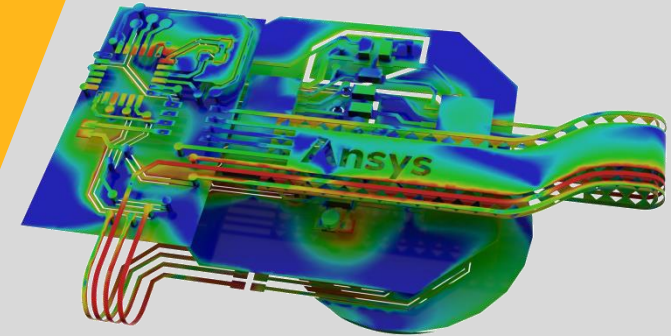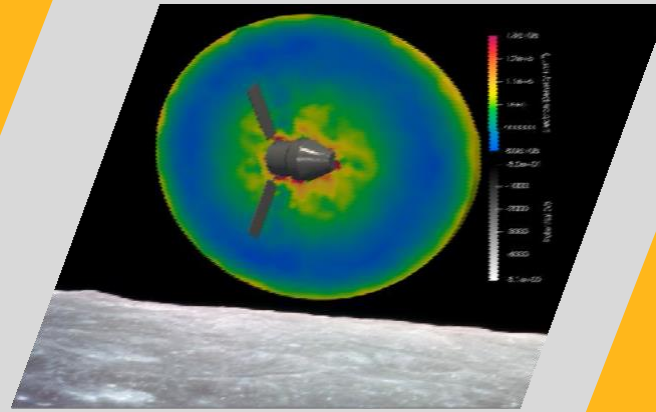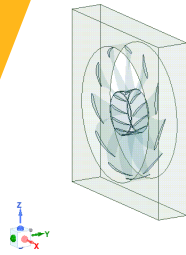# ANSYS ICEPAK 2022R2 新功能介绍

新科益系统与咨询（上海）有限公司

Agenda

Thermal Integrity Highlights

- ✓ Virtual Mesh Regions
- ✓ New slider bar meshing capability
- ✓ Thermal Design Creation, Icepak or Mechanical Thermal, from Existing HFSS/Maxwell/Q3D Design

2022 R2 What's New
Thermal Integrity
Icepak & Mechanical Thermal

CAD-IT
CONSULTANTS

What's New – Multiphysics workflow within AEDT for Thermal Design Creation - Beta

What's New

- ✓ Thermal Design Creation, Icepak or Mechanical Thermal, from Existing HFSS/Maxwell/Q3D Design

- ✓ Ensure Relevant Thermal Properties are included

User Benefits

- ✓ Provides the user with ready-to-start solving Thermal design, supporting either Icepak or Mechanical Thermal, at the click of a button from an existing HFSS/Maxwell/Q3D design that includes the setup of coupling between the two designs for Electrothermal analysis.

- ✓ Allows users to leverage a linked Multiphysics workflow between HFSS/Maxwell/Q3D and Icepak and Mechanical Thermal in AEDT

End User and Applicable Industries

- ✓ Power Electronics, Motor Analysis, ECAD Reliability studies, Module on PCB Electrothermal analysis, Antenna Systems
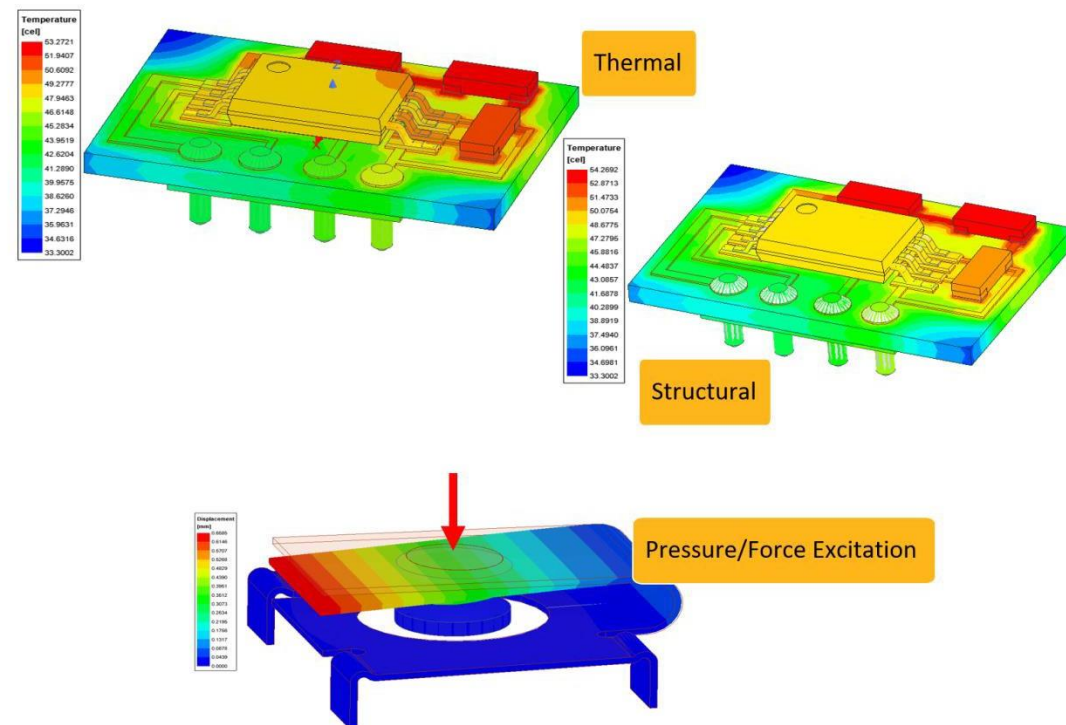
What's New – Virtual Mesh Regions - Beta
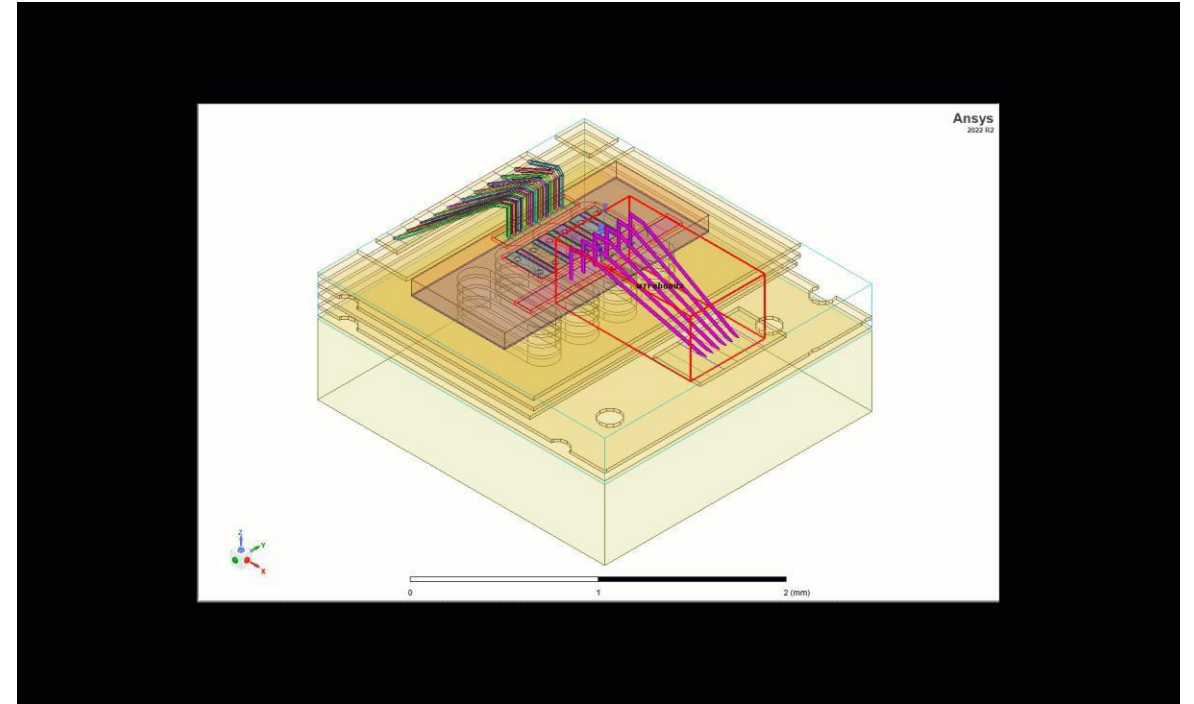
What's New

- Availability of virtual mesh regions in Icepak

User Benefit

- Create mesh regions in Icepak in AEDT with offset from the objects of interest.

- Gives user the ability to track the objects for parametric analysis.

- Run parametric and variation analysis in Icepak significantly improving the user experience.

End User and Applicable Industries

- Electrical Engineers and Thermal Engineers utilizing Icepak

- Applies to all applications utilizing Icepak

What's New – Slider Bar Meshing Capability - Beta

What's New

- Slider Bar Meshing capability enabling enhanced automated mesh generation and refinement

User Benefit

- Enables an improved meshing experience for users in both Icepak and in Mechanical Thermal.

- Capability will aid users with more automated and robust mesh generation for complex geometries in Icepak

- In Mechanical Thermal, this capability enables physics-aware mesh refinements to aid in a better mesh for solving the conduction-only simulations more accurately and with less manual mesh refinements.

End User and Applicable Industries

- Designers and Analysts interested in reduced pre-processing effort in creating accurate meshes for thermal simulations in AEDT.

- Applicable to 5G, Aerospace, Electronics Reliability, RF Modules, System Thermal

CAD-IT
CONSULTANTS

Icepak 2022R2 Highlights

- **Workflow Enhancements**
  - Thermal Design creation from HFSS/Maxwell/Q3D [Beta]
  - Icepak-Sherlock data transfer

- **Reduced Order Modeling (ROM)**
  - Redhawk CTM version 2.0
  - Delphi Network Creation

- **Meshing Enhancements**
  - Virtual Mesh Region [Beta]
  - Enhanced Slider Bar Meshing
  - Coordinate System Aligned Mesh

- **PCB/IDF Enhancements**
  - Option for Holes
  - Polygonal Board Cutout

- **Post Processing**
  - Streamline Animations

- **Improved TZR Conversion**

- **Toolkits**
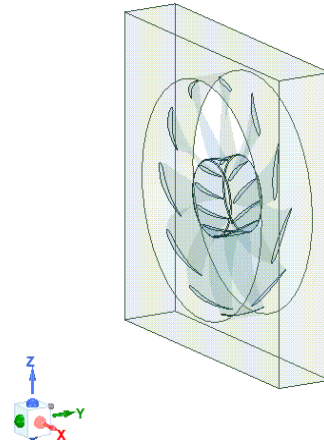
Animated streamlines out of an axial fan with swirl

Workflow Enhancements: Thermal Design Creation [Beta]

- Automated creation of linked thermal design from a source EM design
  - Icepak/Mechanical target designs created
  - Source Designs can be HFSS/Maxwell/Q3D
  - Materials need to have Thermal Properties defined

- Boundary conditions and excitations created automatically
  - Forced convection & Natural convection domains (Icepak)
  - Conduction setup (Mechanical)
  - Solution setup created in ready-to-run design
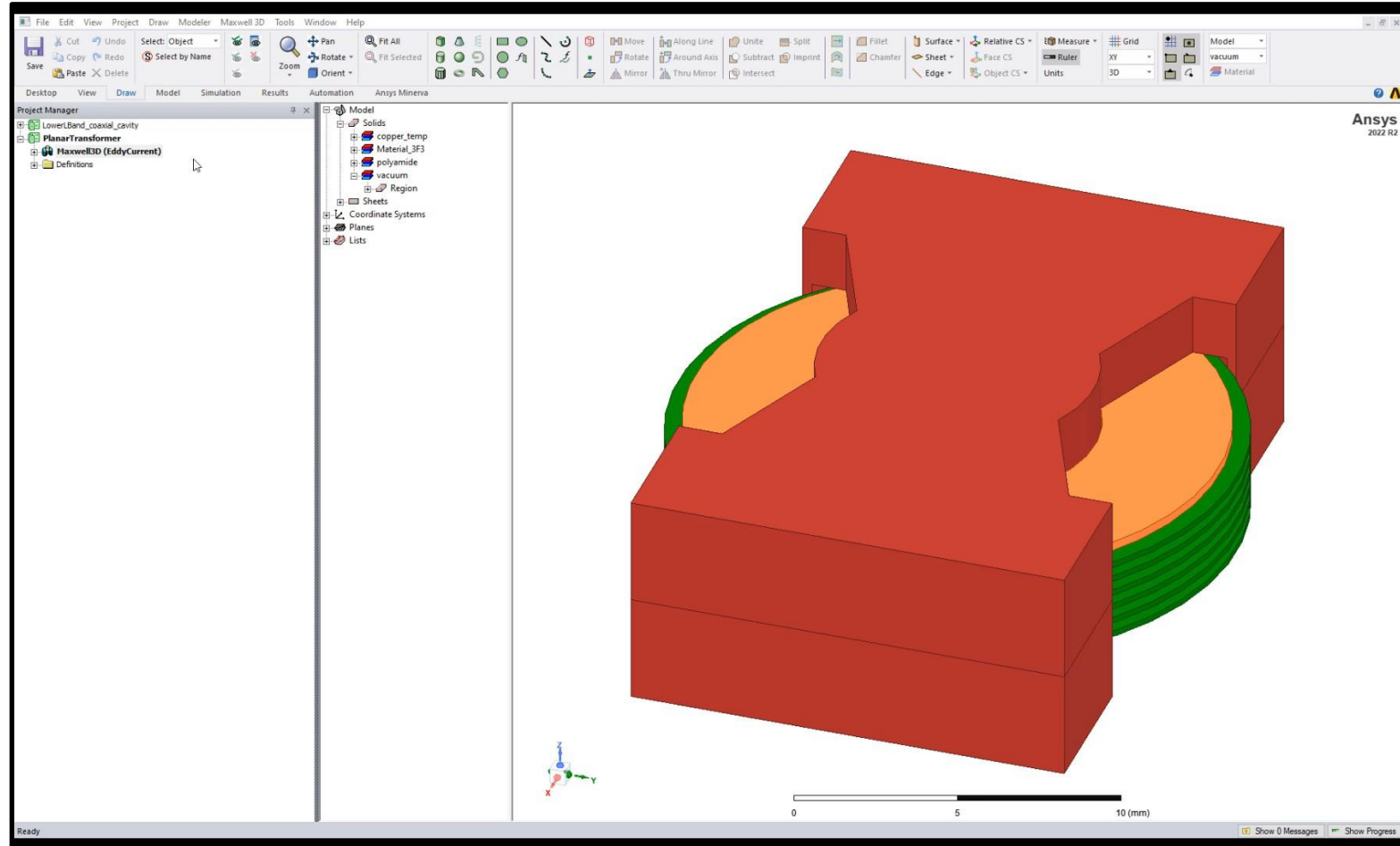
Workflow Enhancements: Icepak-Sherlock Data Transfer

- Enable 1-way data transfer between Icepak and Sherlock for co-simulation
  - Solder Fatigue Analysis for single PCB supported

- PCB transformations supported
 - Temperature data is written at the location of PCB in EDB file
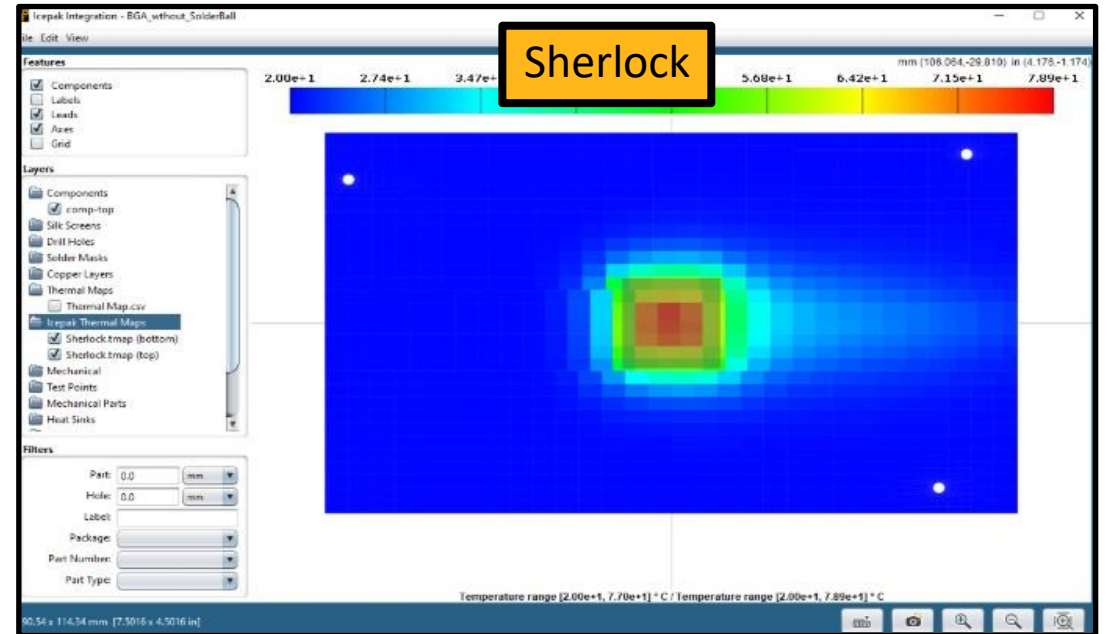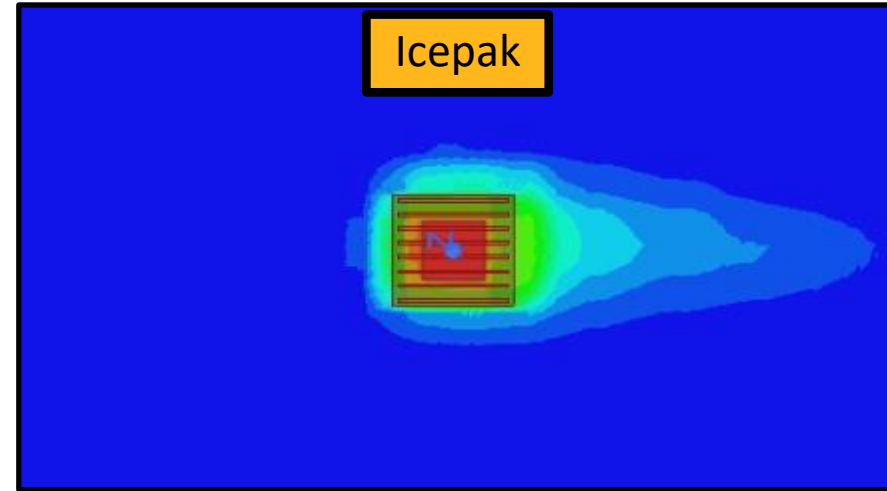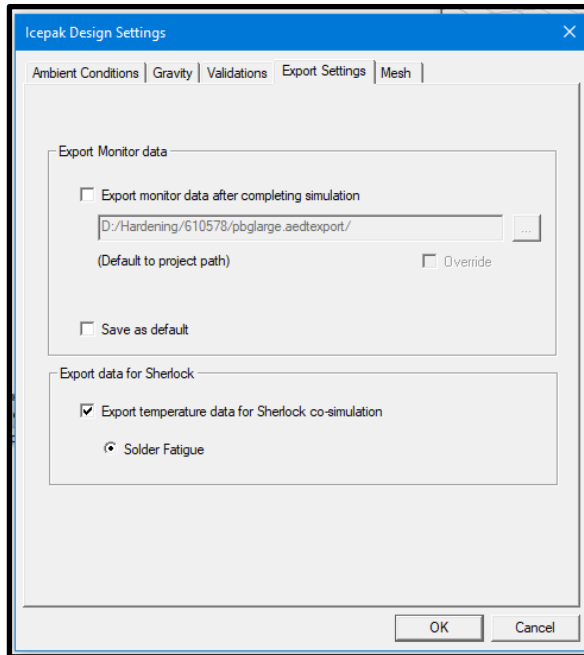
Workflow Enhancement: Heat Sink Fin Parameterization

- ## User Defined Model Heat Sink
  - UDM provides alternate method to create heatsink that enables parameters in heatsink to be parameterized, *including fin count*
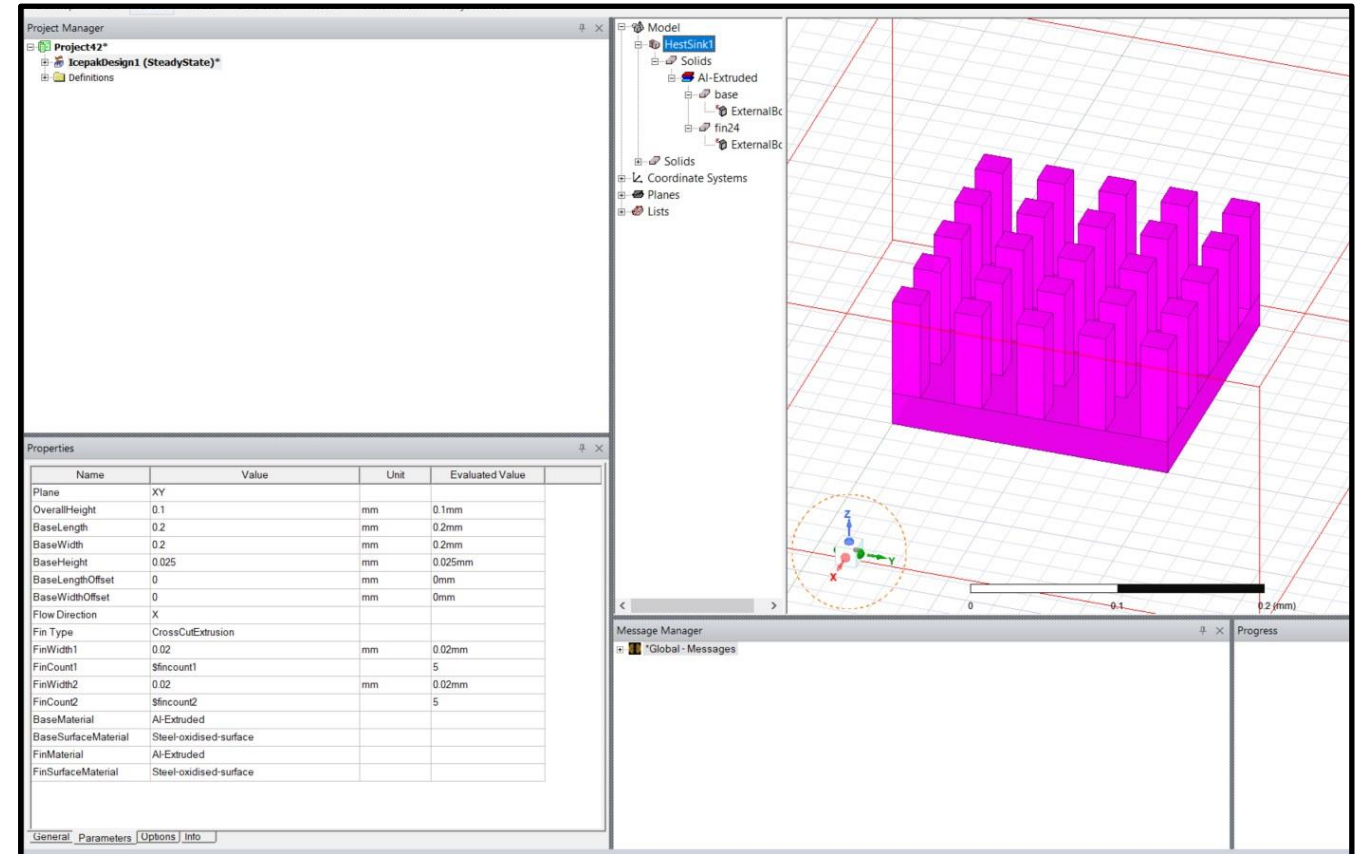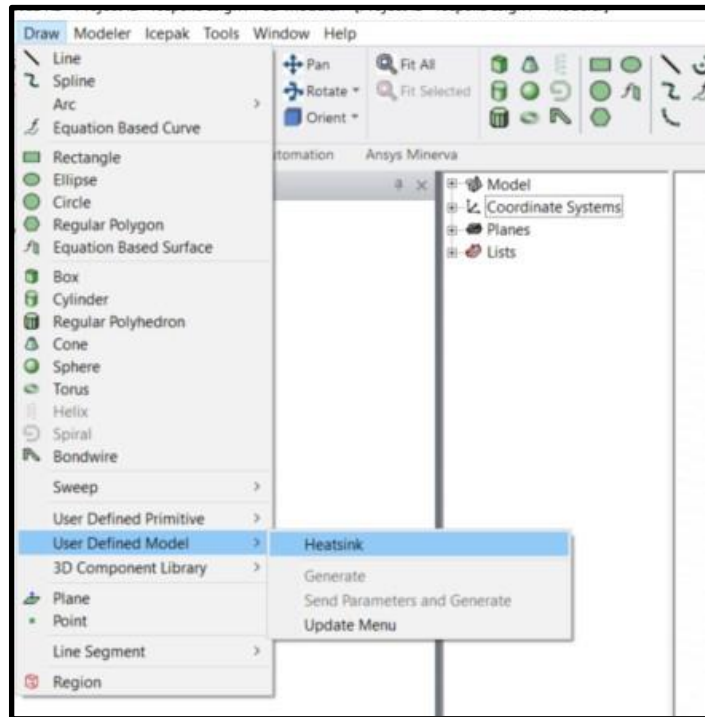
Reduced Order Modeling: CTM Version 2.0 Support

- Icepak-RHSC-ET CTM version 2.0. support
  - 2D sources between Substrate (bottom) and Routing(top) layers
  - Encryption for the layers using encrypted component workflow
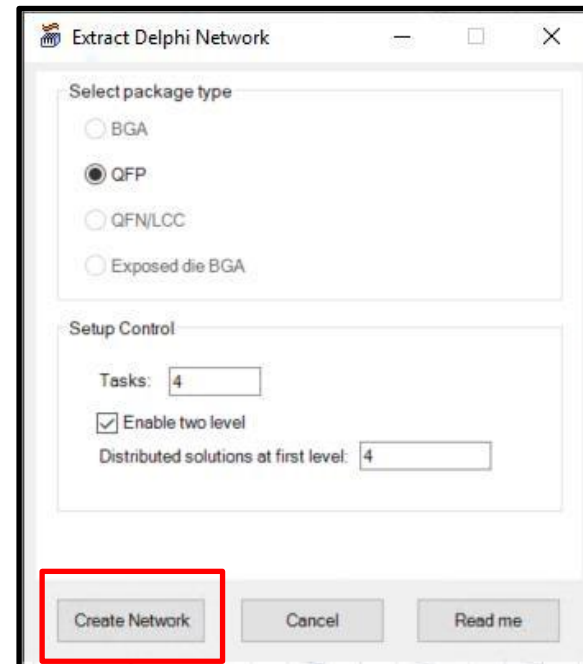 - Geometry and Material information hidden
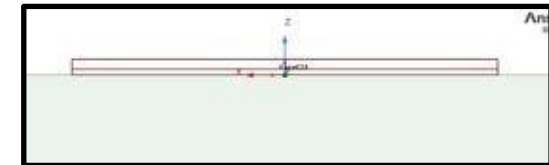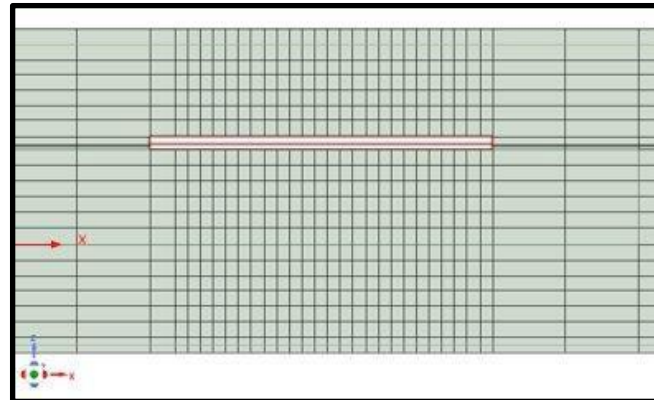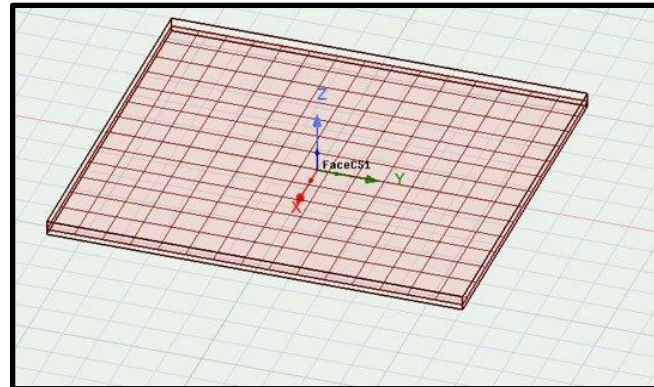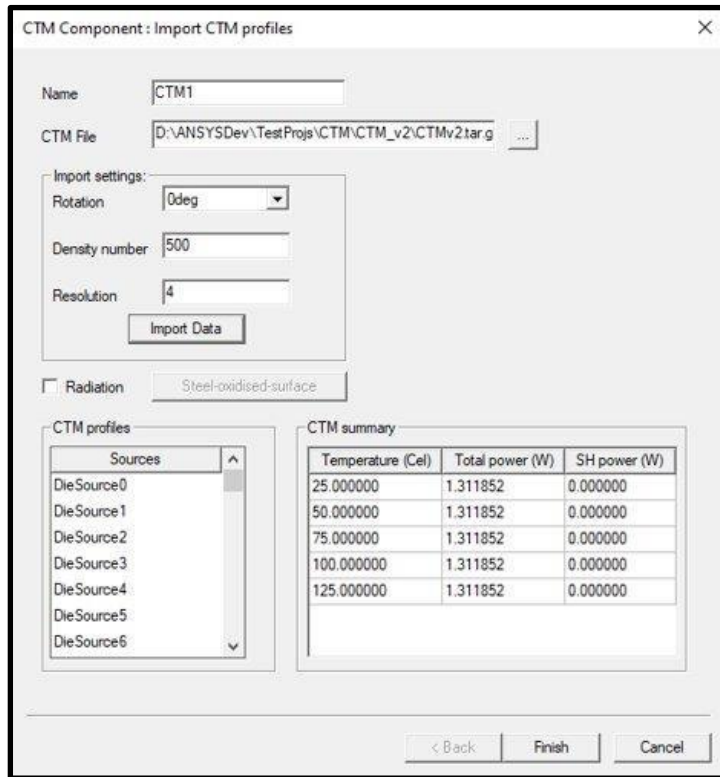
Reduced Order Modeling: DELPHI Network Creation [Beta]

- Steady-State DELPHI network creation for QFP packages available
  - Automates all steps of DELPHI Network Extraction

- Accuracy of DELPHI optimizer improved

- Increased accuracy of network creation
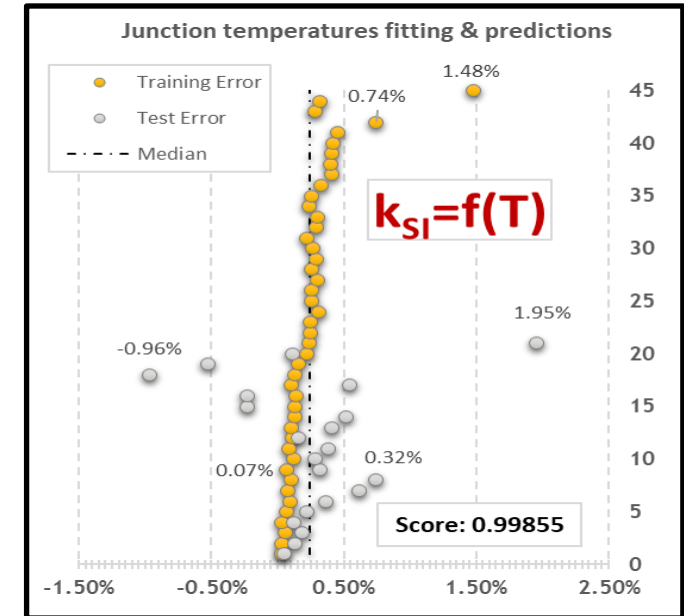
✓ 45 training scenarios

✓ 21 testing scenarios

✓ **BCI**

ICEPAK - Automated DELPHI network extraction process flow
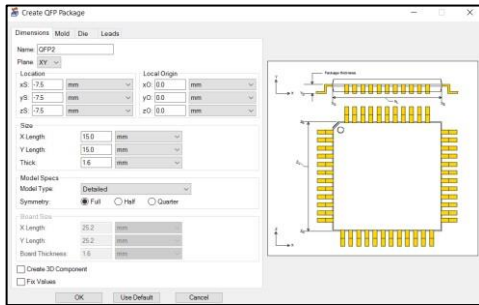

AEDT – ICEPAK 22R2

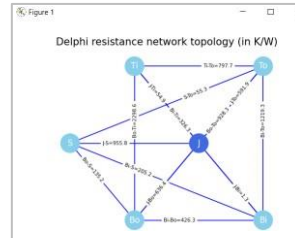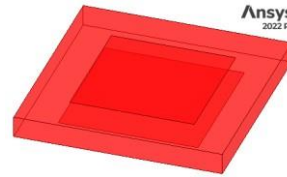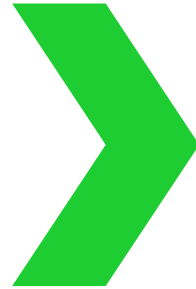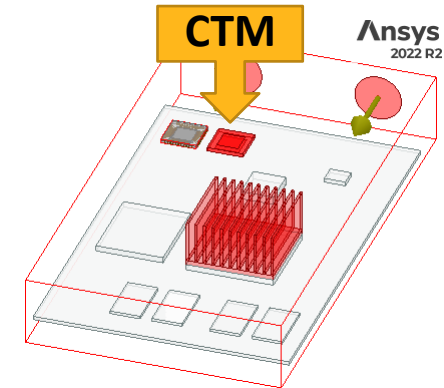| Create a 3D model | Create network node setup | 3D thermal model sanity check | Solve Boundary Condition scenarios Extract thermal results | Identify the best thermal network | Generate AEDT Thermal Network Model |

Once obtained **DELPHI network** model can be added to a library for reuse

QFN44_3Dmodel.a3dcomp

QFN44_CNTM.a3dcomp

CTM

# Meshing Enhancements: Virtual Mesh Regions

- New Virtual Region paradigm for Mesh Region creation
  - Slack settings available now

- Continued support for assigning Mesh regions to non-model objects

- Key Features
  - Mesh Region moves with Objects
  - Support for automatic transformations
    - Coordinate System setting for Mesh Region is available
  - Global Region resizing based on Mesh Region Slacks
  - Visualization options
    - Rubber band to ascertain slack sizing before update
    - Turn on/off Virtual Box
  - Component Mesh Region creation possible
  - Easy to export Mesh Region to 3D component
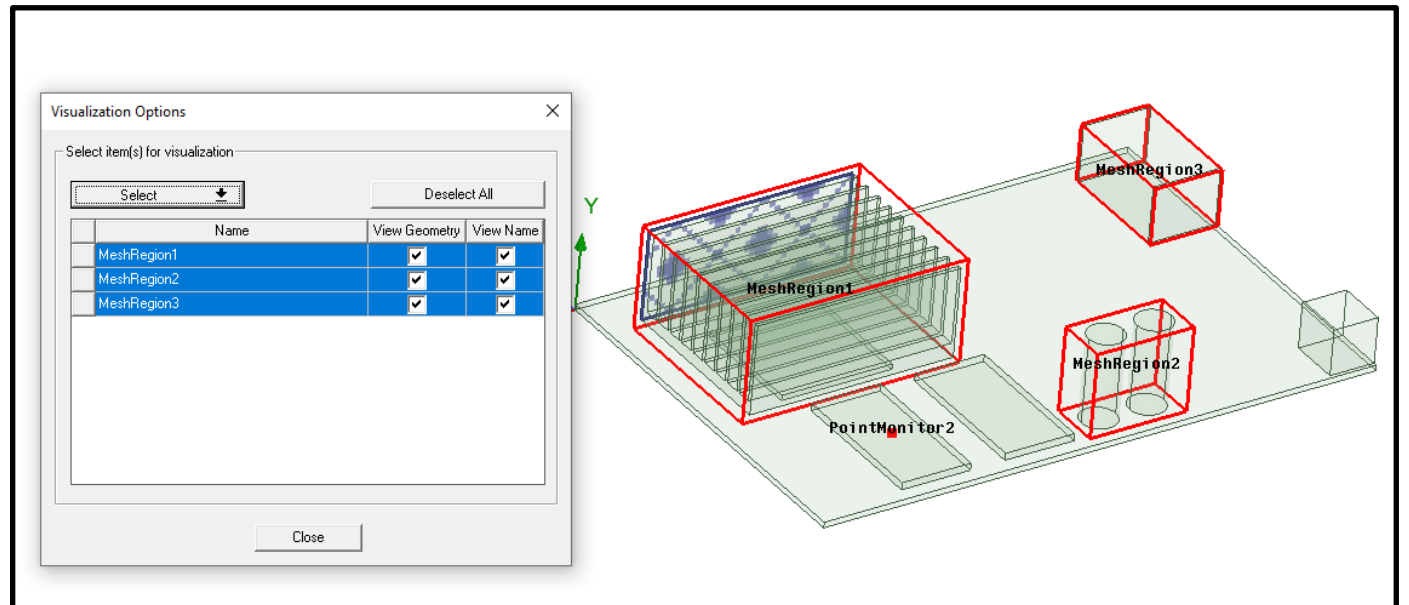
Meshing Enhancements: Improved Slider Bar Accuracy

- Improved Accuracy of EM Loss Mapping in Slider Bar Setting
  - EM loss Boundaries are automatically identified during meshing
    - Enhanced resolution is applied
  - Works for slider level medium, fine and very fine
  - Geometry facet level also contributes to the accuracy of EMLoss mapping.
    For curved geometries, it is recommended to use finer level of faceting

Coil model with EM loss BC:
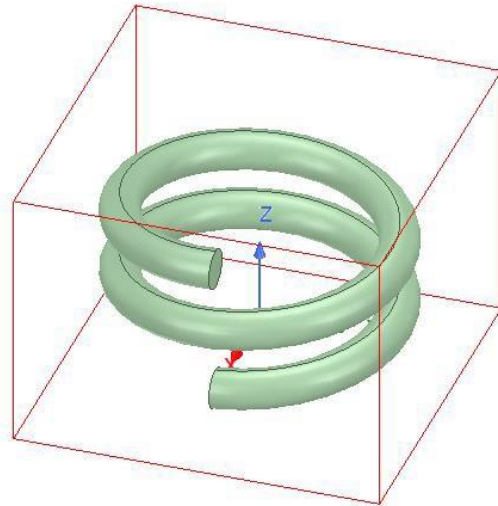
| Slider Level	Facet Level	Max Temperature (cel)		Relative Error(%)	
		2022R2	2022R1	2022R2	2022R1
M	F	390.25	34.44	4.64	91.60
M	VF	400.85	157.49	2.19	61.55
F	VF	406.70	92.7	0.72	77.37
VF	VF	407.90	179.55	0.43	56.17
Reference		409.65		-	

M – medium; F – fine; VF very fine.

Meshing Enhancements: Coordinate System Aligned Mesh

- For objects created in Relative Coordinate System, create aligned mesh with the Coordinate System
  - Mesh aligned with inclined objects
  - Transformation automatically calculated
  - Mesh bleeding stopped at the interface
  - Works similarly with an inclined mesh region, but with added flexibility to apply directly on objects


Stop mesh bleeding at boundary
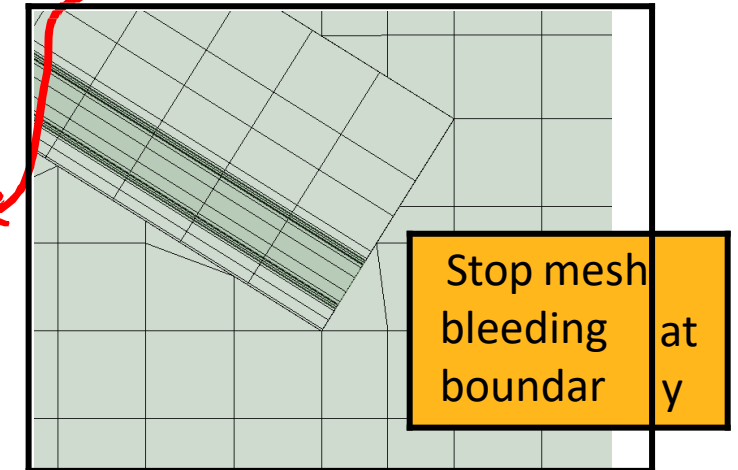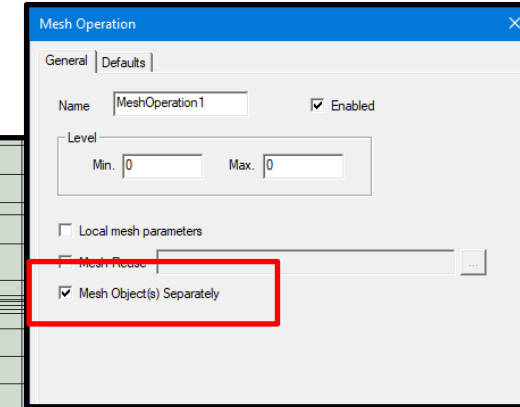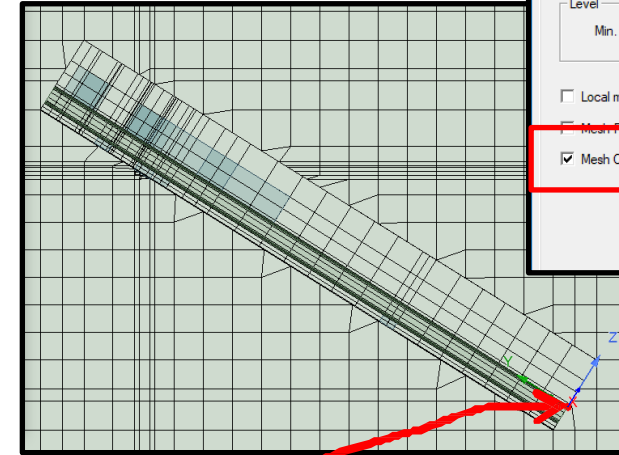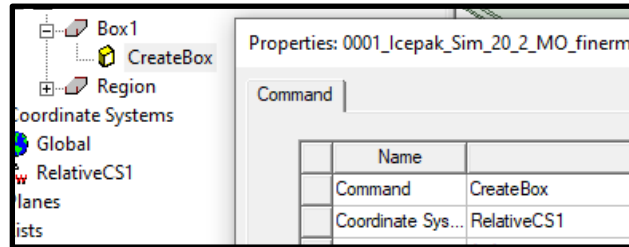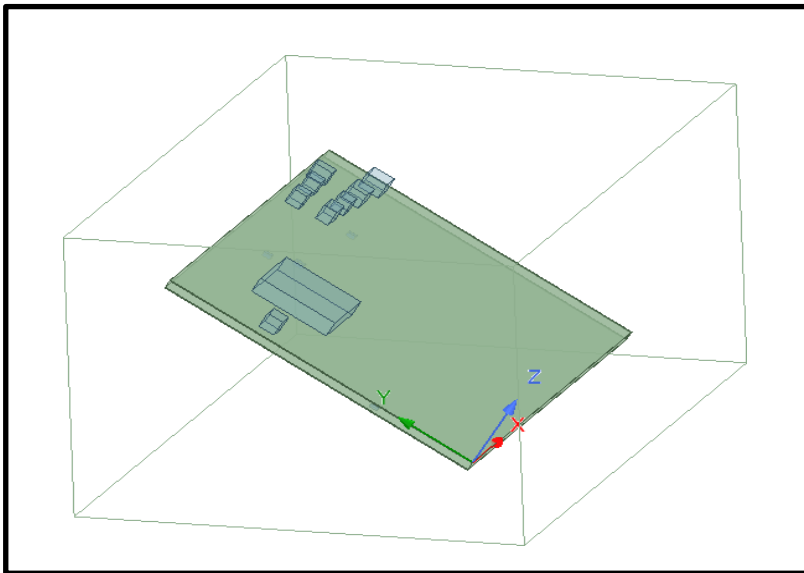
Meshing Enhancements: Better Capture of Interior Features Using 2D MLM

- Automatically detect the interior features of CAD objects
- Add additional mesh ticks to the interior features for better resolution

CAD model with interior gap

2022 R1 gap not resolved

2022 R2 gap properly resolved
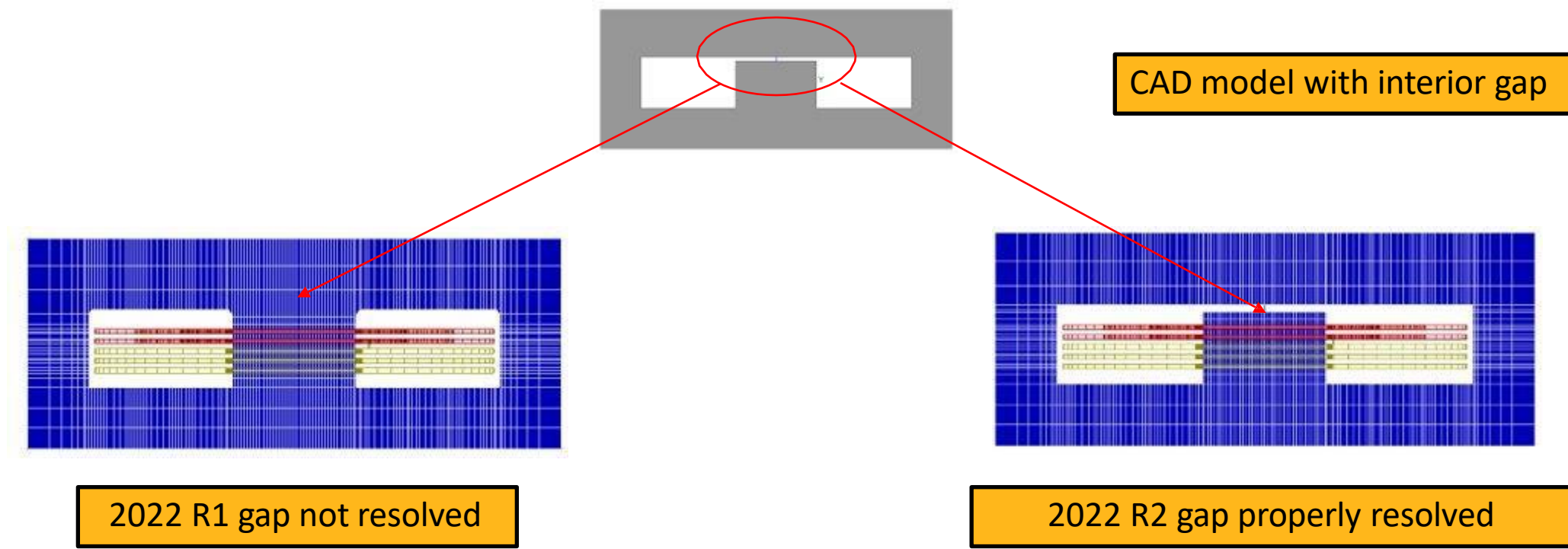
Postprocessing: Streamlines

- Animations available
  - Animation based on flow time
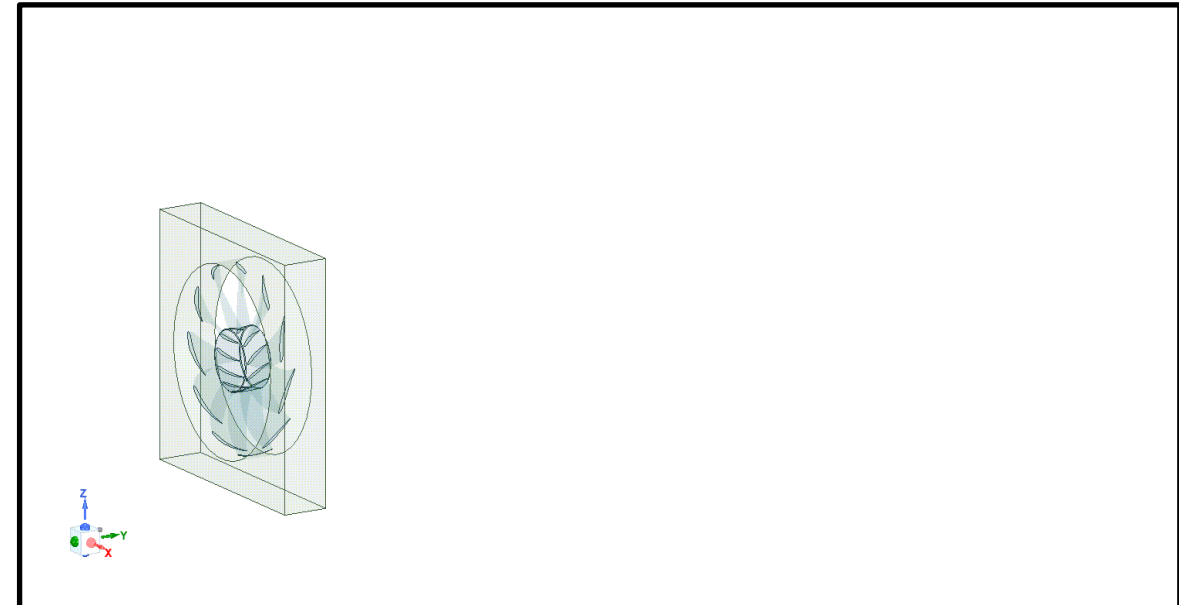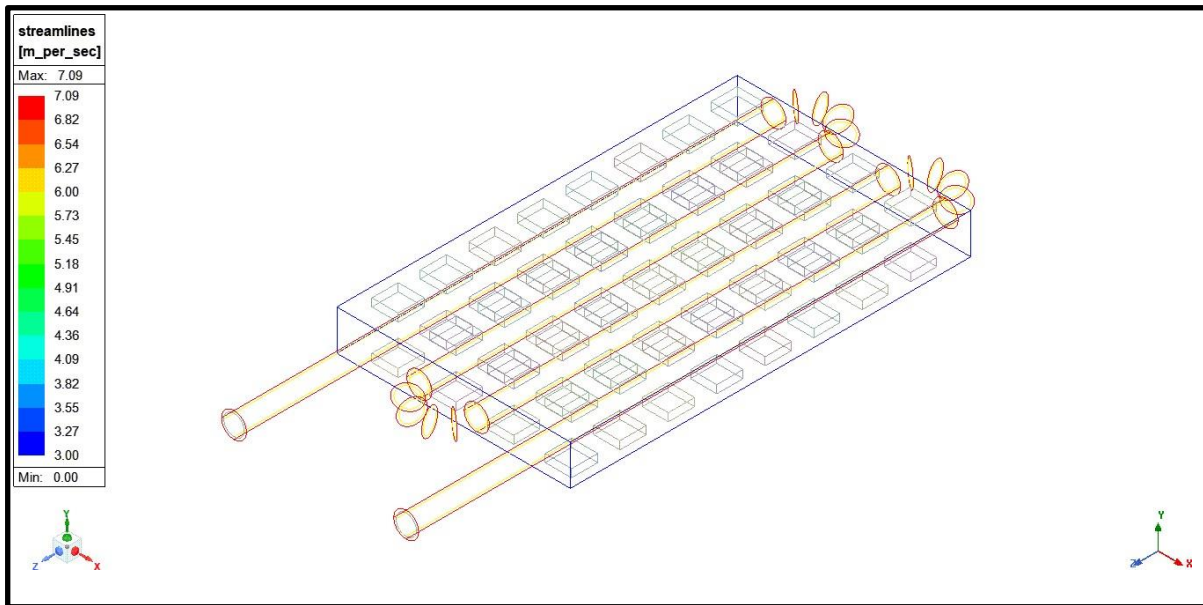
TZR Import Enhancements: Increased Compatibility

- Inactive items import
  - Imported in new design under same projects
    - Geometries with priorities and associated BCs
    - Non-geometry items
    - Mesh regions

- 3D Source object Import
  - Transient Joule heating currently not supported
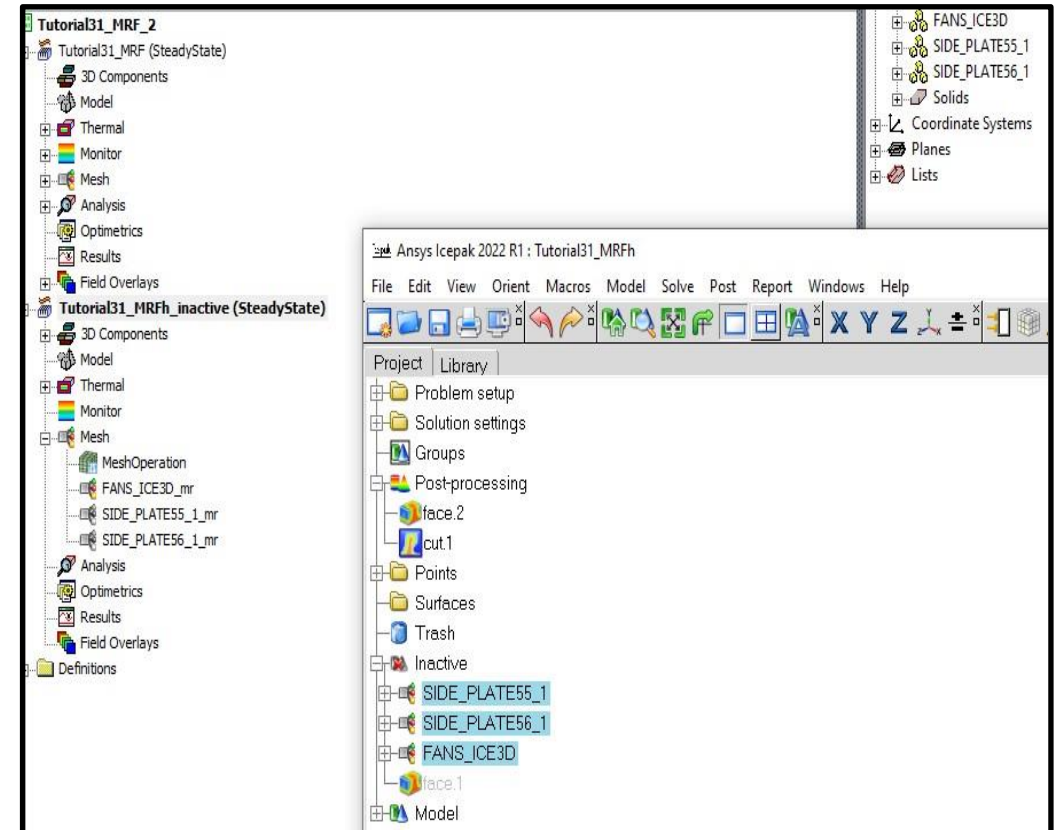
TZR Import Enhancements: Improved Speed

- ECAD Import
  - No extra project during ECAD import

- MCAD Import
  - Performance improvement for projects with multiple CAD data

- Increased Speed of Import
  - Synchronization is only done at the end
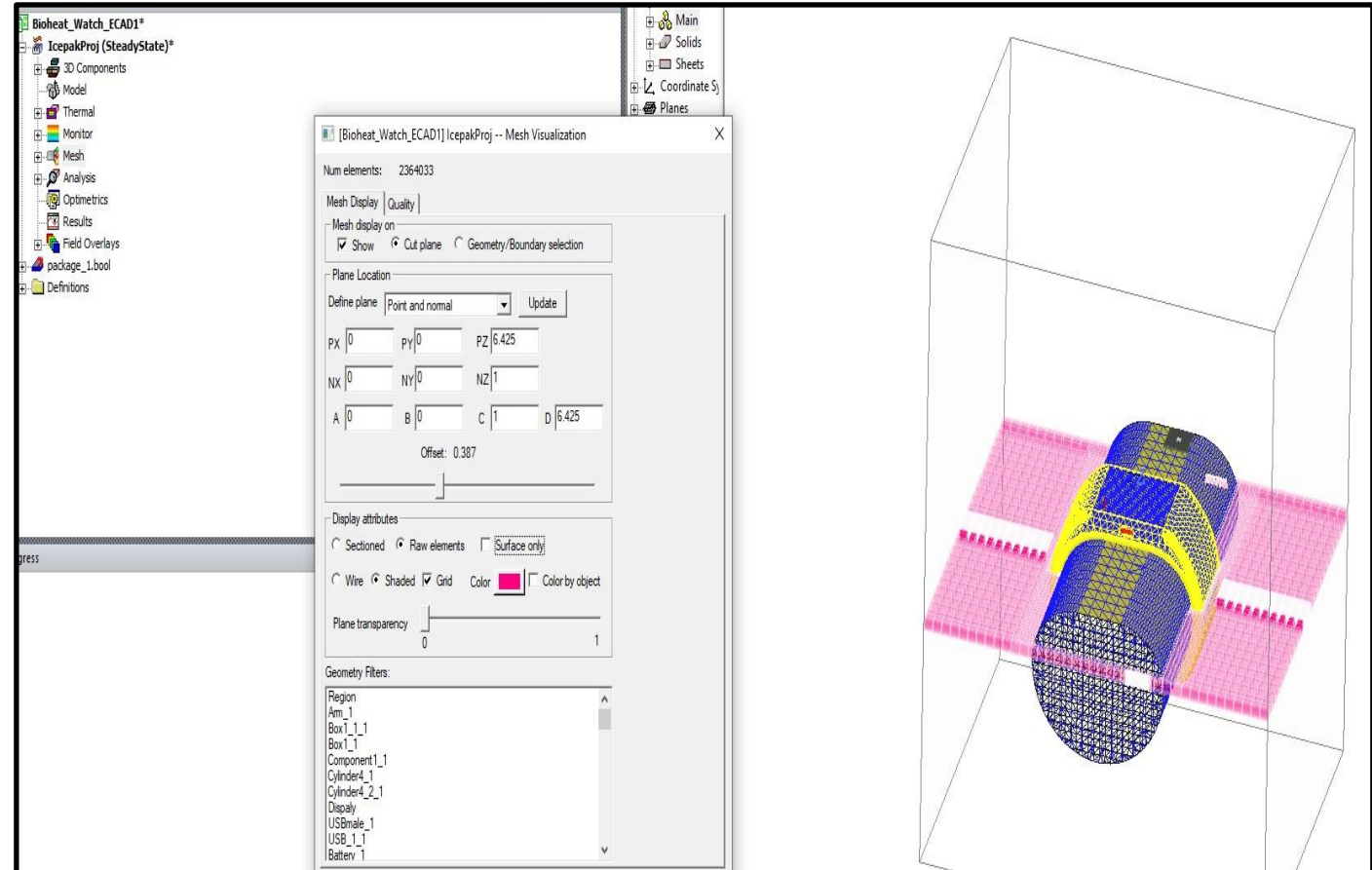
2022R2 Toolkits: Run Thermo-Electric Cooler

- Thermo-Electric Cooler (TEC) Toolkit
  - Define Current and Calculate Temperature
  - Define Temperature and Calculate Current
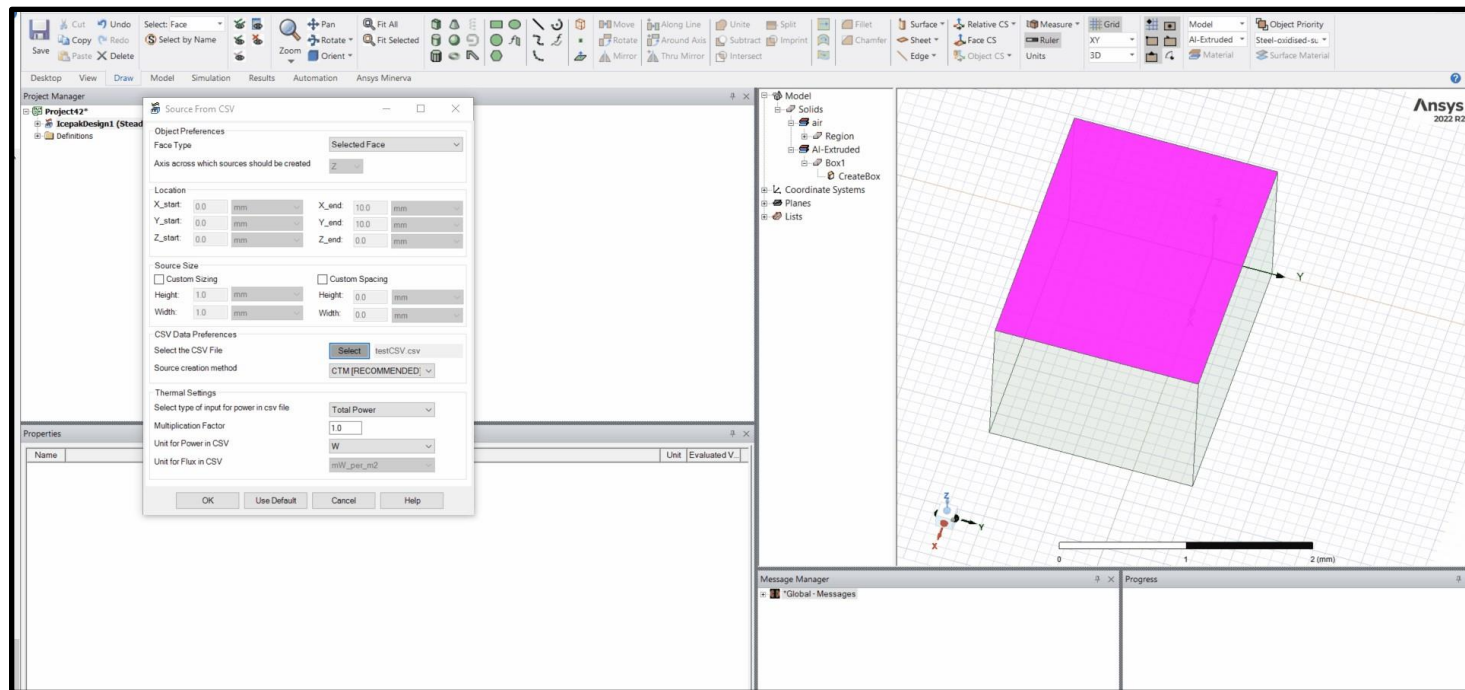
2022R2 Toolkits: Fluent Mesh Import
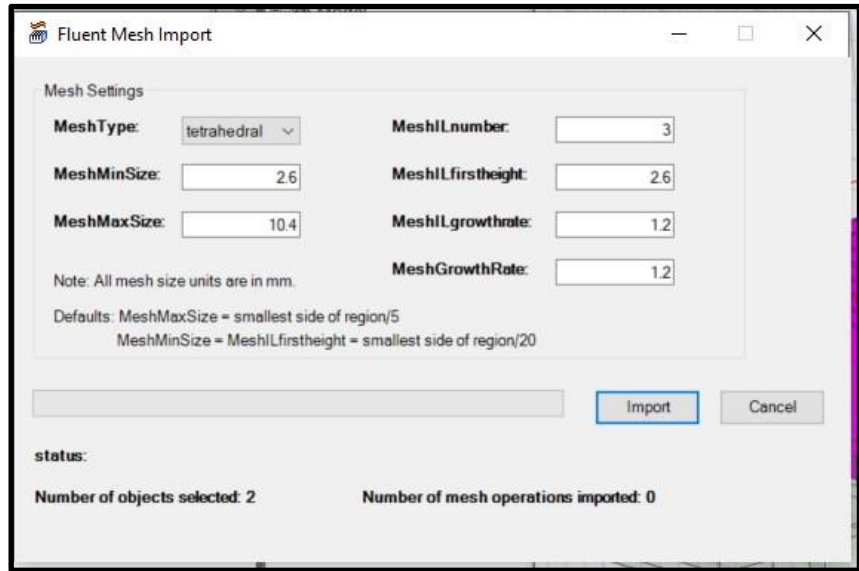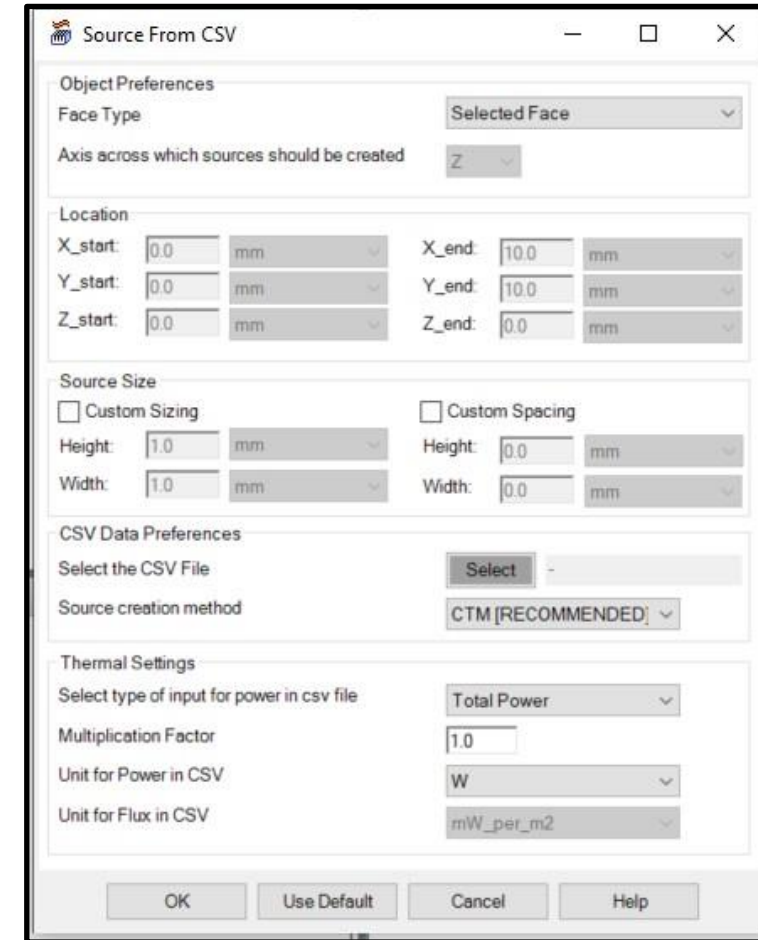

Fluent Mesh Import
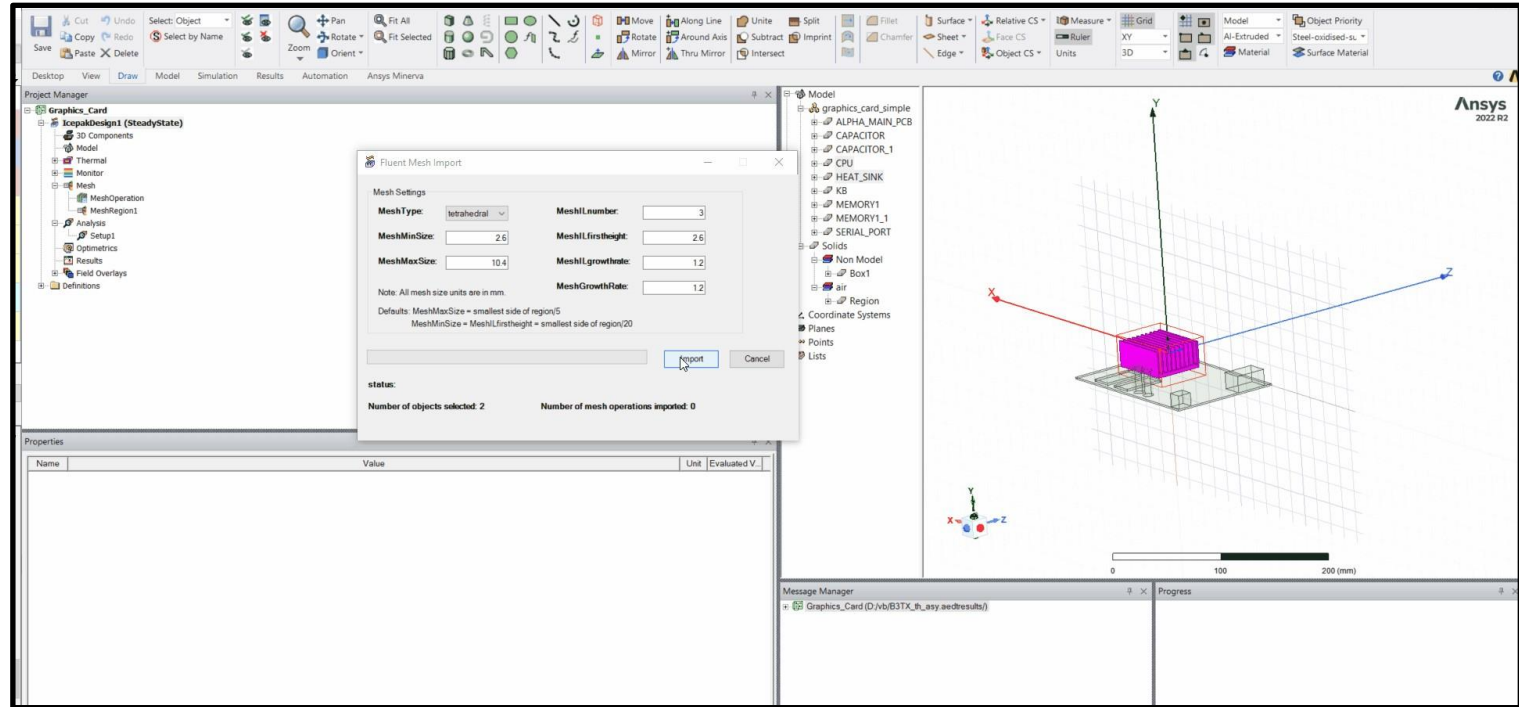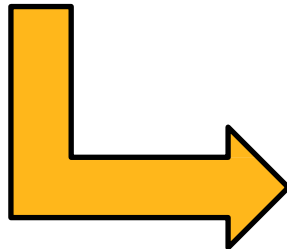
2022R2 Toolkits: Source From CSV

- Pick a face to import sources or create a new sheet
- Source Creation
  - CTM, dataset or individual sources can be selected
- Power or Surface flux can be applied to the sources from CSV file

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AEDT Mechanical: 2022R2 Update

Mechanical 2022R2 Highlights

- **Thermal**
  - **Workflow Enhancements**
    - Thermal Design creation from HFSS/Maxwell/Q3D [Beta]
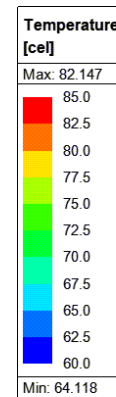   - Enhanced Slider Bar Meshing [Beta]
  - **Enhanced Boundaries and Solver Capability**
    - Thermal Contacts [Beta]
    - Heat Transfer Boundary Paradigm
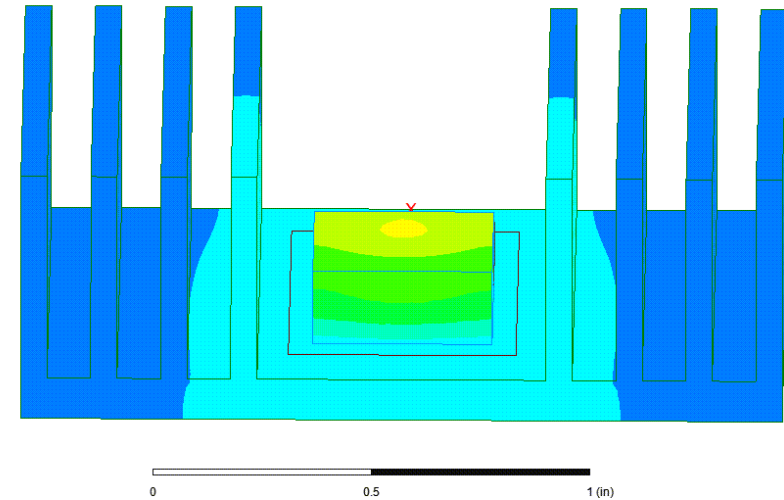   - Non-Linear Solution Controls

- **Structural [Beta]**
  - **Workflow Enhancements**
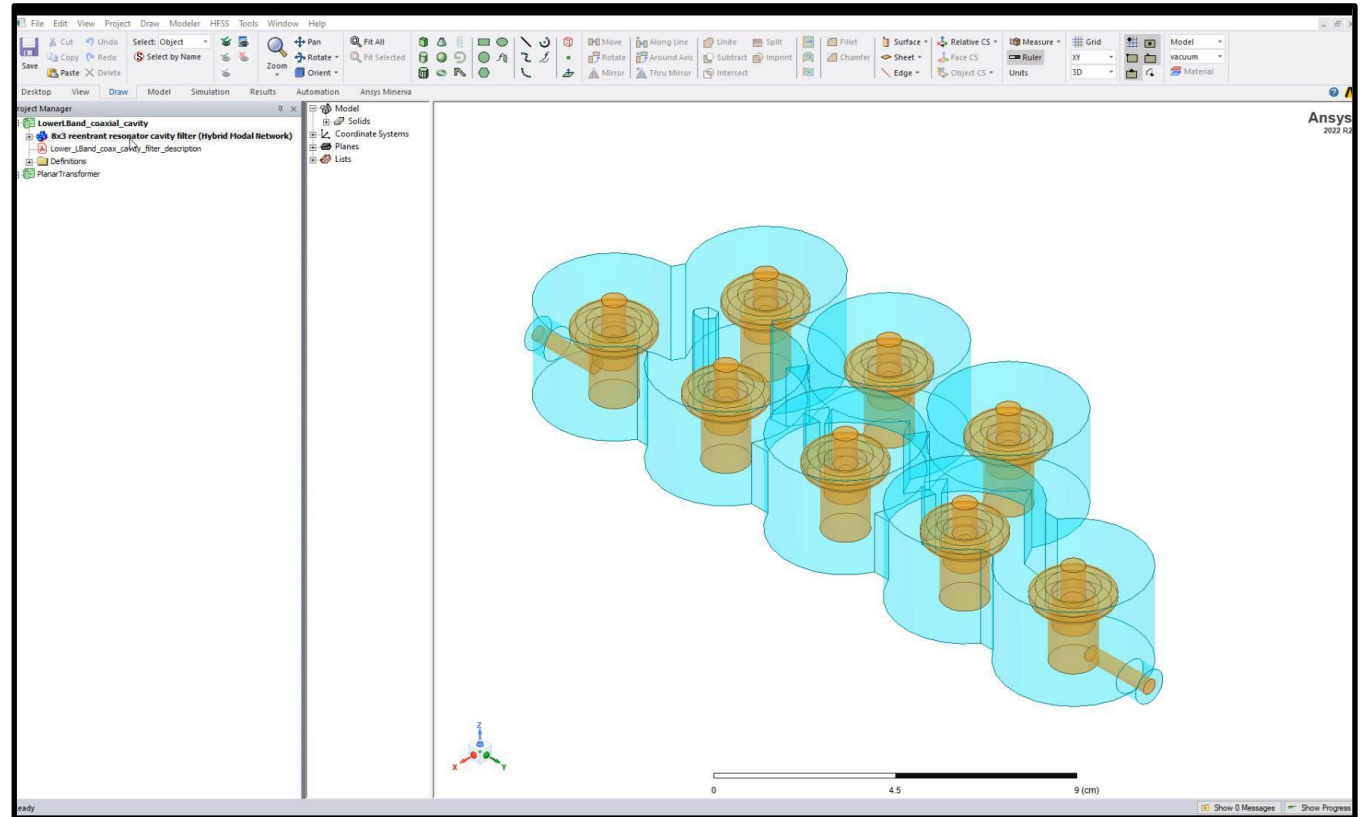   - Enabled Slider Bar Meshing
   - Reaction Force Report

Workflow Enhancements: Thermal Design Creation

- Automated creation of linked thermal design from a source EM design
  - Icepak/Mechanical target designs created
  - Source Designs can be HFSS/Maxwell/Q3D
  - Ensure Materials have Thermal properties

- Boundary conditions and excitations created automatically
  - Forced convection & Natural convection domains (Icepak)
  - Conduction setup (Mechanical)
 - Solution setup created in ready-to-run design

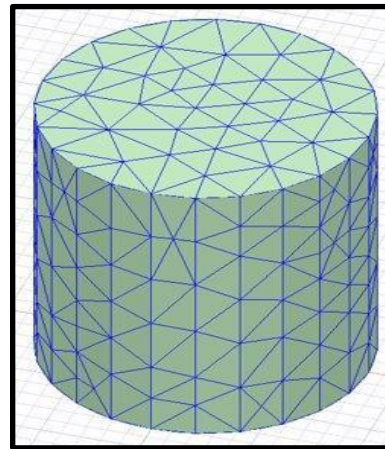# Workflow Enhanced: Slider Meshing Enabled [Beta]

- Automated refinement based on slider position
  - Length-based refinement inside and on surfaces of all objects
  - Refinement tailored to curvilinear and rectilinear geometries
  - Improved algorithm for curvilinear geometries
  - Algorithms tailored for individual solution type

- Restrict/eliminate the need for user-defined mesh operations
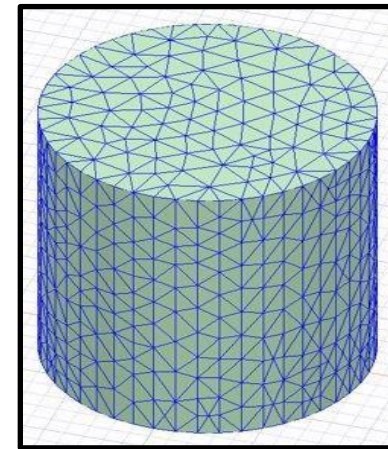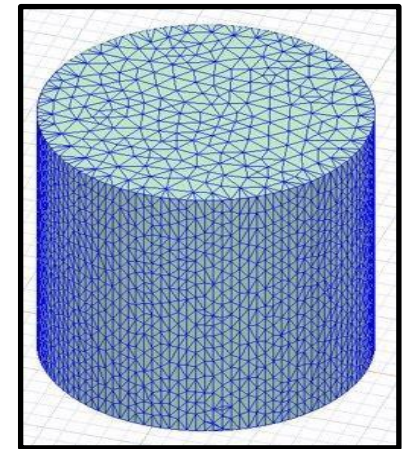
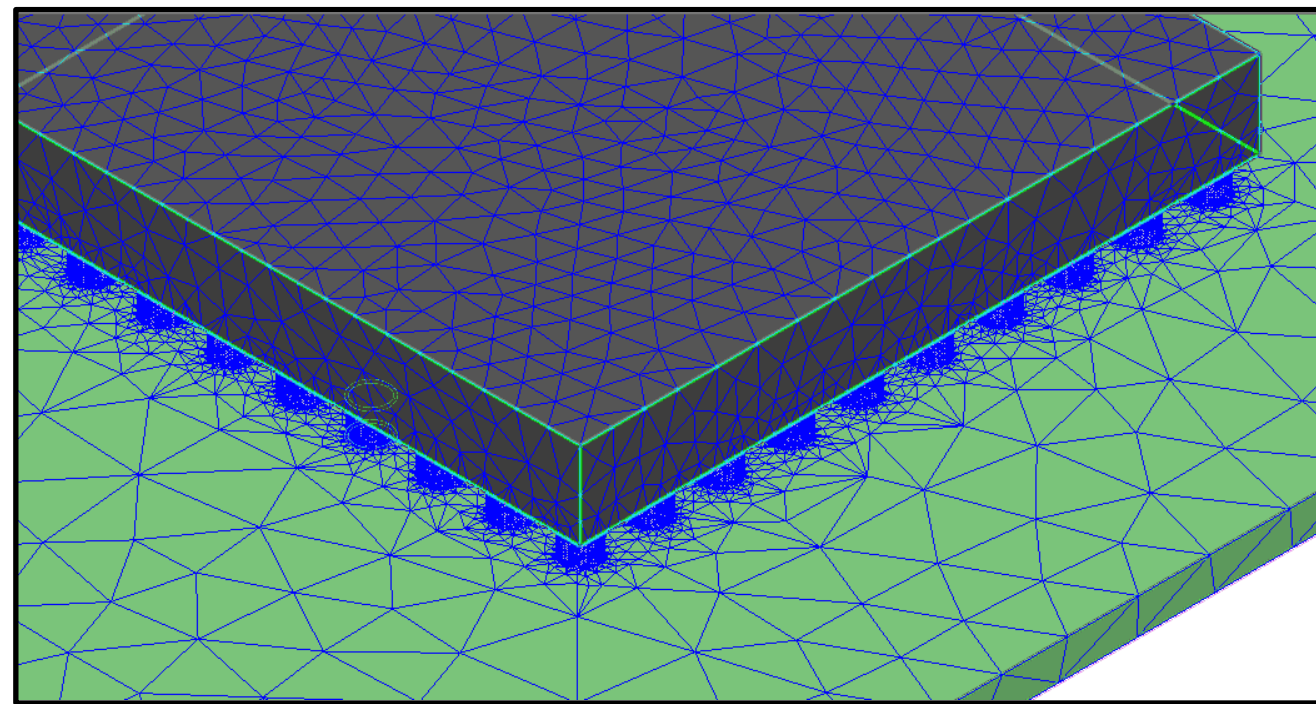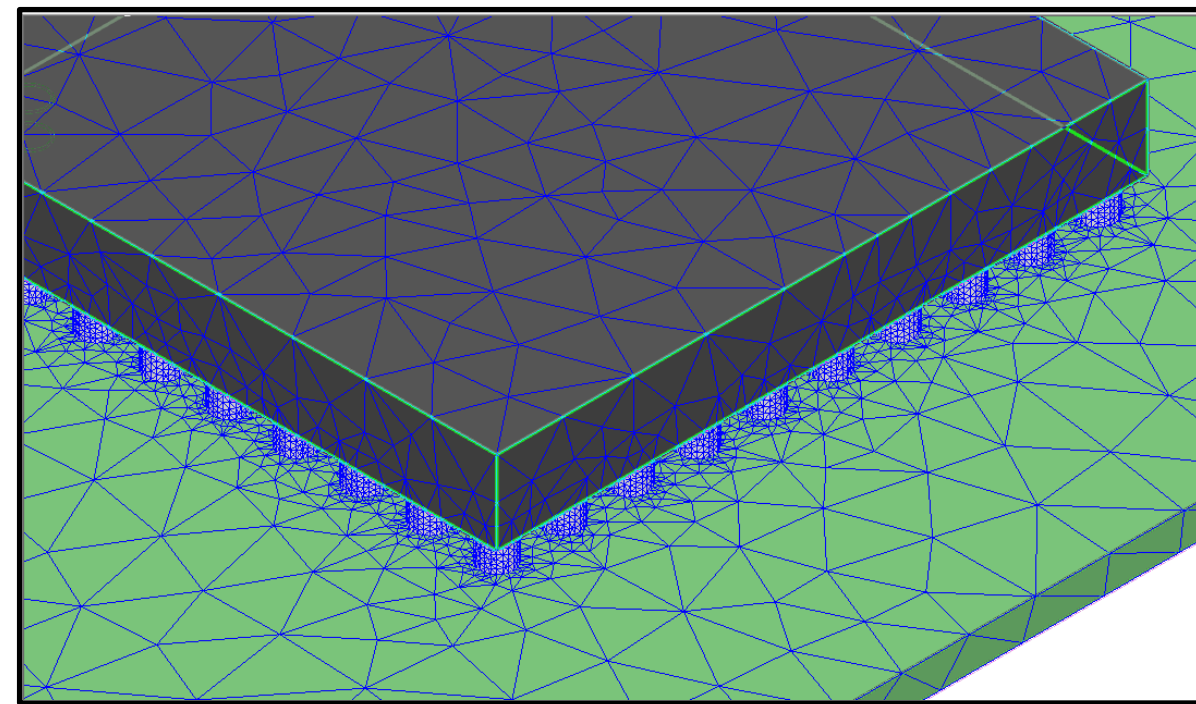- Improved solution accuracy
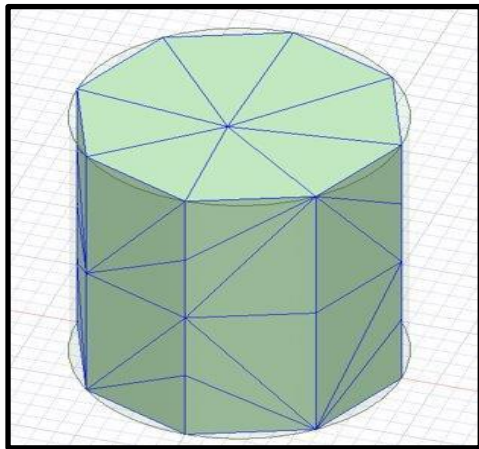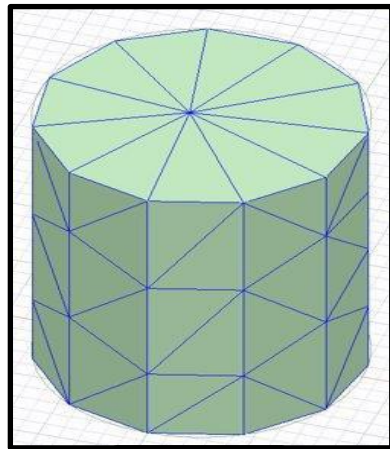
Level 1   Level 3   Level 5   Level 7   Level 9

Workflow Enhanced: Slider Meshing Enabled [Beta]

- Length-based refinement based on individual object shapes and dimensions


2022R1
Count: 3.88M

2022R2
Count: 264K

Enhanced Boundaries & Solver: Thermal Contacts [Beta]

- Support for Thermal Contacts
  - Assignment on Faces or Shells in contact with other objects/shells
    - Select faces/shells for contacts, target faces automatically determined
  - All Thermal Resistance Types Supported
    - Thickness and Material – Conductance calculated based on material and thickness (k/t)
  - Multi-Region mesh created when contacts created
    - Nodes no longer shared at contacts
- Constraints
  - Thermal cannot be used as source design for Datalinks with other products including structural/modal
  - Appy mesh operations in target design not supported for the mesh link in Optimetrics

Target Objects

Contact Object
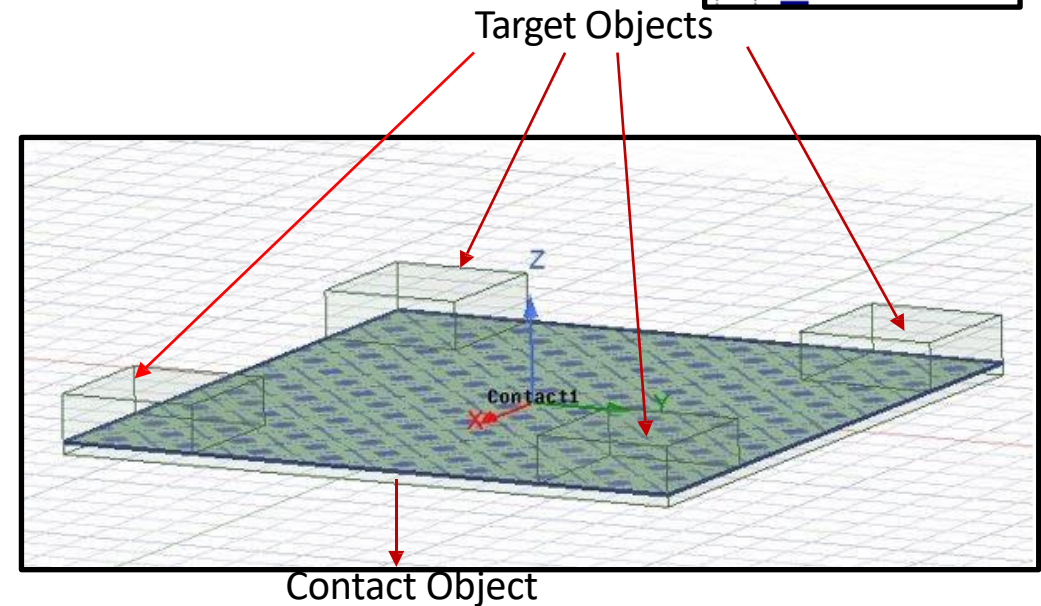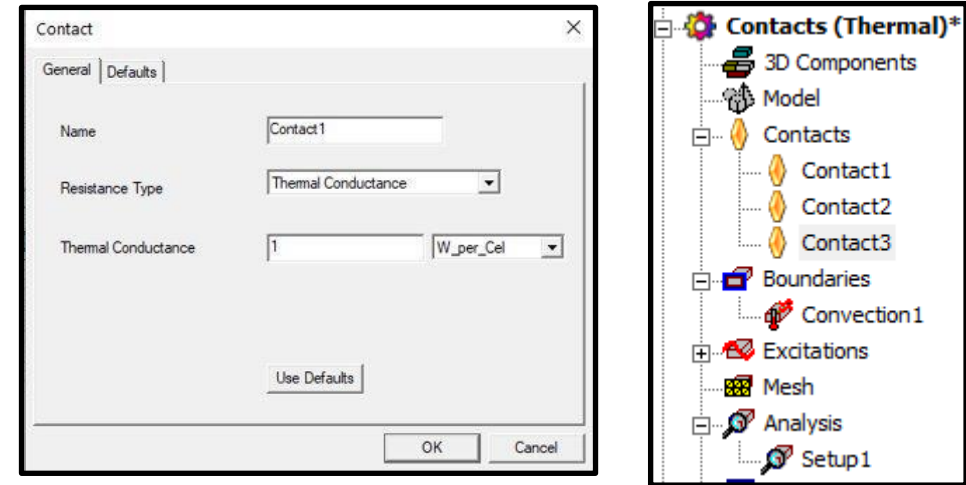
Enhanced Boundaries & Solver: Thermal Contacts [Beta]
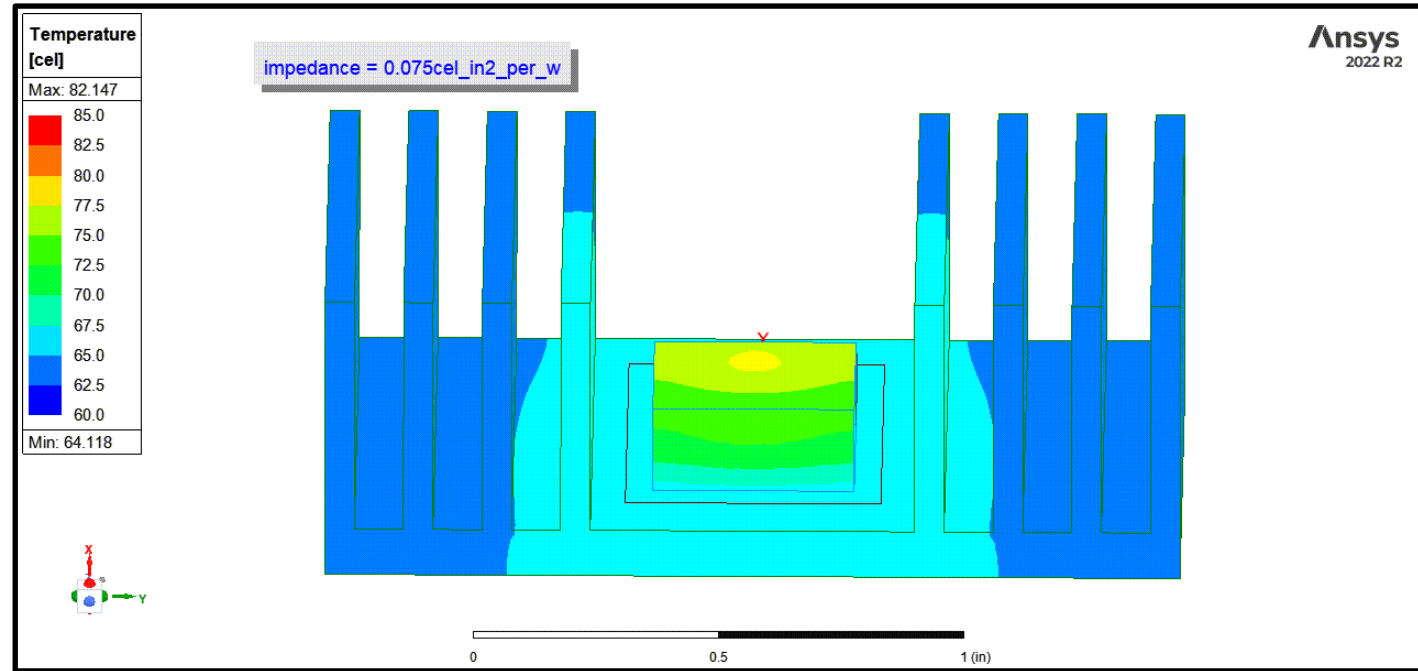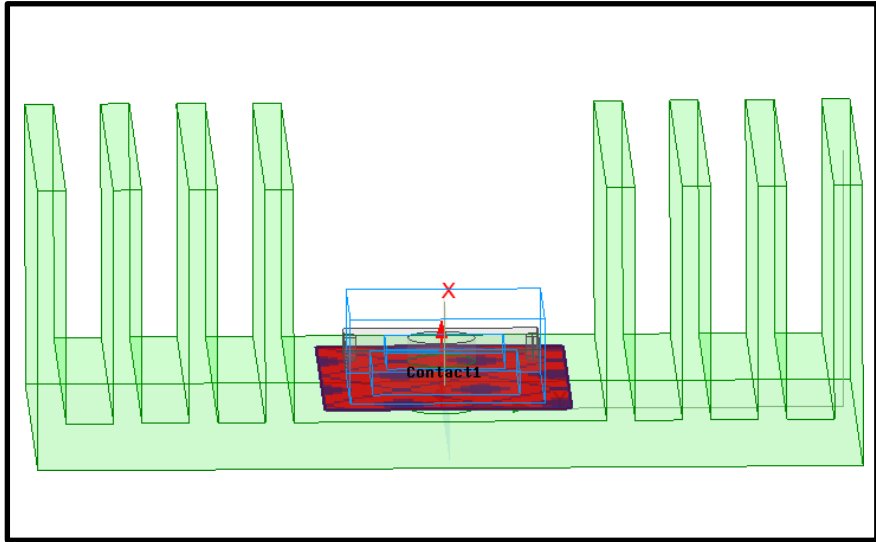
Thermal

Optimetrics Analysis showing Effect of Thermal Impedance on Maximum Temperatures

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Enhanced Boundaries & Solver: Heat Transfer Coefficient

- Heat Transfer Coefficient Assignment Enhancement
  - Convection boundary ignored for shared nodes
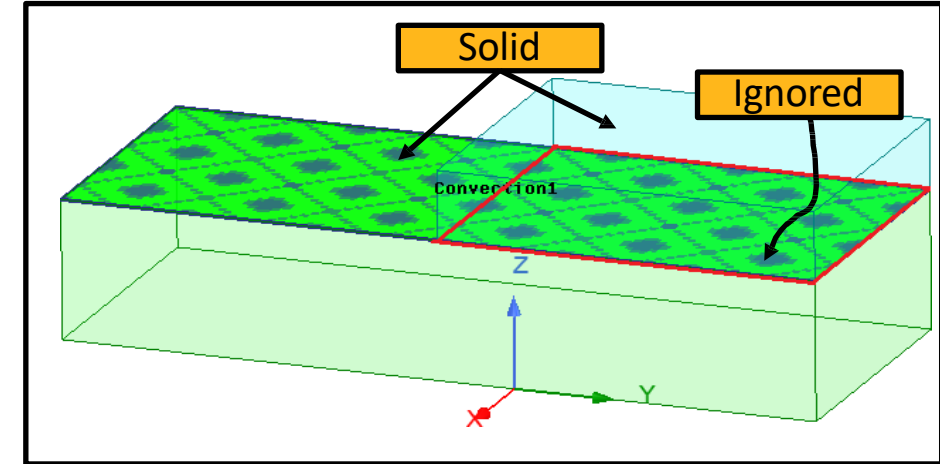   - Solid-solid nodes
  - No need to isolate 1-sided sections of faces
    - Example: HTC can be assigned to entire PCBs
    - Component contact faces automatically ignored
  - Constraints:
    - Convection boundary setting not ignored when contacts defined
    - HTC boundary cannot be defined for faces when mixed fluid and solid regions overlap

⚠ Convection boundaries assigned to faces that are in contact with solid-solid regions will be ignored.

Enhanced Boundaries & Solver: Non-Linear Settings [Beta]

- Non-Linear Solver Settings
  - Temperature Convergence
    - **Program Controlled** or **On**
      - Tolerance – 0.5% (default)
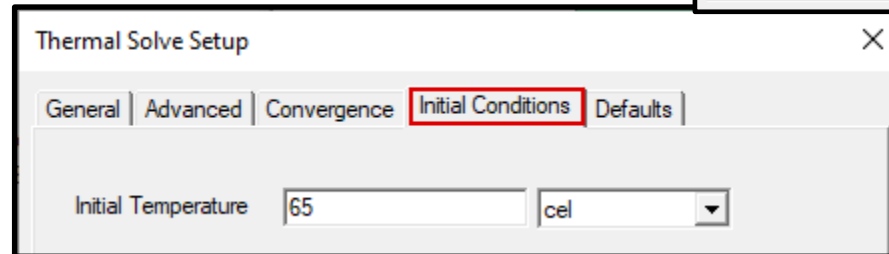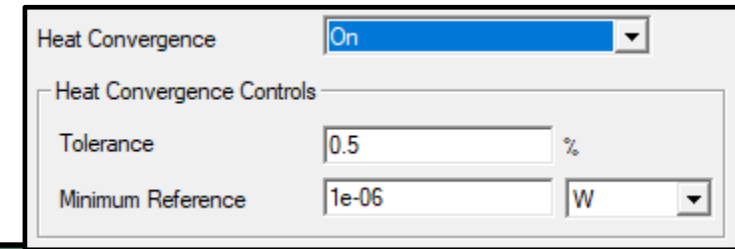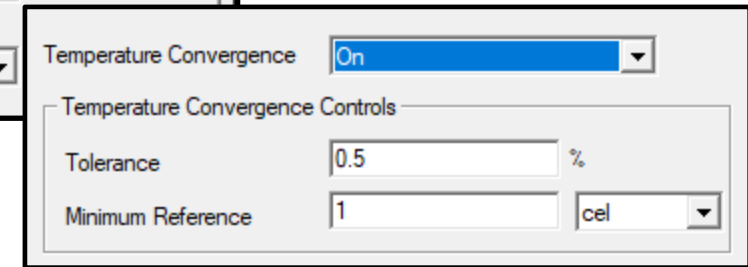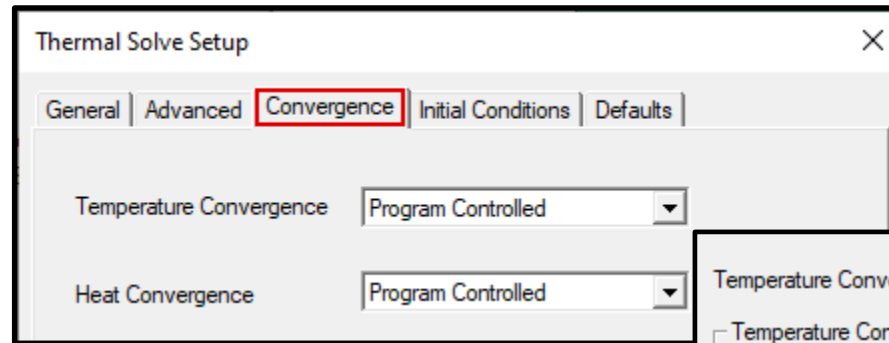   - Minimum Reference – 1 C (default)
  - Heat Convergence
    - **Program Controlled**, **On** or **Off**
      - Tolerance - 0.5% (default)
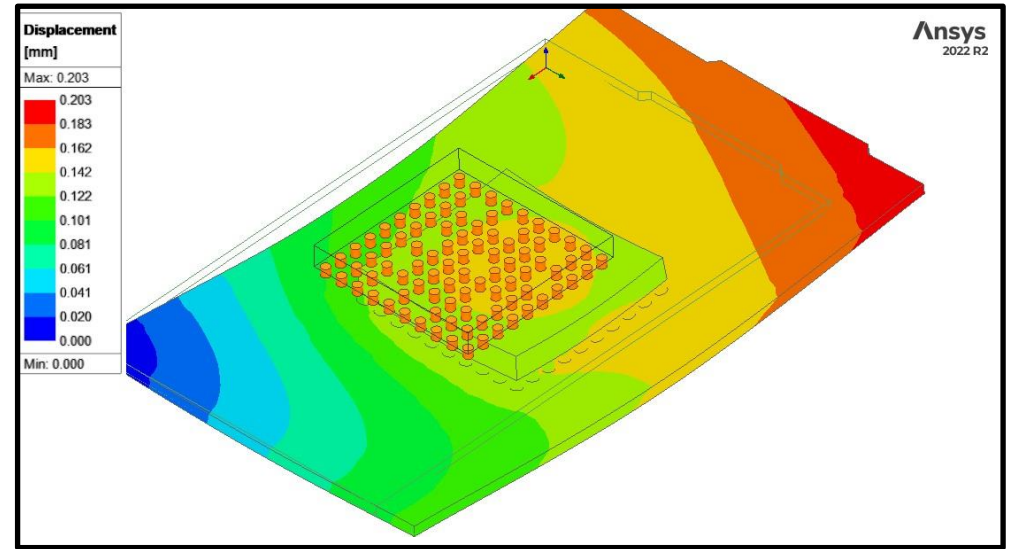   - Minimum Reference – 1e-6 W (default)

- Initial Conditions
  - Initial Temperature

Workflow Enhancements: Slider Bar Mesh & Report [Beta]

- **Structural Solution type [Beta]**
  - Slider Bar Meshing Enhancements

- **Reaction Force Report**
  - Available for Boundaries
  - Vector output
  - Helpful in evaluating structural load paths

- **PCB Substrate Warpage Example**

新科益工程仿真中心

咨询邮箱：ansyssupport@cadit.com.cn

公司网址：http://www.cadit.com.cn

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