Scalable Platform for Keeping SSD Test Costs Under Control

Ben Rogel-Favila, Ph.D.

and

Scott West

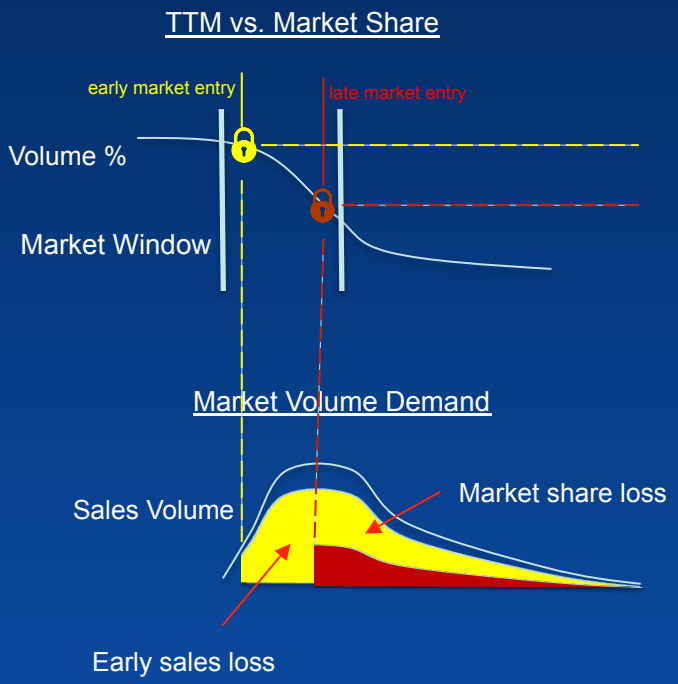
Advantest America, Inc.

Outline

- Time to market and test
- SSD Test Platform
  - Main characteristics
- SSD Test Platform Automation
- Traffic Capture and Debug Tools
- Conclusions

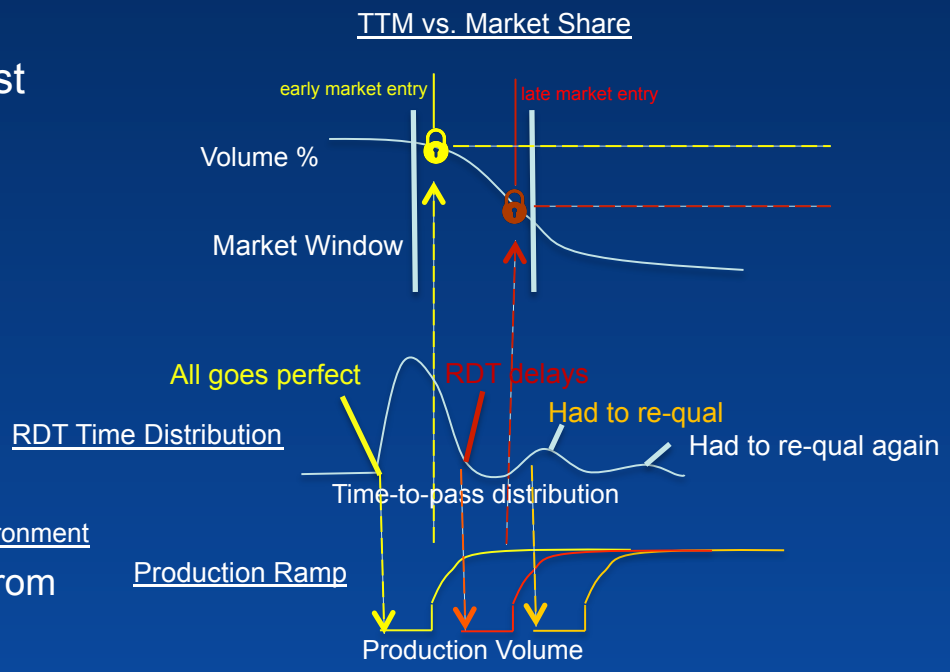
Time-To-Market and Market Share

- Hitting market window greatly increases product revenue
- Both early market volume and increased market share are gained
- TTM is critical to determining product success



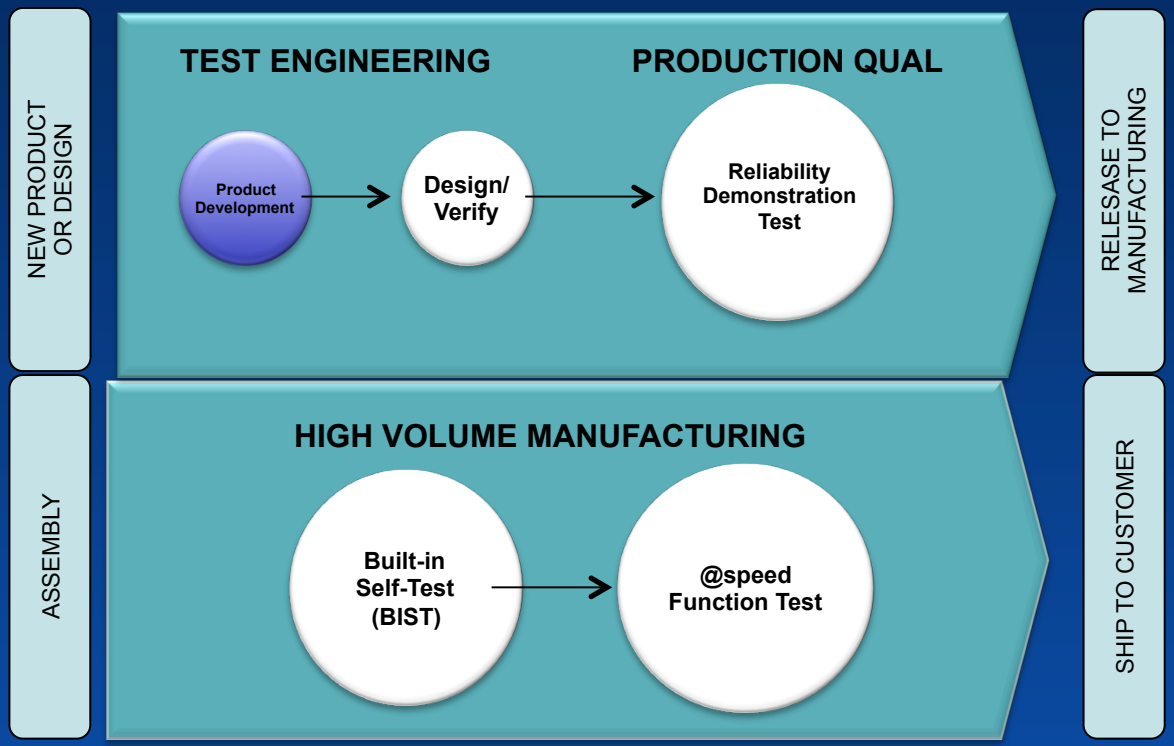
How Does Test Affect TTM?

- RDT is needed to qualify the SSD product
- Followed by time to release to production test
- Risks to hit market window:
  - Product and Test development delays
  - Qual failures
- Risk Mitigation
  - Catch device problems early
    - Thorough set of Engineering Tools
    - Support from tester provider
  - Catch test development problems early
    - Run all production, RDT at engineering, in the same environment
  - Minimize introduction of new test conditions from engineering through production
    - Reuse tests and interfaces



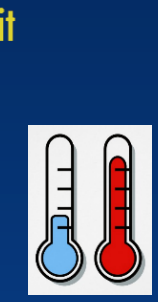
Flash Memory Summit

SSD Lifecycle Test Stages



Flash Memory Summit

SSDs Wide Variety of Test Requirements



-10 to 85 degC
(125 degC)

Different Temperatures

Different Protocols

HHHL

2.5”/U.2

M.2

Different Form Factors

SSDs

Operator/Robot

Manual/ Automated

Different Test Methods

BIST

Functional

Enterprise/ Consumer

Different Speeds

1.5 Gbps to 12 Gbps

How to address all these test needs?

- All-included Test Cell
  - Advantage: Can do everything
  - Disadvantage: Expensive

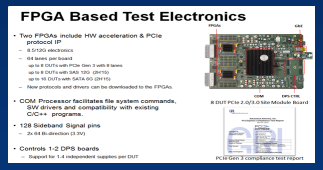
- Application Specific Test Cell
  - Advantage: Inexpensive
  - Disadvantage: Can only do one thing

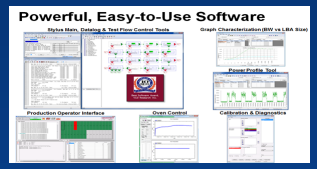
- **Is it possible to have the best of both worlds?**

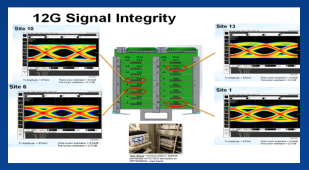
- Test Platform – SLT Test Platform
  - Allows for component "mix-and-match" to develop optimal tester at the right cost.

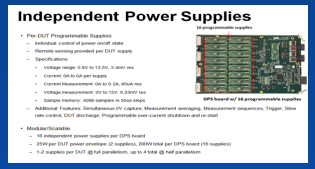
Application Specific Optimal Test Systems

Flash Memory Summit









\+

Hoth – Double Density Site Module

BIST – BI Site Module

HDDPS – High Density DPS

DRDPS – Dual Range DPS

Thermal Control
Control
Closed Loop

Thermal

Open Loop

Test Cell Automation

Test Floor Automation

High Performance System
SM + DPS + TCL + Stylus

HP HVM System
Hoth + HDDPS + TOL + Stylus

HP A HVM System
Hoth + HDDPS + TOL + Stylus + Automation

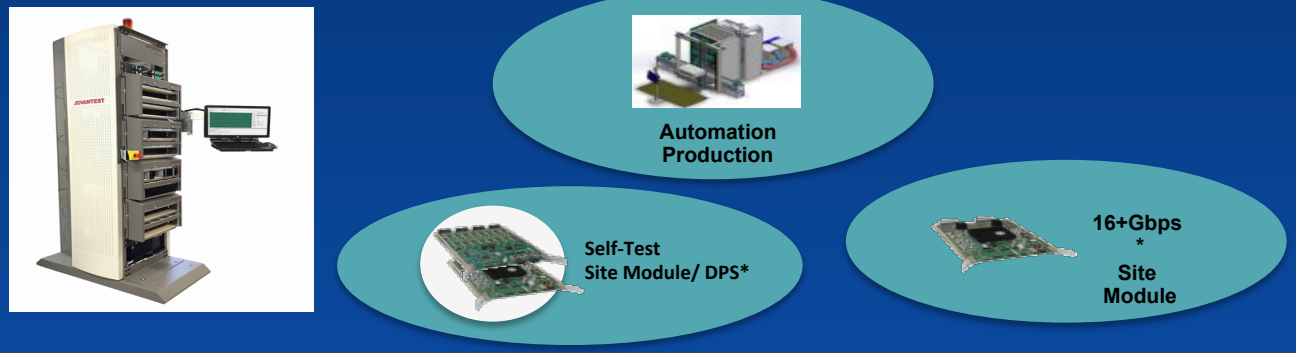
BI/BIST HVM System
BIST + HDDPS + TOL + Stylus

BI/BIST A HVM System
BIST + HDDPS + TOL + Stylus + Automation

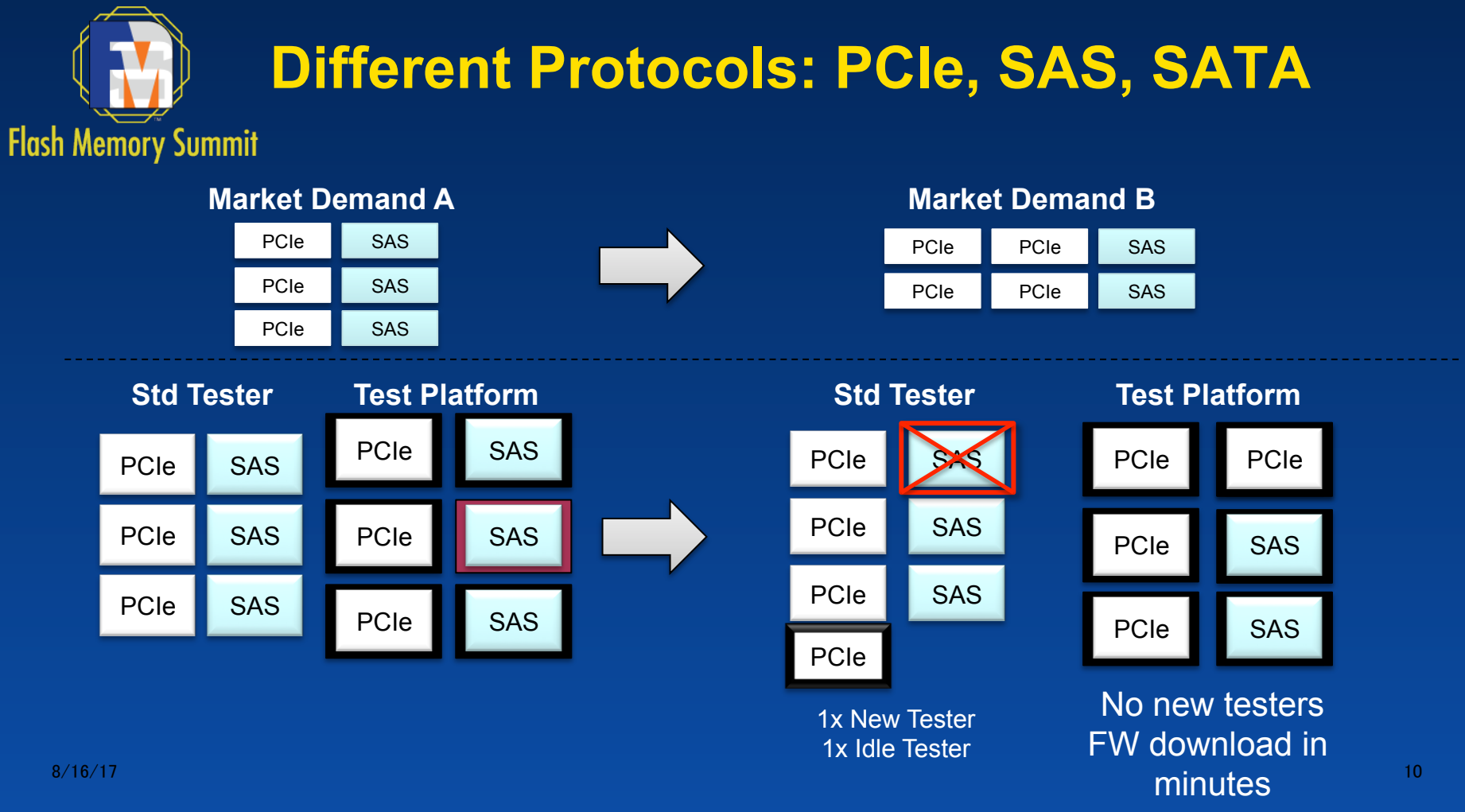
▪ ▪ ▪

SSD Test Platform

- Today
  - Application Specific Test Systems at “optimal” cost.
  - Chose components tailored to address current test needs.
- Tomorrow
  - Only need to buy specific components to cater for new DUT technologies, for instance, “next generation protocol board”.
  - **Reuse the rest of the system.**

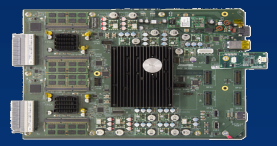


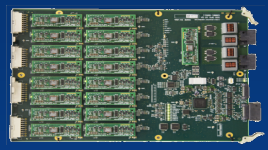
Different Protocols: PCIe, SAS, SATA

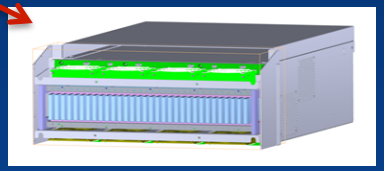


Different Test Methods

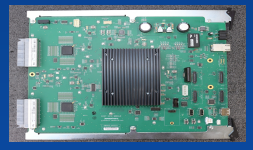
Full Protocol Test

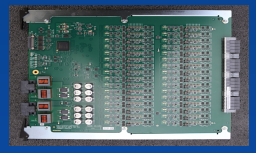






BIST+ Smart Power Test





BIST Test

Different Form Factors

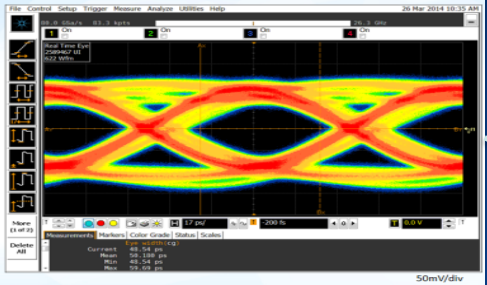
U.2

M.2

Different Speeds: 12G Signal Integrity

Flash Memory Summit

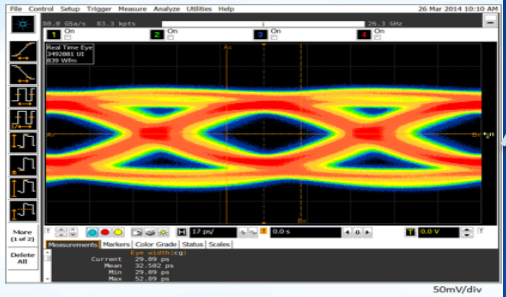
Site 10



Tx Amplitude = 973mV

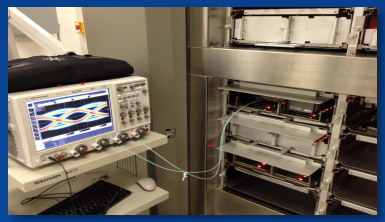
Post-cursor emphasis = 8.52dB
Pre-cursor emphasis = 2.21dB

Site 6



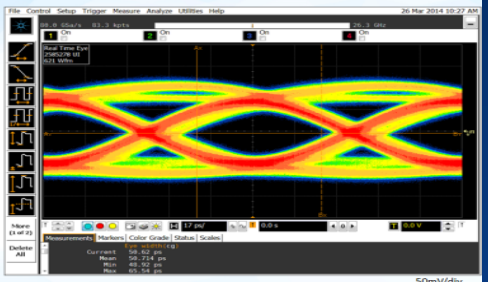
Tx Amplitude = 973mV

Post-cursor emphasis = 8.52dB
Pre-cursor emphasis = 2.21dB



Test Setup: Infiniium DSA-X 92504A connected to PCI-SIG test board on MPT3000ENV load board.

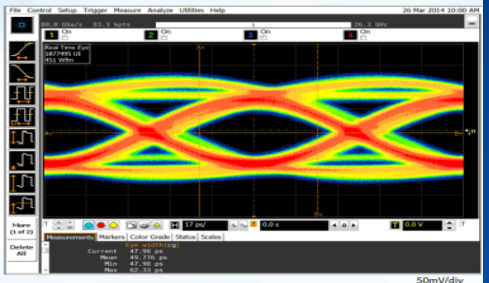
Site 13



Tx Amplitude = 973mV

Post-cursor emphasis = 8.52dB
Pre-cursor emphasis = 2.21dB

Site 1



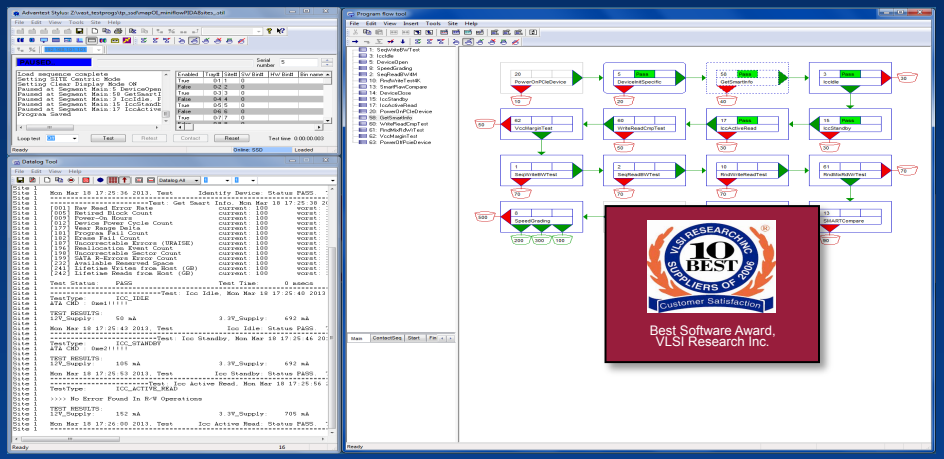
Tx Amplitude = 973mV

Post-cursor emphasis = 8.52dB
Pre-cursor emphasis = 2.21dB

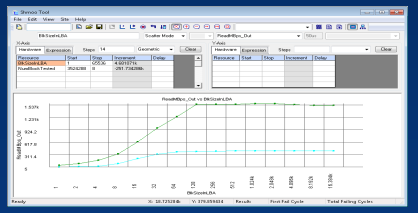
Powerful, Easy-to-Use Software

Flash Memory Summit

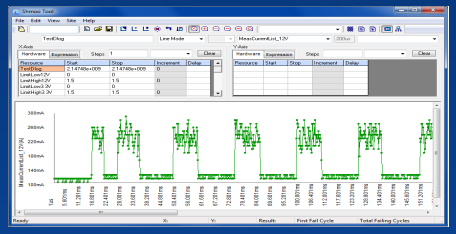
Stylus Main, Datalog & Test Flow Control Tools



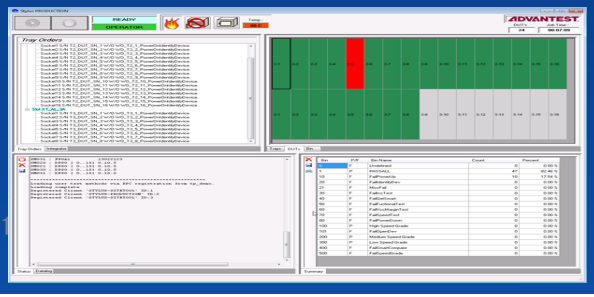
Graph Characterization (BW vs LBA Size)



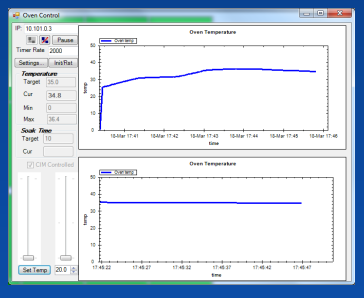
Power Profile Tool



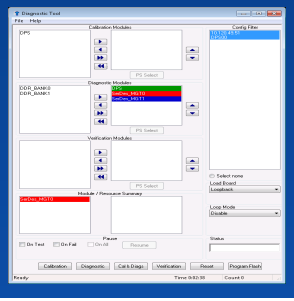
Production Operator Interface



Oven Control

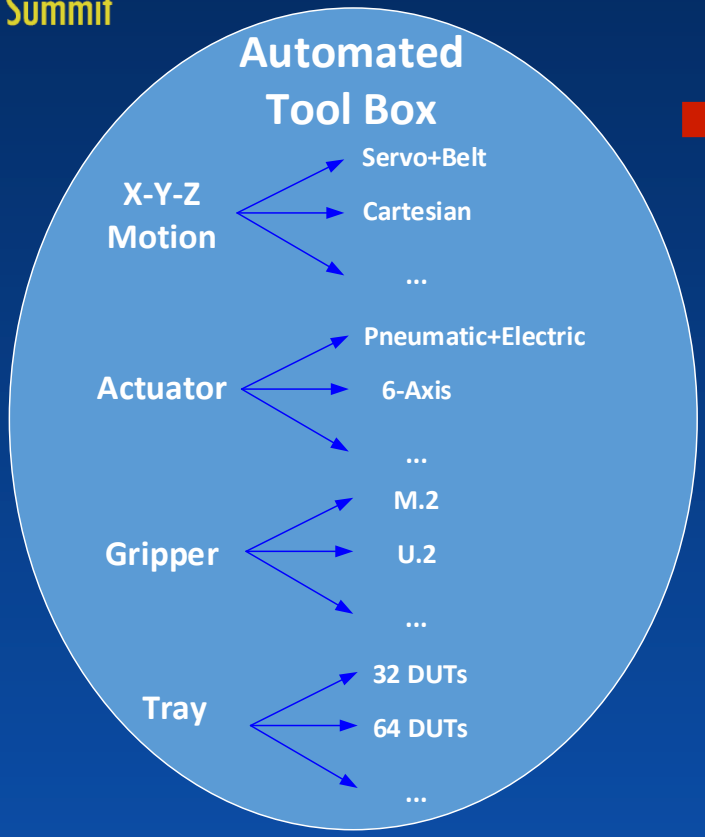


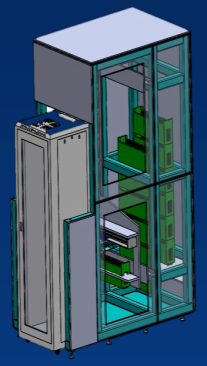
Calibration & Diagnostics

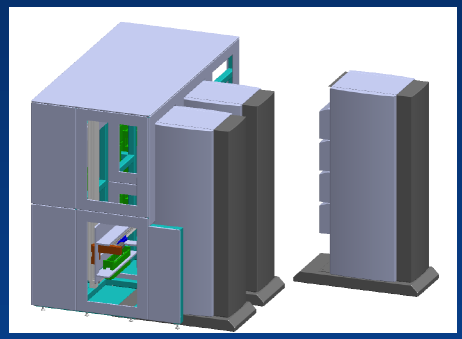


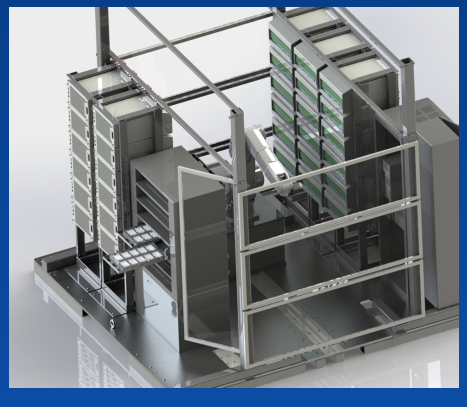
Automation Platform Components

Flash Memory Summit

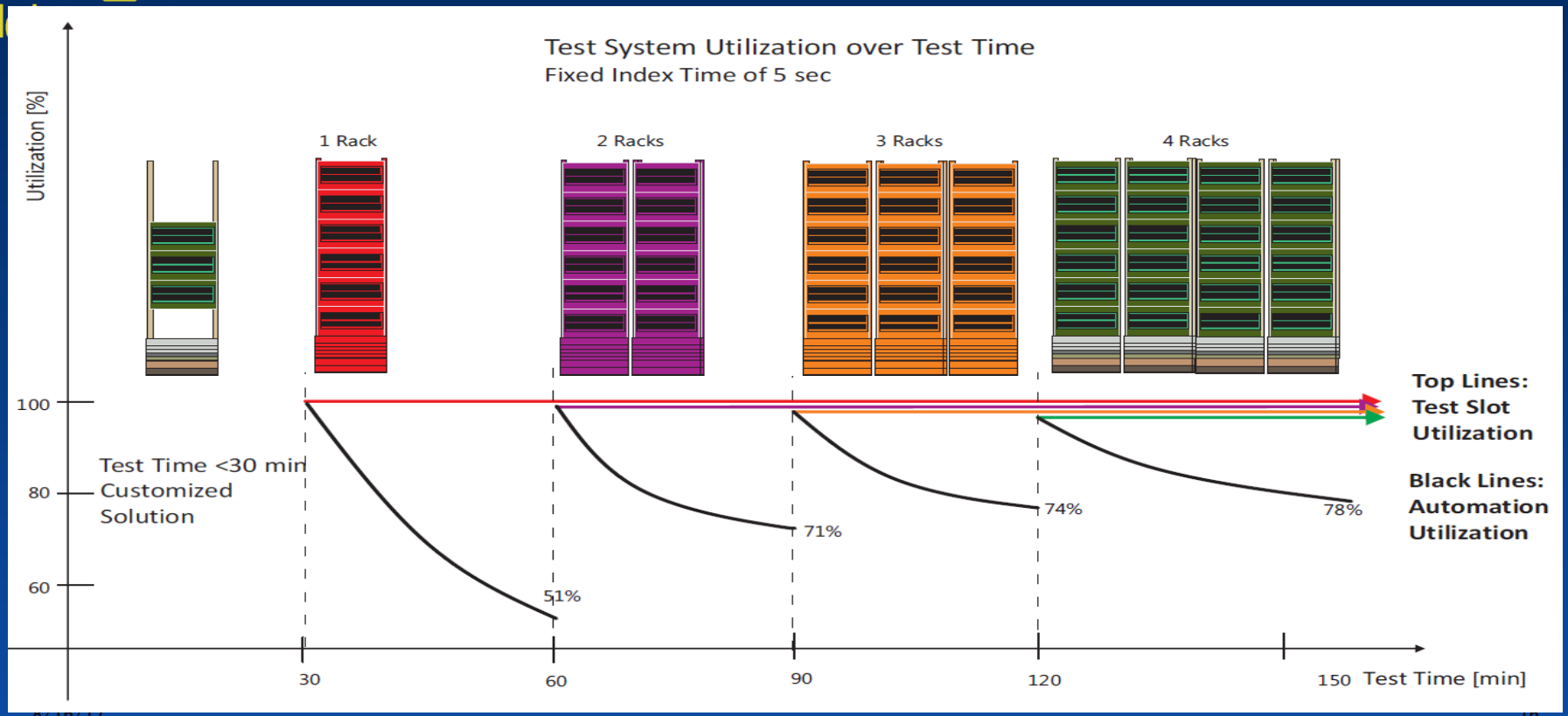








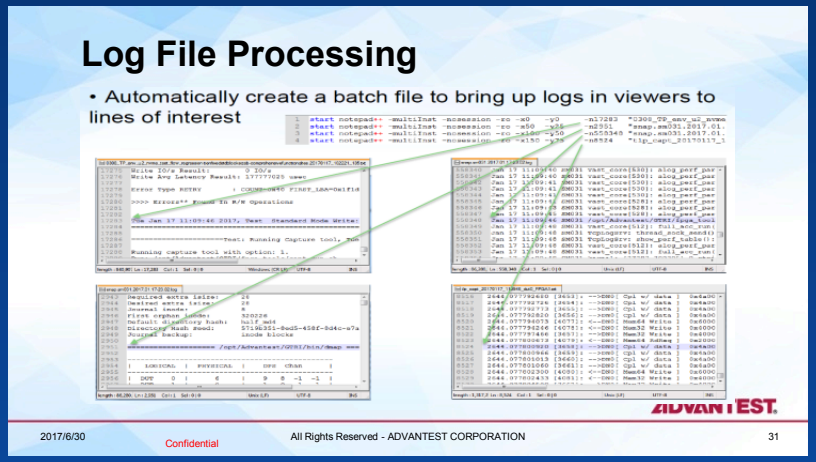
SSD Automated System Scalability

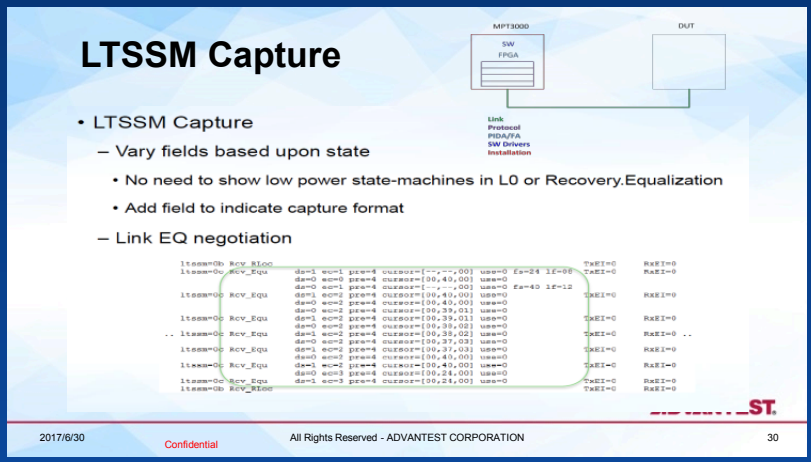


Flash Memory Summit

Fault Detection Vs Fault Location

- ATE normally focuses on fault detection.
- SSD Test requires fault location capabilities.





Conclusions

- Time to market is critical for product success.
  - Test development time and qual risk reduction are keys to TTM.
- An SSD Test Platform optimally addresses:
  - Shortening time to market.
  - Adapt to ever decreasing SSD product lifecycles.
  - Keep test cost under control even as device performance, density, and variety all increase.

Thank you!