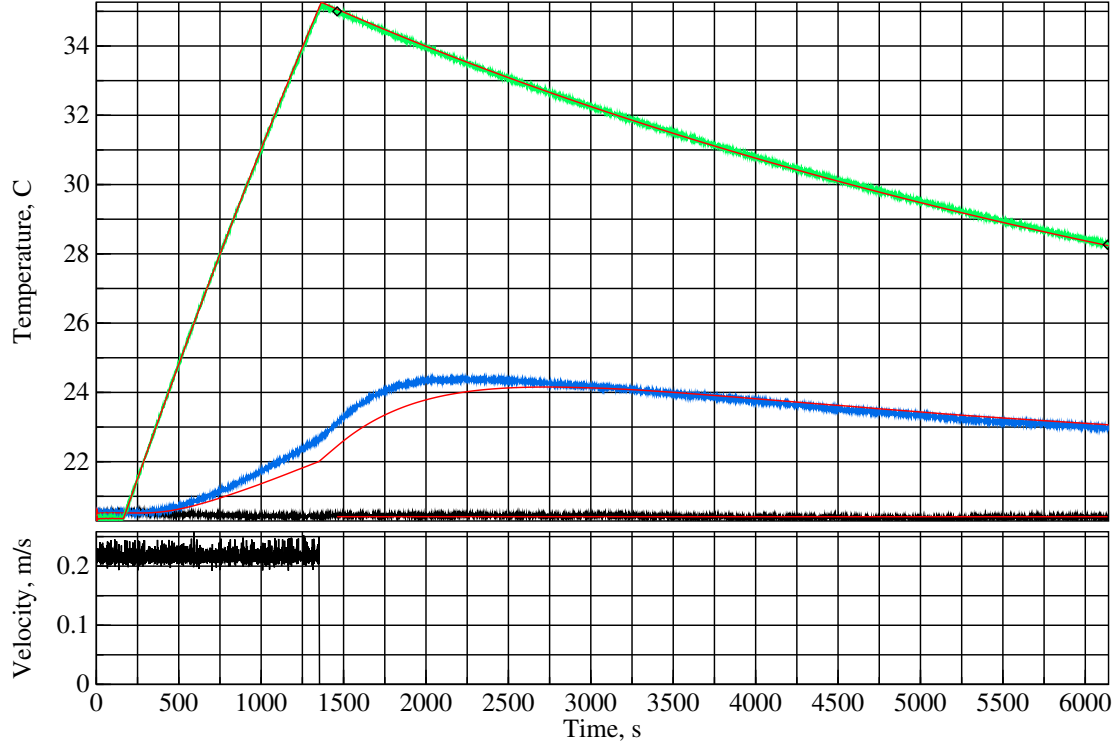


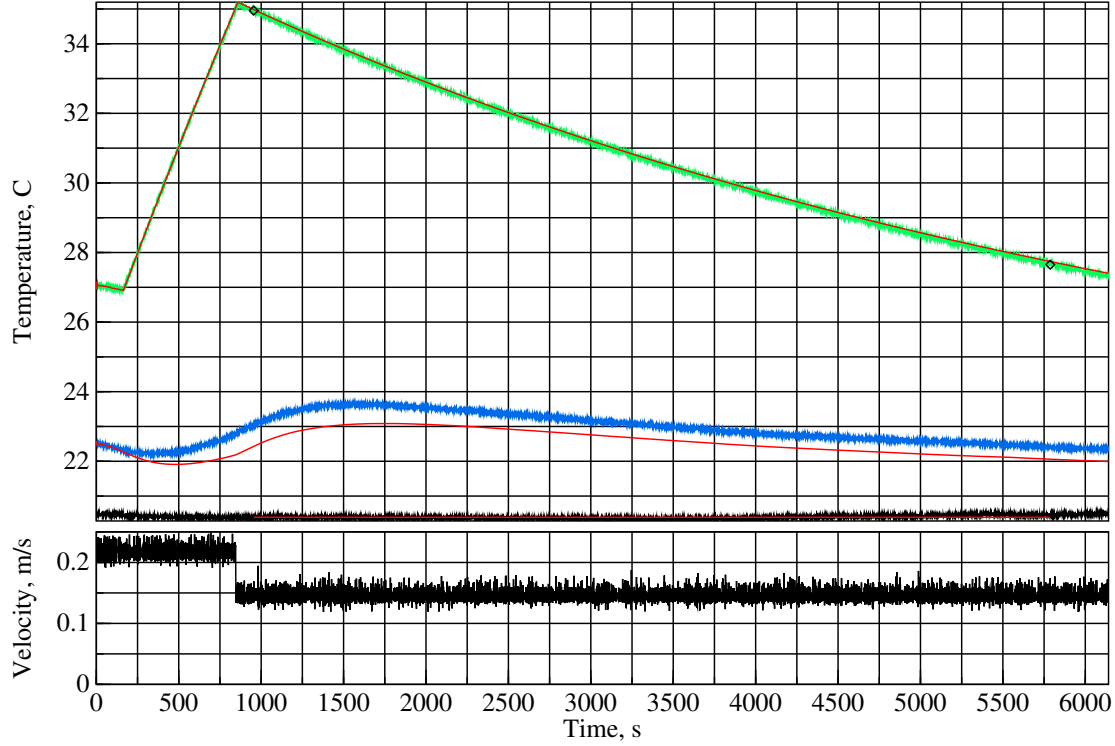
20220915T193701Z – mixed Convection – Roughness=1.04mm; T=20.4+10.8°C; +82.00°
k=0.0256, Ra/L^3=1.057x10^9, h=1.95W/(K.m^2), U=0.181W/K, Nu=23.2, Pr=0.710



Estimated measurement uncertainties of natural convection at $\theta = 82.0$.

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
ΔT	10.8K	+31.3%/K	0.10K	3.13%	LM35C differential
T_{bb}	294K	+0.550%/K	0.50K	0.28%	radiative temperature
P	101kPa	+0.0008%/Pa	1.5kPa	1.26%	MPXH6115A6U air pressure
C_{pt}	4.24kJ/K	+0.070%/(J/K)	42J/K	2.96%	plate thermal capacity
L_c	0.305m	+907%/m	500um	0.45%	characteristic length
D_{PIR}	25.4mm	-704%/m	1.0mm	0.70%	insulation thickness
D_g	1.00mm	-714%/m	500um	0.36%	air gap
L_m	3.57mm	+1987%/m	500um	0.99%	side metal strip width
k_{PIR}	22.2 $\frac{mW}{K \cdot m}$	+0.681%/ $\frac{mW}{K \cdot m}$	1.1 $\frac{mW}{K \cdot m}$	0.76%	PIR thermal conductivity
ϵ_{XPS}	0.515	+61.2%	0.010	0.61%	XPS emissivity
ϵ_{tp}	0.890	+73.8%	0.015	1.11%	tape emissivity
Ω_{tp}	0.540	+49.9%	0.020	1.00%	tape coverage
ϵ_{rs}	0.040	+264%	0.010	2.64%	test-surface emissivity
ϵ_b	0.190	+16.7%	0.020	0.33%	back emissivity
ϵ_{wt}	0.900	+123%	0.025	3.08%	wind-tunnel emissivity
θ	82.0°	-2.53%/°	0.50°	1.26%	plate angle
				6.59%	combined bias uncertainty

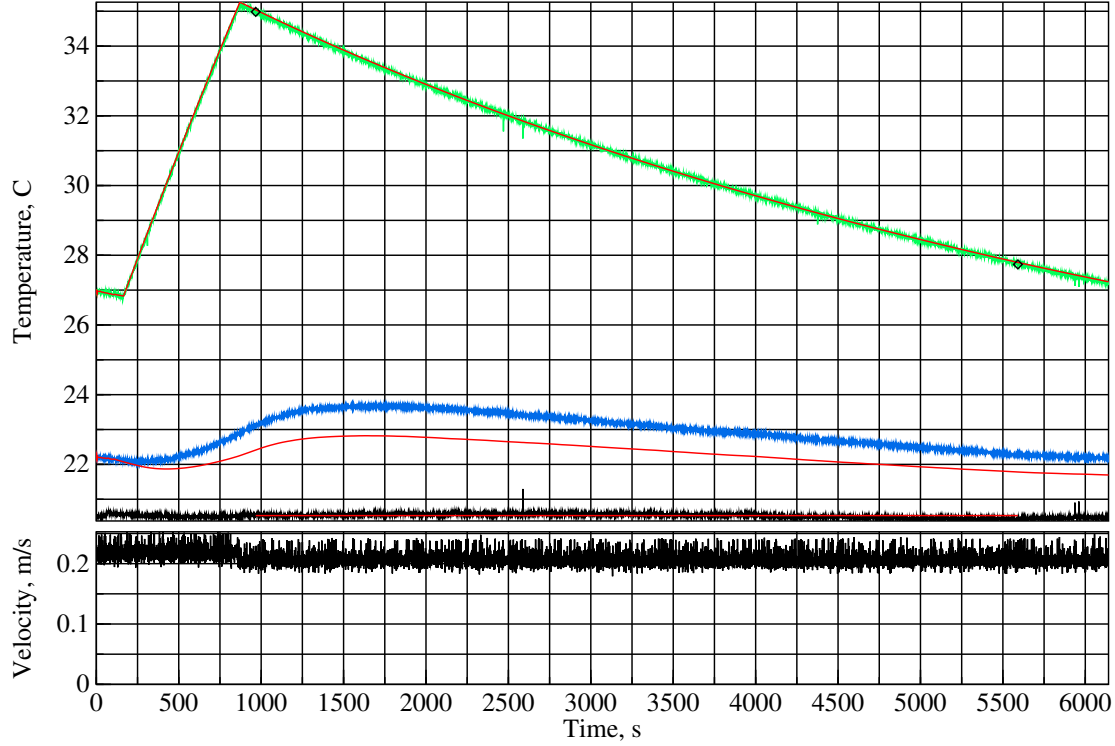
20220915T214034Z – mixed Convection – Roughness=1.04mm; T=20.4+10.5°C; +82.00°
41±3.0r/min, V=0.15m/s, Re=2954, Ra/L^3=1.027x10^9, h=2.49W/(K.m^2), U=0.231W/K, Nu=29.6



Estimated measurement uncertainties, bi-level 1mm roughness at $Re = 2953$.

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
ΔT	10.5K	+29.5%/K	0.10K	2.95%	LM35C differential
T_{bb}	294K	+0.470%/K	0.50K	0.24%	radiative temperature
P	101kPa	+0.0009%/Pa	1.5kPa	1.42%	MPXH6115A6U air pressure
C_{pt}	4.24kJ/K	+0.065%/(J/K)	42J/K	2.75%	plate thermal capacity
η	0.402	+76.3%	0.004	0.31%	anemometer calibration
L_c	0.305m	+804%/m	500um	0.40%	characteristic length
ς	2.00mm	+2649%/m	100um	0.26%	post height
D_{PIR}	25.4mm	-767%/m	1.0mm	0.77%	insulation thickness
D_g	1.00mm	-778%/m	500um	0.39%	air gap
L_m	3.57mm	+1868%/m	500um	0.93%	side metal strip width
k_{PIR}	22.2 $\frac{mW}{K \cdot m}$	+0.755%/ $\frac{mW}{K \cdot m}$	1.1 $\frac{mW}{K \cdot m}$	0.84%	PIR thermal conductivity
ϵ_{XPS}	0.515	+53.2%	0.010	0.53%	XPS emissivity
ϵ_{tp}	0.890	+64.2%	0.015	0.96%	tape emissivity
Ω_{tp}	0.540	+43.4%	0.020	0.87%	tape coverage
ϵ_{rs}	0.040	+230%	0.010	2.30%	test-surface emissivity
ϵ_{wt}	0.900	+105%	0.025	2.63%	wind-tunnel emissivity
θ	82.0°	-1.75%/°	0.50°	0.88%	plate angle
				6.00%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
ω	40.9r/min	+0.749%/(r/min)	3.0r/min	2.26%	fan rotation rate
				7.51%	RSS combined uncertainty

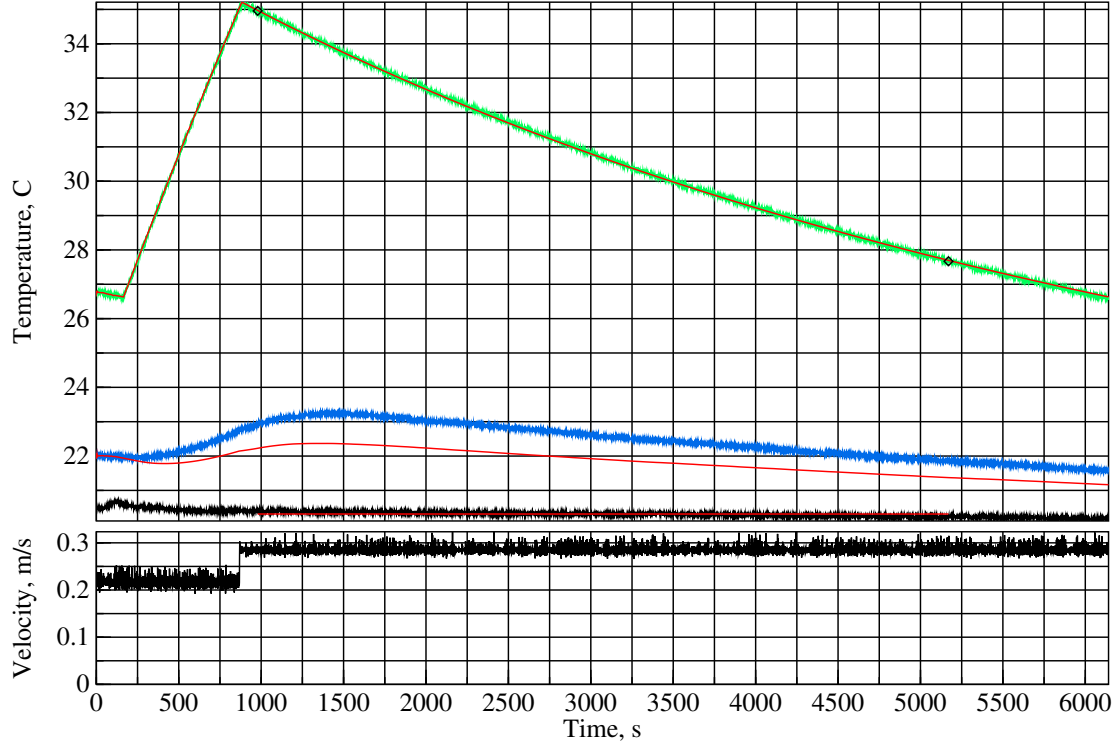
20220915T232855Z – mixed Convection – Roughness=1.04mm; T=20.5+10.4°C; +82.00°
58±3.5r/min, V=0.21m/s, Re=4219, Ra/L^3=1.023x10^9, h=2.74W/(K.m^2), U=0.255W/K, Nu=32.6



Estimated measurement uncertainties, bi-level 1mm roughness at $Re = 4216$.

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
ΔT	10.4K	+27.2%/K	0.10K	2.72%	LM35C differential
T_{bb}	294K	+0.412%/K	0.50K	0.21%	radiative temperature
P	101kPa	+0.0010%/Pa	1.5kPa	1.55%	MPXH6115A6U air pressure
C_{pt}	4.24kJ/K	+0.060%/(J/K)	42J/K	2.55%	plate thermal capacity
η	0.402	+130%	0.004	0.52%	anemometer calibration
L_c	0.305m	+756%/m	500um	0.38%	characteristic length
D_{PIR}	25.4mm	-735%/m	1.0mm	0.74%	insulation thickness
D_g	1.00mm	-746%/m	500um	0.37%	air gap
L_m	3.57mm	+1710%/m	500um	0.85%	side metal strip width
k_{PIR}	22.2 $\frac{mW}{K \cdot m}$	+0.727%/ $\frac{mW}{K \cdot m}$	1.1 $\frac{mW}{K \cdot m}$	0.81%	PIR thermal conductivity
ϵ_{XPS}	0.515	+46.7%	0.010	0.47%	XPS emissivity
ϵ_{tp}	0.890	+56.4%	0.015	0.85%	tape emissivity
Ω_{tp}	0.540	+38.1%	0.020	0.76%	tape coverage
ϵ_{rs}	0.040	+202%	0.010	2.02%	test-surface emissivity
ϵ_{wt}	0.900	+92.2%	0.025	2.30%	wind-tunnel emissivity
θ	82.0°	-1.26%/°	0.50°	0.63%	plate angle
				5.49%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
ω	58.4r/min	+0.891%/(r/min)	3.5r/min	3.15%	fan rotation rate
				8.37%	RSS combined uncertainty

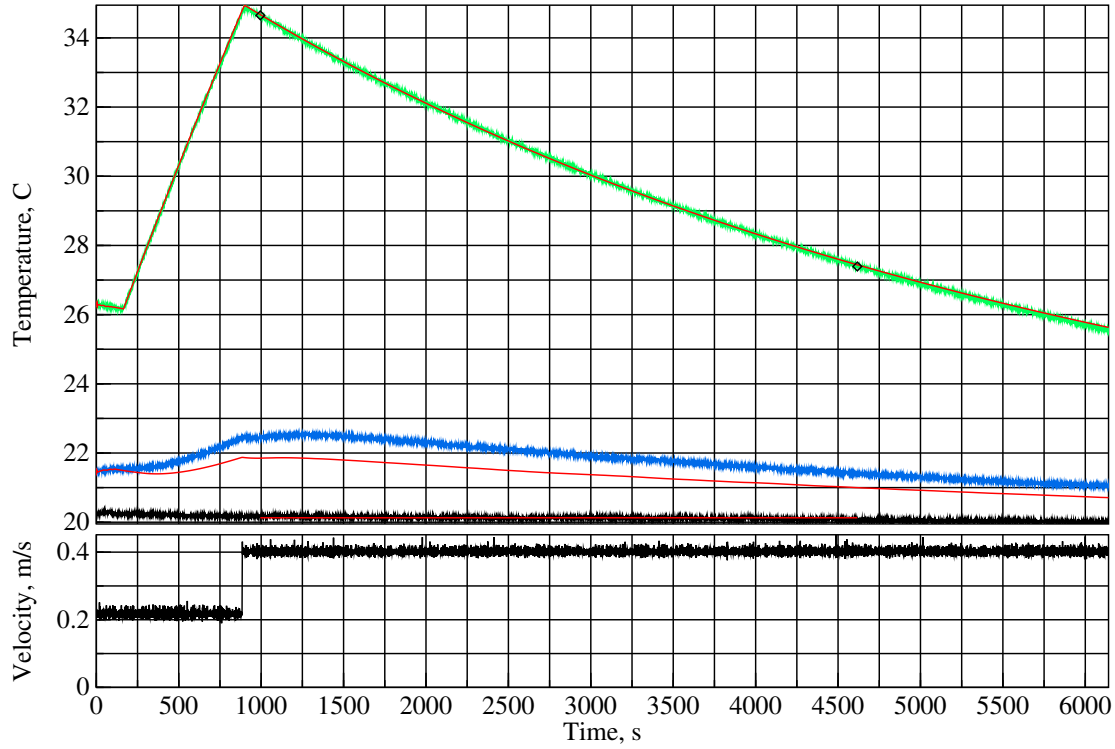
20220916T011817Z – mixed Convection – Roughness=1.04mm; T=20.3+10.6°C; +82.00°
80±2.5r/min, V=0.29m/s, Re=5816, Ra/L^3=1.043x10^9, h=3.27W/(K.m^2), U=0.304W/K, Nu=38.9



Estimated measurement uncertainties, bi-level 1mm roughness at $Re = 5815$.

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
ΔT	10.6K	+23.5%/K	0.10K	2.35%	LM35C differential
P	101kPa	+0.0012%/Pa	1.5kPa	1.74%	MPXH6115A6U air pressure
C_{pt}	4.24kJ/K	+0.054%/(J/K)	42J/K	2.28%	plate thermal capacity
η	0.402	+196%	0.004	0.79%	anemometer calibration
L_c	0.305m	+718%/m	500um	0.36%	characteristic length
L_T	8.34mm	+3351%/m	100um	0.34%	post length
ς	2.00mm	−7932%/m	100um	0.79%	post height
D_{PIR}	25.4mm	−642%/m	1.0mm	0.64%	insulation thickness
D_g	1.00mm	−651%/m	500um	0.33%	air gap
L_m	3.57mm	+1467%/m	500um	0.73%	side metal strip width
k_{PIR}	22.2 $\frac{mW}{K \cdot m}$	+0.637%/ $\frac{mW}{K \cdot m}$	1.1 $\frac{mW}{K \cdot m}$	0.71%	PIR thermal conductivity
ϵ_{XPS}	0.515	+38.1%	0.010	0.38%	XPS emissivity
ϵ_{tp}	0.890	+46.0%	0.015	0.69%	tape emissivity
Ω_{tp}	0.540	+31.1%	0.020	0.62%	tape coverage
ϵ_{rs}	0.040	+165%	0.010	1.65%	test-surface emissivity
ϵ_{wt}	0.900	+75.0%	0.025	1.87%	wind-tunnel emissivity
θ	82.0°	−0.740%/°	0.50°	0.37%	plate angle
				4.93%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
ω	80.5r/min	+0.980%/(r/min)	2.5r/min	2.42%	fan rotation rate
				6.90%	RSS combined uncertainty

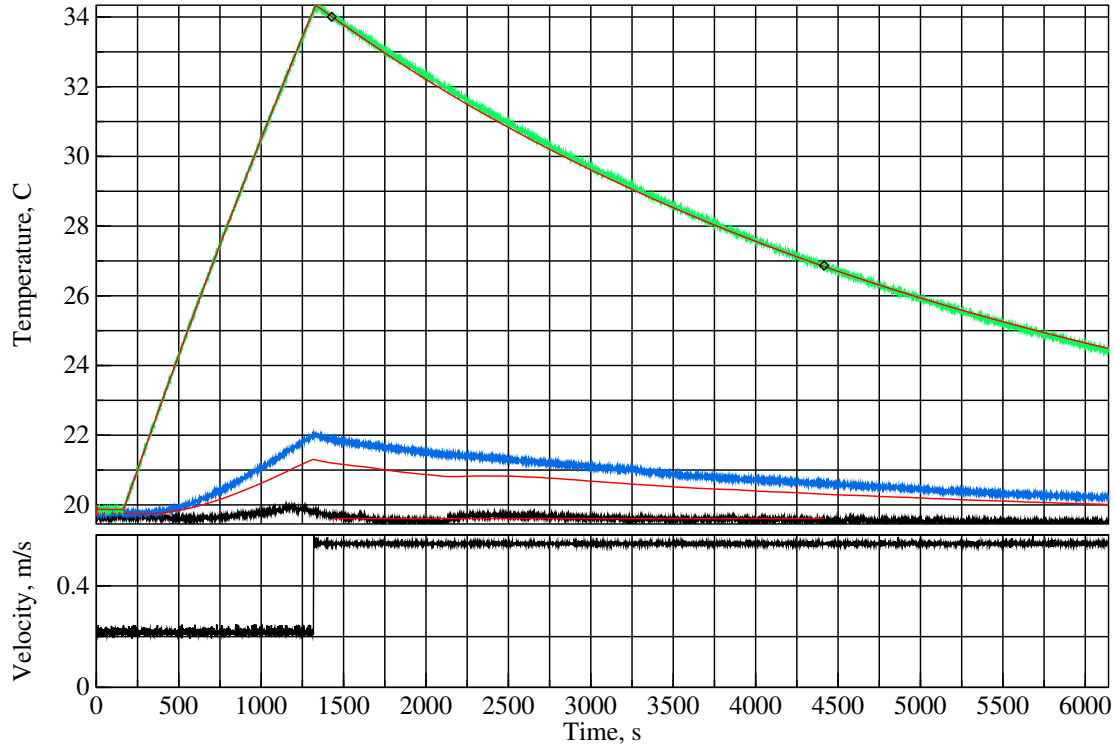
20220916T030456Z – mixed Convection – Roughness=1.04mm; T=20.1+10.5°C; +82.00°
113±2.6r/min, V=0.40m/s, Re=8180, Ra/L^3=1.037x10^9, h=4.50W/(K.m^2), U=0.419W/K, Nu=53.6



Estimated measurement uncertainties, bi-level 1mm roughness at $Re = 8180$.

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
ΔT	10.5K	+20.0%/K	0.10K	2.00%	LM35C differential
P	101kPa	+0.0012%/Pa	1.5kPa	1.83%	MPXH6115A6U air pressure
C_{pt}	4.24kJ/K	+0.046%/(J/K)	42J/K	1.95%	plate thermal capacity
η	0.402	+246%	0.004	0.99%	anemometer calibration
L_c	0.305m	+626%/m	500um	0.31%	characteristic length
L_T	8.34mm	+6190%/m	100um	0.62%	post length
ς	2.00mm	−15635%/m	100um	1.56%	post height
D_{PIR}	25.4mm	−504%/m	1.0mm	0.50%	insulation thickness
D_g	1.00mm	−511%/m	500um	0.26%	air gap
L_m	3.57mm	+1160%/m	500um	0.58%	side metal strip width
k_{PIR}	22.2 $\frac{mW}{K \cdot m}$	+0.503%/ $\frac{mW}{K \cdot m}$	1.1 $\frac{mW}{K \cdot m}$	0.56%	PIR thermal conductivity
ϵ_{XPS}	0.515	+28.1%	0.010	0.28%	XPS emissivity
ϵ_{tp}	0.890	+33.9%	0.015	0.51%	tape emissivity
Ω_{tp}	0.540	+22.9%	0.020	0.46%	tape coverage
ϵ_{rs}	0.040	+122%	0.010	1.22%	test-surface emissivity
ϵ_{wt}	0.900	+55.2%	0.025	1.38%	wind-tunnel emissivity
				4.48%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
ω	113r/min	+0.875%/(r/min)	2.6r/min	2.23%	fan rotation rate
				6.32%	RSS combined uncertainty

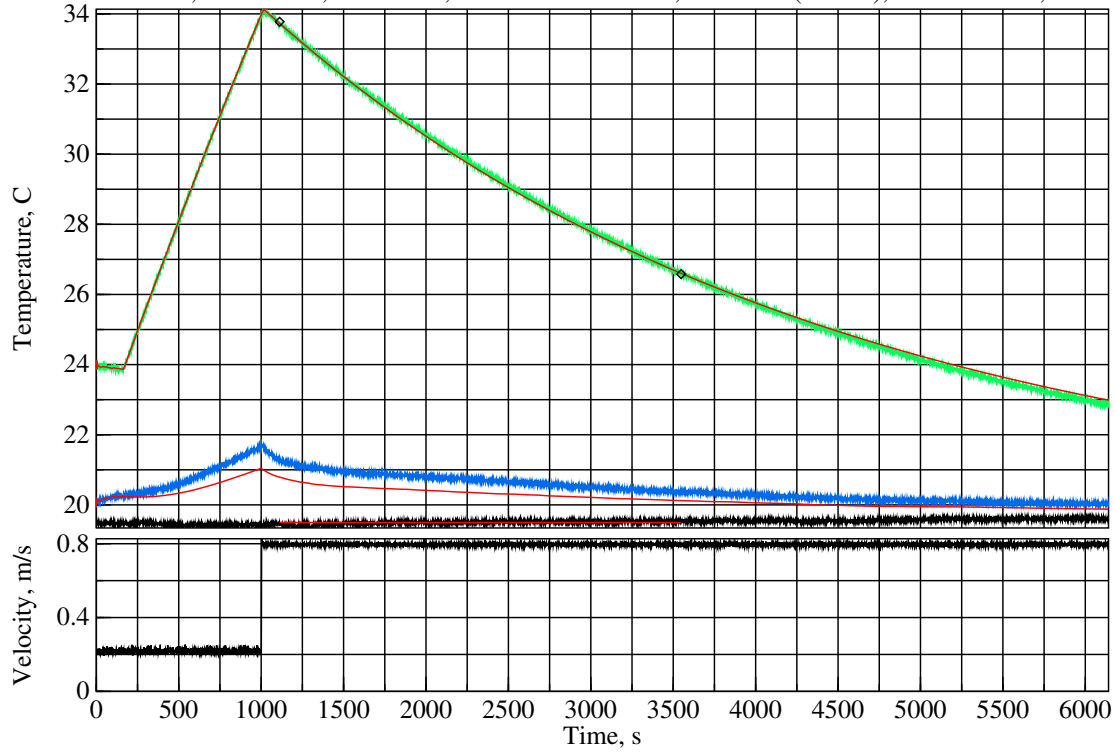
20220916T134758Z – mixed Convection – Roughness=1.04mm; T=19.6+10.5°C; +82.00°
160±0.9r/min, V=0.57m/s, Re=11560, Ra/L^3=1.042x10^9, h=6.26W/(K.m^2), U=0.582W/K, Nu=74.6



Estimated measurement uncertainties, bi-level 1mm roughness at $Re = 11559$.

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
ΔT	10.5K	+16.9%/K	0.10K	1.69%	LM35C differential
P	101kPa	+0.0011%/Pa	1.5kPa	1.72%	MPXH6115A6U air pressure
C_{pt}	4.24kJ/K	+0.040%/(J/K)	42J/K	1.68%	plate thermal capacity
η	0.402	+250%	0.004	1.00%	anemometer calibration
L_c	0.305m	+469%/m	500um	0.23%	characteristic length
L_T	8.34mm	+7881%/m	100um	0.79%	post length
ς	2.00mm	-14984%/m	100um	1.50%	post height
D_{PIR}	25.4mm	-375%/m	1.0mm	0.38%	insulation thickness
L_m	3.57mm	+897%/m	500um	0.45%	side metal strip width
k_{PIR}	22.2 $\frac{mW}{K \cdot m}$	+0.376%/ $\frac{mW}{K \cdot m}$	1.1 $\frac{mW}{K \cdot m}$	0.42%	PIR thermal conductivity
ϵ_{tp}	0.890	+23.9%	0.015	0.36%	tape emissivity
Ω_{tp}	0.540	+16.1%	0.020	0.32%	tape coverage
ϵ_{rs}	0.040	+86.0%	0.010	0.86%	test-surface emissivity
ϵ_{wt}	0.900	+38.8%	0.025	0.97%	wind-tunnel emissivity
				3.89%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
ω	160r/min	+0.627%/(r/min)	0.86r/min	0.54%	fan rotation rate
				4.03%	RSS combined uncertainty

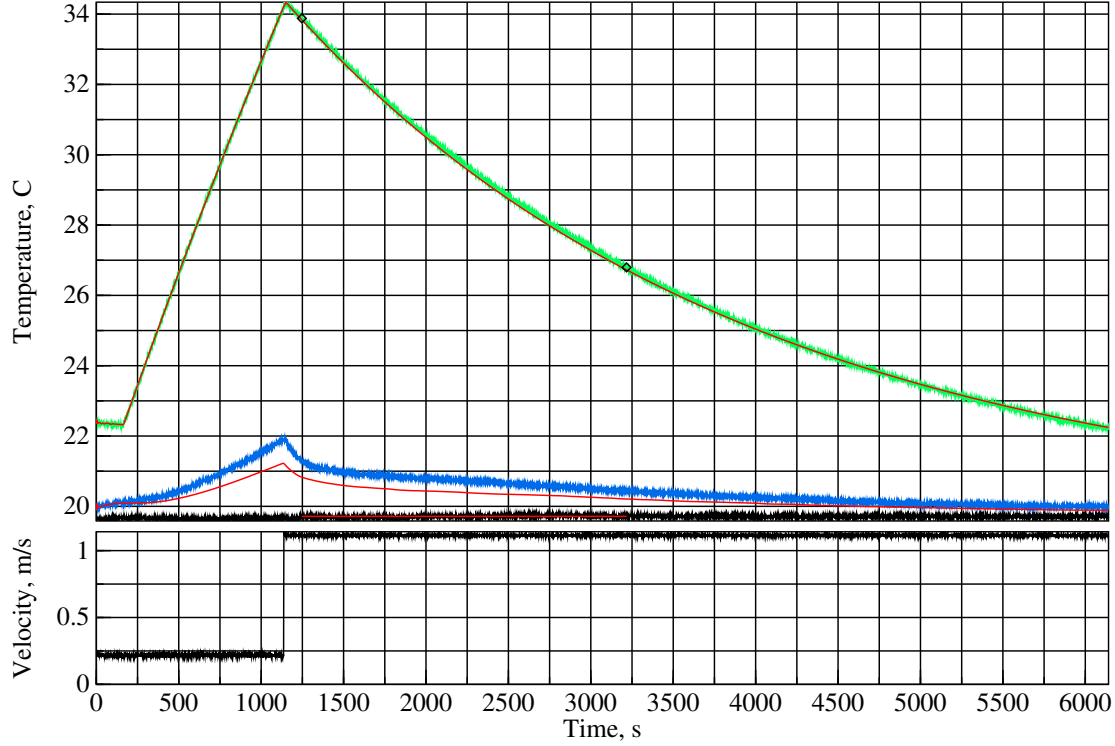
20220916T153642Z – mixed Convection – Roughness=1.04mm; T=19.5+10.3°C; +82.00°
226±1.5r/min, V=0.80m/s, Re=16228, Ra/L^3=1.023x10^9, h=8.73W/(K.m^2), U=0.812W/K, Nu=104.0



Estimated measurement uncertainties, bi-level 1mm roughness at $Re = 16225$.

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
ΔT	10.3K	+15.1%/K	0.10K	1.51%	LM35C differential
P	101kPa	+0.0010%/Pa	1.5kPa	1.56%	MPXH6115A6U air pressure
C_{pt}	4.24kJ/K	+0.035%/(J/K)	42J/K	1.49%	plate thermal capacity
η	0.402	+234%	0.004	0.94%	anemometer calibration
L_T	8.34mm	+8621%/m	100um	0.86%	post length
ς	2.00mm	-11145%/m	100um	1.11%	post height
D_{PIR}	25.4mm	-281%/m	1.0mm	0.28%	insulation thickness
L_m	3.57mm	+721%/m	500um	0.36%	side metal strip width
k_{PIR}	22.2 $\frac{mW}{K \cdot m}$	+0.283%/ $\frac{mW}{K \cdot m}$	1.1 $\frac{mW}{K \cdot m}$	0.31%	PIR thermal conductivity
ϵ_{tp}	0.890	+17.1%	0.015	0.26%	tape emissivity
Ω_{tp}	0.540	+11.5%	0.020	0.23%	tape coverage
ϵ_{rs}	0.040	+61.6%	0.010	0.62%	test-surface emissivity
ϵ_{wt}	0.900	+27.7%	0.025	0.69%	wind-tunnel emissivity
				3.35%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
ω	226r/min	+0.415%/(r/min)	1.5r/min	0.64%	fan rotation rate
				3.59%	RSS combined uncertainty

20220916T172742Z – mixed Convection – Roughness=1.04mm; T=19.7+10.2°C; +82.00°
320±1.2r/min, V=1.1m/s, Re=22671, Ra/L^3=1.013x10^9, h=11.7W/(K.m^2), U=1.09W/K, Nu=139.3



Estimated measurement uncertainties, bi-level 1mm roughness at $Re = 22670$.

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
ΔT	10.2K	+13.8%/K	0.10K	1.38%	LM35C differential
P	101kPa	+0.0010%/Pa	1.5kPa	1.43%	MPXH6115A6U air pressure
C_{pt}	4.24kJ/K	+0.032%/(J/K)	42J/K	1.36%	plate thermal capacity
η	0.402	+215%	0.004	0.86%	anemometer calibration
L_T	8.34mm	+8964%/m	100um	0.90%	post length
ς	2.00mm	−7624%/m	100um	0.76%	post height
D_{PIR}	25.4mm	−213%/m	1.0mm	0.21%	insulation thickness
L_m	3.57mm	+608%/m	500um	0.30%	side metal strip width
k_{PIR}	22.2 $\frac{mW}{K \cdot m}$	+0.216%/ $\frac{mW}{K \cdot m}$	1.1 $\frac{mW}{K \cdot m}$	0.24%	PIR thermal conductivity
ϵ_{rs}	0.040	+45.4%	0.010	0.45%	test-surface emissivity
ϵ_{wt}	0.900	+20.3%	0.025	0.51%	wind-tunnel emissivity
				2.96%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
ω	320r/min	+0.270%/(r/min)	1.2r/min	0.33%	fan rotation rate
				3.03%	RSS combined uncertainty