RedHawk-SC Electrothermal™

Enable RaptorH in CSM Application Note

Version 2021 R2.2

September 22, 2021

TABLE OF CONTENTS

Introduction

Driven by the 2.5DIC/3DIC industry increment, demand of high-speed silicon interposer extraction become more and more common. CSM enable Helic RaptorH for high accuracy interposer extraction.

RaptorH brings two world-class engines in one package: **HFSS** and **RaptorX,** address EM extraction and simulation needs from silicon to package/3DIC variants, board and system, including integrated antennas and other 3D structures.

Consolidate with CSM customized features for silicon interposer usage, like Pin grouping, Via merging, cut region, Smart text label supporting and CSM system level SI analysis and reporting flow, it become a complete 2.5DIC/3DIC SI analysis flow.

The following sections describe how to set up the flow.
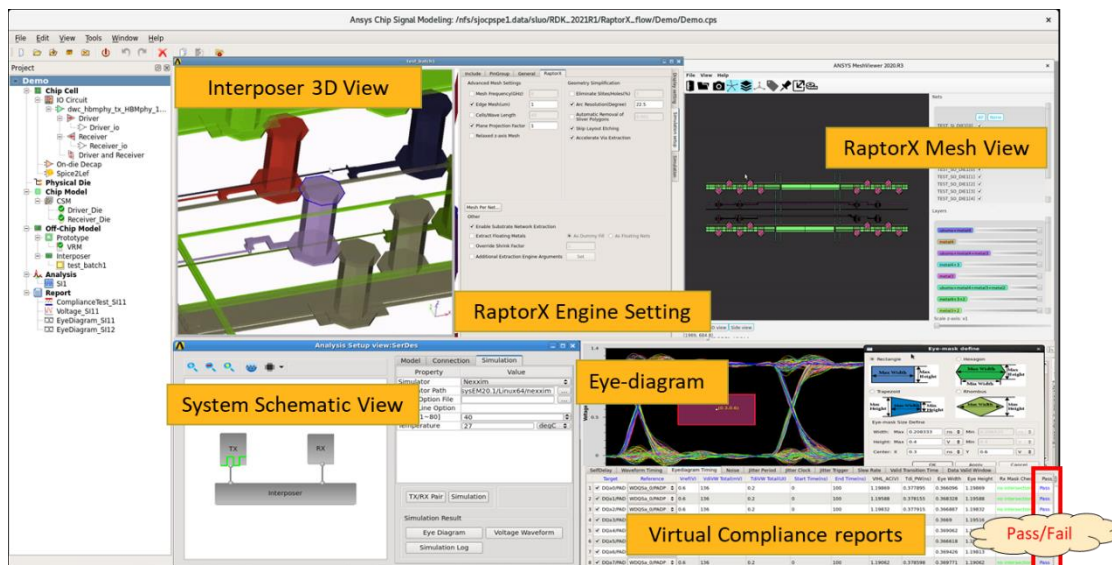
GUI Overview

Figure 1 – GUI Overview.

Setup Flow

   a. First to set the Helic Root, menu bar **Tools** → **Simulators** → **HELIC ROOT** (Figure 2).
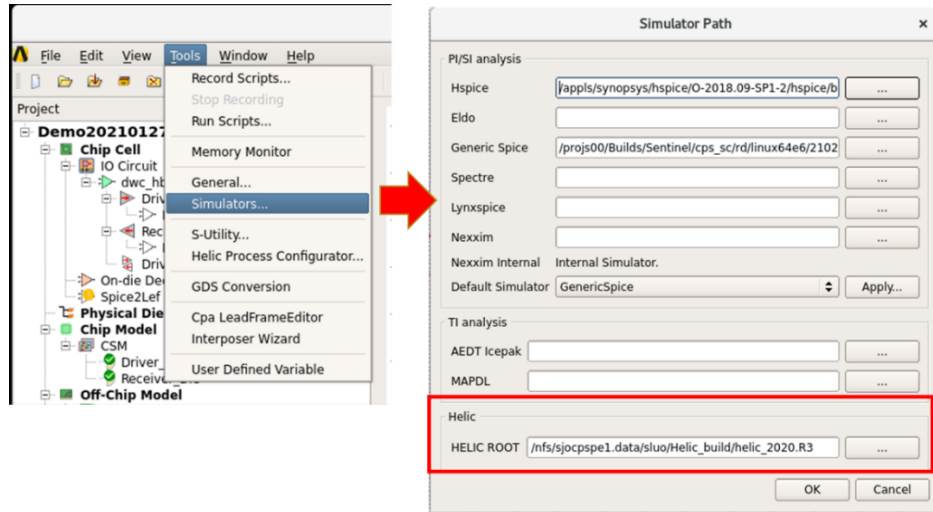
Figure 2 – Set Helic Root in CSM.

b. Create PDK Root through Helic Process Configurator, PDK creation flow is same as standalone Helic flow. **Menu bar → Tools → Helic Process Configurator**.
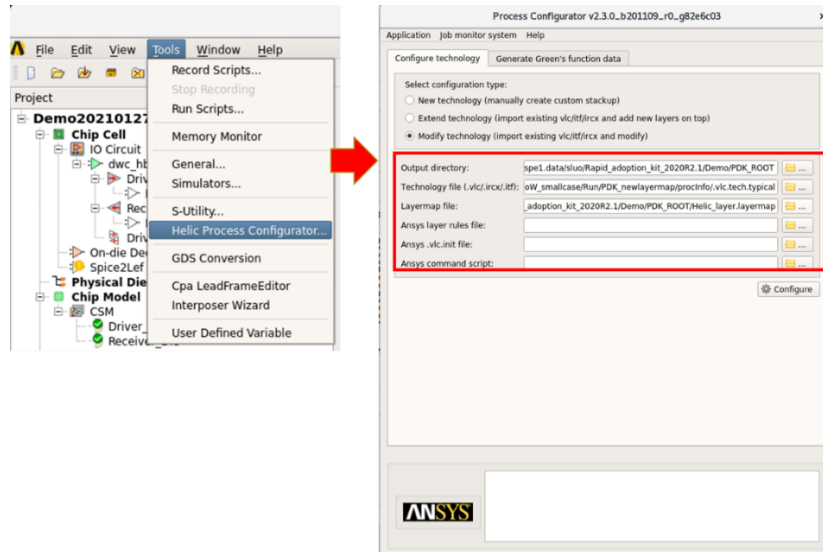

Figure 3 – Create Helic PDK Root in CSM.

c. New an interposer model in "**Off-Chip Model**" → "**Interposer**" in CSM project tree,

d. Import design data: GDS design, PDK root folder and layer map file.

e. Tool will parse GDS to automatic detect top cell, user also can change it accordingly.

f. Tracing net/text options, by default, CSM will trace all the text label, user can trace only selected text for more efficiency, or selected text + cut region (introduce in next section).

g. By default, CSM will treat all text label as pin name, user can switch to "**Uniquify Text Labels**" option, if the GDS design is using uniquify text labels.
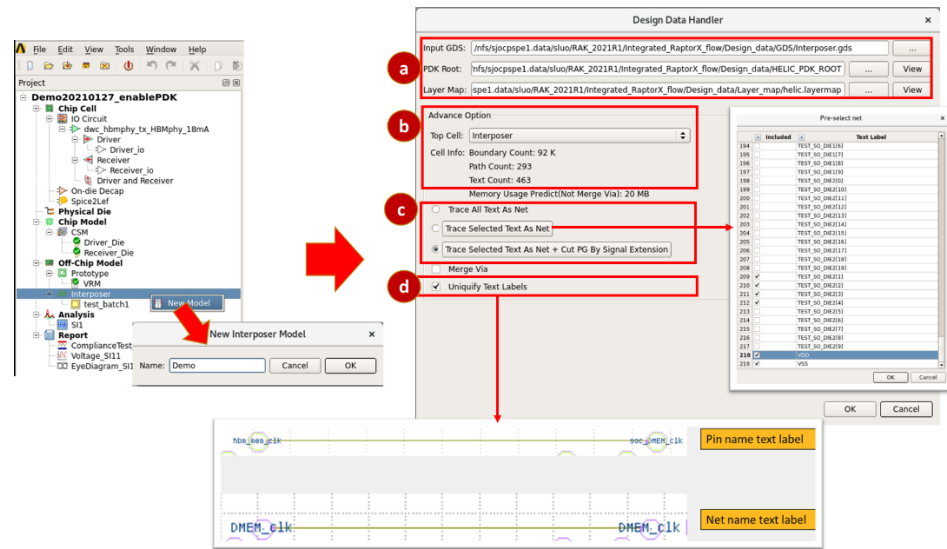
Figure 4 – New an Interposer Model in CSM.

h. When using "**Trace Selected Text as Net + Cut PG By Signal Extension**" option. CSM will first parse the text label and list the available nets. Need to classify the net type first.

i. Auto extension for the signal net area to cut the GND/Power nets by percentage, 10% (user define) of signal area in horizontal direction, 10% (user define) of signal area in vertical direction.

j. Auto extension for the signal net area to cut the GND/Power nets by absolute value, 100um (user define) of signal area in horizontal direction, 100um (user define) of signal area in vertical direction.
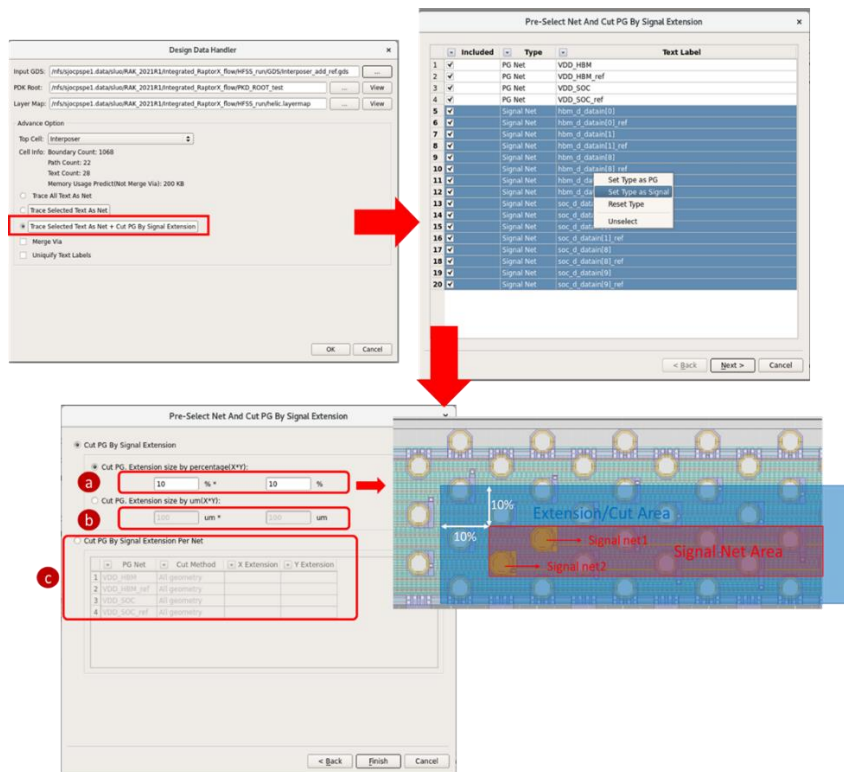
k. Apply extension per net.

Figure 5 – Cut Region Options.

2) Interposer model layout viewer (GDS viewer) Display Setting.

    a. Main steps are "**Display Setting**" to view/check the layout, "**Simulation Setup**" to setup the extraction parameters, "**Simulation**" to start extraction and view result.

    b. Display view can switch between 2D and 3D.

    c. View operation tool bar, and hot key for view operation is also support.

        i. Mouse left button (3D), **drag** to rotate the design.

        ii. Mouse left button (3D), **double click** to return to the original angle (2D angle).

        iii. Mouse middle button (3D and 2D), **drag** to move the layout.

        iv. Mouse middle button (3D and 2D), **double click** to fit all.

        v. Mouse wheel (3D and 2D), zoom in/out.

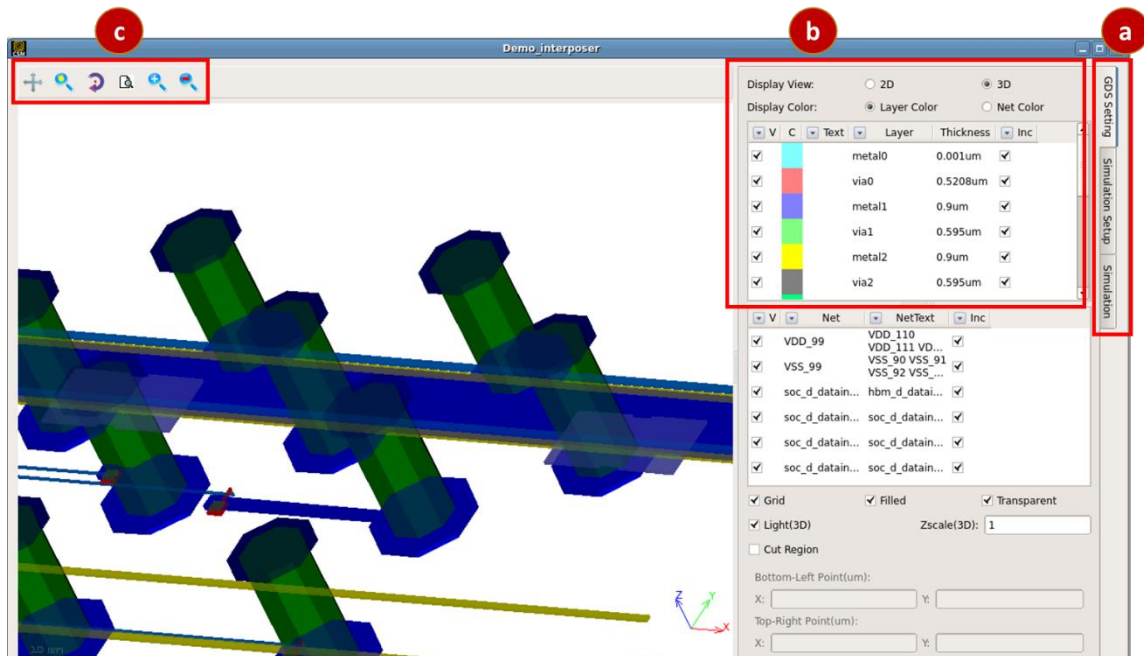   vi. Mouse right button drag (3D and 2D), (from left to right) Zoom In, (from right to left) Zoom Out.

Figure 6 – GDS viewer Display Operation.

    d. Interposer model "**Simulation Setup**" --- "**Pin Group**."

For multi-port signal like VDD and VSS, CSM support group/lump multi-port to one port

    e. First to select the **Pin/text_label** layer.

    f. Select the multi-port net from the list.

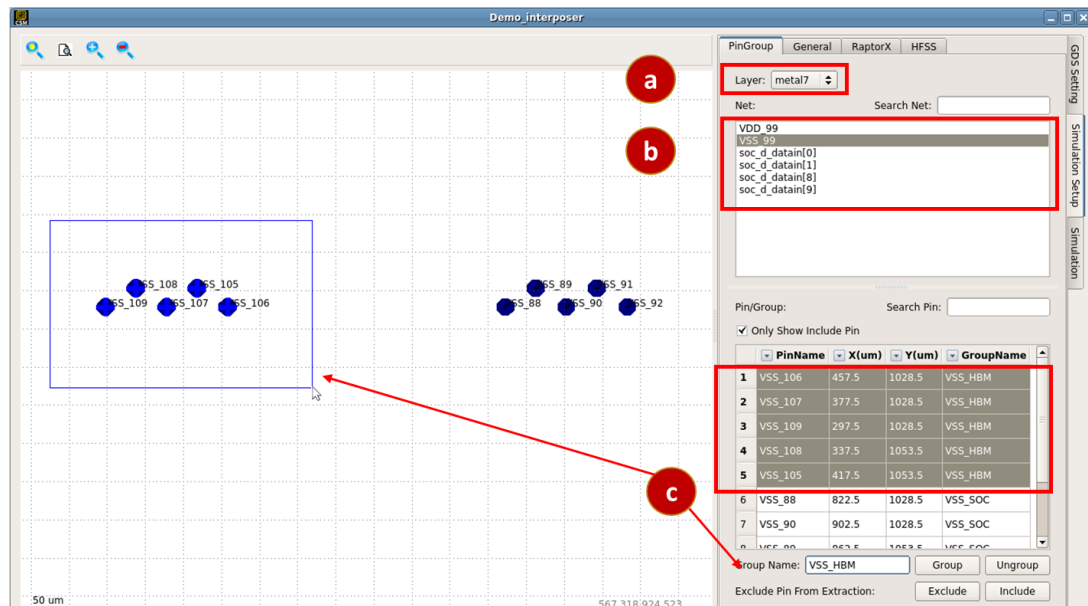   g. Use mouse drag and select or select from the pin list table and give a group name for the pin group.

Figure 7 – Interposer Model Extraction Setup --- "Pin Group" tab.

h.   Interposer model "**Simulation Setup**" --- "**General**."

General setting tab is same as Helic RaptorX general setting, select engine type, set the frequency and the threads number.

i.   Able to select RaptorX engine or HFSS engine, select RaptorX engine will only enable "**RaptorX**" tab, "**HFSS**" tab will be grey. Similar when select "**HFSS**" tab.

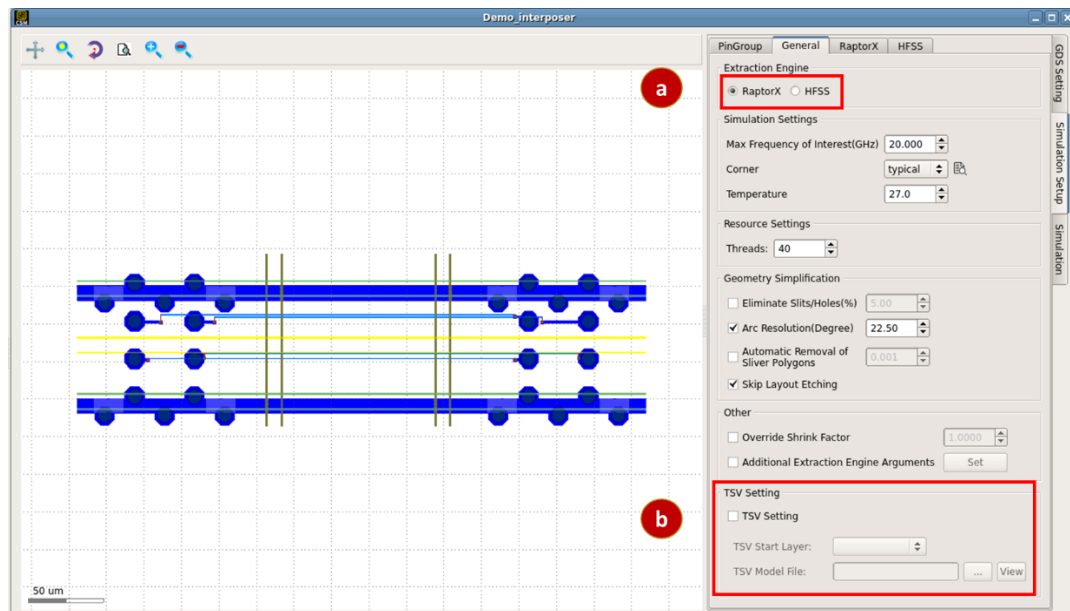j.   Support import TSV Subckt to hook up with extracted interposer model.

Figure 8 – Interposer Model Extraction Setup --- "General" tab.

k.   Interposer model "**Simulation Setup**" --- "**RaptorX**".

RaptorX setting tab is same as standalone RaptorX setting page, set the mesh parameters, geometry simplification parameters etc.

l.   Mesh Per Net to define "**Edge Mesh**" or "**Mesh Frequency**" and "**Plane Projection Factor**" per net and per metal layer.
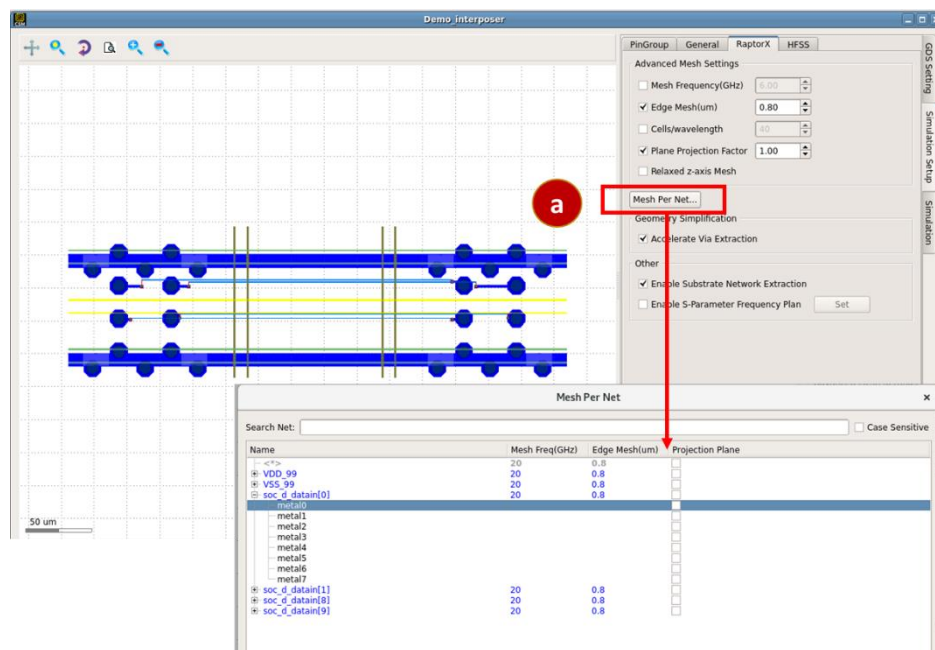
Figure 9 – Interposer Model Extraction Setup --- "RaptorX" tab.

    m. Interposer model "**Simulation Setup**" --- "**HFSS**"

Settings are same as standalone RaptorH HFSS options.

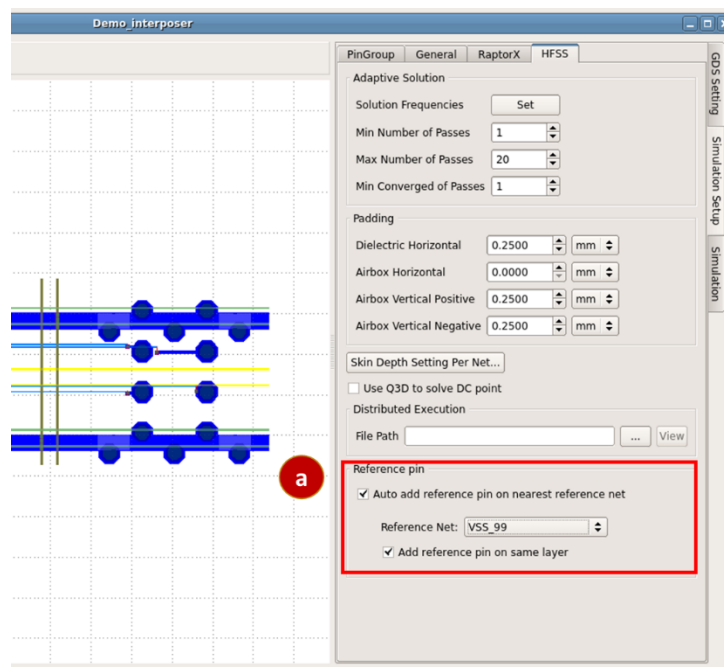   n. CSM support automatic add reference pins to specified reference net.

Figure 10 – Interposer Model Extraction Setup --- "HFSS" tab.

3) Interposer model "**Simulation**"

    a. "**Extract**" button to start extraction.

    b. "**View Log**" button to view the log file (Real-time refresh).

    c. "**Mesh view**" button to launch Helic mesh viewer.

d. After extraction finish, click "**S-parameter viewer**" to launch "**Network Data Explorer**" to plot the S-parameter (need Helic 2020R3 or newer version).
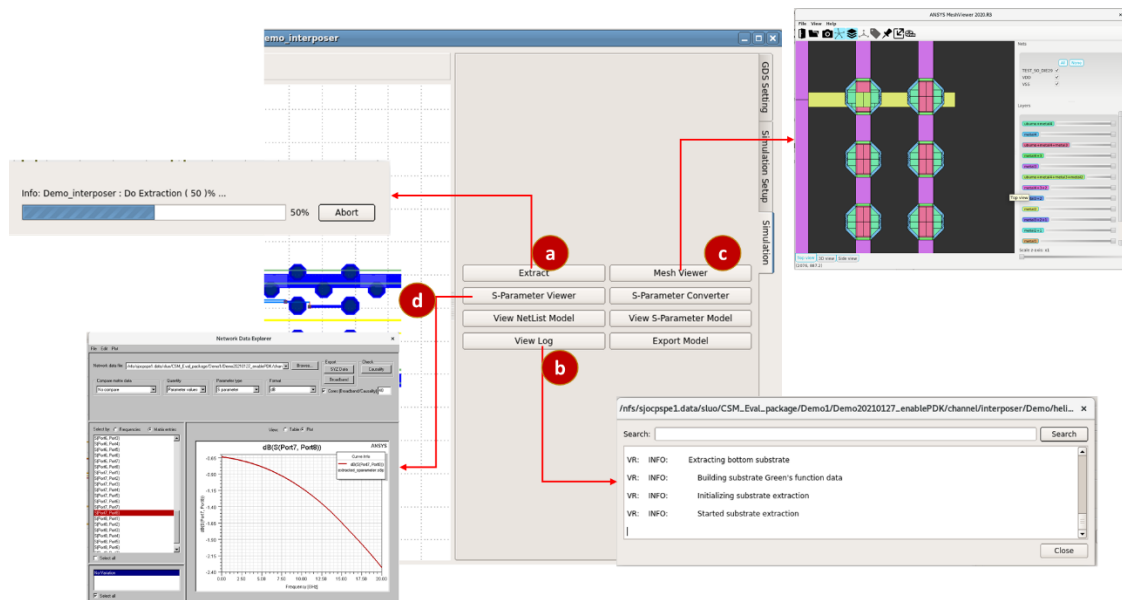

Figure 11 – Interposer Model Simulation tab.

e. Interposer model transient analysis in "**Analysis**" module.

f. Insert a "**Interposer**" object.

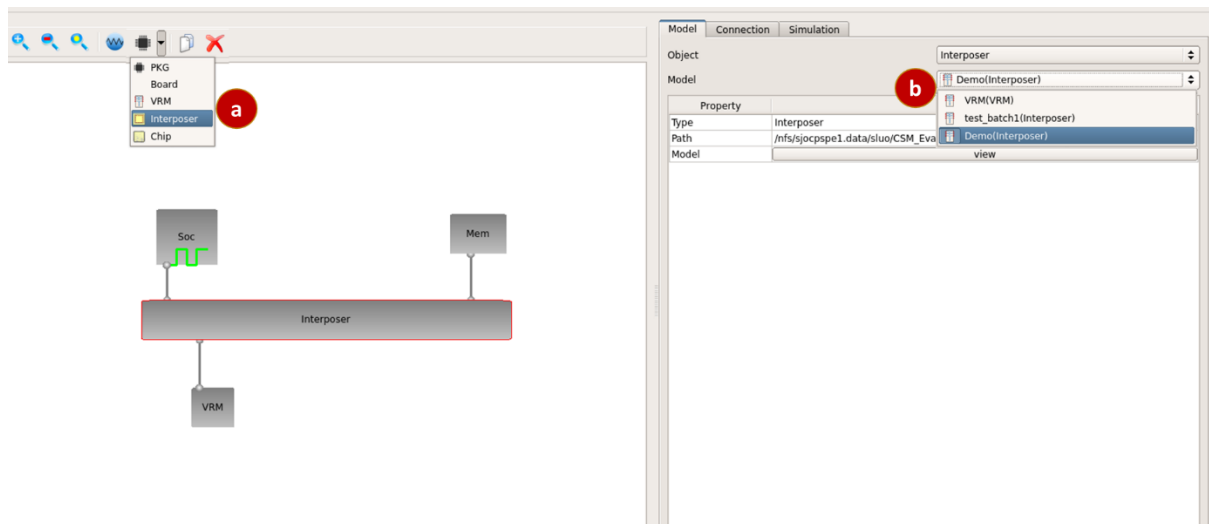g. Assign corresponding interposer model to this object.

Figure 12 – Using Interposer Model in Analysis Module.

ANSYS INC

Semiconductor Business Unit

2645 Zanker Road
San Jose, CA   95134

Main: 408-457-2000
Fax: 408-428-9569