

# ePIC TOF Structure Thermal Test

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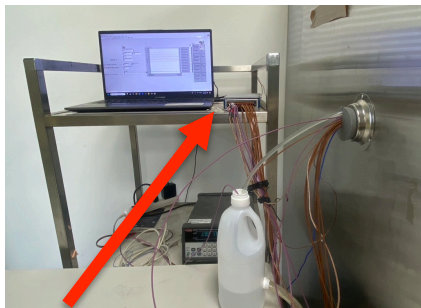
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National Cheng Kung University





# Test Setup



## NI 9213 DAQ



- 16 channels
- Accuracy:
  - High-resolution mode :  $<0.02\text{ }^{\circ}\text{C}$
  - High-speed mode :  $<0.25\text{ }^{\circ}\text{C}$

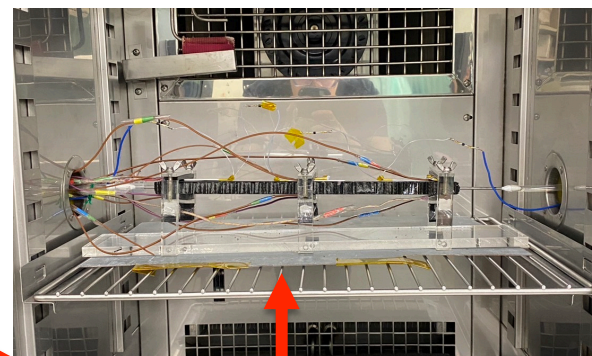


## Heat source (x 9)

- Ceramic plate (5 $\Omega$ ):  $\sim 500\text{ }^{\circ}\text{C}$

## Thermocouple (x 16)

- Type E:  $-250\text{ }^{\circ}\text{C} \sim 900\text{ }^{\circ}\text{C}$



## Environmental chamber

- Inner dimensions:  $40 \times 50 \times 60\text{ cm}^3$
- Temperature:  $-40\text{ }^{\circ}\text{C} \sim 100\text{ }^{\circ}\text{C}$  ( $\pm 0.2\text{ }^{\circ}\text{C}$ )
- Humidity:  $10\% \sim 98\%$  ( $\pm 2.5\%$ )

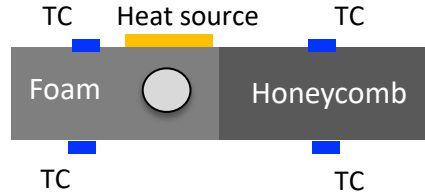
## Flow meter

- $20 - 300\text{ cc/min}$

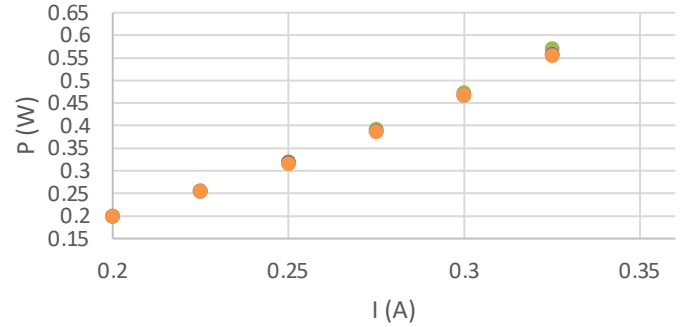
## Cooling system

- Temperature:  $3\text{ }^{\circ}\text{C} \sim 32\text{ }^{\circ}\text{C}$

3D-printed holder

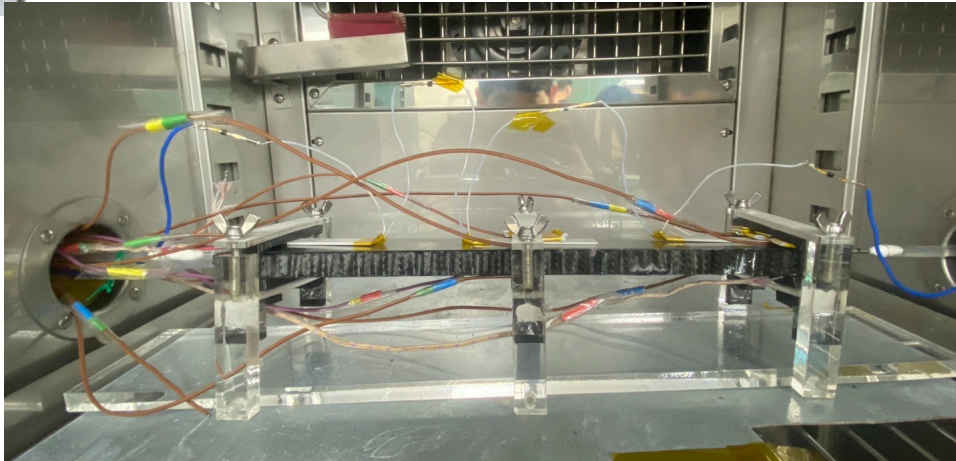


Power vs current



● source 2 ● source 3 ● source 5

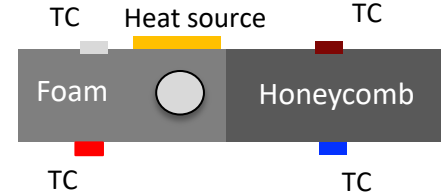
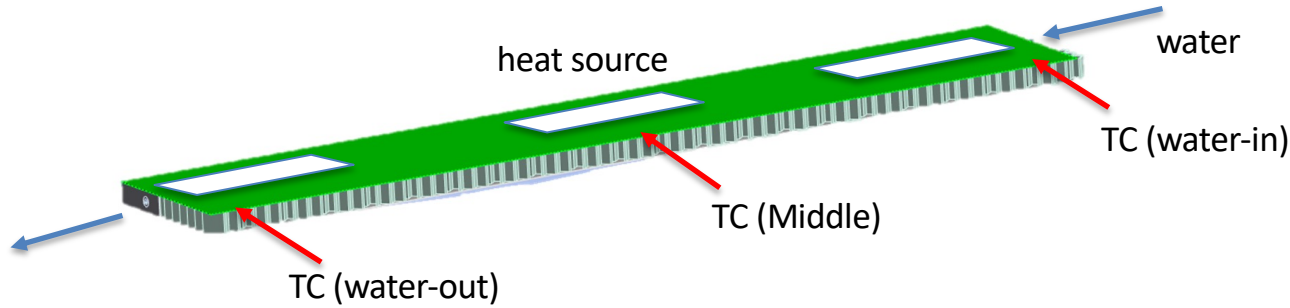
Water out ←



← Water in



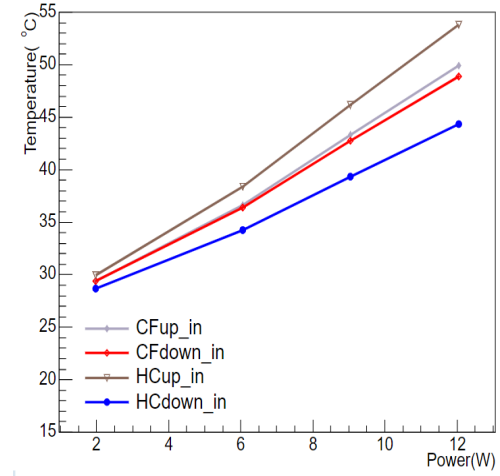
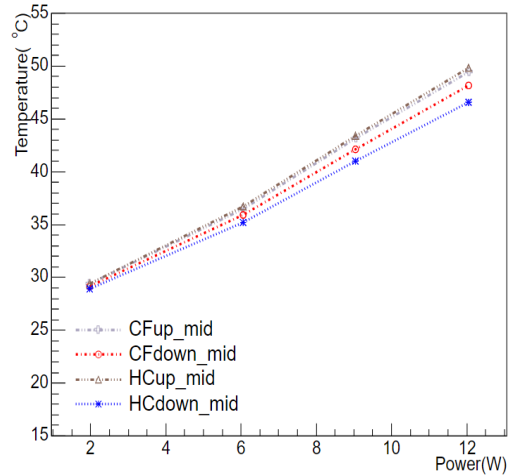
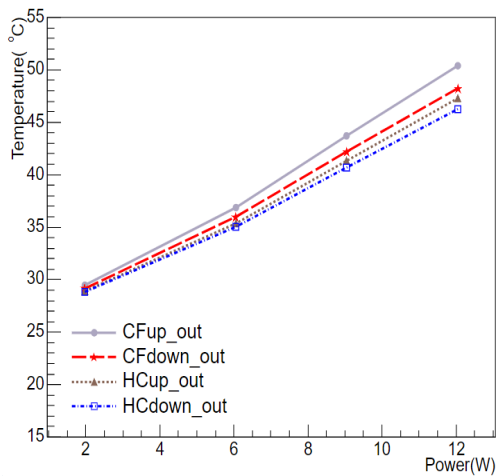
# No Cooling water



Water-out

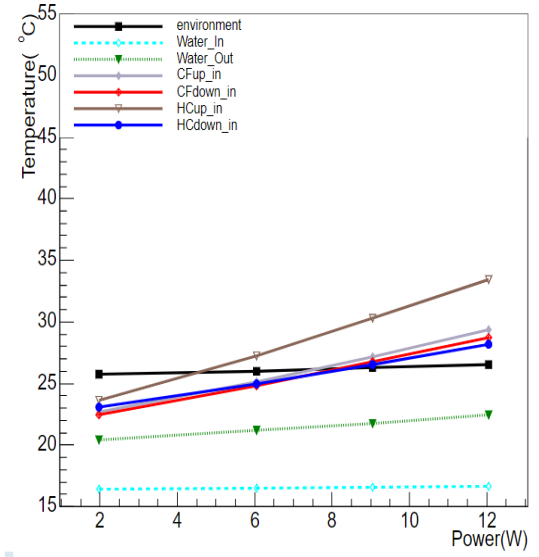
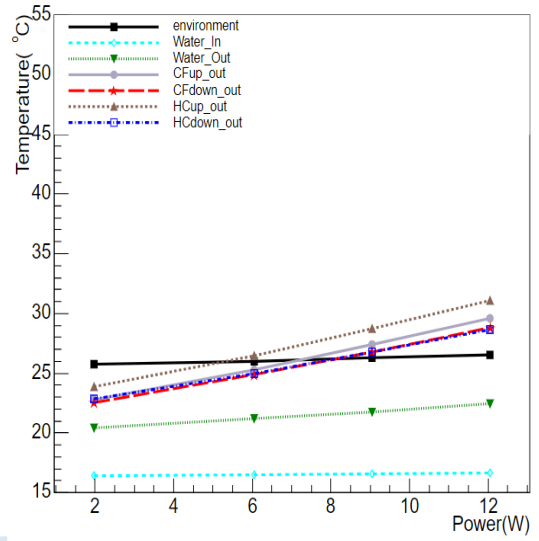
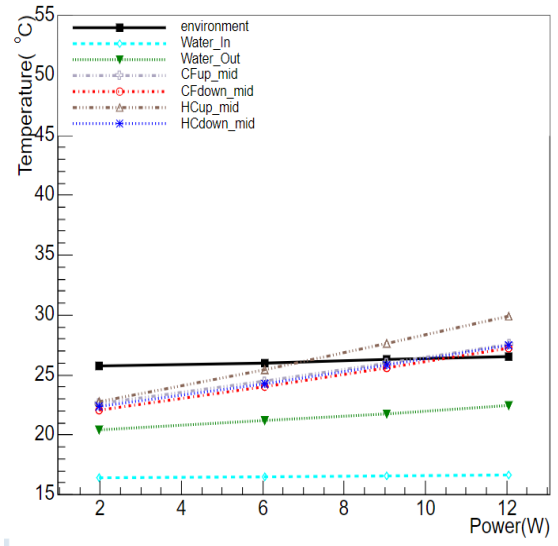
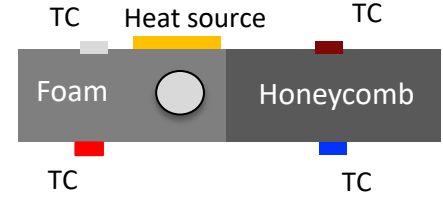
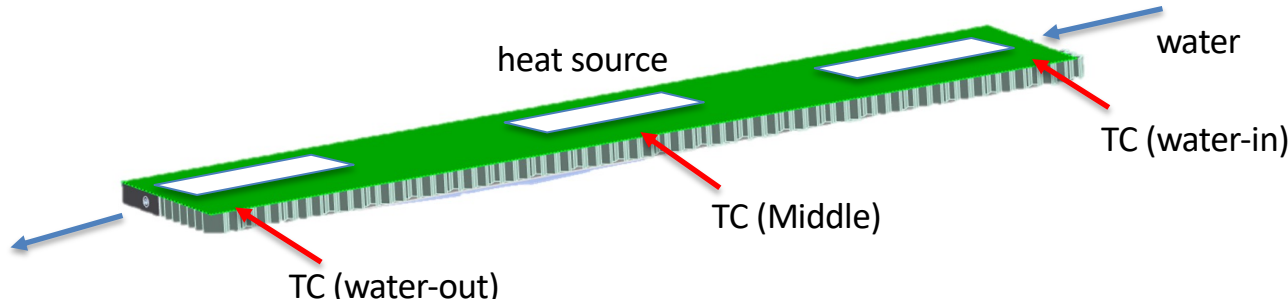
Middle

Water-in



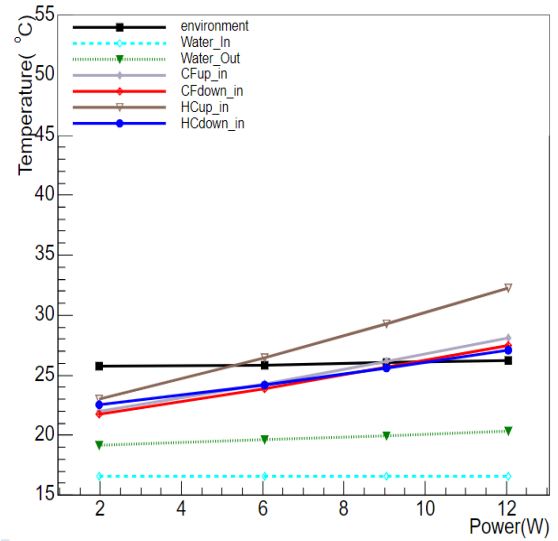
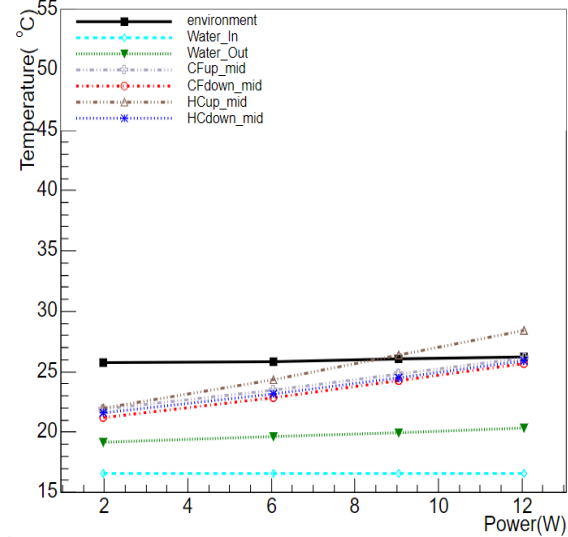
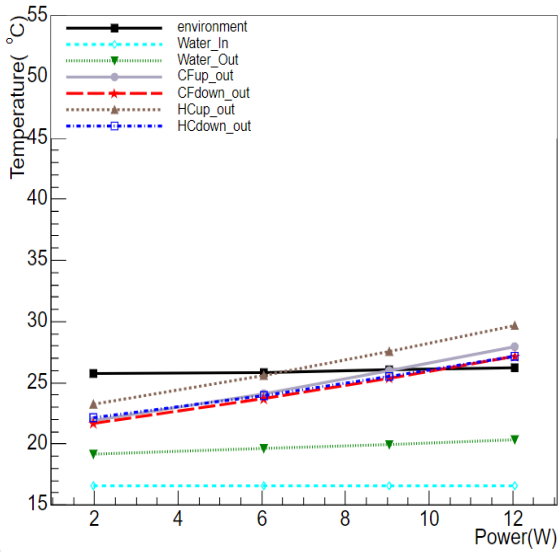
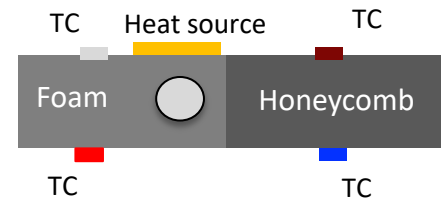
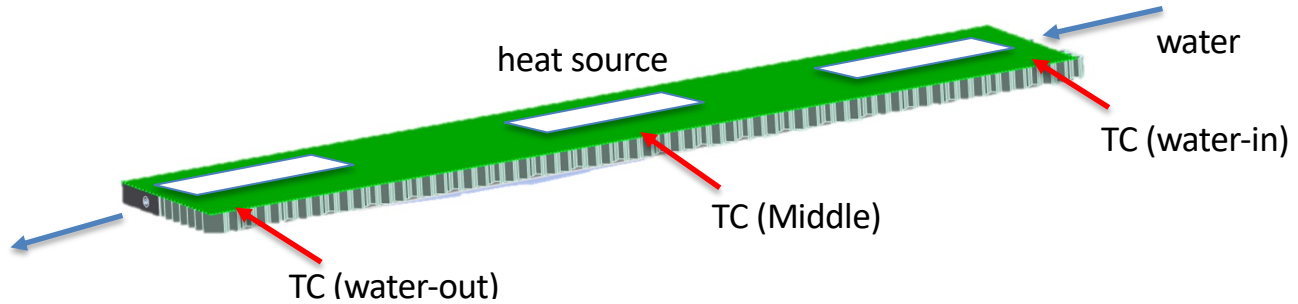


# Cooling water @ 15 °C, 50 c.c./min



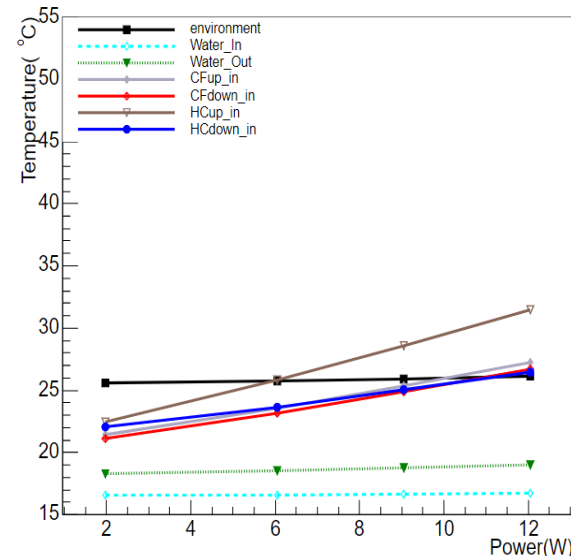
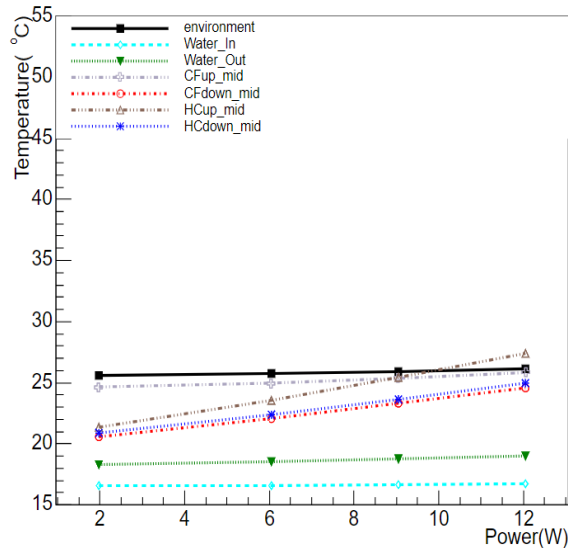
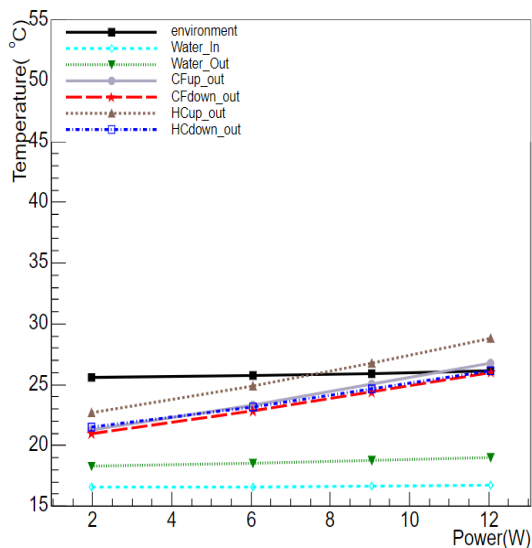
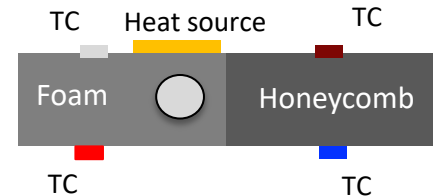
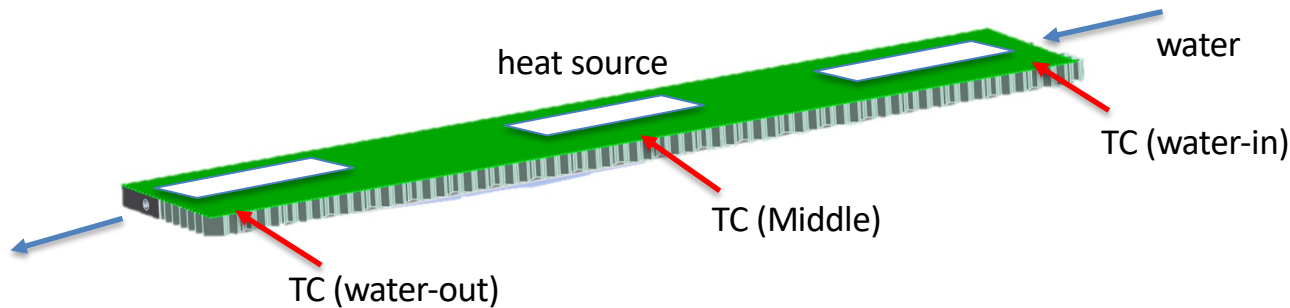


# Cooling water @ 15 °C, 100 c.c./min



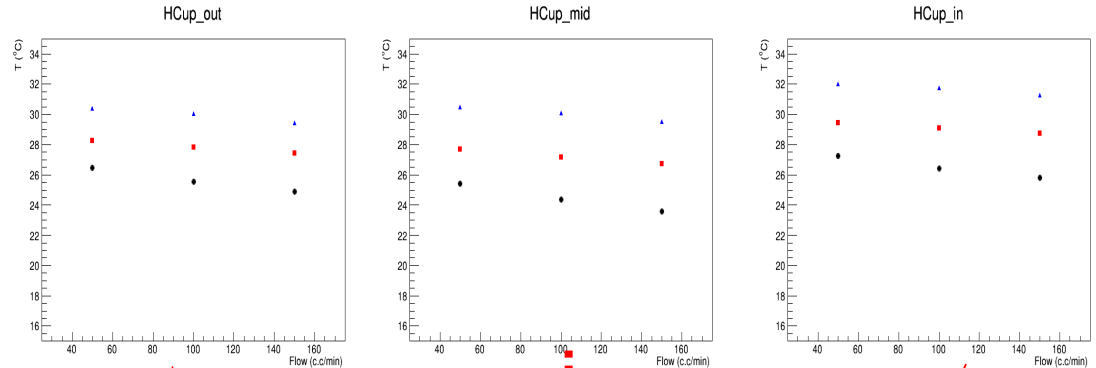


# Cooling water @ 15 °C, 150 c.c./min



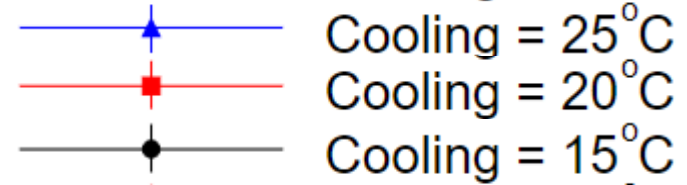
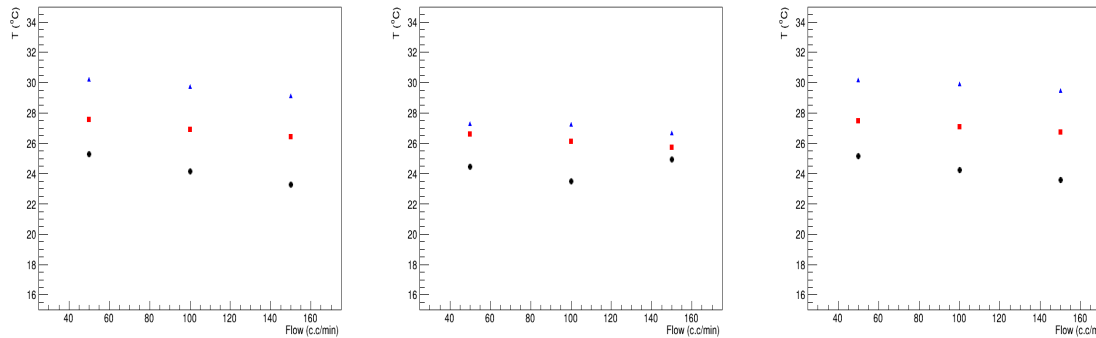
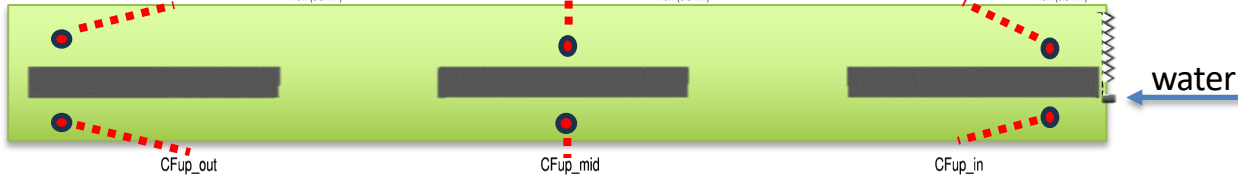


# Top side , Power : 6 W



○ Best cooling performance

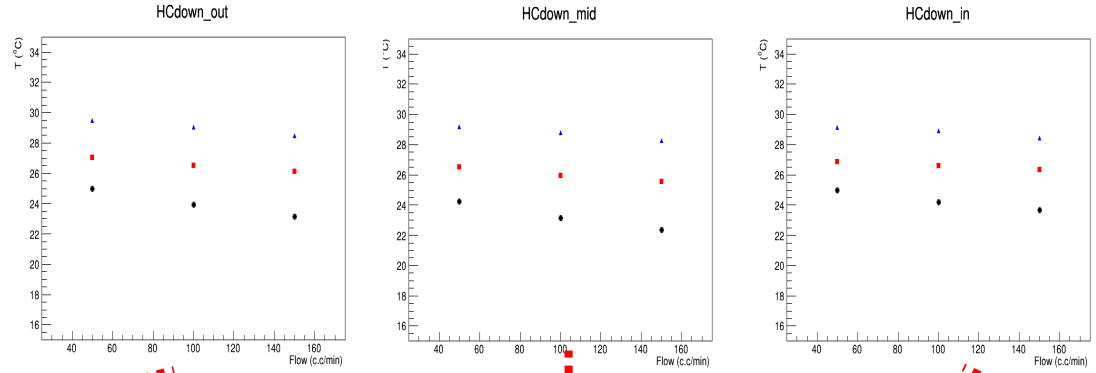
- High flow rate
- Lower cooling temperature





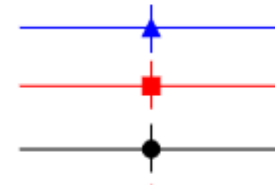
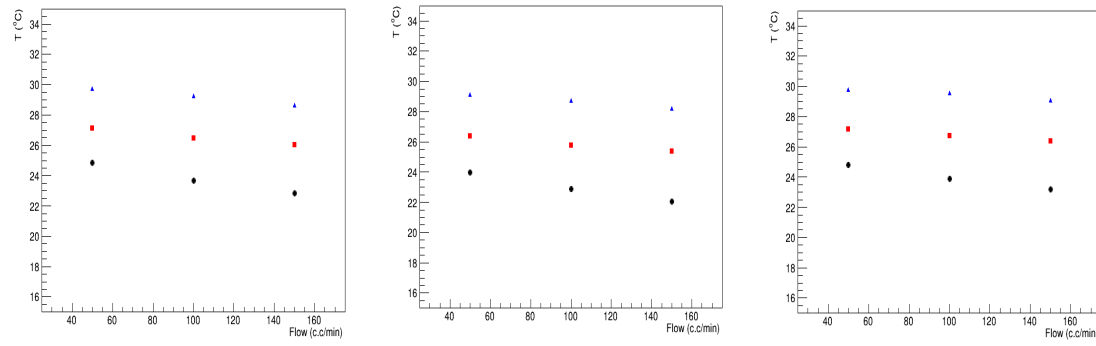
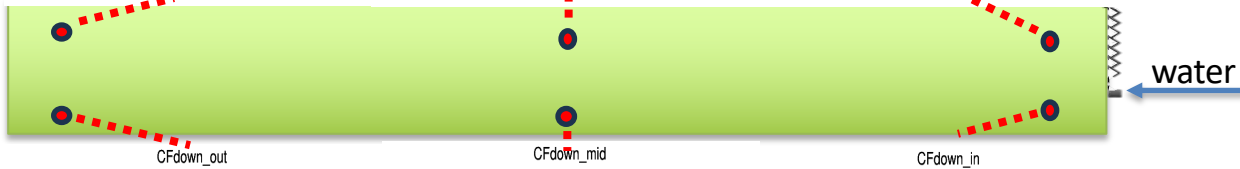


# Bottom side , Power : 6 W



○ Best cooling performance

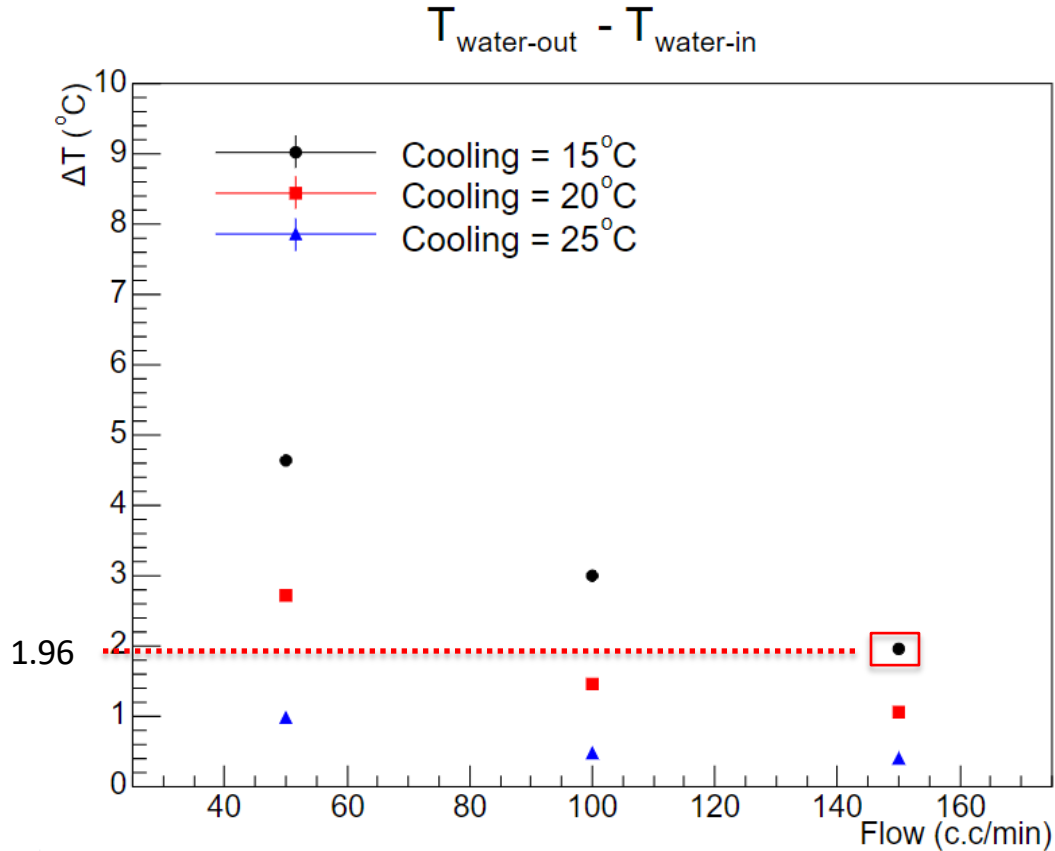
- High flow rate
- Lower cooling temperature



Cooling = 25°C  
Cooling = 20°C  
Cooling = 15°C

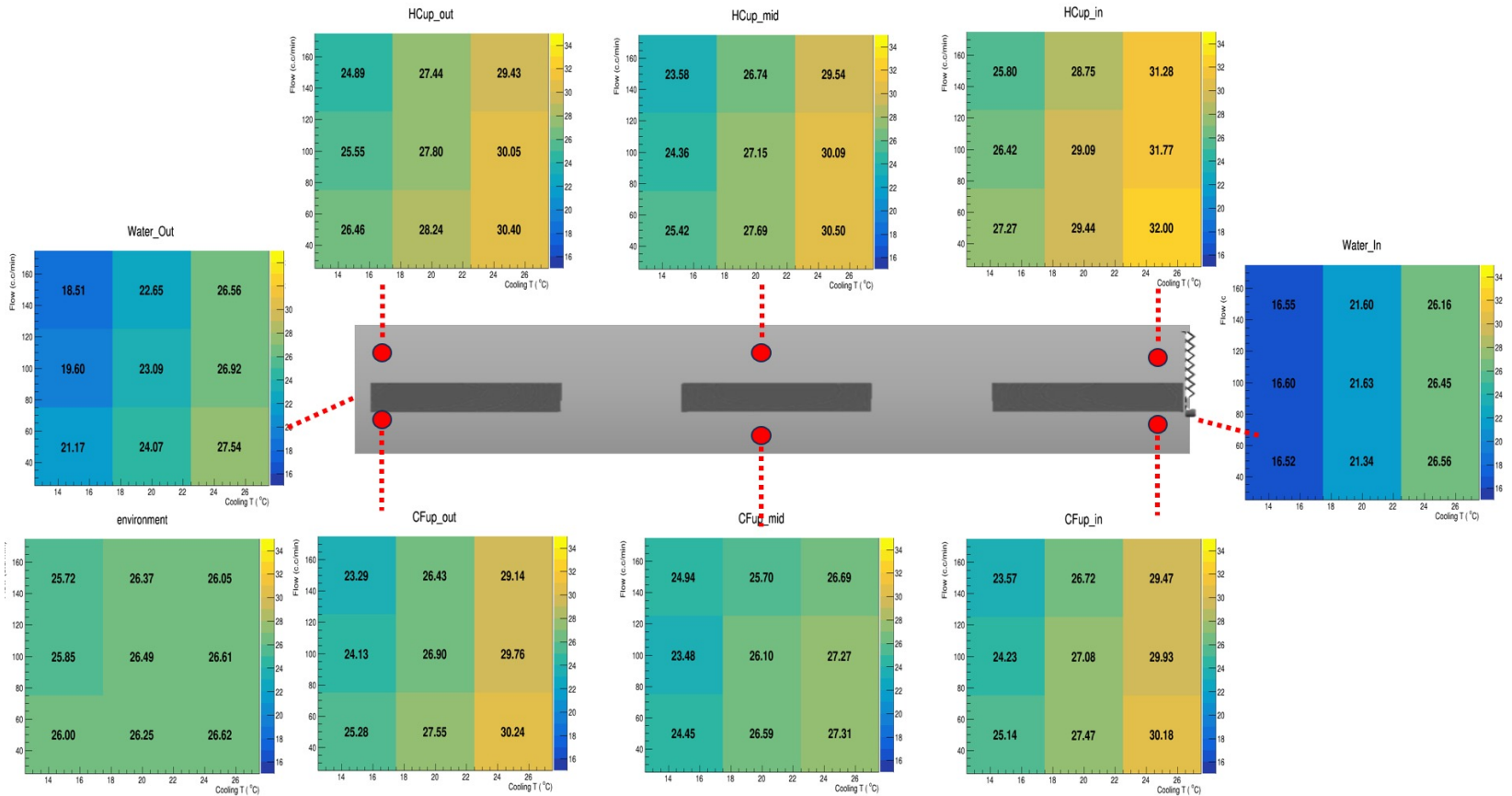


# $\Delta T$ between Water in and Water out



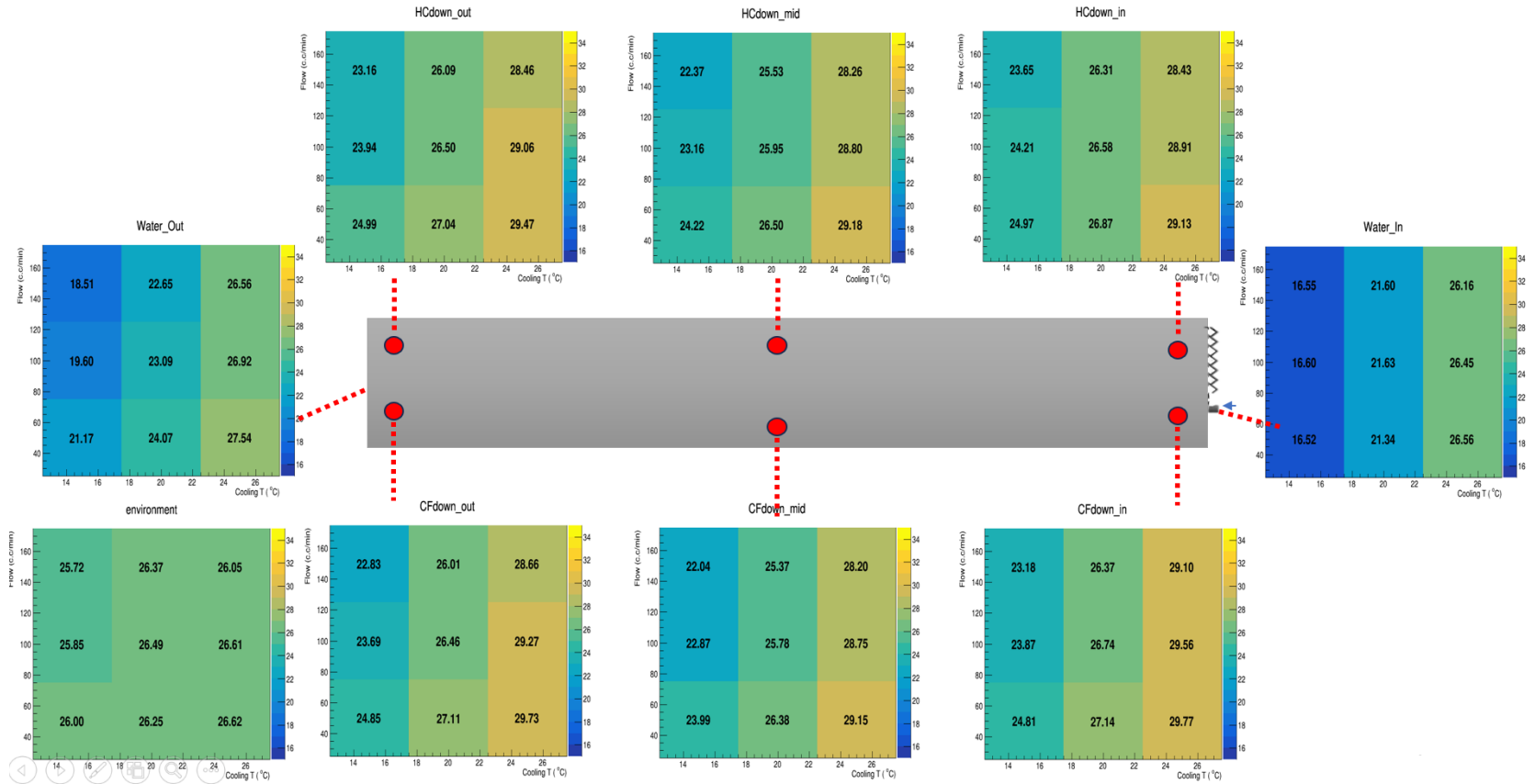


# Temperature in different Flow and Cooling Temperature ( Power : 6 W , top side )



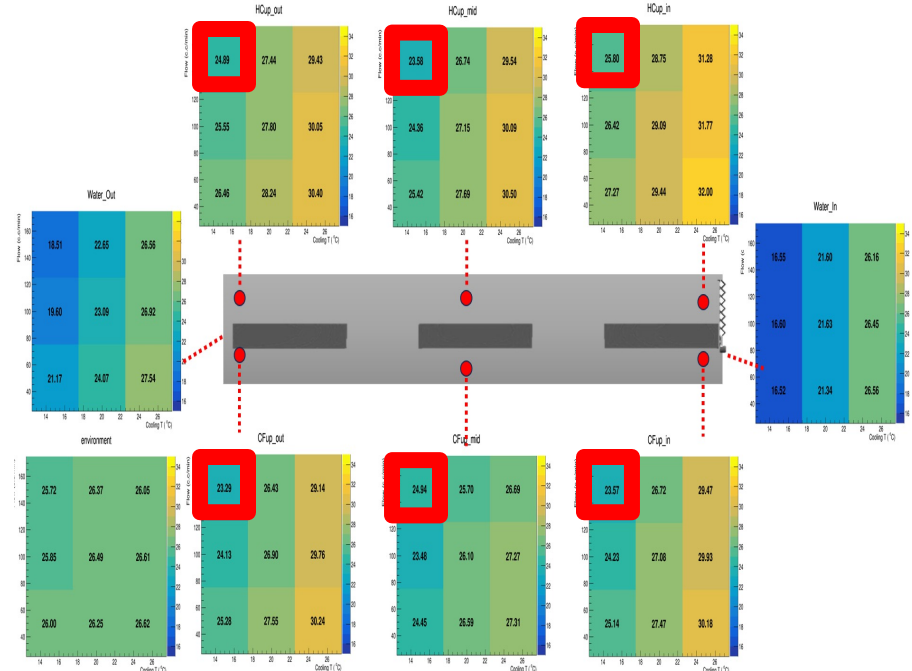
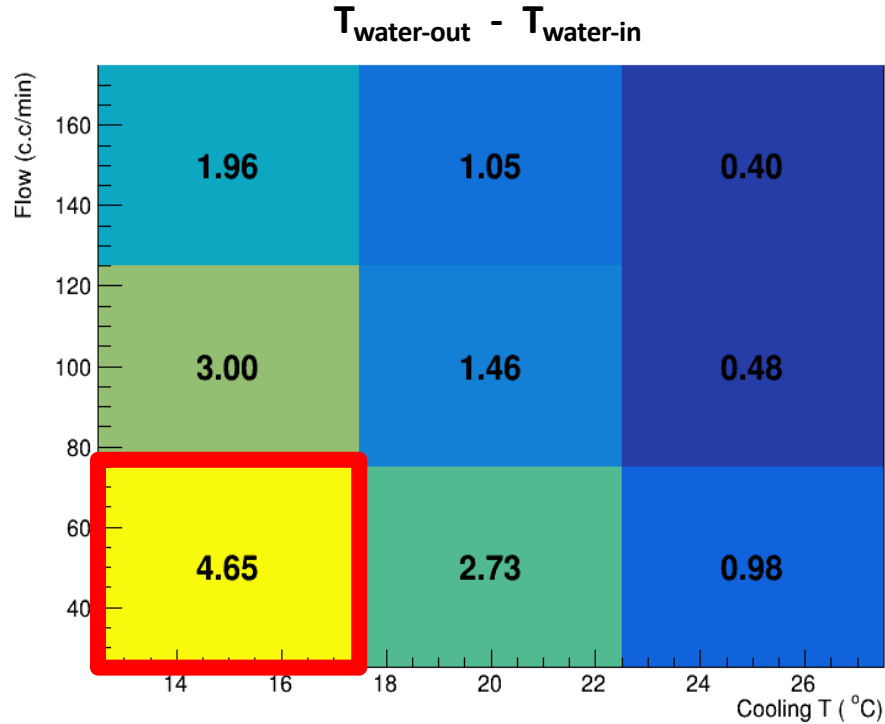


# Temperature in different Flow and Cooling Temperature ( Power : 6 W , bottom side )





# $\Delta T$ between Water in and Water out





# To-Do-list

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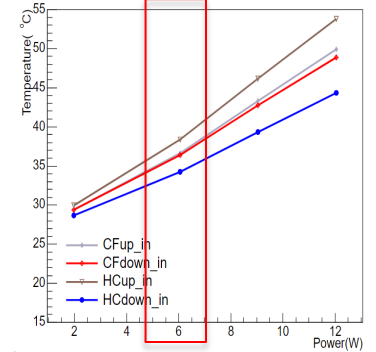
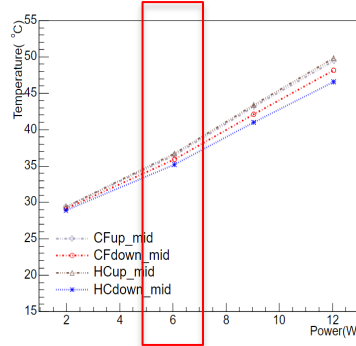
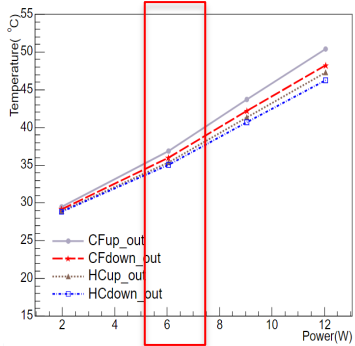
- More measurements will be done



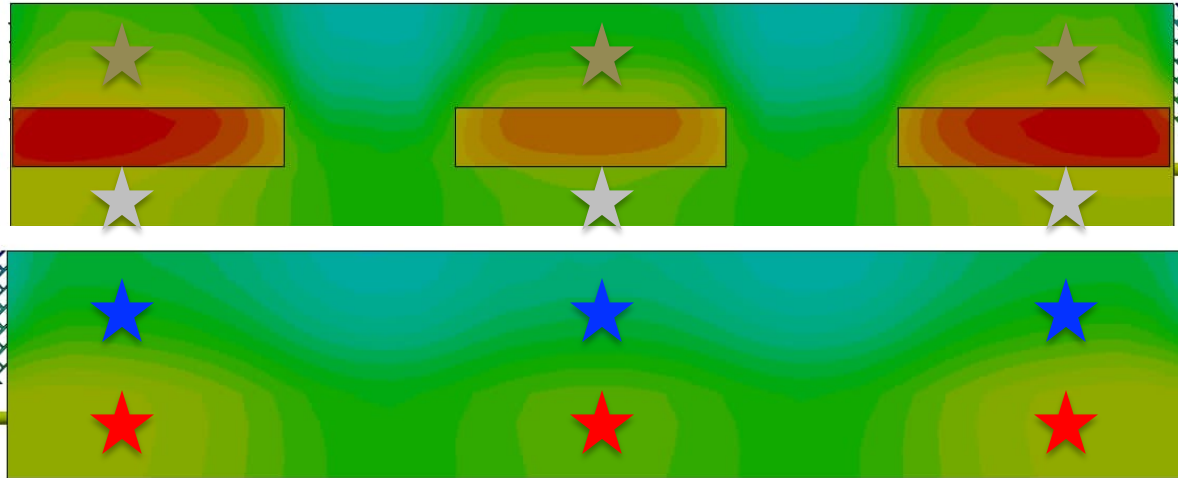
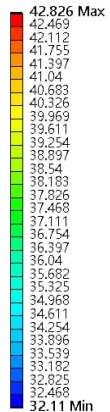
# Back up



# Simulation: No Cooling water, 6 W



A: Transient Thermal  
 Temperature  
 Type: Temperature  
 Unit: °C  
 Time: 1 s  
 2024/5/29 下午 04:26



Very preliminary results done by undergrad student of NCKU, need to double check