Ansoft HFSS Version 7 Training

Section 7: Matrix Post-Processing

Synopsis

Interfaces
- HFSS Executive Matrix View
- Matrix Data Post-Processor
- Matrix Plot Post-Processor

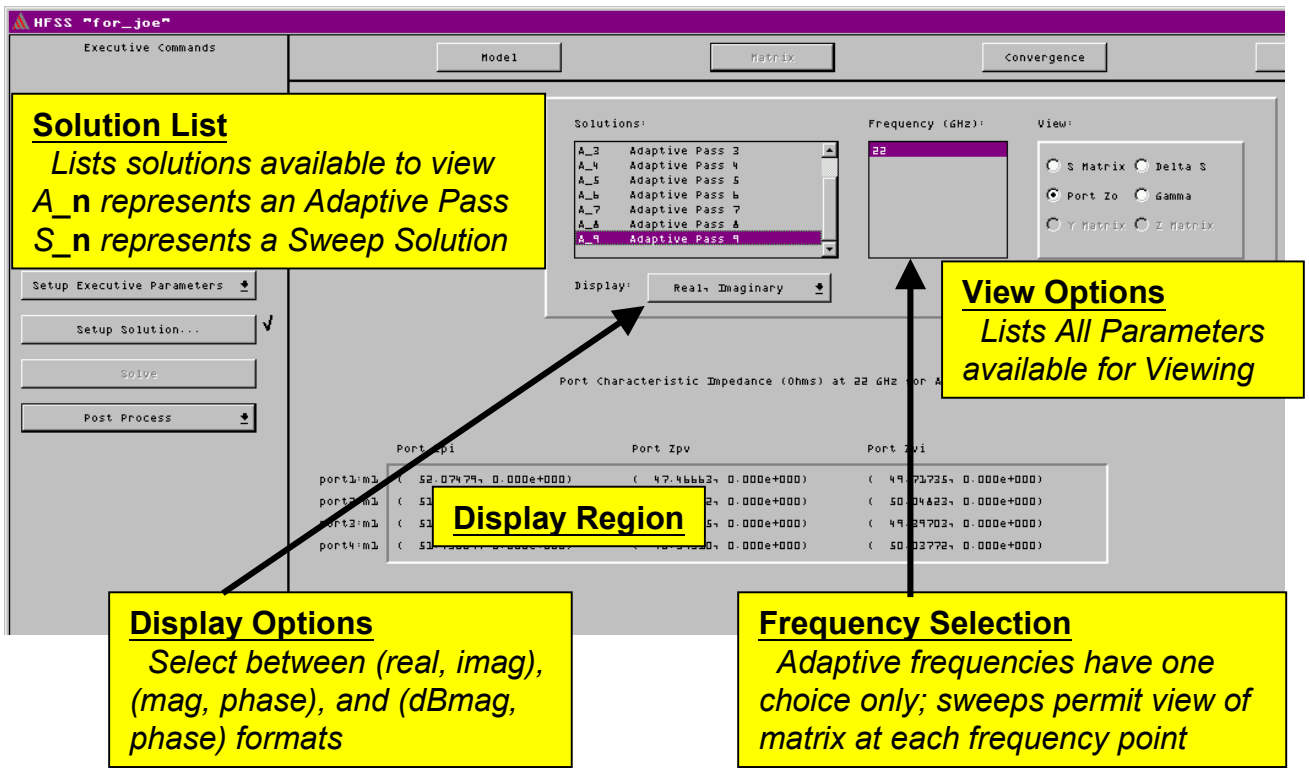
Matrix Data Manipulation
- S-Parameter Format
- Renormalizing
- Deembedding
- Exportation

Plotting Matrix Information
- Plot Creation, Navigation and Editing
- Saving and Opening Plots

Eigenmode Post-Processing

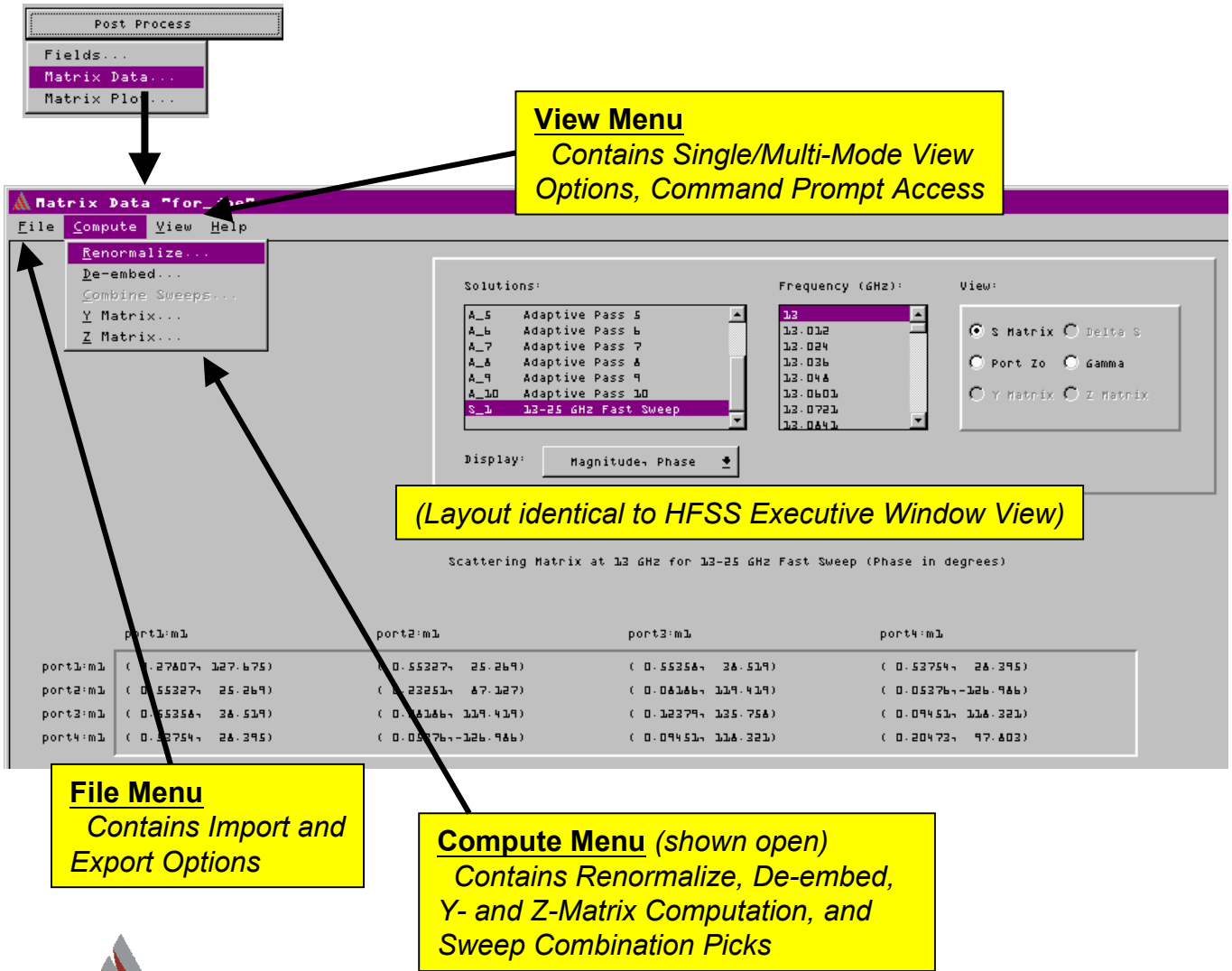
Instructor-Led Exercises

HFSS Executive Window *Matrix* View



- Available as long as at least one solution is complete
- View S-parameters, Delta-S data, Impedance, and Propagation Constants in Tabular Form
- Various Display Formats
- No data manipulation or save capability

Matrix Data Post-Processor Interface



View Menu
Contains Single/Multi-Mode View Options, Command Prompt Access

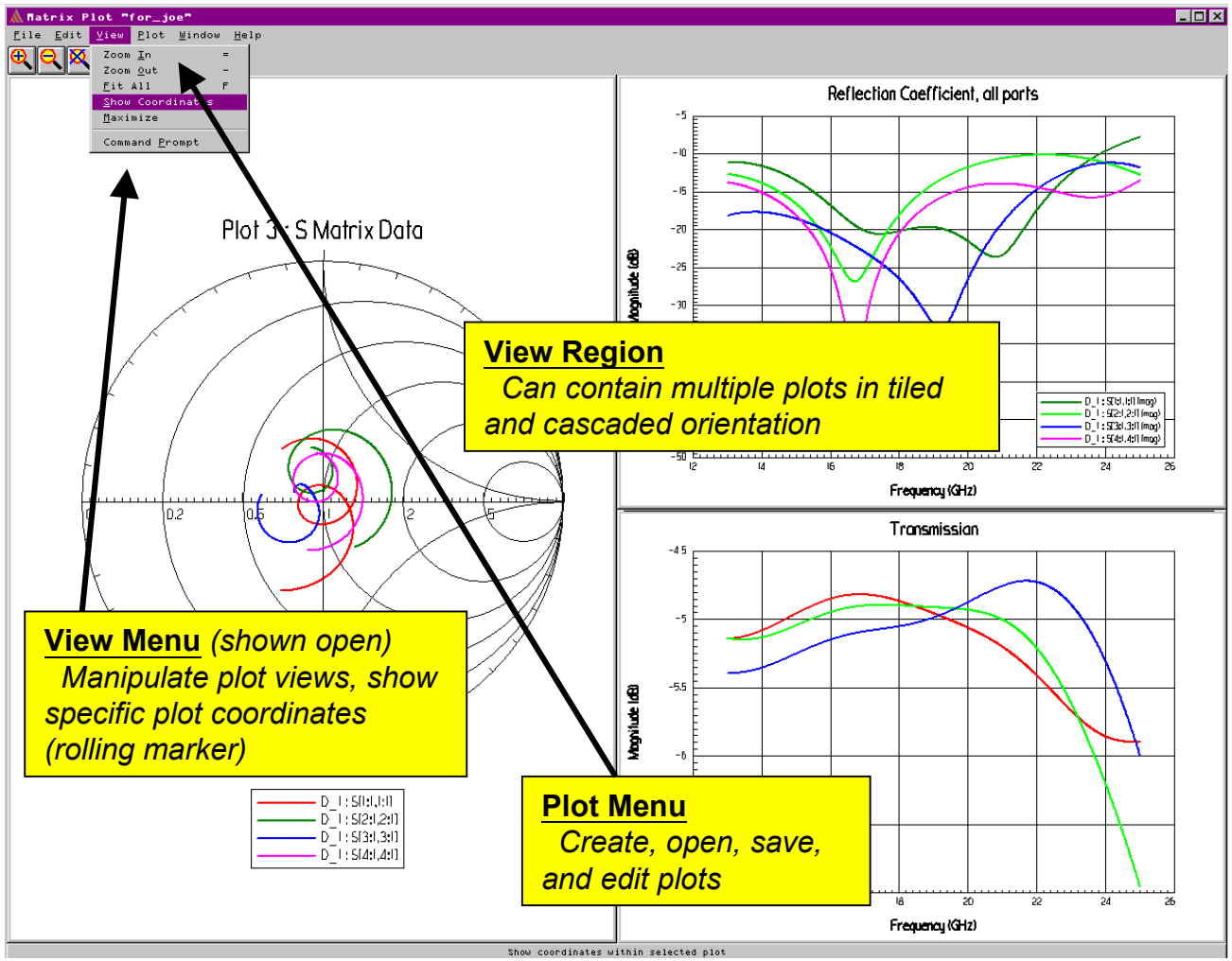
(Layout identical to HFSS Executive Window View)

File Menu
Contains Import and Export Options

Compute Menu *(shown open)*
Contains Renormalize, De-embed, Y- and Z-Matrix Computation, and Sweep Combination Picks

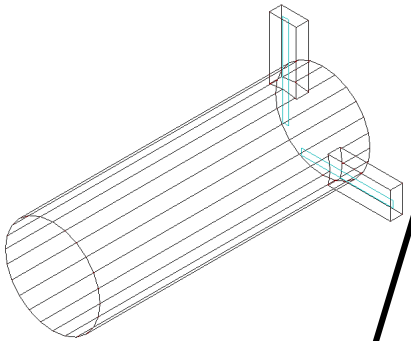
- Interface layout identical to HFSS Executive Window Matrix View
- Data import/export, computation (de-embed, renormalize, etc.) available via menu picks
- Saved data from other projects can also be accessed and viewed

Matrix Plot Post-Processor Interface



- Allows plotting of any available solution parameter from the Matrix Data contents
  - S-parameters, Impedance, Gamma, etc.
- Cartesian and Polar (Smith) formats
- Plots can be navigated, edited, and saved
- Plots from other projects may be opened

Matrix Data Format



S[1:1,1:1] = “S11, same mode” (reflection coefficient)

S[2:1,3:1] = “S23” (transmission coefficient from Port 2 to Port 3)

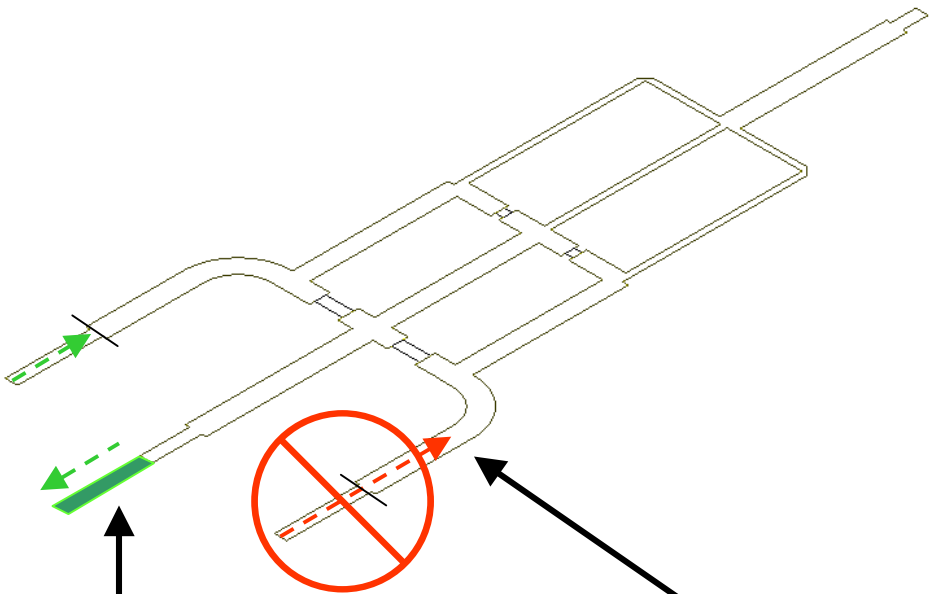
	port1:m1	port2:m1	port3:m1
port1:m1	(0.23446, 91.889)	(0.12055,-142.971)	(0.09672, 14.263)
port2:m1	(0.12055,-142.972)	(0.27848, 96.964)	(0.94759, -82.541)
port3:m1	(0.09672, 14.263)	(0.94759, -82.541)	(0.29389, -44.817)
port3:m2	(0.95976, 114.974)	(0.09997,-162.311)	(0.07969, -5.212)
port3:m3	(0.00398,-151.996)	(0.00368,-133.791)	(0.00301, 84.484)

S[3:2,3:1] = “S33, mode 1 to mode 2” (mode-converted reflection coefficient)

This Orthomode Coupler has three propagating modes at the circular waveguide port and one at each rectangular port. Due to the numbering of the circular port modes, Mode 1 of Port 3 transmits directly to the only mode (Mode 1) in Port 2, while Mode 2 in Port 3 transmits directly to the only mode (Mode 1) in Port 1. [The rightmost column of the above matrix is not shown.]

- HFSS reports *Generalized S-Parameters*
  - Normalized to impedance of each port at each frequency point
  - *Implication:* To output data for use in a circuit analysis tool, the data should first be *renormalized* to a **single** characteristic impedance for all ports and frequencies
- S-Parameters are reported by *port* and *mode*
  - Mode-to-mode interactions between all ports included
  - Reported format is [{terminating} *port:mode,* {originating} *port:mode*]

Matrix Data: De-embedding

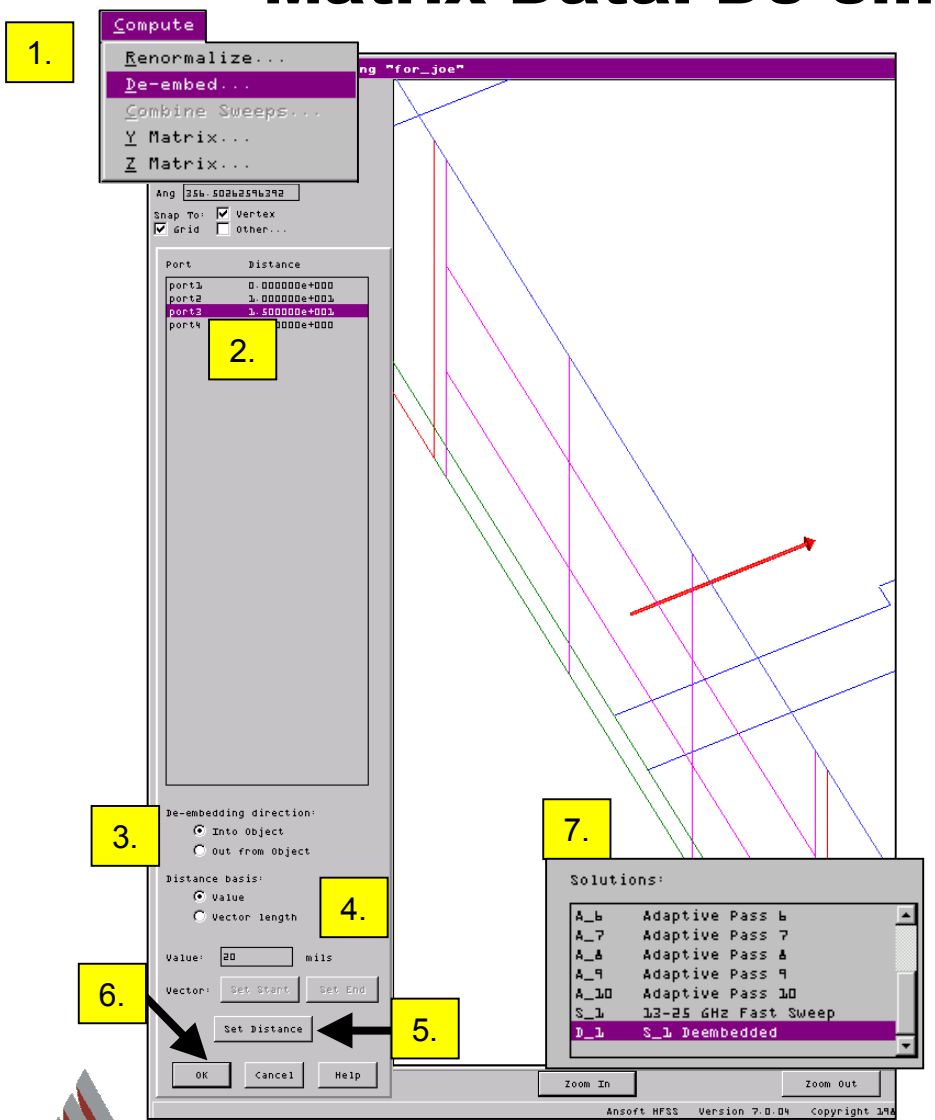


The S-Matrix for this three-way power divider are evaluated at the Ports. Deembedding can add line length, assuming the transmission line cross-section at the port remains the same...

...subtracting length is also possible. However, specifying a distance which would deembed past a **change** *in the transmission line cross-section will provide invalid results!!*

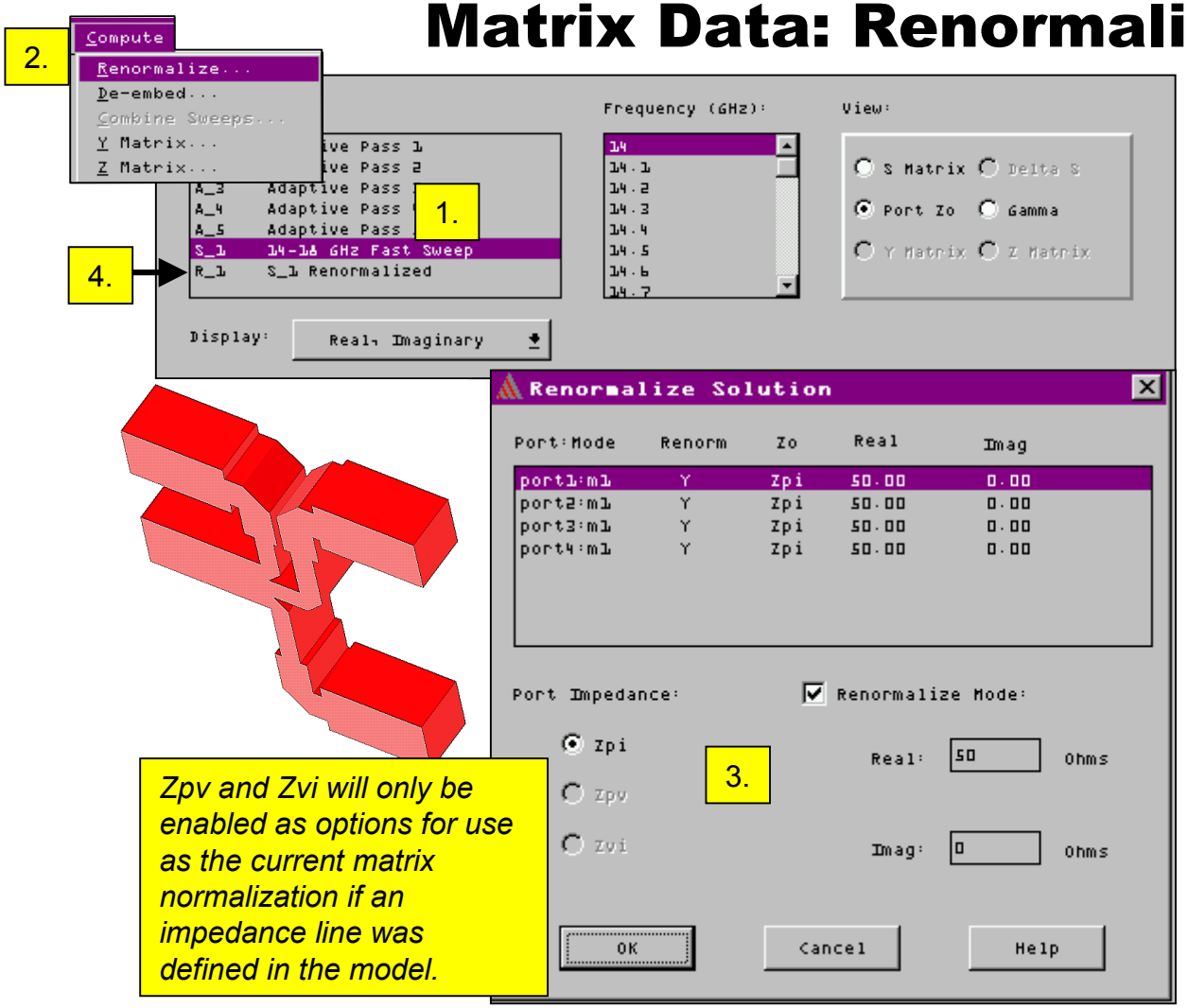
- *De-embedding* is the process of shifting the S-matrix's *reference plane* away from the ports
- De-embedding can be done *into* or *out of* the modeled geometry
- *Caution:* De-embedding uses the complete (complex) propagation constant solution found at the port, therefore loss is taken into effect. However, de-embedding into a model across a *discontinuity* in the transmission line cross-section is not valid!

Matrix Data: De-embedding Procedure



- From the *Compute* Menu, pick *De-embed....* This opens the graphical de-embedding window.
- Select a *Port* for de-embedding from the list
- Specify direction as *into* or *out from* model geometry
- Specify de-embedding length
  - Either select the *Value* button and enter a numerical length, or
  - Select the *Vector length* button and pick endpoints representing the vector from the geometry
- Press the *Set Distance* button to confirm the selected port's settings
- Repeat for all ports to de-embed, then press the *OK* button
- De-embedded dataset shows in Matrix Data Solution List as "***D_n***"

Matrix Data: Renormalization

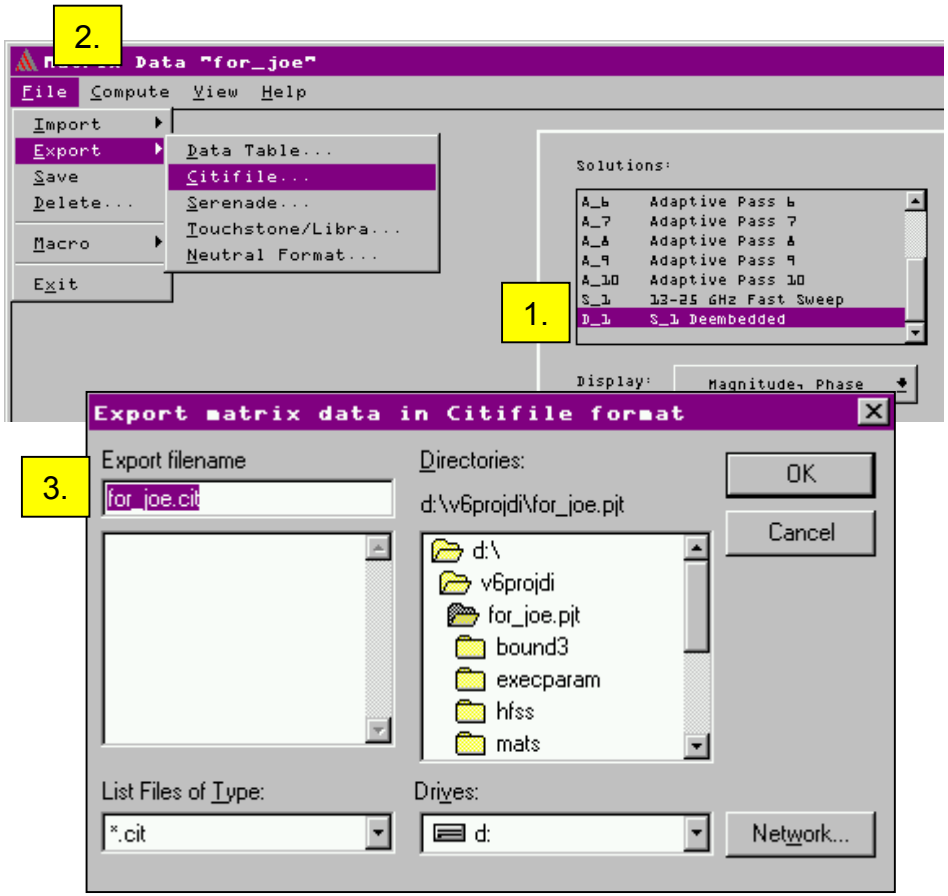


Zpv and Zvi will only be enabled as options for use as the current matrix normalization if an impedance line was defined in the model.

- Select the Solution set for which you wish to obtain renormalized data
- Pick *Renormalize* from the *Compute* Menu
- Identify which characteristic impedance definition should be used for the current matrix normalization, and define the desired Renormalization impedance
- Renormalized Solution data will be shown as "***R_n***" in Solution List

NOTE: Re-normalization should ALWAYS be performed AFTER any required de-embedding.

Matrix Data: Data Export



- Data is exported directly from the Matrix Data interface into several popular formats
  - First select the desired Solution set to export
  - Select *Export* from the *File* menu, and define the desired type:

    Data Table is a format readable by MS Excel (.tab)

    Citifile is formatted like network analyzer output files

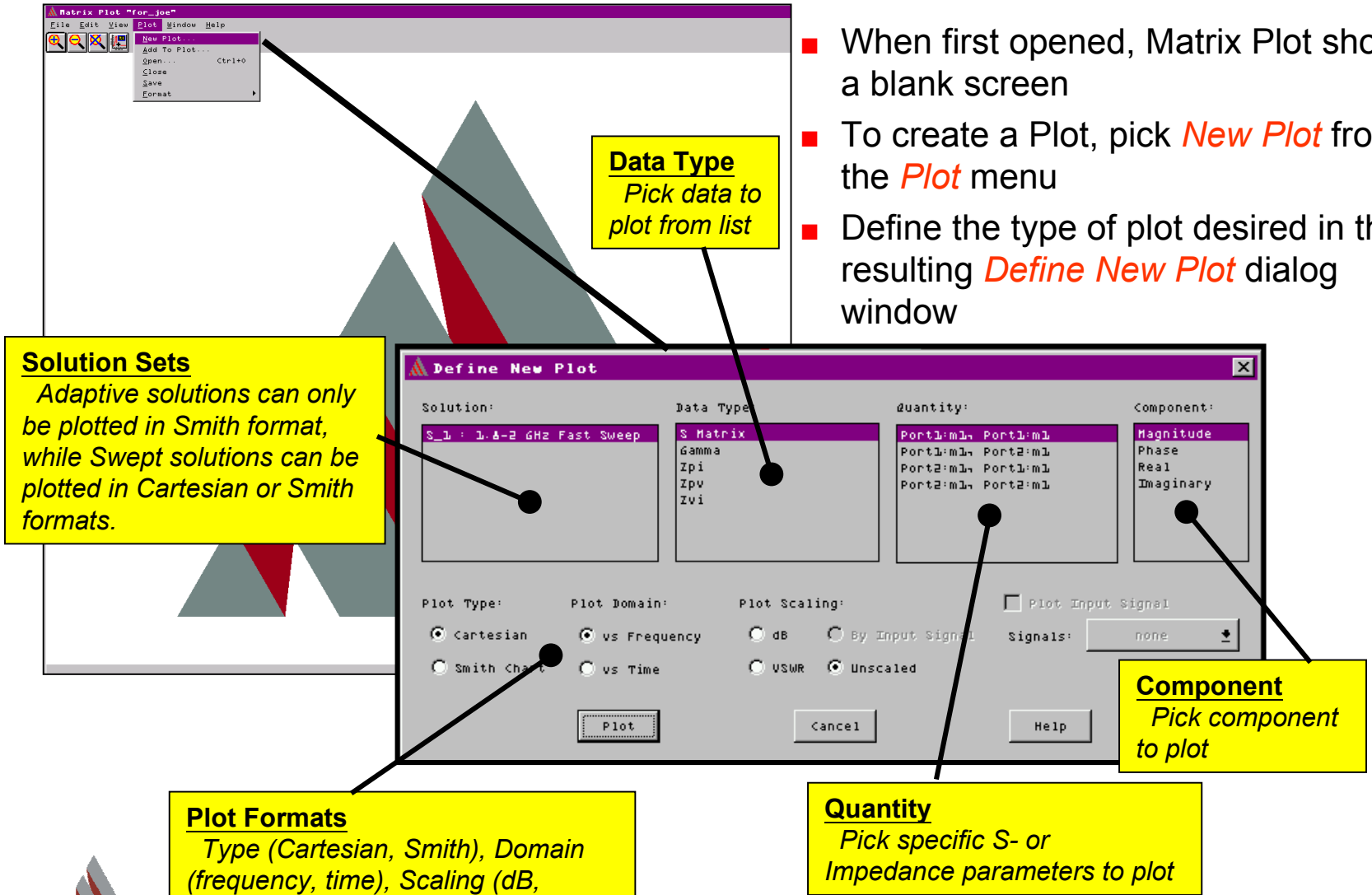
    Serenade is the Ansoft circuit simulation suite

    Touchstone/Libra is an alternate simulation suite

    Neutral Format is an Ansoft format, exportable to other products
  - The correct file extension should be defaulted in the file save dialog which results

*NOTE: If you choose to export to a circuit simulator format (e.g. Touchstone), the interface will warn you if **renormalization** is recommended prior to Exportation.*

Matrix Plot: Creating New Plots



- When first opened, Matrix Plot shows a blank screen
- To create a Plot, pick *New Plot* from the *Plot* menu
- Define the type of plot desired in the resulting *Define New Plot* dialog window

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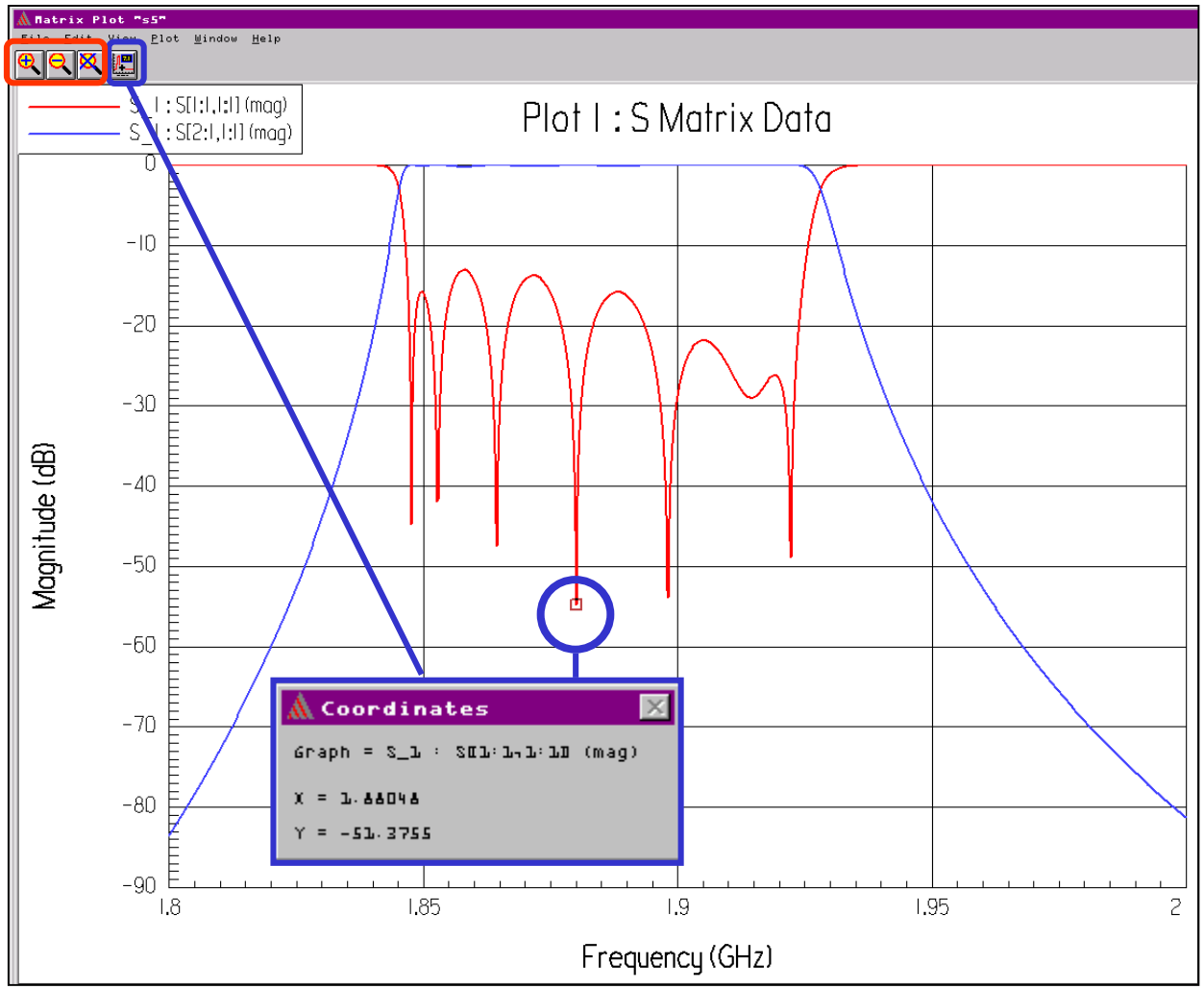
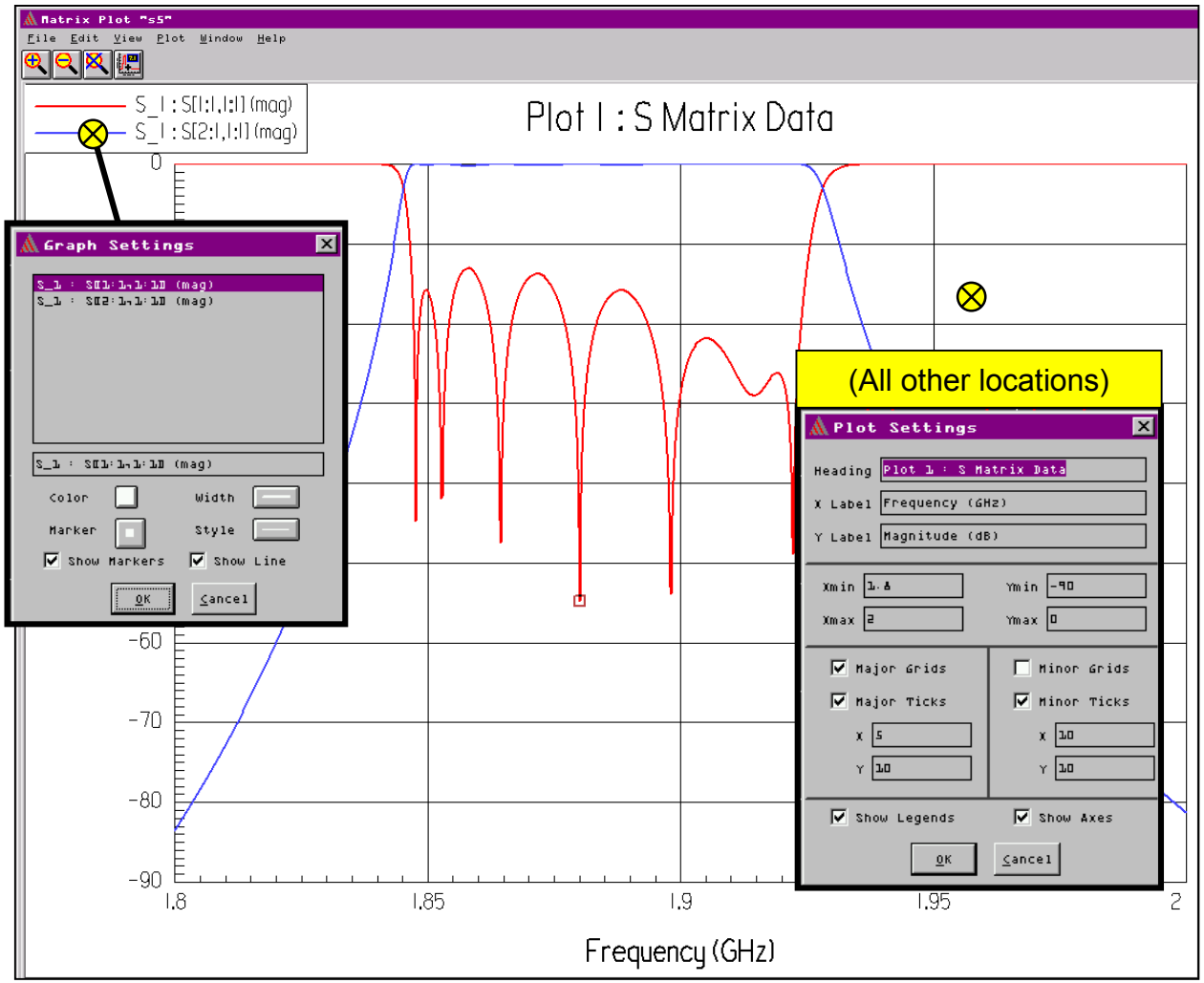
Matrix Plot: Navigating a Plot



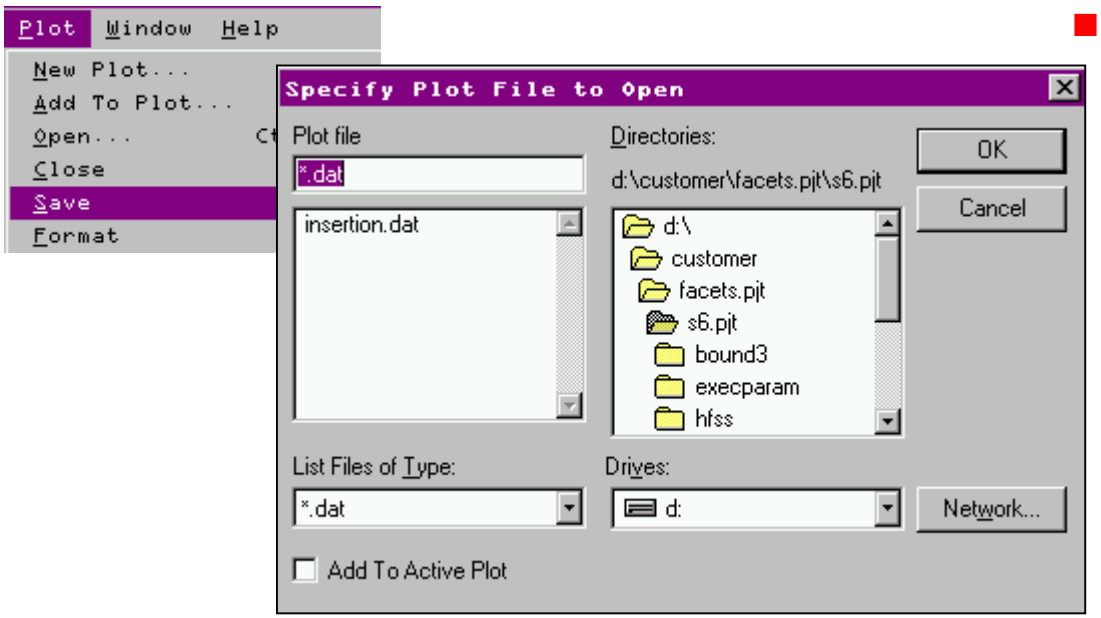
- The *Zoom* tool icons work the same as in all other modules
  - Plot scale is auto-created with zoom in or out
- A data marker can be placed using the *Show Coordinates* menu pick or tool icon, and can be rolled along the trace using the keyboard cursor keys.
  - Mouse *right click* exits show coord. mode

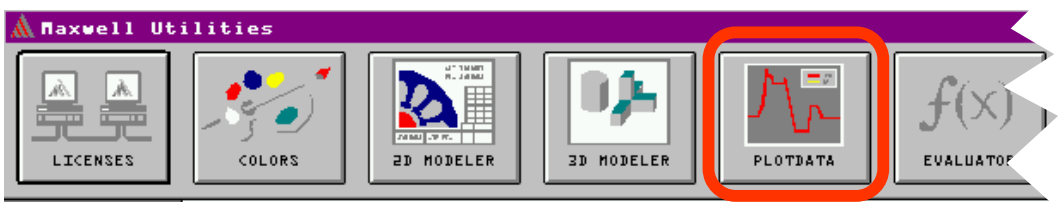
Matrix Plot: Reformatting a Plot



- Double-clicking anywhere on the plot allows reformatting
  - Horizontal and vertical axis
  - Title or Axis Headers
  - Double-clicking on the plot *Legend* allows reformatting of the trace lines (color, data symbol, etc.)
- More traces can be overlaid on the same chart using the *Add to Plot* pick from the *Plot* menu

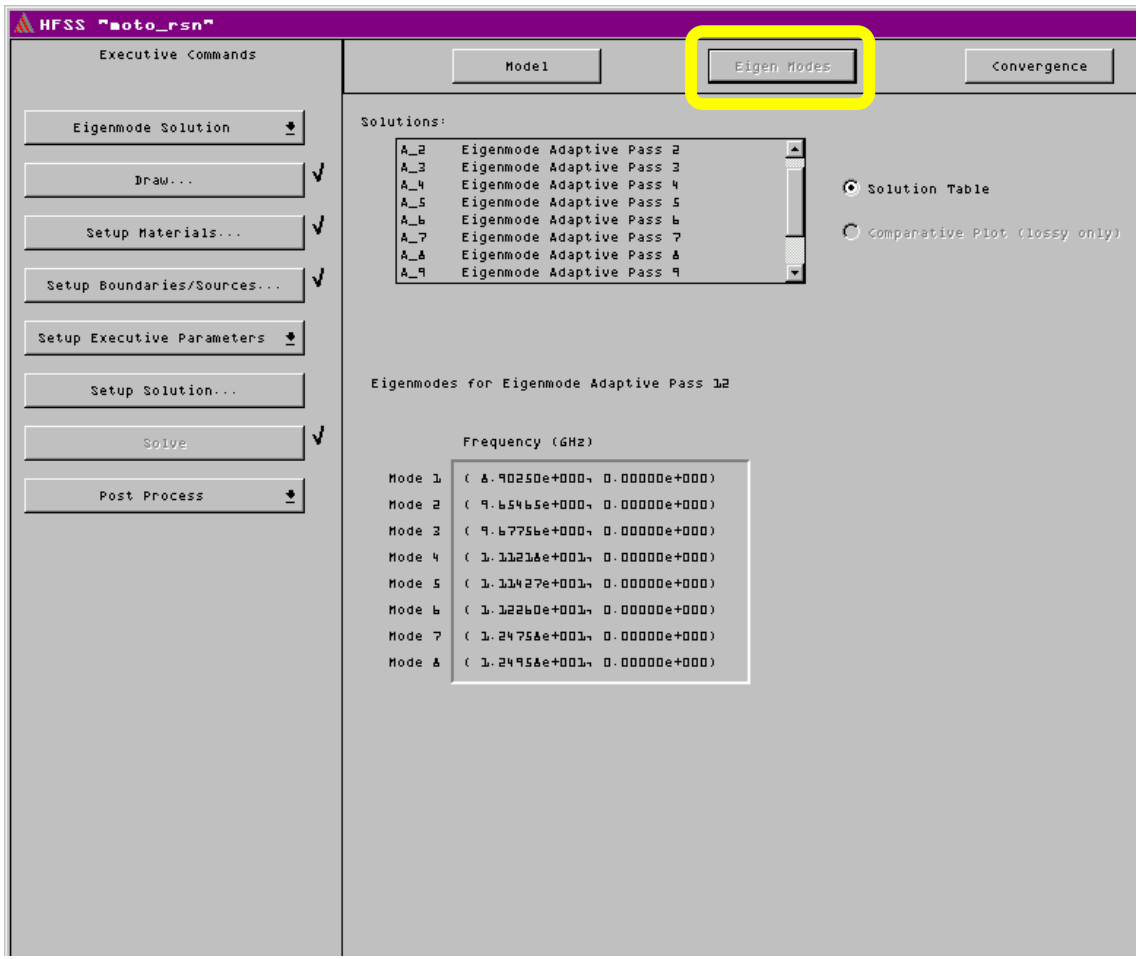
Matrix Plot: Saving and Opening Plots





- *Save* and *Open* options are also in the *Plot* menu
  - Plots are saved in a *.dat format by default
  - Plots from other projects may be opened in this interface
    - Data from current project can be 'added' to other project data plots in this manner
- For further Plot manipulation and comparison functions, including a *signal calculator*, see the *PlotData* utility off the *Utilities* toolbar of the main *Maxwell* control panel

Eigenmode Data Post-Processing



- *Eigenmode* solutions do not have matrix results
  - *Matrix Data* and *Matrix Plot* Post-Processors are disabled
- View Eigenmode results directly in HFSS Executive Window
  - Eigenmode frequencies and Q (if applicable) are displayed in tabular format
  - Comparative Plot of real vs. imaginary frequency components is available for models with lossy conductors and/or dielectrics

Matrix Post-Processing Exercise

There is no formally-directed “Exercise” written for Matrix Plot and Matrix Data Operations

Your instructor will guide you through viewing some solved project data to familiarize you with the use of the interface

- Look for projects named “*_slv” in your Project Manager