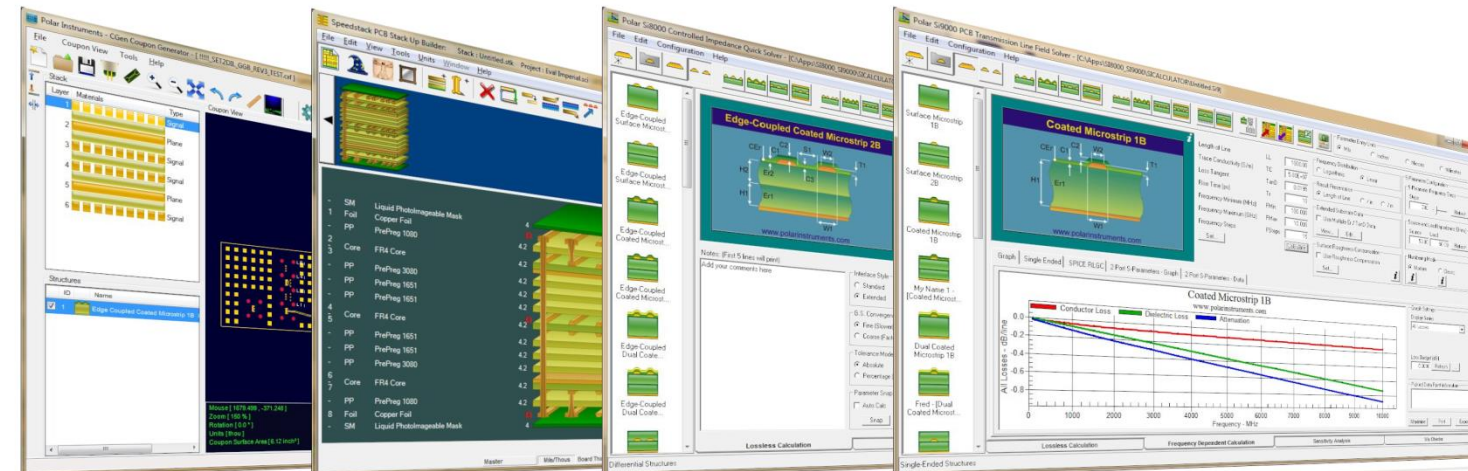
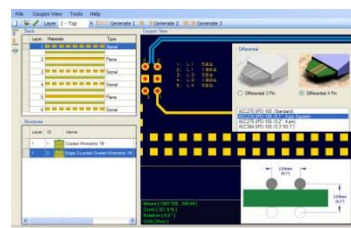
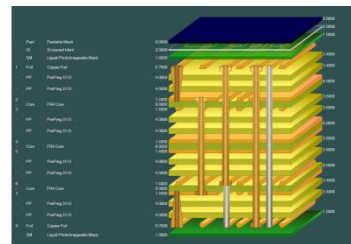
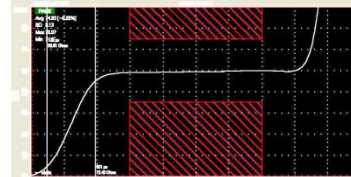
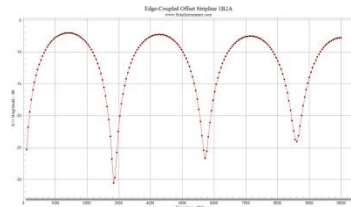
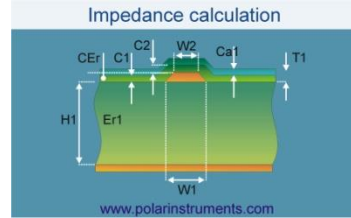




# Si8000m 2021 - 2022 Preview

Richard Attrill – September 2022 (Rev 3)



## Introducing the latest features of Si8000m

Welcome to a preview of Si8000m.

Since January 2021 we have released seven versions of Si8000m, each introducing a number of new features that have been requested through our Polarcare software maintenance service.

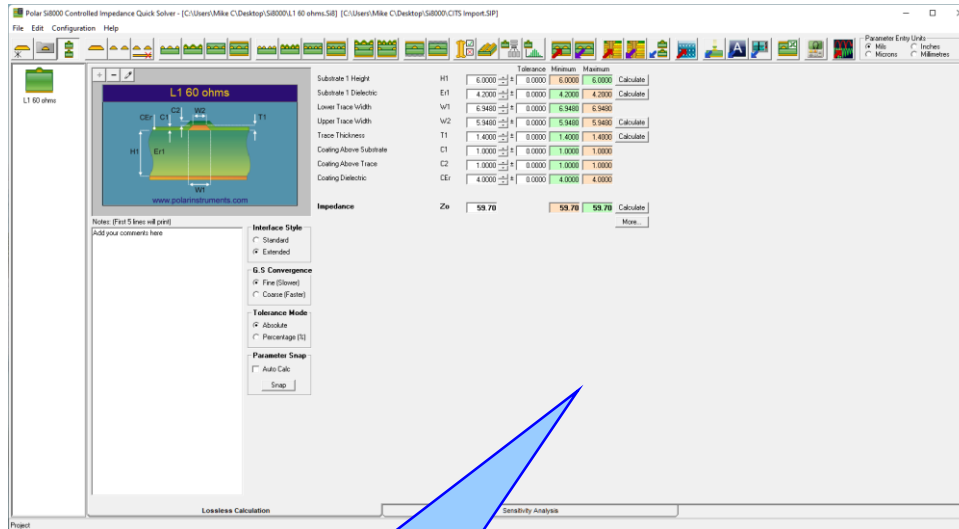
These slides are arranged in a “newest first” format. A slide containing the version number and release date precedes information detailing the new features contained in each release.

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

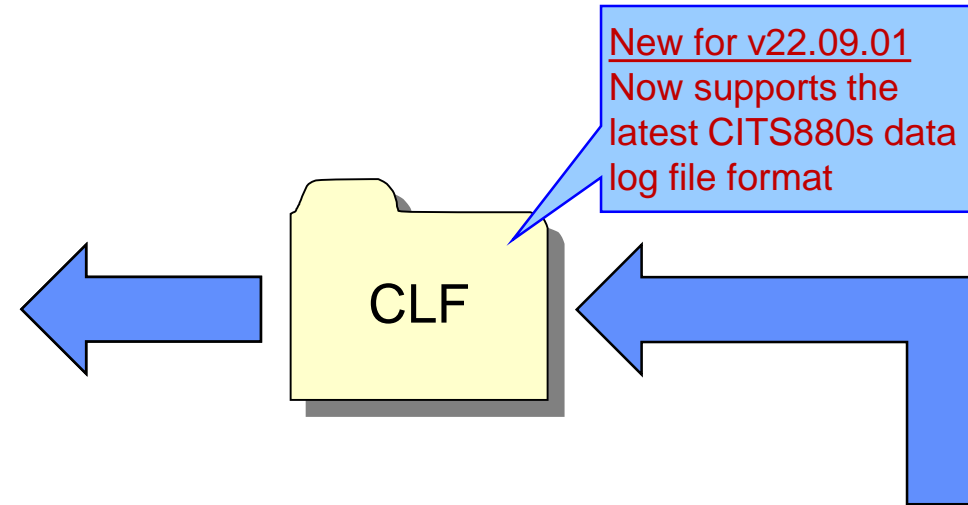
*Please note: the Si8000m units have been set to Mils in the following screen grabs*

# Si8000m v22.09.01 (September 2022)

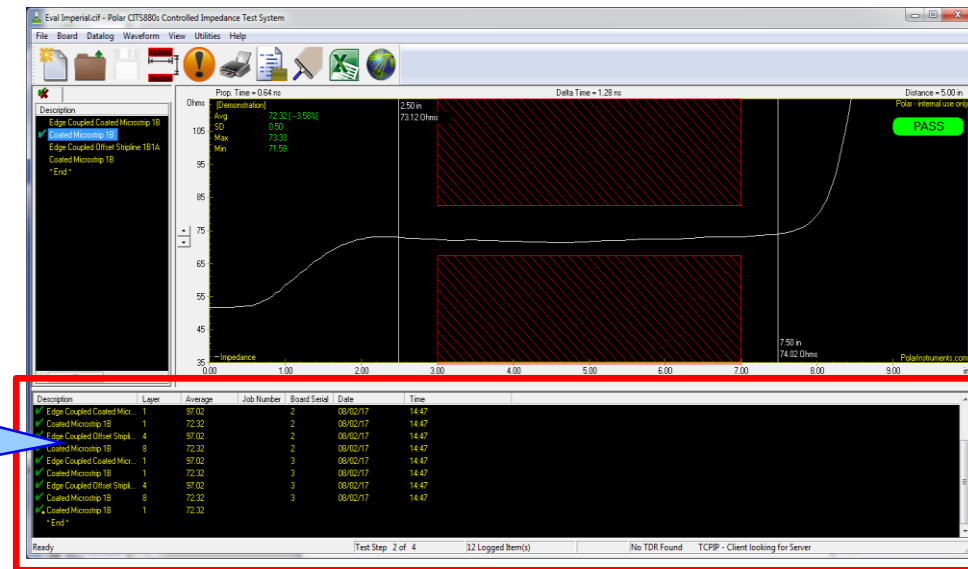
# Enhancements to the Import Polar CITS Datalog File option



**Overview**  
 The Polar Si8000m / Si8000m field solver products have the capability to read a Polar CITS Data Log File (.CLF). This file contains comprehensive impedance measurement data and, along with existing modelled structure information, offers graphing capabilities and statistical analysis where the modelled and measured data can be presented together.



**New for v22.09.01**  
 Now supports the latest CITS880s data log file format



The Data Log of the CITS software is stored in a CLF file

## Import CITS Datalog File option – feature recap

Whilst working with controlled impedance designs it is often desirable to compare the reality of the measurement data against the modelled structure.

‘Closing the loop’ between the predicted and actual measured results has a number of benefits for both the design and fabrication environments. It allows for fine tuning of the structure parameters in future manufacturing batches, statistical analysis and improved overall process control.

This capability within the Polar’s Si8000m / Si8000m field solver products allows the user to quickly import measurement data directly from the industry-standard Polar Controlled Impedance Test System (CITS).

If you are a design customer using the Si8000m / Si8000m and would like to use this feature, please request the Polar CITS Datalog File from your fabricator.

# Import CITS Datalog File option – feature recap

ed Impedance Quick Solver - [C:\Users\Mike C\Desktop\Si8000\L1 60 ohms.Si8] [C:\Users\Mike C\Desktop\Si8000\CITS Import.SIP]

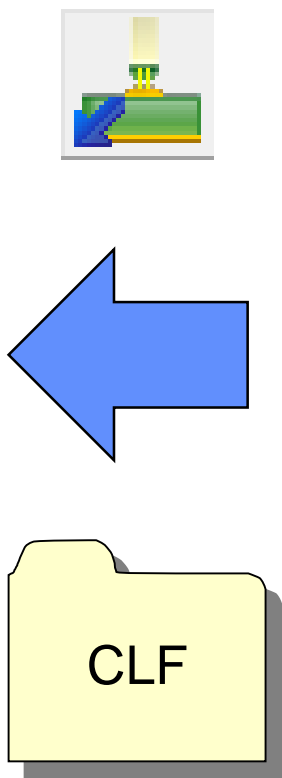
in Help

		Tolerance	Minimum	Maximum	
Substrate 1 Height	H1	± 0.0000	6.0000	6.0000	Calculate
Substrate 1 Dielectric	Er1	± 0.0000	4.2000	4.2000	Calculate
Lower Trace Width	W1	± 0.0000	6.9480	6.9480	
Upper Trace Width	W2	± 0.0000	5.9480	5.9480	
Trace Thickness	T1	± 0.0000	1.4000	1.4000	
Coating Above Substrate	C1	± 0.0000	1.0000	1.0000	
Coating Above Trace	C2	± 0.0000	1.0000	1.0000	
Coating Dielectric	CEr	± 0.0000	4.0000	4.0000	
<b>Impedance</b>	<b>Zo</b>		<b>59.70</b>	<b>59.70</b>	

Notes: (First 5 lines will print)  
Add your comments here

**Interface Style**  
 Standard  
 Extended

The 'Import CITS file' toolbar option. On selecting this option a dialog guides the user through the import process



# Import CITS Datalog File option – feature recap

The screenshot shows the 'Import CITS File' dialog box. It is divided into two steps: 'Step 1: Read CITS Log File' and 'Step 2: Select Data Log Record'. Step 1 includes fields for 'Filename', 'Instrument Model' (CITS880), 'Instrument Serial No' (17581), 'Data Log Record Count' (160), 'Per Board / Coupon' (4), and 'Board / Coupon Count' (40). Step 2 includes a 'Data Log Records' dropdown menu, 'Project Structure' dropdown, 'Description' (L01), and 'Layer' (1). A 'Graph' tab is active, showing a line graph of 'Impedance - Ohms' vs 'Index' for 'L1 60 ohms'. The graph has a red horizontal line at 60 Ohms and a green line representing measured data. A 'Graph Settings' panel on the right has 'Impedance Options' and 'Impedance Results' sections. A 'Picked Data Point Information' panel is at the bottom right.

**Callout 1:** Once the CITS CLF data log file has been identified the software reads key information – Instrument Model, Serial Number, Data Log Record Count, Tests per Board / Coupon

**Callout 2:** A Data Log Records dropdown list built from the data log file, allowing the user to select the appropriate test records they would like to view / plot

**Callout 3:** The Project Structure dropdown presents a list of structures currently available within the Project. Together with the Data Log Records dropdown it allows the user to quickly match the data log records against the correct structure

**Callout 4:** It is possible to plot the modelled and measured impedance data in a number of ways. The following slides provide more details

## Import CITS Datalog File option – feature recap

**Step 2 : Select Data Log Record**

Data Log Records	Description - L01, Layer - 1, Nominal Impedance - 60.00
Project Structure	Description - L01, Layer - 1, Nominal Impedance - 60.00 Description - L03, Layer - 3, Nominal Impedance - 60.00 Description - L06, Layer - 6, Nominal Impedance - 60.00 Description - L08, Layer - 8, Nominal Impedance - 60.00
Description	
Nominal Impedance	60.00 Tol+ % 10.00 Tol- % 10.00

Each test record type found in the data log file is listed in the drop down. In this case there are four tests.

**Step 2 : Select Data Log Record**

Data Log Records	Description - L01, Layer - 1, Nominal Impedance - 60.00
Project Structure	L1 60 ohms (1)
Description	L1 60 ohms (1) L3 60 ohms (2) L6 60 ohms (3) L8 60 ohms (4)
Nominal Impedance	

To match one of the four modelled structures from the Project group against a data log test record simply select the structure from the Project Structure dropdown

Polar Si8000 Control  
File Edit Configurati

L1 60 ohms (1)  
L3 60 ohms (2)  
L6 60 ohms (3)  
L8 60 ohms (4)

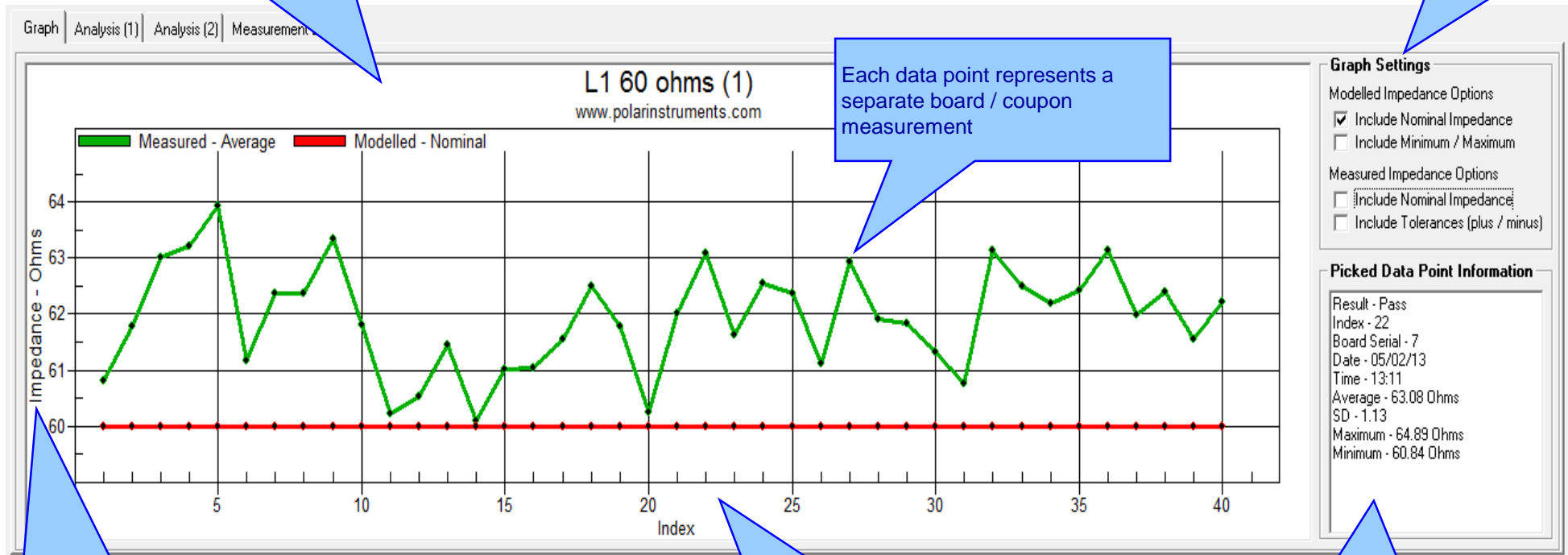
Four structures loaded into the Project group



# Import CITS Datalog File option – feature recap

The Graph tab provides a number of plot options. In this case the measured data is shown in Green, the modelled data in Red

Graph Settings allow the selection of modelled / measured data to be plotted



Each data point represents a separate board / coupon measurement

The y-axis is the measured impedance for each board / coupon

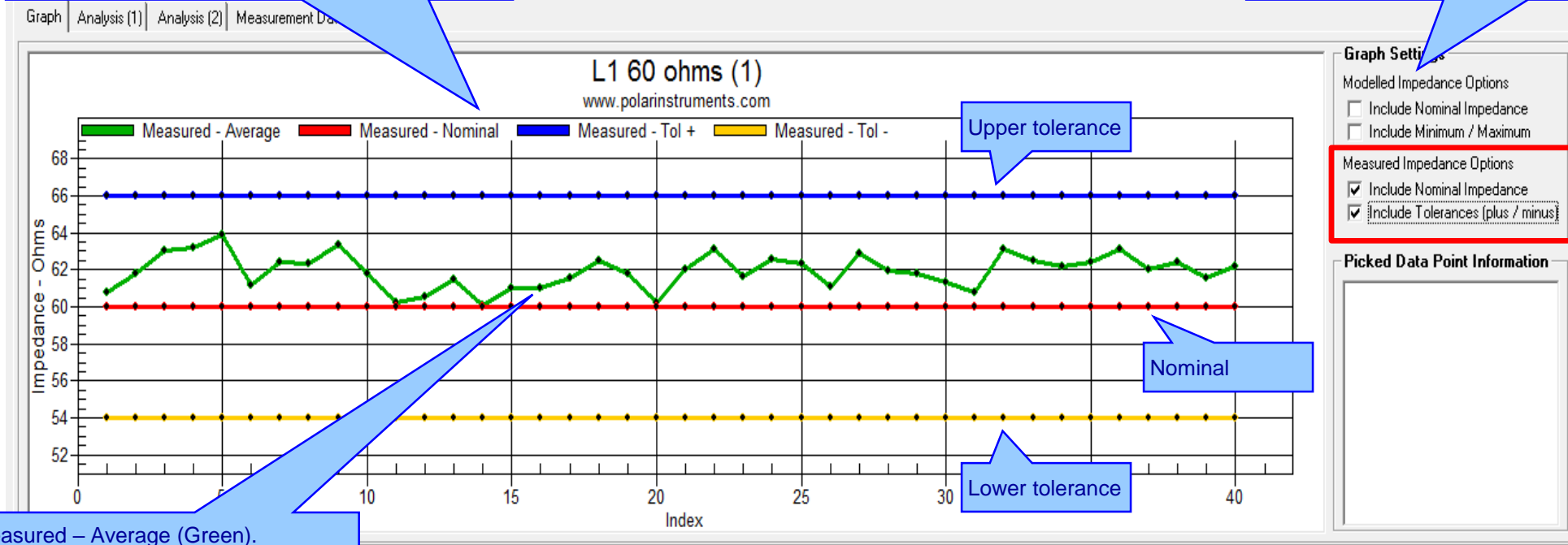
The x-axis is the identifying Index of the board / coupon read from the data log file

It is possible to pick a measured data point, key information is displayed here

# Import CITS Datalog File option – feature recap

In this case the Graph contains:  
 Measured – Average (Green)  
 Nominal (Red)  
 Upper Tolerance (Blue)  
 Lower Tolerance (Yellow)

Graph Settings allow the selection of modelled / measured data to be plotted

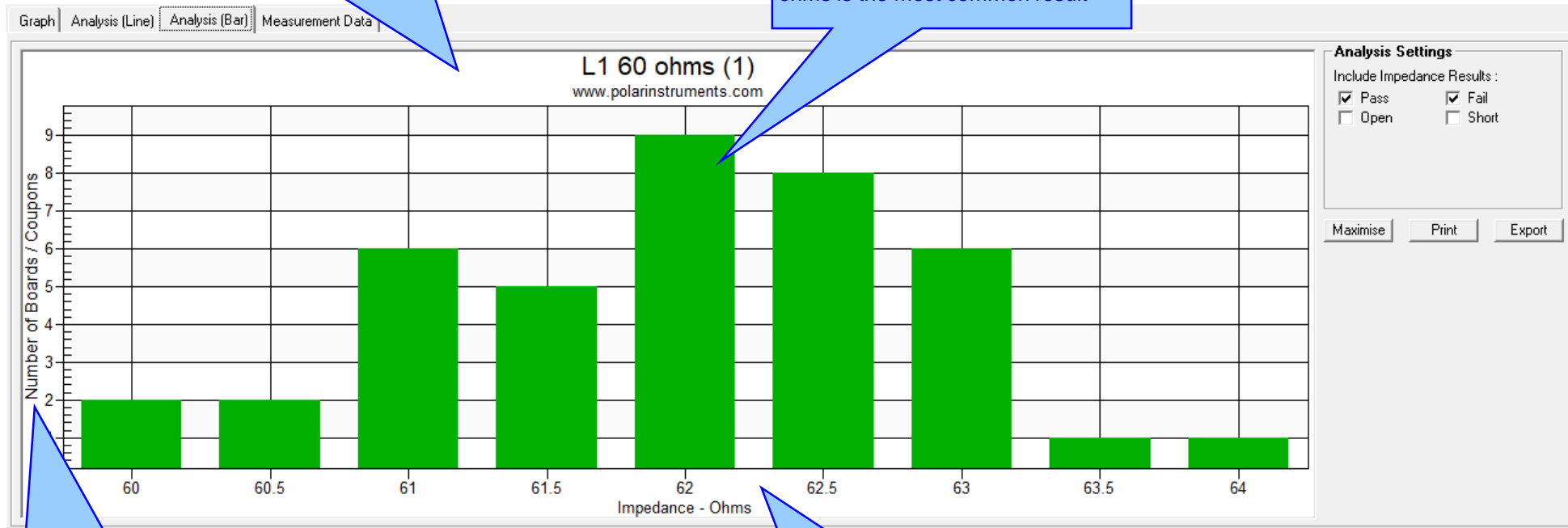


Measured – Average (Green).  
 Whilst reading slightly higher than the Nominal (60 ohms) all measured data points are within the upper and lower tolerance bands

## Import CITS Datalog File option – feature recap

Analysis options:  
This bar chart shows the distribution of measurement results over an impedance range

From this batch of 40 board / coupon measurements, 62 +/- 0.25 ohms is the most common result



The y-axis is the number of boards / coupons that fall within a given impedance as detailed on the x-axis

The x-axis is the measured impedance in 0.5 ohm increments

## Import CITS Datalog File option – feature recap

Measurement Data:  
The CITS Data Log data may also be viewed in a data grid layout. This is especially useful for viewing the Result data (Pass / Fail)

Result	Index	Board Serial	Date	Time	Average	SD	Maximum	Minimum	Station	Description	Layer	Nominal	Tol+ %	Tol- %	Instrument	Serial No
Passed	1	24	05/02/13	12:48	60.8	0.8	61.9	59.56	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	2	29	05/02/13	12:50	61.77	0.95	63.21	59.93	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	3	17	05/02/13	12:51	63.01	0.94	64.48	61.68	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	4	39	05/02/13	12:52	63.22	1.07	64.62	61.29	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	5	8	05/02/13	12:59	63.93	0.95	65.32	62.2	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	6	10	05/02/13	13:00	61.17	0.89	62.69	59.63	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	7	32	05/02/13	13:01	62.38	0.88	63.58	60.72	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	8	21	05/02/13	13:01	62.37	0.82	63.88	60.98	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	9	4	05/02/13	13:02	63.35	0.68	64.41	61.75	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	10	33	05/02/13	13:03	61.81	0.78	62.95	60.09	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	11	18	05/02/13	13:03	60.22	0.62	61.48	59.09	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	12	3	05/02/13	13:04	60.54	0.75	62.1	59.19	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	13	15	05/02/13	13:05	61.46	0.73	62.83	60.12	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	14	2	05/02/13	13:05	60.09	0.67	61.24	58.57	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	15	23	05/02/13	13:06	61.01	0.78	62.4	59.69	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	16	5	05/02/13	13:07	61.05	0.63	62.14	59.49	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	17	6	05/02/13	13:07	61.54	0.8	62.98	60.11	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	18	76	05/02/13	13:08	62.49	0.92	63.44	60.32	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	19	11	05/02/13	13:09	61.79	0.83	63.08	60.37	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	20	31	05/02/13	13:09	60.25	0.65	61.37	58.85	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	21	12	05/02/13	13:10	62.01	0.69	63.24	60.65	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	22	7	05/02/13	13:11	63.08	1.13	64.89	60.84	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581
Passed	23	19	05/02/13	13:11	61.63	0.72	62.81	60.19	_TEST STATION 1_	L01	1	60	10	10	CITS880	17581

# Si8000m v22.04 (April 2022)

# New Differential Via Calculation capability

The screenshot shows the Polar Si8000 Controlled Impedance Quick Solver interface. A red box highlights the 'Via Checks' icon in the toolbar. A blue callout box contains the following text:

The new Via Checks toolbar option. This Differential Via Calculation is now part of a new tabbed Via Checks dialog accessible from the toolbar. It also contains the Via Stub Check and Via Pad / Anti Pad Coaxial Calculation that were previously present on the main interface

The software interface includes a central diagram of an 'Edge-Coupled Coated Microstrip 1B' with various parameters labeled (H1, Er1, W1, S1, W2, T1, C1, C2, C3, CEr). To the right, a table lists these parameters with their values and tolerance ranges:

Parameter	Value	Tolerance	Minimum	Maximum	Action
H1	8.5000	±0.0000	8.5000	8.5000	Calculate
Er1	4.2000	±0.0000	4.2000	4.2000	Calculate
W1	5.0000	±0.0000	5.0000	5.0000	
W2	4.0000	±0.0000	4.0000	4.0000	
S1	2.2810	±0.0000	2.2810	2.2810	
T1	1.2000	±0.0000	1.2000	1.2000	
C1	1.0000	±0.0000	1.0000	1.0000	
C2	1.0000	±0.0000	1.0000	1.0000	
C3	1.0000	±0.0000	1.0000	1.0000	
CEr	4.2000	±0.0000	4.2000	4.2000	
Zdiff	85.02				

Below the diagram, there are sections for 'Interface Style' (Standard, Extended), 'G.S Convergence' (Fine (Slower), Coarse (Faster)), 'Tolerance Mode' (Absolute, Percentage (%)), and 'Parameter Snap' (Auto Calc, Snap).

# New Differential Via Calculation

Via Checks
Close

Via Stub Check
Via Pad / Anti-Pad Calculation
Differential Via Calculation

Differential Via Calculation

www.polarinstruments.com

Please refer to the parameters in parentheses when reading [Application Note](#)  
 Courtesy of Bert Simonovich, Lamsim Enterprises Inc

Note: The model works for a simple differential pair structure with no pads and several planes throughout the board. If there is, say, only a 4 or 6 layer stackup, there will not be sufficient excess capacitance from the planes so the accuracy will suffer. When planes are spaced like modern designs it will be more accurate.

**Anti-Pad Style**

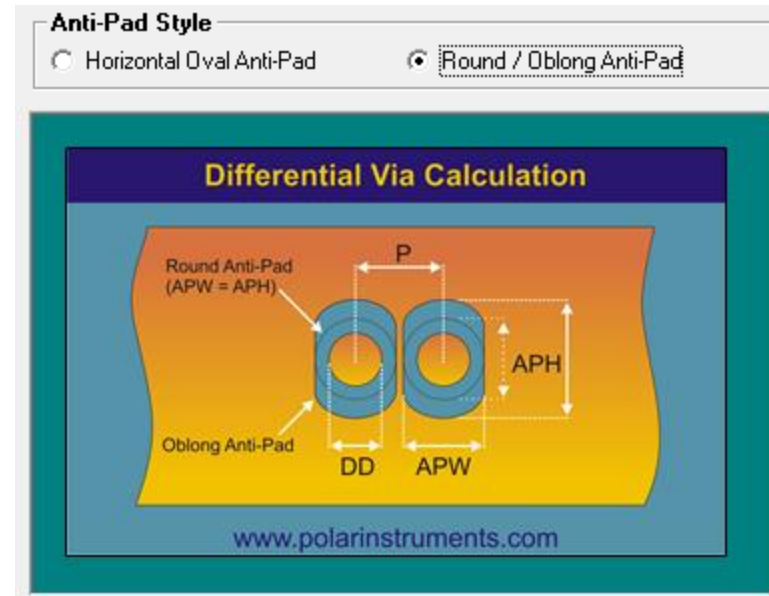
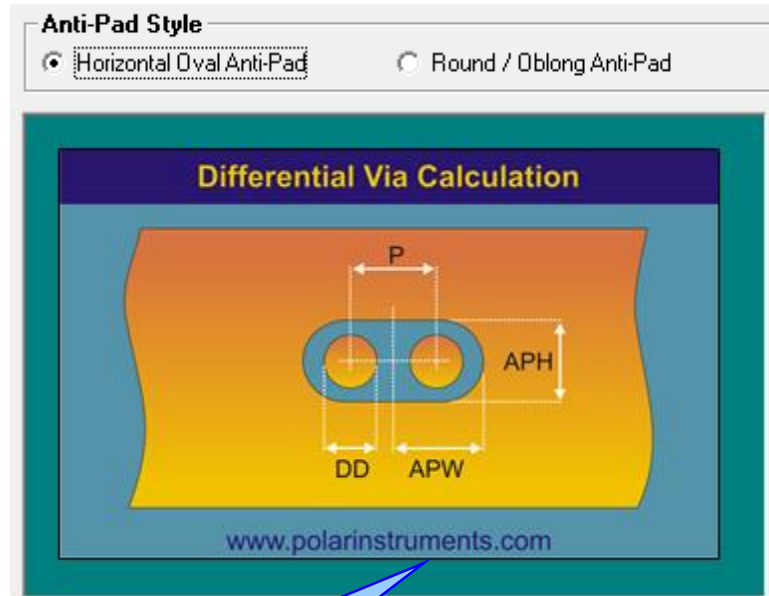
Horizontal Oval Anti-Pad
  Round / Oblong Anti-Pad

Drill Diameter (t)	DD	<input type="text" value="15.0000"/>	
Via Pitch (S)	P	<input type="text" value="35.0000"/>	
Anti-Pad Width (b)	APW	<input type="text" value="50.8000"/>	
Anti-Pad Height (w')	APH	<input type="text" value="50.8000"/>	
Dielectric Constant (Dkz)	Dkz	<input type="text" value="3.6350"/>	
Dielectric Anisotropy (%)		<input type="text" value="0.00"/>	
Odd Mode Impedance (Zvia)    Zodd <input type="text" value="42.44"/>			
Differential Impedance        Zdiff <input type="text" value="84.88"/>			
Effective Dielectric Constant    DkEff <input type="text" value="4.4430"/>			

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

Via Checks

Via Stub Check | Via Pad / Anti-Pad Calculation | Differential Via Calculation

Please refer to the parameters in parentheses when reading [Application Note](#)  
 Courtesy of Bert Simonovich, Lamsim Enterprises Inc

Note: The model works for a simple differential pair structure with no pads and several reference planes so the accuracy will be high. If there will not be sufficient excess capacitance on the reference planes so the accuracy will be low.

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

AP8204.pdf 1 / 9 100%

### 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.

HLD Plan

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

# Si8000m v22.02 (February 2022)

# Track Resistance Calculator (TRC Plus) enhancements

		Tolerance	Minimum	Maximum	
H1	2.5000	± 0.0000	2.5000	2.5000	Calculate
Er1	4.2000	± 0.0000	4.2000	4.2000	Calculate
W1	3.9752	± 0.0000	3.9752	3.9752	Calculate
W2	2.9752	± 0.0000	2.9752	2.9752	Calculate
T1	0.7000	± 0.0000	0.7000	0.7000	Calculate
C1	1.0000	± 0.0000	1.0000	1.0000	Calculate
C2	1.0000	± 0.0000	1.0000	1.0000	Calculate
CEr1	4.2000	± 0.0000	4.2000	4.2000	Calculate
Impedance	Zo	50.00	50.00	50.00	Calculate

# Track Resistance Calculator (TRC Plus) enhancements

The screenshot displays the TRC Plus software interface. At the top left, there is a menu bar with 'File', 'Tools', and 'Help'. The main window is titled 'TRC Plus' and 'Si9000'. On the left, a 3D model of a 'Single Ended Coated Microstrip 1B' is shown with dimensions labeled: LL (Length of Line), W1 (Lower Trace Width), W2 (Upper Trace Width), and T1 (Trace Thickness). Below the model is a 'Material & Calculated Impedance' section with a dropdown menu set to '-- From Si8000 / Si9000 --'. It includes fields for 'Calculated Impedance (Zo)' (50), 'Resistivity (Ohm Metres)' (1.724E-08  $\Omega$ m and 5.80E+07 S/m), and 'TCR' (0.00386). A 'Track Dimensions' section on the left lists: Lower Trace Width (W1: 3.9752), Upper Trace Width (W2: 2.9752), Trace Thickness (T1: 0.7000), and Length of Line (LL: 8000.0000). A 'Units' section has radio buttons for Mils (selected), Inches, Microns, and Millimetres. A 'Track Resistance  $\Omega$ ' section has input fields for 'Single Trace' (2.2323) and 'Dual Trace'. A 'Voltage Drop (Single Trace)' section has 'Current (Amps)' (1) and 'VD (Volts)' (2.232285). On the right, a graph plots 'Resistance  $\Omega$ ' (y-axis, 0.00 to 2.50) against 'Line Length (Mils)' (x-axis, 0 to 9000). A blue line starts at (0,0) and ends at (8000, 2.2323). A blue callout box points to the graph with the text: 'This new TRC Plus graphing feature shows the track resistance (y-axis) plotted against the line length (x-axis)'. At the bottom right, there are checkboxes for 'Show Grid Lines' (checked), 'Tracking', and 'Dark Mode', along with a 'TDR View' section with 'On' and 'Adjust Y Scale' controls. A 'Close' button is at the bottom right.

# Track Resistance Calculator (TRC Plus) enhancements

TRC Plus

File Tools Help

Si9000

Single Ended Coated Microstrip 1B

Material & Calculated Impedance

-- From Si8000 / Si9000 --

Calculated Impedance (Zo)

Resistivity (Ohm Metres)

Conductivity (Siemens / m)

Temp. Coefficient (/ °C) TCR

Reference Temp. (°C)

Operating Temp. (°C)

Units

Mils  Inches

Microns  Millimetres

Track Resistance Ω

Single Trace

Dual Trace

Voltage Drop (Single Trace)

Current (Amps)

VD (Volts)

Track Dimensions

Lower Trace Width W1

Upper Trace Width W2

Trace Thickness T1

Length of Line LL

Ohms per division : 1

TDR indicative Ω

Line Length (Mils)

Show Grid Lines

Tracking

Dark Mode

TDR View

On

Adjust Y Scale

# Si8000m v21.09 (Sept 2021)

## 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

**Coated Microstrip 1B**

Parameter: H1 None Calculate  
 Range Start Value: 3.0000 4.0000  
 Range Finish Value: 12.0000  
 Increment: 1.0000 1.0000

Constant Impedance vs Changing Parameters  
 Parameter: W1 Calculate  
 Target Impedance: 50.0000  
 Process Window: Minimum / Maximum 67.5000 82.5000

**Coated Microstrip 1B - 50 Ohms**

The plot shows Substrate Height (H1) X-axis and the Trace Width (W1) Y-axis. Each data point represents the H1 / W1 parameter values to achieve 50 ohms.

H1 (Mils)	W1 (Mils)
3	5.000
4	6.667
5	7.500
6	8.333
7	9.000
8	9.667
9	10.200
10	10.714
11	11.200
12	11.667

Picked Data Point Information:  
 H1 (Mils): 5.000  
 W1: 8.657



# Populate a Project from Sensitivity Analysis Results

**Coated Microstrip 1B**

Impedance vs Changing Parameter(s)

Parameter: H1 None Calculate

Range Start Value: 3.0000 4.0000

Range Finish Value: 12.0000 1.0000

Changing Parameters: W1 Calculate

Minimum: 67.5000 82.5000

Graph: Results

H1	Er1	W1	W2	T1	C1	C2	CEr	Zo	Calc Success
3.0000	4.2000	4.5870	3.5870	1.2000	1.0000	1.0000	4.2000	50.0051	Yes
4.0000	4.2000	6.4263	5.4263	1.2000	1.0000	1.0000	4.2000	49.9918	Yes
5.0000	4.2000	8.2865	7.2865	1.2000	1.0000	1.0000	4.2000	49.9991	Yes
6.0000	4.2000	10.1886	9.1886	1.2000	1.0000	1.0000	4.2000	49.9957	Yes
7.0000	4.2000	12.0847	11.0847	1.2000	1.0000	1.0000	4.2000	50.0006	Yes
8.0000	4.2000	13.9988	12.9988	1.2000	1.0000	1.0000	4.2000	49.9906	Yes
9.0000	4.2000	15.9248	14.9248	1.2000	1.0000	1.0000	4.2000	49.9923	Yes
10.0000	4.2000	17.8508	16.8508	1.2000	1.0000	1.0000	4.2000	49.9952	Yes
11.0000	4.2000	19.7769	18.7769	1.2000	1.0000	1.0000	4.2000	50.0044	Yes
12.0000	4.2000	21.6909	20.6909	1.2000	1.0000	1.0000	4.2000	50.0043	Yes

Copy Results to Clipboard (for Excel)

Create Project Structures

Parameter Entry Units:  Mils  Inches  Microns  Millimetres

Single-Ended Structures

Lossless Calculation

Sensitivity Analysis

The Results tab contains the calculated results data used for the Sensitivity Analysis plot

The right-click menu now has a new Create Project Structures option. On selection the software will create an individual structure per row of the Results grid and add it to the Project. In this example there are 10 result rows so 10 structures will be created

The Project now contains 10 structures. Notice the structure name is auto-assigned based upon the sensitivity analysis parameters selected. In this example the H1 and W1 parameter values are used

# 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

Parameter	Tolerance	Minimum	Maximum	Calculate
H1	± 0.0000	5.0000	5.0000	Calculate
Er1	± 0.0000	4.2000	4.2000	Calculate
W1	± 0.0000	8.2865	8.2865	Calculate
W2	± 0.0000	7.2865	7.2865	Calculate
T1	± 0.0000	1.2000	1.2000	Calculate
C1	± 0.0000	1.0000	1.0000	Calculate
C2	± 0.0000	1.0000	1.0000	Calculate
CEr	± 0.0000	4.2000	4.2000	Calculate
Zo		50.00	50.00	Calculate

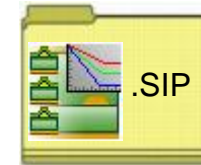
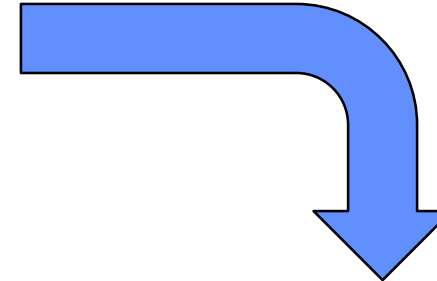
Structure Name: H1=5.0000 W1=8.2865 Zo=50.00

Project List:

- H1=3.0000 W1=4.58...
- H1=4.0000 W1=6.42...
- H1=5.0000 W1=8.2865 Zo=50.00**
- H1=6.0000 W1=10.18...
- H1=7.0000 W1=12.08...
- H1=8.0000 W1=13.99...
- H1=9.0000 W1=15.92...
- H1=10.0000 W1=17.85...

# Populate a Project from Sensitivity Analysis Results

Parameter	Value	Tolerance
Substrate 1 Height	H1	5.0000 ± 0.0000
Substrate 1 Dielectric	Er1	4.2000 ± 0.0000
Lower Trace Width	W1	8.2865 ± 0.0000
Upper Trace Width	W2	7.2865 ± 0.0000
Trace Thickness	T1	1.2000 ± 0.0000
Coating Above Substrate	C1	1.0000 ± 0.0000
Coating Above Trace	C2	1.0000 ± 0.0000
Coating Dielectric	CEr	4.2000 ± 0.0000
<b>Impedance</b>	<b>Zo</b>	<b>50.00</b>



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
- As a Project the structure data can be stored as a .SIP file and recalled later
- Useful to both fabricators and design companies

# Track Resistance Calculator (TRC Plus)

**Impedance vs Changing Parameter(s)**

Parameter: H1 None Calculate

Range Start Value: 3.0000 4.0000

Graph

H1	W1	W2	T1	LL	Zo	TCR
3.0000	4.2000	7.2337	6.2337	1.2000	45.3332	Yes
4.0000	4.2000	9.1658	8.1658	1.2000	49.9972	Yes
5.0000	4.2000	11.1038	10.1038	1.2000	49.9944	Yes
6.0000	4.2000	13.0417	12.0417	1.2000	50.0082	Yes
7.0000	4.2000	14.9917	13.9917	1.2000	50.0023	Yes
8.0000	4.2000	16.9417	15.9417	1.2000	50.0028	Yes
9.0000	4.2000	18.8916	17.8916	1.2000	50.0081	Yes
10.0000	4.2000	20.8535	19.8535	1.2000	49.9990	Yes
11.0000	4.2000	22.8035	21.8035	1.2000	50.0028	Yes
12.0000	4.2000			1.2000		

Material & Calculated Impedance

-- From Si8000 / Si9000 --

Calculated Impedance (Zo) 75.18

Resistivity (Ohm Metres) 1.68E-08 Ωm

Conductivity (Siemens / m) 5.952E+07 S/m

Temp. Coefficient (/ °C) TCR 0.00386

Reference Temp. (°C) 20

Operating Temp. (°C) 20

Track Dimensions

Lower Trace Width W1 7.0000

Upper Trace Width W2 6.0000

Trace Thickness T1 1.2000

Length of Line LL 1000.0000

Units

Mils  Inches

Microns  Millimetres

Track Resistance Ω

Single Trace 0.0848

Dual Trace

Voltage Drop (Single Trace)

Current (Amps) 1

VD (Volts) 0.084797

Show Grid Lines

Tracking

Dark Mode

TDR View  On

Adjust Y Scale

Resistance Ω

Ohms per division : 0.005

0.0950

0.0900

0.0850

0.0800

0.0750

0.0700

0.0650

0.0600

0.0550

0.0500

0.0450

0.0400

0.0350

0.0300

0.0250

0.0200

0.0150

0.0100

0.0050

0.0000

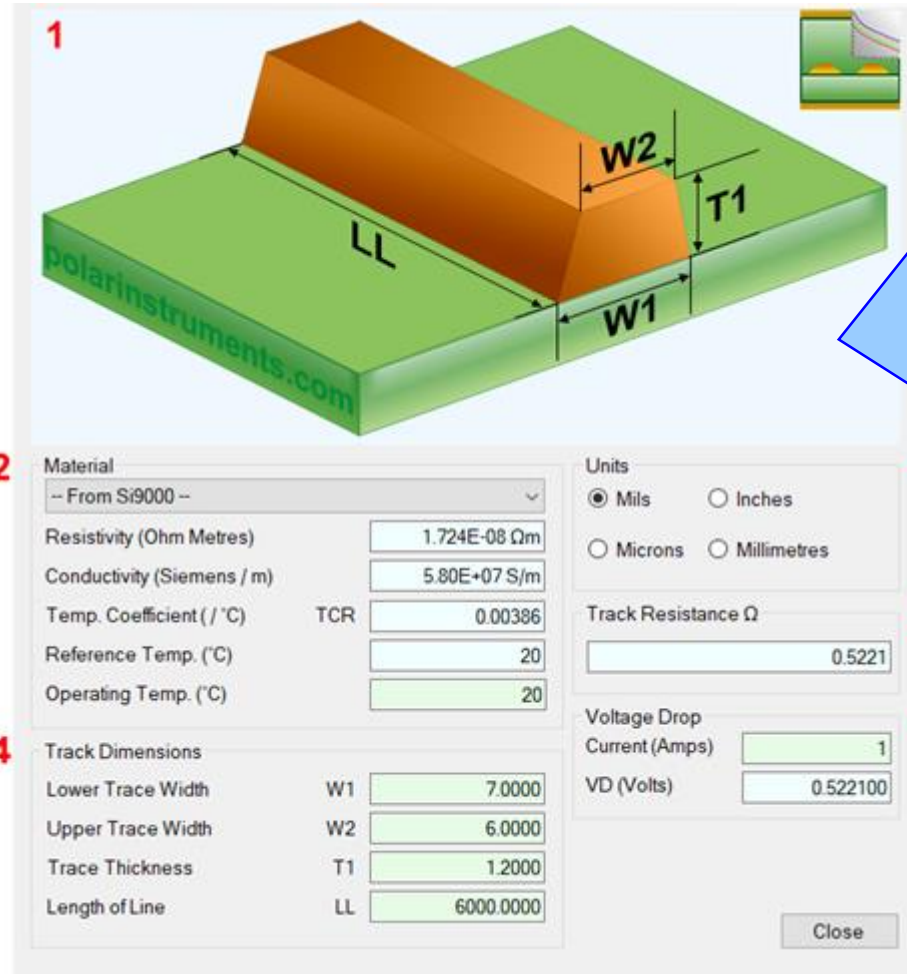
0 100 200 300 400 500

Lit

Lossless Calculation

Sensitivity Analysis

# Track Resistance Calculator (TRC Plus)



The image shows a 3D perspective view of a track on a substrate. The track is a raised rectangular block with a top width of  $W2$ , a bottom width of  $W1$ , and a thickness of  $T1$ . The length of the track is  $LL$ . Below the 3D model is a software interface with several sections:

- Material:** A dropdown menu set to "-- From Si9000 --".
- Resistivity (Ohm Metres):**  $1.724E-08 \Omega m$
- Conductivity (Siemens / m):**  $5.80E+07 S/m$
- Temp. Coefficient (/ °C):** TCR  $0.00386$
- Reference Temp. (°C):**  $20$
- Operating Temp. (°C):**  $20$
- Units:** Radio buttons for Mils (selected), Inches, Microns, and Millimetres.
- Track Resistance  $\Omega$ :**  $0.5221$
- Voltage Drop:**
  - Current (Amps):**  $1$
  - VD (Volts):**  $0.522100$
- Track Dimensions:**
  - Lower Trace Width W1:**  $7.0000$
  - Upper Trace Width W2:**  $6.0000$
  - Trace Thickness T1:**  $1.2000$
  - Length of Line LL:**  $6000.0000$

A "Close" button is located at the bottom right of the interface.

## 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

# Si8000m v21.04 (April 2021)



# Monte Carlo Analysis maximum iteration increased to 9000

**Coated Microstrip 1B**

www.polarinstruments.com

	Nominal	Tol (Abs)	Minimum	Maximum	Mean	Std Dev
Substrate 1 Height	H1	8.5000 ± 0.0000	8.5000	8.5000	8.5000	1.0000
Substrate 1 Dielectric	Er1	4.2000 ± 0.0000	4.2000	4.2000	4.2000	0.0000
Lower Trace Width	W1	14.9629 ± 0.0000	14.9629	14.9629	7.0000	0.0000
Upper Trace Width	W2	13.9629 ± 0.0000	13.9629	13.9629	6.0000	0.0000
Trace Thickness	T1	1.2000 ± 0.0000	1.2000	1.2000	1.2000	0.0000
Coating Above Substrate	C1	1.0000 ± 0.0000	1.0000	1.0000	1.0000	0.0000
Coating Above Trace	C2	1.0000 ± 0.0000	1.0000	1.0000	1.0000	0.0000
Coating Dielectric	CEr	4.2000 ± 0.0000	4.2000	4.2000	4.2000	0.0000
<b>Impedance</b>	<b>Zo</b>	49.99	49.99	49.99		

**Settings**  
 Iterations:

Uniform Distribution (Tol/Min/Max)  
 Normal Distribution (Mean/Std Dev)

Close

Nom -> Mean

Tol -> Std Dev

It is now possible to run a Monte Carlo Analysis for 9,000 calculations on any selected structure

Graph | Iterations / Results

**Coated Microstrip 1B - Monte Carlo Analysis**

www.polarinstruments.com

Impedance - Ohms

**Results Summary**

Impedance - Zo

Nominal: 49.99

Minimum (worst case): 52.50

Maximum (worst case): 84.69

---

Monte Carlo Analysis

Mean: 70.85

Standard Deviation: 3.93

Maximise | Print | Export

# Si8000m v21.01 (January 2021)

# Monte Carlo support added for Dual Coated structures

Edge-Coupled Dual Coated Microstrip 1B

	Nominal	Tol (Abs)	Minimum	Maximum	Mean	Std Dev
Substrate 1 Height	H1	8.5000 ± 0.0000	8.5000	8.5000	8.5000	0.5000
Substrate 1 Dielectric	Er1	4.2000 ± 0.0000	4.2000	4.2000	4.2000	0.0000
Lower Trace Width	W1	7.0000 ± 0.0000	7.0000	7.0000	7.0000	0.0000
Upper Trace Width	W2	6.0000 ± 0.0000	6.0000	6.0000	6.0000	0.0000
Trace Separation	S1	5.9669 ± 0.0000	5.9669	5.9669	5.9669	0.0000
Trace Thickness	T1	1.2000 ± 0.0000	1.2000	1.2000	1.2000	0.0000
Coating Above Substrate	C1	1.0000 ± 0.0000	1.0000	1.0000	1.0000	0.0000
Coating Above Trace	C2	1.0000 ± 0.0000	1.0000	1.0000	1.0000	0.0000
Coating Between Traces	C3	1.0000 ± 0.0000	1.0000	1.0000	1.0000	0.0000
Coating Dielectric	CER	4.2000 ± 0.0000	4.2000	4.2000	4.2000	0.0000
2nd Coating Above Substrate	CS1	1.0000 ± 0.0000	1.0000	1.0000	1.0000	0.0000
2nd Coating Above Trace	CS2	1.0000 ± 0.0000	1.0000	1.0000	1.0000	0.0000

2nd Coating Between Traces CS3

Nominal	Tol (Abs)	Minimum	Maximum	Mean	Std Dev
1.0000 ± 0.0000	0.0000	1.0000	1.0000	1.0000	0.0000

2nd Coating Dielectric CSEr

Nominal	Tol (Abs)	Minimum	Maximum	Mean	Std Dev
4.2000 ± 0.0000	0.0000	4.2000	4.2000	4.2000	0.0000

**Differential Impedance** Zdiff: 99.99

Settings: Iterations: 500, Normal Distribution (Mean/Std Dev)

**Results Summary**

Impedance - Zdiff

Nominal: 99.99

Minimum (worst case): 95.41

Maximum (worst case): 102.72

Monte Carlo Analysis

Mean: 99.94

Standard Deviation: 1.11

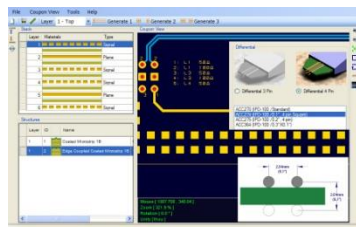
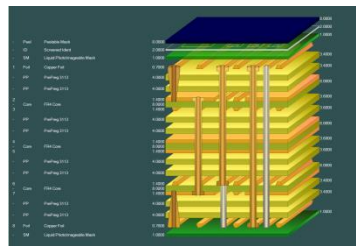
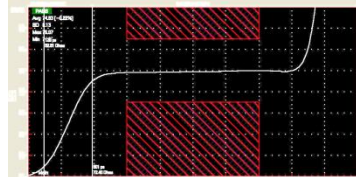
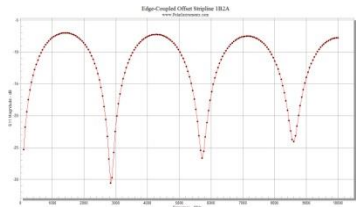
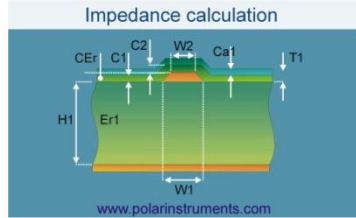
Graph | Iterations / Results

### Edge-Coupled Dual Coated Microstrip 1B - Monte Carlo Analysis

The Monte Carlo Analysis option now supports Dual Coated structures

## Other enhancements

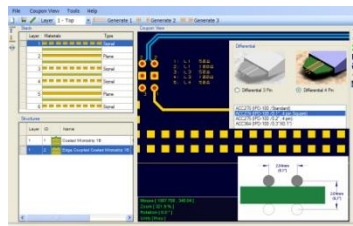
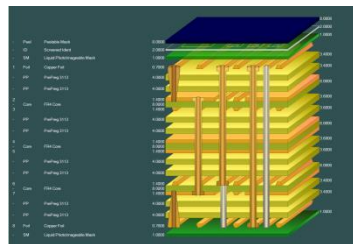
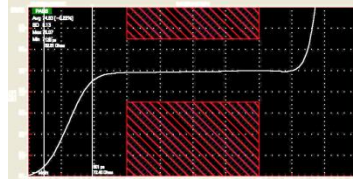
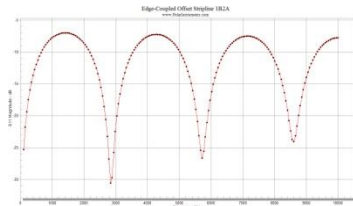
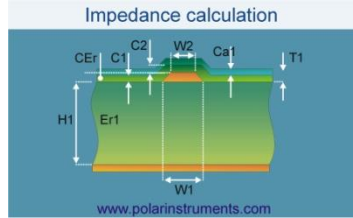
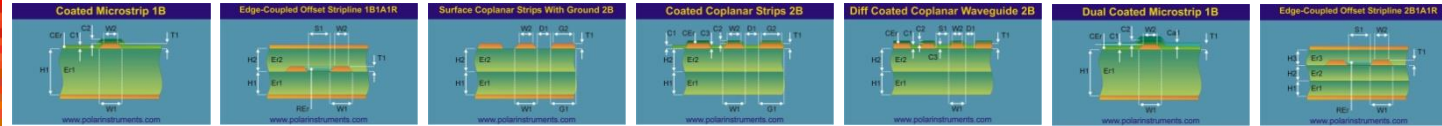
- FlexNet Publisher / FLEXIm v11.17.2.0 supported



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