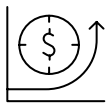
Virtual Metrology (VM)

Reinvents process monitoring and control

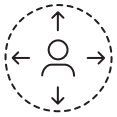
Background

In manufacturing, raw materials and intermediary goods undergo hundreds of different process steps to become a final product. In each process step, key characteristics are measured and monitored using metrology equipment to ensure high quality and yield. For example, in a typical thin-film deposition process step in semiconductor manufacturing, the thickness and refractive index of the film are measured by ellipsometry tools. Conducting a full-scale measurement of the entire production line would be ideal, but in reality, it is rather difficult to increase the sampling rate due to various practical challenges.

Challenges manufacturers face in increasing the sampling rate for metrology



Metrology Equipment Costs
causing a financial burden to manufacturers



Additional Resources Requirements
such as maintenance costs or space in a manufacturing plant

Longer Cycle Time
as a result of adding metrology to the process

Fortuitously, modern manufacturing equipment generates a massive amount of sensor data, such as temperature, pressure, and electric current, that contain valuable information relevant not just to the equipment, but also to each material it processes. This leads to a natural idea of modeling the statistical relationship between process outcomes and sensor data. Such a model then can predict process outcomes from the sensor data and effectively increase the measurement sampling rate to 100% without incurring any additional physical measurement. Naive approaches to such virtual metrology face many challenges, however. First, the sensor and measurement data drift and shift as the condition of the equipment changes over time. Second, given the sheer volume of the sensor data, it is extremely difficult to recognize a subset that is relevant to predictive modeling. Finally, the small amount of measurement data, which is the raison d'etre of virtual metrology, significantly reduces the accuracy of most modeling techniques.

Product Description

Panoptes VM is the industry's first successful virtual metrology solution that predicts process outcomes reliably and robustly for real-time process monitoring and control. It tracks the temporal changes in sensor and measurement data by updating and optimizing the model continuously. Panoptes VM navigates massive data from hundreds of sensors and other metadata, and selects most relevant features for best prediction performance. By aggregating measurement data from multiple machines and tools for the same process, Panoptes VM overcomes the scarcity of the measurement data while providing precise and individualized models for the multiple machines and tools. Although all these core features are fully auto matized without any manual intervention, process engineers can incorporate their domain knowledge of process data and physics into main steps of predictive modeling.

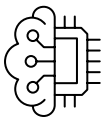
Panoptes VM Product Features

Accurate and Robust Prediction

provides reliable and consistent results
against data drift and shift

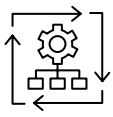
Automatic Feature Selection

shows important input parameters with high impact on
quality and yield



Flexible Customization

allows process engineers to embed domain knowledge in
feature selection and modeling



Aggregate Modeling

builds individualized models across multiple tools and machines
for the same process

Automatic Model Update

enables the model to quickly relearn
without any manual intervention

Customer Values

Process Quality Improvement

Panoptes VM achieves **up to 30% reduction of process variability** by utilizing predicted measurement outcomes in advanced process control, which ultimately increases the production yield.

Capital Expense Savings

Panoptes VM provides full-scale measurements with no additional CapEx investment in metrology equipment, which amounts to **potential capital savings of 95%.**

Cycle Time Reduction

By varying the sampling frequency of measurement equipment dynamically based on the reliability of Panoptes VM, manufacturers can **reduce the cycle time up to 3%.**

Gauss Labs provides advanced AI solutions for manufacturing process monitoring

Panoptes *(n.)*

1. Many-eyed giant in Greek mythology
2. A collection of advanced AI solutions from Gauss Labs

Panoptes Image Metrology (IM)
Shatters the limit of conventional image metrology solutions

Panoptes Virtual Metrology (VM)
Reinvents process monitoring and control

Panoptes Root Cause Analysis (RCA)
Revolutionizes the workflow of process engineers

Any inquiries? Contact us!

https://gausslabs.ai

solutions@gausslabs.ai

We normalize AI.