Thermal FEA mini stave PCB

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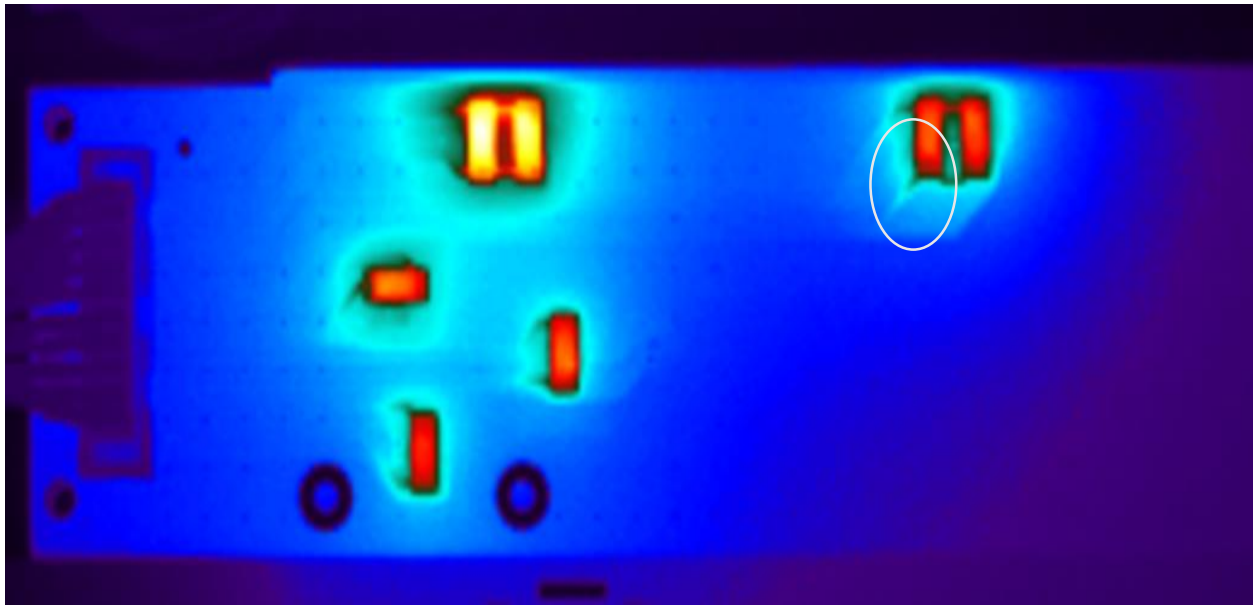
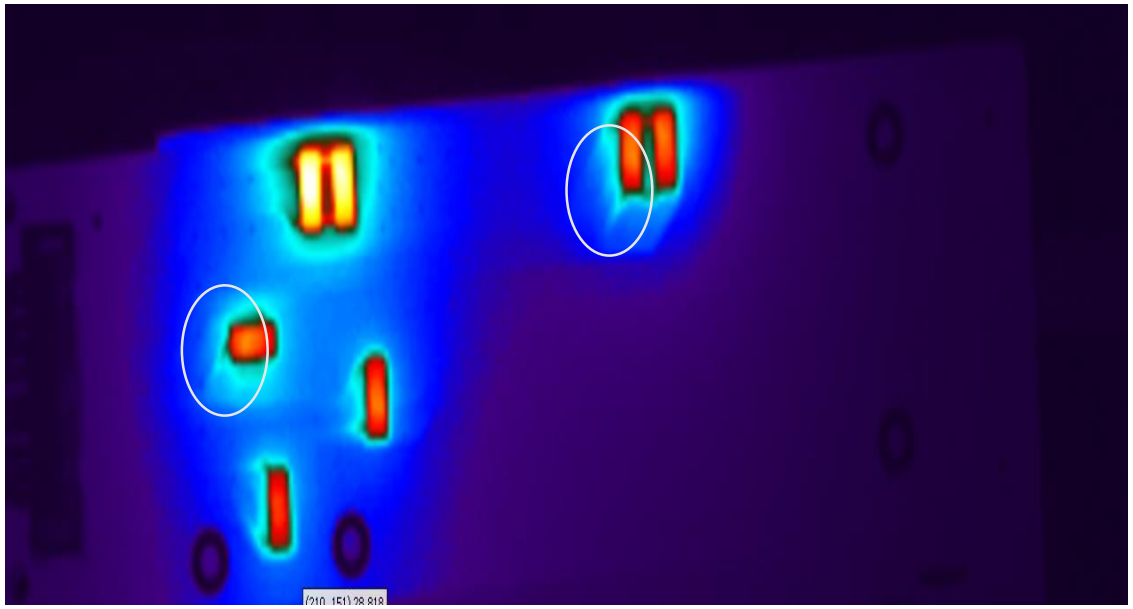
2019/06/13

Spray painting mini stave PCB

- Sprayed second time this Tuesday, resistor may not be coated uniformly
- Reflection still exists



After first spray



After second spray

Mini stave thermal measurement at T 21C (06/08)

Run measurement again to see resistor T after spraying PCB, set up is same as 05/23

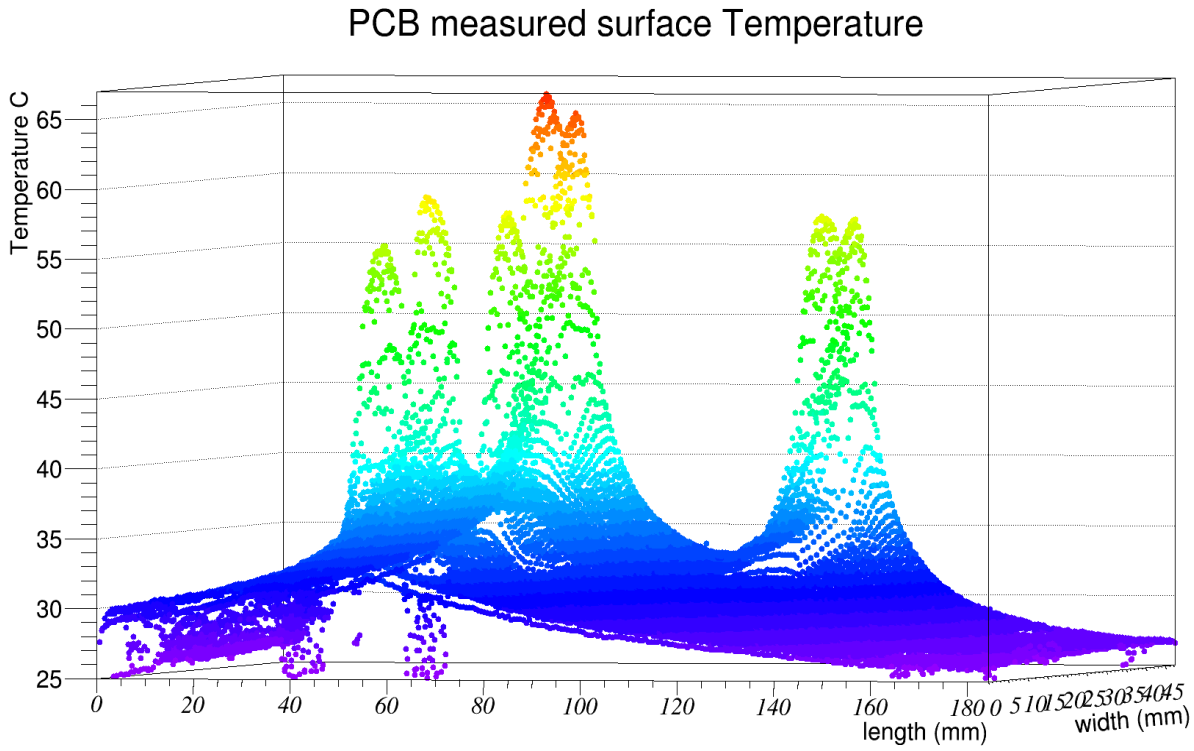
- Cooling fluid flow rate: ~0.34L/min
- No resistor power
- Add box air flow
- Chiller set T +20C
- Bypass T: inlet 21.1C, outlet 21.6C
- Pixel length: ~0.63 mm

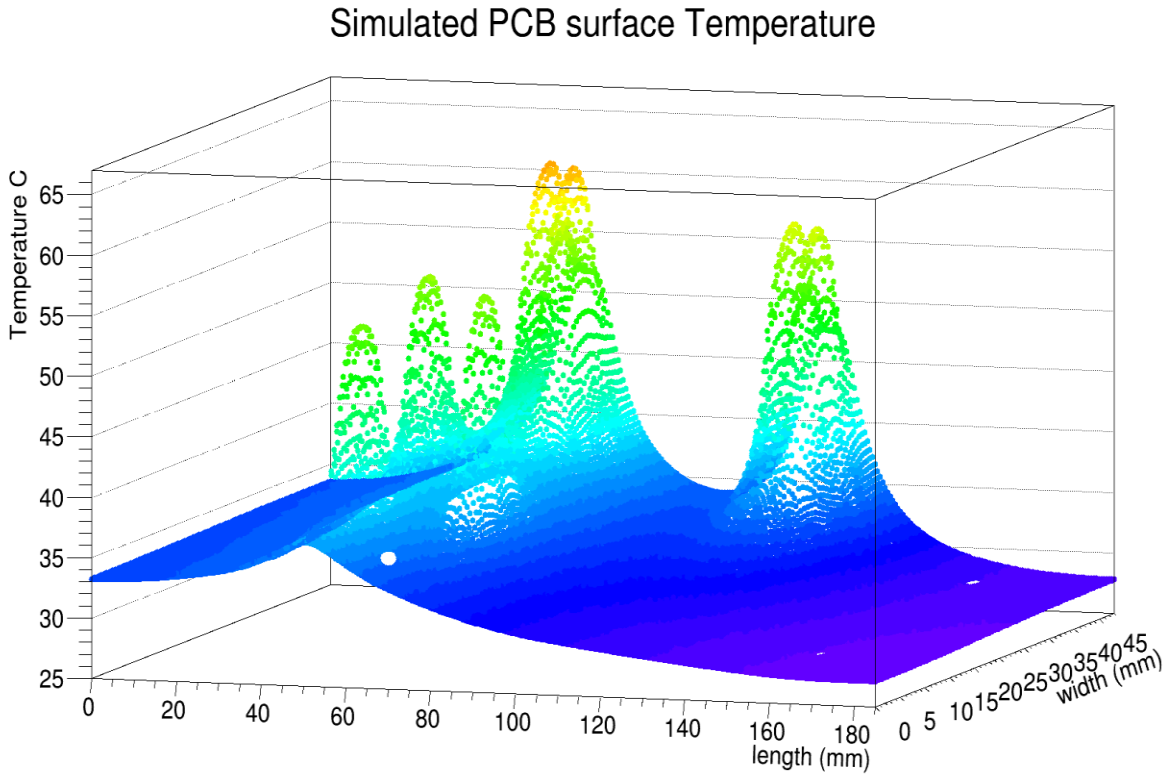
Mini stave FEA simulation

- Pipe T: 21.35C
- Ambient T: 21.4C
- Ambient contact coefficient: 5.5×10^{-6}W/mm²K
- Cooling fluid contact coefficient: 3×10^{-3} W/mm²K for flow rate~0.34L/min @ 21C
- Ambient contact region: PCB & main stave surface, both sides

add PCB side surface (changes a little)

PCB surface temperature



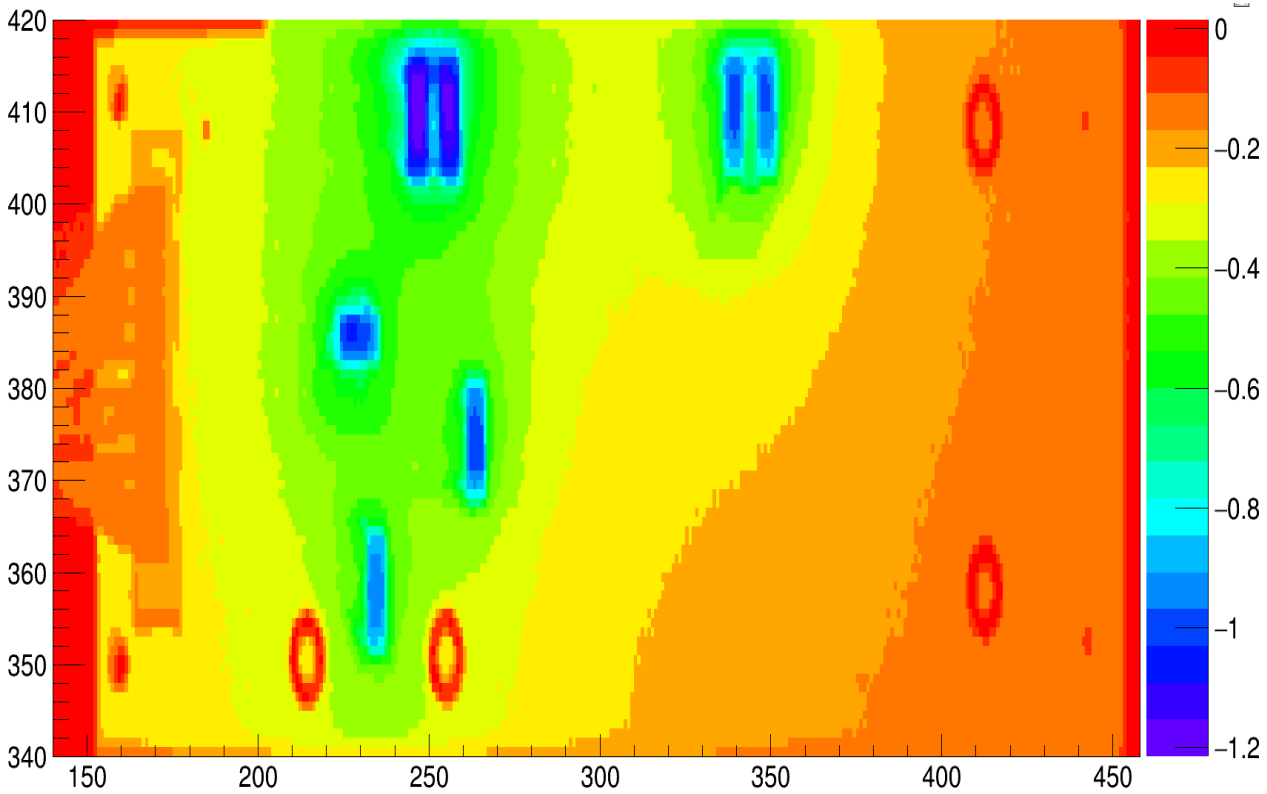


Temperature across PCB

Paint emissivity: 0.89

PCB emissivity: 0.92

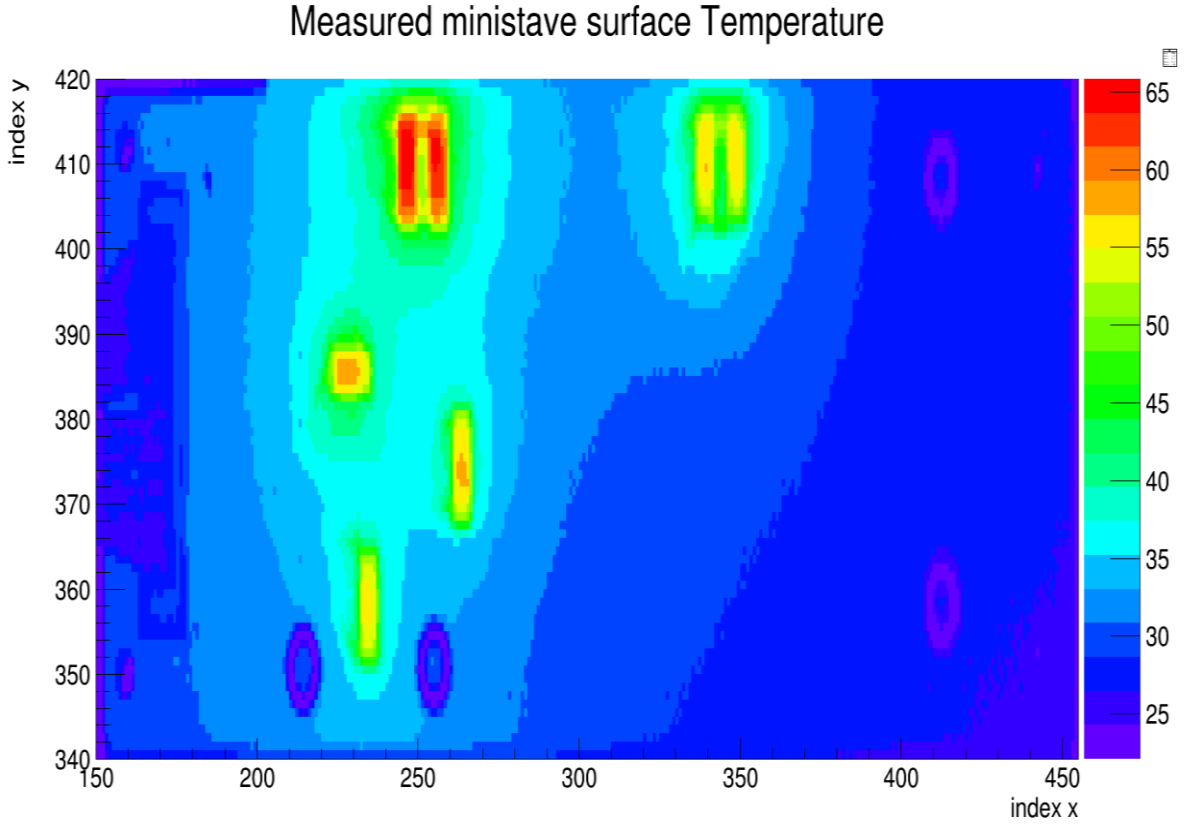
PCB T difference 0.92 - 0.89



T difference: ~1C difference at resistor

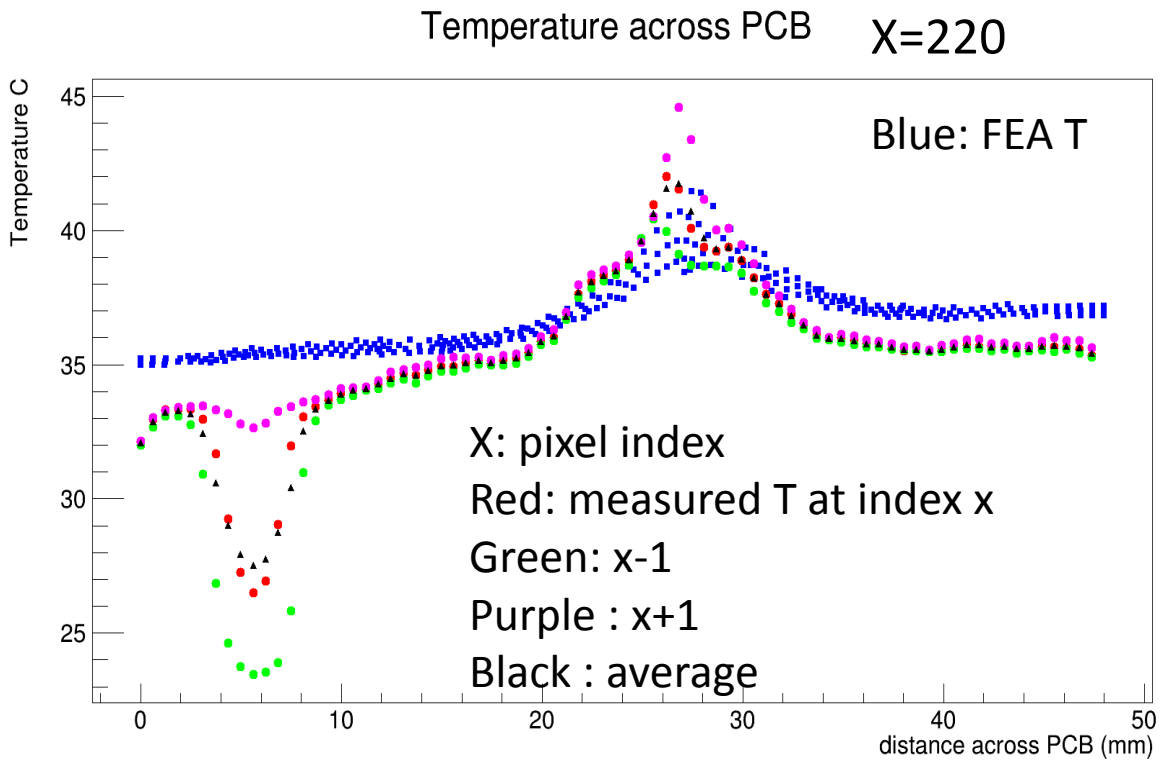
~0.5C near resistor

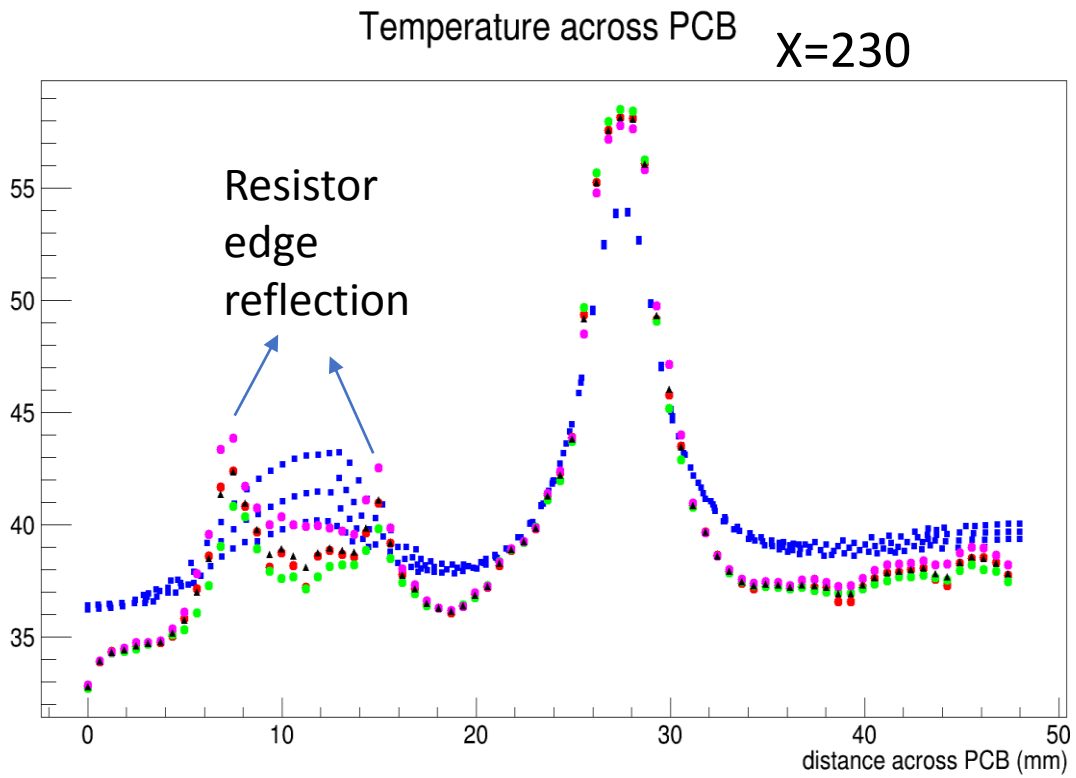
~ 0.3C other area

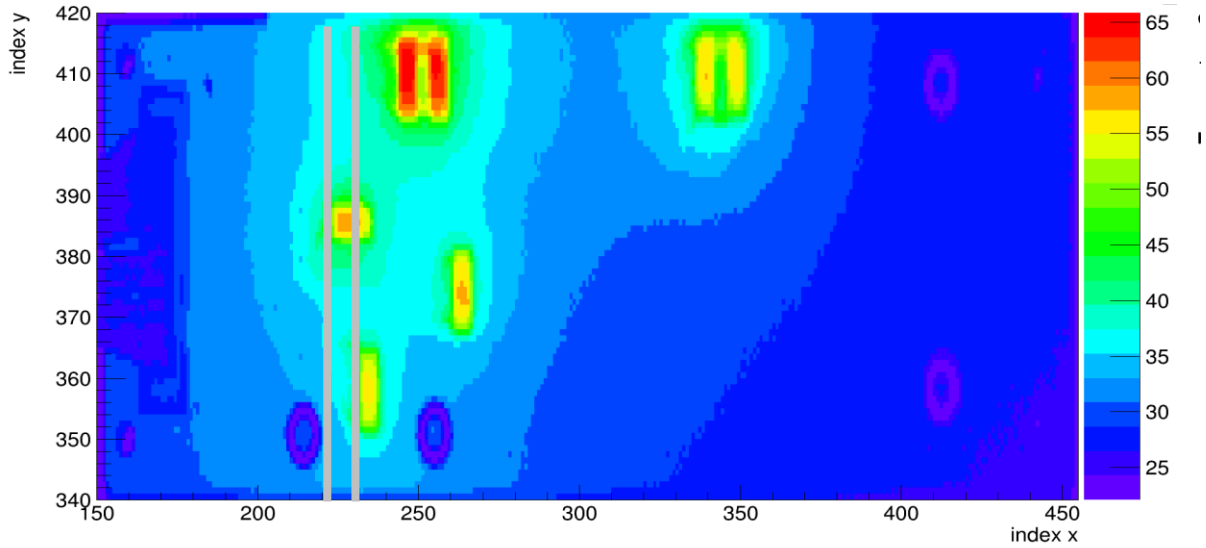


emissivity: 0.89

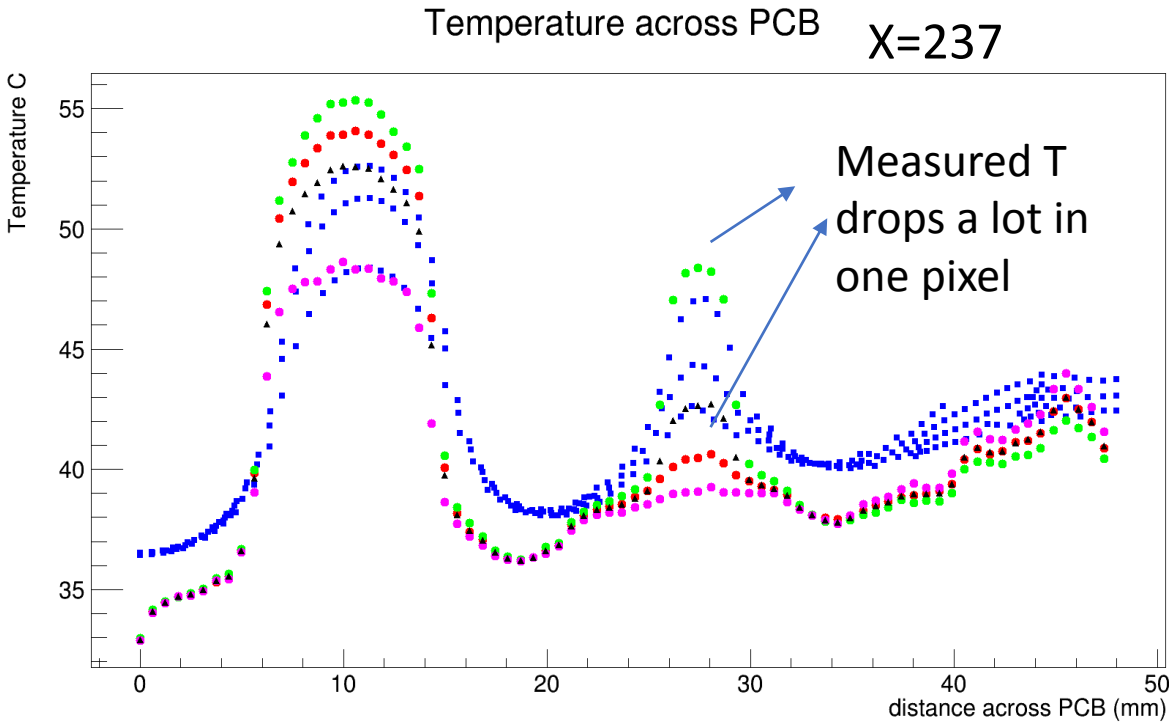
Temperature across PCB (06/08)

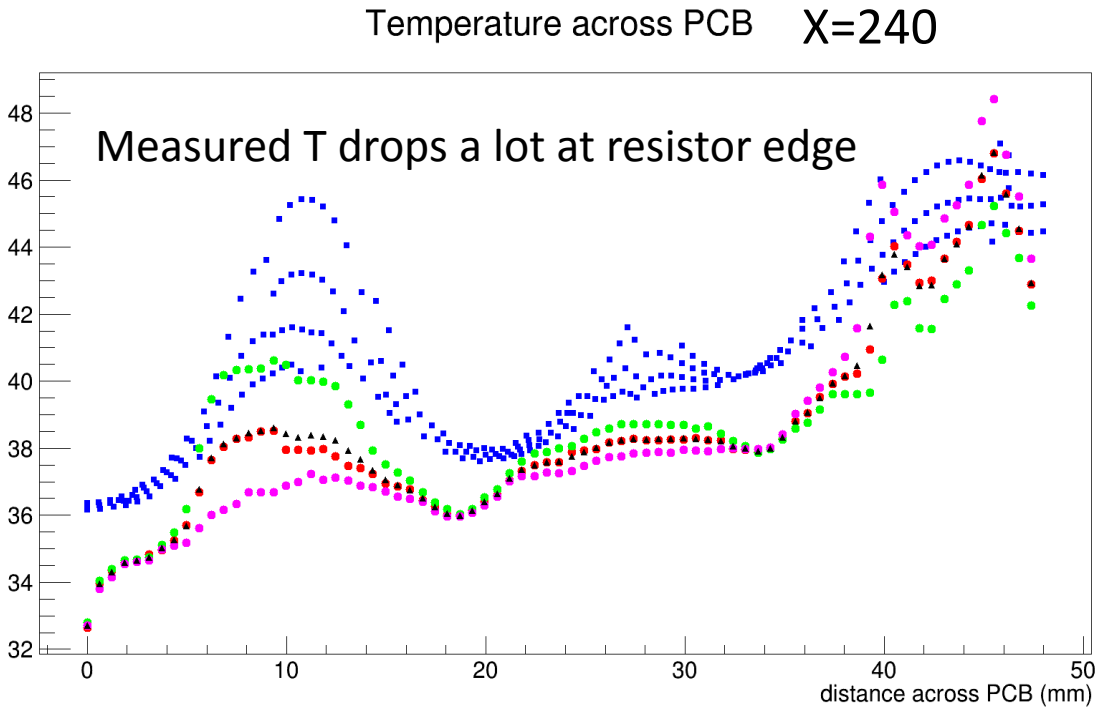


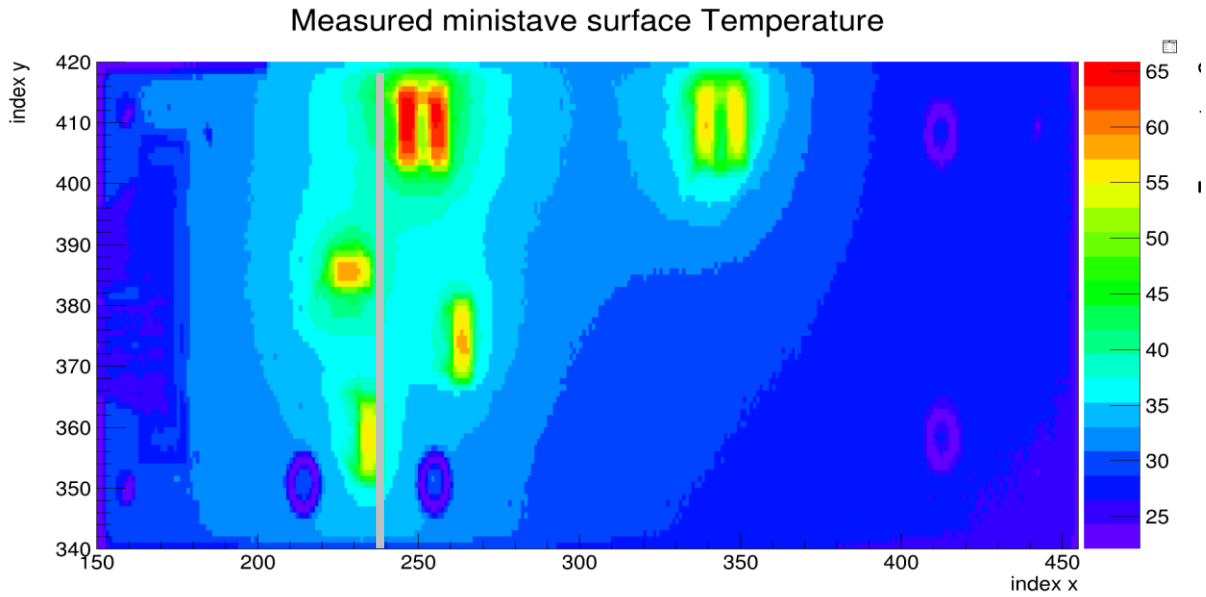


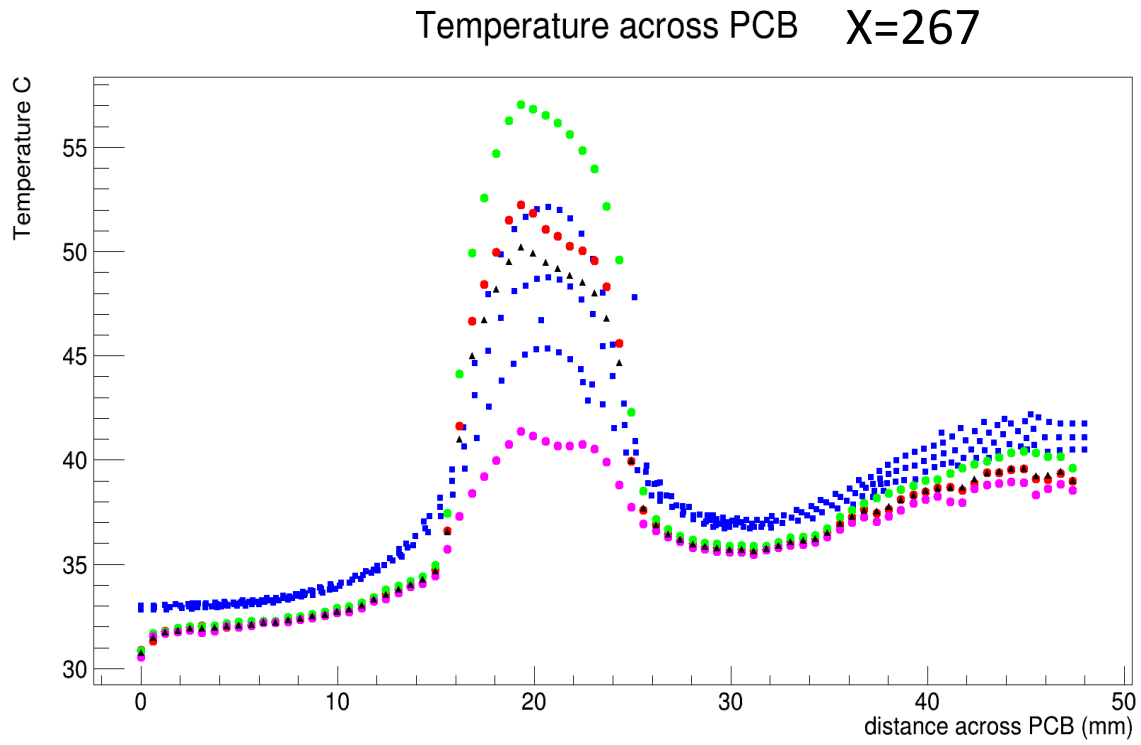


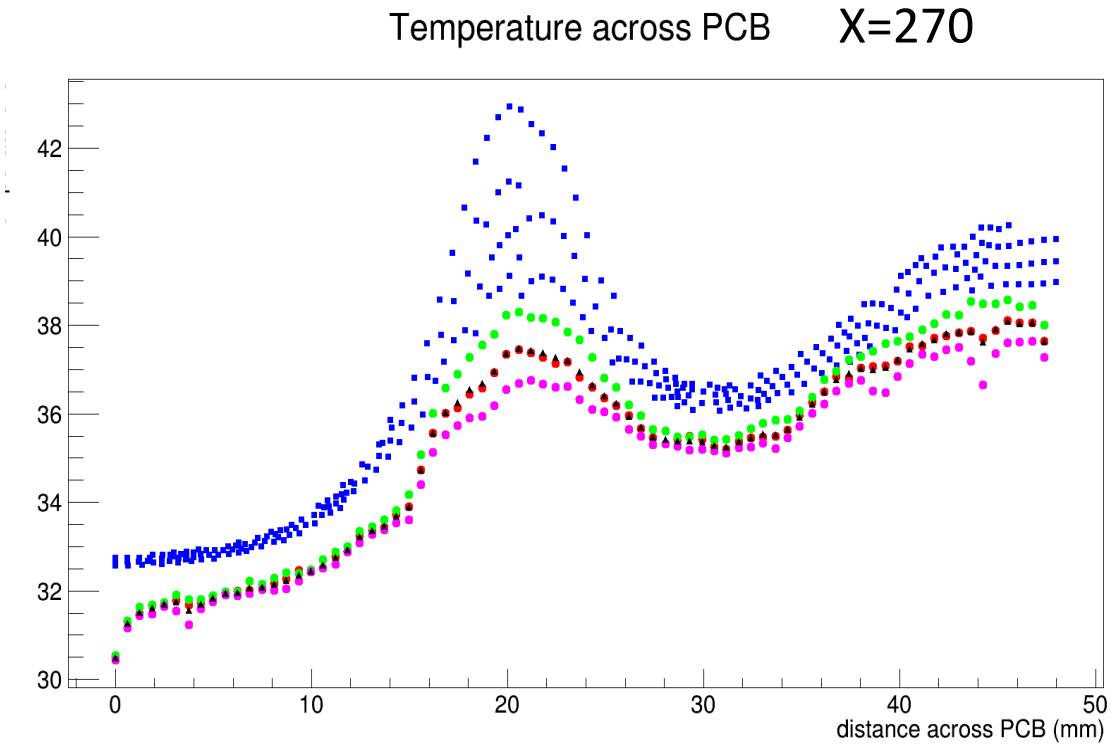
Emissivity used for PCB: 0.89

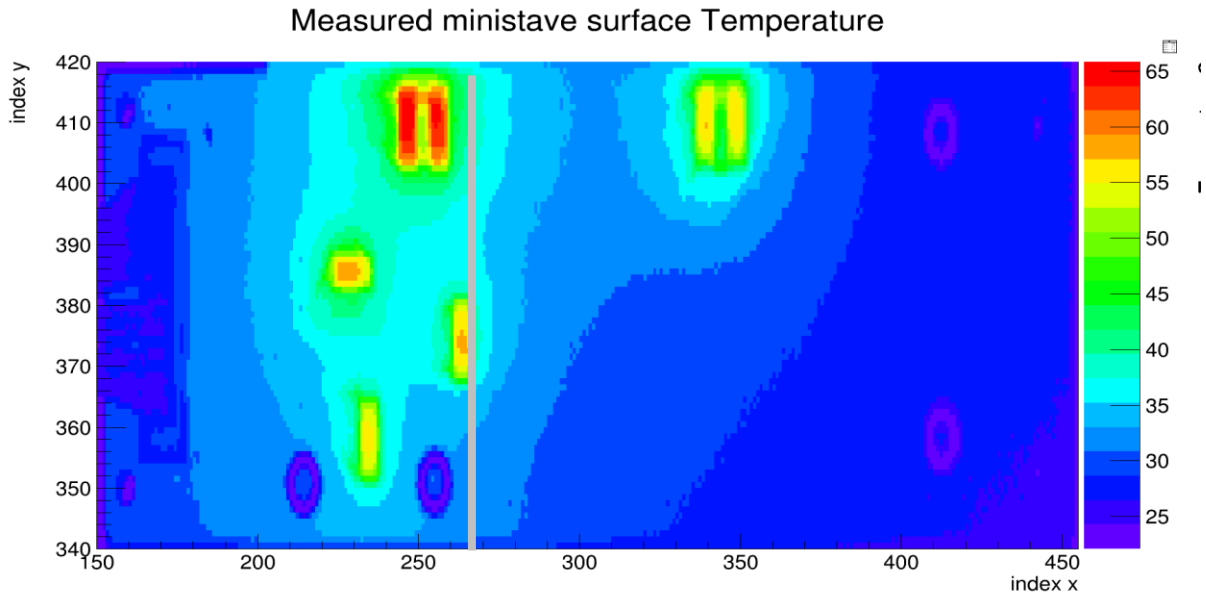

Temperature across PCB
X=237
Temperature C
Measured T drops a lot in one pixel
distance across PCB (mm)


Temperature across PCB
X=240
Measured T drops a lot at resistor edge
distance across PCB (mm)

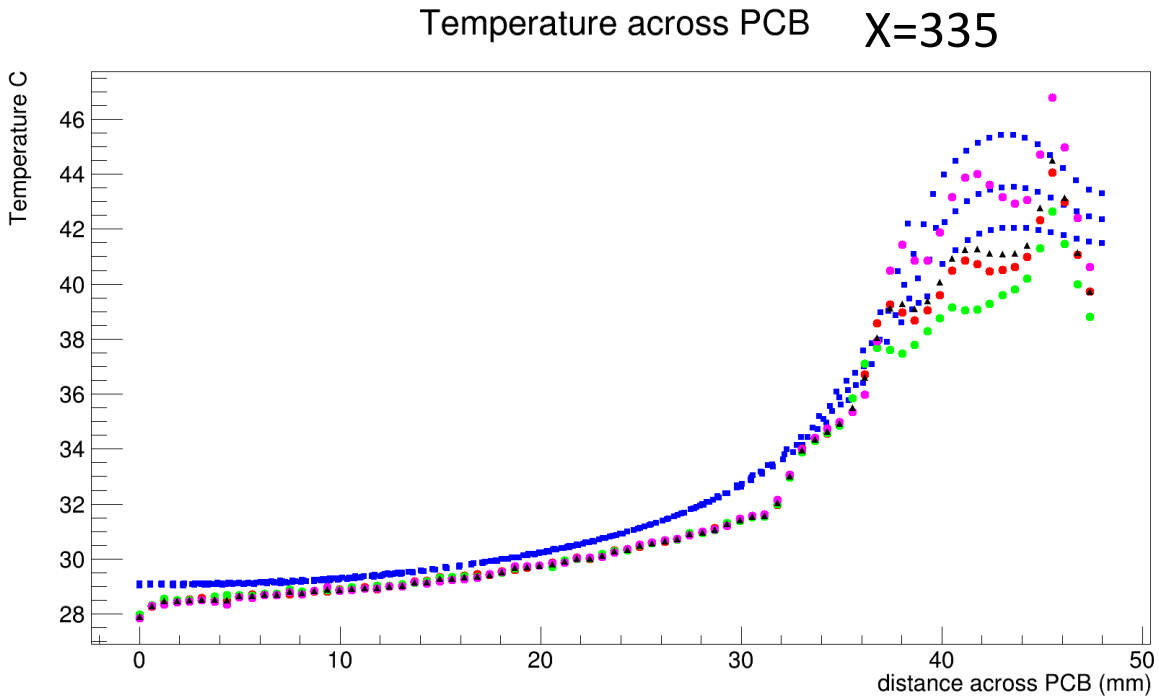

Measured ministave surface Temperature
index y
index x

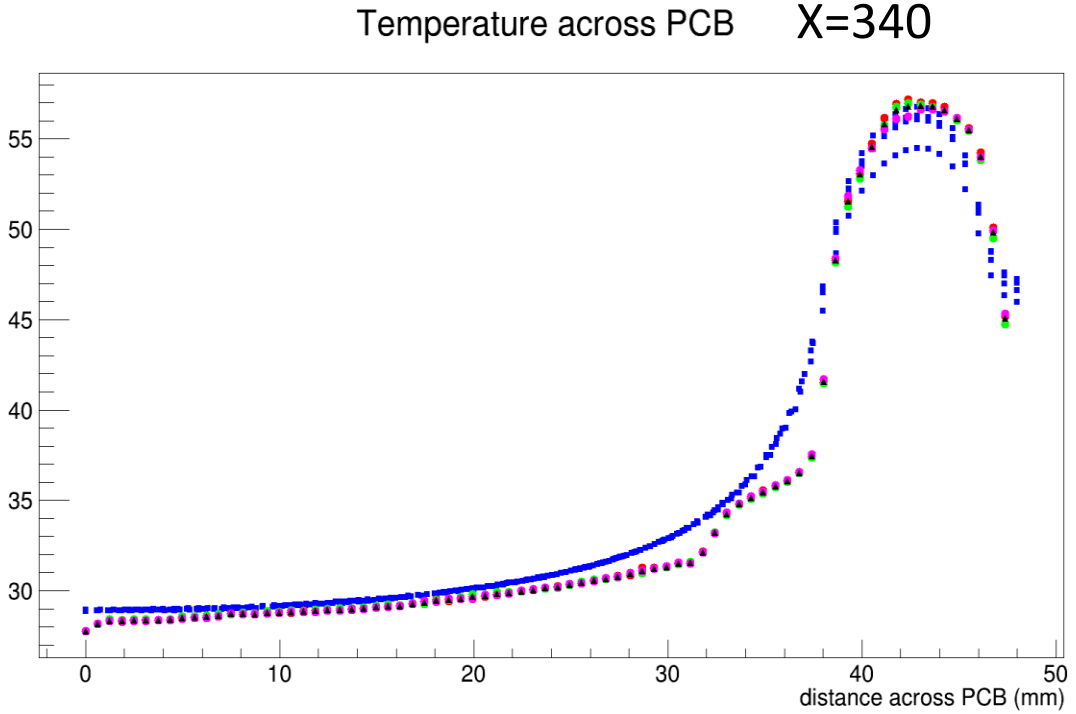


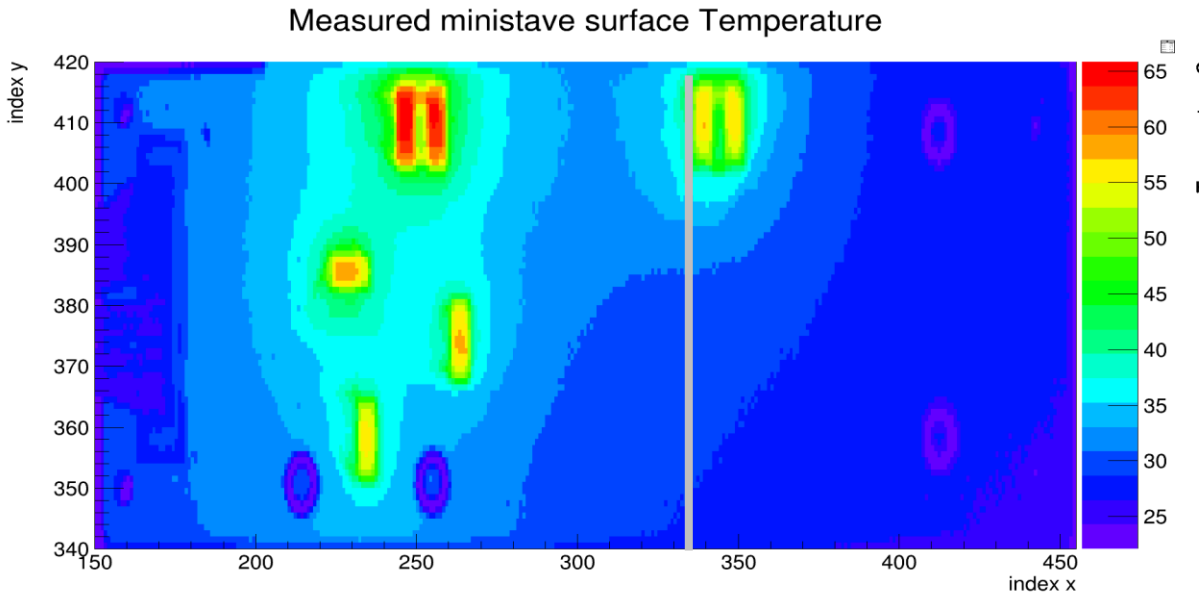


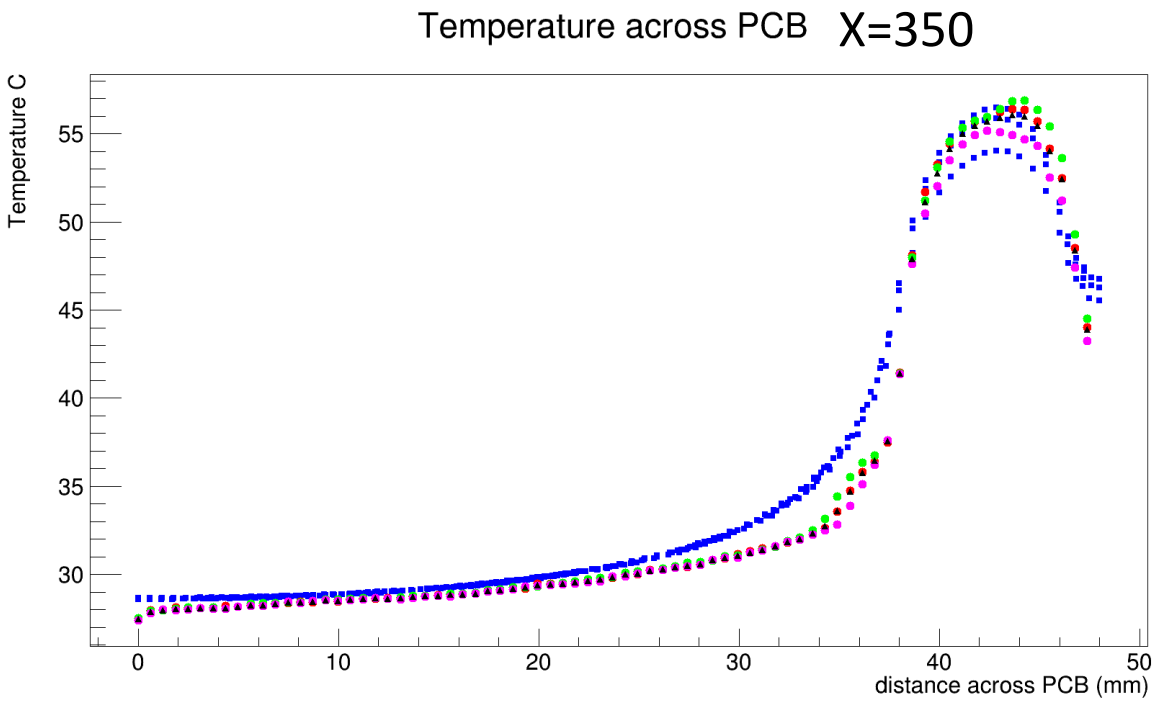


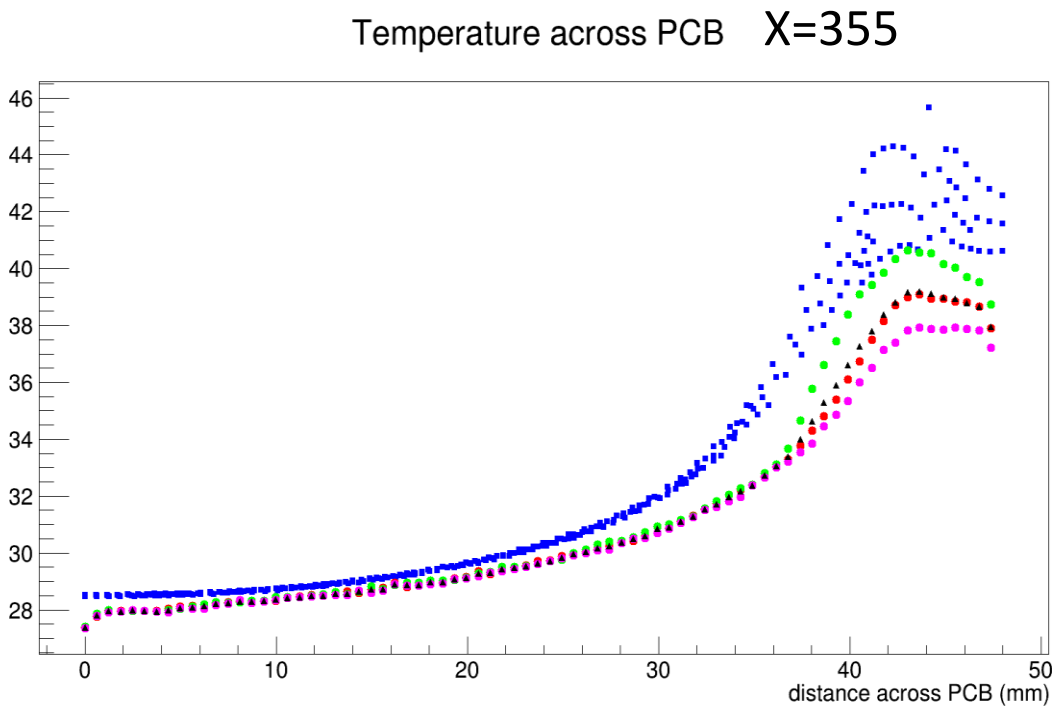
Temperature profile has same pattern as previous slide

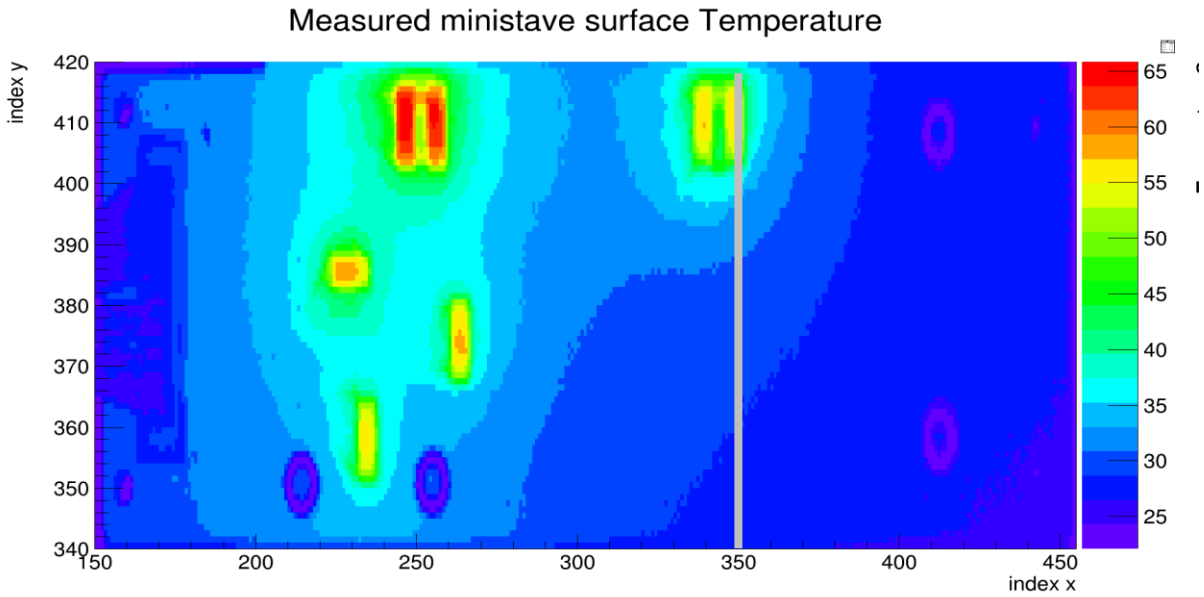

Temperature across PCB X=335
Temperature C
46
44
42
40
38
36
34
32
30
28
0
10
20
30
40
50
distance across PCB (mm)

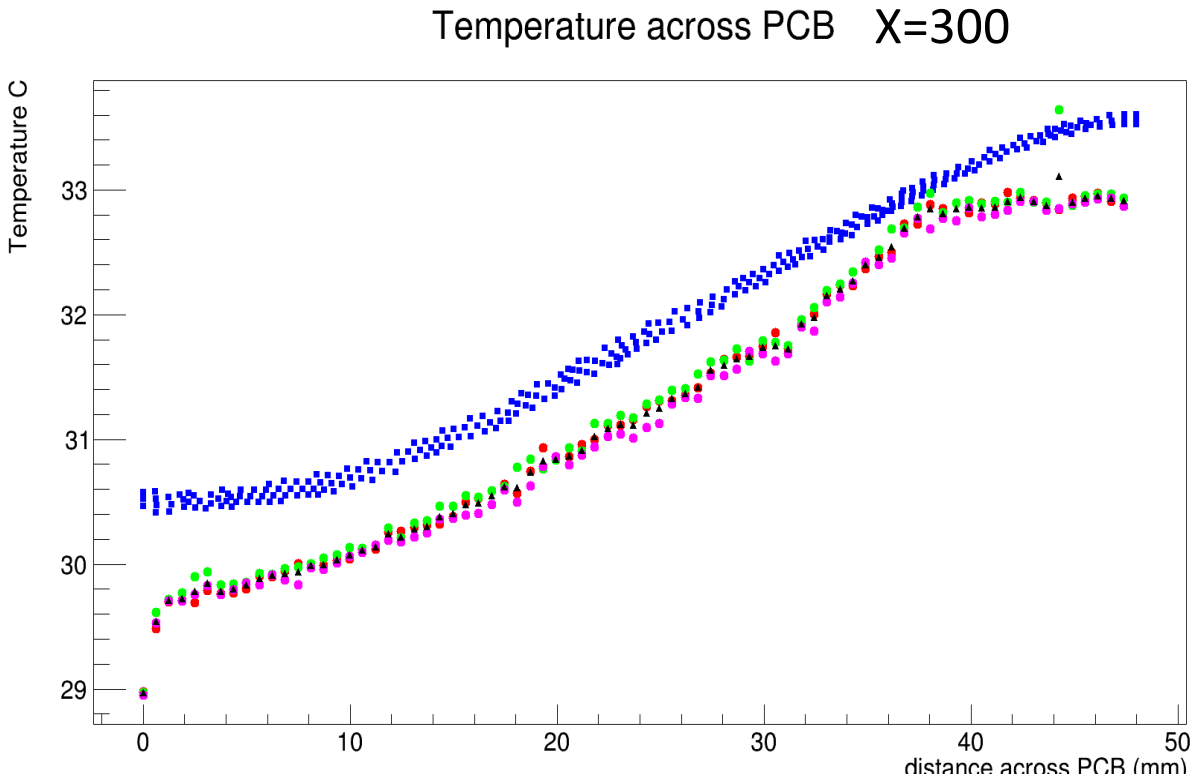

Temperature across PCB X=340
55
50
45
40
35
30
0
10
20
30
40
50
distance across PCB (mm)

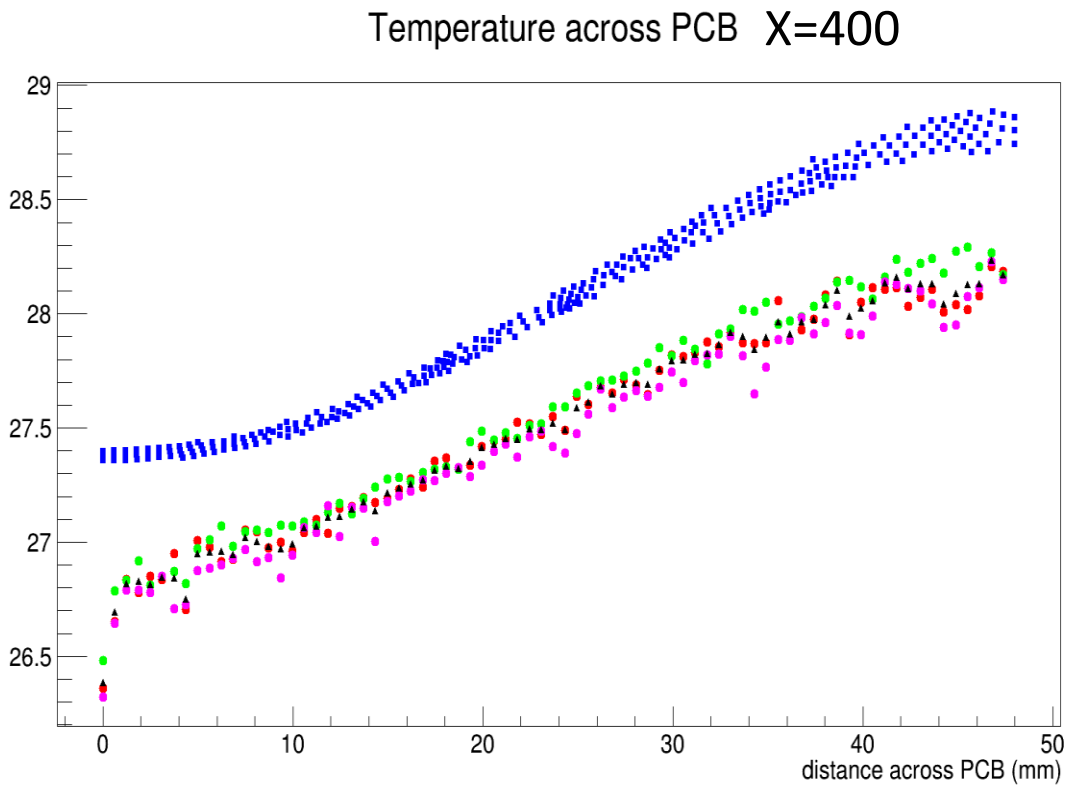

Measured ministave surface Temperature
index y
420
410
400
390
380
370
360
350
340
150
200
250
300
350
400
450
index x
65
60
55
50
45
40
35
30
25

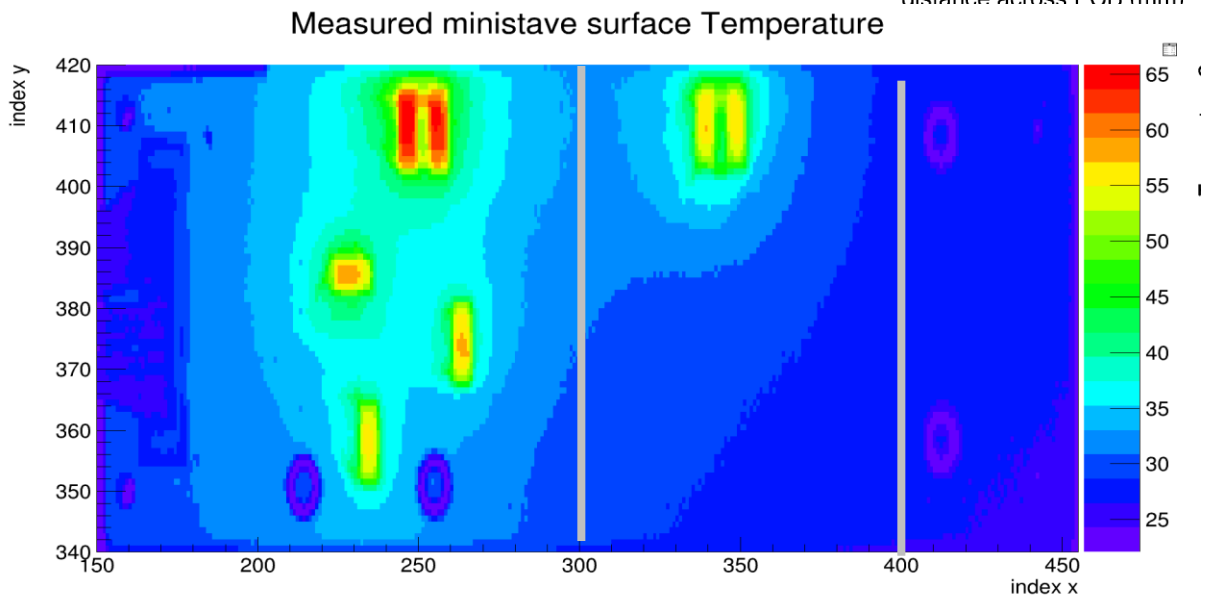

Temperature across PCB X=350
Temperature C
55
50
45
40
35
30
0
10
20
30
40
50
distance across PCB (mm)


Temperature across PCB X=355
46
44
42
40
38
36
34
32
30
28
0
10
20
30
40
50
distance across PCB (mm)

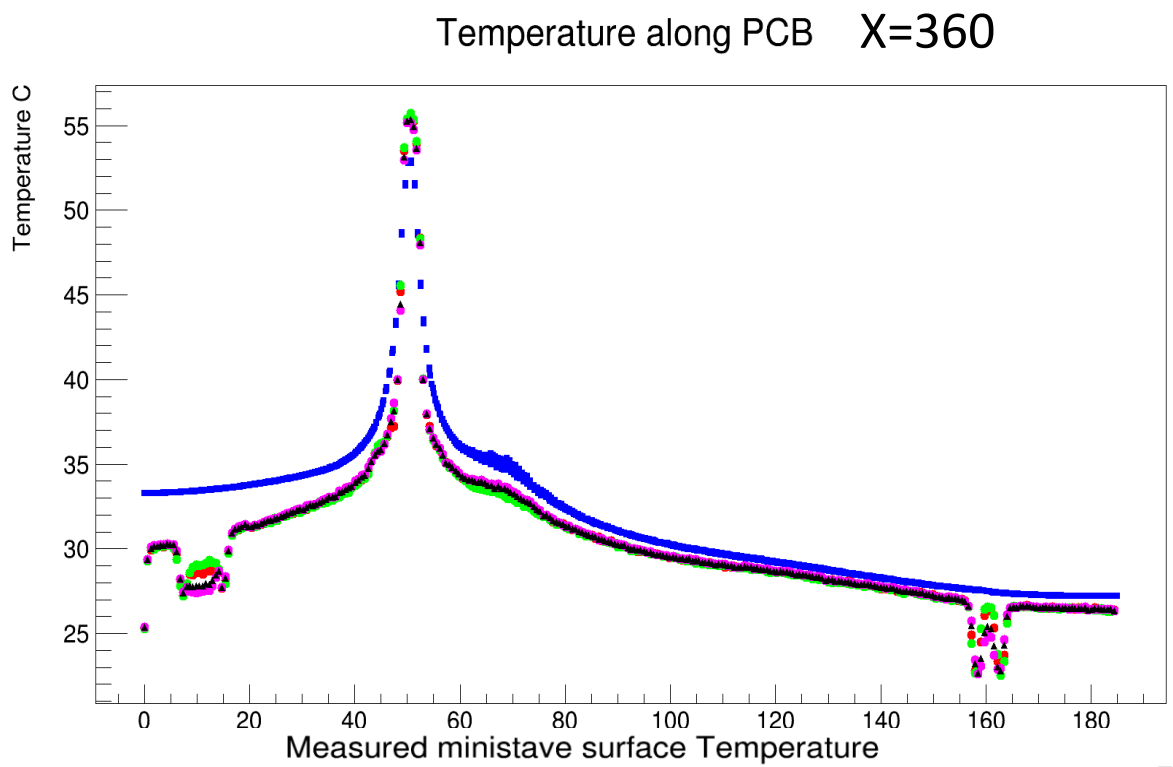

Measured ministave surface Temperature
index y
420
410
400
390
380
370
360
350
340
150
200
250
300
350
400
450
index x
65
60
55
50
45
40
35
30
25

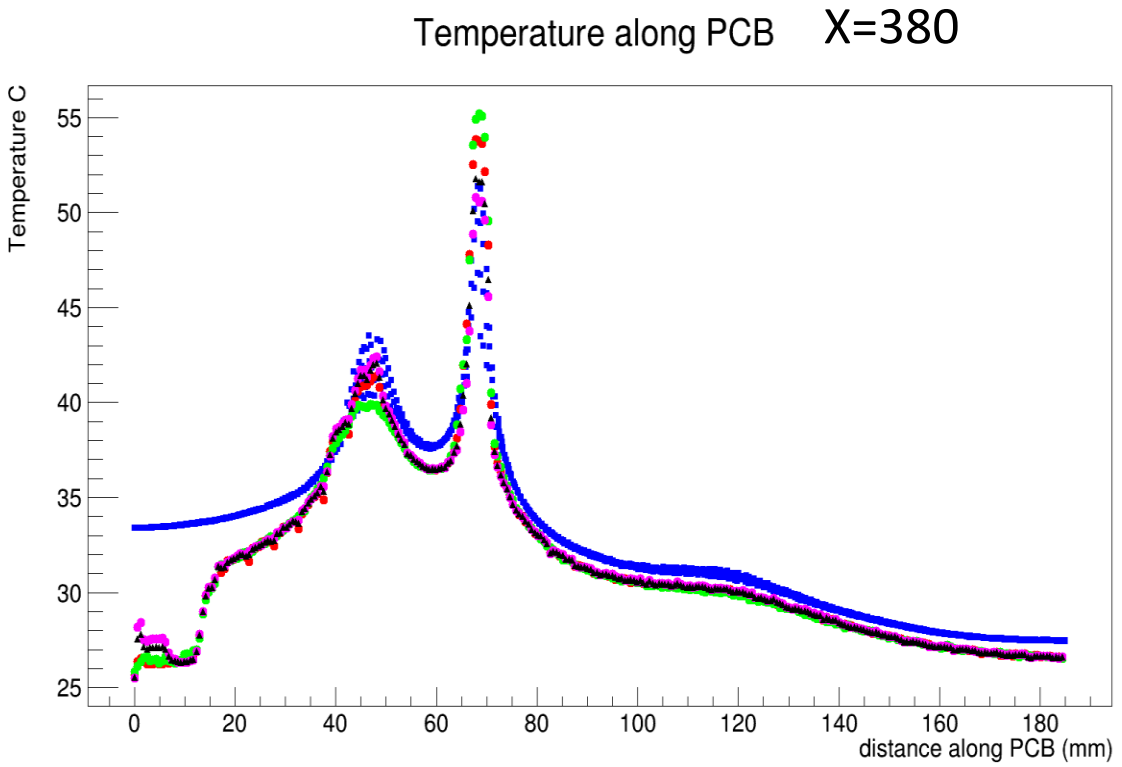

Temperature across PCB X=300
Temperature C
33
32
31
30
29
0
10
20
30
40
50
distance across PCB (mm)

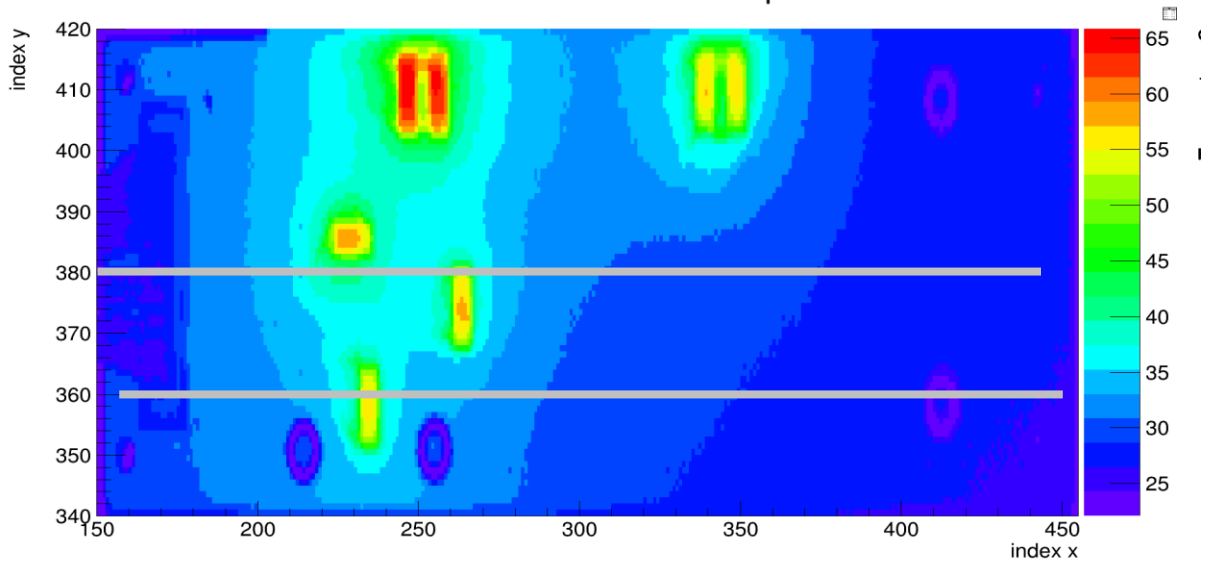

Temperature across PCB X=400
29
28.5
28
27.5
27
26.5
0
10
20
30
40
50
distance across PCB (mm)


Measured ministave surface Temperature
index y
420
410
400
390
380
370
360
350
340
150
200
250
300
350
400
450
index x
65
60
55
50
45
40
35
30
25

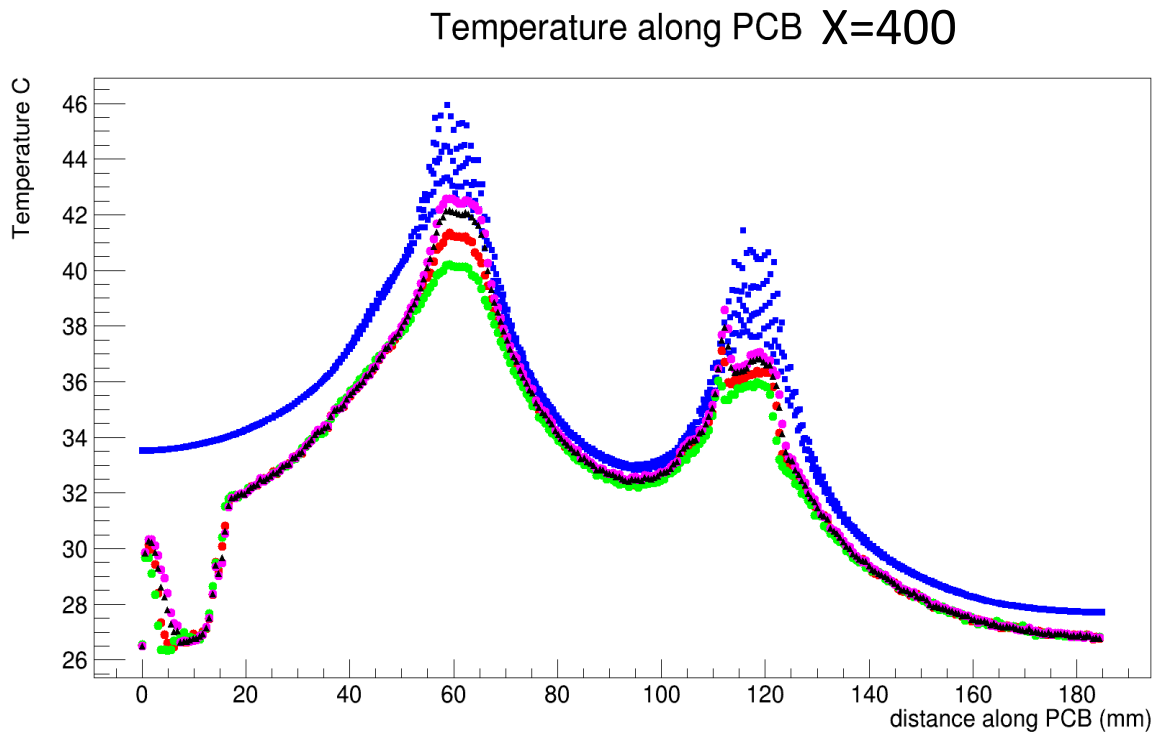
Temperature along PCB (06/08)

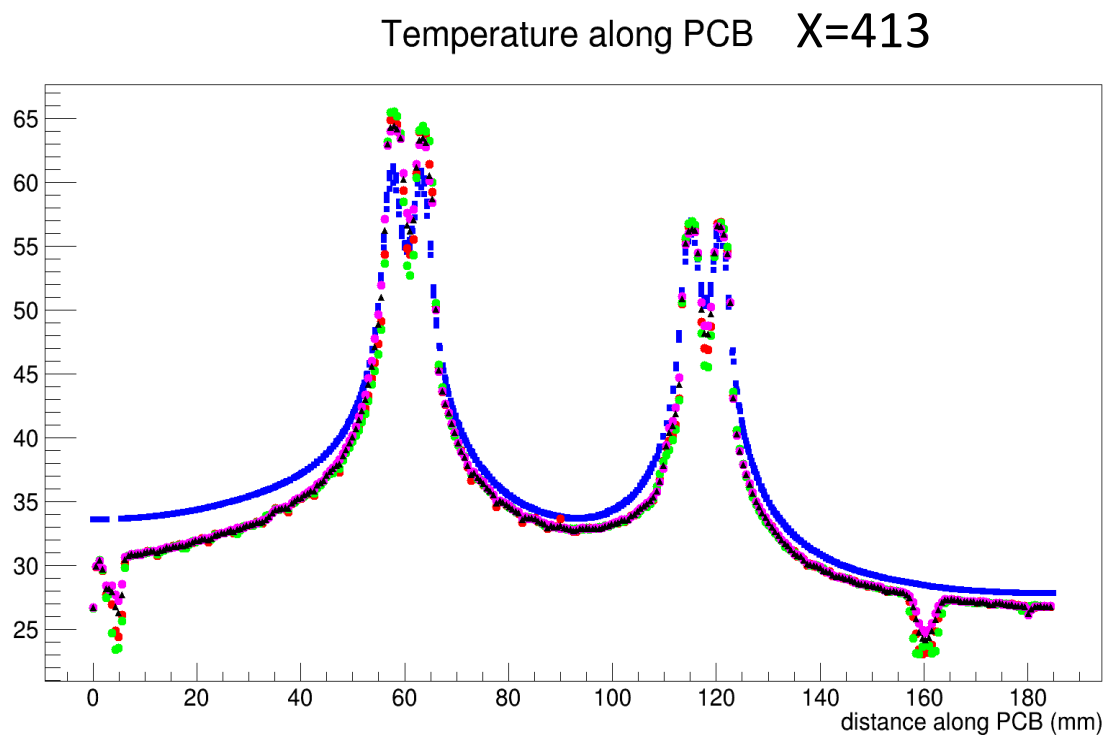


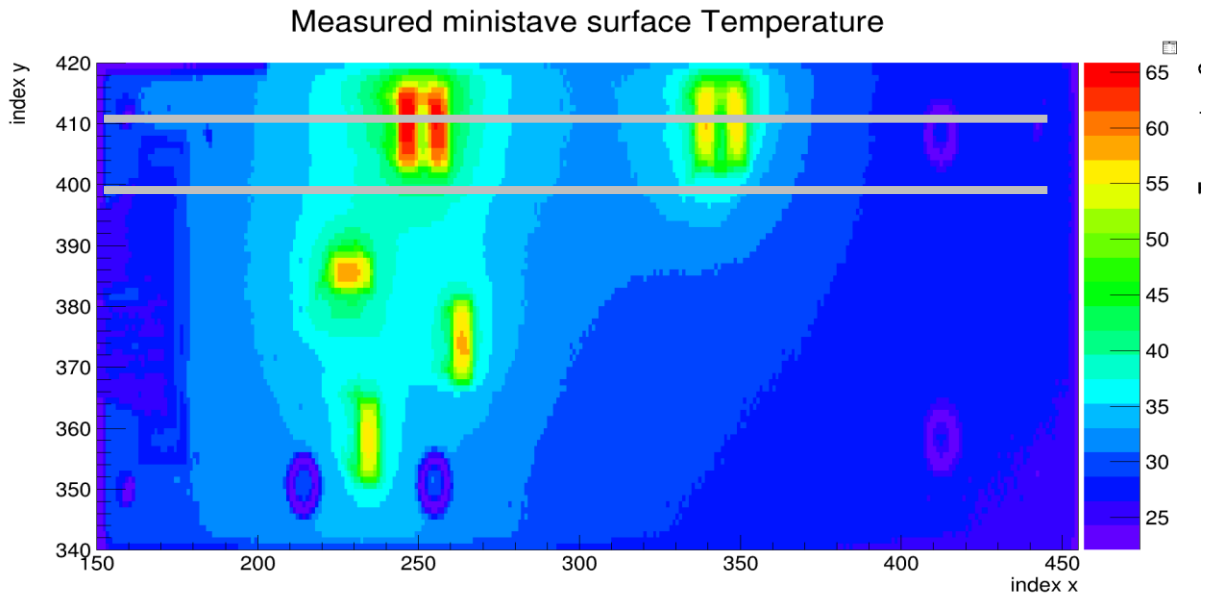




Emissivity used for PCB: 0.89


Temperature along PCB X=400
Temperature C
distance along PCB (mm)


Temperature along PCB X=413
distance along PCB (mm)


Measured ministave surface Temperature
index y
index x

Summary

1. Measured T peak at resistor are narrow and taller than FEA when there is large T drop in one pixel
2. Resistor power is not dissipated well than FEA