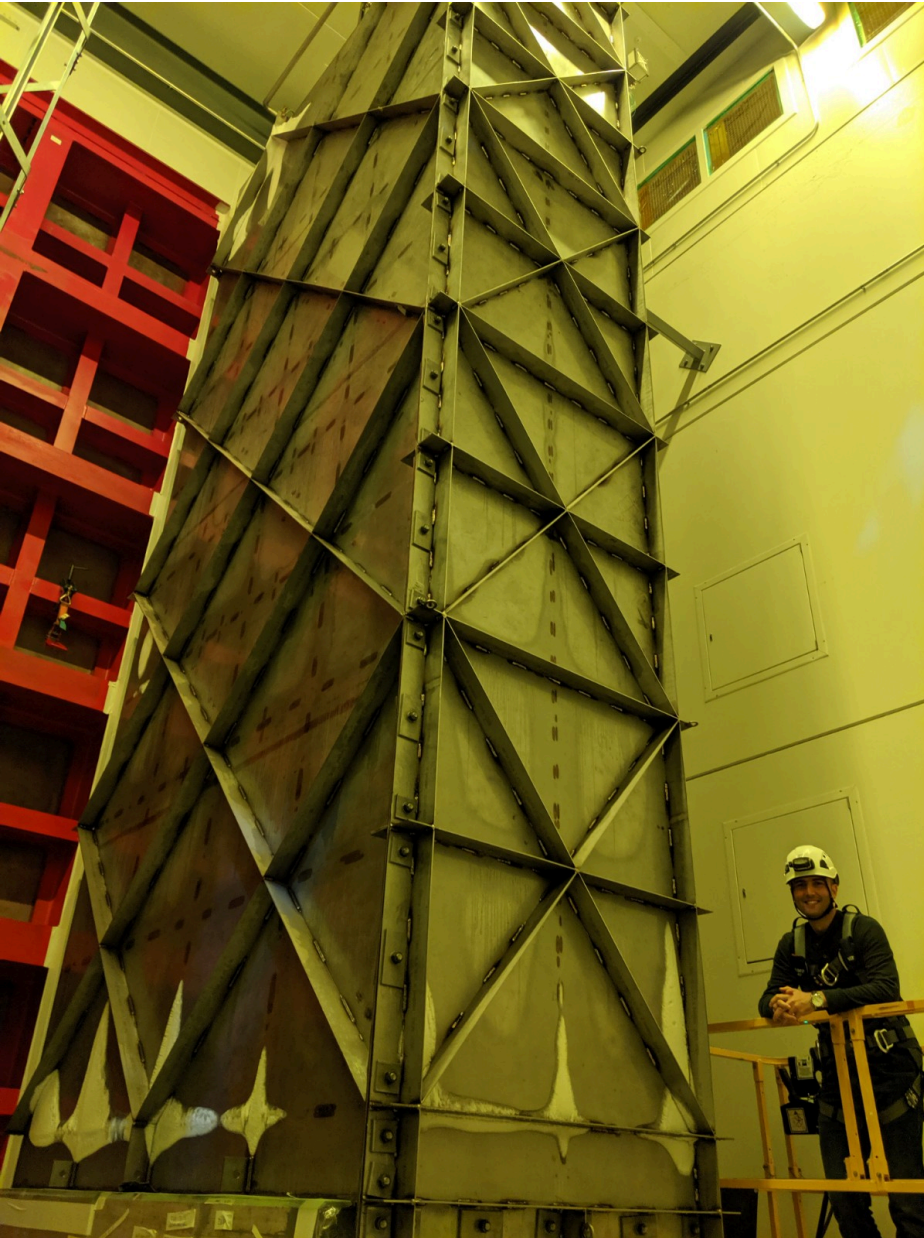
Serhan installing of TPC Wire Bias box on top of the coldbox during DAQ down time on 31-Oct (bias box almost ended up in Africa ☺)

Data Sample for APA#7

- Have taken a large sample of CE data for the past two weeks
- Most data taken using the nominal DAQ chain. A small set of data taken with special BNL firmware for cross check

Summary of data set:
- Long noise run during cool down
- Noise data for various CE gains and shaping time configurations at both warm and cold
- External pulser data for various CE gains and shaping time configs at both warm and cold
- Special 15msec and 100msec readout window runs to study low frequency noise
- Etc.

- Data is available at both CERN eos and Fermilab. The latest run list is maintained at the google sheet:
  https://docs.google.com/spreadsheets/d/1QOdzk1xNTc7-KXrpiMoUMLn1dNTxSLOGaX4eHR7c6DA/

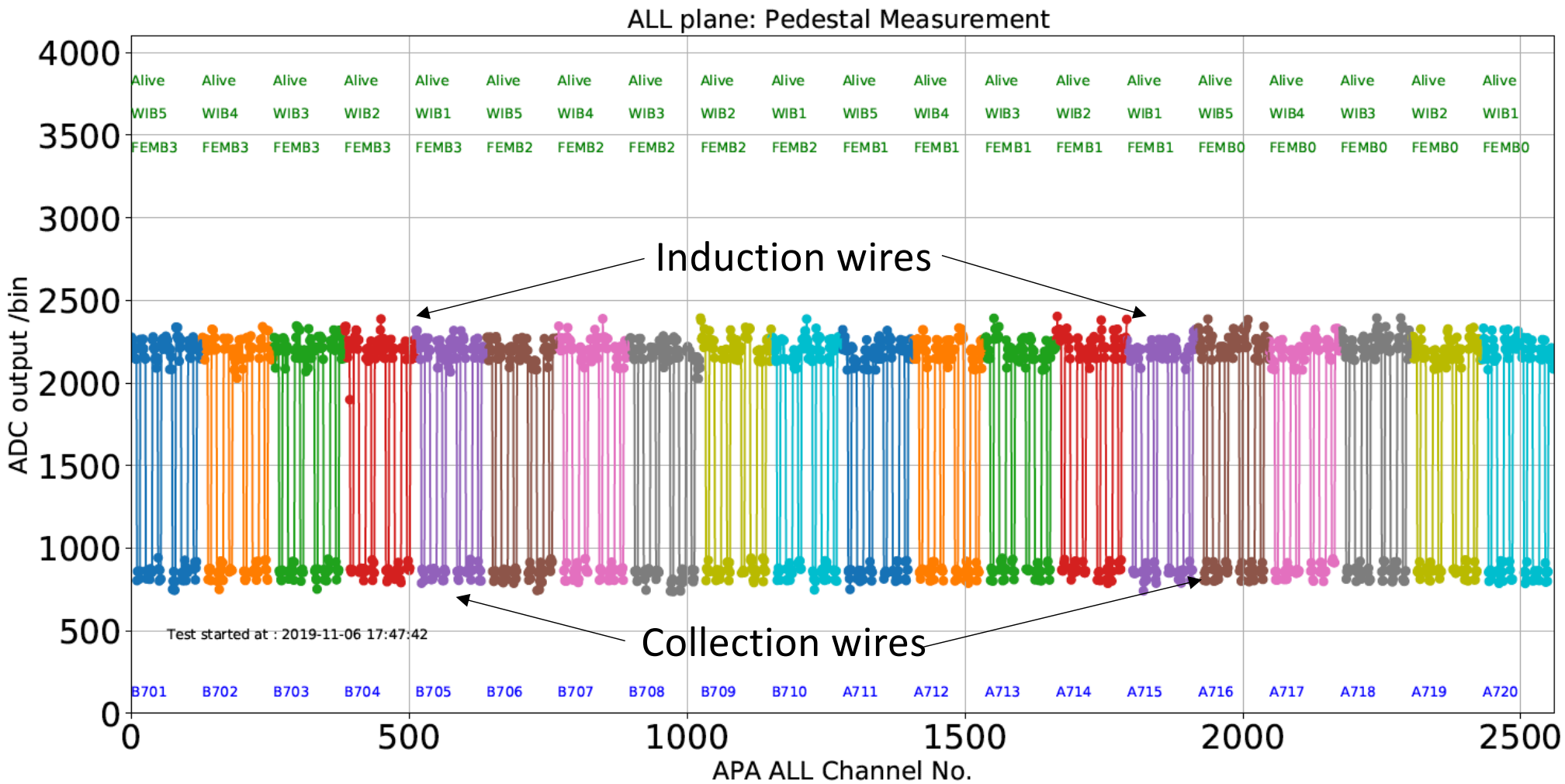|	A	B	C	D	E	F	G	Tem
1	**Run Number**	**DAQ Configuration filename**	**Date (y/m/d)**	**Duration of the run (minutes)**	**Wire Plane Bias (ON/OFF)**	**Comment (CE configuration)**	**Trigger**	**(TE**
172	10263	np04_coldbox_g0s0b2_expulser1_00001	2019/11/07	5m	OFF	4.7mV/fC gain, 0.5us shaping time, external pulser=1	5 Hz	1
173	10264	np04_coldbox_g0s0b2_expulser5_00001	2019/11/07	5m	OFF	4.7mV/fC gain, 0.5us shaping time, external pulser=5	5 Hz	1
174	10265	np04_coldbox_g0s0b2_expulser10_00001	2019/11/07	5m	OFF	4.7mV/fC gain, 0.5us shaping time, external pulser=10	5 Hz	1
175	10266	np04_coldbox_g0s0b2_expulser15_00001	2019/11/07	5m	OFF	4.7mV/fC gain, 0.5us shaping time, external pulser=15	5 Hz	1
176	10267	np04_coldbox_g0s1b2_expulser1_00001	2019/11/08	6m	OFF	4.7mV/fC gain, 1us shaping time, external pulser=1	5 Hz	1
177	10268	np04_coldbox_g0s1b2_expulser5_00001	2019/11/08	6m	OFF	4.7mV/fC gain, 1us shaping time, external pulser=5	5 Hz	1
178	10270	np04_coldbox_g0s1b2_expulser10_00001	2019/11/08	5m	OFF	4.7mV/fC gain, 1us shaping time, external pulser=10	5 Hz	1
179	10272	np04_coldbox_g0s1b2_expulser15_00001	2019/11/08	5m	OFF	4.7mV/fC gain, 1us shaping time, external pulser=15	5 Hz	1
180	10274	np04_coldbox_g0s3b2_expulser1_00001	2019/11/08	5m	OFF	4.7mV/fC gain, 3us shaping time, external pulser=1	5 Hz	1
181	10275	np04_coldbox_g0s3b2_expulser5_00001	2019/11/08	5m	OFF	4.7mV/fC gain, 3us shaping time, external pulser=5	5 Hz	1
182	10276	np04_coldbox_g0s3b2_expulser10_00001	2019/11/08	5m	OFF	4.7mV/fC gain, 3us shaping time, external pulser=10	5 Hz	1
183	10277	np04_coldbox_g0s3b2_expulser15_00001	2019/11/08	5m	OFF	4.7mV/fC gain, 3us shaping time, external pulser=15	5 Hz	1
184	10278	np04_coldbox_g2s2b2_nopulser_00007	2019/11/08	5m	ON (+25,-25,-25)	14mV/fC gain, 2us shaping time, no pulser	5 Hz	1
185	10279	np04_coldbox_g2s2b2_nopulser_00007	2019/11/08	5m	ON (-25,-25,-25)	14mV/fC gain, 2us shaping time, no pulser	5 Hz	1

This tab gives you all runs

Noise runs at cold

Special runs

Ivan Furic has written a tutorial in google doc to help get people started on looking at the CE data:

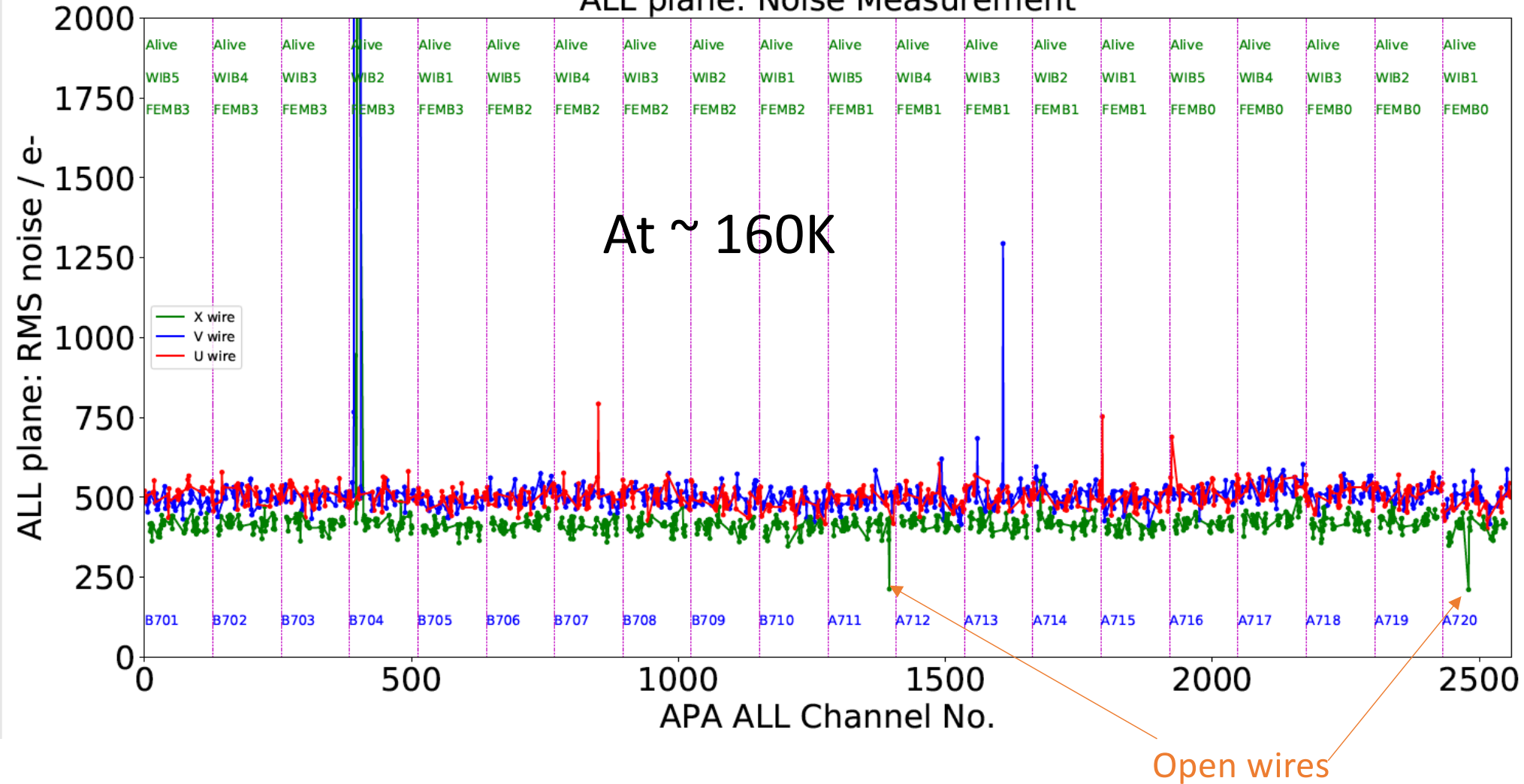https://docs.google.com/document/d/1IsTNzYb7f3jm65s-R5Q02RuFZ2zdvce2eT1hq7e4mJE/edit?usp=sharing

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Pedestal Measurements (APA#7 ProtoDUNE CE)

(From S. Gao)

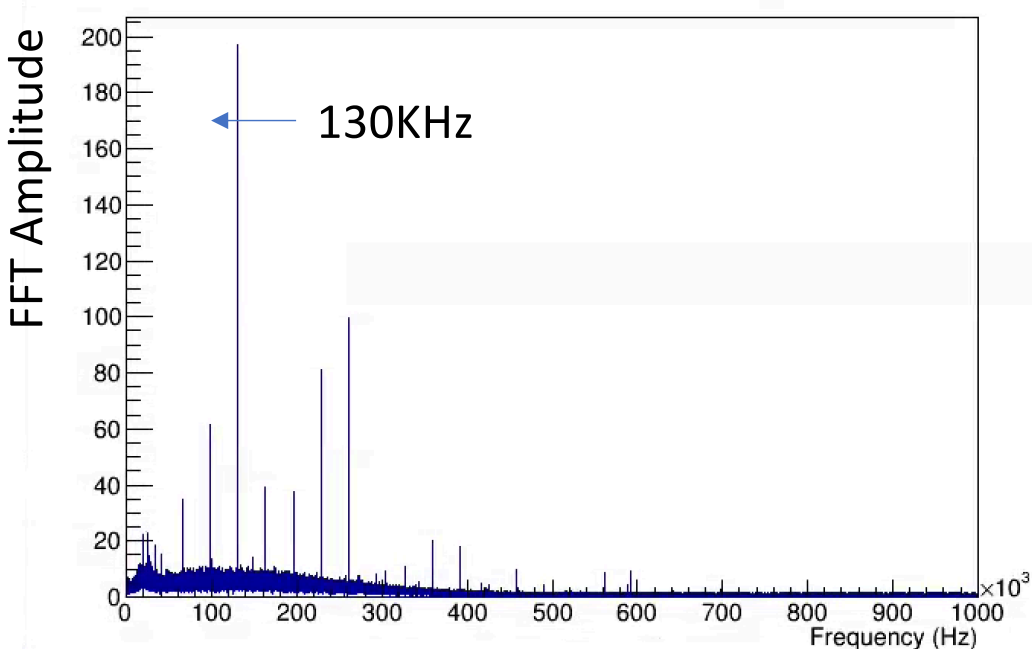# Noise Measurements (APA#7 ProtoDUNE CE)

- Most channels look good. Out of 2560 wires, there are two open wires and a handful of noisy channels
- D. Adams is maintaining the latest list of problematically wires in:
  dunetpc/dune/Protodune/singlephase/fcl/channelstatus_apa7.fcl

Frequency Analysis of Noise Data

- FFT plots show high and low frequency noise components. See D. Adams's online page for complete set of plots:
  https://internal.dunescience.org/people/dladams/protodune/data/coldbox/dft/run010158/event000001-000101/

Run10245 Event#2 Channel#1600 FFT Spectrum

130KHz

Run10245 Event#2 Channel#600 FFT Spectrum

~75Hz

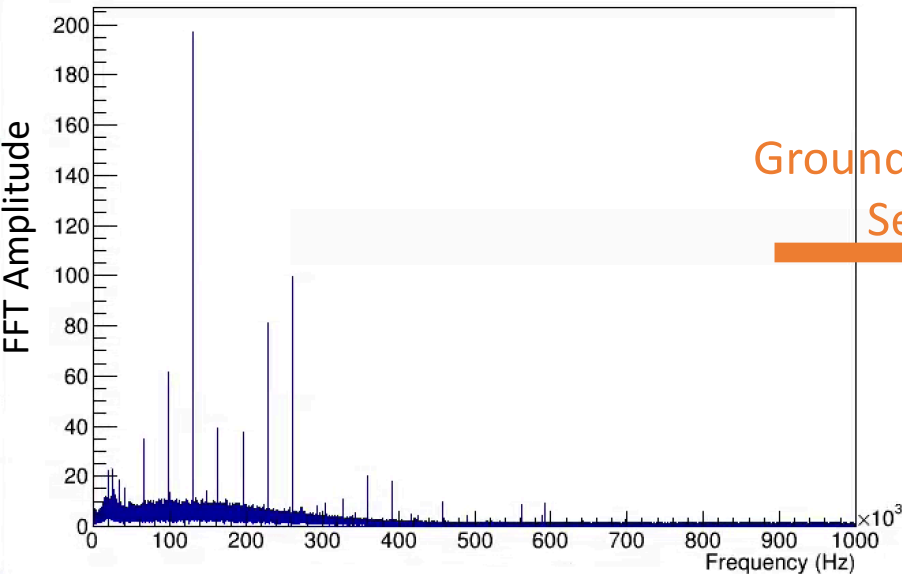High frequency noise is affecting a handful of collection wires near the edge of the TPC
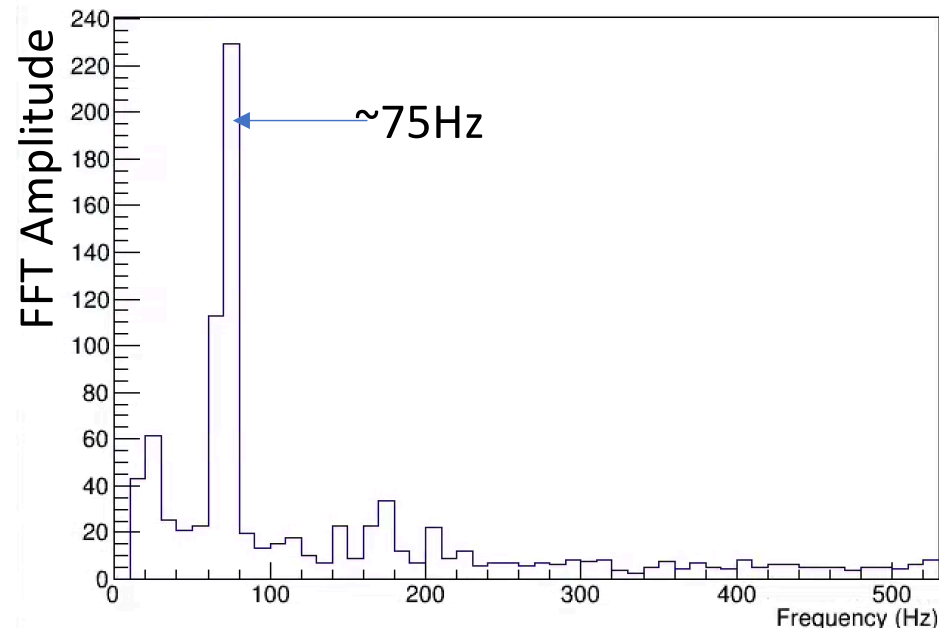
Low frequency (~75Hz) only shows up when the wire bias voltage are on. Affecting mostly the induction wires
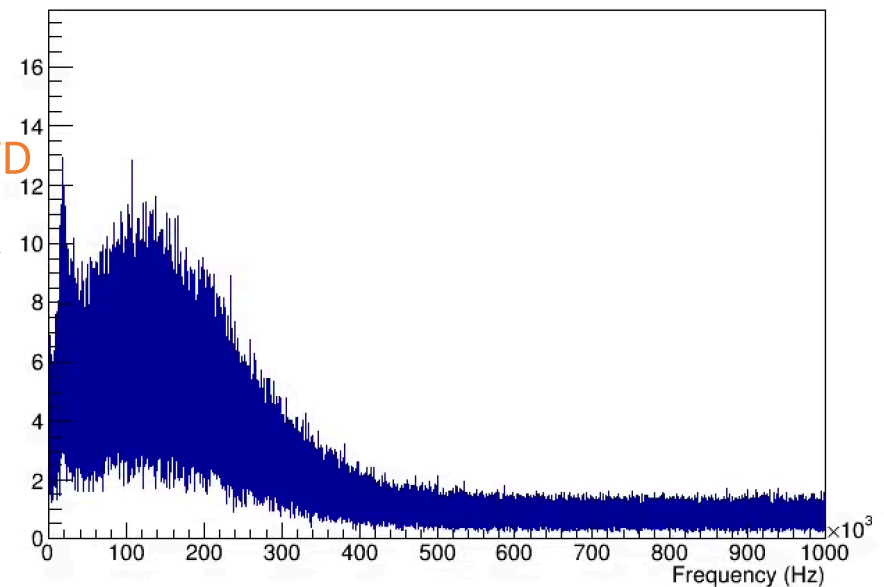
Run10245 Event#2 Channel#1600 FFT Spectrum

Grounded the RTD Sensors

Run10247 Event#2 Channel#1600 FFT Spectrum

- The high frequency noise spikes appear to be due to the RTD sensors. Discussion about replacing exiting wires with better shielded ones if needed. Only affecting a handful of collection wires
- The low frequency noise is still not well understood. The prevailing theory is that it's due to wire vibration
- Similar low frequency noise was also observed in previous coldbox testings. Continue to investigate

Summary

- The APA#7 coldbox run has been very smooth. Plan to warm up the coldbox on Monday.

- Preliminary look at the data looks good, no big surprises

- Will follow up on the low frequency noise. Not a show stopper

- Have a lot of data on disk. Will systematically go through them

- Thanks to all the groups for their help in making this a success, in particular: CERN cryogenic, Bill's installation, DAQ, DCS/Slow Control, Fermi Offline/Computing, CE groups and Serhan!!!