

伺服器水冷散熱應用

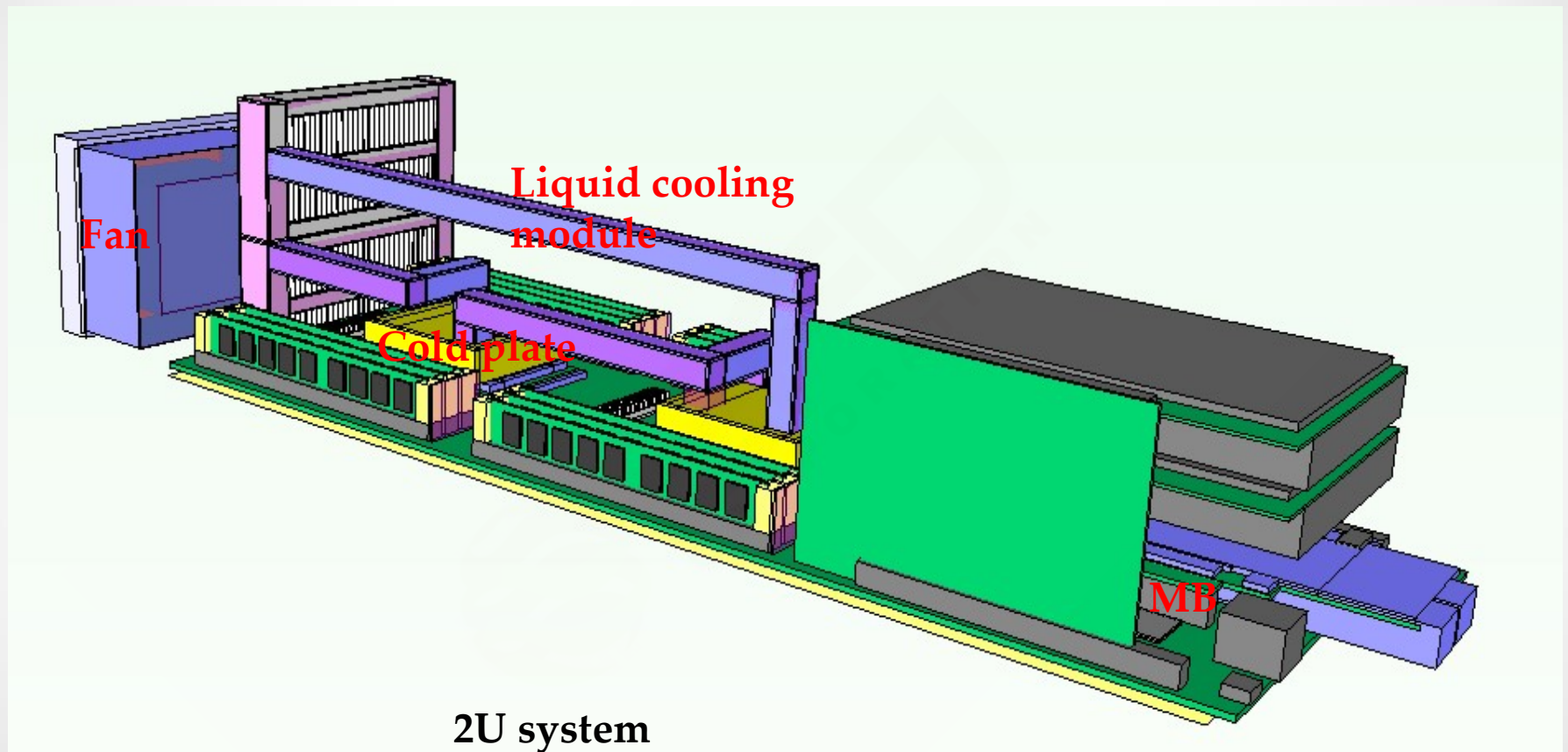
Liquid Cooling Application in Server System

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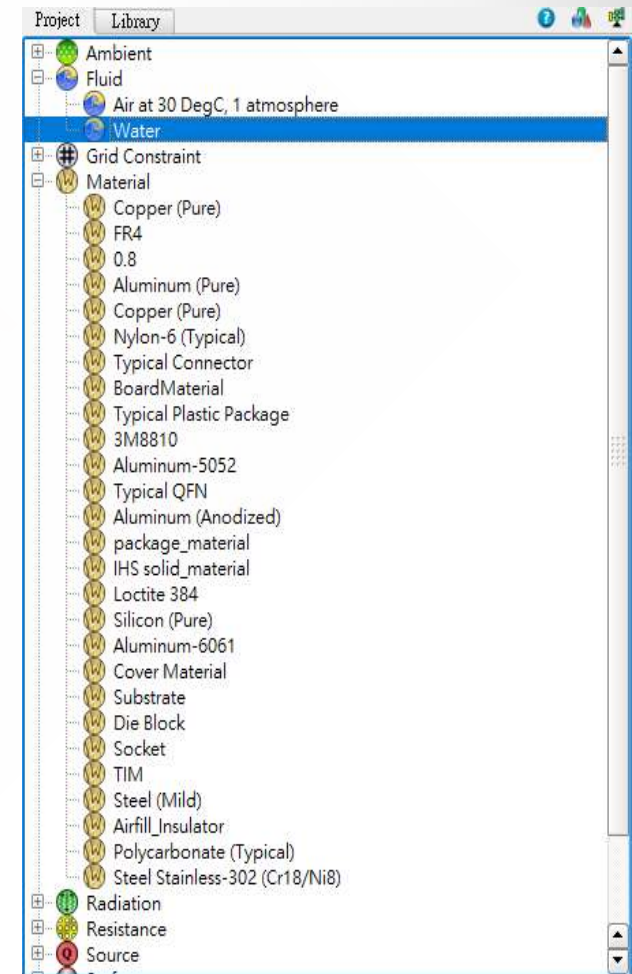
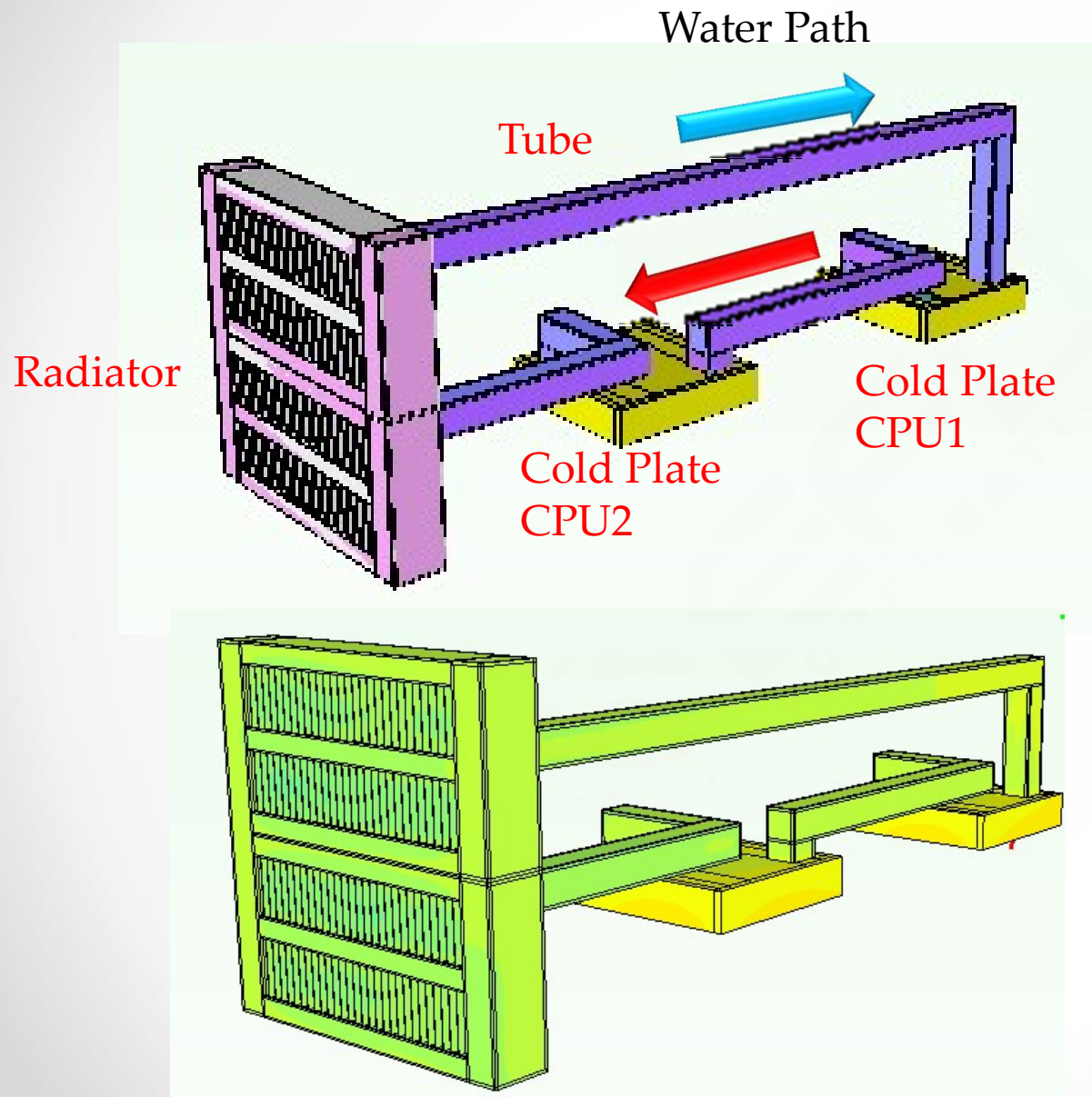
Simulation model



2U system

L*W*H:660mm*174mm*88.3mm

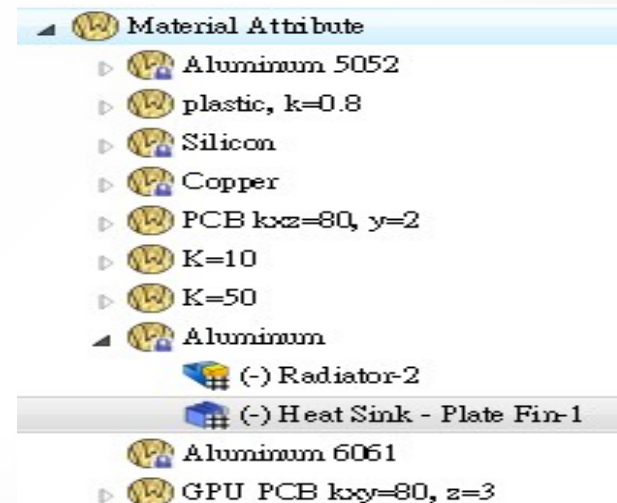
Water Cooling Module



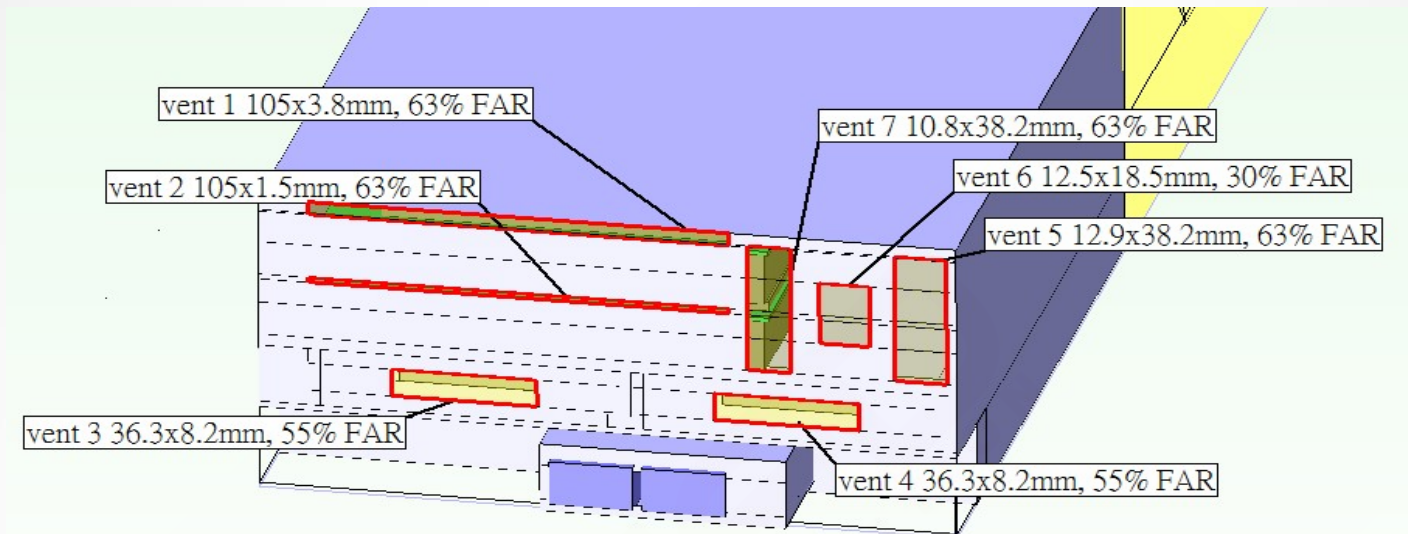
Material & Power Setting

Item	Material List
Fan	Plastic, 0.8 W/m-k
Tube	Plastic, 0.8 W/m-k
Pump	Plastic, 0.8 W/m-k
Radiator	Aluminum, 237 W/m-k
Chassis	Steel, 63 W/m-k
Cold plate	Copper, 401 W/m-k
PCH Heat sink	Aluminum, 237 W/m-k
CPU	Silicon, 117.5 W/m-k + Copper, 401 W/m-k
TIM	$0.01^{\circ}\text{C}\cdot\text{in}^2 / \text{W}$

Item	Power (W)	Quantity	Total (W)
2.5" HDD	1.4	2	2.8
PCIe card	25	2	50
RDIMM	3.5	12	42
PCH	15	1	15
AST2500	1.4	1	1.4
VRD	18.3	2	36.6
CPU Intel® Xeon® Gold 6146	205	2	410
Total			557.8



Front panel FAR



Item	Region (mm ²)	Open hole area (mm ²)	FAR (%)
Vent 1	105x3.8	251.3	63
Vent 2	105x1.5	99.2	63
Vent 3	36.3x8.2	163.7	55
Vent 4	36.3x8.2	163.7	55
Vent 5	12.9x38.2	310.4	63
Vent 6	12.5x18.5	69.3	30
Vent 7	10.8x38.2	259.9	63
Vent 8	80x80	3840	60
Vent 9	80x80	3840	60

Note: Free air ratio (FAR)=open hole area/region

Fan & Pump Setting

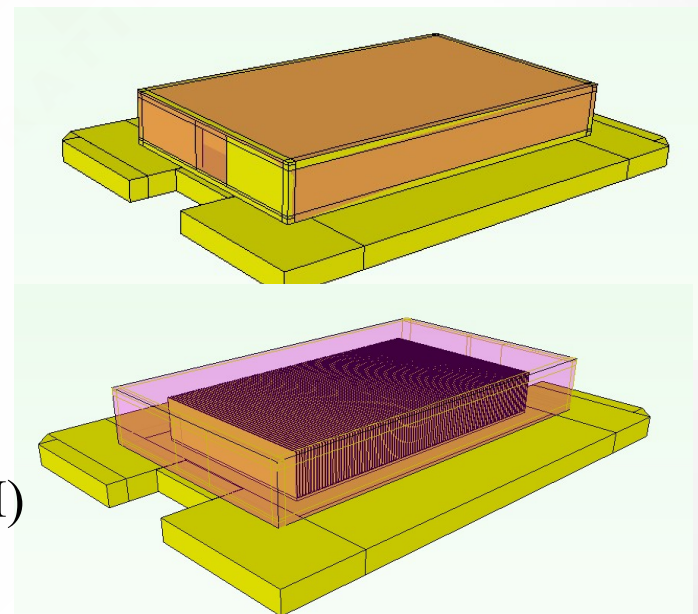
Item	Dimension (mm)	Pmax	Qmax
System fan	80*80*38	3.827 inH ₂ O	90.12 CFM
Power Supply fan	40*40*28	4.01 inH ₂ O	31.78 CFM
Radiator fan	80*80*38	3.827 inH ₂ O	90.12 CFM
Pump	35*35*20	H=1.0 m	1.5 L/min

•Environment

- Fluid Inlet Temperature 25°C
- Flow rate of each cold plate 1.5L/Min
- Quick connector internal diameter 3.175mm (1/8 inch)

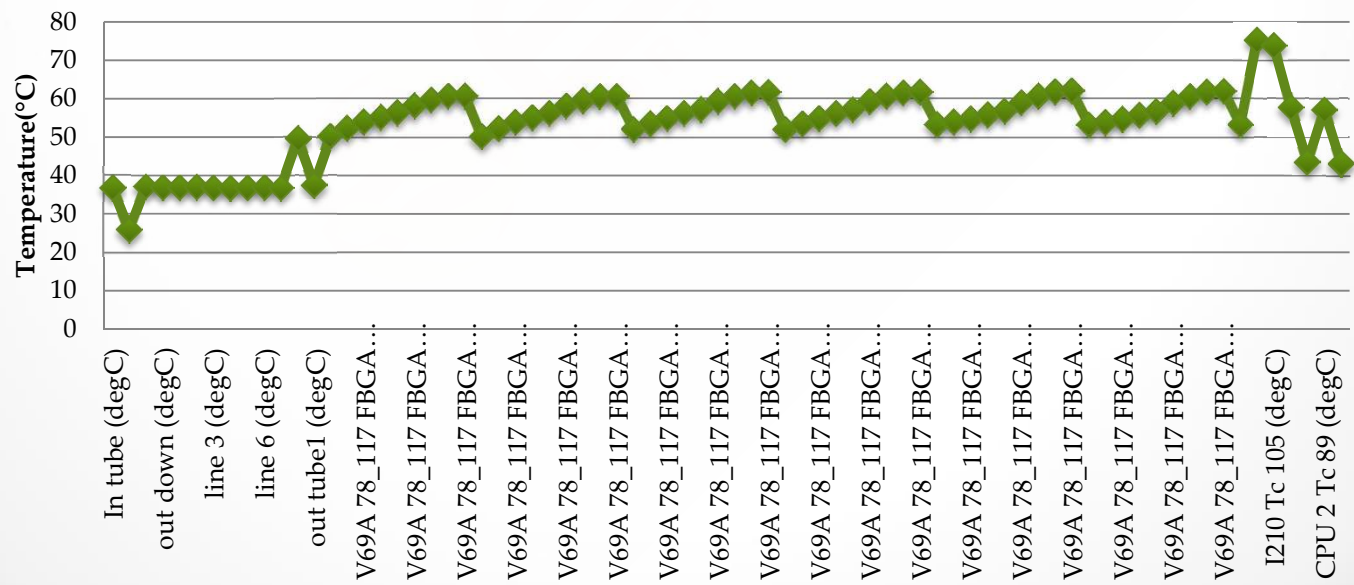
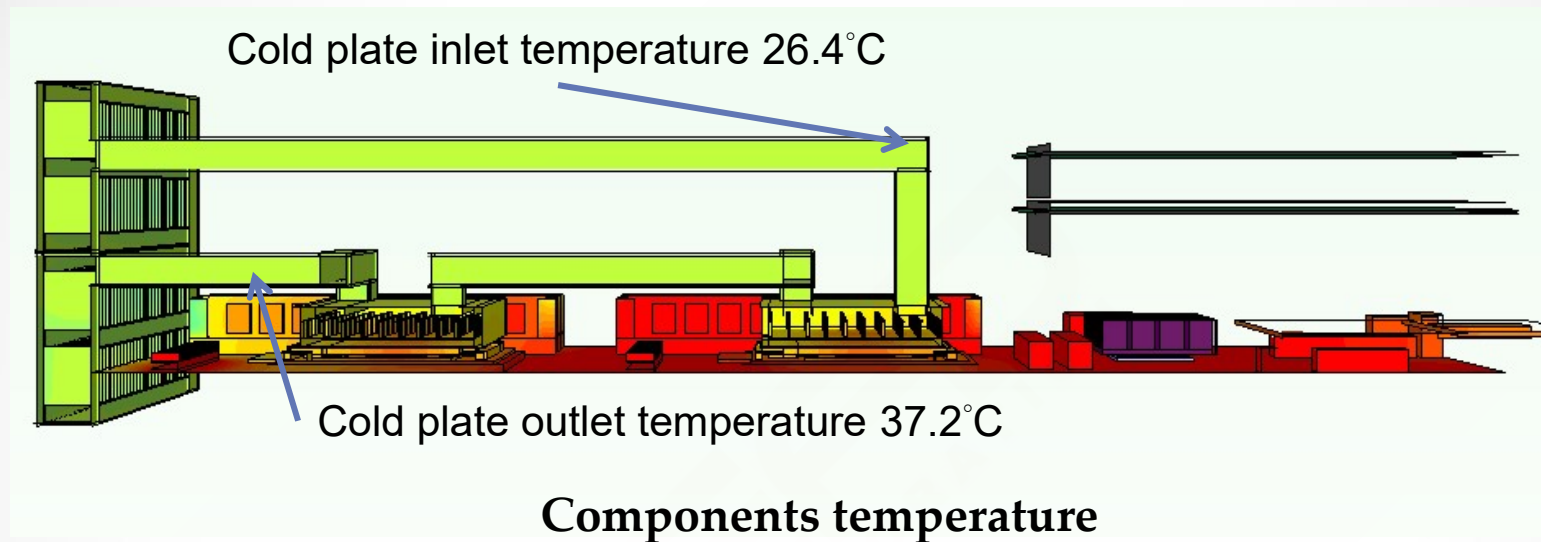
•Requirements

- Heatsink Size : 108 x 78 x 16mm (LWH)
- Package Size : 79 x 56.6
- Heatsink Material : C2680+CU1100

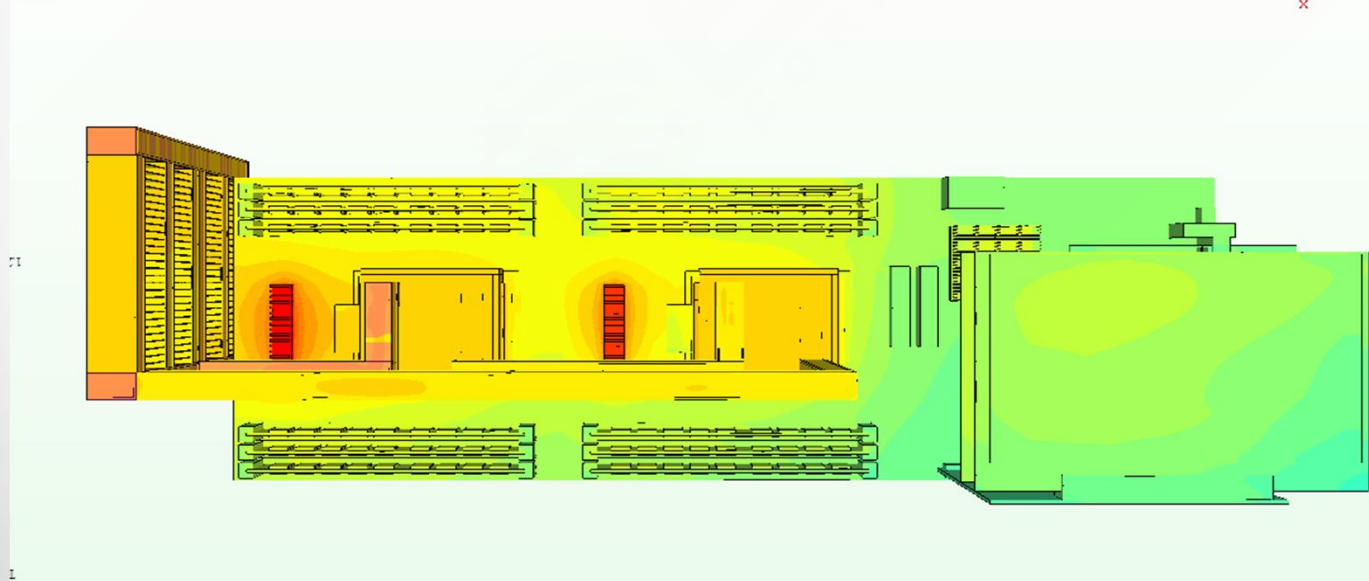
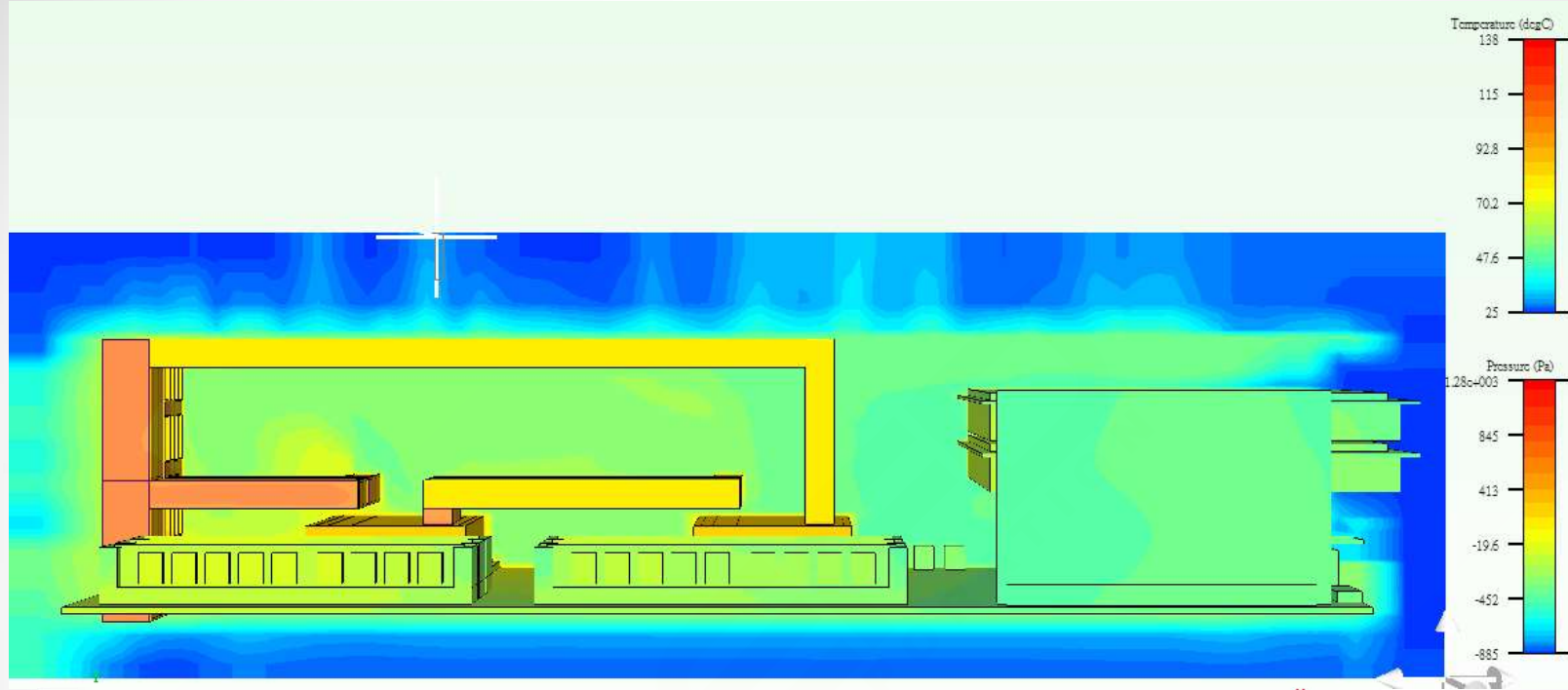


Cold plate model inner fin design

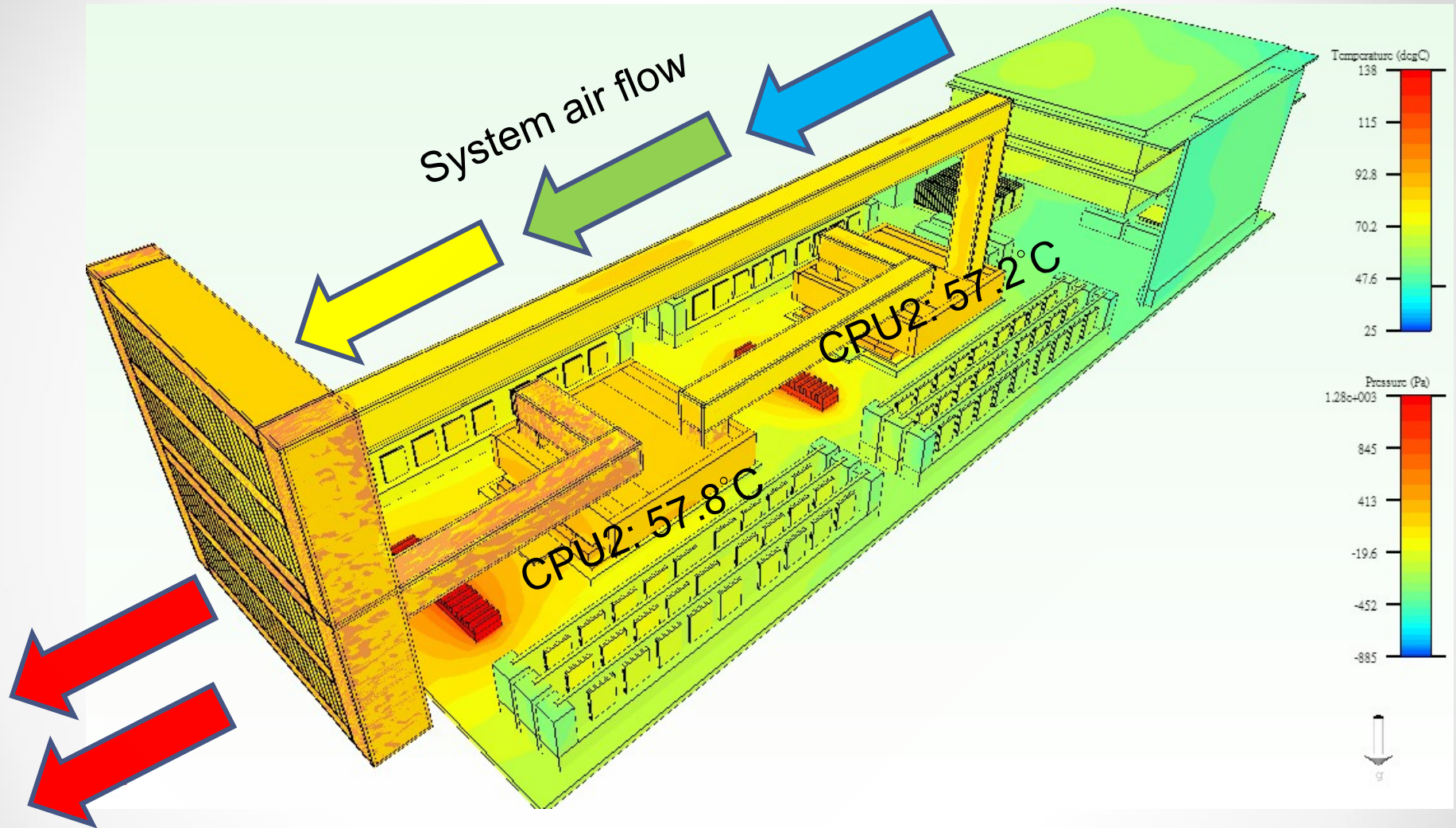
Simulation Result - Water Cooling Module Temperature



Simulation Result – Components Temperature



Simulation Result – System Temperature



Summary

1. High performance thermal design(CPU TDP 205W above).
Air cooling is necessary for DIMM, PCH, HDD, VRM,Riser card etc. and liquid cooling is add-on solution for Purely, Whitley platform processors.
2. Liquid model must set into an enclosure to divide 2 different fluids to prevent error grid property adjacent.
3. Trace airflow by creating particle source to check flow region and components temperature. Animation can check flow direction inside tube in order to figure out the best loop design for liquid cooling.
4. Use command center to optimize fin design of RHE condenser and volume rate of pump.