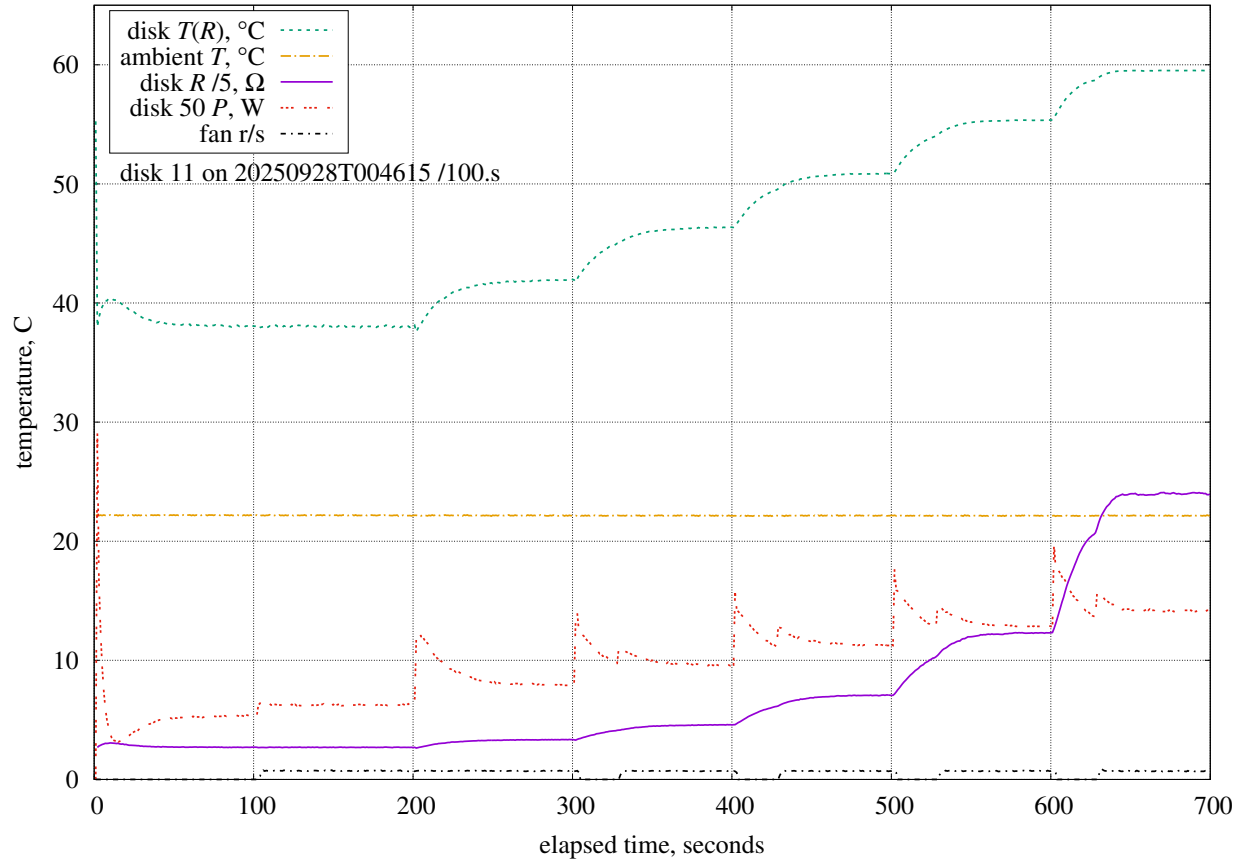


$\theta = 7.7^\circ$ ;  $\psi = 7.7^\circ$ ;  $V = 0.000 \text{ m/s}$  (0 r/min)

Estimated measurement uncertainties of natural convection at  $\theta = 7.8$ .

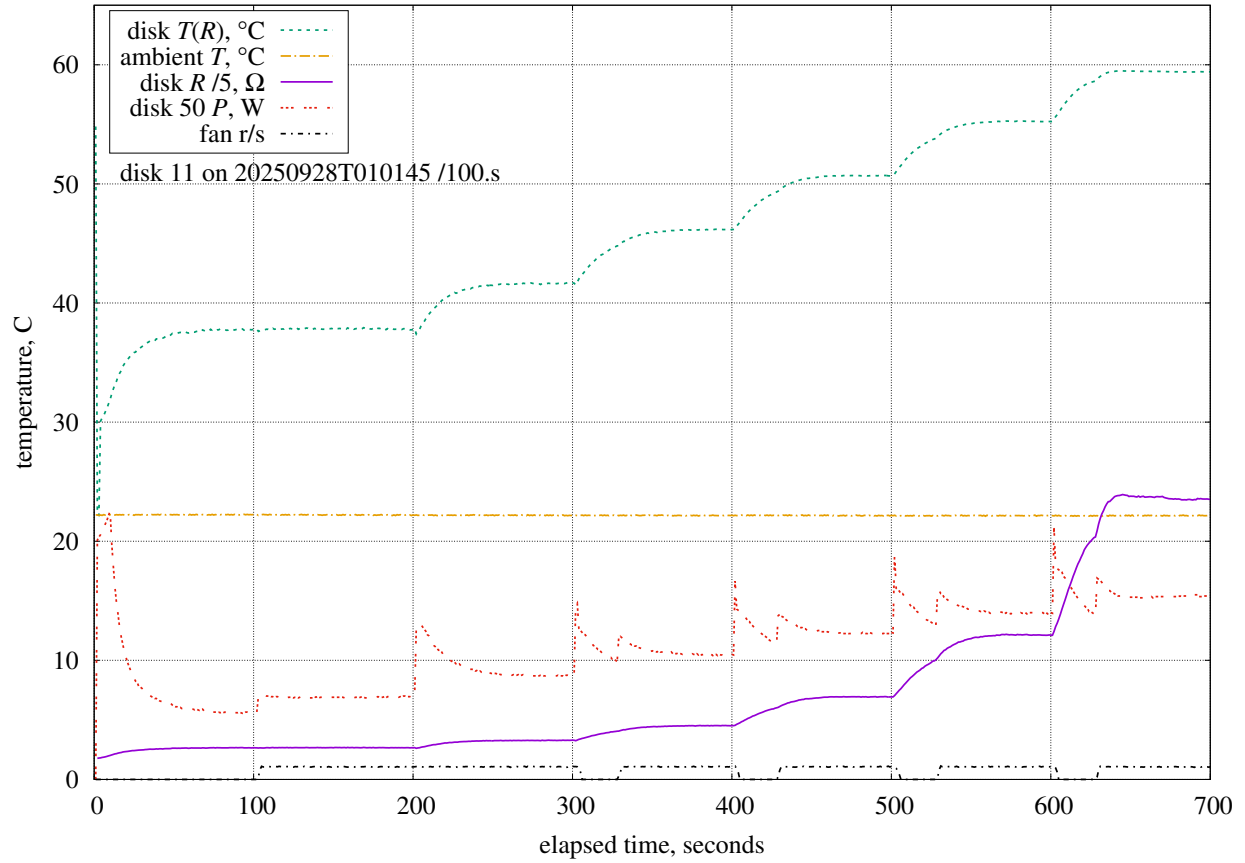
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$\Delta T$	25.0.K	+4.29%/K	0.10.K	0.43%	LM35C differential
$P$	100.kPa	+0.0002%/Pa	1.5.kPa	0.25%	MPXH6115A6U air pressure
$D_o$	2.81.mm	+2240%/m	500.um	1.12%	tube outer diameter
$D_i$	1.11.mm	+7666%/m	200.um	1.53%	tube inner diameter
$D_g$	166.um	-1294%/m	750.um	0.97%	tube air gap
$L_{\text{wire}}$	38.0.mm	+1135%/m	500.um	0.57%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.144%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.29%	ABS thermal conductivity
$d$	12.0.mm	+3920%/m	100.um	0.39%	disk diameter
				2.63%	combined bias uncertainty



$\theta = 7.7^\circ$ ;  $\psi = 7.7^\circ$ ;  $V = 0.129$  m/s (43 r/min)

Estimated measurement uncertainties at  $Re = 94$ .

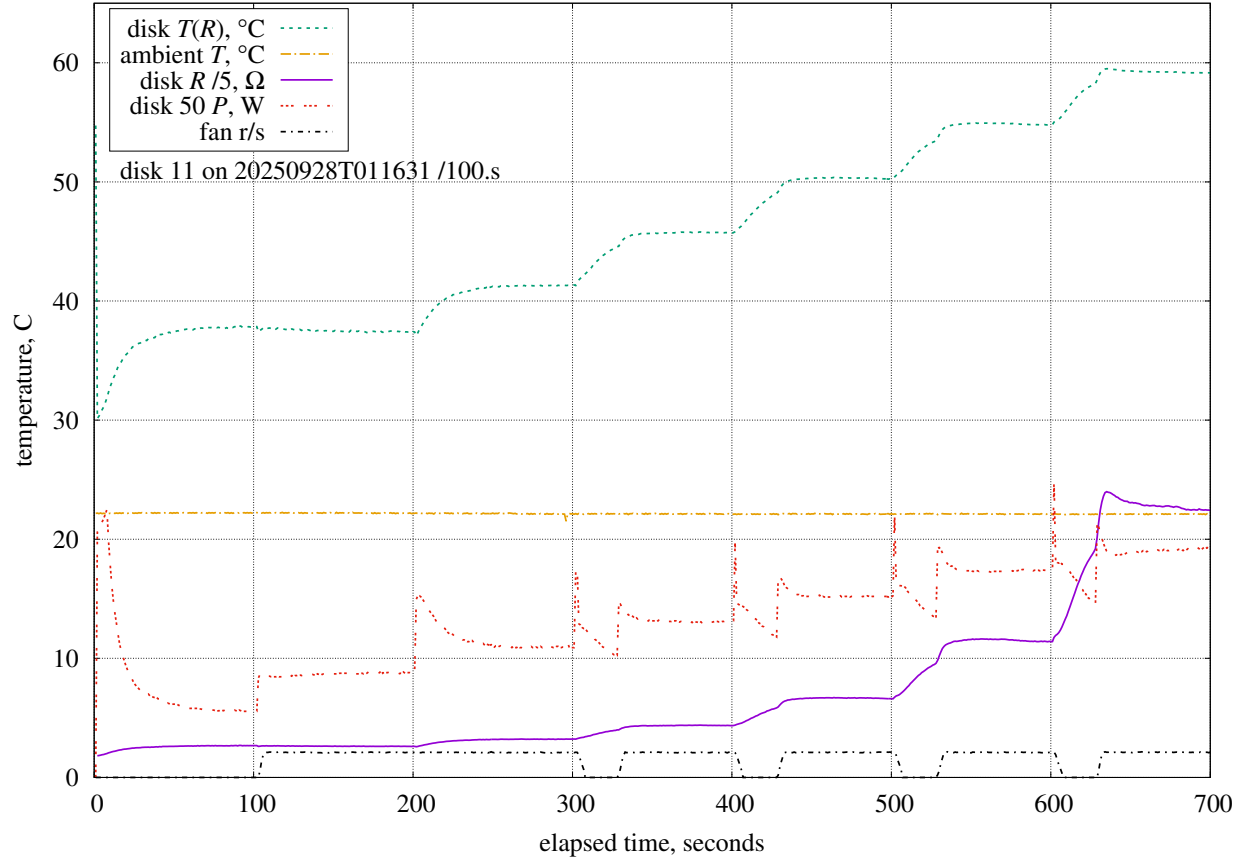
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$\Delta T$	25.0.K	+4.00%/K	0.10.K	0.40%	LM35C differential
$P$	100.kPa	+0.0004%/Pa	1.5.kPa	0.59%	MPXH6115A6U air pressure
$\eta$	0.340	+105%	0.007	0.71%	anemometer calibration
$Re_0$	600	-0.0056%	60	0.34%	integration lower-bound
$D_o$	2.81.mm	-3418%/m	500.um	1.71%	tube outer diameter
$D_i$	1.11.mm	+8704%/m	200.um	1.74%	tube inner diameter
$D_g$	166.um	-1457%/m	750.um	1.09%	tube air gap
$L_{\text{wire}}$	38.0.mm	+1278%/m	500.um	0.64%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.162%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.45%	ABS thermal conductivity
$d$	12.0.mm	+3465%/m	100.um	0.35%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	-29.0%	0.010	0.29%	ABS emissivity
$\epsilon_{wt}$	0.900	-28.9%	0.025	0.72%	wind-tunnel emissivity
				3.40%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	42.8.r/min	+0.834%/(r/min)	1.6.r/min	1.36%	fan rotation rate
				4.35%	RSS combined uncertainty



$\theta = 7.7^\circ$ ;  $\psi = 7.7^\circ$ ;  $V = 0.192$  m/s (64 r/min)

Estimated measurement uncertainties at  $Re = 140$ .

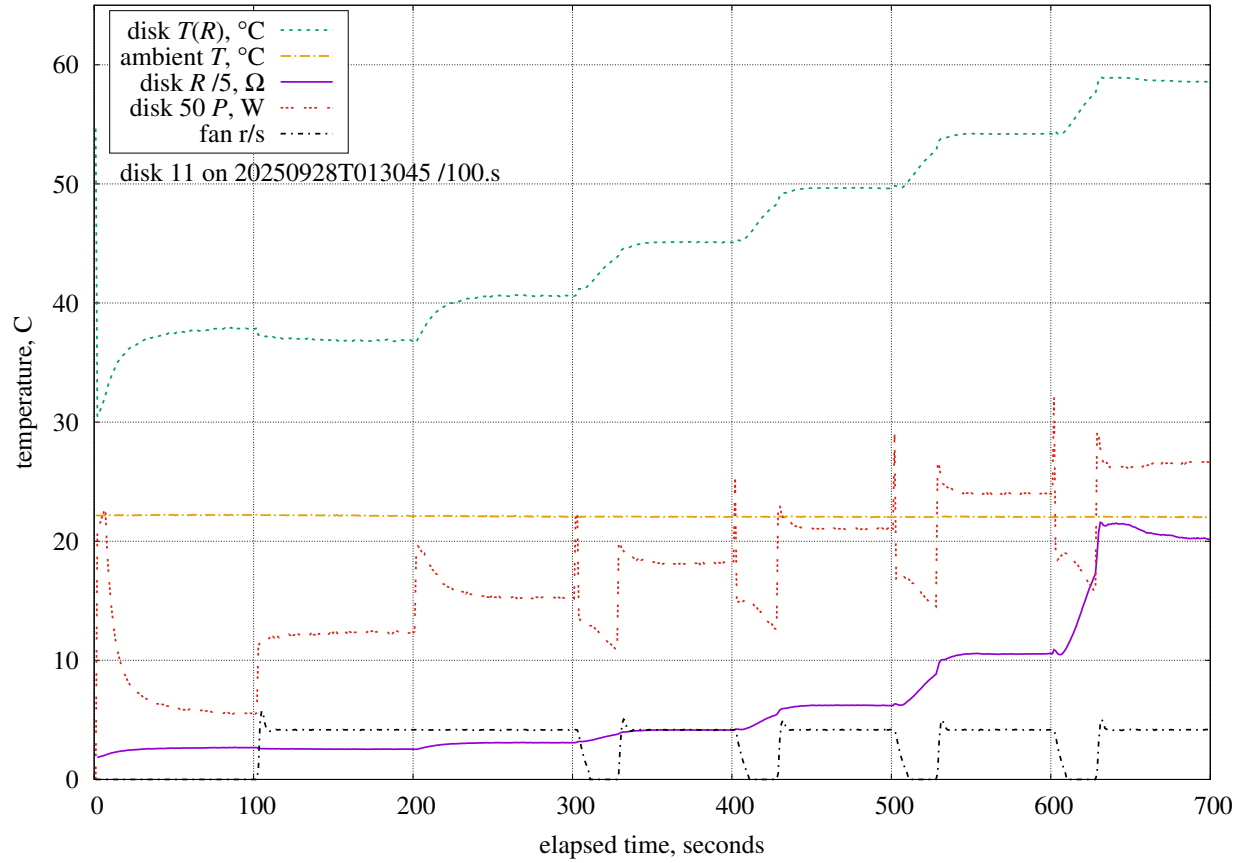
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$\Delta T$	25.0.K	+3.96%/K	0.10.K	0.40%	LM35C differential
$P$	100.kPa	+0.0004%/Pa	1.5.kPa	0.63%	MPXH6115A6U air pressure
$\eta$	0.340	+117%	0.007	0.79%	anemometer calibration
$Re_0$	600	-0.0063%	60	0.38%	integration lower-bound
$D_o$	2.81.mm	-5181%/m	500.um	2.59%	tube outer diameter
$D_i$	1.11.mm	+10167%/m	200.um	2.03%	tube inner diameter
$D_g$	166.um	-1673%/m	750.um	1.25%	tube air gap
$L_{\text{wire}}$	38.0.mm	+1468%/m	500.um	0.73%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.170%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.52%	ABS thermal conductivity
$d$	12.0.mm	+3537%/m	100.um	0.35%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	-33.4%	0.010	0.33%	ABS emissivity
$\epsilon_{wt}$	0.900	-33.5%	0.025	0.84%	wind-tunnel emissivity
				4.19%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	63.8.r/min	+0.622%/(r/min)	1.3.r/min	0.82%	fan rotation rate
				4.50%	RSS combined uncertainty



$\theta = 7.7^\circ$ ;  $\psi = 7.7^\circ$ ;  $V = 0.380 \text{ m/s}$  (126 r/min)

Estimated measurement uncertainties at  $Re = 276$ .

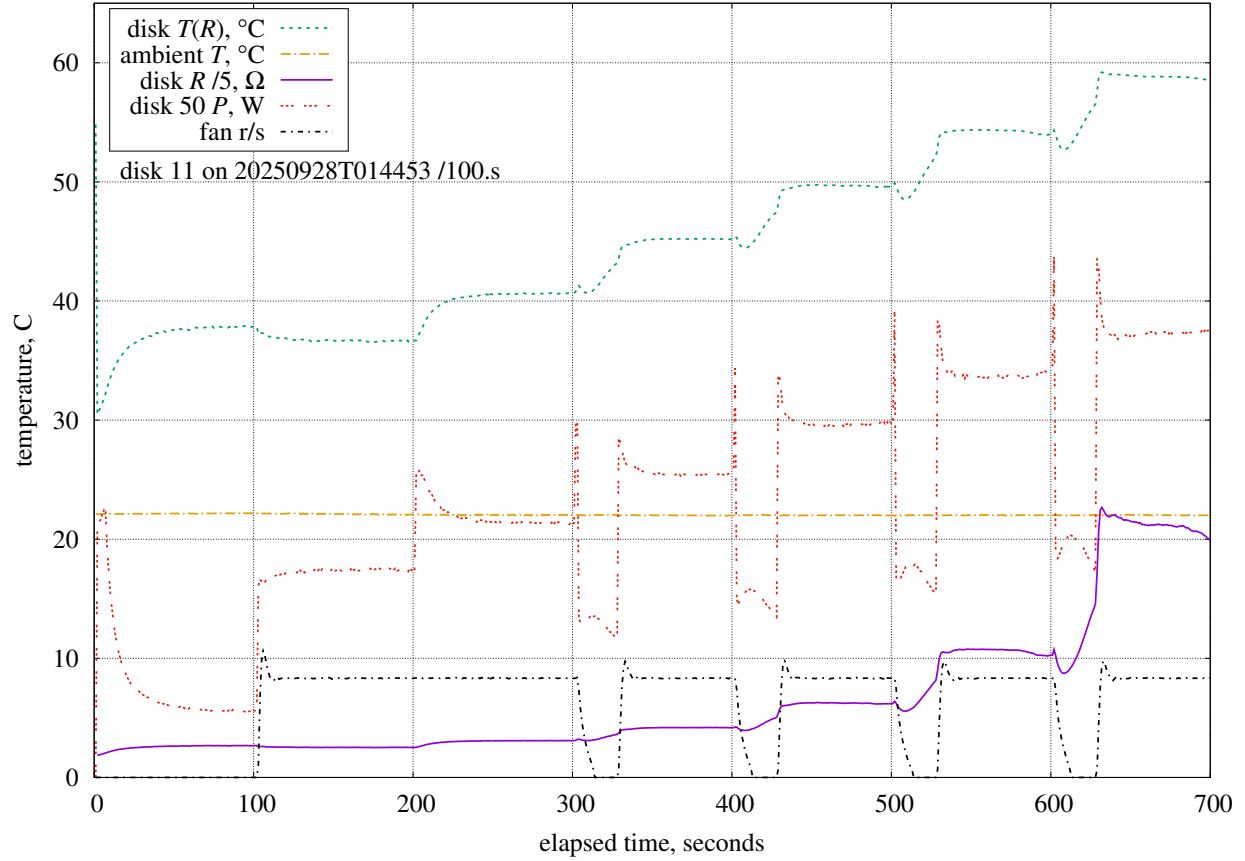
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$\Delta T$	25.0.K	+3.93%/K	0.10.K	0.39%	LM35C differential
$P$	100.kPa	+0.0004%/Pa	1.5.kPa	0.63%	MPXH6115A6U air pressure
$\eta$	0.340	+117%	0.007	0.80%	anemometer calibration
$Re_0$	600	-0.0063%	60	0.38%	integration lower-bound
$D_o$	2.81.mm	-7604%/m	500.um	3.80%	tube outer diameter
$D_i$	1.11.mm	+12989%/m	200.um	2.60%	tube inner diameter
$D_g$	166.um	-2066%/m	750.um	1.55%	tube air gap
$L_{\text{wire}}$	38.0.mm	+1813%/m	500.um	0.91%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.180%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.61%	ABS thermal conductivity
$d$	12.0.mm	+3817%/m	100.um	0.38%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	-35.4%	0.010	0.35%	ABS emissivity
$\epsilon_{wt}$	0.900	-35.7%	0.025	0.89%	wind-tunnel emissivity
				5.43%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	126.r/min	+0.317%/(r/min)	0.99.r/min	0.31%	fan rotation rate
				5.46%	RSS combined uncertainty



$\theta = 7.7^\circ$ ;  $\psi = 7.7^\circ$ ;  $V = 0.749 \text{ m/s}$  (250 r/min)

Estimated measurement uncertainties at  $Re = 544$ .

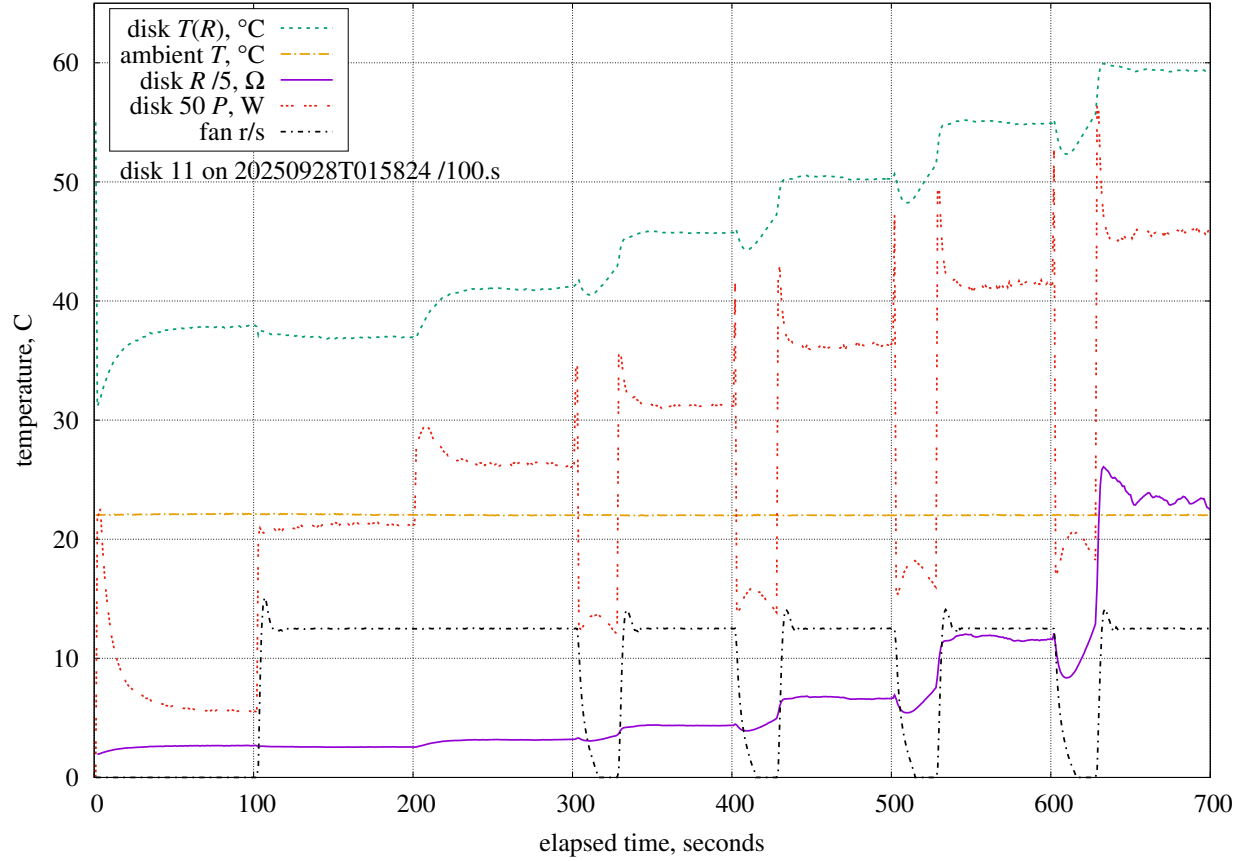
Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$\Delta T$	25.0.K	+3.86%/K	0.10.K	0.39%	LM35C differential
$P$	100.kPa	+0.0004%/Pa	1.5.kPa	0.62%	MPXH6115A6U air pressure
$\eta$	0.340	+117%	0.007	0.79%	anemometer calibration
$Re_0$	600	-0.0073%	60	0.44%	integration lower-bound
$D_o$	2.81.mm	-10129%/m	500.um	5.06%	tube outer diameter
$D_i$	1.11.mm	+16126%/m	200.um	3.23%	tube inner diameter
$D_g$	166.um	-2539%/m	750.um	1.90%	tube air gap
$L_{\text{wire}}$	38.0.mm	+2227%/m	500.um	1.11%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.192%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.71%	ABS thermal conductivity
$d$	12.0.mm	+4171%/m	100.um	0.42%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	-36.1%	0.010	0.36%	ABS emissivity
$\epsilon_{wt}$	0.900	-36.5%	0.025	0.91%	wind-tunnel emissivity
				6.81%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	250.r/min	+0.159%/(r/min)	1.3.r/min	0.20%	fan rotation rate
				6.82%	RSS combined uncertainty



$\theta = 7.7^\circ$ ;  $\psi = 7.7^\circ$ ;  $V = 1.467$  m/s (500 r/min)

Estimated measurement uncertainties at  $Re = 1066$ .

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$\Delta T$	25.0.K	+3.76%/K	0.10.K	0.38%	LM35C differential
$P$	100.kPa	+0.0004%/Pa	1.5.kPa	0.63%	MPXH6115A6U air pressure
$\eta$	0.340	+118%	0.007	0.80%	anemometer calibration
$Re_0$	600	-0.010%	60	0.60%	integration lower-bound
$D_o$	2.81.mm	-12372%/m	500.um	6.19%	tube outer diameter
$D_i$	1.11.mm	+18711%/m	200.um	3.74%	tube inner diameter
$D_g$	166.um	-2989%/m	750.um	2.24%	tube air gap
$L_{\text{wire}}$	38.0.mm	+2622%/m	500.um	1.31%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.197%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.76%	ABS thermal conductivity
$d$	12.0.mm	+4822%/m	100.um	0.48%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	-35.5%	0.010	0.35%	ABS emissivity
$\epsilon_{\text{wt}}$	0.900	-36.0%	0.025	0.90%	wind-tunnel emissivity
				8.05%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	500.r/min	+0.080%/(r/min)	1.4.r/min	0.11%	fan rotation rate
				8.06%	RSS combined uncertainty

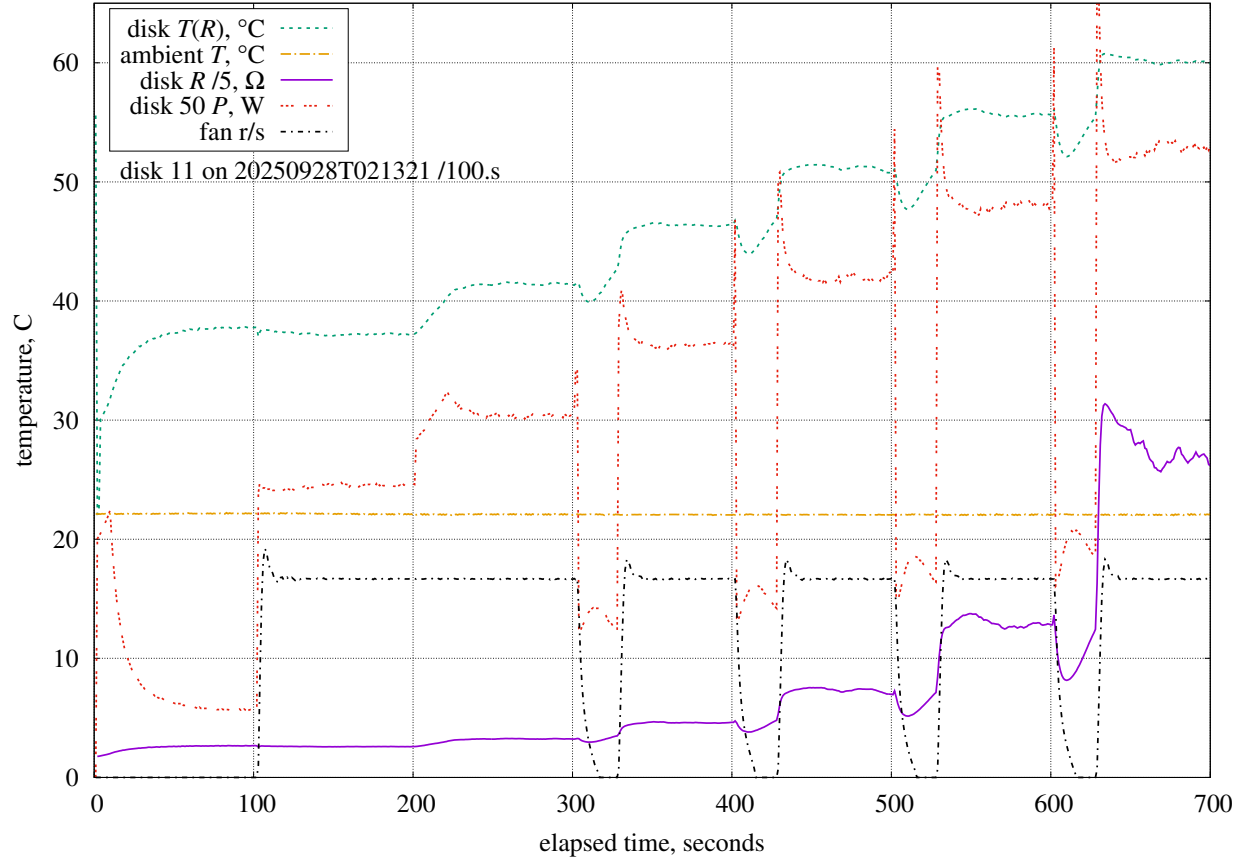


$\theta = 7.7^\circ$ ;  $\psi = 7.7^\circ$ ;  $V = 2.131 \text{ m/s}$  (750 r/min)

Estimated measurement uncertainties at  $Re = 1549$ .

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$\Delta T$	25.0.K	+3.70%/K	0.10.K	0.37%	LM35C differential
$P$	100.kPa	+0.0004%/Pa	1.5.kPa	0.62%	MPXH6115A6U air pressure
$\eta$	0.340	+111%	0.007	0.75%	anemometer calibration
$Re_0$	600	-0.011%	60	0.64%	integration lower-bound
$D_o$	2.81.mm	-13441%/m	500.um	6.72%	tube outer diameter
$D_i$	1.11.mm	+19678%/m	200.um	3.94%	tube inner diameter
$D_g$	166.um	-3209%/m	750.um	2.41%	tube air gap
$L_{\text{wire}}$	38.0.mm	+2815%/m	500.um	1.41%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.196%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.75%	ABS thermal conductivity
$d$	12.0.mm	+5250%/m	100.um	0.52%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	-34.9%	0.010	0.35%	ABS emissivity
$\epsilon_{\text{wt}}$	0.900	-35.5%	0.025	0.89%	wind-tunnel emissivity
				8.62%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	750.r/min	+0.050%/(r/min)	1.1.r/min	0.05%	fan rotation rate
				8.62%	RSS combined uncertainty





Estimated measurement uncertainties at  $Re = 1980$ .

Symbol	Nominal	Sensitivity	Bias	Uncertainty	Component
$\Delta T$	25.0.K	+3.65%/K	0.10.K	0.37%	LM35C differential
$P$	100.kPa	+0.0004%/Pa	1.5.kPa	0.62%	MPXH6115A6U air pressure
$\eta$	0.340	+101%	0.007	0.69%	anemometer calibration
$Re_0$	600	-0.011%	60	0.65%	integration lower-bound
$D_o$	2.81.mm	-14137%/m	500.um	7.07%	tube outer diameter
$D_i$	1.11.mm	+20121%/m	200.um	4.02%	tube inner diameter
$D_g$	166.um	-3349%/m	750.um	2.51%	tube air gap
$L_{\text{wire}}$	38.0.mm	+2938%/m	500.um	1.47%	wire length
$k_{\text{ABS}}$	179. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	+0.194%/ $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	9.0. $\frac{\text{mW}}{\text{K}\cdot\text{m}}$	1.74%	ABS thermal conductivity
$d$	12.0.mm	+5530%/m	100.um	0.55%	disk diameter
$\epsilon_{\text{ABS}}$	0.920	-34.8%	0.010	0.35%	ABS emissivity
$\epsilon_{\text{wt}}$	0.900	-35.4%	0.025	0.88%	wind-tunnel emissivity
				8.96%	combined bias uncertainty
Symbol	Nominal	Sensitivity	Variability	Uncertainty	Component
$\omega$	1.00.kr/min	+0.034%/(r/min)	2.0.r/min	0.07%	fan rotation rate
				8.96%	RSS combined uncertainty