Using Sonnet with Agilent EEsof EDA's Advanced Design System (ADS)
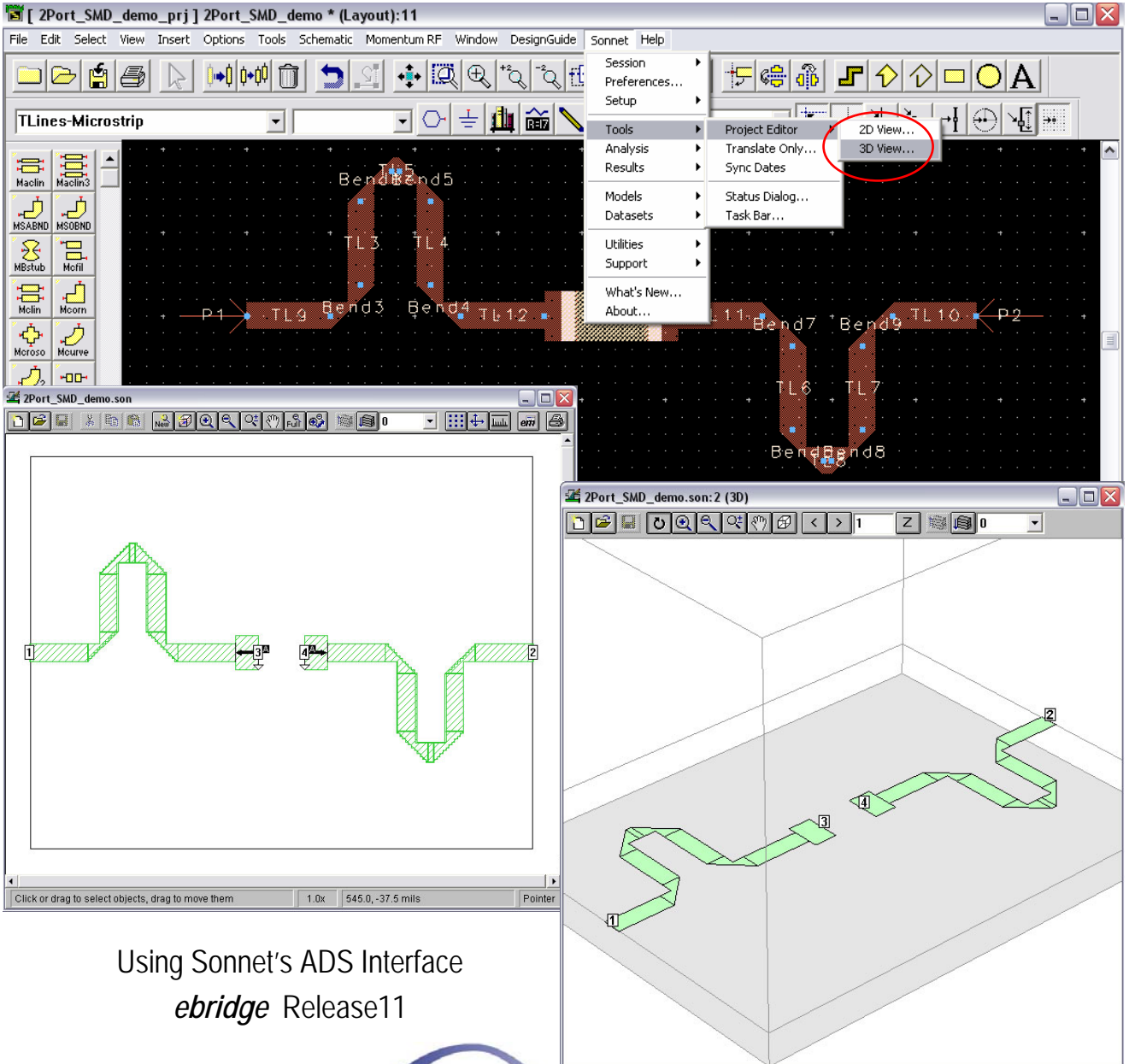
Using Sonnet's ADS Interface
ebridge Release11

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# Introduction: Sonnet Interface for ADS - *ebridge*

Sonnet's **ebridge** v11.0 offers a complete GUI integration into the Agilent EEsof EDA's Advanced Design System (ADS).   The totally redesigned interface allows the designer to take layouts very easily from ADS into Sonnet for high precision EM analysis and extract accurate electrical models for the layout along with a layout look-alike schematic symbol. Material and technology information can be obtained from the schematic MSUB blocks, from a project technology file or from an existing Momentum project.

Agilent ADS

Layout
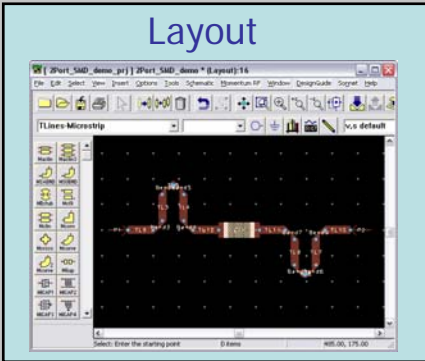
Schematic
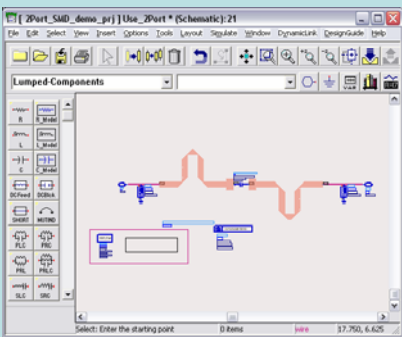
Automatic Generation of:

1) **Touchstone S-Parameters**
2) **ADS Dataset**
3) **Blackbox Symbol**
4) **Layout Look-Alike Symbol**
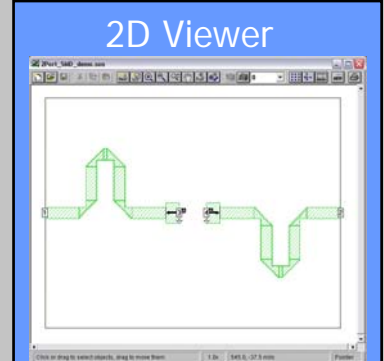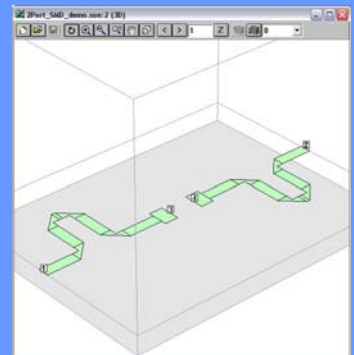5) **New ADS Layout to Reflect Changes Made within Sonnet**

Sonnet® EM

2D Viewer

3D Viewer

In Sonnet, you can:

1) **Instantly View 3D Model**
2) **Edit Geometry in 2D View**
3) **Add Co-Calibrated™ Ports**
4) **Perform Highly Accurate EM Analysis**

Physical Design Translation

ADS Layout → Sonnet
ADS Schematic → Sonnet

S-Param Model Extraction

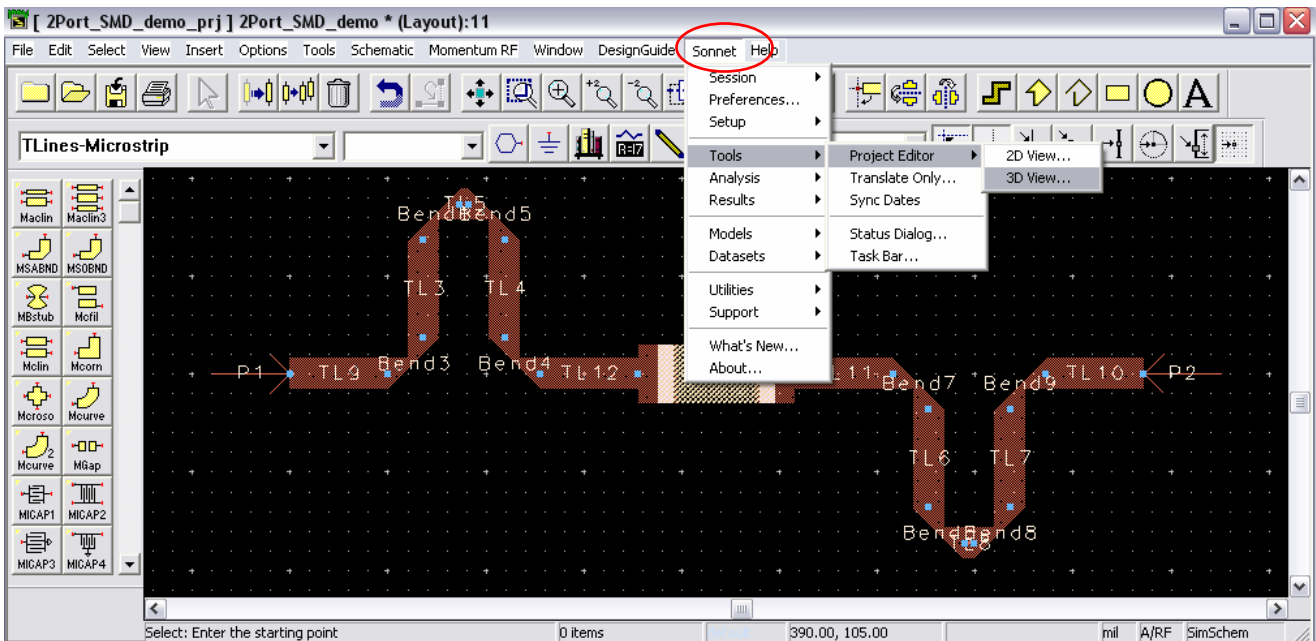ADS Schematic ← Sonnet
ADS Layout ← Sonnet

1 - Installing *ebridge*

Sonnet offers a menu level integration into the ADS environment through the **ebridge** interface. This is an optional module from Sonnet Software which requires a license. The **ebridge** interface is installed as a Design Kit within the ADS environment or it can be installed with just a few clicks by using the **Sonnet Task Bar**.
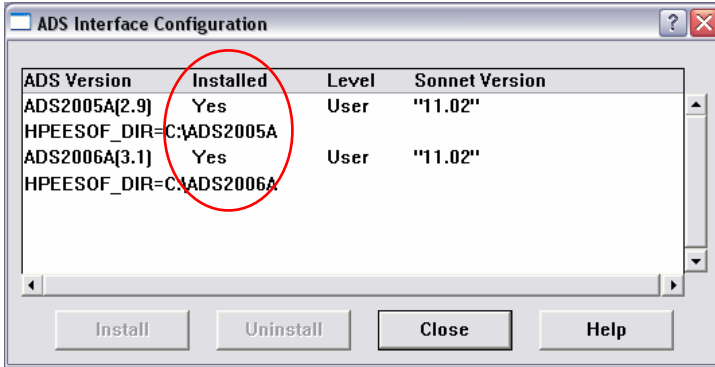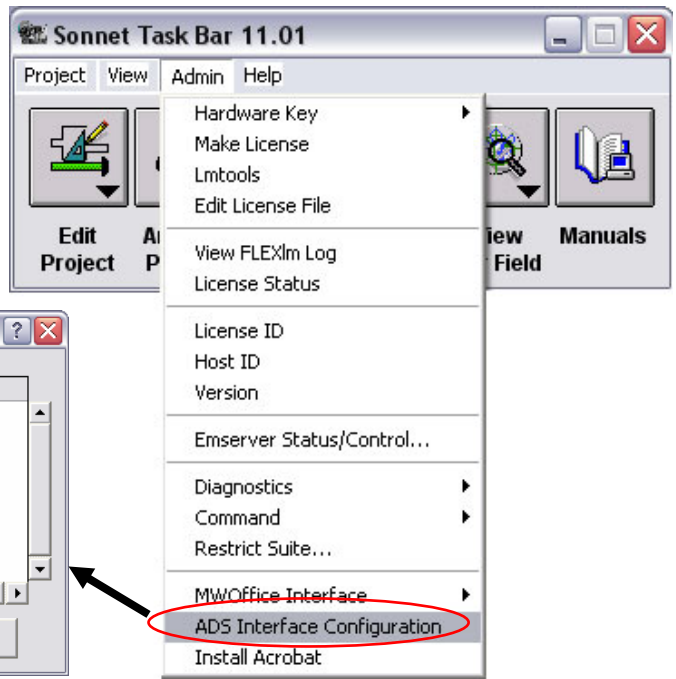
(Note: For users with multiple versions of ADS, click **Install** for each ADS version.)

When activated, the Sonnet menu appears in the ADS Layout window.

Sonnet Menu within Agilent ADS

2 – Setup Sonnet simulation model from ADS

To create a Sonnet simulation model, the user can choose to **Update All from Momentum** or **Update All from Schematic**. During this step, the interface updates all of the Sonnet project model information such as the substrate information, metal layers, frequency plans, analysis settings, port information, box size, cell size, etc. If any of the information is not available in the Momentum or the Schematic design, then the interface pulls the default settings from the **Preferences**.
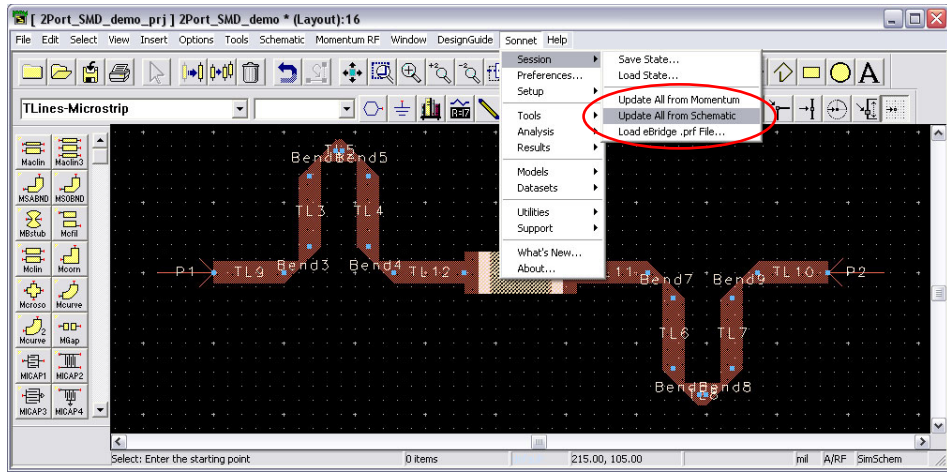

3 – Immediately View 3D Model

Sonnet now has enough information to create a 3D view of the design. Within ADS, select **Sonnet > Tools > Project Editor > 3D View** to view the design in 3D.
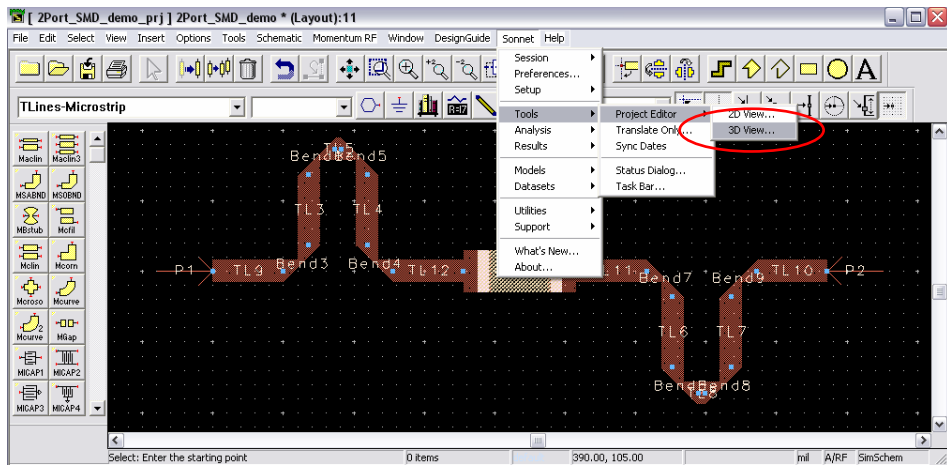
Bi-directional Layout Translation:
The 2D geometry project can be modified within the Sonnet environment prior to Sonnet EM analysis. Any changes made to the layout in Sonnet will be reflected in the Sonnet Layout Look-alike Component and the new Layout that are imported back into ADS. New types of ports like the Co-calibrated™ Ports can be added to the EM projects. This is truly a bi-directional interfacing capability between Sonnet and Agilent ADS.
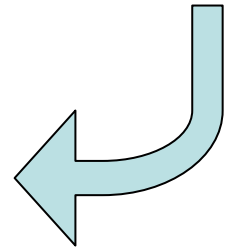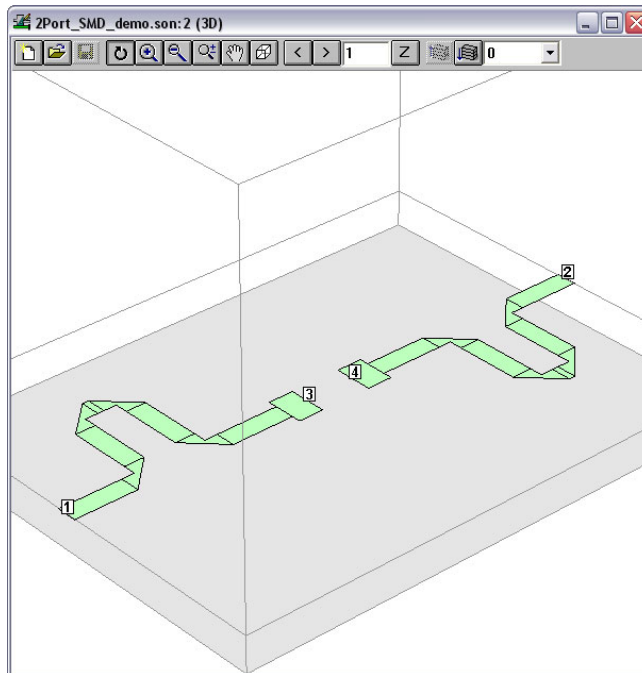

ADS Layout to 3D View in a Single Menu Selection
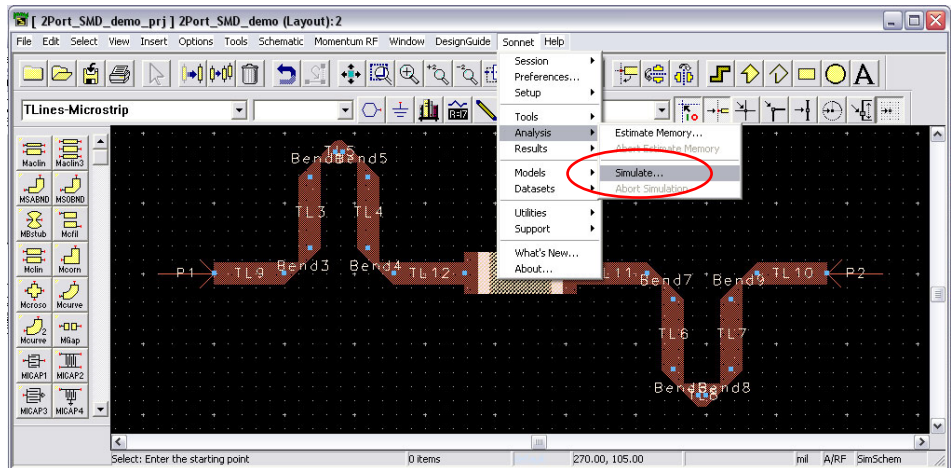
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4 – Start Sonnet EM Simulation from ADS

Your design may now be simulated in Sonnet. However, it is recommended that you verify your **Analysis Box** settings. (Please, refer to Step 13 on page 17 for Analysis Box settings)
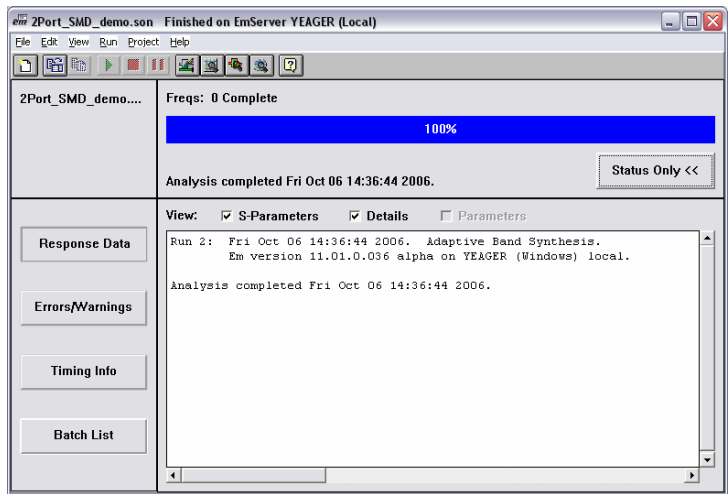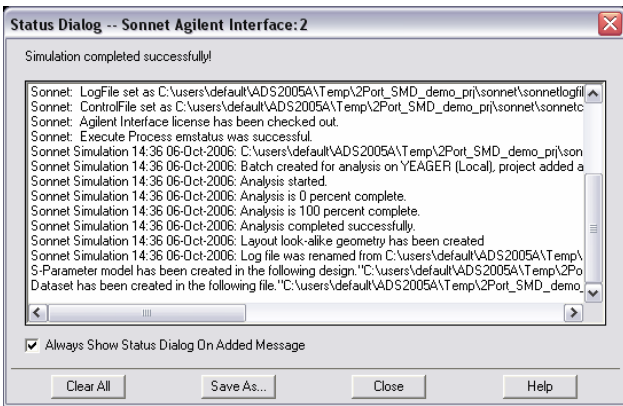
For a pre-analysis estimate of computer memory requirements, select **Sonnet > Analysis > Estimate Memory**.
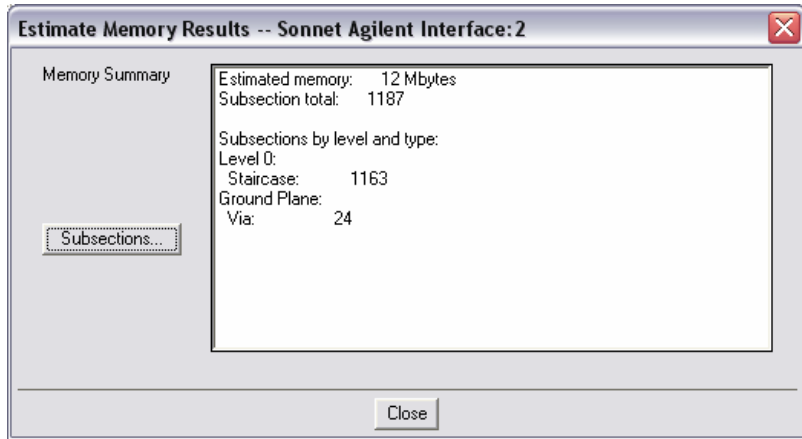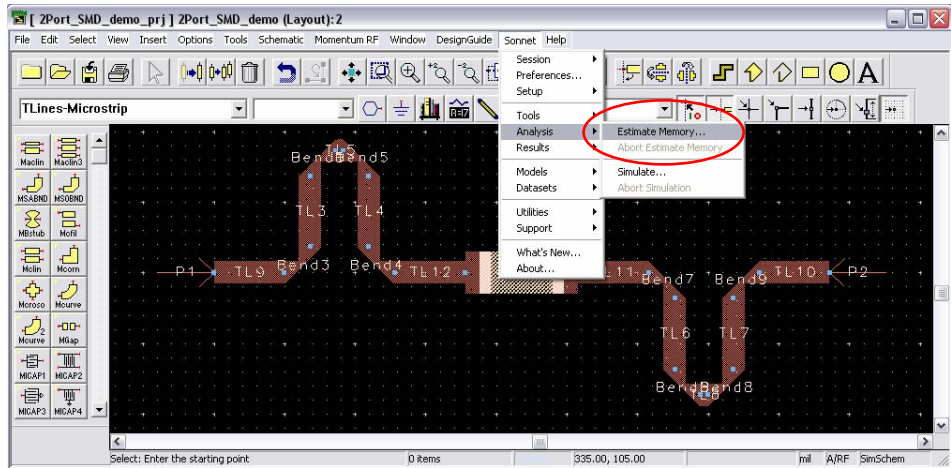
To start Sonnet EM simulation, select **Sonnet > Analysis > Simulate**.
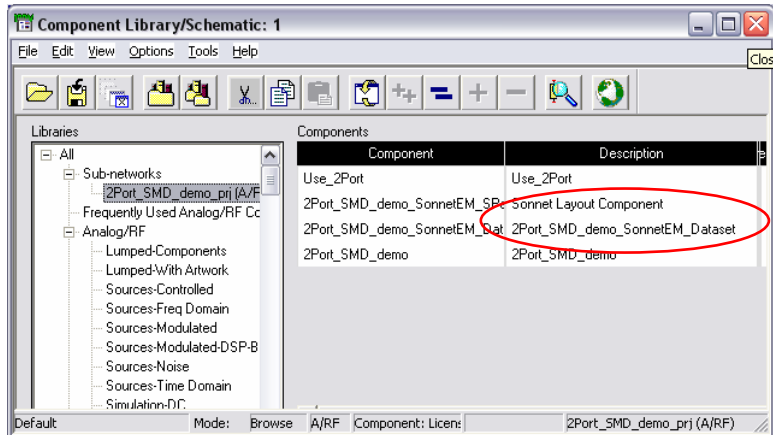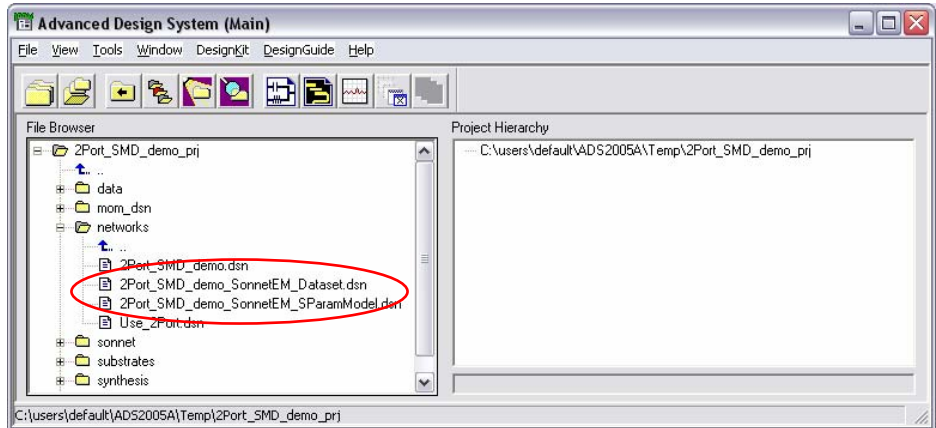
During the Sonnet EM simulation, status dialog boxes from both ADS and Sonnet can be seen.

ebridge creates two new designs in the Project folder, the *Dataset* and the *S-parameter model*.   They are also added to the Component Library within the ADS Schematic.

The Dataset is created from an S-parameter simulation driven by a schematic that contains the S-parameter model.

5 – Using the Extracted Sonnet EM Model

The newly created Sonnet EM model is ready for use within the ADS Schematic.   In the example used here, a blank design called **Use_2Port.dsn** is created and the new Sonnet EM generated component is placed in the new schematic.   Within the ADS Schematic window, select *Insert > Component > Component Library…*
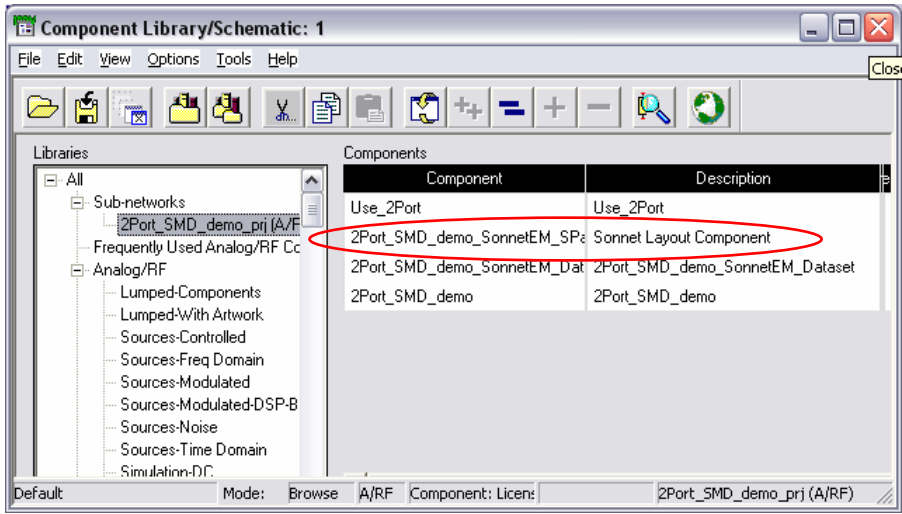
The Sonnet generated Layout Component is listed under the *Sub-networks* library. Select the Sonnet Layout Component. Place the Layout Look-alike Component into the ADS Schematic.

Internal ports have appropriate pins at the connection locations, keeping the schematic clear and intuitive.
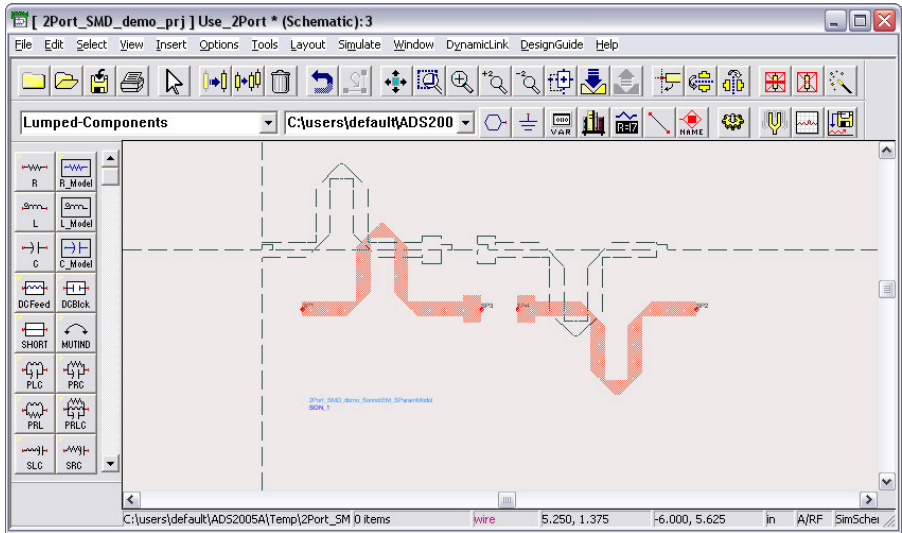
Complete the design by adding terminations, additional components, ports, S-parameter simulation, etc.   Perform the simulation.
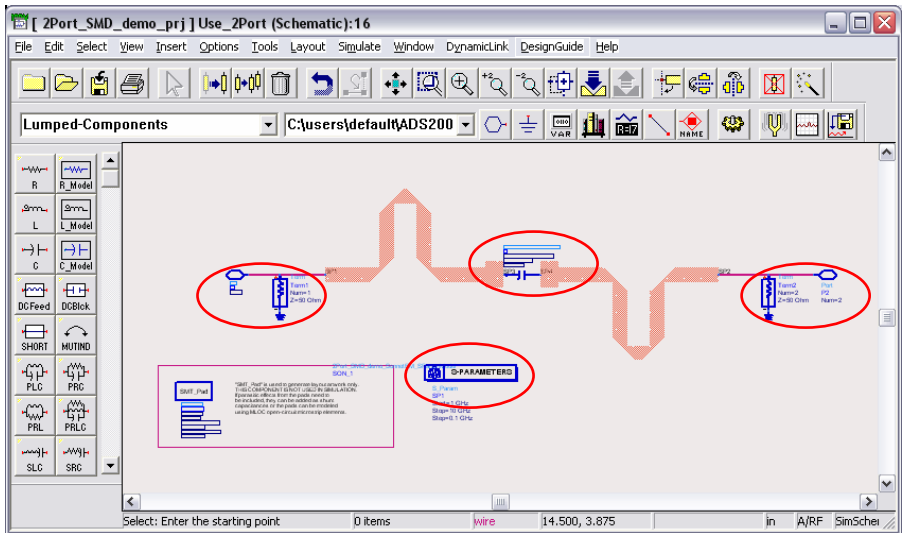
6 – View and Compare the Results between the Schematic and EM-based Models
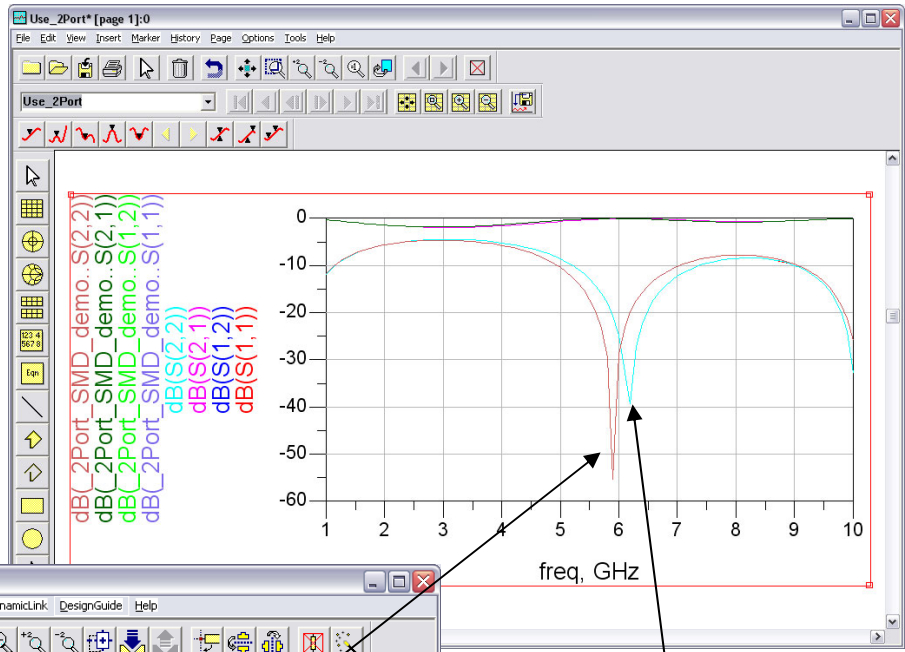
ADS Schematic with Sonnet generated Layout Look-alike EM-based Model
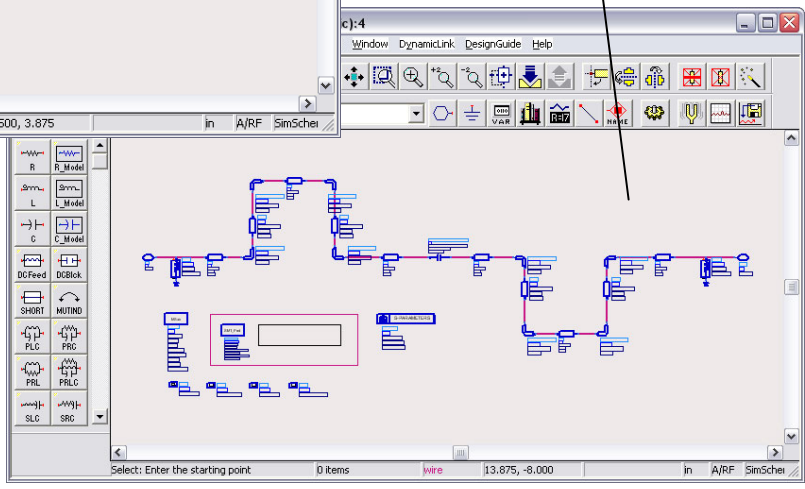
ADS Schematic with Transmission Line Models

7 – Importing Sonnet Layout Changes into ADS

In this section, we will briefly highlight the bi-directional data exchange capabilities of the ADS Interface. In this example, the layout in ADS is imported into the Sonnet project editor by selecting **Sonnet > Tools > Project Editor > 2D View**.
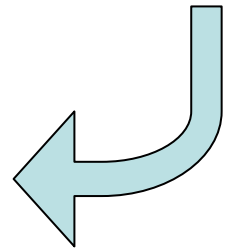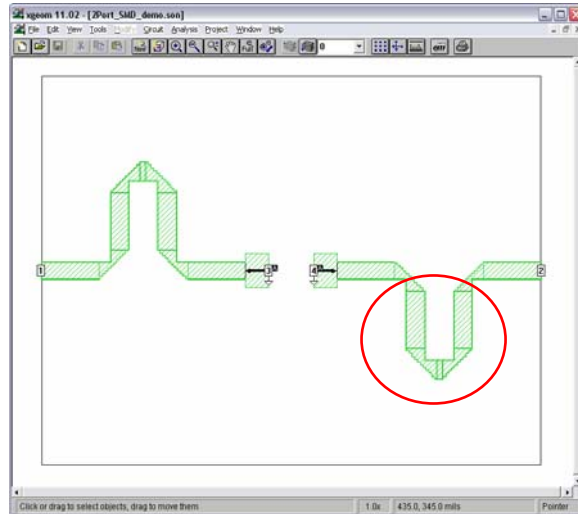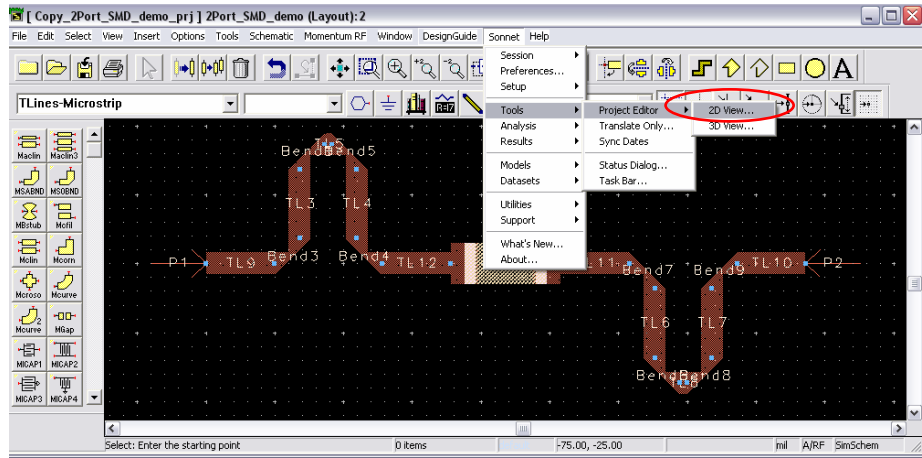
ADS Layout to 2D View in a Single Menu Selection

In the Sonnet project editor, edge coupled tuning stubs are placed across the bend in the design. The project is saved and then analyzed.
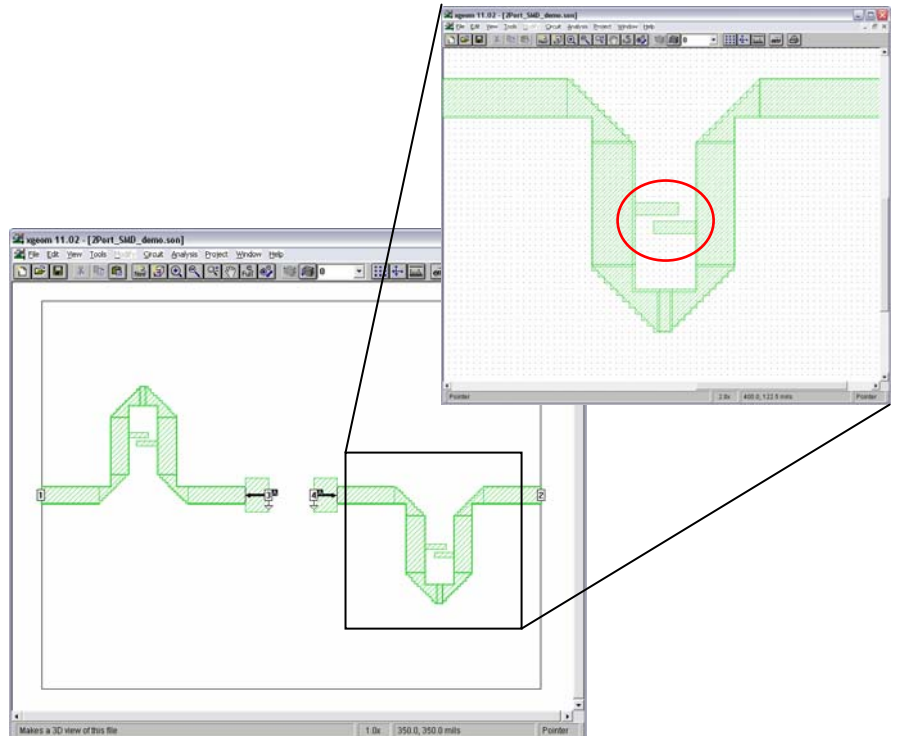
Once the EM analysis is complete, **ebridge** creates two new designs in the Project folder, the *Dataset* and the *S-Parameter Model*. They are also added to the Component Library within the ADS Schematic.
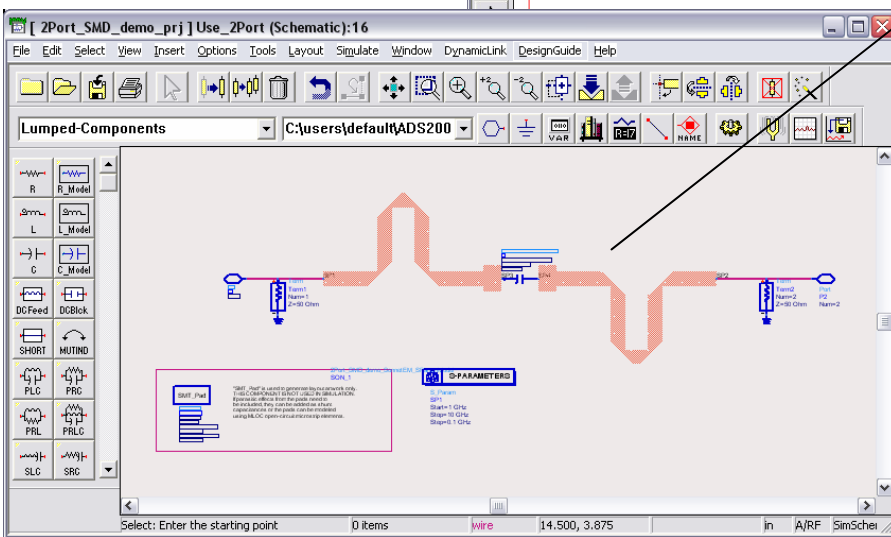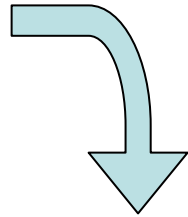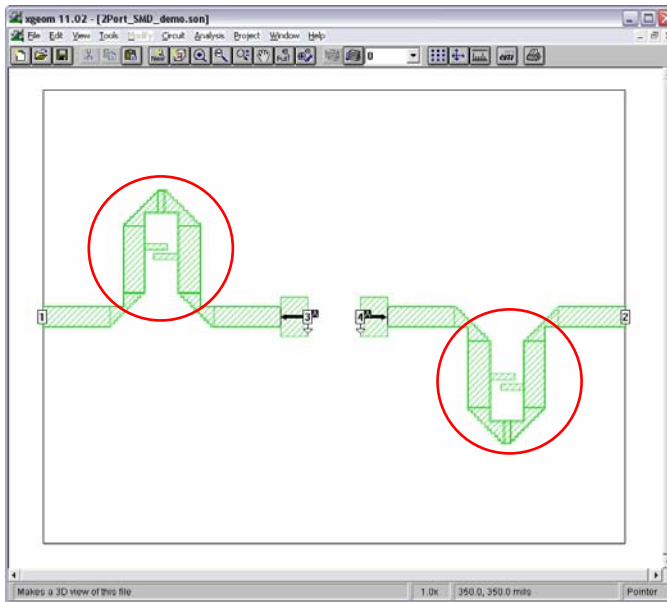

The Sonnet generated Layout Look-alike Component listed under the *sub-networks* component library reflects the changes that were made in the Sonnet project editor.
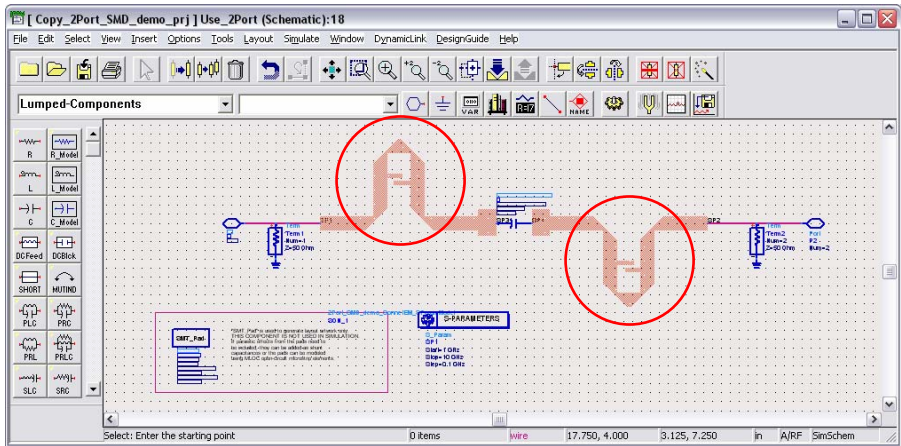
The ADS Layout associated with the EM based model also reflects the changes made in Sonnet.
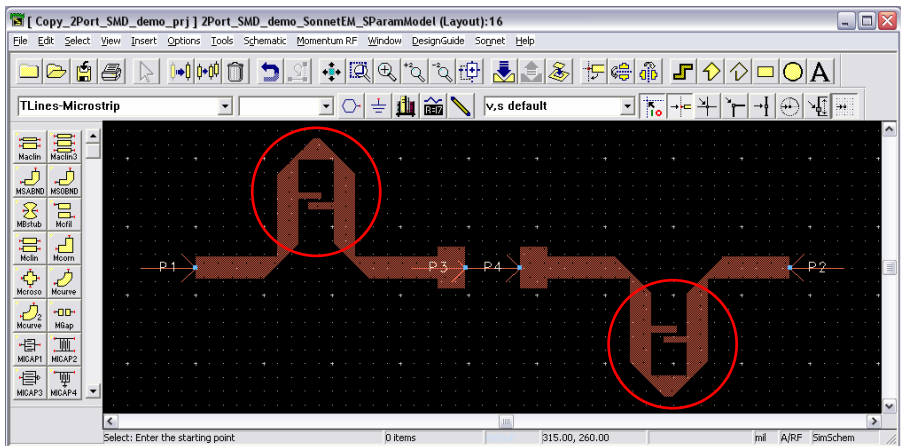
8 – Taking a Closer Look into the ADS Interface

As mentioned earlier, Sonnet's *ebridge* Release 11 offers a complete GUI integration into the Agilent ADS. The totally redesigned interface adds numerous new functionalities which were not possible in the previous versions. In addition to being able to translate and update all necessary design and analysis information from ADS to Sonnet, the new interface allows you to access many of the features only available in Sonnet such as the analysis box, 3D viewer, estimating memory, subsection viewer, etc. Default interface settings can also be configured by using the **Preferences** dialogue box.

ADS Interface Menu Structure
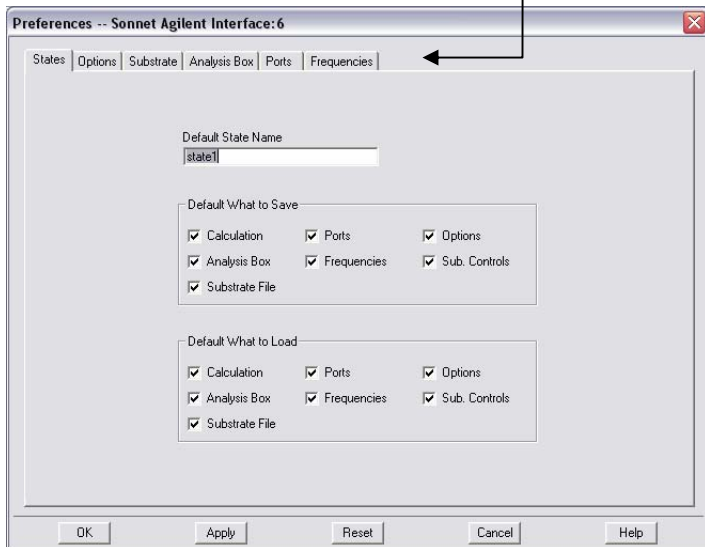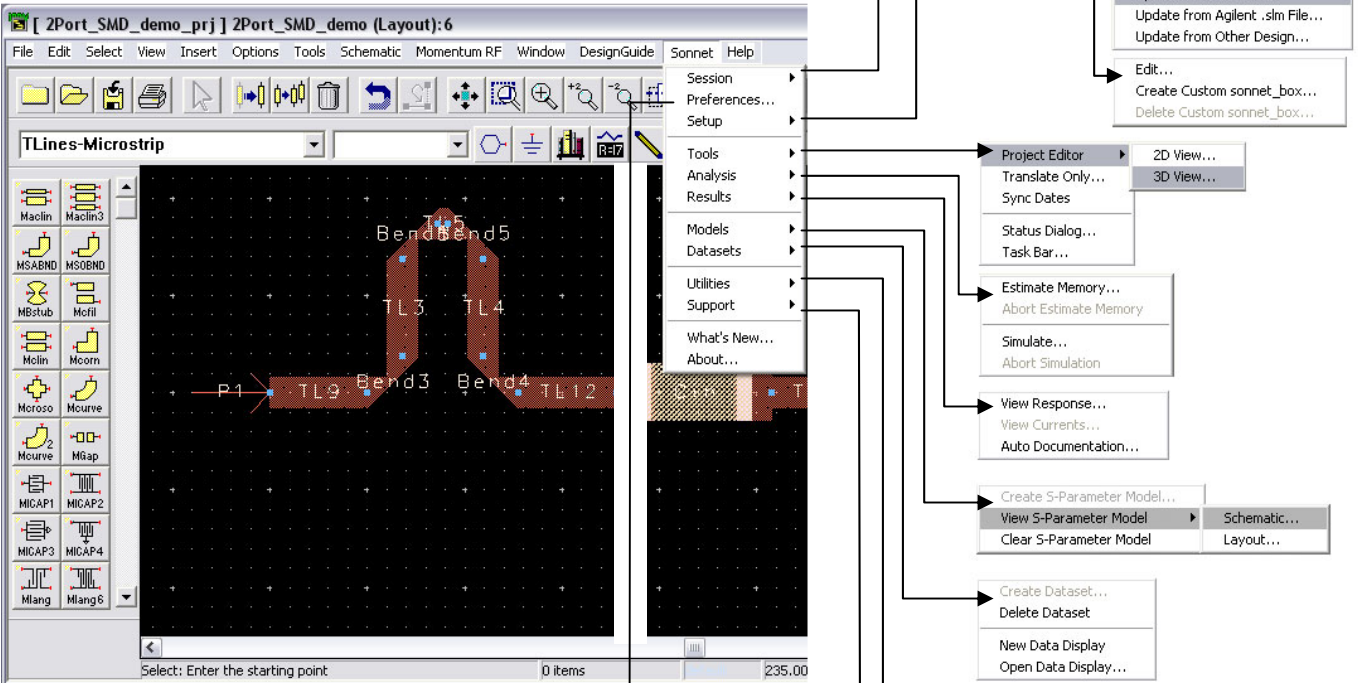
9 – Updating the Design Information from ADS to Sonnet

Earlier, this paper showed you how to **Update All** the information from either the **Momentum** or the **Schematic** design. This method of updating simply pulls all the specifics of the design to be translated into the Sonnet project.
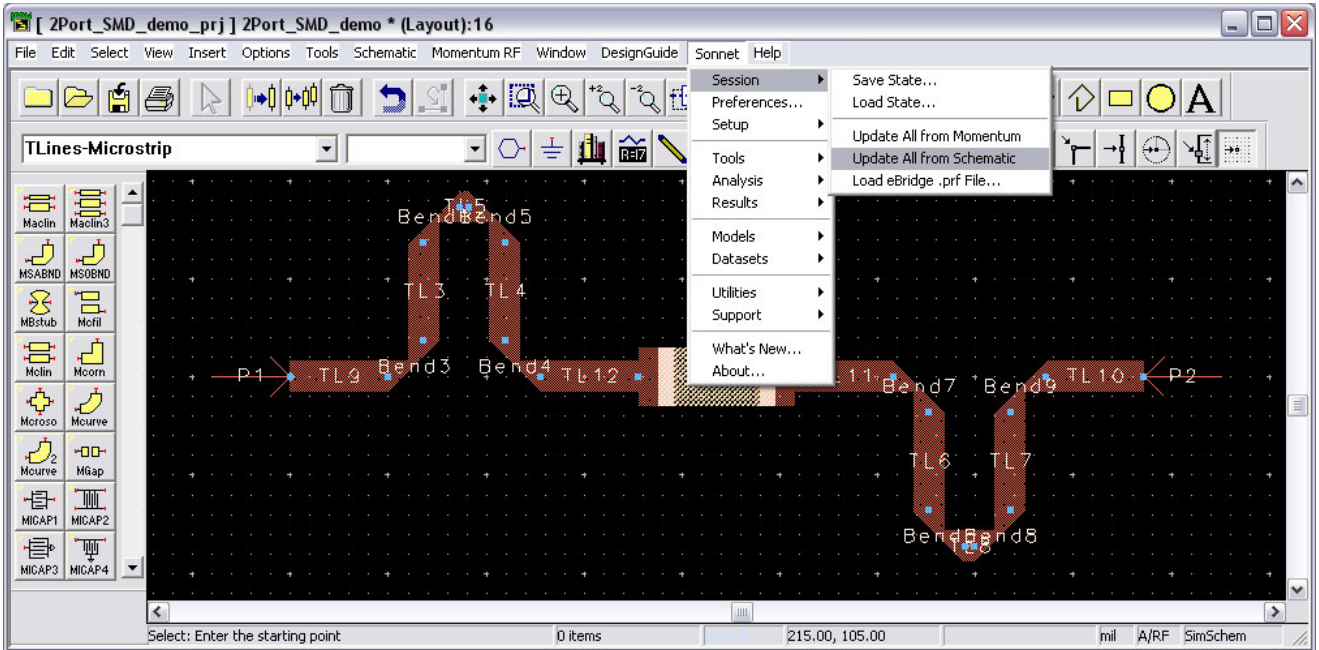
In order to create a Sonnet project, five categories of information are needed to complete the translation process.   They are the Analysis Option, Substrate (and Metal) Information, Analysis Box, Ports and Frequency Plan.

Analysis Option

Substrate

Analysis Box

Ports

Frequencies
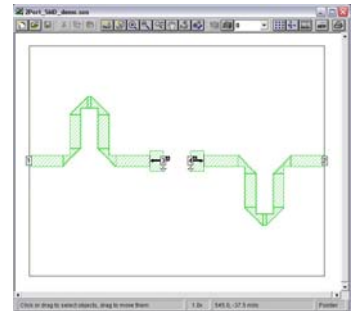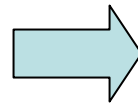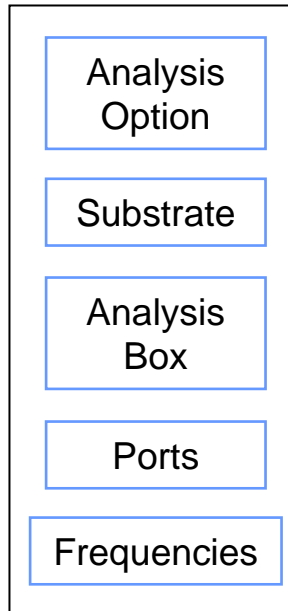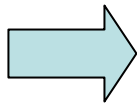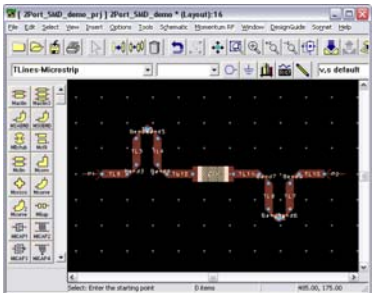
The default settings for all five categories are found in the **Preferences** dialog box. (**Sonnet > Preferences**)   There are five ways to update the information in these five categories.   They are:

1) Update All from Momentum

2) Update All from Schematic

3) Load State

4) Manual Setup

5) Load (legacy) Ebridge .prf File

Since 1) and 2) have already been demonstrated, we will look further into the other methods of creating a Sonnet project.

10 – Save State/ Load State
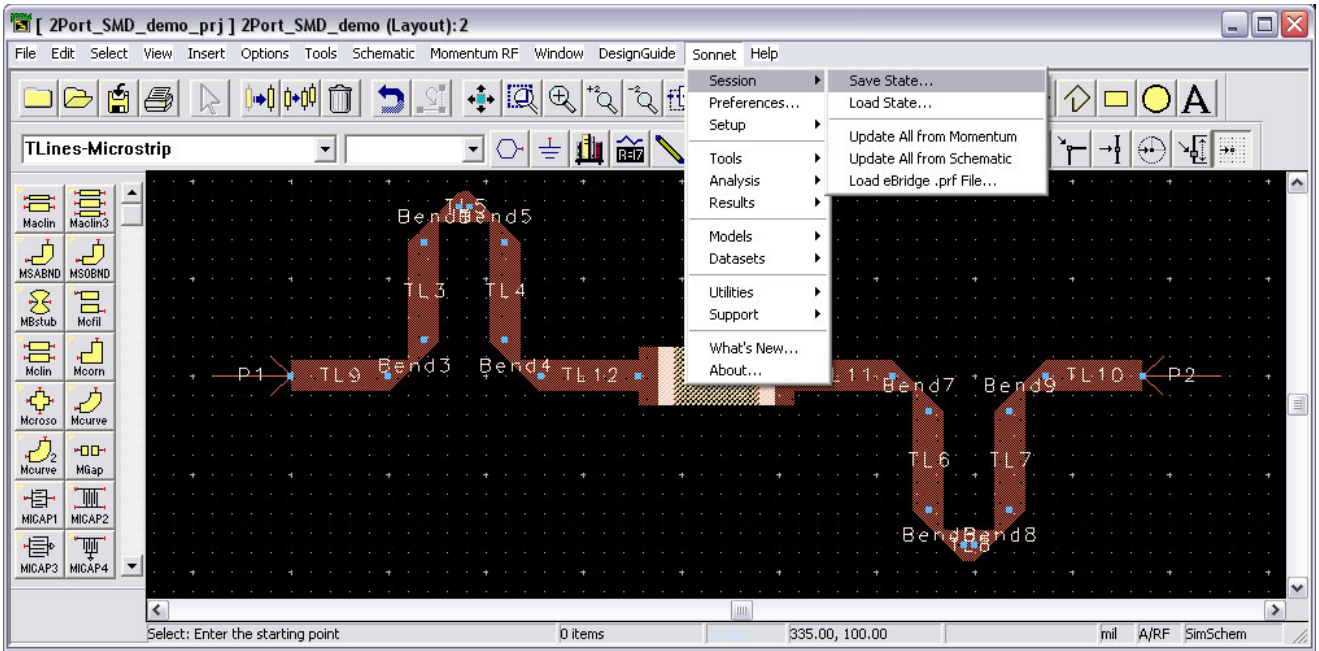
ebridge v11 now offers **Save/Load State** functionality which allows the user to choose what specific analysis information is to be saved or loaded for future use.

Select **Sonnet > Session > Save State** to save specific settings of the analysis such as the calculation models, analysis box, substrate files, ports, frequencies, and etc. You may choose which parameters to save for each state.

You can select **Sonnet > Session > Load State** to load any of the saved states to another ADS design for which you want to use the same analysis setup.

For more information on states, please refer to the Sonnet Translators manual.
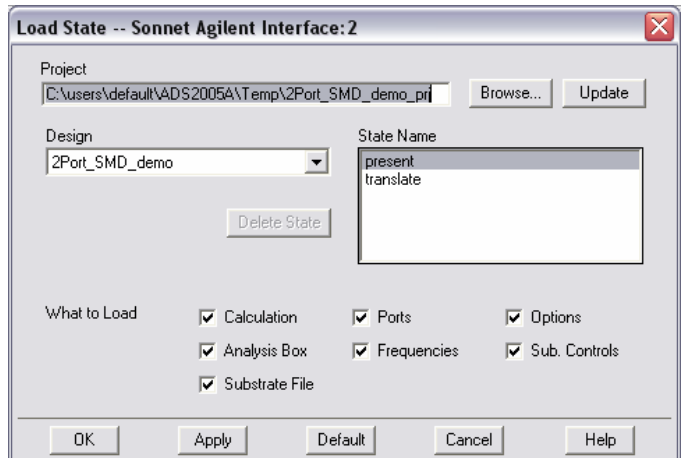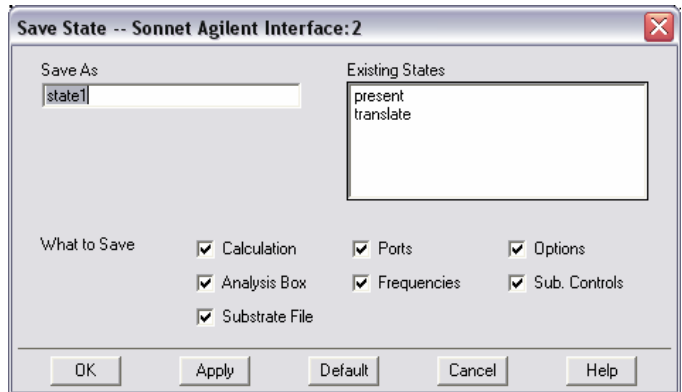
11 – Manual Setup (Analysis Run Options)
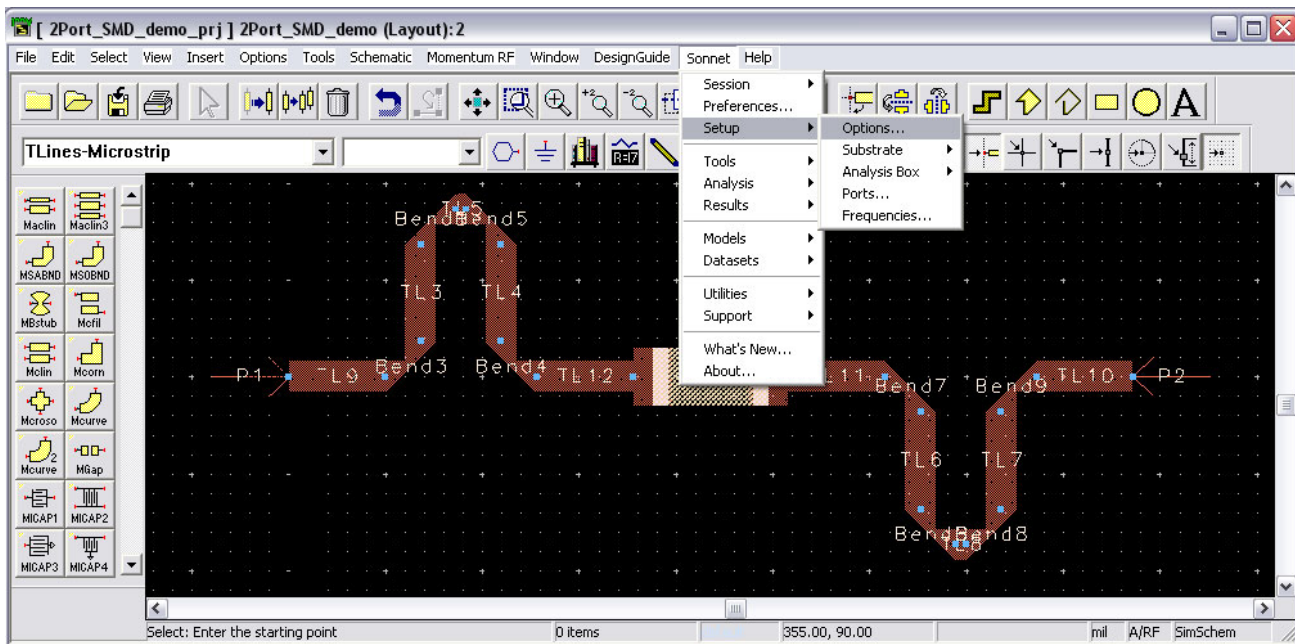
Select **Sonnet > Setup > Options** to set up analysis run options. Within the Options dialog box, you can define the type of electrical model you wish to create, choose default subsection fill type, set analysis speed control etc.

For more information on setting up Analysis Options, please refer to the online Sonnet Translators guide, available through the Sonnet task bar.
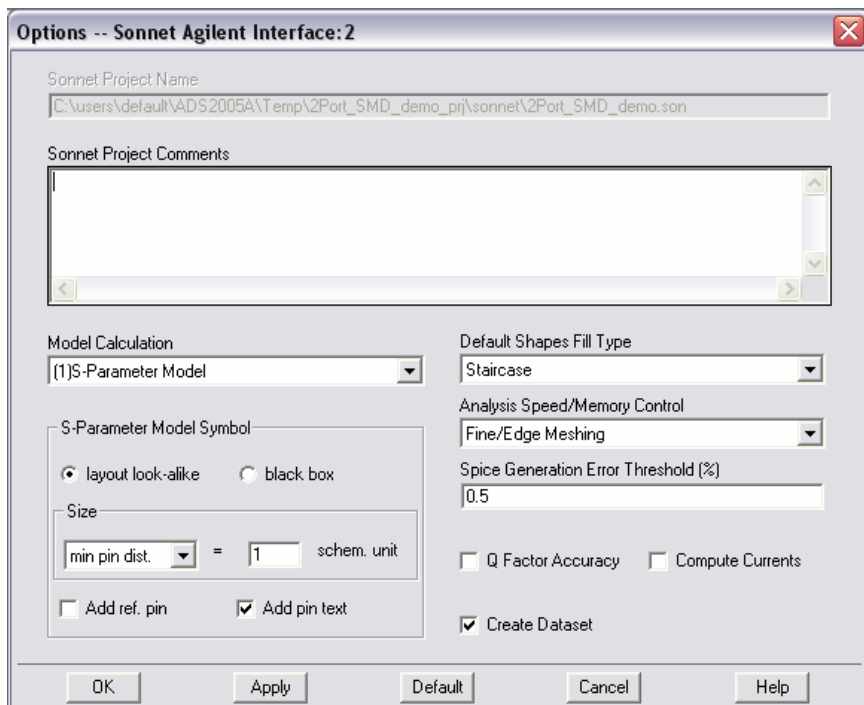
12 – Manual Setup (Substrate Definition)
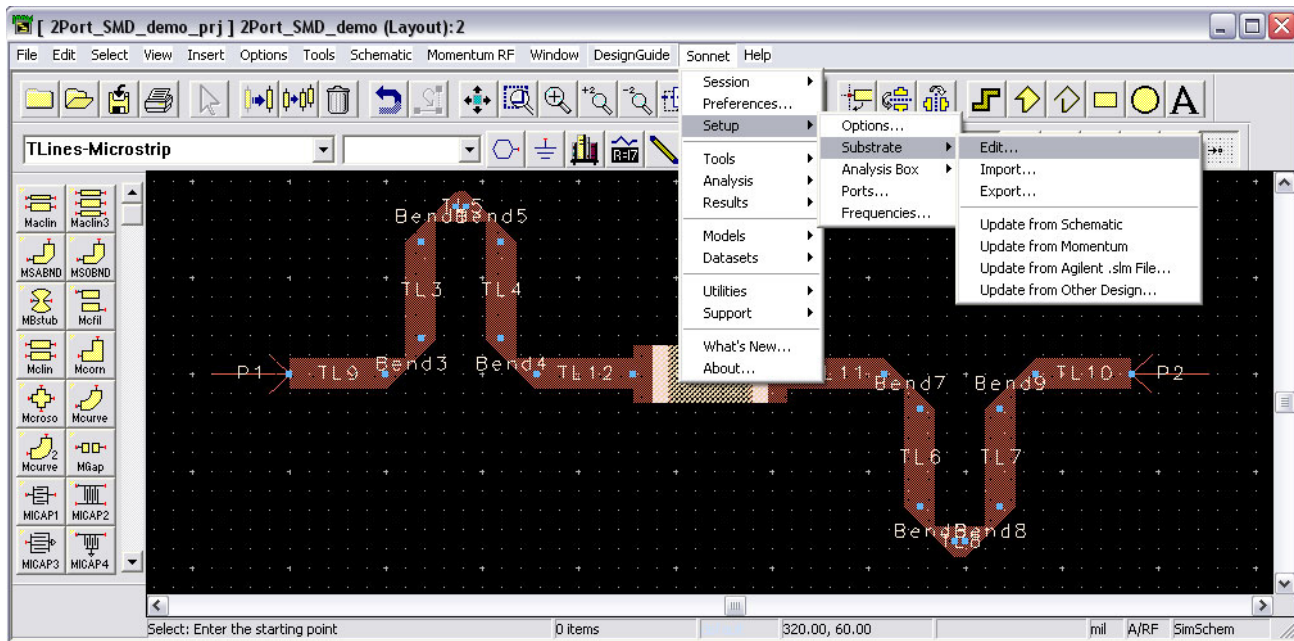
Select **Sonnet > Setup > Substrate > Edit** to define the mapping of substrate and layers from ADS to Sonnet. The Substrate File Setup dialogue box also allows you to define the Sonnet Layers and Materials in order to map the ADS layers.
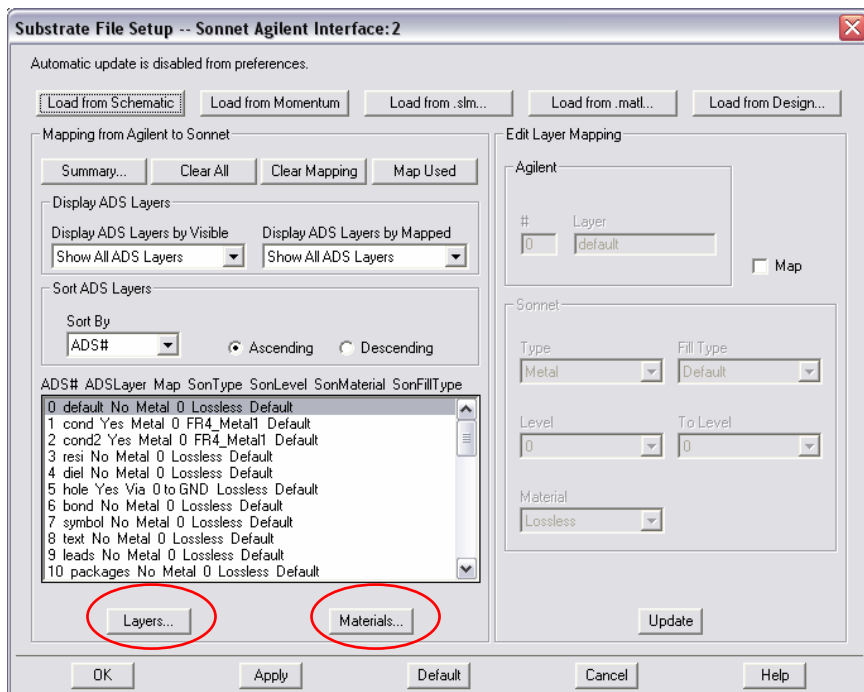
Layer Setup dialogue box allows you to define dielectric layers and metal levels for the Sonnet project.

Material Setup dialogue box allows you to define metal types for the Sonnet project.

Layer Setup -- Sonnet Agilent Interface:2

Automatic update is disabled from preferences.

Layers
[Summary...]   [Clear All]

Layer# Thickness Name Erel DLoss Cond Mrel MLoss
```
0 300 Air 1 0 0 1 0
1 28 FR4_1 4.3 0 0 1 0
```

Edit/Define Layer

Layer #   Thickness(mil)
0   300

Name
Air

Erel   DLoss   Cond
1   0   0

Mrel   MLoss
1   0

[Delete] [Move Up] [Move Down]   [Update]   [Add]

[OK]   [Apply]   [Cancel]   [Help]

Material Setup -- Sonnet Agilent Interface:2

Automatic update is disabled from preferences.

Materials
[Summary...]   [Clear All]

Name Type Pattern Values
```
FR4_Metal1  Normal 1 Cnd= 500000000 T= 2 CR= 0
Lossless  Normal 0 Cnd= INF T= 0 CR= 0
```

Edit/Define Material

Name
FR4_Metal1

Type   Pattern
Normal   1

Values

Conductivity(S/m)   Current Ratio
500000000   0

Thickness(mil)
2

[Delete]   [Update]   [Add]

[OK]   [Apply]   [Cancel]   [Help]

Substrate File Setup -- S...

Ascending   Descending

SonType SonLevel SonMaterial SonFillType
```
  Lossless Default
  FR4_Metal1 Default
0 FR4_Metal1 Default
ossless Default
ossless Default
5 hole Yes Via 0 to GND Lossless Default
6 bond No Metal 0 Lossless Default
7 symbol No Metal 0 Lossless Default
8 text No Metal 0 Lossless Default
9 leads No Metal 0 Lossless Default
10 packages No Metal 0 Lossless Default
```

Type   Fill Type
Metal   Default

Level   To Level
0   0

Material
Lossless

[Layers...]   [Materials...]   [Update]

[OK]   [Apply]   [Default]   [Cancel]   [Help]

To map the ADS layers to Sonnet, select the layer in the ADS layers list and then use the *Edit Layer Mapping* section to map it to a Sonnet layer.   Once the substrate and layers have been mapped, these settings can be saved to be recalled later in other projects or be included in the current "State" definition.

Please refer to the Sonnet Translators manual for more detailed information on mapping layers.

Substrate File Setup -- Sonnet Agilent Interface:2

Automatic update is disabled from preferences.

[Load from Schematic] [Load from Momentum] [Load from .slm...] [Load from .matl...] [Load from Design...]

Mapping from Agilent to Sonnet
[Summary...]   [Clear All]   [Clear Mapping]   [Map Used]

Display ADS Layers

Display ADS Layers by Visible   Display ADS Layers by Mapped
Show All ADS Layers   Show All ADS Layers

Sort ADS Layers

Sort By
ADS#   Ascending   Descending

ADS# ADSLayer Map SonType SonLevel SonMaterial SonFillType
```
0 default No Metal 0 Lossless Default
1 cond Yes Metal 0 FR4_Metal1 Default
2 cond2 Yes Metal 0 FR4_Metal1 Default
3 resi No Metal 0 Lossless Default
4 diel No Metal 0 Lossless Default
5 hole Yes Via 0 to GND Lossless Default
6 bond No Metal 0 Lossless Default
7 symbol No Metal 0 Lossless Default
8 text No Metal 0 Lossless Default
9 leads No Metal 0 Lossless Default
10 packages No Metal 0 Lossless Default
```

[Layers...]   [Materials...]

Edit Layer Mapping

Agilent

Layer
1   cond

☑ Map

Sonnet

Type   Fill Type
Metal   Default

Level   To Level
0   0

Material
FR4_Metal1

[Update]

[OK]   [Apply]   [Default]   [Cancel]   [Help]

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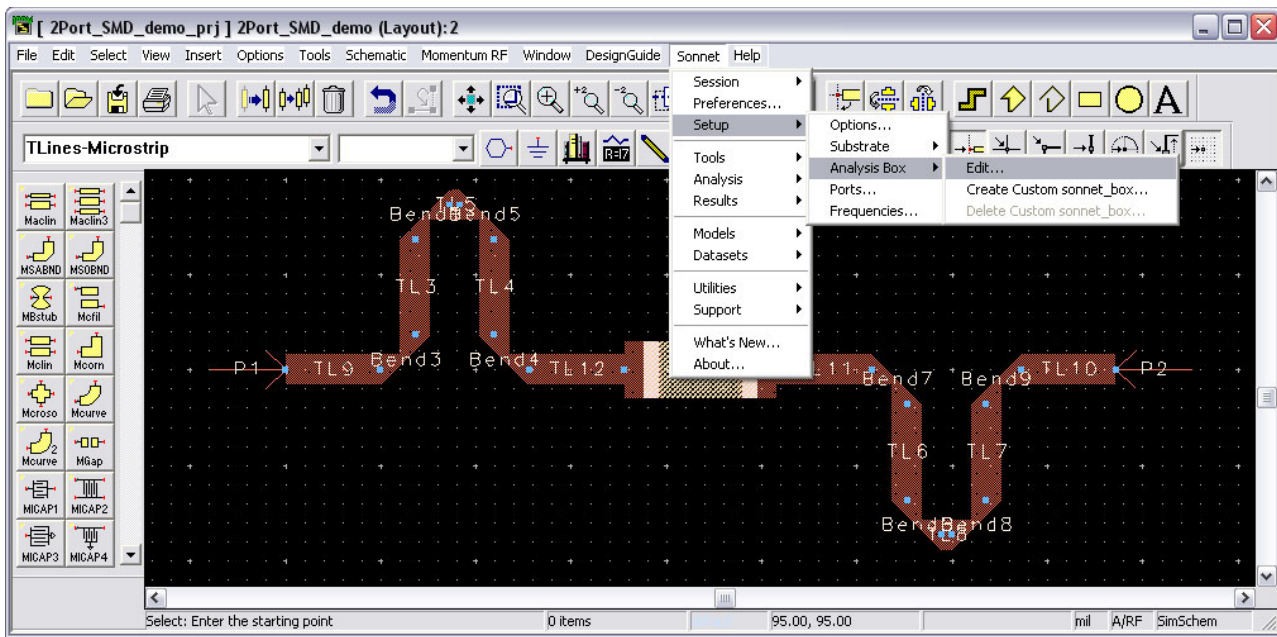
16

13 – Manual Setup (Defining the Analysis Box)

Select **Sonnet > Setup > Analysis Box > Edit** to specify the analysis box used in Sonnet. Within the Analysis Box dialog, you can configure the top and bottom box cover, the analysis cell size, analysis box margins, etc. You can also select **Estimate Memory** to estimate the Sonnet processing requirements and view subsections. Also **Show Box** can be selected to show the analysis box in the ADS layout.

For more information on setting up the Analysis Box, please refer to the Sonnet Translators manual.
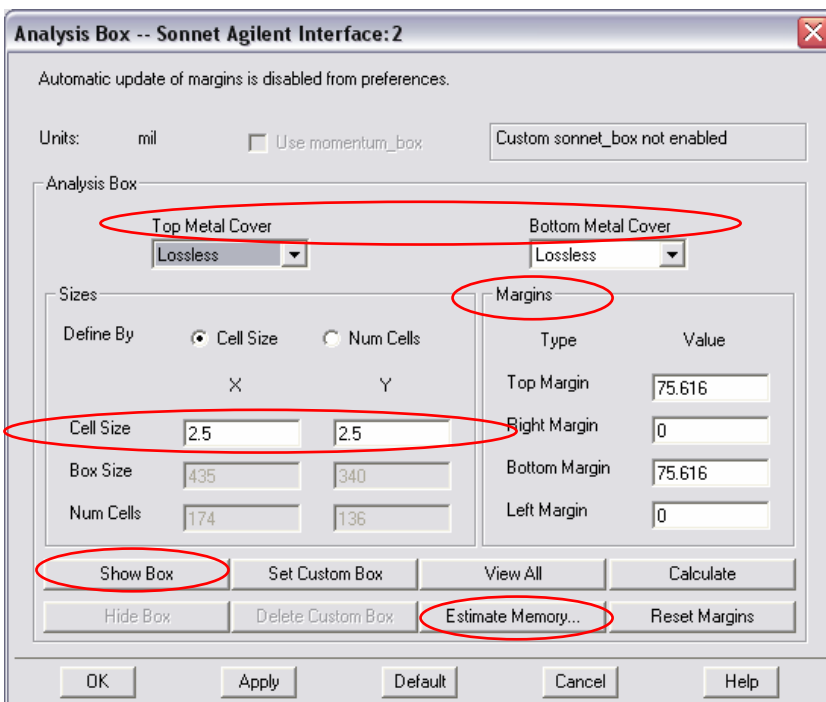
14 – Manual Setup (Port Definition)
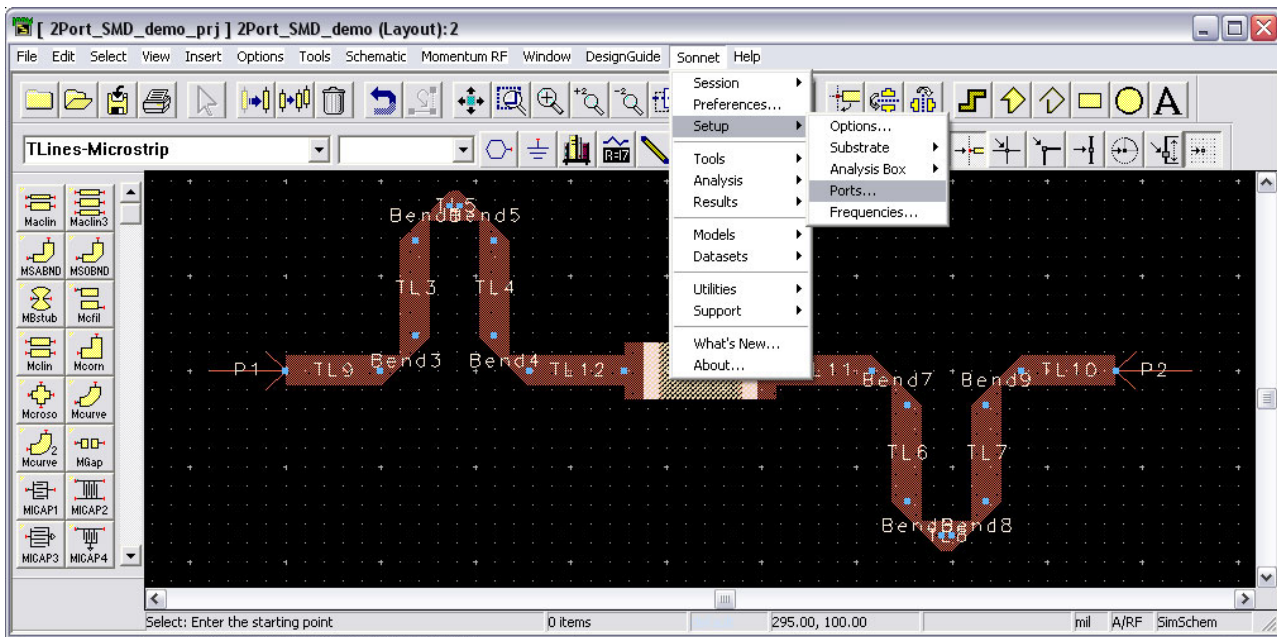
Select **Sonnet > Setup > Ports** to convert the ADS ports to Sonnet ports. By default, the Ports list shows all the ports in the ADS layout and the Sonnet parameters for each of the ports. The port definitions may also be inherited from the Momentum setup if they exist.

To change the port parameters, select the port from the list, then enter the desired parameters in the right side of the dialog box. Once you have finished entering the desired parameters, click on the Update button to apply the changes. ADS Ports are automatically imported into Sonnet as standard box-wall ports, auto-grounded ports, via ports or internal ports. The ADS Port-to-Sonnet Port conversion is based on the layer the port is on and its placement in the circuit.

For more information on setting up the Ports, please refer to the Sonnet Translators manual.
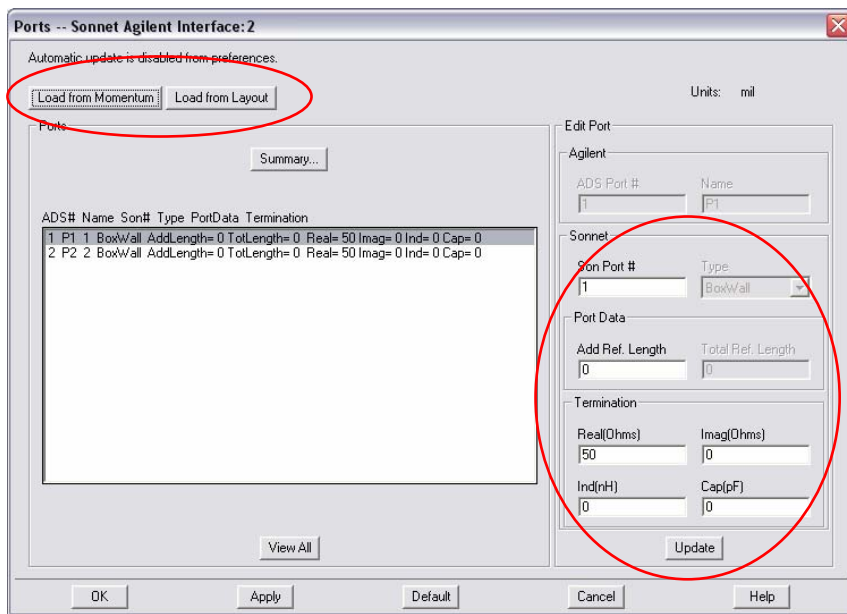
15 – Manual Setup (Define the Frequency Plan)
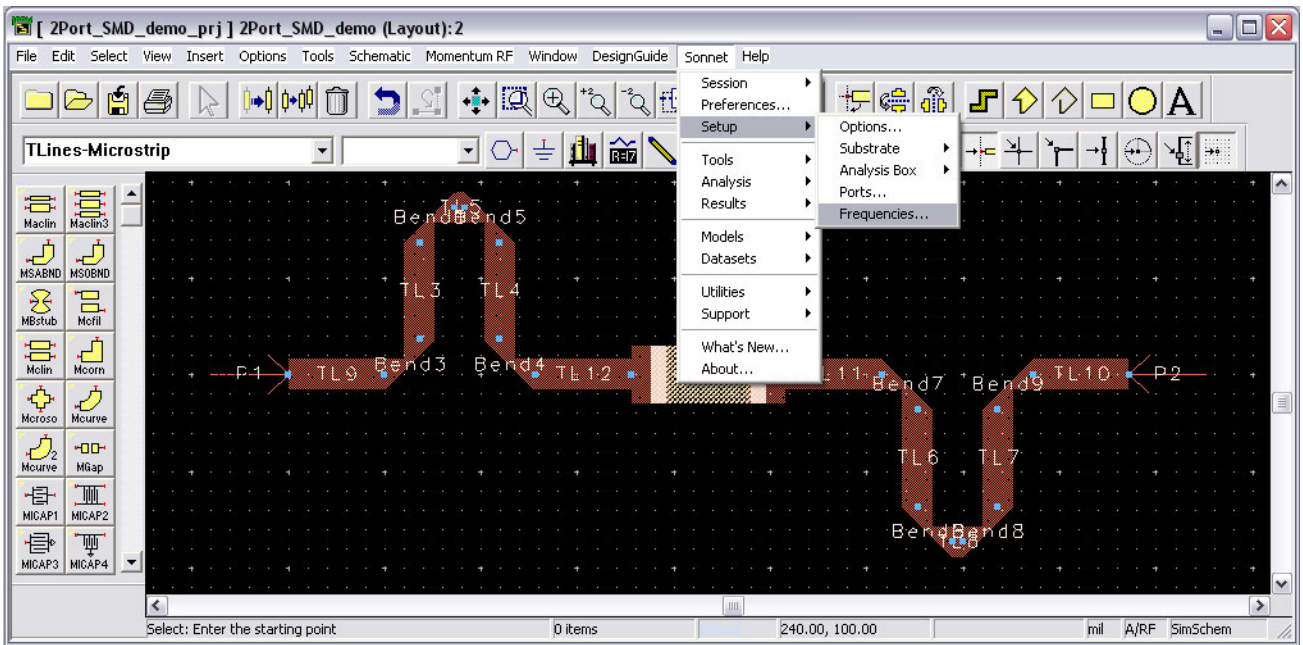
Select **Sonnet > Setup > Frequencies** to setup multiple frequency sweeps in Sonnet. Within the Frequency Plan dialog box, you can add, delete, and edit any number of frequency sweeps that are desired in the Sonnet analysis. By default, the Frequency Plan from the Schematic design is imported into the Sonnet project. However, if one exists, you can import the Frequency Plan from the Momentum design.

For more information on setting up Frequency plan, please refer to the Sonnet Translators manual.
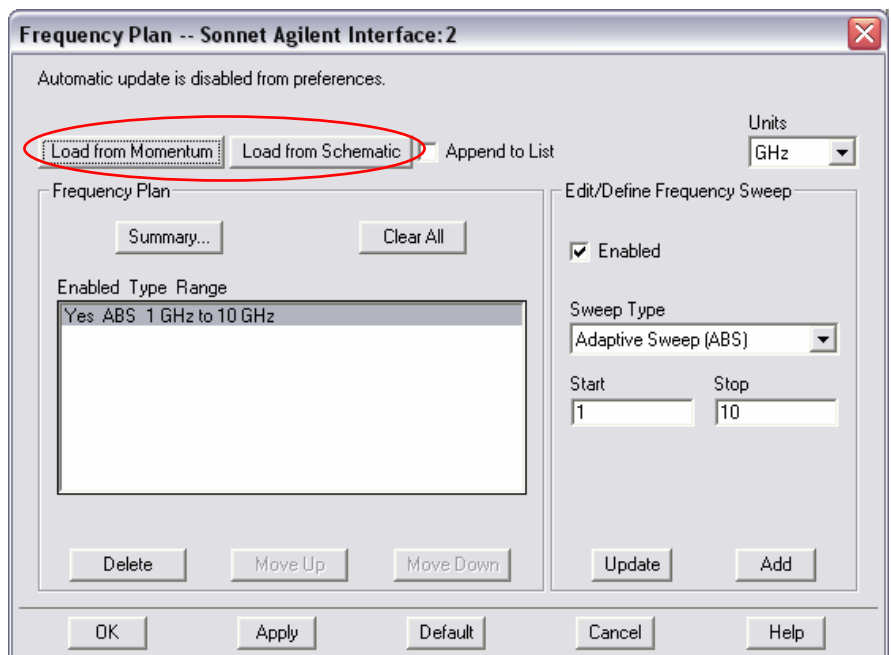
16 – Setting Preferences

Within the *Preferences* dialogue box, you can configure the default settings for ALL the information in the five categories that are necessary to setup a Sonnet analysis.   This includes the options in the saving and loading states, analysis run options, substrate definition, analysis box, ports and frequency plans.

For more information on setting the Preferences, please refer to the Sonnet Translators manual.
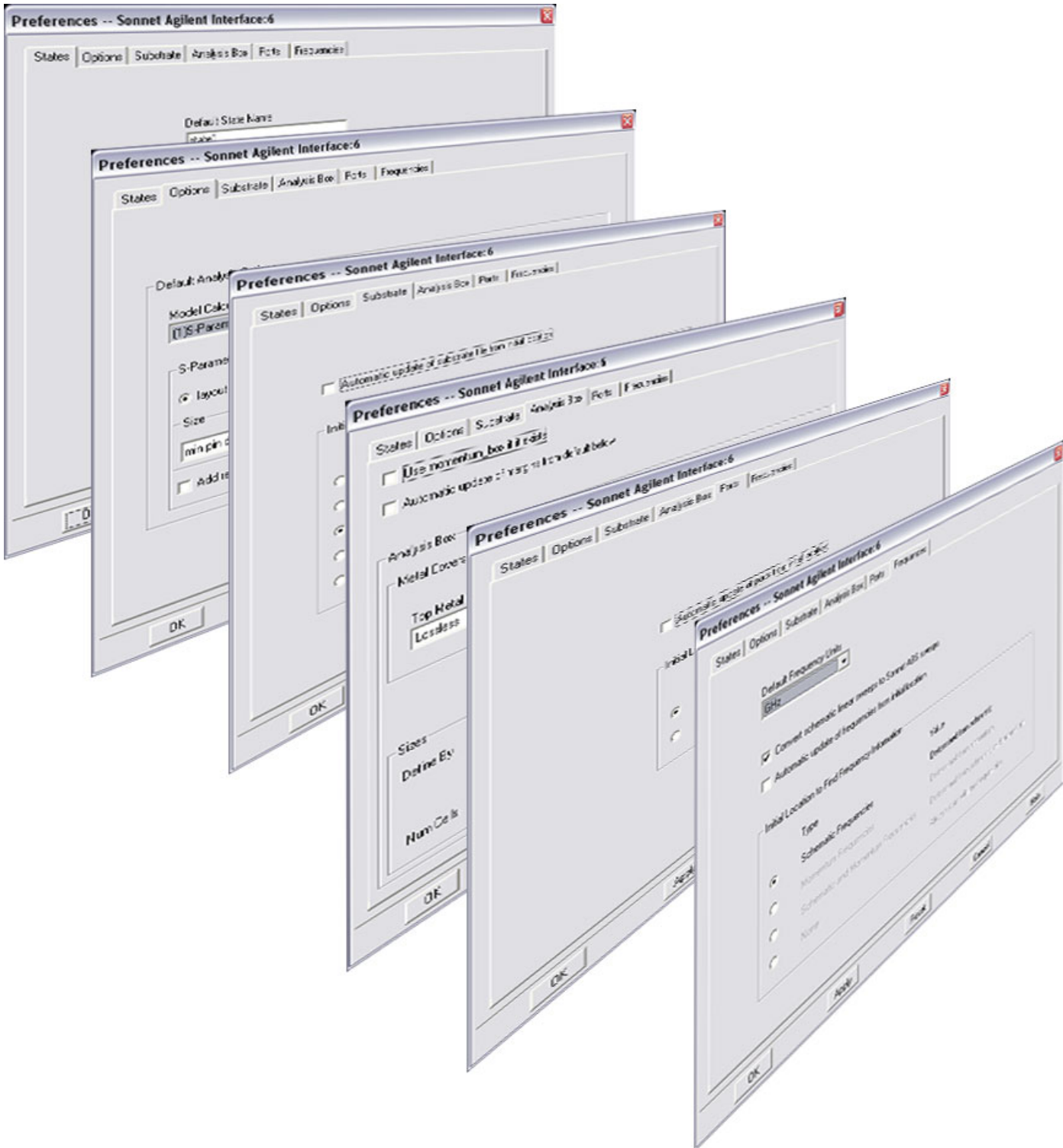
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