



Semiconductor Solutions

Visual Numerics Delivers Powerful Yield Analysis Tools to the Semiconductor Industry

The Semiconductor Yield Analysis Challenge

Yield analysts in the Semiconductor industry face manufacturing processes that are highly specialized and unique in several significant ways:

- The process to build a semiconductor wafer is very long and complicated and the amount of data collected in the modern fabrication is growing rapidly and instrumentation improvements can increase throughput dramatically
- The process of building a semiconductor is often a global activity with outsourcing and collaboration occurring at many stages
- Due to increasingly intense competition, many semiconductor companies are making significant changes in their supply chain management such as outsourcing and fabless integrated device manufacturing – to achieve optimal production efficiencies
- Traditional supply chain management products and techniques ignore an important component to the semiconductor manufacturing process - yield analysis
- Time to market pressures result in manufacturers using new chip designs prematurely – before bugs are completely addressed – making it difficult to achieve predictable yield output of quality chips

Product life cycles for semiconductors are getting shorter and shorter, and selling prices are declining rapidly after new products are introduced. Competitive companies need to send their products to market quickly with the highest yield production possible. Custom, flexible, yet easy to use, analysis tools are essential to meeting this goal.

Effective yield analysis achieves accurate yield prediction and ensures the right level of work in progress (WIP). Whether you need to **improve time to volume, quickly identify yield issues, improve yield visibility, analyze split lot or lot quality, perform outlier or trend analysis, or accelerate the yield learning curve**, the ability to quickly, consistently, and flexibly analyze and visualize specialized data from your wafer manufacturing process will significantly increase your return on investment (ROI). Accurate yield analysis increases yield predictability, ensures quick response time to yield problems, and reduces die loss. In addition, the right analysis framework will allow manufacturers to monitor process tool performance, improve maintenance schedules, and enhance control of process modules.

The Solution: Accurate, Reliable, Customizable

The PV-WAVE family of products by Visual Numerics — PV-WAVE, JWAVE, and TS-WAVE — delivers yield analysts with a customizable analysis and visualization framework to optimize their specialized manufacturing environments.

PV-WAVE development solutions allow analysts to rapidly import, manipulate, analyze and visualize data. And, PV-WAVE Advantage has the added benefit of a sophisticated set of mathematical and statistical analysis routines based on our industry standard IMSL libraries.

JWAVE provides a web enabled solution that allows teams to collaborate across the enterprise and quickly access and understand what yield data means, from anywhere, at anytime. Using JWAVE and/or our Visual Numerics' highly specialized consulting team with our customizable yield analysis technical frameworks, we can quickly address your specific requirements in the wafer manufacturing process.

Finally, TS-WAVE delivers an extensible, off-the-shelf solution that allows for custom interactive time-series data analysis.

"Engineers can carry out real time analysis and quickly find the yield parameters... saving more than 50% in time and work efficiency."

Mr. Chen – Manager / ICSI

Value Proposition

Visual Numerics provides the Semiconductor industry with a proven technical framework and consulting expertise for specialized, custom-designed, yield analysis solutions. With the PV-WAVE family, companies can rapidly and easily analyze and visualize manufacturing data for quality and process improvements and achieve a significant ROI.

Key Benefits

Visual Numerics delivers consulting services and a technical framework to the Semiconductor industry for fast and highly accurate yield analysis and effective management of manufacturing processes. Some of the key benefits are:

- Maximized insight into mass manufacturing data
- Quick identification of critical manufacturing problem areas and yield issues
- Detection and reduction of variations on yield
- Developed manufacturing control models
- Understanding of optimized yield processes and models
- Minimized inventories and Work in Progress (WIP)
- Improved time to market and volume of quality yields with yield visibility early on
- Accelerated learning curve for optimal yield management
- Easy creation of Web-based analysis tools
- Utilization of proven, industry standard algorithms for robust and specialized analysis

ROI Impact

The PV-WAVE Suite of products provides significant ROI to the Semiconductor industry in many ways.

- **It is fast and flexible** – quickly import, process, visualize, and analyze data, and rapidly switch between projects for maximum efficiency
- **It is proven, consistent and reliable** – for over 30 years, these development tools have been meticulously maintained and highly supported
- **It is highly accurate** - rapidly perform complex yield analysis for your custom manufacturing environment
- **It is easy to use** – easily import large datasets from multiple sources and formats and efficiently analyze data and render complex charts, plots and reports
- **It is a customizable, all-in-one solution** – learn and use only one tool for all of your custom yield analysis needs
- **It is cost effective** - saves valuable engineering time and application development dollars

World Class Products, Services and Support

Visual Numerics, with its PV-WAVE and IMSL product families, has provided trusted visualization and numerical analysis tools to top companies in the Semiconductor industry.

The PV-WAVE Family has the custom yield analysis functionality you need. Its open software environment allows for integration with any technology, and the IMSL Library delivers over 370 mathematical and statistical routines, creating the most powerful data analysis software available. Visual Numerics provides consulting services and a specialized technical framework for any yield analysis challenge, while delivering significant return on investment through maximum productivity.

Visual Numerics partners with its customers to provide world-class products, services and support. We have unparalleled technical support that can answer the hard questions fast, and responsive consultants that can provide in-depth expertise and timely delivery of time-critical solutions.

"We not only improve the efficiency of yield analysis, but also reduce the number of defective products. The result is improved production efficiency"

Mr. Yang Ching Sheng
Deputy Manager of Parameter Engineering
Winbond Electronics



IMSL[®]
Trusted For Over **30** Years

Visual Numerics[®]

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Proven Results

Visual Numerics solves complex yield analysis problems for Semiconductor customers worldwide. Companies use Visual Numerics' PV-WAVE products and/or its yield analysis framework combined with its consulting expertise to build custom manufacturing solutions. Some of the Semiconductor solutions we can share include:



- **Winbond Electronics** – Winbond Electronics turned to Visual Numerics to develop an enhanced data analysis system based on its JWAVE product. Winbond used a JWAVE solution to speed up the processing of large amounts of data and graphics, improve overall operation customized efficiencies, meet the requirements of the company's e-strategy, and build a web-based user interface. The Visual Numerics consulting team worked with Winbond's engineers to develop a new interactive yield management system. Using JWAVE's Web-enabled architecture, Winbond has integrated several modules under a single portal, including LQC (Lot QC), yield-yield map, WAT (wafer acceptance test), correlation, defect, WIP (work in progress), MQC (machine QC) and others. Thanks to Visual Numerics' consulting expertise and leading visualization products, Winbond engineers can now use different modules concurrently to carry out interactive data analysis.
- **ICSI** – ICSI built a sophisticated, web-based data analysis system using Visual Numerics' JWAVE product. According to ICSI, the greatest benefit of JWAVE's Web-based yield analysis capabilities is increased performance due to a tremendous time savings. Prior to JWAVE's use, engineers would have to download the WAT or yield data to their computers and then analyze individual data using programs such as Excel, which are not economical especially in terms of time, efficiency, and performance. Now with the new yield management system, built on the foundation of PV-WAVE, ICSI engineers can carry out real time data and visualization analysis and quickly find the accurate yield parameters to send to the fabrication plant, saving more than 50% in time and efficiency.

Unparalleled PV-WAVE Functionality

- **Advanced Graphical Representation** – Quickly perform trend and outlier analysis and create histograms and wafer maps for lot quality analysis.
- **Advanced Statistical Analysis** - Easily create descriptive statistics, including correlation analysis, split lot analysis, and trend analysis. PV-WAVE Advantage delivers powerful data analysis capabilities, which include the industry standard IMSL libraries of over 370 mathematical and statistical routines.
- **Web-based Solutions** – JWAVE allows you to create a custom and interactive web environment for global sharing, collaboration, and a quick learning curve.
- **Data Acquisition** – PV-WAVE can easily import proprietary and custom data formats and support a wide range of image formats. PV-WAVE can access data directly from commercial databases such as Oracle and Sybase, and manage very large datasets.
- **Custom Yield Analysis Solution using Standardized Tools** – PV-WAVE products are standardized tools which can easily be customized for specialized wafer fabrication environments.
- **Integration** – Easily integrate with existing data collection methods. No major change to current infrastructure is required with the PV-WAVE family.
- **Platform Support** - PV-WAVE runs on all platforms, including Windows, Linux, UNIX, and OpenVMS. Code created using PV-WAVE is platform neutral, so it can run on any system.
- **Legacy Code** - Call your legacy C or FORTRAN code from PV-WAVE, or call PV-WAVE directly from your own C or FORTRAN application.

Visual Numerics has Offices Worldwide

USA • UK • France • Germany • Mexico • Japan • Korea • Taiwan

For contact information, please visit www.vni.com