

## Layer Stackup Wizard: Intuitive Pre-Layout Design

This Application Brief describes the **Layer Stackup Wizard**, a powerful utility within Ansys SIwave for pre-layout stackup configuration and post-layout stackup analysis. This wizard, which supplements the traditional **Layer Stackup Editor**, lets engineers quickly modify the number of layers, materials, trace cross-sections, metal roughness parameters, etc. of a printed circuit board (PCB)/package stackup to assess impact on performance. It also provides a 3D interactive rendering of the layer stack to aid visual debugging.

The wizard utilizes the highly accurate Method of Moments (MoM) transmission line solver in SIwave to synthesize and analyze single-ended or differential microstrip and stripline structures. It quickly computes values of key layout parameters such as transmission line widths, spacing and characteristic impedance (ZO), and can export HSPICE-based tabular w-elements. These capabilities assist engineers in understanding the performance impact of trace etching, material attributes and signal transmission frequency.

Figure 1 shows an image of the **Layer Stackup Wizard** upon importing a PCB into Ansys SIwave.

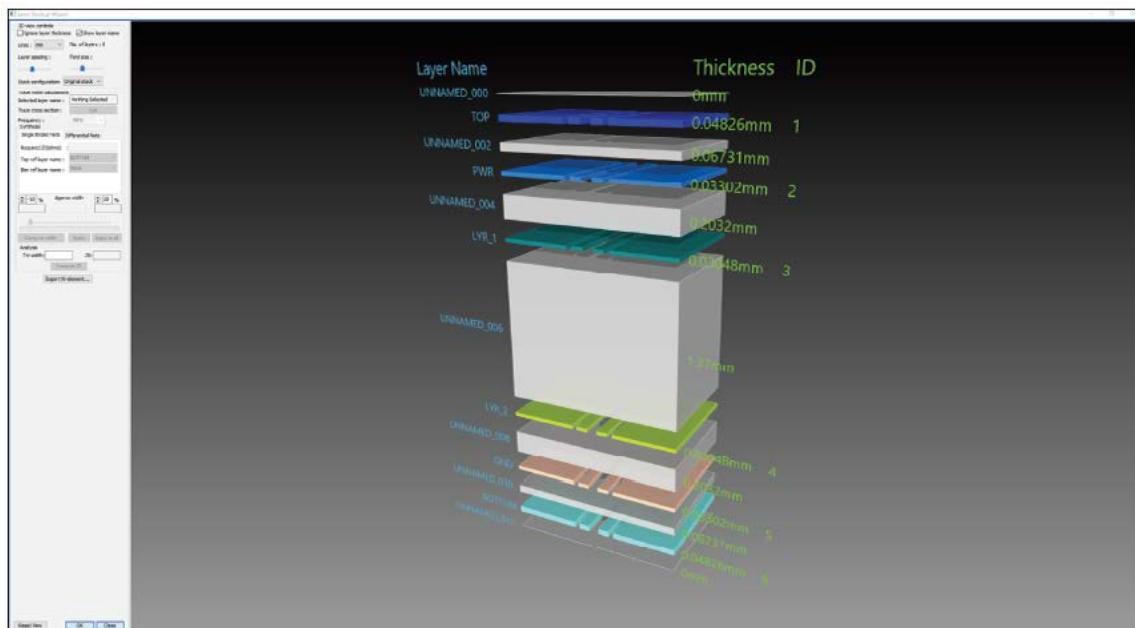



Figure 1. Layer Stackup Wizard within SIwave when launched directly from the Home tab.

### / Launching the Layer Stackup Wizard

There are two ways to launch the wizard in SIwave. Click this icon  on the **Home** tab to launch the wizard directly. Alternatively, as depicted in Figure 2, open the **Layer Stackup Editor** and click the **3D View** button on the bottom right of the editor window to launch the wizard. We recommend using the second method since you can simultaneously configure/adjust the settings both in the stackup editor and wizard to obtain immediate visual feedback.

When you click a layer in the editor it is also selected in the wizard. Also, the wizard reflects the changes made to the layer properties in the editor. For example, compare Figures 2 and 3. Upon changing the material in **LVR\_1** from copper to aluminum, increasing its thickness and applying a different color (red) in the editor, the wizard automatically replicates the corresponding settings and updates the display. Changes in the editor for a selected layer are also included in the corresponding trace-width computation. The visual representation of a layout in the **Layer Stackup Wizard** is controlled by the parameters on the **3D View Controls** and **Trace Width Calculations** panels on the left.

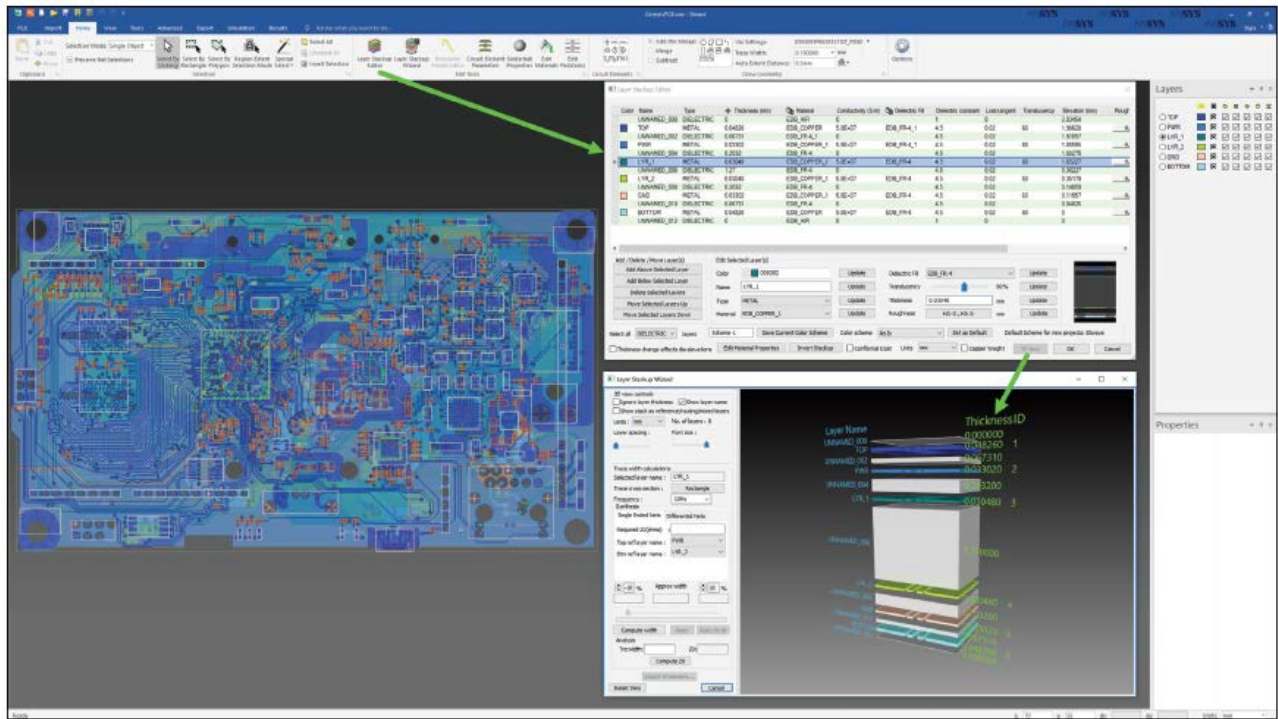


Figure 2. Launching the wizard.

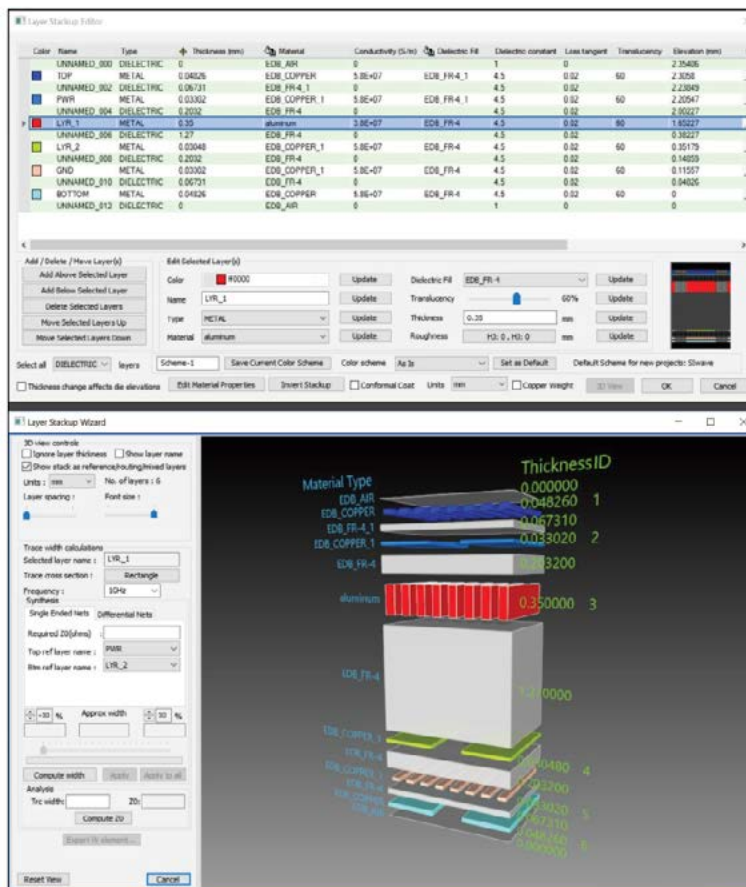


Figure 3. The wizard reflects the changes made to the layer properties in the editor.

## / 3D View Controls

This panel provides controls for visual manipulation of the layer stackup. You can set units and adjust various visibility options such as layer spacing, font size, rendering of layers at either their actual or uniform thicknesses, material display, etc. From the pull-down menu, you can change the stackup configuration. The default configuration, **Original stack**, is the stackup defined in the design shown in Figure 1. Additional stackup options depend on adding or removing metal layers below the **Original stack**.

## / Trace Width Calculations

This panel provides options to configure and perform trace width (or separation) calculations, define shapes for the trace cross-sections, specify reference planes for single-ended or differential nets, etc. If you select the metal layer of your desired transmission line in the graphical display of the wizard, the **Selected layer name** is updated accordingly in the panel. Depending upon the PCB layout configuration, you can define a layer as a stripline or a microstrip by specifying its appropriate top and bottom reference layers. For example, in Figure 4 the top reference layer for **LYR\_1** is set to **PWR** and the bottom reference layer is set to **GND**, configuring traces routed on **LYR\_1** as striplines.

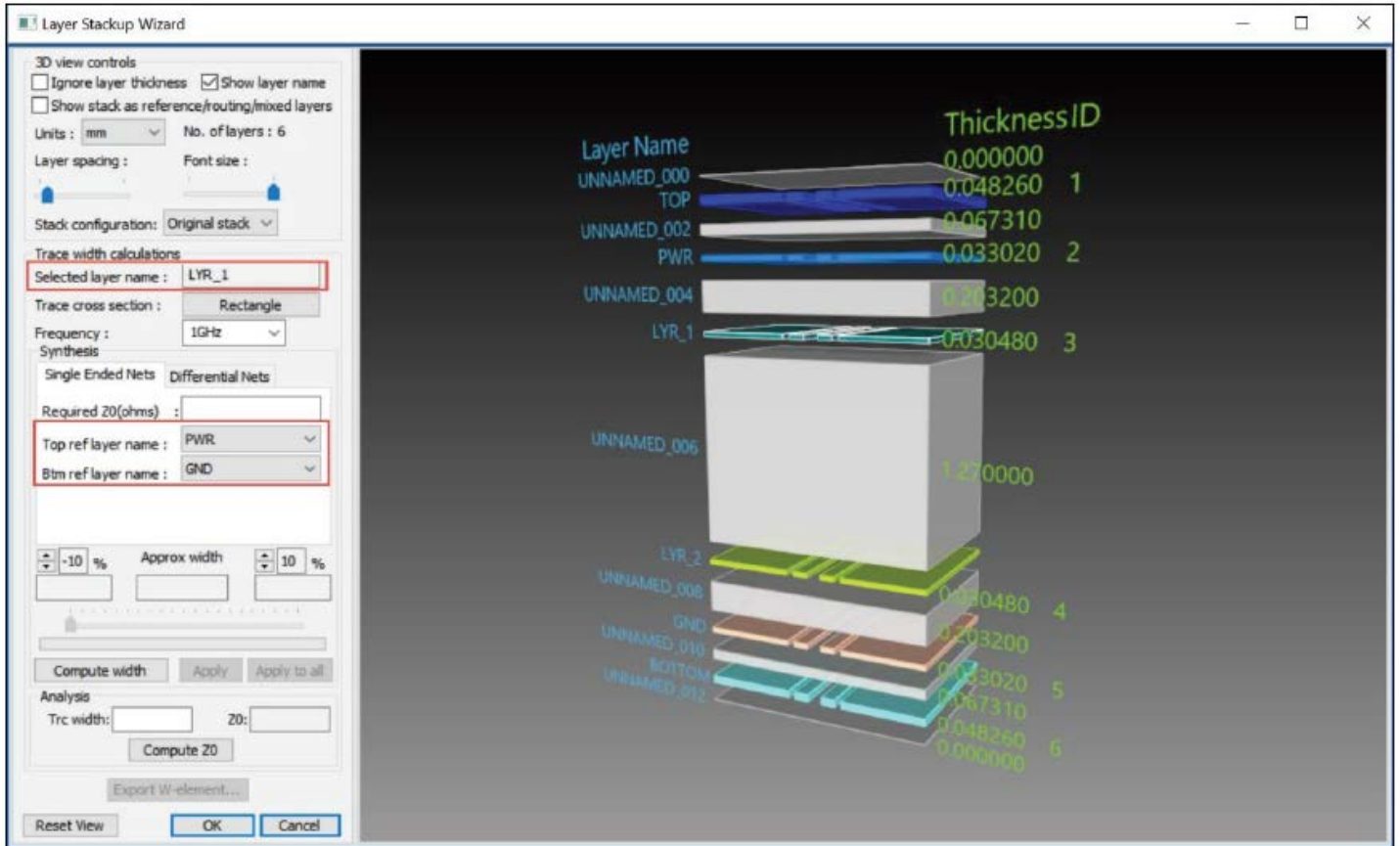


Figure 4. Defining reference layers.

Clicking the **Trace cross section** button opens the **Trace Cross Section Shape Editor** window, where you can set the layer's trace etching and choose etching options from rectangle, trapezoid or hexagon as shown in Figure 5.

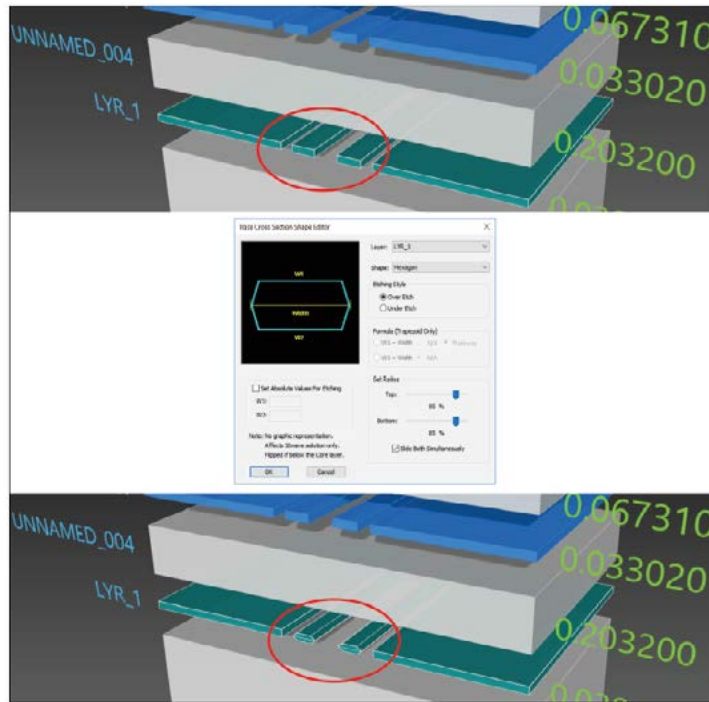
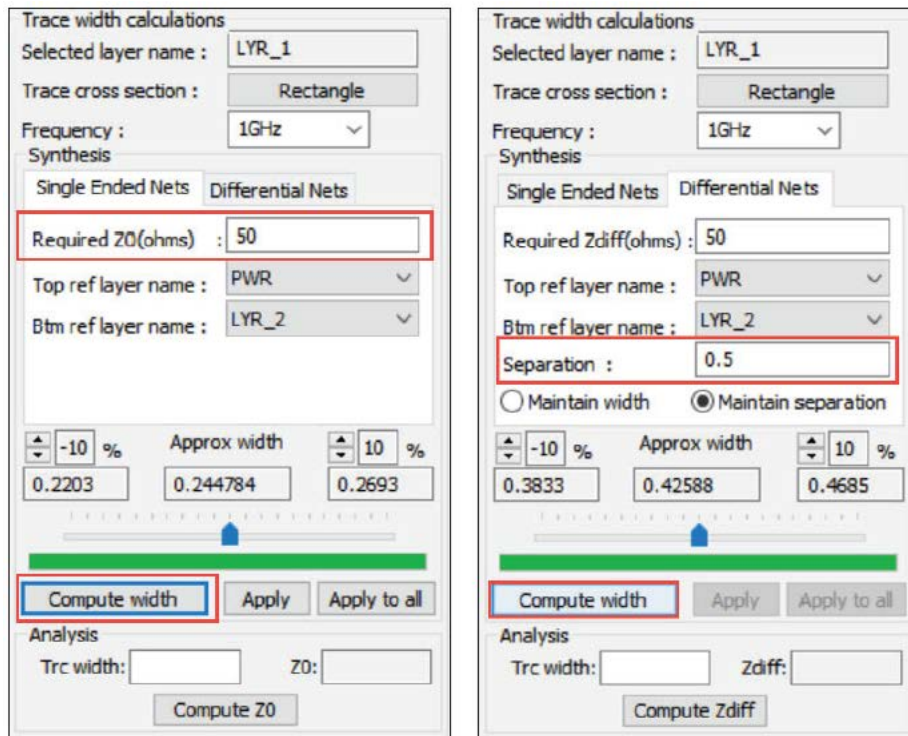


Figure 5. Trace etching.

The **Trace Width Calculation** panel lets you specify the frequency for the impedance ( $Z_0$ ) calculations. You can toggle between single-ended or differential transmission lines for Synthesis or Analysis.

Figure 6a displays the settings for computing the width of a single-ended net. For **Synthesis**, enter the desired value of impedance  $Z_0$  and press the **Compute width** button. Additionally, enter the separation distance for a differential net, as shown in Figure 6b.



Figures 6a and 6b. Computing Trace Width for the required value of impedance.

For a single-ended transmission line, if you click the **Apply** or **Apply to all** button, the **Trace Width** field within the **Slwave Draw Geometry** group on the **Home** tab is updated with this computed value either for the selected metal layer or for all metal layers respectively.



Figure 7. Draw Geometry Menu.

In case of **Analysis**, enter values in the **Trc width** field and press the **Compute ZO** or **Compute Zdiff** button for single-ended and differential net, respectively, to display the evaluated value of ZO or Zdiff.

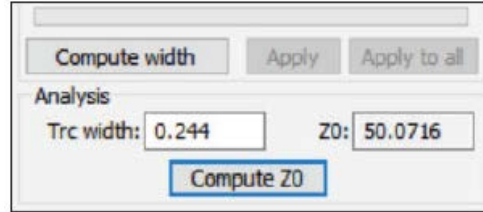


Figure 8. Analysis.

You can also export w-element of the transmission line at the single calculation frequency defined in the **Layer Stackup Wizard**, and save it in \*.sp format.

## / Highlights

The Layer Stackup Wizard is a powerful utility in Ansys SIwave. Its main benefits are summarized below:

- It enables users to quickly explore variations in their stackup dimensions and material parameters to assess impact on performance.
- It provides significant time savings by minimizing trace width experimentation on the user's part to achieve desired impedance values.
- Non-idealities such as surface roughness and sidewall etching are fully accounted for during analysis and synthesis calculations.
- Changes made to the stackup are immediately reflected in an interactive 3D viewer, facilitating visual error checking.
- Computed width values can be applied to the main design, allowing engineers to easily route traces whose impedances are guaranteed to be desired values.

**ANSYS, Inc.**  
 Southpointe  
 2600 Ansys Drive  
 Canonsburg, PA 15317  
 U.S.A.  
 724.746.3304  
 ansysinfo@ansys.com

If you've ever seen a rocket launch, flown on an airplane, driven a car, used a computer, touched a mobile device, crossed a bridge or put on wearable technology, chances are you've used a product where Ansys software played a critical role in its creation. Ansys is the global leader in engineering simulation. We help the world's most innovative companies deliver radically better products to their customers. By offering the best and broadest portfolio of engineering simulation software, we help them solve the most complex design challenges and engineer products limited only by imagination.

**Visit [www.ansys.com](http://www.ansys.com) for more information.**

Any and all ANSYS, Inc. brand, product, service and feature names, logos and slogans are registered trademarks or trademarks of ANSYS, Inc. or its subsidiaries in the United States or other countries. All other brand, product, service and feature names or trademarks are the property of their respective owners.

© 2021 ANSYS, Inc. All Rights Reserved.