

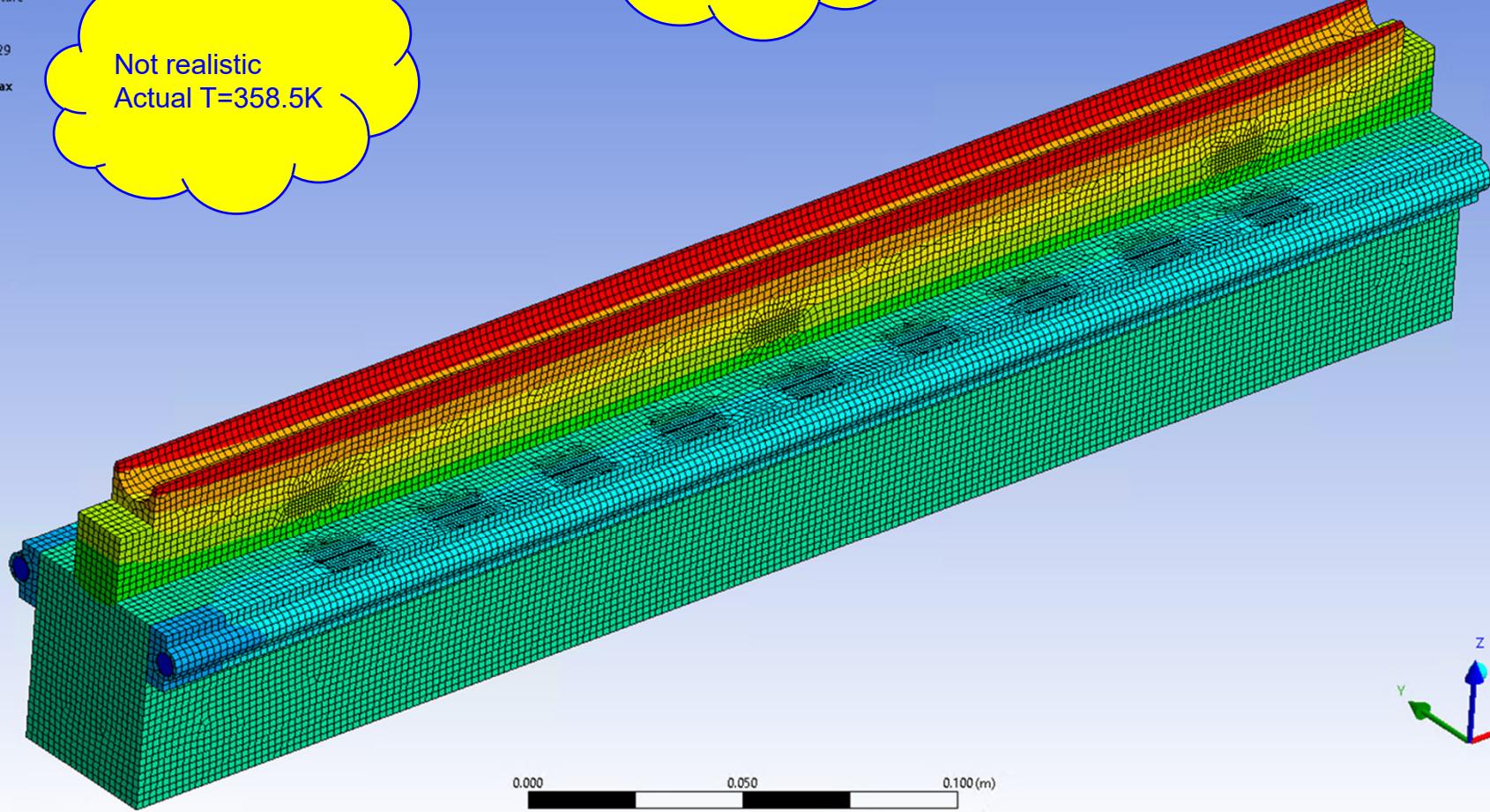
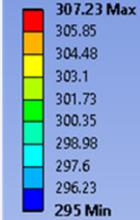
THERMAL CONTACT CONDUCTANCE IN A TYPICAL SILICON CRYSTAL ASSEMBLY FOUND IN PARTICLE ACCELERATORS

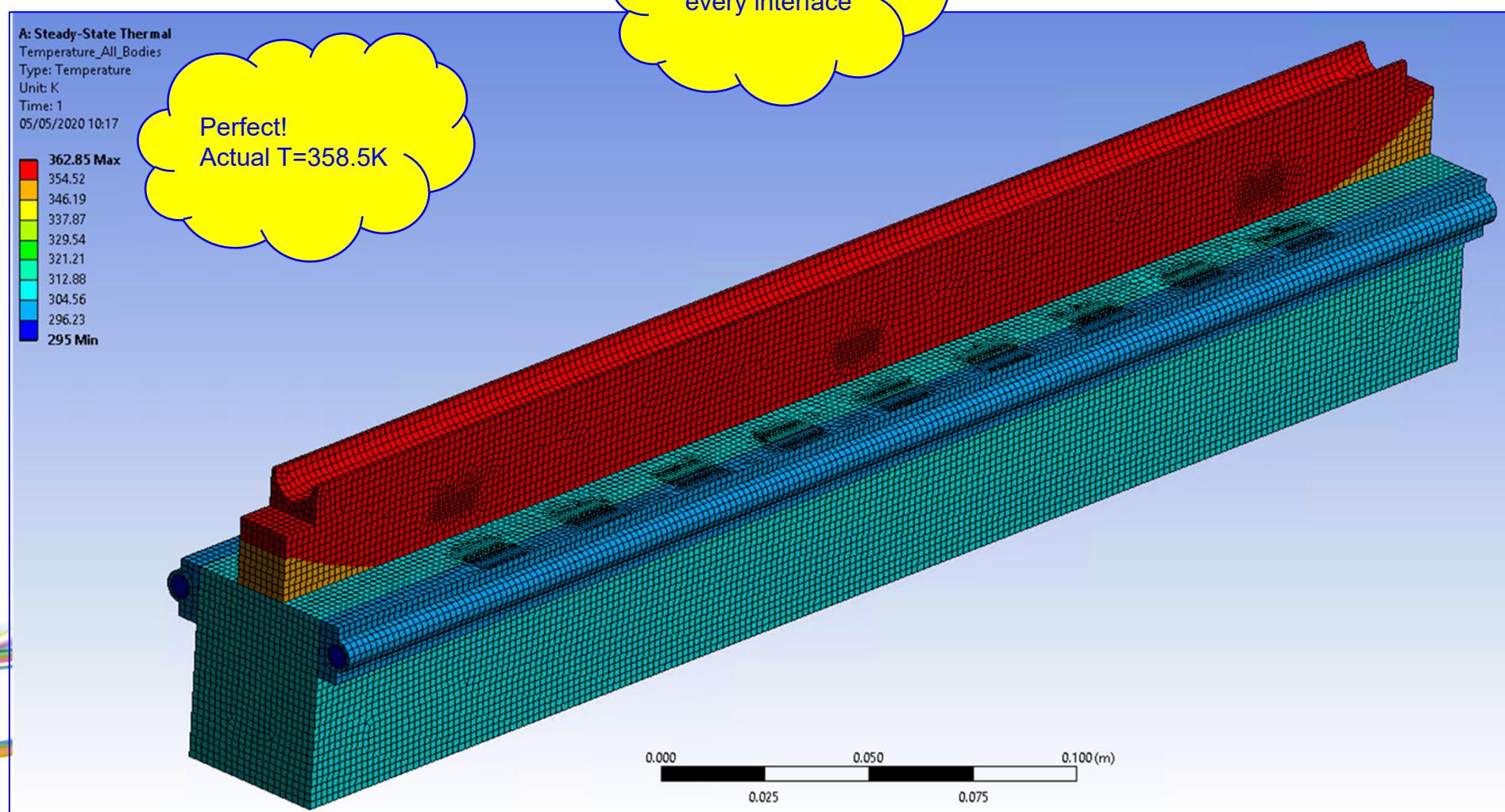
Pablo Sanchez Navarro BEng MSc IEng MIMechE

Diamond Light Source Ltd, Didcot, United Kingdom



A: Steady-State Thermal
Temperature_All_Bodies
Type: Temperature
Unit: K
Time: 1
12/05/2020 20:29





SETUP

MATLAB PROGRAMMED CODE
FOR PLOTING TEMPERATURE
MEASUREMENTS

TWO CUSTOM ARDUINO BOARDS
FOR MONITORING TEMPERATURE
WITH 10 PORTS EACH

PT100s
TEMPERATURE
READERS

INSULATION

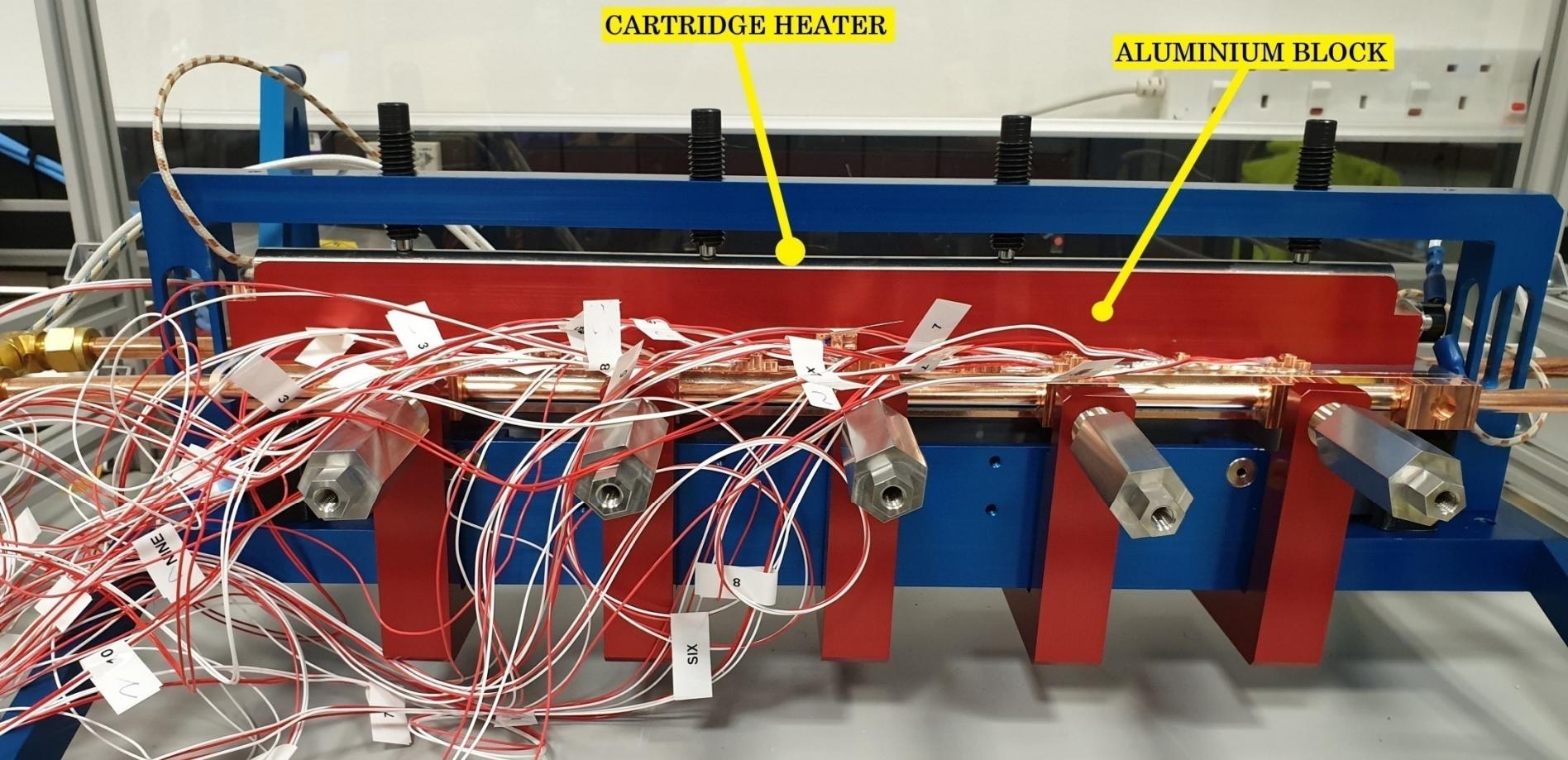
INLET

OUTLET

ADJUSTABLE
CLAMPS

COPPER
COOLING
MANIFOLD

SILICON
CRYSTAL



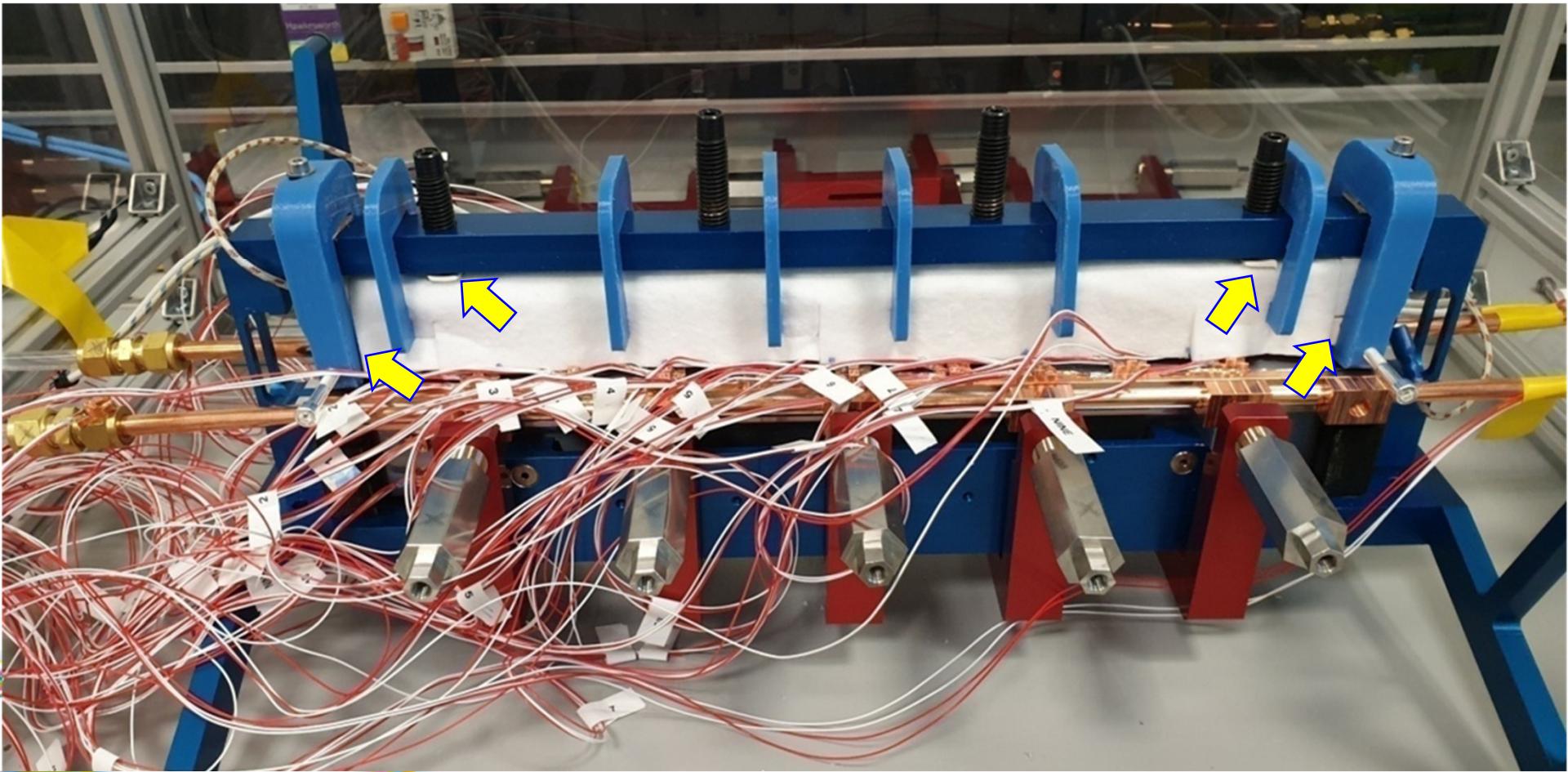
INDIUM FOIL

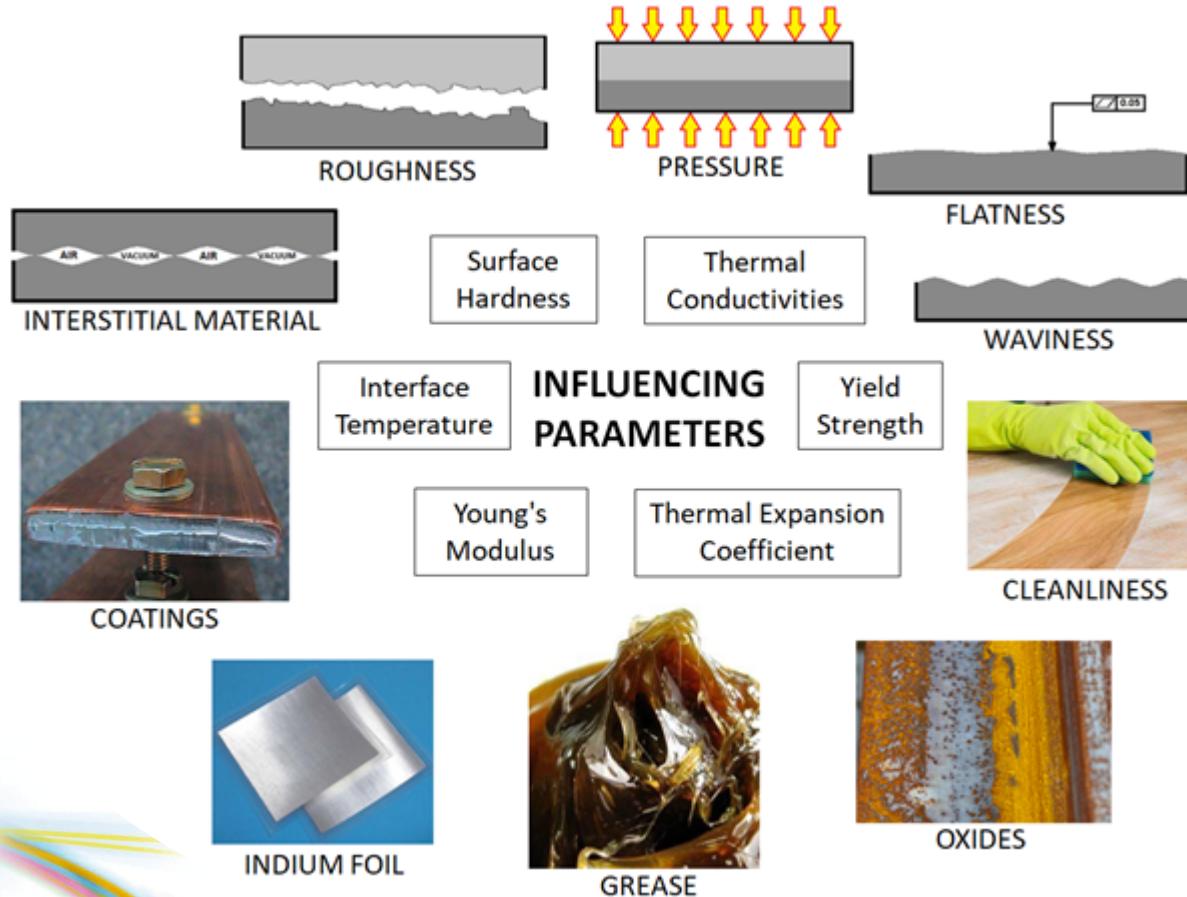
THERMAL CUTTER SWITCH

INLET

SILICON CRYSTAL

Improved Assembly

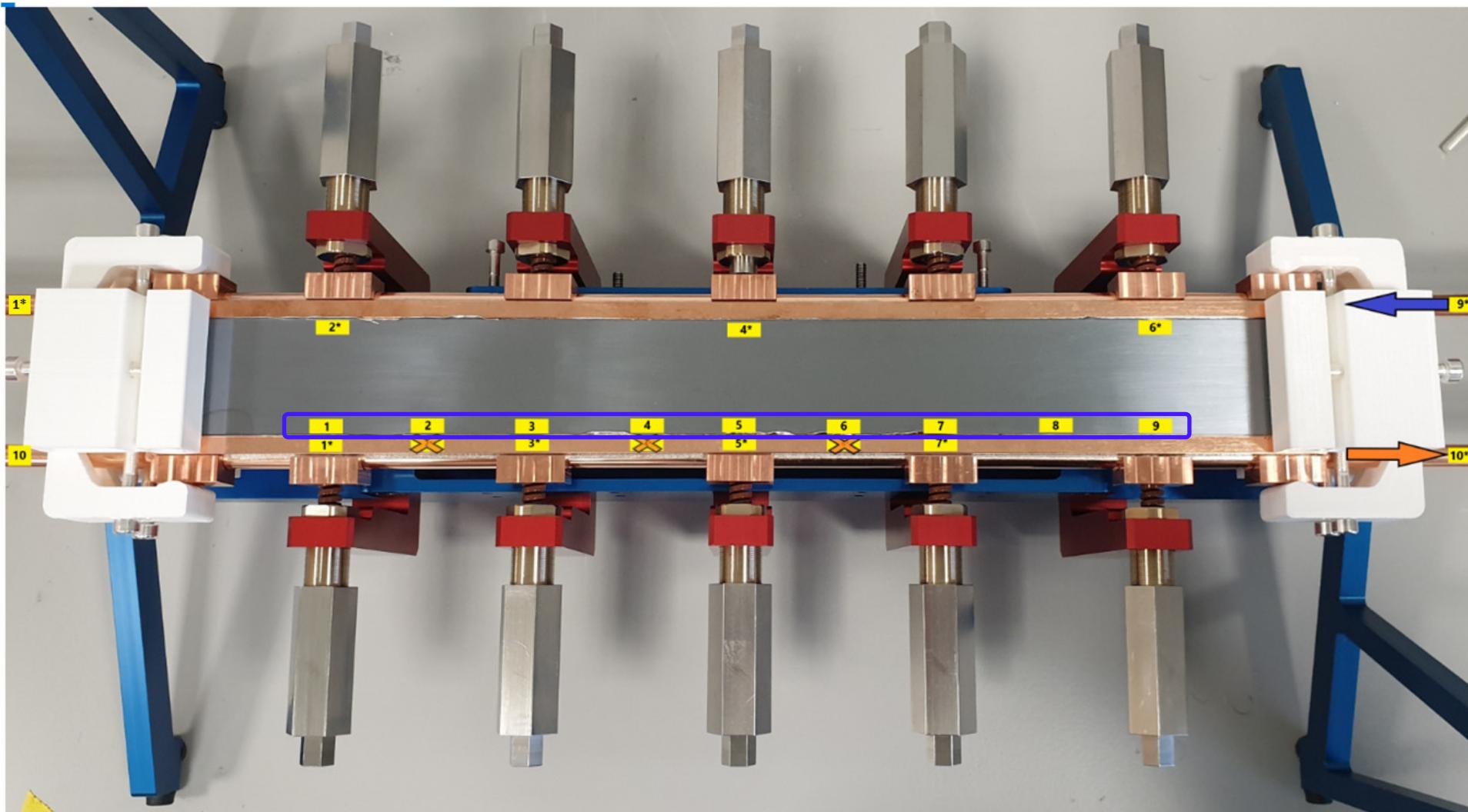




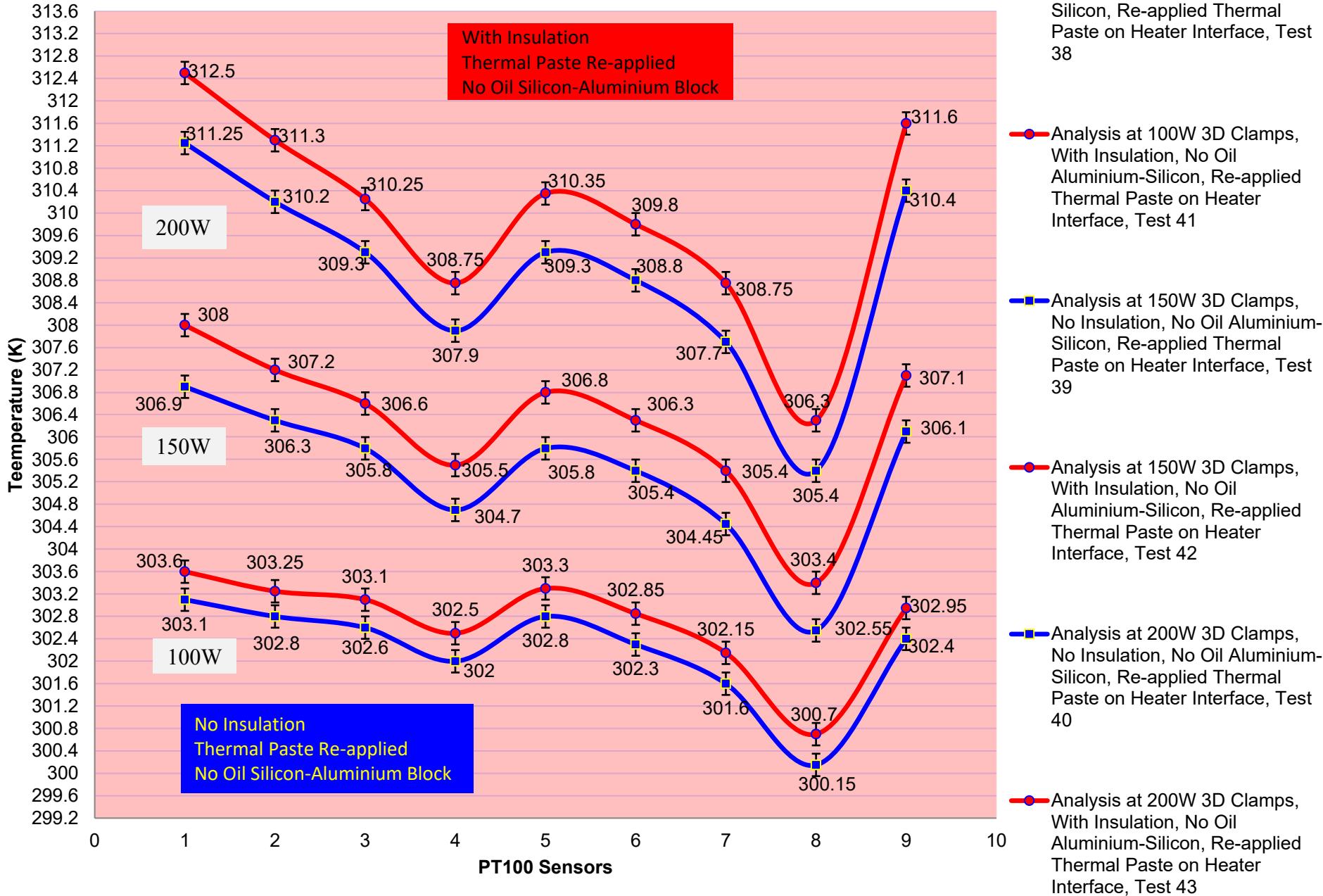
Analysis

- Analysis of the Thermal Contact Conductance (TCC) in every case
- Temperature comparison using different Power Inputs (100W, 150W & 200W)
- Temperature comparison using different fluids at the interface between the cartridge heater and the aluminium block and between the latter and the silicon crystal (Oil, Thermal Paste and Bare Surfaces)
- Effect of the flow rate on the temperatures (Pump speed 3[2l/min] and 5[20l/min])
- Measurement of the temperature Drop across 7mm of the top surface of the silicon crystal
- Temperature measurement at the front surface of the silicon crystal near the copper manifold
- Temperature measurement along the length of the Cartridge Heater
- Effect of the insulation with different Input Power (100W, 150W & 200W)
- Effect of clamping pressure on the TCC (15, 30, 45, 60, 75, 90N)
- Calculation of power loss by convection and radiation in every case

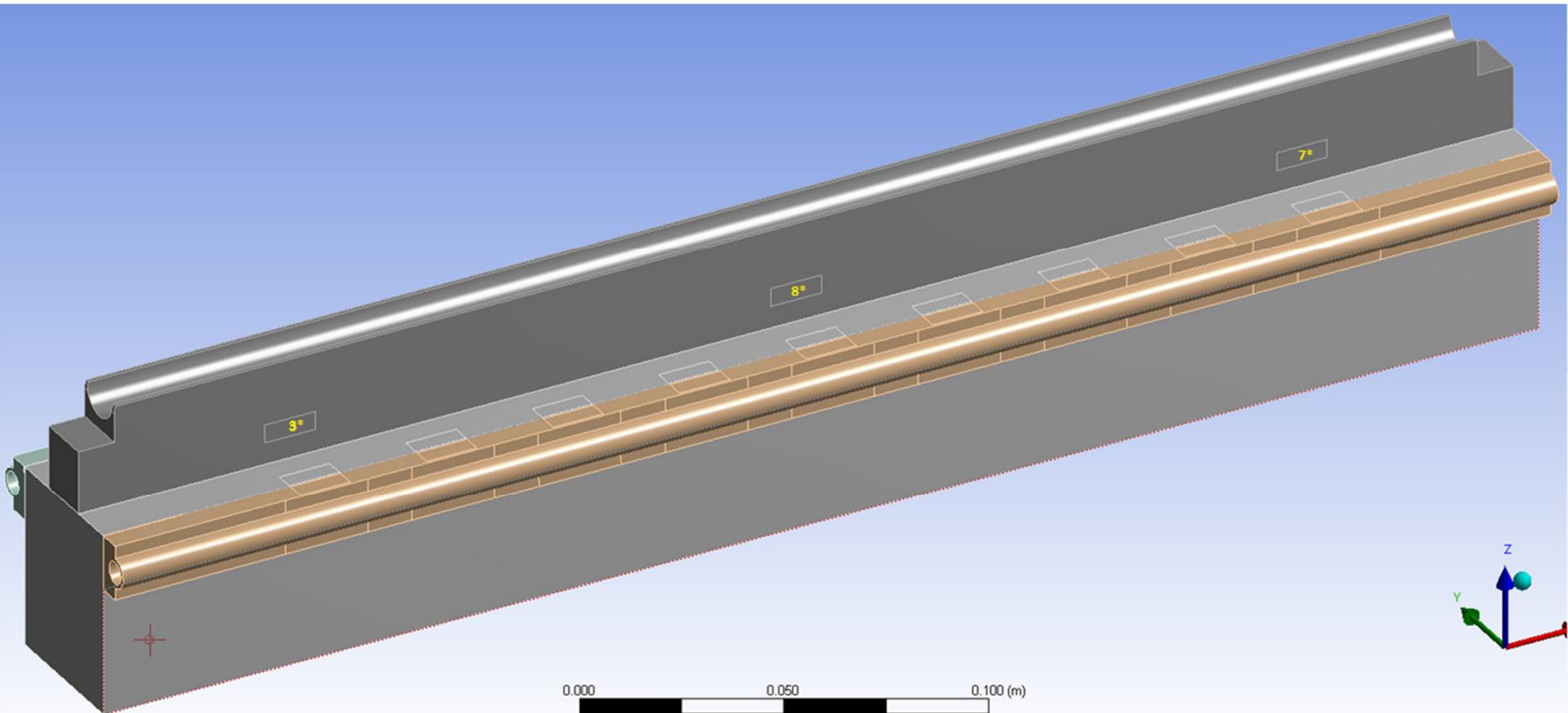
Temperature Along the Silicon Surface 45N



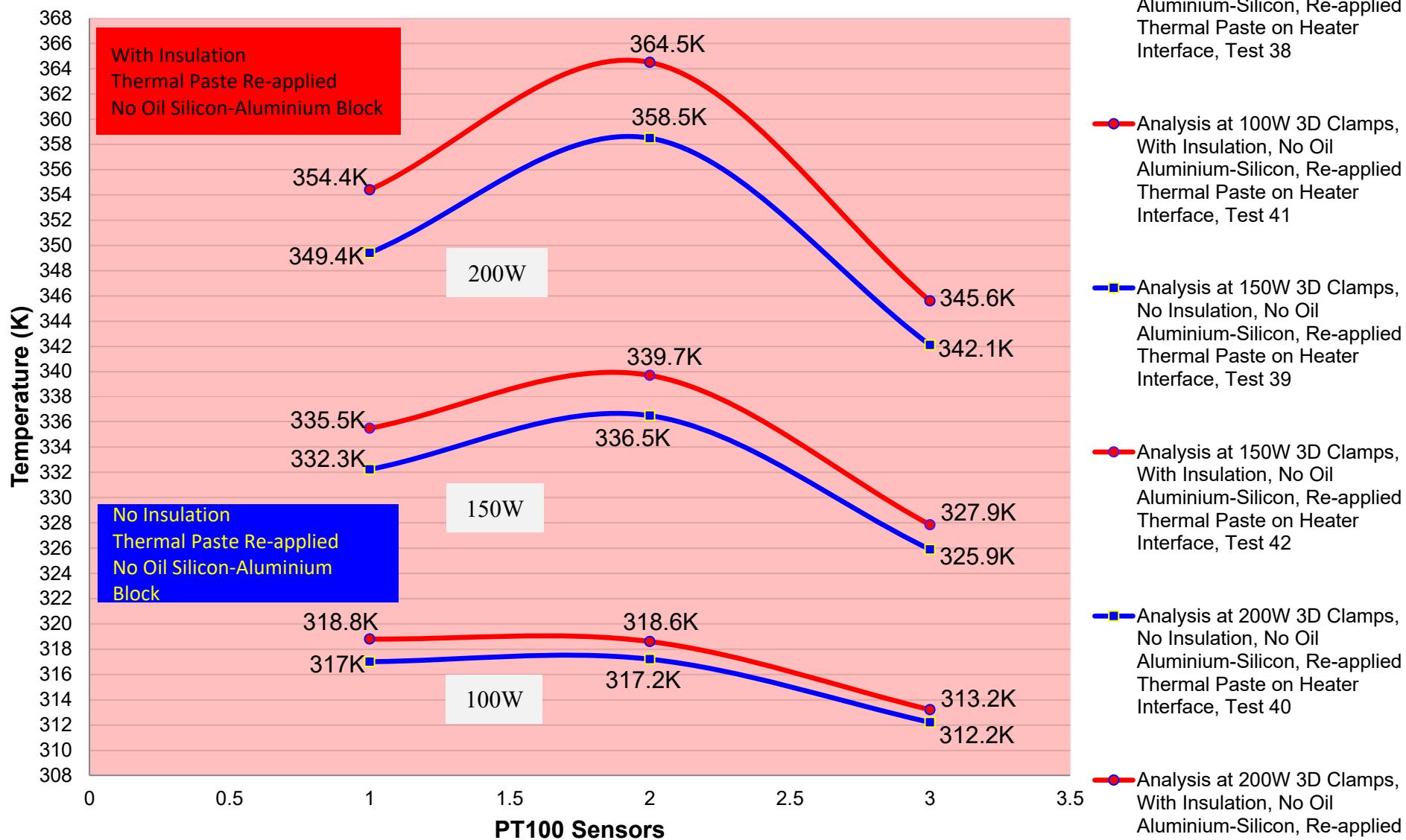
Temperature Along the Silicon Surface 45N



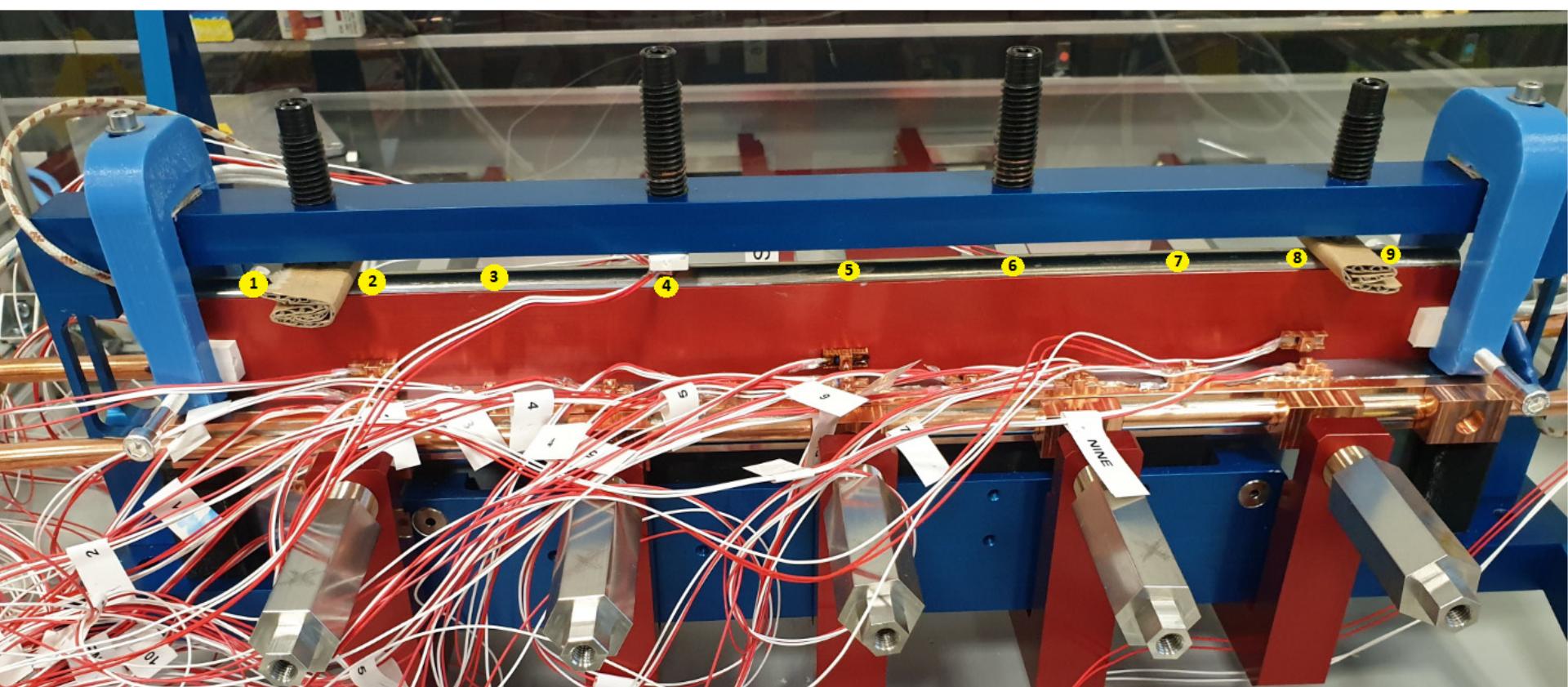
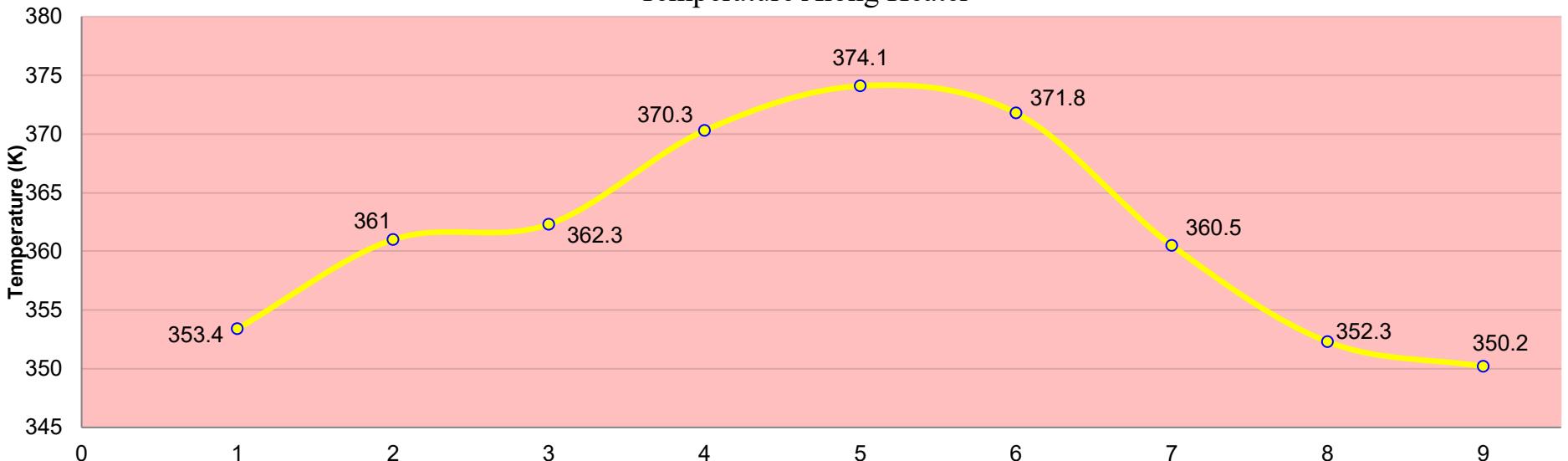
Aluminium Block Temperature 45N



Aluminium Block Temperature 45N

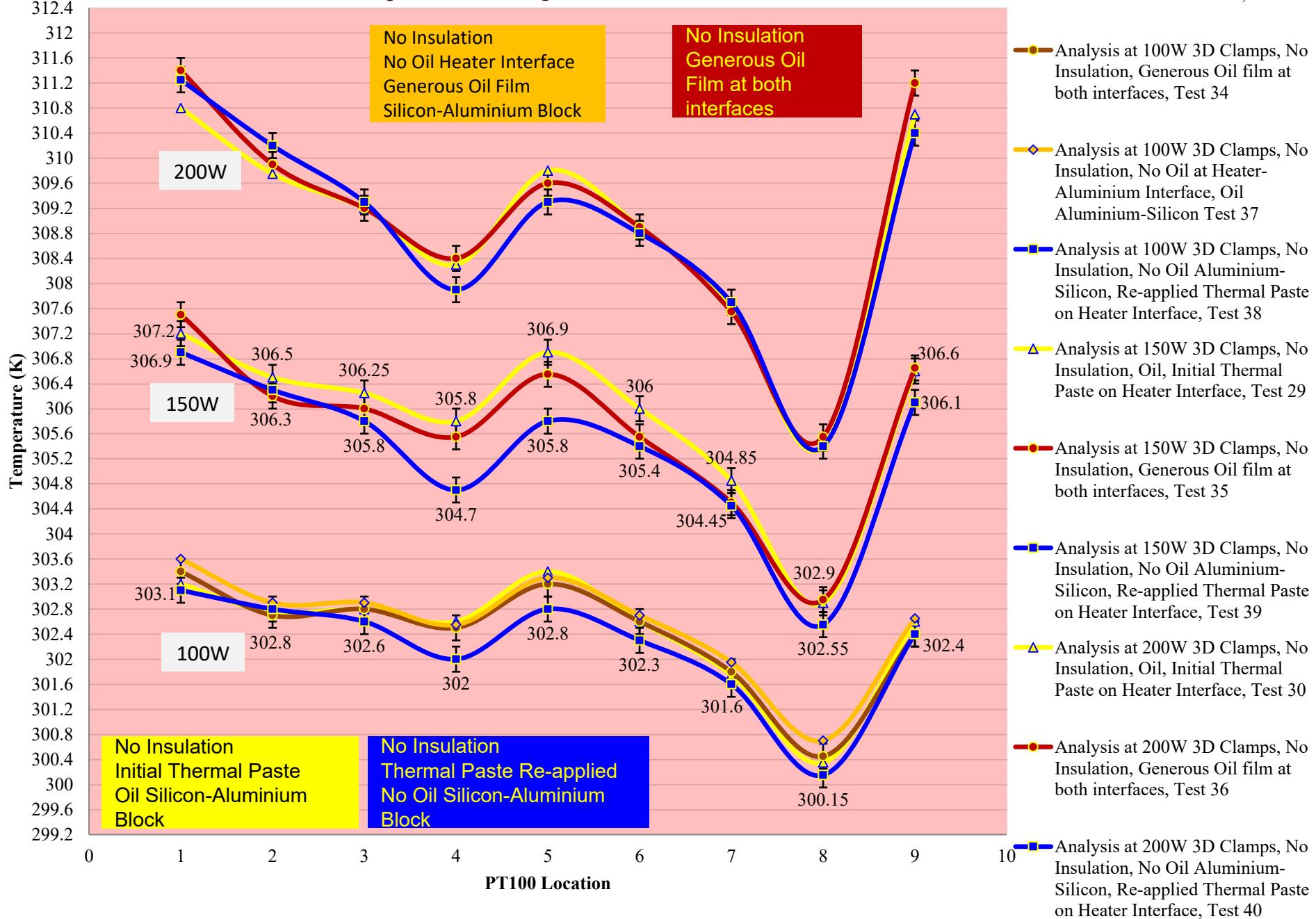


Temperature Along Heater



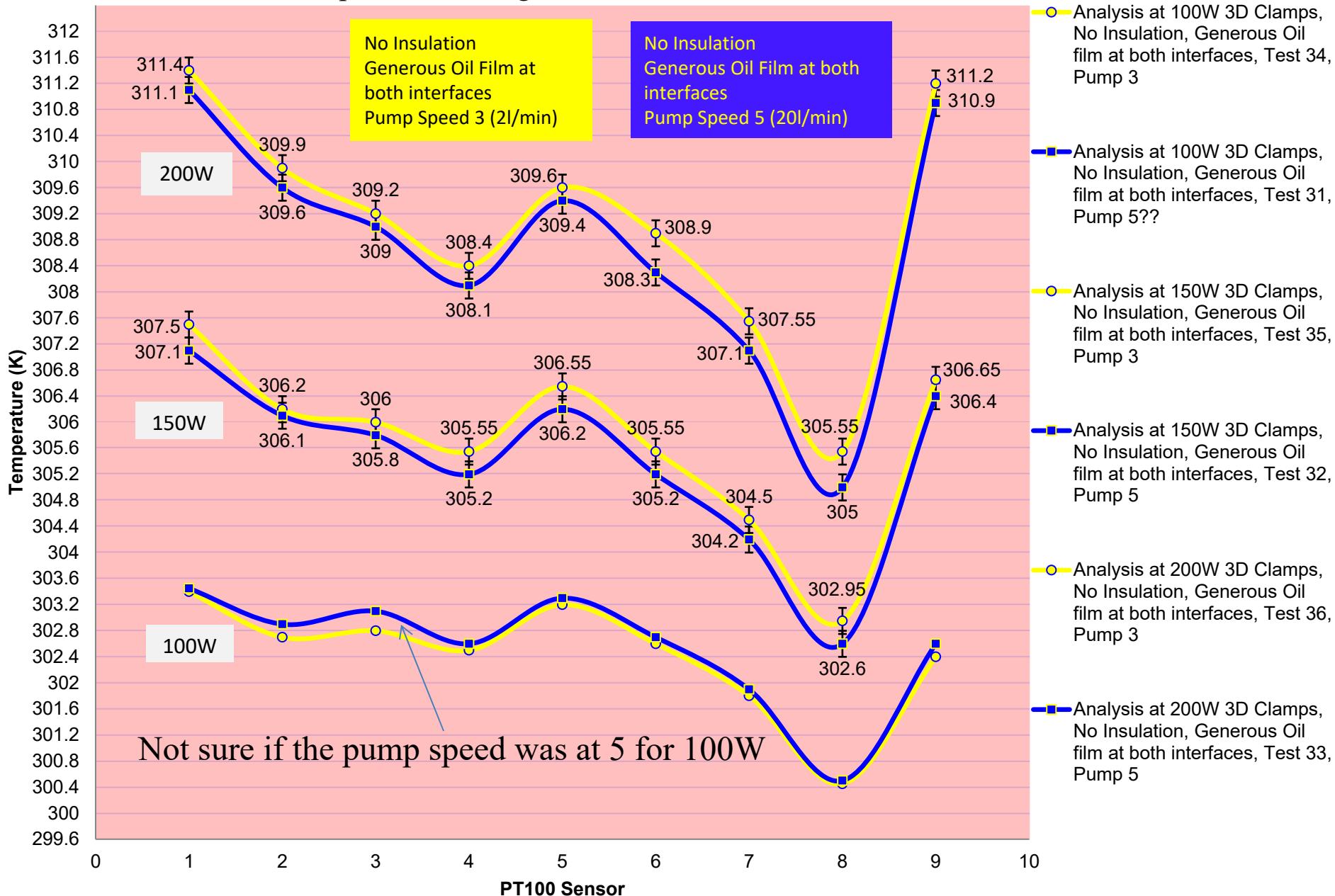
Using different fluids at both interfaces

Temperatures Along Silicon Surface 45N

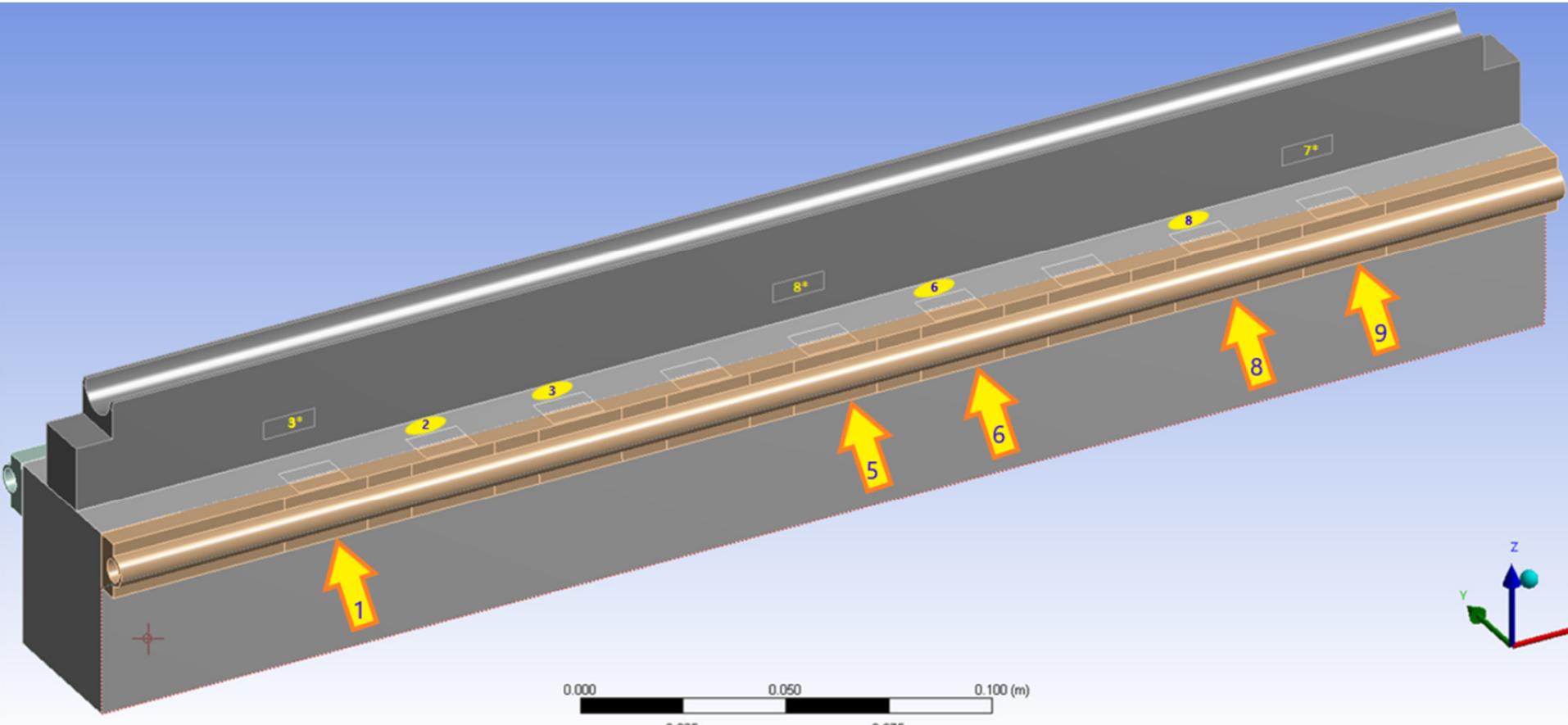


Water flow rate comparison

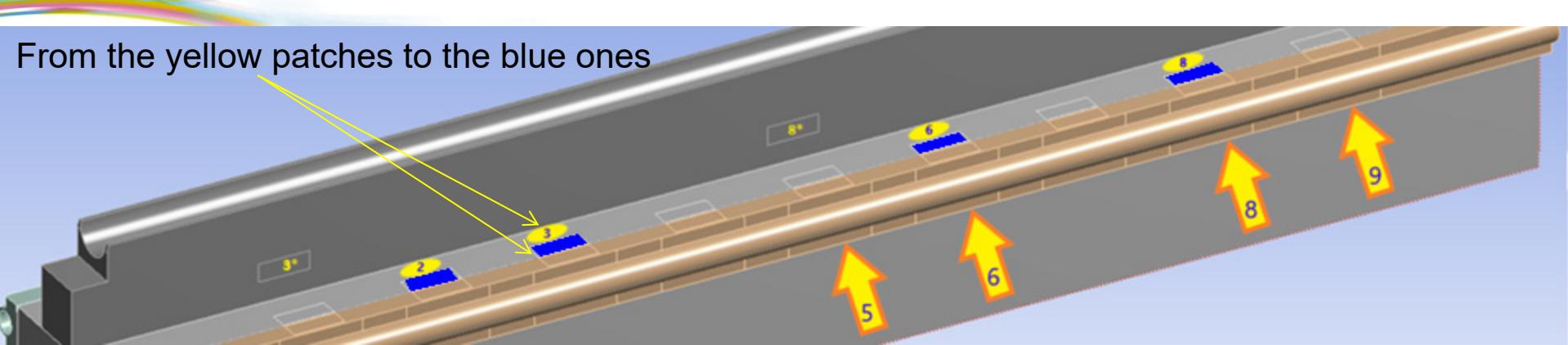
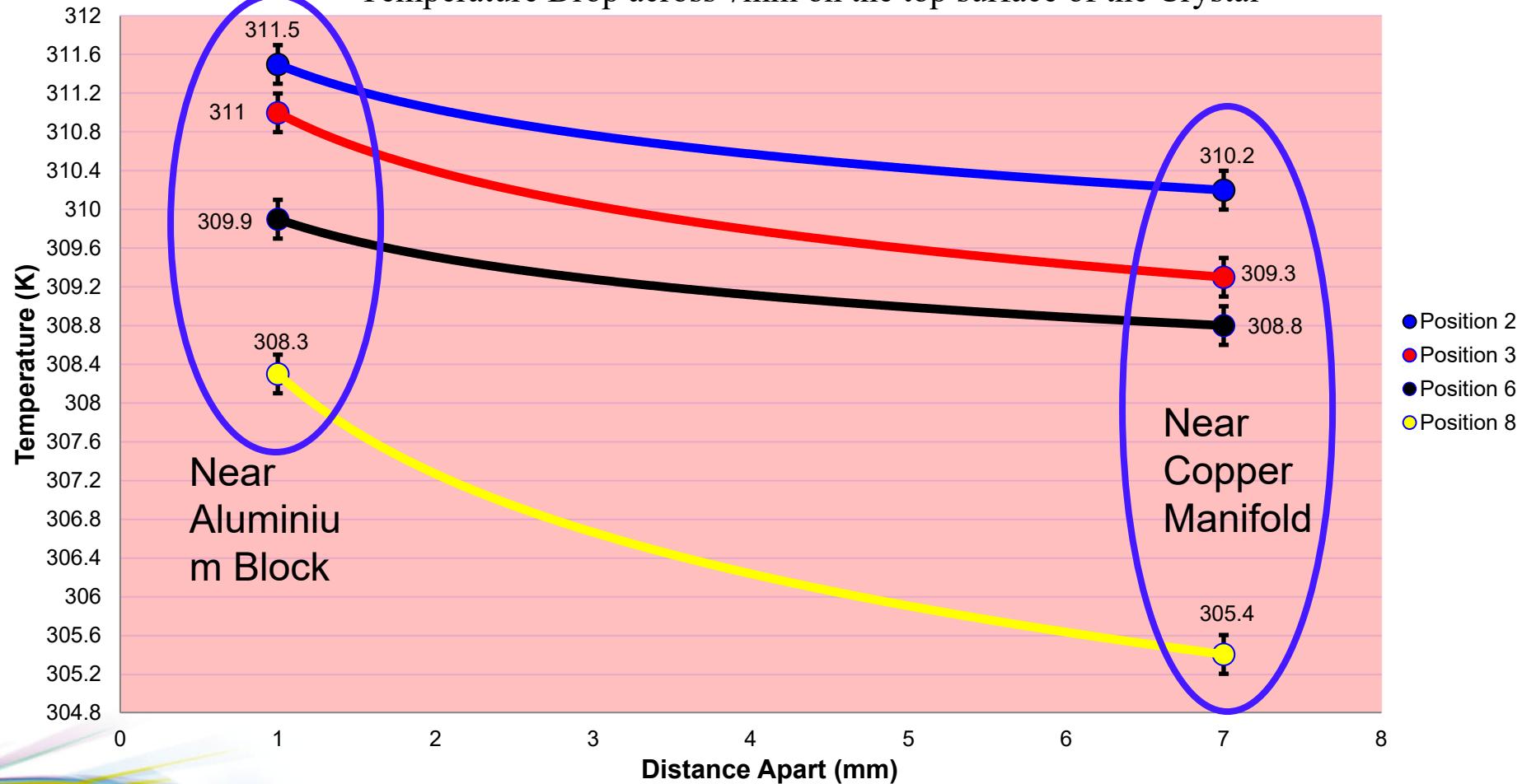
Temperatures Along Silicon Surface 45N



Temperature Comparison

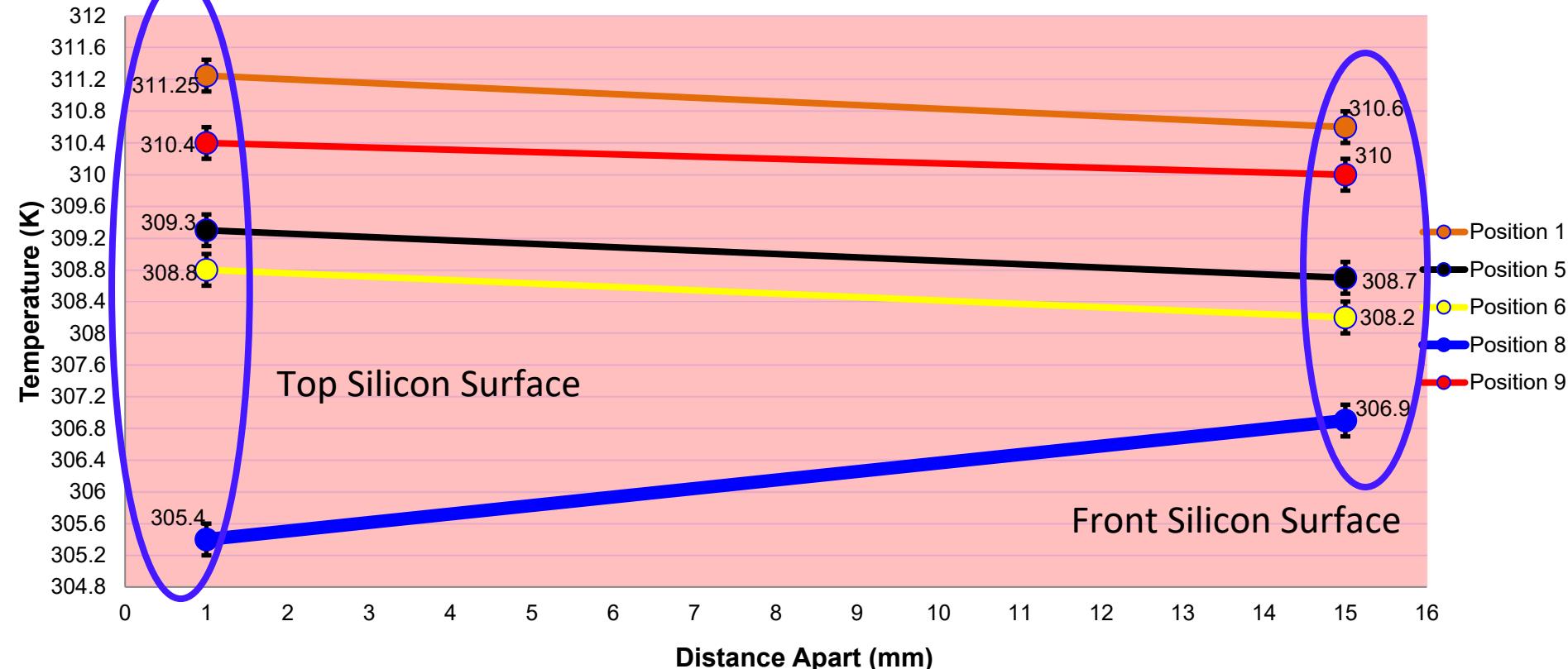


Temperature Drop across 7mm on the top surface of the Crystal

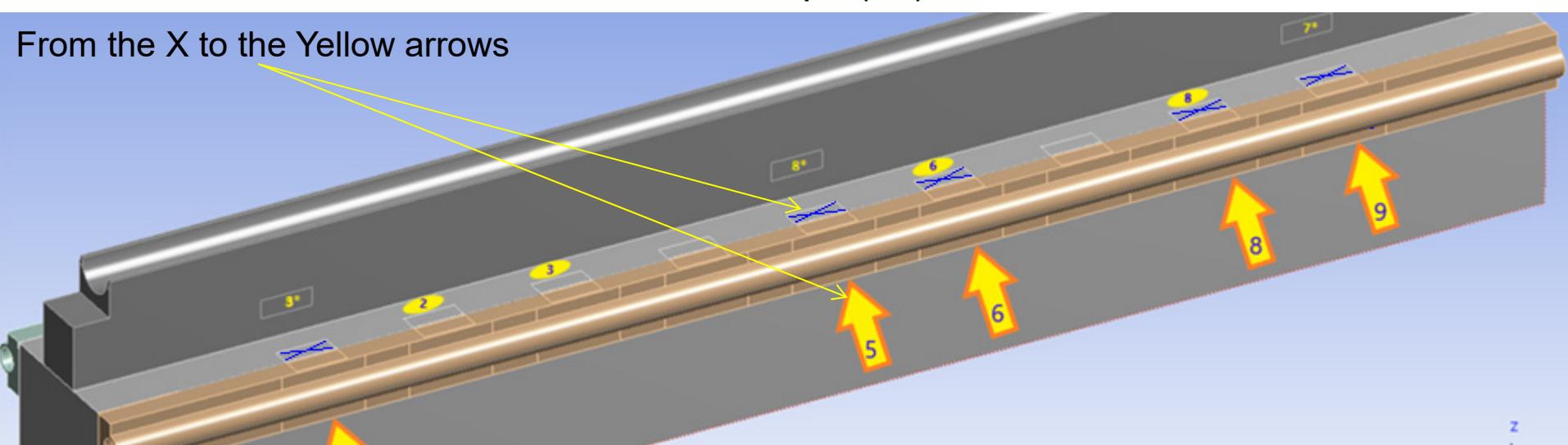


From the yellow patches to the blue ones

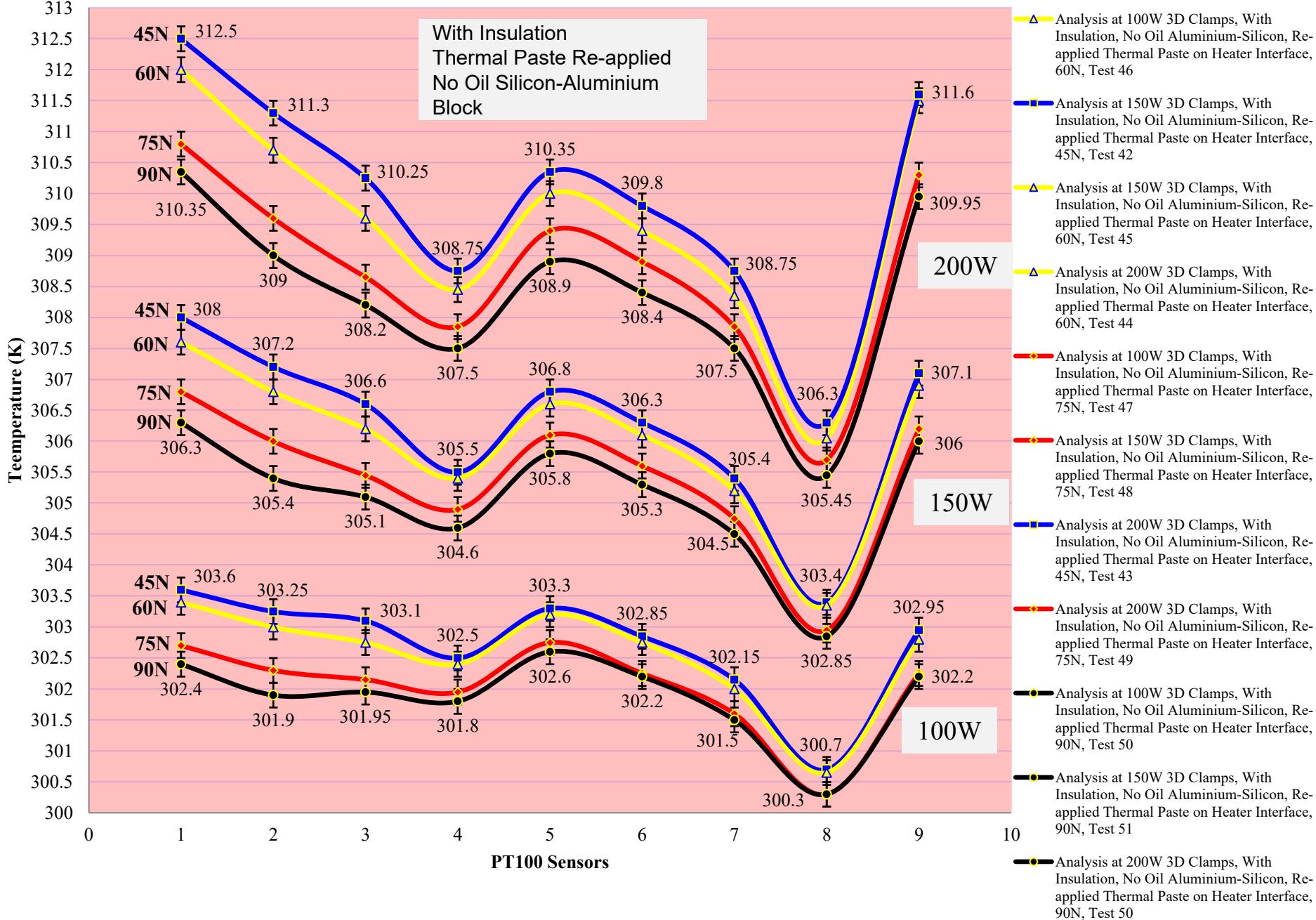
Temperature Drop Across the 15mm height of the Copper Manifold Footprint



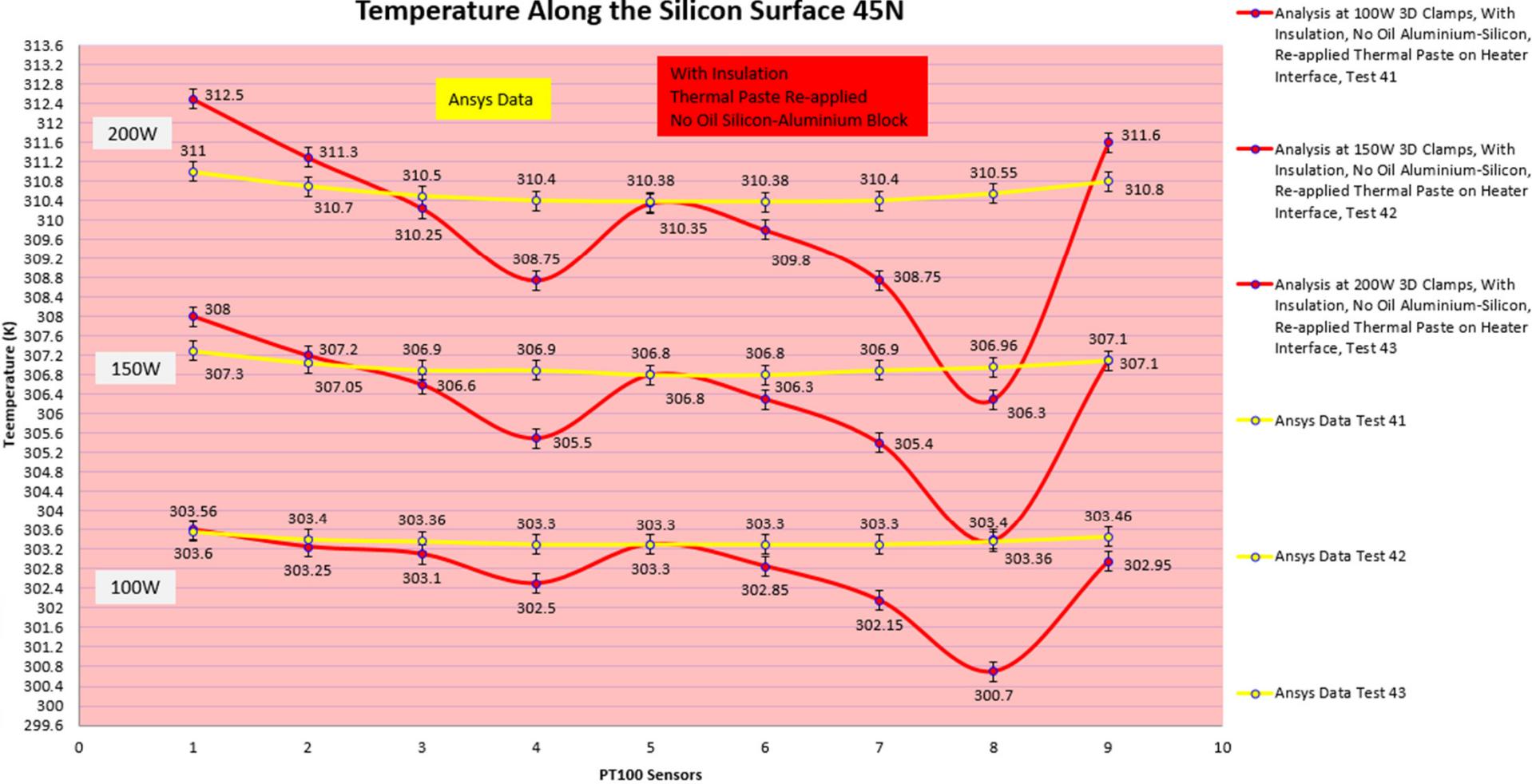
From the X to the Yellow arrows



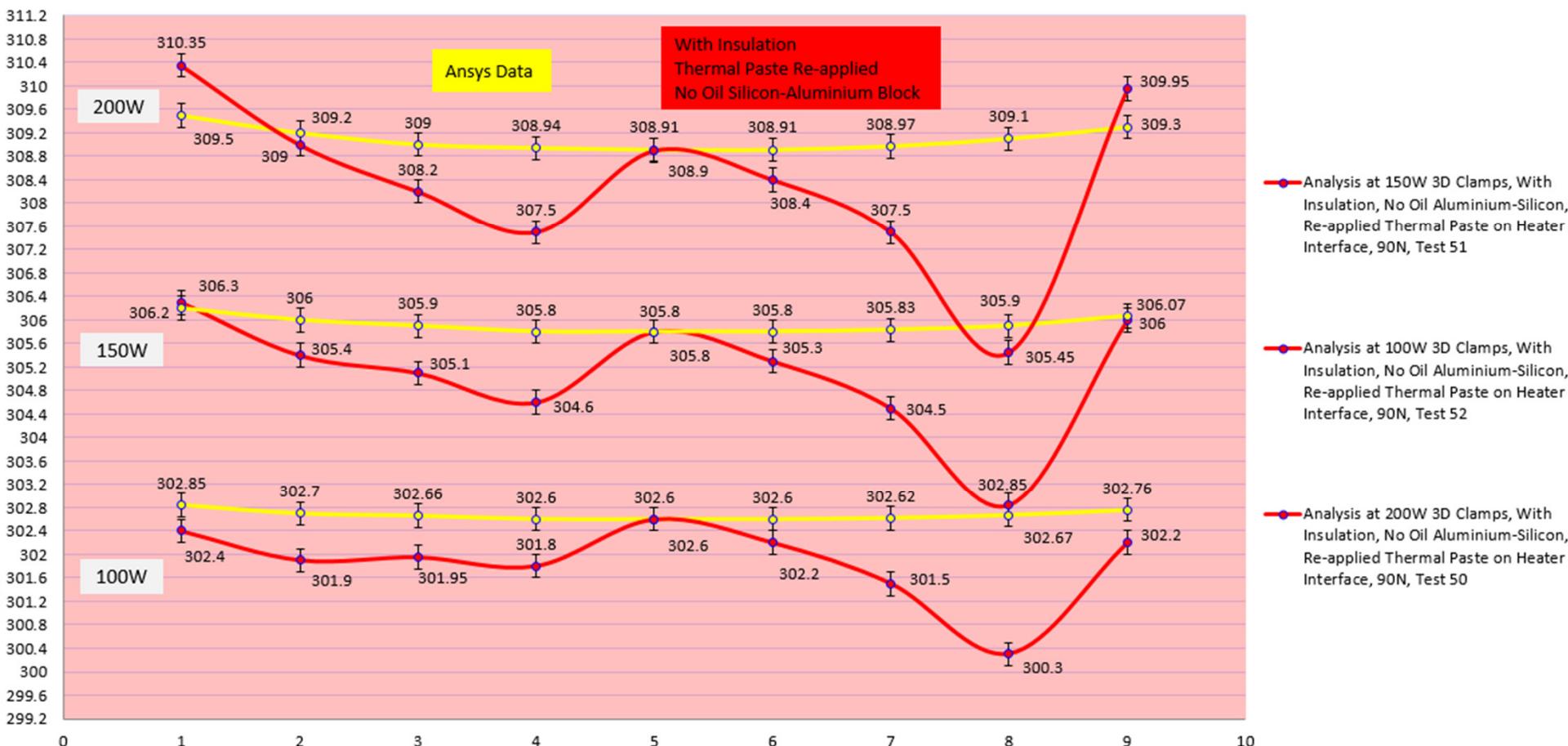
Temperature Along the Silicon Surface 45N vs 60, 75, 90N with 100W, 150W, 200W



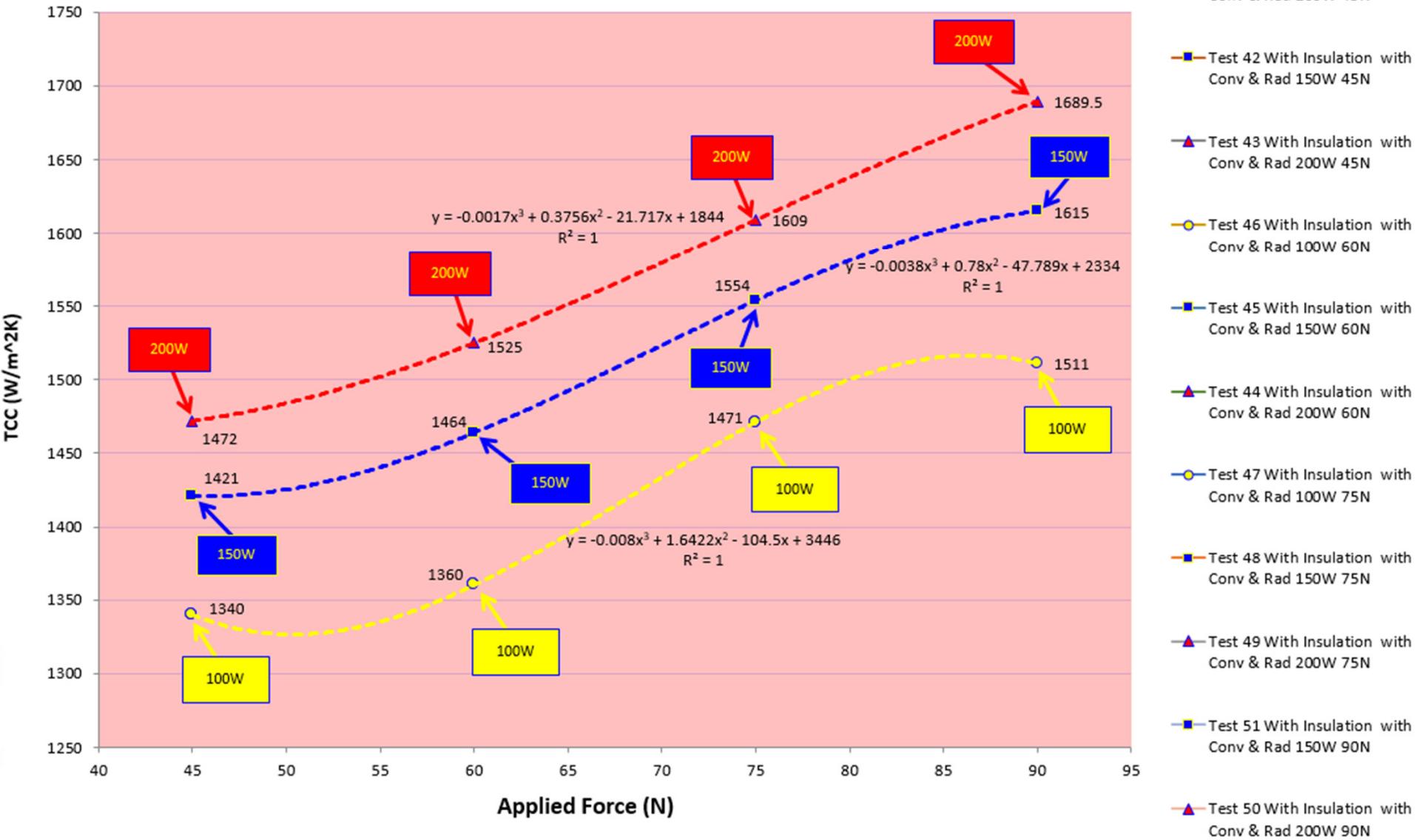
Temperature Along the Silicon Surface 45N



Temperature Along the Silicon Surface 90N



TCC Indium-Silicon



Thanks for listening

