Mini stave Thermal Finite Element Analysis

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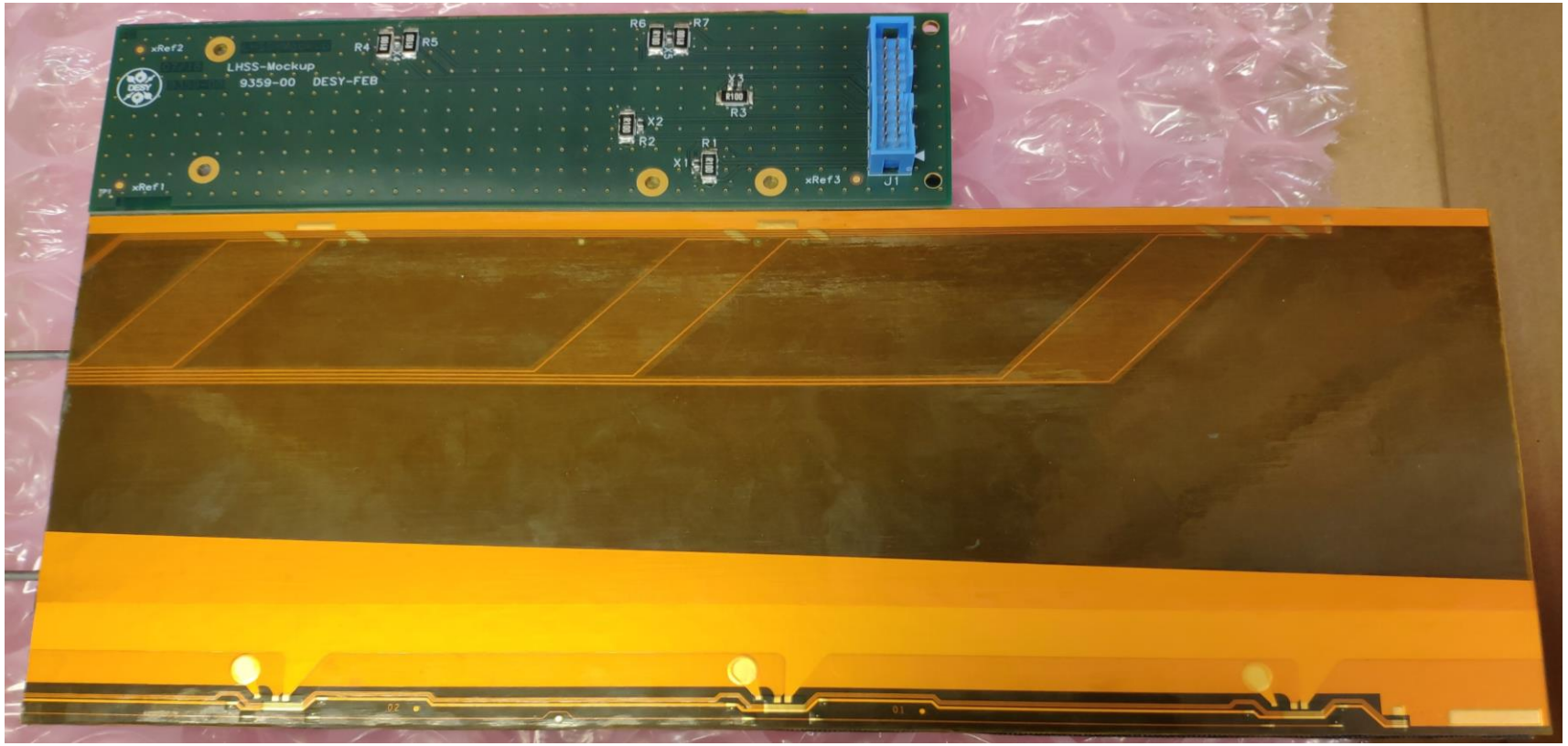
Mini stave with dummy PCB

Features: A 3-module long stave ~300 mm, design is similar to the normal 14-module stave
Two dummy PCBs glued on EOS card region
Seven resistors (~0.1 ohm) and five thermistors on each PCB
Resistors are used for simulating heat dissipation from chips on PCB

Objective: Do measurements using IR imaging and compare with FEA simulation

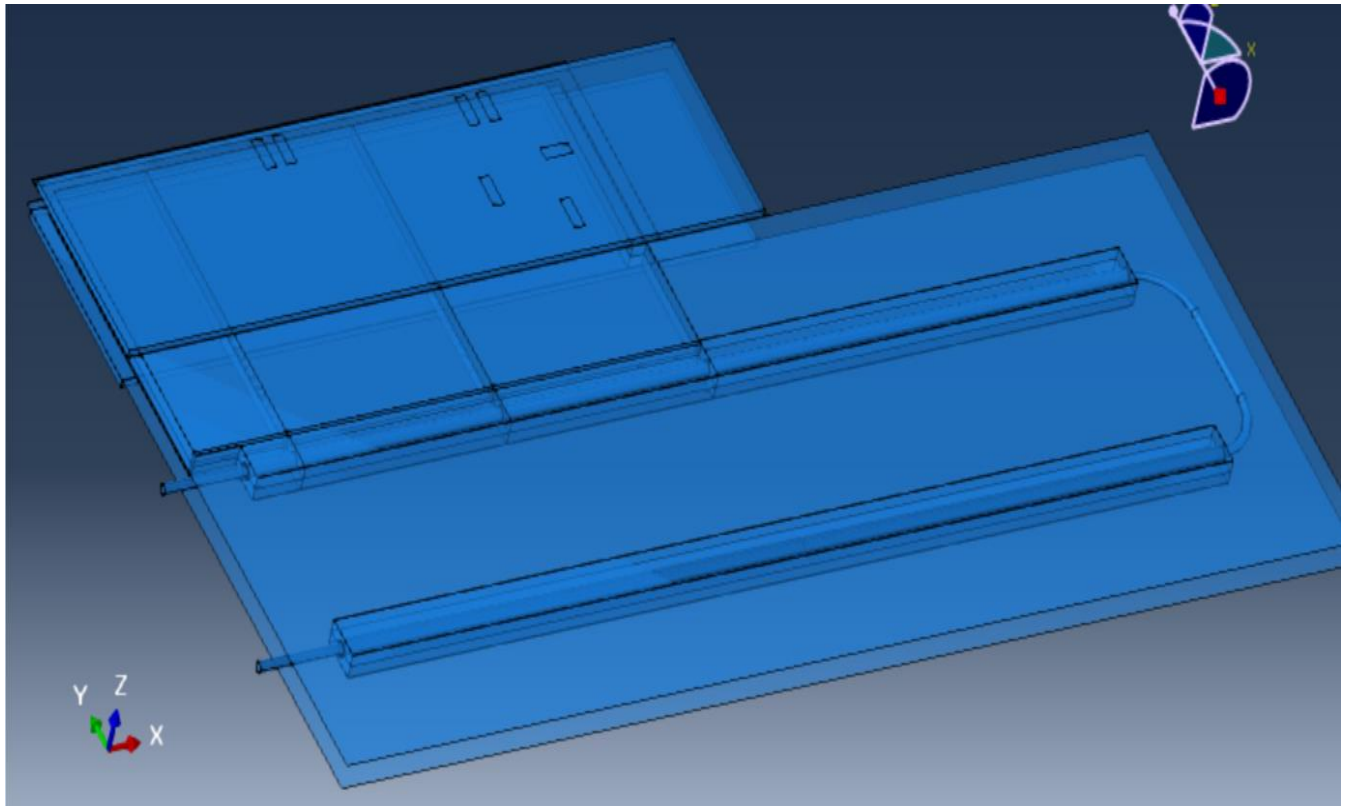


What is Finite Element Analysis (FEA)?

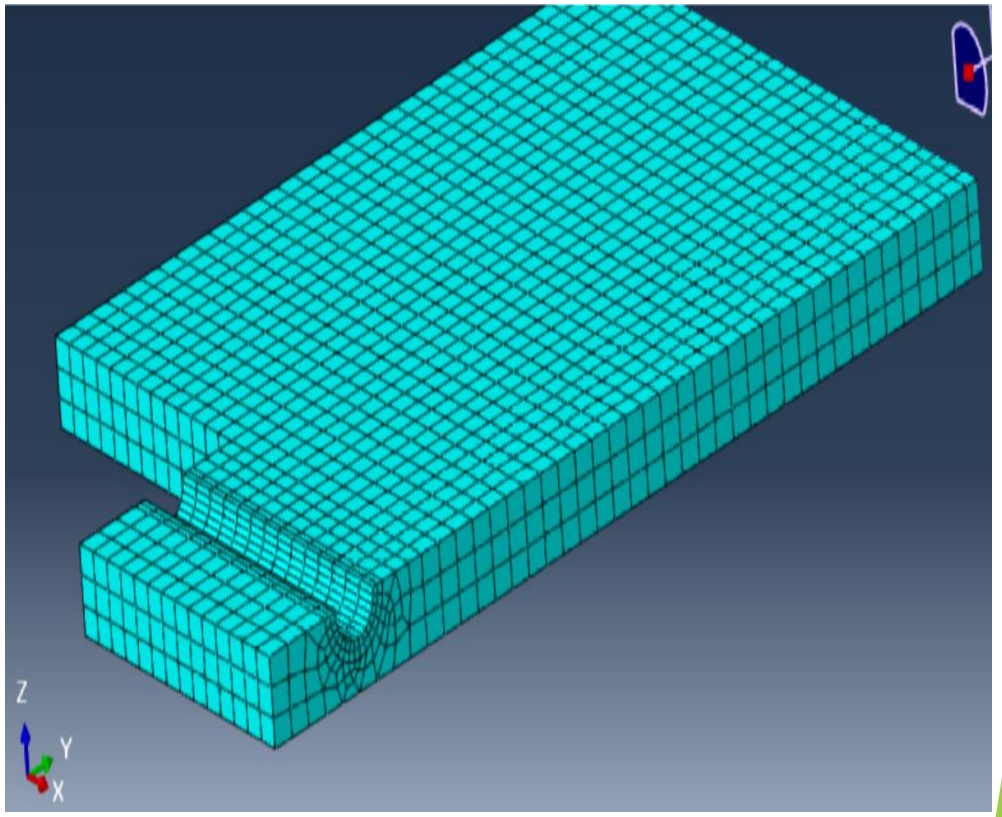
FEA is a simulation method first developed in 19th century which is now widely used in civil engineering and aerospace. FEA gives the prediction of how a part behaves under given conditions. For example, it offers numerical approach to heat diffusion problems governed by complicated partial differential equations.

Mesh, consisting of minions of fine elements, is the fundamental of FEA simulation. Each element is calculated separately and then combined together to give final result of a model.

Mini stave Model



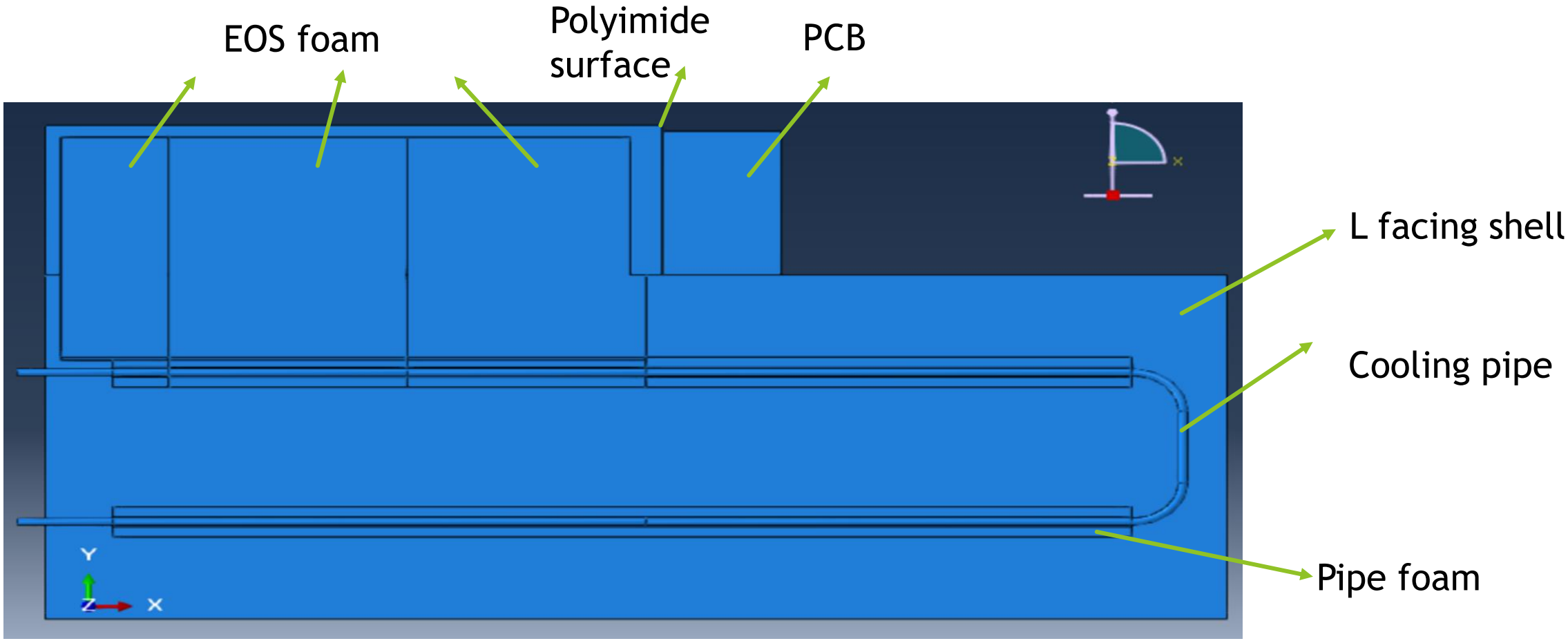
U-bend foam and bus tape currently are not included



One “meshed” EOS foam
Element size ~1mm^3

Mini stave Model

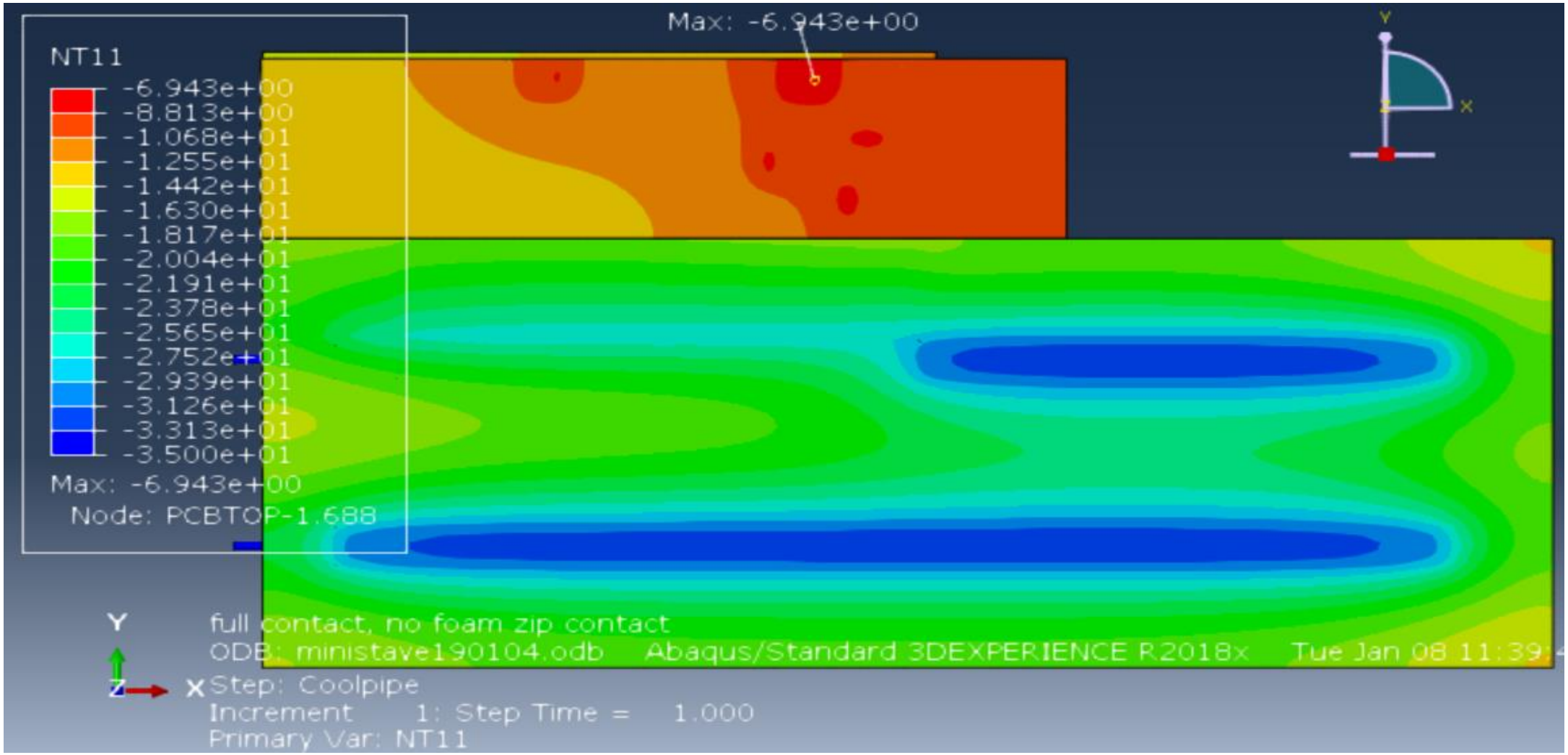
Parts are modeled individually then assembled together



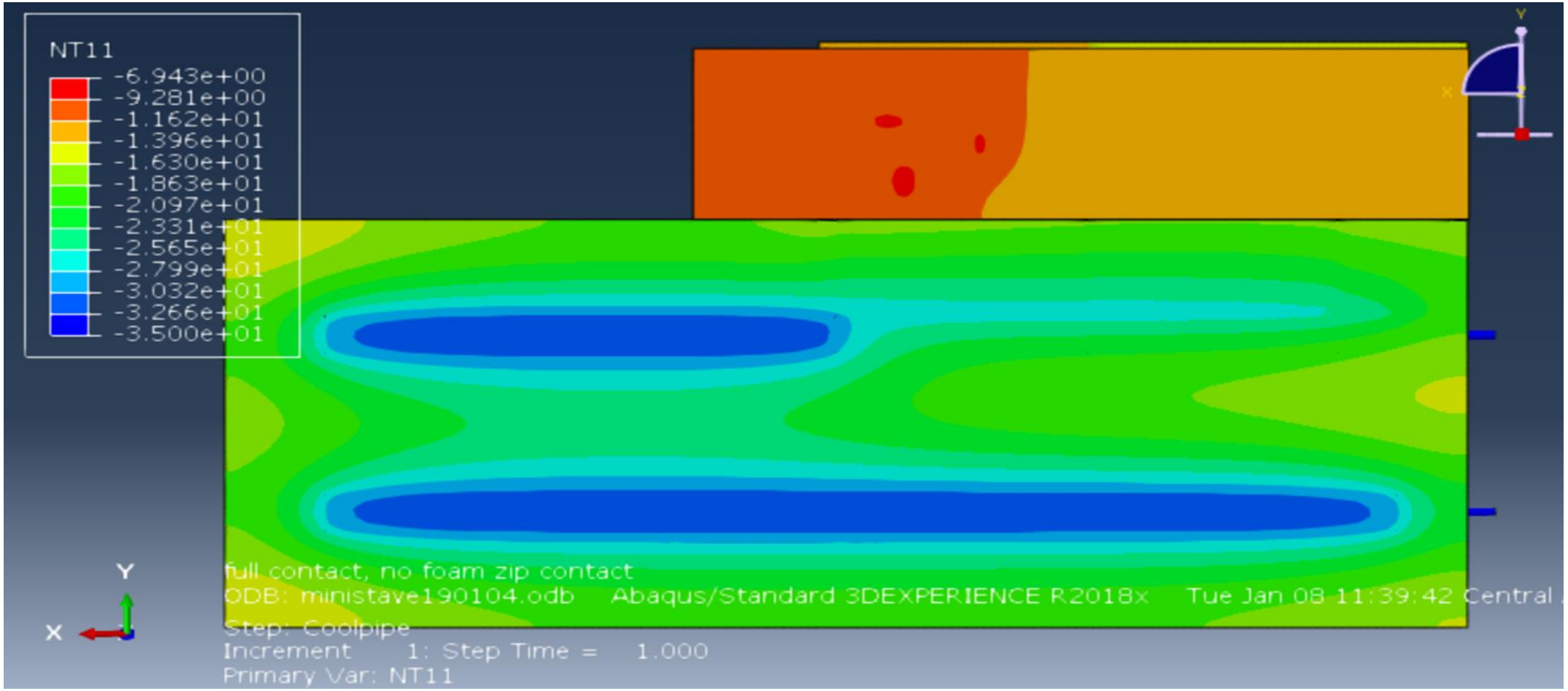
X-Y view of the mini stave model (upper parts not shown)

Mini stave surface temperature (master)

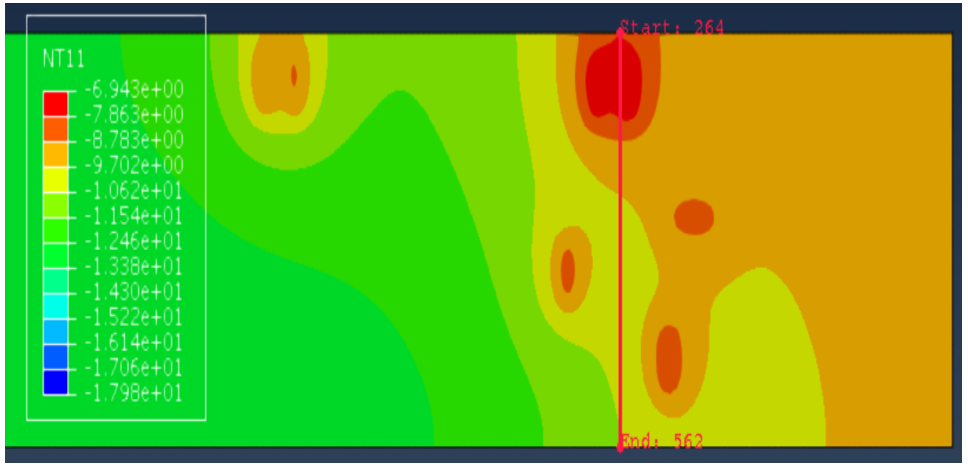
Ambient T at + 20C; surface to surface conductivity $10^{-5}\ W/(K \cdot mm^2)$;
pipe inner surface T at -35C; load on PCB resistors (in backup);



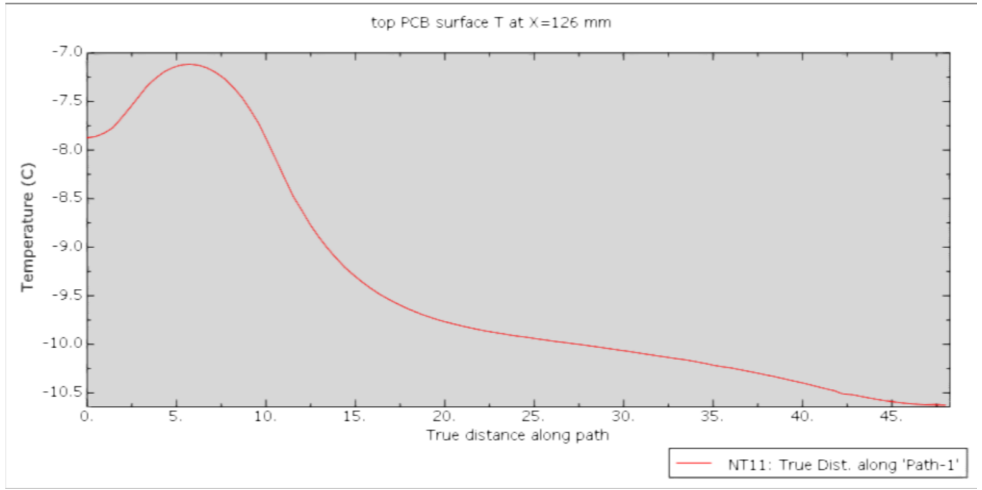
Mini stave surface temperature (slave)

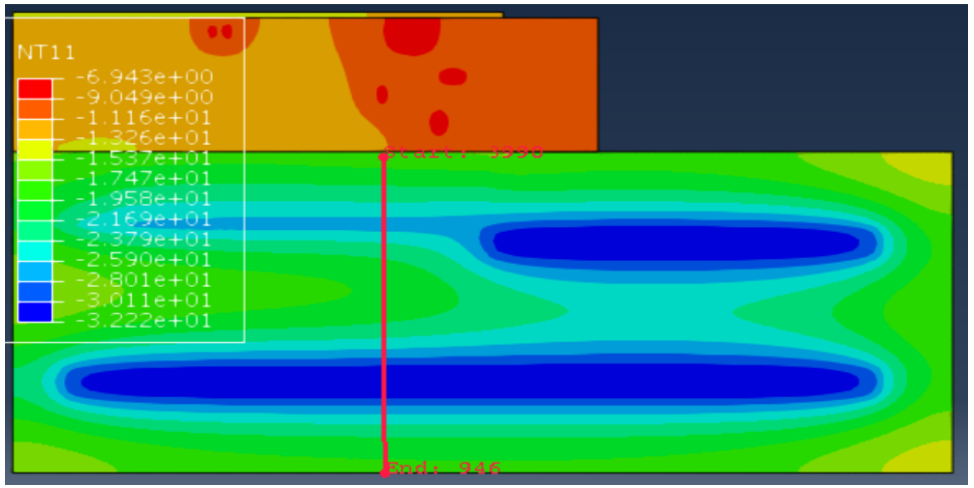


Surface temperature across stave

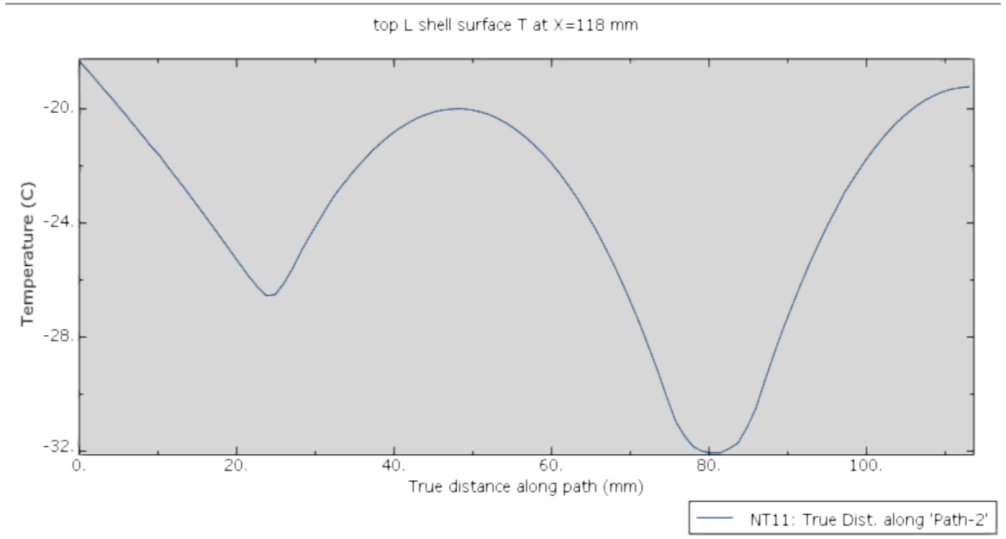


Top PCB surface T





Top L shell surface T



Next:

Compare the FEA simulation results with mini stave temperature measurement.

Back up : Load for PCB resistors

For LHSS & LHSM side:

R_1 , R_2 each 0.169W(0.13V, 1.3A) R_3 0.1W(0.1V, 1A)

For LHSS Only:

R_4 // R_5 ; R_6 // R_7 each 0.144W(0.12V,1.2A)