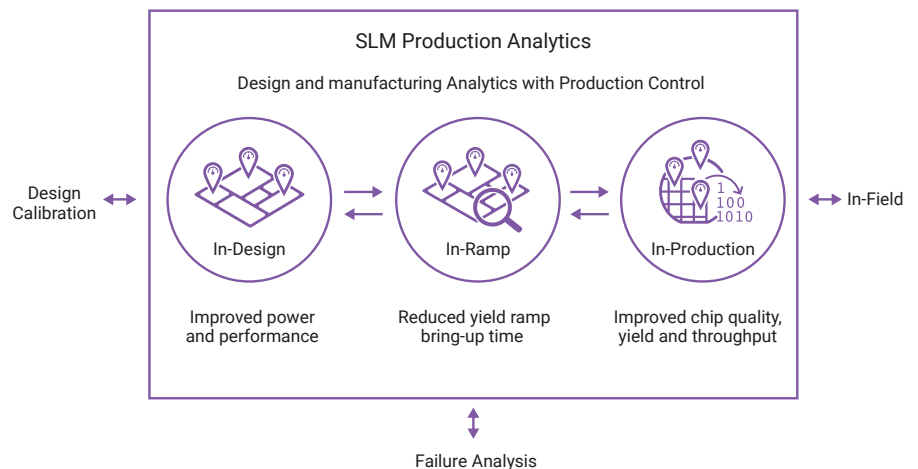# SLM Production Analytics

## Integrated SLM analytics solution from design through manufacturing

Overview

SLM Production Analytics is a unique analytics solution spanning design and product manufacturing lifecycle phases from in-design to in-ramp and then onto in-production as part of the Synopsys Silicon Lifecycle Management (SLM) family of solutions.

This solution offers the ability to process and analyze orders of magnitude more silicon data compared to prior approaches. SLM Production Analytics automatically highlights silicon data outliers, enabling engineering teams to quickly identify and correct underlying issues in the semiconductor supply chain. The solution also boosts productivity by consolidating analytics across all manufacturing phases within a single environment and avoiding time-consuming usage of multiple tools.

With SLM Production Analytics, engineering teams can leverage silicon design, production and sensor data to quickly determine how to improve key chip production metrics such as yield, quality and throughput, while also improving key silicon operational metrics such as chip power and performance.

The benefits of SLM Production Analytics span three key focus areas:
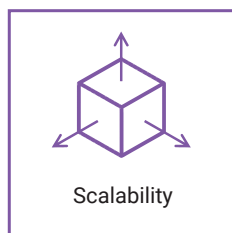
Scalability

The enhanced product architecture accommodates petabytes of data across the full breadth and depth of data types including design, sensor, diagnostic, fab and test which most analytics tools cannot process. A solution which can handle massive amounts of data becomes crucial for performing timely root cause analysis, especially to debug silicon chip issues further downstream in manufacturing or to debug RMAs (return merchandise authorization) or performing historical analysis. Also, the flexibility to provide users an option to process and store their data on the cloud is critical. SLM Production Analytics offers several cloud solutions including Microsoft Azure and Amazon Web Services (AWS).

Key Features

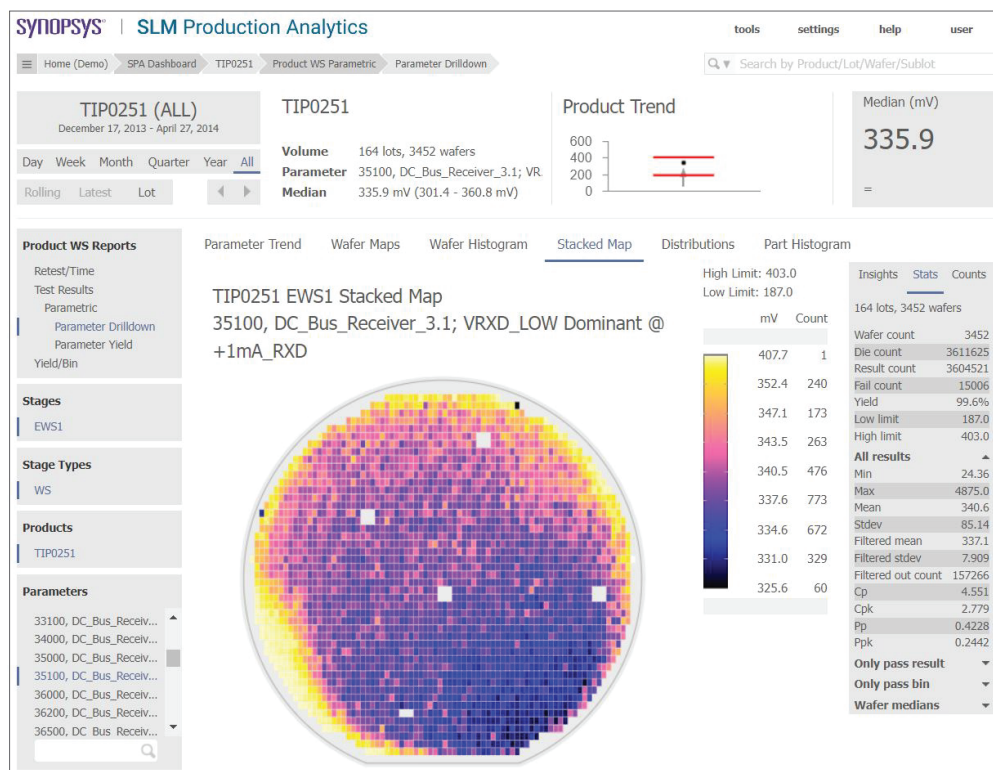- Petabytes of data
- Multi domain support
- Cloud enabled

Figure 1: Stacked wafer map example. Solution can handle over 1 billion dies being analyzed at once (not shown).

Productivity

Most data today is either unused by engineers due to the massive amount of data or due to lack of an automated process on where to look for issues within this data. With SLM Production Analytics, engineers are now able to gain instant value from all data integrated into one solution. Automated analysis and identification of issues or key points of interest is shown in the form of insights. Part-level traceability and debug enables quick root cause analysis along with corrective action recommendations back into the supply chain. Sub-die analysis is also available in early New Product Introduction (NPI) product stages to identify systematic issues causing failure analysis that are preventing high yield and high-volume production.

Key Features

- Actionable insights out-of-the box
- Automated root cause analysis
- Accurate failure analysis candidate selection

Figure 2: All insights are instantly and automatically refreshed within seconds as your data continuously streams in independent of data volume

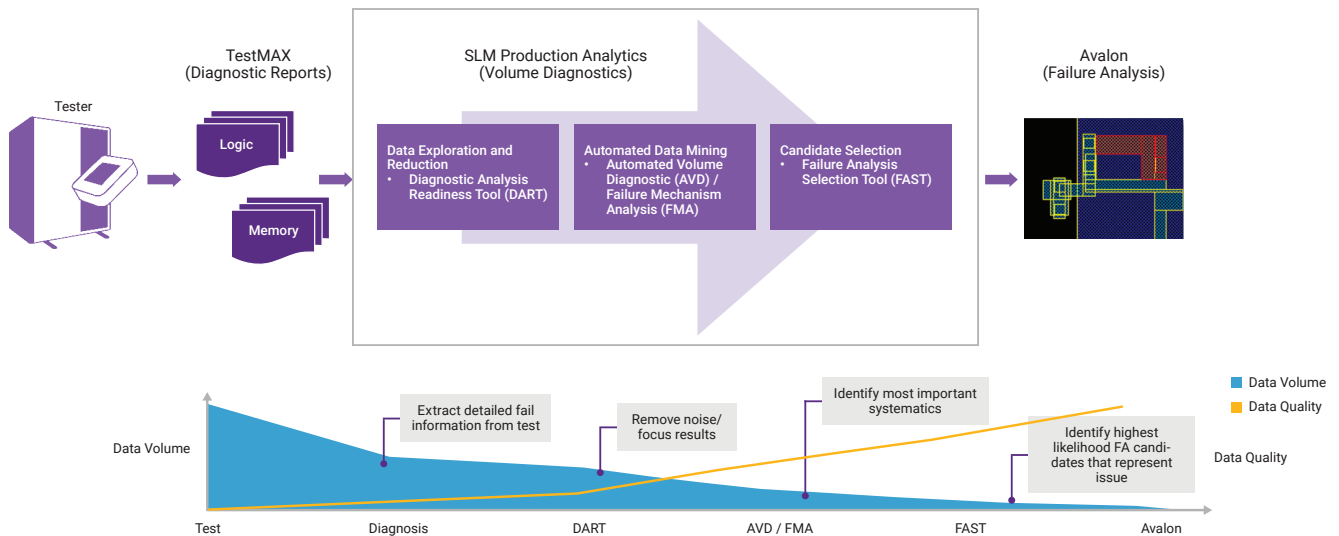Figure 3: From hierarchical analysis to root cause in only a few clicks

Figure 4: Complete yield learning and yield optimization flow with high accuracy identifying failure mechanisms for Failure Analysis

Efficiency

Chip power and performance optimization is made possible by the inclusion of sensors into the design enabling feedback of the sensor data for performing design calibration. Comprehensive yield optimization is enabled by combining yield trend analysis, diagnostics and failure analysis with improvements made back into the design and/or process. An automated recipe flow for quality optimization containing outlier detection techniques is provided during production control back into the manufacturing supply chain. OEE analysis of the tester fleet enables throughput optimization of the chip production. Real-time data collection & production control is provided for minimal latency to correct issues resulting in cost savings and preventing quality escapes.

Key Features

- Power and performance optimization
- Quality, yield and throughput optimization
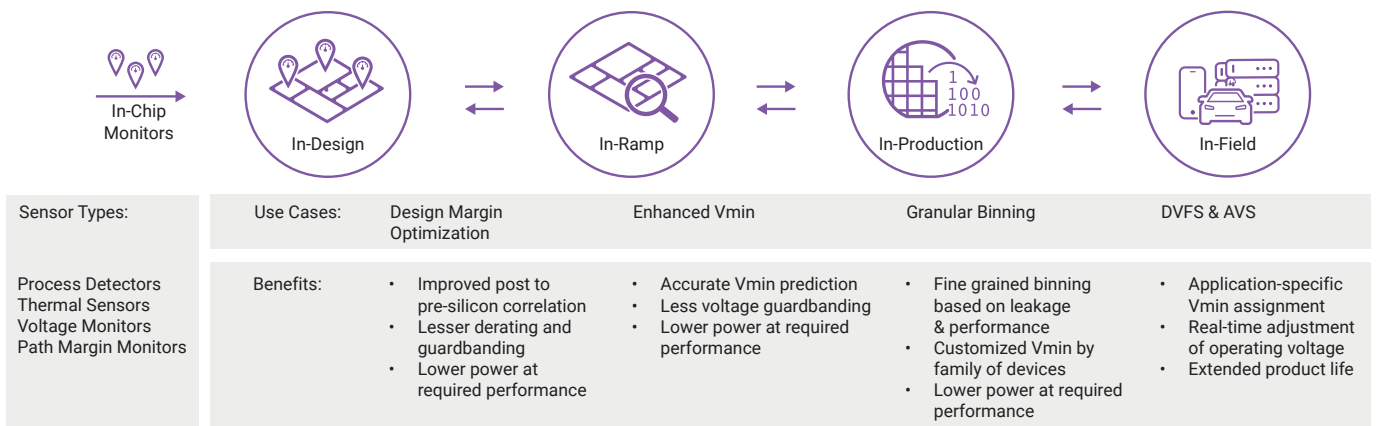- Real-time data collection and production control

Sensor Types:		Use Cases:	Design Margin Optimization	Enhanced Vmin	Granular Binning	DVFS & AVS
Process Detectors Thermal Sensors Voltage Monitors Path Margin Monitors		Benefits:	• Improved post to pre-silicon correlation • Lesser derating and guardbanding • Lower power at required performance	• Accurate Vmin prediction • Less voltage guardbanding • Lower power at required performance	• Fine grained binning based on leakage & performance • Customized Vmin by family of devices • Lower power at required performance	• Application-specific Vmin assignment • Real-time adjustment of operating voltage • Extended product life

Figure 5: Complete end-to-end power and performance optimization

Quality Optimization

DPAT

Failed dice clusters

Good Die in Bad Neighborhood (GDBN)

Pre-ink
Yield stacked map

Post-ink
Yield stacked map

ZPAT

Yield Optimization

Yield Trend → Production Test → Core Level Analysis → Fingerprinting → Diagnostics

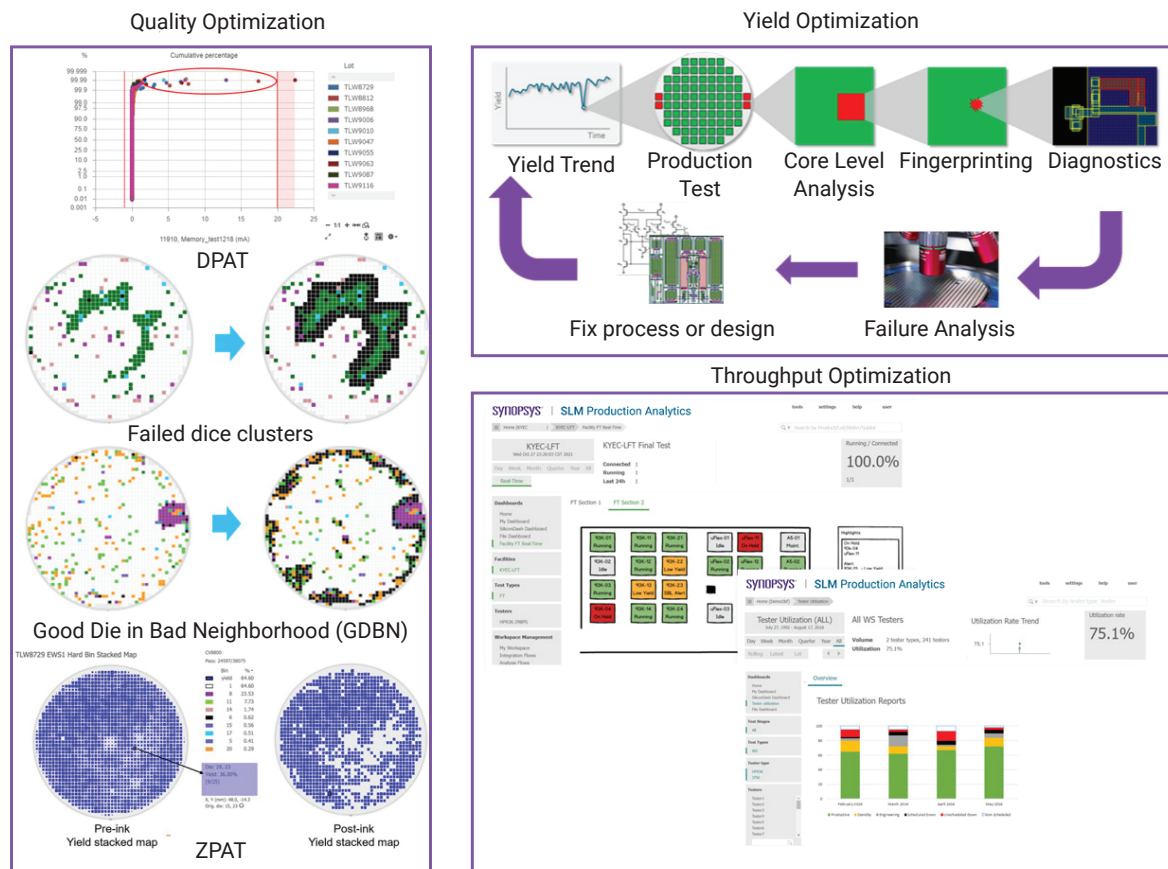Fix process or design ← Failure Analysis

Throughput Optimization

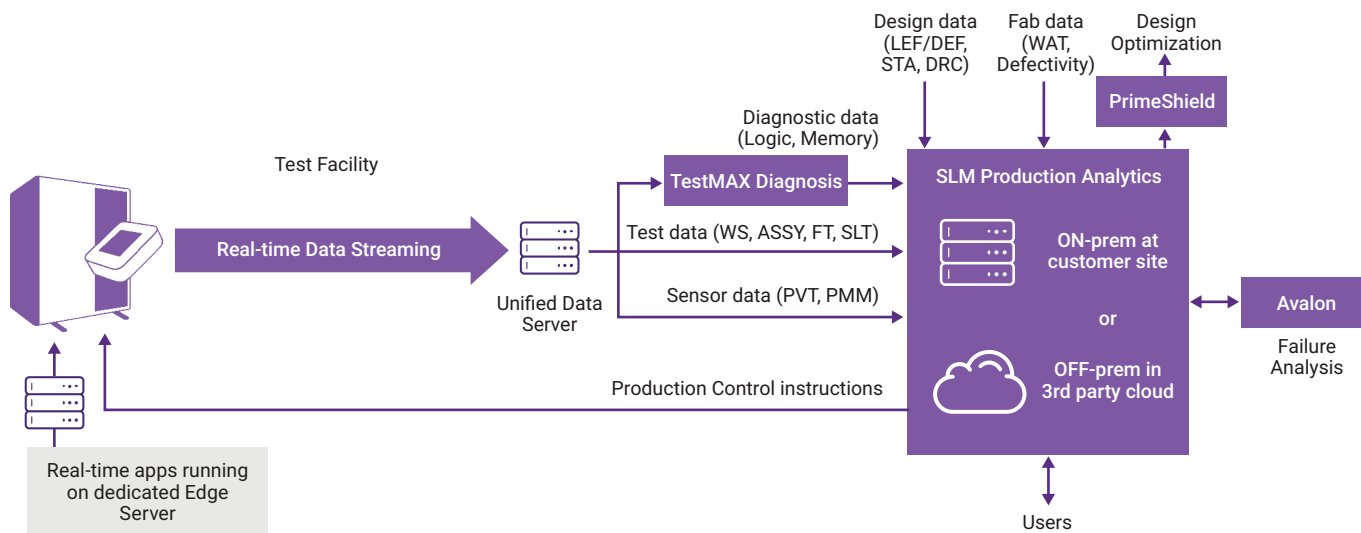Figure 6: Comprehensive quality, yield and throughput optimization flows

Figure 7: Real-time data collection and production control for minimal latency and improved cost savings and quality

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