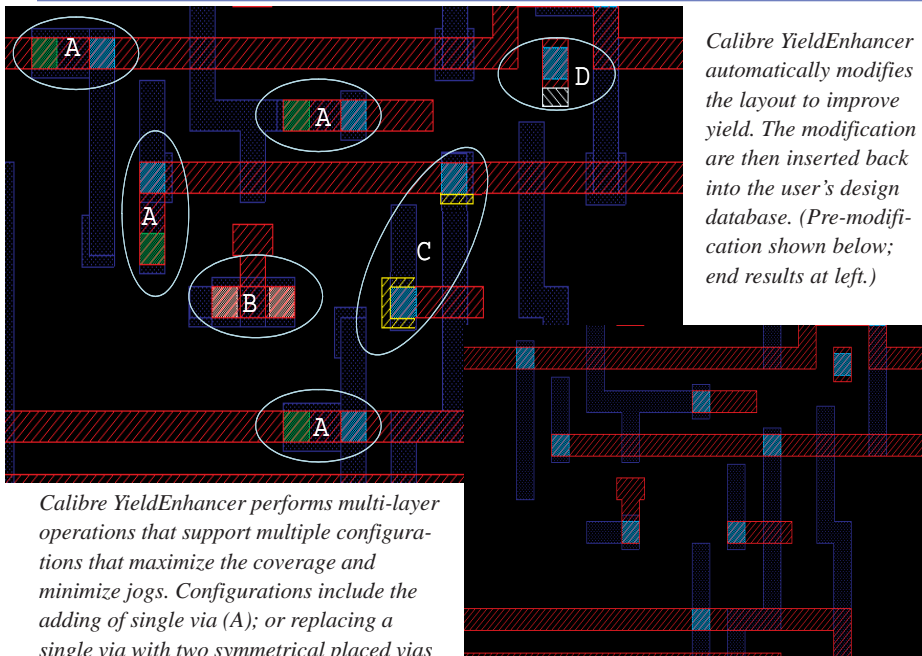


Calibre YieldEnhancer



Calibre YieldEnhancer automatically modifies the layout to improve yield. The modification are then inserted back into the user's design database. (Pre-modification shown below; end results at left.)

Calibre YieldEnhancer performs multi-layer operations that support multiple configurations that maximize the coverage and minimize jogs. Configurations include the adding of single via (A); or replacing a single via with two symmetrical placed vias (B); edge modifications based on multi-layer checks such as enclosure and extensions rules (C) and, single layer grow operations (D). Layout modifications remain DRC clean while taking advantage of as much white space as possible.

Layout Modifications to Improve Yield

With the progression of complex, high-performance nanometer designs, acceptable yield has become difficult to attain. While manufacturers have traditionally handled yield management, more pressure is being placed on designers to adopt design for manufacturing (DFM) methods that help ensure success. Mentor Graphics provides a comprehensive suite of products that work together to improve yield.

Calibre® YieldEnhancer offers an automated approach to layout enhancements that will improve yield. It addresses the issue of area with a core philosophy to take advantage of any white space. This method improves yield without sacrificing area. To balance performance, YieldEnhancer offers both a net-aware capability and back annotation to the design database. To determine the impact on yield, YieldEnhancer works with Calibre YieldAnalyzer to measure the impact of the layout modification.

One issue that can contribute significantly to yield loss is the number of single vias and the number of via transitions with minimal overlap. However, to make a blanket rule that every via must be doubled results in area penalty that most designs cannot afford. Calibre YieldEnhancer automatically evaluates every single via and uses a powerful array of configurations to maximize the number of vias doubled without affecting area and while minimizing run time.

YieldEnhancer performs multi-layer operations that support multiple configurations that maximize the coverage and minimizes jogs. These include edge modifications based on multi-layer checks such as enclosure and extensions rules, and single layer grow operations. Layout modifications remain DRC clean while taking advantage of as much white space as possible.

Key Product Benefits

- **Automatically modifies the layout to improve yield**, including via doubling, via extensions, and enclosure as well as growing polygons to a minimum size.
- In addition to the automatic enhancements, YieldEnhancer also has the **flexibility to allow back annotation of users' specific layout modifications**, which is critical with new technologies.
- **Integrated with the industry standard databases** such as OpenAccess® and Milkyway®.
- **Extends Calibre platform beyond DRC functionality** to address DFM issues. Calibre YieldEnhancer leverages the common Calibre interface by integrating with Calibre RVE and DESIGNrev for visualization and to Calibre Interactive for push-button access from the design framework.
- **Fully integrated with the Calibre tool suite**, and popular layout environments, such as Cadence® Virtuoso and Encounter, Synopsys® Astro and more.

Calibre YieldEnhancer Overview

YieldEnhancer is part of the Calibre design to silicon platform and a natural extension of the Calibre Standard Verification Rules Format (SVRF) language. Many customers have used SVRF to do their own layout enhancements and output modifications to GDSII or OASIS format.

Calibre YieldEnhancer expands this capability in two ways. First, it uses built-in functions optimized to maximize coverage and minimize run times. YieldEnhancer provides the functionality to double vias, expand/extend enclosures, and grow polygons.

For example, via doubling supports multiple via patterns, including symmetrically placed vias to increase the number of correctly placed vias. When comparing YieldEnhancer against the user-defined via doubling SVRF code, designers have seen the number of vias increase by 4-10% while reducing runtimes between 5-15X.

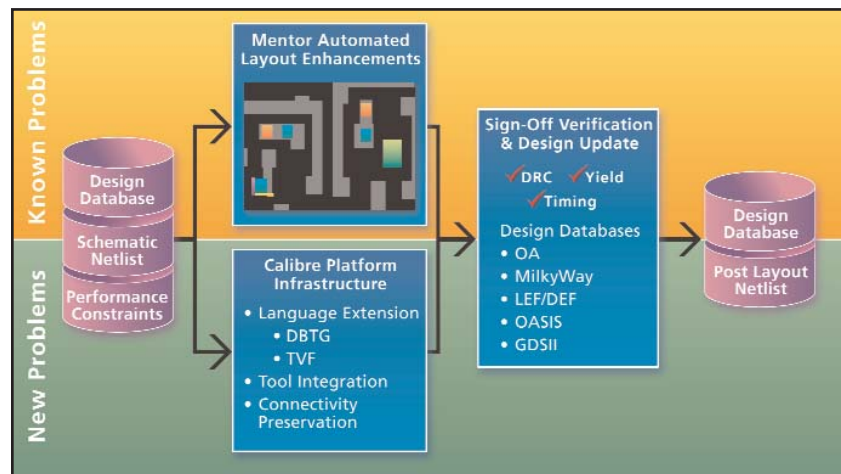
Second, YieldEnhancer gives designers to have the best of both worlds: the industry's most powerful layout modification environment that fits into the industry leading design environments. As new problems are discovered, users need to respond quickly to the types of layout modifications that are required to improve yield. Calibre YieldEnhancer will continue to support user defined enhancements and will facilitate that capability through back annotation of the changes into industry standard databases, such as OpenAccess® or Milkyway®.

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Making the Area/Yield Trade-Off

To make the area/yield trade-off, Calibre YieldEnhancer focuses on taking advantage of white space. Layout modifications are made if they can improve yield without increasing die area. Calibre DRC, the industry standard in physical verification, provides the flexibility to move from the minimum DRC rules toward the recommended value. Since YieldEnhancer is integrated with the Calibre platform, users can be assured that the outcome is DRC clean. Calibre provides as much layout modification as possible without creating violations.



Ensuring Performance

Performance is another critical factor that designers need to balance. It is important to limit the impact of DFM modification on the final timing. YieldEnhancer uses a multi-prong method for dealing with timing. First, designers can simply provide a list of critical nets that are timing sensitive. This will ensure that no vias are added on these timing critical nets. In this case, the additional via coverage is sacrificed to reduce the impact on timing.

Second, YieldEnhancer enables the back annotation of the yield

modifications to the designer's database. So users can easily verify timing, power and signal integrity with their standard procedures.

Calibre DFM Platform

Calibre is the sign-off standard at a majority of the world's foundries and offers a comprehensive set of tools that address the complex handoff between design and manufacturing. It also acts as the conduit for a DFM feedback loop. Calibre YieldEnhancer not only produces DRC clean results but also works with Calibre YieldAnalyzer to provide a before and after view of the yield improvements. YieldAnalyzer combines critical area and

Calibre YieldEnhancer is a layout modification platform that provides automatic modifications, or allows the user to create their own modifications, while managing database integrations.

recommended rules into a signal analysis package. Both tools leverage the interface tools of Calibre that include Calibre Interactive for job submission and Calibre RVE (Results Viewing Environment) for displaying the output within the leading design tools from Cadence, Synopsys and Magma.

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