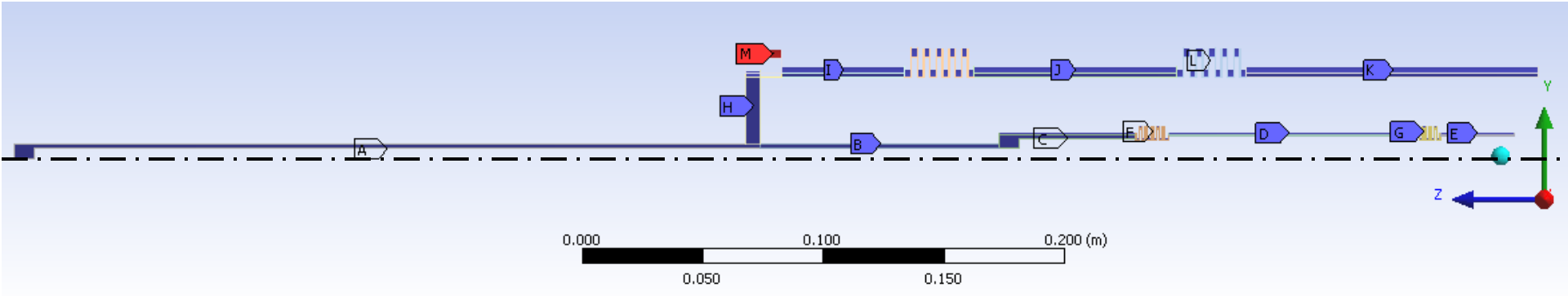
325MHz COUPLER INNER CONDUCTOR AIR COOLING FEM

Boundary Conditions (No Flow)

	CFX VARIABLE					I, A/m	L, mm	R, mm		P, W	
		1/8 V, m^3	V, m^3	MATERIAL	σ, S*m^-1				P_IN=0.5W	P_IN=6 kW	P_IN=30 kW
A	Q ANTENA 0	2.23E-06	1.78E-05	COPPER	5.80E+07	2.44	309	6.35	0.000172104	2.1	10.3
B	Q ANTENA 1	6.90E-07	5.52E-06	COPPER	5.80E+07	3.1	99	6.35	8.90043E-05	1.1	5.3
C	Q ANTENA 2	9.25E-07	7.40E-06	COPPER	5.80E+07	2	28	10.7	1.76555E-05	0.2	1.1
D	Q ANTENA 3	6.02E-07	4.82E-06	COPPER	5.80E+07	1.9	98	10.7	5.57694E-05	0.7	3.3
E	Q ANTENA 4	1.85E-07	1.48E-06	COPPER	5.80E+07	1.8	30.4	10.7	1.55268E-05	0.2	0.9
F	Q ANTENA BELLOW 1	1.16E-07	9.30E-07	PHOSPHOR BRONZE	1.15E+07	2	59	22.1	0.000172563	2.1	10.4
G	Q ANTENA BELLOW 2	1.16E-07	9.30E-07	PHOSPHOR BRONZE	1.15E+07	1.9	59	22.1	0.000155738	1.9	9.3
H	Q CERAMIC	3.04E-06	2.44E-05	AL2O3					0.0001	1.2	6.0
I	Q SHELL 1	3.18E-06	2.54E-05	COPPER	5.80E+07	0.42	59.7	36.45	5.65522E-06	0.1	0.3
J	Q SHELL 2	4.07E-06	3.25E-05	COPPER	5.80E+07	0.46	84	36.45	9.5449E-06	0.1	0.6
K	Q SHELL 3	5.84E-06	4.67E-05	COPPER	5.80E+07	0.45	120.7	36.45	1.31253E-05	0.2	0.8
L	Q SHELL BELLOW	7.65E-07	6.12E-06	PHOSPHOR BRONZE	1.15E+07	0.4	100	40	2.1175E-05	0.3	1.3

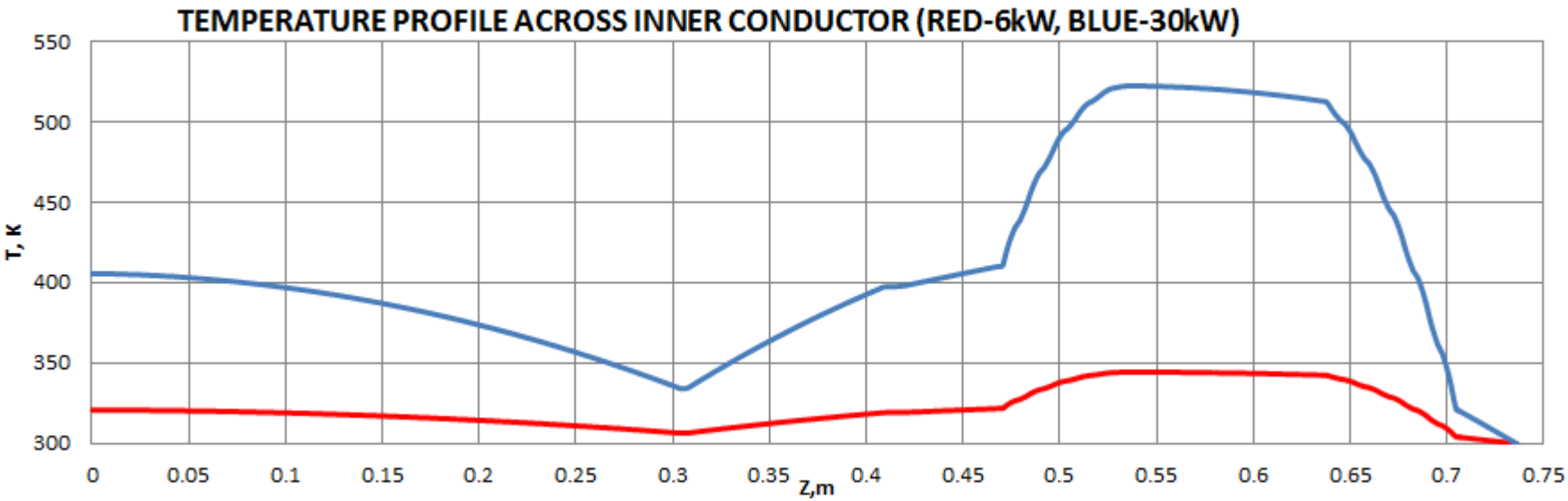


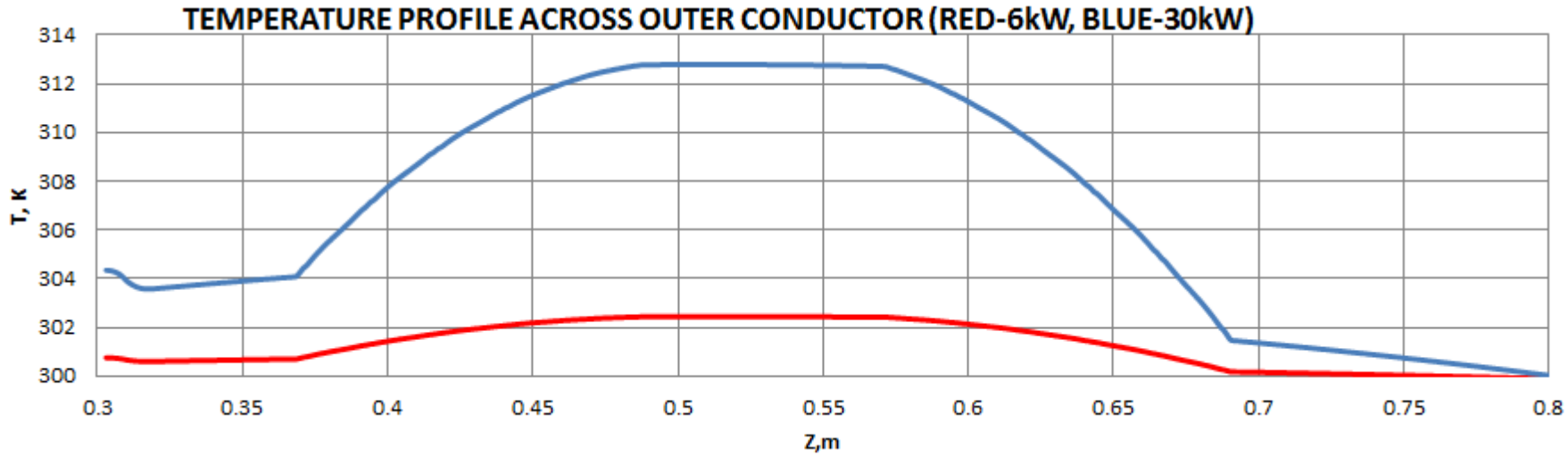
*1/8 of design is shown

Maximum Temperatures (No Flow)

Pin	TB1	TB2	TMAX	TMAXCER	TEND
kW	K	K	K	K	K
6	344.5	342.6	344.5	306.9	320.9
30	522.5	512.8	522.5	335.4	405.7

TB1;TB2-Maximum temperature on inner bellows; TMAX-Maximum temperature in system; TMAXCER-Maximum temperature in ceramic; TEND-Temperature at the end of antenna

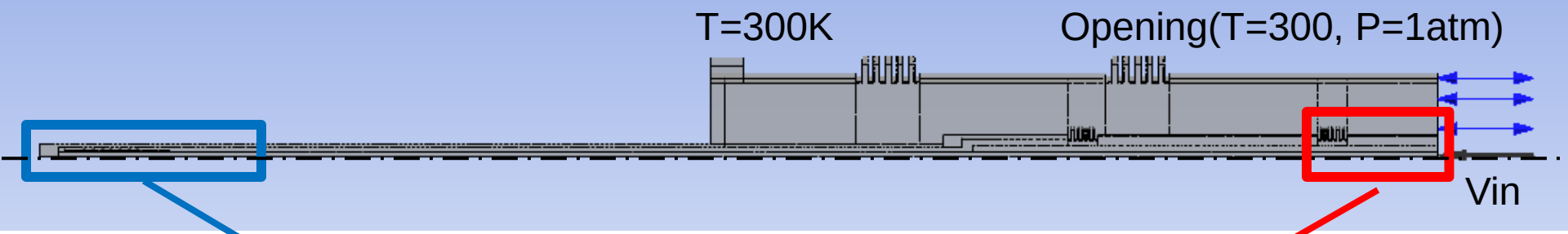


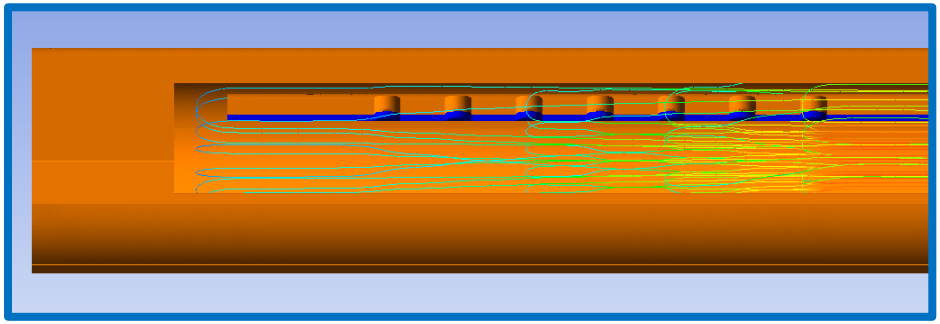


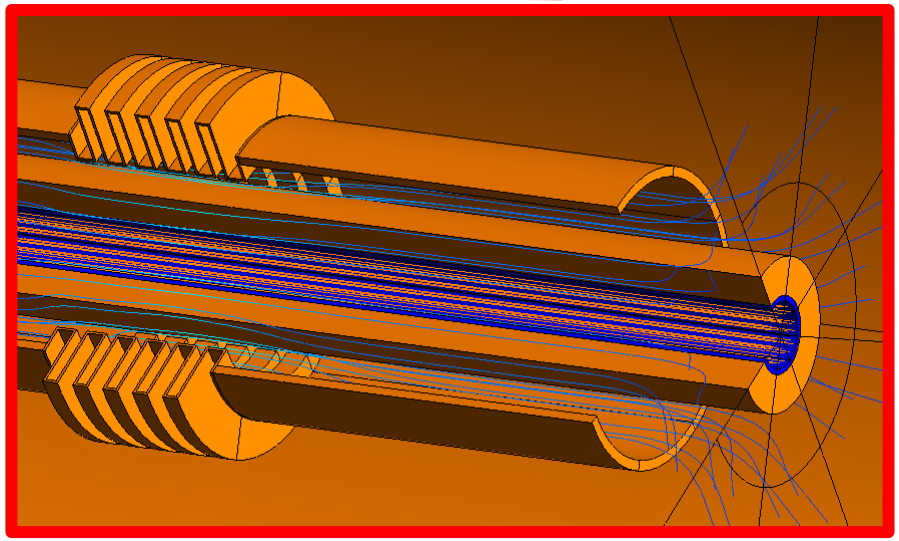
Boundary Conditions (Forced Flow)

*heat generation is the same as in previous modeling

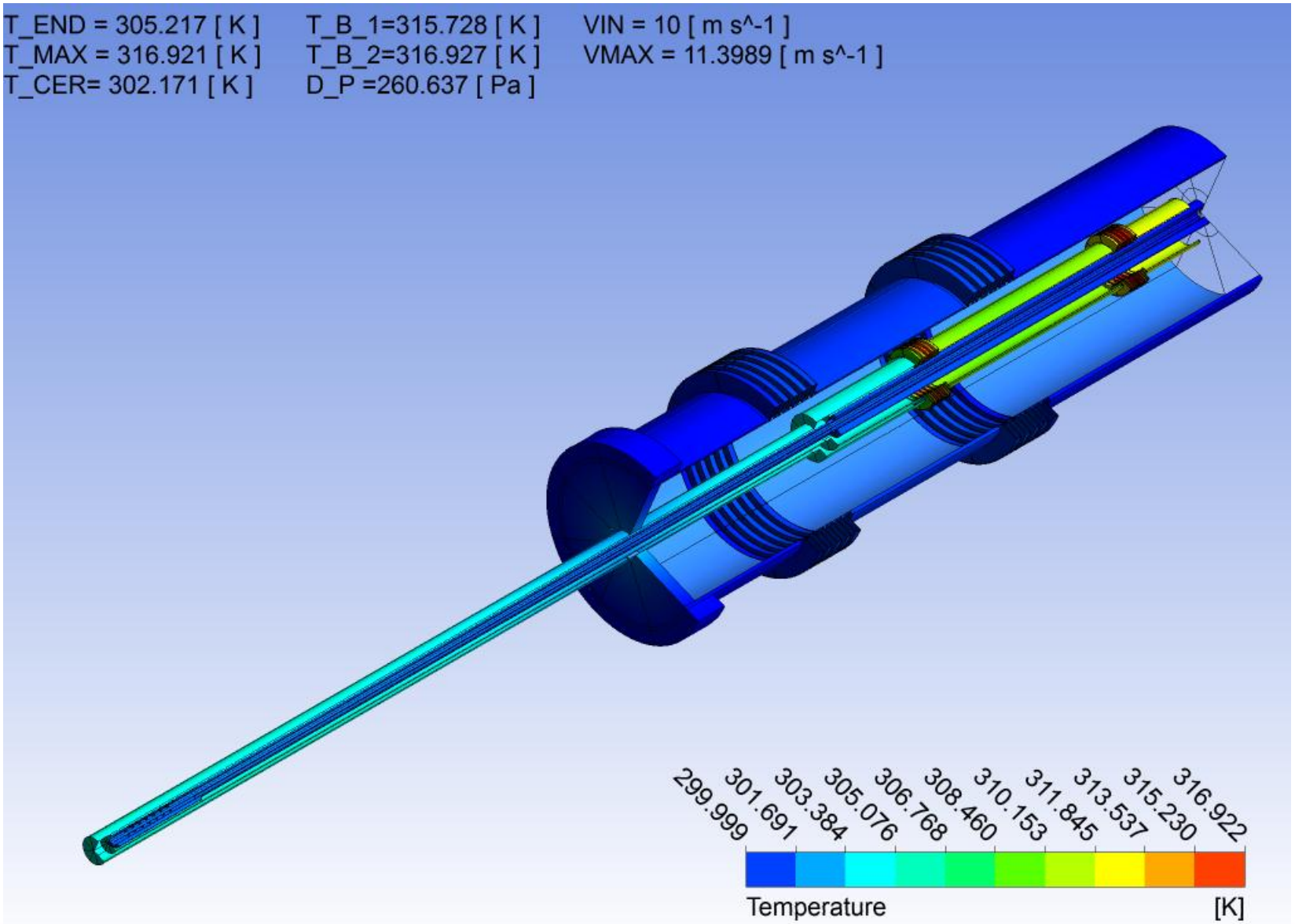
*1/8 of design is shown



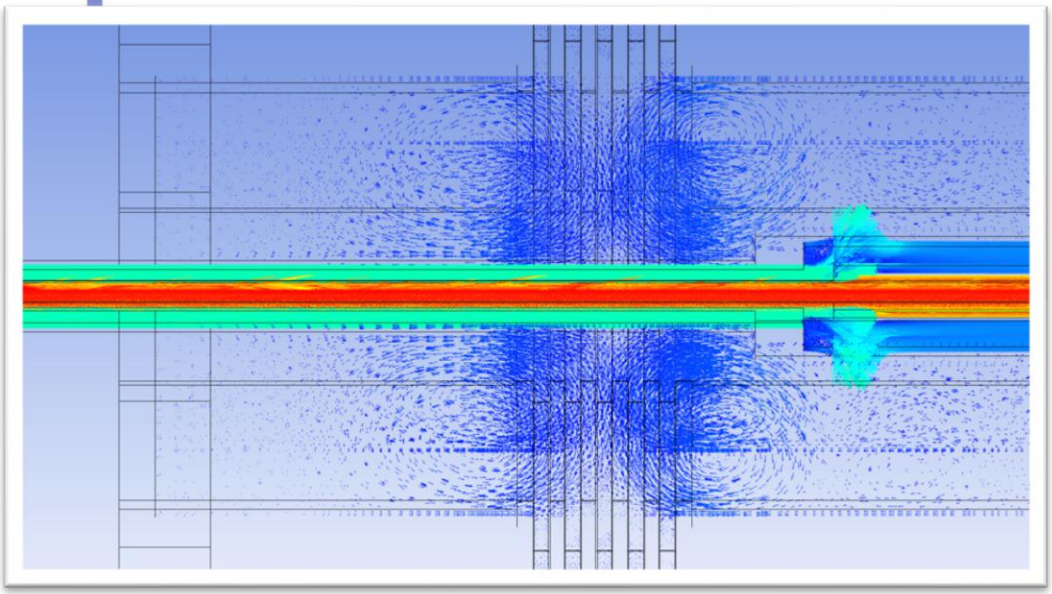


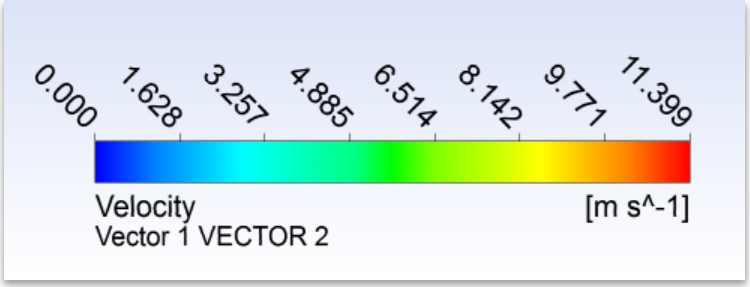


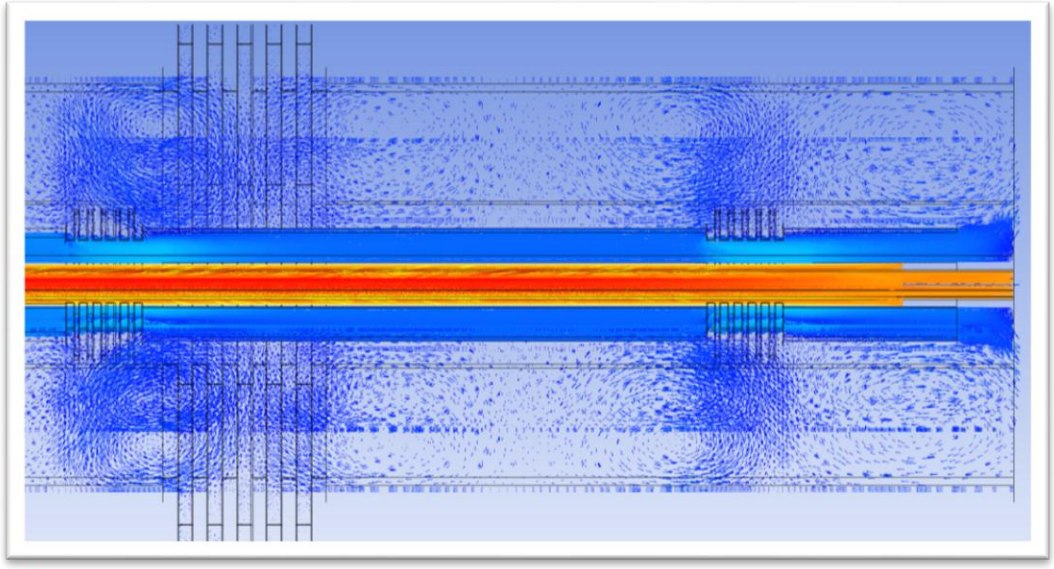
P_in=6kW V_in=10m/s (Forced Flow)

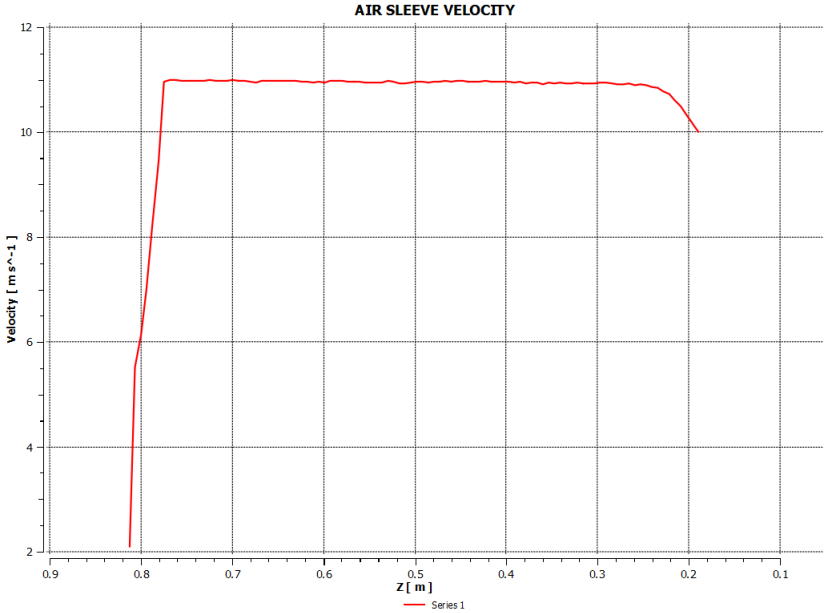


Vector Velocity (P_in=6kW V_in=10m/s)

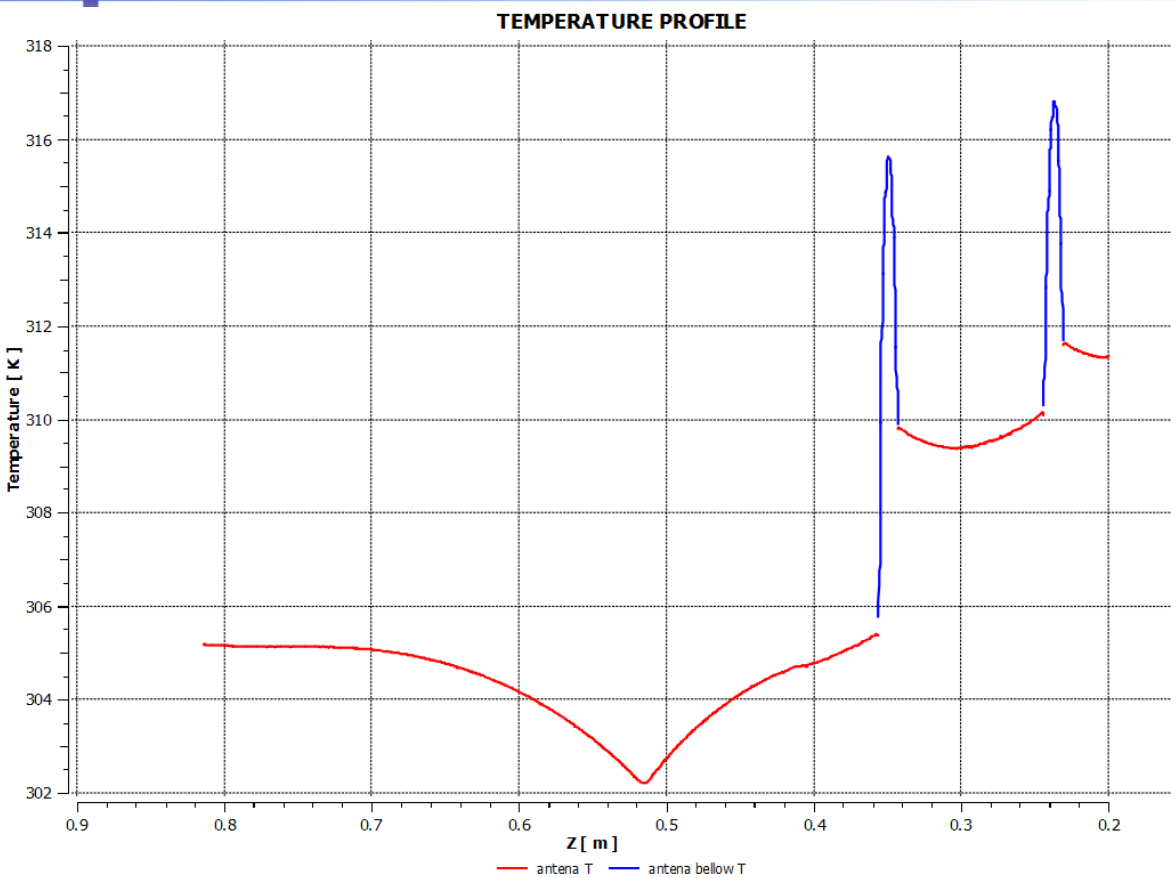


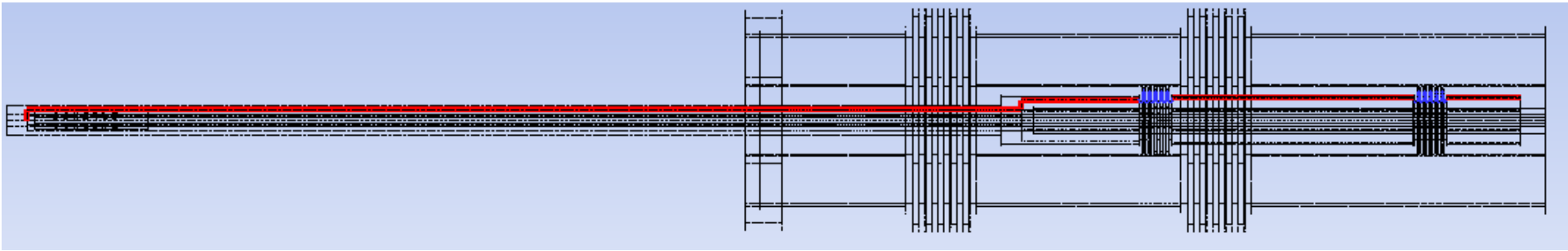




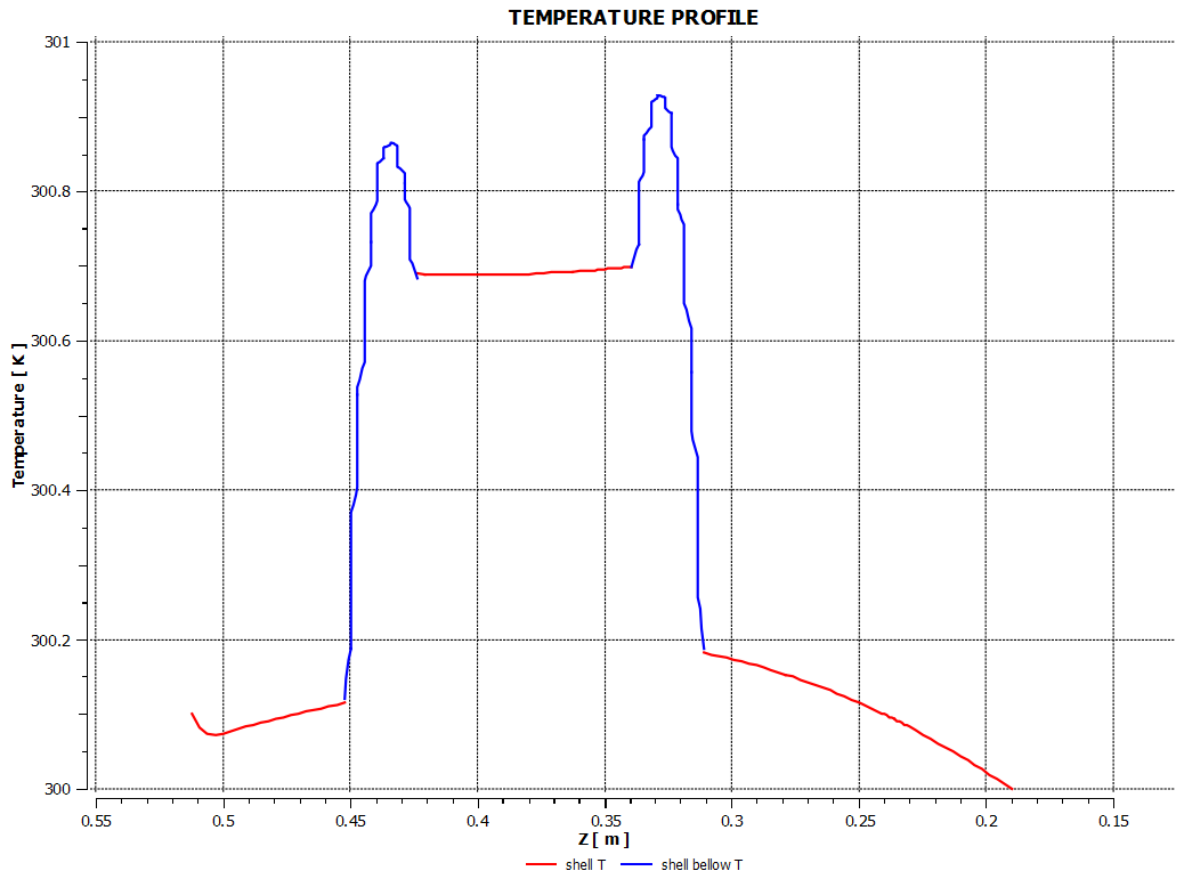


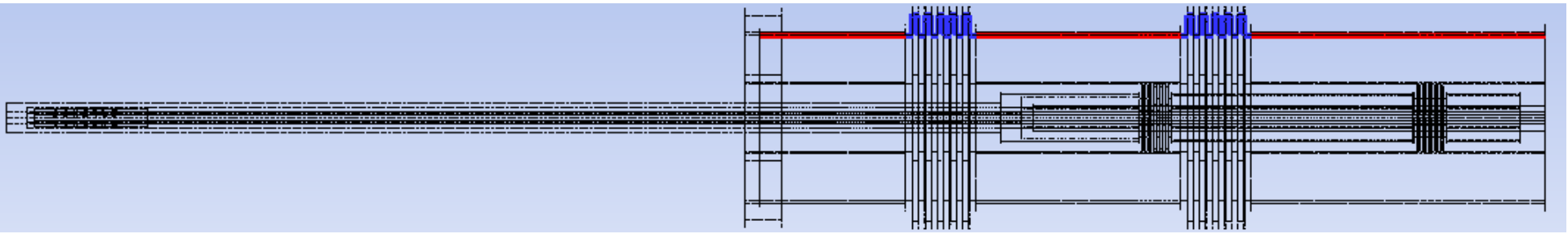
Inner Conductor T (P_in=6kW V_in=10m/s)



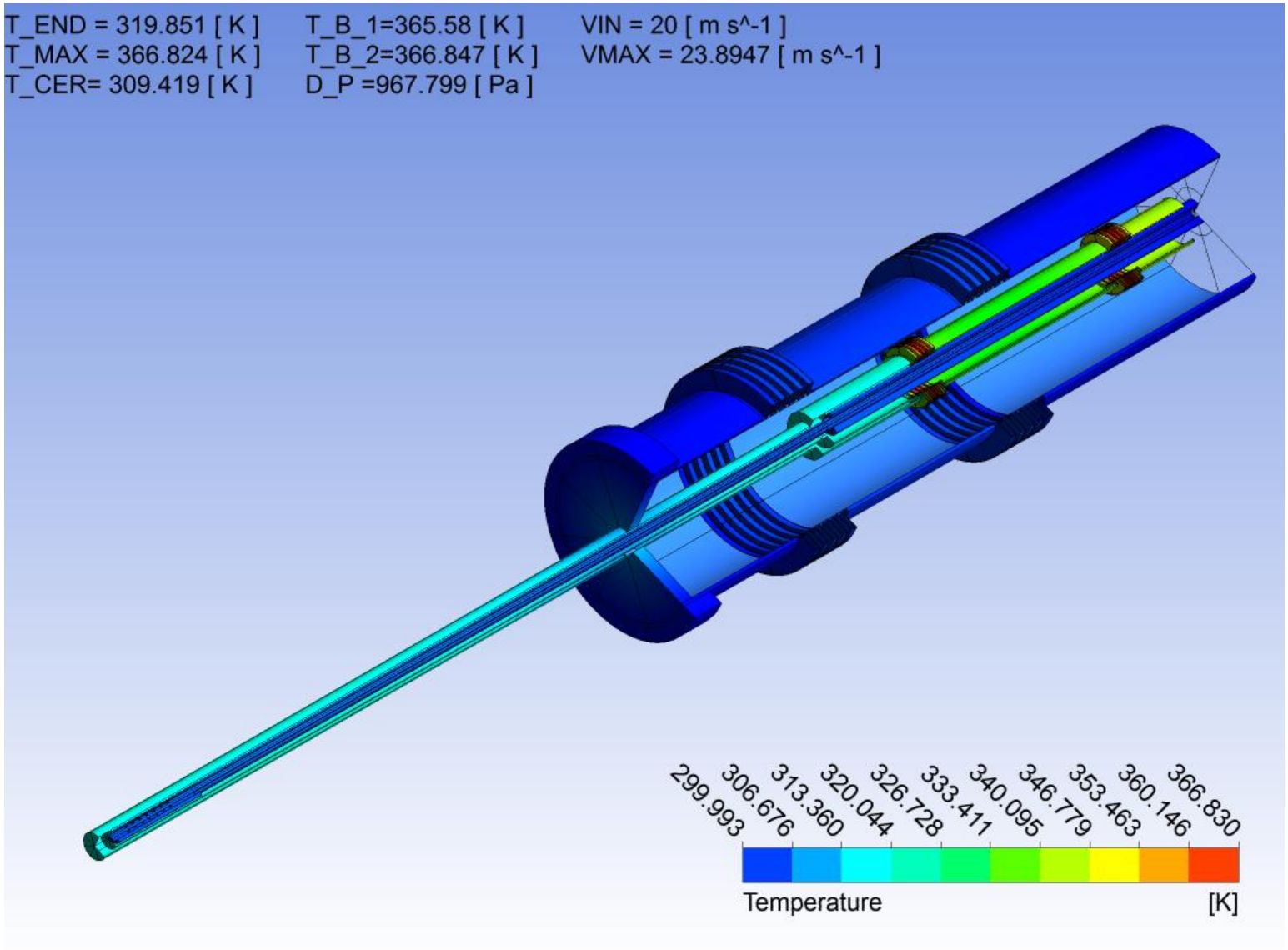


Outer Conductor T (P_in=6kW V_in=10m/s)

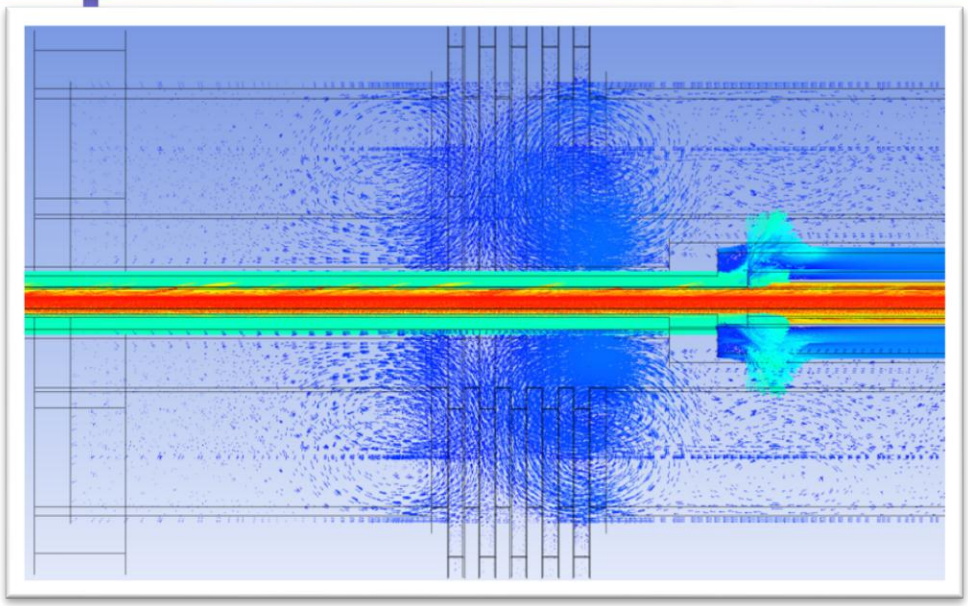


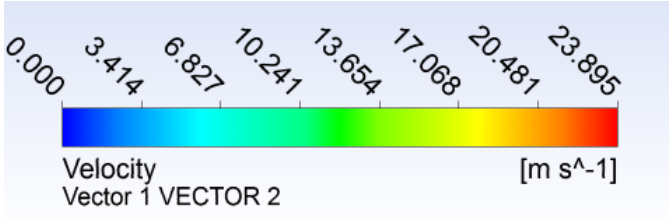


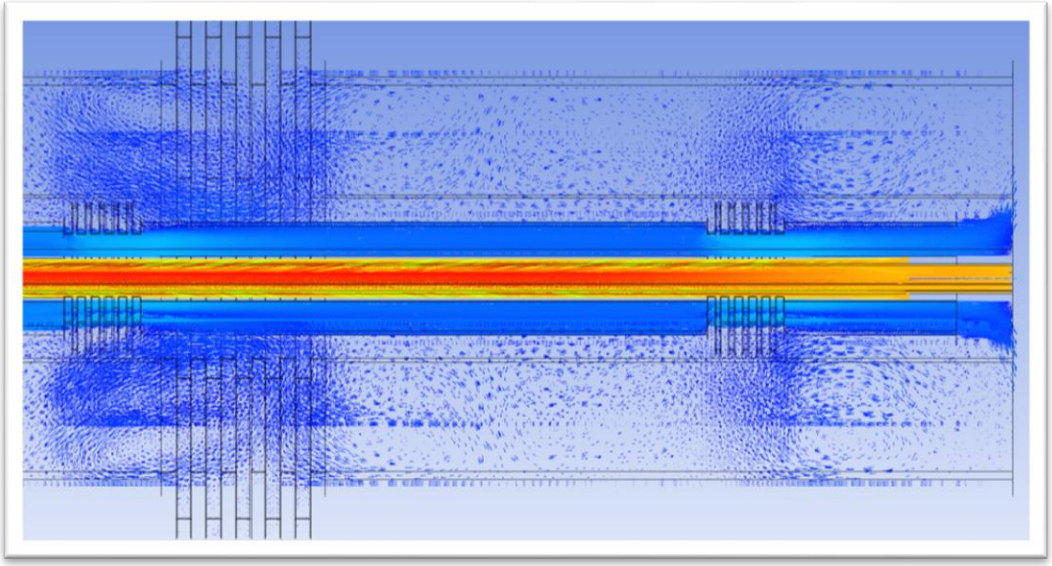
P_in=30kW V_in=20m/s (Forced Flow)

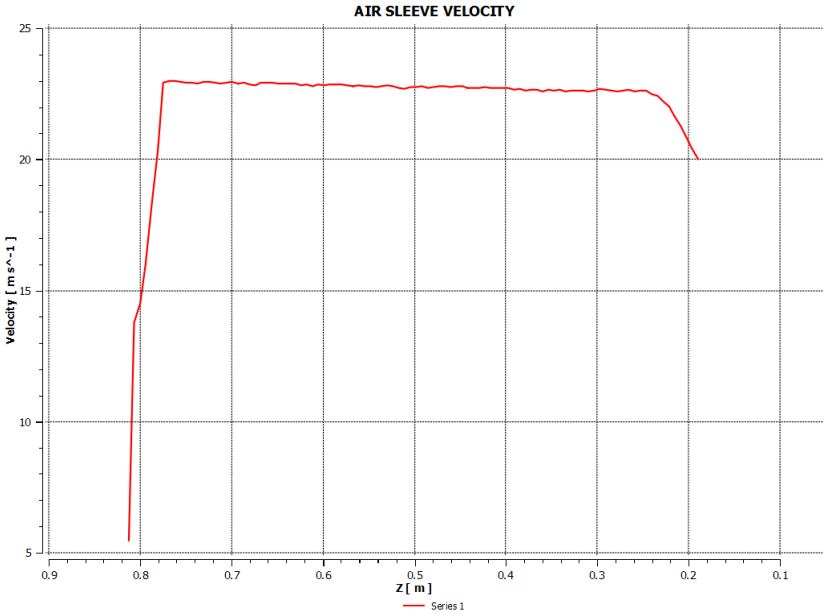


Vector Velocity (P_in=30kW V_in=20m/s)

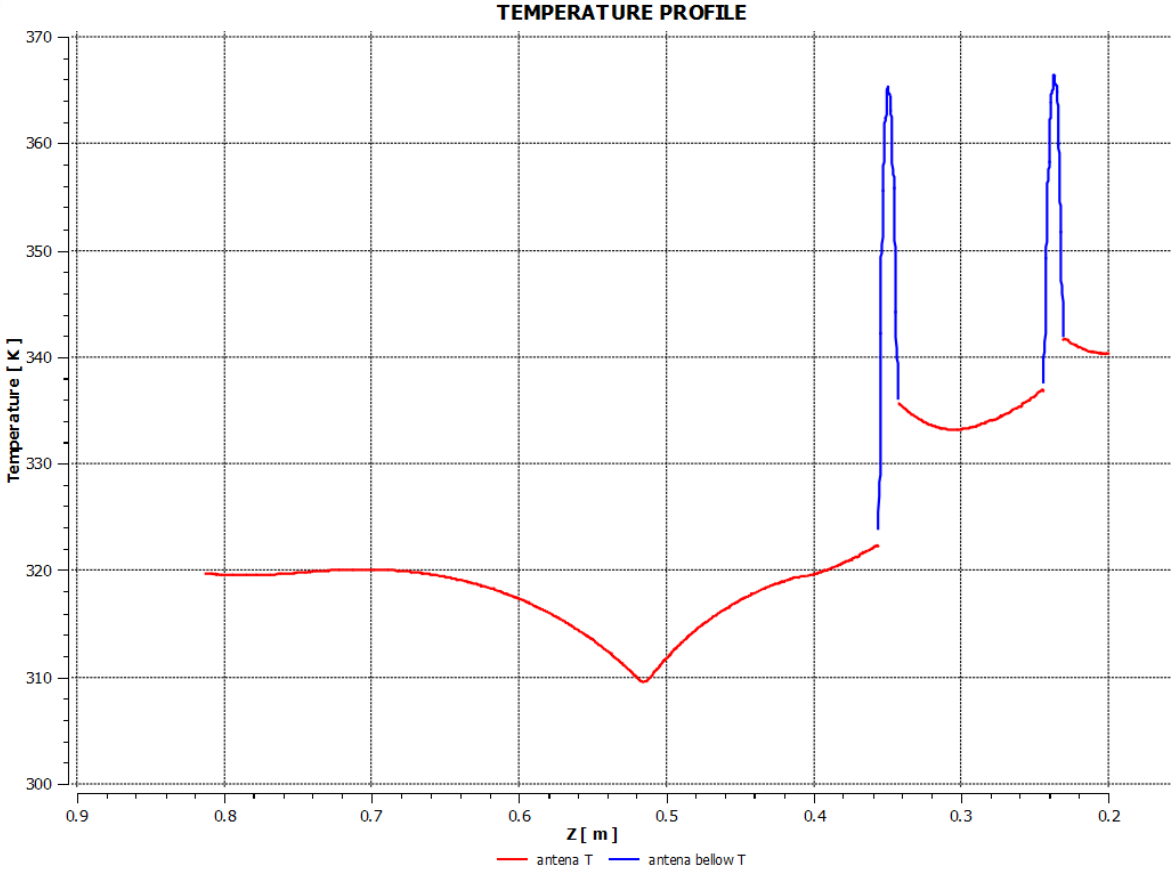


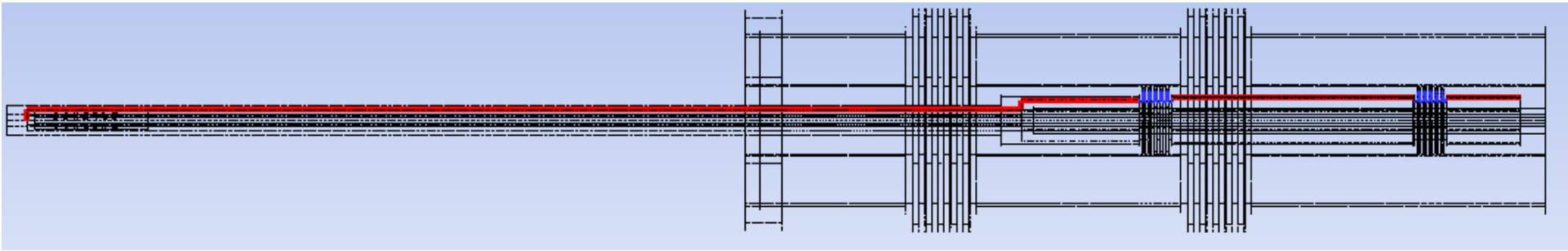




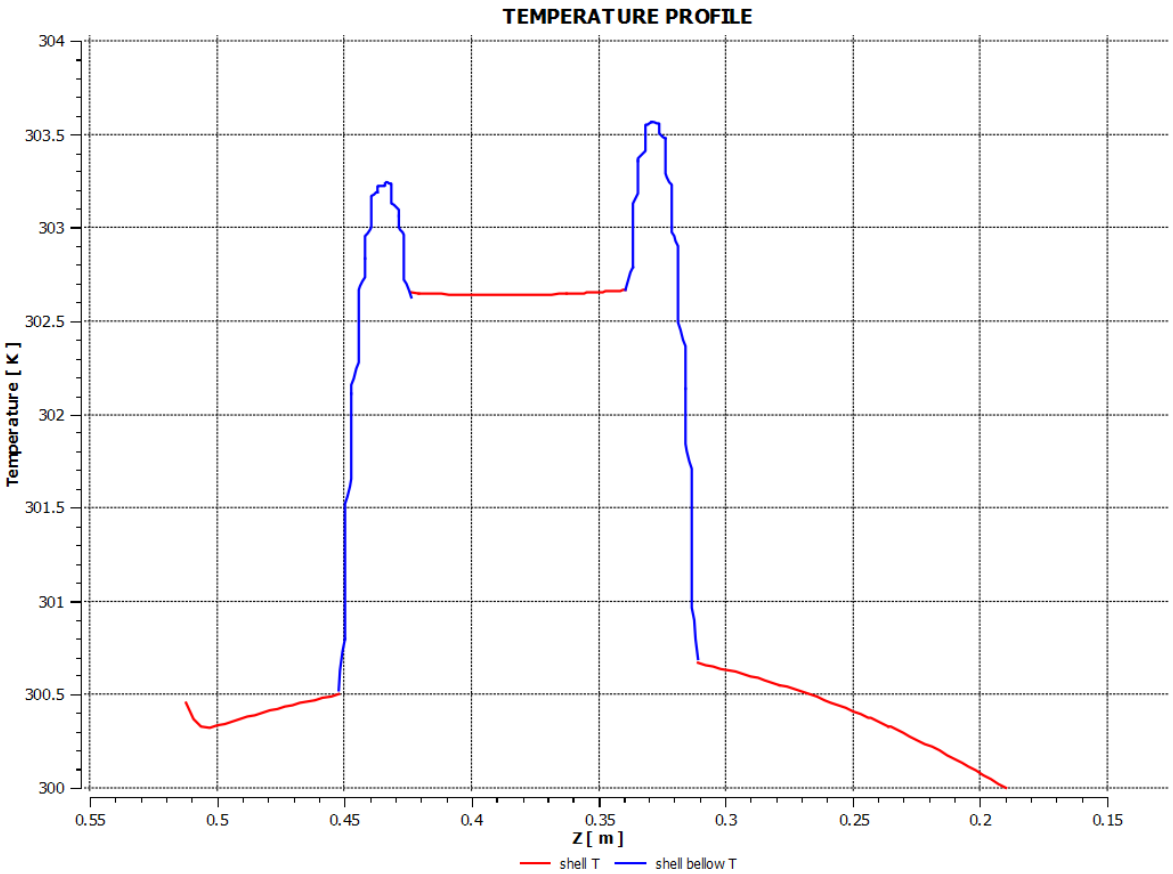


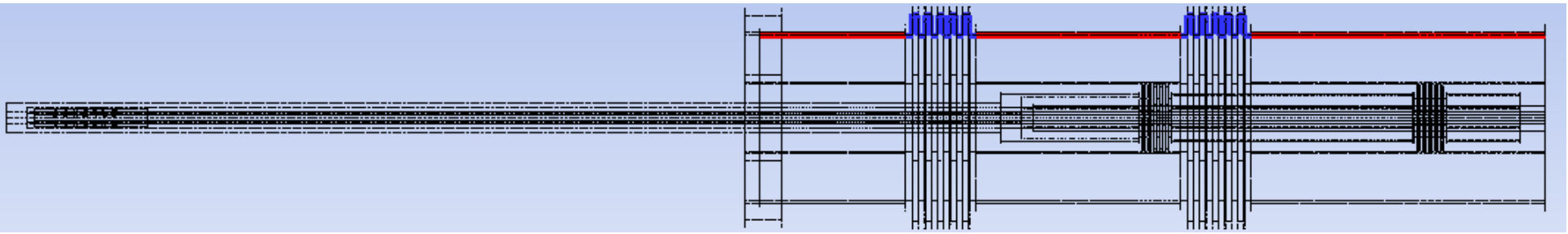
Inner Conductor T (P_in=30kW V_in=20m/s)





Outer Conductor T (P_in=30kW V_in=20m/s)





Summary

1 Thermal modeling (no air inside of inner and outer conductor)

Pin	TB1	TB2	TMAX	TMAXCER	TEND
kW	K	K	K	K	K
6	344.5	342.6	344.5	306.9	320.9
30	522.5	512.8	522.5	335.4	405.7

2 CFD modeling (forced air flow inside of inner conductor, stagnant air inside of outer conductor)

Pin	DELTAP	TB1	TB2	TMAX	TMAXCER	TEND	VMAX	MASS IN	VIN
kW	Pa	K	K	K	K	K	m s^-1	kg/s	m/s
6	260.6	315.7	316.9	316.9	302.2	305.2	11.4	2.65E-05	10.0
30	967.8	365.6	366.8	366.8	309.4	319.9	23.9	5.34E-05	20.0

VIN-Air inlet velocity
DELTAP-Pressure drop in system
VMAX-Maximum air velocity in system
TB1;TB2-Maximum temperature on inner bellows
TMAX-Maximum temperature in system
TMAXCER-Maximum temperature in ceramic
TEND-Temperature at the end of antenna
MASS IN- Mass flow rate of inlet air in system