Application Note

External Icepak Flow for Thermal Integrity

VERSION: 2024R1.0

Outline

3D-IC thermal simulation requires accurate system boundary conditions (BCs) of model surfaces. User needs an automated flow to map 3D coordinates from system (Icepak) to 3D-IC (RH-SC ET). With the new enhancements, 3D-IC thermal simulation accuracy is significantly enhanced to consider real system boundary conditions.

The new Ansys RedHawk-SC Electrothermal (RH-SC ET) flow for external Icepak flow features:

1) Visualization of the BC before simulation for easy verification.

2) Auto Mapping imported HTC data to RHSC-ET model surfaces.

3) Easy usage for manual usage to adjust imported HTC data to RH-SC ET model surfaces.

The details of the flow usage are described below.

Usage

Tool Version and License

1. Tool Version
   RedHawk-SC Electrothermal v2024R1.0
2. License
   redhawk_sc_electrothermal

Select BC

1. For Boundary Type, select “Boundary Conditions from Icepak”.
2. From 24R1 version, RHSC-ET supports two types of Icepak BC files, HTC, and Temperature.

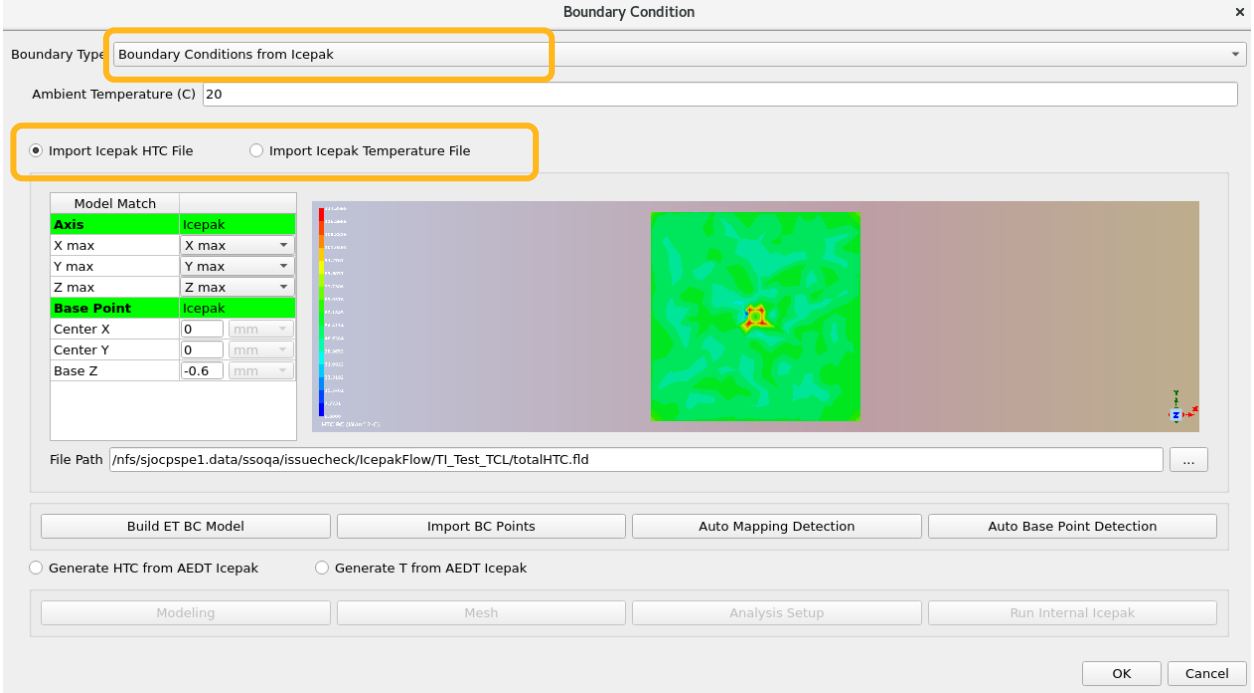

Figure 1 – Boundary Condition Setting

Export HTC fld File from AEDT Icepak

Before introducing RHSC-ET external Icepak flow usage, the method to prepare BC file from Icepak also provide here for user reference.

- Step1: Icepak>Fields>Calculator…

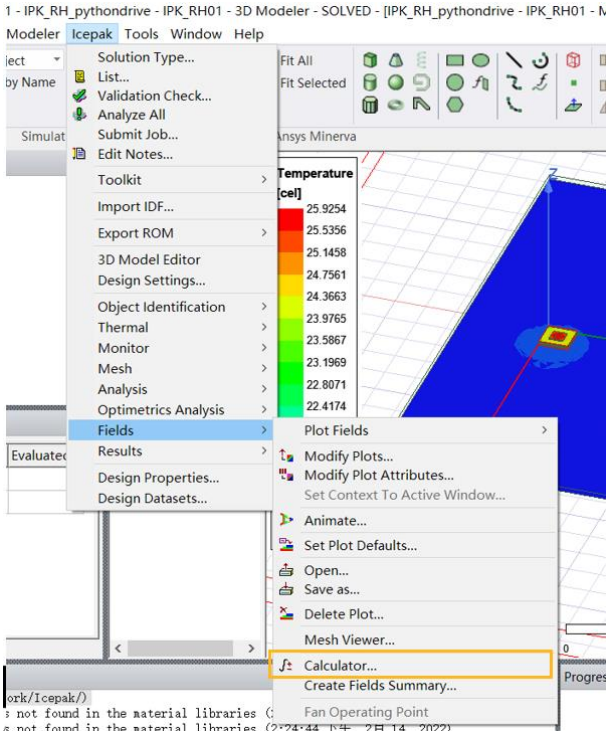

Figure 2 – Export HTC File from Icepak

- Step2: In Fields Calculator panel, please select:
  Quantity>Heat_Transfer_Coeff

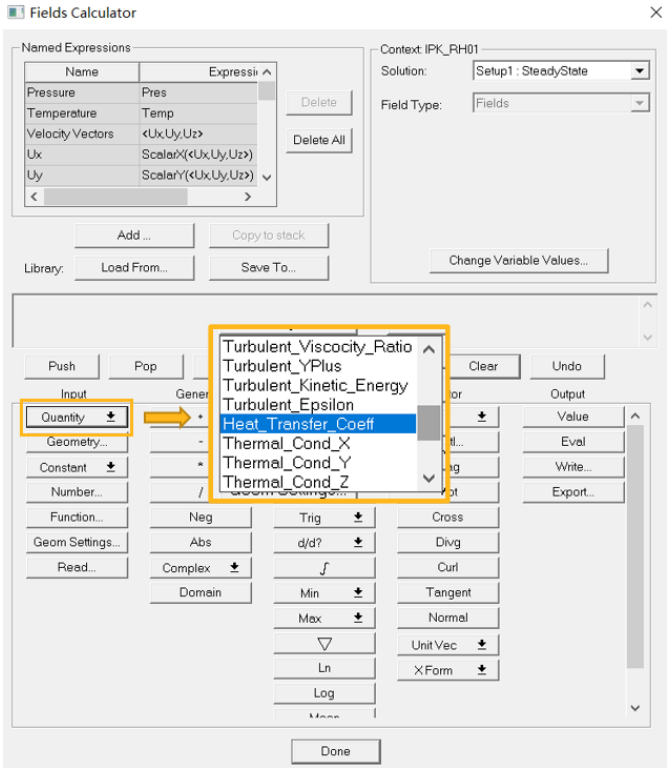

Figure 3 – Icepak Fields Calculator Options

- Step3: In Fields Calculator panel, please select:
  Geometry>Surface>AllObjects/Any objects needed.

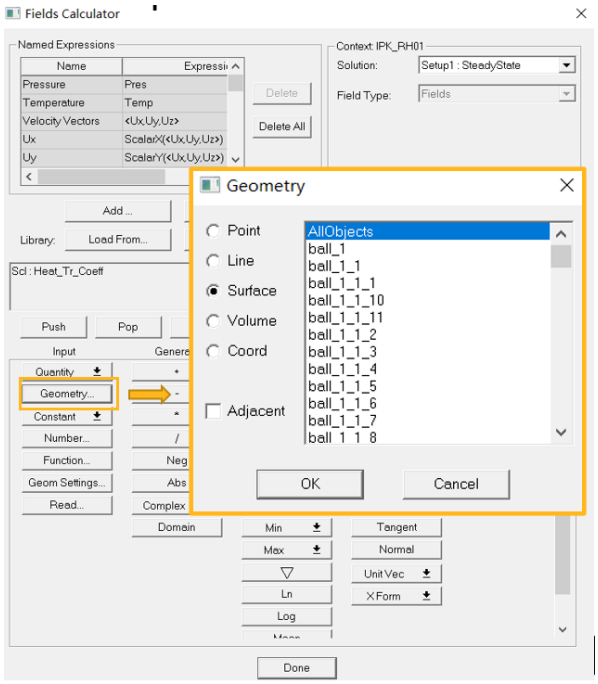

Figure 4 – Specify Geometry

- Step4: In Fields Calculator panel, please click: Value.
  The program will calculate the HTC results of the selected surfaces.

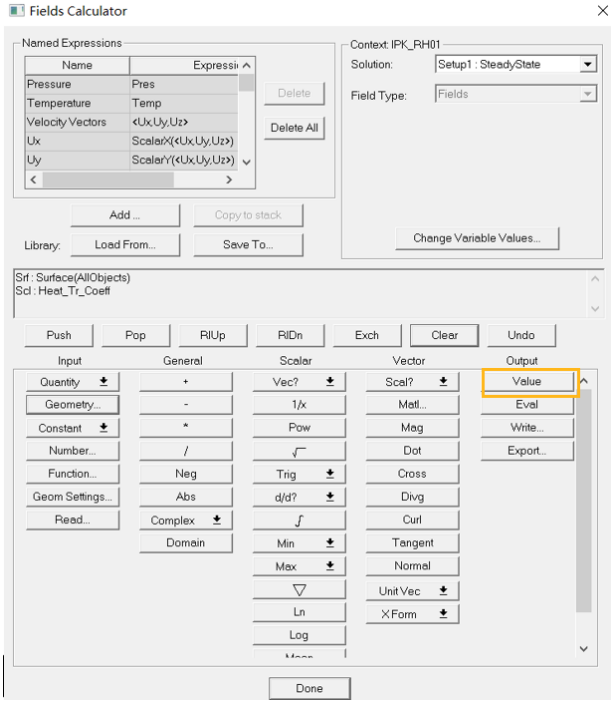

Figure 5 – Specify Value Option

- Step5: In Fields Calculator panel, please click: Write.
  Then give the fld file a name and save.

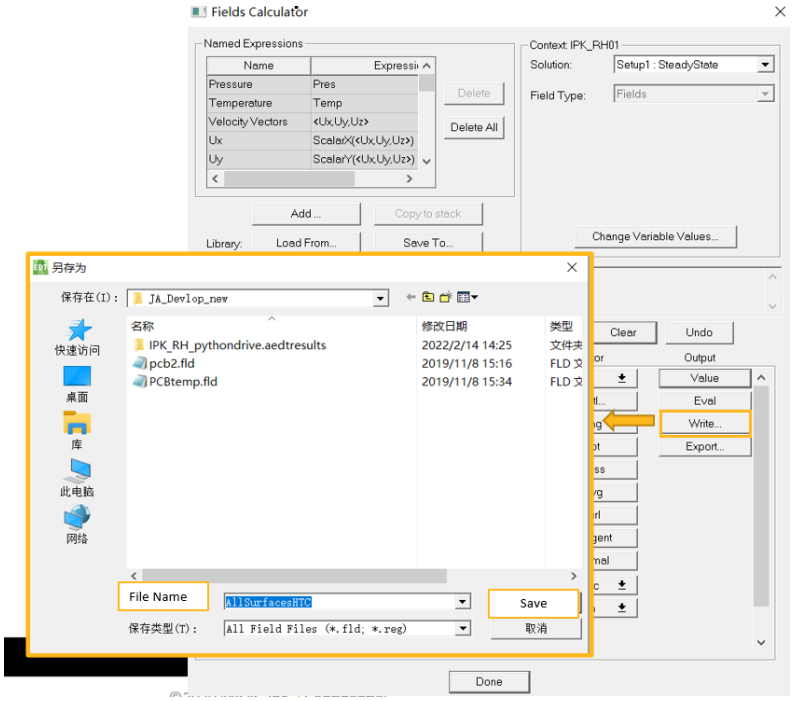

Figure 6 – Write FLD File

Boundary Condition from Icepak

RHSC-ET provides four buttons for detecting the BC data and model, helping users to do auto mapping.

1) Build ET BC Model
2) Import BC Points
3) Auto Mapping Detection
4) Auto Base Point Detection

- Step1: Import *.fld file.

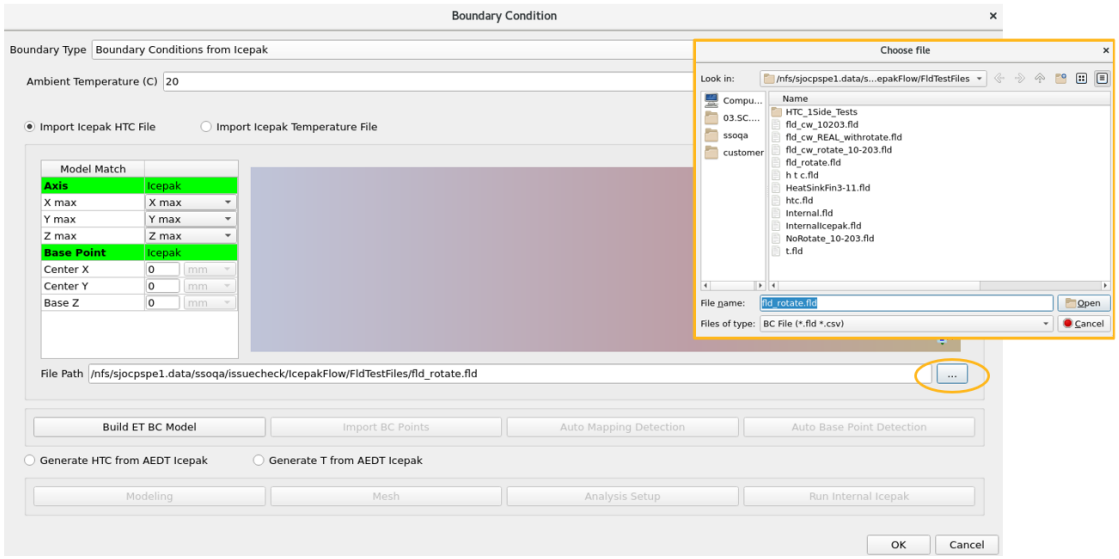

Figure 7 – Import FLD File in RH-SC ET

- Step2: Build ET BC Model.

Click the button **Build ET BC Model**, program will do simulation to get the fld and pre-match on ET model surface. After data is matched, user needs to rotate the model to see if the HTC/Temperature is matched on ET model as expected.

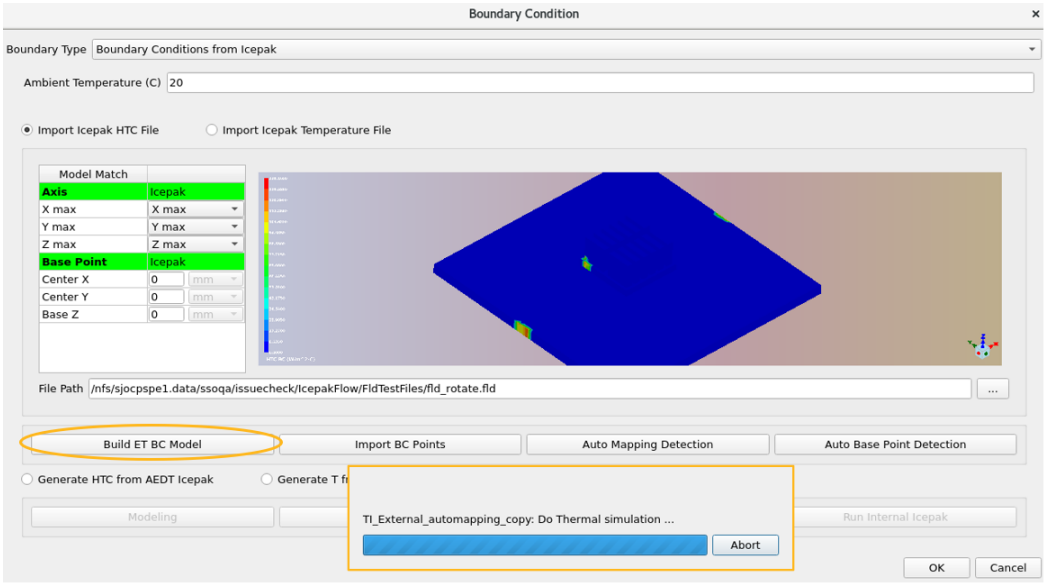

Figure 8 – Build ET BC Model

- Step3: Import BC Points.

If imported HTC/Temperature values are not matched on ET model surfaces as expected. Then, click the button **Import BC Points**.

FLD points model will display in viewer. It will help the user clearly see where the BC model is.

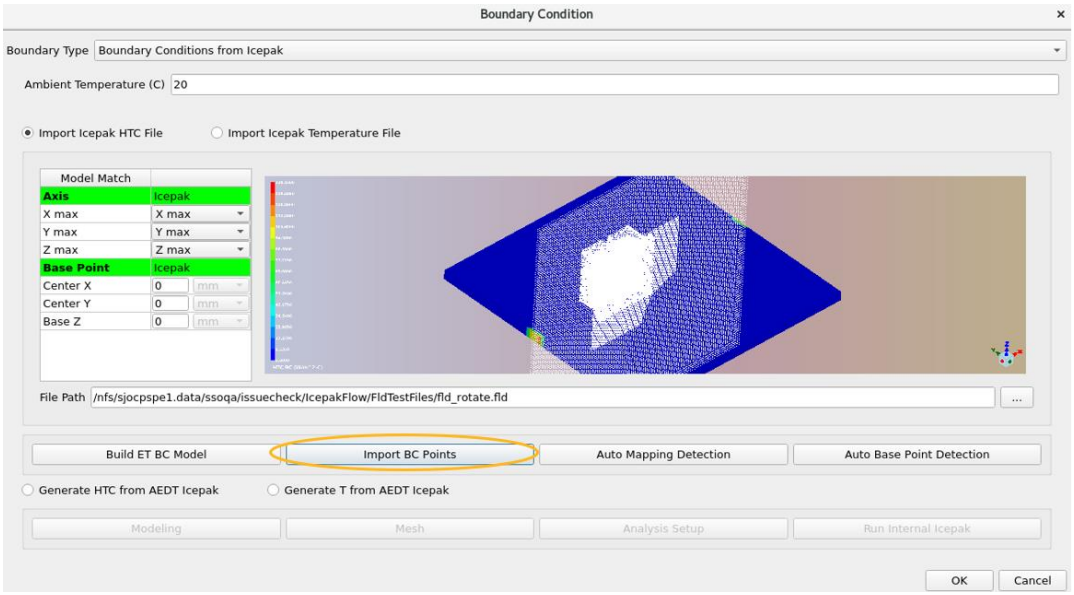

Figure 9 – Import BC Points

- Step4: Auto Mapping Detection

If the BC model is not matched as expected. Then click **Auto Mapping Detection**. The program will automatically try to match the BC point model to the related surfaces.

After matching, the Axis and Base Point information has been automatically modified.

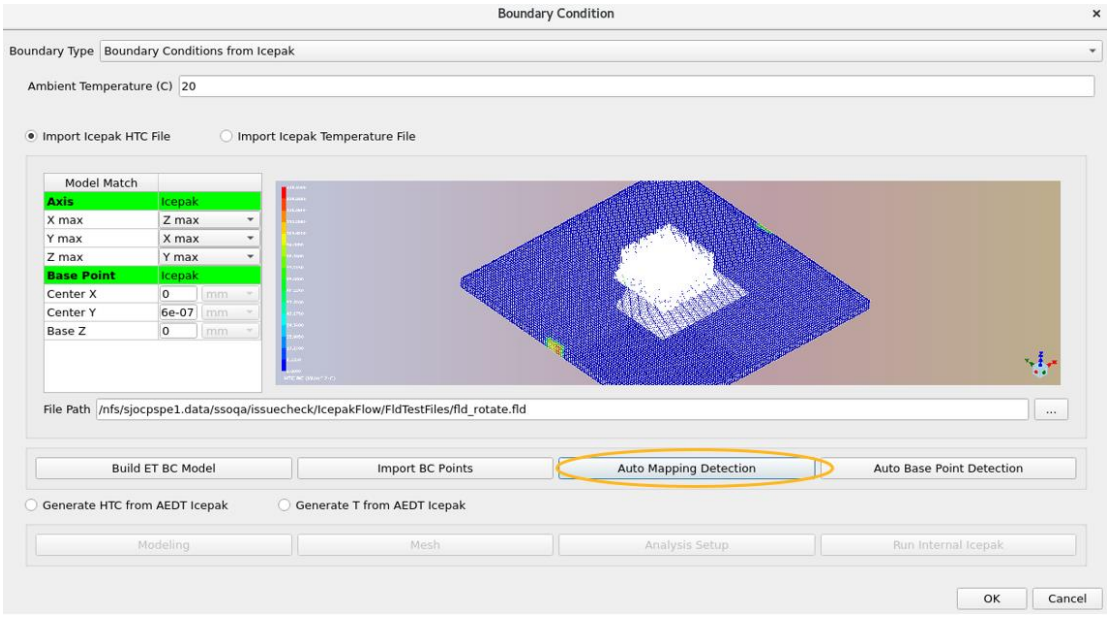

Figure 10 – Auto Mapping Detection

- Step5: Build ET Model

After BC point model matched on ET model surfaces, click the button **Build ET BC model** to re-match the BC data on to the accurate surfaces.

Program will re-do simulation based on the updated axis and based point information.

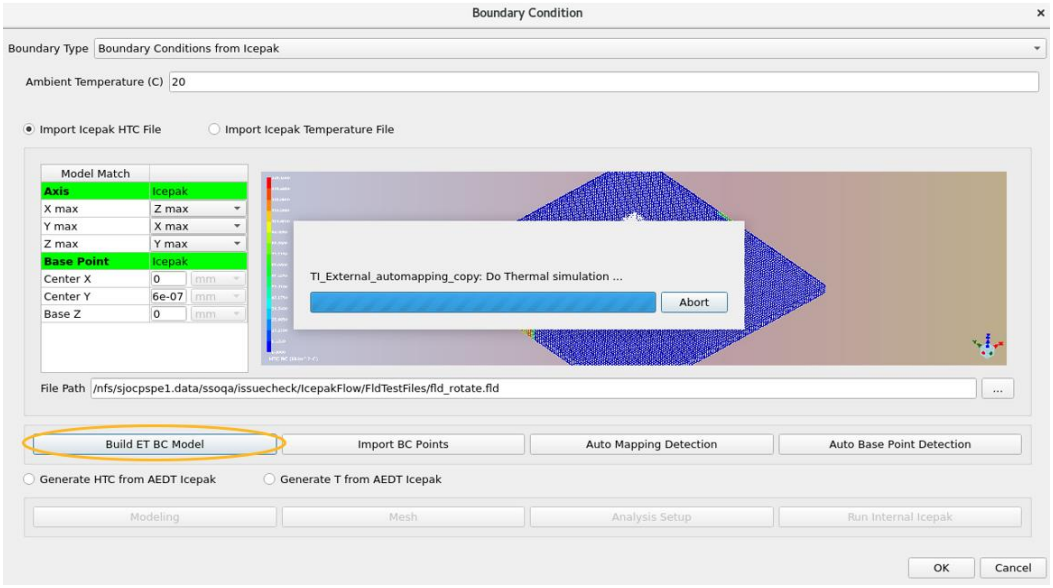

Figure 11 – Re-match BC Data

- Step6: After the new match is done, the BC values are assigned to the accurate locations.

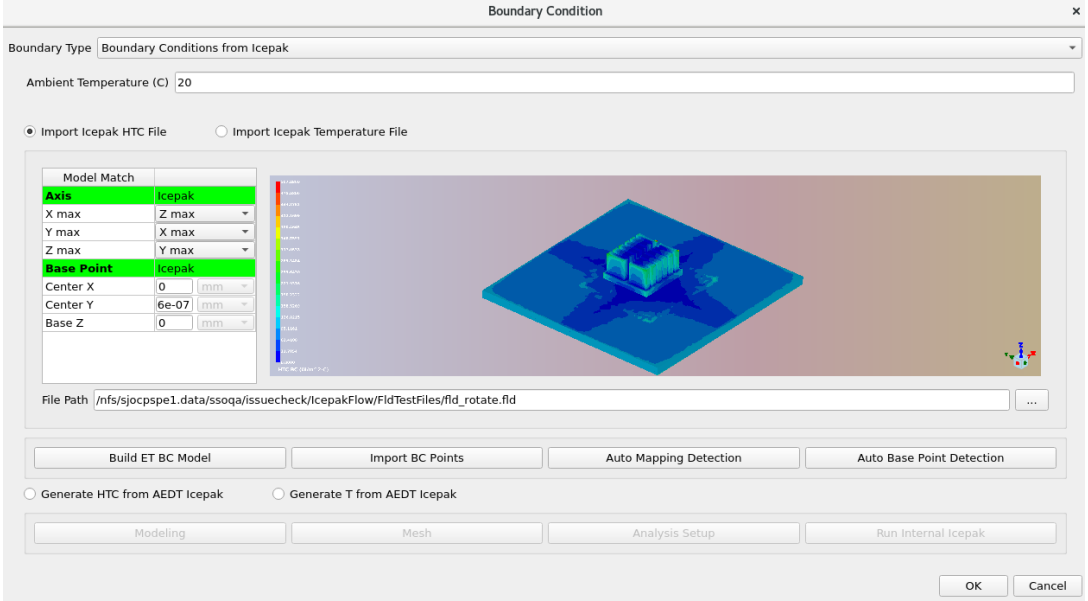

Figure 12 – Display ET BC Model

- Base Point match

After you do the **Auto Mapping Detection**, or just after you import the fld file, if only the base point is not at the accurate location, user can click the button **Auto Base Point Detection**.

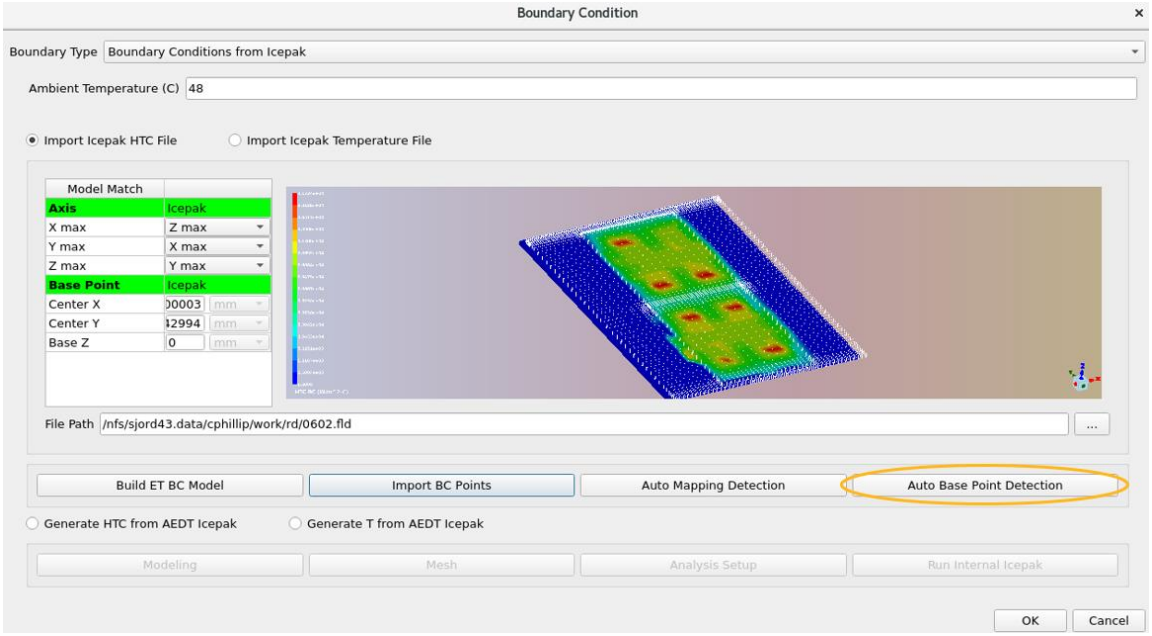

Figure 13 – Auto Base Point Detection

The program will focus on the base point side to check the accurate location and re-match the BC point model and ET model.

The base point coordinates information will be automatically modified when the program finds the accurate location.

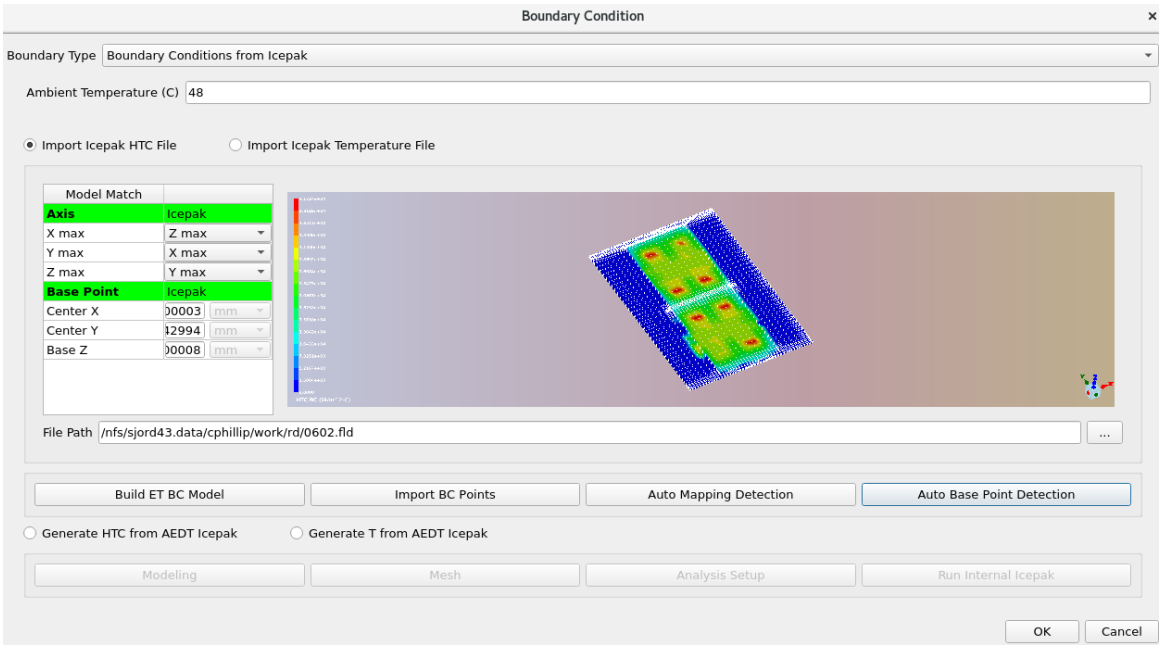

Figure 14 – Display the Matching Points

Then click the button **Build ET BC Model** and re-do the pre-simulation.

After that, the BC values are matched on the ET model surfaces on the accurate locations.

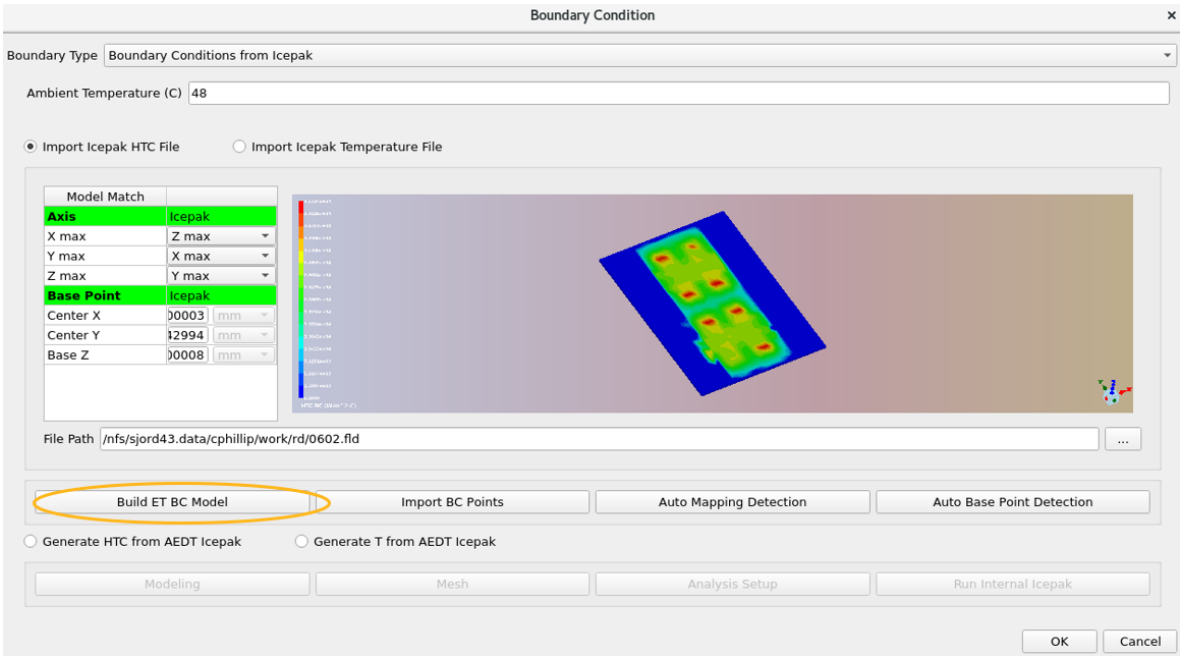

Figure 15 – Display ET BC Model

Manual Method to Match Icepak BC file to RHSC-ET Model

For some complex cases or some very symmetrical models, even the **Auto Mapping Detection** and **Auto Base Point Detection** used, but program still cannot find the accurate location for the BC model. Then the user can use the manual method to match the BC model to accurate surfaces.

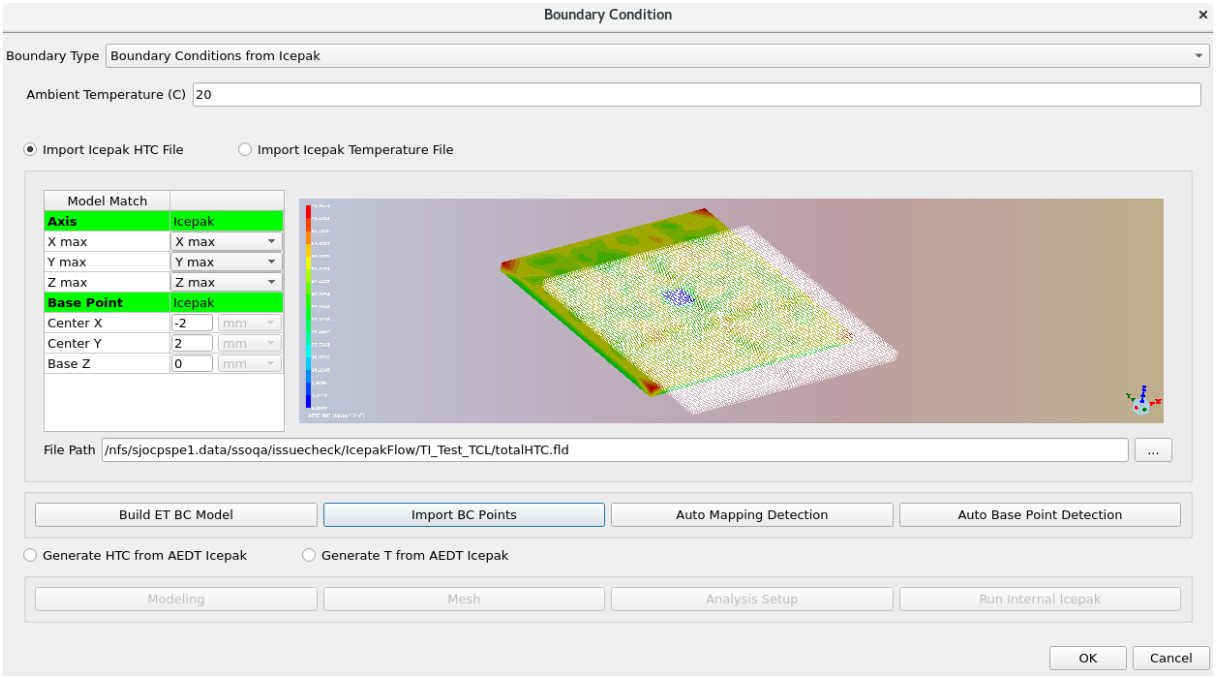

Figure 16 – Import FLD File

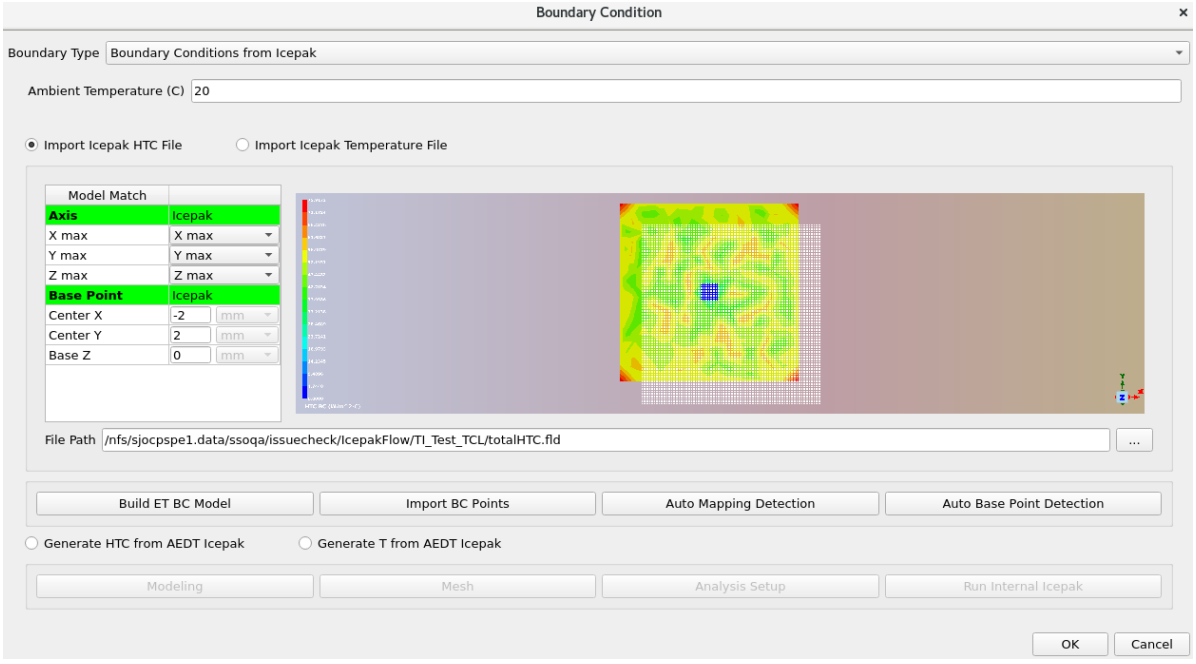

Figure 17 - Adjust the model to Top View

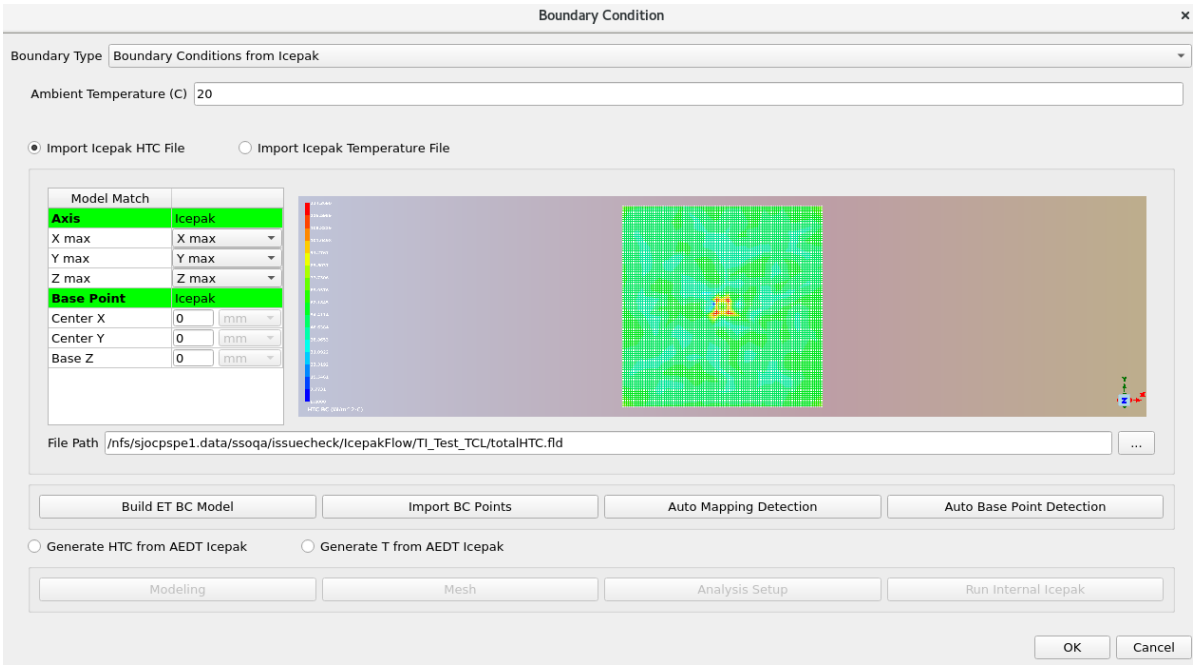

Figure 18 – Modify the Center X and Center Y Data

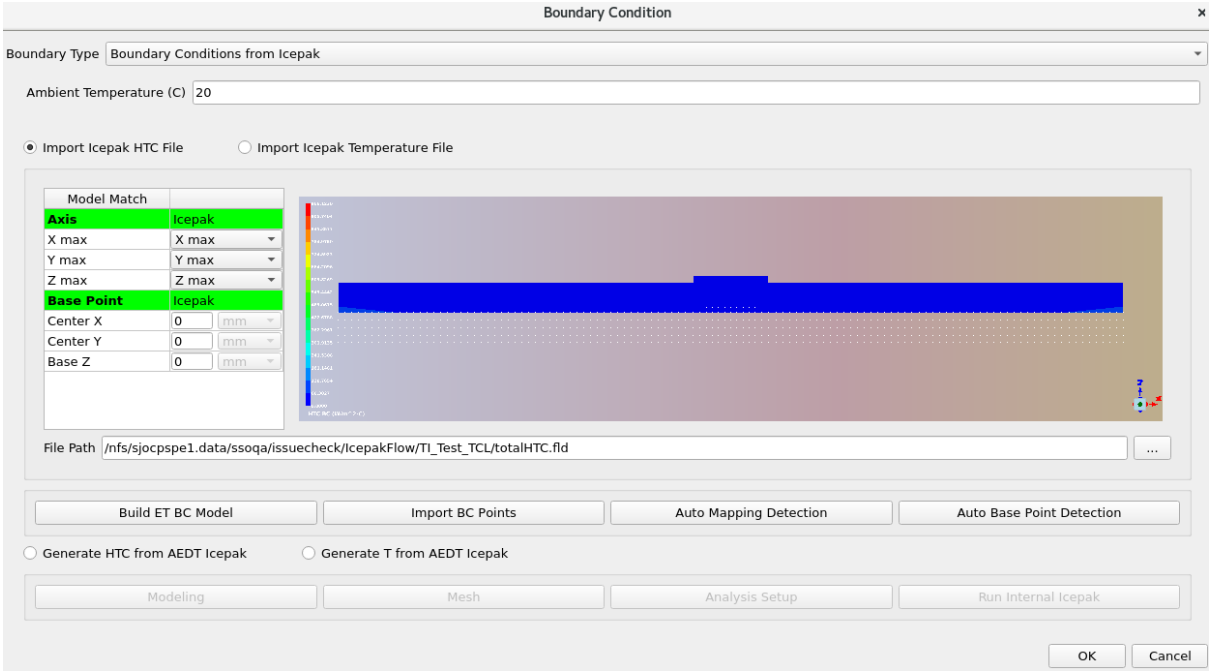

Figure 19 – Adjust the model to Front View

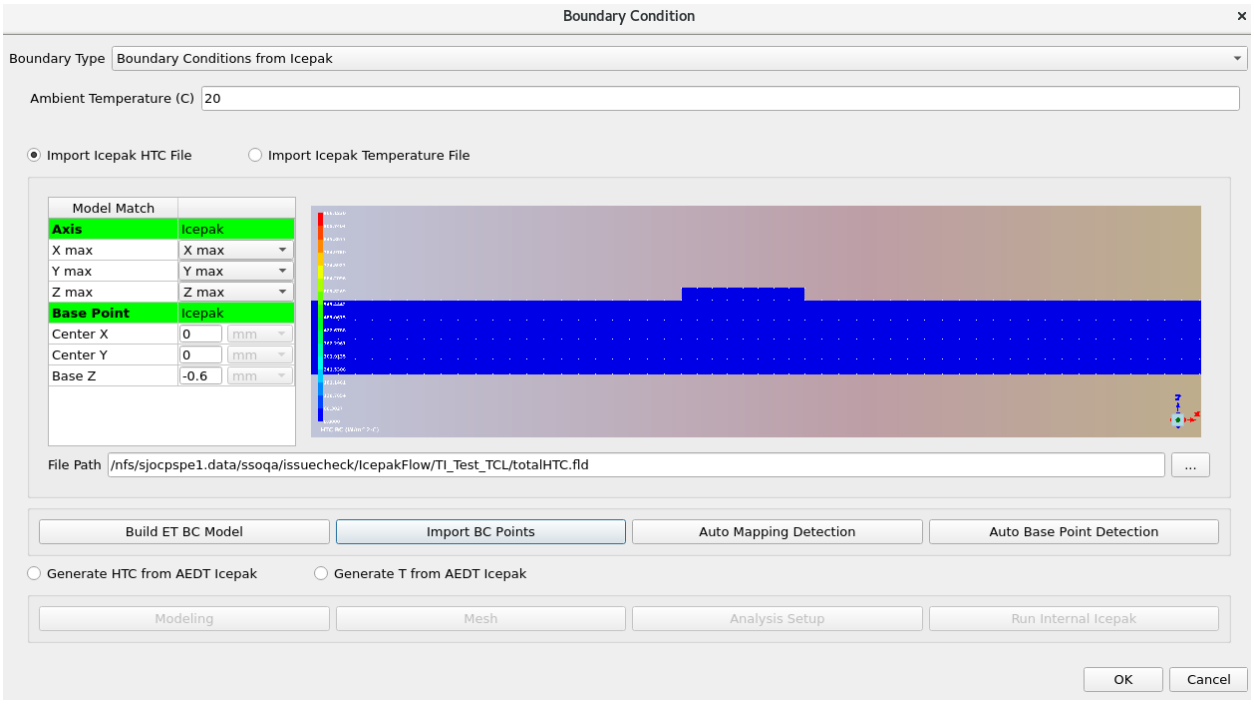

Figure 20 – Modify the Base Z Data

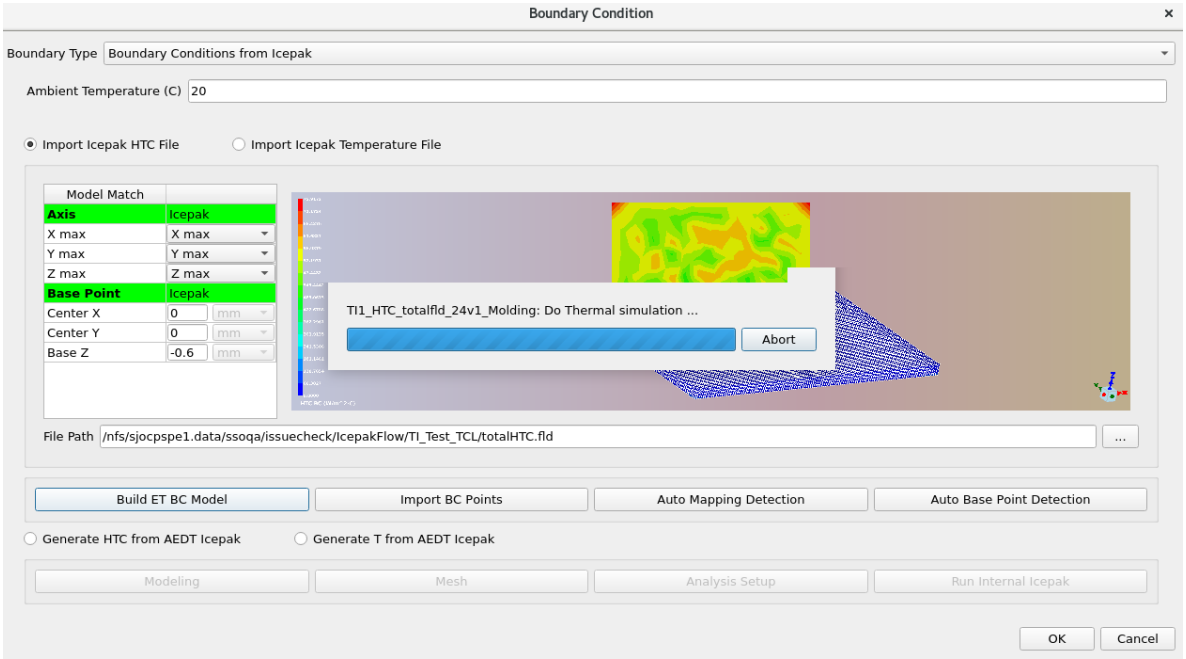

Figure 21 – Re-run Build ET BC Model

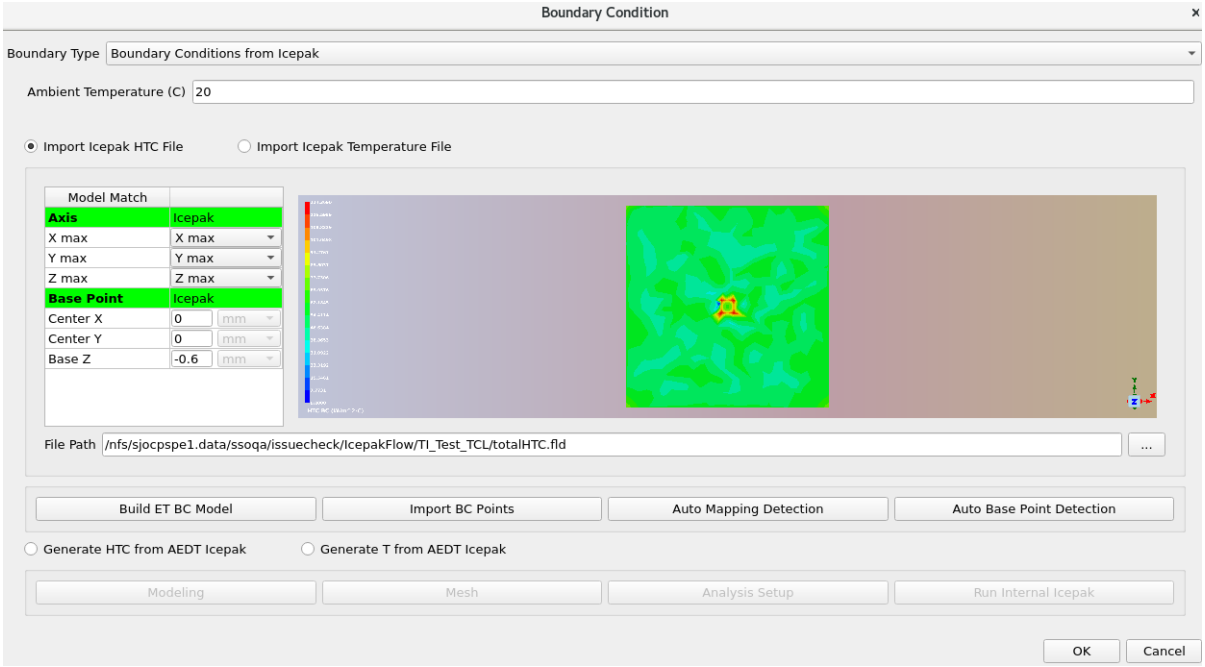

Figure 22 – Updated HTC Data Matched on Accurate Model Surfaces

Export Temperature BC File from AEDT Icepak

The way is similar to importing HTC file. Click the option “Import Icepak Temperature File” and activate it.

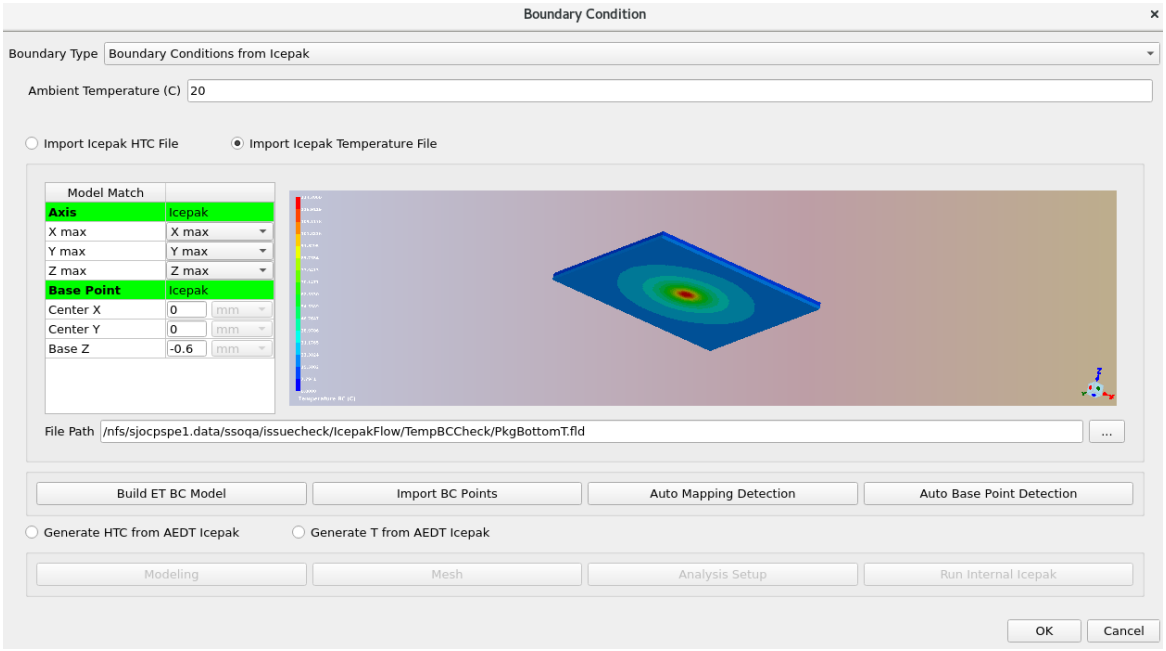

Figure 23 – Import Icepak Temperature File