



POWERING INNOVATION THAT DRIVES HUMAN ADVANCEMENT

© 2025 ANSYS, Inc. or its affiliated companies
Unauthorized use, distribution, or duplication is prohibited.

Getting Started with Icepak®: Extract Delphi Network



ANSYS, Inc.
Southpointe
2600 Ansys Drive
Canonsburg, PA 15317
ansysinfo@ansys.com
<https://www.ansys.com>
(T) 724-746-3304
(F) 724-514-9494

Release 2025 R1
July 2022

ANSYS, Inc. and
ANSYS Europe,
Ltd. are UL
registered ISO
9001:2015 com-
panies.

Copyright and Trademark Information

© 1986-2025 ANSYS, Inc. Unauthorized use, distribution or duplication is prohibited.

ANSYS, Ansys Workbench, AUTODYN, CFX, FLUENT and any and all ANSYS, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of ANSYS, Inc. or its subsidiaries located in the United States or other countries. ICEM CFD is a trademark used by ANSYS, Inc. under license. All other brand, product, service and feature names or trademarks are the property of their respective owners. FLEXlm and FLEXnet are trademarks of Flexera Software LLC.

Disclaimer Notice

THIS ANSYS SOFTWARE PRODUCT AND PROGRAM DOCUMENTATION INCLUDE TRADE SECRETS AND ARE CONFIDENTIAL AND PROPRIETARY PRODUCTS OF ANSYS, INC., ITS SUBSIDIARIES, OR LICENSORS. The software products and documentation are furnished by ANSYS, Inc., its subsidiaries, or affiliates under a software license agreement that contains provisions concerning non-disclosure, copying, length and nature of use, compliance with exporting laws, warranties, disclaimers, limitations of liability, and remedies, and other provisions. The software products and documentation may be used, disclosed, transferred, or copied only in accordance with the terms and conditions of that software license agreement.

ANSYS, Inc. and ANSYS Europe, Ltd. are UL registered ISO 9001: 2015 companies.

U.S. Government Rights

For U.S. Government users, except as specifically granted by the ANSYS, Inc. software license agreement, the use, duplication, or disclosure by the United States Government is subject to restrictions stated in the ANSYS, Inc. software license agreement and FAR 12.212 (for non-DOD licenses).

Third-Party Software

See the legal information in the product help files for the complete Legal Notice for Ansys proprietary software and third-party software. If you are unable to access the Legal Notice, please contact ANSYS, Inc.

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

Table of Contents	Contents-1
1 - Introduction	1-1
2 - Create the Project	2-1
Set 3D UI Options	2-1
	2-2
3 - Create a QFN Package	3-1
4 - Run the Extract Delphi Network Toolkit	4-1
Extract the Geometry	4-1
Generate the Data	4-3
Optimize the STM	4-5
Review the Training Results	4-7
Open the Optimized STM 3D Component	4-9

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.

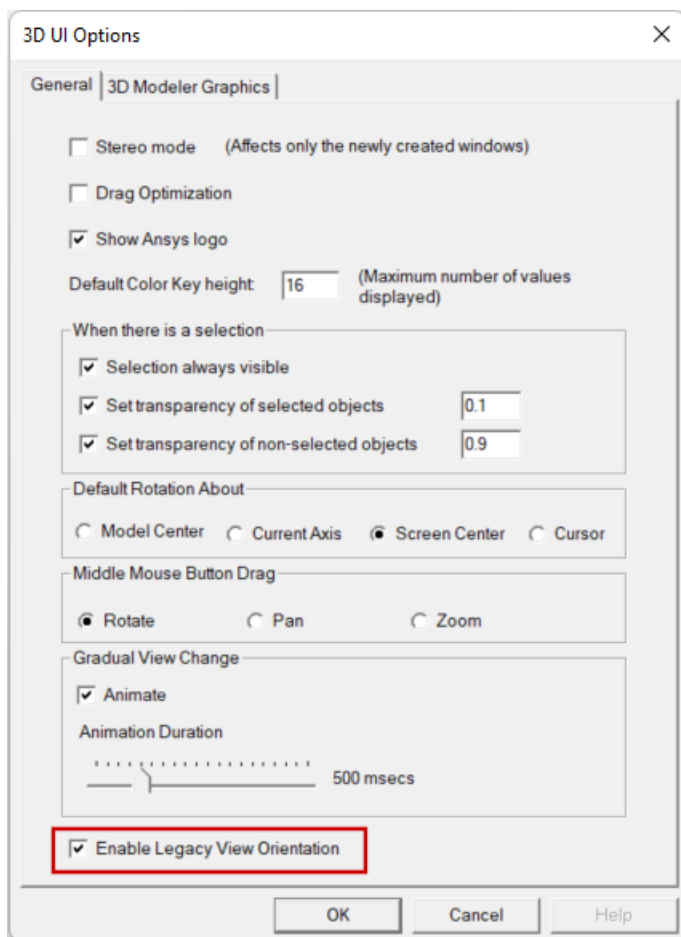
Set 3D UI Options

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:

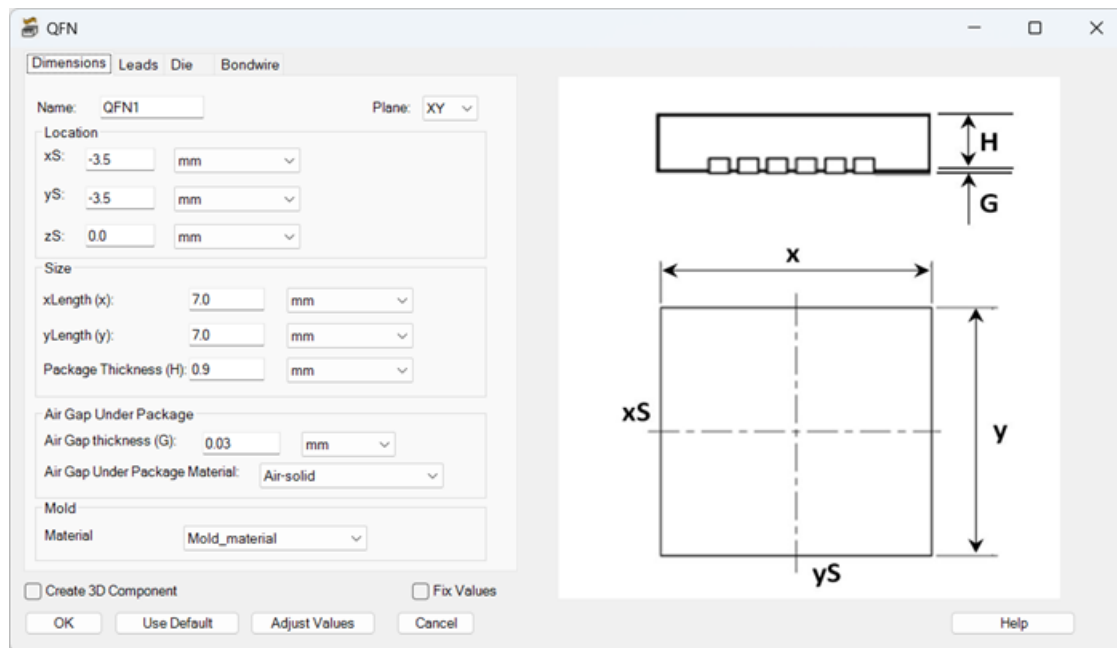


3. Click **OK**.

3 - Create a QFN Package

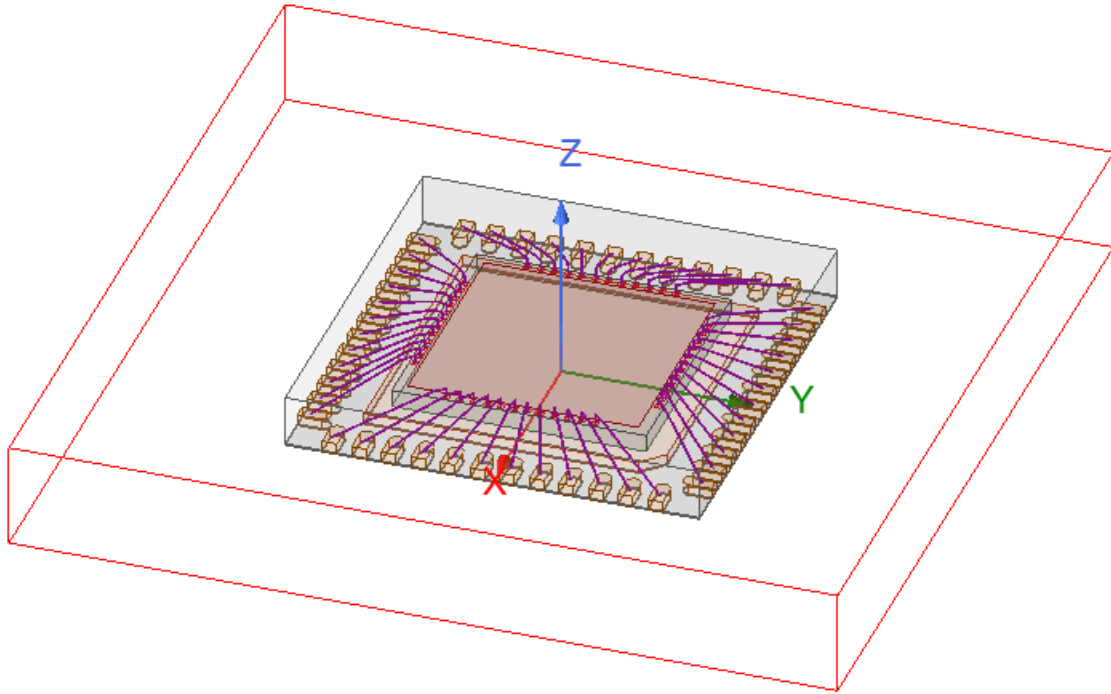
Use the QFN toolkit to generate QFN package geometry to serve as the basis for Delphi network extraction.

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

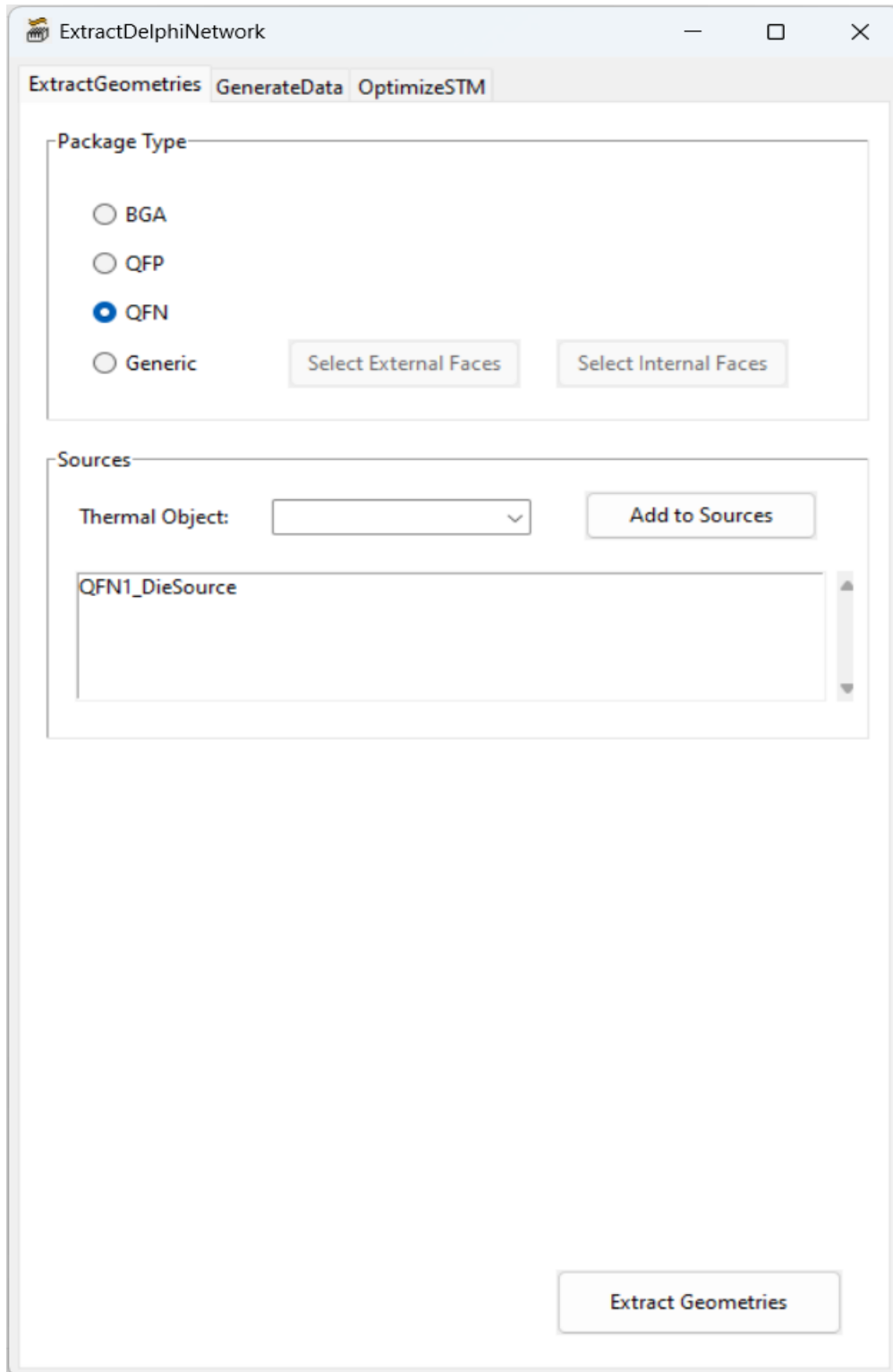
Run the Extract Delphi Network toolkit to create network geometry, generate training data, and use the data to optimize the Delphi-like Surrogate Thermal Model (STM).

- [Extract the Geometry](#)
- [Generate the Data](#)
- [Optimize the STM](#)

Extract the Geometry

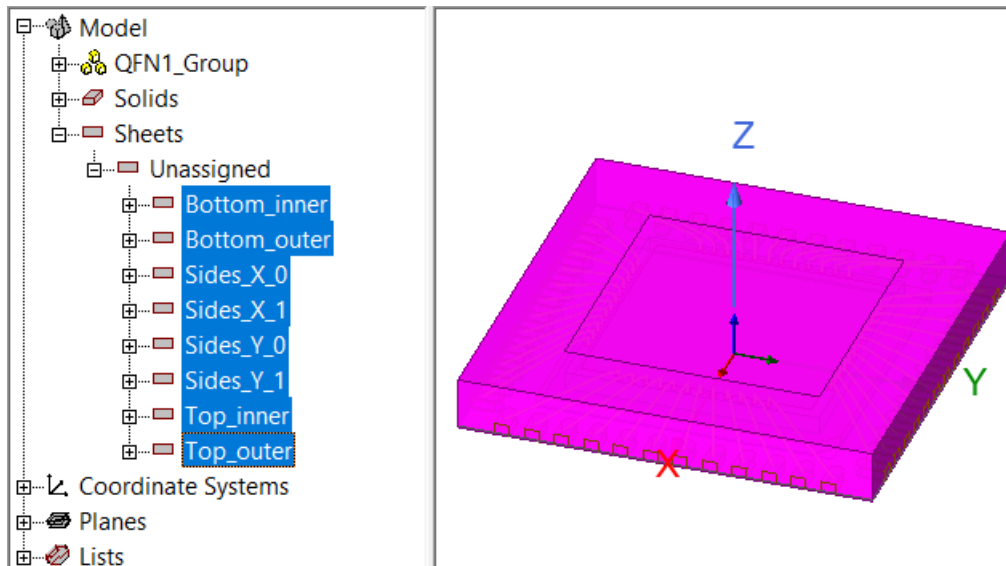
Use the Extract Delphi Network toolkit's **ExtractGeometries** tab to add network face geometry to the model.

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 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 STM 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**.

The screenshot shows the 'ExtractDelphiNetwork' application window with the 'GenerateData' tab selected. The interface is divided into four main sections: 'Parameters', 'Settings', 'Mesh Settings', and 'HPC Setup'. In the 'Parameters' section, a list contains 'Delphi.csv (SteadyState)' and 'Jedec.csv (SteadyState)', with an 'Add New' button to the right. The 'Settings' section includes 'Max No. of Iterations' set to 1000 and 'Energy' set to 1e-13. The 'Mesh Settings' section has an unchecked 'Auto Adjustment' checkbox. The 'HPC Setup' section shows 'Tasks' set to 8, 'Enable two level' checked, and 'Distributed Solutions at First Level' set to 4. A 'Generate Data' button is located at the bottom right of the window.

ExtractDelphiNetwork

ExtractGeometries GenerateData OptimizeSTM

Parameters

Delphi.csv (SteadyState)
Jedec.csv (SteadyState)

Add New

Settings

Max No. of Iterations: 1000

Energy: 1e-13

Mesh Settings

☐ Auto Adjustment

HPC Setup

Tasks: 8 ☒ Enable two level

Distributed Solutions at First Level: 4

Generate Data

6. Click **Generate Data**.

Optimize the STM

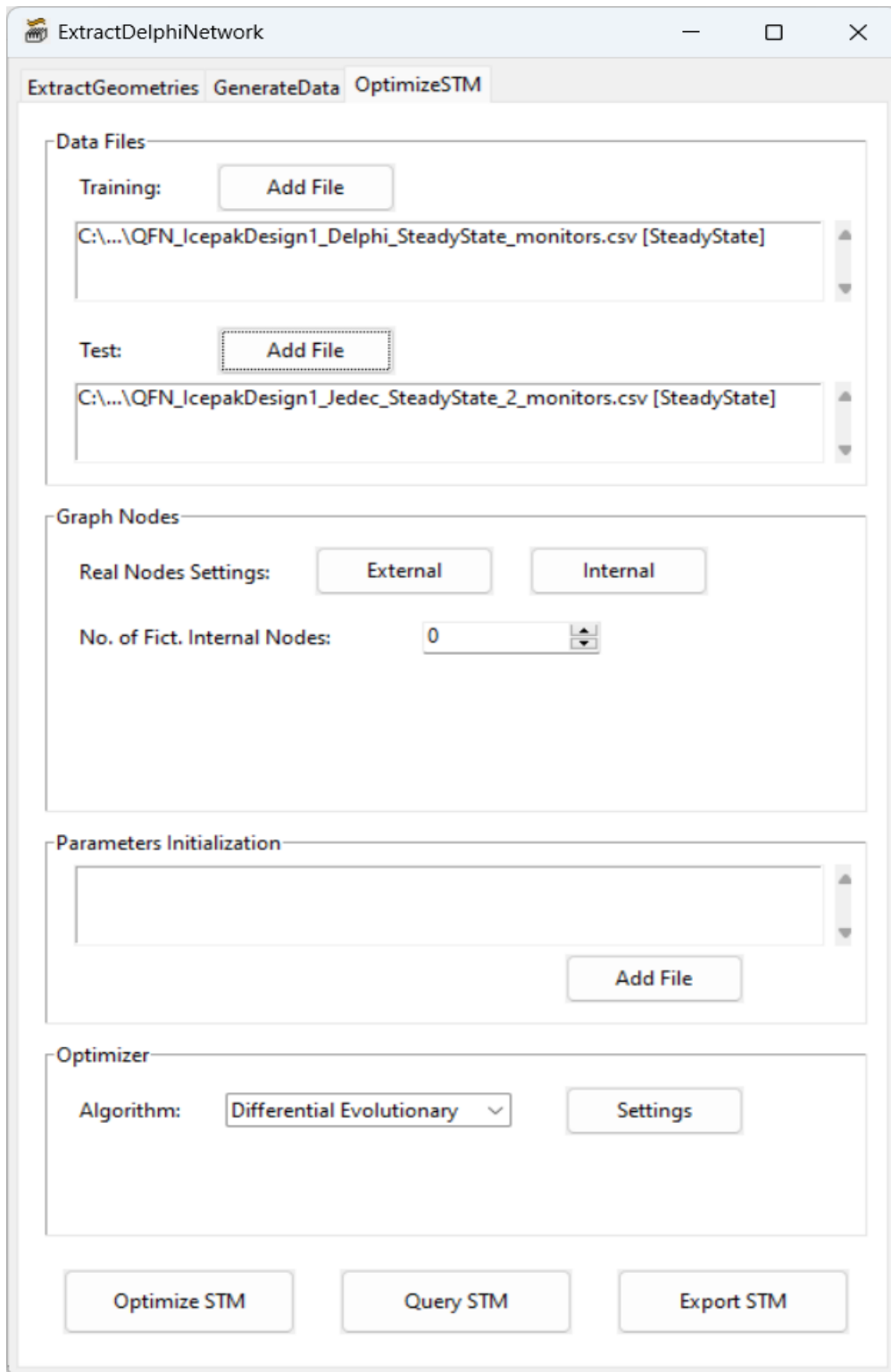
Use the Extract Delphi Network's toolkit's **OptimizeSTM** tab to generate a 3D component of the optimized STM.

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.

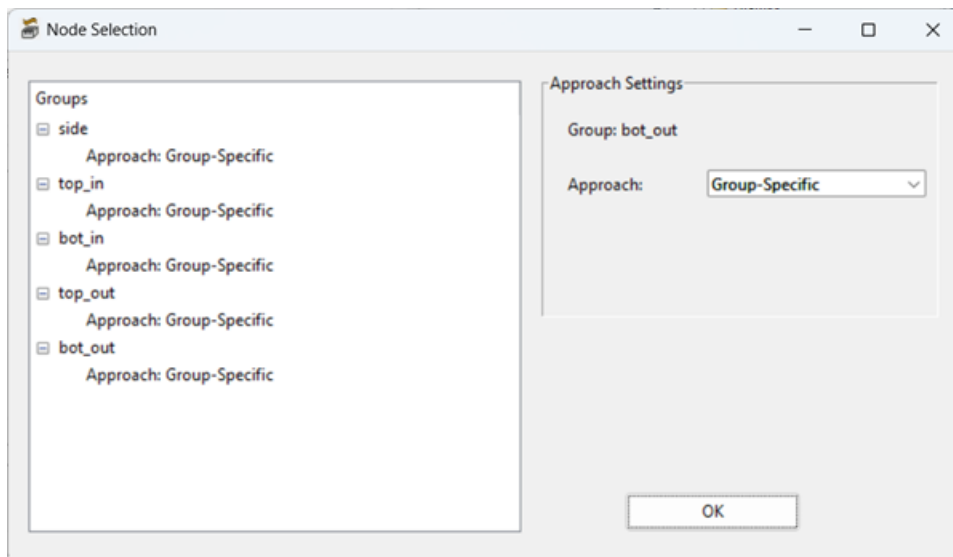
3. In the **Select Validation File** dialog box, browse in your working directory select the testing data file and click **Open**.

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.

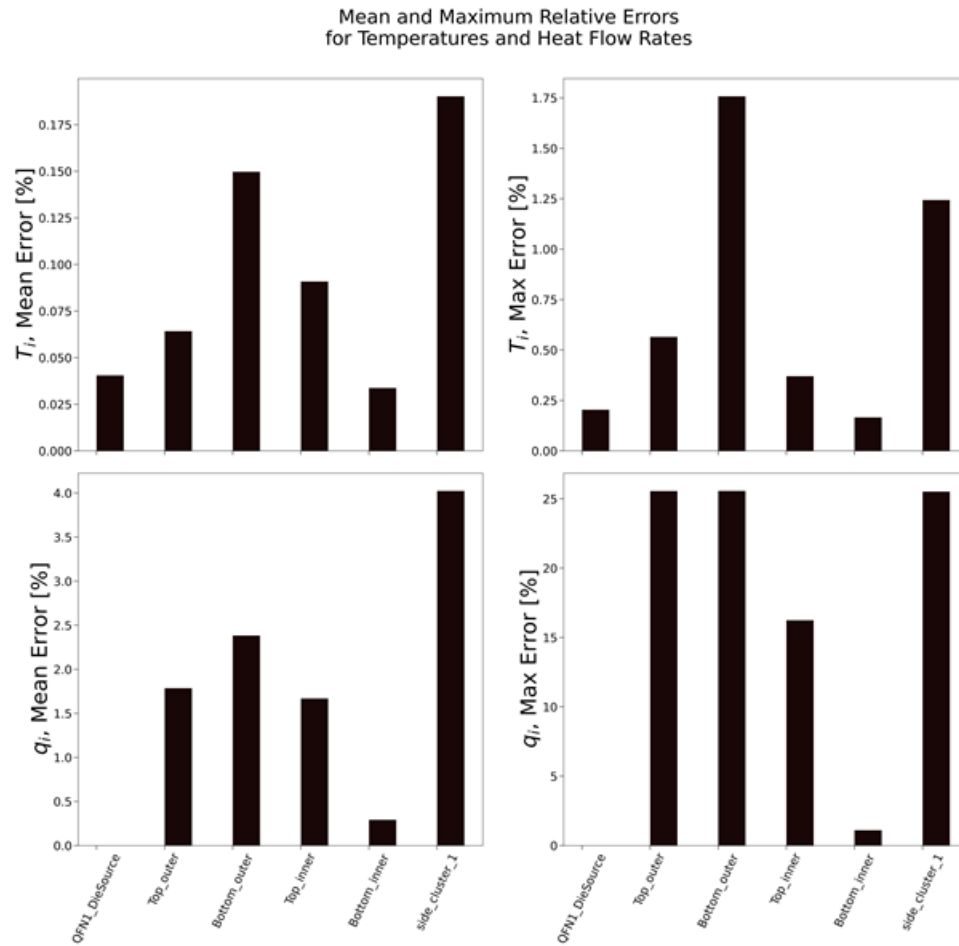


Figure 4-1: SteadyState Solve Setup Mean and Maximum Relative Errors Values

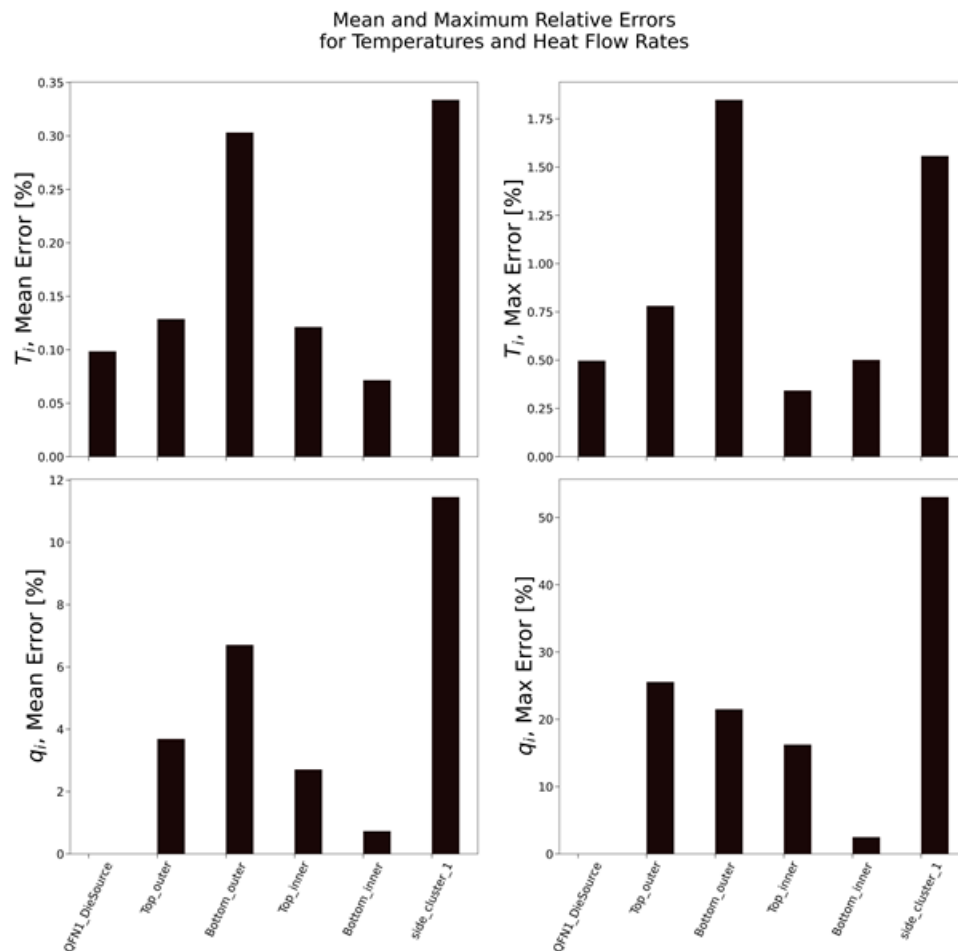
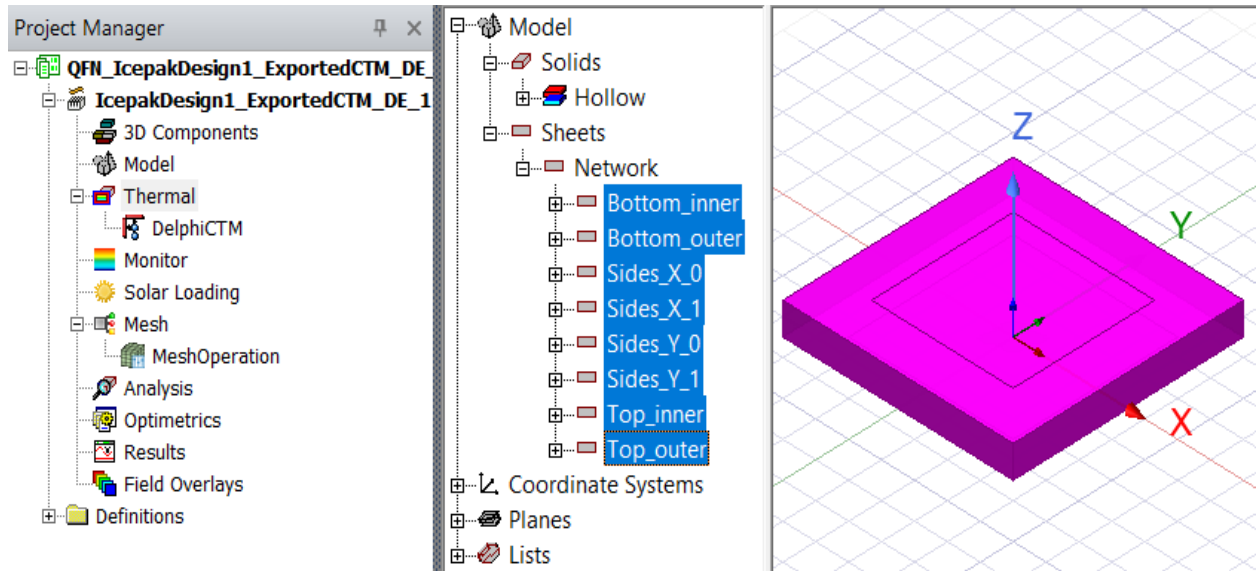


Figure 4-2: SteadyState2 Solve Setup Mean and Maximum Relative Errors Values

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 application. 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.



To edit the STM component's junction power, select the 3D component's project in the **Project Manager**. Edit the variable's power definition in the **Properties** window.

