Getting Started with Icepak: Extract Delphi Network

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Conventions Used in this Guide

Please take a moment to review how instructions and other useful information are presented in this documentation.

- Procedures are presented as numbered lists. A single bullet indicates that the procedure has only one step.
- Bold type is used for the following:
  - Keyboard entries that should be typed in their entirety exactly as shown. For example, “**copy file1**” means you must type the word **copy**, then type a space, and then type **file1**.
  - On-screen prompts and messages, names of options and text boxes, and menu commands. Menu commands are often separated by greater than signs (>). For example, “click **HFSS** > **Excitations** > **Assign** > **Wave Port**.”
  - Labeled keys on the computer keyboard. For example, “Press **Enter**” means to press the key labeled **Enter**.
- Italic type is used for the following:
  - Emphasis.
  - The titles of publications.
  - Keyboard entries when a name or a variable must be typed in place of the words in italics. For example, “**copy** *filename*” means you must type the word **copy**, then type a space, and then type the name of the file.
- The plus sign (+) is used between keyboard keys to indicate that you should press the keys at the same time. For example, “Press Shift+F1” means to press the **Shift** key and, while holding it down, press the **F1** key also. You should always depress the modifier key or keys first (for example, Shift, Ctrl, Alt, or Ctrl+Shift), continue to hold it/them down, and then press the last key in the instruction.

Accessing Commands: *Ribbons, menu bars,* and *shortcut menus* are three methods that can be used to see what commands are available in the application.

- The *Ribbon* occupies the rectangular area at the top of the application window and contains multiple tabs. Each tab has relevant commands that are organized, grouped, and labeled. An example of a typical user interaction is as follows:

  "Click **Draw** > **Line**"

  This instruction means that you should click the **Line** command on the **Draw** ribbon tab. An image of the command icon, or a partial view of the ribbon, is often included with the instruction.

- The *menu bar* (located above the ribbon) is a group of the main commands of an application arranged by category such File, Edit, View, Project, etc. An example of a typical user interaction is as follows:

"On the **File** menu, click the **Open Examples** command" means you can click the **File** menu and then click **Open Examples** to launch the dialog box.

- Another alternative is to use the *shortcut menu* that appears when you click the right-mouse button. An example of a typical user interaction is as follows:

  "Right-click and select **Assign Excitation> Wave Port**" means when you click the right-mouse button with an object face selected, you can execute the excitation commands from the shortcut menu (and the corresponding sub-menus).

Getting Help: Ansys Technical Support

For information about Ansys Technical Support, go to the Ansys corporate Support website, http://www.ansys.com/Support. You can also contact your Ansys account manager in order to obtain this information.

All Ansys software files are ASCII text and can be sent conveniently by e-mail. When reporting difficulties, it is extremely helpful to include very specific information about what steps were taken or what stages the simulation reached, including software files as applicable. This allows more rapid and effective debugging.

Help Menu

To access help from the Help menu, click **Help** and select from the menu:

- **[product name] Help** - opens the contents of the help. This help includes the help for the product and its *Getting Started Guides*.
- **[product name] Scripting Help** - opens the contents of the *Scripting Guide*.
- **[product name] Getting Started Guides** - opens a topic that contains links to Getting Started Guides in the help system.

Context-Sensitive Help

To access help from the user interface, press **F1**. The help specific to the active product (design type) opens.

You can press **F1** while the cursor is pointing at a menu command or while a particular dialog box or dialog box tab is open. In this case, the help page associated with the command or open dialog box is displayed automatically.

Table of Contents

1 - Introduction

This document is intended as supplementary material to Icepak for beginners and advanced users. It includes instructions to:

- Use Icepak's QFN toolkit to create a QFN package.
- Use the Extract Delphi Network to generate a Delphi-like Surrogate Thermal Model (STM) 3D component, which can be used to replace a detailed thermal model (DTM) in a system-level design to reduce mesh size and simulation duration, while yielding accurate thermal results.

2 - Create the Project

1. On the **Desktop** ribbon tab, click **Icepak** to insert an Icepak design.
2. From the **File** menu, select **Save As**, and save the project in the desired working directory.

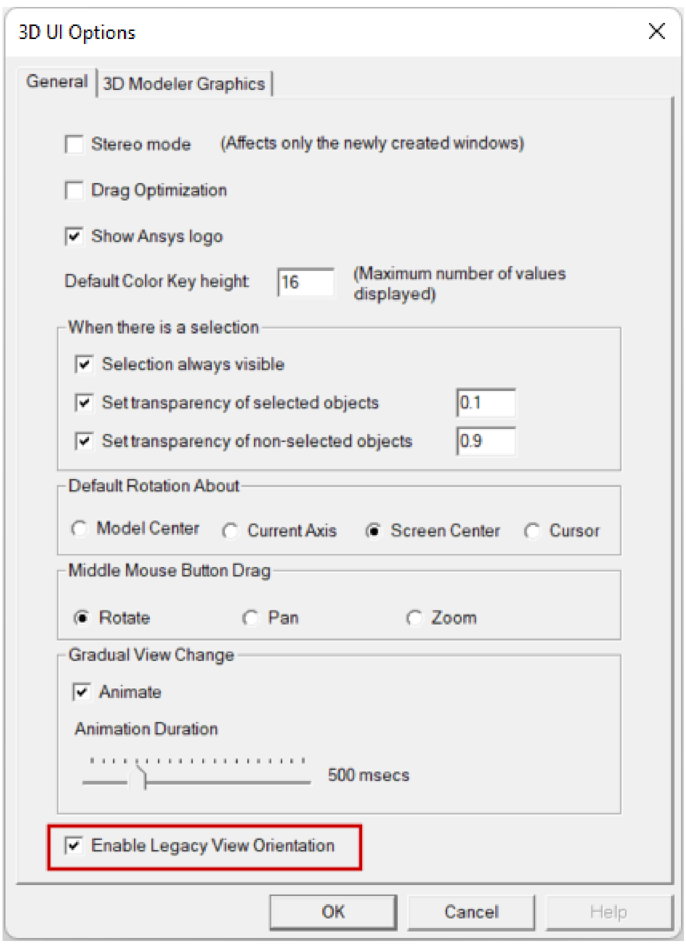
Set 3D UI Options

Ensure that the new view orientation scheme introduced in release 2024 R1 is not being used, since the instructions and images in this guide are based on the legacy orientation scheme.

1. From the menu bar, click **View** > **Options**.

   The **3D UI Options** dialog box appears.

2. Ensure that **Enable Legacy View Orientation** is enabled:

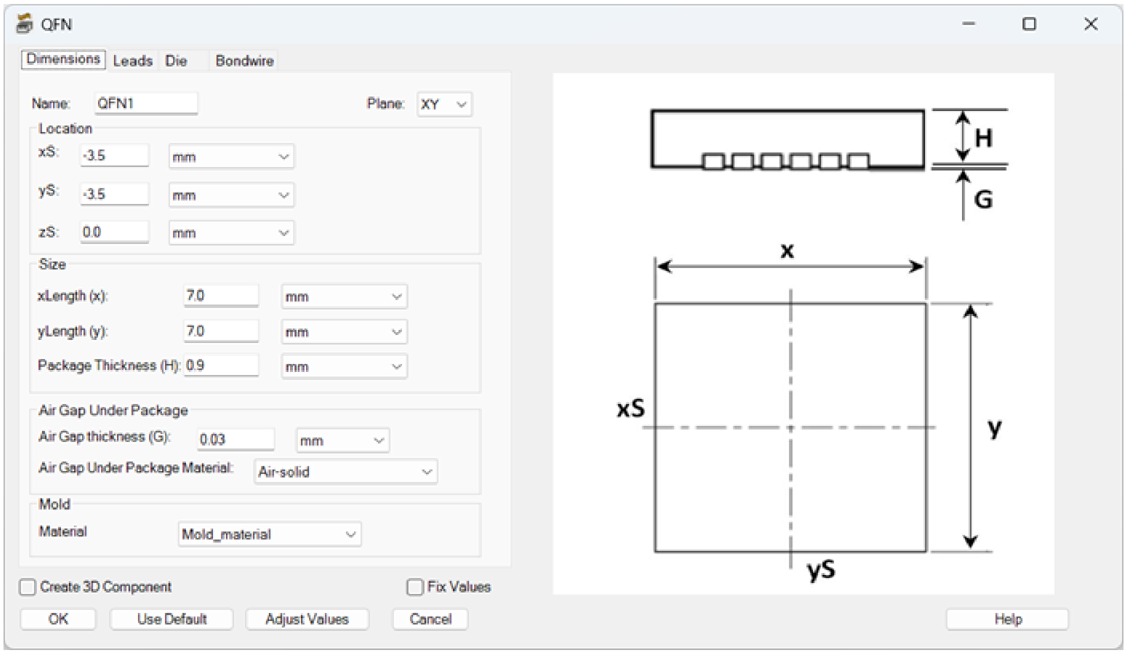


3. Click **OK**.

3 - Create a QFN Package

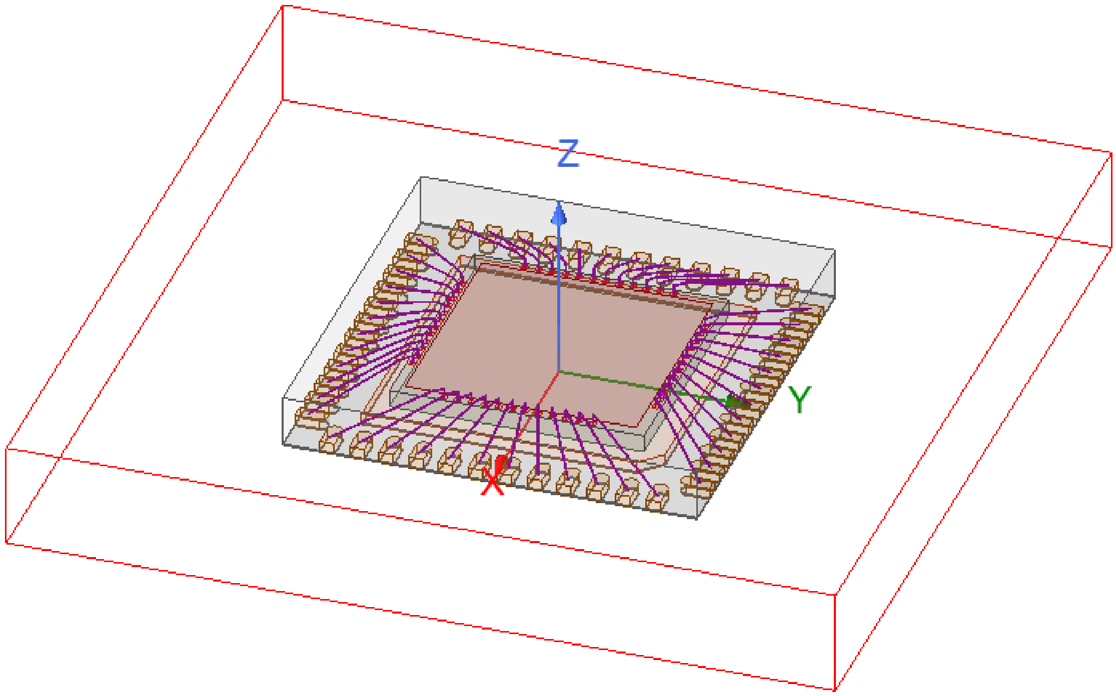
Use the QFN toolkit to generate QFN package geometry to serve as the basis for Delphi network extraction.

1. From the **Icepak** menu, select **Toolkit** > **Geometry** > **Packages** > **QFN**.



2. In the **QFN** dialog box, review the default settings on the **Dimensions**, **Leads**, **Die**, and **Bondwire** tabs.

3. Click **OK** to generate the package based on the default settings.



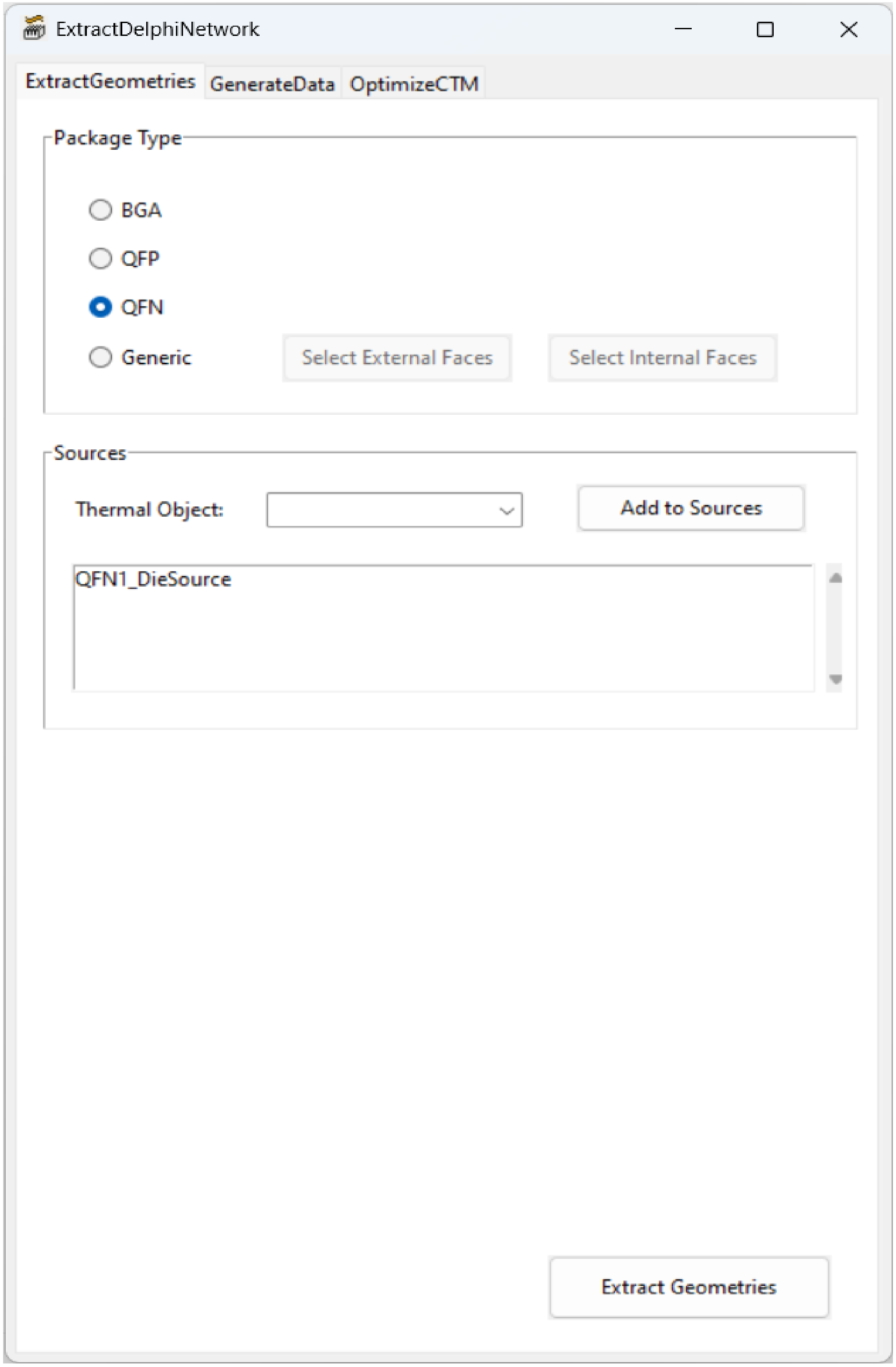
4 - Run the Extract Delphi Network Toolkit

Run the Extract Delphi Network toolkit to create network geometry, generate training data, and use the data to optimize the compact thermal model (CTM).

Extract the Geometry

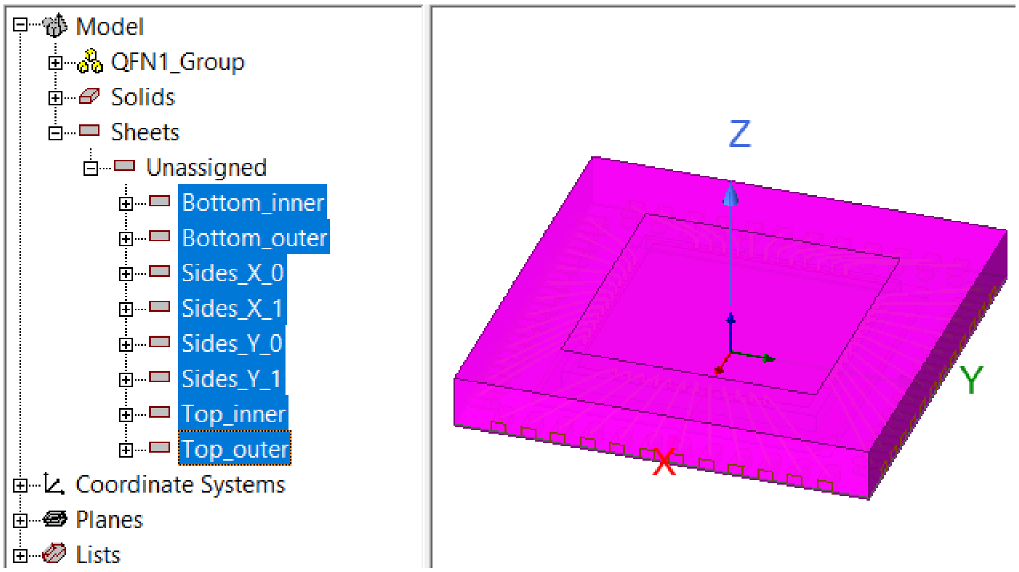
Use the Extract Delphi Network toolkit's **ExtractGeometries** tab to add network face geometry to the model.

1. From the **Icepak** menu, select **Toolkit** > **Modeling** > **IC Packages** > **ExtractDelphiNetwork**.



2. In the **ExtractDelphiNetwork** dialog box under **Package Type**, select **QFN**.

3. Click **Extract Geometries** to generate the generate the network faces. When geometry extraction is complete, the **Extract Geometries** button appears green and the faces are displayed in the **3D Modeler** window and history tree.



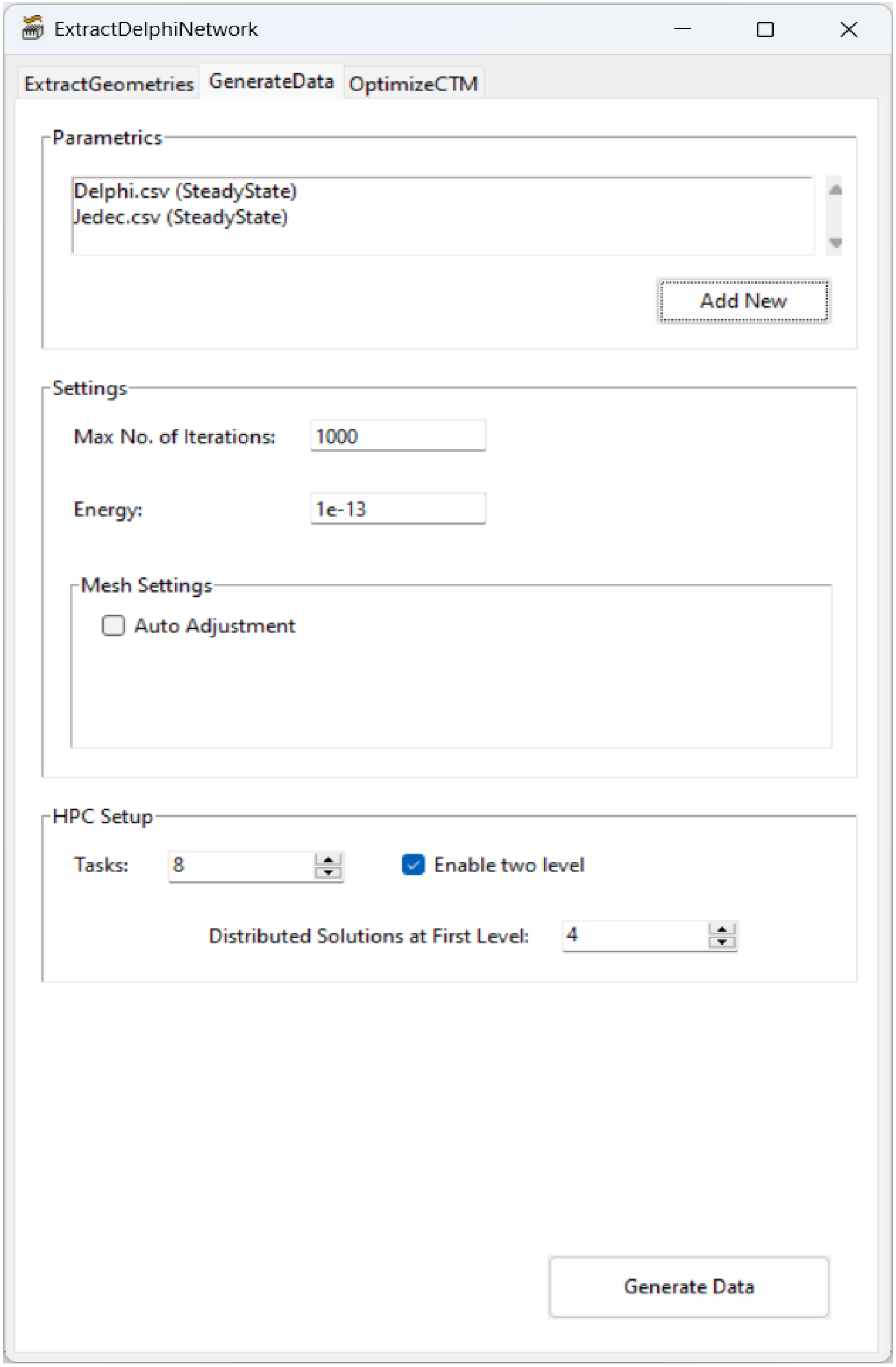
4. Click the **GenerateData** tab.

Generate the Data

Use the Extract Delphi Network toolkit's **GenerateData** tab to create and run parametric trials. Data from the trials will be used for the training and test data during CTM optimization.

1. On the **GenerateData** tab under **Parametrics**, click **Add New**.
2. In the **New Parametric Setup Editor** dialog box under **Parametric Setup**, select **Pre-defined** for the **Parametric Origin**.
3. Under **Predefined**, select **Delphi** for the **Reference**.
4. Retain the other default settings and click **Add Setup**.

5. Repeat steps 1 through 4, selecting **JEDEC** for the predefined **Reference**.



6. Click **Generate Data**.

Optimize the STM

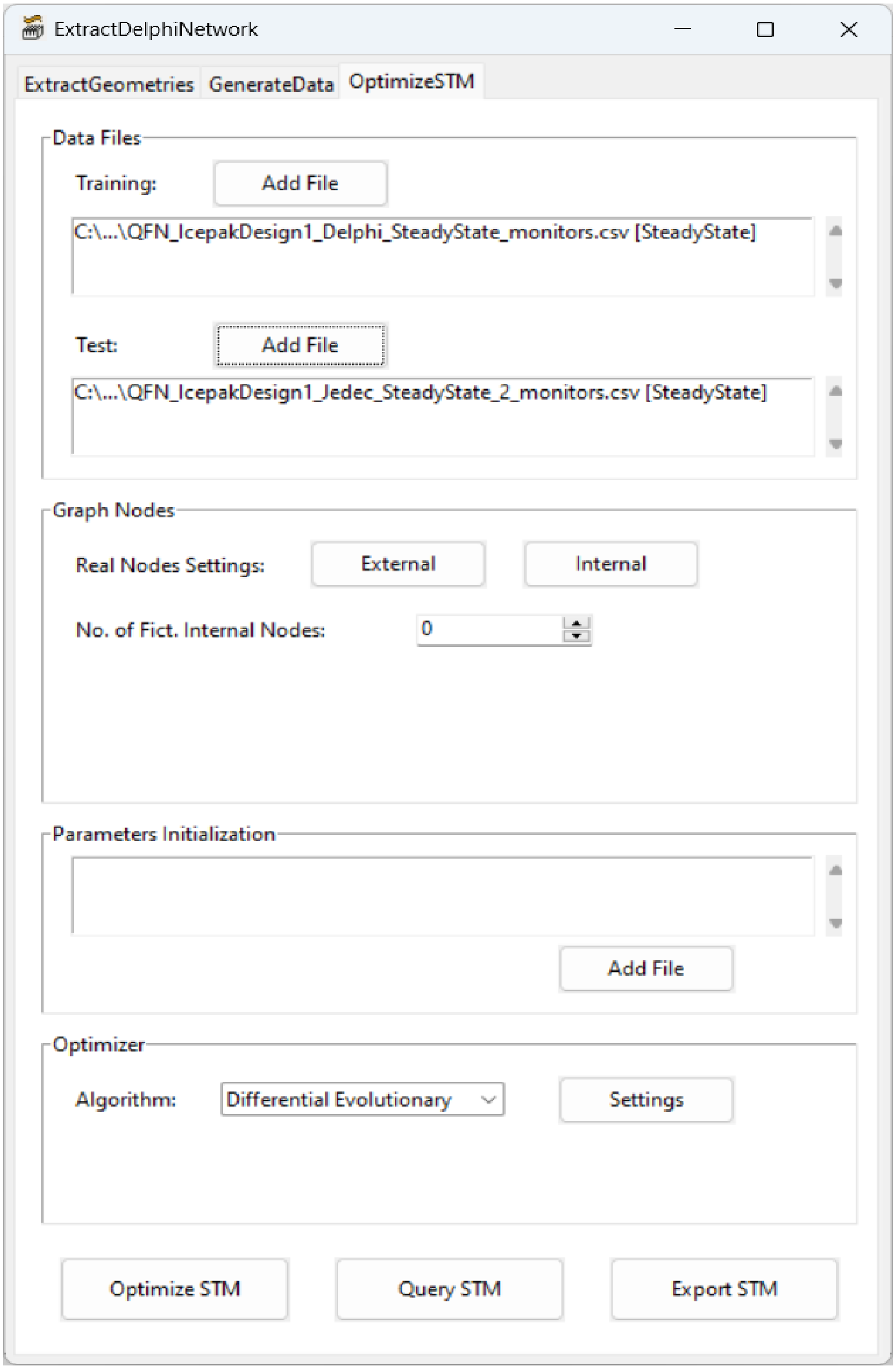
Use the Extract Delphi Network's toolkit's **OptimizeSTM** tab to generate a 3D component of the optimized STM.

1. On the **OptimizeSTM** tab under **Data Files** next to **Training**, click **Add File**.
2. In the **Select Training File** dialog box, browse in your working directory select the training data file and click **Open**.

> **Note:** The training and testing data is saved comma-separated value (.csv) files appended with "_monitors" (steady-state) or "_aedtexport" (transient) at the end of the file name.

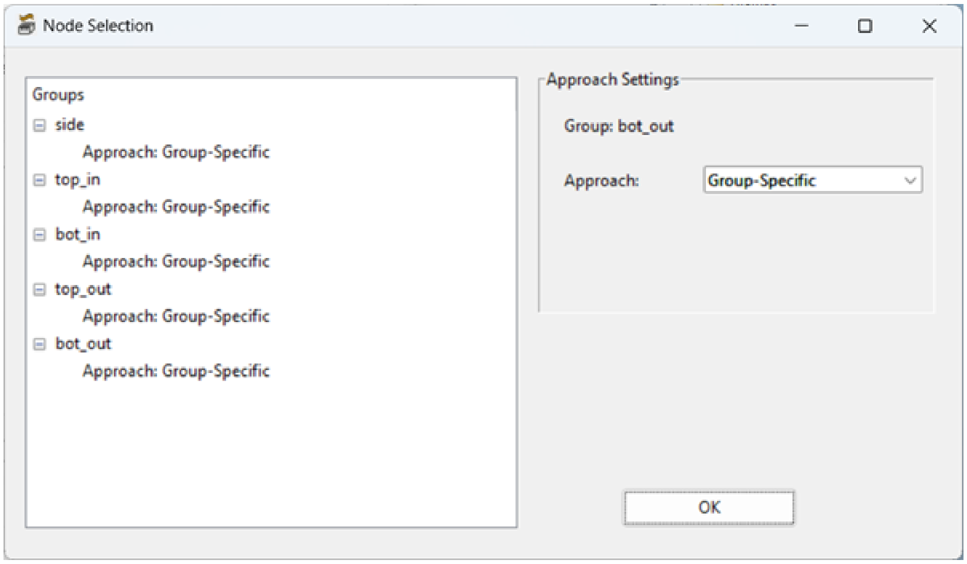
3. In the **Select Validation File** dialog box, browse in your working directory select the testing data file and click **Open**.

4. Under **Data Files** next to **Test**, click **Add File**.



5. Under **Graph Nodes** next to **External Nodes**, click **Settings**.

6. In the **Node Selection** dialog box, select each face group and select **Group-specific** for **Approach** under **Approach Settings**.



7. Click **OK** to close the **Node Selection** dialog box.
8. Retain the other default settings and click **Optimize STM** to generate training results.
9. Click **Export** to open the **STM Querying Settings** dialog box.
10. Under **Select STM**, click **Browse** and select the folder in which to create the 3D component of the optimized STM.
11. Retain the .a3dcomp file format for the STM and click **OK** to generate it.

Review the Training Results

In the training files directory, open the .png image file appended with "_error_bars" to view the temperature mean and max temperature error percentage.

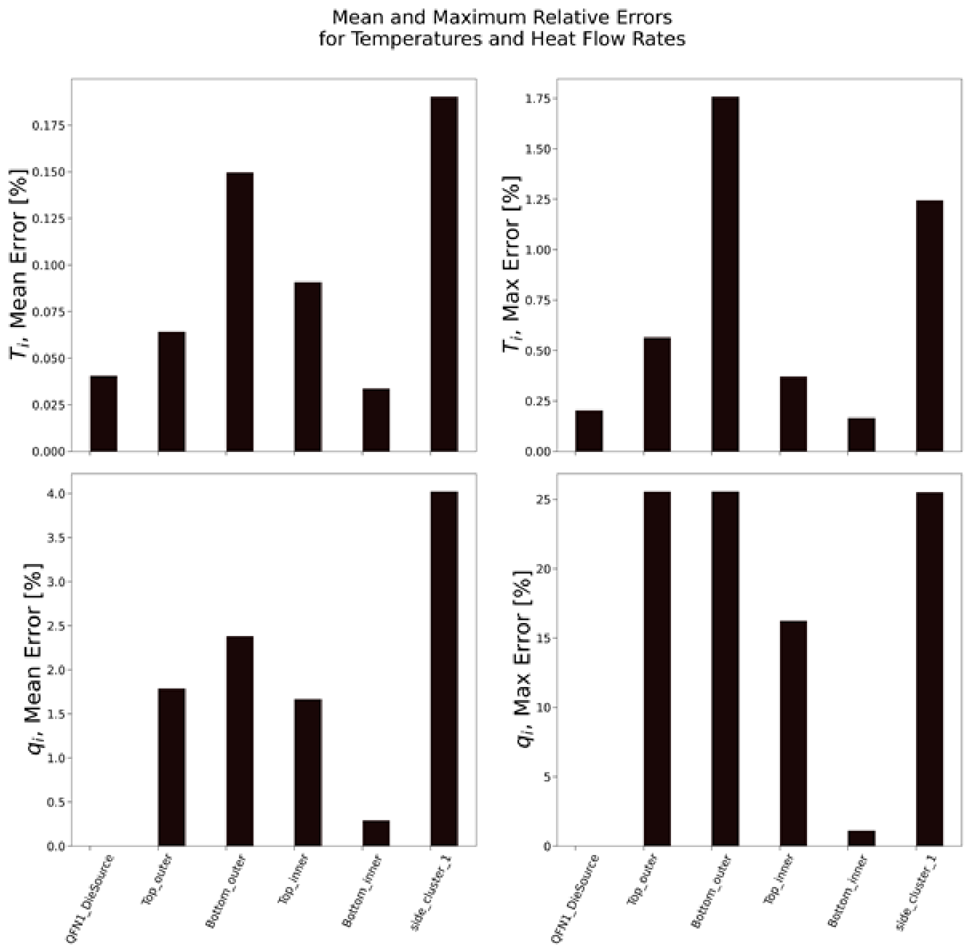


Figure 4-1: SteadyState Solve Setup Mean and Maximum Relative Errors Values

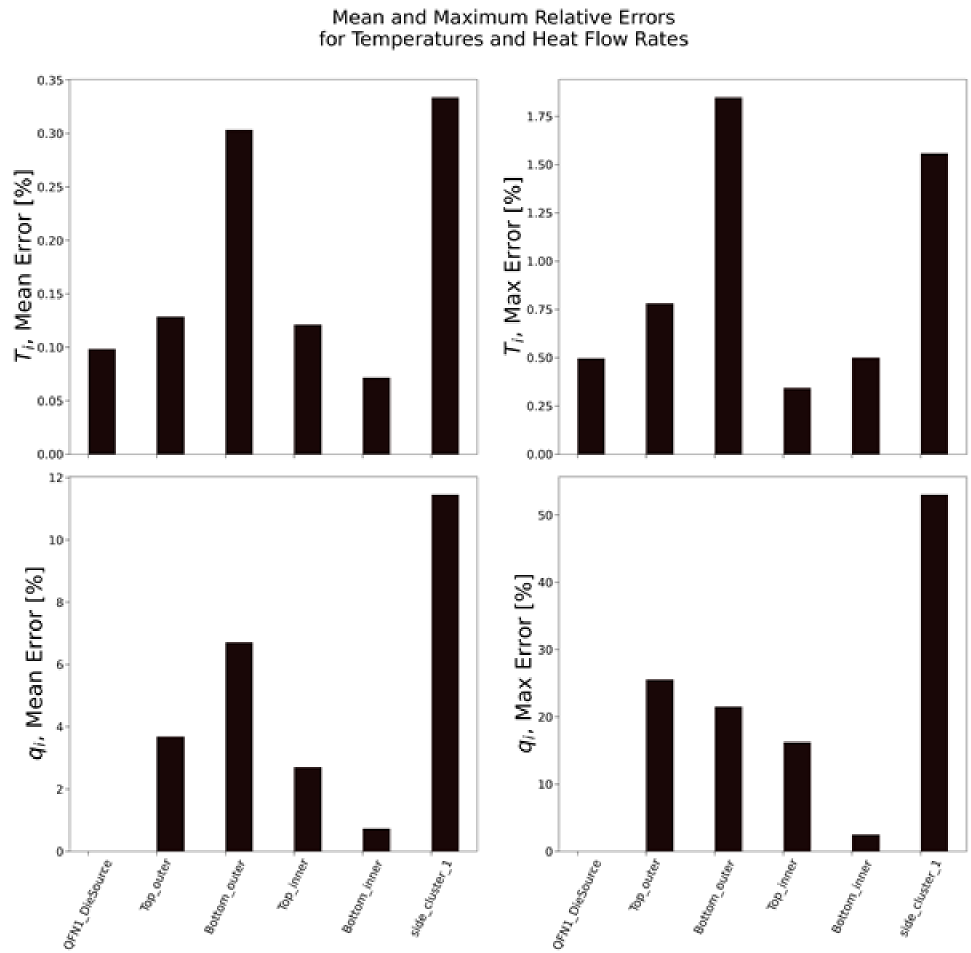
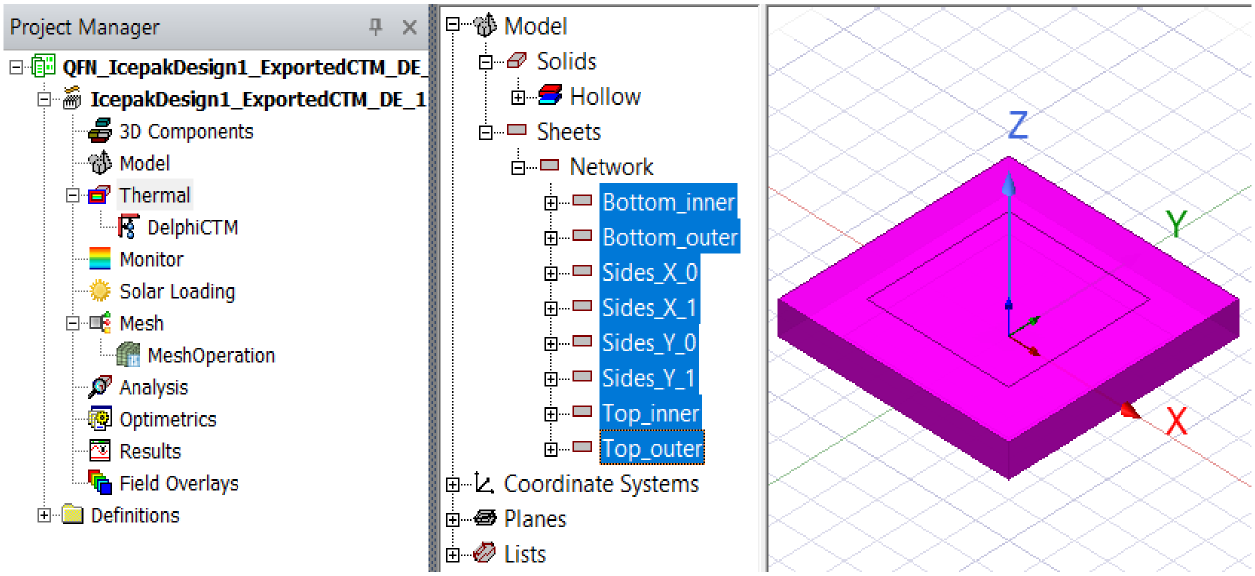


Figure 4-2: SteadyState2 Solve Setup Mean and Maximum Relative Errors Values

Open the Optimized STM 3D Component

In the directory you specified early, open the optimized STM's 3D component (.a3dcomp) file in the Electronics Desktop. Note the package geometry in the 3D Modeler window and history tree, and note the assigned network boundary condition in the Project Manager.

The optimized STM can replace a detailed thermal model in a system-level simulation to reduce mesh size and simulation duration, while yielding accurate thermal results.


Project Manager
QFN_IcepakDesign1_ExportedCTM_DE_
IcepakDesign1_ExportedCTM_DE_1
3D Components
Model
Thermal
DelphiCTM
Monitor
Solar Loading
Mesh
MeshOperation
Analysis
Optimetrics
Results
Field Overlays
Definitions
Model
Solids
Hollow
Sheets
Network
Bottom_inner
Bottom_outer
Sides_X_0
Sides_X_1
Sides_Y_0
Sides_Y_1
Top_inner
Top_outer
Coordinate Systems
Planes
Lists
Z
Y
X