HR2 Updates

2018 October Materials Meeting
Atlantic City, NJ USA

Materials Working Group

Michael Burns, FAA Tech Center

October, 2018

Federal Aviation Administration

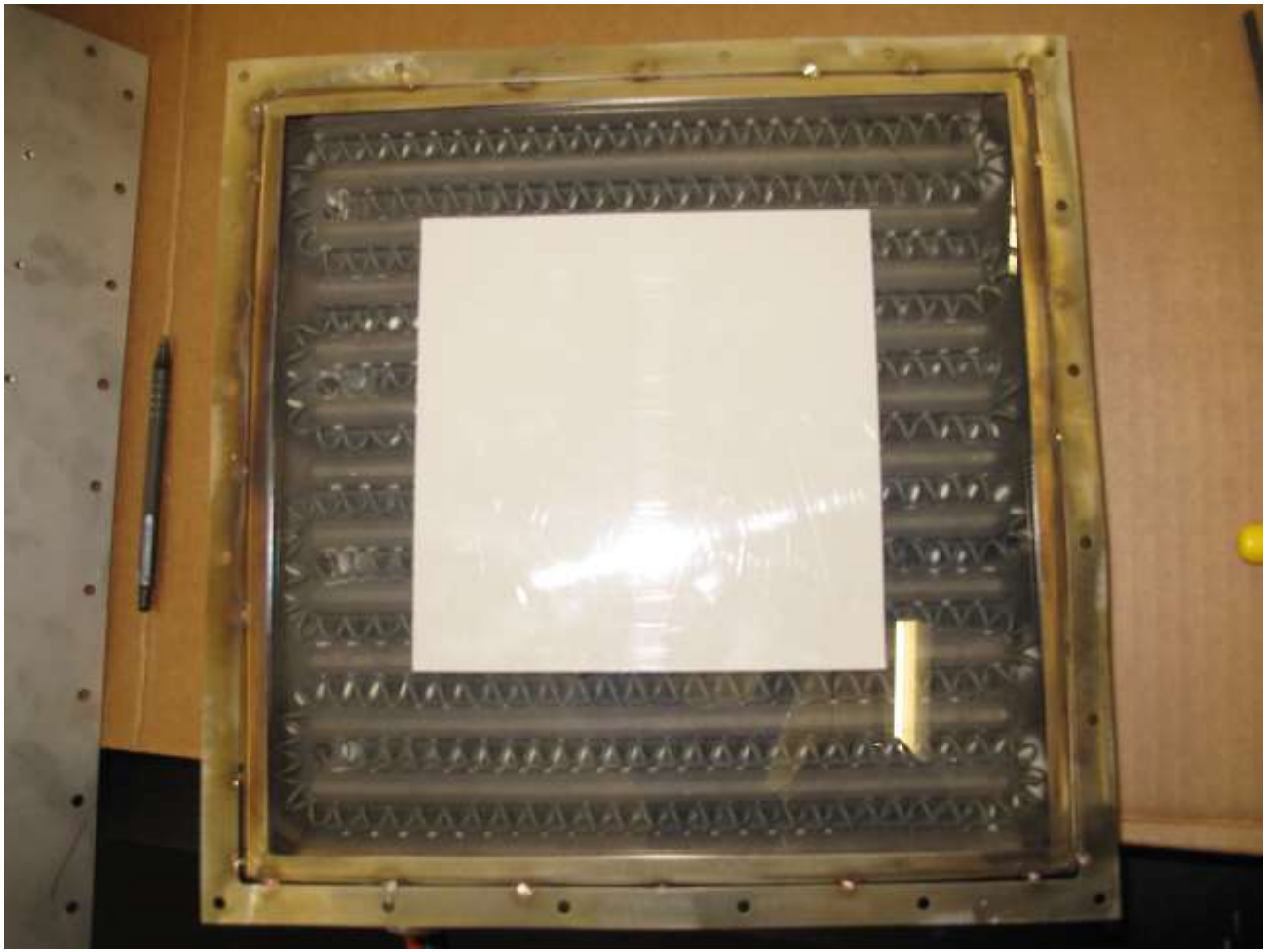
AGENDA

- New Prototype Heater Research
- Bypass Cooling Effect in Heat Release Rate Apparatus
- NEXT

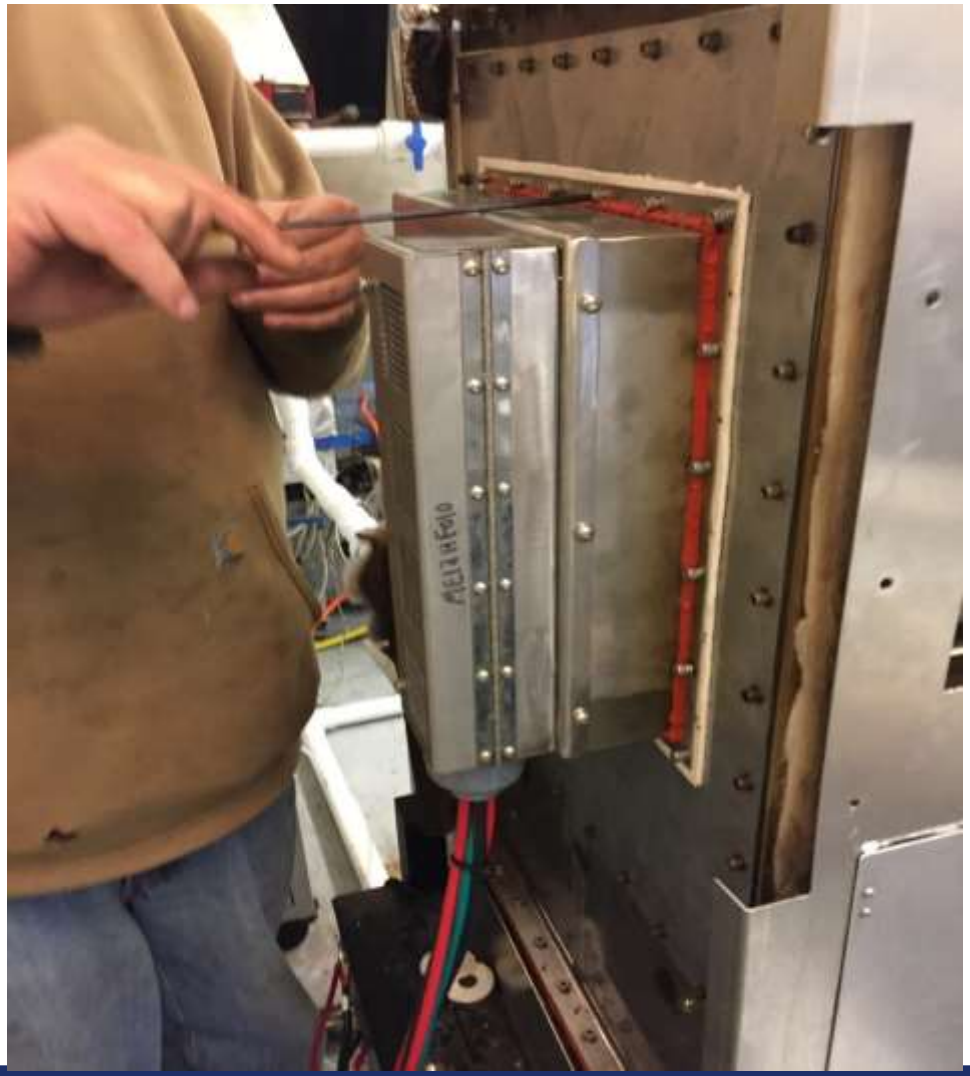
HR2 Prototype Heater

- Dimensions: 10” W x 10” H x 2” D
- Zones: 2 (Upper / Lower)
- Flush mounted glass with rear wall (sealed)
  - Removed from air stream (internally)
- Replaces the following components:
  - Globar pan (Globar end penetrations), Diamond-shaped Mask & Rear Reflector Plate

HR2 Prototype Heater



HR2 Prototype Heater



HR2 Prototype Heater

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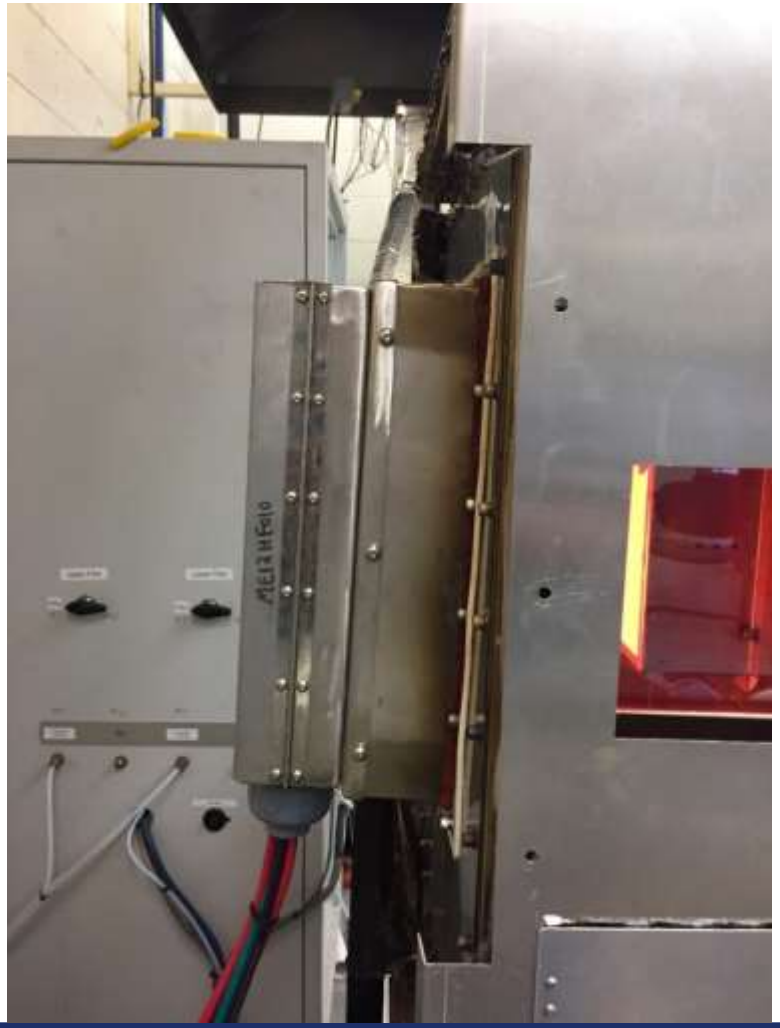
		Globar	Radiant Heater	% Delta
Upper Elements	% Power	51.7	47.1	
	Amps	32.0	14.8	-54%
Lower Elements	% Power	66.4	49.8	
	Amps	36.0	19.6	-46%

HR2 Prototype Heater

HR2 Prototype Heater

- After the heater was running a while I noticed the lower section being pushed out (away from the sample).
- The new panel developed a warpage due to the lower elements running hotter than the upper (which is a normal situation with the globars).
- Left side HF slightly lower than the right.
- Unable to achieve good uniformity between center and corner heat flux

HR2 Prototype Heater



HR2 Prototype Heater

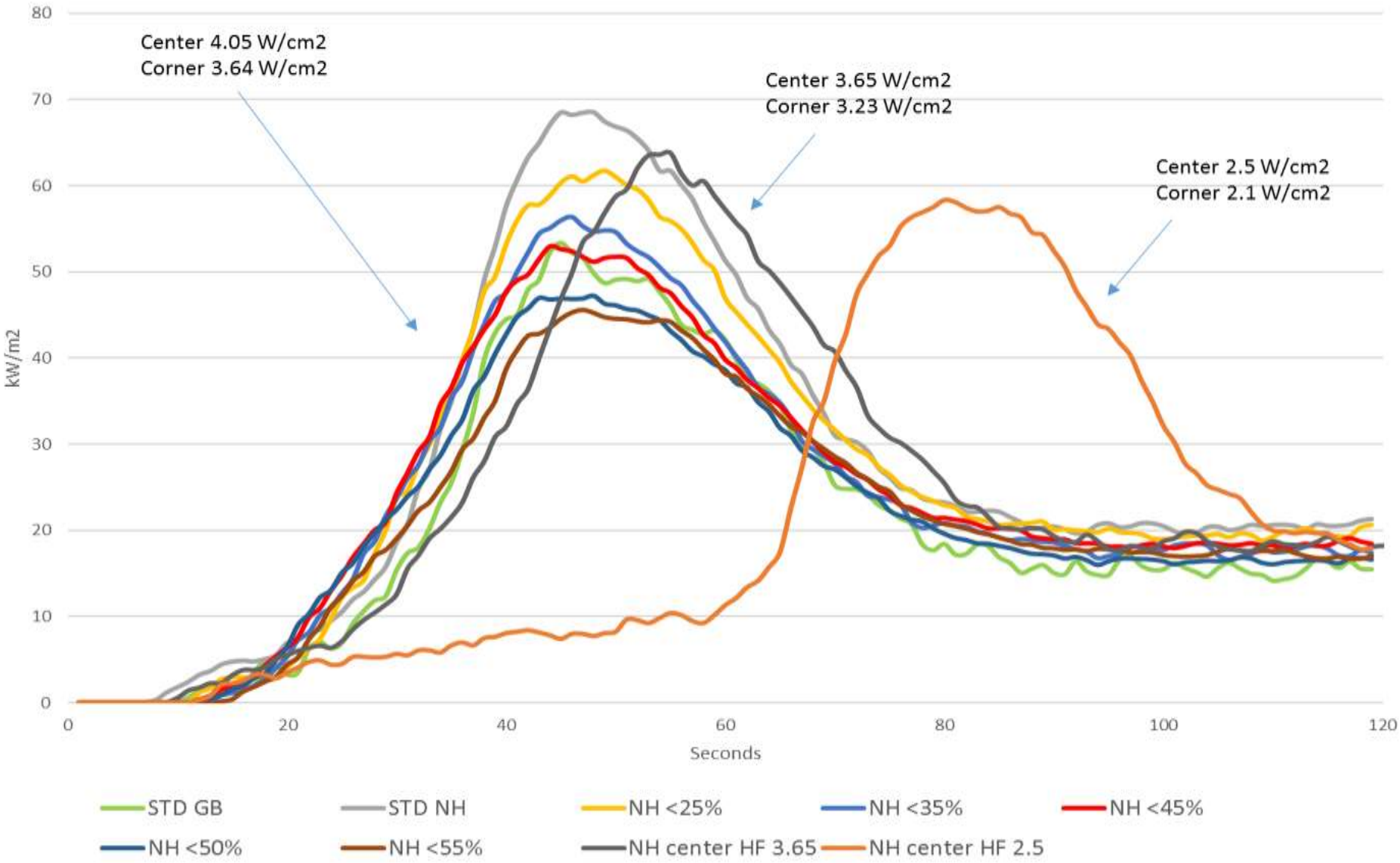
- For most testing the center HF was about 0.41 W/cm^2 higher than the corners except for the last test.

  (4-Corners set to 3.65 W/cm^2 / Center @ 4.06 W/cm^2)

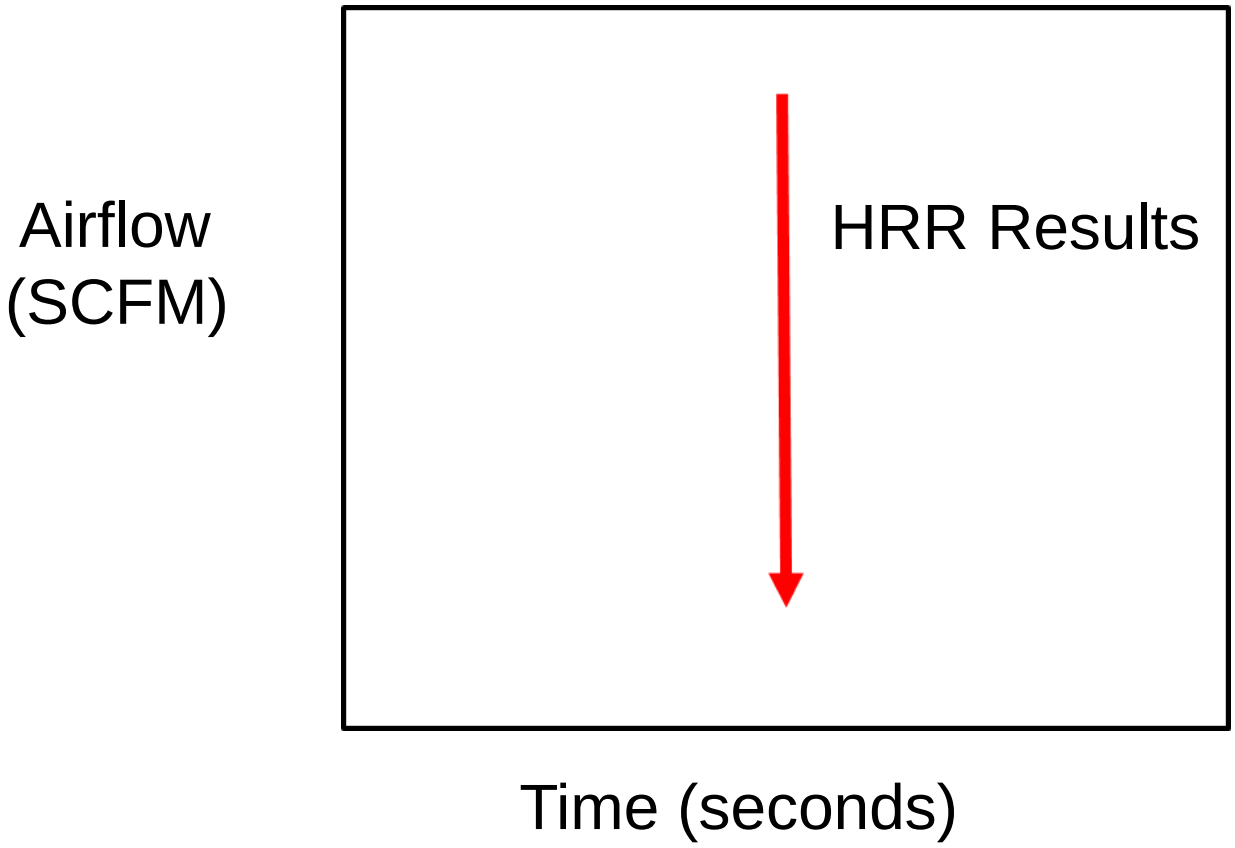
- The last test: center HF was set to 3.65 and the corners came in about 3.23 W/cm^2.

- The average thermopile at baseline with no flames was about 120 degrees C lower than previously with the globars (280 °C down to 160 °C).

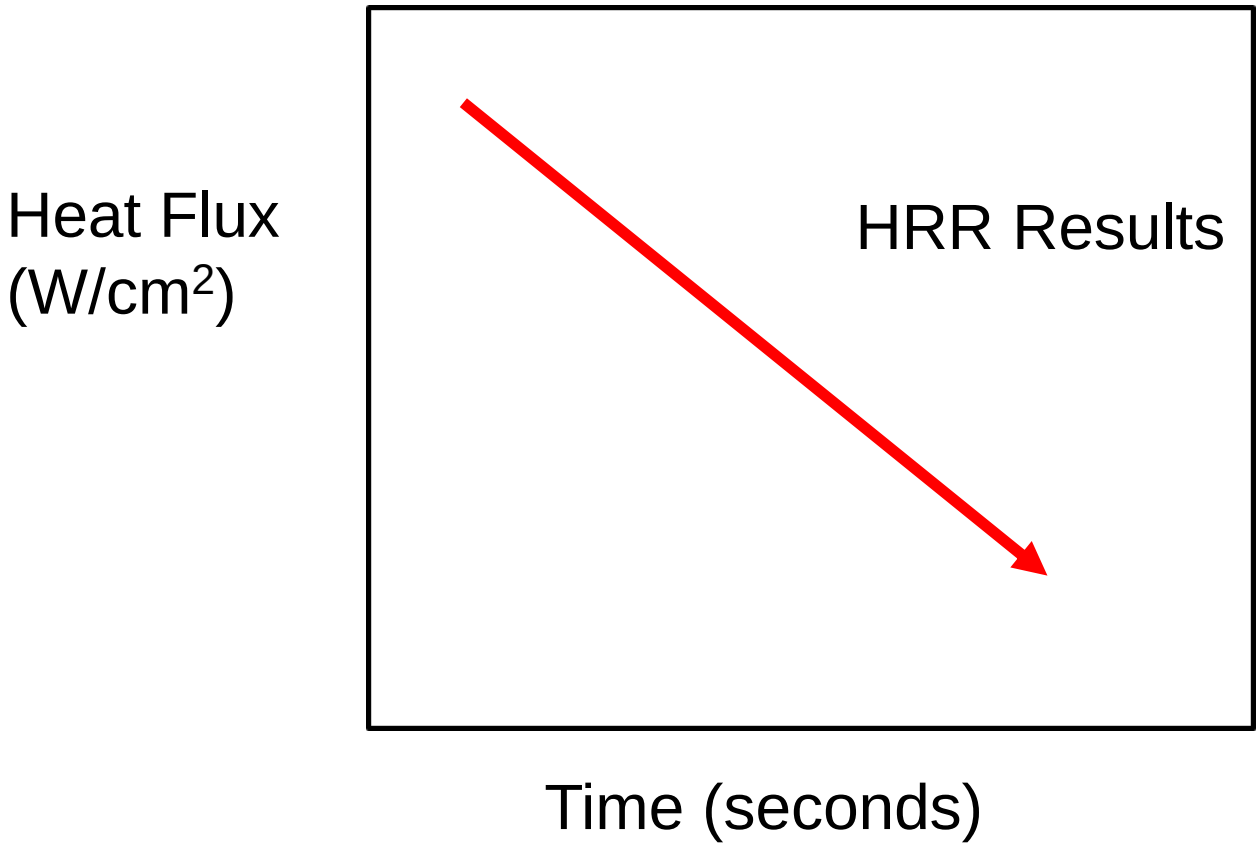
Prototype Heater R&D (Shneller Test Panel)

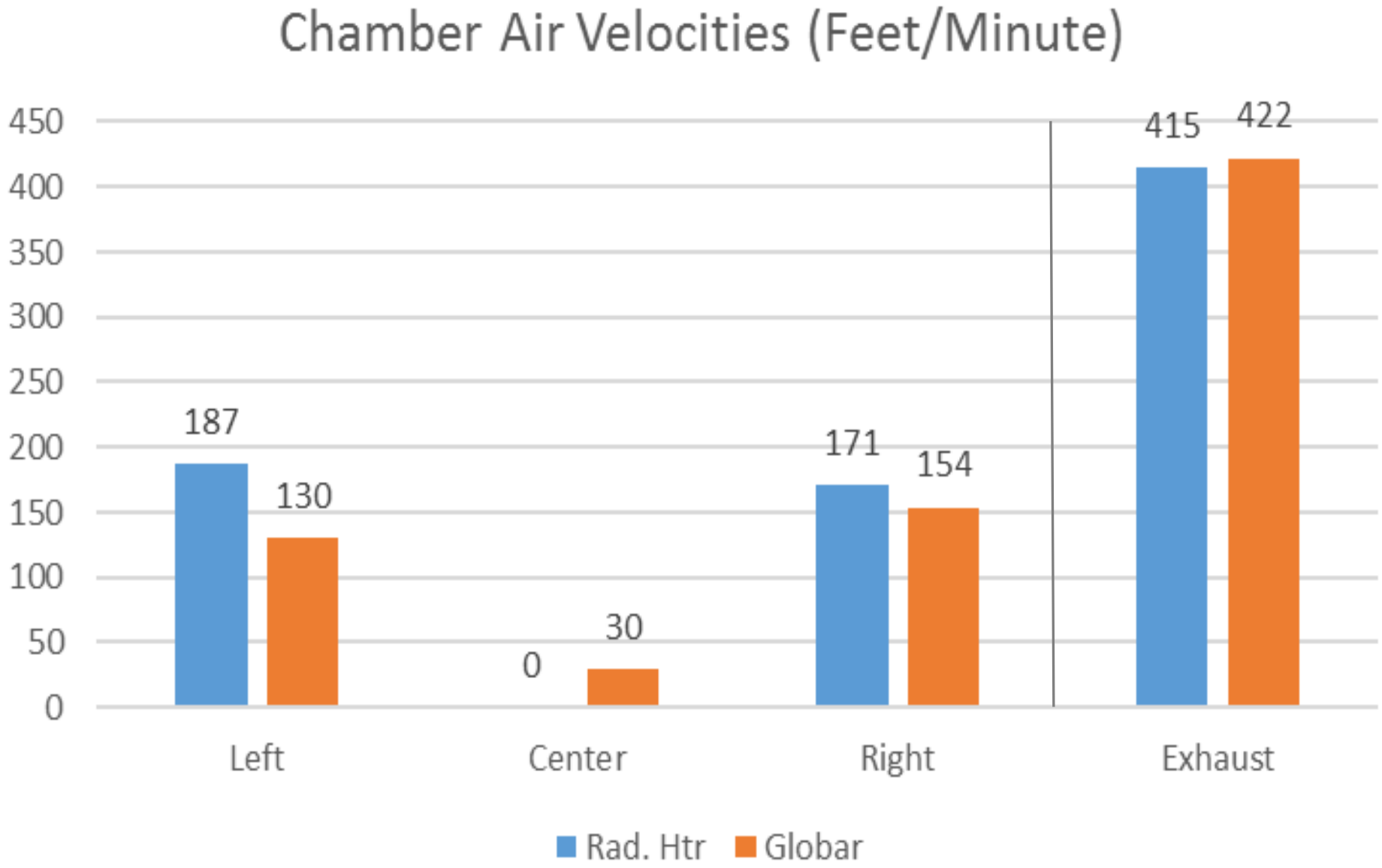


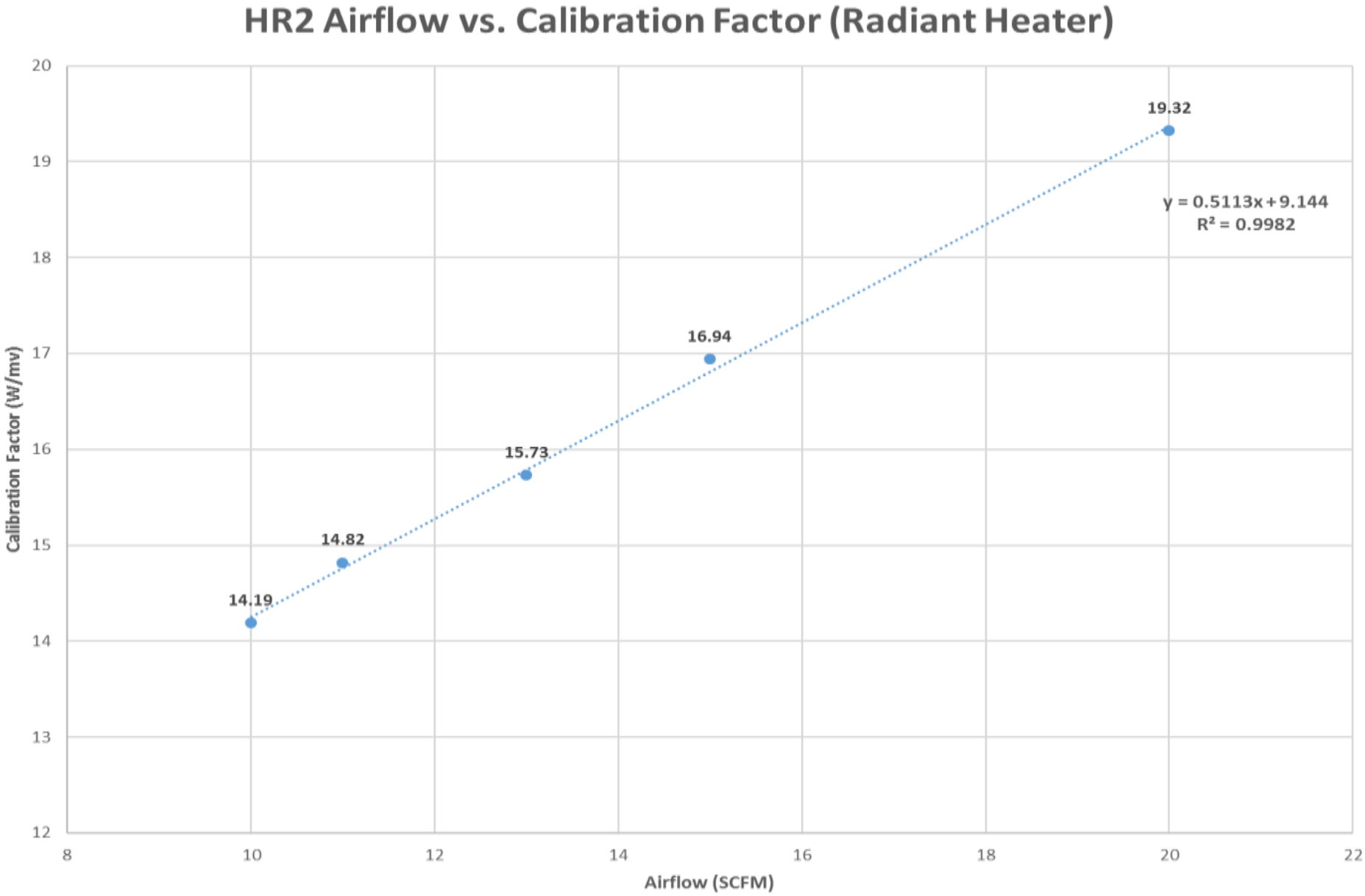
HR2 Prototype Heater

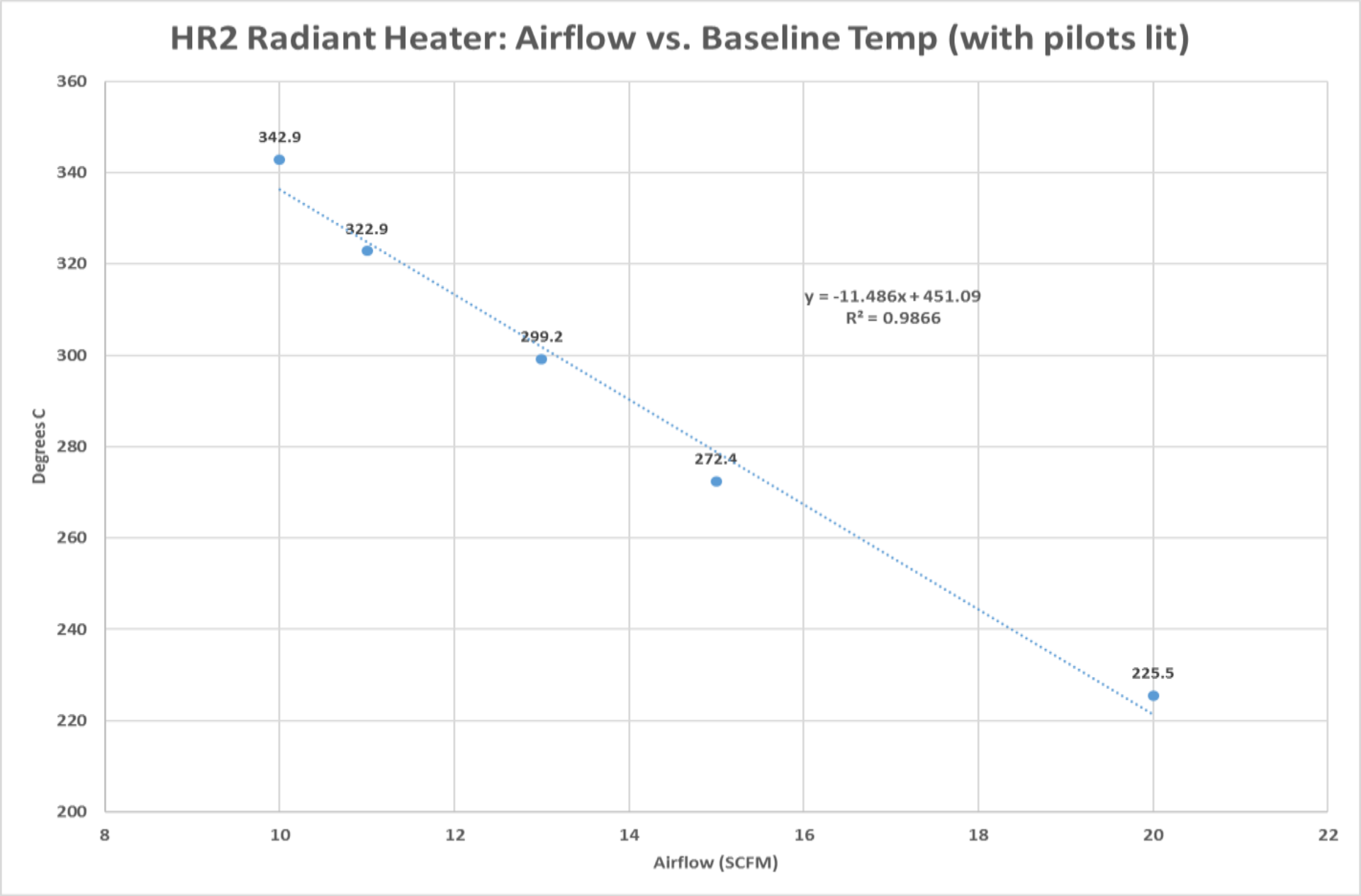


HR2 Prototype Heater

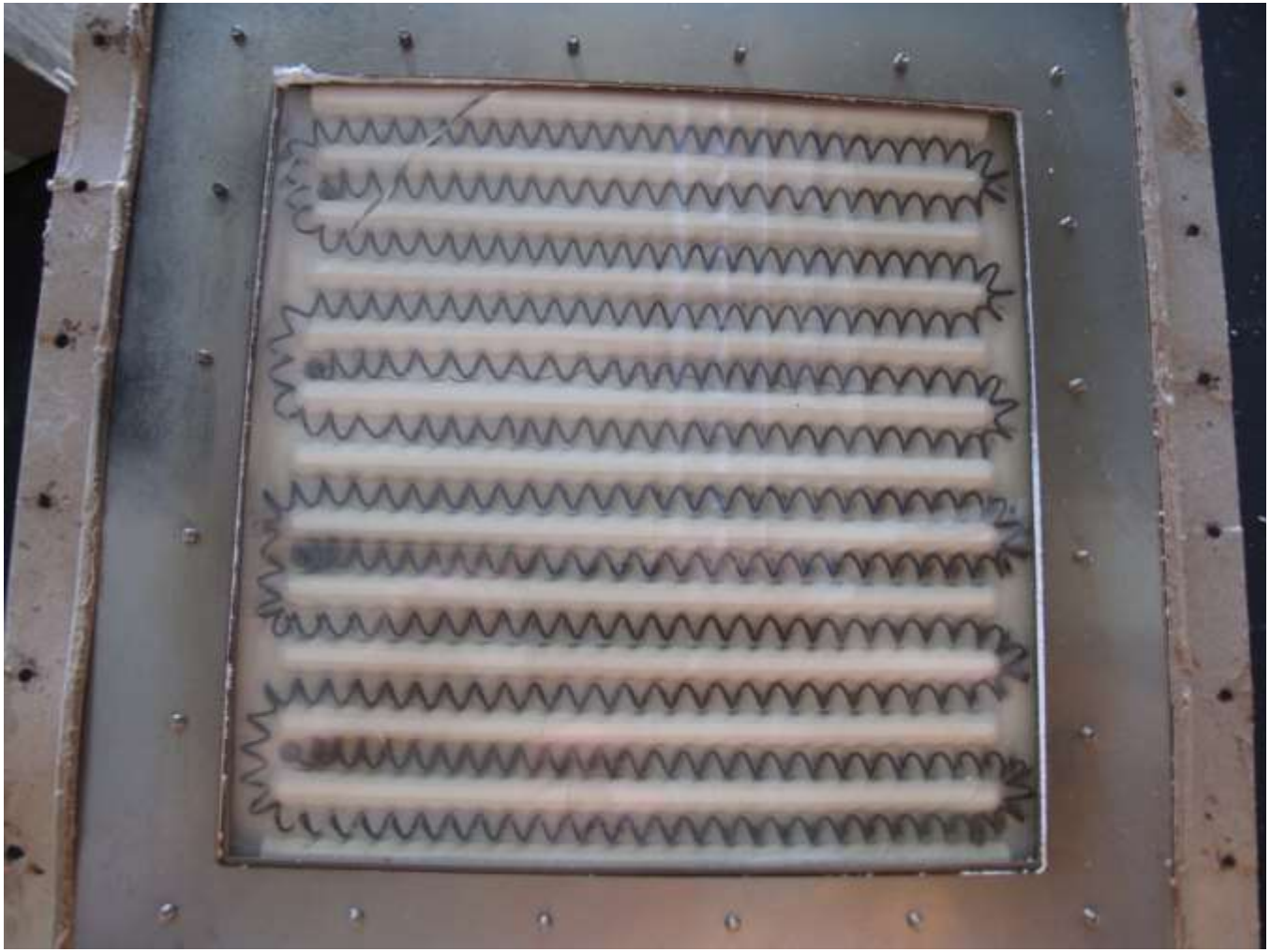



Chamber Air Velocities (Feet/Minute)
450
400
350
300
250
200
150
100
50
0
187
130
0
30
171
154
415
422
Left
Center
Right
Exhaust
Rad. Htr
Globar


HR2 Airflow vs. Calibration Factor (Radiant Heater)
Calibration Factor (W/mv)
Airflow (SCFM)
20
19
18
17
16
15
14
13
12
8
10
12
14
16
18
20
22
19.32
16.94
15.73
14.82
14.19
y = 0.5113x + 9.144
R² = 0.9982

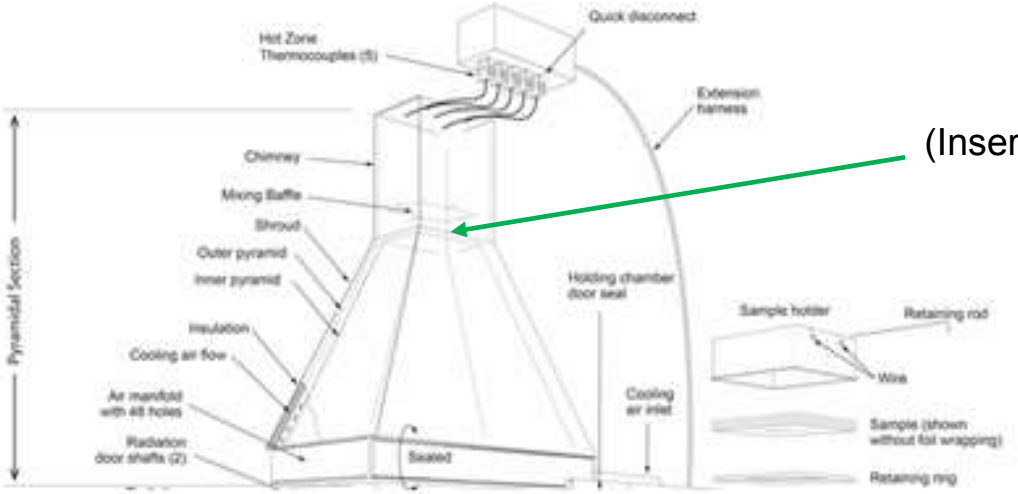

HR2 Radiant Heater: Airflow vs. Baseline Temp (with pilots lit)
360
340
320
300
280
260
240
220
200
Degrees C
342.9
322.9
299.2
272.4
225.5
y = -11.486x + 451.09
R² = 0.9866
8
10
12
14
16
18
20
22
Airflow (SCFM)

HR2 Prototype Heater



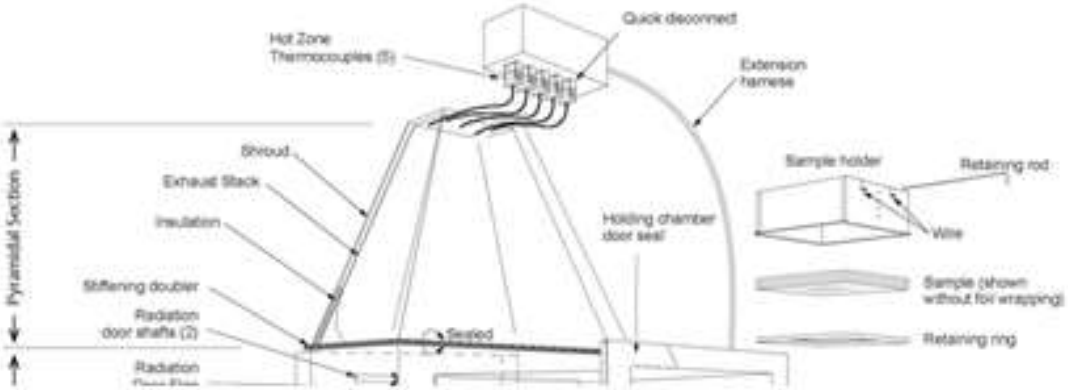
Bypass Cooling Effect in Heat Release Rate Apparatus

Cooled Exhaust

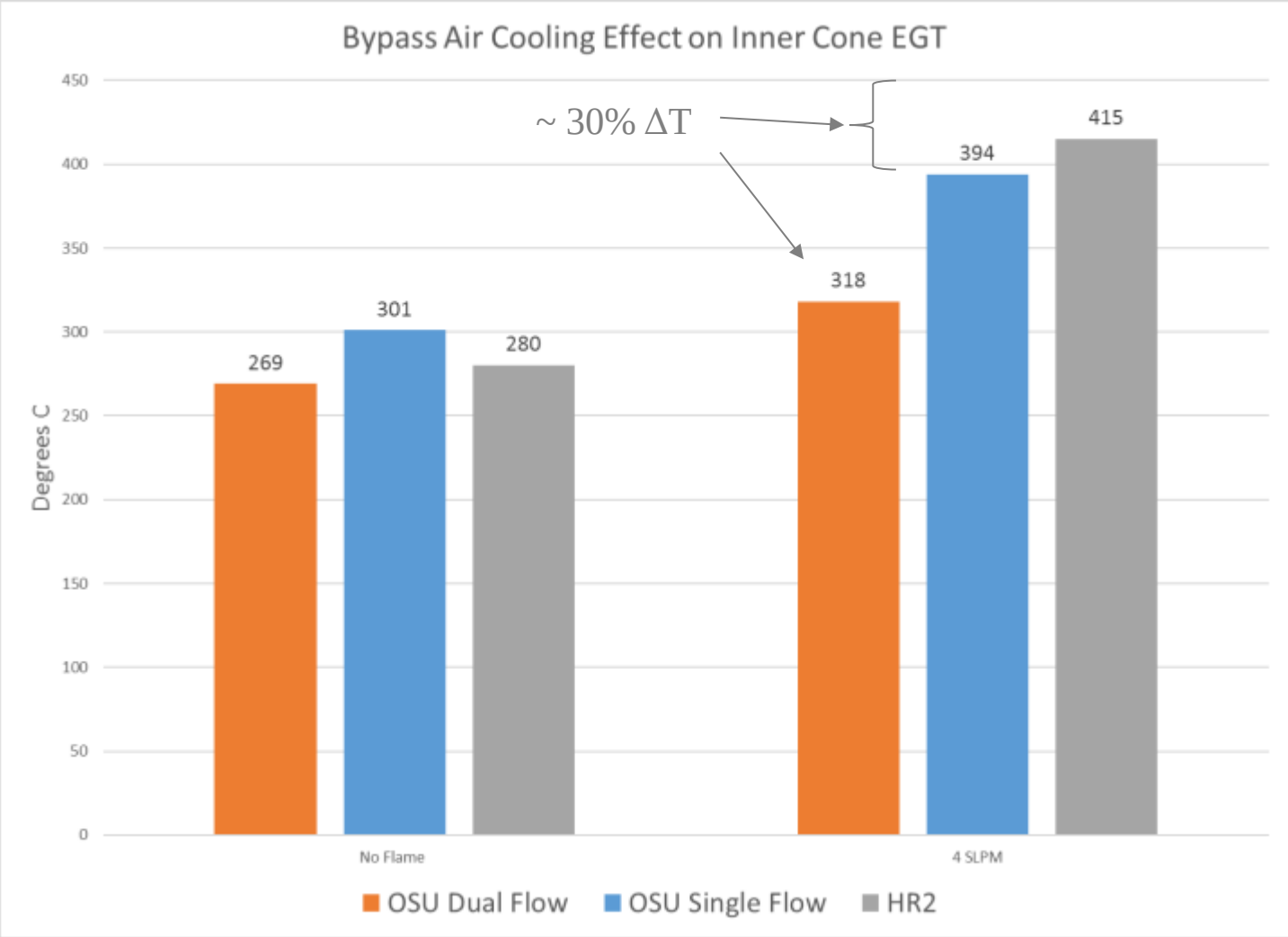


(Inserted 5 TC's here)

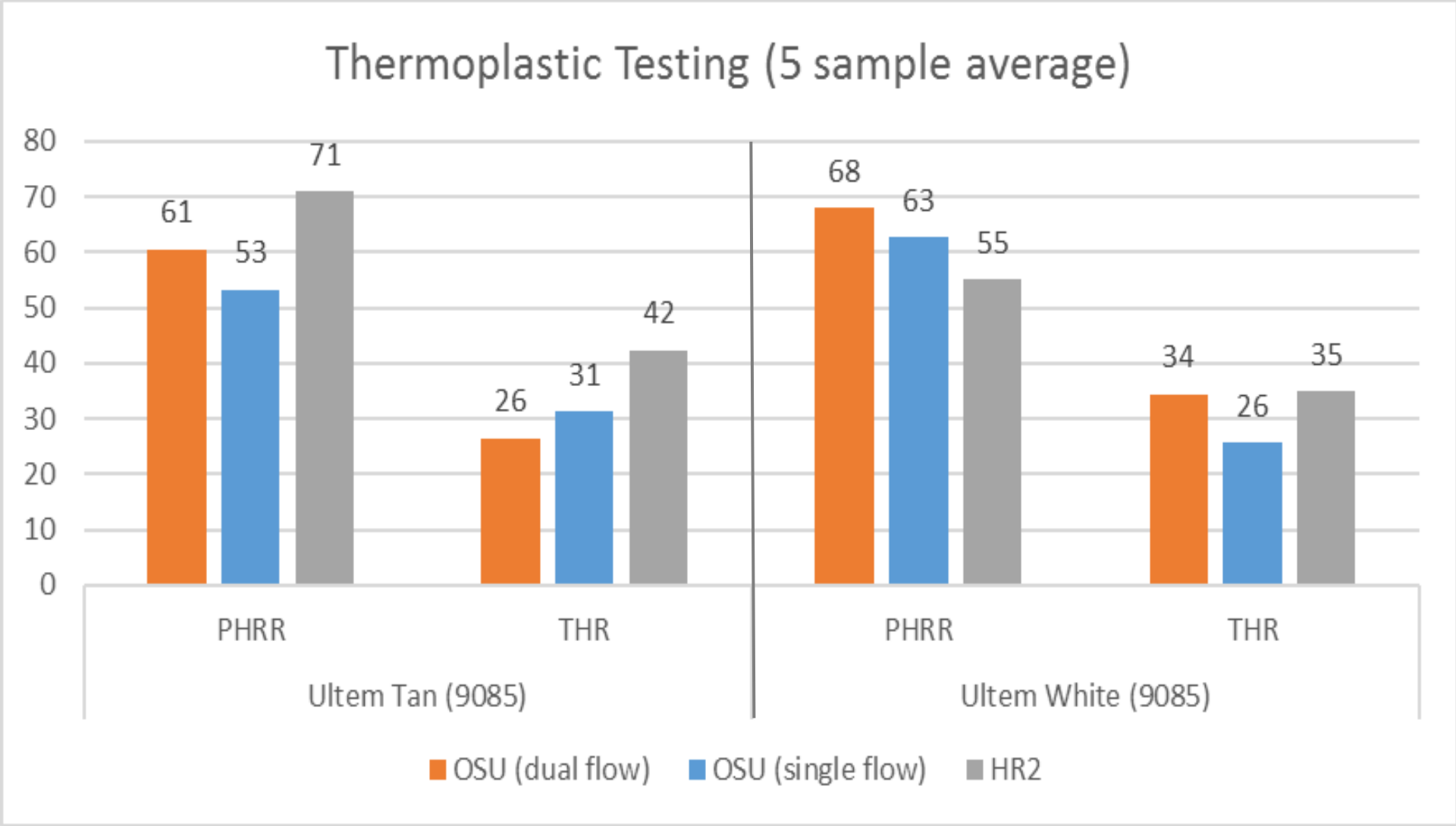
Non-Cooled Exhaust



Bypass Cooling Effect in Heat Release Rate Apparatus



Bypass Cooling Effect in Heat Release Rate Apparatus



NEXT

- HR2 Update (if any relative to TRL5 activity)
- Discussions on New Prototype Heater Development
- Exhaust Stack Cooling Effect Discussion

Questions?