



NOvA Electronics Temperature Rise Tests

Wiener Low Voltage Crates
and Fan trays



Test Setup

- Wiener PL506 in the NOvA configuration was mounted in a 19 inch relay rack with side panels
- Mounting position was:
 - 3U above a CAEN SY1527 HV mainframe
 - 3U below a CAEN SY8800 LV mainframe
 - Neither unit was powered for initial tests
- 3U air gaps are the same as proposed for normal NOvA power rack.
- PL506 has the air intake located below the unit, with exhaust above. Internal fans move the air between inlet and exhaust.
- Room used for test was a maintenance area at Feynman computing center.
 - Ambient room temperature started at 22.5C
 - Room size was roughly 400 ft², total volume 4500 ft³

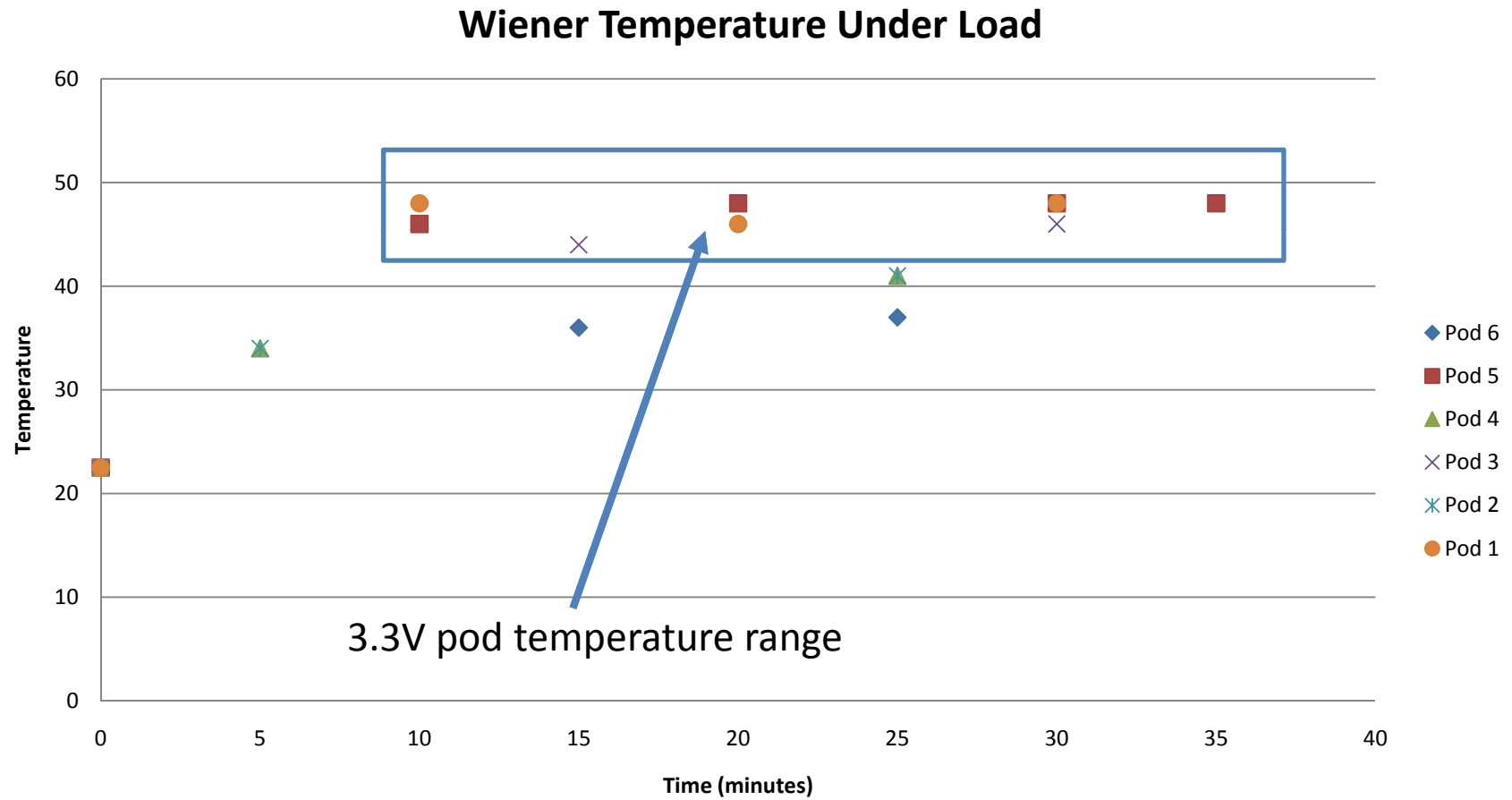


Test Setup

- Wiener supply was powered off of a 240V single phase variac to allow for maximum output power.
- Unit was loaded using programmable load boxes
 - Initial target load was set at 90% of available power.
 - 2-7V pods run: 3.3V @ 100-105A
 - 12-30V pods run: 24V @ 20A
- Loads were separated from the supply rack by supply and sense cable runs of 3 meters, and one run (pod 5) was a 50ft run to simulate the actual maximum runs at the far detector.
- Temperatures were taken in 5 minute intervals over each of the supply pod areas using a set of thermometers.
 - Thermometers were swapped between positions and allowed to equalize between readings
 - An air gap (5mm) was maintained between the chassis and the thermometers that were used
 - Temperature of the main controller and the backplane were taken after 45 minutes of continues operation at load.
 - Thermocouple was calibrated and connected to Fieldpoint to do continuous heat curve
 - Internal RTDs for each pod are available for readout, but record temp on board not at exhaust.

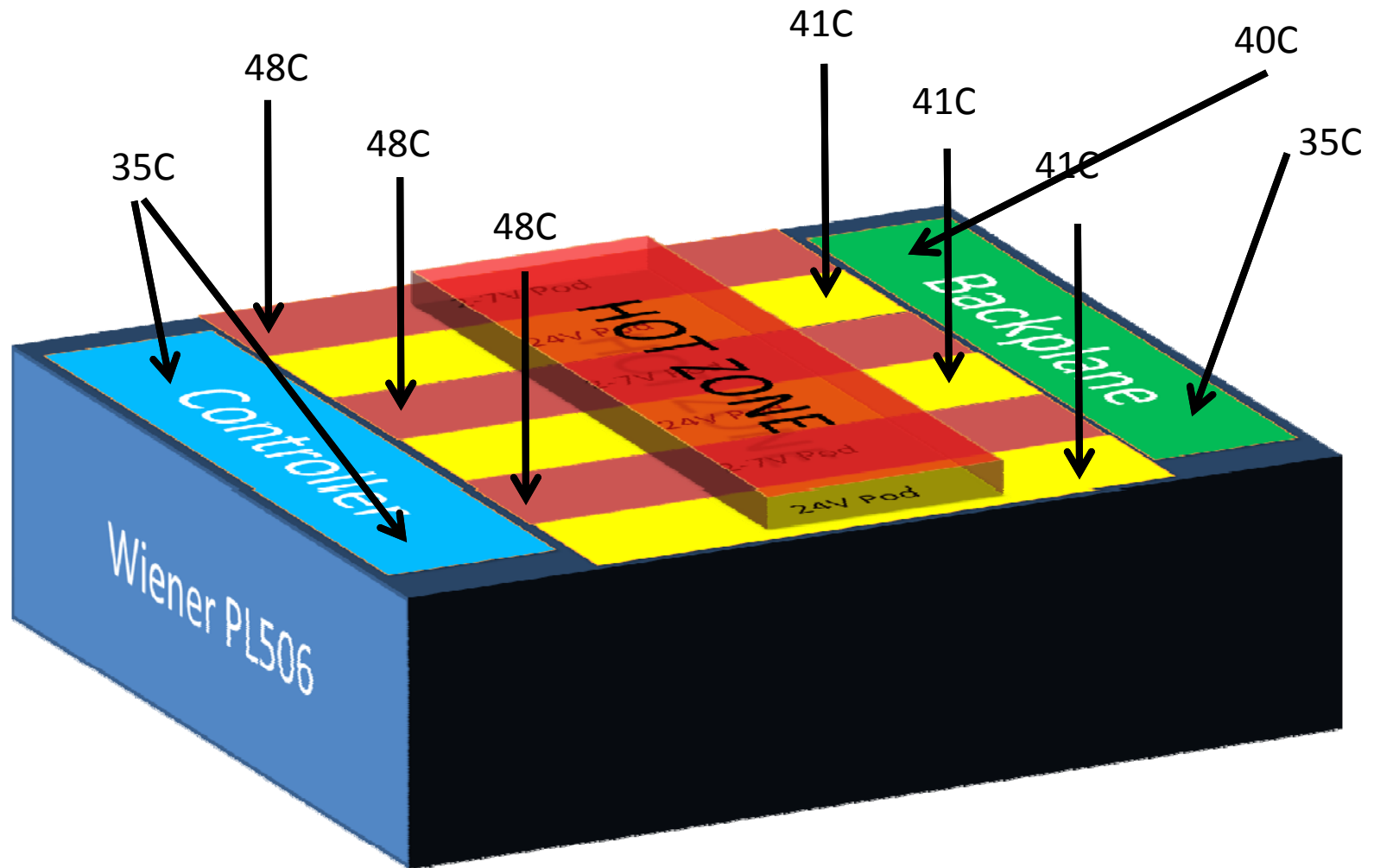


Temperature Profile





Schematic Profile





Operational Range

- Specified operational range of the Wiener PL506 is 0-70C
- Maximum heat rise across the single unit was measured at 25C
 - The heat rise was not uniform.
 - More heat is present over the 2-7V pods than over the 24V pods
 - Internal fans to provide some airflow, but there were still definite “hot spots” between the exhaust
 - Temp at input at input to next unit is roughly 5 deg lower than at exhaust
 - For near detector we are only stacking 2 units per rack
 - Would mean a total heat rise of roughly 45C over both units (assuming 5 deg drop between exhaust and inlet)
 - Operating temp of top unit would be roughly ambient + 45C
 - $22C + 45C = 67C$
 - This is within maximum operational range, but would result in reduced reliability
 - For far detector we are stacking 4 units per rack
 - Would result in roughly 85C rise over room temp
 - Would put operating temp of top unit near $22 + 85 = 107C$
 - This is in excess of the operational range of these units.

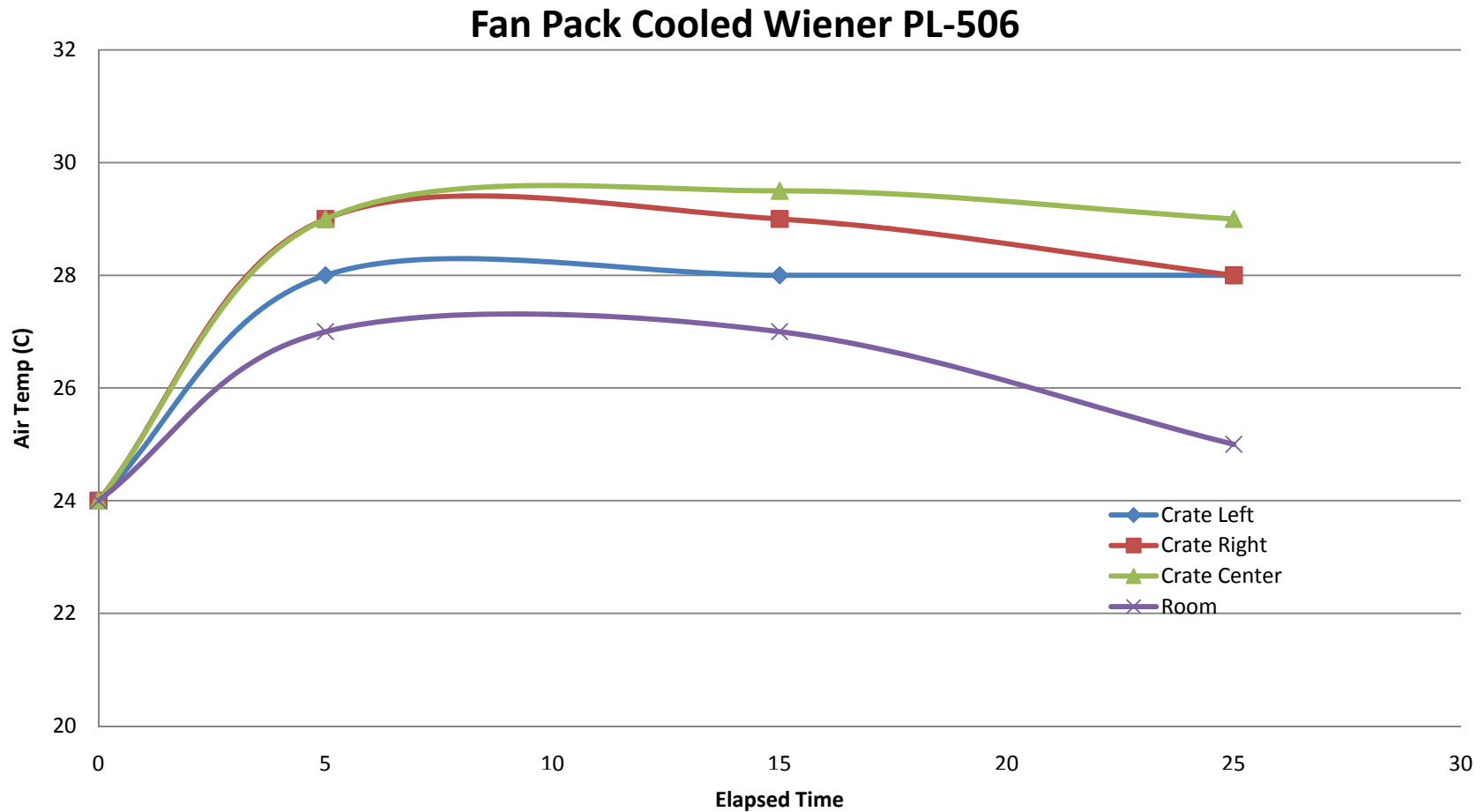


Fan Tray Cooling

- Procurred 1U fan tray from CDF
 - 8(9) 120mm fans in a single unit
 - Produces airflow \approx 900cfm
- Installed directly above the PL506
- Temperatures measured at intake on the SY8800
- No apparent hot spots.
 - Measured Crate Left/Center/Right
 - Largest temp rise was in center at 29.5C



Fan Pack Cooled PL506





Proposed Cooling Config

- Single fan pack with an air gap should be sufficient to cool the supplies
- Base configuration per rack would have:
 - 1 pack at bottom for air intake
 - 1 pack above each PL506 for exhaust
 - For Near Det. would use 3 fan packs total per rack
 - For Far Det. would use 5 fan packs total per rack