

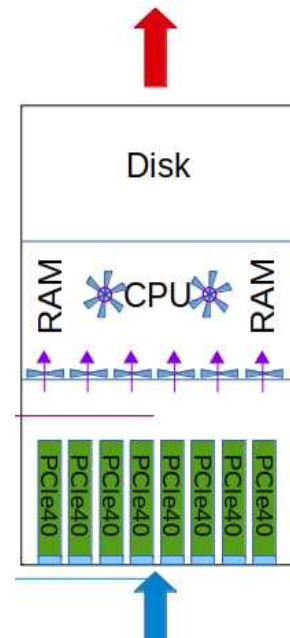
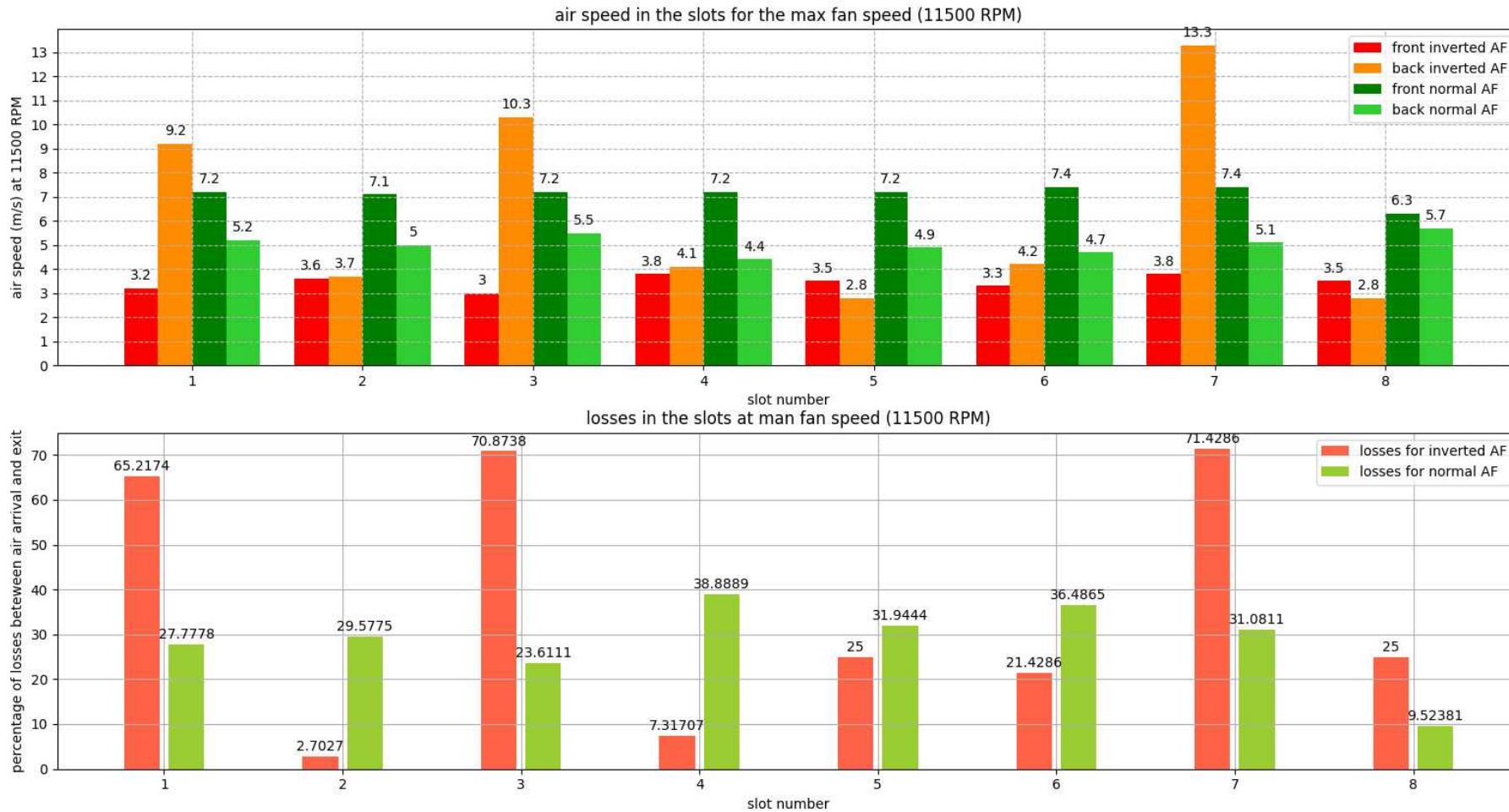
# Airflow measures and Cecla CFD results



Julien Langouët,

# Airflow measurement

airflow characterisation without radiators

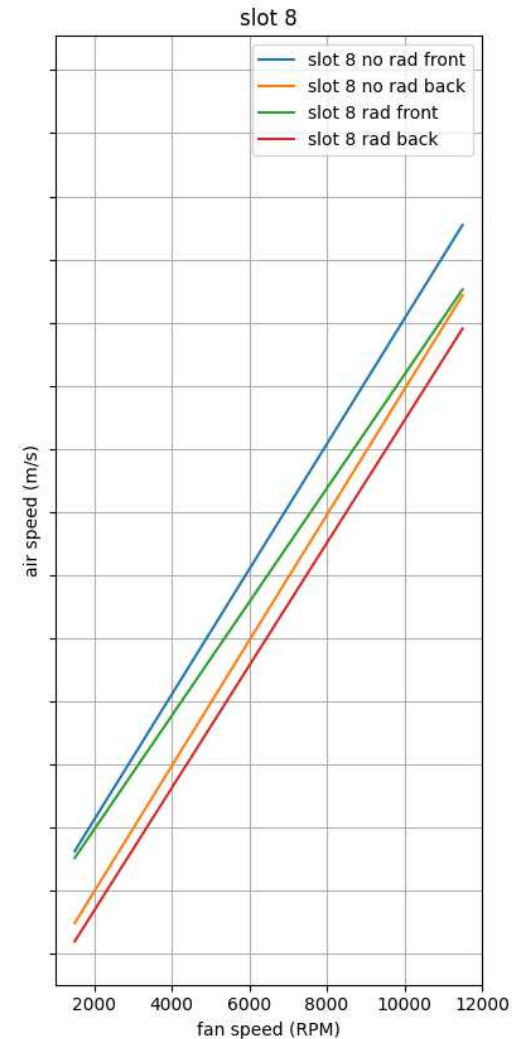
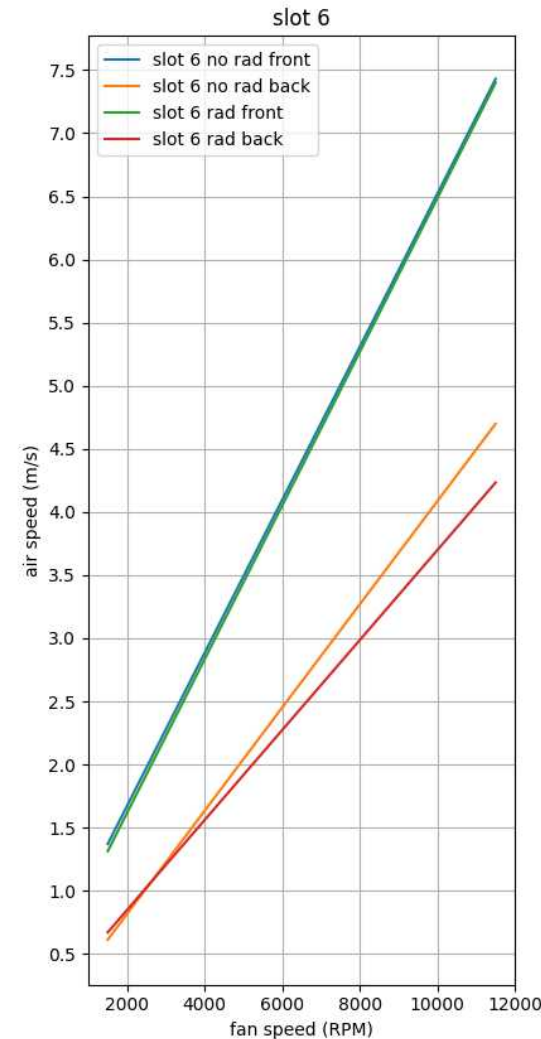
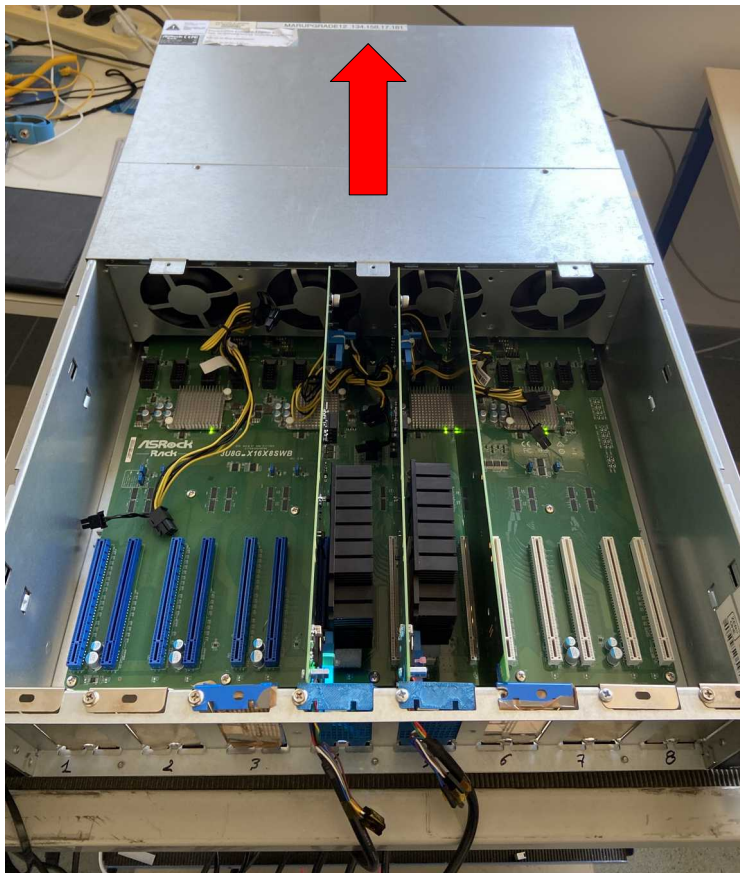


# Effect of radiator on airflow

**airflow direction : Suck**

radiator effect with normal AF (front->back)

- All slots are occupied with a board equipped with a PCIe40 heatsink
- Comparison of airflow in best and worst slot (respectively 6 and 8)

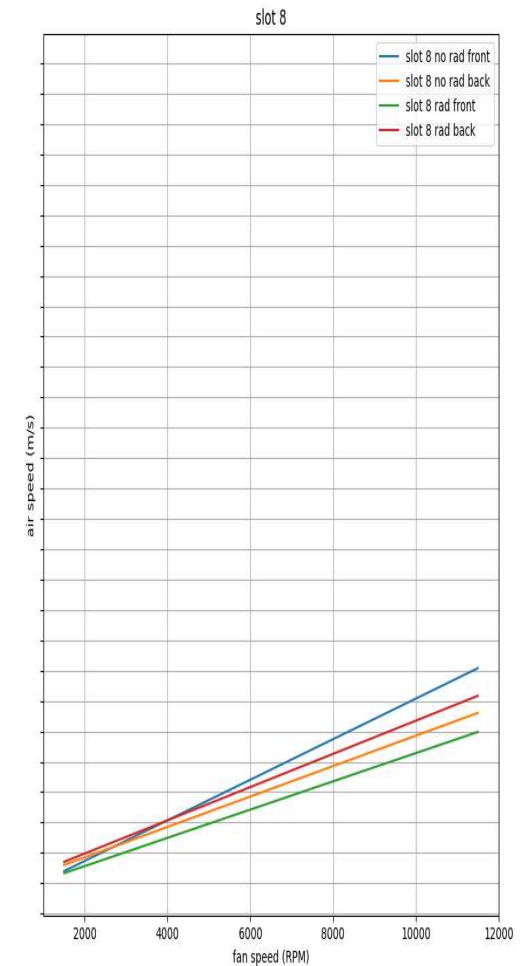
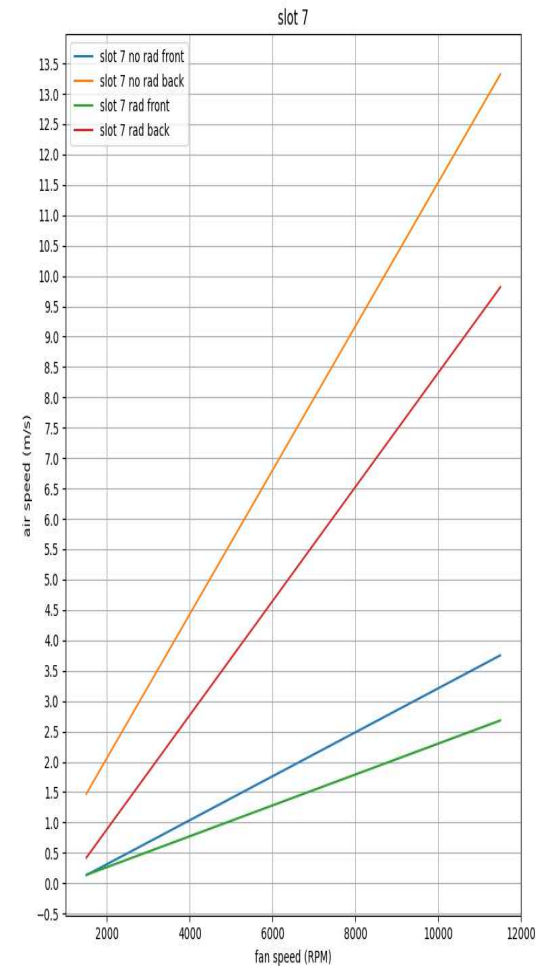
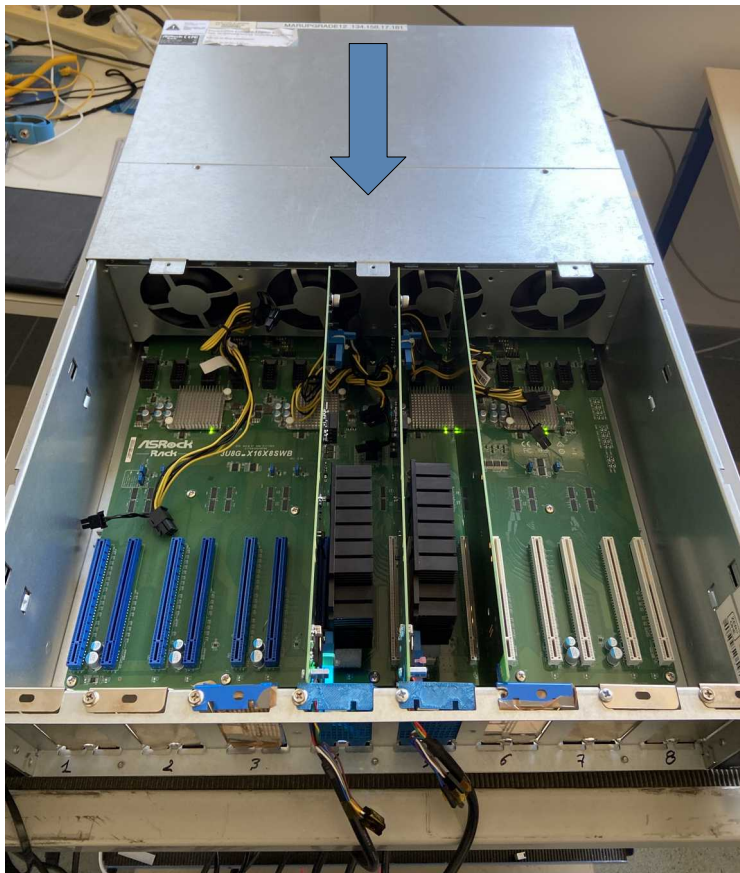


# Effect of radiator on airflow

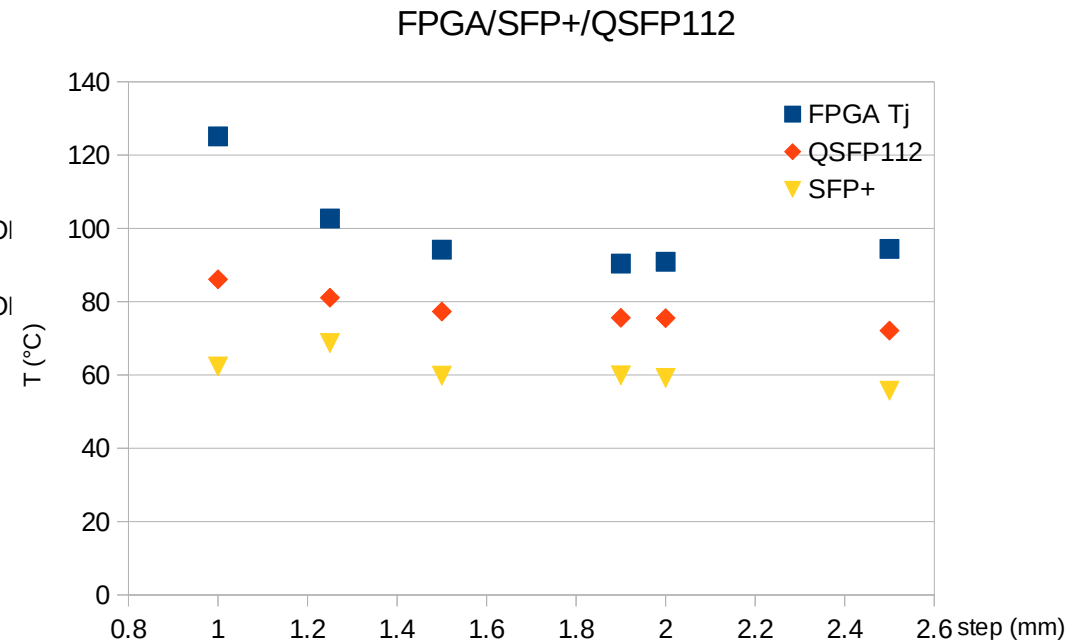
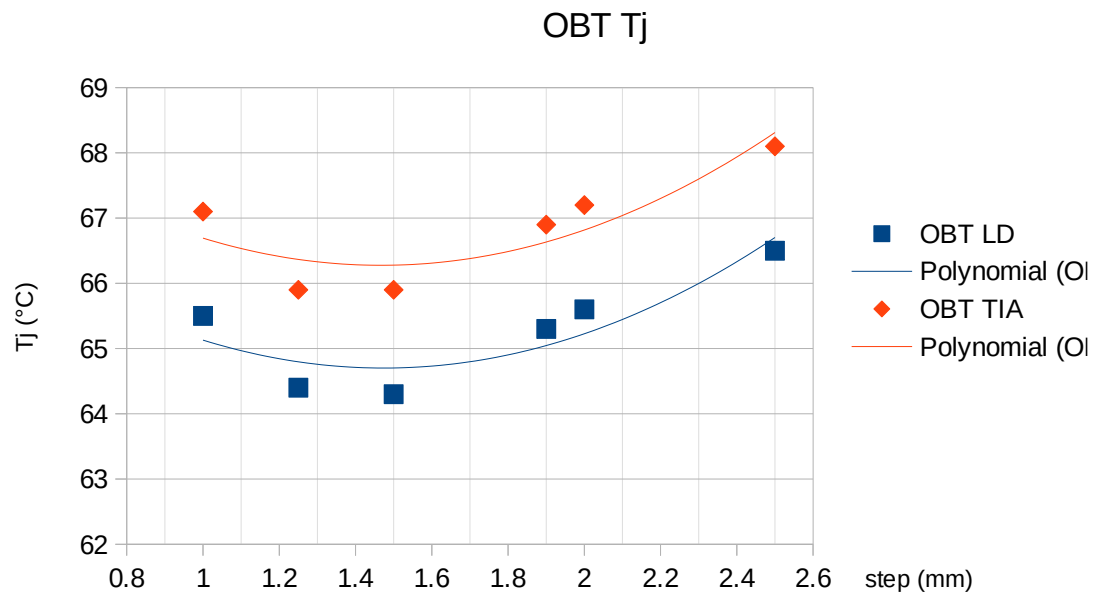
## Airflow direction : push

radiator effect with inverted AF (back->front)

- All slots are occupied with a board equipped with a PCIe40 heatsink
- Comparison of airflow in best and worst slot (respectively 7 and 8)



# Fin step optimization

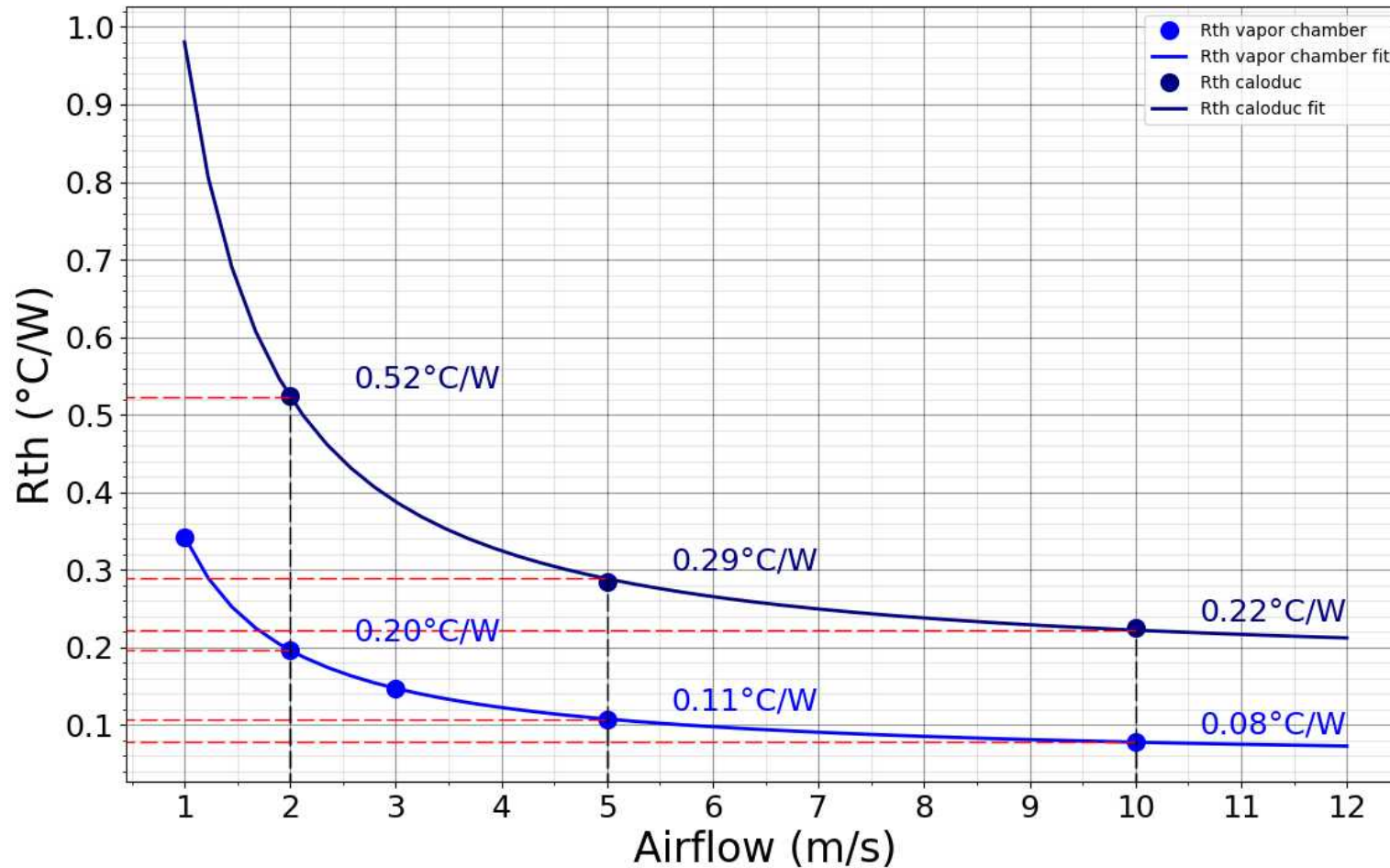


**OB T heatsink show best result with 1.5mm between fins**

**FPGA heatsink show best results with 1.9mm between fins**

# FPGA Heatsink Vapor chamber vs Caloduc

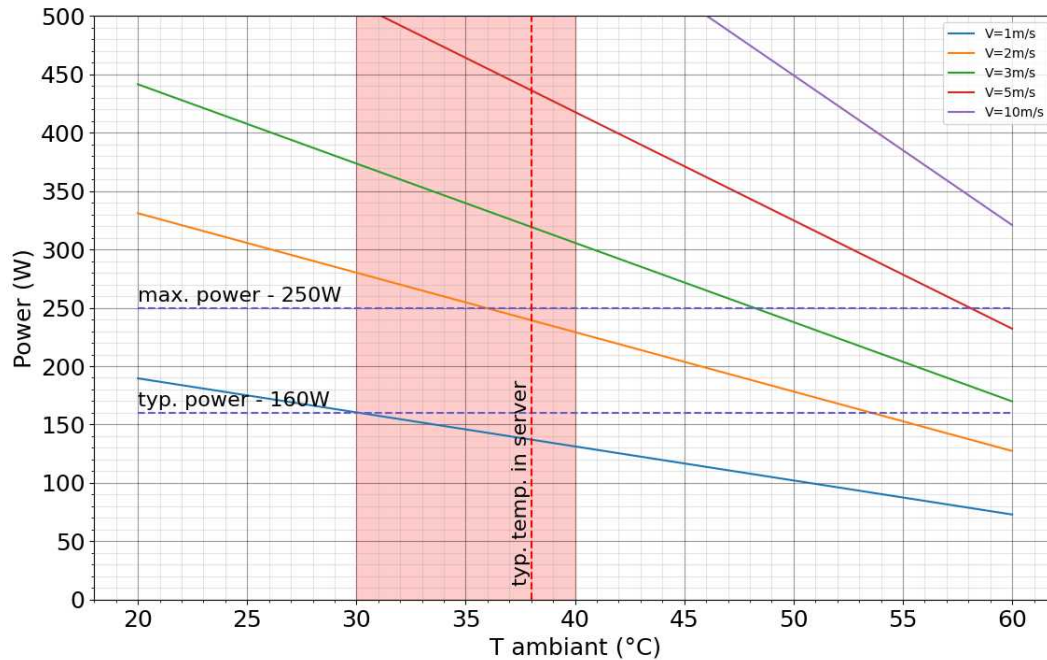
FPGA Heatsink thermal resistance in function of airflow



# FPGA maximum power dissipable

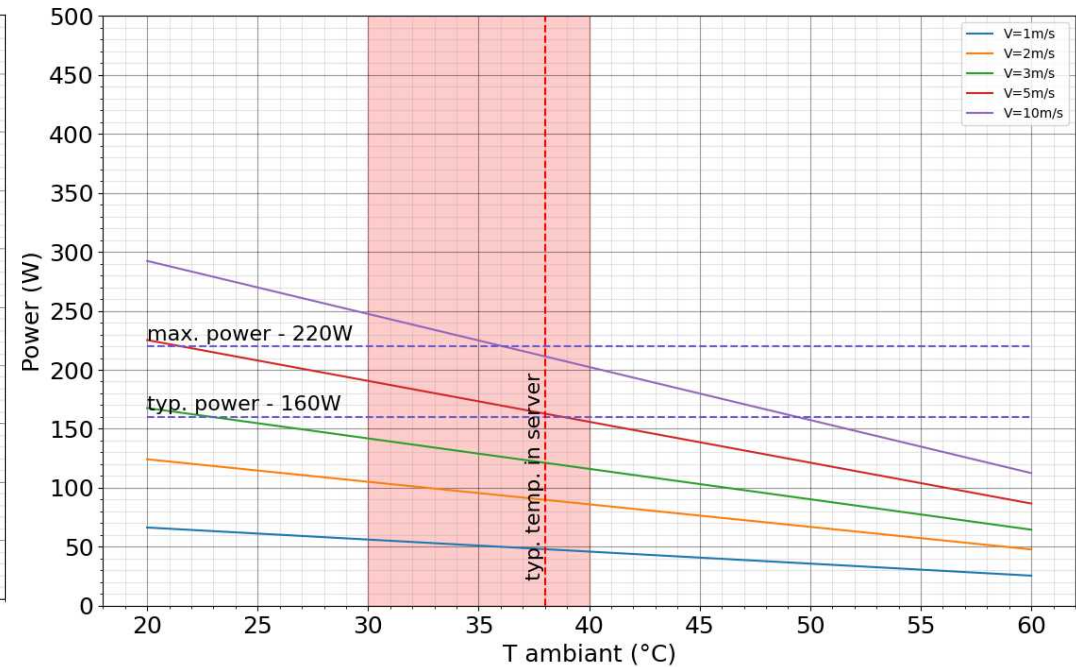
## Vapor chamber

FPGA '3/4' length passive Maximum power dissipable with  $T_j=85^\circ\text{C}$



## Caloduc

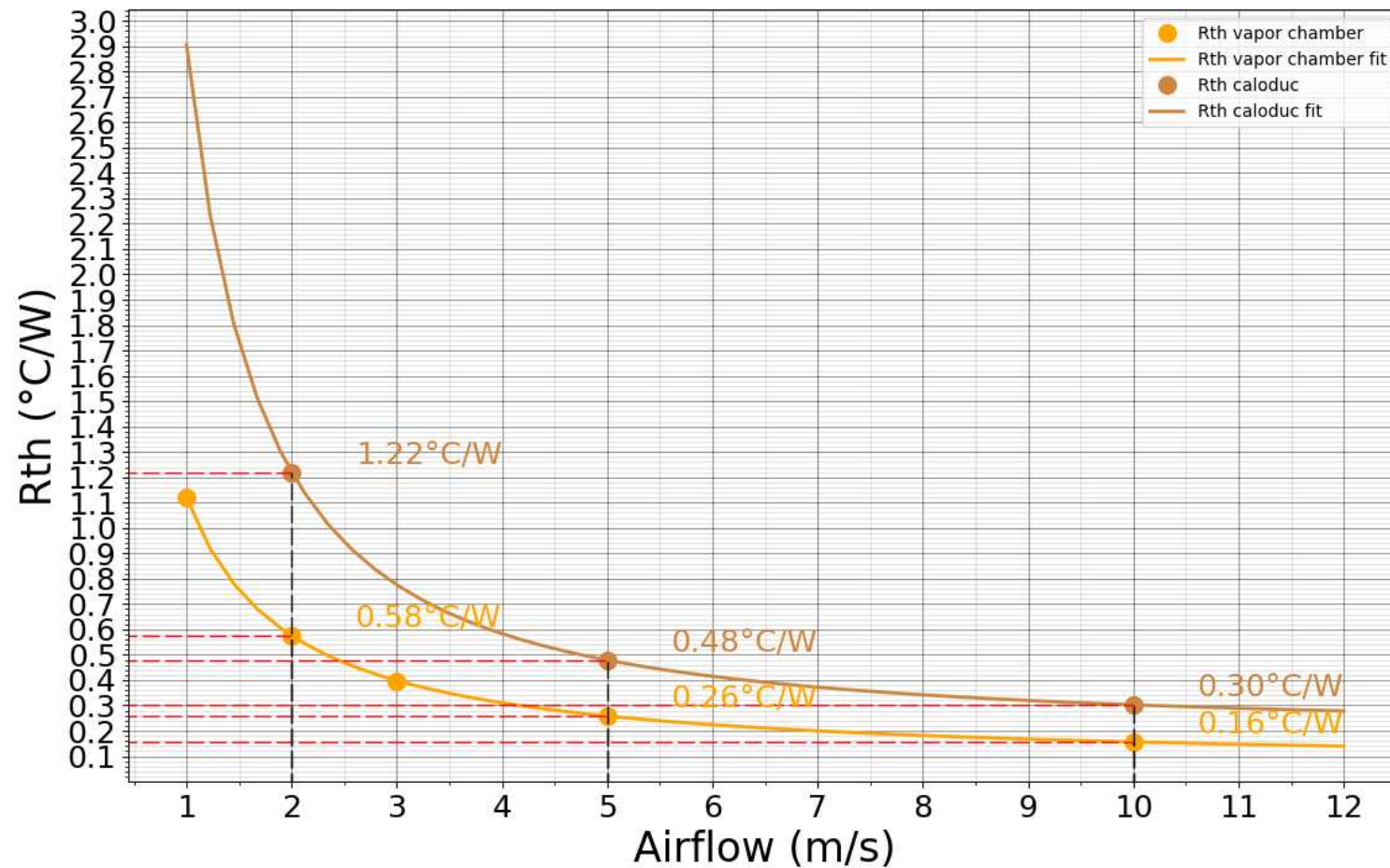
Maximum power dissipable Heatsink with Caloduc in function of ambient temperature and airflow to maintain  $T_j=85^\circ\text{C}$



- Nominal case (160W) requires 5m/s with a caloduc heatsink
- ECS type server can reach 4m/s (all slots occupied with PCIe40 heatsink)

# OBT heatsink Vapor chamber vs caloduc

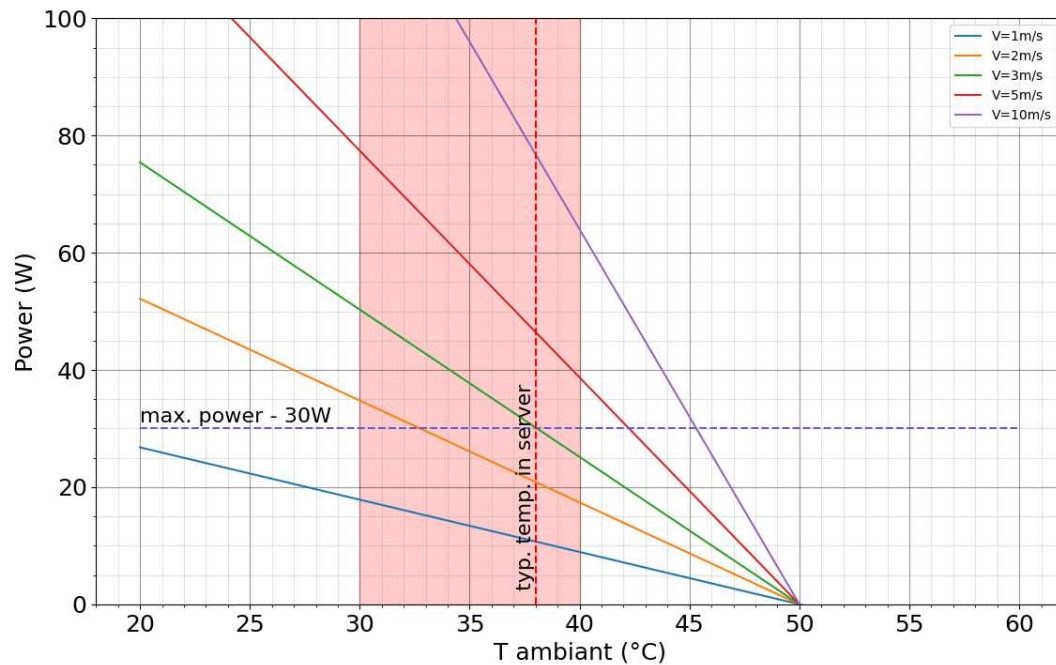
OBT Heatsink thermal resistance Comparison Vapor chamber vs Caloduc



# OBT Maximum power dissipable

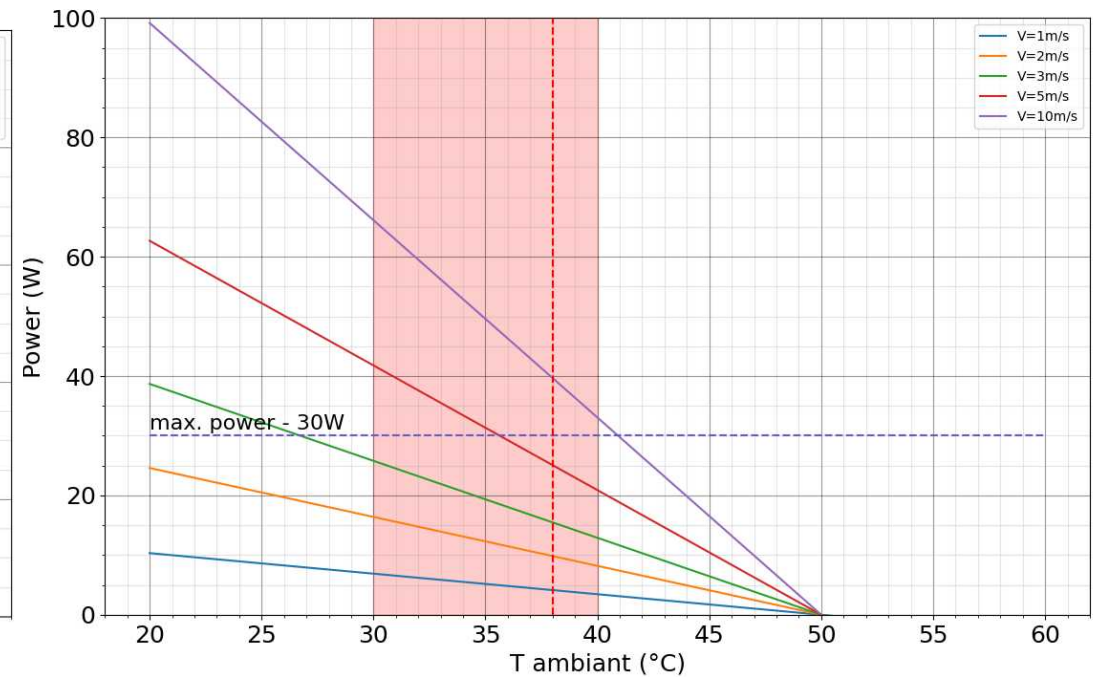
## Vapor chamber

OBT '3/4' length passive Maximum power dissipable with  $T_c=50^\circ\text{C}$



## Caloduc

Maximum power dissipable Heatsink with Caloduc in function of ambient temperature and airflow to maintain  $T_c=50^\circ\text{C}$



- Nominal case (160W) requires  $>5\text{m/s}$  with a caloduc heatsink
- ECS type server can reach  $4\text{m/s}$  (all slots occupied with PCIe40 heatsink)