Mini stave FEA update

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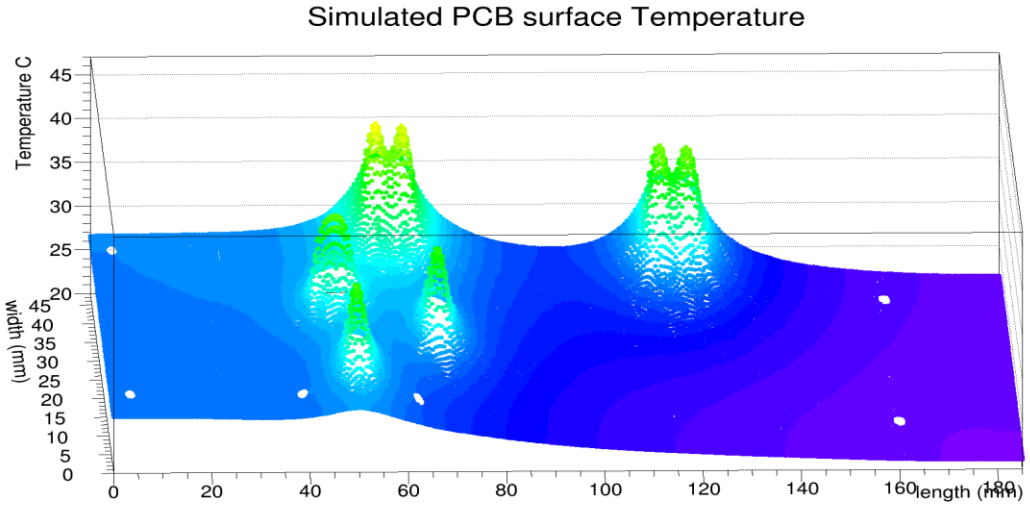
Mini stave thermal measurement at +15C (03.26)

- Take measurement using small angle IR camera lens, pixel length~0.6 mm
- Chiller set Temperature +15C, Bypass inlet 16.7 C, outlet 17.1C, FEA pipe T 16.9C, Box air T 21.5C
- Powered resisters: only LHSM; R4//R5 , R6//R7 each resistor ~ 0.445W; R3~0.446W; R1&R2~0.447W
- Total PCB power: ~3.12W
- Air is off during the entire measurement
- Data obtained at 20,40,60 mins after bypass in/out T is stable
- Average flow rate: ~0.97L/min
- Insulation foam on extension pipe

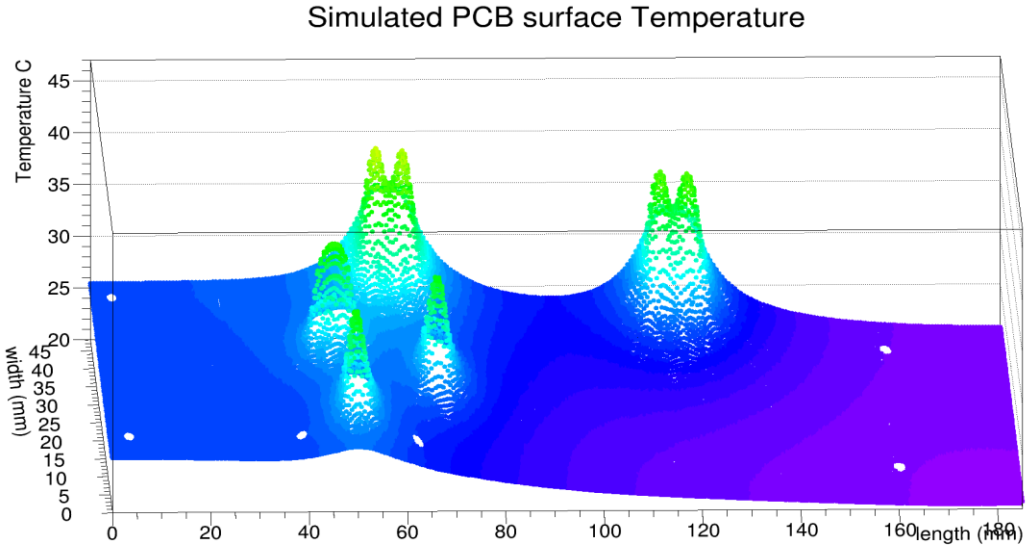
Mini stave FEA model

- Pipe temperature :16.9 C
- Ambient contact coefficient : 8E-6 W/mm^{2}K ; pipe surface contact coefficient: 7E-3 W/mm^{2}K
- PCB conductivity: x & y direction: 2.5E-2 , z direction: 5E-4 W/mK (FEA 03.26)
- EOS foam conductivity: x&y&z direction: 30W/mK (FEA 03.26); 40W/mK (FEA 04.03)

PCB surface temperature comparison at Chiller set T +15C

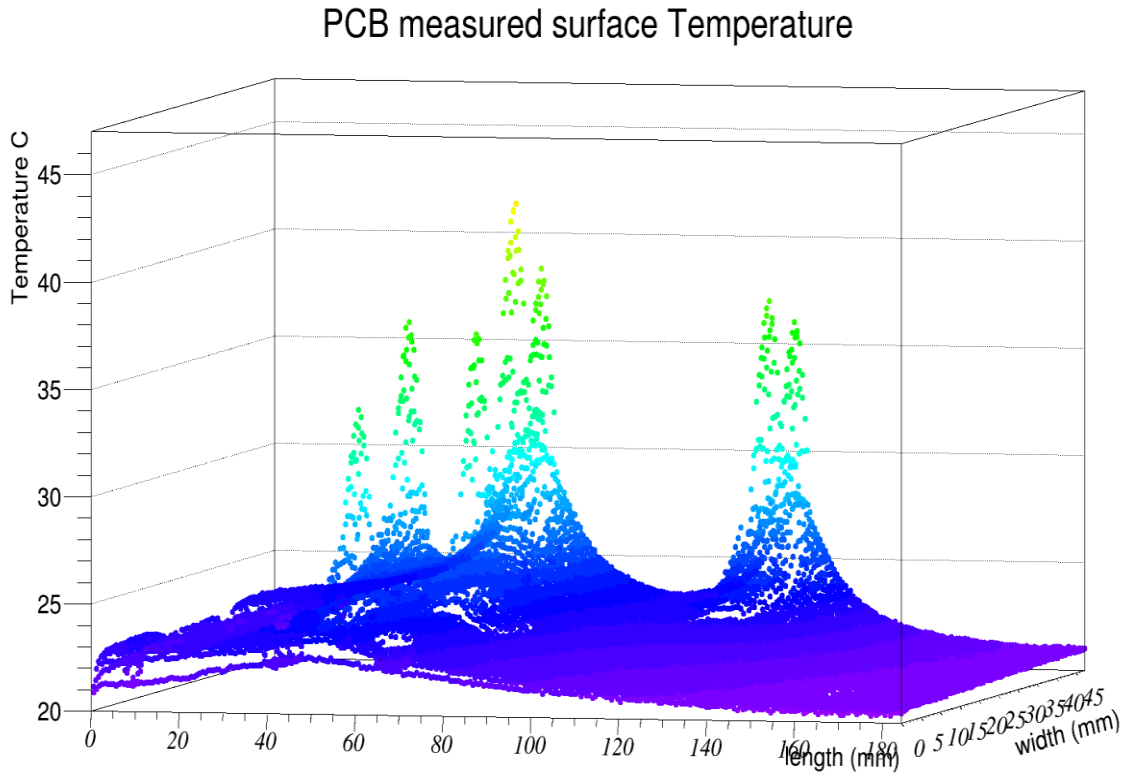


Foam conductivity 30W/mK



Foam conductivity 40W/mK

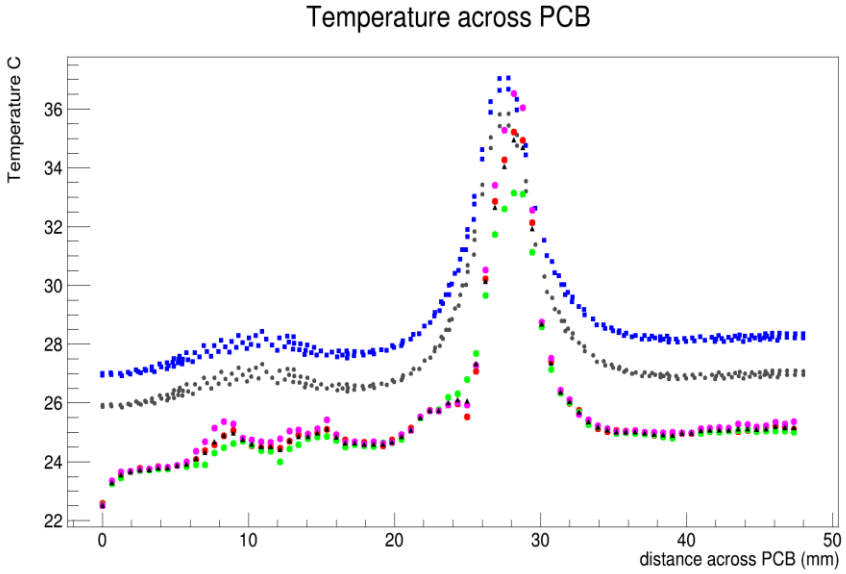
Ambient contact area: PCB and main stave region



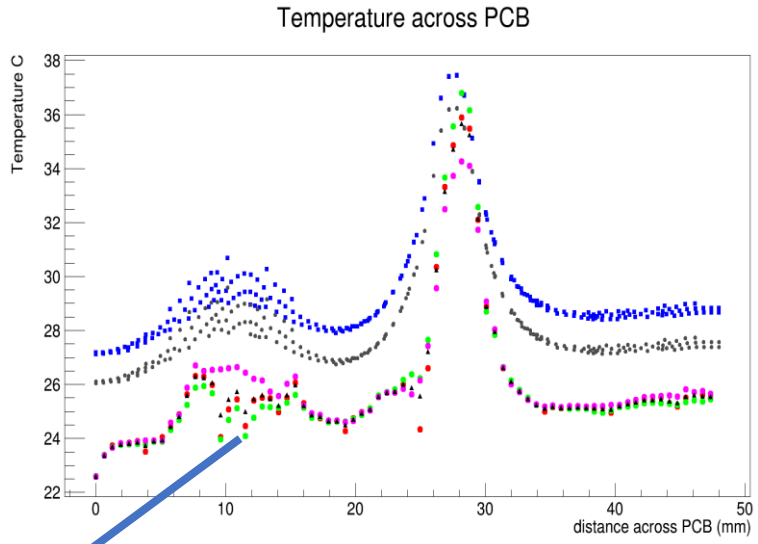
Data taken at 60mins

Temperature across PCB at Chiller set T +15C

- Curve color: red x ; green x-1; purple x+1; black T average of three curves. x is pixel index along PCB length
- FEA (foam 30W/mK): blue square
- FEA (foam 40W/mK): gray circle

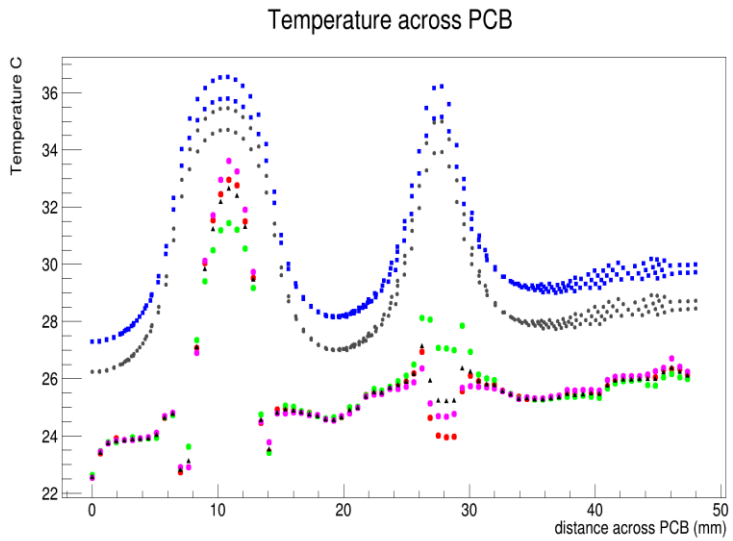


passes R3, x=223

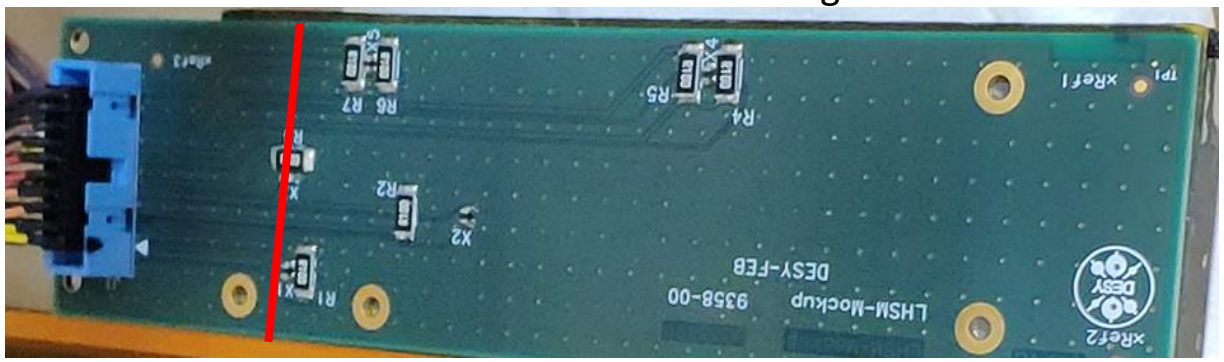


Thermistor region

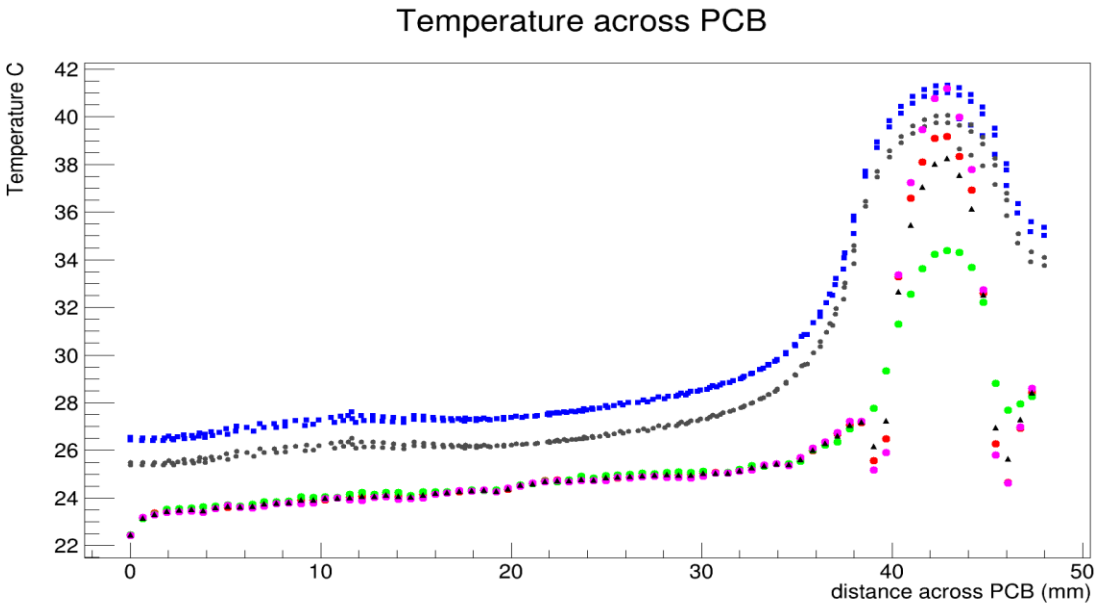
passes R3, x=226



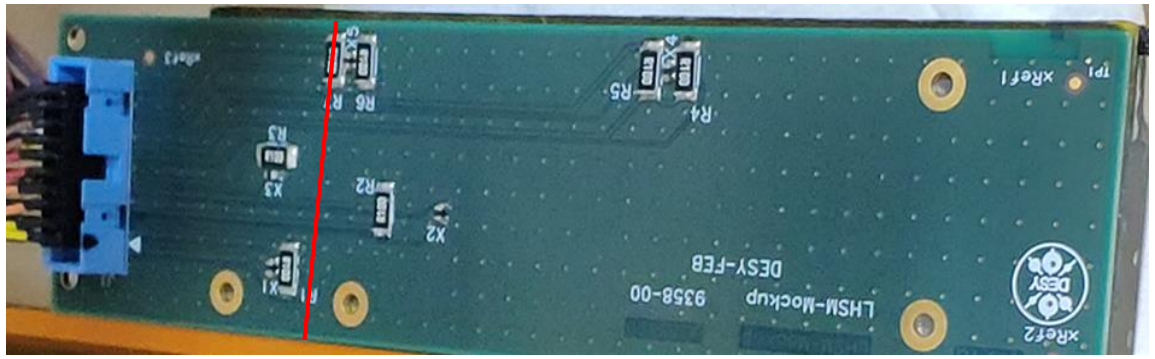
passes R1, R3 soldering point ;x=230

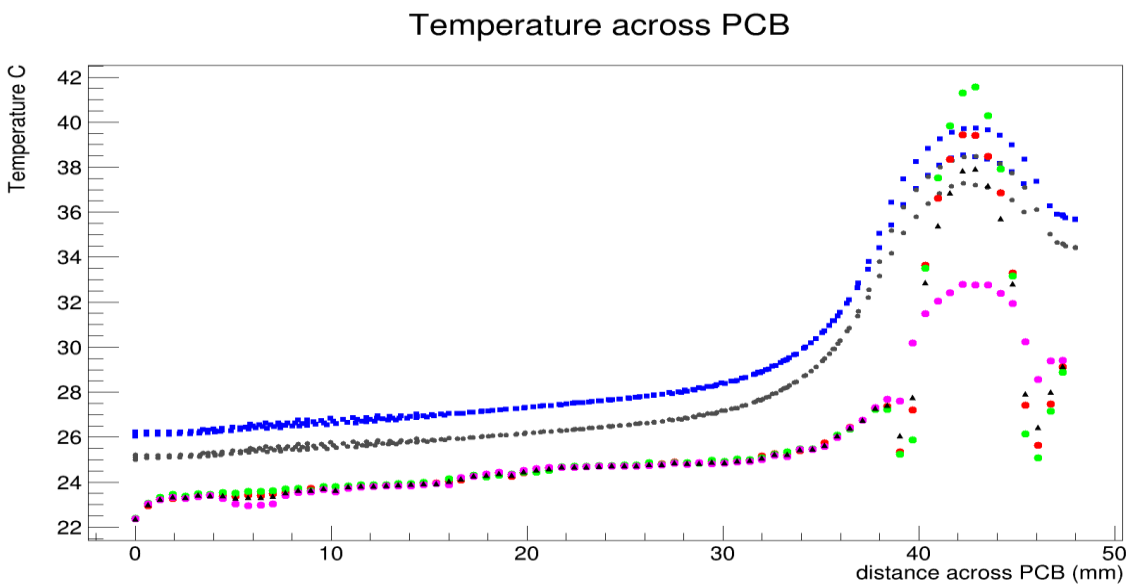


Temperature across PCB at Chiller set T +15C

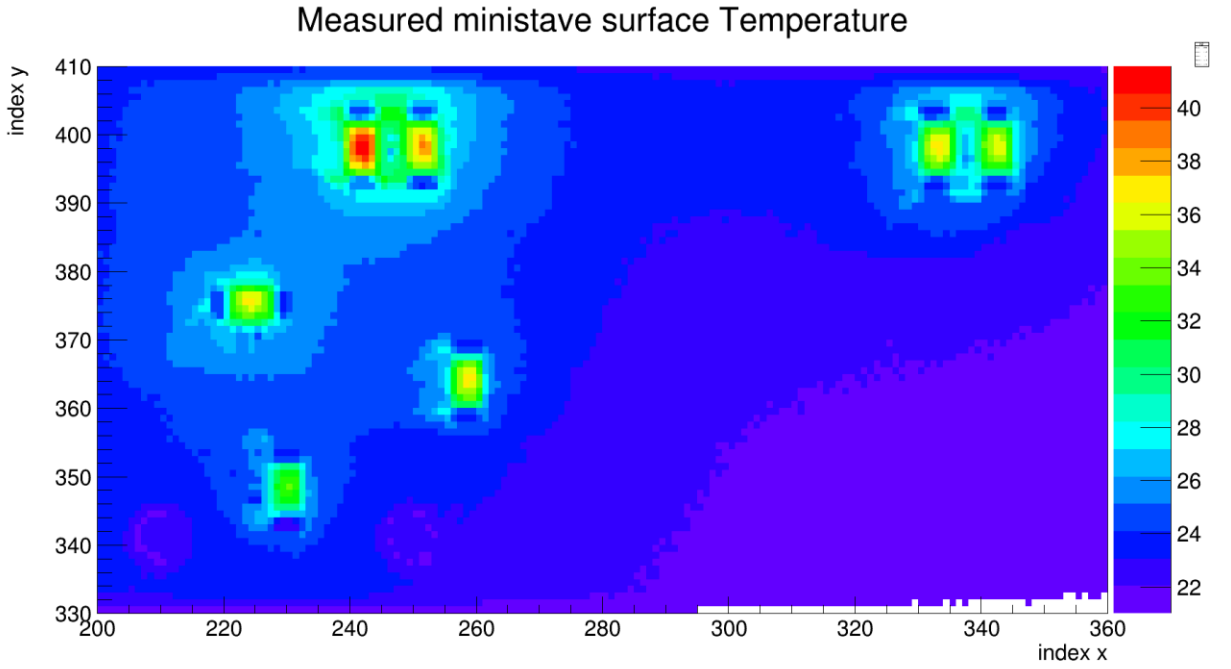


passes R7, x=241

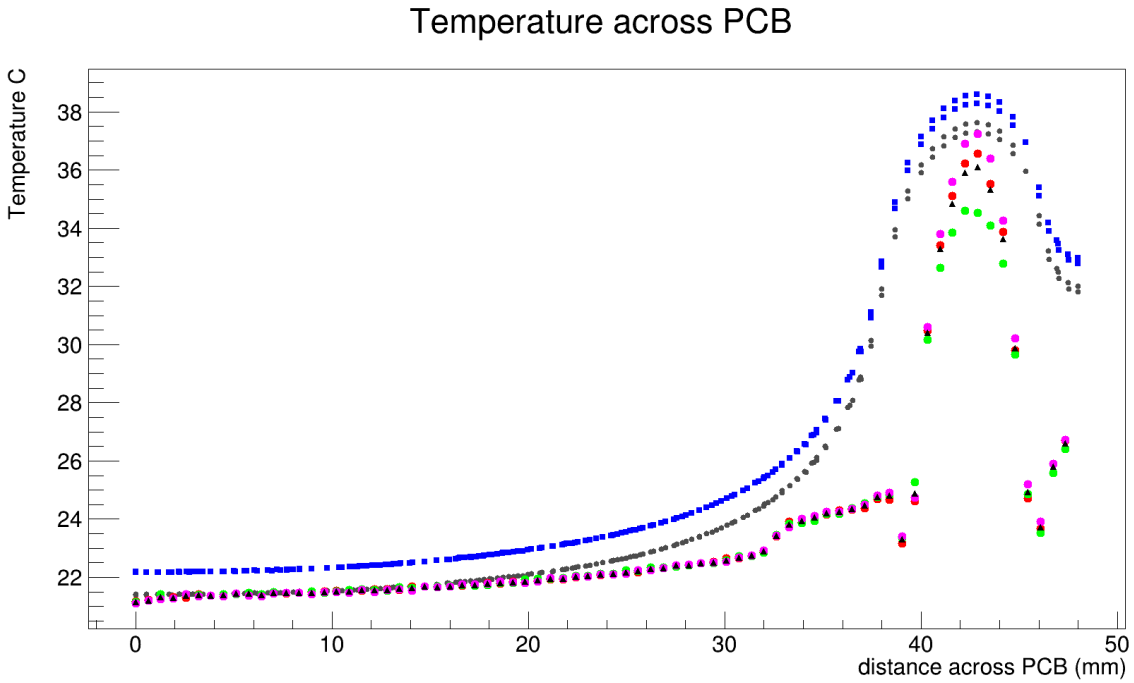




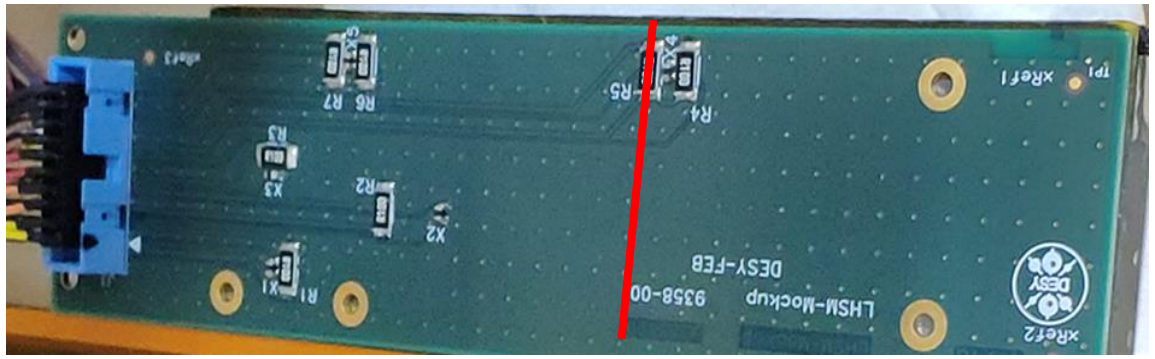
passes R7, x=244

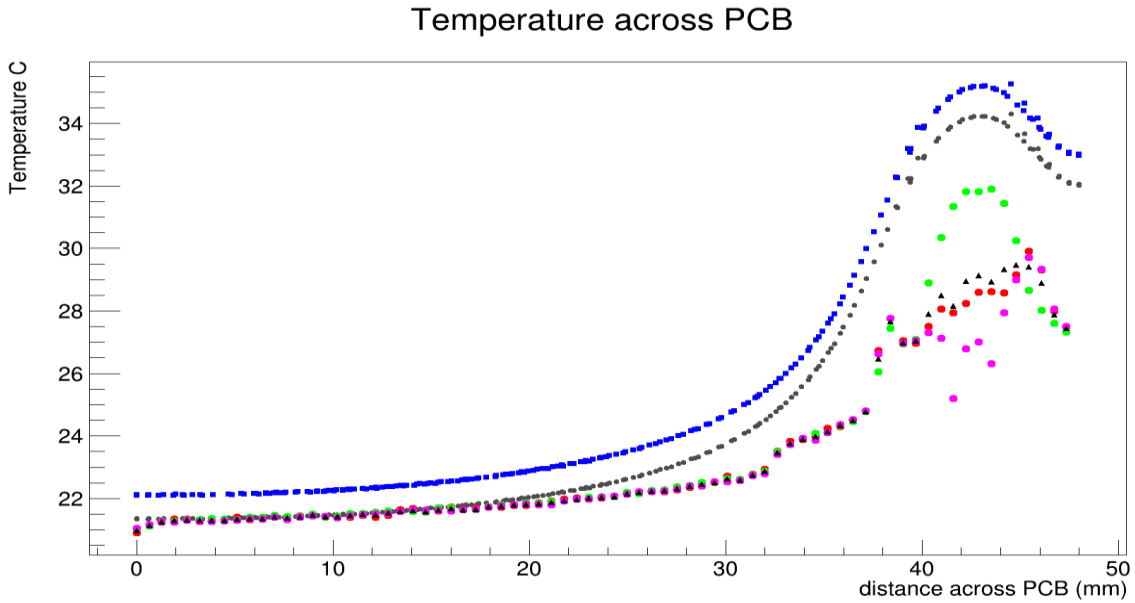


Temperature across PCB at Chiller set T +15C

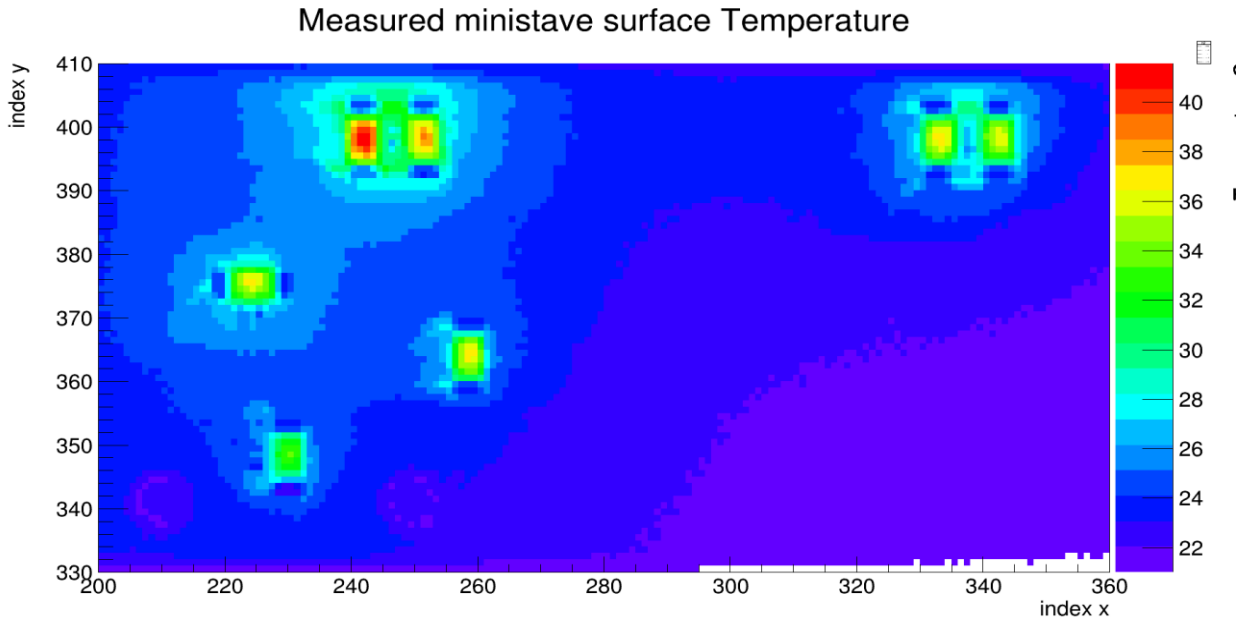


passes R5, x=333



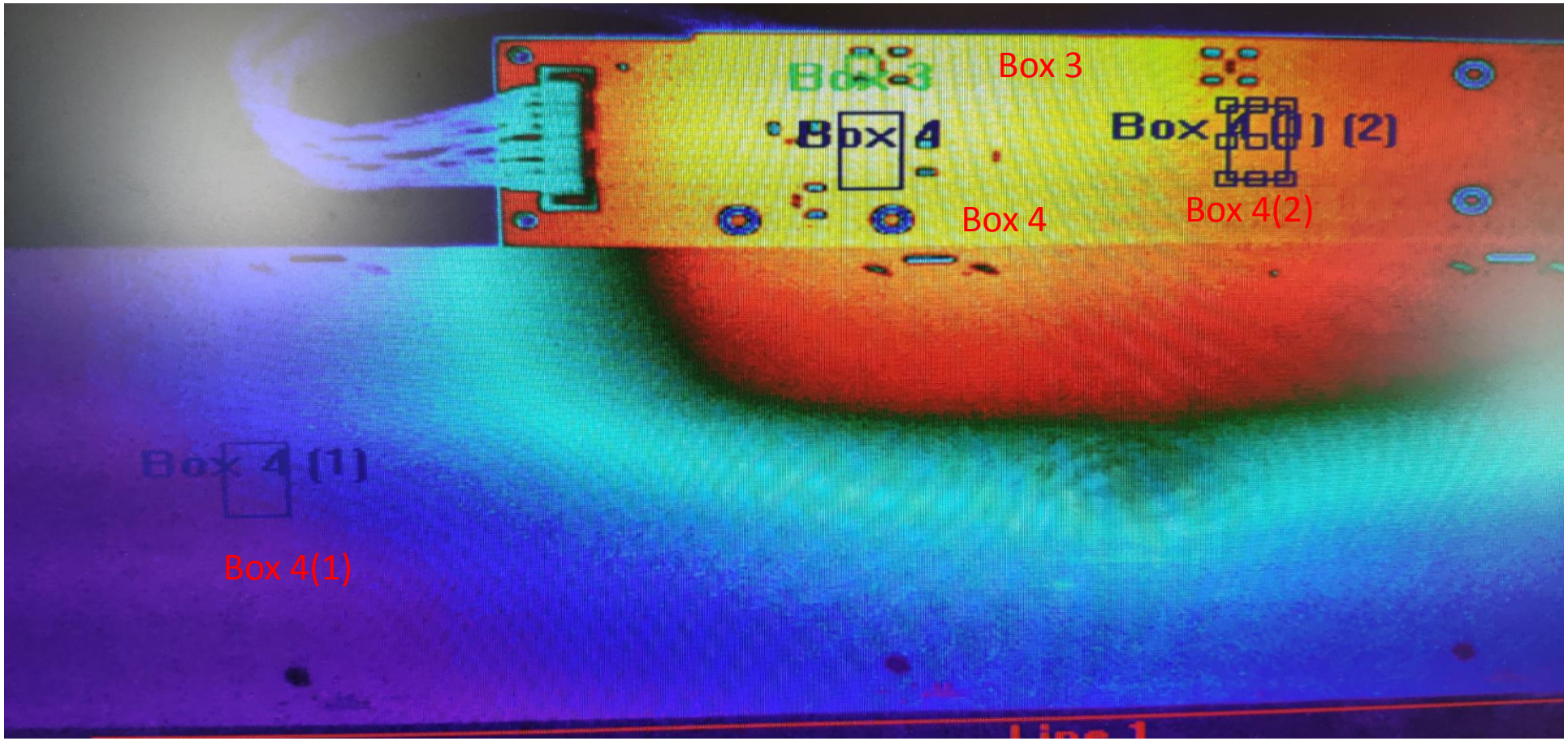


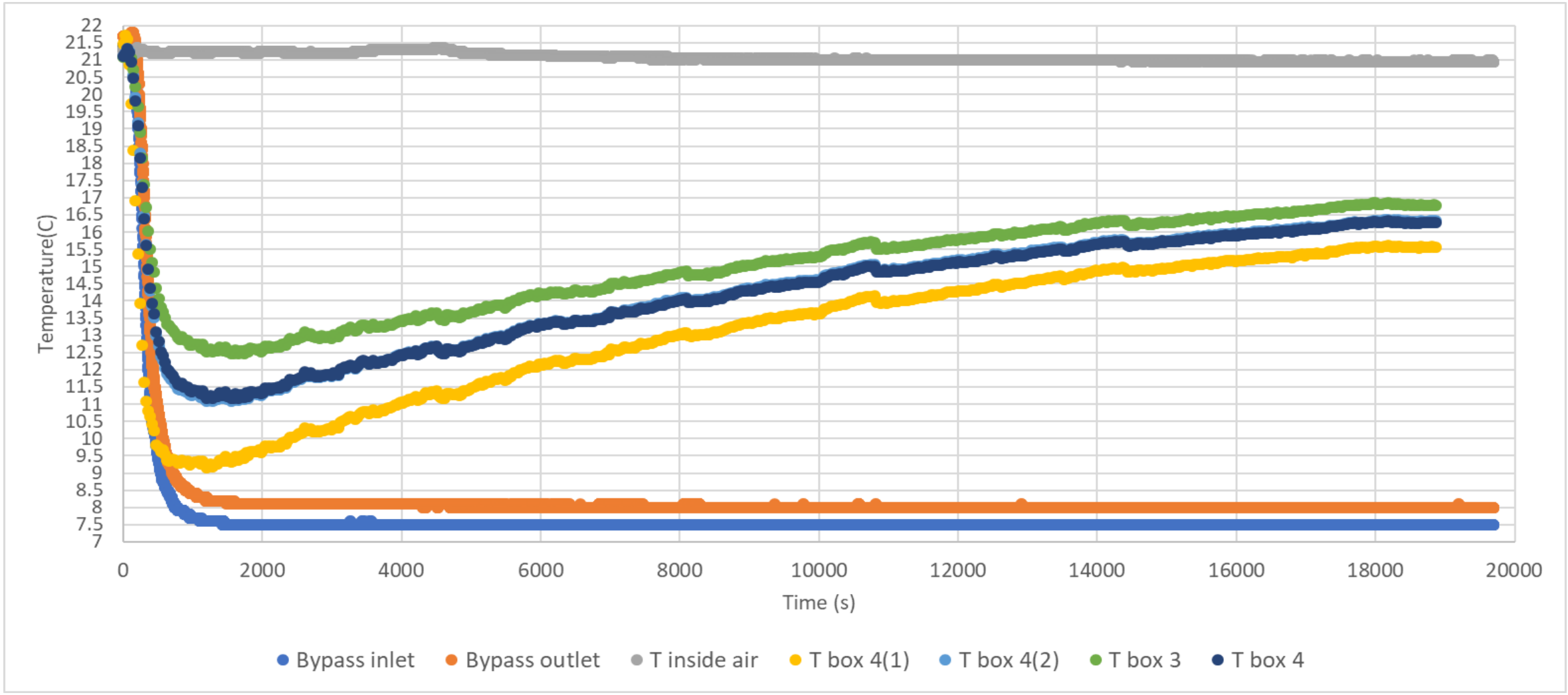
between R5 & R4 (thermistor region), x=337



Time for reaching equilibrium at chiller set T +5C

- Four areas are selected for obtaining averaged T during measurement
- Air is off through entire measurement
- No resistor power, only contact with ambient
- Two separate measurements, results have same pattern





Averaged T for area 4 is close to area 4(2) , the small steps are due to IR camera preforming corrections (auto NUC) stave reaches equilibrium with air close to it at first. If the ambient contact coefficient is 8E-6W/mm^{2}K, assume the stave equilibrium temperature is 16C. The heat transfer from air to stave is Q=2*stave surface area*ΔT*8E-6~3.44W. For flow rate close to 0.96L/min, heat need for fluid reach 0.1C is about 2.85W . Accuracy of thermal couple is 0.2C