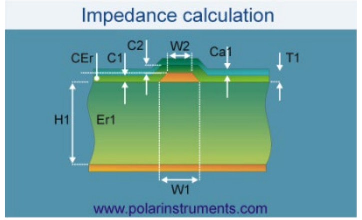
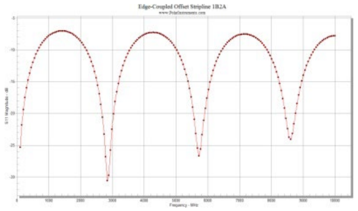
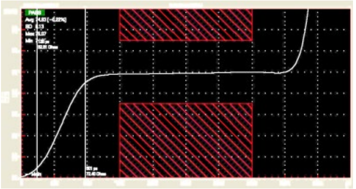
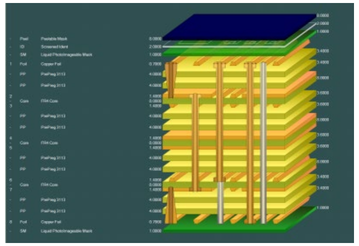
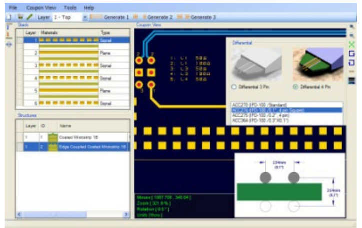










Si9000e 2021 - 2022 Preview

Richard Attrill – May 2022 (Rev 2)

polarinstruments.com

Introducing the latest features of Si9000e

Welcome to a preview of Si9000e.

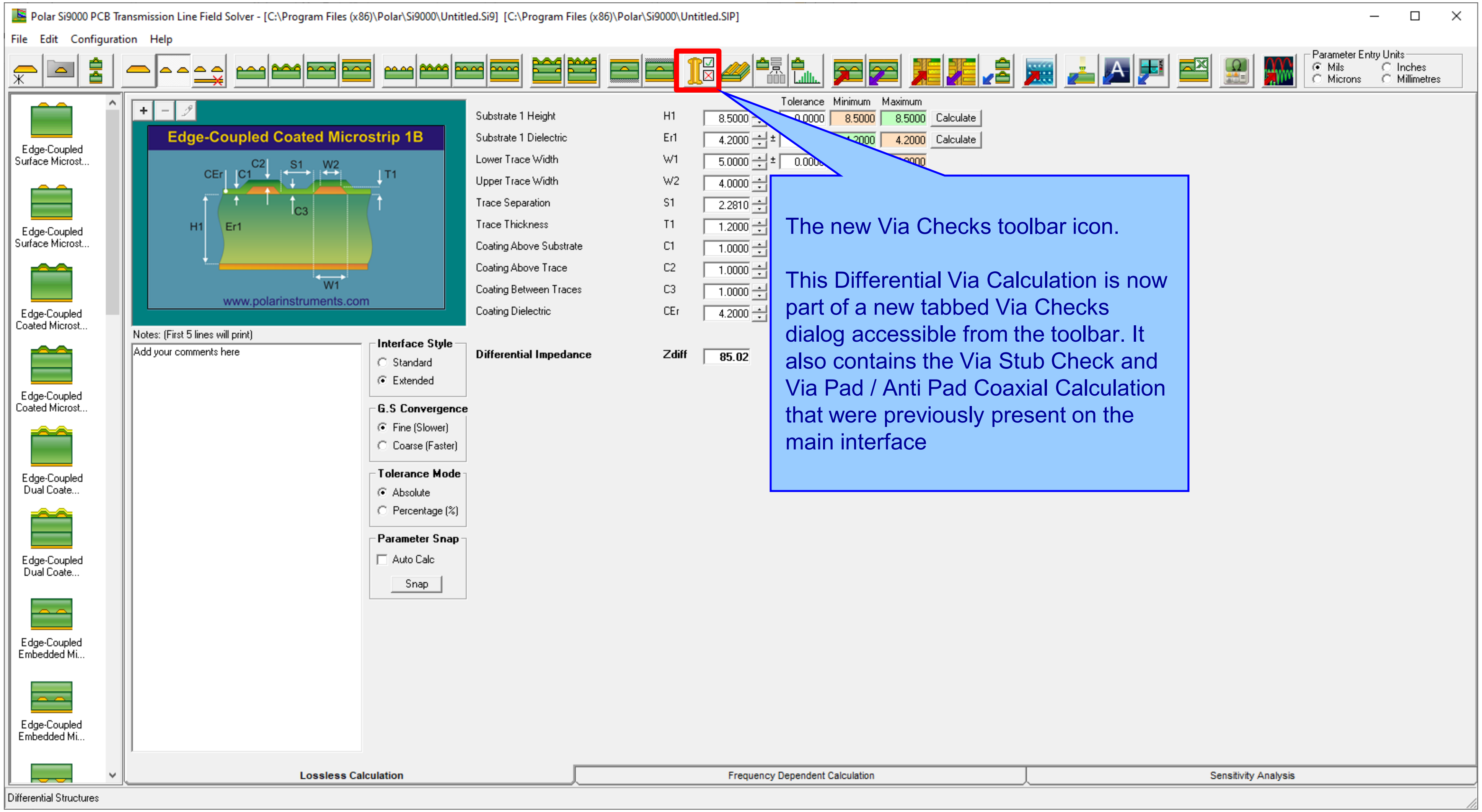
Since January 2021 we have released six versions of Si9000e, each introducing a number of new features that have been requested through our Polarcare software maintenance service. A slide containing the version number and release date precedes information detailing the new features contained in each release.

If you would like to have a web-based demonstration please contact your local Polar office, details are shown on the last slide of this presentation

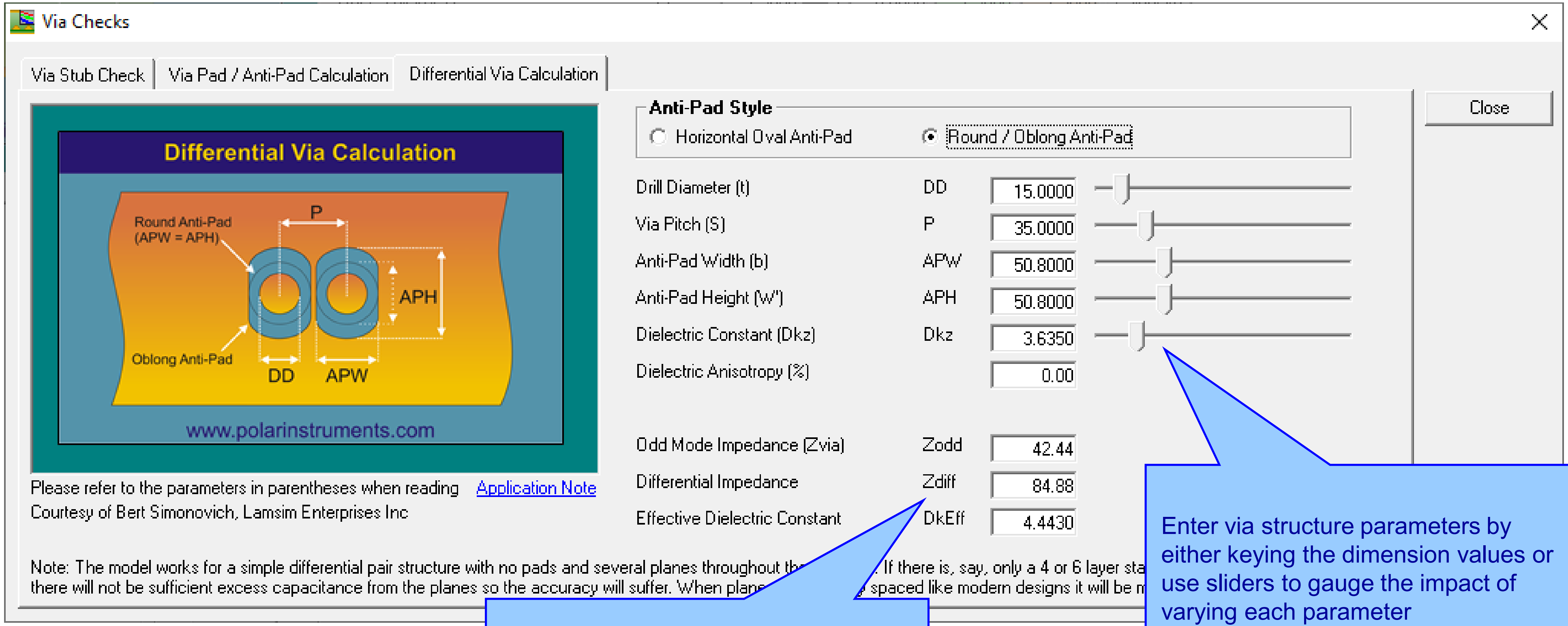
Please note: the Si9000e units have been set to Mils in the following screen grabs

Si9000e v22.04 (April 2022)

New Differential Via Calculation capability



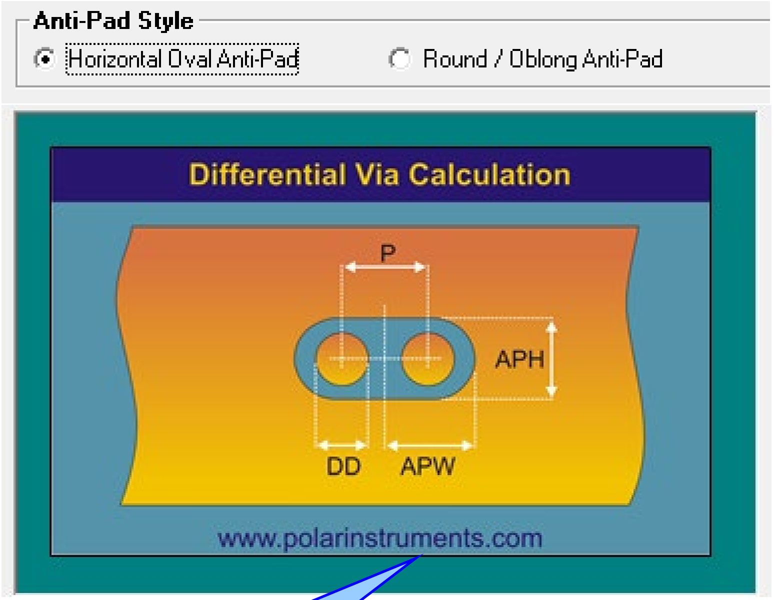
New Differential Via Calculation

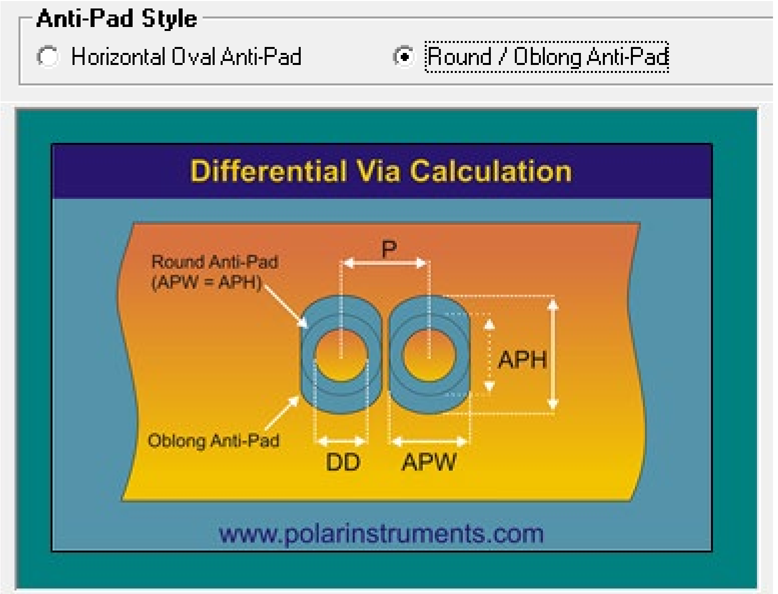


Calculation results are presented here

Enter via structure parameters by either keying the dimension values or use sliders to gauge the impact of varying each parameter

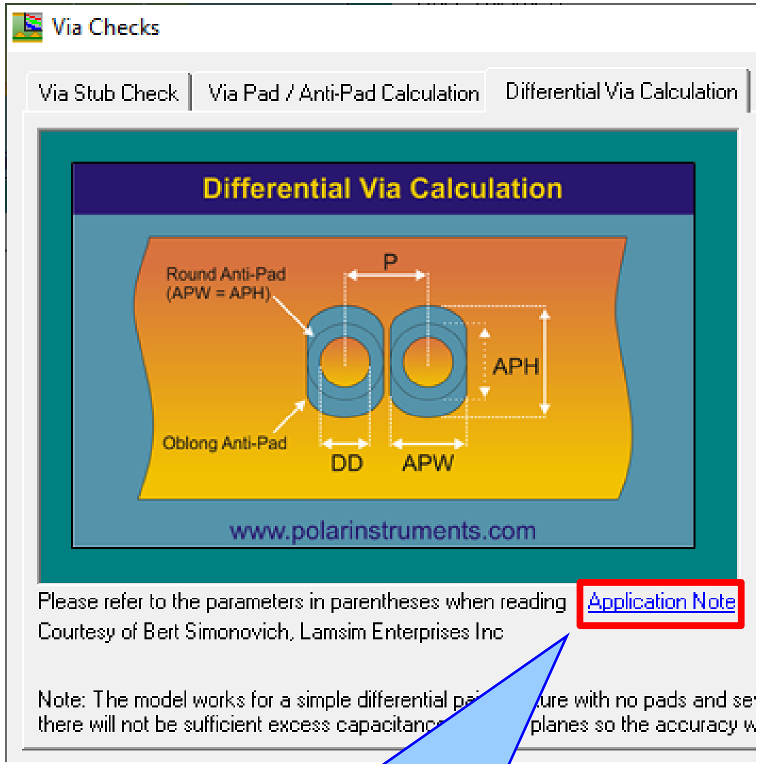
New Differential Via Calculation



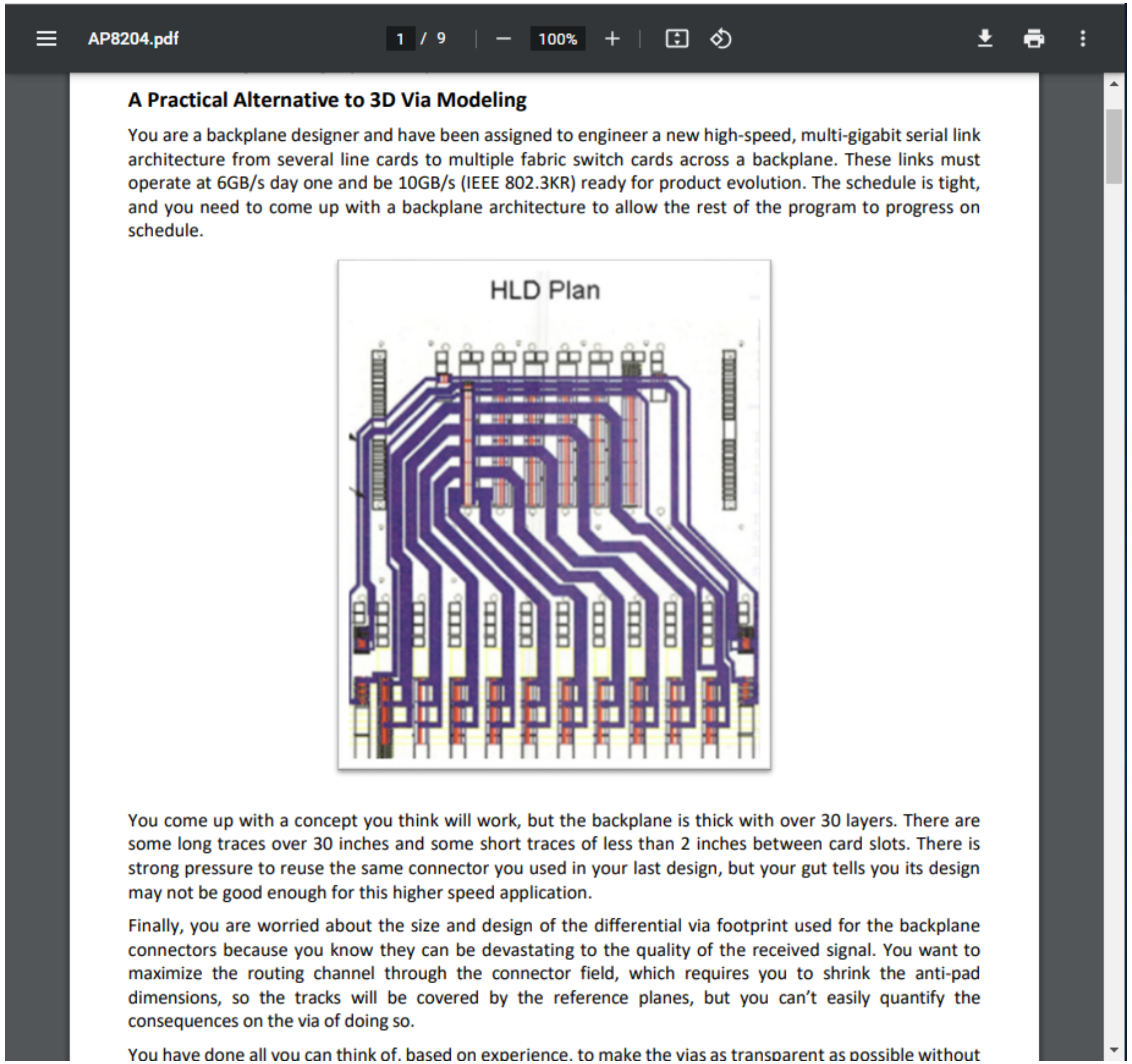


Two different selectable Anti-Pad Styles available

New Differential Via Calculation



The Application Note link provides further details of how the model works



A Practical Alternative to 3D Via Modeling

You are a backplane designer and have been assigned to engineer a new high-speed, multi-gigabit serial link architecture from several line cards to multiple fabric switch cards across a backplane. These links must operate at 6GB/s day one and be 10GB/s (IEEE 802.3KR) ready for product evolution. The schedule is tight, and you need to come up with a backplane architecture to allow the rest of the program to progress on schedule.

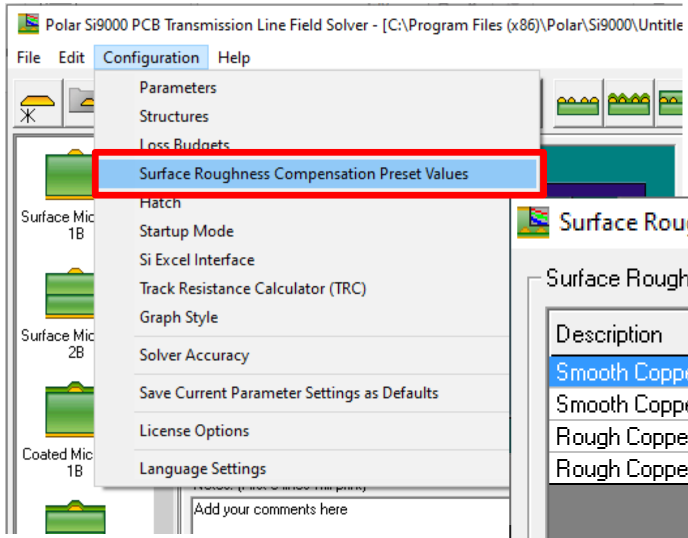
You come up with a concept you think will work, but the backplane is thick with over 30 layers. There are some long traces over 30 inches and some short traces of less than 2 inches between card slots. There is strong pressure to reuse the same connector you used in your last design, but your gut tells you its design may not be good enough for this higher speed application.

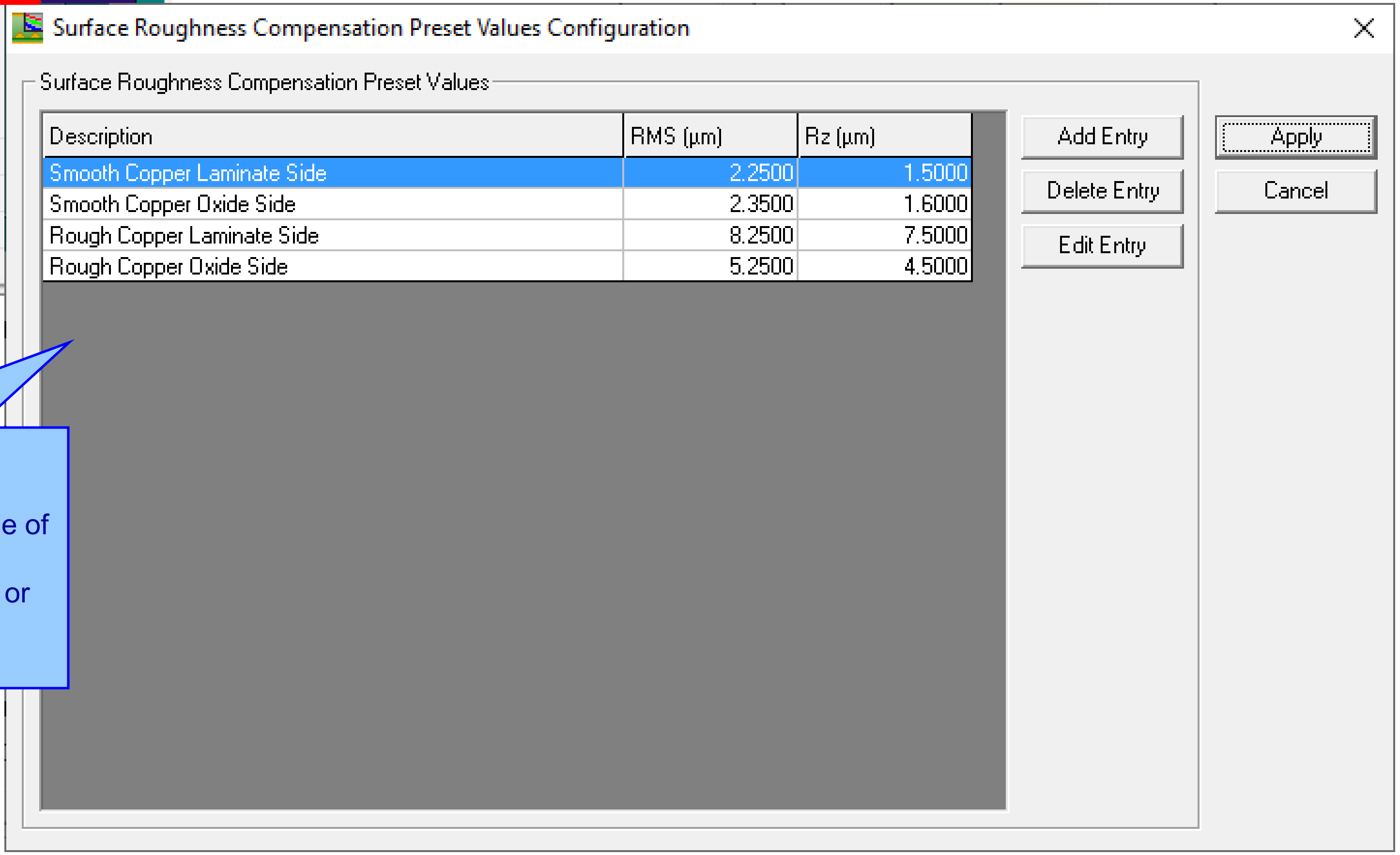
Finally, you are worried about the size and design of the differential via footprint used for the backplane connectors because you know they can be devastating to the quality of the received signal. You want to maximize the routing channel through the connector field, which requires you to shrink the anti-pad dimensions, so the tracks will be covered by the reference planes, but you can't easily quantify the consequences on the via of doing so.

You have done all you can think of, based on experience, to make the vias as transparent as possible without

Si9000e v22.03 (March 2022)

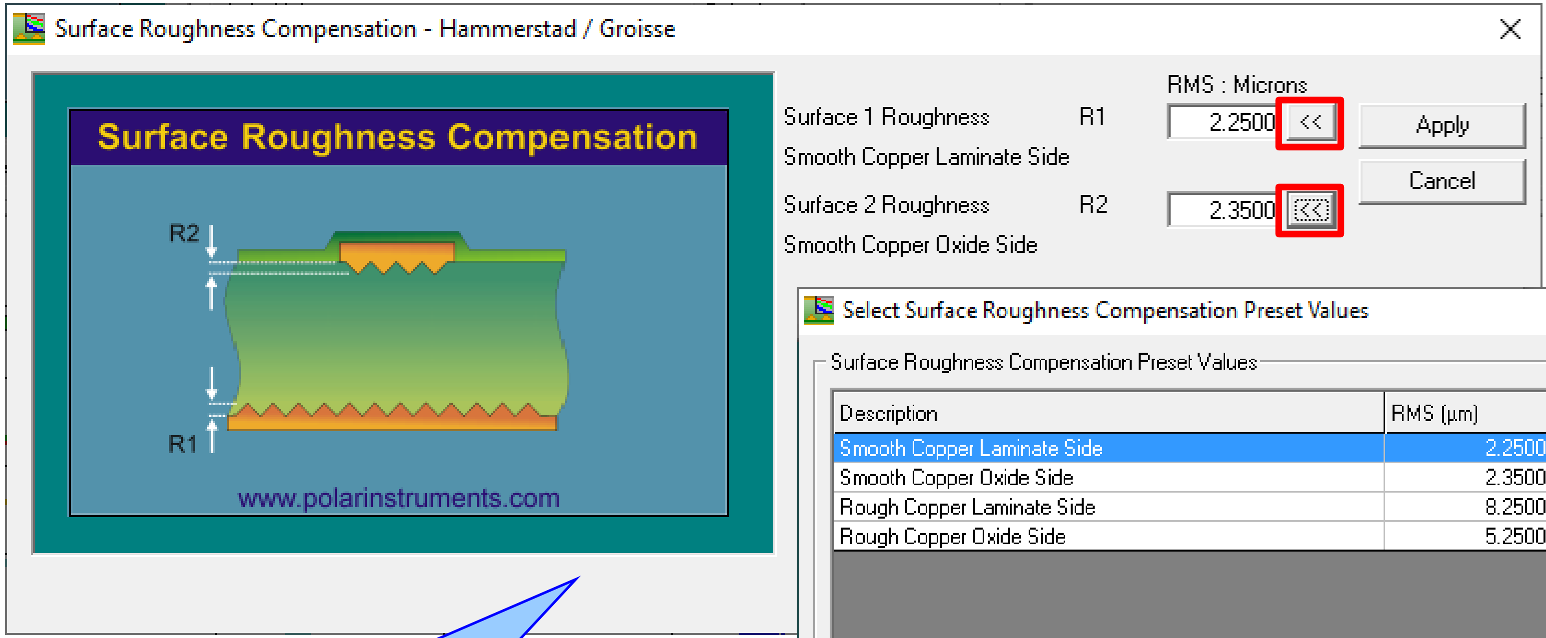
New Surface Roughness Compensation Preset Values feature

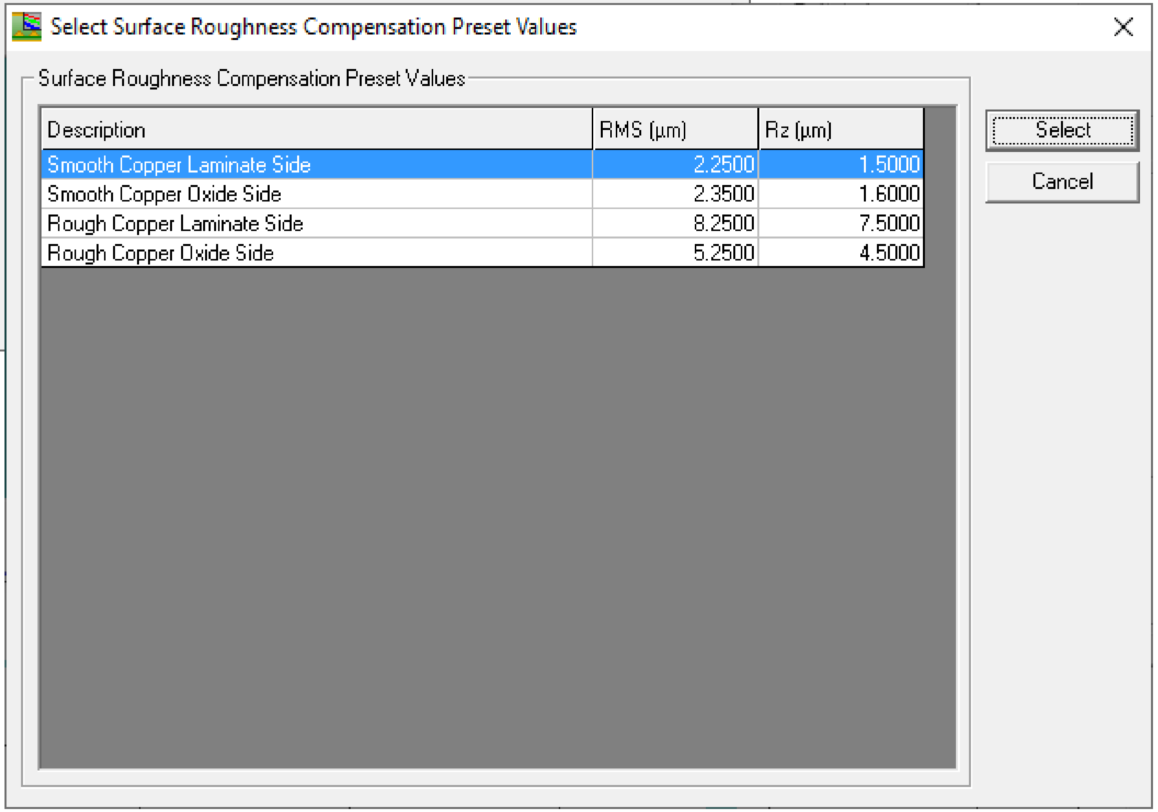




A new entry has been added to the Configuration menu to manage a table of Surface Roughness Preset Values composed of Description, RMS and / or Rz values

New Surface Roughness Compensation Preset Values feature

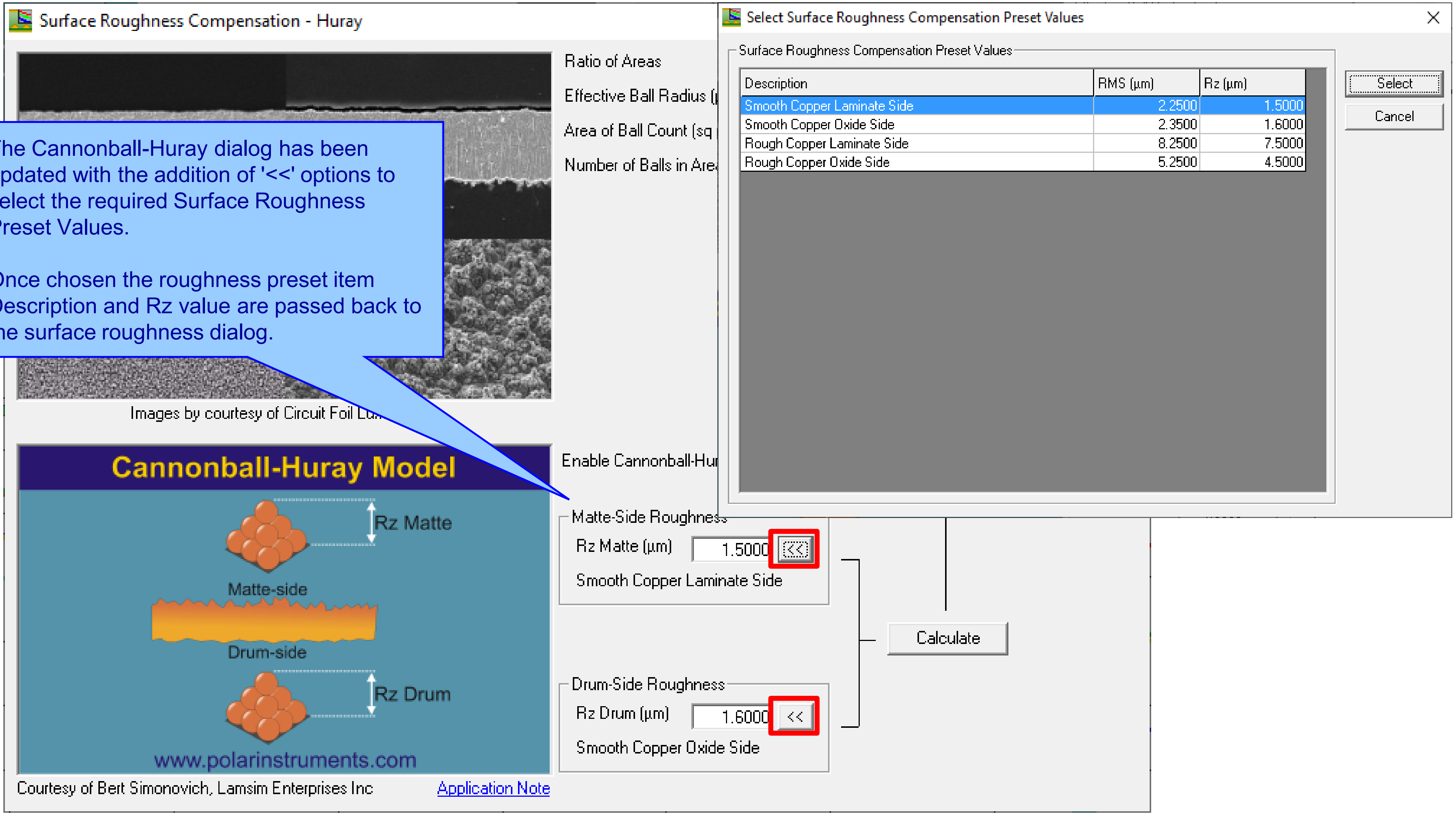




The Hammerstad / Groisse dialog has been updated with the addition of '<<' options to select the required Surface Roughness Preset Values.

Once chosen the roughness preset item Description and RMS value are passed back to the surface roughness dialog.

New Surface Roughness Compensation Preset Values feature

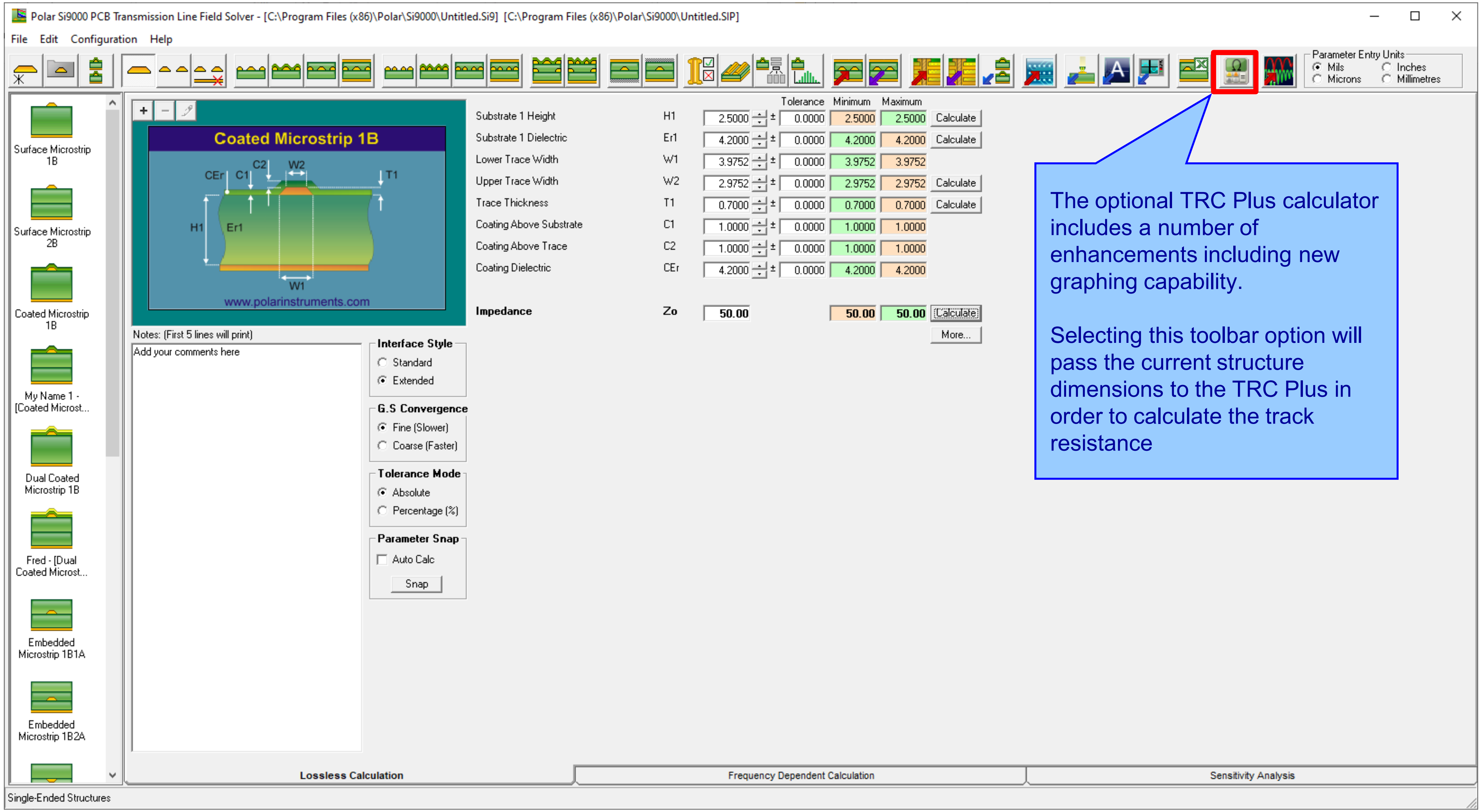


The Cannonball-Huray dialog has been updated with the addition of '<<' options to select the required Surface Roughness Preset Values.

Once chosen the roughness preset item Description and Rz value are passed back to the surface roughness dialog.

Si9000e v22.02 (February 2022)

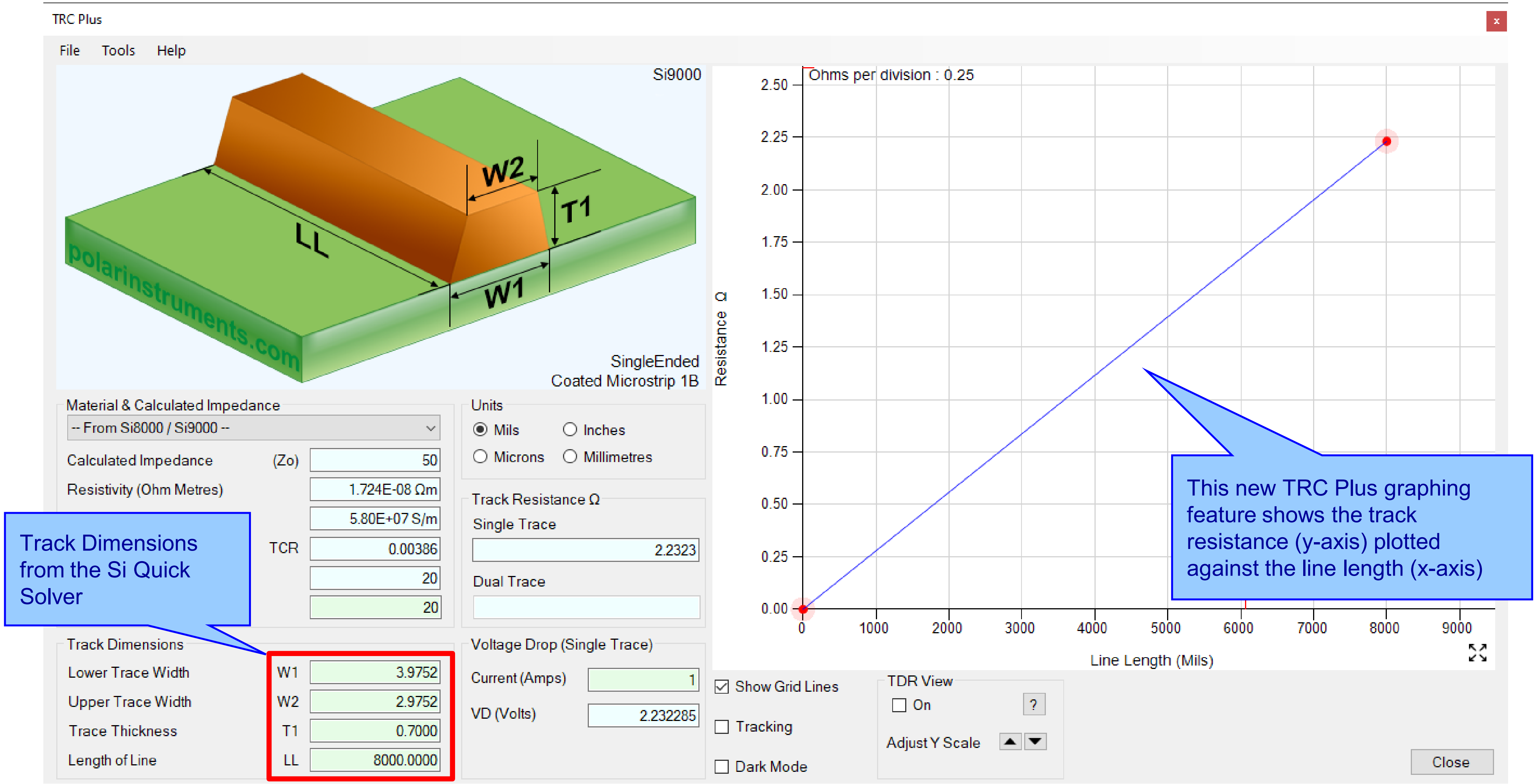
Track Resistance license option (TRC Plus) enhancement



The optional TRC Plus calculator includes a number of enhancements including new graphing capability.

Selecting this toolbar option will pass the current structure dimensions to the TRC Plus in order to calculate the track resistance

Track Resistance license option (TRC Plus) enhancements



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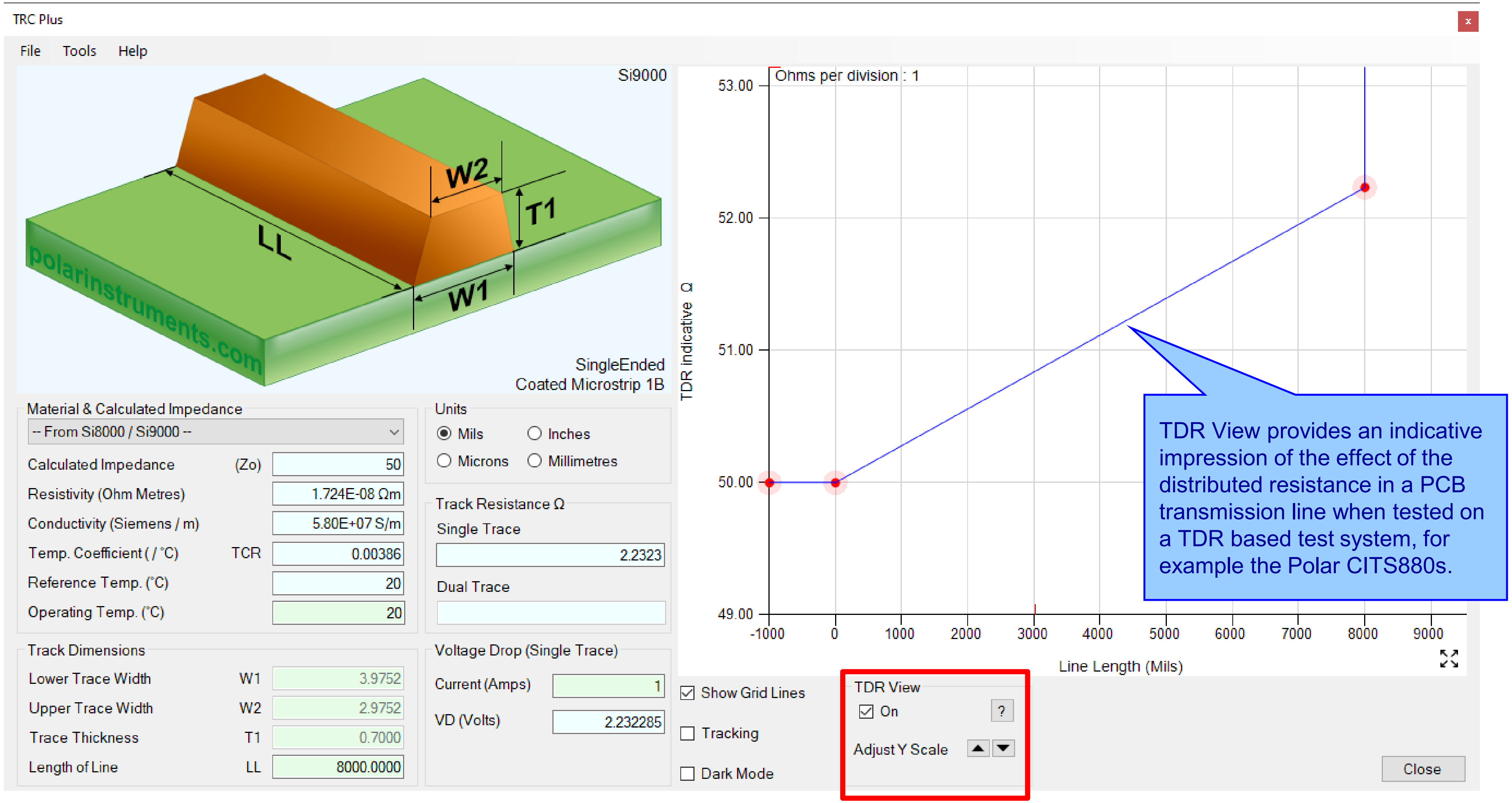
Track Resistance license option (TRC Plus) enhancements



Si9000e v21.09 (Sept 2021)

Project Graphing – Introduction *(requires the Si Projects feature)*

It is often useful to compare the results from similar structures, especially with frequency dependent calculations where changing just one or two parameters can have significant impact.

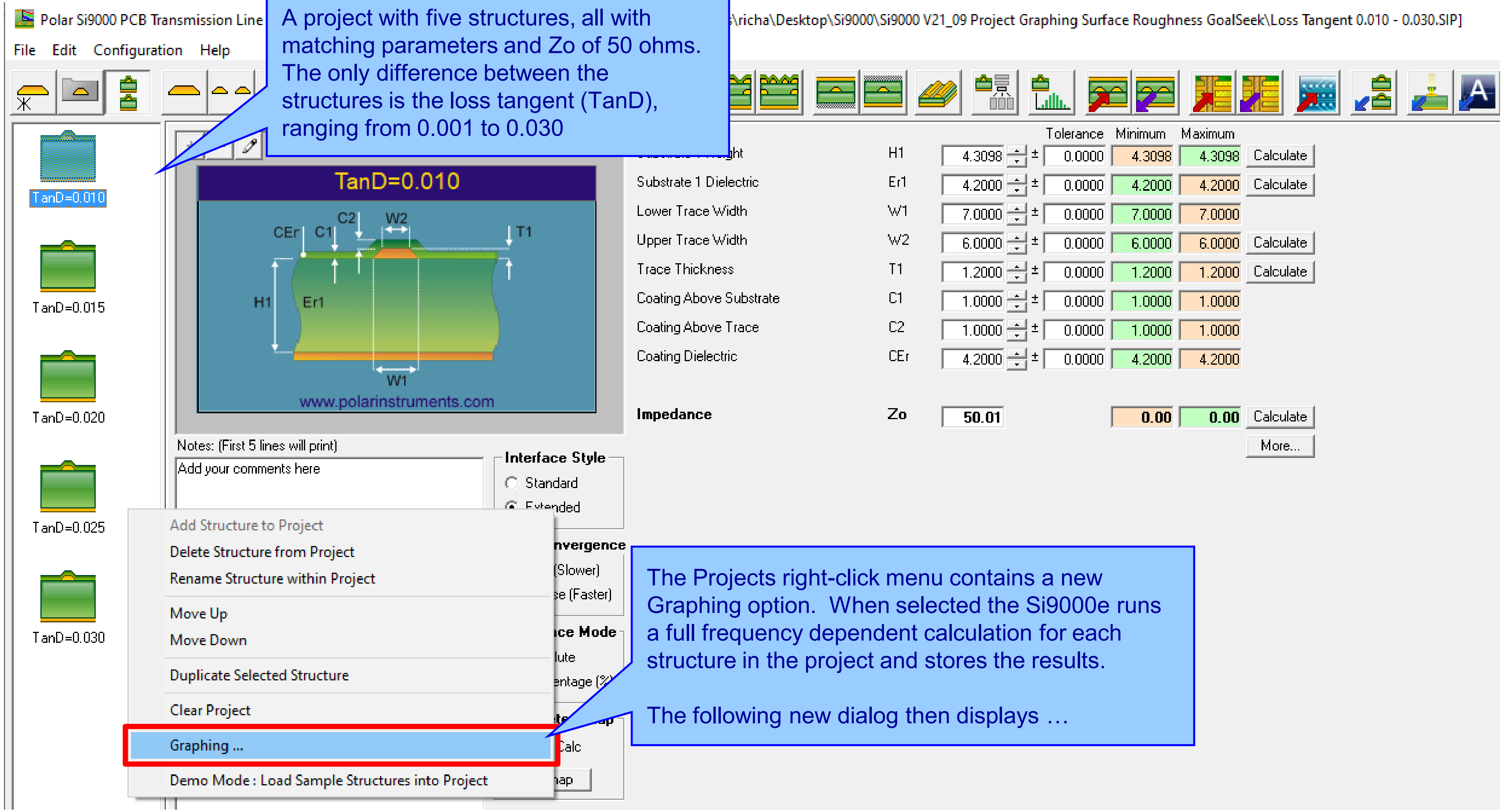
Until now the Si9000e Quick Solver graphing has focused on a single structure, for instance the All Losses graph will display a single plot that includes multiple data series for the same structure.

The new Project Graphing option calculates all the results for a group of structures contained in the Project and then plots the selected data series (total attenuation, conductor loss or dielectric loss etc) on the same graph.

A single graph that combines results from multiple structures is useful in a number of ways. Comparing the impact of different dielectric materials, different roughness, sensitivity analysis for lossy calculations and many more uses.

Project Graphing

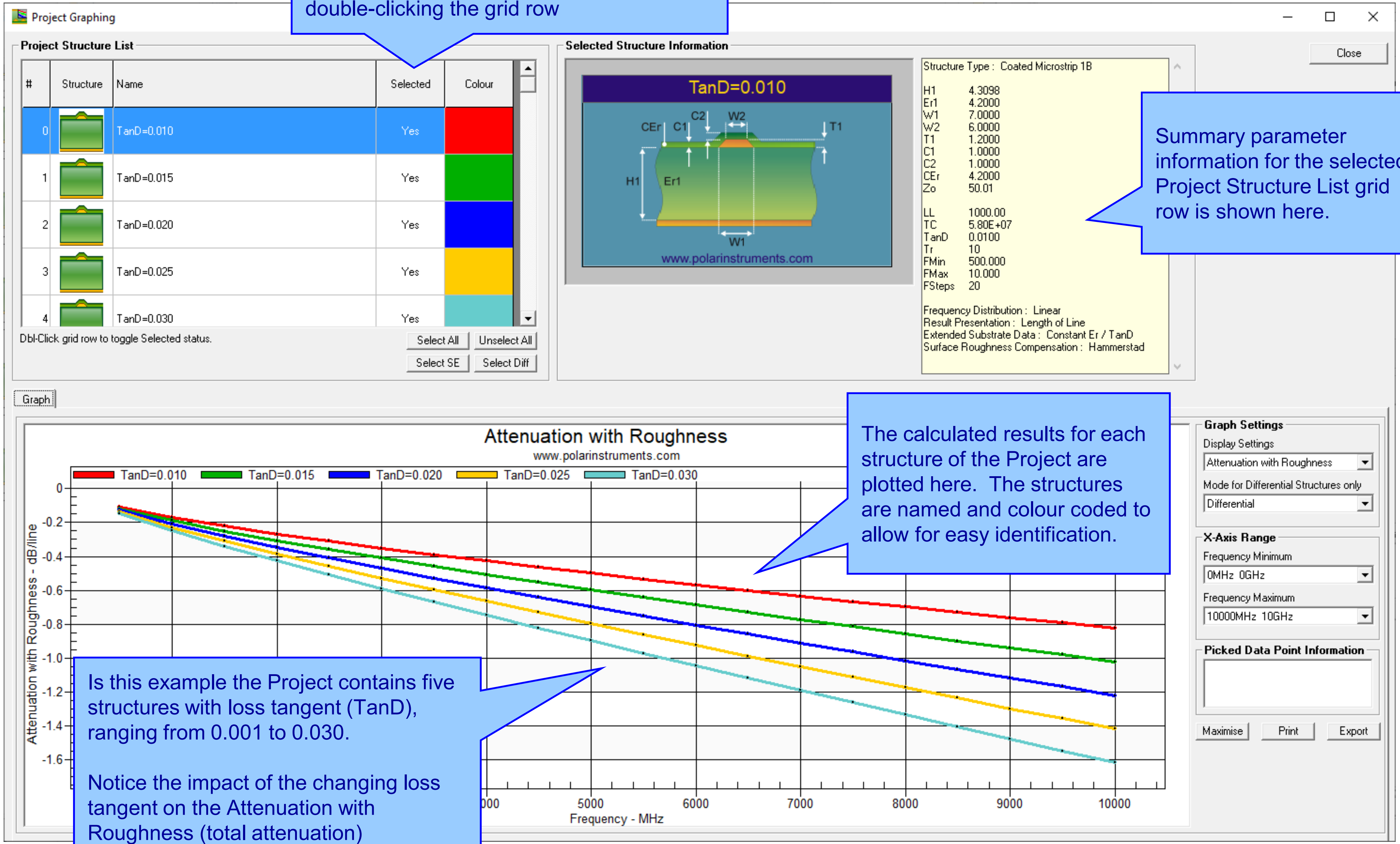
A project with five structures, all with matching parameters and Zo of 50 ohms. The only difference between the structures is the loss tangent (TanD), ranging from 0.001 to 0.030



The Projects right-click menu contains a new Graphing option. When selected the Si9000e runs a full frequency dependent calculation for each structure in the project and stores the results.

The following new dialog then displays …

The Project Structure List provides options to choose which structures from the Project are plotted. Individual structures can toggled between selected / deselected by double-clicking the grid row

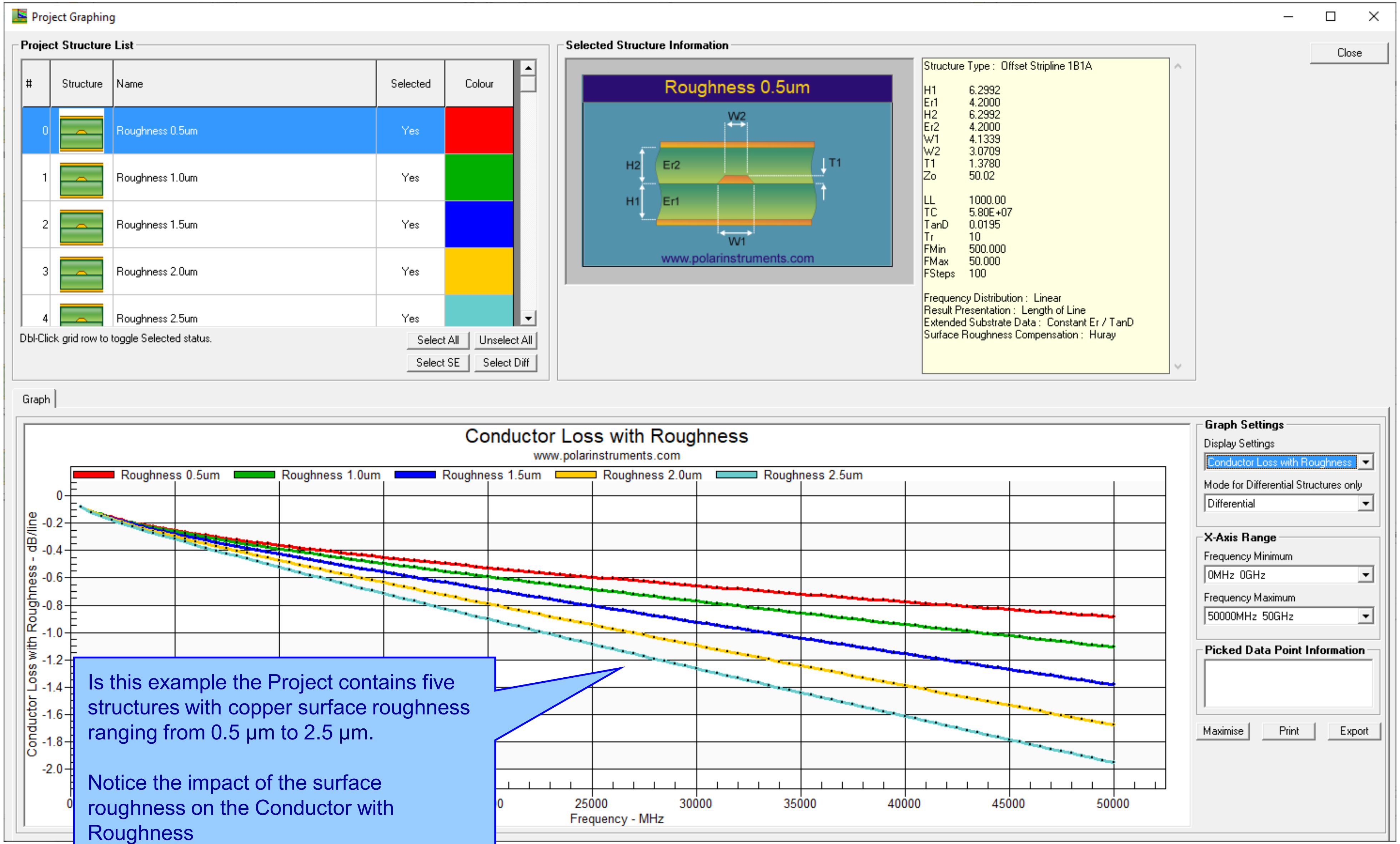


Summary parameter information for the selected Project Structure List grid row is shown here.

The calculated results for each structure of the Project are plotted here. The structures are named and colour coded to allow for easy identification.

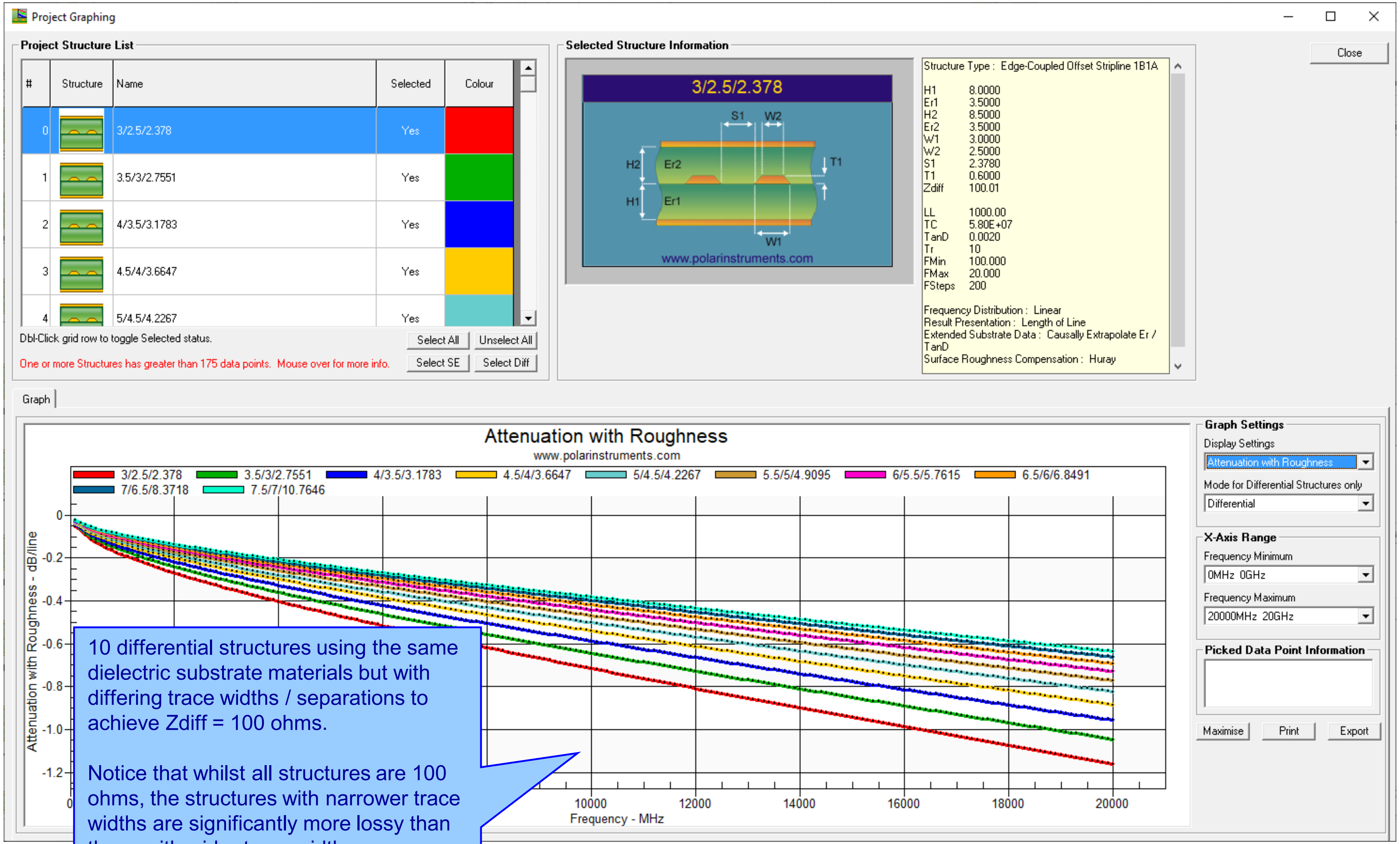
Is this example the Project contains five structures with loss tangent (TanD), ranging from 0.001 to 0.030.

Notice the impact of the changing loss tangent on the Attenuation with Roughness (total attenuation)



Is this example the Project contains five structures with copper surface roughness ranging from 0.5 µm to 2.5 µm.

Notice the impact of the surface roughness on the Conductor with Roughness



10 differential structures using the same dielectric substrate materials but with differing trace widths / separations to achieve Zdiff = 100 ohms.

Notice that whilst all structures are 100 ohms, the structures with narrower trace widths are significantly more lossy than those with wider trace widths.

Project Graphing – Summary

- The new Graphing option for Si Projects provides useful plots that contain data from multiple structures
- There are numerous uses for this type of option - comparing the impact of different dielectric materials, different roughness, sensitivity analysis for lossy calculations and more
- ‘What if’ scenarios where one structure in the project would use the current design parameters and the second structure would contain a modified set based on a newer material. The plots comparing the original versus the new material will instantly show the impact
- Useful to both fabricators and design companies

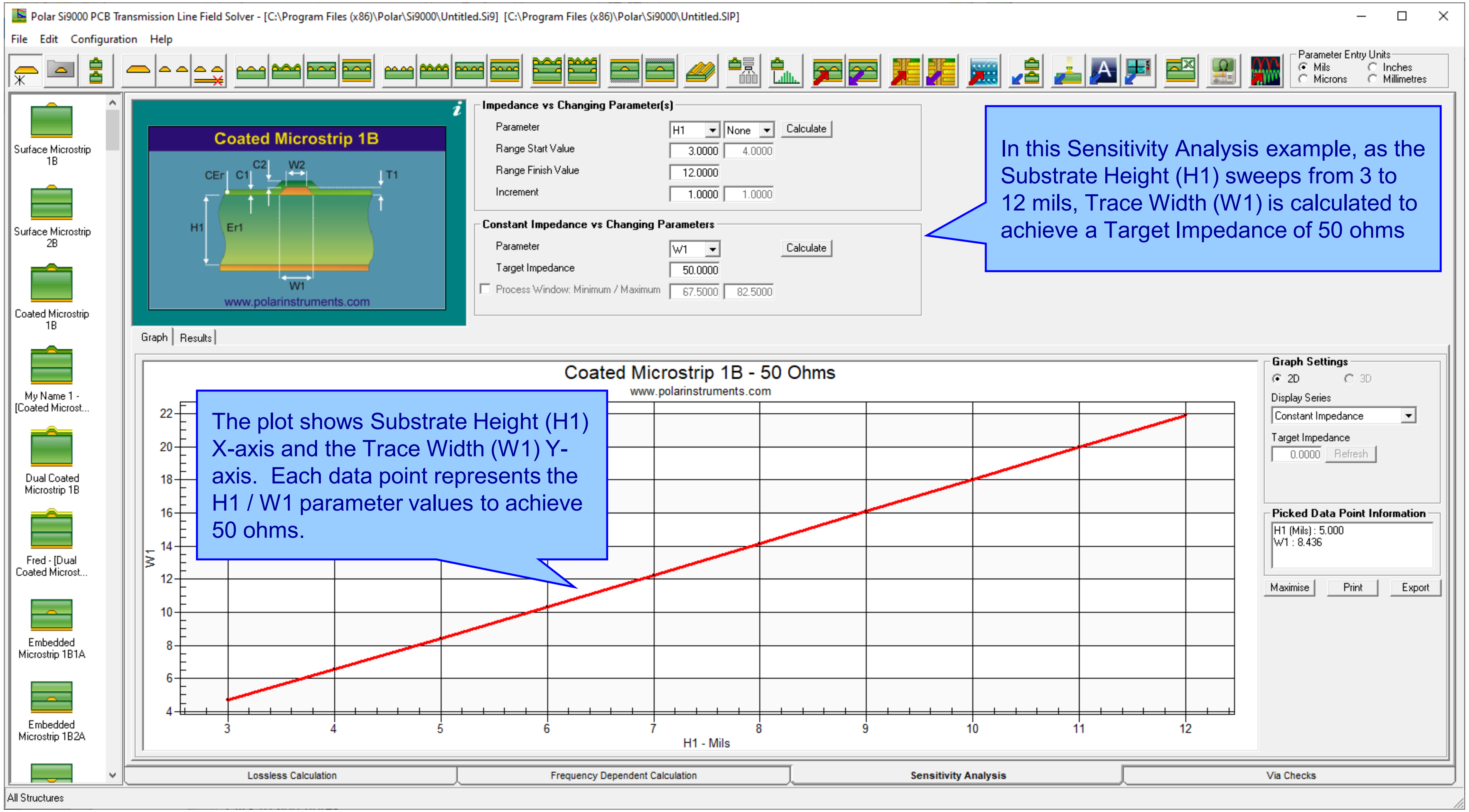
Populate a Project from Sensitivity Analysis Results

(requires the Si Projects feature)

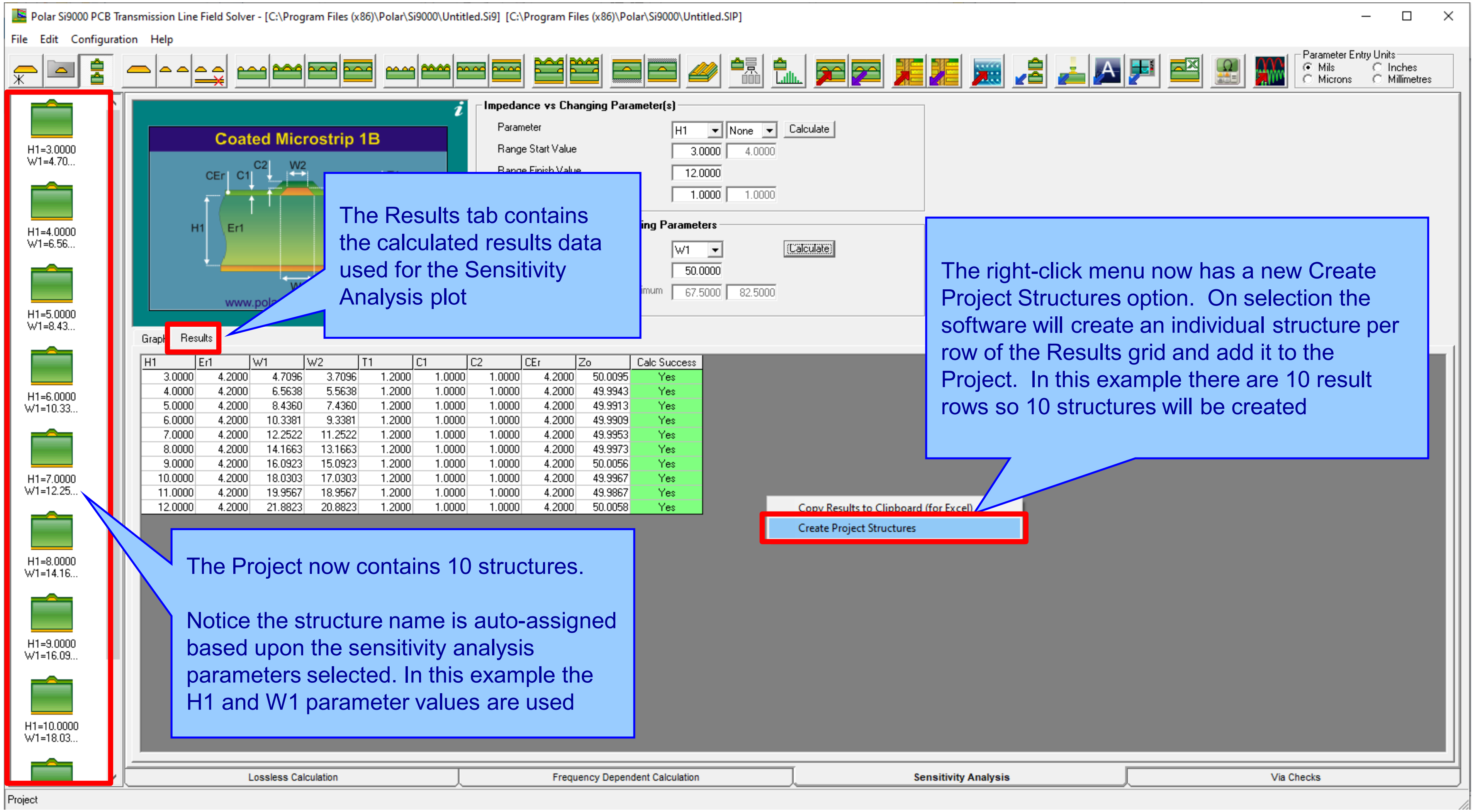
When using the Sensitivity Analysis option it is often useful to examine the calculated results in more details. It is now possible to auto-create a Project containing structures based upon the Sensitivity Analysis results data.

The following slides provide further details:

Populate a Project from Sensitivity Analysis Results

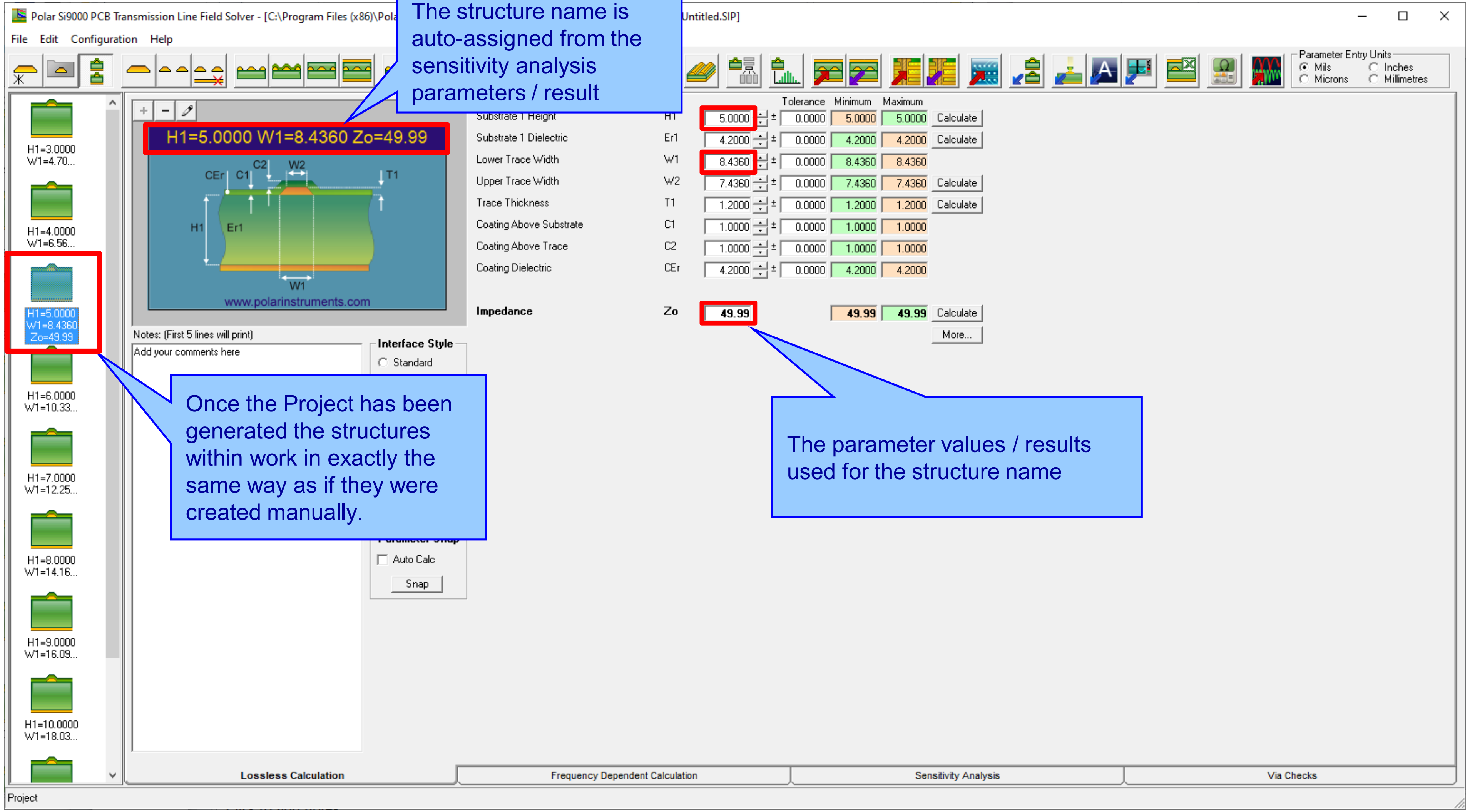


Populate a Project from Sensitivity Analysis Results



H1	Er1	W1	W2	T1	C1	C2	CEr	Zo	Calc Success
3.0000	4.2000	4.7096	3.7096	1.2000	1.0000	1.0000	4.2000	50.0095	Yes
4.0000	4.2000	6.5638	5.5638	1.2000	1.0000	1.0000	4.2000	49.9943	Yes
5.0000	4.2000	8.4360	7.4360	1.2000	1.0000	1.0000	4.2000	49.9913	Yes
6.0000	4.2000	10.3381	9.3381	1.2000	1.0000	1.0000	4.2000	49.9909	Yes
7.0000	4.2000	12.2522	11.2522	1.2000	1.0000	1.0000	4.2000	49.9953	Yes
8.0000	4.2000	14.1663	13.1663	1.2000	1.0000	1.0000	4.2000	49.9973	Yes
9.0000	4.2000	16.0923	15.0923	1.2000	1.0000	1.0000	4.2000	50.0056	Yes
10.0000	4.2000	18.0303	17.0303	1.2000	1.0000	1.0000	4.2000	49.9967	Yes
11.0000	4.2000	19.9567	18.9567	1.2000	1.0000	1.0000	4.2000	49.9867	Yes
12.0000	4.2000	21.8823	20.8823	1.2000	1.0000	1.0000	4.2000	50.0058	Yes

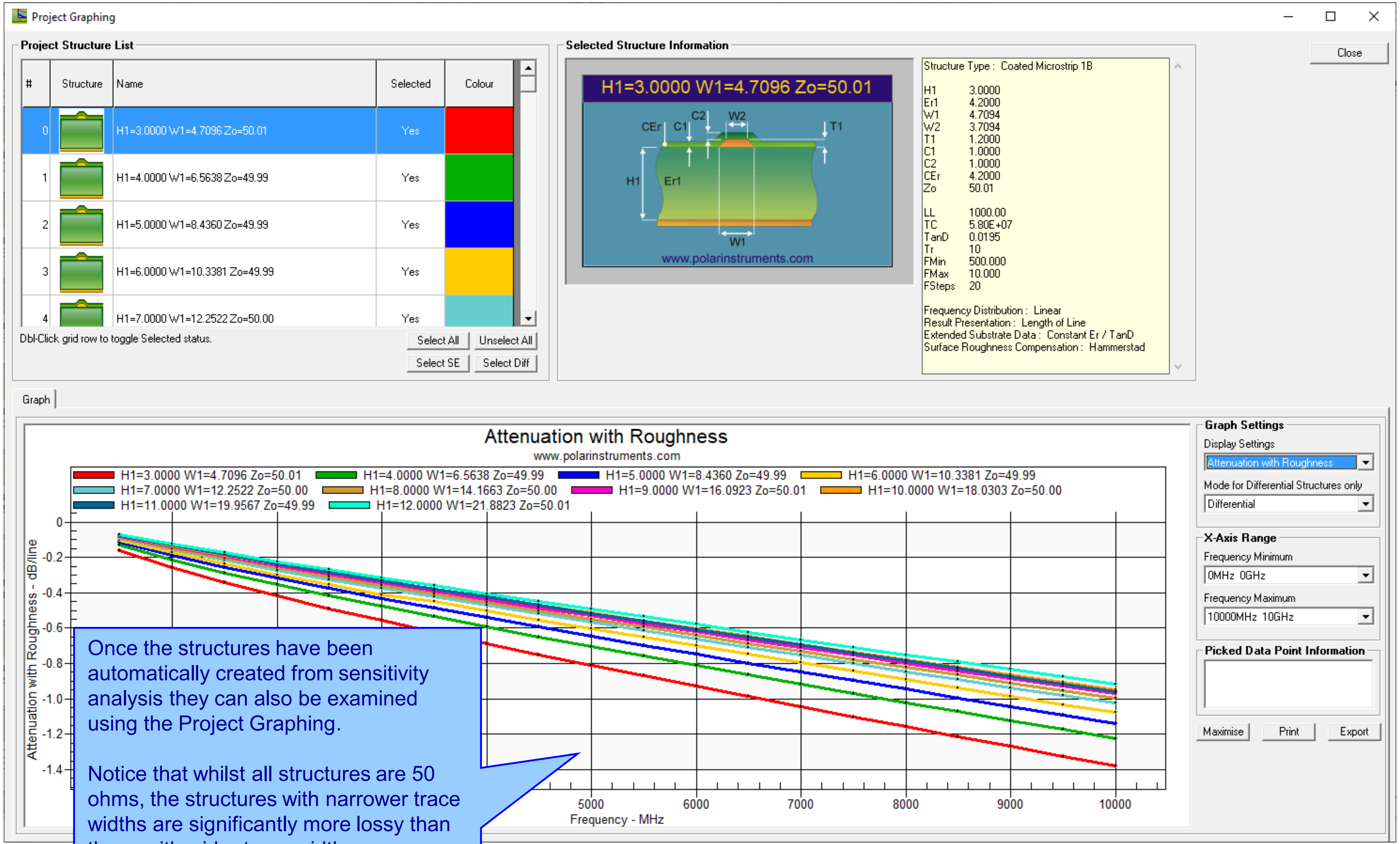
Populate a Project from Sensitivity Analysis Results



The structure name is auto-assigned from the sensitivity analysis parameters / result

Once the Project has been generated the structures within work in exactly the same way as if they were created manually.

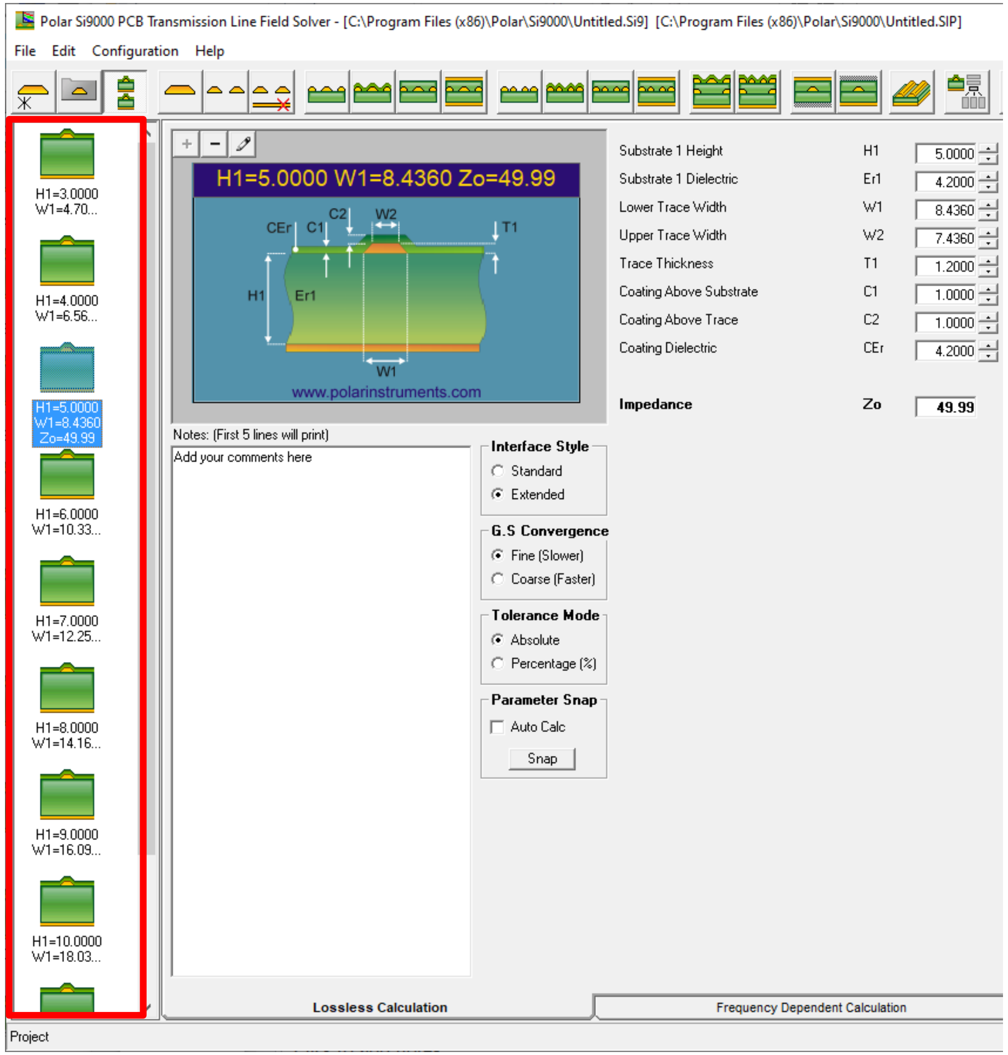
The parameter values / results used for the structure name

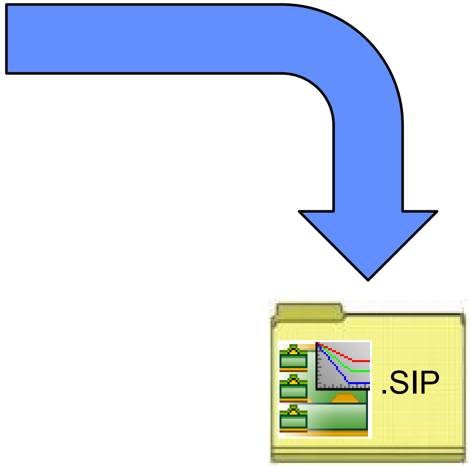


Once the structures have been automatically created from sensitivity analysis they can also be examined using the Project Graphing.

Notice that whilst all structures are 50 ohms, the structures with narrower trace widths are significantly more lossy than those with wider trace widths.

Populate a Project from Sensitivity Analysis Results





Save the newly created project to the Si Project file format (.SIP) so that it can be recalled at a later date.

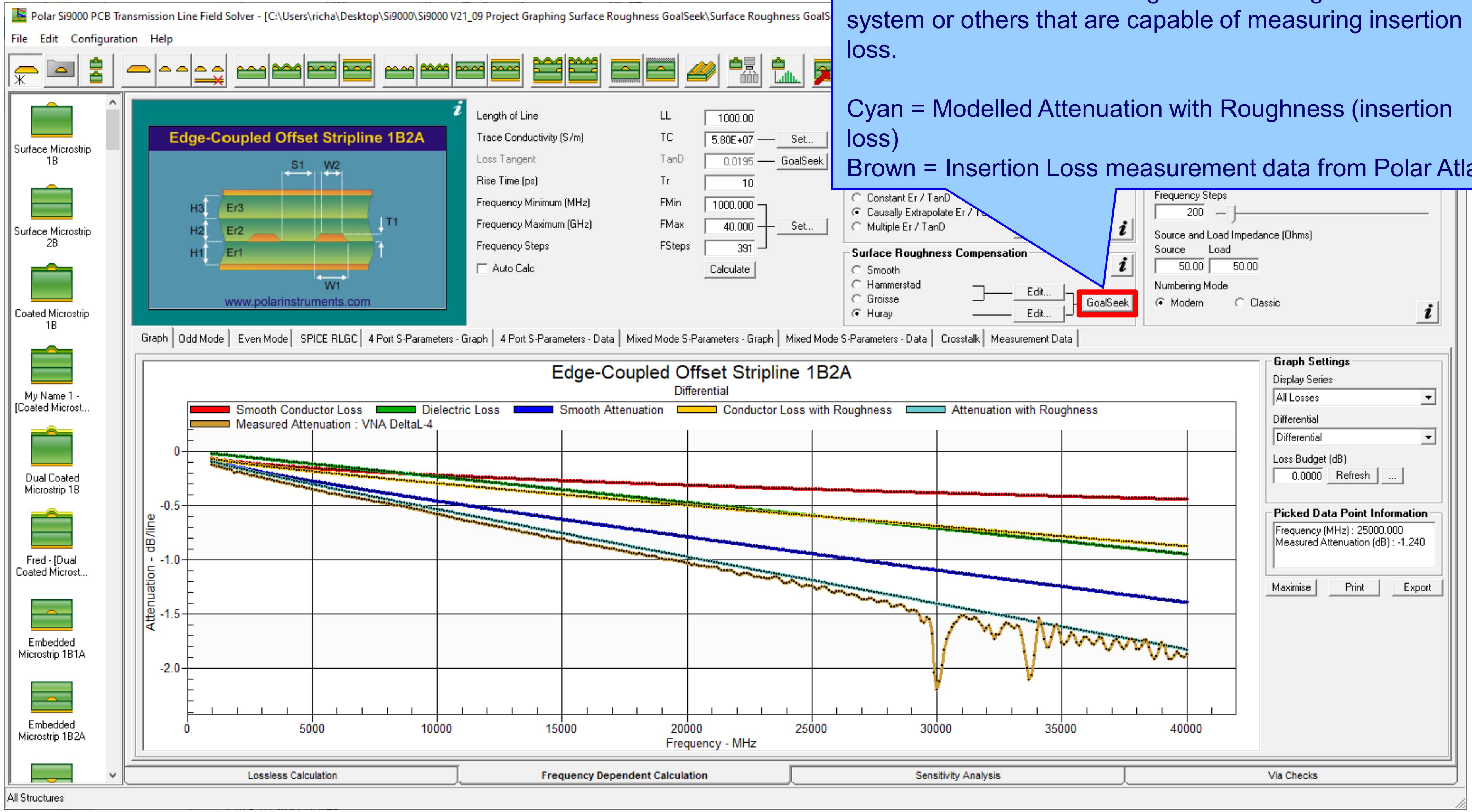
Populate a Project from Sensitivity Analysis Results - Summary

- As separate structure in a Project it is now possible to examine the results in a lot more detail than when in sensitivity analysis
- Lossy calculations can be performed and compared
- As a Project the structure data can be stored as a .SIP file and recalled later
- Useful to both fabricators and design companies

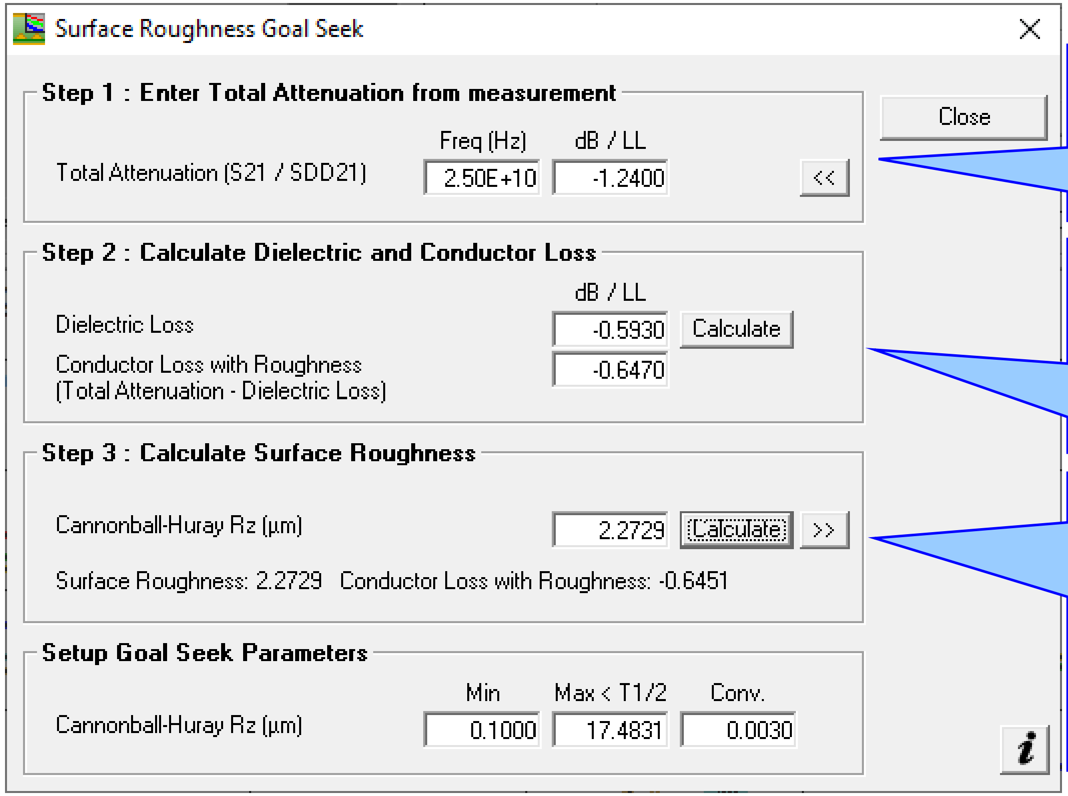
Surface Roughness Goal Seek option

New option to back calculate the surface roughness value for a structure from the insertion loss measurement data. The measurements can be generated using the Polar Atlas system or others that are capable of measuring insertion loss.

Cyan = Modelled Attenuation with Roughness (insertion loss)
Brown = Insertion Loss measurement data from Polar Atlas



Surface Roughness Goal Seek option

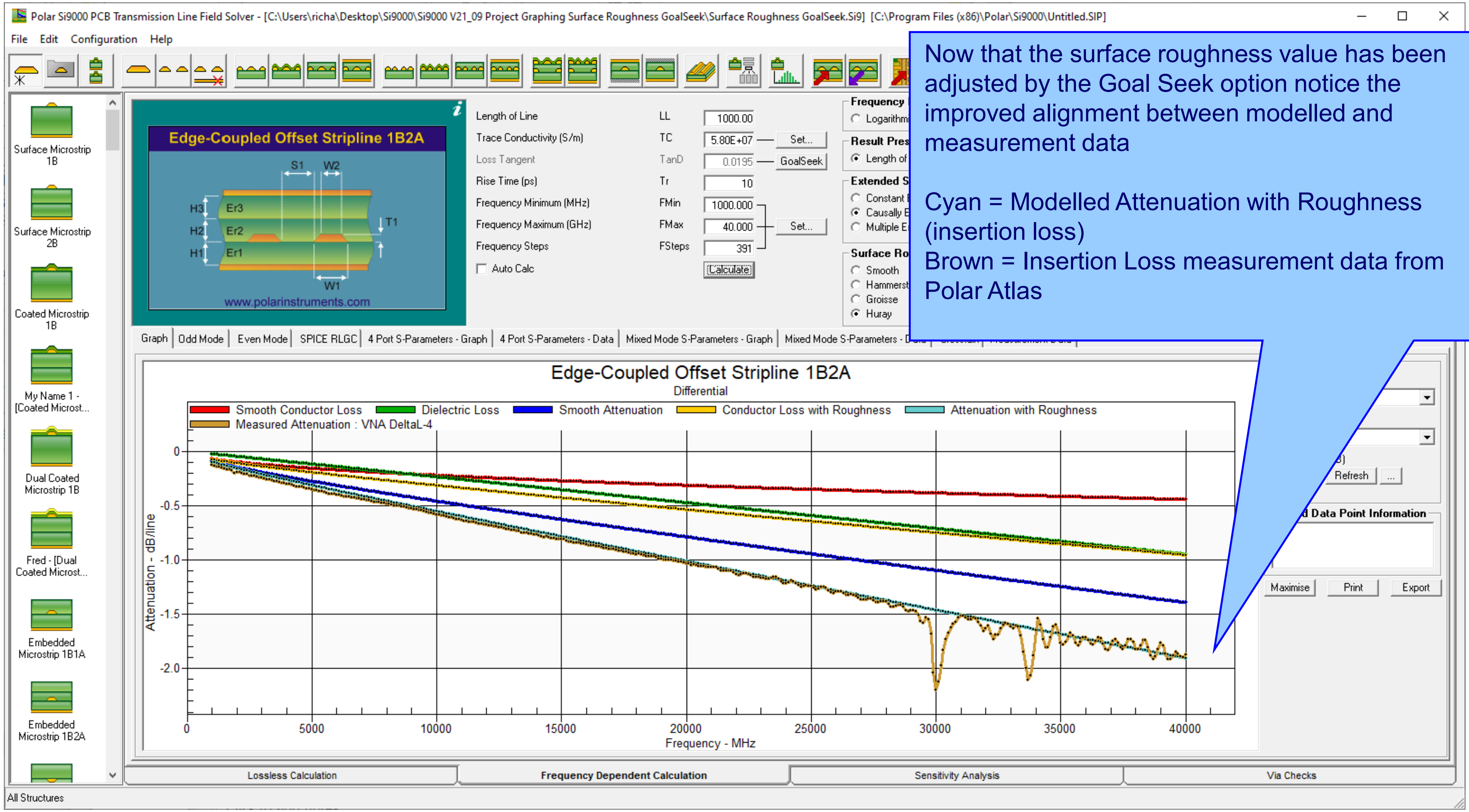


Step 1
Key in or pick the total attenuation (S21 / SDD21) at a given frequency from the insertion loss measurement data

Step 2
Calculate the dielectric loss for the frequency entered from the current structure parameters. Subtracting this calculated dielectric loss from the total attenuation will leave the target conductor loss

Step 3
Use the Si9000 Goal Seek algorithm to vary the surface roughness until it matches the required value to achieve the conductor loss as calculated in Step 2.
In this example a Surface Roughness of 2.2729 µm is required

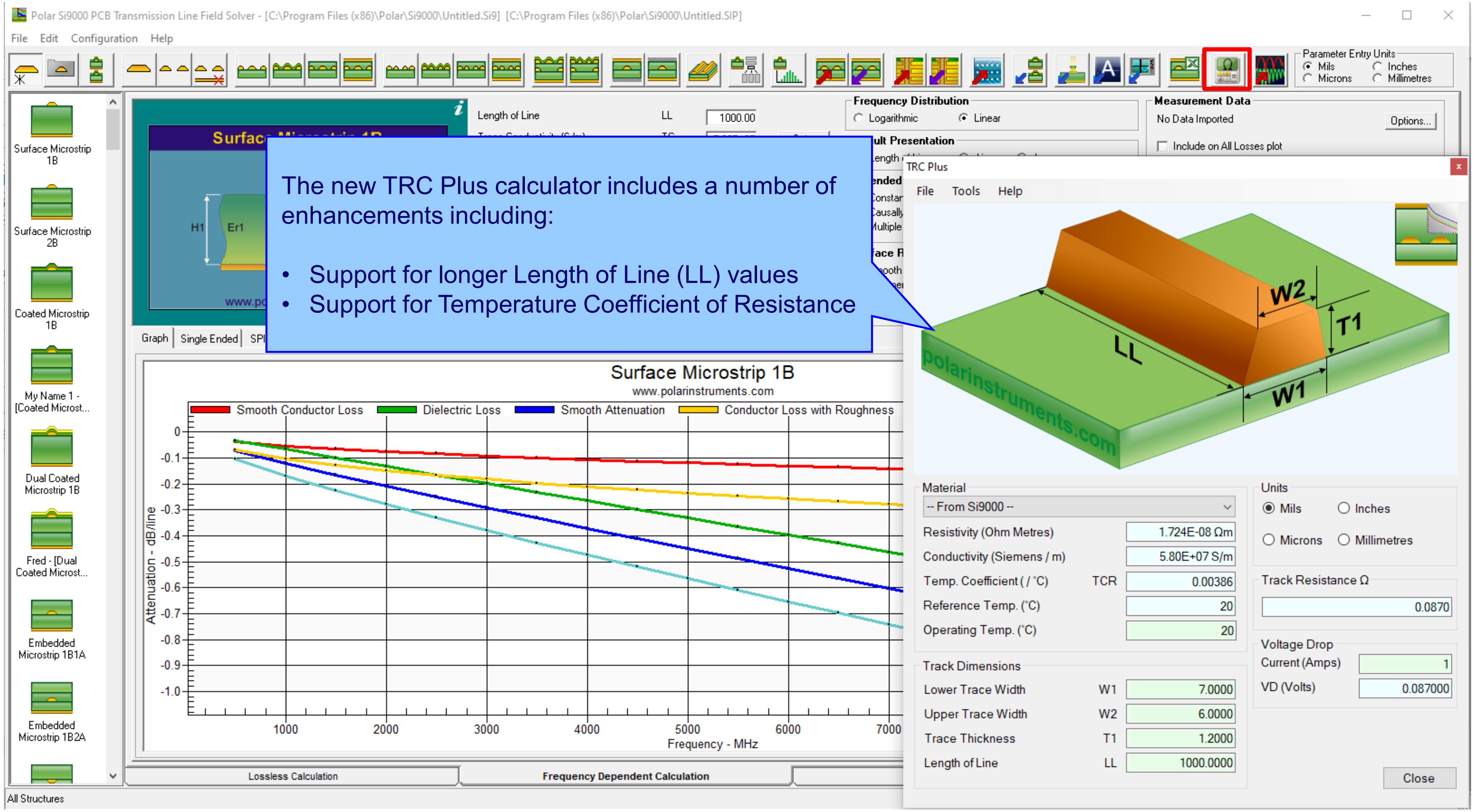
Surface Roughness Goal Seek option



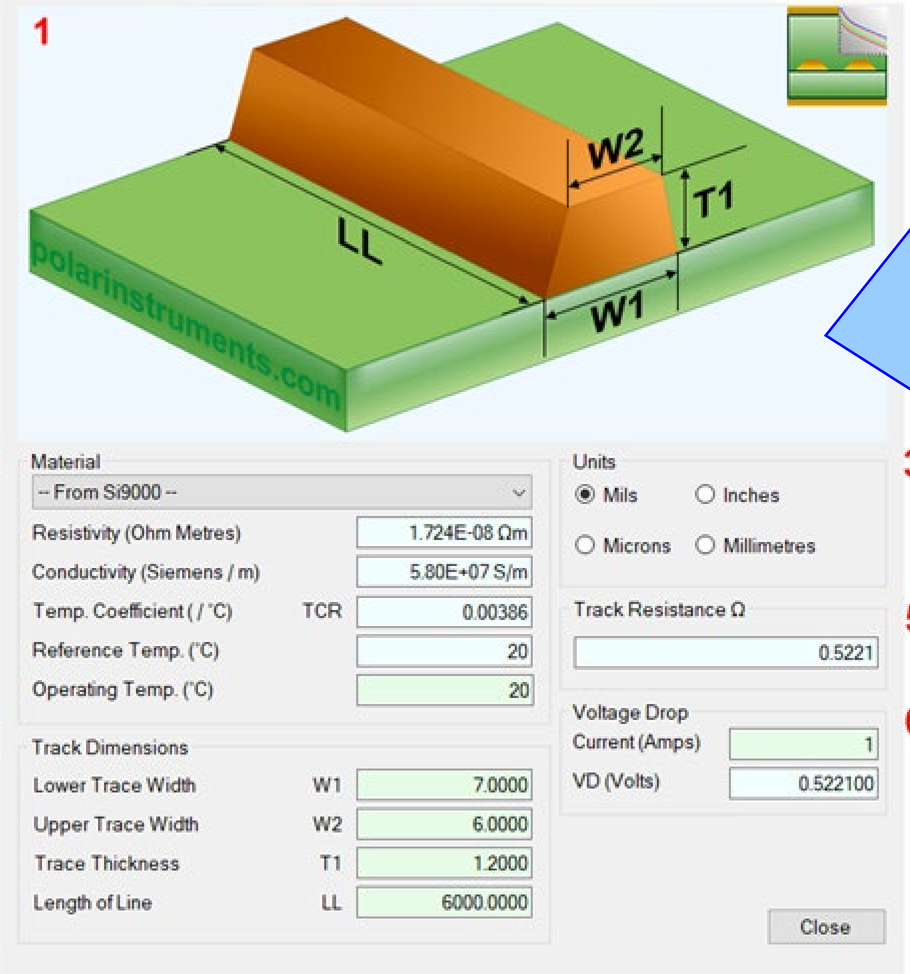
Now that the surface roughness value has been adjusted by the Goal Seek option notice the improved alignment between modelled and measurement data

Cyan = Modelled Attenuation with Roughness (insertion loss)
Brown = Insertion Loss measurement data from Polar Atlas

Track Resistance Calculator (TRC Plus)



Track Resistance Calculator (TRC Plus)



1. Interactive track material image.
Clicking on a track parameter label will highlight the associated Track Dimension field (text box). Enter data into the active field.

Double-clicking anywhere on the image will bring up the Materials Editor.

2. Material selection and properties
Select the material via the drop-down list.

Fields coloured in light-blue are not directly editable but the field values can be in the Materials Editor.

Fields coloured in light-green are editable by the user. For example, Operating Temperature will determine a material's resistivity at that temperature, which in turn will be applied in calculating the track resistance.

3. Units
Switch to your preferred units by clicking the associated option button – imperial units include Mils (Thou) and Inches; for metric units choose Microns (Micrometres) or Millimetres.

4. Track or trace dimensions
Enter or change track dimensions in the Track Dimensions in the chosen units.

5. Resistance result
Calculation of the track resistance. The result should update immediately upon any changes to the editable (light-green) fields.

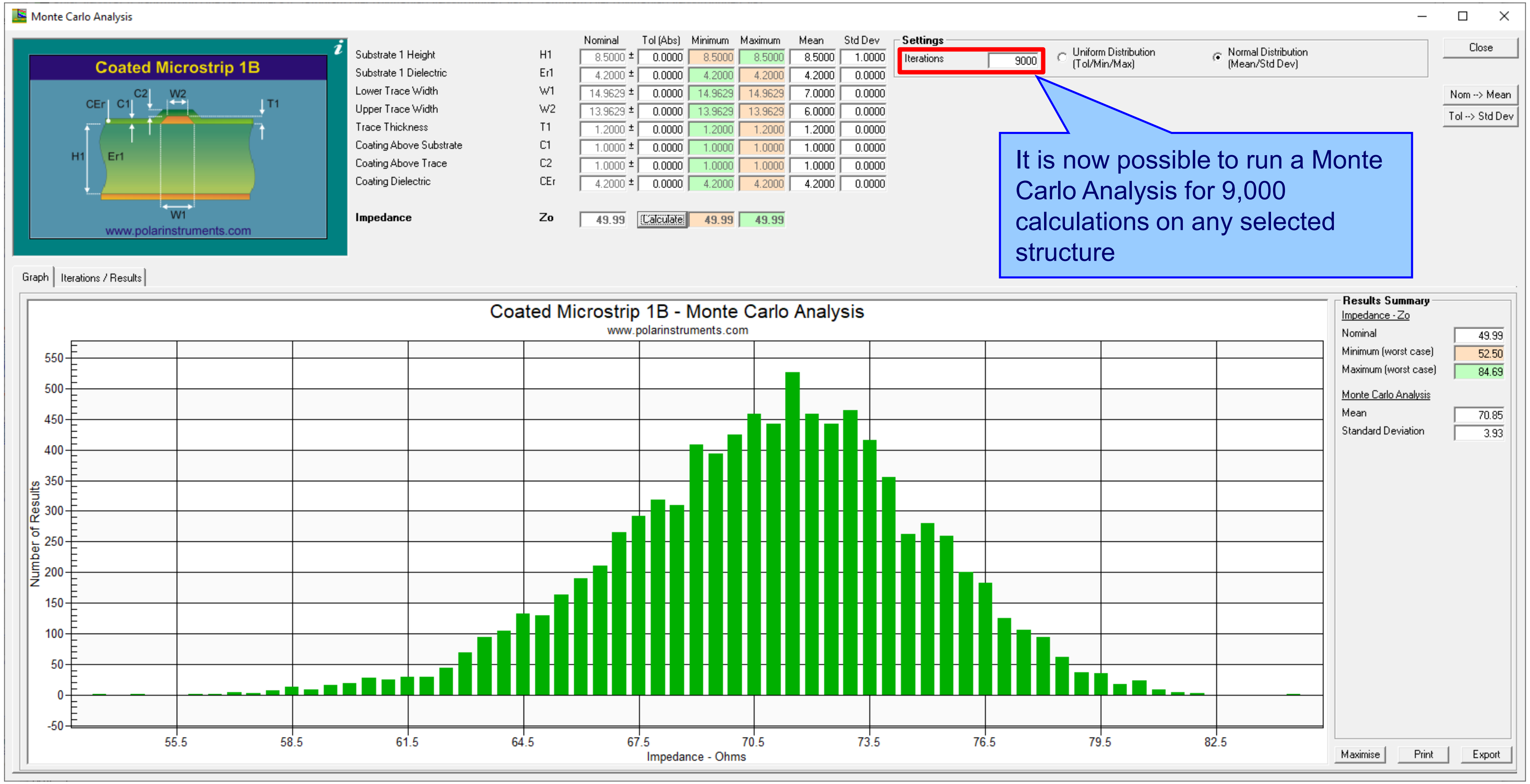
6. Voltage Drop calculation result
The calculated Voltage Drop is displayed in the VD (Volts) text box

Other enhancements

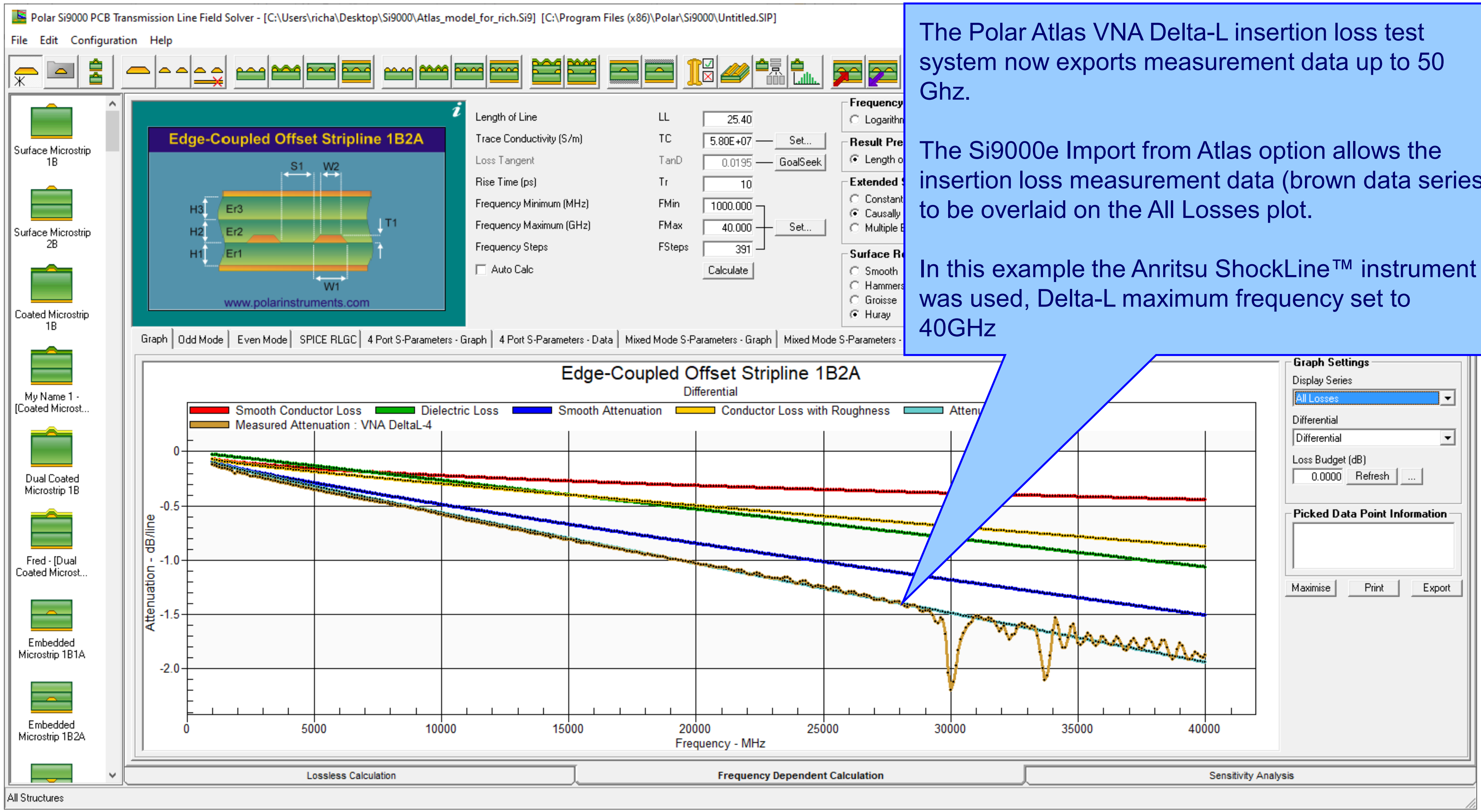
- Monte Carlo Analysis. New option added to export the Iterations / Results to Clipboard (for Excel), accessible from the right-click menu
- Causally Extrapolated Substrate Data. New option added to export the Results to Clipboard (for Excel), accessible from the right-click menu

Si9000e v21.04 (April 2021)

Monte Carlo Analysis maximum iteration increased to 9000



Import from Atlas enhanced to support measurement data to 50GHz



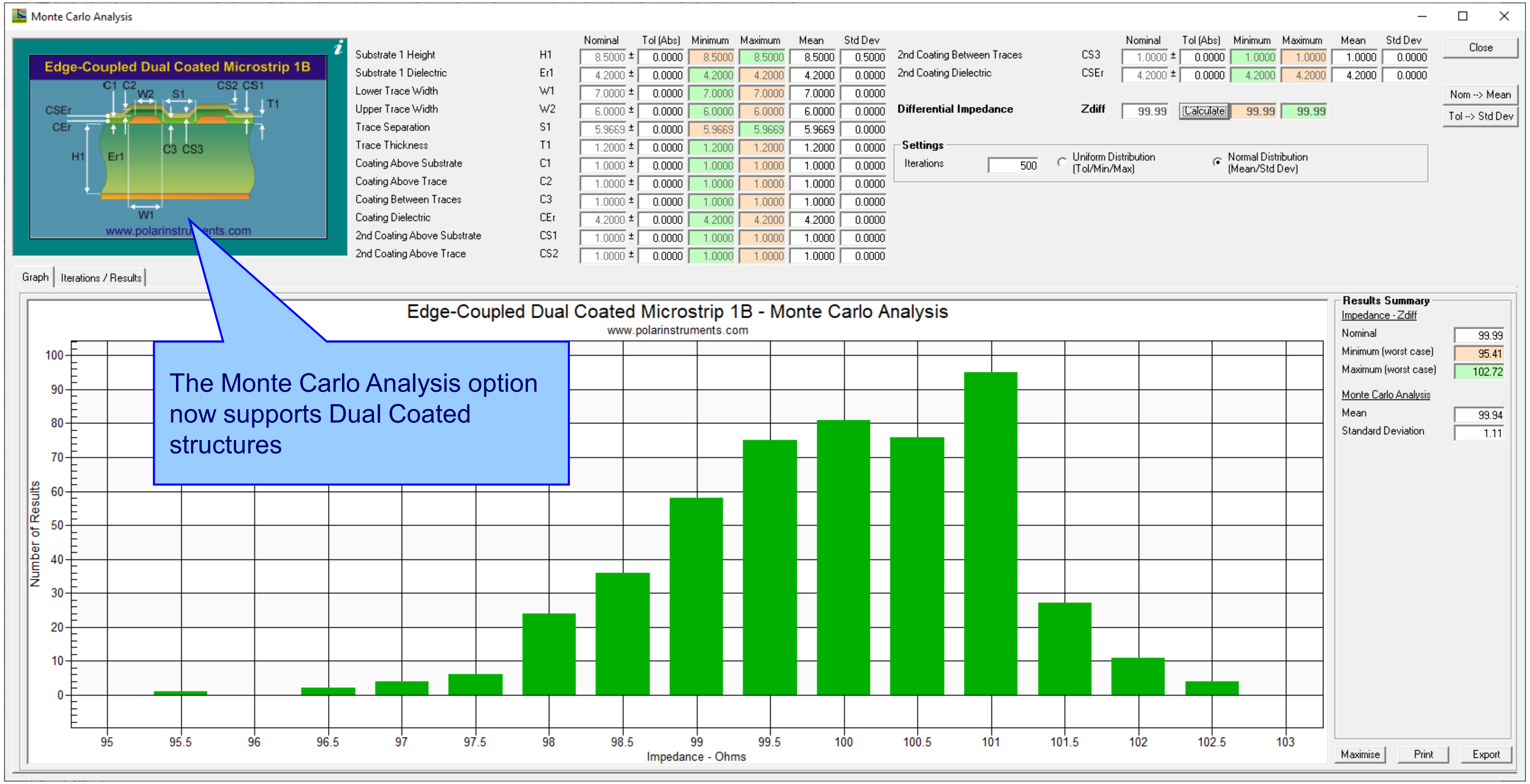
The Polar Atlas VNA Delta-L insertion loss test system now exports measurement data up to 50 Ghz.

The Si9000e Import from Atlas option allows the insertion loss measurement data (brown data series) to be overlaid on the All Losses plot.

In this example the Anritsu ShockLine™ instrument was used, Delta-L maximum frequency set to 40GHz

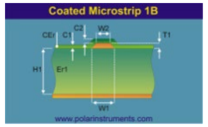
Si9000e v21.01 (January 2021)

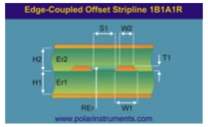
Monte Carlo support added for Dual Coated structures

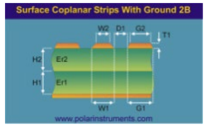


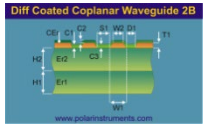
Other enhancements

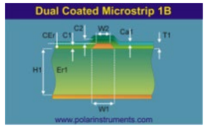
- FlexNet Publisher / FLEXlm v11.17.2.0 supported

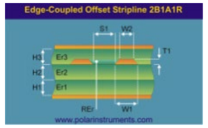


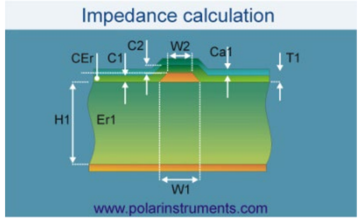


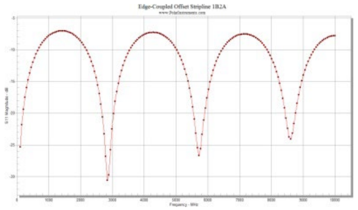


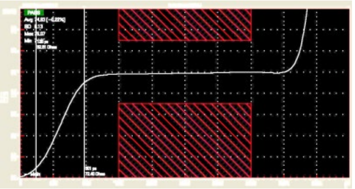


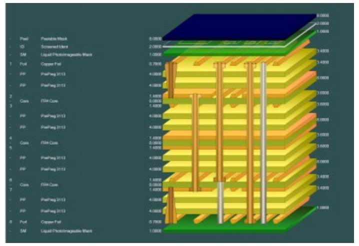


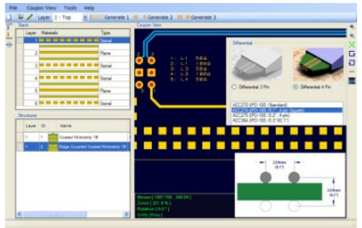












Thank you for viewing this Si9000e 2021 – 2022 preview. If you have questions we would be delighted to help you. Your local contact information is contained on the following slide

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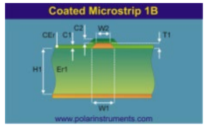

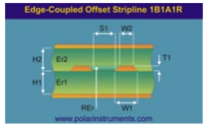

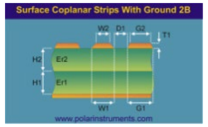

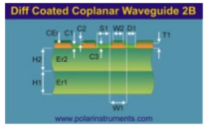

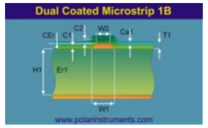

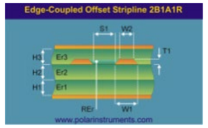

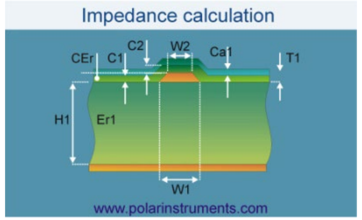

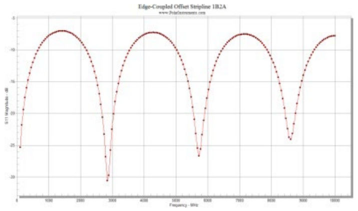
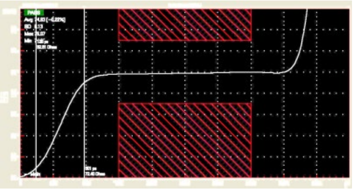
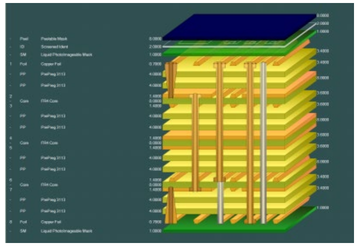
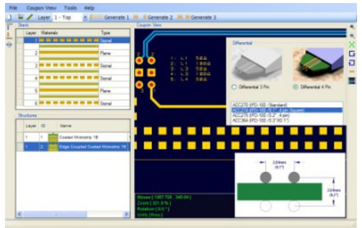

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