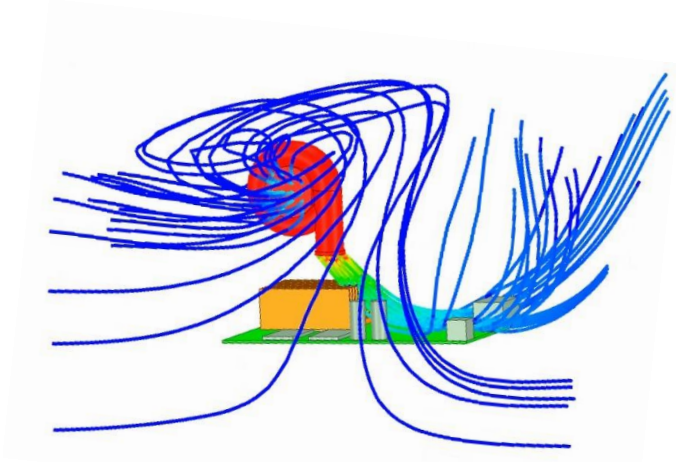
ANSYS 2022 R1
Icepak新功能介绍

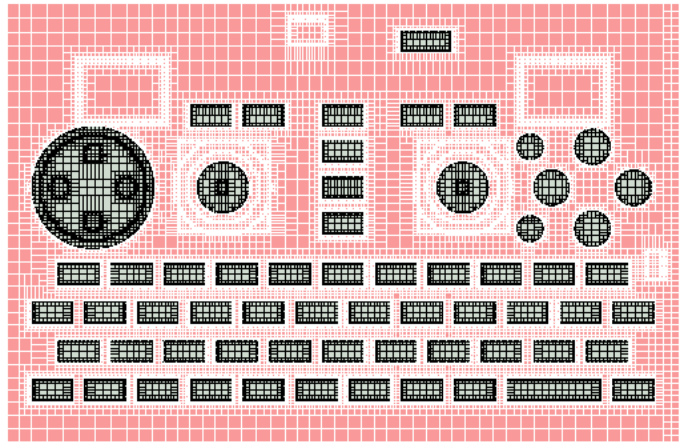
新科益系统与咨询（上海）有限公司

Icepak 2022 R1 Highlights

- **Reduced Order Modeling (ROM)**
  - Redhawk CTM 2-Way & New Delphi Network Creation
- **Blower Modeling**
- **ECAD Import -** Wirebond & IDX
- **Maxwell 2D** – Icepak EM Loss Coupling



Streamlines into and out of a Centrifugal CAD Blower cooling a PCB assembly



- **Mesher Enhancements –** 2.5D Improvements
- **User Experience**
  - Streamlines & Validation Enhancements
  - Improved Error messaging & troubleshooting
- **Migration**
  - Improve speed of TZR conversion
  - Network Schematic enhancements
  - Toolkit enhancements
    - PCB, Package parameterization

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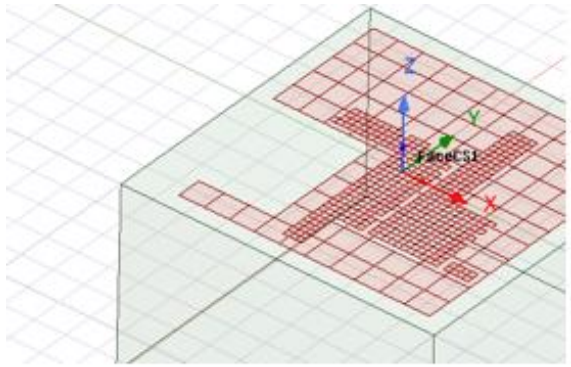
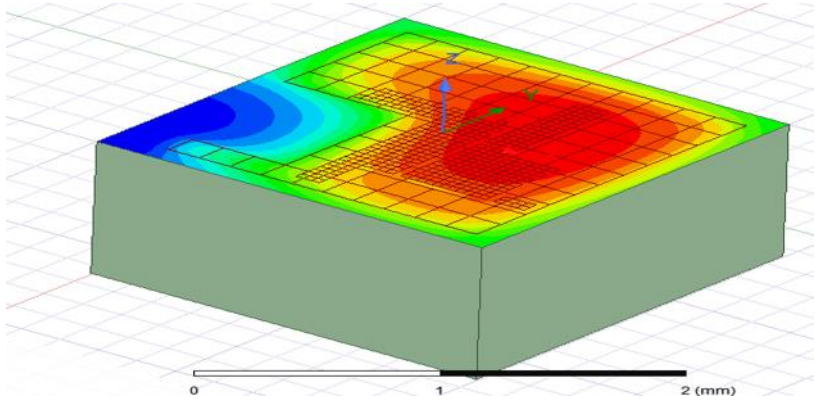
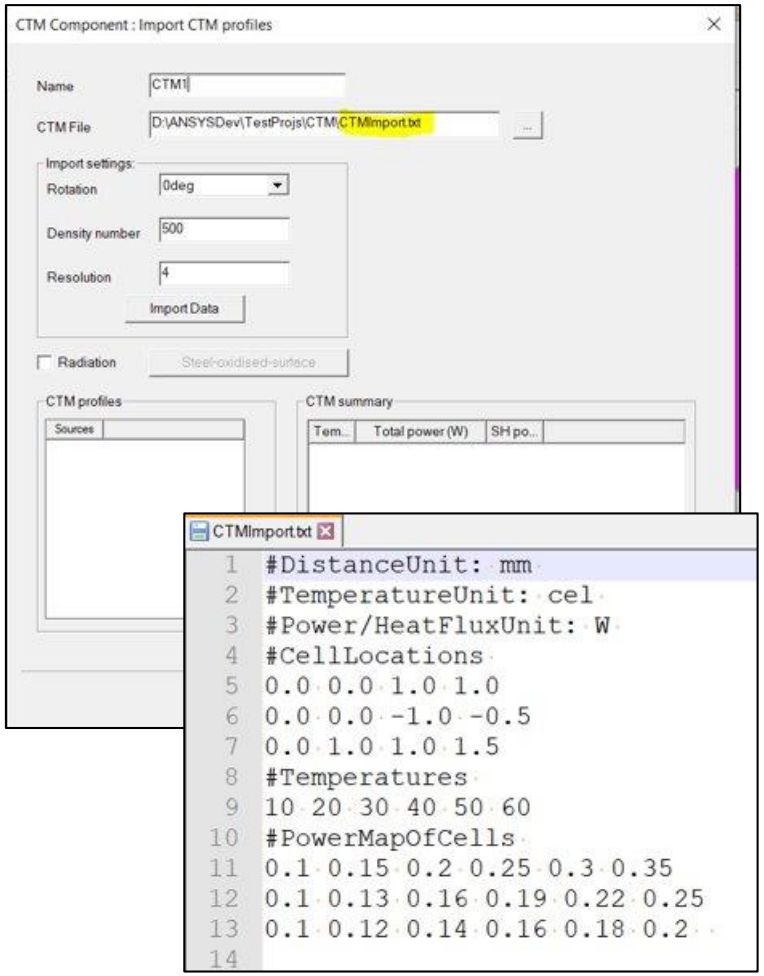
RedHawk CTM Two-Way Workflow

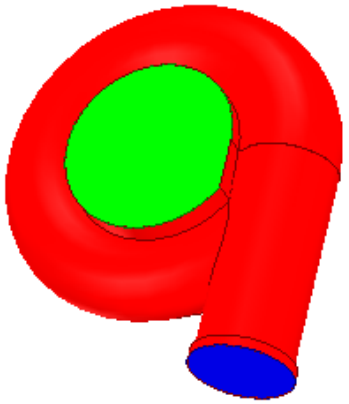
- **Chip Thermal Model (CTM) two-way co-simulation**
  - Chip-aware system design (2021 R2)
  - System-aware chip design (2022 R1)
  - Auto-export temperatures to RedHawk after simulation
    - Defaults to export folder specified under Design Settings
    - Binary format
  - CTM import using a 3rd party text file
    - CTM native component created
    - No temperature data export

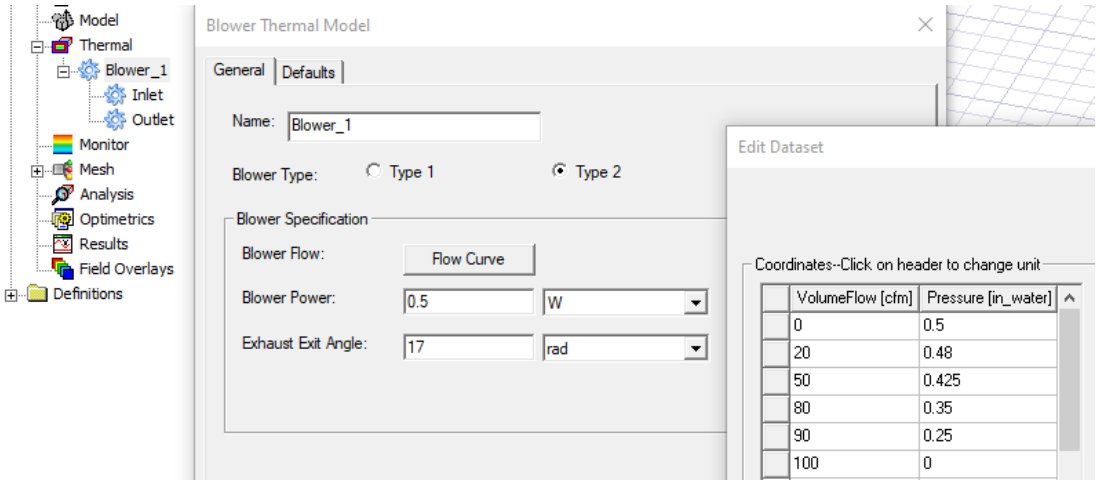




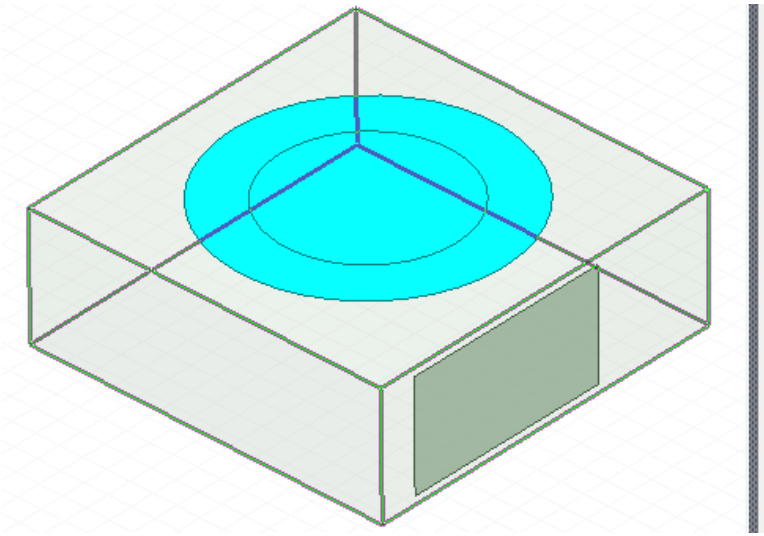


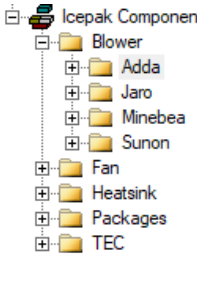
Blower Modeling

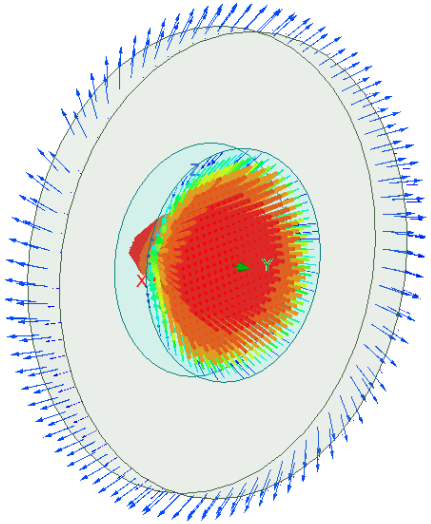




- Generalized Blower boundary
  - Impellers (type 1)
  - Centrifugal blowers (type 2)
  - Single and dual inlets for all geometries
- Blower toolkit
  - Geometry and BC for rectangular and cylindrical geometries
- Vendor Component Library
  - Adda, Jaro, Minebea, Sunon
- Blower Assignment
  - Polygonal approximation allowed for type 1
  - Multiple co-planar inlet faces allowed for type 2
  - Ability to toggle inlet/outlet faces
- Blower Specifications
  - Blower flow curve
  - Fan blade/exit angle
  - RPM (type 1)
  - Blower Power

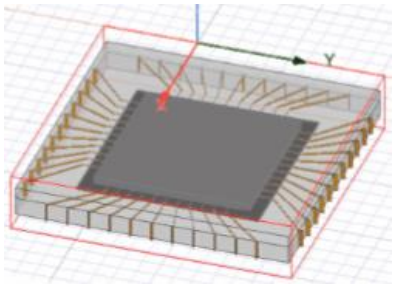




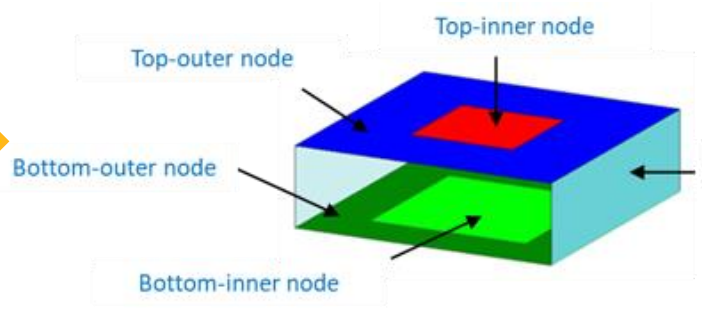


Reduced Order Modeling - Delphi Network Creation*

- Steady-state Delphi network creation for QFP packages



Detailed Package CFD Model



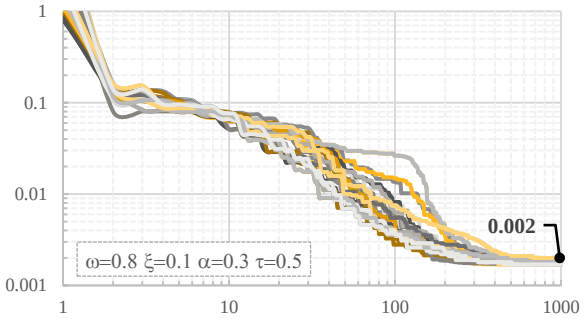
DELPHI's Black-box thermal model

Sides node

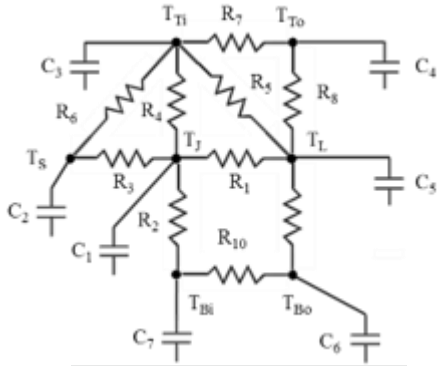
Delphi boundary condition setup

$$\begin{bmatrix} Case & \overline{h}_{TOP} & \overline{h}_{BOTTOM} & \overline{h}_{SIDES} & \overline{h}_{LEADS} \\ 1 & 5 & 1 & 5 & 1 \\ 2 & 15 & 1 & 15 & 1 \\ \vdots & \vdots & \vdots & \vdots & \vdots \\ 48 & 10 & 1000 & 10 & 100000 \end{bmatrix}$$

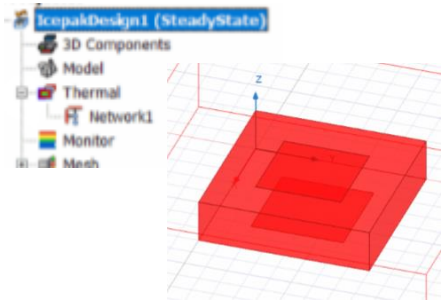
Parametric setups with training BCs



Delphi Optimizer



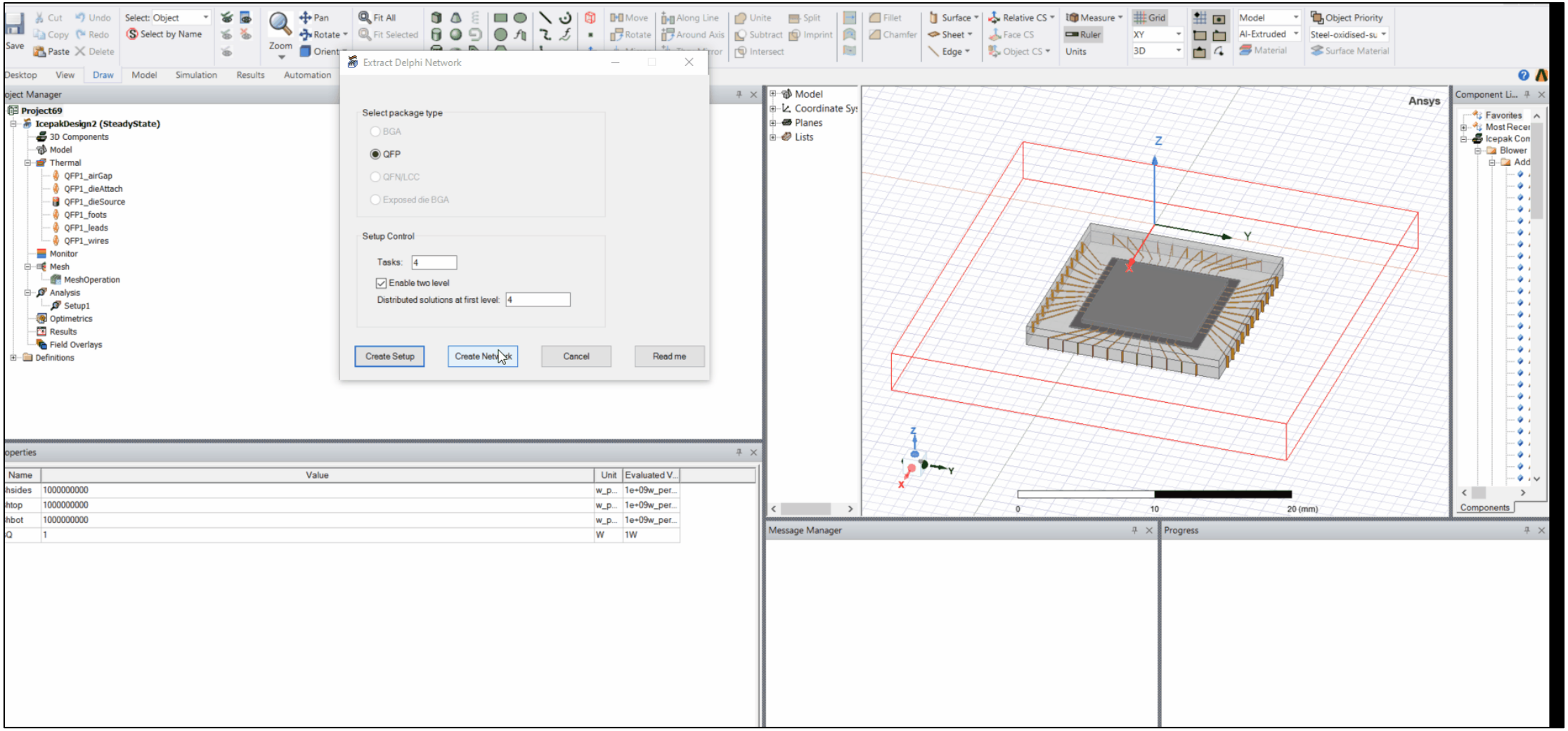
Delphi Network



Icepak Design

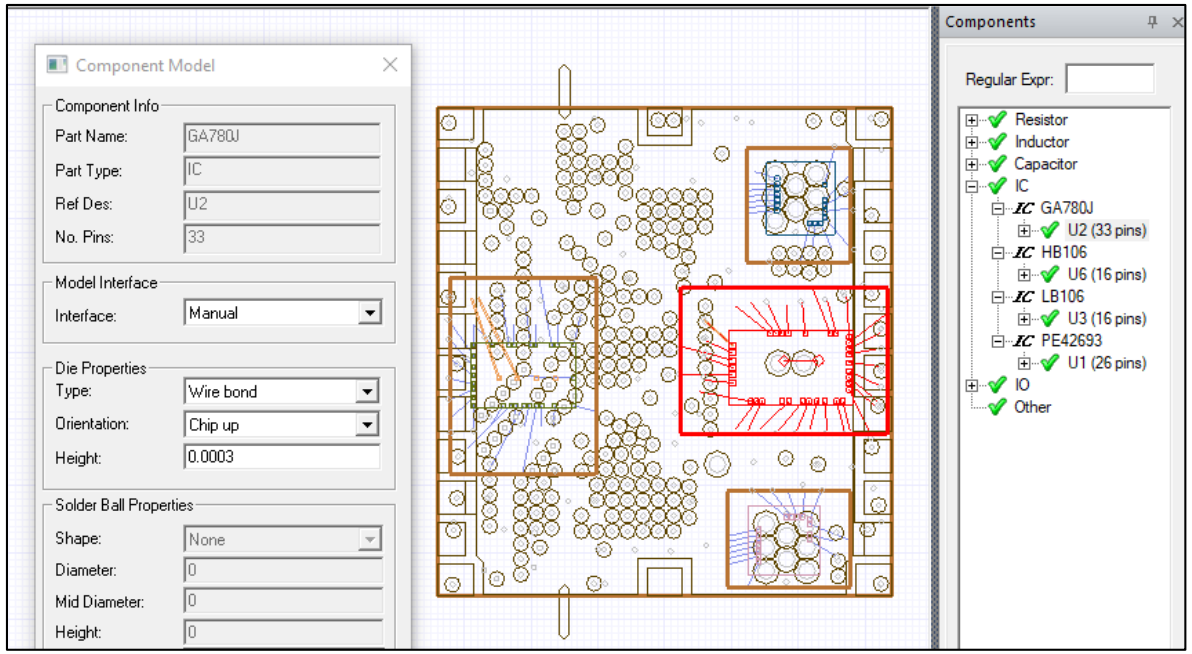
* Requires Feature Flag

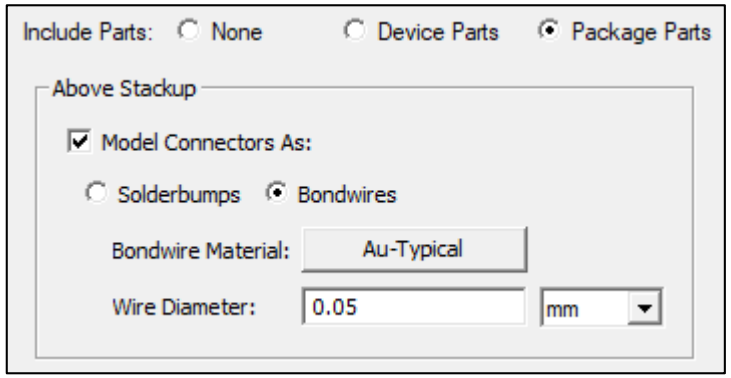
Automated Delphi Network Creation Workflow in AEDT



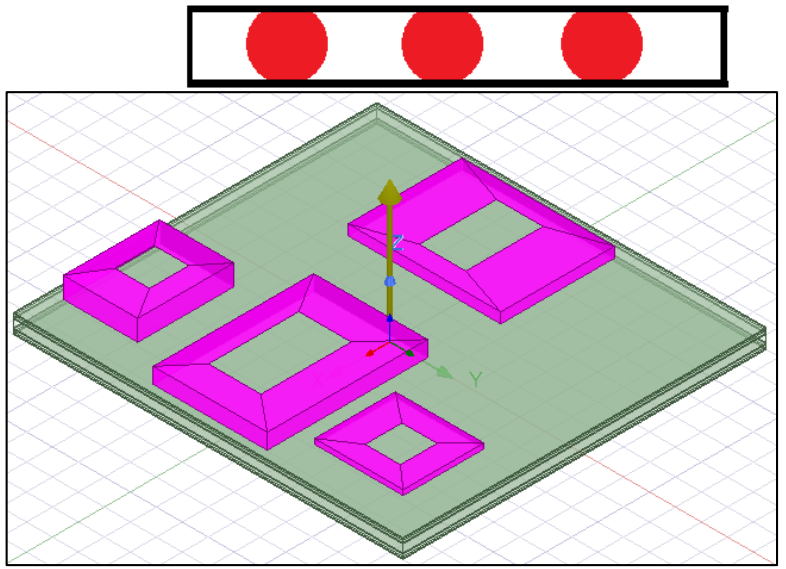
ECAD - Bondwire Import

- **Bondwire Import with PCB Component**
  - Bondwires attached to components with die properties
    - Material and wire diameter input options
    - Modeled as sheets with shell conduction plate BC

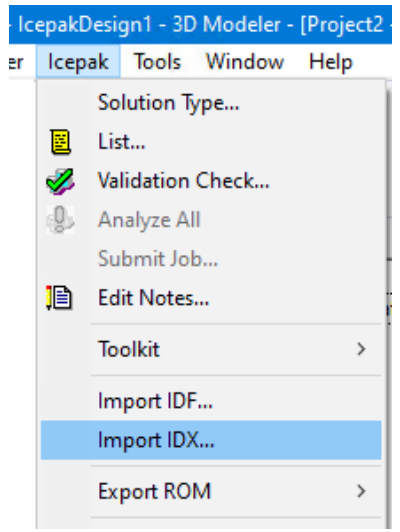




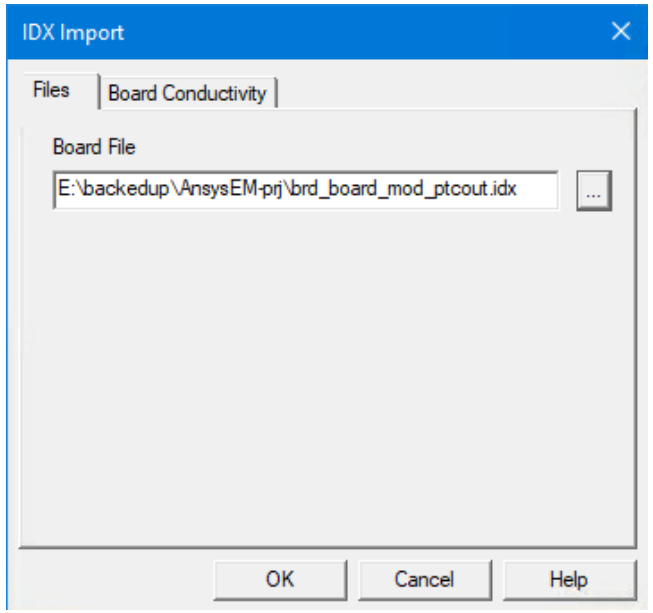
Cross-section View

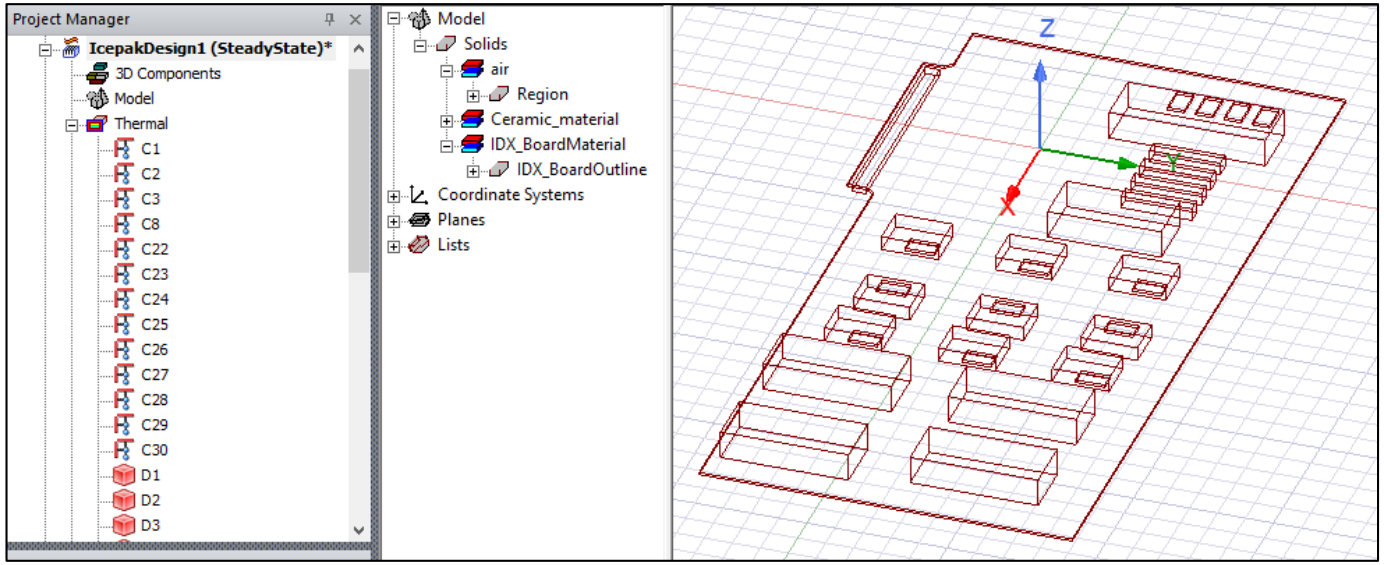


ECAD - IDX Import



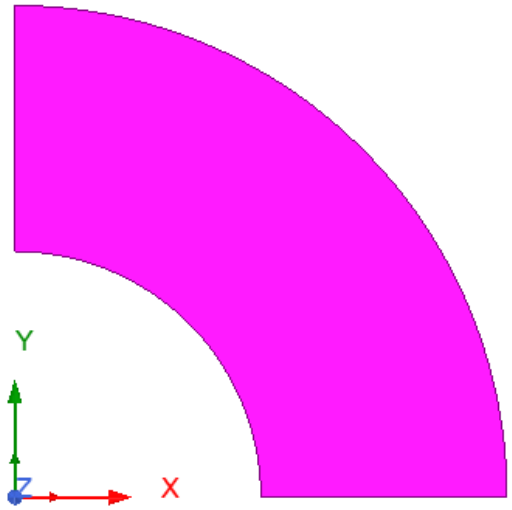
- **IDX Import – XML based format consisting of ECAD and MCAD data**
  - Support geometry and boundary condition import (MCAD)
    - Like IDF import in Icepak AEDT
  - Limitations
    - ECAD data import not supported
    - Filters, Modeling options, Cutouts not supported



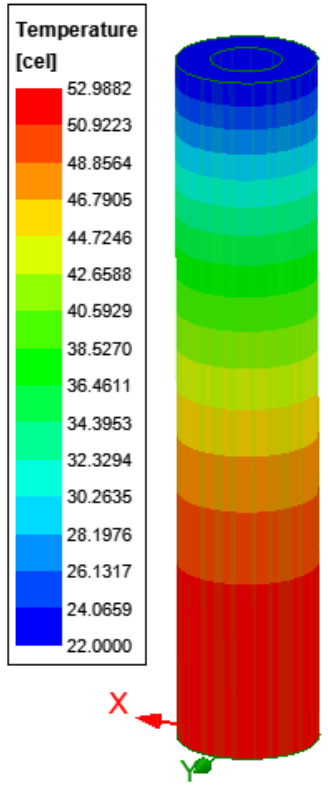


Maxwell 2D – Icepak EM Loss Coupling

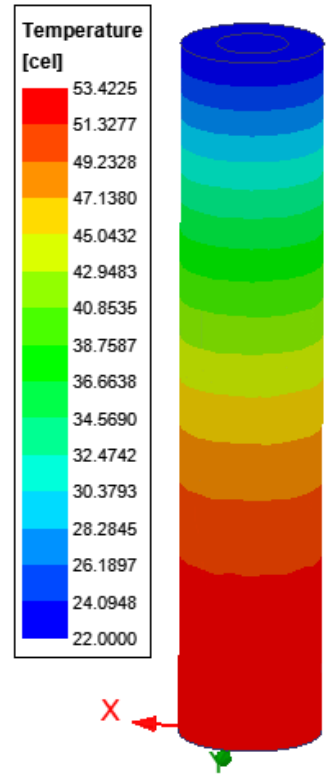
- Support EM Loss Import from Maxwell 2D
  - Extruded geometries of 2D representations
    - Support both +ve and –ve extrusions in XY
    - Can be partial geometries
  - Coupling projects 3D mesh points onto 2D geometry
  - Limitations
    - Extrusions need to be along Z axis
    - Losses not conservative



Maxwell 2D Geometry



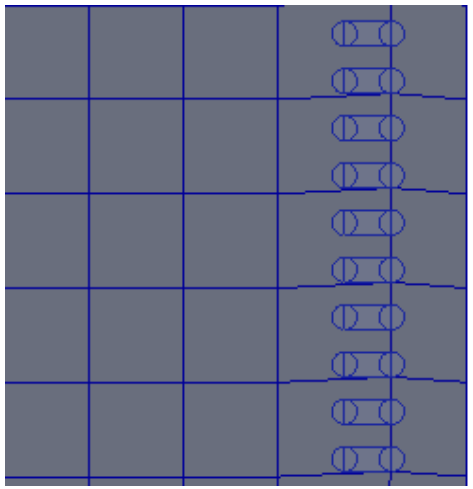
Maxwell 2D Coupling



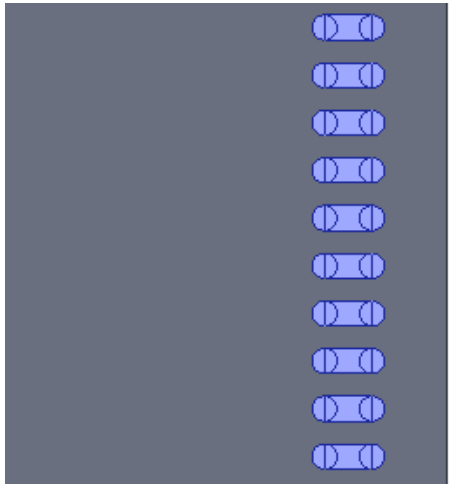
Maxwell 3D Coupling

Meshing Enhancements - 2.5D Meshing

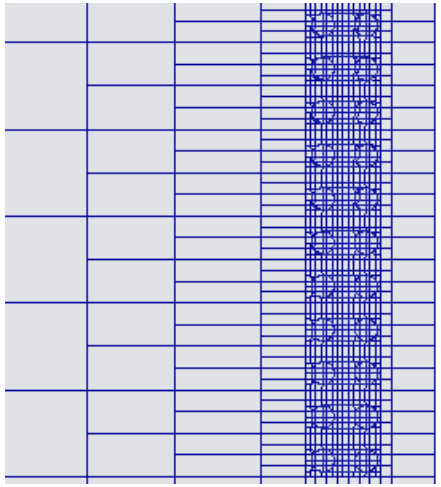
- Capturing Thin Objects in 2.5D Meshing
  - Refinement around 2D sheets parallel to the 2.5D meshing plane
    - Create additional refinement and multi-level around 2D sheets
  - Further mesh optimization using 2.5D mesh sub-blocking in following slide



2021 R2: 2D Sheets not meshed



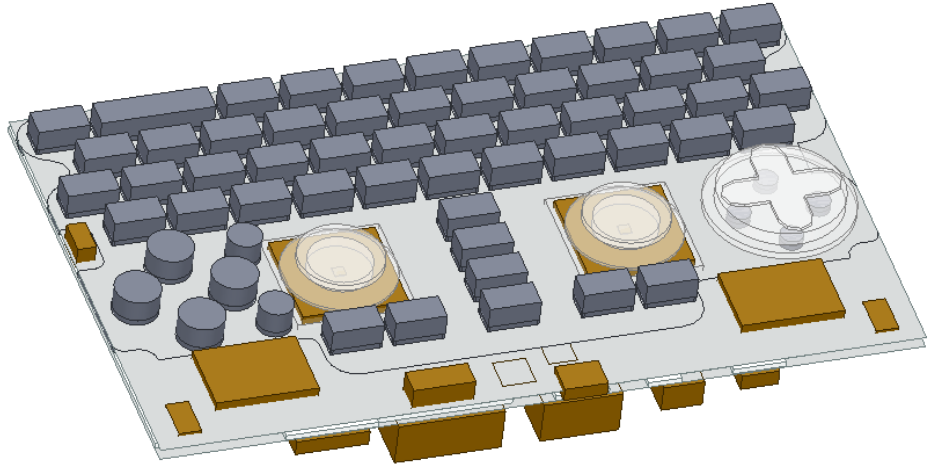
2D Sheets parallel to 2.5D meshing plane



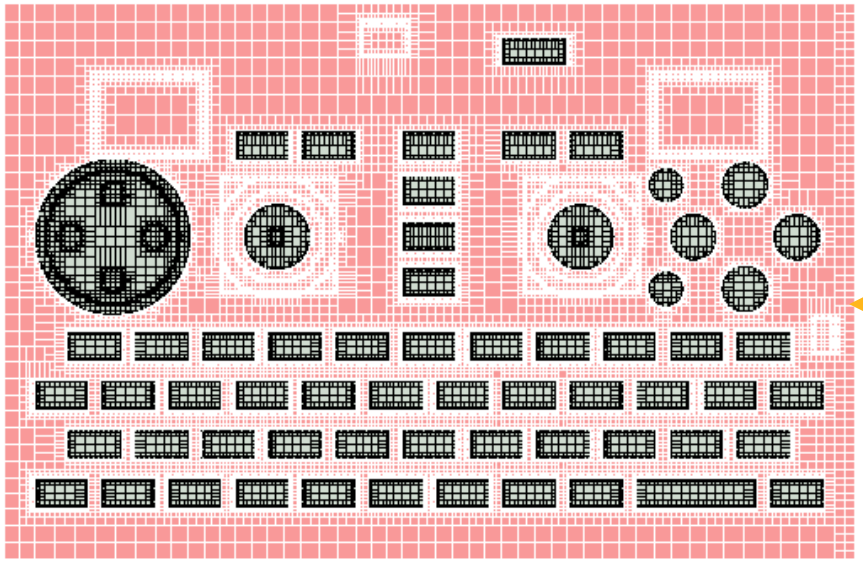
2022 R1: 2D Sheets meshed

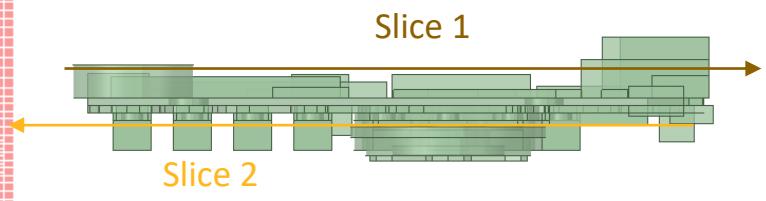
Meshing Enhancements - 2.5D Meshing*

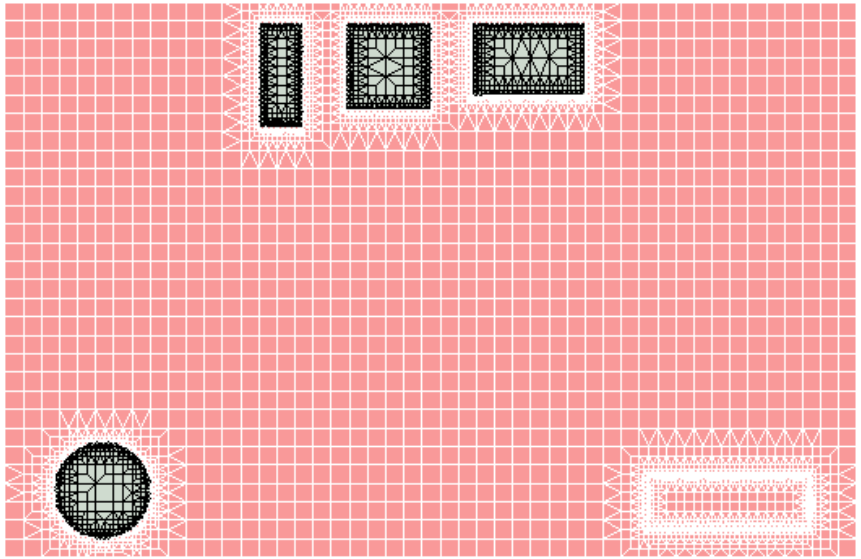
- Domain Sub-blocking for 2.5D Meshing
  - Prevent refinement from being imprinted throughout extrusion
    - Domain split according to in-plane geometry features
    - Uses non-conformal interface to couple different meshing blocks
  - **Reduced mesh counts and improved performance (~50%)**



Keyboard model mesh count:
2021 R2: **2.35M**
2022 R1: **1.38M**



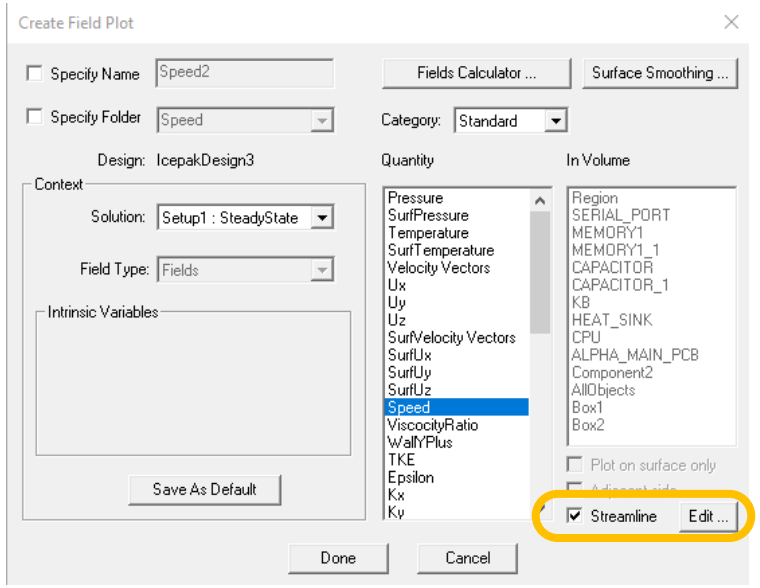


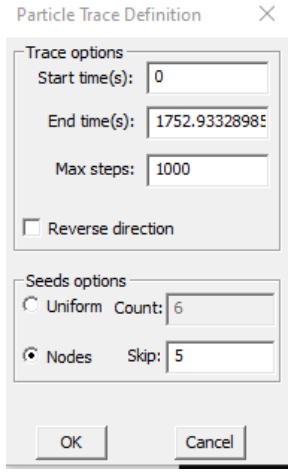


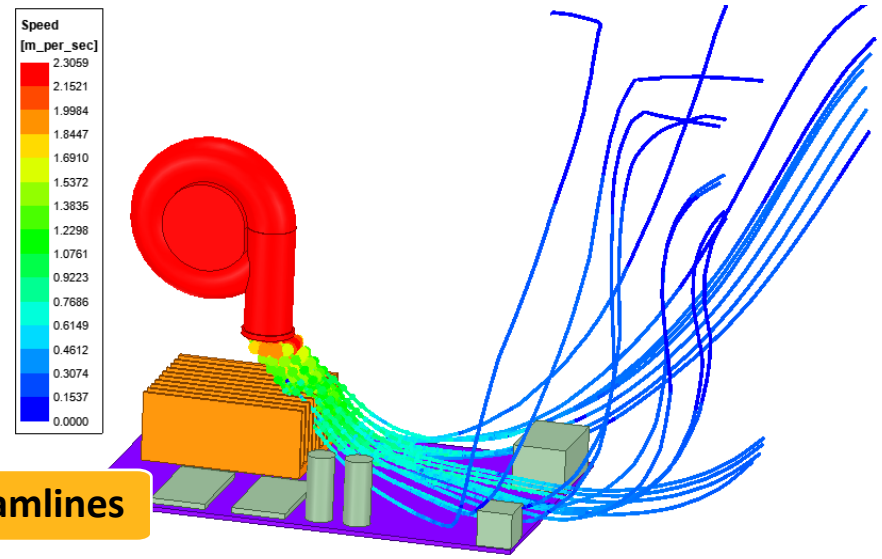
* Requires Feature Flag

Fluid Flow Streamlines*

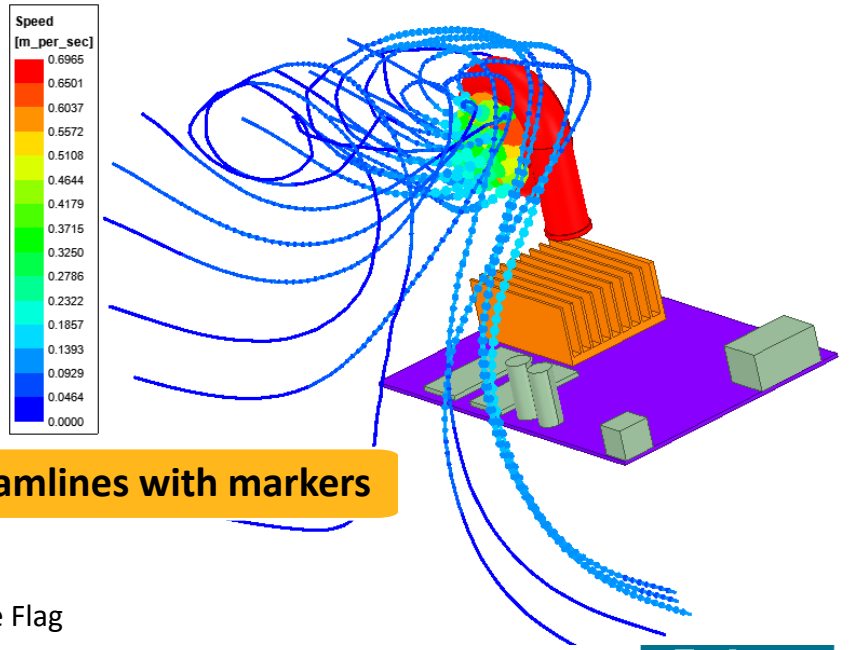
- Steady-state and transient particle traces
  - Forward and reverse direction
  - Uniform and mesh node seeding with skip option
    - Color by variable
    - Standard AEDT line and marker options
  - Animations are not supported yet







Forward streamlines

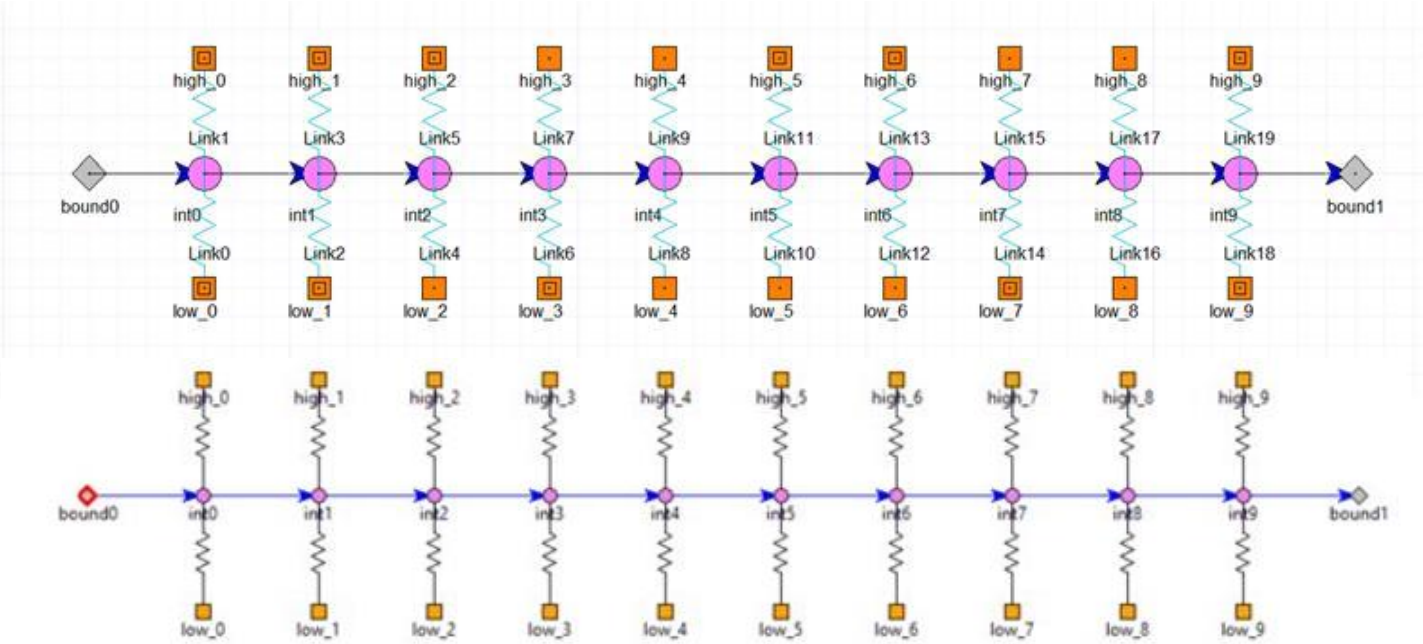


Reverse streamlines with markers

* Requires Feature Flag

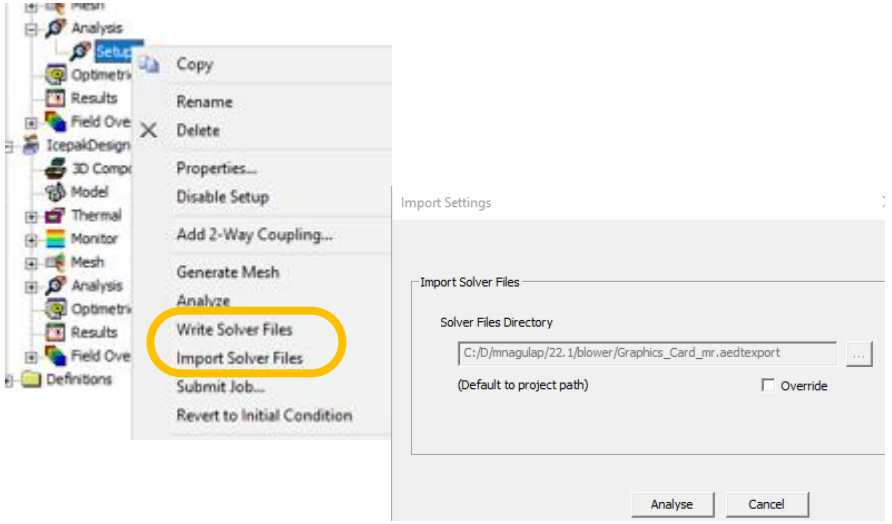
Network Schematic Enhancements

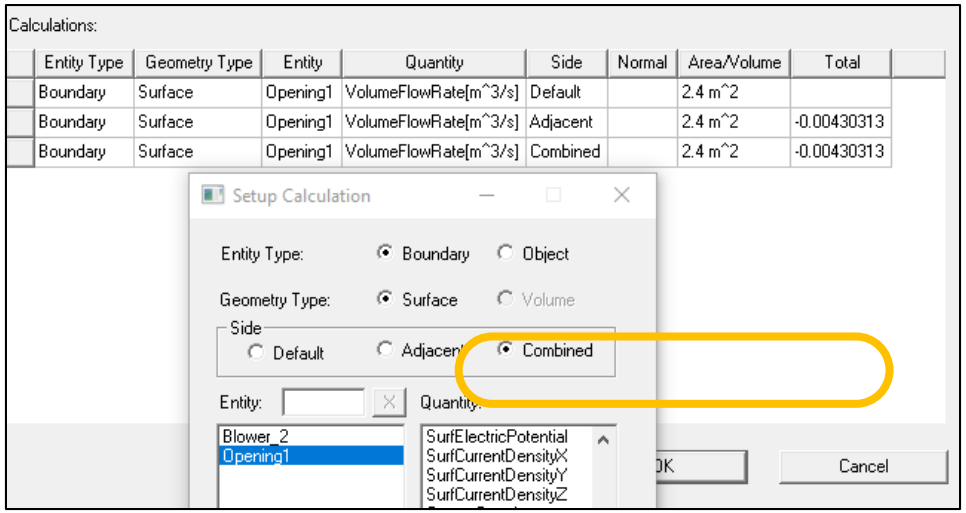
- Network circuit schematic enhancements
  - Simplified node representations
    - Similar ‘look-and-feel’ to Icepak Classic
    - Symbols
    - Color scheme
    - Links connect to nodes directly at centers
  - Icepak Classic network import
    - Networks with non-angled links imported
    - Angled links still imported using page ports



Miscellaneous Enhancements

- Solver File Export / Import
  - Write Solver Files option
  - Import Solver Files option*
- Fields Summary
  - Combined side option for surface quantities
  - Algebraic sum of Default and Adjacent side values
  - Single option to report:
    - Non-zero values at all 1-sided surfaces
    - Ensure heat balance at 2-sided surfaces
- TZR File Import Speed Improvement
  - Synchronization & Validation*
  - Speed-ups up to 70x observed





* Requires Feature Flag

Toolkits Development

New Toolkits (10)

- Geometry Approximations(6)
- Blower
- Extract Delphi Network
- Contour File Export
- Cut Plane

Enhancements (5)

- Variable support for Packages and PCB
- PCB
- DTM Monitor Support
- Dataset support for Power Budget
- Power density support for Bio-Heat Source

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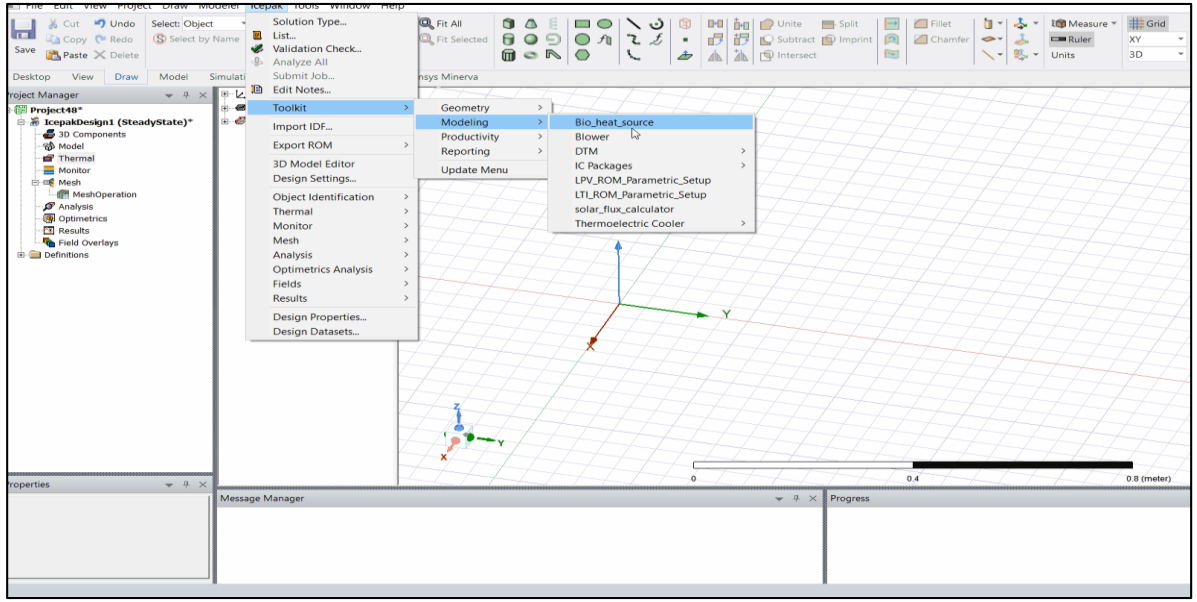
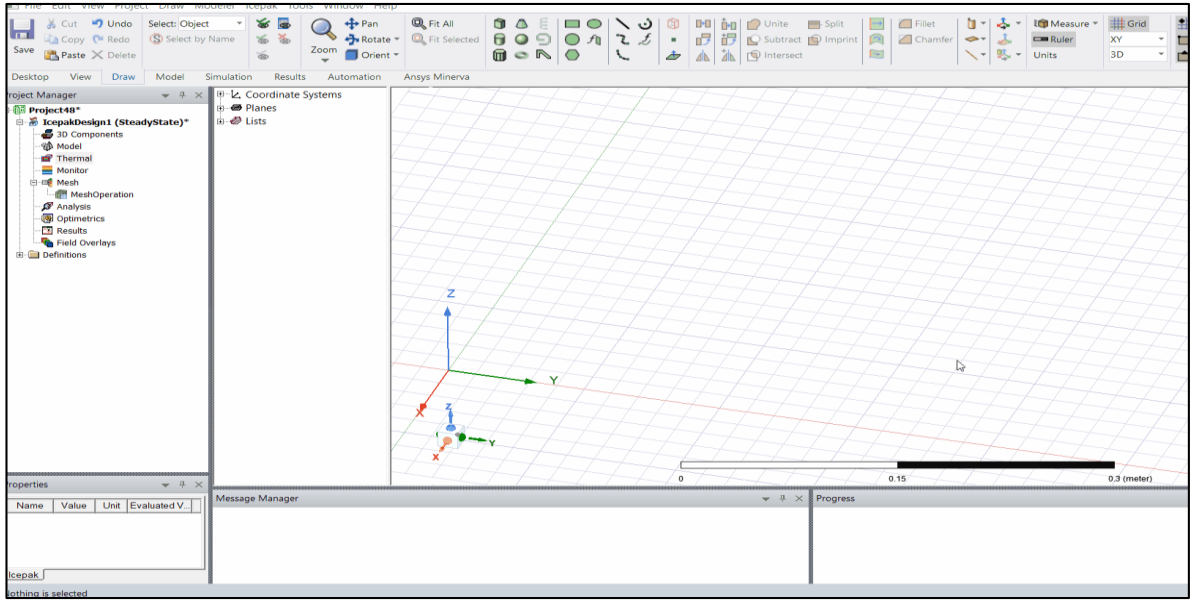
Blower Modeling - Toolkits

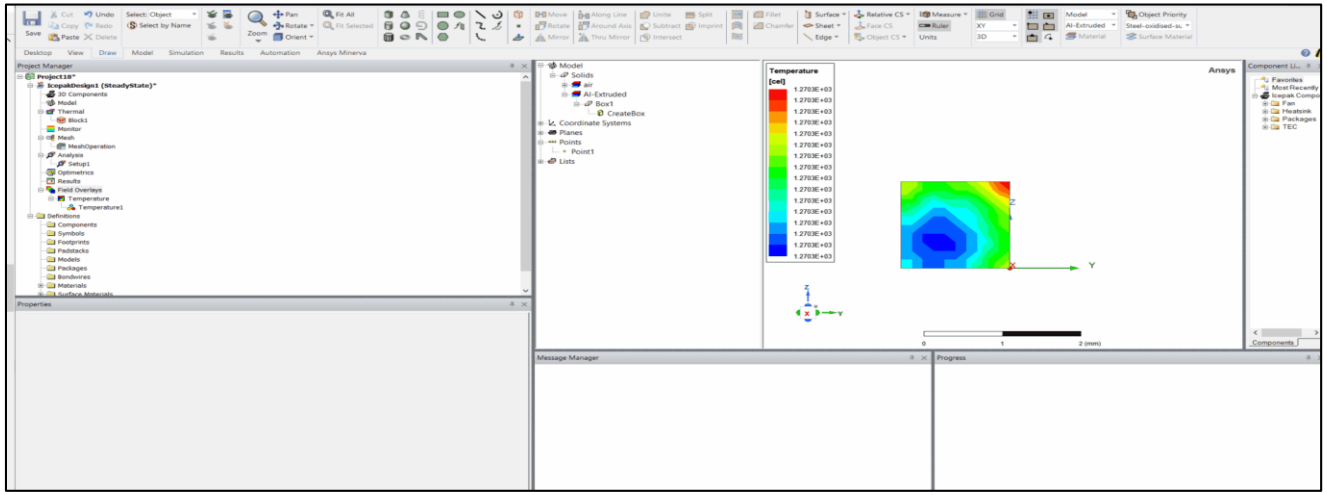


Type 1 Blowers

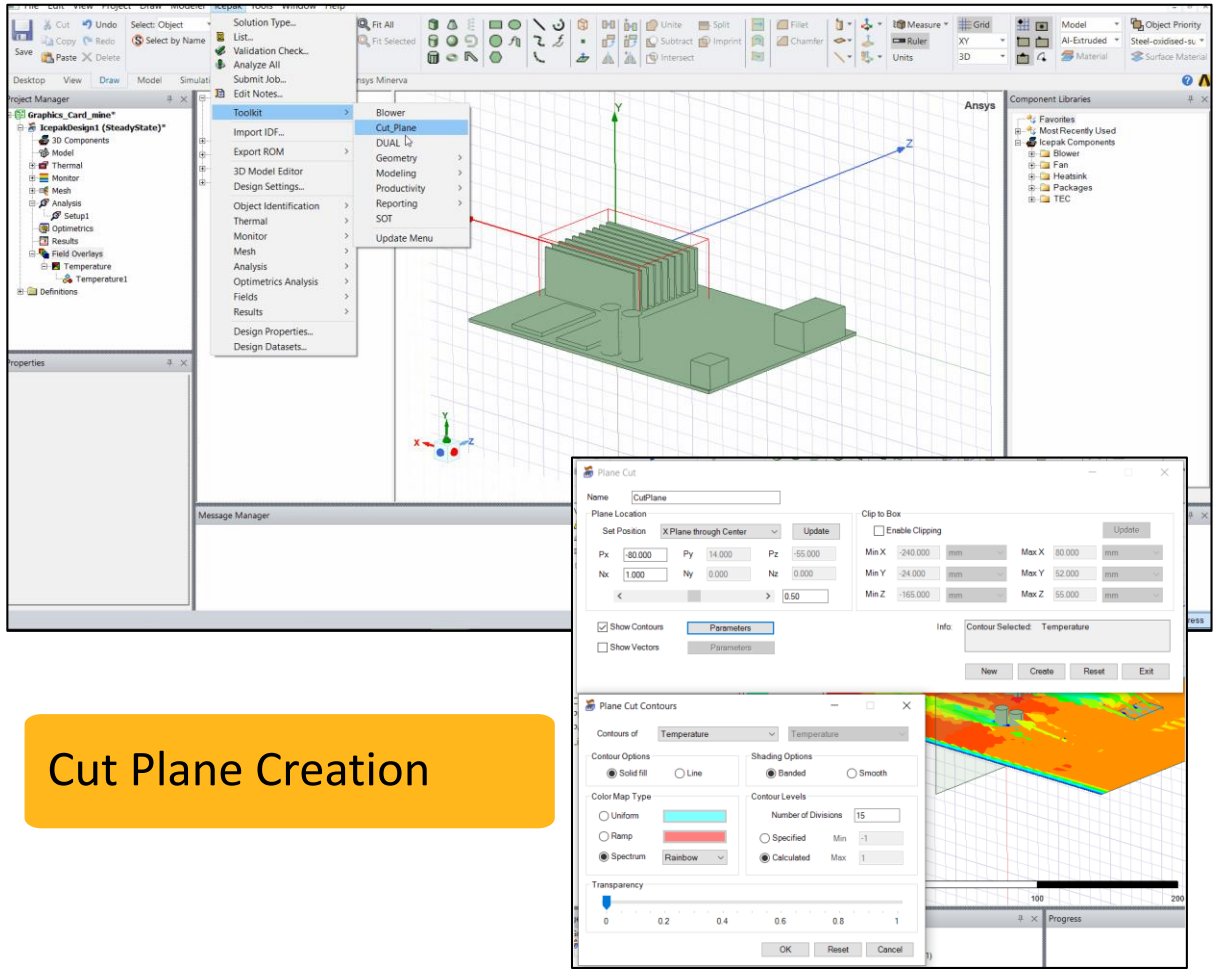


Type 2 Blowers

Post Processing Toolkits

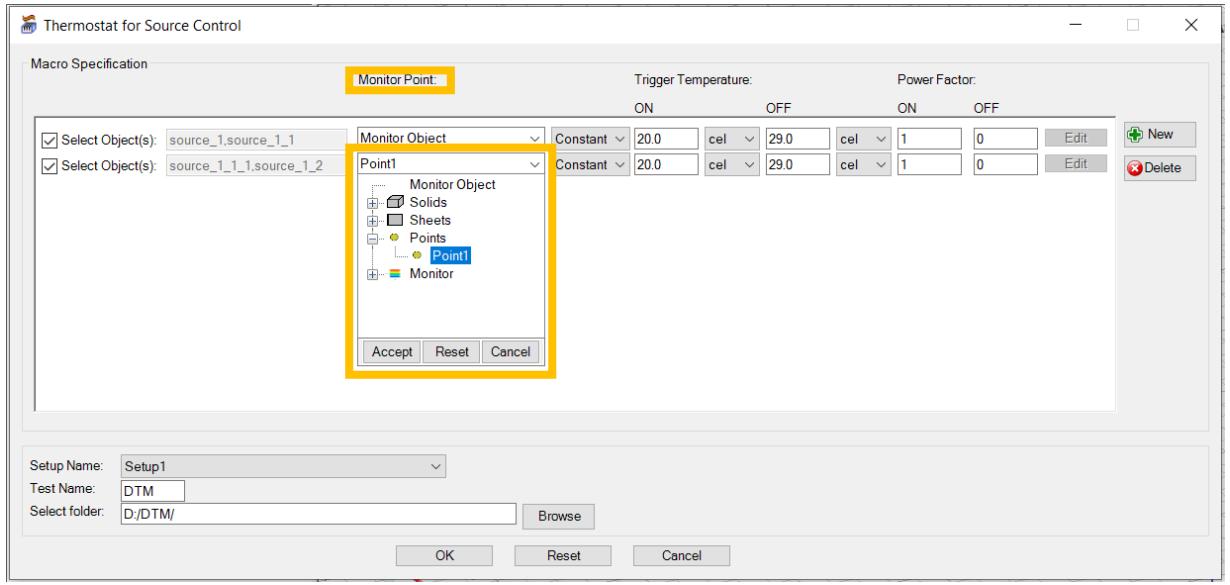


Field Plot ASCII Export

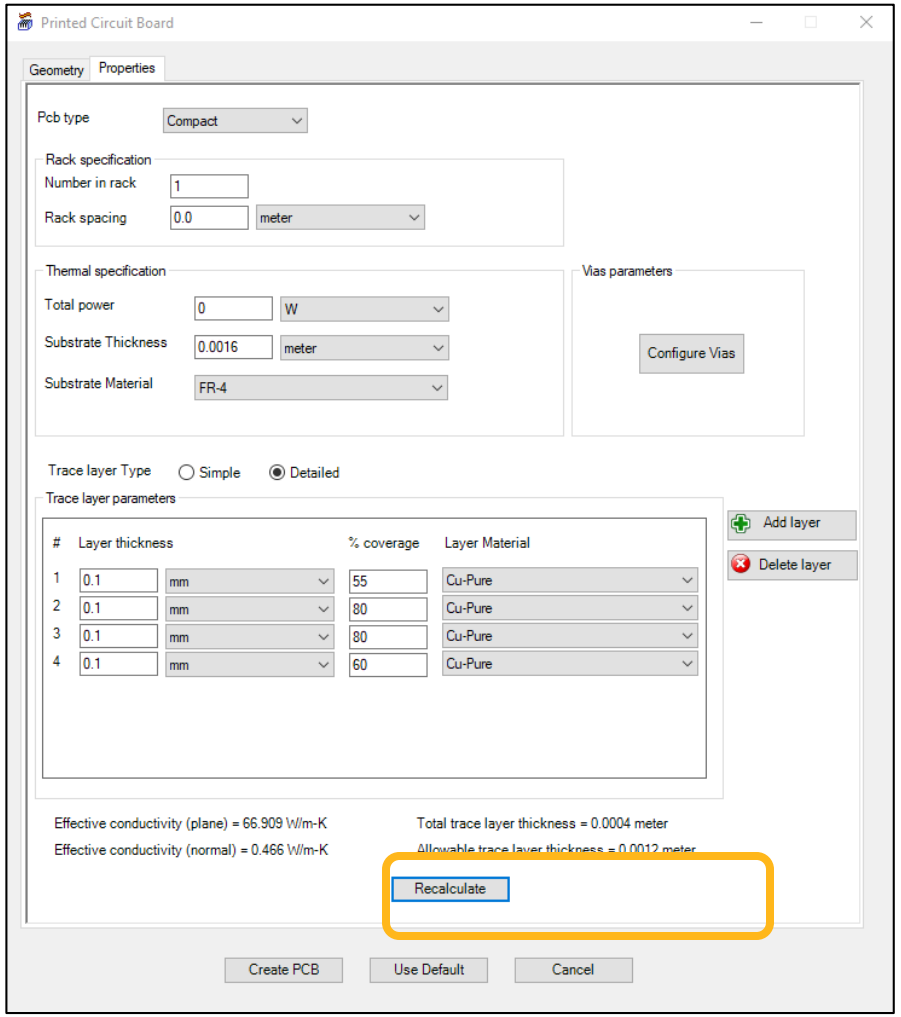


Cut Plane Creation

Other Toolkit Enhancements



DTM Monitor Support

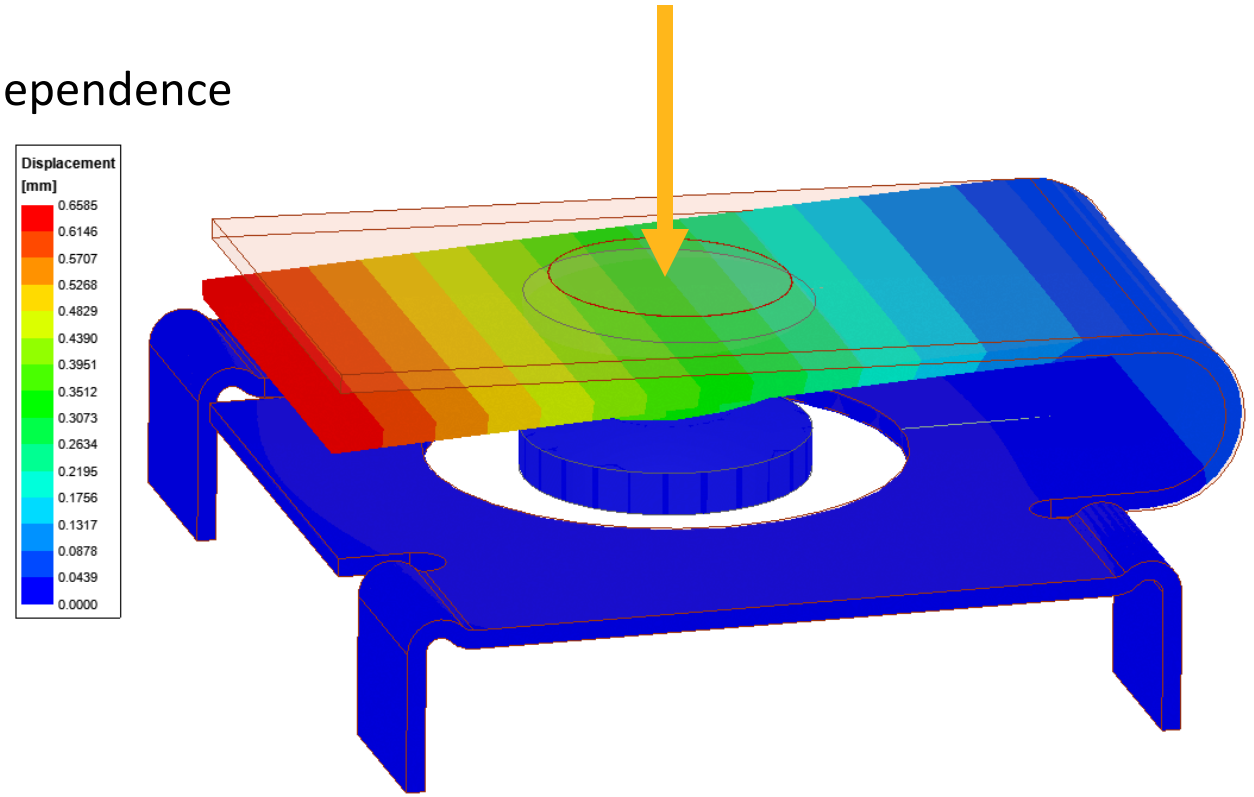


PCB

2022 R1 AEDT Mechanical Update

AEDT Mechanical 2022 R1 Highlights

- Coupling
  - Maxwell 2D – Thermal EM Loss Coupling
- Materials
  - General expression support for temperature-dependence
- Structural - Beta
  - Boundaries
    - Displacement
    - Pressure/Force
  - Coupling
    - Mechanical Thermal-Structural Link
    - EM Force – Structural Coupling
- Meshing - Beta
  - Thermal Slider bar Meshing
- Reporting
  - Fields Summary



Maxwell 2D – Thermal EM Loss Coupling

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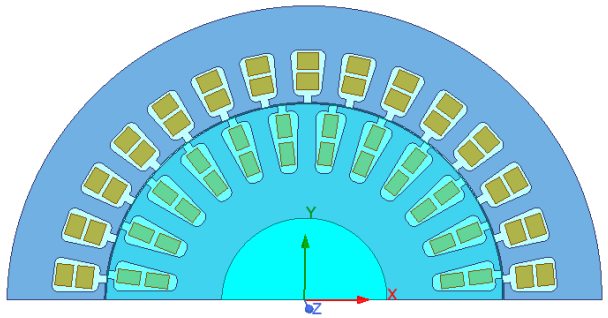
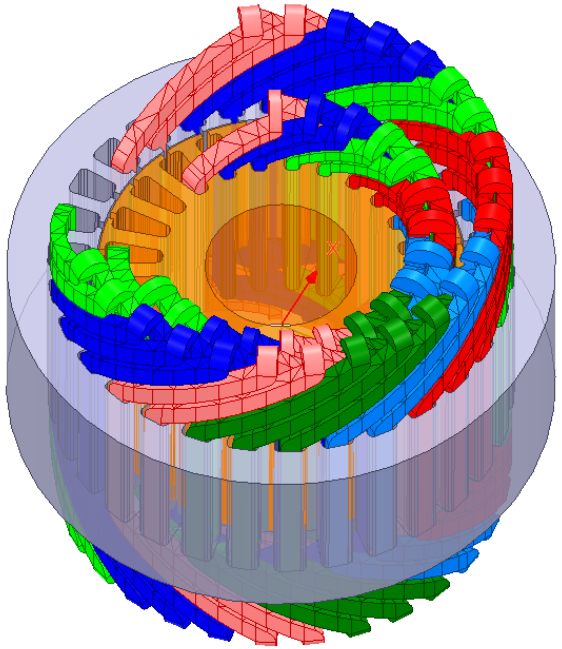
    - Losses not conservative
    - 2-way coupling not supported



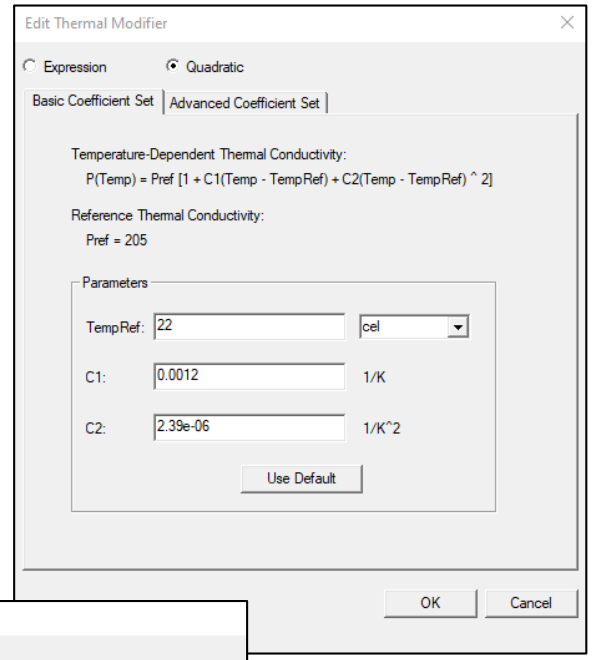
Maxwell 2D Geometry

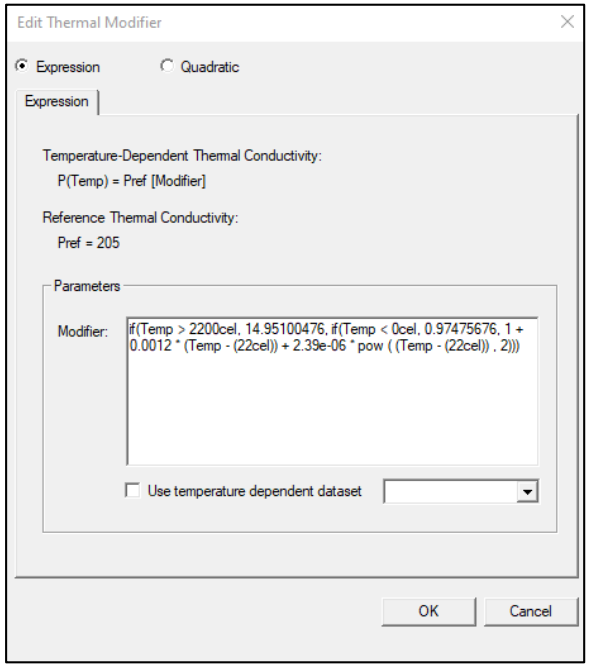


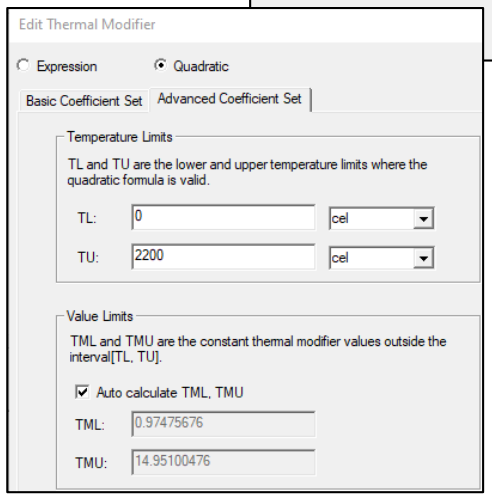
Thermal 3D Geometry

Temperature-Dependent Materials

- Temperature Dependent Materials
  - General expression support
  - Quadratic expressions
    - Advanced coefficient support
  - Converted to datasets for solver
  - Thermal & Structural





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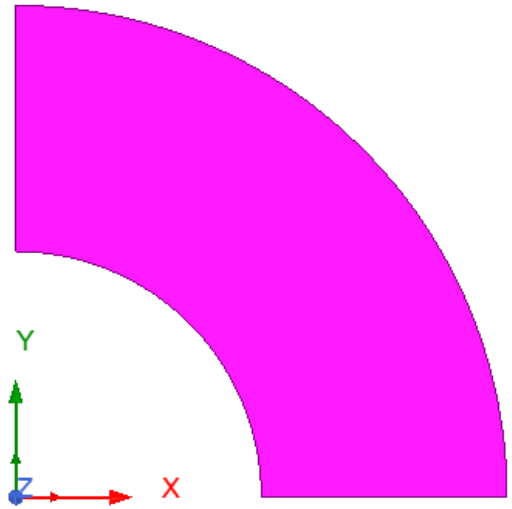
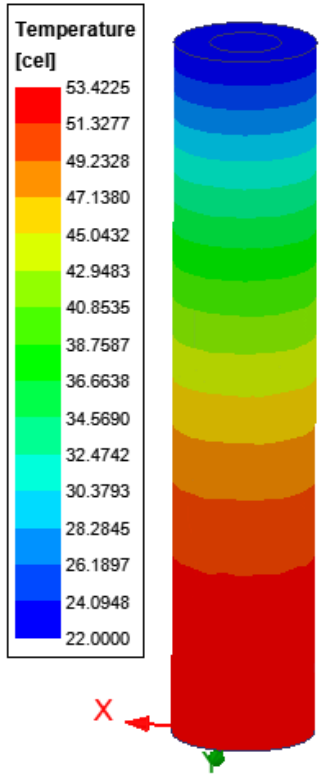
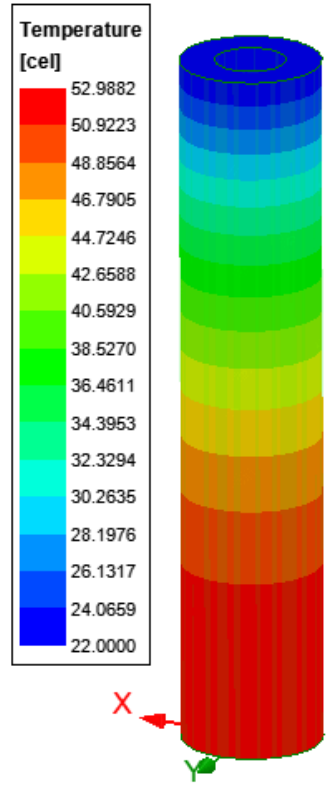
Maxwell 2D – Thermal EM Loss Coupling



Maxwell 2D Geometry



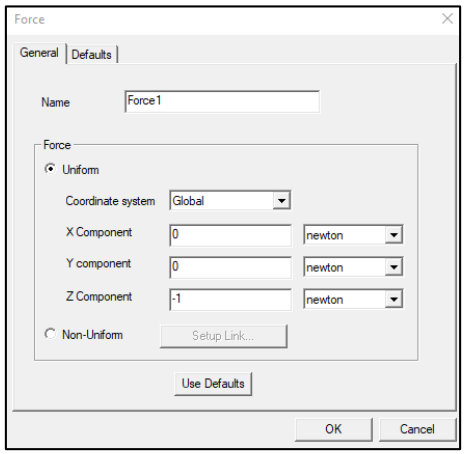
Maxwell 3D Coupling

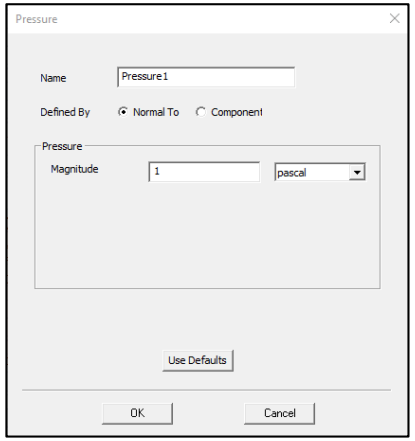


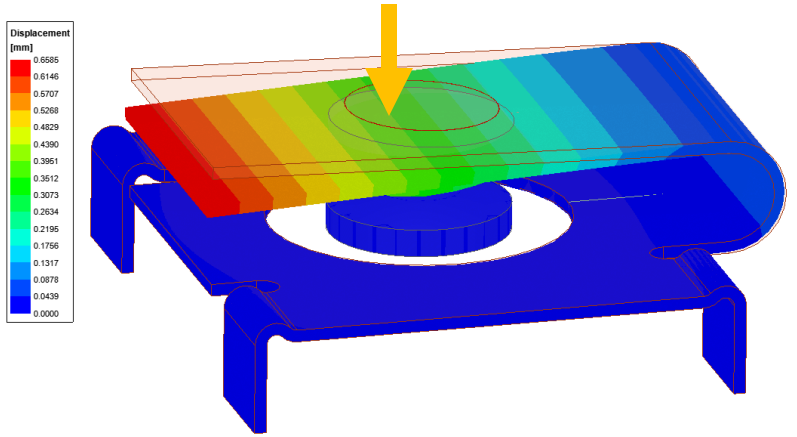
Maxwell 2D Coupling

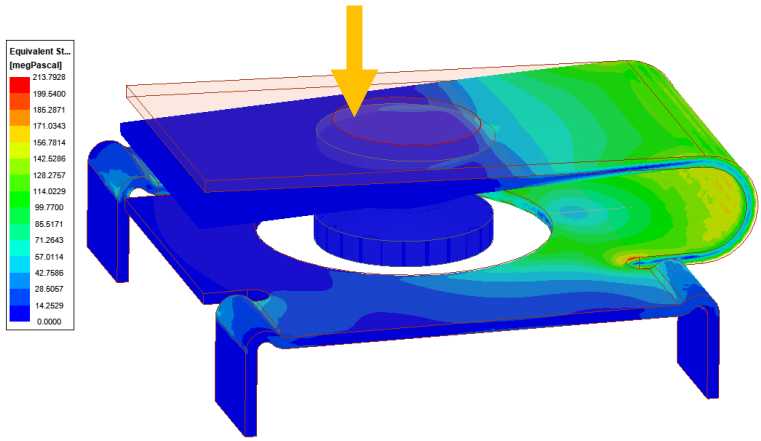
Mechanical Structural - Pressure/Force Excitations

- Force Excitation
  - Face and Object assignment
  - Uniform and Non-uniform Force options
    - Uniform (face): X, Y, Z components
    - Non-uniform via Setup Link to HFSS/Maxwell
- Pressure Excitation
  - Face assignment
  - Normal To or Component options
    - Normal To: Magnitude
    - Component: X, Y, Z components
  - Support curved faces





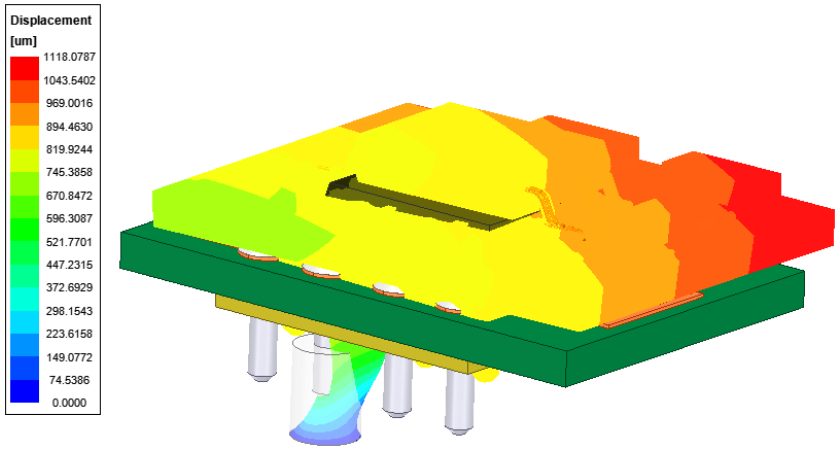




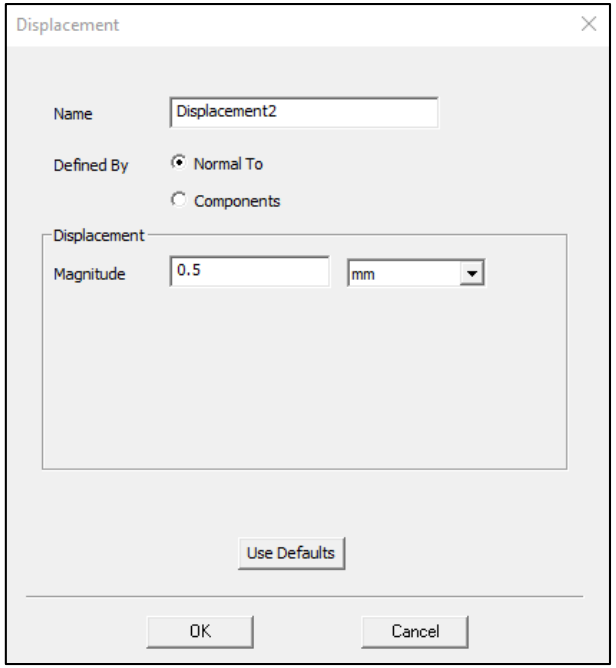
Assembly under 1N vertical force

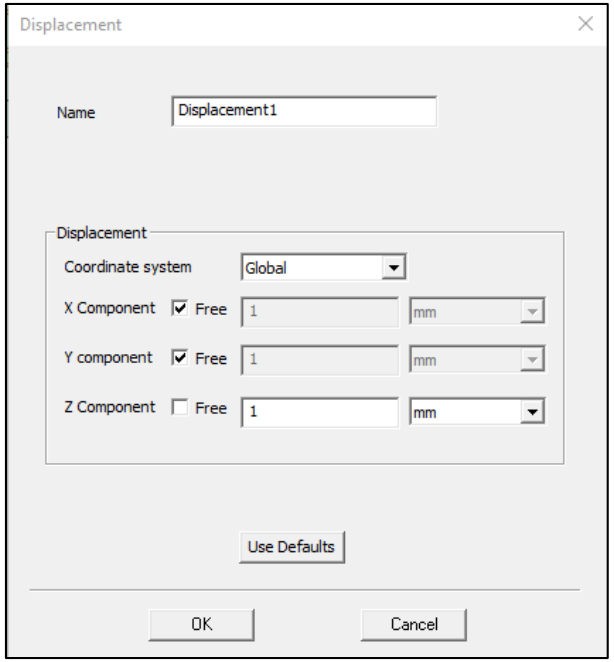
Structural - Displacement Excitation

- Displacement Excitation
  - Assignment: Faces and Edges
  - Normal To (faces)
    - Magnitude
  - Components (faces and edges)
    - X, Y, Z components
    - Each component can be fixed magnitude or free



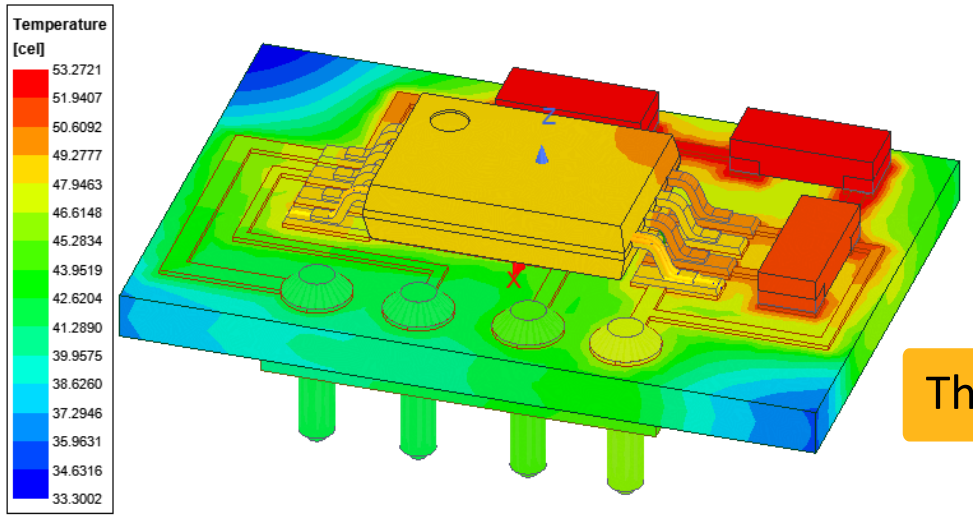
PCB Assembly with Y, Z displacements along edge



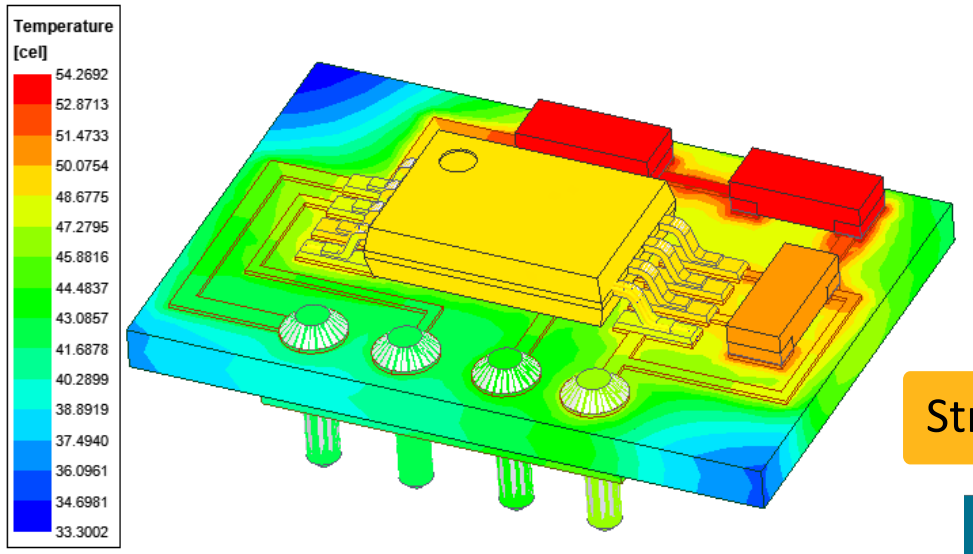


Thermal Stress Analysis - Link to Mechanical Thermal

- Coupled Thermal Stress Analysis
  - Linked to Thermal design
    - Thermal condition excitation
  - Temperatures imported for objects
    - System Coupling mapper
  - Temperature field plots



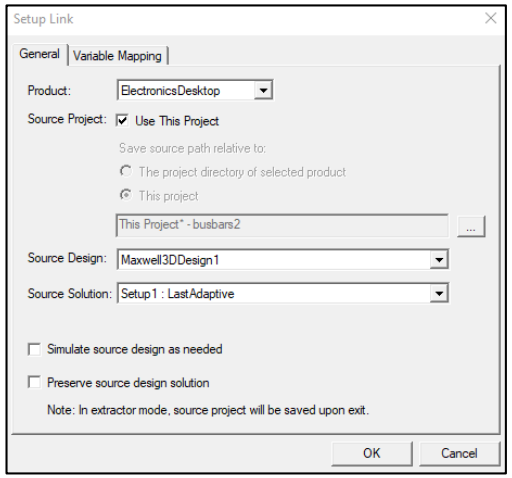
Thermal

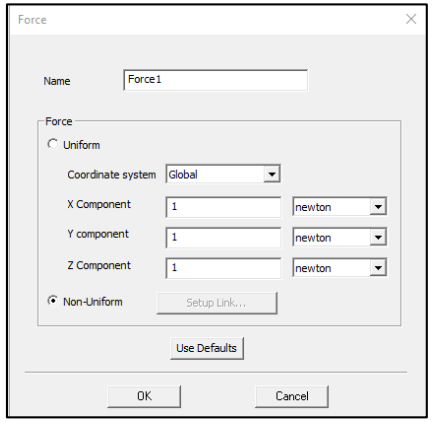


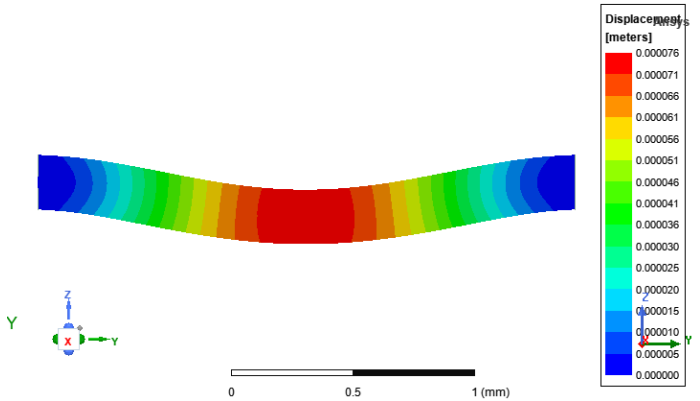
Structural

EM Force – Structural Coupling

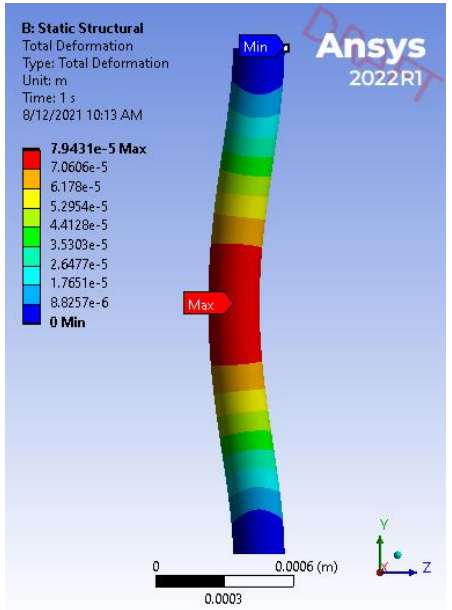
- Coupled EM Force - Structural Analysis
  - Linked to Maxwell 3D
    - Surface and Volume assignment
  - Linked to HFSS
    - Surface assignment
  - Assignment: Faces and Objects
  - 1-way coupling support







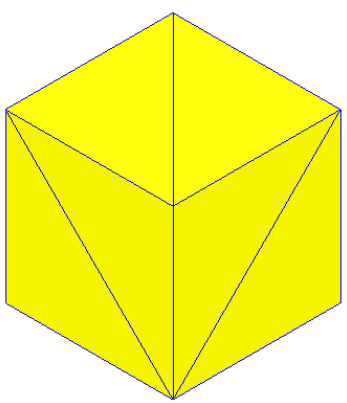
AEDT

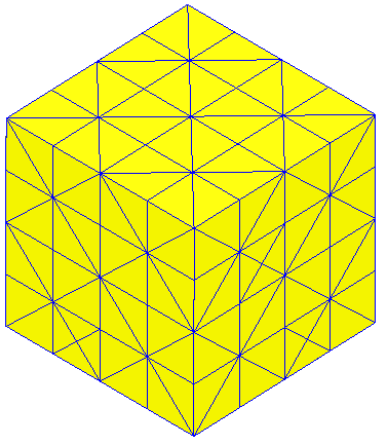


Workbench

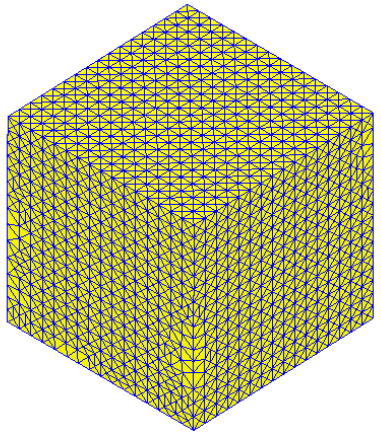
Automated Slider-bar Meshing – Mechanical Thermal [Beta]

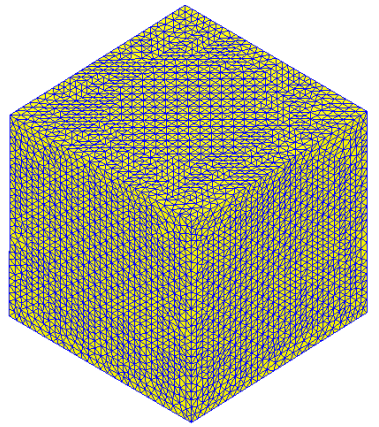
- Automated refinement based on slider position
  - Length-based refinement inside and on surfaces of all objects
  - Refinement tailored to curvilinear and rectilinear geometries
- Restrict the need for user-defined mesh operations
- **<u>Improved solution accuracy</u>**





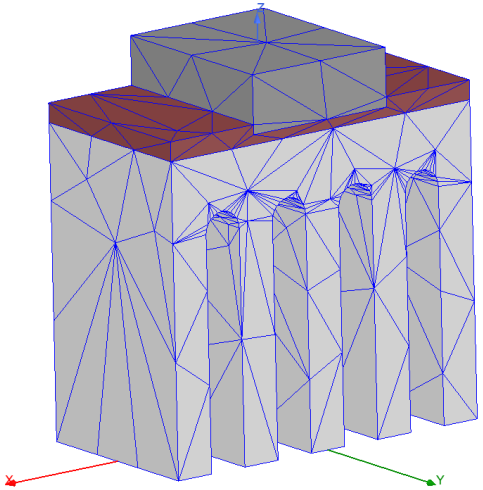
2021 R2 (All slider positions)



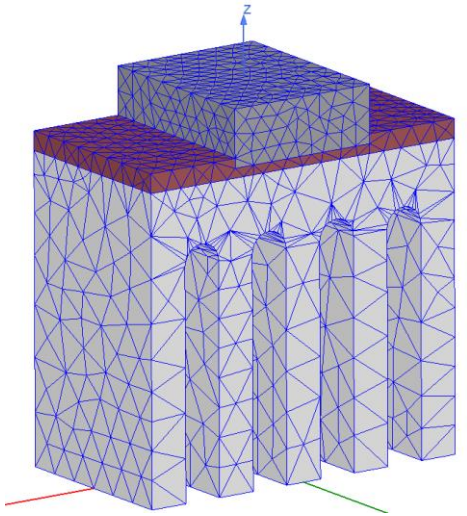


2022 R1 Auto refinement

Automated Slider-bar Meshing – Mechanical Thermal [Beta]



2021 R2 (Count: 2k)



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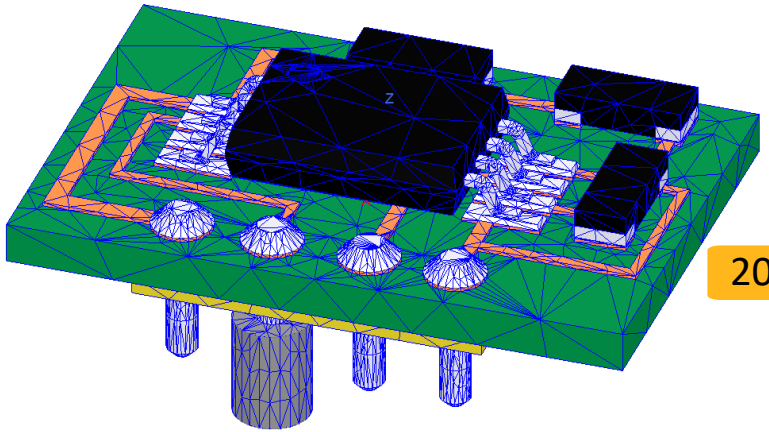

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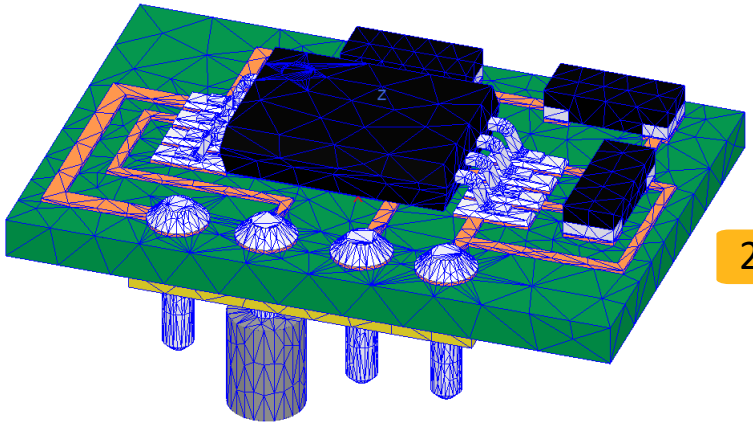
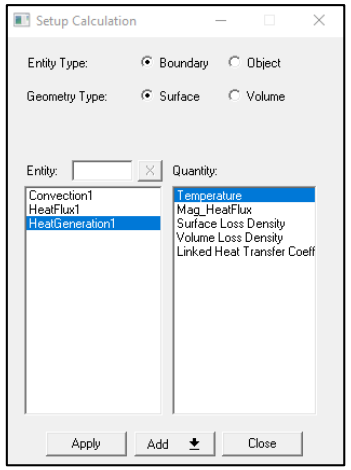
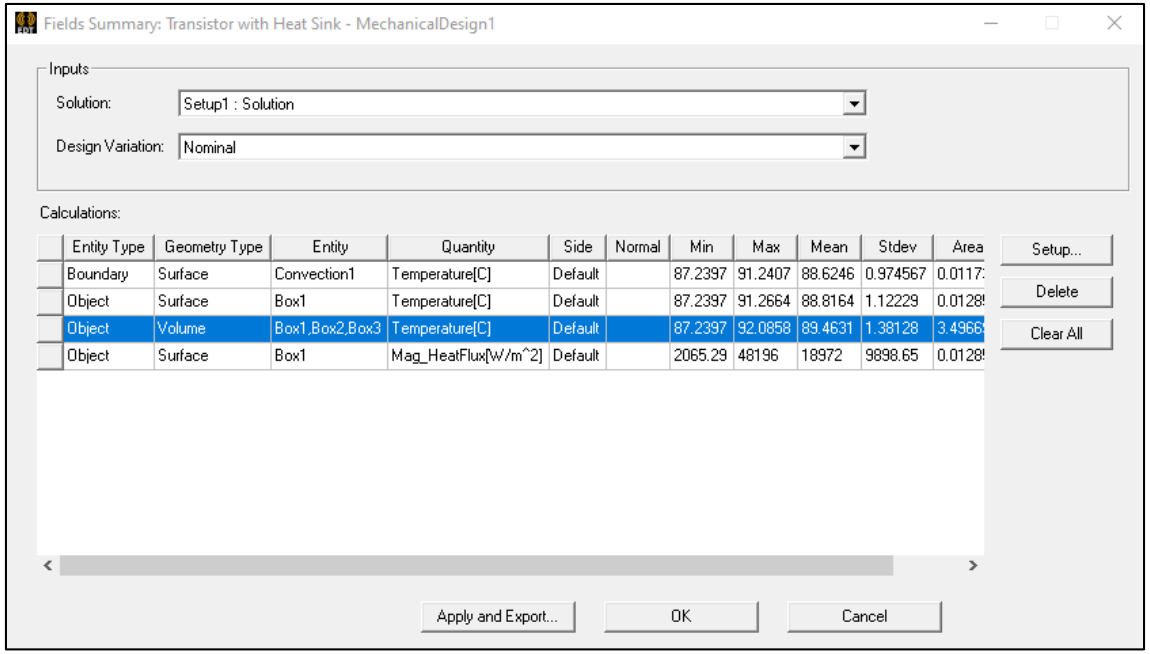


2022 R1 (Count 14k)

Fields Summary

- User-friendly report calculation capability
  - Supports all Fields Calculator variables
  - Boundary and Object selection
  - Surface and Volume calculations
  - Min, Max, Mean, Standard Deviation, Total**
  - Multi-select and multiple calculations
  - Export to CSV format

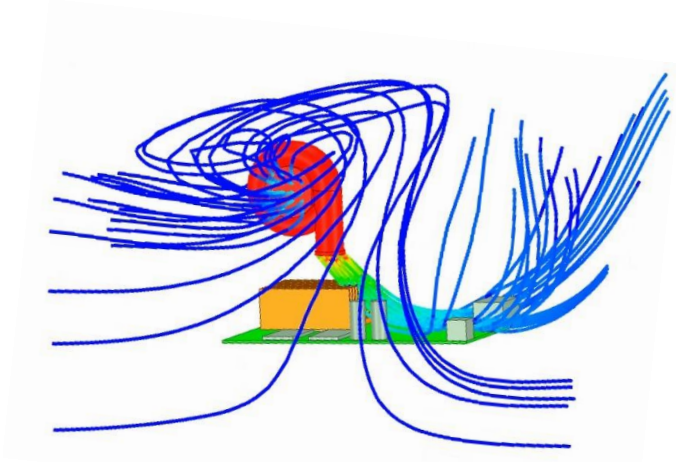




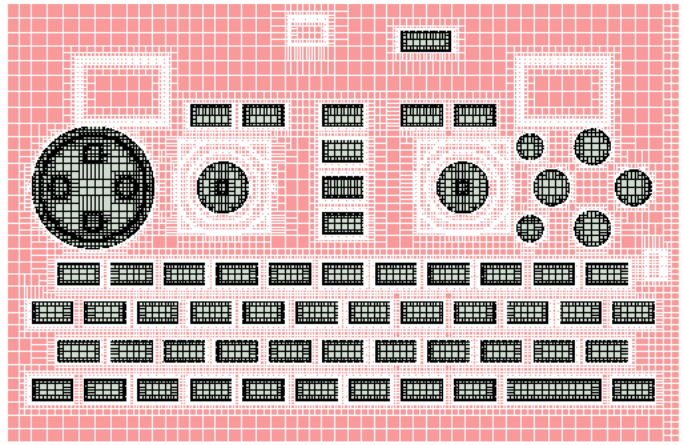
** Total and Heat Flow Rate available for Objects, but not boundaries

Icepak 2022 R1 Highlights

- **Reduced Order Modeling (ROM)**
  - Redhawk CTM 2-Way & New Delphi Network Creation
- **Blower Modeling**
- **ECAD Import -** Wirebond & IDX
- **Maxwell 2D** – Icepak EM Loss Coupling



Streamlines into and out of a Centrifugal CAD Blower cooling a PCB assembly

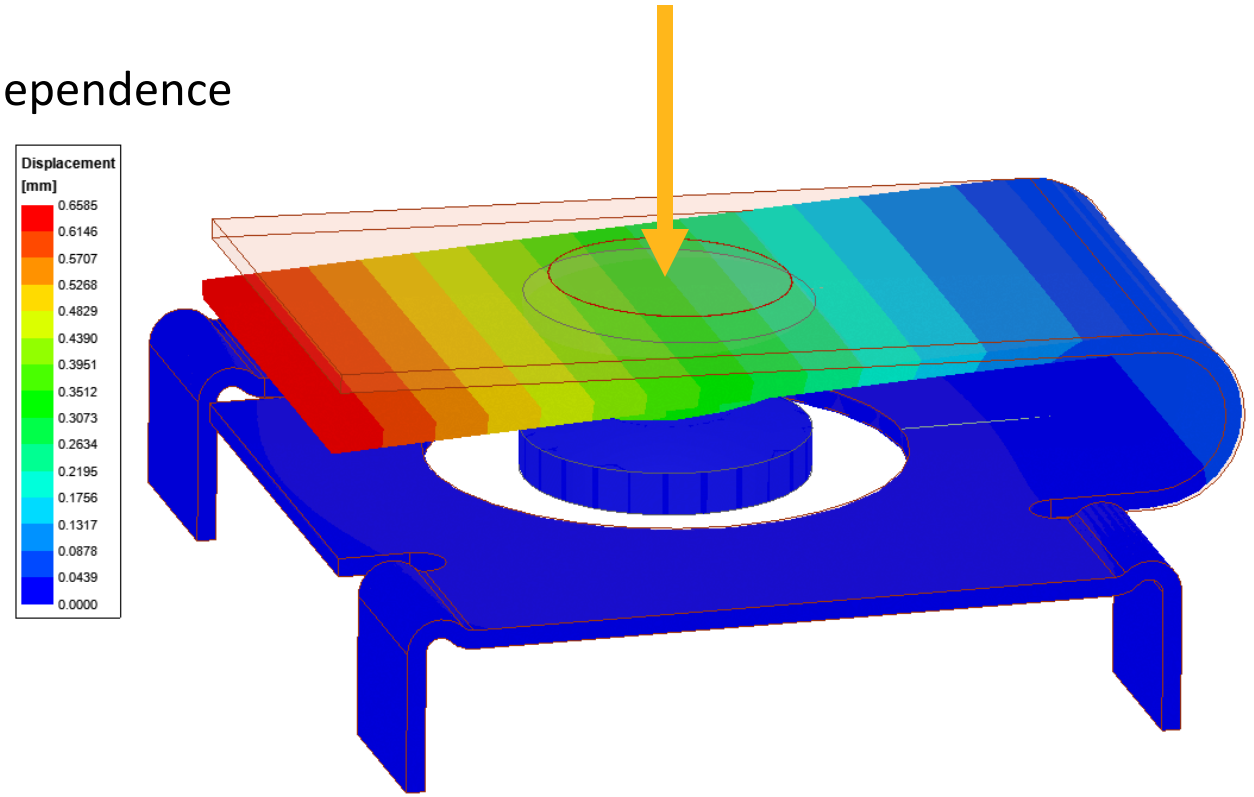


- **Mesher Enhancements –** 2.5D Improvements
- **User Experience**
  - Streamlines & Validation Enhancements
  - Improved Error messaging & troubleshooting
- **Migration**
  - Improve speed of TZR conversion
  - Network Schematic enhancements
  - Toolkit enhancements
    - PCB, Package parameterization

CAD-IT CONSULTANTS

Mechanical 2022 R1 Highlights

- Coupling
  - Maxwell 2D – Thermal EM Loss Coupling
- Materials
  - General expression support for temperature-dependence
- Structural - Beta
  - Boundaries
    - Displacement
    - Pressure/Force
  - Coupling
    - Mechanical Thermal-Structural Link
    - EM Force – Structural Coupling
- Meshing - Beta
  - Thermal Slider bar Meshing
- Reporting
  - Fields Summary



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公司网址：http://www.cadit.com.cn