Dual Robot Photolithography Cluster Tool Throughput Improvement

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Vertical

Semiconductor | Pharmaceutical | Healthcare | Portfolio | Logistics | Financial | Government | Business

Genre

Case Study | Project Review | White Paper | Technology Overview

Client

Texas Instruments

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Situation

Texas Instruments is a leading supplier of high-performance analog ICs specializing in power management, amplifier, data conversion, and high-speed interface products. With future demand forecasts on the rise, they needed to understand the maximum throughput they could expect from their constraint – the photolithography cluster tool. If constraint throughput could be increased by 10%, they could avoid purchasing another cluster tool at the cost of $4 million.

Semiconductor wafer fabrication facilities are highly complex queuing networks with process flows consisting of hundreds of steps utilizing a wide array of sophisticated manufacturing equipment. Each piece of equipment itself typically includes multiple process steps. For such equipment types, flexible simulation models can allow evaluation of configuration and process scenarios to more accurately determine throughput. After having previous success with ProModel technology, they used it again to model the photolithography cluster tool.

Objective

Determine the maximum throughput from the Dual Robot Photolithography Cluster Tool constraint, in order to meet increased future demand without purchasing new equipment or expanding the facility.

Results

A comparison of wafer level times between model and tool led to the following:

- Discovered the tool was missing the latest coat/develop track software update causing a wafer flow disruption between lots resulting in a partial break in cascade driving both a ph reduction as well as a cycle time increase due to wafer delays.
- A schedule was established to ensure roll-out of the latest software upgrade to gain the associated throughput and cycle time improvements.
- Implementing the software update improved throughput enough to avoid purchasing a new cluster tool thus avoiding a $4 million capital expense.

Lithography Cluster Tool Model Output

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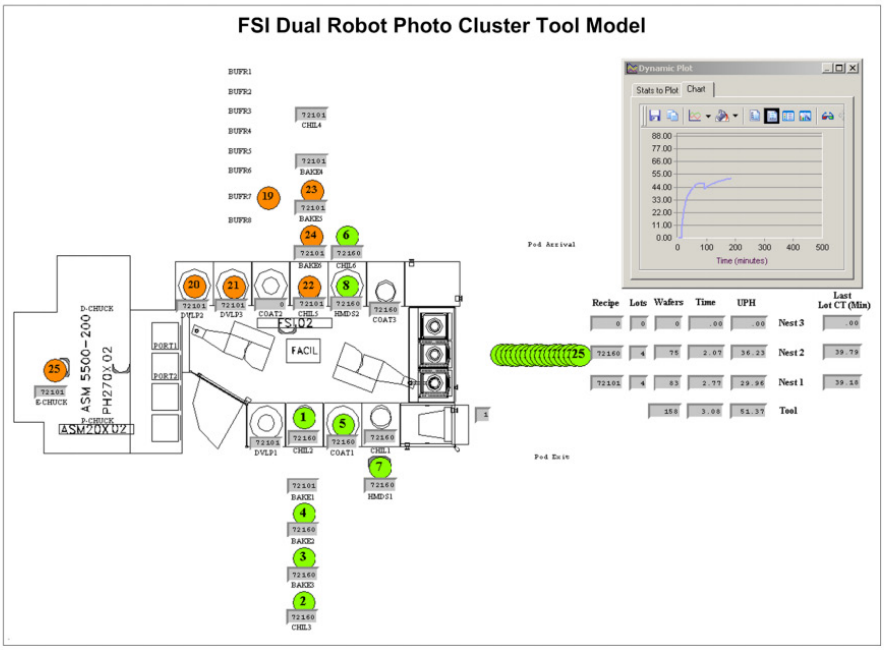
Solution

A model was developed to study the throughput of a photolithography cluster tool configured for high capacity processing. Due to the need for higher throughput, this cluster tool was built with additional modules necessitating two robots to accomplish the required wafer movement. A simulation was perfect for displaying multiple resources servicing multiple locations for multiple entities in a reenter process flow. This kind of complexity needed the simulation over the company's previous use of spreadsheets.

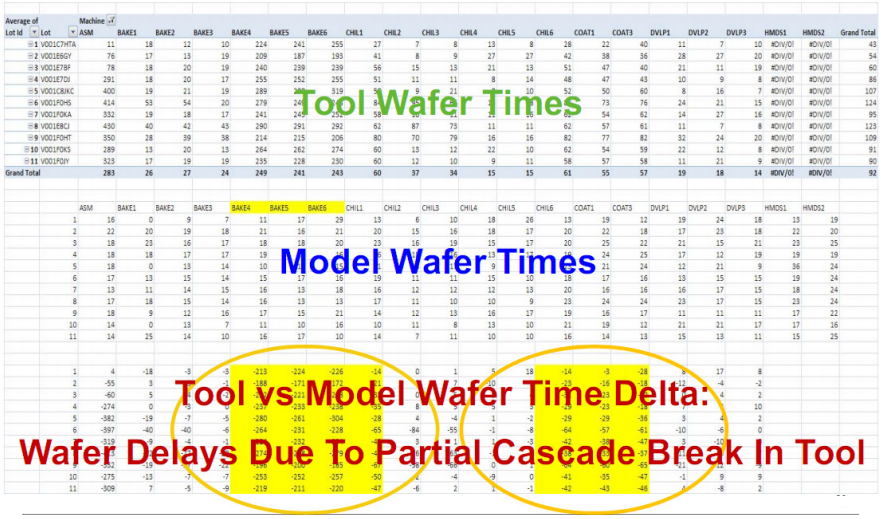
Lithography Cluster Tool Model



Model accuracy determines the ability to confidently predict improvements using it; current accuracy is well within 5%. However they need to refine it further in an attempt to reach +/- 2% because they have run out of low hanging fruit so they must now look for smaller incremental gains and the model must be highly accurate to help accomplish that.

During preliminary model validation a question was posed about the effect an increase in processing of small lots would have on photo cluster throughput. The model was used to provide a relative understanding of the impact, and was found to have little to no impact as long as sufficient operators are available to load the cluster and mask/reticle changes are minimized to avoid breaking continuous cascade mode. They did however discover the software version issue as described in the results section.

Wafer Level Validation (Ongoing)



The facility now has the model as an ongoing project to use for more tools and also possibly use for sector models.