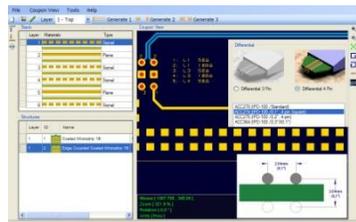
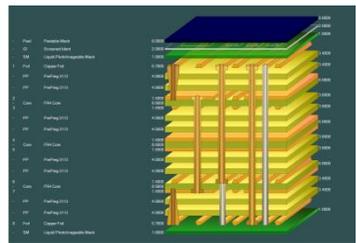
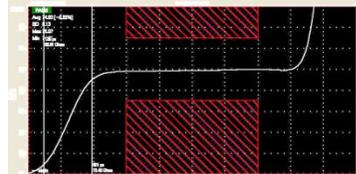
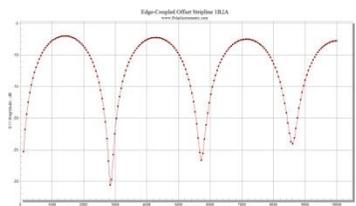
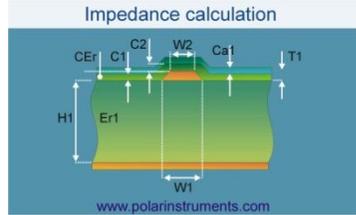




# Speedstack 2016 : Changing layer functionality / count of a stack up without removing structures – Preview

Jan 2016 - Richard Attrill



## Overview

An enhancement that is often requested for Speedstack is to be able to change the electrical layer count without removing structures. Some users would like to base a new design on an existing known stack up and then add / remove electrical layers to create the new stack, leaving the previous existing structures intact.

There is also a requirement to switch between layer types (Signal, Plane, Mixed, Hatched), again without removing structures.

With Speedstack 2016 it is now possible to retain and re-allocate structures when changes are made to the electrical layers of the stack up. New Structure Layer Properties and Structure Validation toolbar options have been introduced to the Controlled Impedance tab, the following slides provide a walk-through / introduction to this new functionality.

# Switching layer types and re-allocating structures – Step 1

The screenshot shows the Polar Speedstack PCB Stack Up Builder interface. The main window displays a 3D model of a PCB stack up with a table of layers on the left. The table lists layers from 1 to 8, including Liquid Photolmageable Mask, Copper Foil, PrePreg, FR4 Core, and another Copper Foil. The stack up thickness is shown as 59.4600 units, with a target of 60.0000. A red box highlights the layer type selection icons in the toolbar. A blue callout box explains the process of switching layer 2 to a Plane and layer 3 to a Signal. A warning dialog box is open, asking for confirmation to proceed with the change, which will invalidate existing structures.

**Speedstack**

This action will invalidate some or all existing structures. You will be able to check and re-allocate them afterwards using the Structure Validation and Structure Layer Properties options. Do you wish to proceed?

Yes No

# Switching layer types and re-allocating structures – Step 2

Layer	Material	Thickness (Mils/Thous)	
-	SM	Liquid Photolimageable Mask	4.000
1	Foil	Copper Foil	1.400
-	PP	PrePreg 1080	4.200
2	Core	FR4 Core	4.200
-	PP	PrePreg 3080	4.200
-	PP	PrePreg 1651	4.200
-	PP	PrePreg 1651	4.200
4	Core	FR4 Core	4.200
-	PP	PrePreg 1651	4.200
-	PP	PrePreg 1651	4.200
-	PP	PrePreg 3080	4.200
6	Core	FR4 Core	4.200
-	PP	PrePreg 1080	4.200
8	Foil	Copper Foil	1.400
-	SM	Liquid Photolimageable Mask	4.000

The stack up has now changed, layer 2 is a Plane and layer 3 a Signal.

Note the flashing Rebuild indicator, due to the changes to the stack up it is necessary to refresh the structures. On selecting Rebuild an information dialog will display indicating which structures need re-allocating.

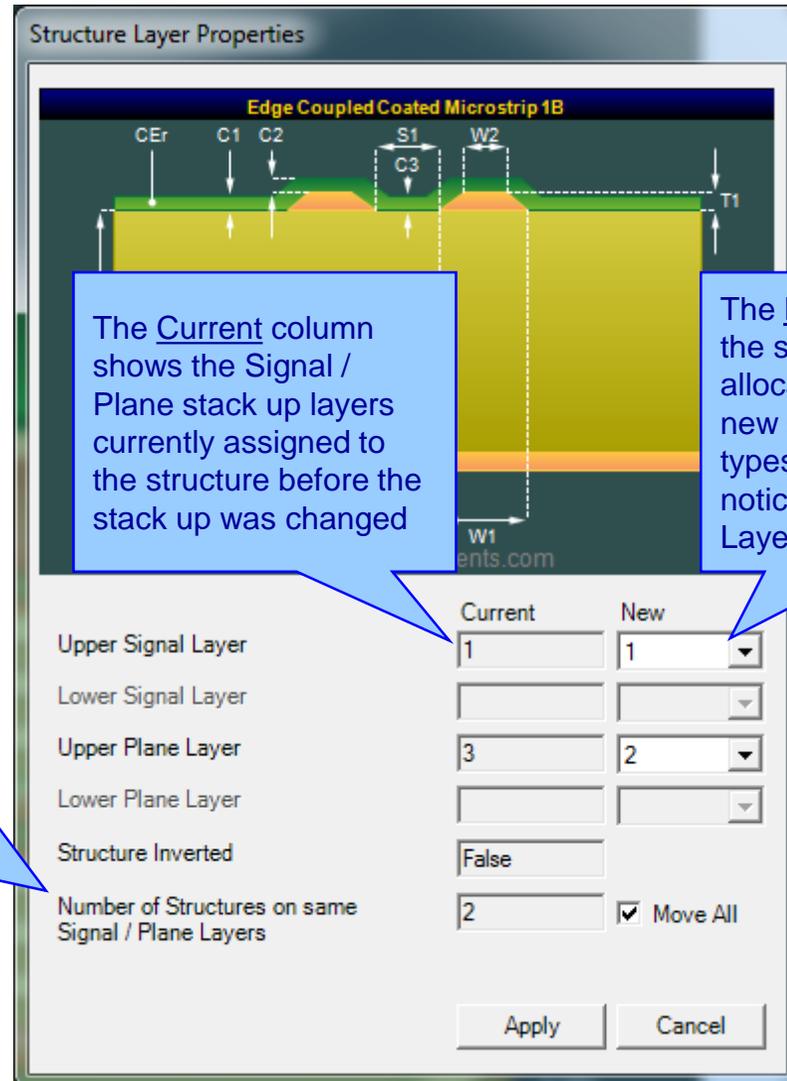
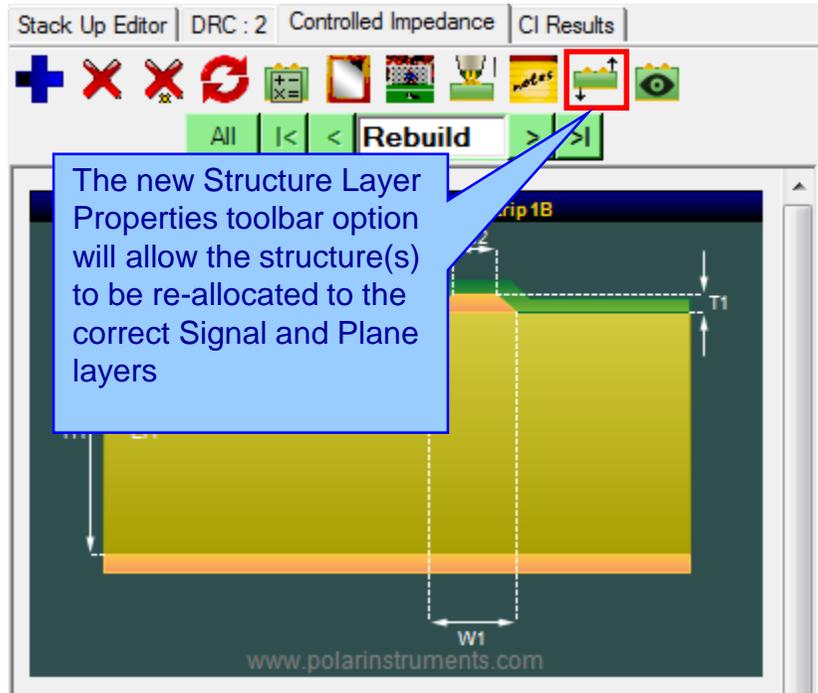
**Speedstack**

**The following structures require attention. Please re-allocate each structure using the Structure Layer Properties option.**

- Layer: 1, Edge Coupled Coated Microstrip 1B, 100 ohms
- Layer: 1, Coated Microstrip 1B, 75 ohms
- Layer: 4, Edge Coupled Offset Stripline 1B1A, 100 ohms

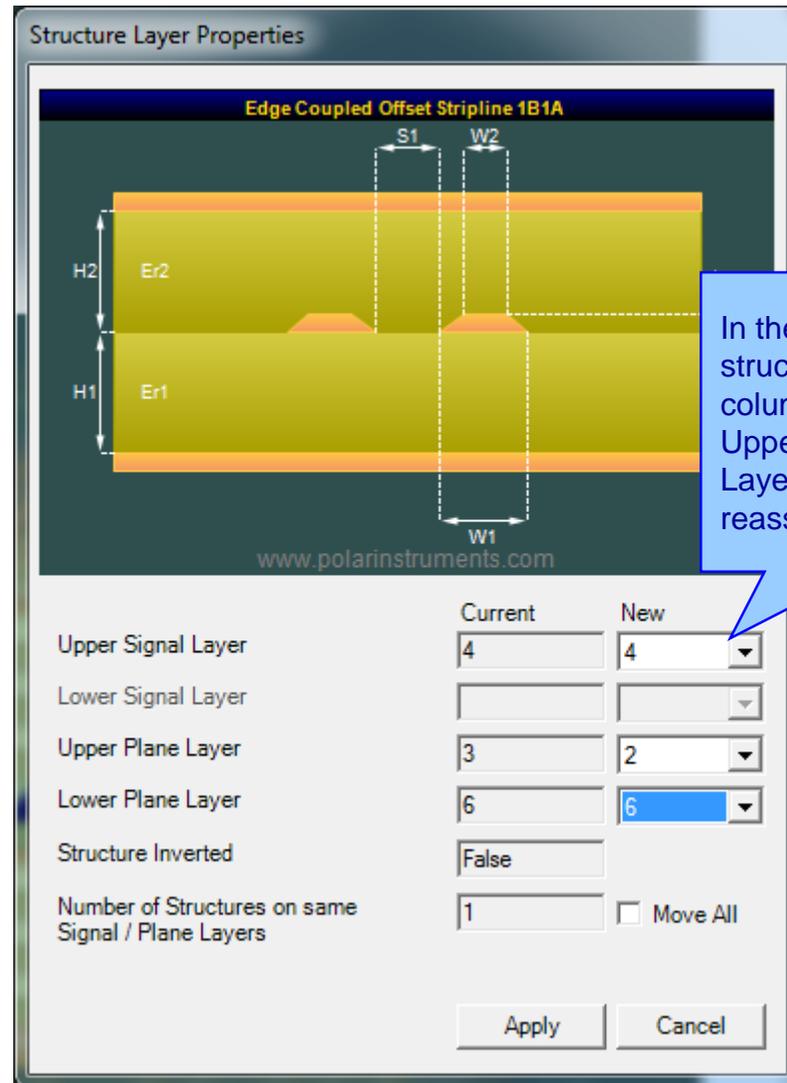
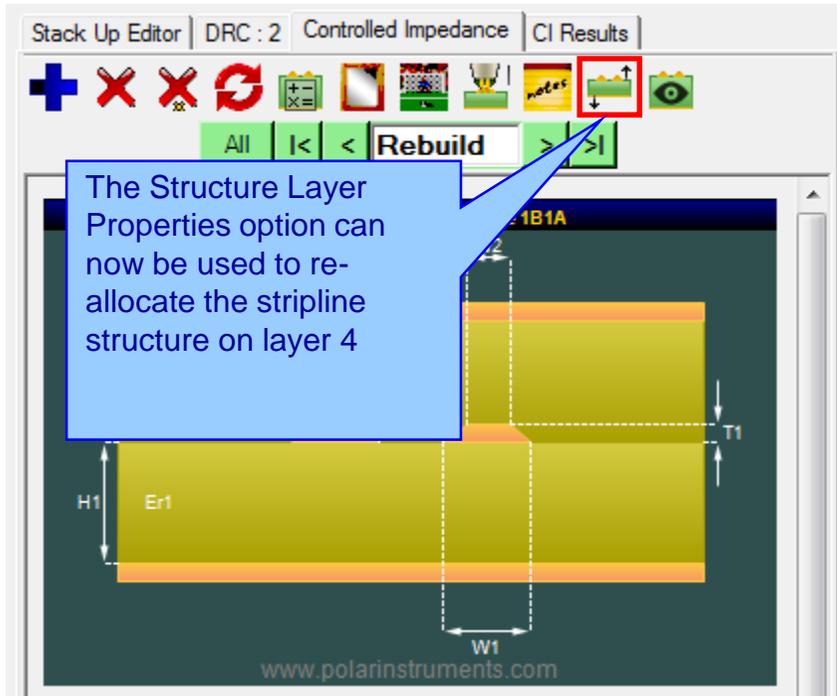
OK

## Switching layer types and re-allocating structures – Step 3

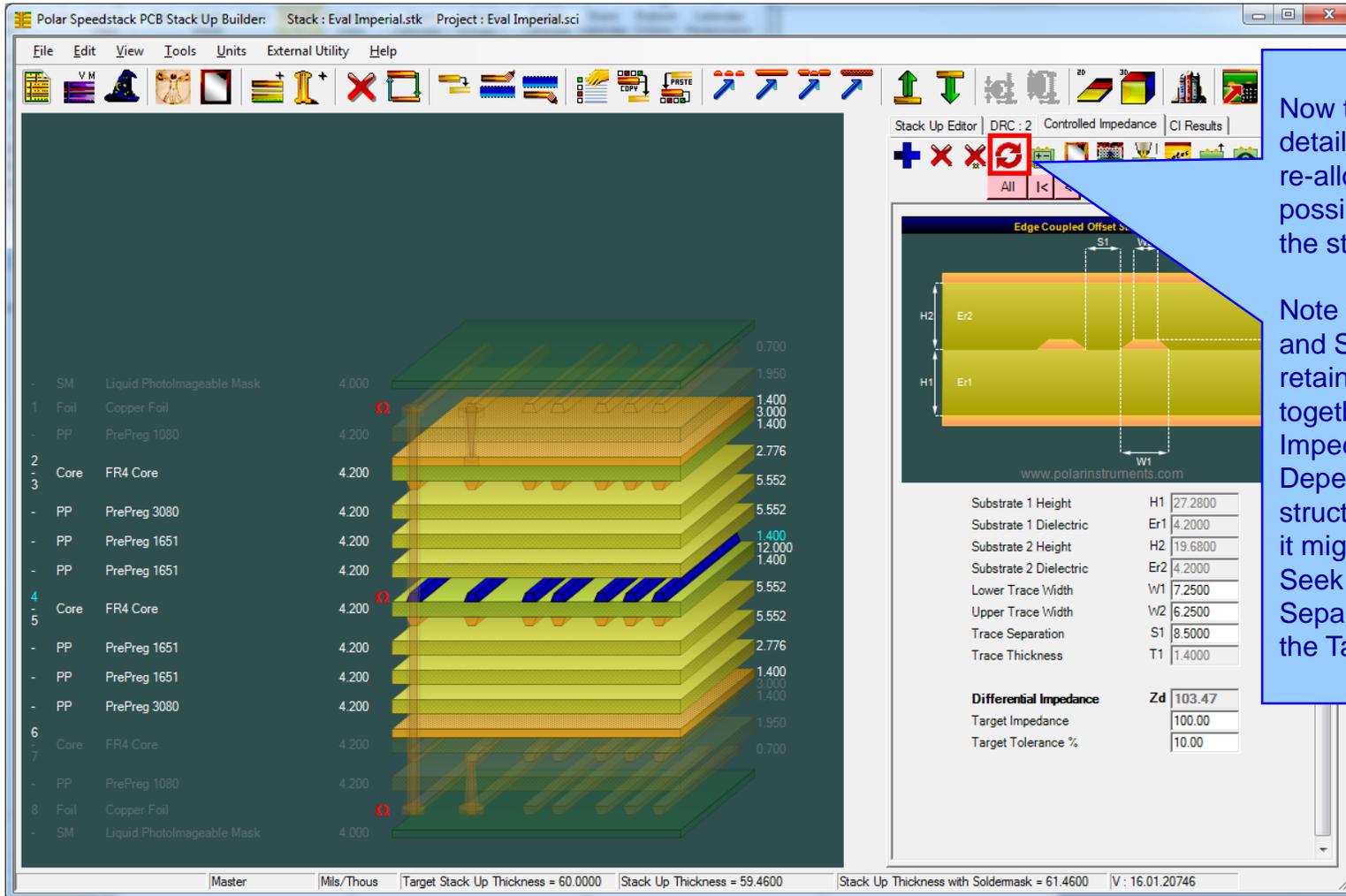


In many cases multiple structures will have the same Signal / Plane layer assignments. This is indicated here, selecting Move All will re-allocate all matching structures in a single operation

## Switching layer types and re-allocating structures – Step 4



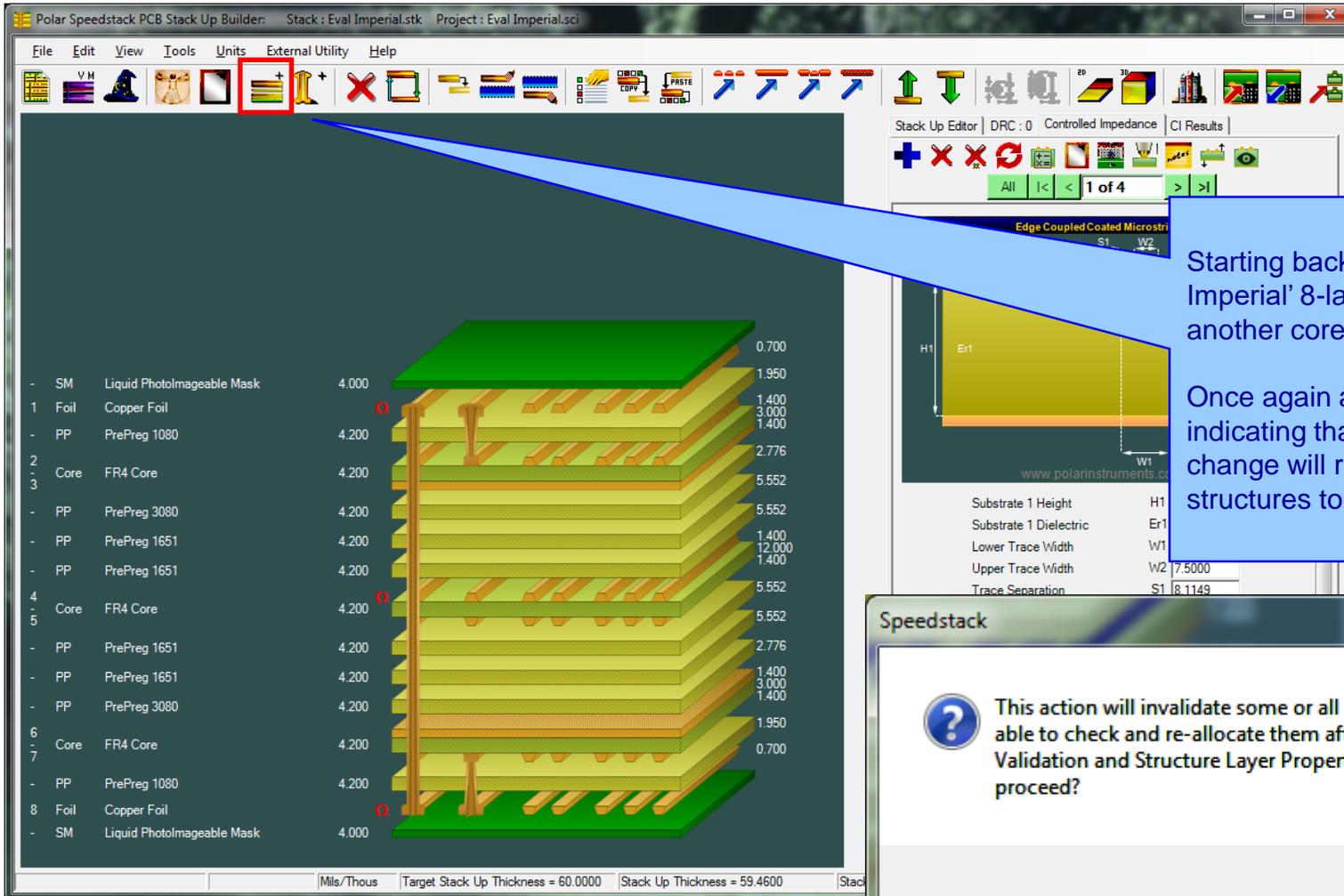
# Switching layer types and re-allocating structures – Step 5



Now that the three structures detailed on slide # 4 have been re-allocated successfully it is possible to Rebuild and Calculate the structures in the normal way.

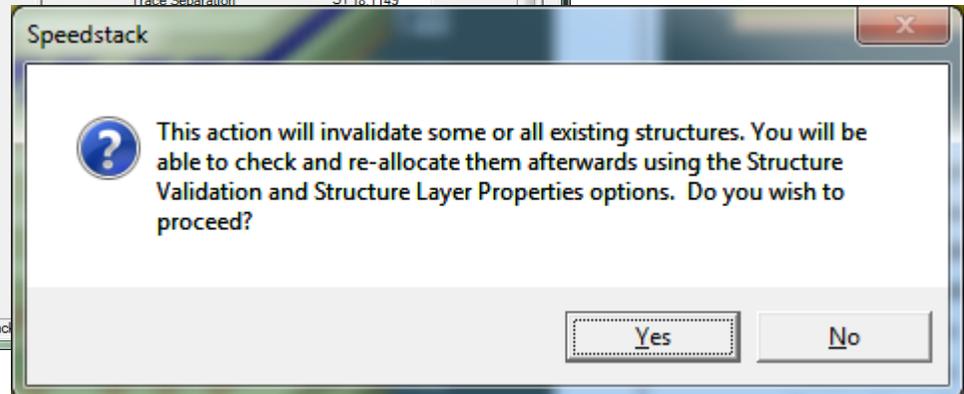
Note that structure Trace Width and Separation parameters are retained at their original values together with the Target Impedance and Tolerance. Depending upon how the structures have been re-allocated it might be necessary to Goal Seek the Trace Width / Separation parameters to meet the Target Impedance.

# Increasing the layer count by adding a core – Step 1



Starting back with the original 'Eval Imperial' 8-layer sample stack up, add another core between layers 5 and 6.

Once again a warning is displayed indicating that continuing with the change will require the existing structures to be re-allocated.



## Increasing the layer count by adding a core – Step 2

The screenshot shows the Polar Speedstack PCB Stack Up Builder interface. The main window displays a 3D stack up of 10 layers. The layers are listed in a table on the left:

Layer	Material	Thickness (Mils)	Thickness (Thous)
SM	Liquid Photolimageable Mask	4.000	1.950
1	Foil Copper Foil	4.000	1.400
PP	PrePreg 1080	4.200	3.000
2	Core FR4 Core	4.200	1.400
3	Core FR4 Core	4.200	1.400
PP	PrePreg 1651	4.200	5.552
PP	PrePreg 1651	4.200	5.552
4	Core FR4 Core	4.200	1.400
5	Core FR4 Core	4.200	12.000
PP	PrePreg 1651	4.200	1.400
PP	PrePreg 1651	4.200	1.400
6	Core FR4 Core	4.200	5.552
7	Core FR4 Core	4.200	5.552
PP	PrePreg 1651	4.200	1.400
PP	PrePreg 1651	4.200	3.000
8	Core FR4 Core	4.200	1.400
9	Core FR4 Core	4.200	1.400
PP	PrePreg 1080	4.200	5.552
10	Foil Copper Foil	4.200	1.950
SM	Liquid Photolimageable Mask	4.000	0.700

The dialog box titled "Speedstack" contains the following text:

The following structures require attention. Please re-allocate each structure using the Structure Layer Properties option.

- Layer: 4, Edge Coupled Offset Stripline 1B1A, 100 ohms
- Layer: 8, Coated Microstrip 1B, 75 ohms

OK

In order to maintain a symmetrical stack remove the PrePreg 3080 materials and add additional PrePreg 1651 materials. A symmetrical 10-layer stack up has now been created.

The Rebuild flag indicates stack up changes have been made. Selecting this option will display an information dialog indicating which structures need re-allocating, in this case two structures.





# Increasing the layer count by adding a core – Step 5

The screenshot shows the Polar Speedstack PCB Stack Up Builder interface. The main window displays a 3D cross-section of a 10-layer PCB stack up. The layers are listed on the left, including Liquid Photolimageable Mask, Copper Foil, PrePreg 1080, FR4 Core, PrePreg 1651, and another FR4 Core. The total stack up thickness is 79.8120 mils. A detailed view of an Edge Coupled Coated Microstrip structure is shown on the right, with parameters for Substrate 1 Height (H1), Substrate 1 Dielectric (Er1), Lower Trace Width (W1), Upper Trace Width (W2), Trace Separation (S1), Trace Thickness (T1), and various coating parameters (C1, C2, C3, CEr). The differential impedance (Zd) is 100.35, with a target impedance of 100.00 and a target tolerance of 10.00%.

Layer	Material	Thickness (mils)	Cumulative Thickness (mils)
SM	Liquid Photolimageable Mask	4.000	4.000
1	Foil Copper Foil	1.400	5.400
	PP PrePreg 1080	4.200	9.600
2	Core FR4 Core	4.200	13.800
3	Core FR4 Core	4.200	18.000
	PP PrePreg 1651	1.400	19.400
	PP PrePreg 1651	12.000	31.400
	PP PrePreg 1651	1.400	32.800
4	Core FR4 Core	4.200	37.000
5	Core FR4 Core	4.200	41.200
	PP PrePreg 1651	1.400	42.600
	PP PrePreg 1651	12.000	54.600
	PP PrePreg 1651	1.400	56.000
6	Core FR4 Core	4.200	60.200
7	Core FR4 Core	4.200	64.400
	PP PrePreg 1651	1.400	65.800
	PP PrePreg 1651	12.000	77.800
	PP PrePreg 1651	1.400	79.200
8	Core FR4 Core	4.200	83.400
9	Core FR4 Core	4.200	87.600
	PP PrePreg 1080	4.200	91.800
10	Foil Copper Foil	1.400	93.200
SM	Liquid Photolimageable Mask	4.000	97.200

Now that the two structures detailed on slide # 9 have been re-allocated successfully it is now possible to Rebuild and Calculate the structures in the normal way.

Editing the Drill Properties completes the stack up changes, the four existing structures from the original 8-layer stack up have been re-allocated to the 10-layer design

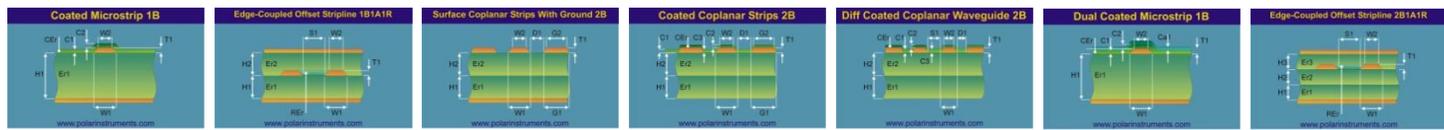
## Summary

It is now possible to retain and re-allocate structures when changes are made to the electrical layers of the stack up. This allows the user to re-allocate structures after the following stack up changes:

- o Add foil / core – increase layer count
- o Delete foil / core – reduce layer count
- o Move foil / core up and down, beyond another copper layer – maintain layer count but perhaps to swap two different thickness cores within the stack up
- o Copy / paste foil or core – increase layer count

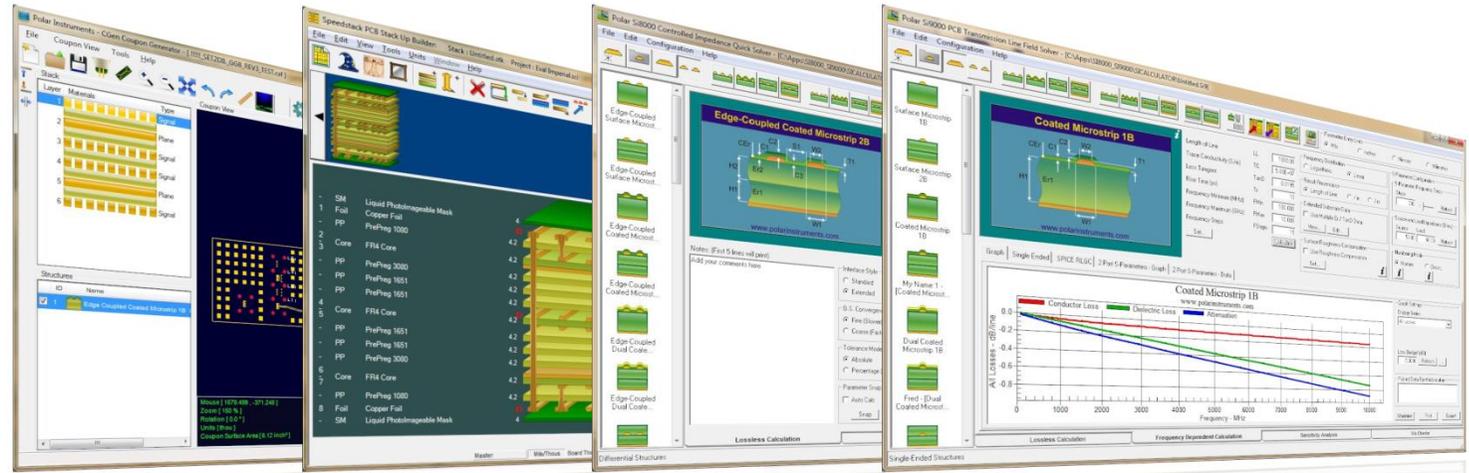
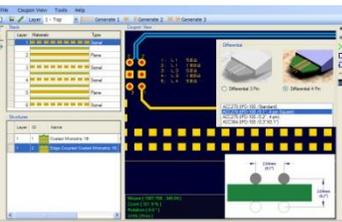
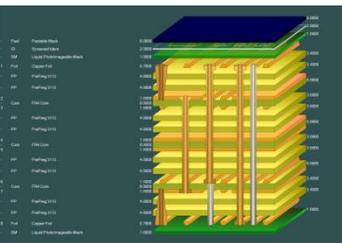
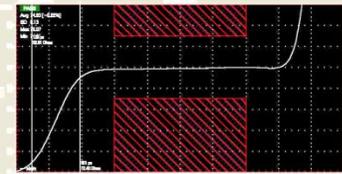
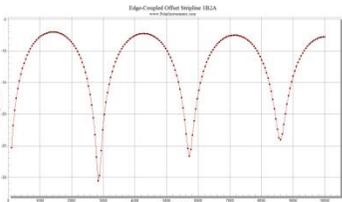
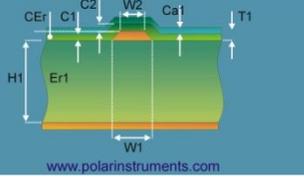
## Summary

- o Change layer type – signal to plane, plane to signal, mixed to signal or plane, signal to hatch, hatch to signal.
- o Delete rigid core and add flex core – to maintain layer count but swap material type
- o Delete a rigid core and add two foils – to maintain layer count but switch to an HDI type build



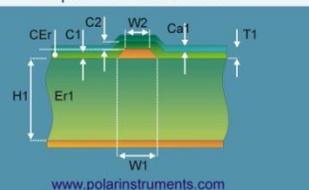
Thank you

Impedance calculation



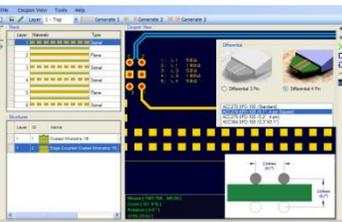
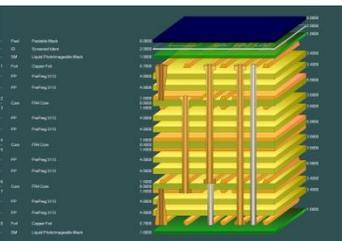
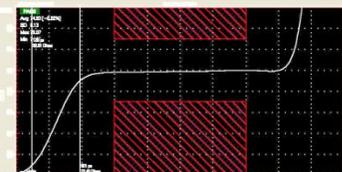
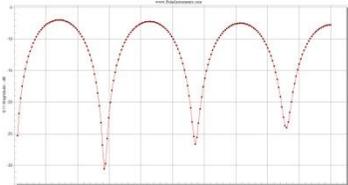


Impedance calculation



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