Improving TPS Runtimes Through Parallel Analog Test

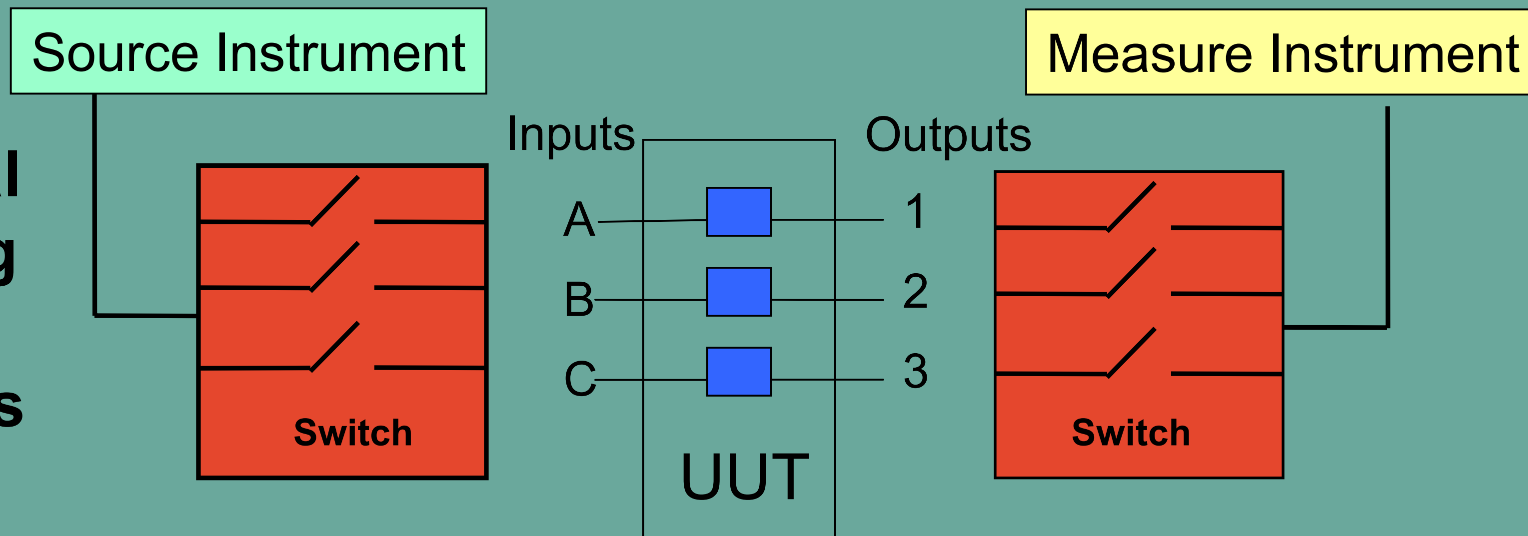
TERADYNE

Assembly Test Division

Current Analog Test Philosophy

- **Analog test today**
  - Traditional Analog test is sequential
    - High Instrument cost and footprint necessitates dedicated resources that must be switched in
    - Parametric testing done sequentially ('sensitized path testing')

Sequential Test using Dedicated Resources



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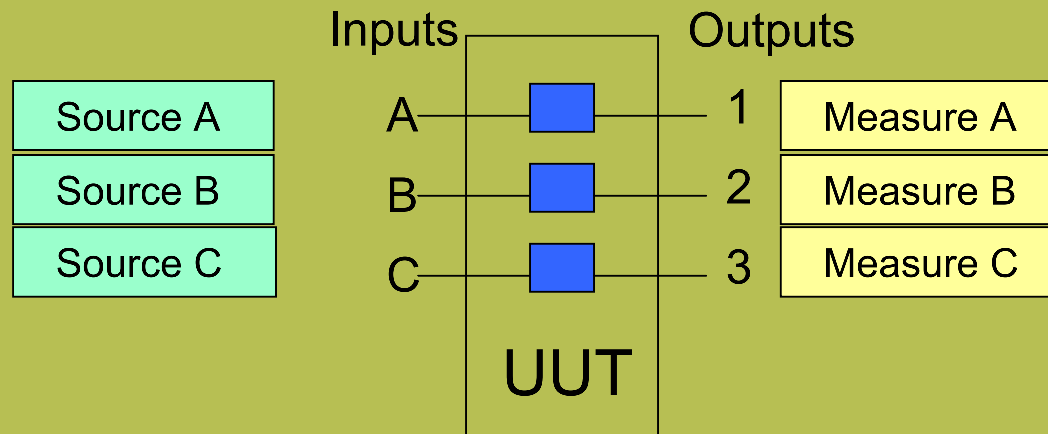
Parallel/Operational Analog Test

- **Concurrent testing**
  - Testing multiple analog functions simultaneously within the UUT
    - Reduces Test time
    - Reduces RTOK/Increases Fault Capture Envelope
  - Reduces the need for switching
    - Simplifies fixturing

Parallel Test



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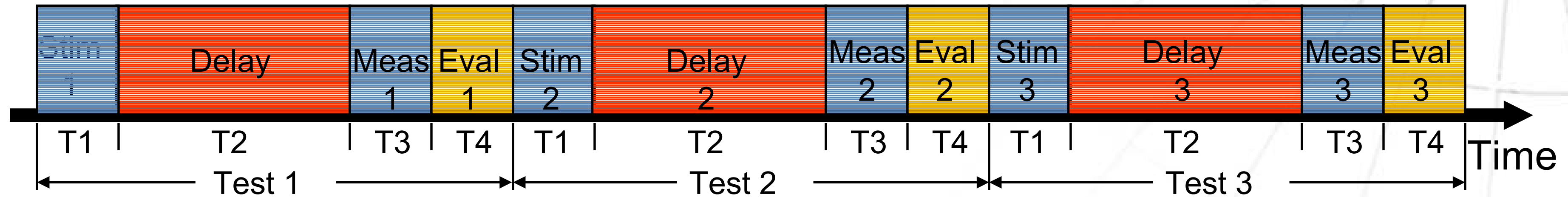
Synthesized Path Testing

Before: (sequential tests)



- With synthesized testing, delays are added for instability caused by relay closure. The greater the number of measurements taken, the greater the impact these stability delays have against the TPS runtime.

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PARALLEL TEST

- By applying multiple sources simultaneously, the delay time needed for stability of test is reduced by a factor of the number of paths being tested, decreasing the test time.

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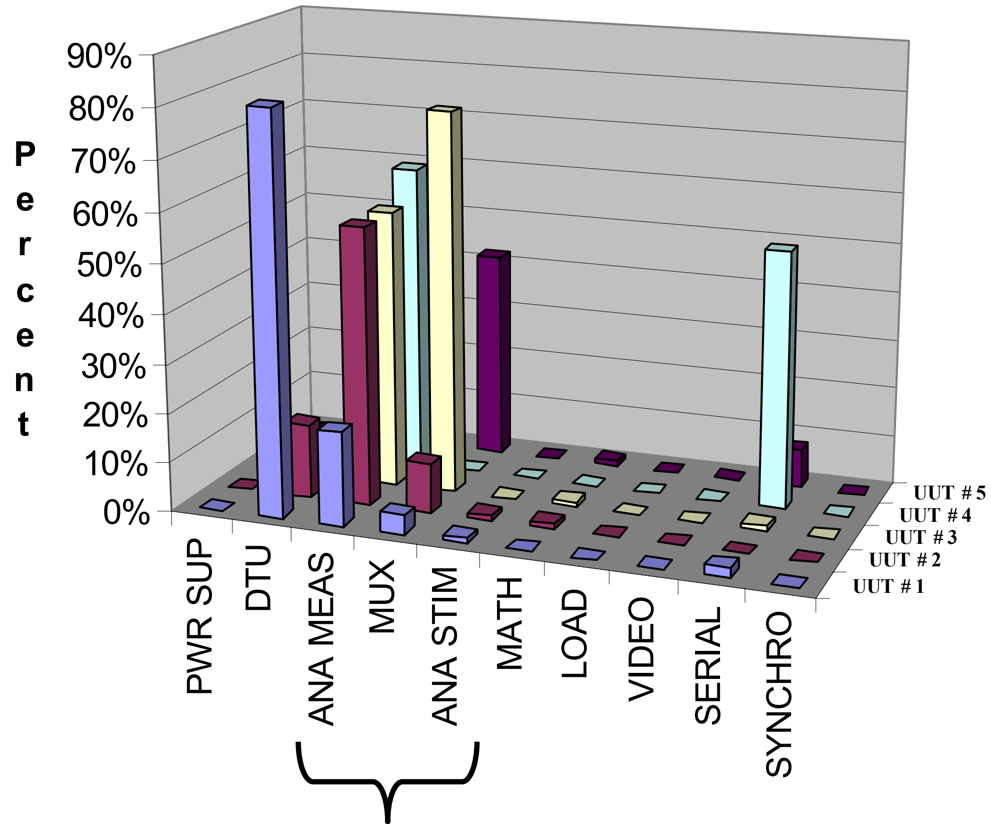
Why Parallel Analog Test?

- Dedicated Resources Require Sequential Analog Testing
- Resources must be Switched to connect to UUT Pins
- Switching and Measurements account for an average of 66% of total TPS test times*



Analog Testing and Switching accounts for 2/3 of Test Time!

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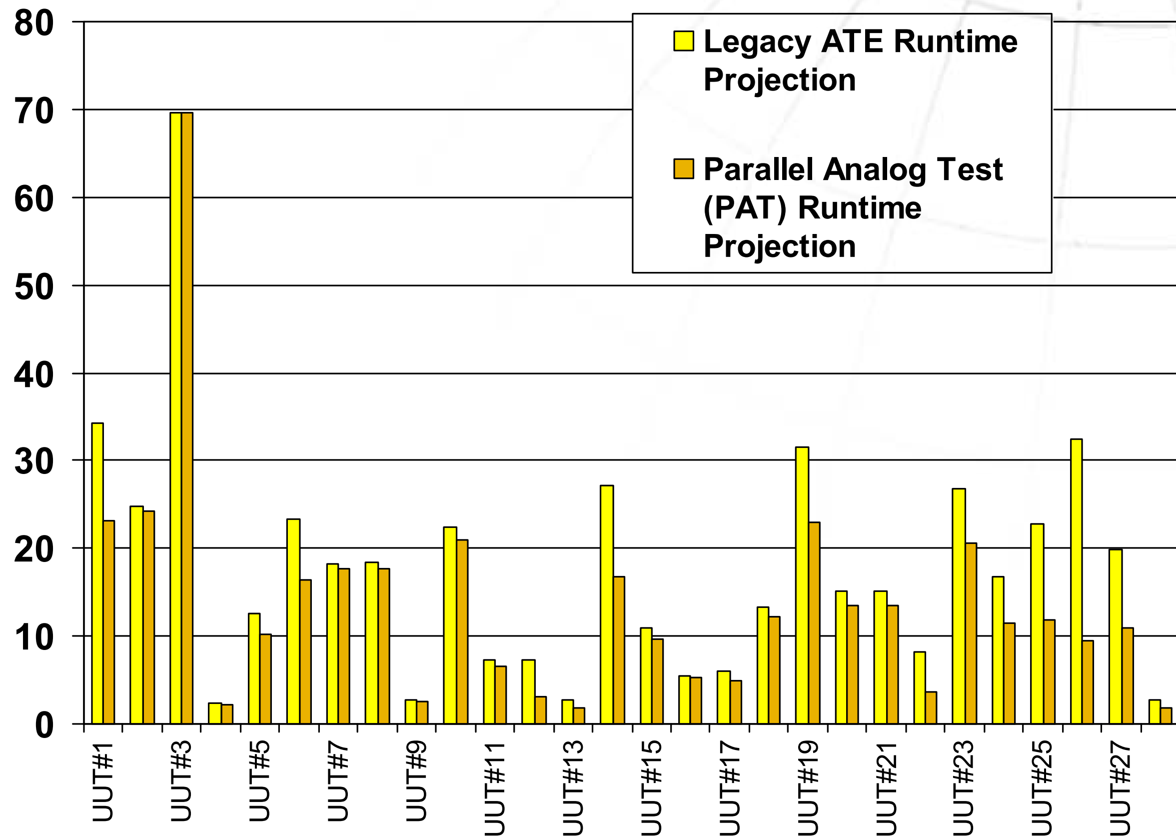
Projected Runtime Improvement

- **Legacy ATE Average Runtime is 17.9 Minutes**
- **Using Parallel Analog Test: Projected Average Runtime 13.7 Minutes**

About a 23% average throughput improvement



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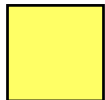
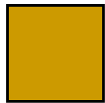
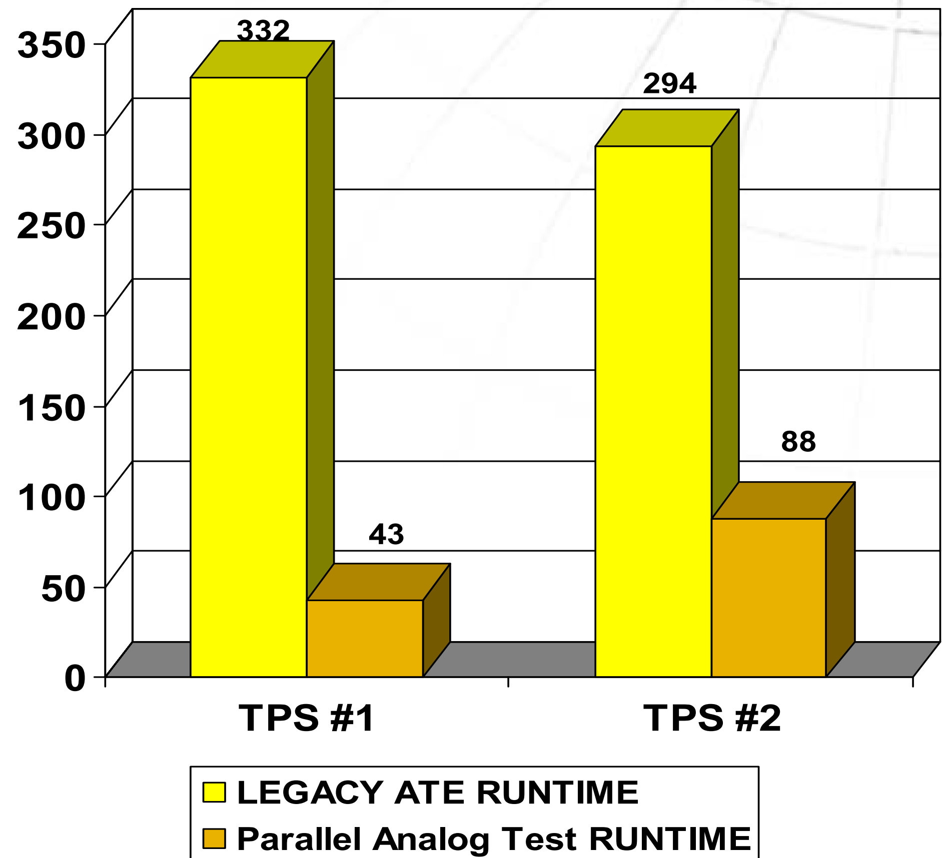
Actual Runtime Improvements

- **Partial TPS Runtimes**

  Analog Stimulus and Measure only


Legacy configuration


Parallel Analog Test configuration



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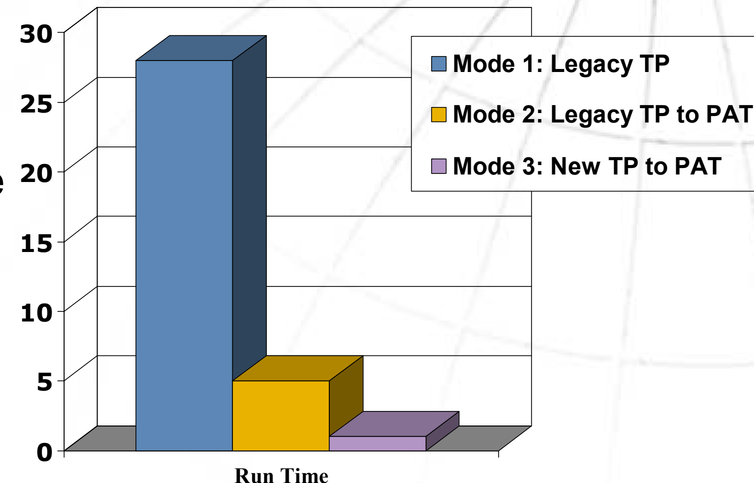
Why Consider Parallel Analog Test

Cost Reduction – TPS Development

- **Reduced runtimes**
  - Less time spent in integration
  - Less on-station time → less station maintenance
- **Reduced ID complexity**
  - Direct connections to instrument channels
    - Reduced switch tree/matrix requirements
    - Reduced ID density
  - Some UUT interfaces can be emulated in software
    - Software on PC can provide real-time feedback functions to UUT thru Analog Instrumentation
    - Real-time adjust to reach capability
    - ID circuitry not required
- **Enhanced debug features**
  - Simultaneously measure incremental test points as debug gathering points of reference to analyze upon failure.



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Functional/Operational Test

- **Operational test**
  - Operational test is a *given* in digital functional test
    - Must exercise many digital I/O simultaneously to test digital functional behavior – this is why 100s of digital I/O pins are needed
  - There is no Analog operational test today
    - Although sequential analog test is a viable method of testing – it is not '*true*' operational test
    - Providing enough analog I/O to accommodate true operational analog test using conventional instruments would cost big $$$
- **Ai7-Series Changes Analog Testing**
  - Analog Operational test is made possible with low cost instruments
    - Multiple analog stimulus and measurement
    - UUT is tested like it is operated in the field

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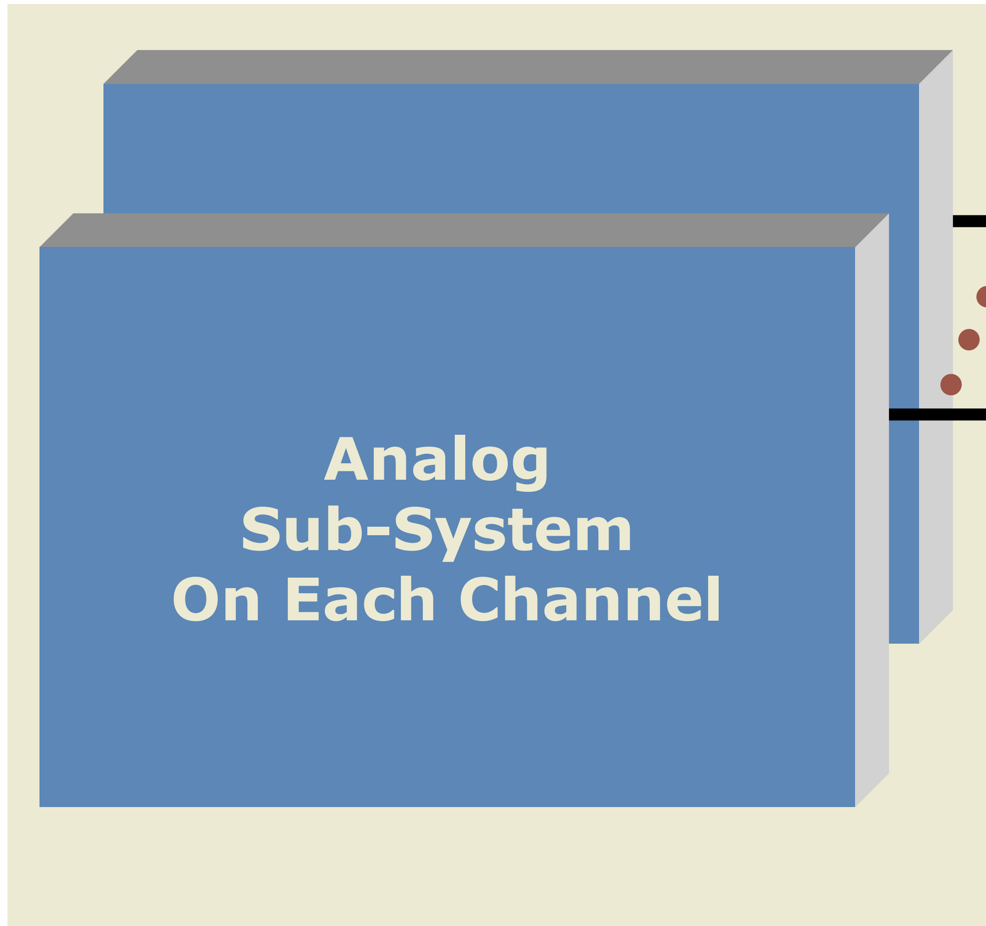
Analog Test Instrument:
Parallel Multi-function Stimulus And Measurement



- Tests UUT as it is used in the next level of assembly
- Higher throughput with shift from sequential to parallel test
- Simplifies routing by eliminating the matrix
- Greater flexibility & quality of test

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Ai-710 Analog Test Instrument

- Parallel Test using a Tester-Per-Pin Framework
- 32 Independent Channels
- 6 Instruments Per Channel
- 12 bits, 1MHz
- VXI-C instrument with VXI Plug&Play driver
- Mixed Signal Test capabilities
- Synthetic Instruments
  - Audio analyzer, stripchart recorder, etc.

Ai-710

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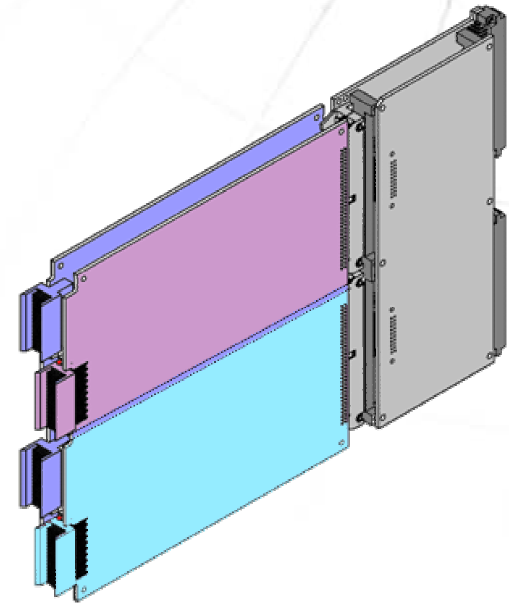
Ai-760 High-Performance Parallel/Operational Analog Test

- Perform operational or parallel analog test with high fidelity instruments
- 8 single-ended / 4 differential channels
  - 50 MHz AWG
  - 50 MS/s Digitizer
  - 200 MHz Universal Counter
- Modular Instruments:
  - 6.5 digit DMM
  - 1 GSa/s DSO
- Integrated Ai-series triggering



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Summary

- **Parallel/Operational test**
  - Reduces TPS Runtime
  - Increases Fault Coverage
  - Simplifies fixture wiring
- **Teradyne has tester-per-pin solution**
  - **Ai-760 Analog Test Instrument Subsystem**
    - High Performance VXI C-Size Parallel Analog Test
    - 8 or 16 channels of stimulus/measurement
  - **Ai-710 High-Density VXI C-Size Options for Parallel Analog Test**
    - 32 Channels, Six independent instruments behind every analog channel

More info: http://www.teradyne.com/militaryaerospace