

# **Yield Dynamics Turns to Data Mining for Semiconductor Yield Management**

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Data mining algorithms have a long and successful history in manufacturing process control and optimization applications. A new and interesting addition to that genealogy is the use of data mining to perform yield management and process control for the semiconductor industry. Santa Clara, CA-based Yield Dynamics, Inc. has developed a decision tree-based Yield Mine™ software module as part of its larger Genesis™ software suite.

## **Genesis**

In addition to Yield Mine, Genesis includes the Yield Wizard™ toolset of semiconductor specific analysis routines and the FLEXTRACT™ module for interfacing with databases and file systems. The software is a client-server application running on PC's with Windows 95, 98, and NT systems. "This is a good idea and a good use of the technology. The use of these tools for process control and yield optimization makes sense because semiconductors involve fine grain quality manufacturing," reported Erick Brethenoux, vice president, Lazard Freres.

"We believe that data mining technology will become increasingly important in semiconductor manufacturing because with each new generation more sophisticated diagnostic equipment generates more data," reported Dr. Richard Kittler, vice president, product development, Yield Dynamics. The level of data collection in the industry today is already impressive.

Manufacturers start with a slice of single crystal silicon that goes through a series of 300 to 500 individual manufacturing steps. As many as 24 individual chips can be produced on each original slice of silicon. This batch of chips is typically called a Lot. During the manufacturing process 1,500 to 5,000 individual measurements are made on each chip.

Genesis is used by engineers who are responsible for finding and fixing process problems in semiconductor manufacturing that affect the ability to control the overall yield of the manufacturing process and device performance in general. Genesis allows engineers to bring data into an analysis environment, that is like a spreadsheet, and apply a suite of basic statistics and graphics for exploratory data analysis.

## **Yield Wizard**

The Yield Wizard is a complementary module. It is a family of tools within Genesis that automate a series of tasks associated with specific types of analysis the engineer will face. Analysis routines include commonality reports and charts, difference reports, equipment comparison reports, outlier analysis, split-lot analysis, and detection of parametric shifts.

The suite of tools in Yield Wizard today are all based on traditional statistics but Kittler noted that additional tasks will be automated through integration with Yield Mine.

The Yield Mine module allows engineers to find relationships in the data and to relate different device characteristics affecting performance or speed of a microprocessor to its manufacturing history. Yield Mine has its own user interface. Users can select the response, select a list of possible explanatory variables, set some tuning options and then develop models.

## **Spatial Pattern Recognition**

Yield Dynamics is developing a spatial pattern recognition module that will be added to Yield Mine. "The performance metrics of each wafer can be mapped across the wafer and that map has some spatial characteristics, such as center to edge variations. The new module will allow us to very quickly extract features from the maps. We will couple that with the Yield Mine module to determine what in the processing history of those wafers may be related to the presence or absence of those features," Kittler said.

Yield Dynamics sees the Yield Mine and FLEXTRACT technologies as its key differentiators.