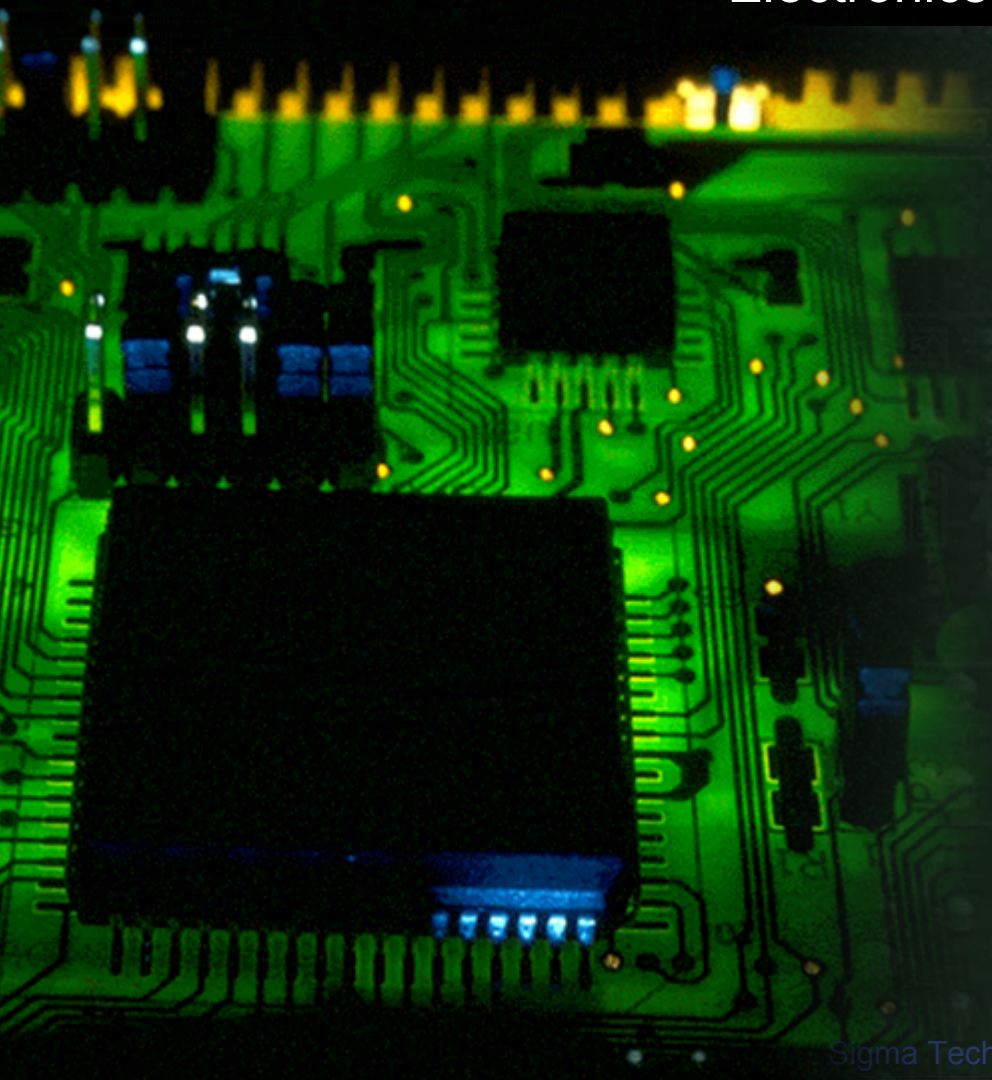
Electronics cooling



Geometrical parameters optimization for microprocessor radiator

3D task statement

CFD + solid heat transfer

2 objectives (minimization of maximal temperature in microprocessor and minimization of radiator volume)

20 independent variables – geometrical parameters of the radiator

Electronics cooling

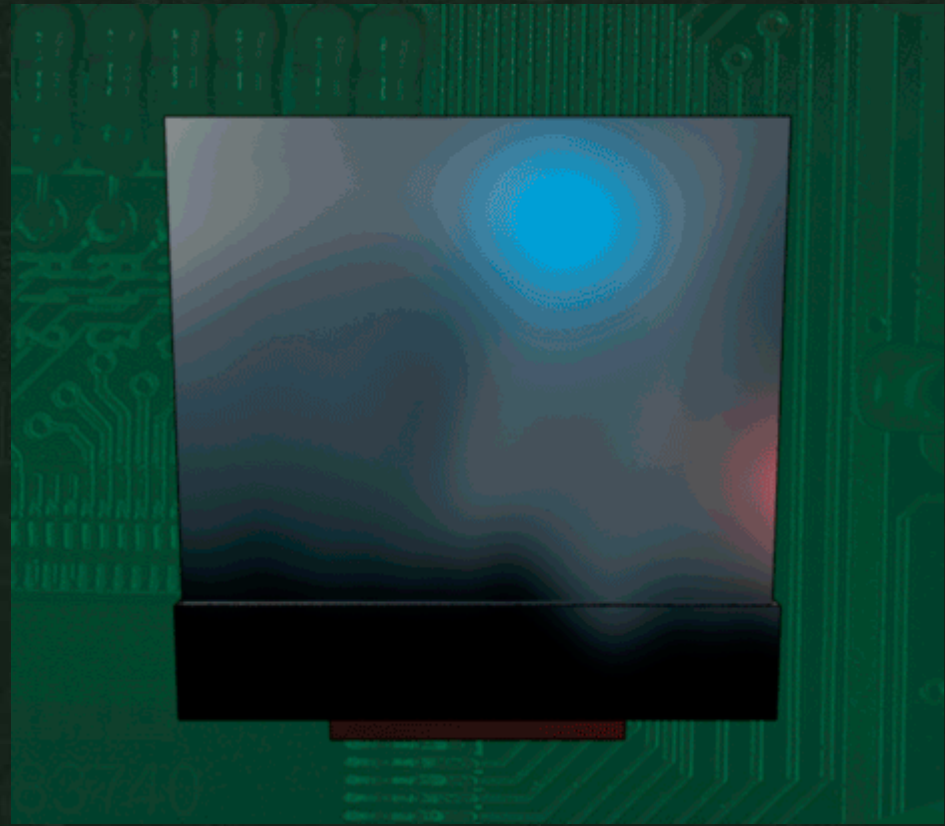
CFD task statement

Microprocessor – silicon

Radiator - aluminum

Fan – V flow velocity (constant)

Microprocessor – constant heat source



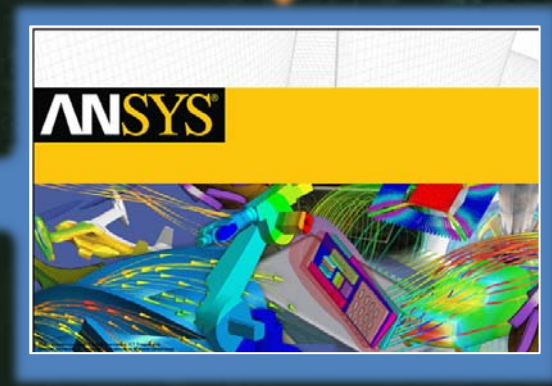
Electronics cooling

Software being used

Geometry parameterization	Mesh building	CFD Solver	Optimization software
Pro/Engineer	ANSYS ICEM CFD	ANSYS CFX	IOSO NM

Electronics cooling

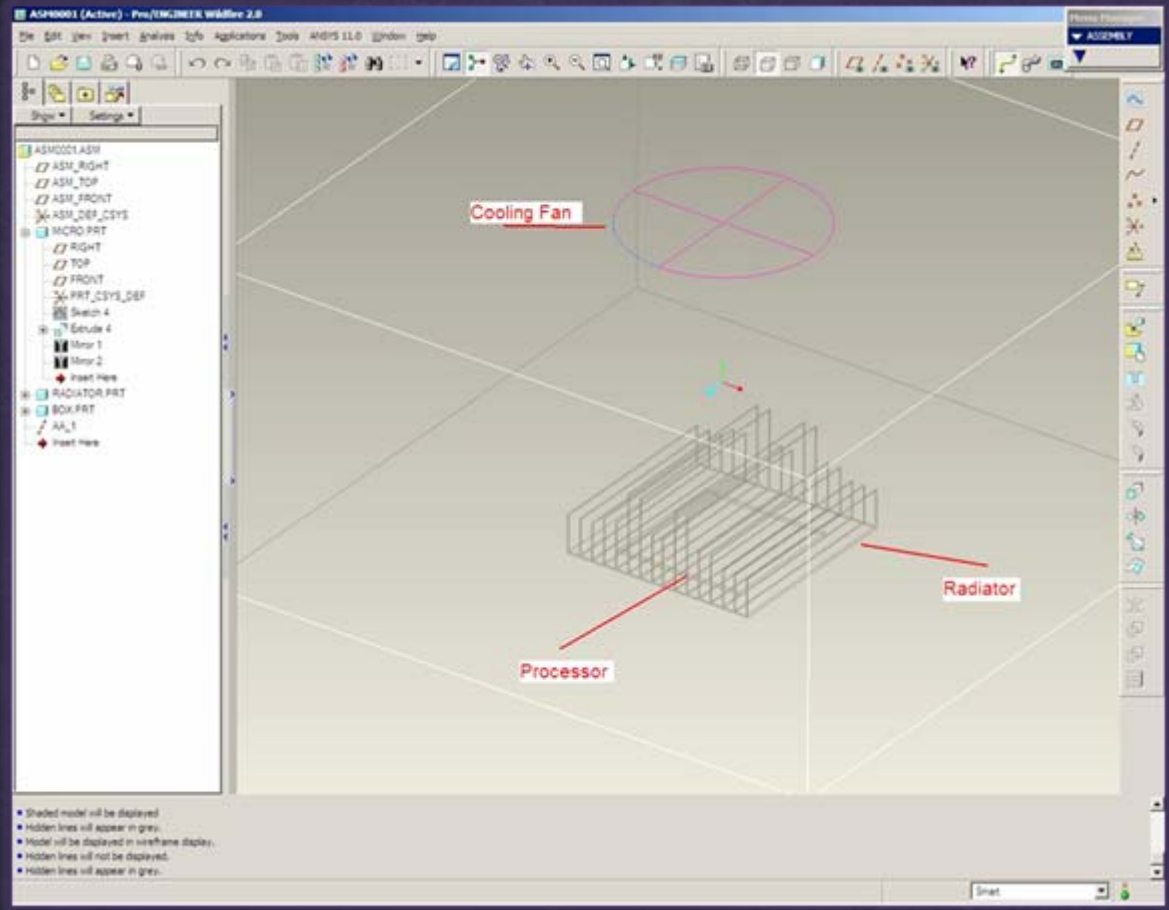
Software being used



Electronics cooling

Geometry (general view)

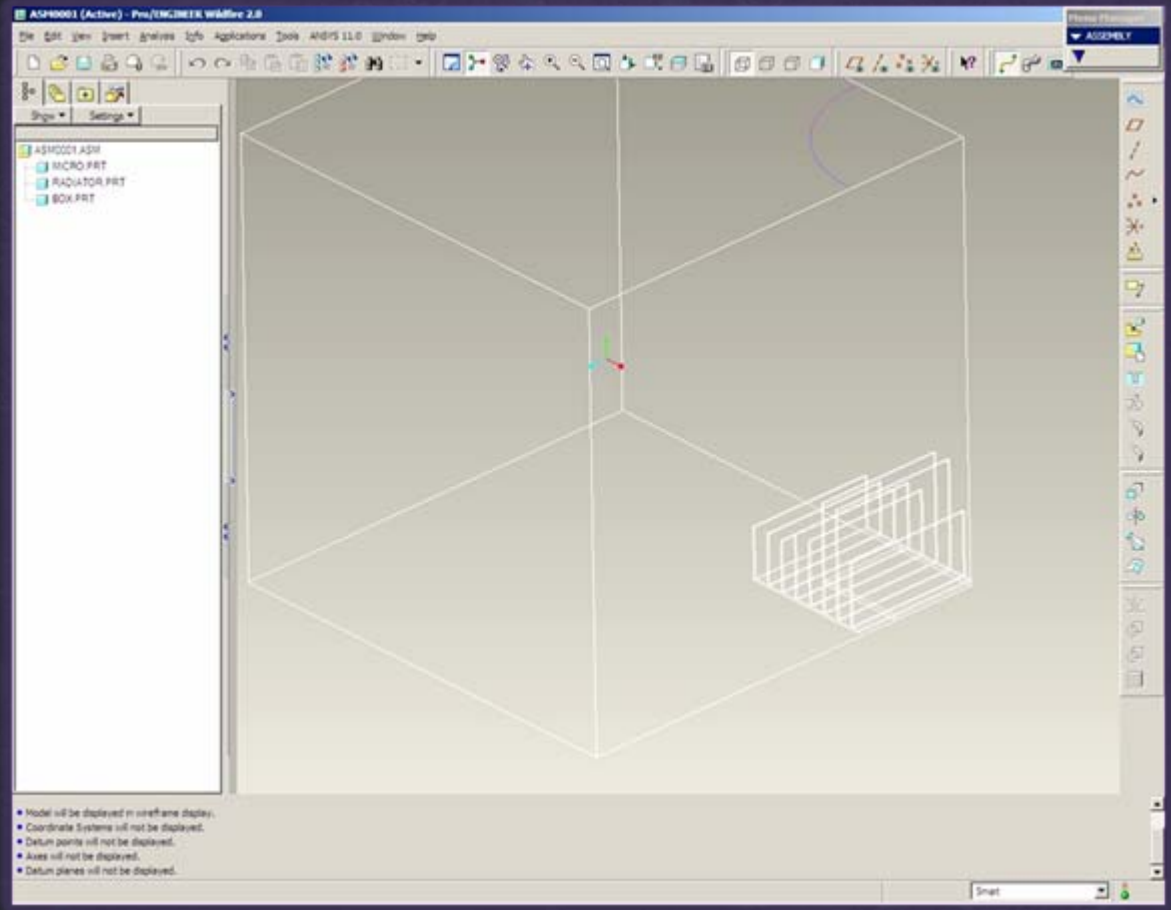
Pro/Engineer



Electronics cooling

Geometry (computational volume) quarter part – symmetrical task statement

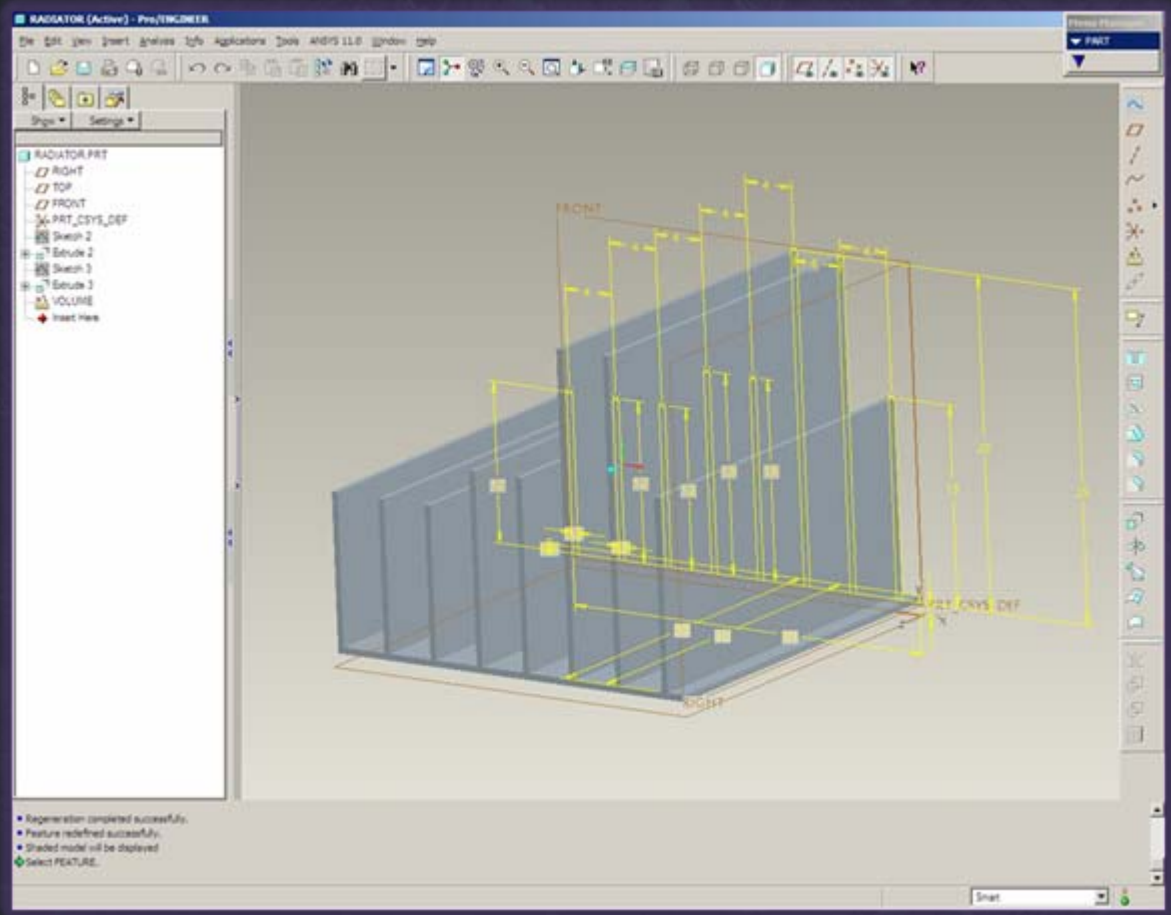
Pro/Engineer



Electronics cooling

Radiator, parameterization

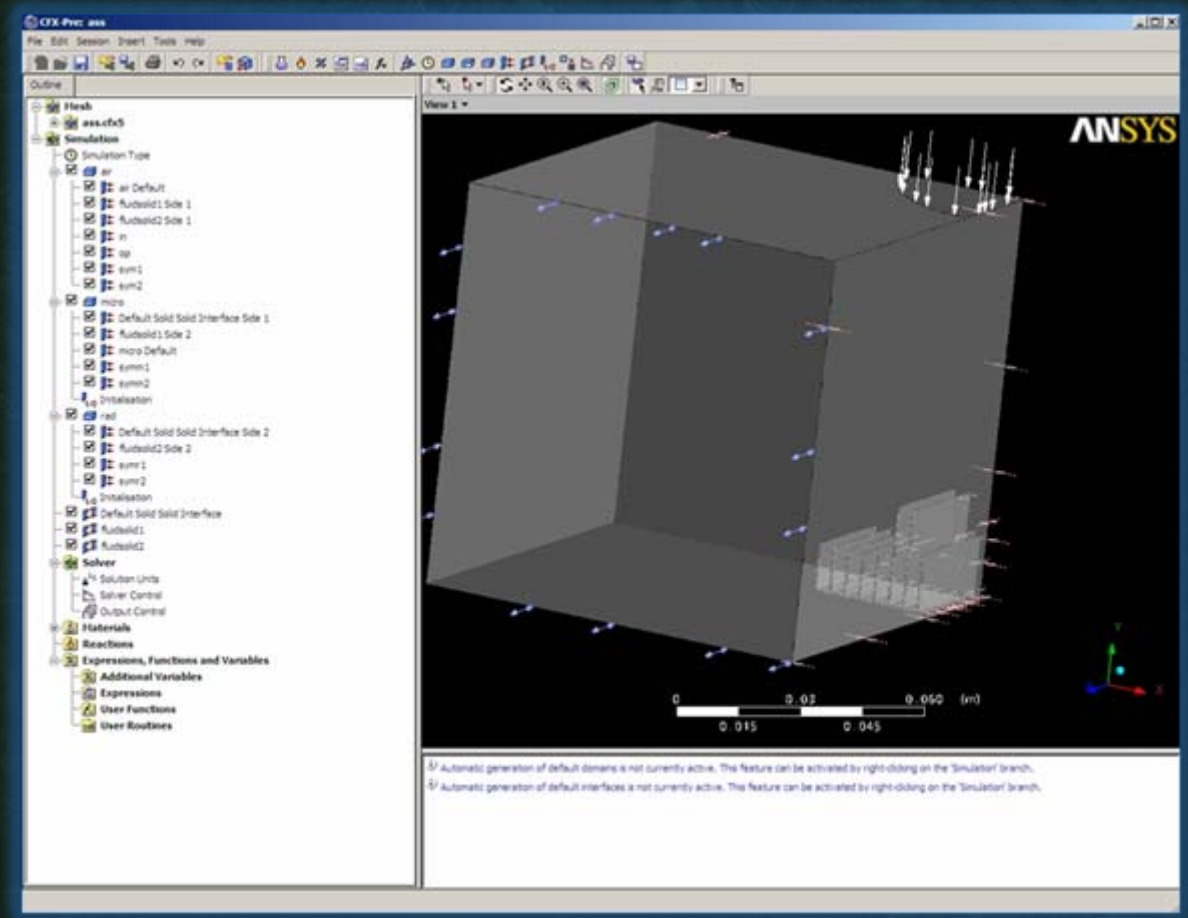
Pro/Engineer



Electronics cooling

CFD task statement

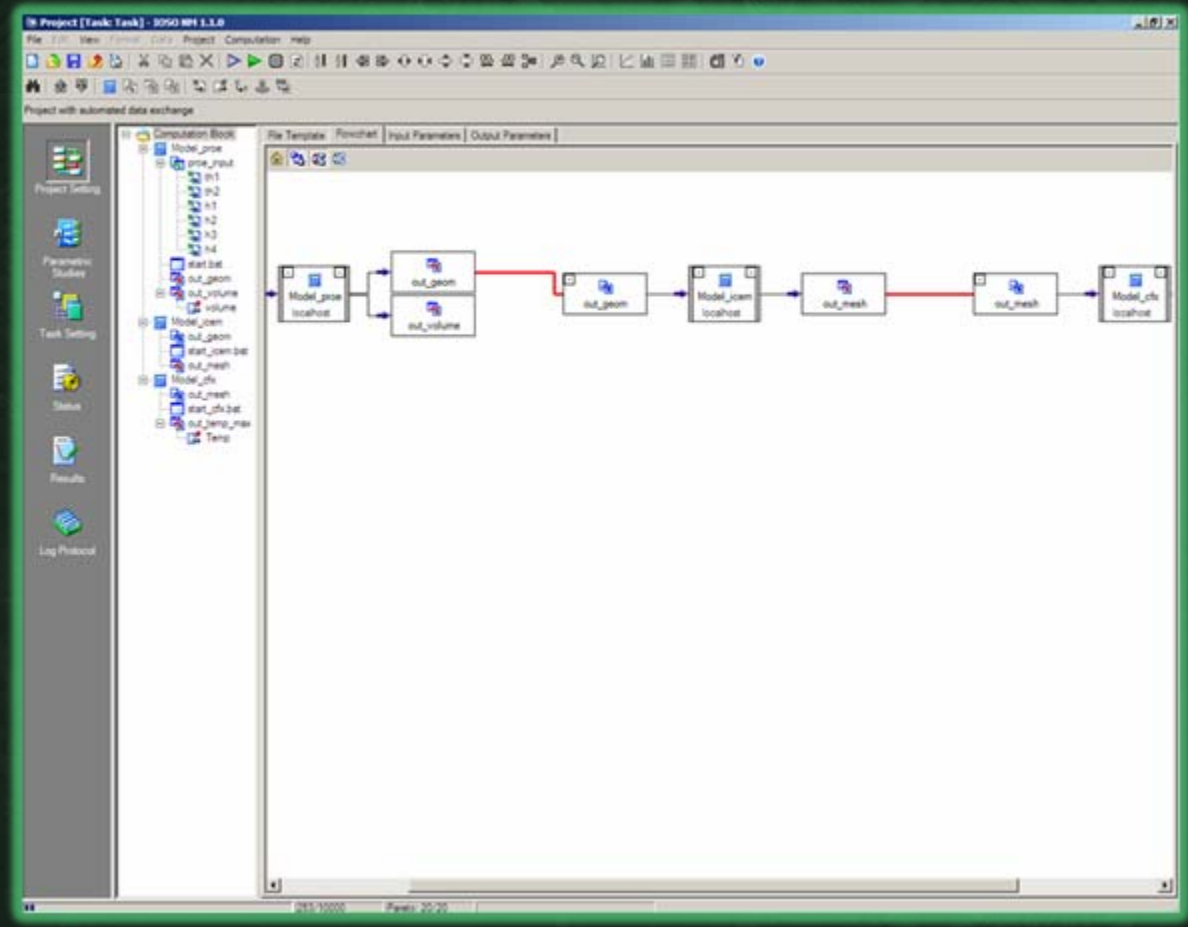
ANSYS CFX



Electronics cooling

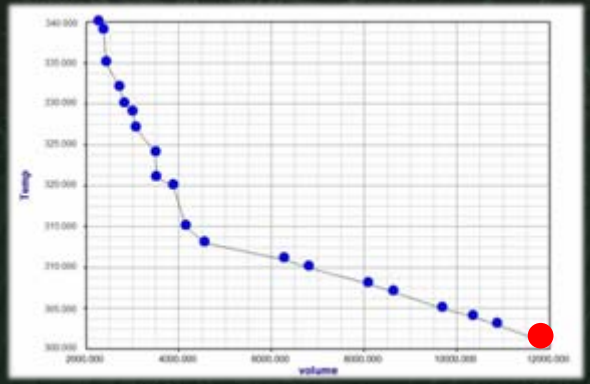
Optimization project

IOSO NM



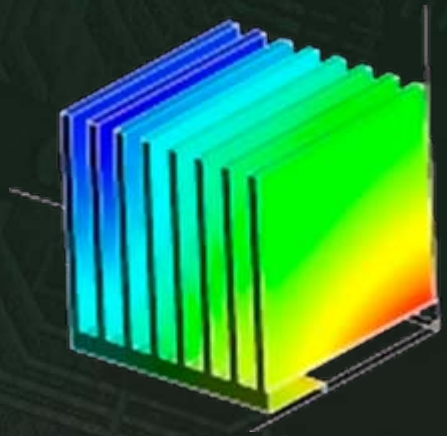
Electronics cooling

Electronics cooling

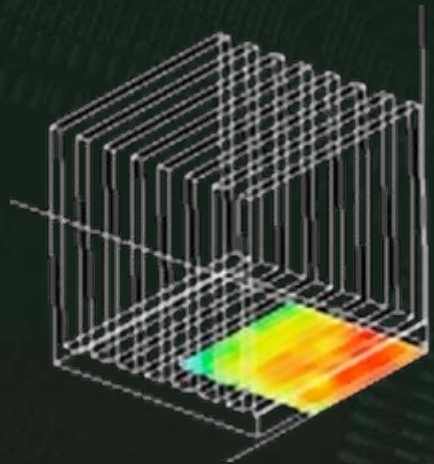


Pareto set: Point 1

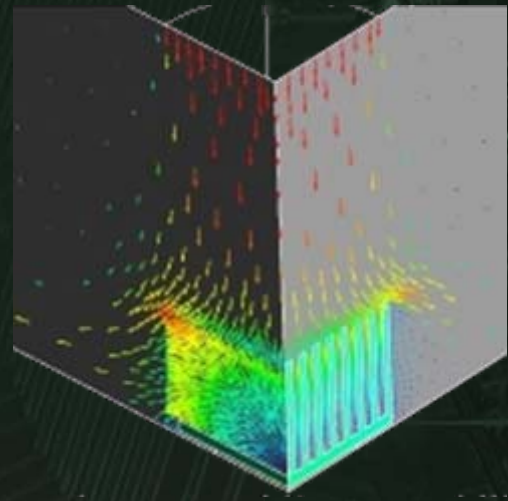
Radiator Volume	Maximal temperature in the microprocessor
11850	301 K



Radiator temperature distribution

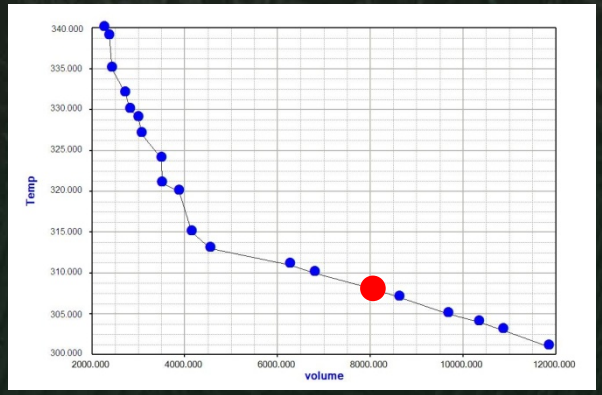


Microprocessor temperature distribution



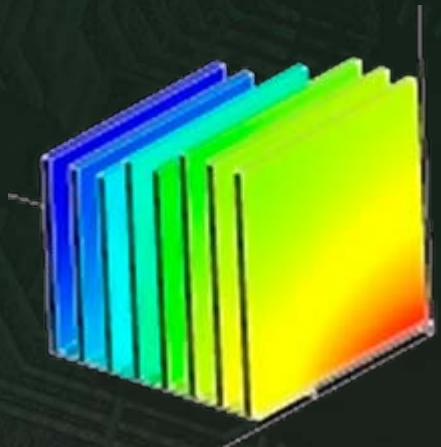
Cooling airflow vector plots

Electronics cooling

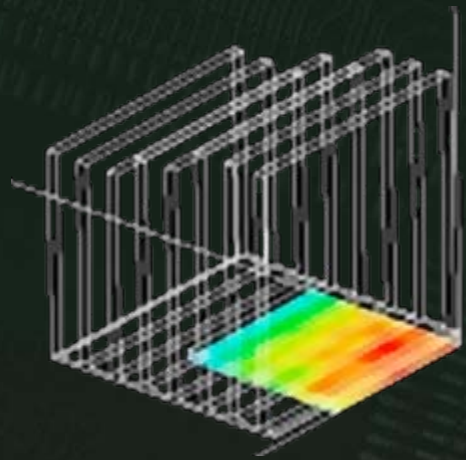


Pareto set: Point 6

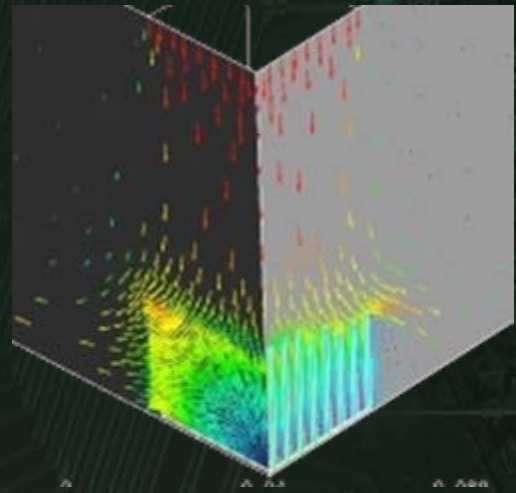
Radiator Volume	Maximal temperature in the microprocessor
8080	308 K



Radiator temperature distribution

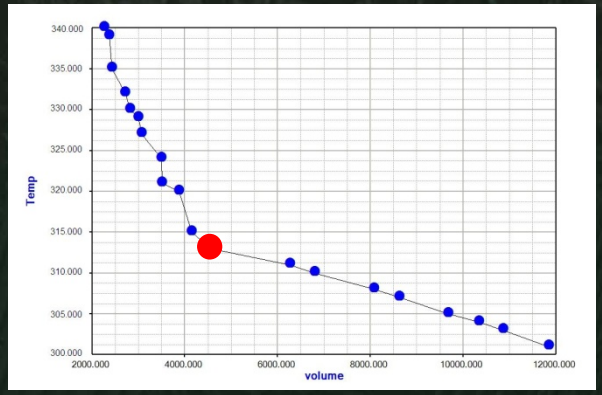


Microprocessor temperature distribution



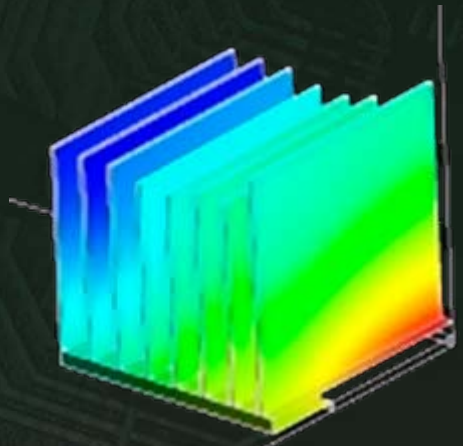
Cooling airflow vector plots

Electronics cooling

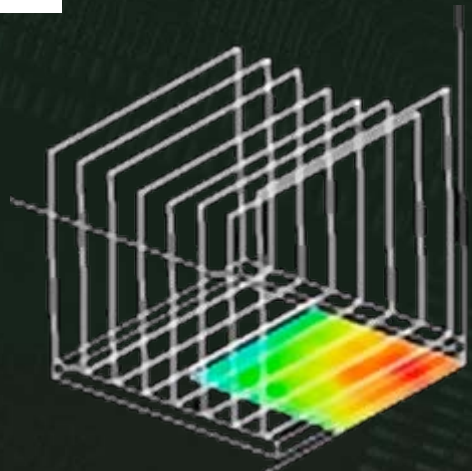


Pareto set: Point 9

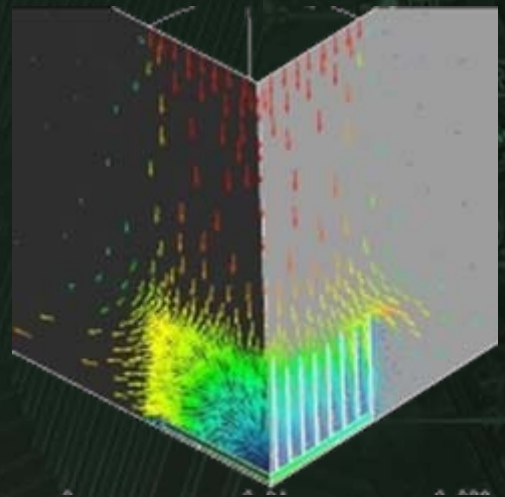
Radiator Volume	Maximal temperature in the microprocessor
4550	313 K



Radiator temperature distribution

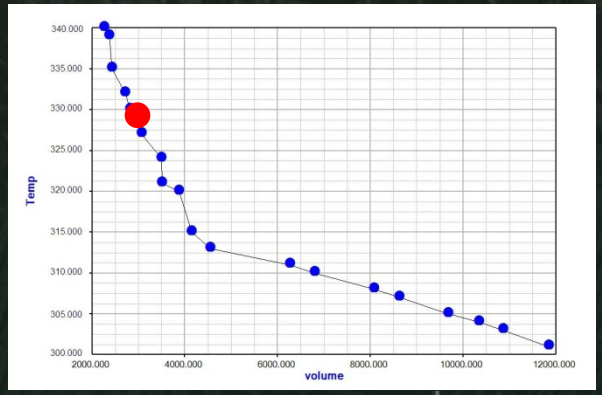


Microprocessor temperature distribution



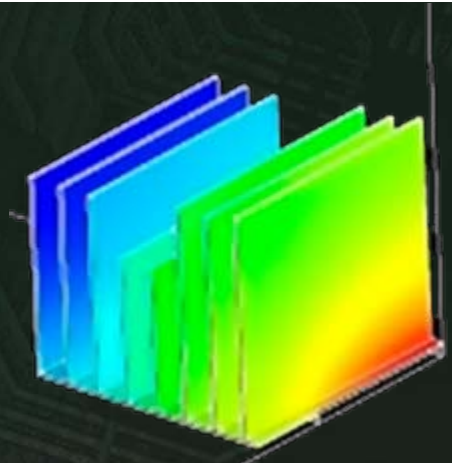
Cooling airflow vector plots

Electronics cooling

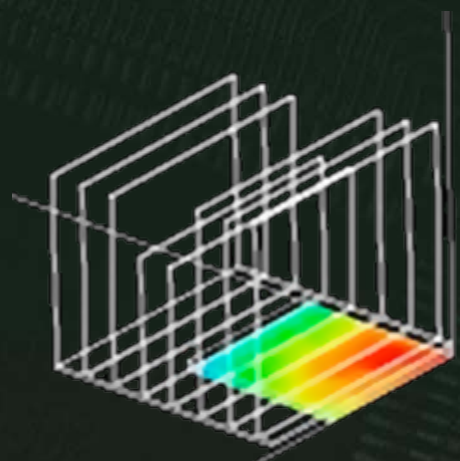


Pareto set: Point 14

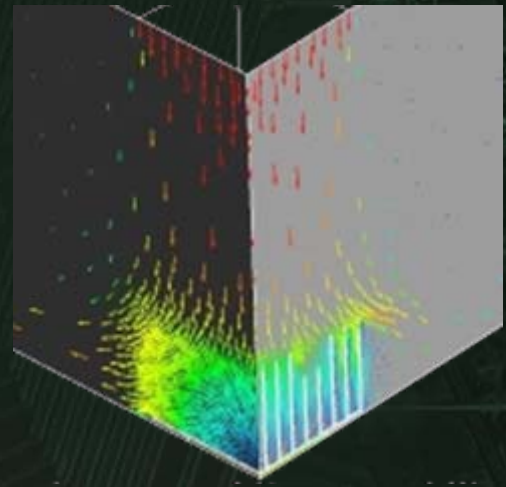
Radiator Volume	Maximal temperature in the microprocessor
3075	327 K



Radiator temperature distribution

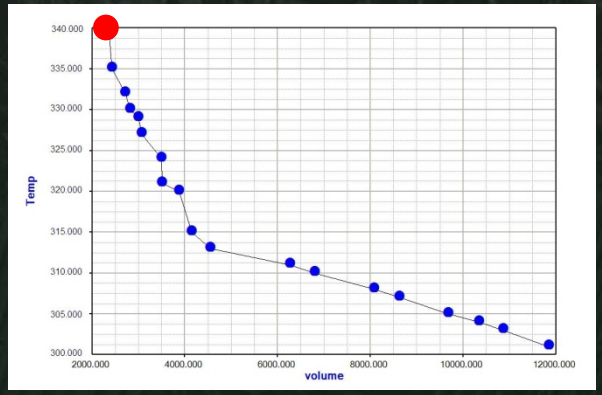


Microprocessor temperature distribution



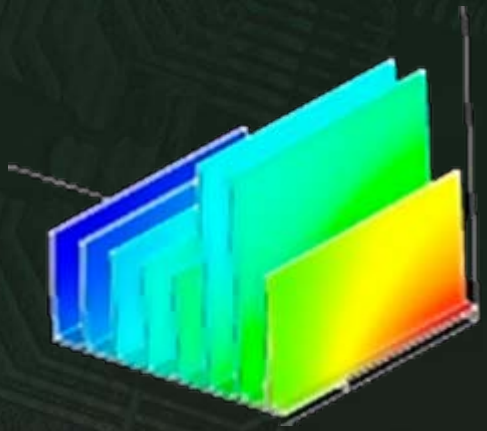
Cooling airflow vector plots

Electronics cooling

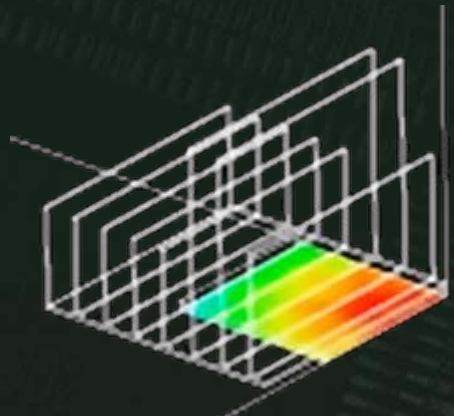


Pareto set: Point 20

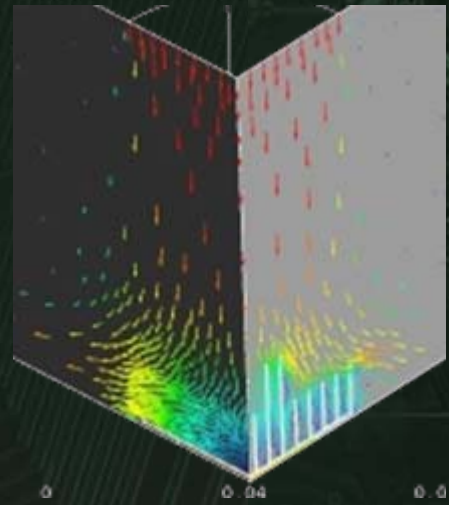
Radiator Volume	Maximal temperature in the microprocessor
2265	340 K



Radiator temperature distribution

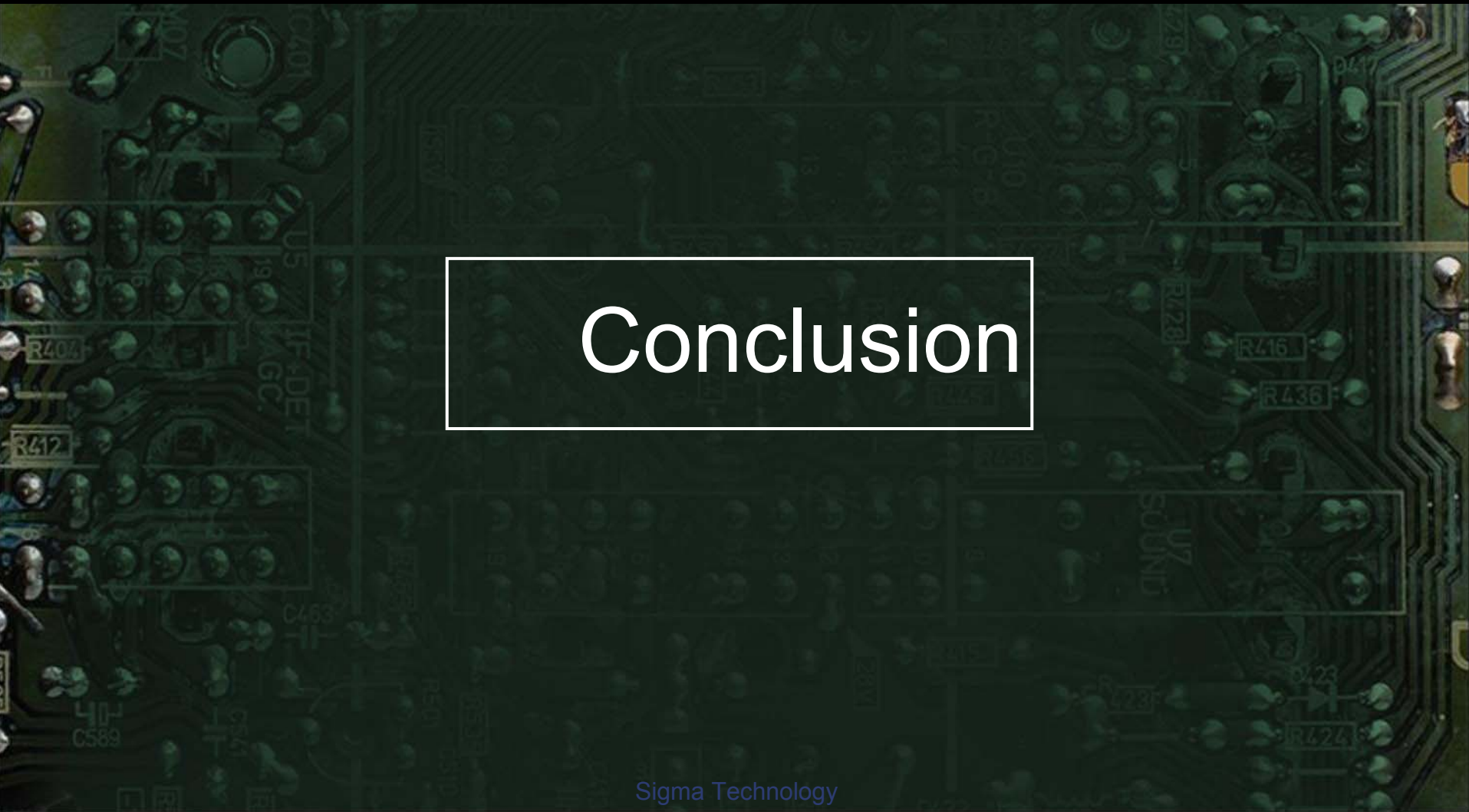


Microprocessor temperature distribution

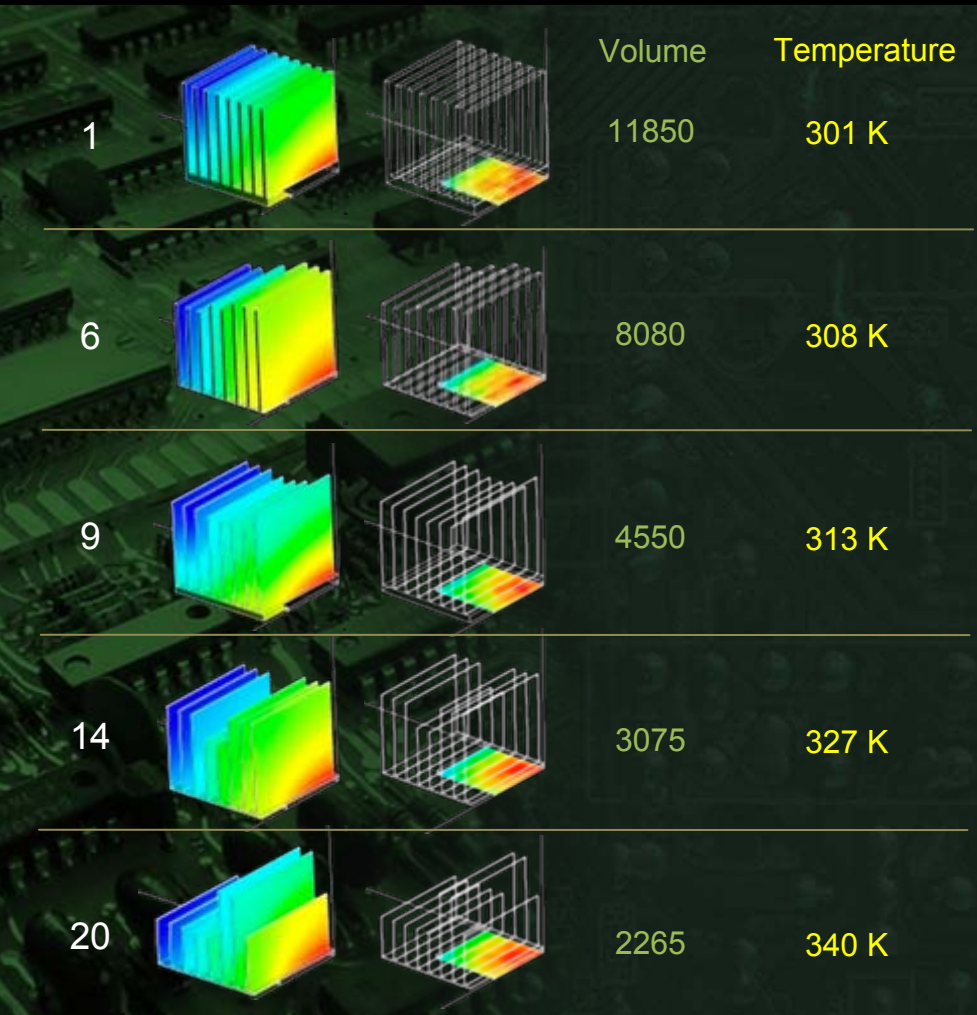


Cooling airflow vector plots

Electronics cooling



Electronics cooling



	Volume	Temperature
1	11850	301 K
6	8080	308 K
9	4550	313 K
14	3075	327 K
20	2265	340 K

Geometrical parameters of microprocessor radiator Optimization task has been solved

Mathematical model calls - 200

Objective Volume changes inside Pareto set in the bounds from 2265 to 11850

Objective maximal temperature in the microprocessor changes inside Pareto set in the bounds from 300K to 340K