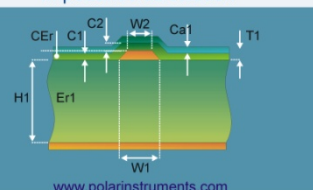


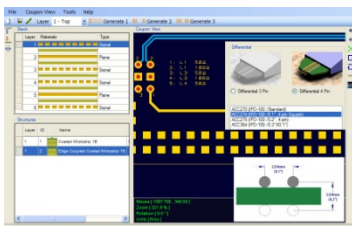
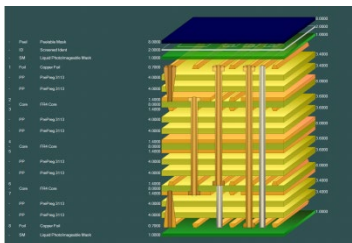
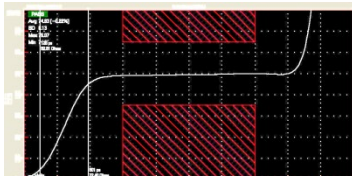
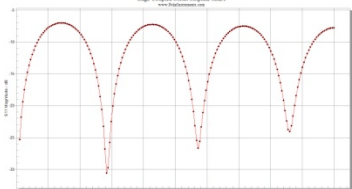
Speedstack 2020 Release

Richard Attrill – January 2020 (Rev 2)

Impedance calculation



Edge-Coupled Offset Stripline 1B1A



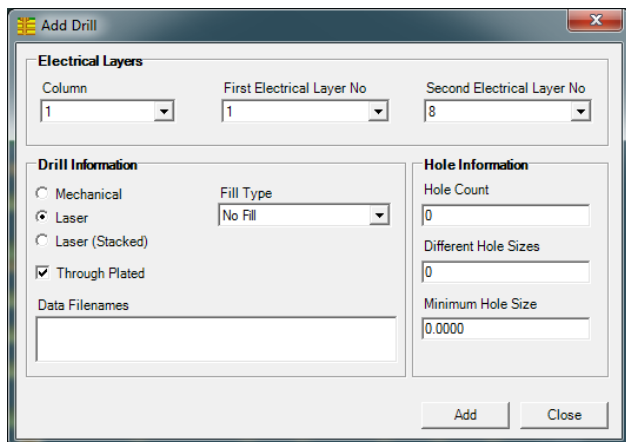
Introducing Speedstack 2020

Welcome to Speedstack 2020.

Speedstack 2020's new features include many 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.

Drilling enhancements

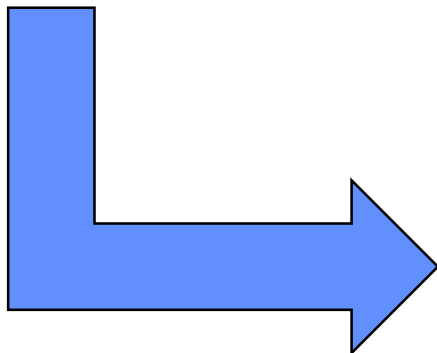
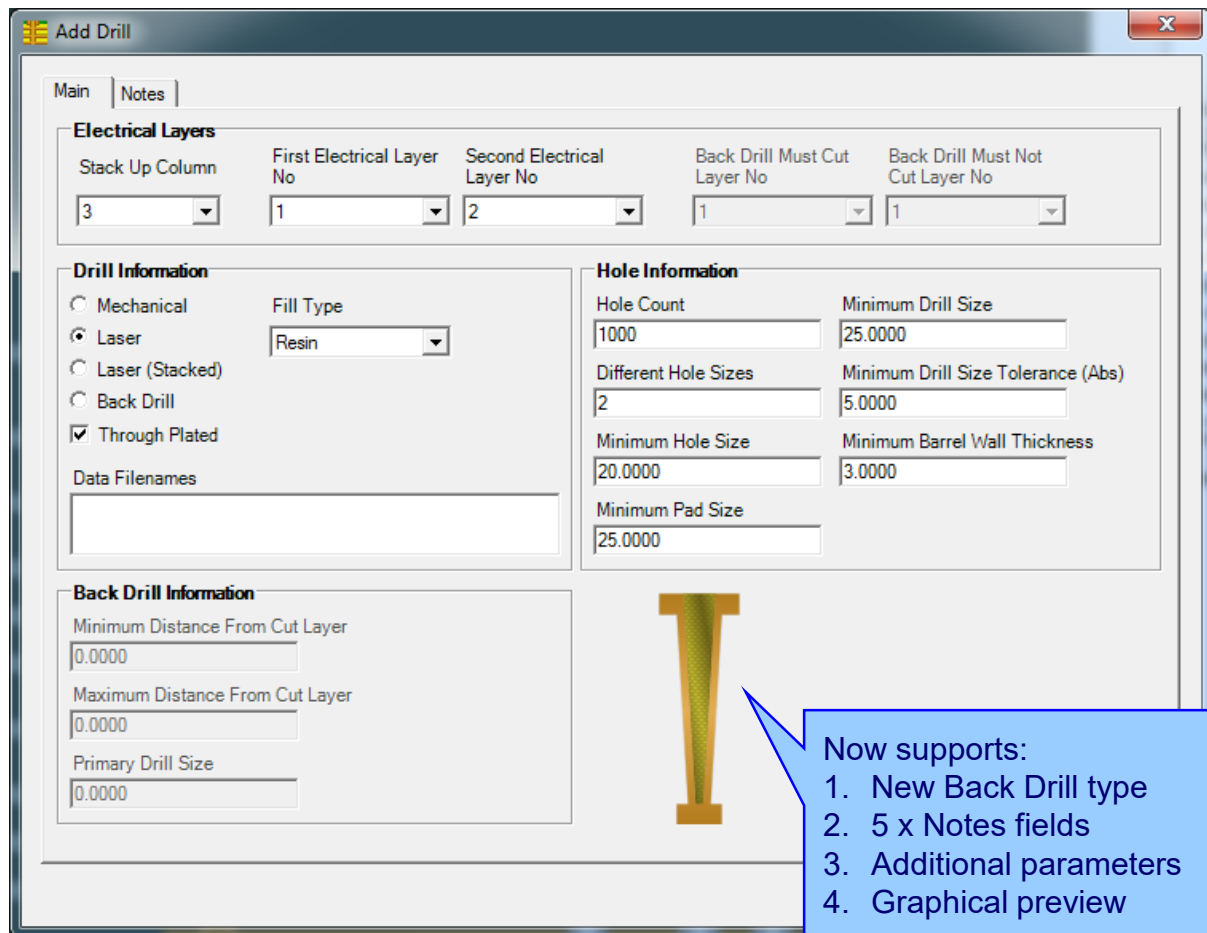


The 'Current Add Drill dialog' is a simple window with the following fields:

- Electrical Layers:** Column (1), First Electrical Layer No (1), Second Electrical Layer No (8).
- Drill Information:**
 - Radio buttons: Mechanical, **Laser**, Laser (Stacked).
 - Checkboxes: **Through Plated**.
 - Field: Data Filenames.
- Hole Information:**
 - Field: Fill Type (No Fill).
 - Field: Hole Count (0).
 - Field: Different Hole Sizes (0).
 - Field: Minimum Hole Size (0.0000).

Buttons: Add, Close.

Current Add Drill dialog

The 'Enhanced Add Drill dialog' is a more complex window with the following fields:

- Electrical Layers:**
 - Stack Up Column (3)
 - First Electrical Layer No (1)
 - Second Electrical Layer No (2)
 - Back Drill Must Cut Layer No (1)
 - Back Drill Must Not Cut Layer No (1)
- Drill Information:**
 - Radio buttons: Mechanical, **Laser**, Laser (Stacked), Back Drill.
 - Checkboxes: **Through Plated**.
 - Field: Data Filenames.
- Hole Information:**
 - Field: Fill Type (Resin).
 - Field: Hole Count (1000).
 - Field: Minimum Drill Size (25.0000).
 - Field: Different Hole Sizes (2).
 - Field: Minimum Drill Size Tolerance (Abs) (5.0000).
 - Field: Minimum Hole Size (20.0000).
 - Field: Minimum Barrel Wall Thickness (3.0000).
 - Field: Minimum Pad Size (25.0000).
- Back Drill Information:**
 - Field: Minimum Distance From Cut Layer (0.0000).
 - Field: Maximum Distance From Cut Layer (0.0000).
 - Field: Primary Drill Size (0.0000).

Buttons: Add, Close.

A graphical preview of a back drill is shown on the right side of the dialog.

- Now supports:
1. New Back Drill type
 2. 5 x Notes fields
 3. Additional parameters
 4. Graphical preview

Enhanced Add Drill dialog with improved functionality

New Back Drill type

Add Drill

Main | Notes

Electrical Layers

Stack Up Column: 3 | First Electrical Layer No: 8 | Second Electrical Layer No: 7 | Back Drill Must Cut Layer No: 7 | Back Drill Must Not Cut Layer No: 6

Drill Information

☐ Mechanical | ☐ Laser | ☐ Laser (Stacked) | ☒ **Back Drill** | ☐ Through Plated | Fill Type: No Fill

Data Filenames:

Hole Information

Hole Count: 1000 | Minimum Drill Size: 55.0000 | Different Hole Sizes: 2 | Minimum Drill Size Tolerance (Abs): 5.0000 | Minimum Hole Size: 50.0000 | Minimum Barrel Wall Thickness: 0.0000 | Minimum Pad Size: 0.0000

Back Drill Information

Minimum Distance From Cut Layer: 5.0000 | Maximum Distance From Cut Layer: 5.0000 | Primary Drill Size: 30.0000

Graphical preview of drill to be added, in this case a Back Drill

Add | Close

Back drills require the nomination of the Must Cut Layer (MC) and Must Not Cut Layer (MNC)

New Back Drill option

Important Back Drill information is entered here

[illegible]

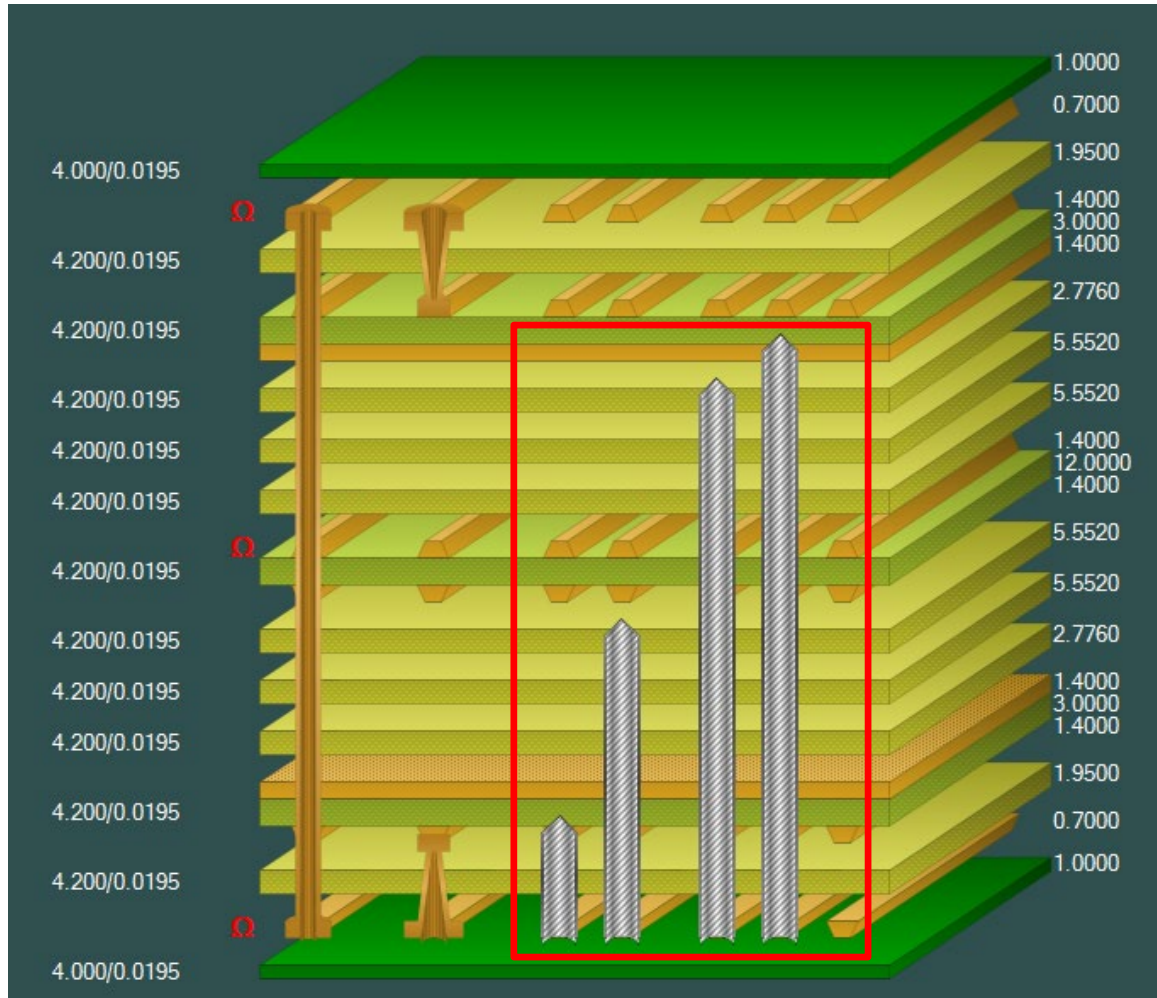
The diagram illustrates a 16-layer PCB stackup with the following layers and properties:

Layer	Material	Thickness (mm)	Dielectric Constant (Dk)	Loss Tangent (Df)	Notes
1	FR-4	1.0000	4.000	0.0195	Top Copper Layer
2	FR-4	0.7000	4.200	0.0195	Prepreg
3	FR-4	1.9500	4.200	0.0195	Core
4	FR-4	1.4000	4.200	0.0195	Prepreg
5	FR-4	3.0000	4.200	0.0195	Core
6	FR-4	1.4000	4.200	0.0195	Prepreg
7	FR-4	2.7760	4.200	0.0195	Core
8	FR-4	5.5520	4.200	0.0195	Prepreg
9	FR-4	5.5520	4.200	0.0195	Core
10	FR-4	1.4000	4.200	0.0195	Prepreg
11	FR-4	12.0000	4.200	0.0195	Core
12	FR-4	1.4000	4.200	0.0195	Prepreg
13	FR-4	5.5520	4.200	0.0195	Core
14	FR-4	5.5520	4.200	0.0195	Prepreg
15	FR-4	1.4000	4.200	0.0195	Core
16	FR-4	3.0000	4.200	0.0195	Prepreg
17	FR-4	1.4000	4.200	0.0195	Core
18	FR-4	0.7000	4.000	0.0195	Bottom Copper Layer
19	FR-4	1.0000	4.000	0.0195	Bottom Copper Layer

Key manufacturing constraints highlighted in the diagram:

- Must Not Cut Layer 6:** Indicated by a blue callout pointing to the 6th layer.
- Must Cut Layer 7:** Indicated by a blue callout pointing to the 7th layer.
- Layer 8:** Indicated by a blue callout pointing to the 8th layer.

New Back Drill type



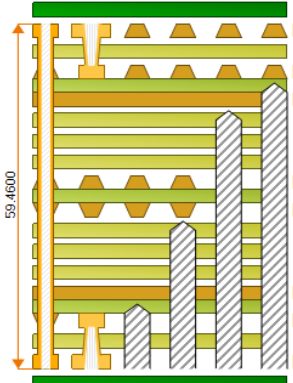
Other examples of the new Speedstack Back Drill capability. Although this is not a 'real world' stack up it does show how back drills can be added using the Must Cut / Must Not Cut methodology

New Back Drill type

C:\Program Files\Polar\Speedstack\Samples\Eval Imperial Back Drill v17.sci





Units: Mils



Layer	Stack up	Description	Processed Thickness	εr	Loss Tangent	Impedance ID
1		Liquid PhotoImageable Mask	1.000	4.000	0.0195	
		Copper Foil	0.700			1, 2
		PrePreg 1080	1.950	4.200	0.0195	
2			1.400			
		FR4 Core	3.000	4.200	0.0195	
			1.400			
		PrePreg 3080	2.776	4.200	0.0195	
		PrePreg 1651	5.552	4.200	0.0195	
3		PrePreg 1651	5.552	4.200	0.0195	
			1.400			3
		FR4 Core	12.000	4.200	0.0195	
			1.400			
		PrePreg 1651	5.552	4.200	0.0195	
		PrePreg 1651	5.552	4.200	0.0195	
		PrePreg 3080	2.776	4.200	0.0195	
4			1.400			
		FR4 Core	3.000	4.200	0.0195	
			1.400			
		PrePreg 1080	1.950	4.200	0.0195	
5		Copper Foil	0.700			4
6		Liquid PhotoImageable 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

The Speedstack technical report option has been enhanced to document the new Back Drill capability.

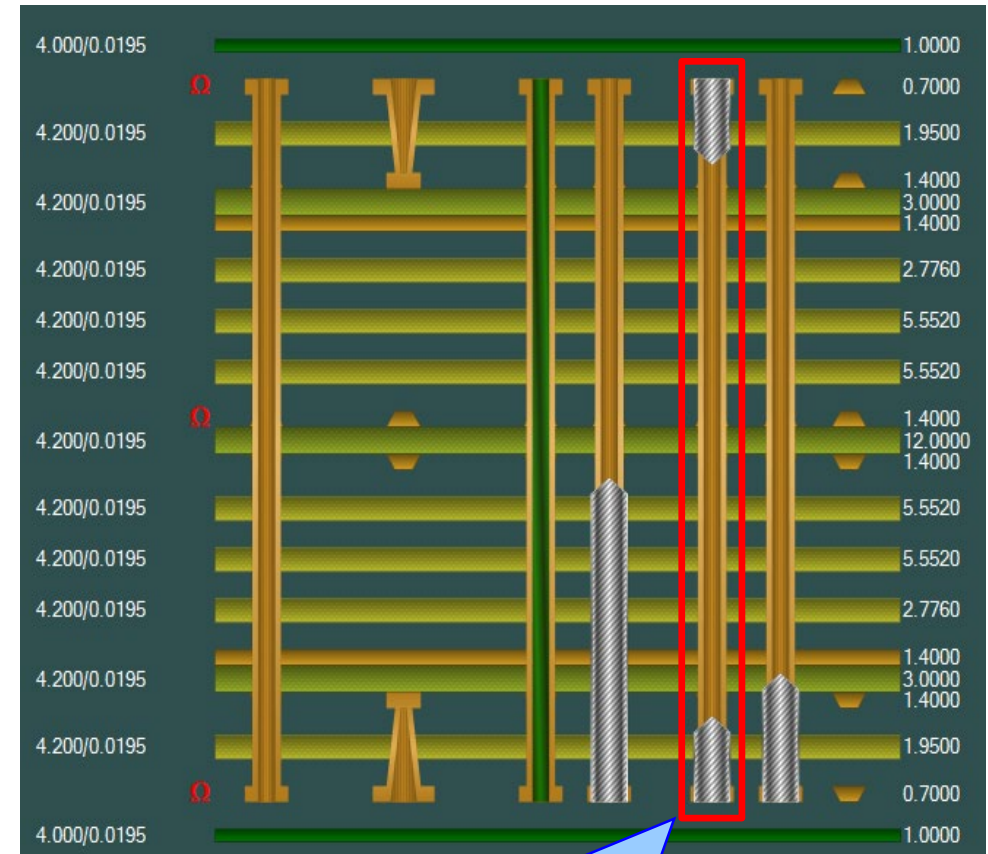
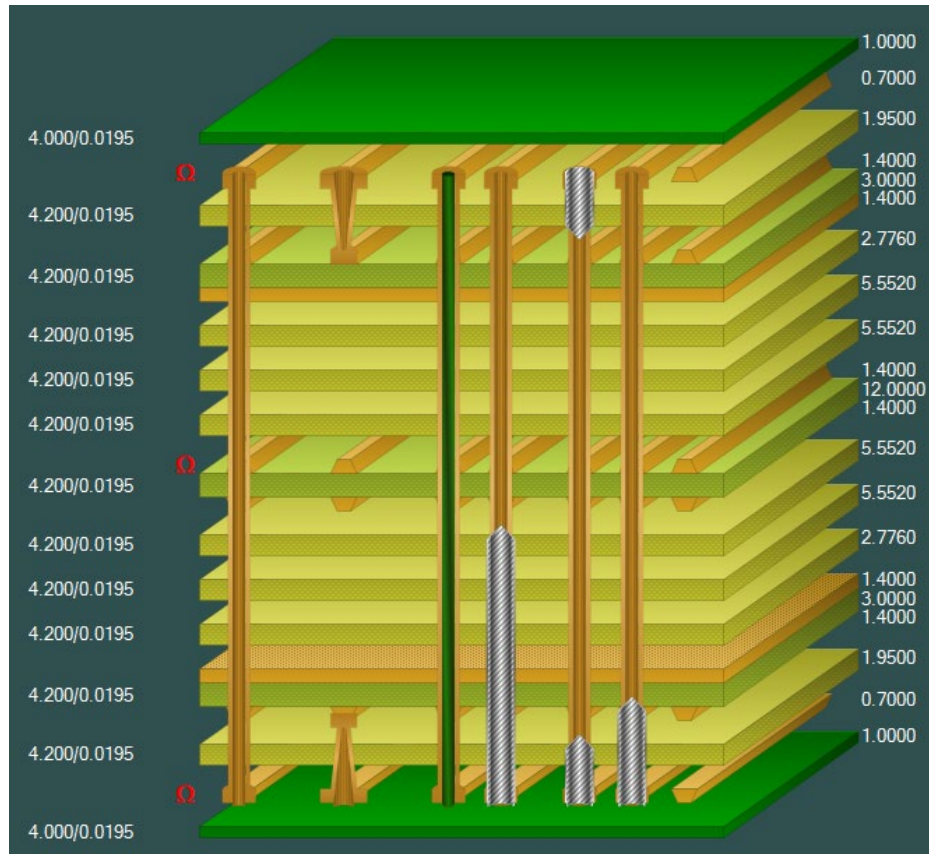
Impedance ID	Structure Image	Impedance Signal Layer	Ref. Plane 1 in Layer	Ref. Plane 2 in Layer	Lower Trace Width (W1)	Upper Trace Width (W2)	Trace Separation (S1)	Target Impedance	Tol (+/- %)	Calculated Impedance
1		1	3	0	8.500	7.500	8.115	100.000	10.000	100.350
2		1	3	0	4.500	3.500	0.000	75.000	10.000	75.870
3		4	3	6	7.250	6.250	8.500	100.000	10.000	101.280
4		8	6	0	4.500	3.500	0.000	75.000	10.000	75.870

StackName: Master		Revision:		Modification:		Date of Revision:		Editor		Page 1/X
Drawing No:										
Date:										
Author:										
Department:										
Site:										

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New Back Drill type

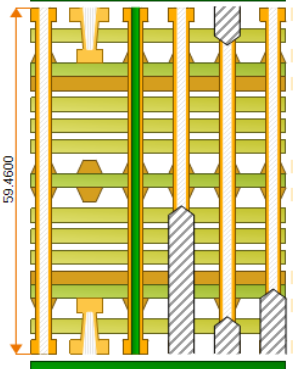


New Back Drill type





C:\Program Files\PolarSpeedstack\Samples\Eval Imperial Back Drill Keep Vias v17.sci

Units: Mils



Layer	Stack up	Description	Processed Thickness	εr	Loss Tangent	Impedance ID
1		Liquid PhotoImageable Mask	1.000	4.000	0.0195	
		Copper Foil	0.700			1, 2
		PrePreg 1080	1.950	4.200	0.0195	
2			1.400			
		FR4 Core	3.000	4.200	0.0195	
			1.400			
		PrePreg 3080	2.776	4.200	0.0195	
		PrePreg 1651	5.552	4.200	0.0195	
		PrePreg 1651	5.552	4.200	0.0195	
			1.400			3
		FR4 Core	12.000	4.200	0.0195	
			1.400			
		PrePreg 1651	5.552	4.200	0.0195	
		PrePreg 1651	5.552	4.200	0.0195	
		PrePreg 3080	2.776	4.200	0.0195	
6			1.400			
		FR4 Core	3.000	4.200	0.0195	
			1.400			
		PrePreg 1080	1.950	4.200	0.0195	
8		Copper Foil	0.700			4
		Liquid PhotoImageable 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	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		1	3	0	8.500	7.500	8.115	100.000	10.000	100.350
2		1	3	0	4.500	3.500	0.000	75.000	10.000	75.870
3		4	3	6	7.250	6.250	8.500	100.000	10.000	101.280
4		8	6	0	4.500	3.500	0.000	75.000	10.000	75.870

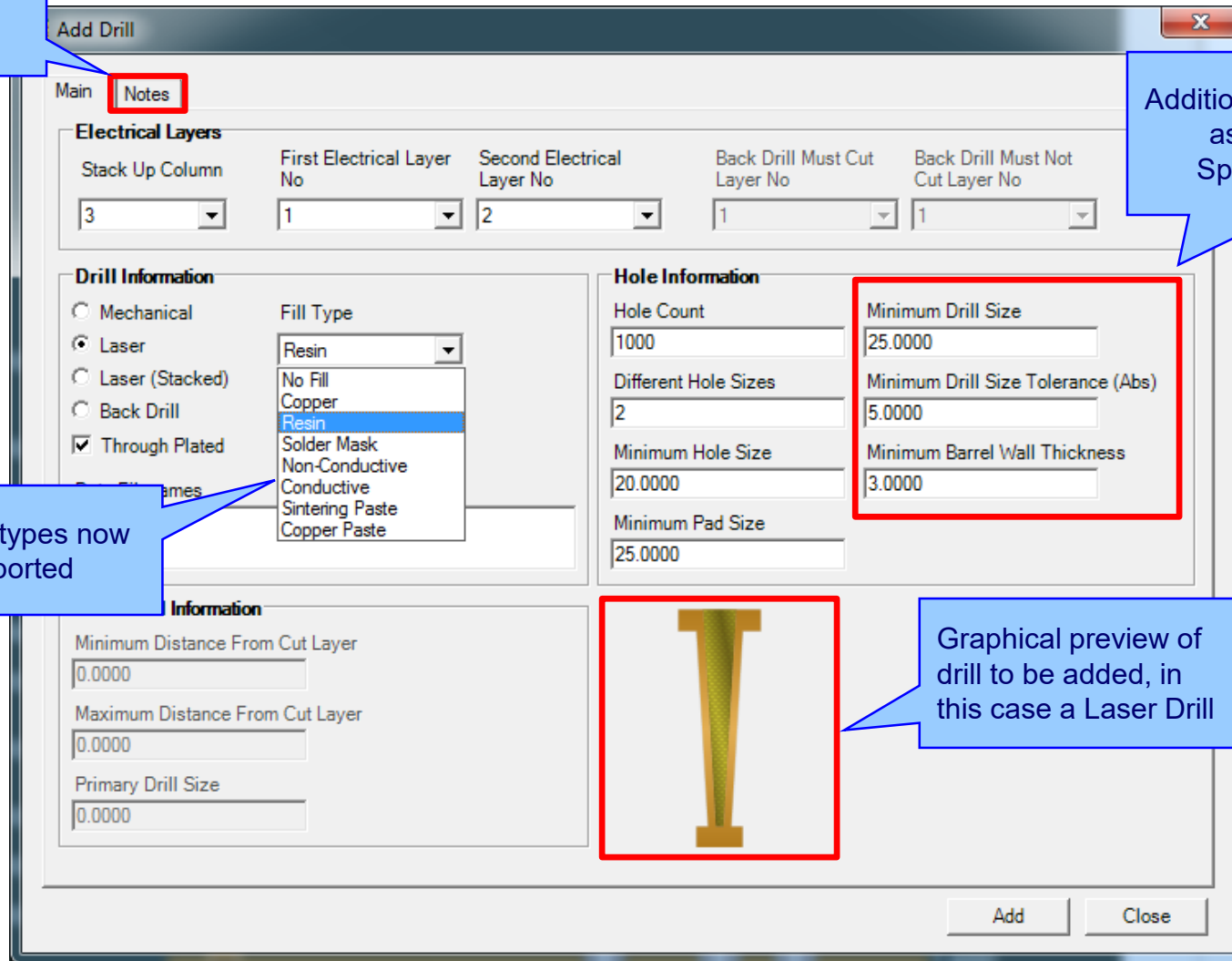
StackName: Master		Revision:		Modification:		Date of Revision:		Editor		Page 1/X	
Drawing No:		Associated Documents:									
Date:											
Author:											
Department:											
Site:											

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Other Drill enhancements

User-definable
Notes feature



Add Drill

Main **Notes**

Electrical Layers

Stack Up Column: 3

First Electrical Layer No: 1

Second Electrical Layer No: 2

Back Drill Must Cut Layer No: 1

Back Drill Must Not Cut Layer No: 1

Drill Information

☐ Mechanical

☒ Laser

☐ Laser (Stacked)

☐ Back Drill

☒ Through Plated

Fill Type: Resin

Fill Type Options: No Fill, Copper, Resin, Solder Mask, Non-Conductive, Conductive, Sintering Paste, Copper Paste

Hole Information

Hole Count: 1000

Different Hole Sizes: 2

Minimum Hole Size: 20.0000

Minimum Pad Size: 25.0000

Minimum Drill Size: 25.0000

Minimum Drill Size Tolerance (Abs): 5.0000

Minimum Barrel Wall Thickness: 3.0000

Information

Minimum Distance From Cut Layer: 0.0000

Maximum Distance From Cut Layer: 0.0000

Primary Drill Size: 0.0000

Add Close

Additional drill parameters
as requested by
Speedstack users

Eight fill types now
supported

Graphical preview of
drill to be added, in
this case a Laser Drill

User-definable Notes fields

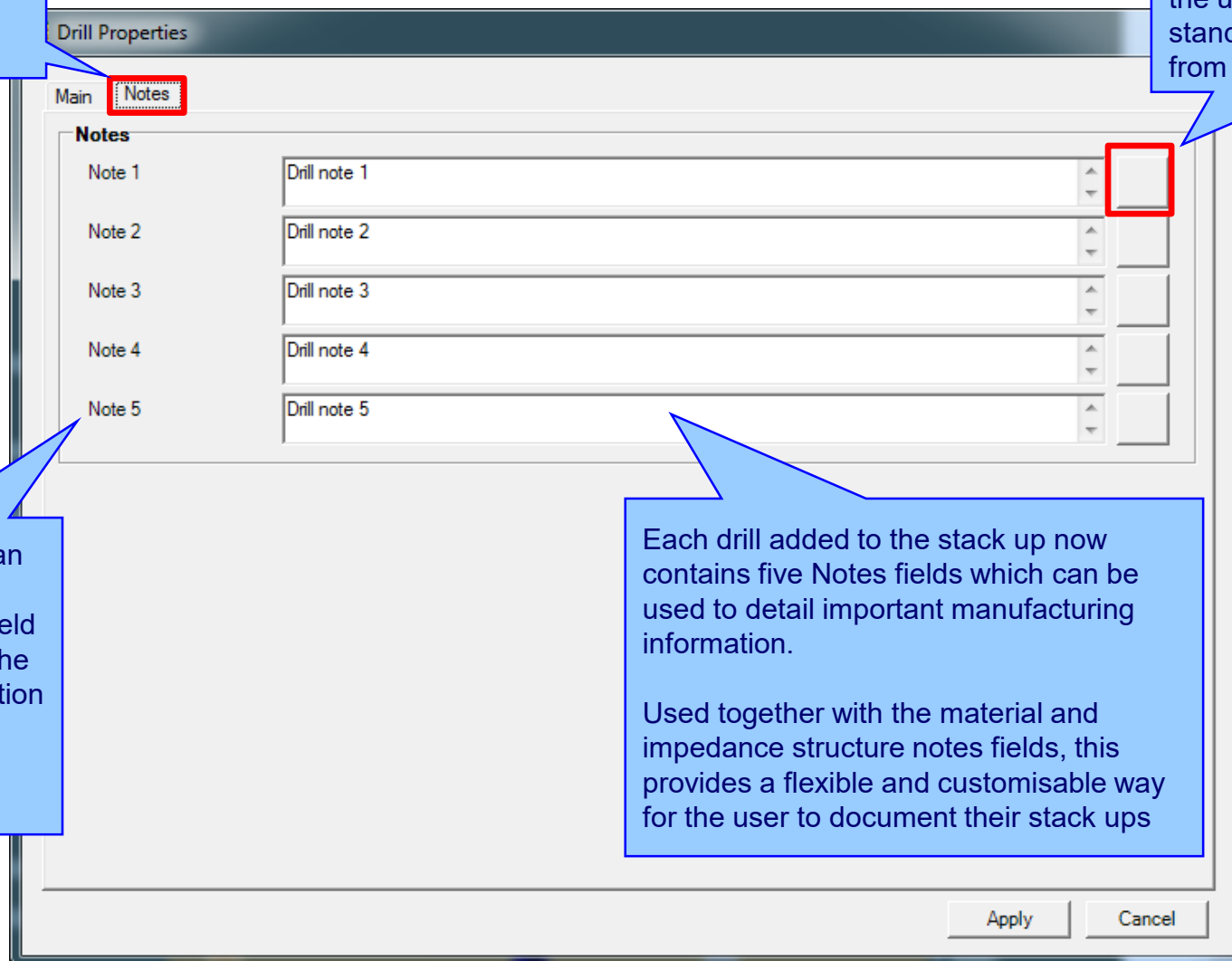
User-definable
Notes feature

Selecting the button next to each Notes field allows the user to import a standard set of notes from a text file

The Notes fields can be used for any purpose. A Note Field Alias capability in the technical report option allows the user to customise the field name printed.

Each drill added to the stack up now contains five Notes fields which can be used to detail important manufacturing information.

Used together with the material and impedance structure notes fields, this provides a flexible and customisable way for the user to document their stack ups



The screenshot shows the 'Drill Properties' dialog box with the 'Notes' tab selected. The 'Notes' section contains five rows, each with a label (Note 1 to Note 5) and a text field. To the right of each text field is a small square button. The 'Notes' tab is highlighted with a red box. The first square button is also highlighted with a red box. At the bottom of the dialog are 'Apply' and 'Cancel' buttons.

Notes		
Note 1	Drill note 1	<input type="button" value="Import"/>
Note 2	Drill note 2	<input type="button" value="Import"/>
Note 3	Drill note 3	<input type="button" value="Import"/>
Note 4	Drill note 4	<input type="button" value="Import"/>
Note 5	Drill note 5	<input type="button" value="Import"/>

Copper Finishing enhancements



Copper Coverage Based Prepreg Corrections

Percentage Copper To Be Embedded in Prepreg

☒ Set by Layer type

Signal Layer % 75

Mixed Layer % 15

Plane Layer % 5

☐ Proportional to Coverage

Copper Finishing

Enter values of thickness according to preference. The selected value will be the one added to the base thickness of copper layers when plating.

Name	Value	Selection
Class 1	0.7000	<input checked="" type="radio"/>
Class 2	1.0000	<input type="radio"/>
Class 3	1.4000	<input type="radio"/>
Class 4	2.8000	<input type="radio"/>

Excess Resin Test

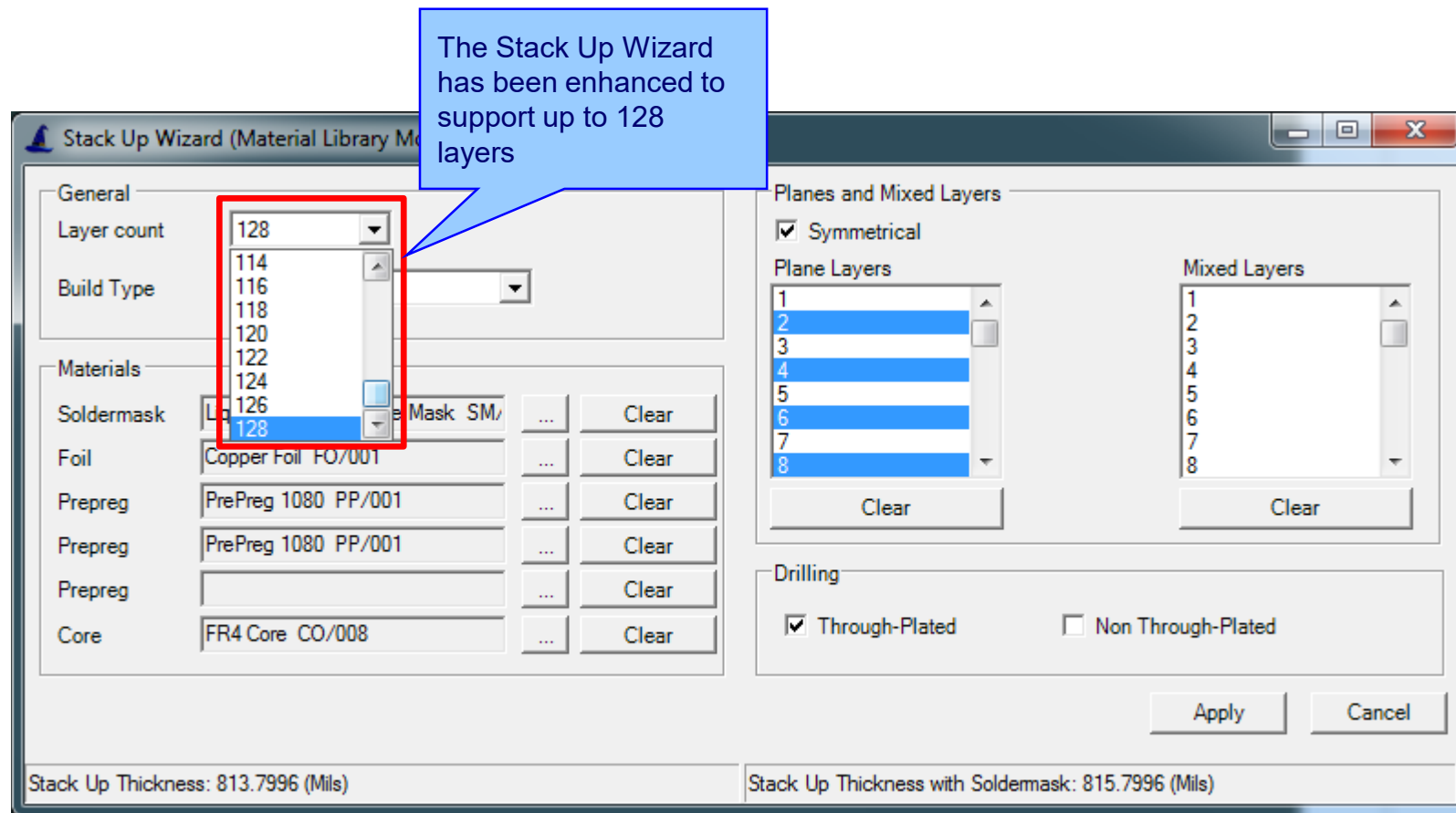
Minimum Excess Resin % 15

Apply Cancel

The Apply Finishing option now supports multiple user-nominated copper finishing values.

Depending upon the PCB Class selected, a different amount of copper plating is applied to the base copper

Stack Up Wizard – now supports build up to 128 layers



Polar Speedstack Stack Up Builder: Stack: Untitled.stk Project: Untitled.stk

File Edit View Tools Units External Utility Help

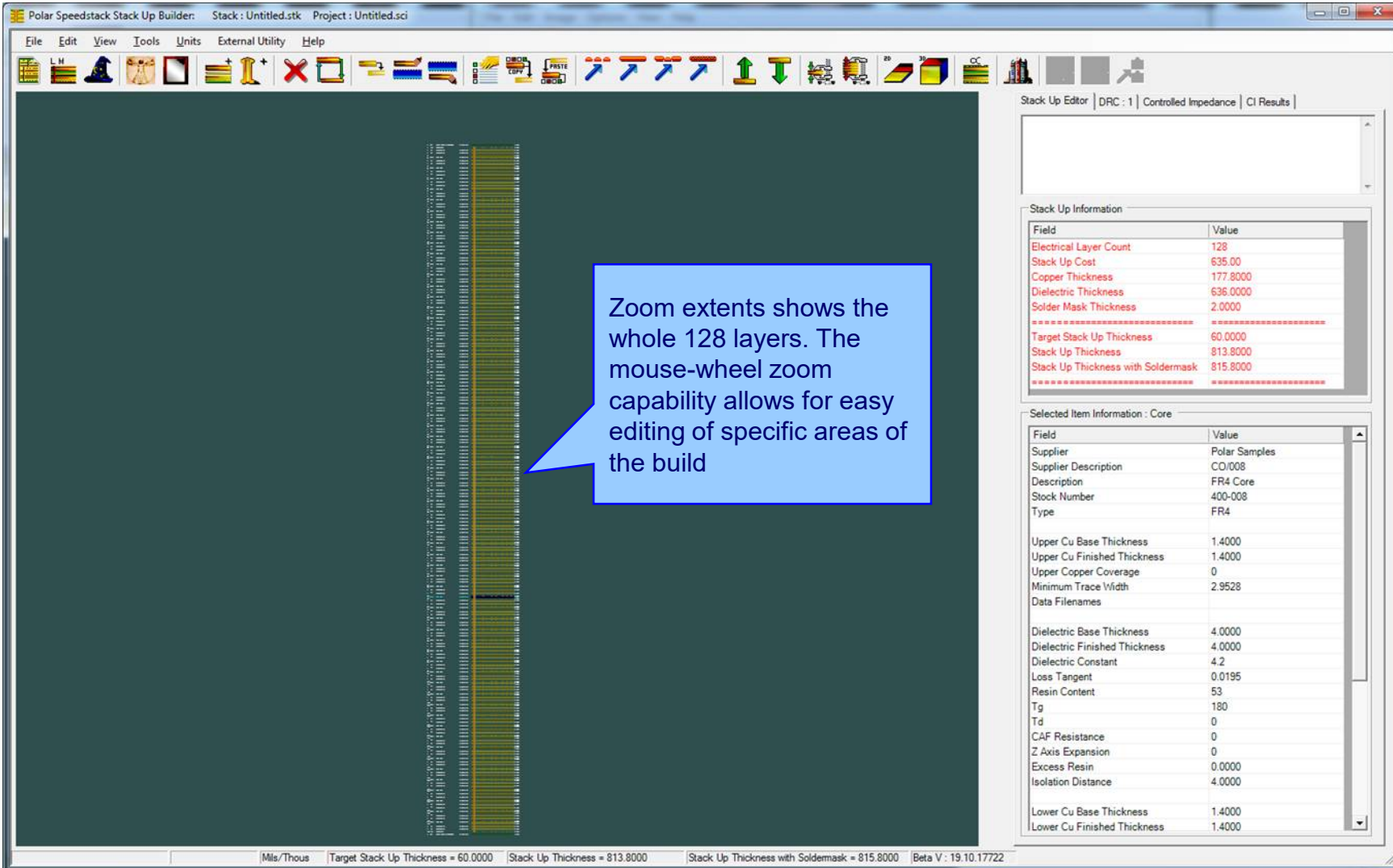
Stack Up Editor | DRC: 1 | Controlled Impedance | CI Results

Field	Value
Electrical Layer Count	128
Stack Up Cost	\$635.00
Copper Thickness	177.8000
Dielectric Thickness	636.0000
Solder Mask Thickness	2.0000
Target Stack Up Thickness	60.0000
Stack Up Thickness	813.8000
Stack Up Thickness with Soldermask	815.8000

Selected Item Information

Mils/Thous | Target Stack Up Thickness = 60.0000 | Stack Up Thickness = 813.8000 | Stack Up Thickness with Soldermask = 815.8000 | Beta V: 19.10.17722

Stack Up Wizard – now supports build up to 128 layers



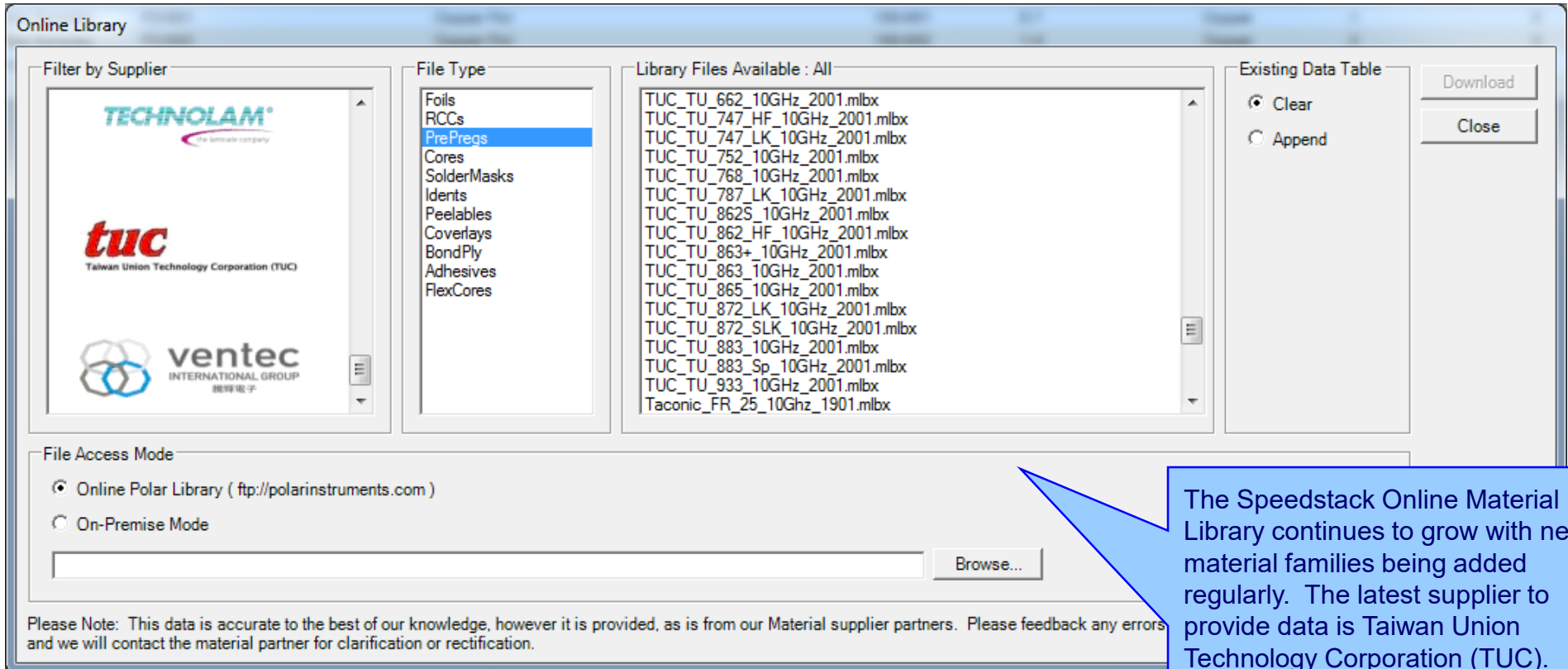
Zoom extents shows the whole 128 layers. The mouse-wheel zoom capability allows for easy editing of specific areas of the build

Field	Value
Electrical Layer Count	128
Stack Up Cost	635.00
Copper Thickness	177.8000
Dielectric Thickness	636.0000
Solder Mask Thickness	2.0000
=====	
Target Stack Up Thickness	60.0000
Stack Up Thickness	813.8000
Stack Up Thickness with Soldermask	815.8000
=====	

Field	Value
Supplier	Polar Samples
Supplier Description	COI008
Description	FR4 Core
Stock Number	400-008
Type	FR4
Upper Cu Base Thickness	1.4000
Upper Cu Finished Thickness	1.4000
Upper Copper Coverage	0
Minimum Trace Width	2.9528
Data Filenames	
Dielectric Base Thickness	4.0000
Dielectric Finished Thickness	4.0000
Dielectric Constant	4.2
Loss Tangent	0.0195
Resin Content	53
Tg	180
Td	0
CAF Resistance	0
Z Axis Expansion	0
Excess Resin	0.0000
Isolation Distance	4.0000
Lower Cu Base Thickness	1.4000
Lower Cu Finished Thickness	1.4000

Mils/Thous | Target Stack Up Thickness = 60.0000 | Stack Up Thickness = 813.8000 | Stack Up Thickness with Soldermask = 815.8000 | Beta V : 19.10.17722

Online Material Library



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

- Filter by Supplier:** A list of suppliers including TECHNOLAM, tuc (Taiwan Union Technology Corporation), and ventec (INTERNATIONAL GROUP).
- File Type:** A list of material types including Foils, RCCs, PrePregs (highlighted), Cores, SolderMasks, Idents, Peelables, Coverlays, BondPly, Adhesives, and FlexCores.
- Library Files Available : All:** A list of material files such as TUC_TU_662_10GHz_2001.mlbx, TUC_TU_747_HF_10GHz_2001.mlbx, TUC_TU_747_LK_10GHz_2001.mlbx, TUC_TU_752_10GHz_2001.mlbx, TUC_TU_768_10GHz_2001.mlbx, TUC_TU_787_LK_10GHz_2001.mlbx, TUC_TU_862S_10GHz_2001.mlbx, TUC_TU_862_HF_10GHz_2001.mlbx, TUC_TU_863+_10GHz_2001.mlbx, TUC_TU_863_10GHz_2001.mlbx, TUC_TU_865_10GHz_2001.mlbx, TUC_TU_872_LK_10GHz_2001.mlbx, TUC_TU_872_SLK_10GHz_2001.mlbx, TUC_TU_883_10GHz_2001.mlbx, TUC_TU_883_Sp_10GHz_2001.mlbx, TUC_TU_933_10GHz_2001.mlbx, and Taconic_FR_25_10Ghz_1901.mlbx.
- Existing Data Table:** Radio buttons for 'Clear' (selected) and 'Append', with 'Download' and 'Close' buttons.
- File Access Mode:** Radio buttons for 'Online Polar Library (ftp://polarinstruments.com)' (selected) and 'On-Premise Mode'. A text input field and a 'Browse...' button are also present.

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 supplier to provide data is Taiwan Union Technology Corporation (TUC).

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

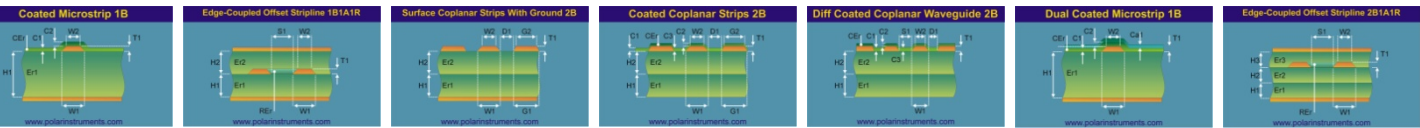
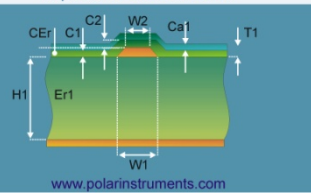
Import / Export enhancements

The following Import / Export options have been updated to support new fields introduced with Speedstack 2020:

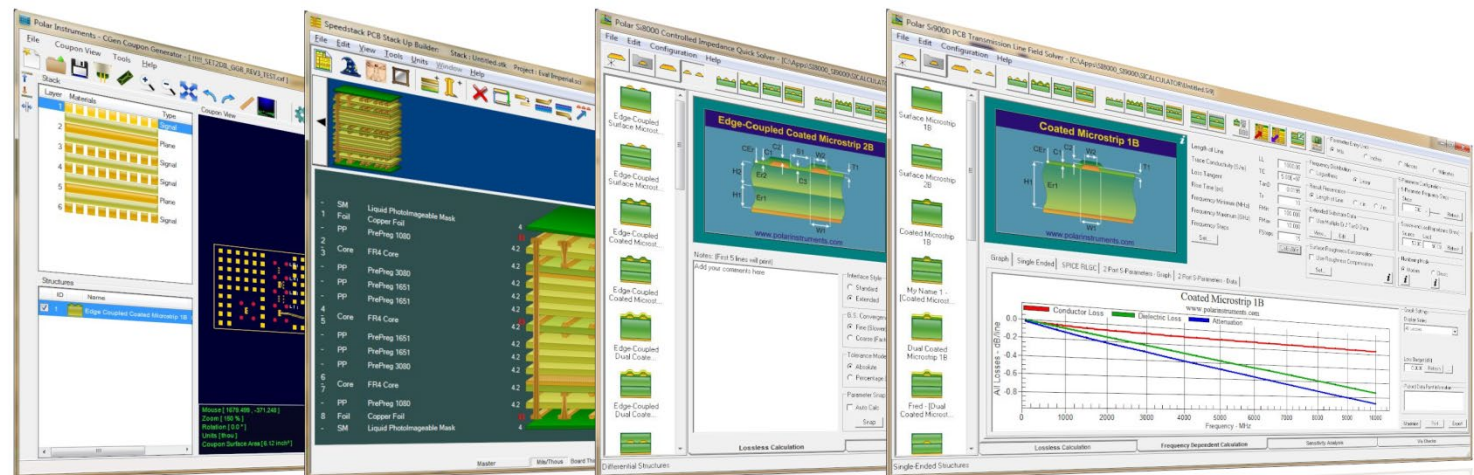
- XML STKX v17.00 and SSX v7.00 import / export options
- CSV export option



Impedance calculation



*Thank you for viewing this introduction to Speedstack 2020.
If you have questions we would be delighted to help you.
Your local contact information is contained on the following slide*

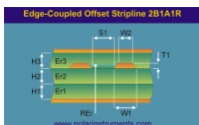
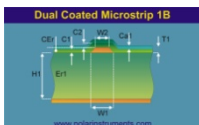
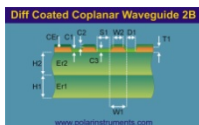
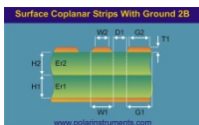
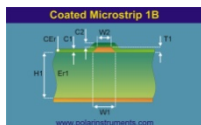
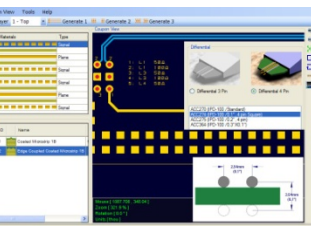
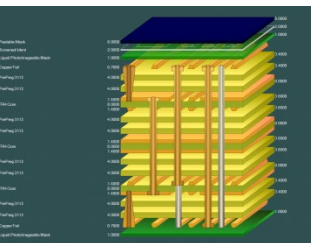
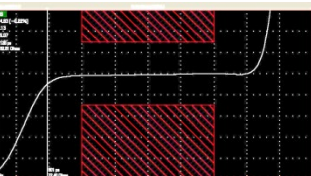
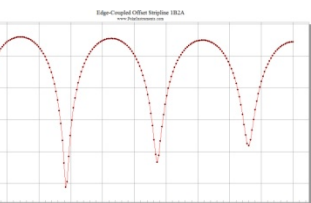
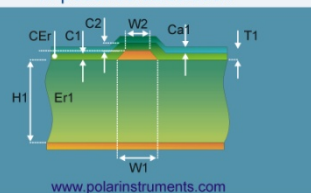


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Impedance calculation



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