

# PTCv4 Testing at NP04 and ICEBERG

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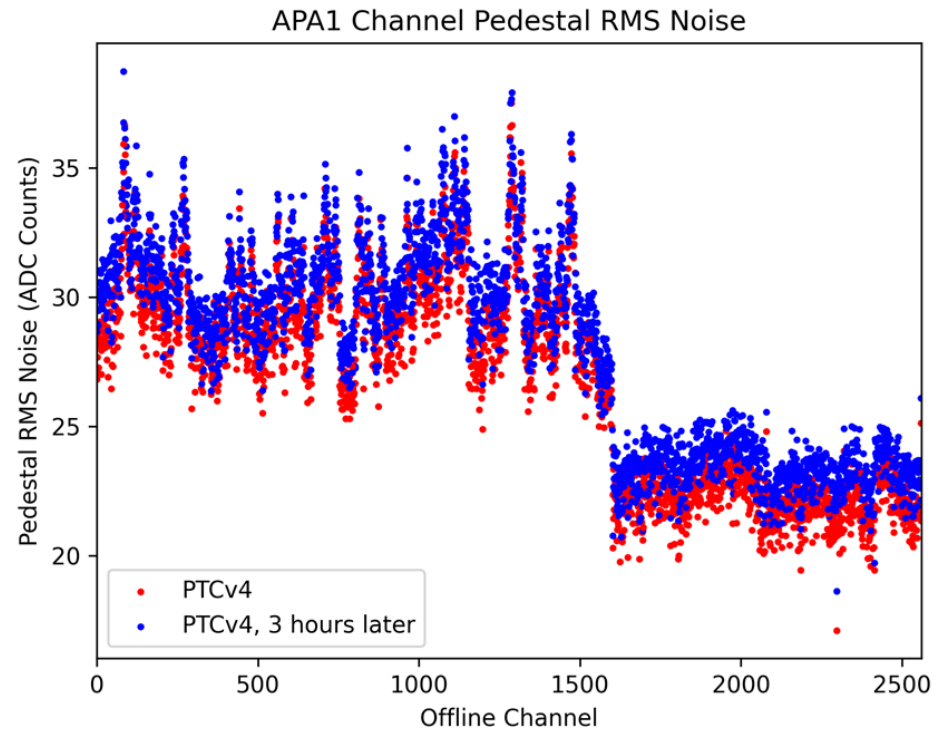
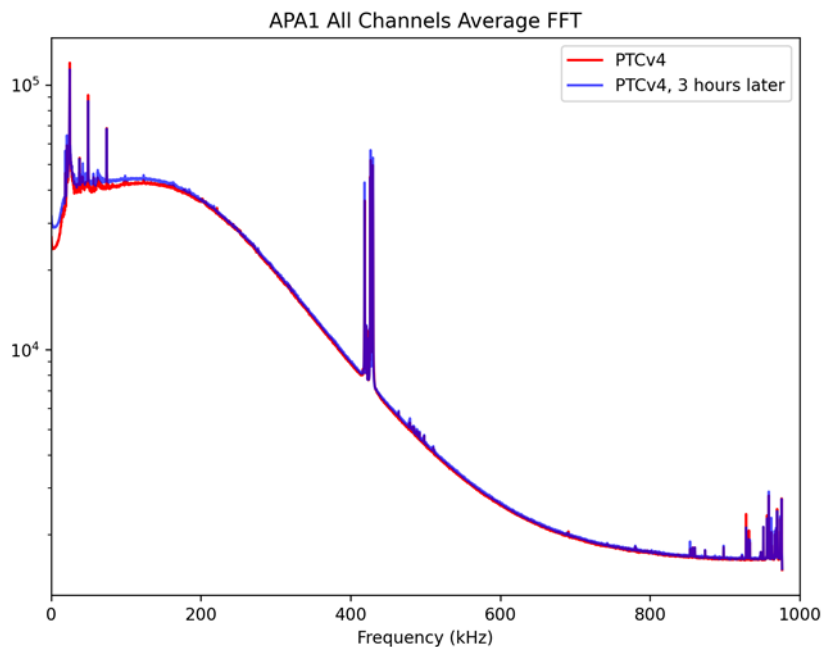
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# PTCv4 Noise Test Setup @ NP04

- Noise tests using one of the APAs in the NP04 cryostat at CERN, fully instrumented and in warm conditions
  - Crate has 5 WIBs
- NP04 cryostat was still open at this point. Noise conditions were fairly quiet, but not completely controlled
- Comparing channel noise levels using PTCv3 against PTCv4
  - Also checking for difference when PTCv4 is “active” (sending I2C commands, being pinged over gigabit ethernet connection, and maintaining active EtherCAT link) vs when it is “idle” (just supplying power and timing to the WIBs)
  - Tests all run using “nominal” LArASIC settings of single-ended mode, 14 mV/fC gain, 2 us peaking time

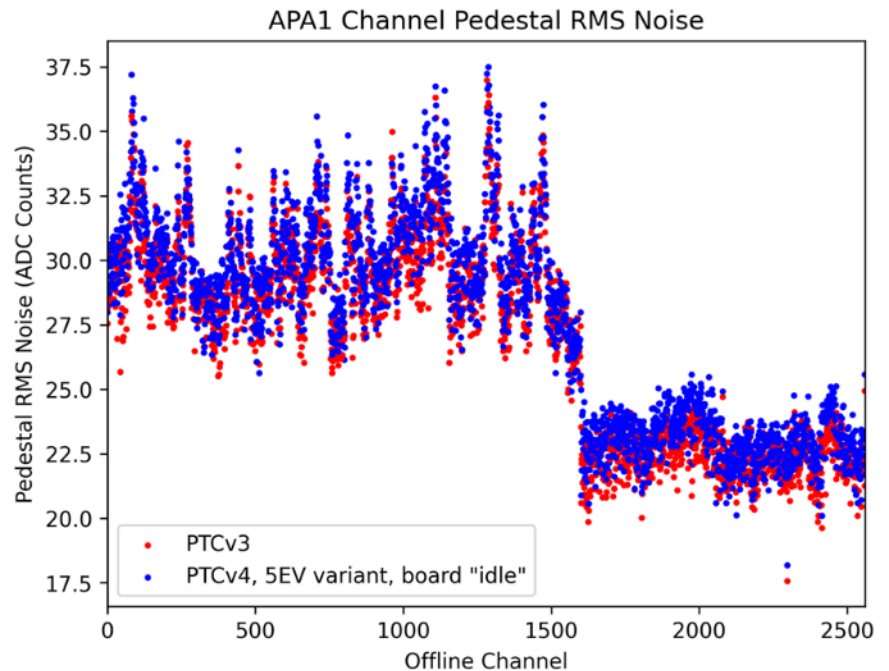
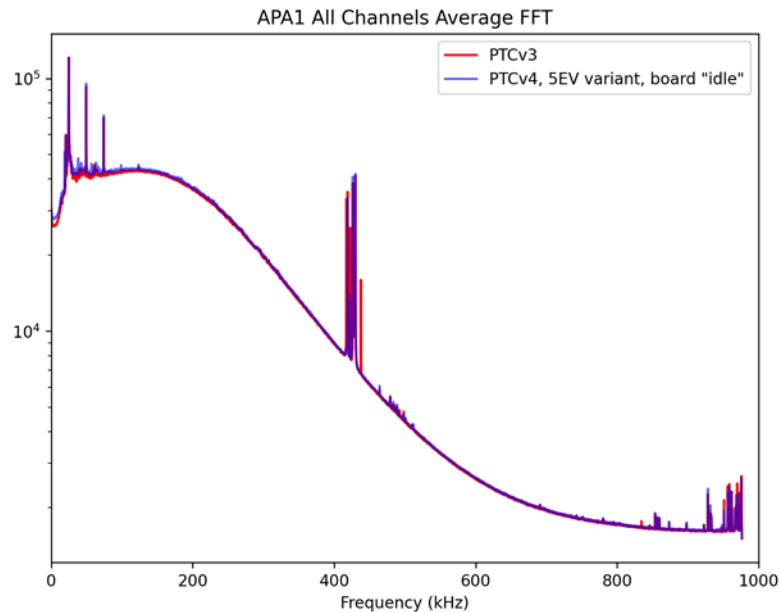
# Note on Noise Conditions

- Noise conditions vary with time
- We try to compare data taken within short periods of time, but a caution to not read too much into small variations



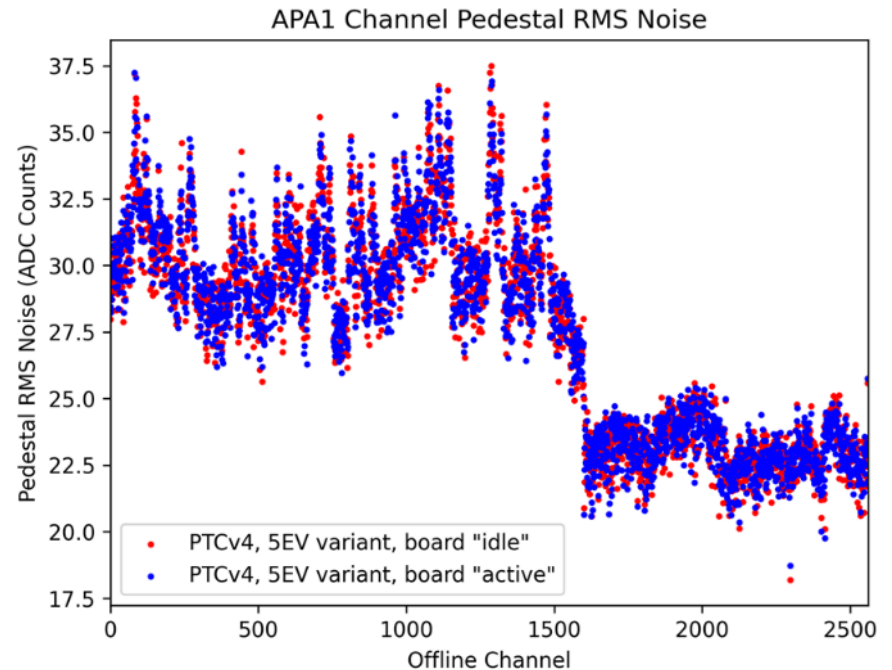
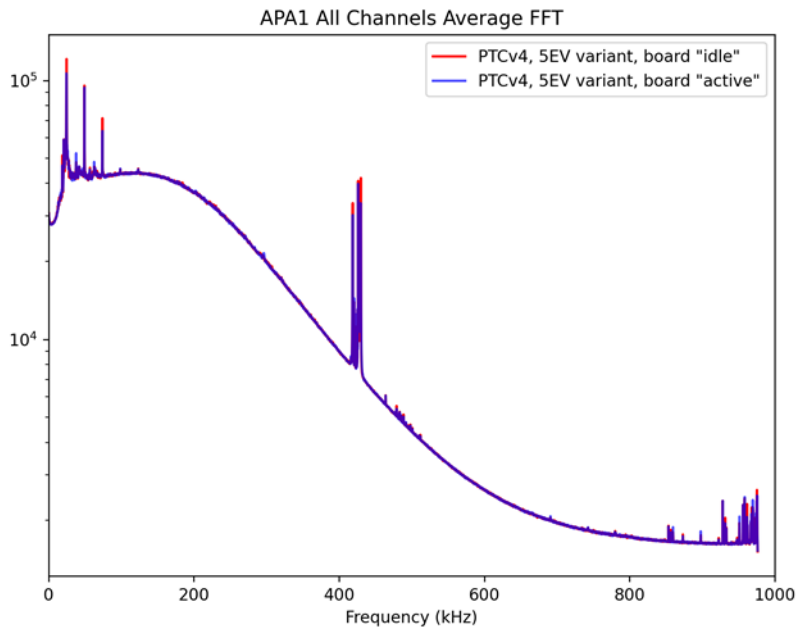
# PTCv4 5EV Variant, “Idle”

- PTCv4 shows no notable difference in noise response
- Note: noise peaks around 400 kHz are due to environmental pickup

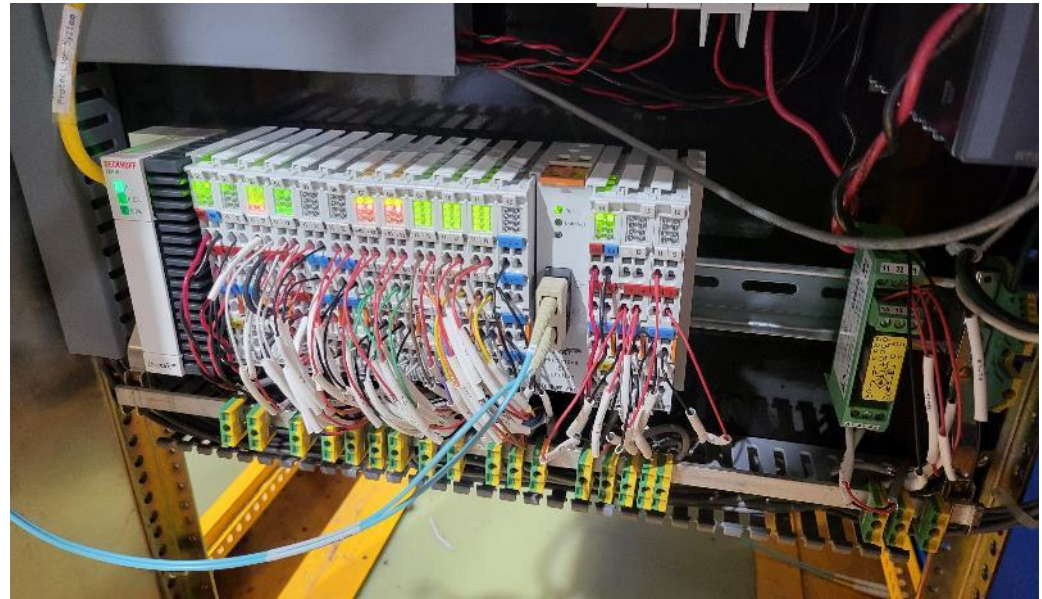


# PTCv4 5EV Variant, “Active”

- Activating the ethernet connection, EtherCAT connection, and I2C communications on the PTCv4 also have no noticeable effect on the noise

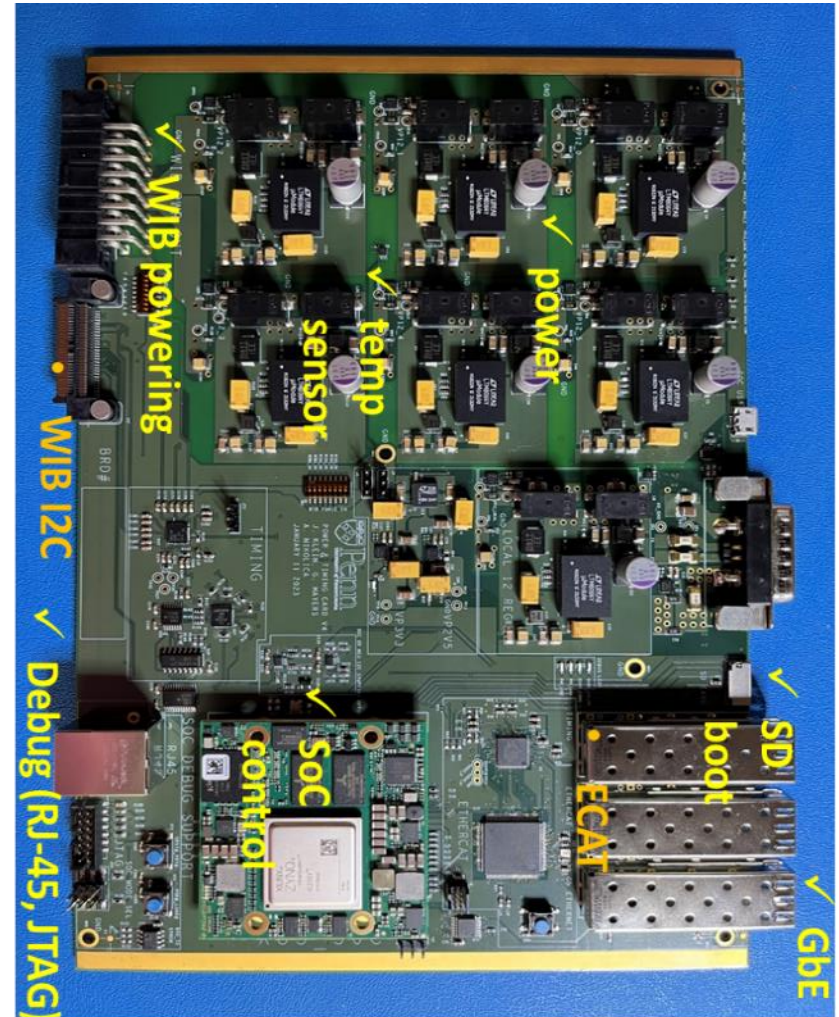


# PTCv4 and DUNE-CE-Interlock

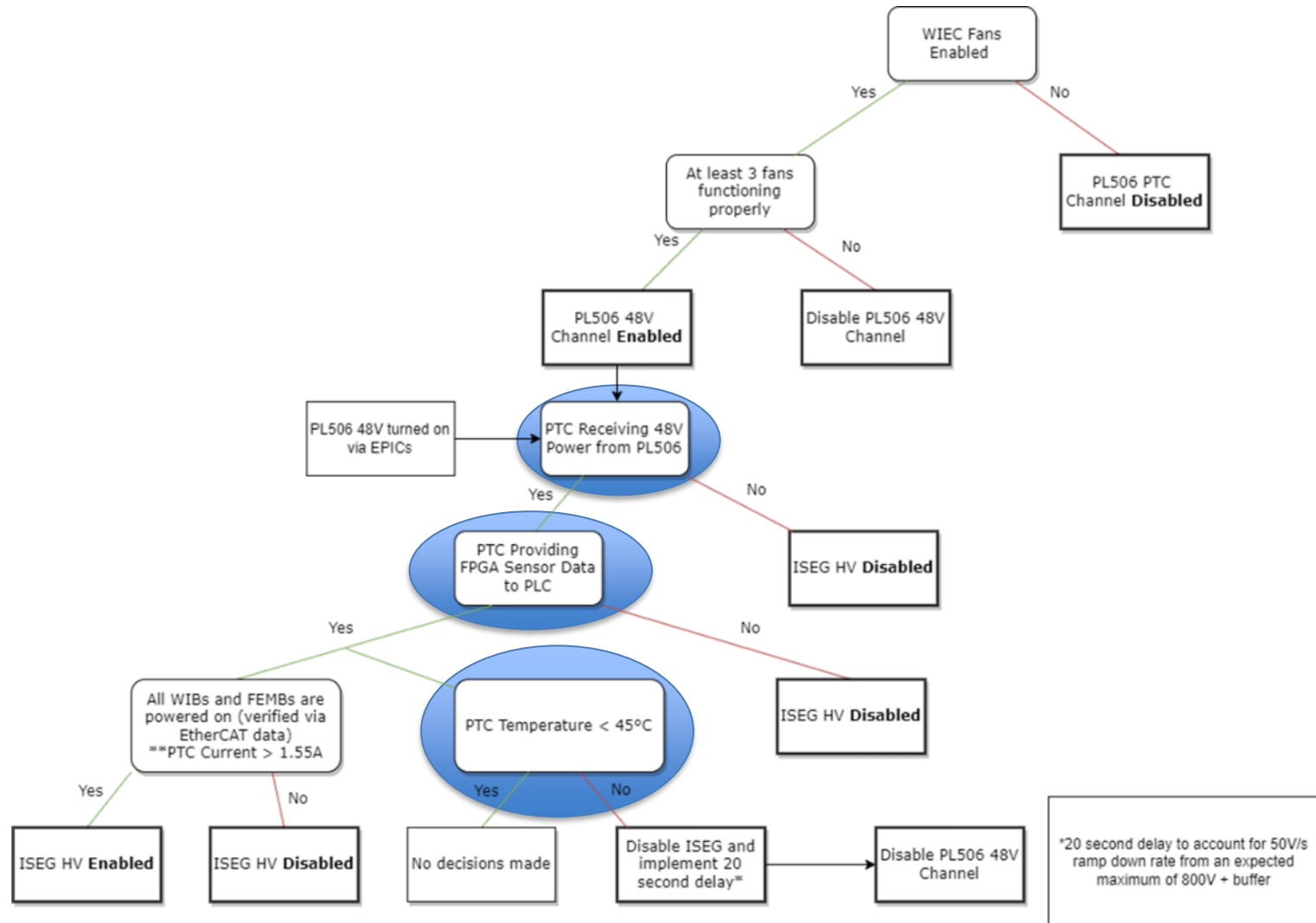


# PTCv4 Integration at ICEBERG

- ✓ All six 12V regulators power up, can be enabled via FPGA register bit
- ✓ Local 12V, 3.3V, 2.5V power all ICs with no excessive current
- ✓ Enclustra Mercury XU5 mezzanine (Zynq 5EV Ultrascale+):
- ✓ Can power WIBs (3 WIBs at ICEBERG, 5 WIBs at NP04@CERN and 6 WIBs at BNL)
- ✓ Timing distribution test (TX and RX) tested at ICEBERG using Bristol Timing Hardware
- ✓ GbE can talk over front panel
- ✓ WIB I2C preliminarily tested
  - Need to scale up to all sensors
- ✓ EtherCAT – Beckhoff Data transmission tested for DUNE-CE Interlock
  - Need to scale up to all 90 sensors



# Logic of DUNE-CE Interlock

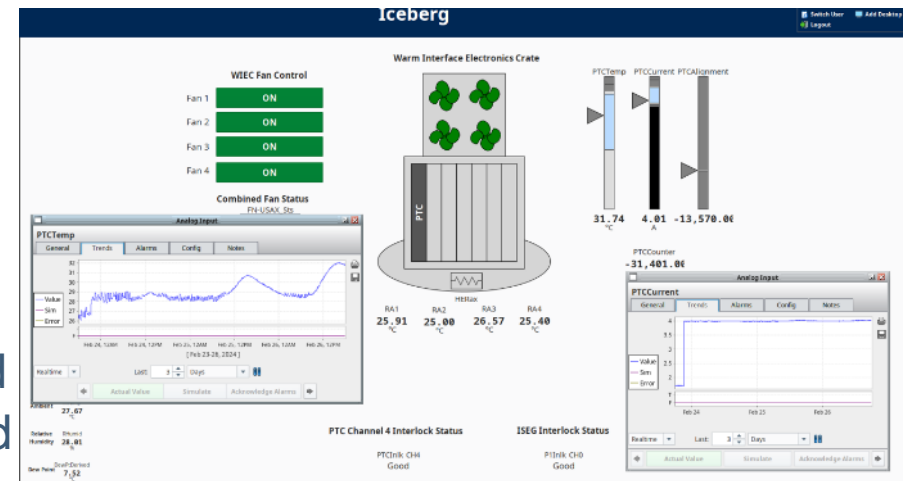




# ICEBERG DUNE-CE Interlock

We have tested the operation of the DUNE-CE-Interlock and its interface to the PTCv4. The requirement for the DUNE-CE Interlock to the 1<sup>st</sup> order are:

1. Prevent APA Wire Bias to be Turned ON if all the FEMBs are not ON.
  - a. Turn OFF Wire Bias of the APA if 1 FEMB power goes OFF.
2. Turn OFF APA Wire Bias, FEMBs and WIBs if the operator does not respond to Over temperature in certain time window.
3. Alert operator if  $\frac{1}{4}$  Fan on WEIC not working.



3 Days of PTCv4 and DUNE-CE Interlock Test

# DUNE-CE-Interlock Test



If the 48 V power to PTC is not ON and current draw by PTC is not above certain value that ensures all FEMBs are ON, the PTC power cannot be turned ON.



If 1/4 Fan is OFF and Temperature of WEIC crate goes above certain trip limit the DUNE-CE-Interlock will turn the 48 V power to the PTC OFF (All WIBs, FEMBs will go OFF)