



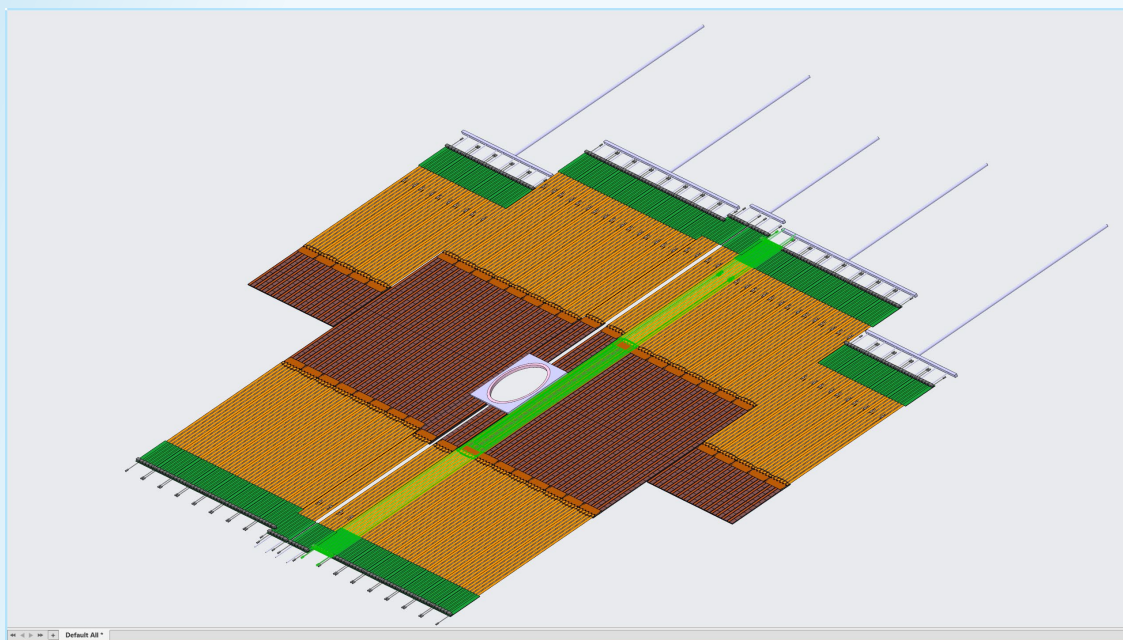
Mighty Tracker Stave FEA – Thermodynamic Analysis

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07/10/2026

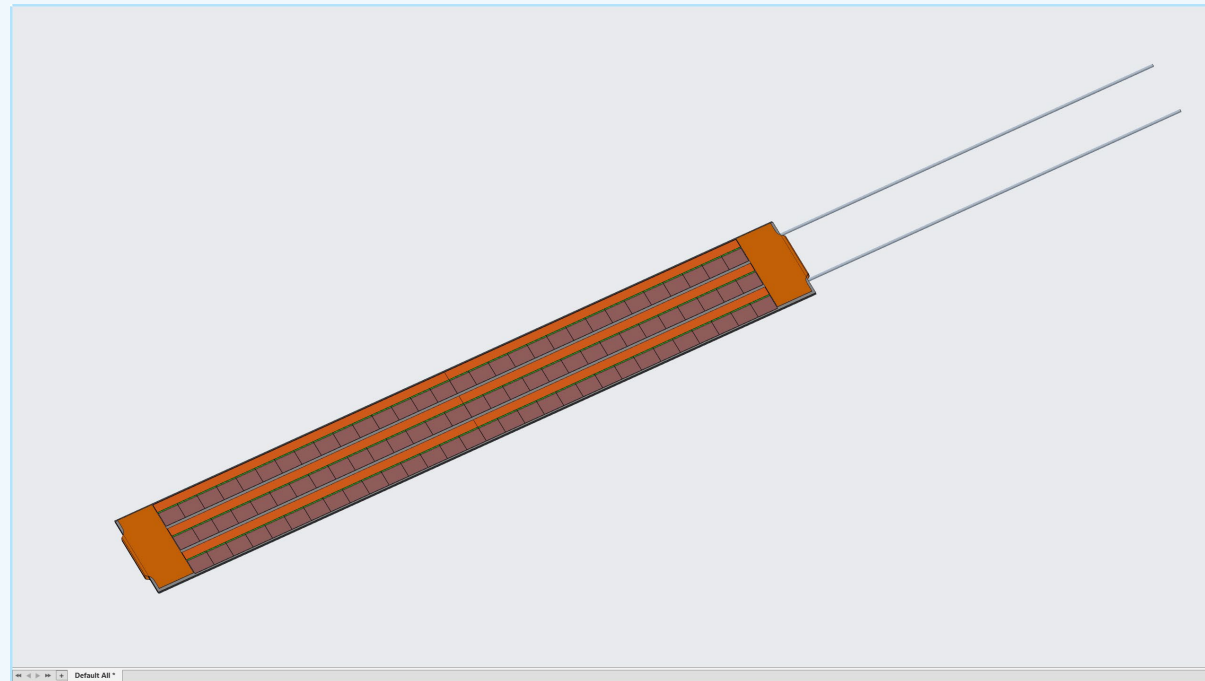
Scope

- This FEA analysis is about the effects of thermal loads on a unit of Might Tracker stave.
- The study is about a part as shown in the pictures



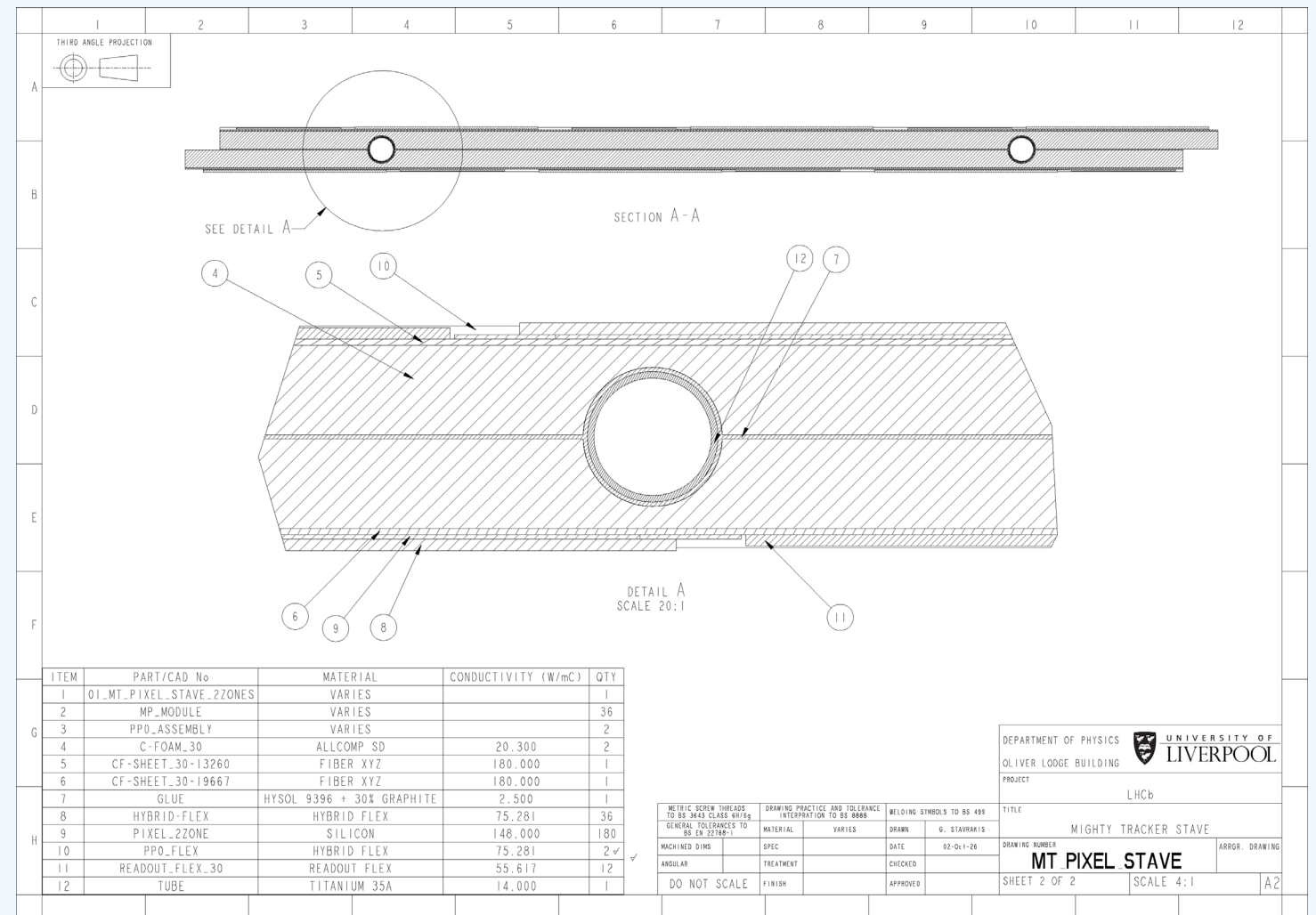
Scope

- The creo model is a simplified model of the stave.
- There are two studies, one for a sensor with 2 zones and one for a sensor with 3 zones.



Scope

- The same model is used for the two studies, with only the sensor type changes (2 zones and 3 zones).
- The materials are as shown in the section detail.
- The thermal conductivity of the materials is taken as previous studies.
- The thermal conductivity of Readout Flex and Hybrid Flex is calculated from the structure of the components.



Mesh control

- There is a difficulty for the mesh for the very thin parts with large surface as the glue. This causes the minimum temperature in results to show less than -30.
- Tube and Chip zones, have independent mesh control.

Details of "Glue Mesh" - Sizing

Scope	
Scoping Method	Named Selection
Named Selection	Glue
Definition	
Suppressed	No
Type	Element Size
☐ Element Size	1.0 mm
Advanced	
☐ Defeature Size	Default (0.5 mm)
☐ Growth Rate	Default (1.8)
Capture Curvature	Yes
☐ Curvature Normal Angle	Default (1.0472 rad)
☐ Local Min Size	Default (1.0 mm)
Capture Proximity	No

Details of "Tube Mesh" - Sizing

Scope	
Scoping Method	Geometry Selection
Geometry	1 Body
Definition	
Suppressed	No
Type	Element Size
☐ Element Size	5.0 mm
Advanced	
☐ Defeature Size	Default (1.395 mm)
☐ Growth Rate	Default (1.8)
Capture Curvature	Yes
☐ Curvature Normal Angle	Default (1.0472 rad)
☐ Local Min Size	Default (5.0 mm)
Capture Proximity	No

Details of "Pixel Matrix Mesh" - Sizing

Scope	
Scoping Method	Named Selection
Named Selection	Pixel Matrix Zone 180 Bodies
Definition	
Suppressed	No
Type	Element Size
☐ Element Size	1.0 mm
Advanced	
☐ Defeature Size	0.1 mm
☐ Growth Rate	Default (1.8)
Capture Curvature	Yes
☐ Curvature Normal Angle	Default (1.0472 rad)
☐ Local Min Size	Default (1.0 mm)
Capture Proximity	No



FEA Thermal Analysis Basic Chip

Pixel Matrix – Digital Periphery



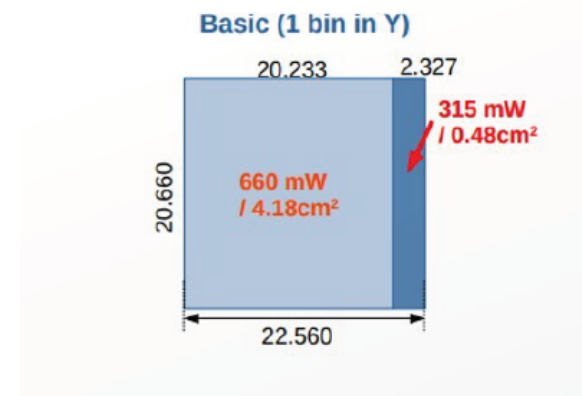
Thermal Loads

- Initial temperature is 22 C.
- The -30 C is a temperature load applied inside the tube.
- The thermal loads for the chip are applied as heat flux load on each zone surface.
- There are 90 chips on top, 90 on bottom, with 2 zones each chip.

Thermal Loads

The thermal loads for this case are

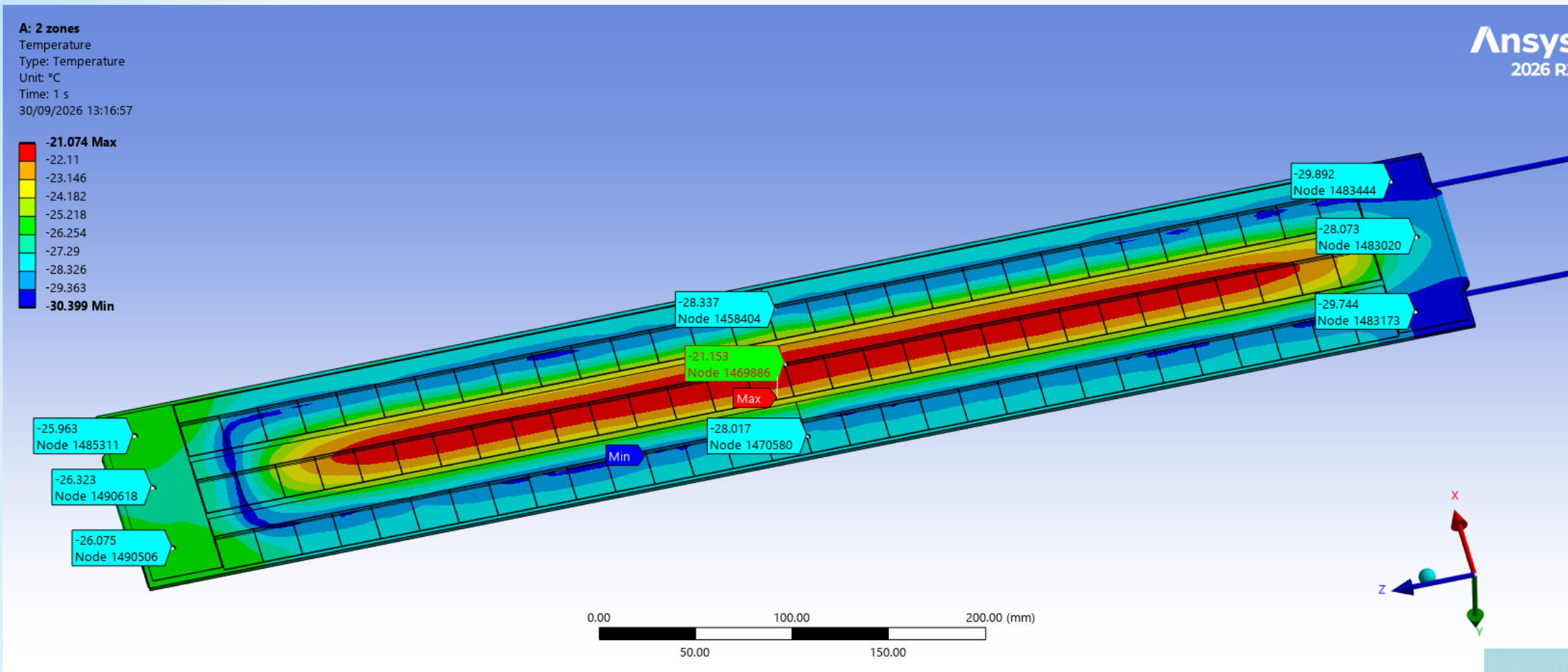
- **0.158 W/cm²** for Pixel Matrix area
- **0.656 W/cm²** for Digital Periphery
- **-30 C** inside tube



$$PM1 := 660 \frac{mW}{4.18 \text{ cm}^2} = 0.158 \frac{W}{\text{cm}^2}$$

$$DP1 := 315 \frac{mW}{0.48 \text{ cm}^2} = 0.656 \frac{W}{\text{cm}^2}$$

Results – Temperature (min, max, 9 points)



Results – Heat flux

A: 2 zones

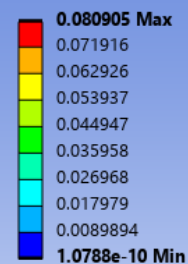
Total Heat Flux

Type: Total Heat Flux

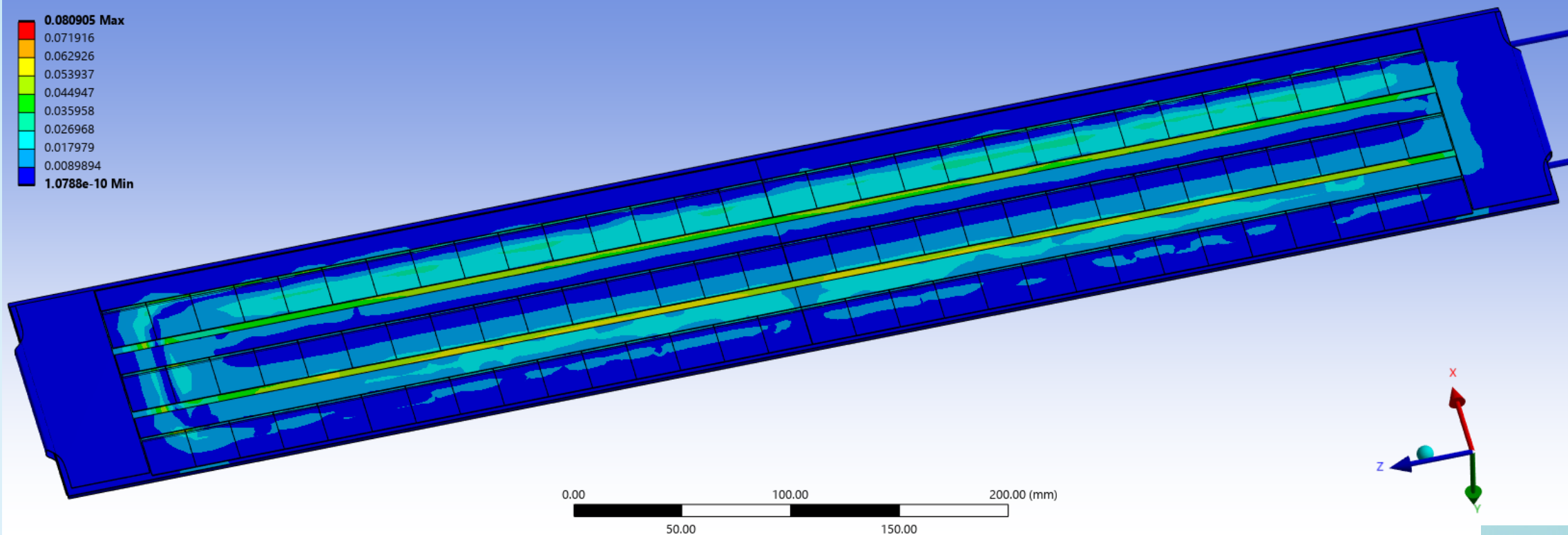
Unit: W/mm²

Time: 1 s

01/10/2026 14:48:57



Ansys
2026 R1





FEA Thermal Analysis Advanced Chip

Pixel Matrix – Digital Periphery - PPL

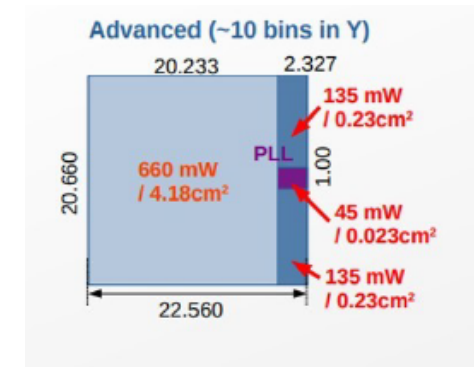
Thermal Loads

- Initial temperature is 22 C.
- The -30 C is a temperature load applied inside the tube.
- The thermal loads for the chip are applied as heat flux load on each zone surface.
- There are 90 chips on top, 90 on bottom, with 4 zones each chip (there are 2 DP zones per chip)

Thermal Loads

The thermal loads for this case are

- **0.158 W/cm²** for Pixel Matrix area
- **0.587 W/cm²** for Digital Periphery
- **1.957 W/cm²** for PPL
- **-30 C** inside tube

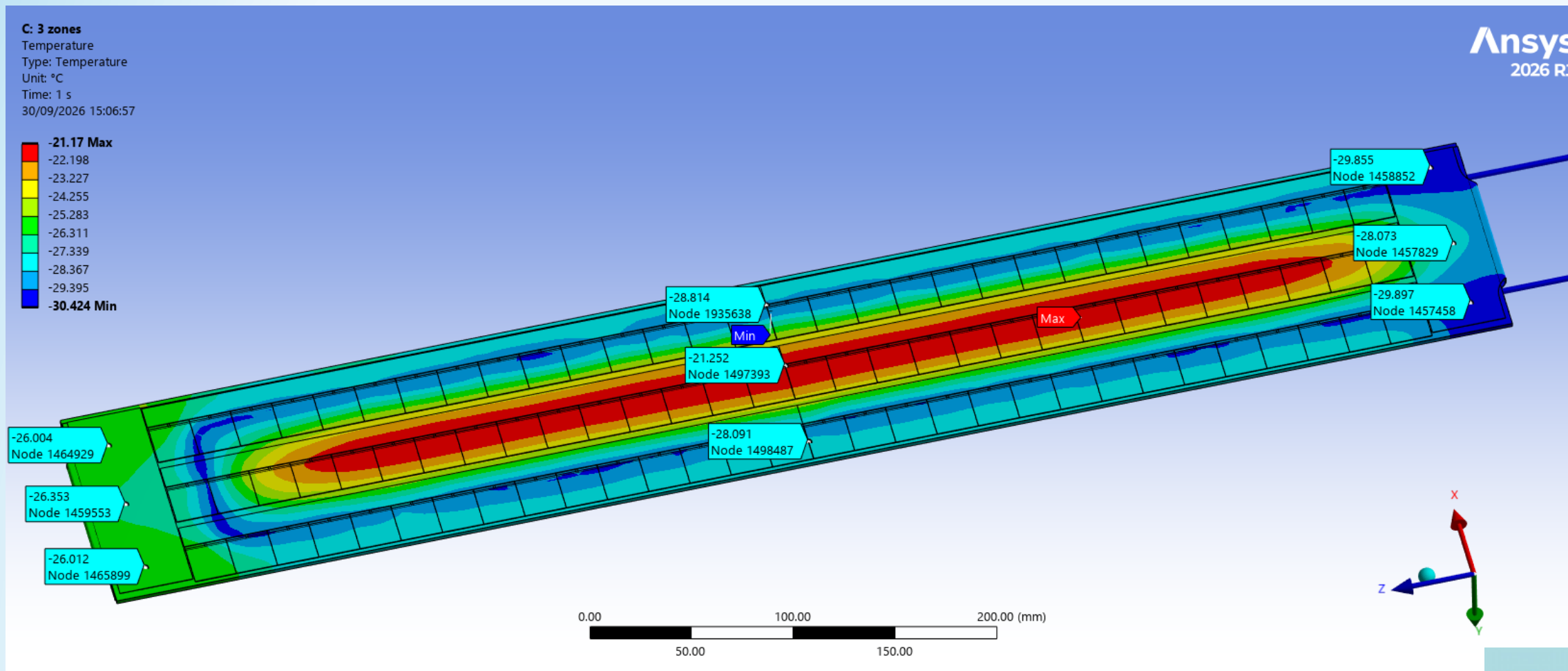


$$PM2 := 660 \frac{mW}{4.18 \text{ cm}^2} = 0.158 \frac{W}{\text{cm}^2}$$

$$DP2 := 135 \frac{mW}{0.23 \text{ cm}^2} = 0.587 \frac{W}{\text{cm}^2}$$

$$PPL := 45 \frac{mW}{0.023 \text{ cm}^2} = 1.957 \frac{W}{\text{cm}^2}$$

Results – Temperature (min, max, 9 points)



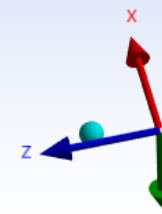
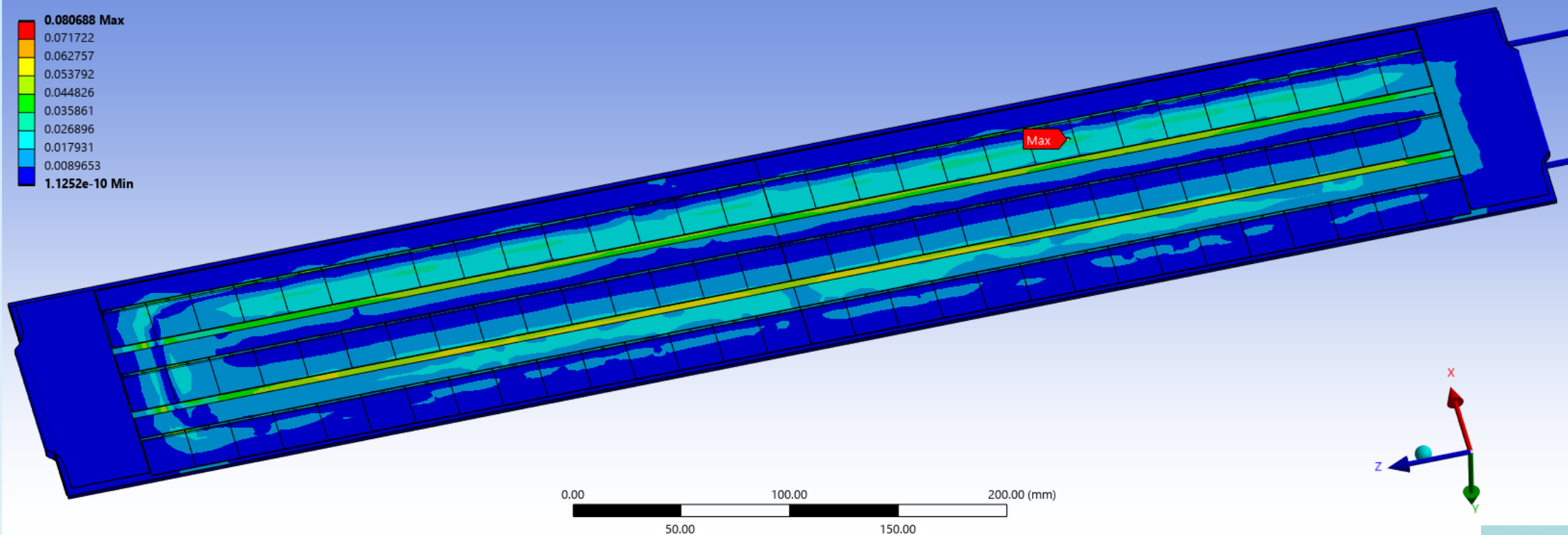
Results – Heat Flux

C: 3 zones

Total Heat Flux
Type: Total Heat Flux
Unit: W/mm²
Time: 1 s
01/10/2026 15:11:38

Ansys
2026 R1

0.080688 Max
0.071722
0.062757
0.053792
0.044826
0.035861
0.026896
0.017931
0.0089653
1.1252e-10 Min





Summary

Summary

The results from the two analyses are summarised in the table below.

[-] Output Parameters			
[-] 🔥 2 zones (A1)			
📍 P1	Temperature Maximum	-21.074	C
📍 P2	Temperature Average	-26.751	C
📍 P3	Total Heat Flux Maximum	8.0905	W cm ⁻²
📍 P4	Total Heat Flux Average	0.77451	W cm ⁻²

[-] Output Parameters			
[-] 🔥 3 zones (C1)			
📍 P9	Temperature Maximum	-21.17	C
📍 P10	Temperature Average	-26.765	C
📍 P11	Total Heat Flux Maximum	8.0688	W cm ⁻²
📍 P12	Total Heat Flux Average	0.77692	W cm ⁻²

Summary

The reference temperature for ΔT is -30 C.

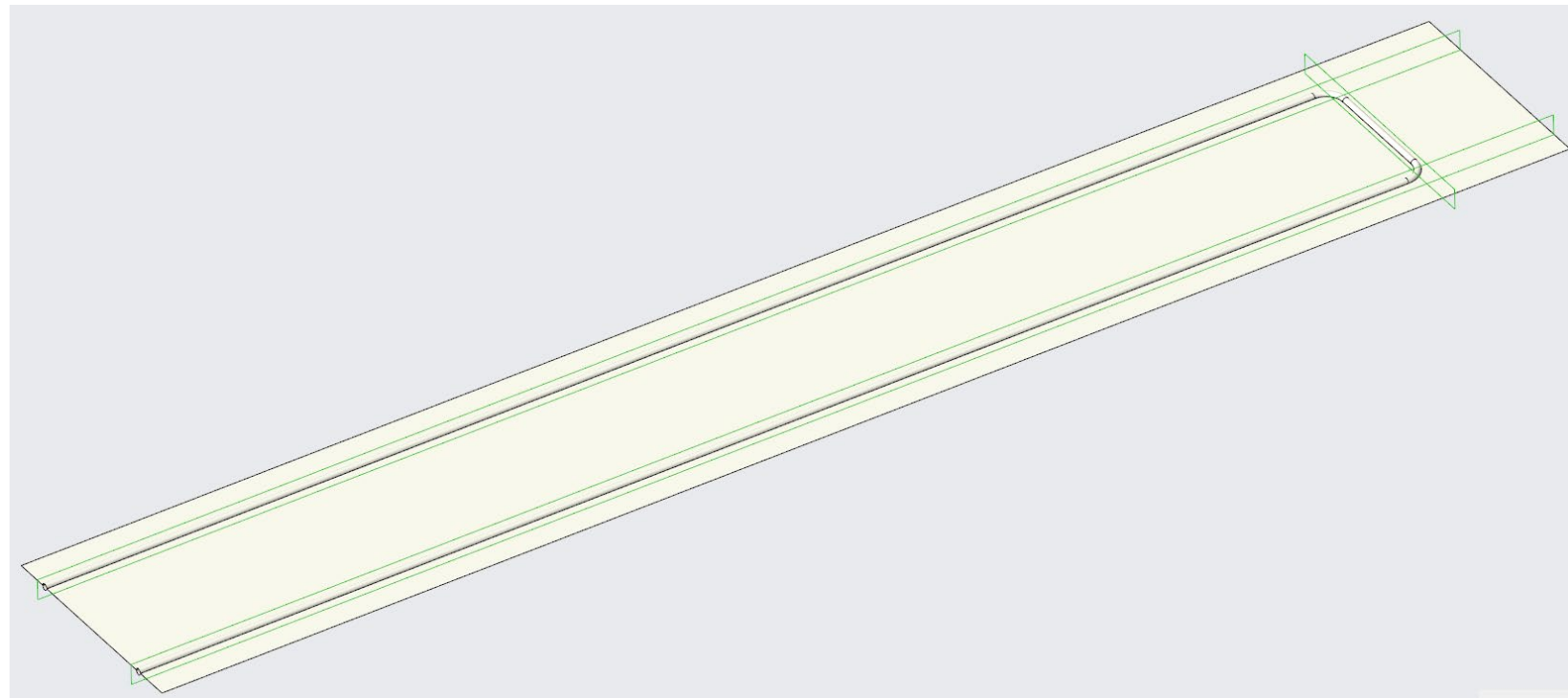
Case		Thermal Loads W/cm2		ΔT (Max) C	ΔT (Average) C
1	Basic Chip Total power consumption 0.975W	Pixel Matrix	0.158	8.93	3.25
		Digital Periphery	0.656		
2	Advanced Chip Total power consumption 0.975W	Pixel Matrix	0.158	8.83	3.24
		Digital Periphery	0.587		
		PPL	1.957		



Next Step

Parametric design of tube position

- The shape and position of the tube and the glue that covers the tube, is controlled by three datum planes. Glue/Tube Head, Glue/Tube Side1 and Glue/Tube Side2.
- Those parameters are transferred in ANSYS and can be changed from there to create scenarios about shape and position of the tube



Parametric design of tube position

The numbers shown on the right, define the original shape and position of the tube as it is now.

Outline of Schematic A8: Parameters				
	A	B	C	D
1	ID	Parameter Name	Value	Unit
2	 Input Parameters			
3	 2 zones (A1)			
4	 P13	DS_TUBE_HEAD	292.9	
5	 P14	DS_TUBE_SIDE1	36.79	
6	 P15	DS_TUBE_SIDE2	36.79	
7	 P16	DS_GLUE_HEAD	292.9	
8	 P17	DS_GLUE_SIDE1	36.79	
9	 P18	DS_GLUE_SIDE2	36.79	
*	 New input parameter	New name	New expression	
11	 Output Parameters			
12	 2 zones (A1)			
13	 P1	Temperature Maximum	-21.074	C
14	 P2	Temperature Average	-26.751	C
15	 P3	Total Heat Flux Maximum	8.0905	W cm ⁻²
16	 P4	Total Heat Flux Average	0.77449	W cm ⁻²
*	 New output parameter		New expression	
18	Charts			