



High Volume/High Mix SSD Production Test

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TERADYNE

40% CAGR for SSD Exabytes!!

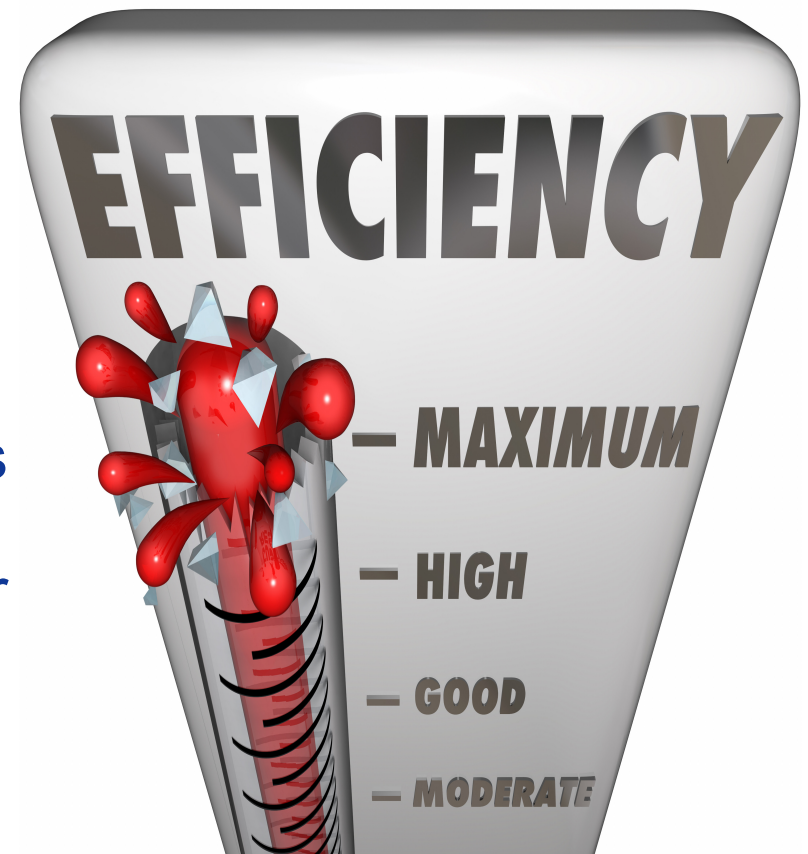
New SSD Exabytes Shipped Forecast



Getting the Most Out of Your Tester

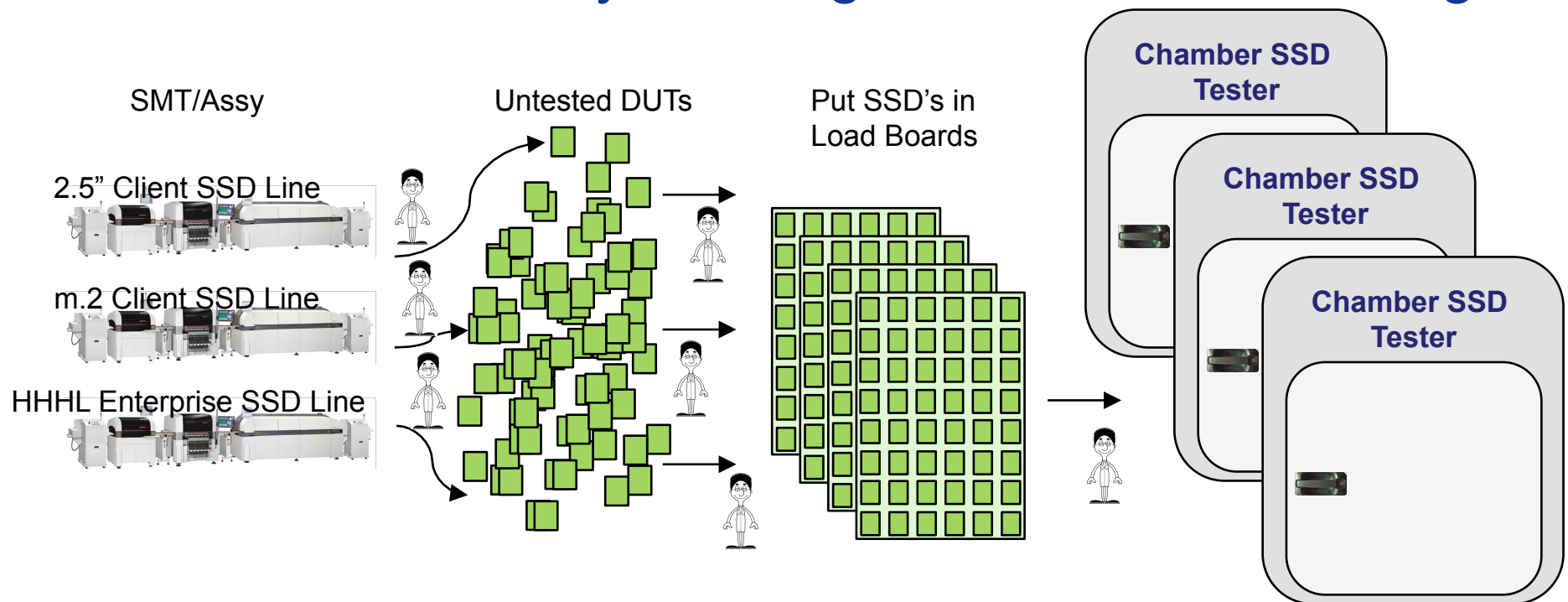
Tester efficiency impacted by many factors

- **Time to load SSD's into tester**
- **Temperature stabilization time**
- **Quickly removing failed SSD's**
- **Quickly removing finished SSD's**
- **Time to unload SSD's from tester**
- **Amount of operator interaction**



SSD Production Testing: Today

After Assembly – SSD's are grouped in batches and loaded manually into large chambers for testing



Great solution for QA & low volume production



SSD Production Testing: An Alternative Approach

asynchronous

adjective asyn·chro·nous \(\,)ā-'sɪŋ-krə-nəs, -'sɪn-\

Definition of asynchronous

1

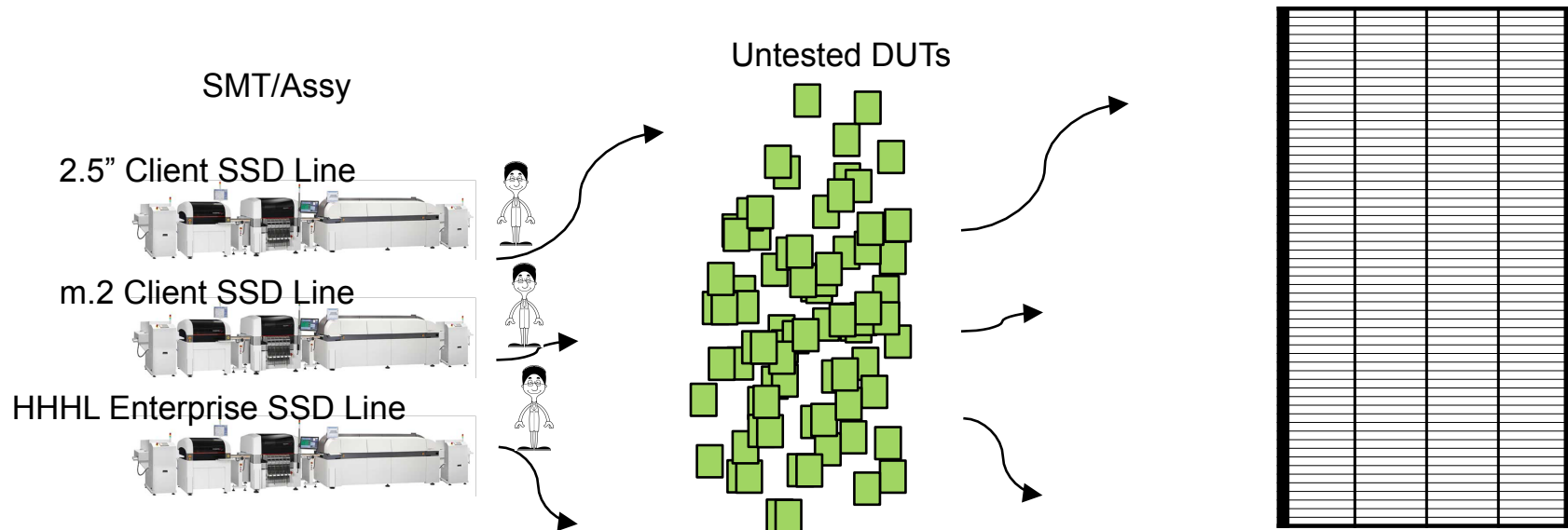
: not synchronous

2

: Having many actions occurring at a time, in any

SSD Production Testing: Asynchronous

After assembly – SSD's are loaded/unloaded automatically into/from any slot at any time



Great solution for med/high volume production



Asynchronous = True Independence

Each DUT is tested with total independence

- Loaded as soon as slot available
- Barcode identifies test program
- Unique test program in each slot
- Closed loop thermal control
- No dependency on nearby DUT
- Unloaded as soon as finished

Example of 9 adjacent asynchronous slots

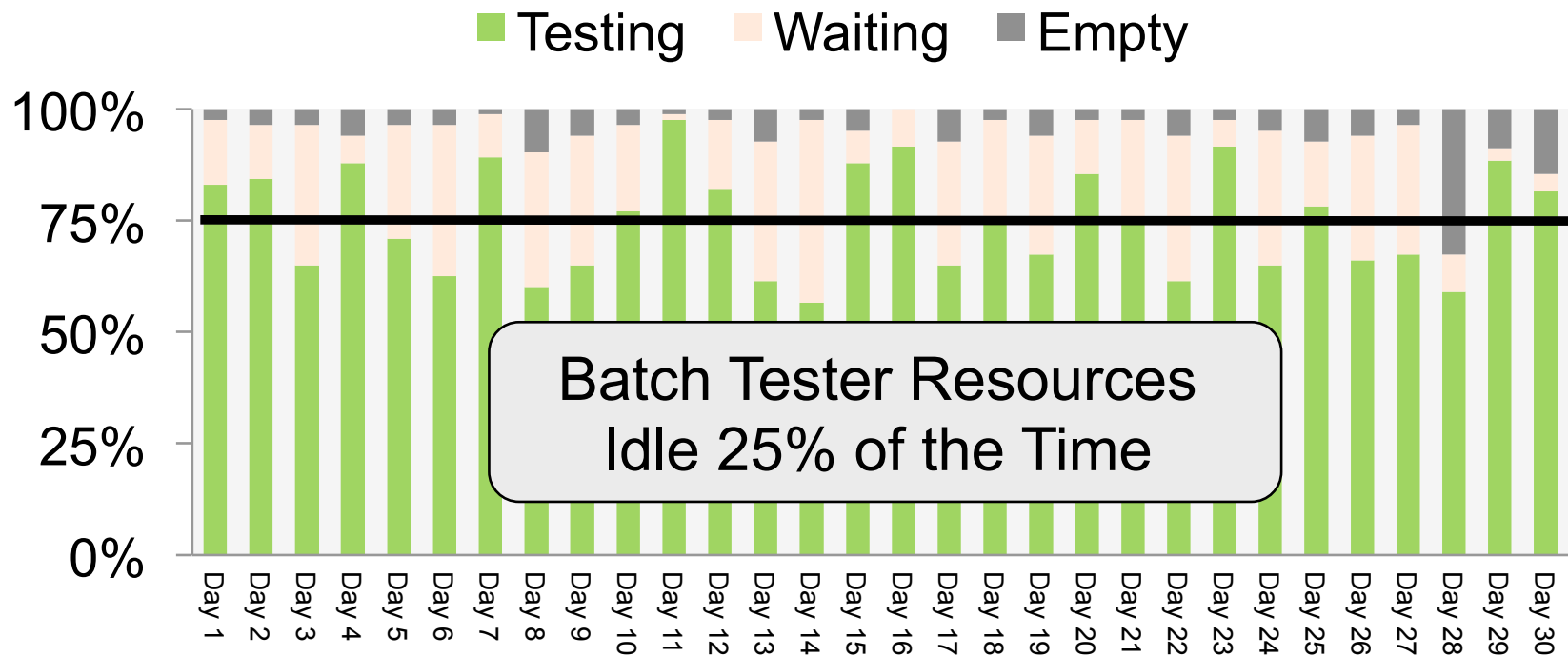
<p>slot 1</p> <p>Status: Loading n/a n/a Room Temp</p>	<p>slot 2</p> <p>Status: Testing 2.5" 6 hrs Ramp Up</p>	<p>slot 3</p> <p>Status: Testing m.2 4 hrs Control 55°</p>
<p>slot 4</p> <p>Status: Passed 2.5" 1 hr Ramp Down</p>	<p>slot 5</p> <p>Status: Testing 2.5" 12 hrs Control 85°</p>	<p>slot 6</p> <p>Status: Testing HHHL 18 hrs Control 45°</p>
<p>slot 7</p> <p>Status: Testing BGA 1 hr Room Temp</p>	<p>slot 8</p> <p>Status: Testing m.2 3 hrs Control 20°</p>	<p>slot 9</p> <p>Status: Failed 2.5" 8 hrs Ramp Down</p>

Efficiency Factors for Each Approach

Efficiency Factor	Batch	Asynchronous	
Time To Load	All slots idle while loading	Single slot at a time	✓
Temperature Stabilization	All devices wait for chamber temp	Each device controlled independently	✓
Removing failed SSD's	Wait for batch to finish	Remove/replace immediately	✓
Removing finished SSD's	Wait for batch to finish	Remove/replace immediately	✓
Time to Unload	All slots idle while unloading	Single slot at a time	✓
Operator Interaction	High level of operator interaction	Suitable for automation & "lights-out" production	✓

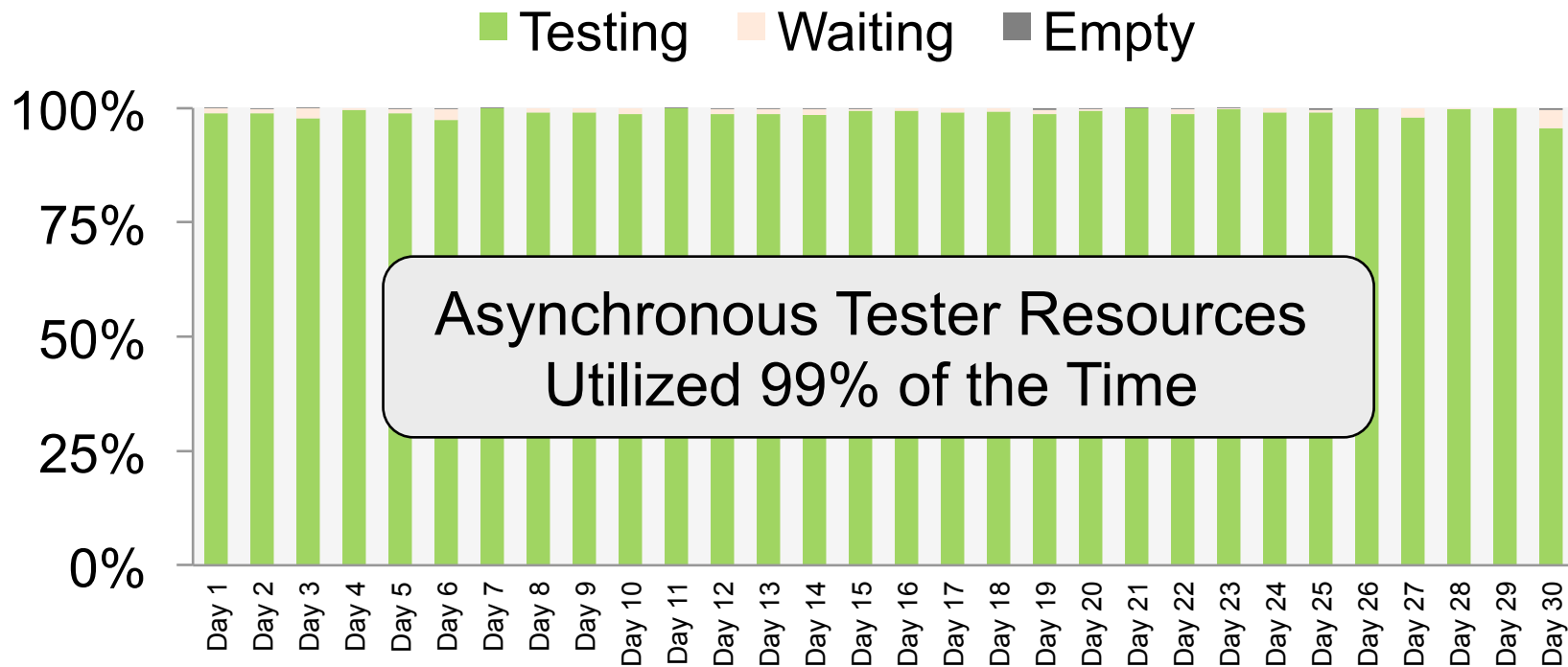
Tester Efficiency Simulation Data

Batch Production Slot Utilization



Tester Efficiency Simulation Data

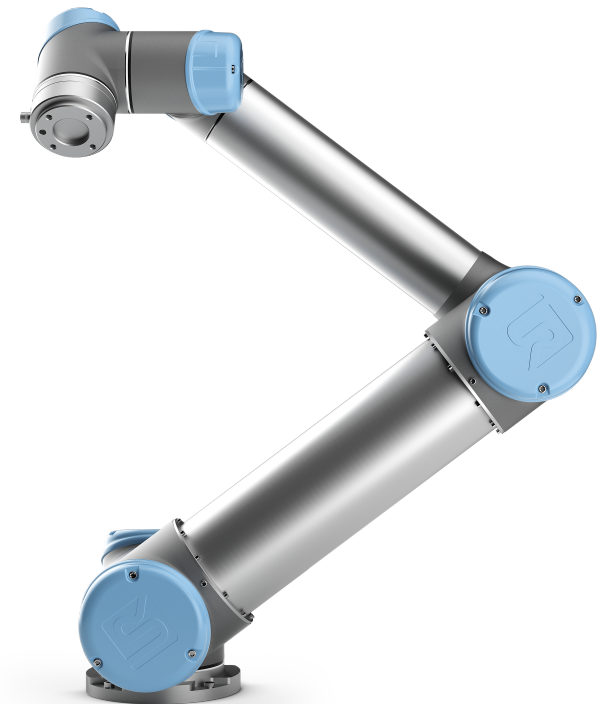
Asynchronous Production Slot Utilization



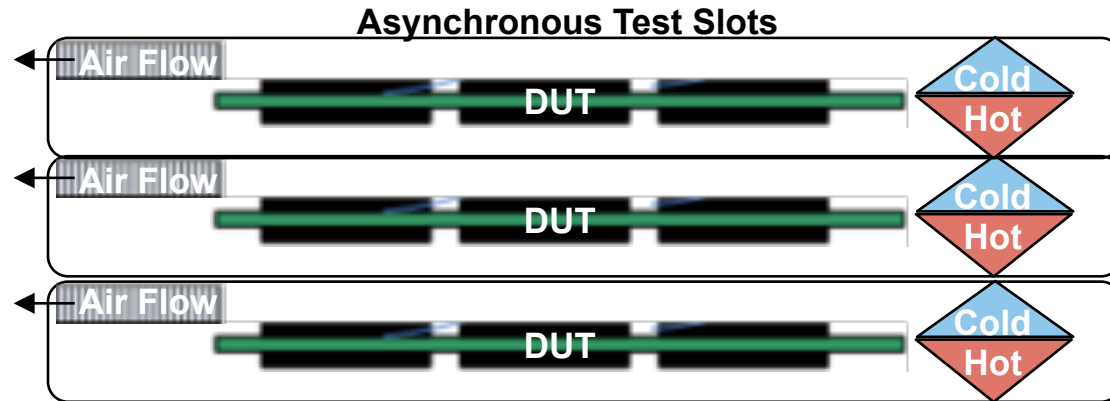


Automation Brings Consistency to High Volume Production

- Improve Quality & Increase Yield
- Uninterrupted Production Flow
- Quicker Ramp to High Volume



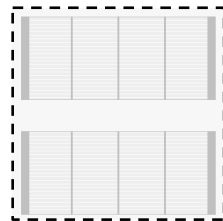
Asynchronous Thermal Consistency



- Each DUT heats and cools independently
- Control loop direct from DUT temp sensor
- Actively compensate for DUT power variations
- Low thermal mass in asynchronous slot yields →
 - Fast cooling rates
 - Power efficient heating/cooling

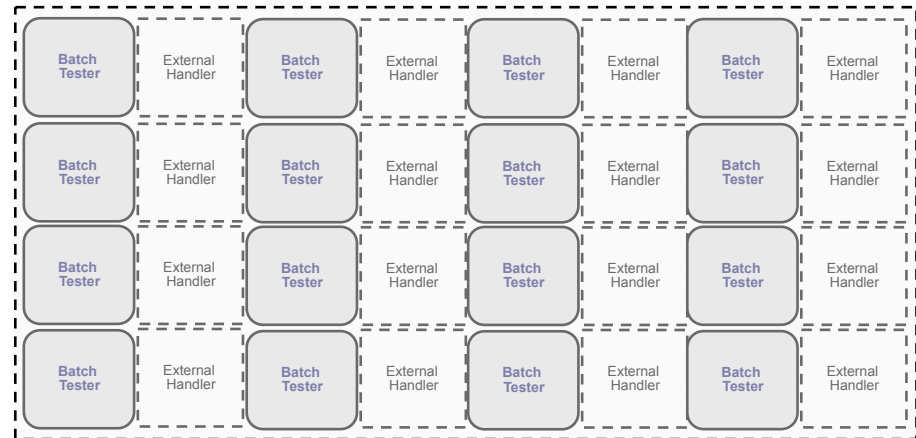
Asynchronous Testing Improves Tester Density

Asynchronous Tester Cell with Integrated Automation



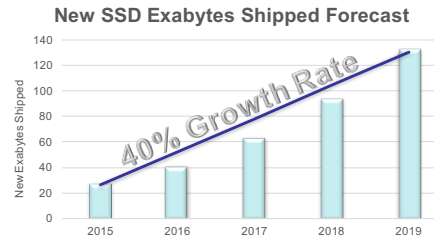
*Equivalent Production Throughput
6x less floor space* ←

Batch Tester Cell with External Automation

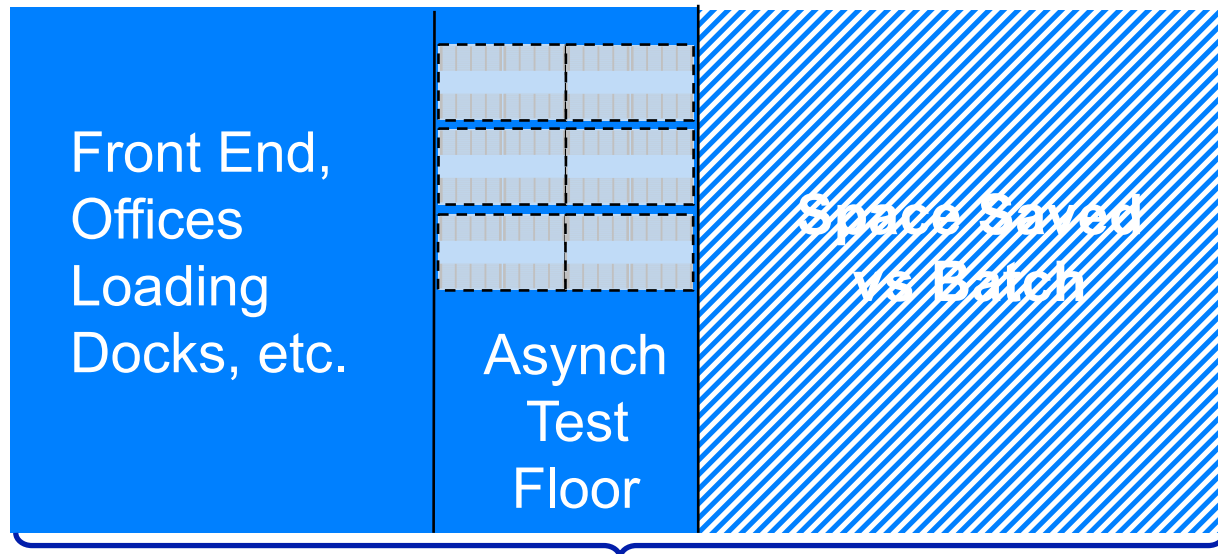


Test up to 6x more drives per m² with Asynch Testers

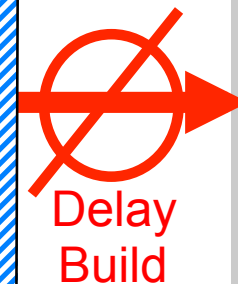
Factory Space Savings: Asynchronous Automation



Space to add test Capacity



Factory Area



New Factory

Avoid time and cost of
new factory space

