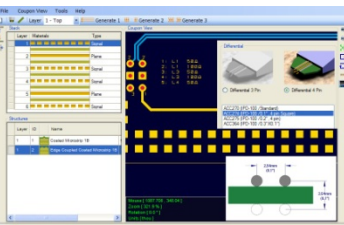
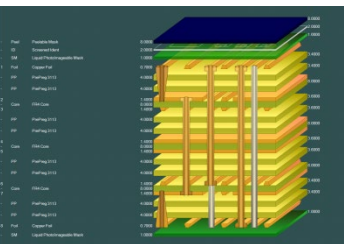
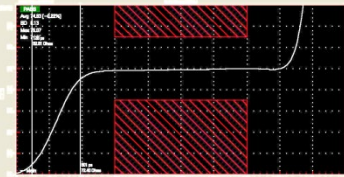
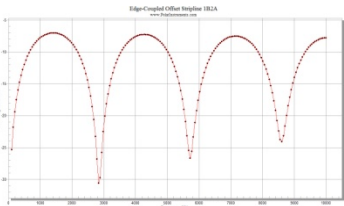
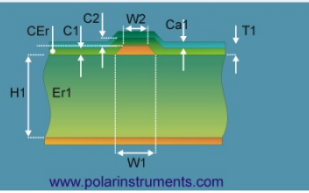


Speedstack 2019 Introduction

Summary of 2019 what's new

Richard Attrill / John Lee – July 2019 (Rev 3)

Impedance calculation



Introducing Speedstack 2019

Welcome to a preview of what's new in Speedstack 2019 editions.

We have introduced a number of new features that have been requested through our Polarcare software maintenance service.

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.

Speedstack v19.05

DRC Resin Check / Excess Resin enhancements

The screenshot shows the Polar Speedstack Stack Up Builder interface. The main window displays a stack up table with columns for layer type, material, thickness, and position. The table includes various layers such as foils, prepreg (PP), and core. A callout box points to the DRC Test Selection panel, which has checkboxes for Design Logic, Board Thickness, and Manufacturing Tests. A specific callout box highlights the 'Excess Resin' table, which shows the percentage of excess resin for each layer.

Layer	Resin
1	81.8%
2	81.8%
3	70.5%
4	70.6%
5	102.6%
6	57.1%

The Resin Check / Excess Resin algorithms have been enhanced to offer improved support for sequential build stack ups

DRC Resin Check / Excess Resin enhancements

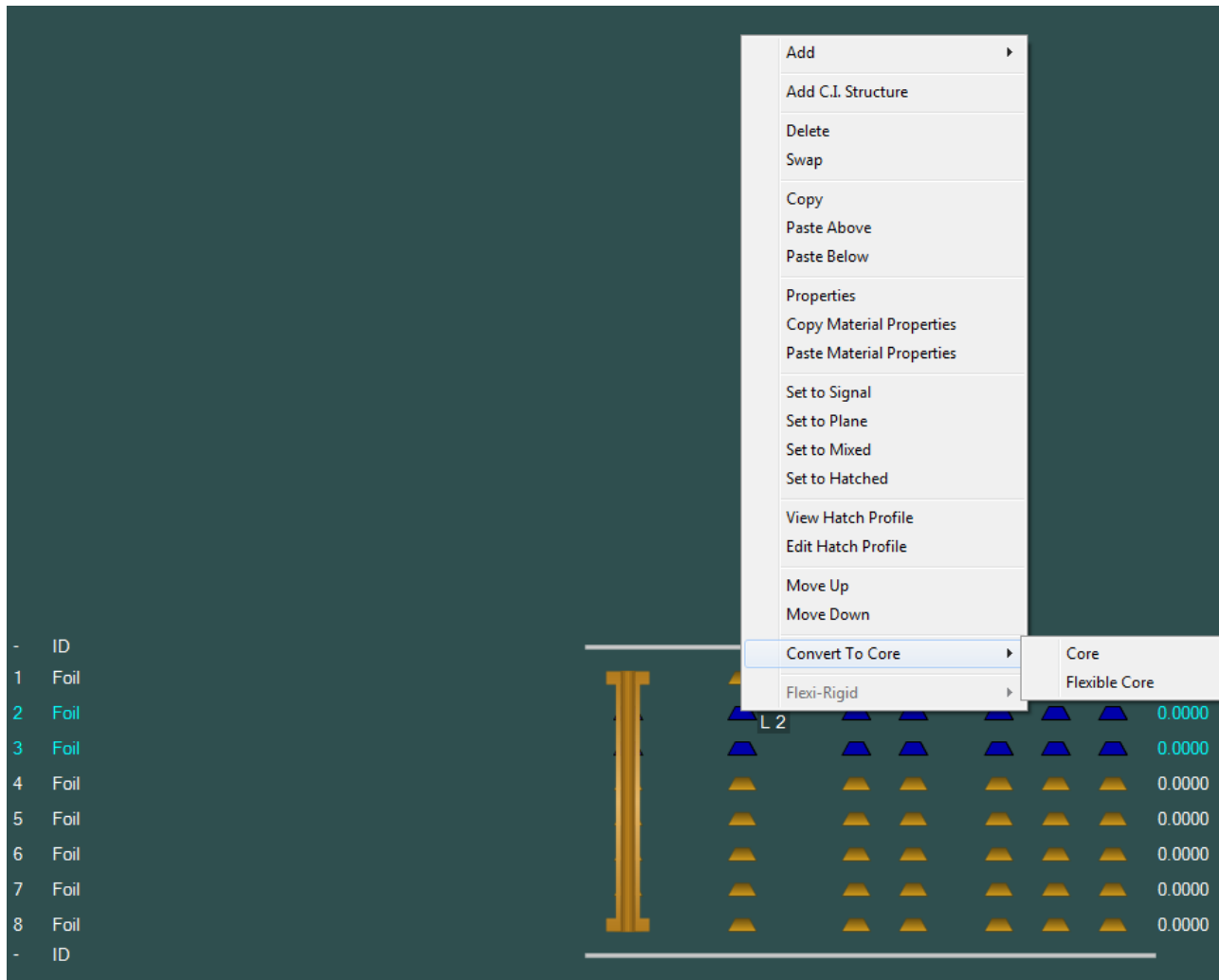


Excess Resin	
Layer	Resin
1	
2	81.8%
3	
3	81.8%
4	
4	70.5%
5	
5	70.6%
6	
6	102.6%
7	
7	57.1%
8	

Sequential builds require multiple press cycles to achieve the final stack up.

The new Resin Check / Excess Resin algorithms determine the order in which the materials are pressed together and return useful resin percentage information that can be used to determine potential de-lamination problems.

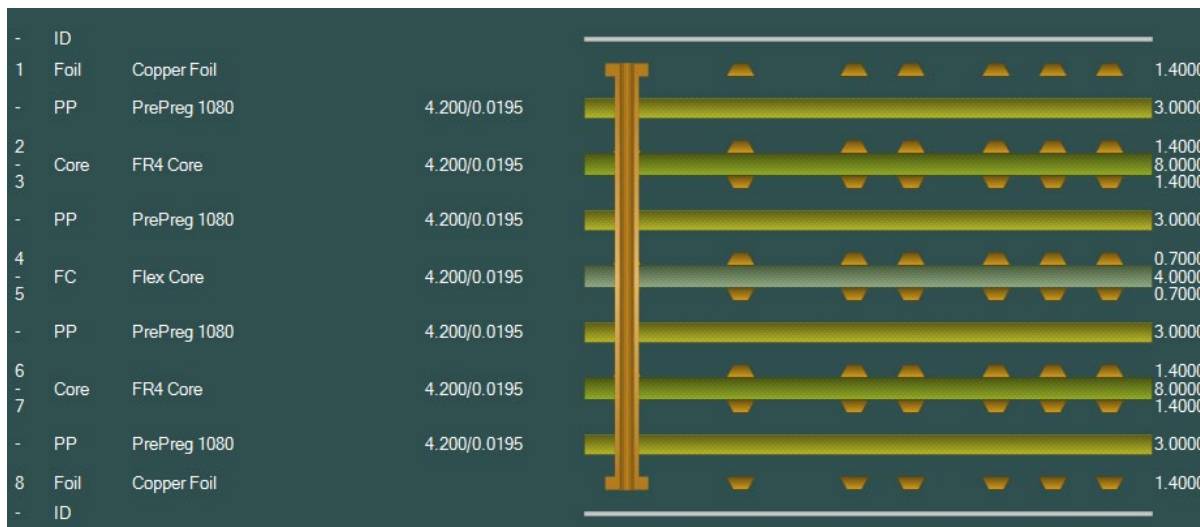
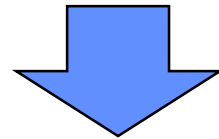
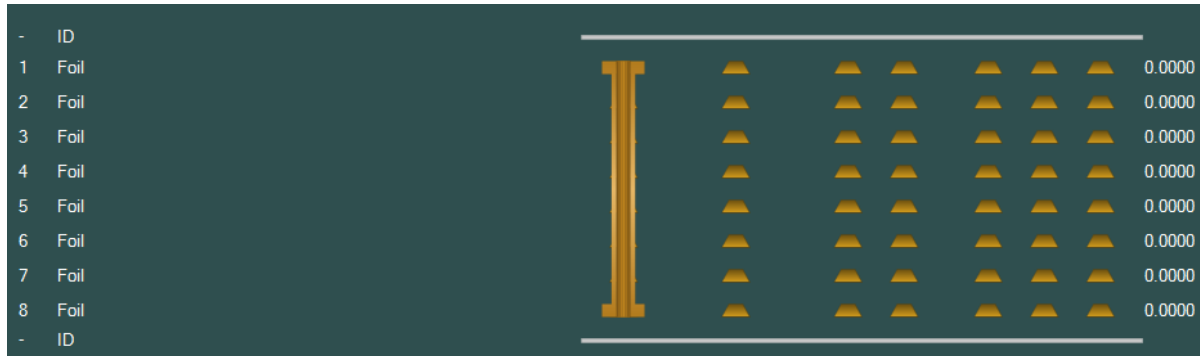
Convert to Core enhancements



When importing stack up data from some CAD / CAM systems only the electrical layers are defined. In this example an eight layer design has been imported.

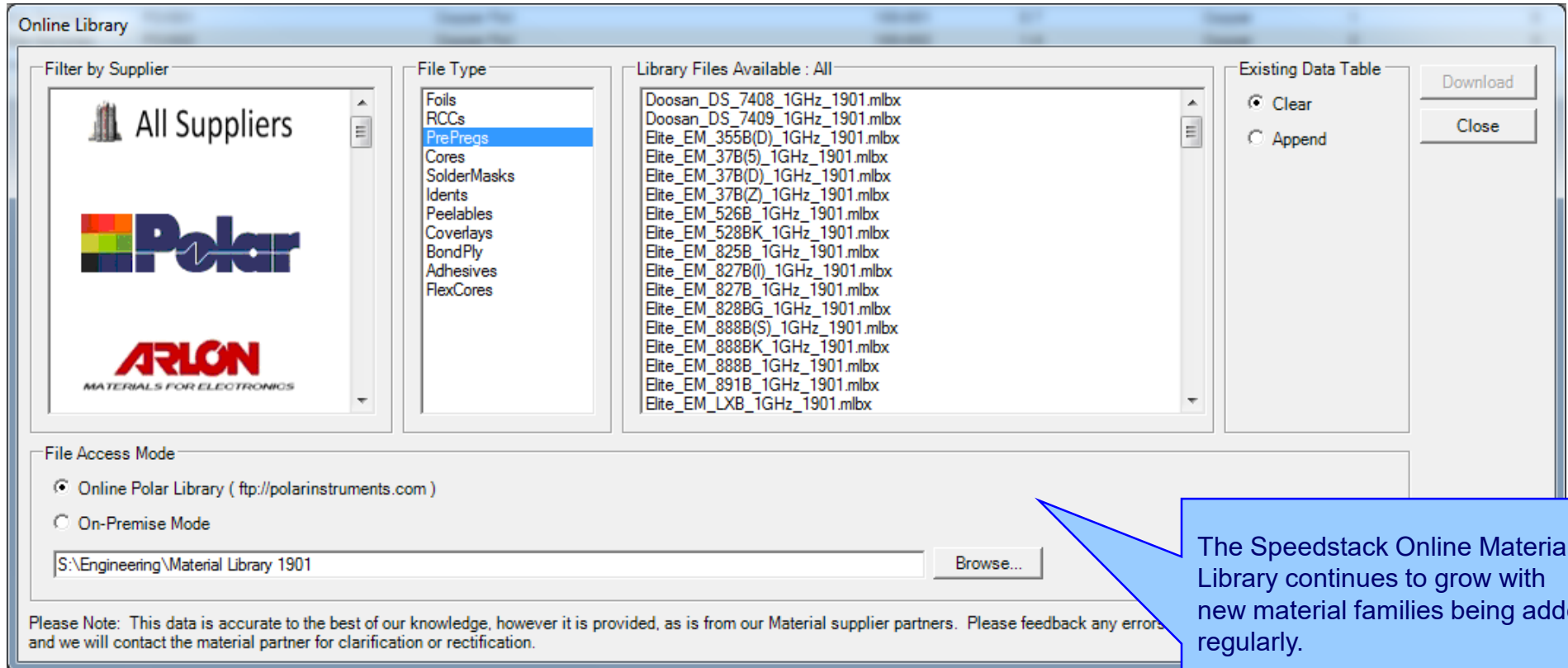
Speedstack allows the user to quickly convert two adjacent electrical layers into Core or Flexible Core materials using the 'Convert to Core' function.

Convert to Core enhancements



Using 'Convert to Core' alongside other Speedstack editing functions, a simple electrical layer only stack up can be quickly converted into a useful fully defined stack up containing full definitions of foils, prepreg and core materials .

Online Material Library







The screenshot shows the 'Online Library' window. It features a 'Filter by Supplier' section with 'All Suppliers' selected, displaying logos for Polar and ARLON. A 'File Type' list includes Foils, RCCs, PrePregs (highlighted), Cores, SolderMasks, Idents, Peelables, Coverlays, BondPly, Adhesives, and FlexCores. The 'Library Files Available : All' list contains numerous files such as Doosan_DS_7408_1GHz_1901.mlbx and Elite_EM_355B(D)_1GHz_1901.mlbx. An 'Existing Data Table' section has 'Clear' selected. At the bottom, 'File Access Mode' is set to 'Online Polar Library (ftp://polarinstruments.com)'. A text box contains 'S:\Engineering\Material Library 1901' with a 'Browse...' button. A 'Please Note' message is at the bottom: 'Please Note: This data is accurate to the best of our knowledge, however it is provided, as is from our Material supplier partners. Please feedback any errors and we will contact the material partner for clarification or rectification.'

The Speedstack Online Material Library continues to grow with new material families being added regularly.





The latest material information is instantly available to all Speedstack users with an active Polarcare contract.

Printing: Sort impedance structures per layer by type

Impedance ID	Structure Image	Structure Name	Impedance Signal Layer	Ref. Plane 1 in Layer	Ref. Plane 2 in Layer	Lower Trace Width (W1)	Upper Trace Width (W2)	Trace Separation (S1)	Target Impedance	Tol (+/- %)	Calculated Impedance
1		Edge Coupled Coated Microstrip 1B	1	3	0	8.500	7.500	8.115	100.000	10.000	100.350
2		Coated Microstrip 1B	1	3	0	4.500	3.500	0.000	75.000	10.000	75.870
3		Coated Microstrip 1B	1	3	0	11.476	10.476	0.000	50.000	10.000	49.520
4		Edge Coupled Coated Microstrip 1B	1	3	0	12.542	11.542	10.000	85.000	10.000	85.220

The order that the structures are added to the stack up is the default print order:

1. Differential - 100 ohms
2. Single-Ended – 75 ohms
3. Single-Ended – 50 ohms
4. Differential – 85 ohms

Impedance ID	Structure Image	Structure Name	Impedance Signal Layer	Ref. Plane 1 in Layer	Ref. Plane 2 in Layer	Lower Trace Width (W1)	Upper Trace Width (W2)	Trace Separation (S1)	Target Impedance	Tol (+/- %)	Calculated Impedance
2		Coated Microstrip 1B	1	3	0	4.500	3.500	0.000	75.000	10.000	75.870
3		Coated Microstrip 1B	1	3	0	11.476	10.476	0.000	50.000	10.000	49.520
1		Edge Coupled Coated Microstrip 1B	1	3	0	8.500	7.500	8.115	100.000	10.000	100.350
4		Edge Coupled Coated Microstrip 1B	1	3	0	12.542	11.542	10.000	85.000	10.000	85.220

New option to sort structures by type has been included with v19.05:

1. Single-Ended – 75 ohms
2. Single-Ended – 50 ohms
3. Differential - 100 ohms
4. Differential – 85 ohms

Printing: Option to hide the footer section

C:\Program Files\Polar\Speedstack\Samples\Eval Imperial.scl Units: Mils



Layer	Stack up	Supplier	Type	Description	Base Thickness	Processed Thickness	Resin Content	εr	Loss Tangent	Impedance ID
1		Polar Samples	SolderMask	Liquid Photolimageable Mask		1.000		4.000	0.0195	
		Polar Samples	Copper	Copper Foil	0.700	0.700				1, 2, 3, 4
		Polar Samples	Dielectric	PrePreg 1080	3.000	1.950	60.000	4.200	0.0195	
2					1.400	1.400				
3		Polar Samples	FR4	FR4 Core	3.000	3.000	60.000	4.200	0.0195	
					1.400	1.400				
		Polar Samples	Dielectric	PrePreg 3080	3.000	2.776	60.000	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 1651	6.000	5.552	47.000	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 1651	6.000	5.552	47.000	4.200	0.0195	
4					1.400	1.400				5
5		Polar Samples	FR4	FR4 Core	12.000	12.000	46.000	4.200	0.0195	
					1.400	1.400				
		Polar Samples	Dielectric	PrePreg 1651	6.000	5.552	47.000	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 1651	6.000	5.552	47.000	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 3080	3.000	2.776	60.000	4.200	0.0195	
					1.400	1.400				
6		Polar Samples	FR4	FR4 Core	3.000	3.000	60.000	4.200	0.0195	
					1.400	1.400				
		Polar Samples	Dielectric	PrePreg 1080	3.000	1.950	60.000	4.200	0.0195	
8		Polar Samples	Copper	Copper Foil	0.700	0.700				6
		Polar Samples	SolderMask	Liquid Photolimageable Mask		1.000		4.000	0.0195	

Copper Thickness = 9.800 | Dielectric Thickness = 49.660 | Solder Mask Thickness = 2.000 | Stack Up Thickness = 59.460 | Stack Up Thickness with Soldermask = 61.460

Impedance ID	Structure Image	Structure Name	Impedance Signal Layer	Ref. Plane 1 in Layer	Ref. Plane 2 in Layer	Lower Trace Width (W1)	Upper Trace Width (W2)	Trace Separation (S1)	Target Impedance	Tol (+/- %)	Calculated Impedance
2		Coated Microstrip 1B	1	3	0	4.500	3.500	0.000	75.000	10.000	75.870
3		Coated Microstrip 1B	1	3	0	11.476	10.476	0.000	50.000	10.000	49.520
1		Edge Coupled Coated Microstrip 1B	1	3	0	8.500	7.500	8.115	100.000	10.000	100.350
4		Edge Coupled Coated Microstrip 1B	1	3	0	12.542	11.542	10.000	85.000	10.000	85.220

The Footer section is now an optional item and can be hidden

StackName: Master	Version:	Revision:	Modification:	Date of Revision:	Editor	Page 1/X
Date:	Associated Documents:					
Author:						
Department:						
Site:						

www.polarinstruments.com

Printing: Option to hide the footer section

C:\Program Files\Polar\Speedstack\Samples\Eval Imperial.sci Units: Mills



Layer	Stack up	Supplier	Type	Description	Base Thickness	Processed Thickness	Resin Content	εr	Loss Tangent	Impedance ID
1		Polar Samples	SolderMask	Liquid Photolimageable Mask		1.000		4.000	0.0195	
		Polar Samples	Copper	Copper Foil	0.700	0.700				1, 2, 3, 4
2		Polar Samples	Dielectric	PrePreg 1080	3.000	1.950	60.000	4.200	0.0195	
3		Polar Samples	FR4	FR4 Core	1.400	1.400				
		Polar Samples	FR4	FR4 Core	3.000	3.000	60.000	4.200	0.0195	
4		Polar Samples	Dielectric	PrePreg 3080	3.000	2.776	60.000	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 1651	6.000	5.552	47.000	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 1651	6.000	5.552	47.000	4.200	0.0195	
5	Polar Samples	FR4	FR4 Core	1.400	1.400					5
	Polar Samples	FR4	FR4 Core	12.000	12.000	46.000	4.200	0.0195		
	Polar Samples	Dielectric	PrePreg 1651	1.400	1.400					
	Polar Samples	Dielectric	PrePreg 1651	6.000	5.552	47.000	4.200	0.0195		
	Polar Samples	Dielectric	PrePreg 1651	6.000	5.552	47.000	4.200	0.0195		
	Polar Samples	Dielectric	PrePreg 3080	3.000	2.776	60.000	4.200	0.0195		
6	Polar Samples	FR4	FR4 Core	1.400	1.400					
	Polar Samples	FR4	FR4 Core	3.000	3.000	60.000	4.200	0.0195		
	Polar Samples	Dielectric	PrePreg 1080	1.400	1.400					
	Polar Samples	Dielectric	PrePreg 1080	3.000	1.950	60.000	4.200	0.0195		
7	Polar Samples	Copper	Copper Foil	0.700	0.700					6
8	Polar Samples	SolderMask	Liquid Photolimageable Mask		1.000			4.000	0.0195	

Copper Thickness = 9.800 | Dielectric Thickness = 49.660 | Solder Mask Thickness = 2.000 | Stack Up Thickness = 59.460 | Stack Up Thickness with Soldermask = 61.460

Impedance ID	Structure Image	Structure Name	Impedance Signal Layer	Ref. Plane 1 in Layer	Ref. Plane 2 in Layer	Lower Trace Width (W1)	Upper Trace Width (W2)	Trace Separation (S1)	Target Impedance	Tol (+/- %)	Calculated Impedance
2		Coated Microstrip 1B	1	3	0	4.500	3.500	0.000	75.000	10.000	75.870
3		Coated Microstrip 1B	1	3	0	11.476	10.476	0.000	50.000	10.000	49.520
1		Edge Coupled Coated Microstrip 1B	1	3	0	8.500	7.500	8.115	100.000	10.000	100.350
4		Edge Coupled Coated Microstrip 1B	1	3	0	12.542	11.542	10.000	85.000	10.000	85.220
5		Edge Coupled Offset Stripline 1B1A	4	3	6	7.250	6.250	8.500	100.000	10.000	101.280
6		Coated Microstrip 1B	8	6	0	4.500	3.500	0.000	75.000	10.000	75.870

When the Footer section is hidden the space is used for other data, often reducing the number of pages required for the technical report

Printing: Customisable footer section

Support for longer stack up names

StackName: POLAR SET2DIL MWP1636		Revision:	Modification:	Date of Revision:	Editor
Version: A	Associated Documents:	A	L2/L3 Core Changed	23/10/2016	R Attrill
Date: 22/01/2014		B	Solder Mask Mod	20/05/2019	J Lee
Author: R Attrill (Polar)					
Department: Engineering					
Site: Waterlooville					

Override Footer Labels

Override the labels shown in the footer of the printout

Version
|Drawing No|

Date

Author

Department

Site

Clear Okay

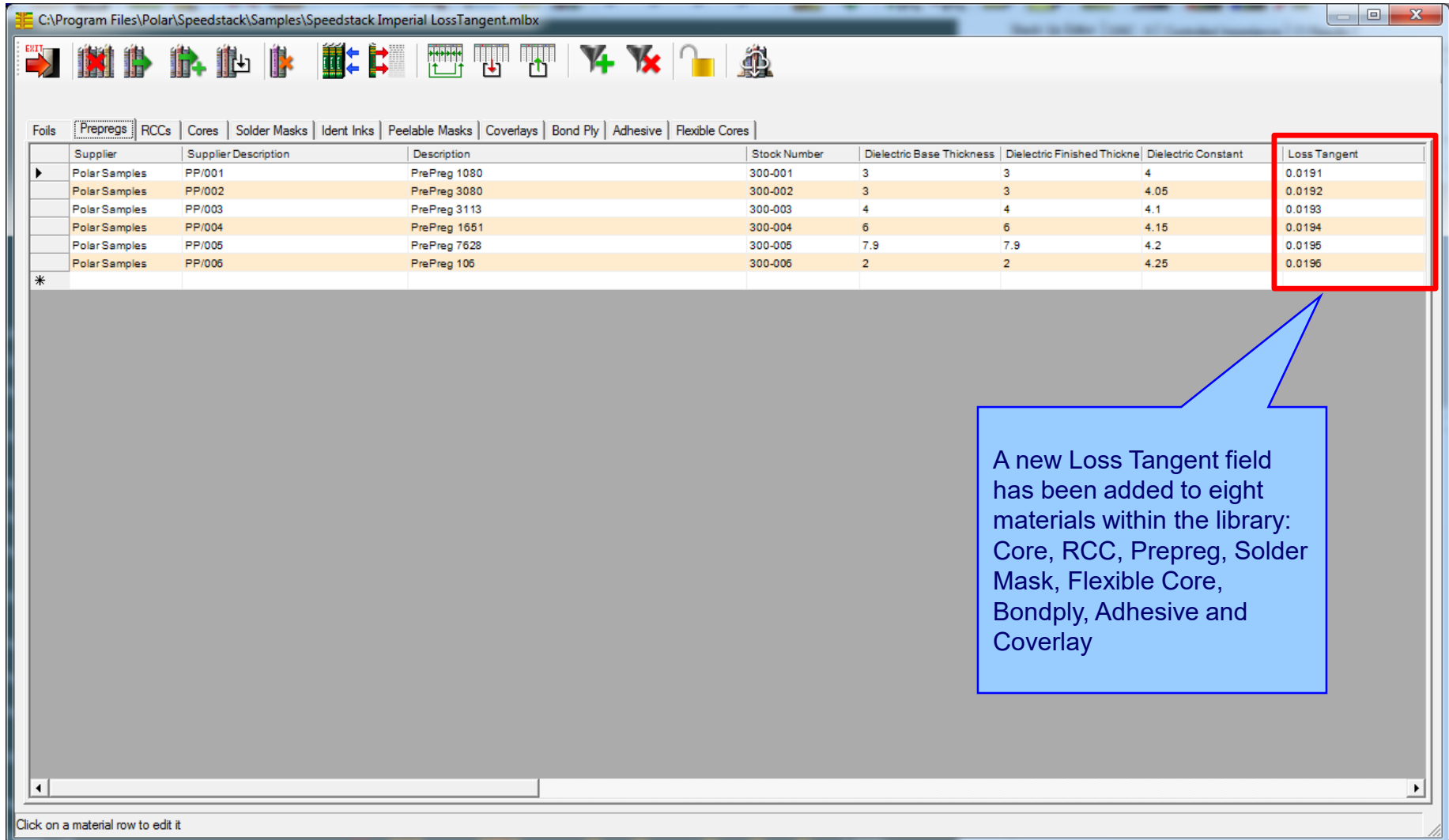
Override footer labels using your own company naming conventions.

In this example Version has been replaced with Drawing No.

StackName: POLAR SET2DIL MWP1636		Revision:	Modification:	Date of Revision:	Editor
Drawing No: A	Associated Documents:	A	L2/L3 Core Changed	23/10/2016	R Attrill
Date: 22/01/2014		B	Solder Mask Mod	20/05/2019	J Lee
Author: R Attrill (Polar)					
Department: Engineering					
Site: Waterlooville					

Speedstack v19.01 (January 2019)

Loss Tangent field now available in the Material Library



C:\Program Files\Polar\Speedstack\Samples\Speedstack Imperial LossTangent.mlbx

EXIT [Icons]

Foils | **Prepregs** | RCCs | Cores | Solder Masks | Ident Inks | Peelable Masks | Coverlays | Bond Ply | Adhesive | Flexible Cores

Supplier	Supplier Description	Description	Stock Number	Dielectric Base Thickness	Dielectric Finished Thickne	Dielectric Constant	Loss Tangent
Polar Samples	PP/001	PrePreg 1080	300-001	3	3	4	0.0191
Polar Samples	PP/002	PrePreg 3080	300-002	3	3	4.05	0.0192
Polar Samples	PP/003	PrePreg 3113	300-003	4	4	4.1	0.0193
Polar Samples	PP/004	PrePreg 1651	300-004	6	6	4.15	0.0194
Polar Samples	PP/005	PrePreg 7628	300-005	7.9	7.9	4.2	0.0195
Polar Samples	PP/006	PrePreg 106	300-006	2	2	4.25	0.0196

* [Empty row]

Click on a material row to edit it

A new Loss Tangent field has been added to eight materials within the library: Core, RCC, Prepreg, Solder Mask, Flexible Core, Bondply, Adhesive and Coverlay

Loss Tangent field now available in the Material Library

Review/Edit Prepregs

Supplier	Polar Samples	Size	
Supplier Description	PP/004	Note 1	
Description	PrePreg 1651	Note 2	
Stock Number	300-004	Note 3	
Type	Dielectric		
Base Thickness	6.0000		
Finished Thickness	6.0000		
Dielectric Constant	4.15		
Loss Tangent	0.0194		
Resin Content	47		
Tg	180		
Td	0		
CAF Resistance	0		
Z Axis Expansion	0		
Excess Resin	0.0000		
Tolerance +/-	10		
Cost	4		
Lead Time	0		
Laser Drillable	<input type="checkbox"/>		
Use in Auto Stack	<input checked="" type="checkbox"/>		
Next To Foils	<input checked="" type="checkbox"/>		

The Loss Tangent field is an important dielectric material property that is used when calculating frequency dependent insertion loss

Add Delete << < 4 of 6 > >> OK

Loss Tangent field now available in the Material Library

The screenshot shows the Speedstack software interface with a material library table and a 'Select Prepreg Fields' dialog box. The table lists various prepreg materials with columns for Supplier, Description, Dielectric Base Thickness, Dielectric Finished Thickness, Dielectric Constant, and Loss Tangent. The 'Loss Tangent' column is highlighted in red. The dialog box shows the 'Selected Columns' list containing Supplier, Description, Base Thickness, Finished Thickness, Dielectric Constant, and Loss Tangent. The 'Available Columns' list includes SupplierDescription, StockNumber, ResinContent, Tg, Td, CAFResistance, ZAxisExpansion, ExcessResin, LaserDrillable, Type, Cost, Tolerance, LeadTime, and Outer. A blue callout box points to the 'Loss Tangent' field in the 'Selected Columns' list.

Supplier	Description	Dielectric Base Thickness	Dielectric Finished Thickness	Dielectric Constant	Loss Tangent
Polar Samples	PrePreg 1080	3	3	4	0.0191
Polar Samples	PrePreg 3080	3	3	4.05	0.0192
Polar Samples	PrePreg 3113	4	4	4.1	0.0193
Polar Samples	PrePreg 1651	6	6	4.15	0.0194
Polar Samples	PrePreg 7628	7.9	7.9	4.2	0.0195
Polar Samples	PrePreg 106	2	2	4.25	0.0196

Select Prepreg Fields

Selected Columns

- Supplier
- Description
- Base Thickness
- Finished Thickness
- Dielectric Constant
- Loss Tangent

Available Columns

- SupplierDescription
- StockNumber
- ResinContent
- Tg
- Td
- CAFResistance
- ZAxisExpansion
- ExcessResin
- LaserDrillable
- Type
- Cost
- Tolerance
- LeadTime
- Outer

Customise and select the material library columns that are critical for your application. In this case Dielectric Constant and Loss Tangent fields have been selected alongside the material thicknesses

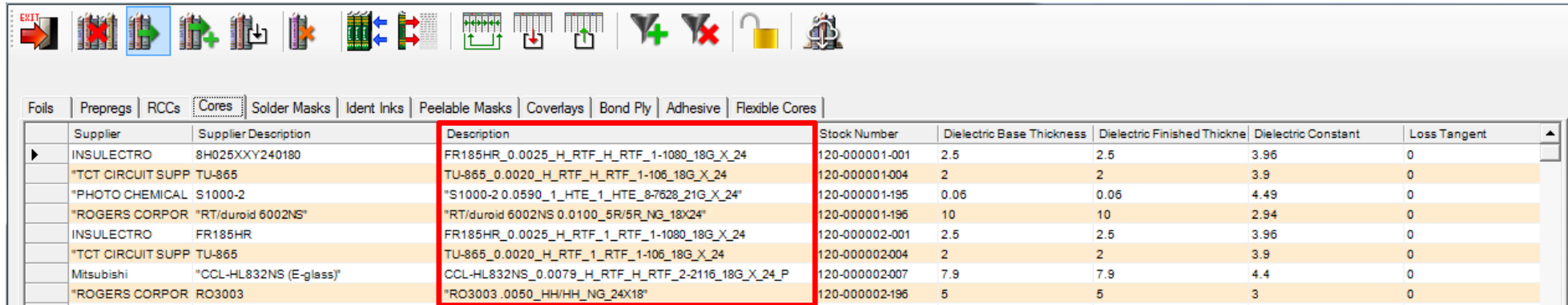
Click on a material row to edit it

Loss Tangent field now available in the Material Library

The Material Library import / export options have been extended to support Loss Tangent. For those who prefer to use Excel to edit the library an additional Loss Tangent column has been added

*Type	Supplier	Supplier Description	Description	Stock Number	Base Thickness	Finished Thickness	Dielectric Constant	Dielectric Loss Tangent	Resin Content	Tg	Td	CAF Resistance
Dielectric	Polar Samples	PP/001	PrePreg 1080	300-001	3	3	4	0.0191	60	180	0	0
Dielectric	Polar Samples	PP/002	PrePreg 3080	300-002	3	3	4.05	0.0192	60	180	0	0
Dielectric	Polar Samples	PP/003	PrePreg 3113	300-003	4	4	4.1	0.0193	53	180	0	0
Dielectric	Polar Samples	PP/004	PrePreg 1651	300-004	6	6	4.15	0.0194	47	180	0	0
Dielectric	Polar Samples	PP/005	PrePreg 7628	300-005	7.9	7.9	4.2	0.0195	45	180	0	0
Dielectric	Polar Samples	PP/006	PrePreg 106	300-006	2	2	4.25	0.0196	60	180	0	0

Description column width has been increased



Supplier	Supplier Description	Description	Stock Number	Dielectric Base Thickness	Dielectric Finished Thickne	Dielectric Constant	Loss Tangent
INSULECTRO	8H025XXY240180	FR185HR_0.0025_H_RTF_H_RTF_1-1080_18G_X_24	120-000001-001	2.5	2.5	3.96	0
"TCT CIRCUIT SUPP	TU-865	TU-865_0.0020_H_RTF_H_RTF_1-106_18G_X_24	120-000001-004	2	2	3.9	0
"PHOTO CHEMICAL	S 1000-2	"S 1000-2 0.0590_1_HTE_1_HTE_8-7628_21G_X_24"	120-000001-195	0.06	0.06	4.49	0
"ROGERS CORPOR	"RT/duroid 6002NS"	"RT/duroid 6002NS 0.0100_5R/5R_NG_18X24"	120-000001-196	10	10	2.94	0
INSULECTRO	FR185HR	FR185HR_0.0025_H_RTF_1_RTF_1-1080_18G_X_24	120-000002-001	2.5	2.5	3.96	0
"TCT CIRCUIT SUPP	TU-865	TU-865_0.0020_H_RTF_1_RTF_1-106_18G_X_24	120-000002-004	2	2	3.9	0
Mitsubishi	"CCL-HL832NS (E-glass)"	CCL-HL832NS_0.0079_H_RTF_H_RTF_2-2116_18G_X_24_P	120-000002-007	7.9	7.9	4.4	0
"ROGERS CORPOR	RO3003	"RO3003_0050_HH/HH_NG_24X18"	120-000002-196	5	5	3	0

More detailed material descriptions can now be viewed without needing to adjust the column widths

Online Library – Now supports libraries contain Loss Tangent data

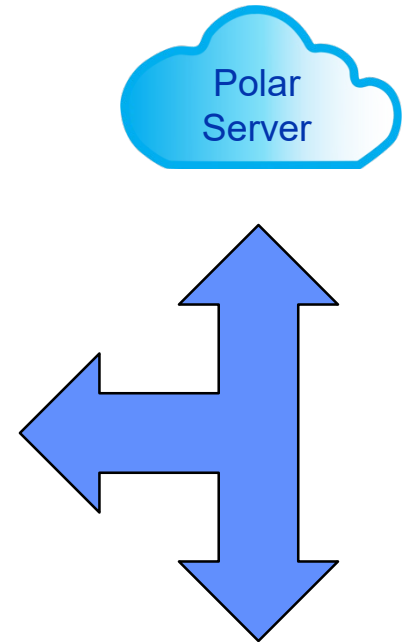
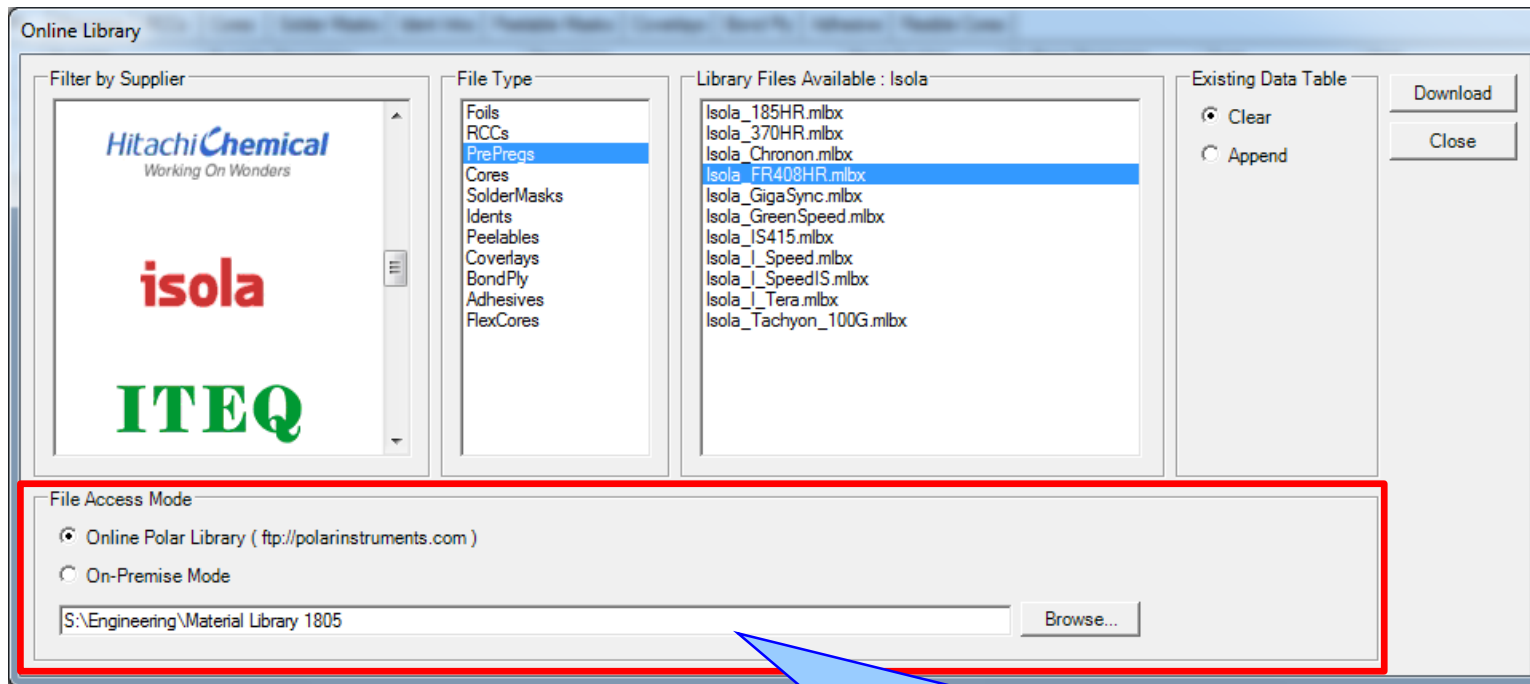
The screenshot shows the 'Online Library' window with the following components:

- Filter by Supplier:** A list of suppliers including DU PONT, EMC (台光電子材料股份有限公司 Elite Material Co., Ltd.), and GORE.
- File Type:** A list of file types including Foils, RCCs, PrePreqs (highlighted), Cores, SolderMasks, Idents, Peelables, Coverlays, BondPly, Adhesives, and FlexCores.
- Library Files Available : All:** A list of files including Doosan_DS_7408.mlbx, Doosan_DS_7409.mlbx, Elite_EM_355B(D).mlbx, Elite_EM_37B(5).mlbx, Elite_EM_37B(Z).mlbx, Elite_EM_526B.mlbx (highlighted), Elite_EM_825B.mlbx, Elite_EM_827B(I).mlbx, Elite_EM_827B.mlbx, Elite_EM_828BG.mlbx, Elite_EM_888B(S).mlbx, Elite_EM_888B.mlbx, Elite_EM_888BK.mlbx, Elite_EM_891B.mlbx, Elite_EM_LXB.mlbx, Gore_G410.mlbx, and Gore_G620.mlbx.
- Existing Data Table:** Radio buttons for 'Clear' (selected) and 'Append'.
- Buttons:** 'Download' and 'Close' buttons.
- File Access Mode:** Radio buttons for 'Online Polar Library (ftp://polarinstruments.com)' (selected) and 'On-Premise Mode'.
- Path:** A text box containing 'C:\Users\Richard Attrill\Desktop\Material Library 1805' and a 'Browse...' button.

A blue callout box points to the 'Elite_EM_526B.mlbx' file in the 'Library Files Available' list, containing the text: "The Online Library is currently being updated to include Loss Tangent data".

Please Note: This data is accurate to the best of our knowledge, however it is provided, as is from our Material supplier partners. Please feedback any errors or inaccuracies to Polarcare and we will contact the material partner for clarification or rectification.

Online Library – On-Premise Mode has been enhanced



On-Premise Server

The Online Library can access the latest material library data from either the Polar FTP Server or an On-Premise Server. The On-Premise Mode is ideal for those users where internal security policies prevent access to external FTP servers. Further enhancements have been made when no access to the Polar FTP Server is allowed

Stack Up Editor Enhancements – Support for Loss Tangent

Stack Up Editor | DRC: 0 | Controlled Impedance | CI Results

All dielectric materials within Speedstack now support the new Loss Tangent field. In this example Dielectric Constant / Loss Tangent are displayed next to the stack up

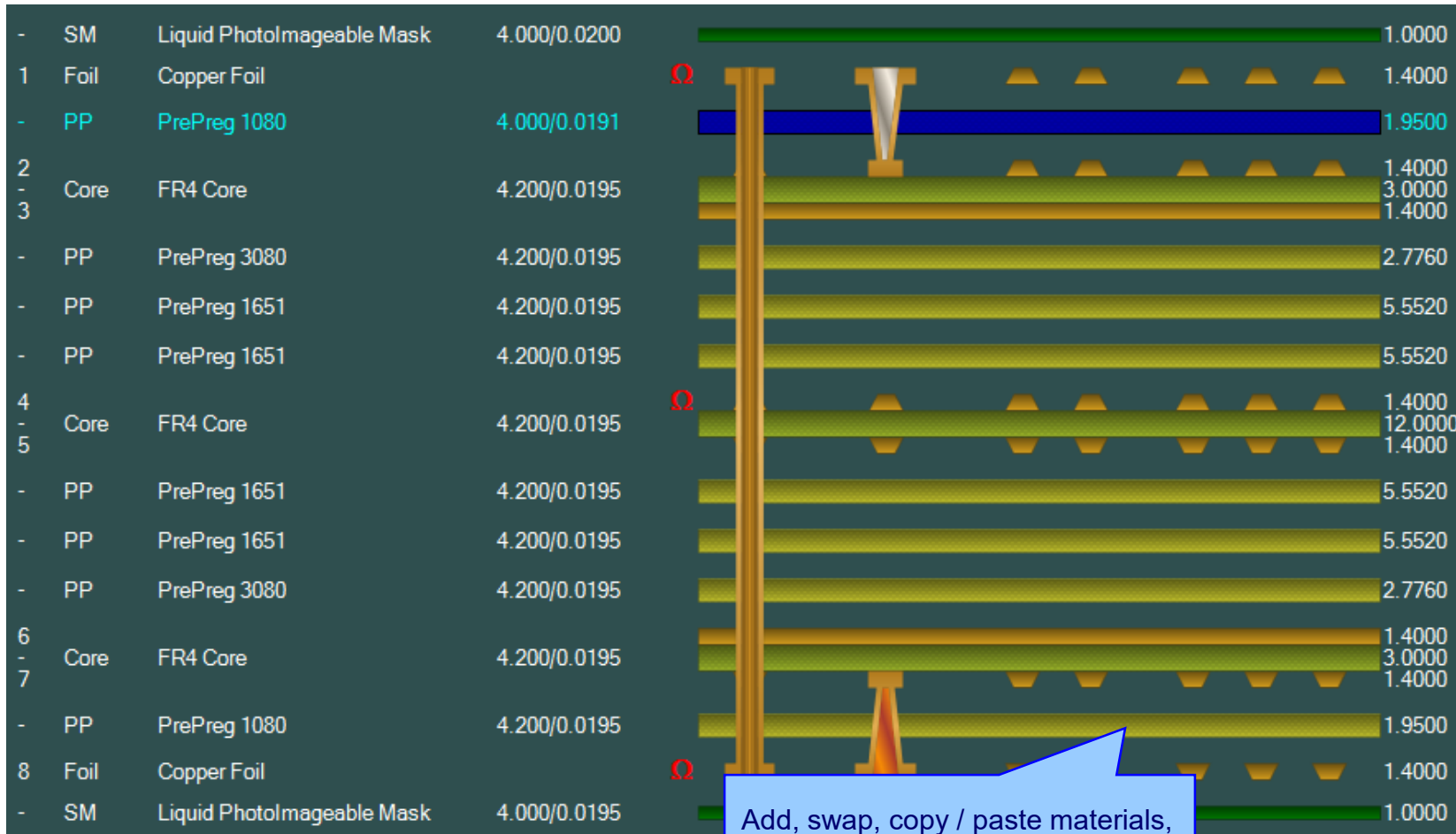
-	SM	Liquid PhotoImageable Mask	4.000/0.0200	1.0000
1	Foil	Copper Foil		1.4000
-	PP	PrePreg 1080	4.000/0.0191	1.9500
2	Core	FR4 Core	4.200/0.0195	1.4000
3				3.0000
				1.4000
-	PP	PrePreg 3080	4.200/0.0195	2.7760
-	PP	PrePreg 1651	4.200/0.0195	5.5520
-	PP	PrePreg 1651	4.200/0.0195	5.5520
4	Core	FR4 Core	4.200/0.0195	1.4000
5				12.0000
				1.4000
-	PP	PrePreg 1651	4.200/0.0195	5.5520
-	PP	PrePreg 1651	4.200/0.0195	5.5520
-	PP	PrePreg 3080	4.200/0.0195	2.7760
6	Core	FR4 Core	4.200/0.0195	1.4000
7				3.0000
				1.4000
-	PP	PrePreg 1080	4.200/0.0195	1.9500
8	Foil	Copper Foil		1.4000
-	SM	Liquid PhotoImageable Mask	4.000/0.0195	1.0000

Substrate 1 Height	H1	3.0000
Substrate 1 Dielectric	Er1	4.2000
Substrate 2 Height	H2	3.3500
Substrate 2 Dielectric	Er2	4.0000
Lower Trace Width	W1	8.5000
Upper Trace Width	W2	7.5000
Trace Separation	S1	8.1150
Trace Thickness	T1	1.4000
Coating Above Substrate	C1	1.0000
Coating Above Trace	C2	1.0000
Coating Between Traces	C3	1.0000
Coating Dielectric	CEr	4.0000

Differential Impedance	Zd	97.04
Target Impedance		100.00
Target Tolerance %		10.00

Master | Mils/Thous | Target Stack Up Thickness = 60.0000 | Stack Up Thickness = 60.8600 | Stack Up Thickness with Soldermask = 62.8600 | Beta V : 18.08.16722

Stack Up Editor Enhancements – Support for Loss Tangent



- Add
- Swap
- Copy
- Paste
- Symmetry

Add, swap, copy / paste materials, symmetry mode functions updated to support loss tangent

Stack Up Editor Enhancements – Support for Loss Tangent

-	SM	Liquid Photolamable Mask	4.000/0.0200		1.0000
1	Foil	Copper Foil			1.4000
-	PP	PrePreg 1080	4.000/0.0191		1.9500
2	Core	FR4 Core	4.200/0.0195		1.4000
-					3.0000
3					1.4000



Properties

Prepreg Properties

Main | Notes | Attributes

General Information

Supplier	Polar Samples		
Supplier Description	PP/001		
Description	PrePreg 1080	Cost	1.00
Stock Number	300-001	Tolerance	10.00
Type	Dielectric	Lead Time	0.00

Apply
Close

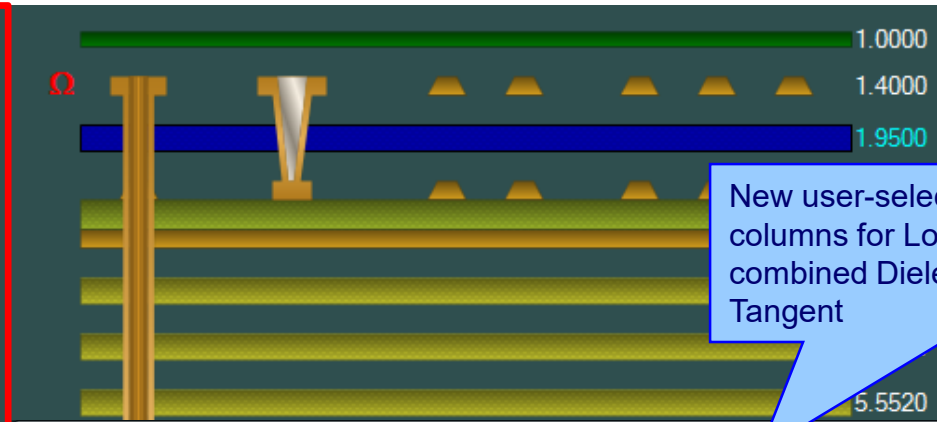
Dielectric

Base Thickness	3.0000	Td	0.0
Finished Thickness	3.0000	CAF Resistance	0.0
Dielectric Constant	4.0000	Z Axis Expansion	0.0
Loss Tangent	0.0191	Excess Resin	0.0000
Resin Content %	60.00	Isolation Distance	1.9500
Tg	180.0	Graphical Colour	

Opening the material Properties dialog allows for the Loss Tangent value to be viewed / changed

Stack Up Editor Enhancements – Support for Loss Tangent

-	SM	Liquid Photolimageable Mask	4.000/0.0200
1	Foil	Copper Foil	
-	PP	PrePreg 1080	4.000/0.0191
2	Core	FR4 Core	4.200/0.0195
3			
-	PP	PrePreg 3080	4.200/0.0195
-	PP	PrePreg 1651	4.200/0.0195
-	PP	PrePreg 1651	4.200/0.0195
4	Core	FR4 Core	4.200/0.0195
5			
-	PP	PrePreg 1651	4.200/0.0195
-	PP	PrePreg 1651	4.200/0.0195
-	PP	PrePreg 3080	4.200/0.0195
6	Core	FR4 Core	4.200/0.0195
7			
-	PP	PrePreg 1080	4.200/0.0195
8	Foil	Copper Foil	
-	SM	Liquid Photolimageable Mask	4.000/0.0195



New user-selectable display columns for Loss Tangent and a combined Dielectric Constant / Loss Tangent

Configuration Options

External Utilities | Rebuild and Calculate Structures

General | Structure Defaults | Licensing | File Locations | Goal Seeking | User | CITS Test | Colours | Miscellaneous | Hatch Defaults

Default Stack Up View
 2D
 3D

Units
 Mils/Thous Microns Millimetres

Display Data
 Display Fields 1 and 2 are reserved for Layer Numbers and Layer Types

Display Field 3: Description

Display Field 4: Dielectric Constant/Loss Tangent

Display Field 5: Processed Thickness

Open last used file on application start up
 Display File Properties Dialog for New Stackups and Projects

Apply Cancel

Frequency Dependent Calculation Enhancements (Speedstack Si)

Stack Up Editor | DRC : 0 | Controlled Impedance | CI Results

GHz

All | 1 of 4

Substrate 1 Height	H1	3.0000
Substrate 1 Dielectric	Er1	4.2000
Substrate 2 Height	H2	3.3500
Substrate 2 Dielectric	Er2	4.0000
Lower Trace Width	W1	8.5000
Upper Trace Width	W2	7.5000
Trace Separation	S1	8.1150
Trace Thickness	T1	1.4000
Coating Above Substrate	C1	1.0000
Coating Above Trace	C2	1.0000
Coating Between Traces	C3	1.0000
Coating Dielectric	CEr	4.0000
Differential Impedance	Zd	97.04
Target Impedance		100.00
Target Tolerance %		10.00

In order to accurately calculate frequency dependent loss it is necessary to know the critical information regarding the transmission line structure.

Speedstack 2019 will now use the dielectric constant and loss tangent data from the stack up

Length of Line LL: 4000.0000

Trace Conductivity (S/m) TC: 5.800E+07

Frequency Minimum (MHz) FMin: 500.0000

Frequency Maximum (GHz) FMax: 10.0000

Frequency Steps FStep: 20

Frequency of Interest (MHz) Freq: 1000.0000

Result Presentation

Length of Line C / in C / m

Substrate Causal Extrapolation Reference Points

Set Dielectric Constant (Er) from Stack Up materials

Set Loss Tangent (TanD) from Stack Up materials

Speedstack 2019 will allow the user to select checkboxes to nominate whether the dielectric constant and / or loss tangent data is determined from the stack up materials

	Freq (Hz)	Ref Er	Ref TanD
H1	1.000E+09	4.2000	0.0195
H2	1.000E+09	4.0000	0.0191
H3			
H4			
REr			
CEr	1.000E+09	4.0000	0.0200

Surface Roughness Compensation

Smooth

Hammerstad

Grosse

Huray

Print Settings

Include Loss Graph for this structure on the report

Graph Settings

Display Series: All Losses

Differential: Differential

Loss Budget (dB): 0.0000

Picked Data Point Information

Speedstack – Material and Surface Roughness properties

Substrate Causal Extrapolation Reference Points

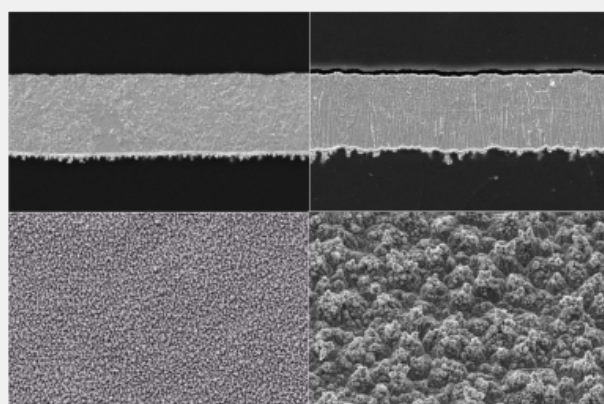
Set Dielectric Constant (Er) from Stack Up materials
 Set Loss Tangent (TanD) from Stack Up materials

	Freq (Hz)	Ref Er	Ref TanD
H1	1.000E+09	4.2000	0.0195
H2	1.000E+09	4.0000	0.0191
H3			
H4			
REr			
CEr	1.000E+09	4.0000	0.0200

Surface Roughness Compensation

Smooth
 Hammerstad
 Grosse
 Huray

Surface Roughness Compensation - Huray - BETA



Ratio of Areas:
 Effective Ball Radius (µm):
 Area of Ball Count (sq µm):
 Number of Balls in Area:

Images by courtesy of Circuit Foil Luxembourg

In order to accurately calculate Dielectric Loss it is important to understand the material / substrate properties.

These substrate properties including dielectric constant (Er) and loss tangent (TanD) are specified here for each structure substrate region.

Speedstack causally extrapolates Er and TanD over the specified frequency range using the Svensson-Djordjevic method, hence the ability to specify the extrapolation reference points for each substrate region. The reference point data is usually available from the material supplier data sheet and can be added to the Speedstack material library. The checkbox options will automatically populate these fields from the stack up materials.

To accurately calculate Conductor Loss it is necessary to specify the surface roughness parameters.

Speedstack supports multiple roughness models: Hammerstad, Grosse, Huray and Cannonball-Huray. In this example the Huray method is used, the dialog prompts for the required roughness parameters.

Virtual Material Mode enhancements

Stack Up Wizard (Virtual Material Mode)

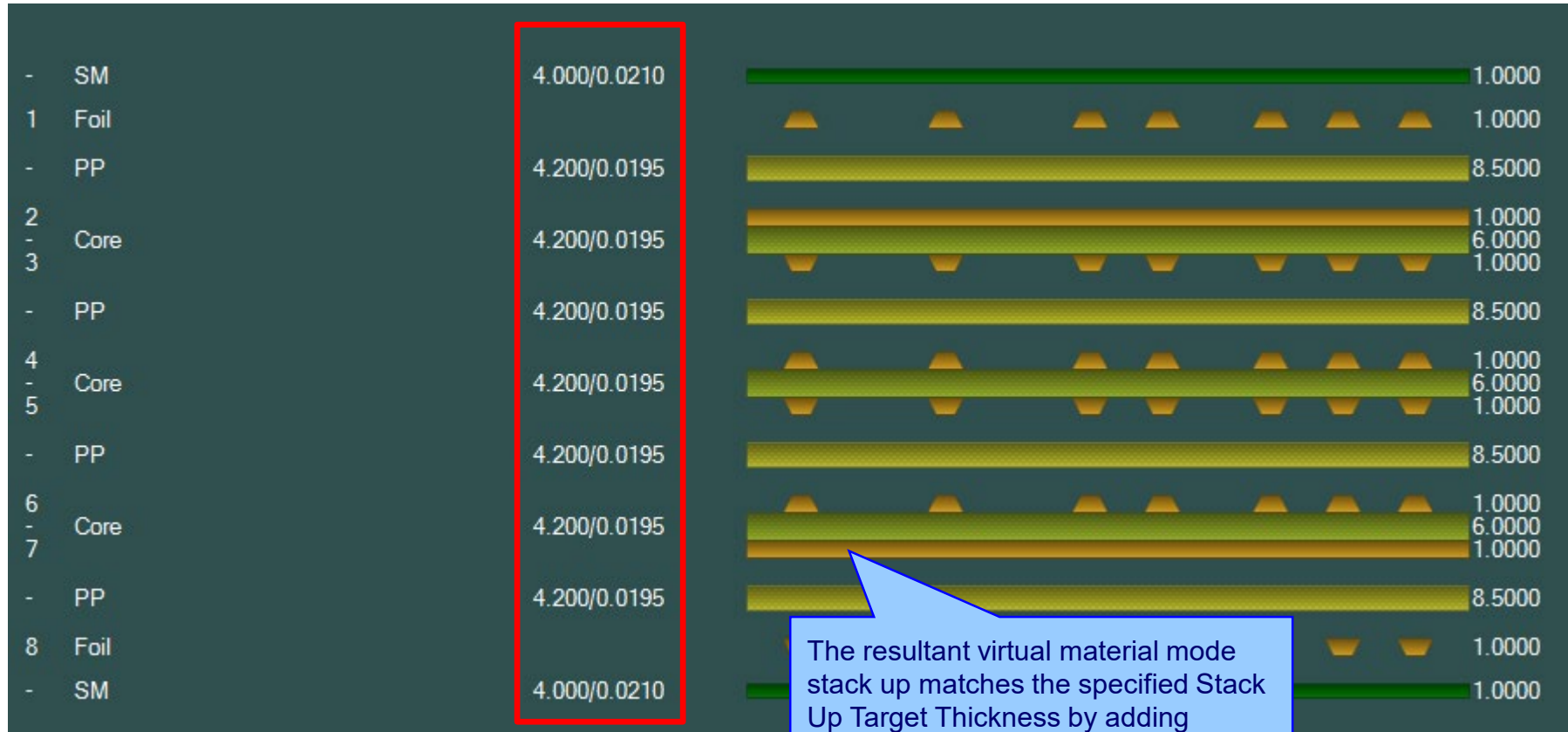
Number of Layers	8	Nominal Dielectric Constant	4.2000	
Target Stack Up Thickness	60.0000	Nominal Loss Tangent	0.0195	
Positive Tolerance %	10	Solder Mask Top <input checked="" type="checkbox"/>	Solder Mask Bottom <input checked="" type="checkbox"/>	
Negative Tolerance %	10	Solder Mask Dielectric Constant	4.0000	
Symmetrical <input checked="" type="checkbox"/>		Solder Mask Loss Tangent	0.0210	
Plane Layers	Mixed Layers	Solder Mask Thickness	1.0000	
1	1	Preferred Core Thickness	6.0000	
2	2	Copper Thickness	1.0000	
3	3			
4	4	Build Type		
5	5	<input checked="" type="radio"/> Foil	<input type="radio"/> Core	<input type="radio"/> Sequential/H
6	6			
7	7			
8	8			

<Previous Next >

Virtual Material Mode allows for very quick generation of stack ups without the need to populate the material library. It is great for 'what if' scenarios.

Speedstack 2019 introduces material and solder mask loss tangent parameter entries to the wizard.

Virtual Material Mode enhancements




Printing Enhancements – Support for Loss Tangent

Speedstack Report Printer

File Options

C:\Program Files\Polar\Speedstack\Samples\Eval Imperial v16.sci Units: Mills



Layer	Stack up	Supplier	Type	Description	Processed Thickness	ϵ_r	Loss Tangent	Impedance ID
1		Polar Samples	SolderMask	Liquid Photolimageable Mask	1.000	4.000	0.0200	
		Polar Samples	Copper	Copper Foil	1.400			1, 2
2		Polar Samples	Dielectric	PrePreg 1080	1.950	4.000	0.0191	
					1.400			
3		Polar Samples	FR4	FR4 Core	3.000	4.200	0.0195	
					1.400			
4		Polar Samples	Dielectric	PrePreg 3080	2.776	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 1651	5.552	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 1651	5.552	4.200	0.0195	
					1.400			3
5		Polar Samples	FR4	FR4 Core	12.000	4.200	0.0195	
					1.400			
6		Polar Samples	Dielectric	PrePreg 1651	5.552	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 1651	5.552	4.200	0.0195	
		Polar Samples	Dielectric	PrePreg 3080	2.776	4.200	0.0195	
7		Polar Samples	FR4	FR4 Core	3.000	4.200	0.0195	
					1.400			
8		Polar Samples	Dielectric	PrePreg 1080	1.950	4.200	0.0195	
		Polar Samples	Copper	Copper Foil	1.400			4
		Polar Samples	SolderMask	Liquid Photolimageable Mask	1.000	4.000	0.0195	

Copper Thickness = 11.200 | Dielectric Thickness = 49.660 | Solder Mask Thickness = 2.000 | Stack Up Thickness = 60.860 | Stack Up Thickness with Soldermask = 62.860

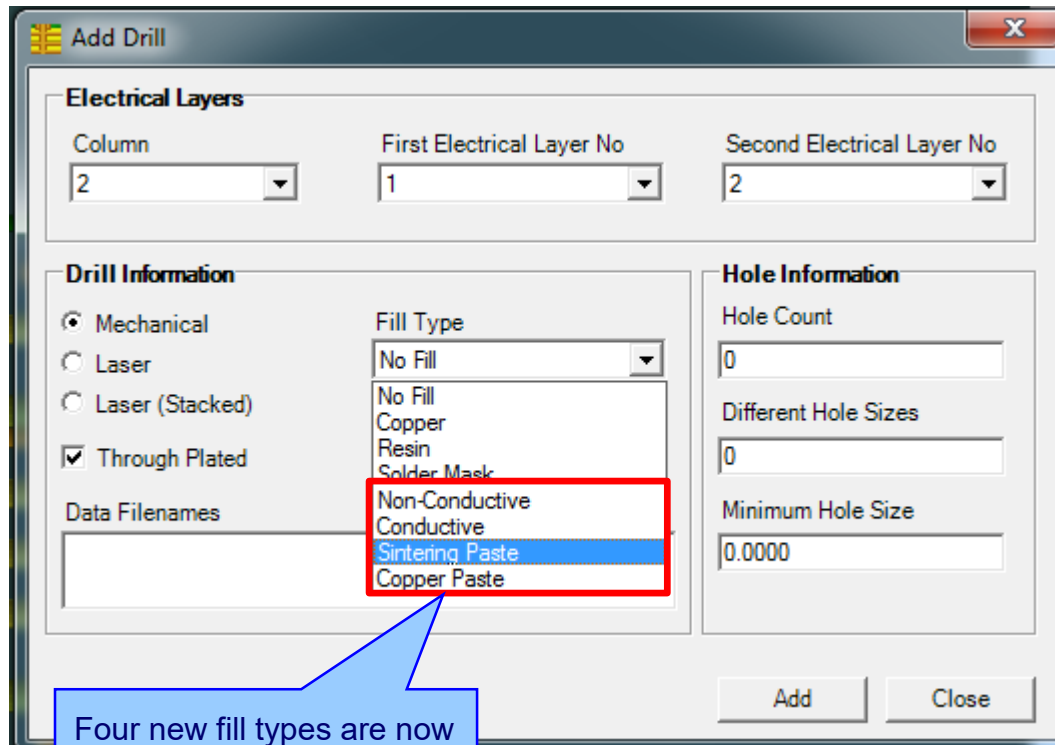
Loss Tangent is a selectable column within the print option

Speedstack 2019 allows comprehensive bidirectional copy and paste from Speedstack into Si9000e including all relevant loss tangent, roughness and roughness method parameters along with frequencies of interest.

The screenshot displays the Polar Si9000 PCB Transmission Line Field Solver interface. The main window shows a cross-section of a 'Coated Microstrip 2B' structure with parameters: Length of Line (LL) = 1000.00, Trace Conductivity (TC) = 5.80E+07, Loss Tangent (TanD) = 0.0195, Rise Time (Tr) = 10, Frequency Minimum (FMin) = 500,000, Frequency Maximum (FMax) = 10,000, and Frequency Steps (FSteps) = 20. The 'Frequency Distribution' is set to Linear, and 'Result Presentation' is set to Length of Line. The 'Extended Substrate Data' includes Er1, Er2, C1, C2, W1, W2, and T1. The 'Surface Roughness Compensation' is set to Smooth. The 'Measurement Data' section shows 'No Data Imported'. A large blue arrow points from the parameter entry area to the 'Frequency Dependent Properties' window.

The 'Frequency Dependent Properties' window shows a graph of 'All Losses with Roughness - dB/m' versus 'Frequency - MHz' for the 'Coated Microstrip 2B' structure. The graph displays five data series: Conductor Loss (red), Dielectric Loss (green), Attenuation (blue), Conductor Loss with Roughness (yellow), and Attenuation with Roughness (cyan). The x-axis ranges from 1000 to 10000 MHz, and the y-axis ranges from 0 to -50 dB/m. The graph shows that all loss components increase with frequency, with Attenuation with Roughness being the most significant loss component at higher frequencies.

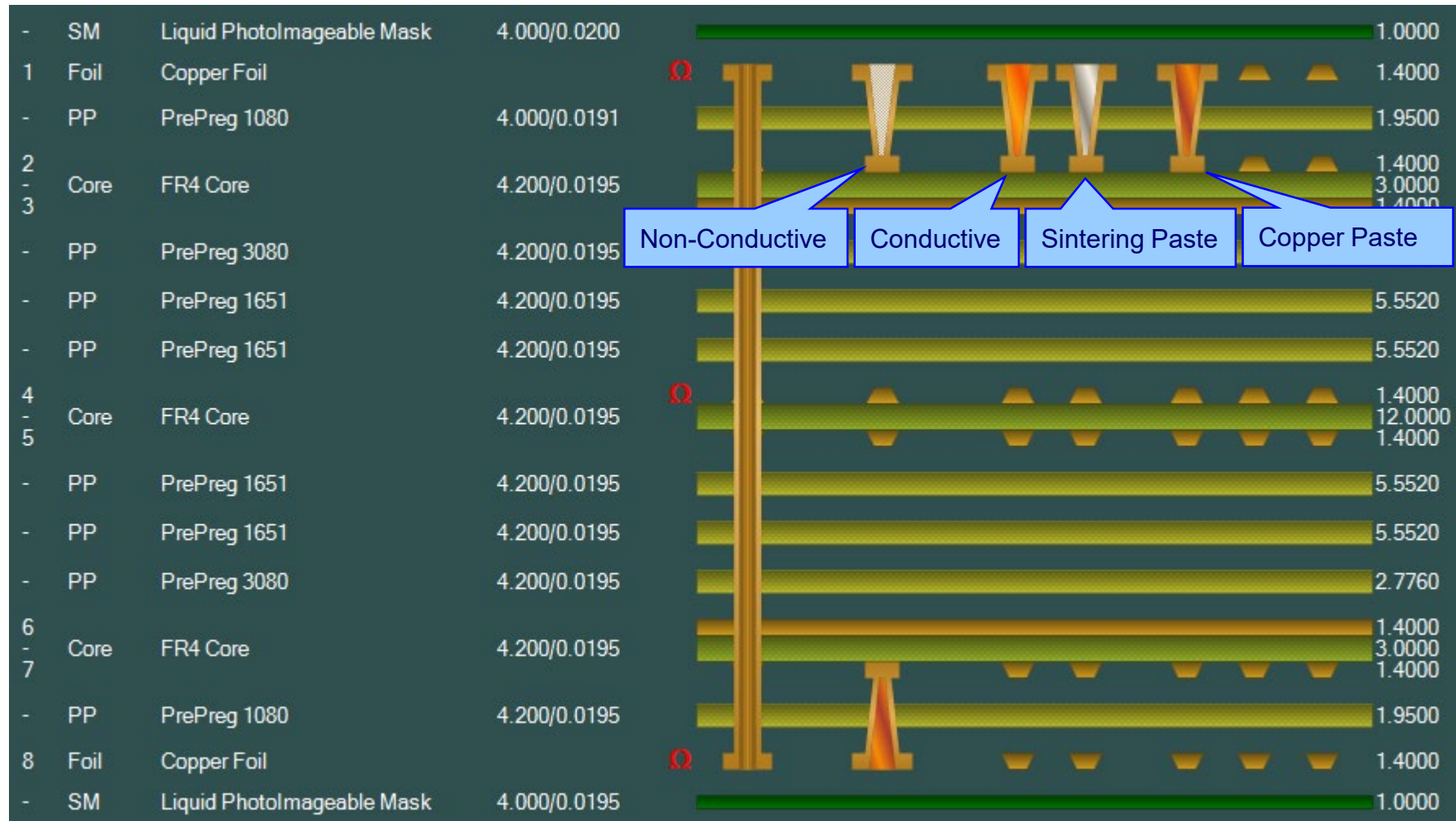
Drill / Via Fill Types – Four new types added



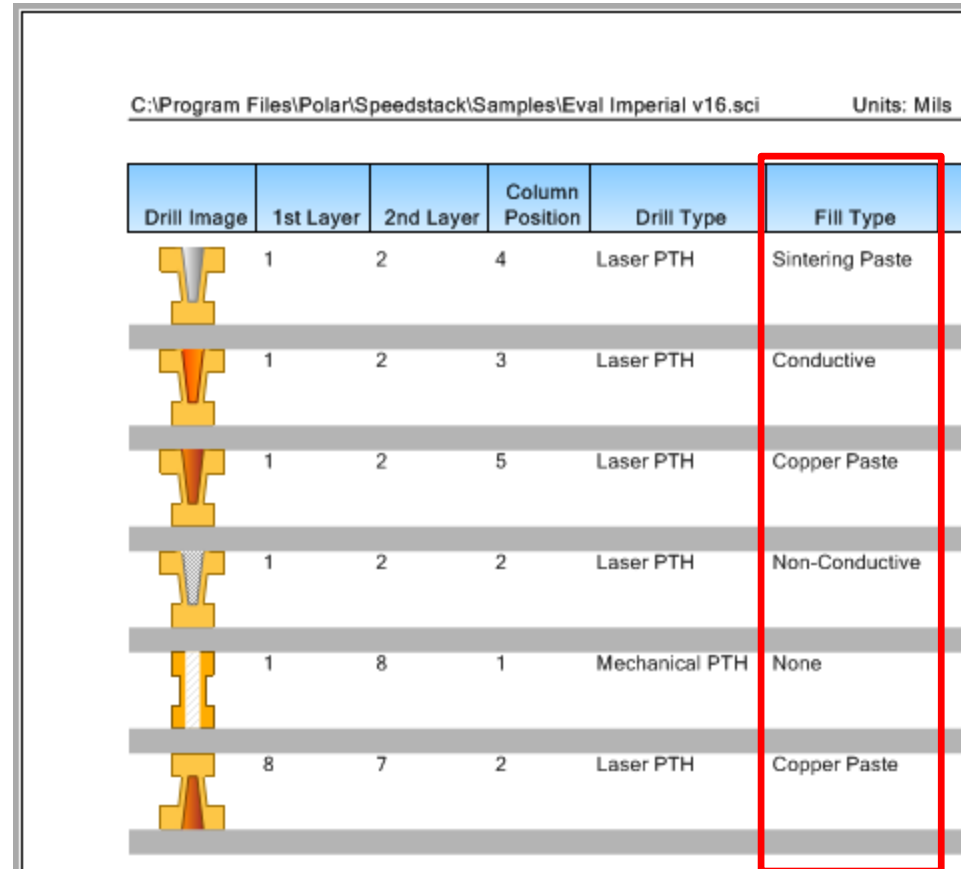
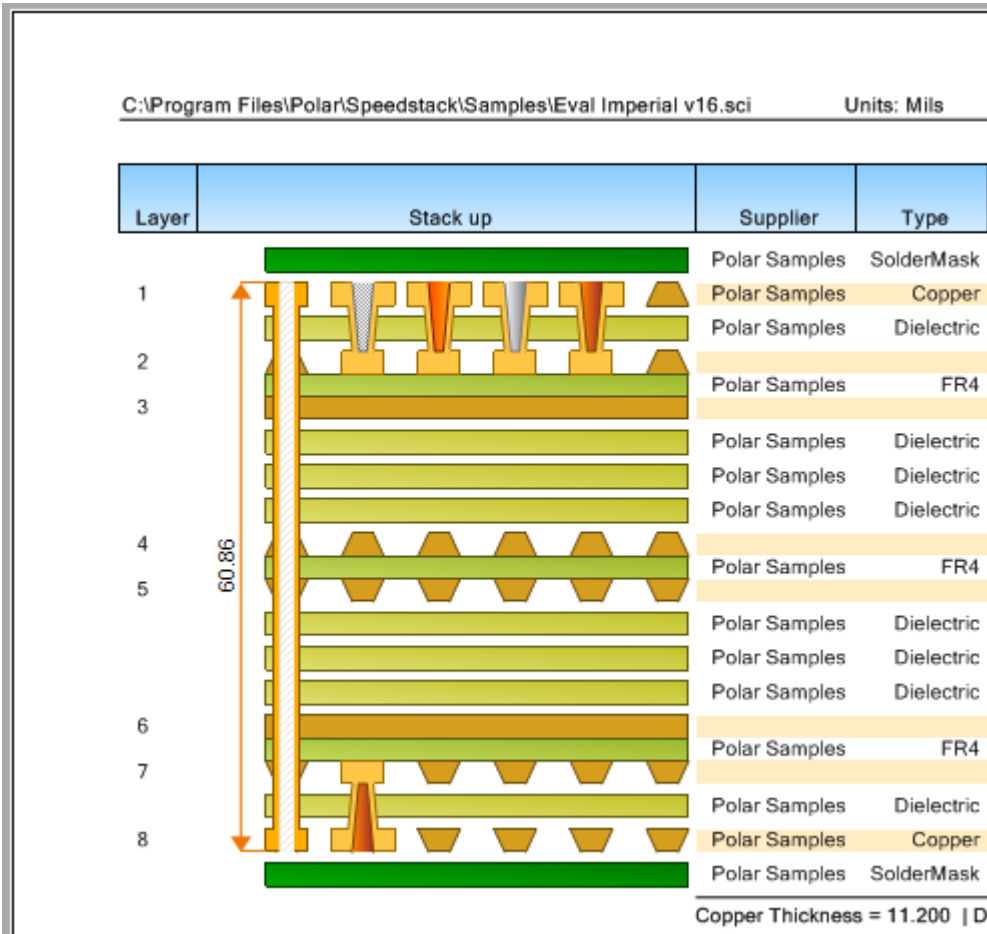
Four new fill types are now supported:

1. Non-Conductive
2. Conductive
3. Sintering Paste
4. Copper Paste

Drill / Via Fill Types – Four new types added



Drill / Via Fill Types – Four new types added



Fill Types

The following Import / Export options have been updated to support new fields introduced with Speedstack 2019:

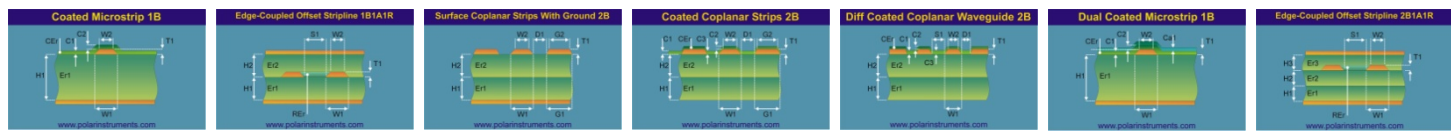
- XML STKX v16.00 and SSX v6.00 import / export options
- IPC-2581 Rev B import / export options
- CSV export option
- Gerber export option
- DXF export option

Impedance and Insertion Loss Calculations:

- New amalgamation algorithm - now amalgamates multiple substrates to a single substrate for both dielectric constant and loss tangent
- Modifications implemented to support causal surface roughness

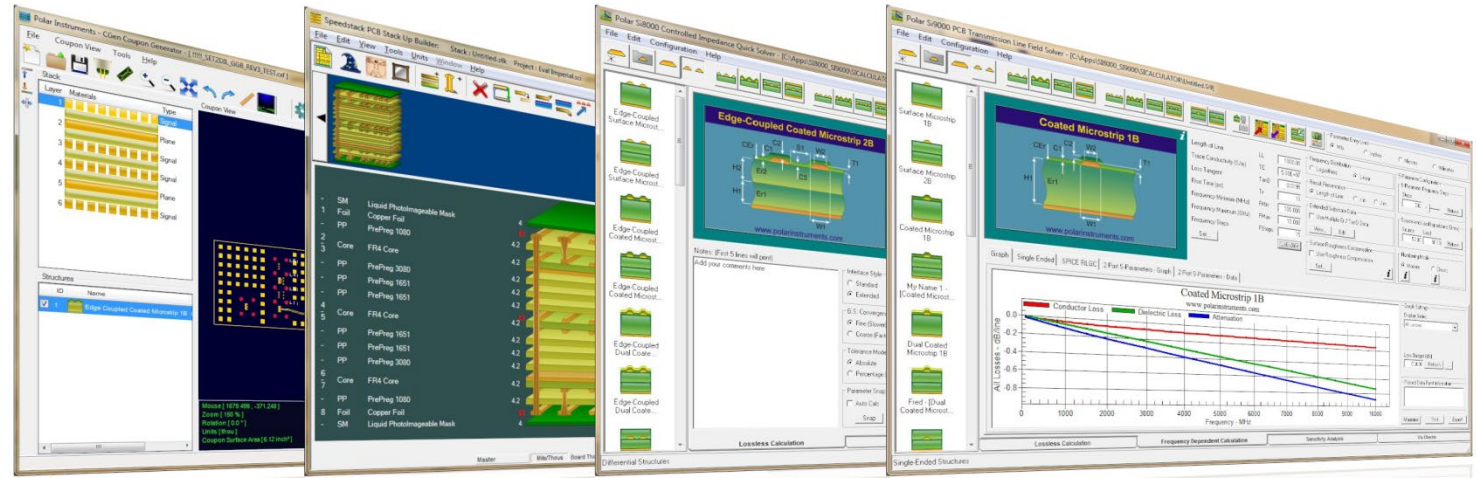
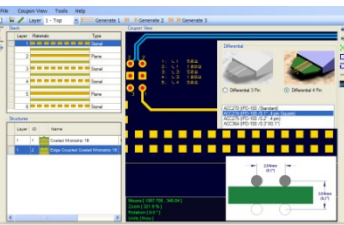
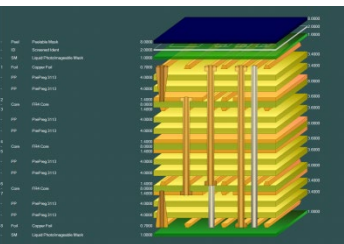
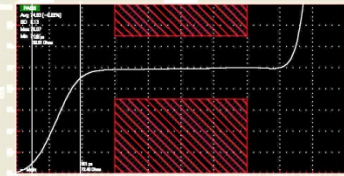
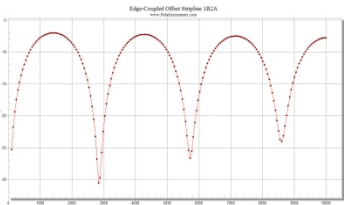
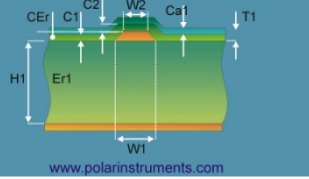
Rigid-Flex Improvements. When introducing air gaps into a sub-stack that previously had contiguous materials it is now possible to reassign this sub-stack to one that contains mini-stacks, by using the 'Reset Mini-Stack Settings' option from the Navigator menu. This is especially useful when designing 'book-binder' or 'doublet' rigid-flex constructions

Ucamco Interface. The File menu 'Save and Continue' and 'Save and Quit' options now support the SSX v6.00 file format

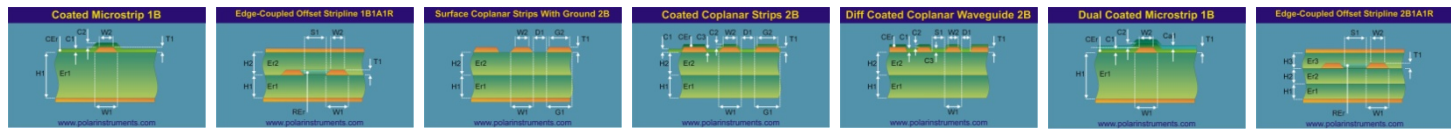


Thank you

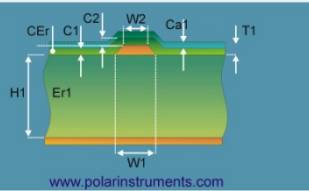
Impedance calculation



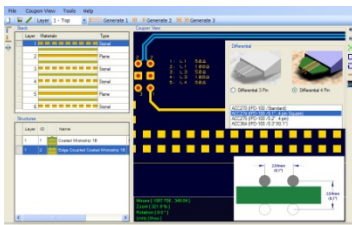
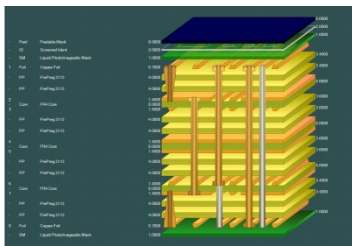
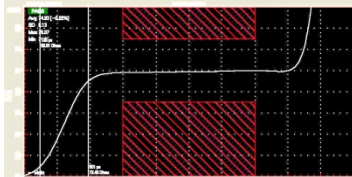
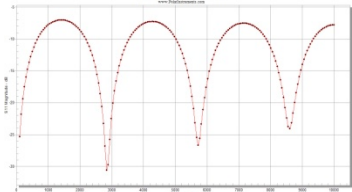
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Impedance calculation



Edge-Coupled Offset Stripline 1B1A



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