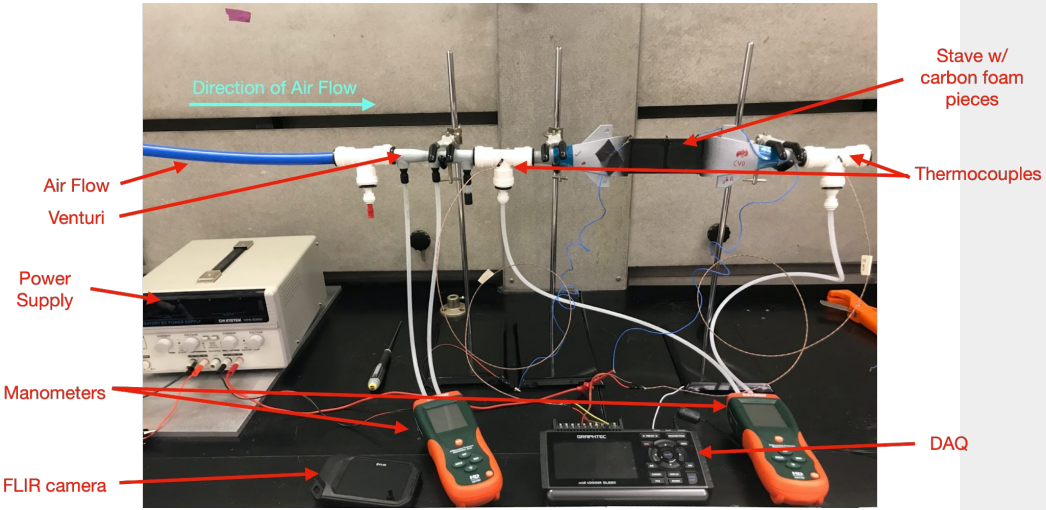
Foam Cooling

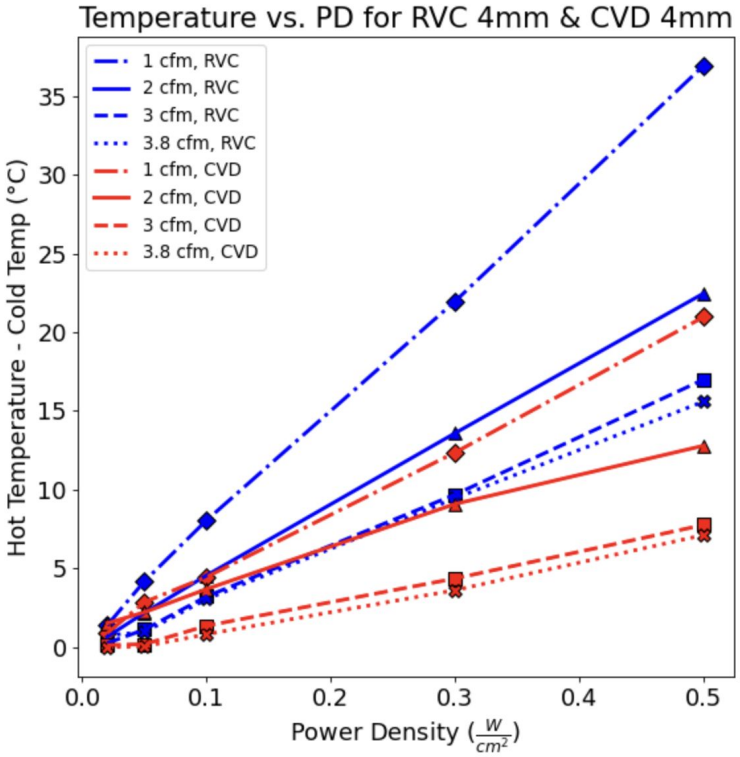
Malika Golshan • 10.28.2023

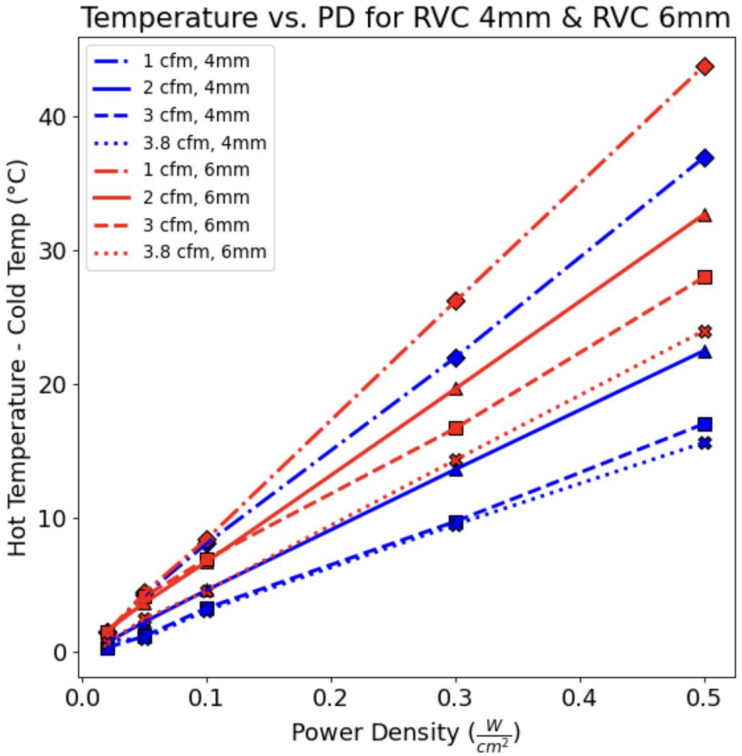
Overview



- Investigated the feasibility of using RVC (insulating) or CVD (conducting) foam for cooling.
- Employed pressurized airflow through the foam.
- Utilized thermal camera/temperature gun for assessment.
- Currently focusing on enhancing temperature reading accuracy.
- Hopeful a higher CFM can make RVC foam a viable and efficient cooling option.

Results From Before

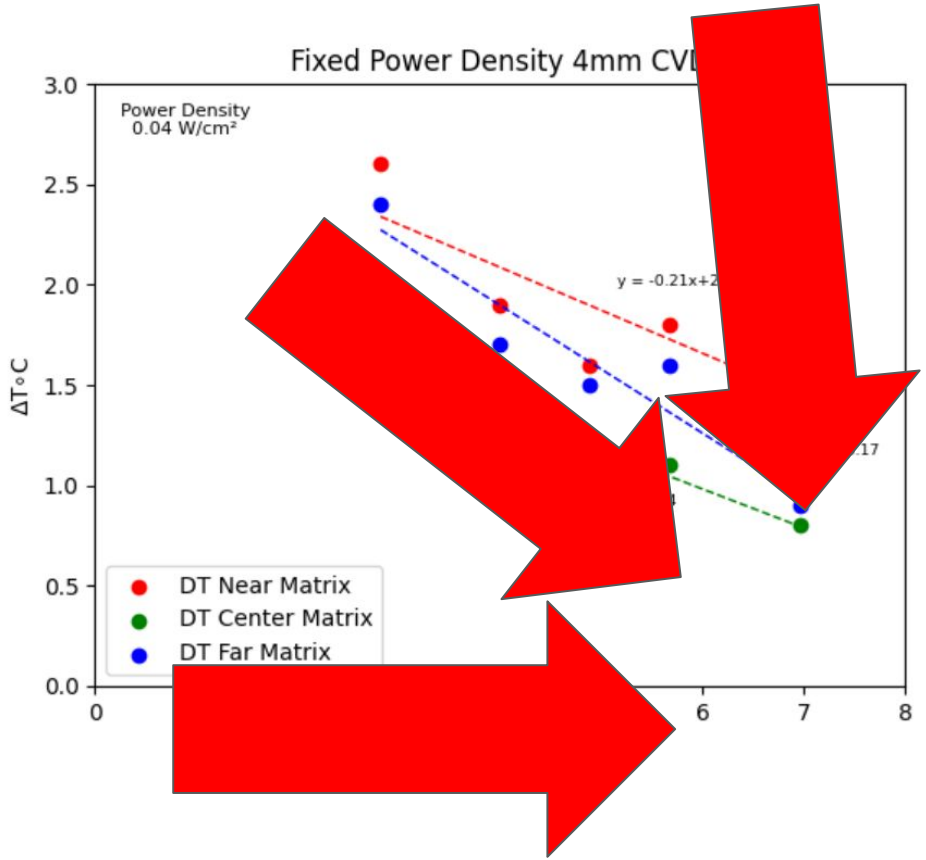




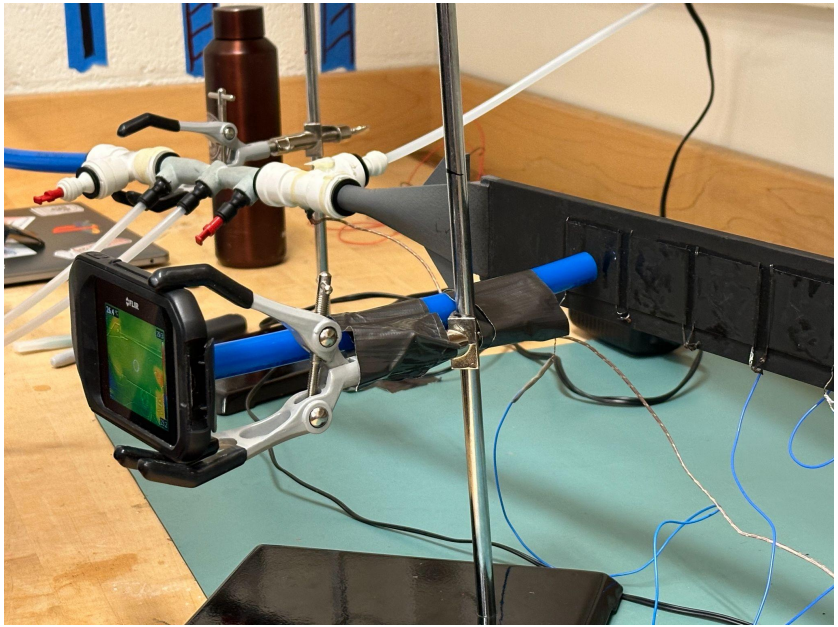
Progress - Higher CFM

- We no longer need to explore the development of a new fan setup, as the pressurized air in room 268 already delivers a high CFM.

- Achieving a CFM of around 7 on most staves is easily attainable for us.

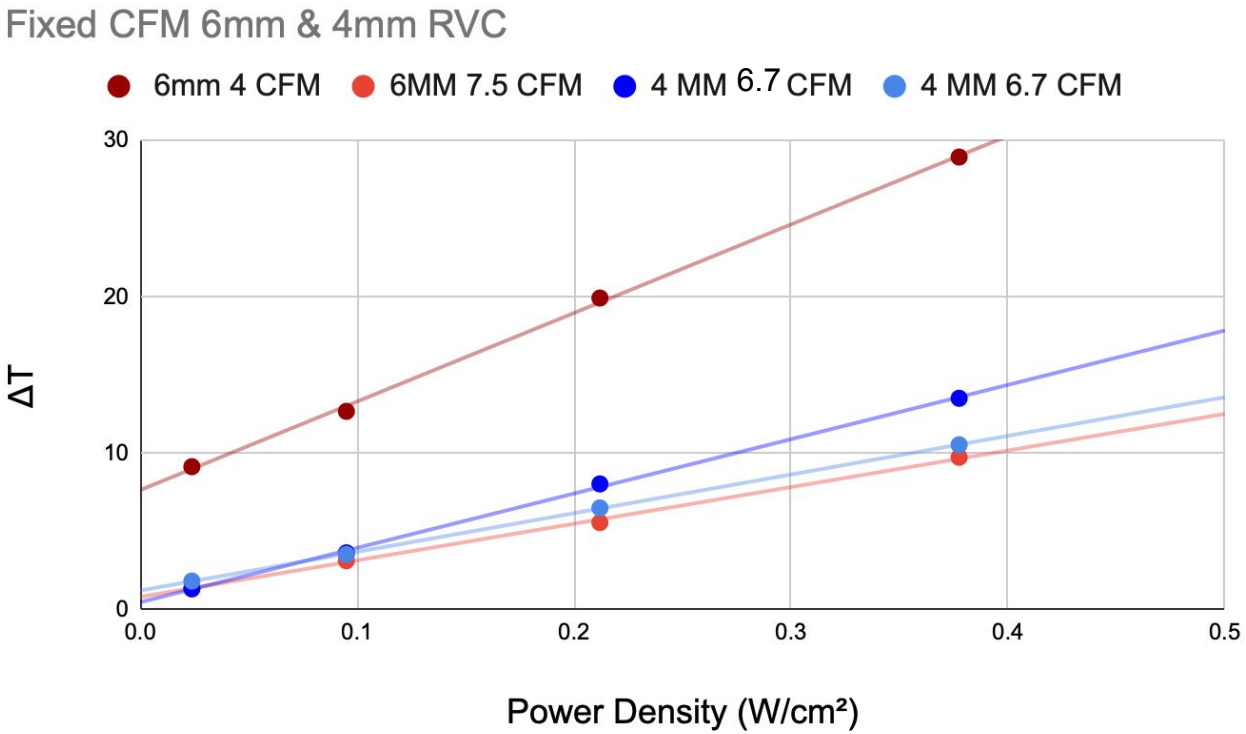


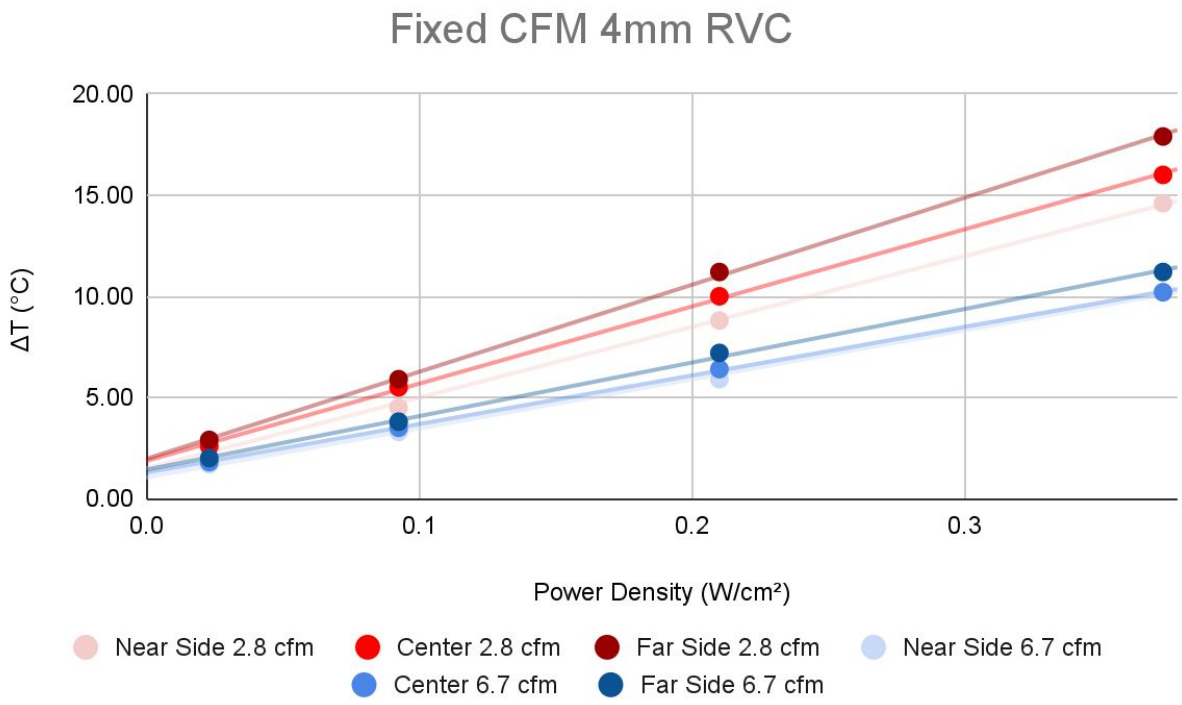
New and Improved Proved Procedures

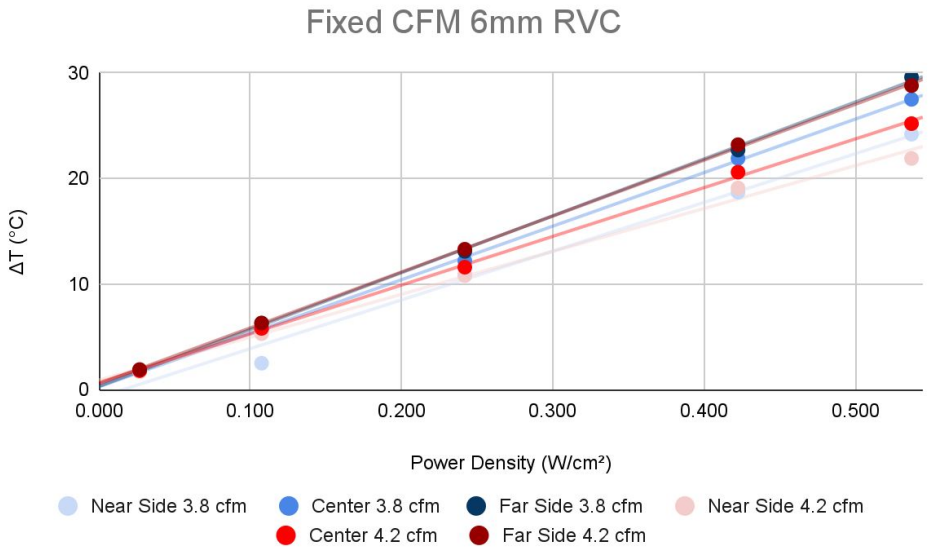


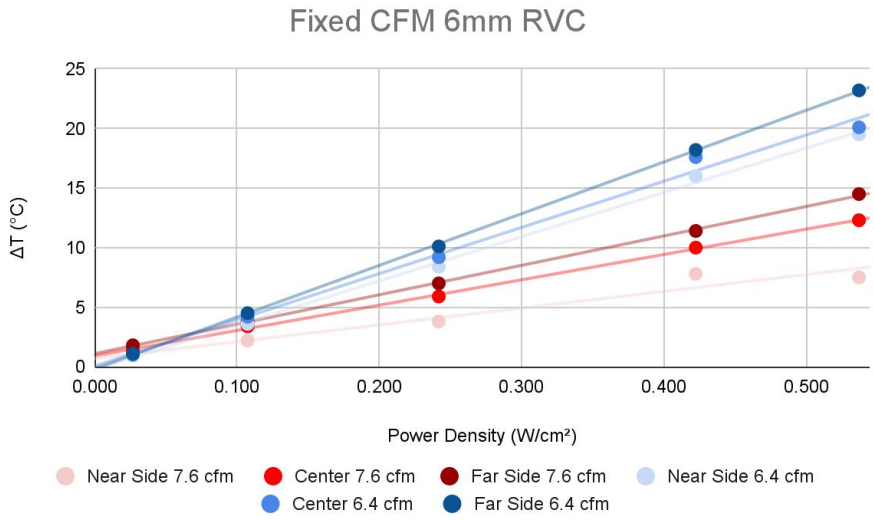
- Calibrated Thermal Camera for 0.25 meters distance.
- Developed a state-of-the-art stick to maintain the camera at a 0.25 m distance.
- Identified problems with PT100 resulting from poor contact with heaters.
- Addressed the issue by using wider PT100s and securing them with super glue.

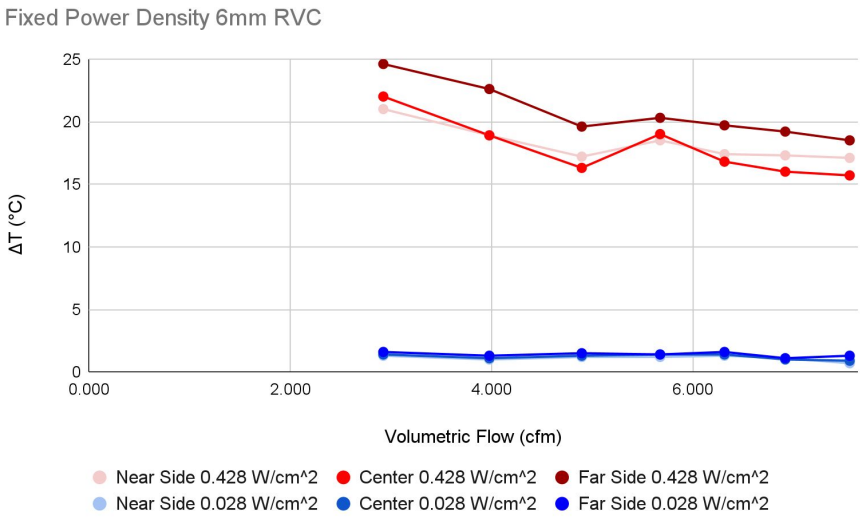
New Plots For RVC

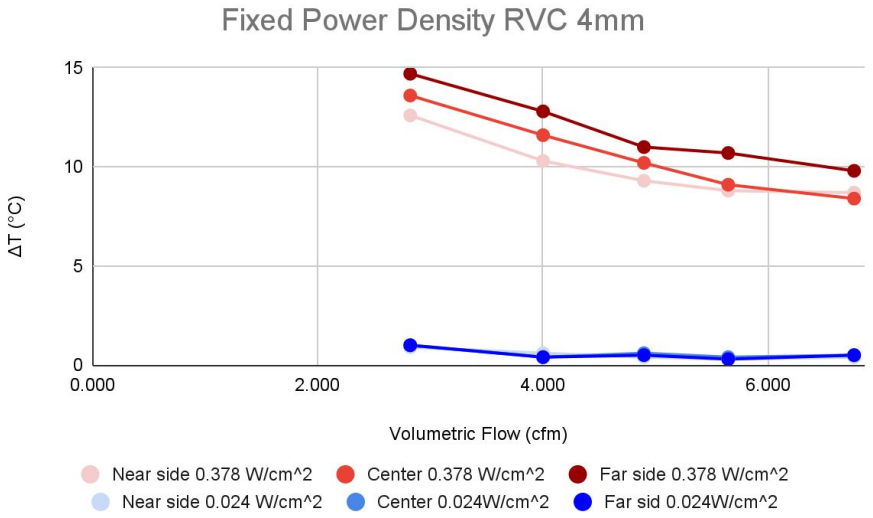



Fixed CFM 4mm RVC
20.00
15.00
10.00
5.00
0.00
ΔT (°C)
0.0
0.1
0.2
0.3
Power Density (W/cm²)
Near Side 2.8 cfm
Center 2.8 cfm
Far Side 2.8 cfm
Near Side 6.7 cfm
Center 6.7 cfm
Far Side 6.7 cfm


Fixed CFM 6mm RVC
30
20
10
0
ΔT (°C)
0.000
0.100
0.200
0.300
0.400
0.500
Power Density (W/cm²)
Near Side 3.8 cfm
Center 3.8 cfm
Far Side 3.8 cfm
Near Side 4.2 cfm
Center 4.2 cfm
Far Side 4.2 cfm


Fixed CFM 6mm RVC
25
20
15
10
5
0
ΔT (°C)
0.000
0.100
0.200
0.300
0.400
0.500
Power Density (W/cm²)
Near Side 7.6 cfm
Center 7.6 cfm
Far Side 7.6 cfm
Near Side 6.4 cfm
Center 6.4 cfm
Far Side 6.4 cfm

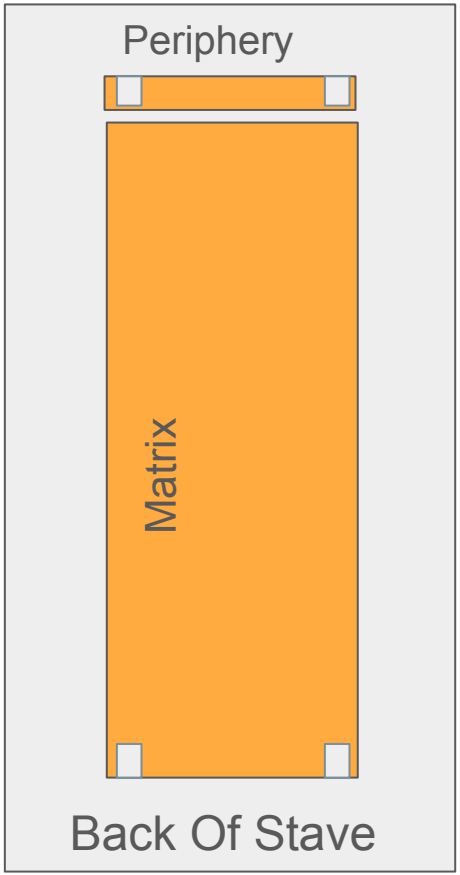

Fixed Power Density 6mm RVC
25
20
15
10
5
0
ΔT (°C)
0.000
2.000
4.000
6.000
Volumetric Flow (cfm)
Near Side 0.428 W/cm^2
Center 0.428 W/cm^2
Far Side 0.428 W/cm^2
Near Side 0.028 W/cm^2
Center 0.028 W/cm^2
Far Side 0.028 W/cm^2

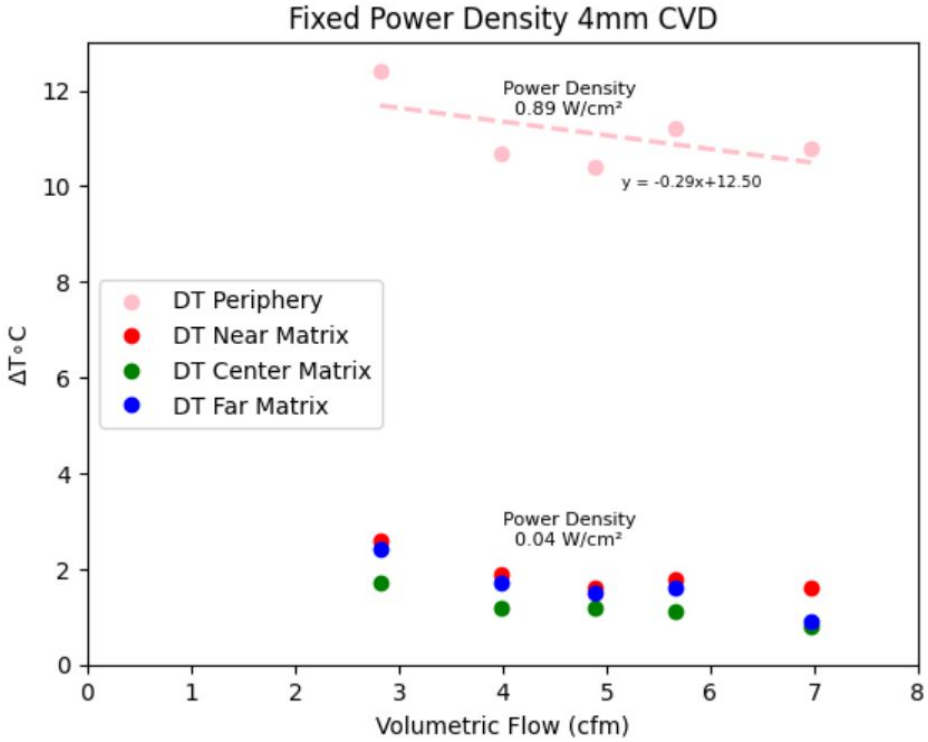

Fixed Power Density RVC 4mm
15
10
5
0
ΔT (°C)
0.000
2.000
4.000
6.000
Volumetric Flow (cfm)
Near side 0.378 W/cm^2
Center 0.378 W/cm^2
Far side 0.378 W/cm^2
Near side 0.024 W/cm^2
Center 0.024W/cm^2
Far sid 0.024W/cm^2

New Kapton Heaters

After testing showing that we could replicate from summer and the prior year we were able to move onto to the new heaters.

- The periphery is 1.9 cm x 0.5 cm and the matrix is 1.9 cm x 8.8 cm
- The periphery is held at power density of **1 W/cm²**
- The matrix maximum power density is **0.05 W/cm²**
- The Heaters are no longer affixed by epoxy but instead 3M 467MP 200MP Adhesive, a double-sided tape is used. This decision was made based on its ease of application, which enabled consistent and repeatable results for adhesion.




Fixed Power Density 4mm CVD
Power Density
0.89 W/cm²
y = -0.29x+12.50
Power Density
0.04 W/cm²
DT Periphery
DT Near Matrix
DT Center Matrix
DT Far Matrix
ΔT°C
Volumetric Flow (cfm)
0
1
2
3
4
5
6
7
8
0
2
4
6
8
10
12