Data Sheet

SYNOPSYS®

Sentaurus TFM
TCAD for Manufacturing Solution

Overview

The Sentaurus TFM suite, which includes PCM Studio and PCM Library, provides a powerful environment for capturing multivariate process–device–circuit relationships in process compact models (PCMs), allowing a fast turnaround for identifying and analyzing factors that cause parametric yield loss in manufacturing. Derived from systematic TCAD simulations, PCMs encapsulate relationships between process variations and device–circuit performance through a set of analytic functions.
PCM Studio enables the construction of PCMs, the visual exploration of data (simulated or measured), and the statistical analysis of the impact of process variability on device and circuit performance. With PCM Library, the process compact models can be embedded into data-mining and yield management tools for further statistical yield analysis.

Parametric yield has become a dominant yield loss mechanism at 90 nm and below due to increased sensitivity of device and circuit performance to process variations in manufacturing. PCMs bring the power of TCAD to the manufacturing environment, enabling users to perform statistical process analysis and yield optimization in seconds. The Sentaurus TFM Suite, with the power of PCMs, allows more efficient in-line yield improvement and advanced process control in manufacturing. The Sentaurus TFM Suite offers a range of options to visualize and use PCMs with manufacturing data.

PCM Studio Benefits

- Bring the power of TCAD-based variability analysis to manufacturing, with an intuitive graphical user interface
- Quantify, explore, visualize, and understand process–device–circuit relationships and their impact on yield in seconds
- Perform statistical process analysis and process optimization to improve parametric yield
- Create process compact models from simulation data and manufacturing data, allowing comprehensive yield management and analysis

PCM Library Benefits

- Embed PCMs into statistical tools, data-mining systems, and yield management systems, as well as Tcl-based applications for comprehensive yield analysis
- Access all PCM analysis methods through an API, making it easy to explore manufacturing processes, which are modeled by PCMs, in different environments

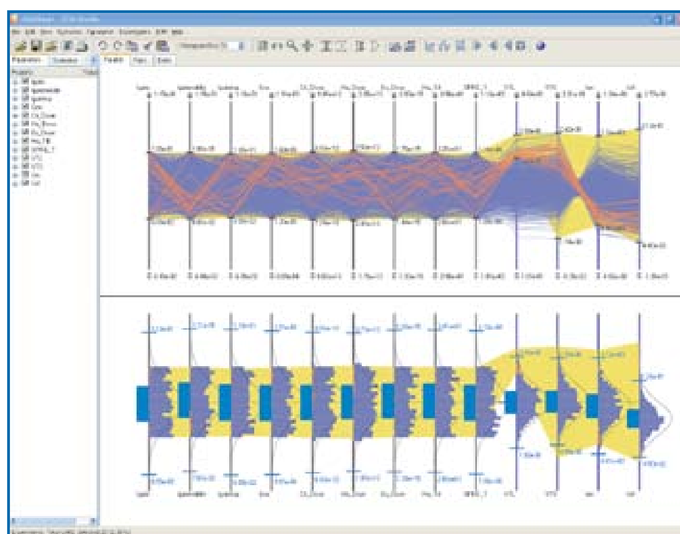


Figure 1. PCM Studio uses parallel coordinate plots, which are a powerful way of representing multivariate data. Each data point is represented by a line connecting the values on each coordinate axis. PCM Studio has several features that allow users to manipulate the plot and explore the data interactively.

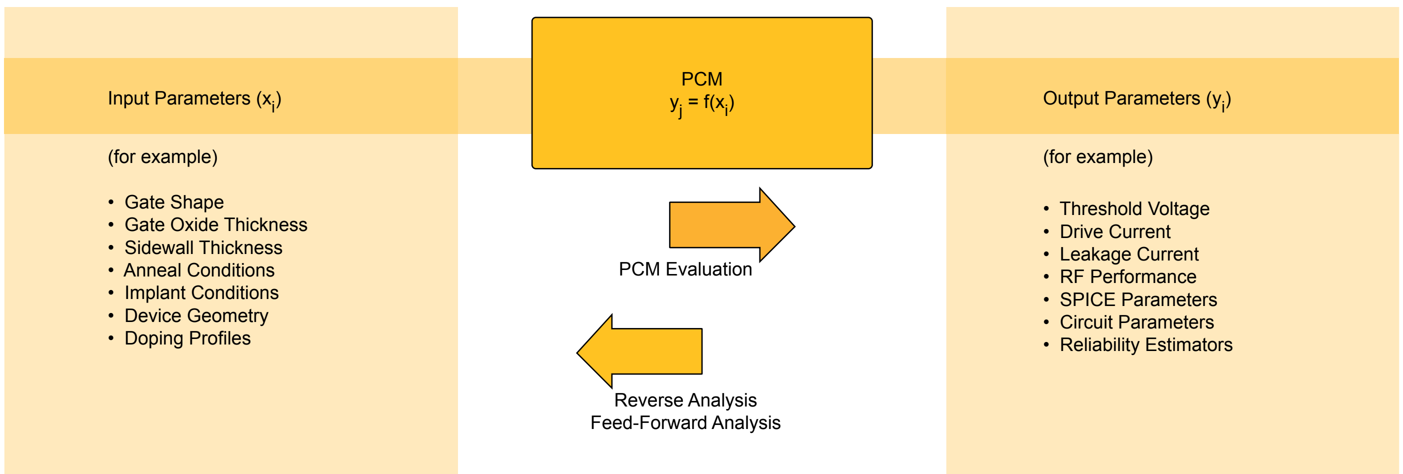


Figure 2. Process compact models capture the relation between process parameters and device performance characteristics in a small and efficient form. Process compact models enable several use cases through evaluation, reverse analysis, and feed-forward analysis.

TCAD and Process Compact Models

The strengths of TCAD lie within the detailed modeling capability of physical phenomena with high precision, allowing users to capture, with great accuracy, the influence of arbitrary process parameters on device and circuit performance. In particular, the use of TCAD enables early and easy access to process parameters and device performance characteristics, which may not be available or are expensive to access by measurements. Process compact models (PCMs) capture these multivariate process–device–circuit relationships and bring them to the manufacturing environment, making it practical to use TCAD for in-line yield improvement and advanced process control. PCMs are derived from systematic TCAD simulations, but can also be created with measurement data. Analogous to device compact models (SPICE), PCMs encapsulate process and device relationships through a set of analytic functions, allowing manufacturing engineers to gain insight into device sensitivity to process variability in an extremely fast and robust manner. No prior TCAD knowledge or expertise is required to use PCMs. Users can perform statistical process analysis and optimization either within PCM Studio or through the PCM Library in arbitrary environments.

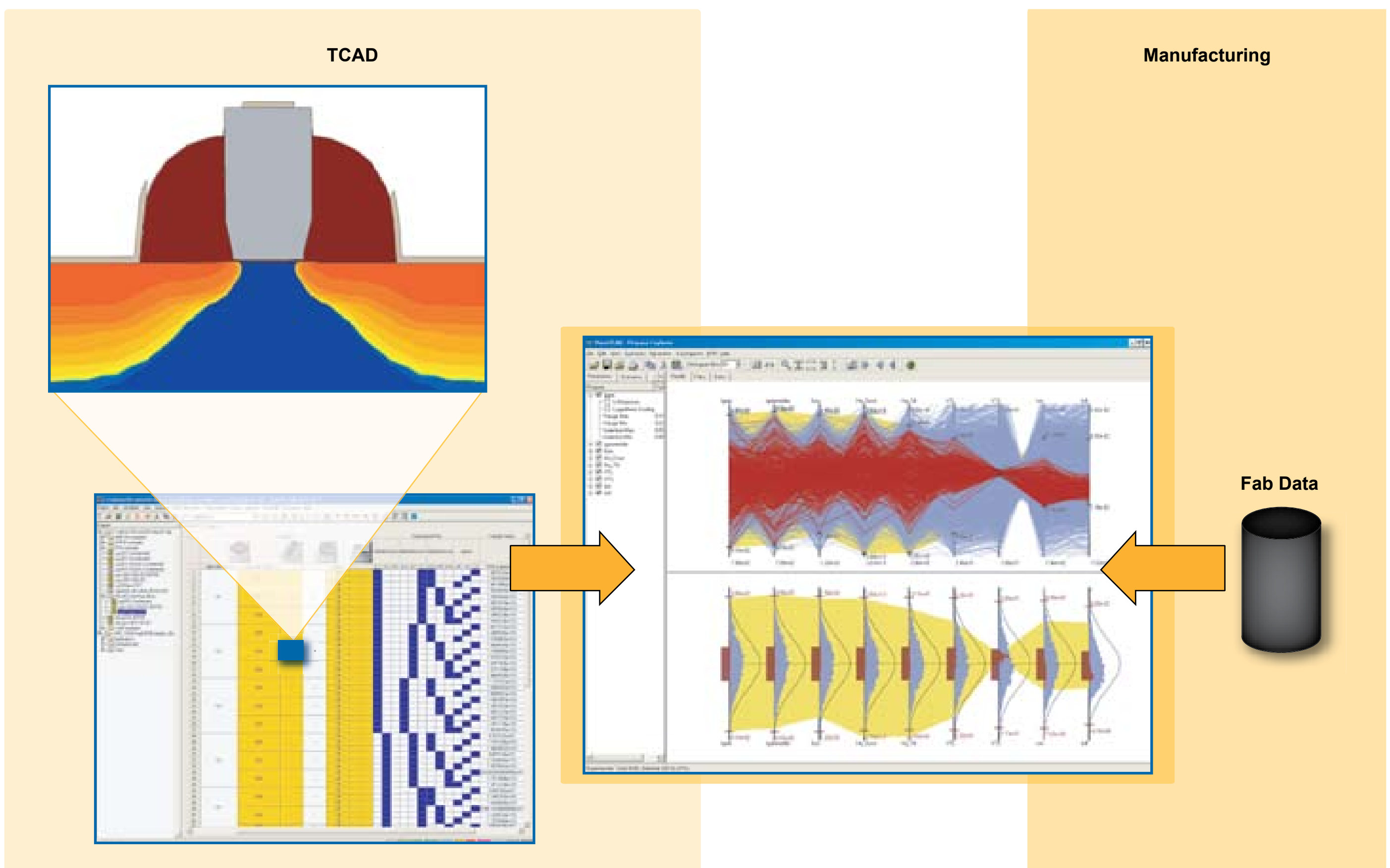
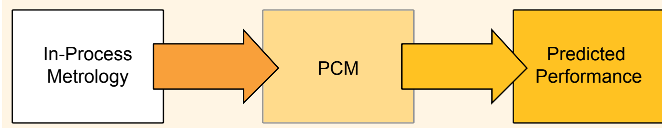


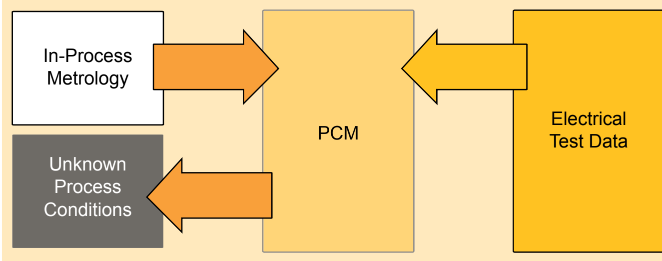
Figure 3. PCM Studio with its link to the TCAD simulation environment and fab database can be used to combine simulations and simulation-based process compact models with actual measurements from the fab.

PCM Evaluation



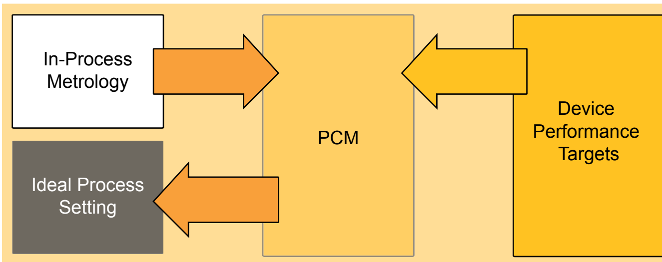
Device performance can be predicted from in-process data in virtual device metrology. This predicted performance data can be used to monitor process variations and changes, or for correlation and analysis with electrical test measurements.

Reverse Analysis



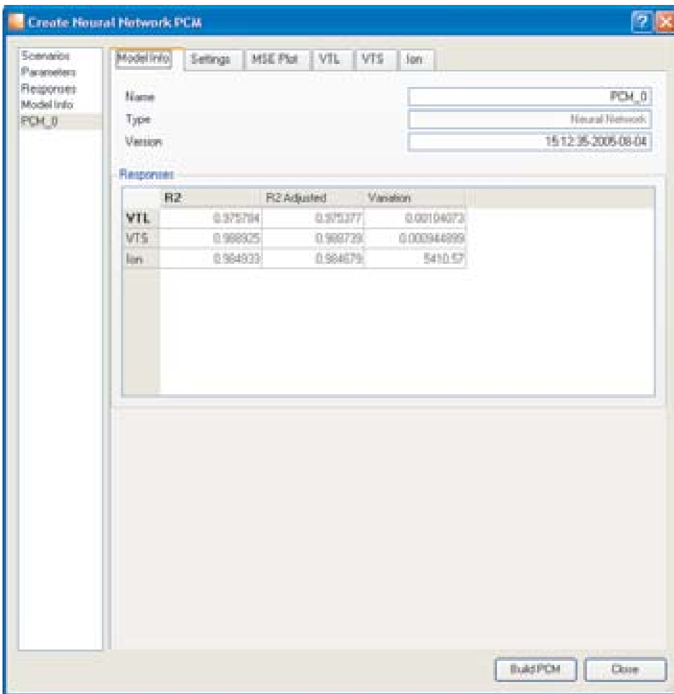
The estimation of unknown or difficult-to-quantify process conditions and their variations can be accomplished using known in-process metrology and electrical test measurements together with process compact models. This technique ensures virtual process metrology data is available for analysis.

Feed-Forward Analysis



Optimal process conditions for process control can be determined with process compact models from in-process metrology and target device performance.

Figure 4. PCM Studio offers other views, in addition to powerful parallel coordinate representation (see Figure 1), such as interactive process window analysis, statistical plots, and spreadsheet representations.



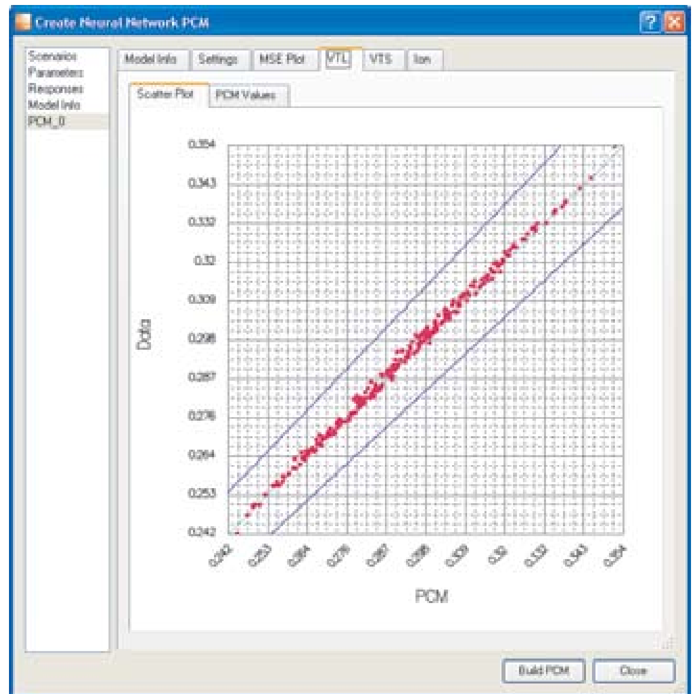


Figure 5. It is essential that a PCM fits well to simulation data or measured data. PCM Studio offers an intuitive and powerful interface to construct polynomial and neural network PCMs, as well as to assess and improve the quality of fit.

Features

- Construct polynomial and neural network PCMs
- Explore simulation and measured data
- Analyze measured data using PCMs
- Perform process window analysis of PCMs
- Embed PCMs using PCM Library into other applications on Windows (PCM ActiveX DLL, PCM Tcl Library) and Linux (PCM Tcl Library)

Supported Platforms

- x86 (IA-32) Linux 32-bit
- x86 (IA-32) Windows 32-bit

SYNOPSYS®

700 East Middlefield Road, Mountain View, CA 94043 T 650 962 5000 www.synopsys.com

Synopsys and the Synopsys logo are registered trademarks of Synopsys, Inc. All other products or service names mentioned herein are trademarks of their respective holders and should be treated as such.
© 2005 Synopsys, Inc. All rights reserved. 10/05.RB.WO.05-13600