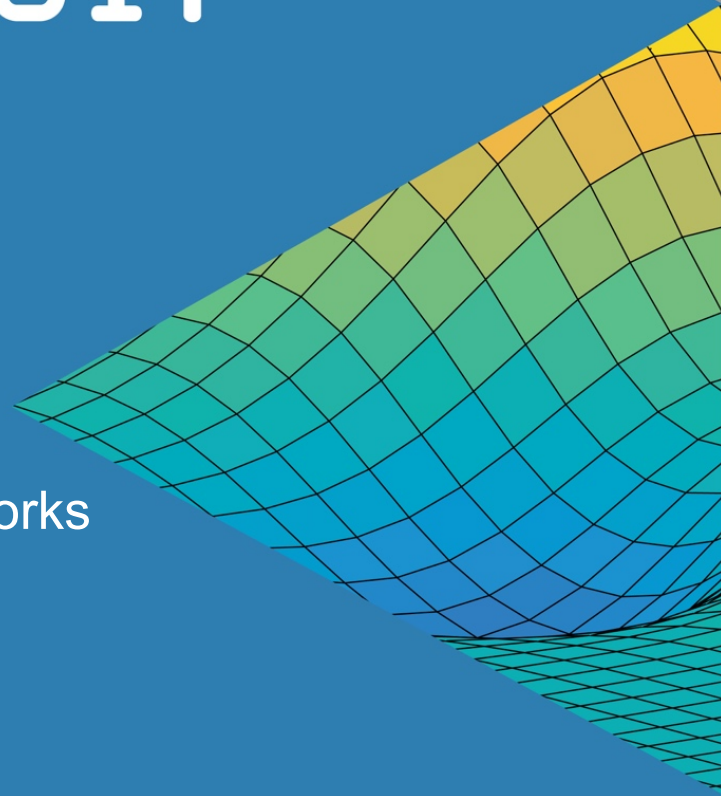


MATLAB EXPO 2017

Test Automation

From Desktop Simulation to Real-Time

Marcus Maurer – Application Engineering, MathWorks



**“Debugging is twice as hard as writing the code
in the first place.**

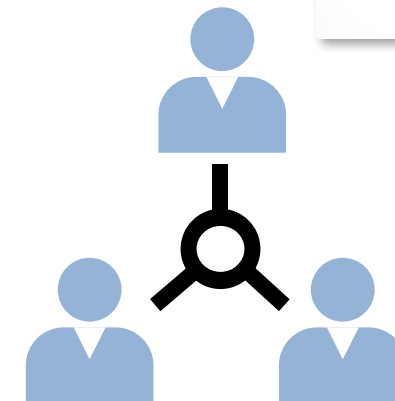
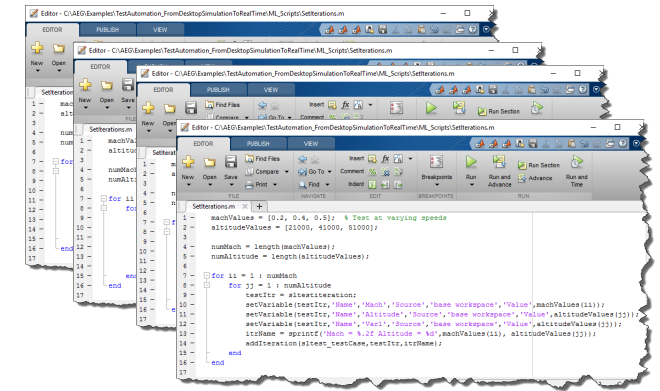
**Therefore, if you write the code as cleverly as
possible,**

you are, by definition,

not smart enough to debug it.”

Common Challenges with Automating Tests

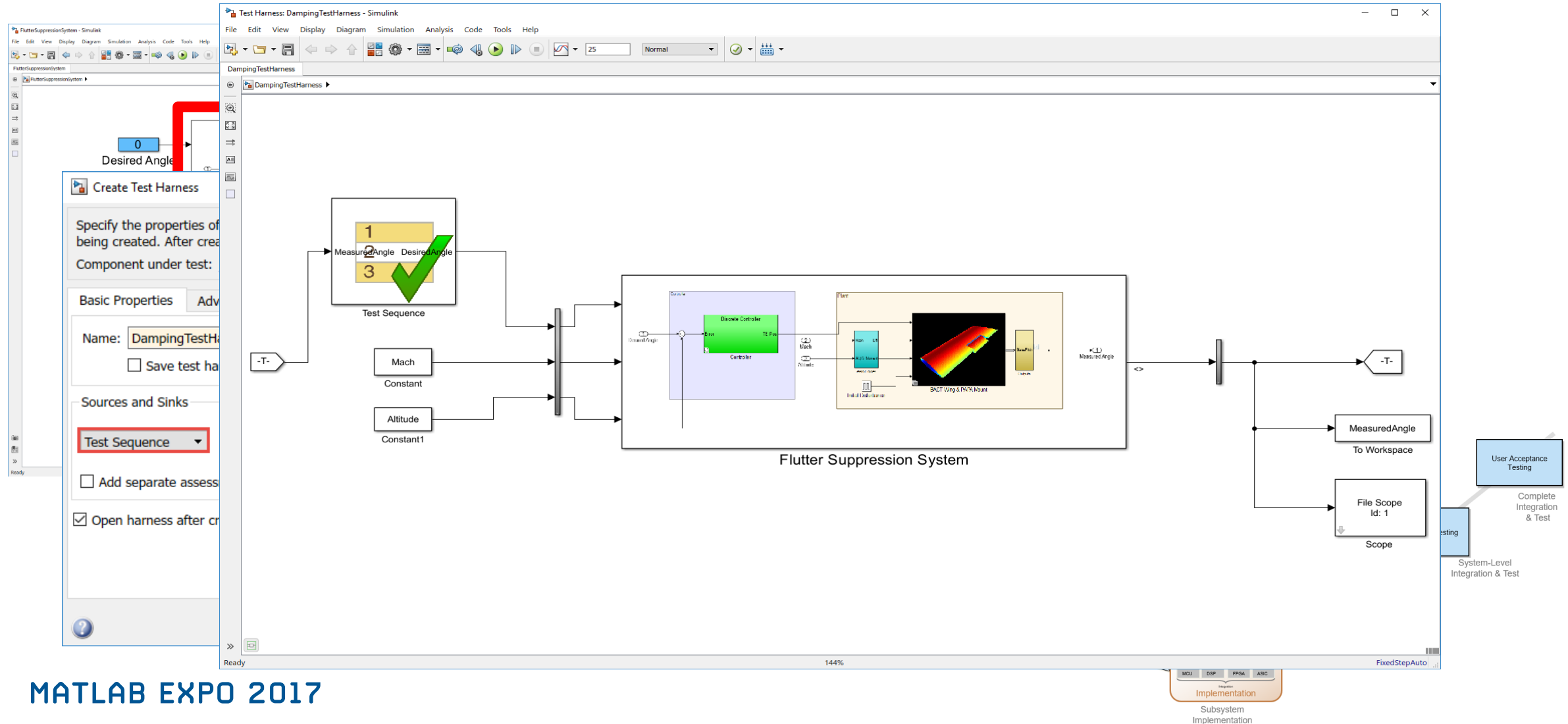
- Too many scripts
- Not flexible without customization (SIL, PIL, HIL)
- Needs to be easily shareable with other Engineers



Today's Talk – Flutter Suppression

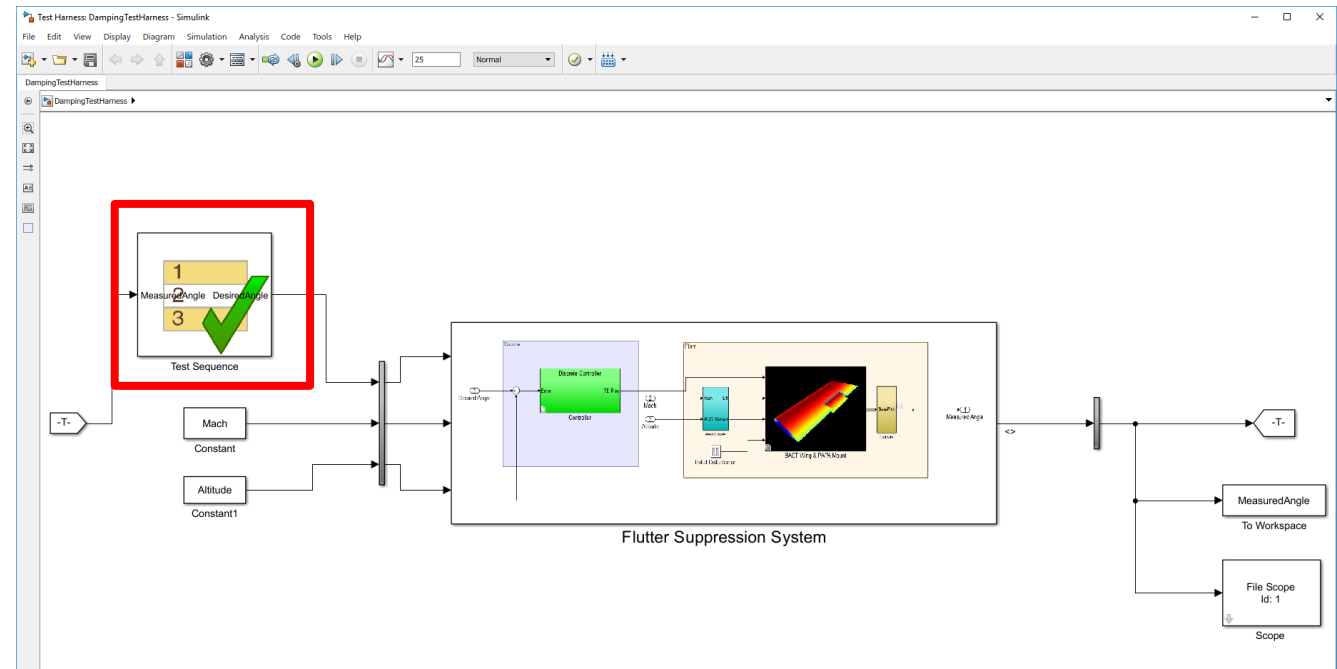


From Requirements to a high-quality Model using Simulink Test



Handling Test Sequences

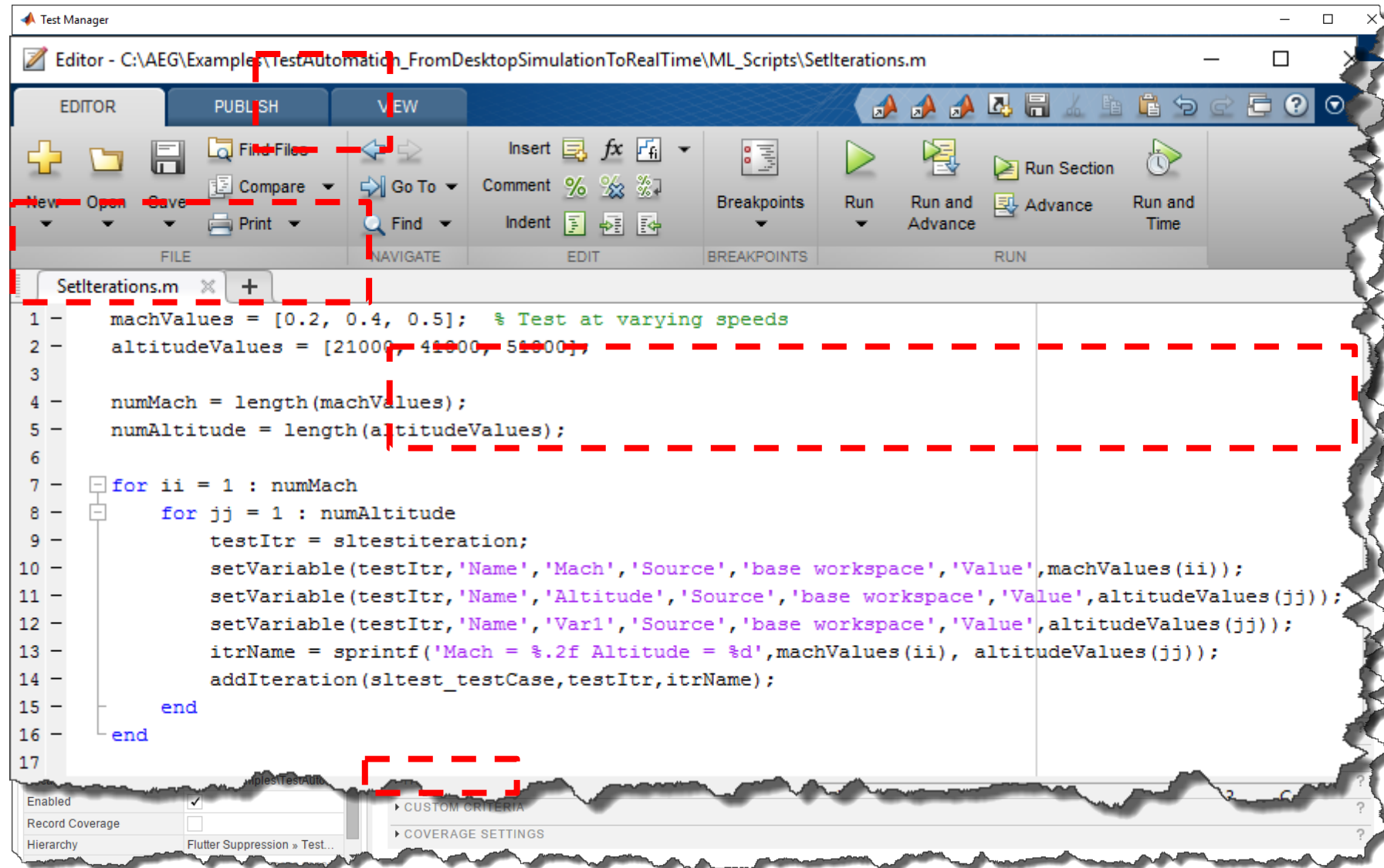
- ✓ Reactive and/or time based test cases
- ✓ Easier translation of test procedures
- ✓ Built on top of Stateflow with extensions for testing (SF license not required)
- ✓ Subset of MATLAB language
- ✓ Steps are temporal or logic-based
- ✓ Create complex test inputs and assessments
- ✓ Supports debugging (breakpoints)



Symbols	Step	Transition	Next Step	Description
Input 1. MeasuredAngle Output 1. DesiredAngle Local e Constant Parameter Data Store Memory	Initialization DesiredAngle = 0; Assessment e = abs(DesiredAngle - MeasuredAngle); verify(e<0.005);	1. after(5,sec)	Assessment	

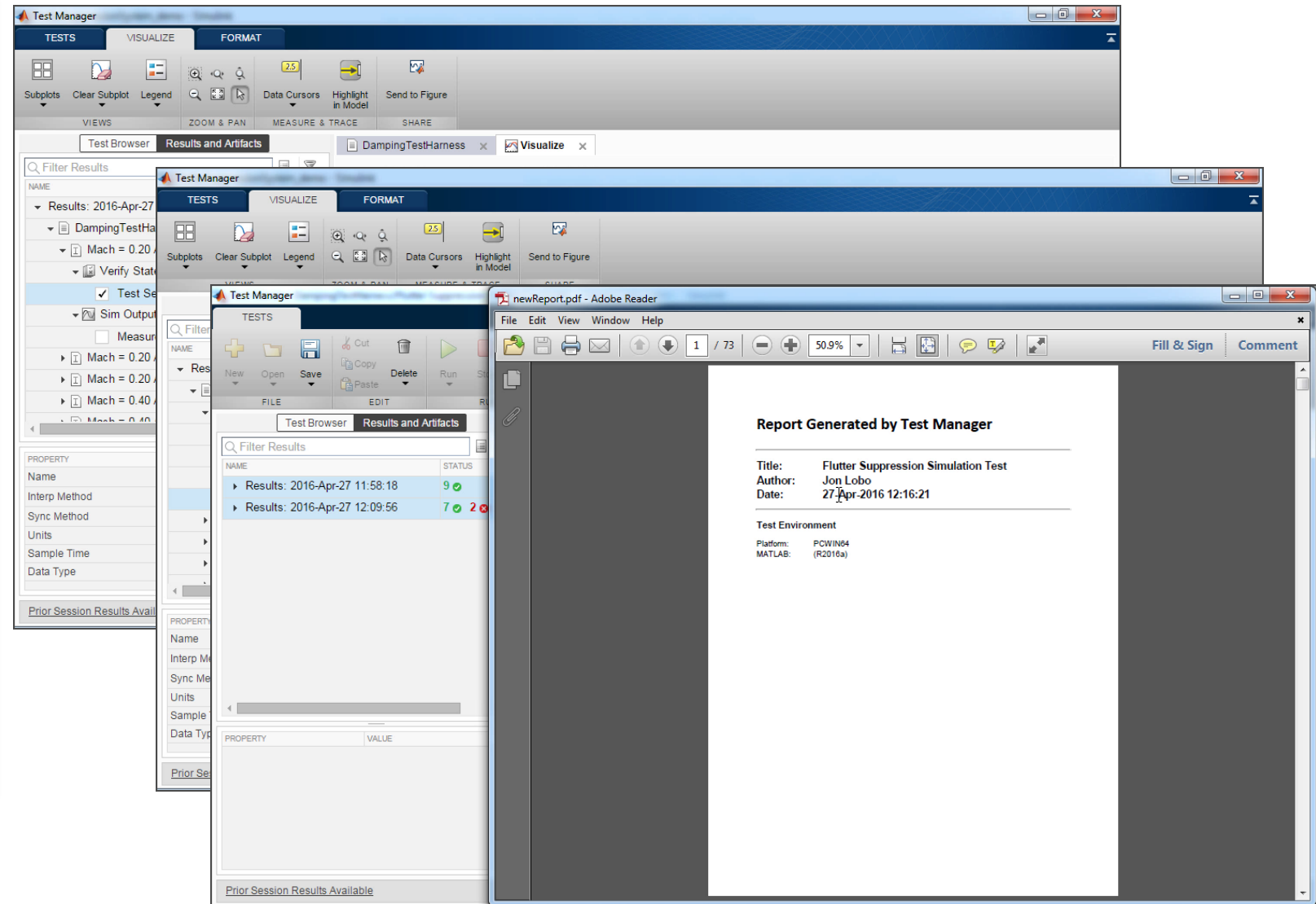
Test Management using the Test Manager

- ✓ Create test cases
- ✓ Link to Requirements
- ✓ Group into suites and test files
- ✓ Add Iterations
- ✓ Execute individual or batch

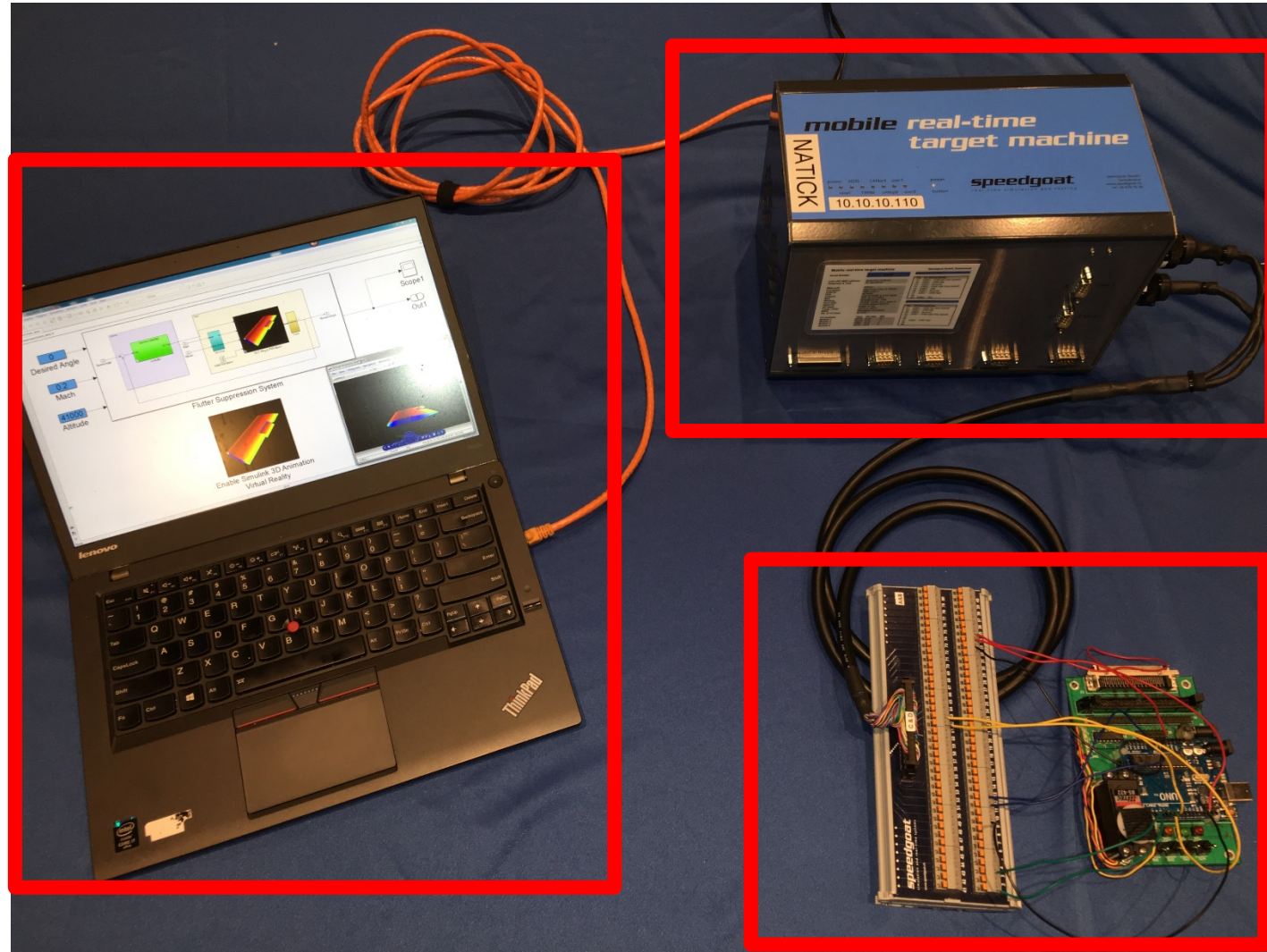


Integrated Simulation Analysis and Reporting

- ✓ Analyze Results
- ✓ Tri-state Output of Verify (Pass/Fail/Untested)
- ✓ Capture Simulation Data of Interest
- ✓ Share the results



Testing with Hardware



Speedgoat Real-Time Target Machines

Designed for Simulink Real-Time, tailored to your needs

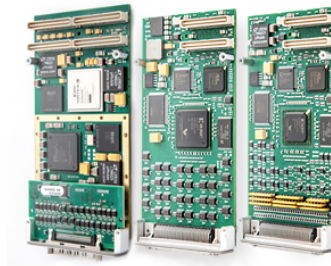
Speedgoat develops and sells real-time target machine solutions consisting of

- Real-time target machine
- I/O modules
- Software drivers, cables and tools to connect with a prototype

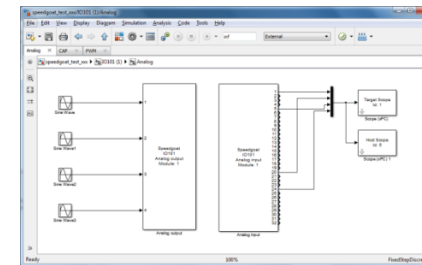
Simulink Real-Time and Speedgoat target computer hardware are expressly designed to work together



Real-time target machine



I/O modules installed in target machine



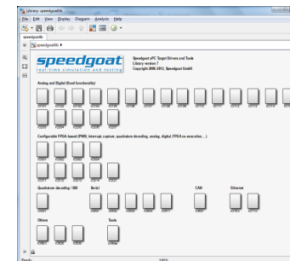
Simulink test models



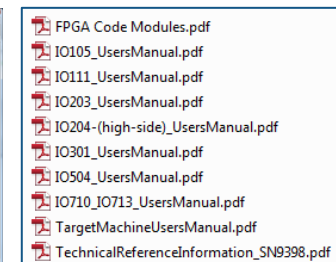
I/O cables



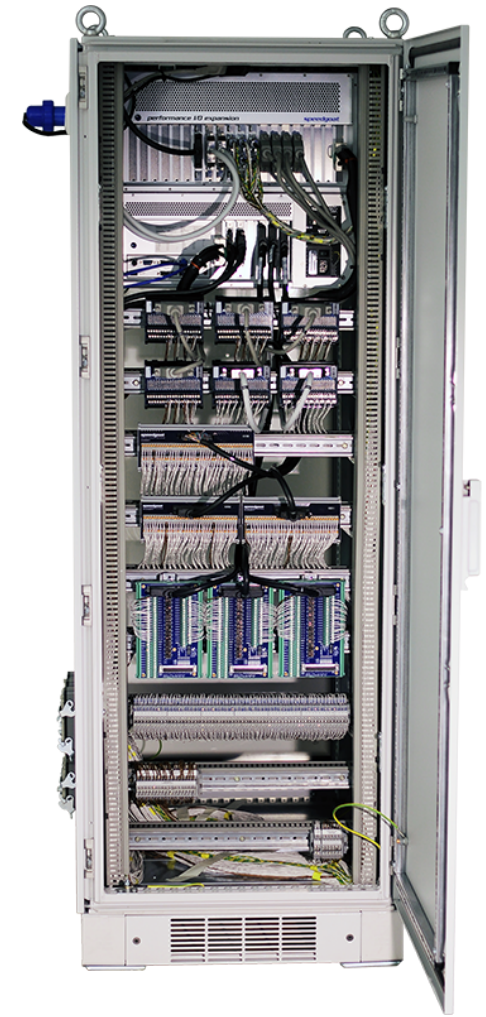
Terminal boards



Driver blocks



Documentation



Custom electronics rack

Speedgoat Target Machine and I/O Offerings

Performance real-time target machine



Office and lab

Mobile real-time target machine



Field and in-vehicle use

Education real-time target machine



Academic use

Analog and digital I/O



Reconfigurable FPGA I/O

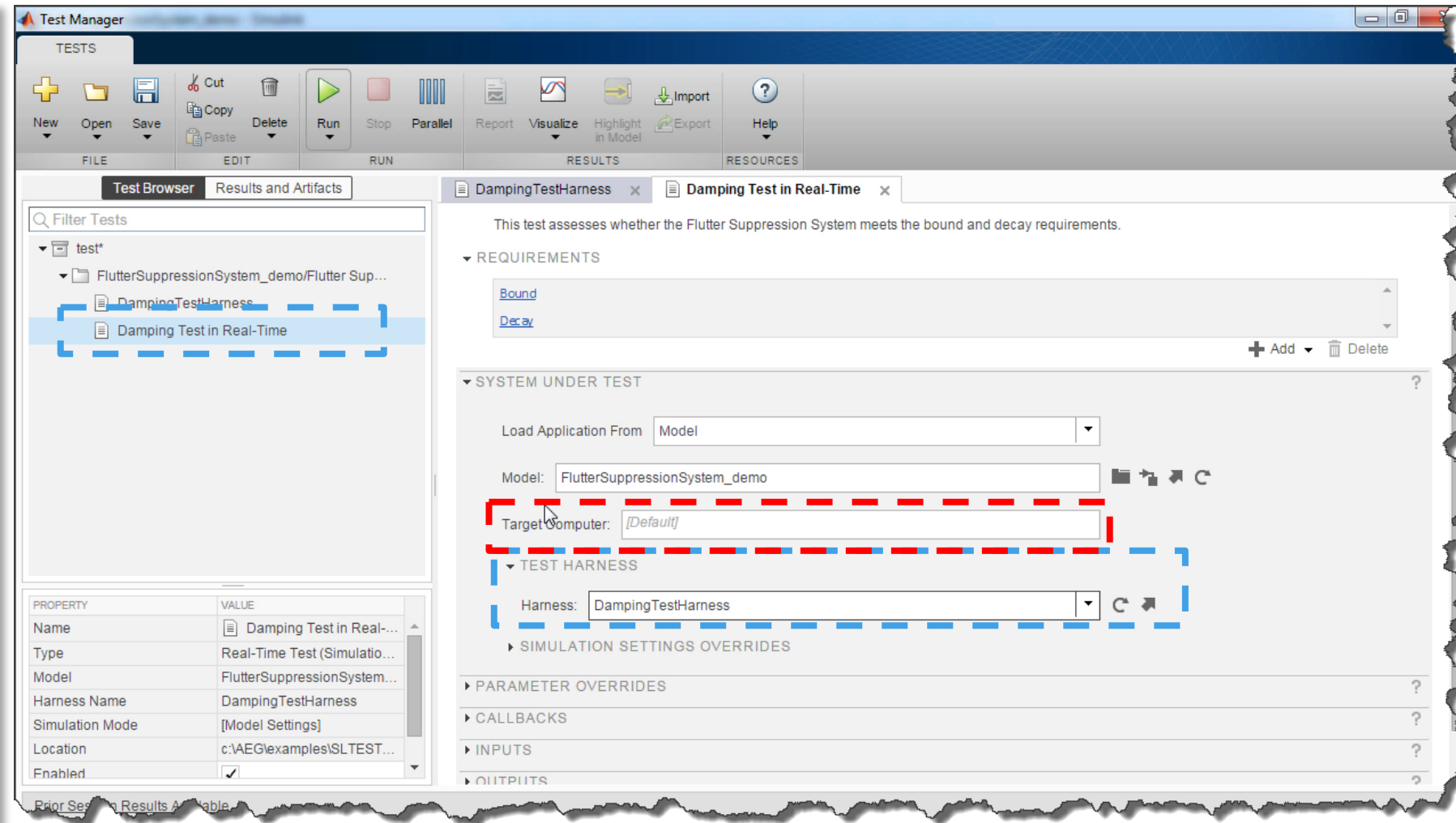


Protocol interfaces



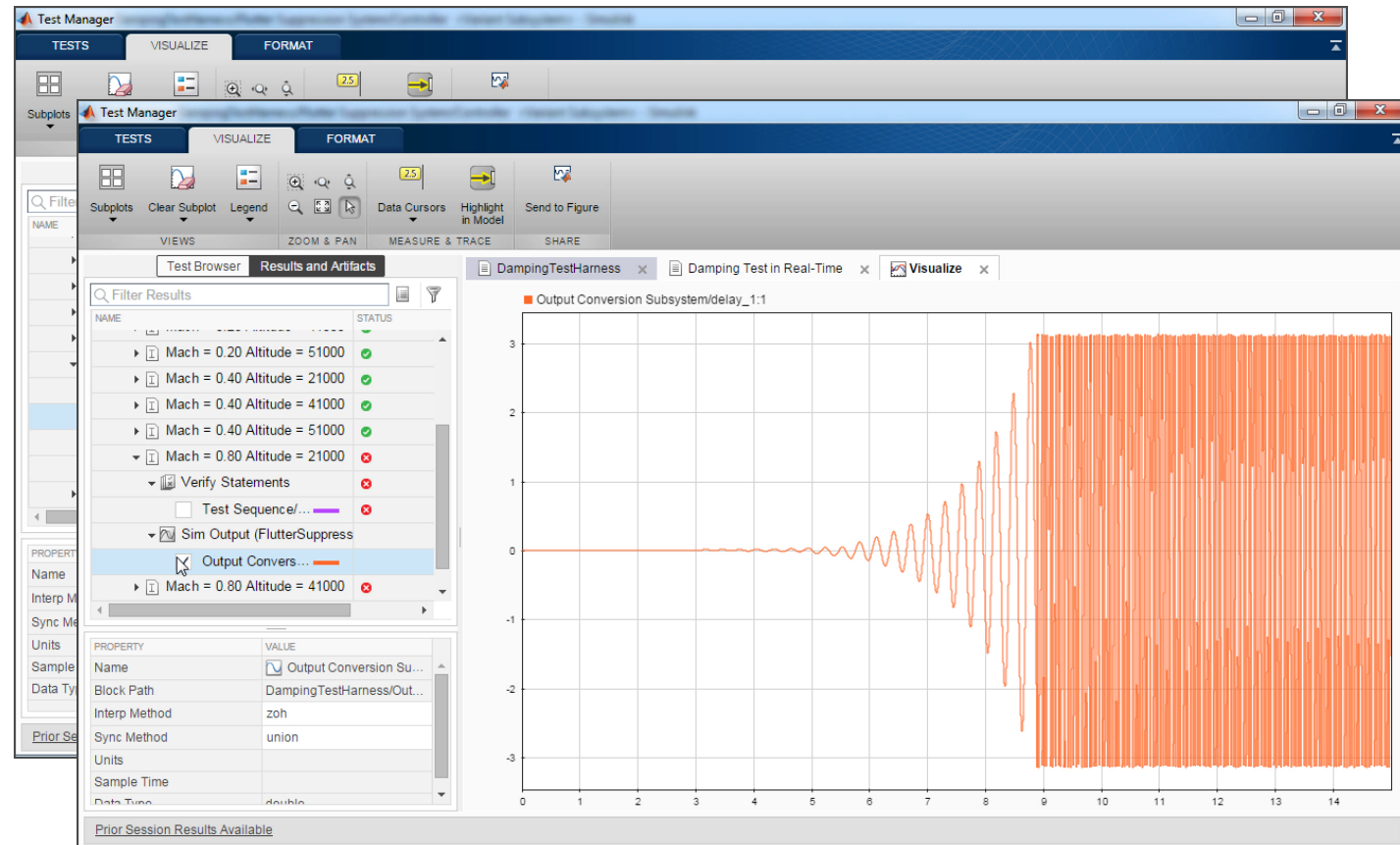
Managing a Real-Time Test with the Test Manager

- ✓ Same as Before
- ✓ Create test cases
- ✓ Same Test Harness
- ✓ Specify Target Computer

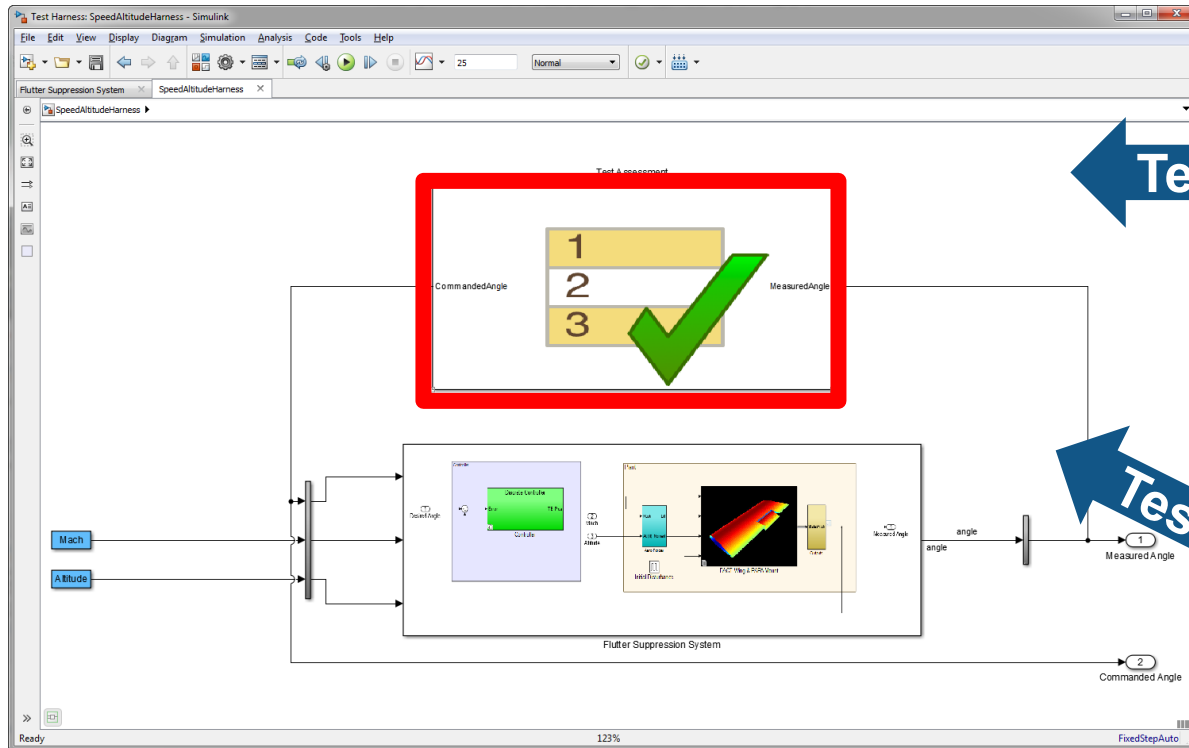


Compare the Simulation Results of diverse test runs

- ✓ Real-Time Test Failed!
- ✓ Verify shows multiple failure points
- ✓ Simulation Data shows instability
- ✓ **Why did it pass in Simulation but not in Real-Time?**

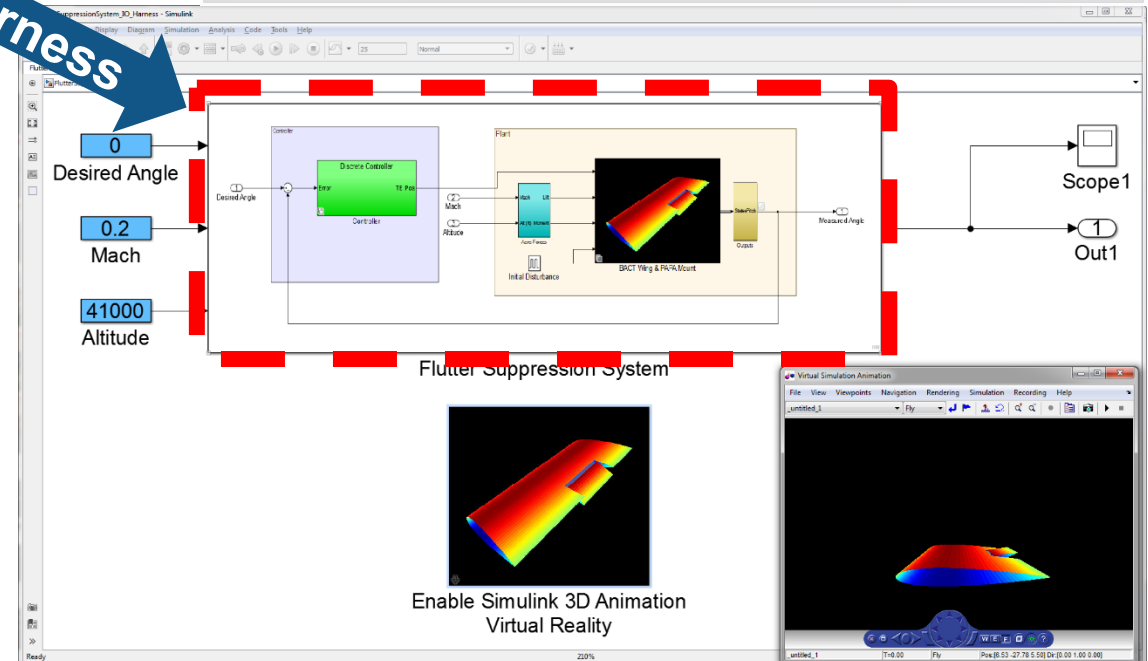
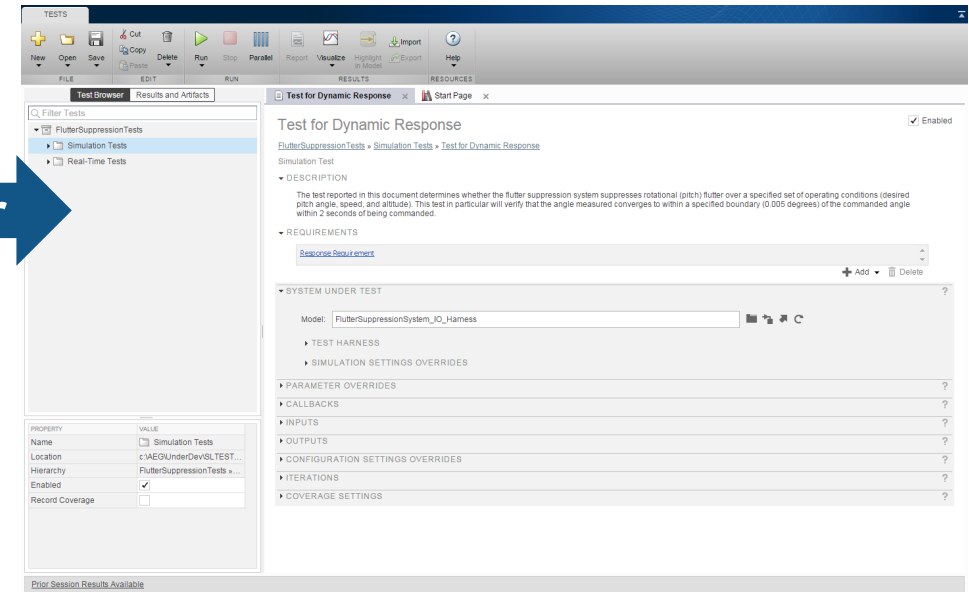


Fully Tested Algorithm in Simulink Test

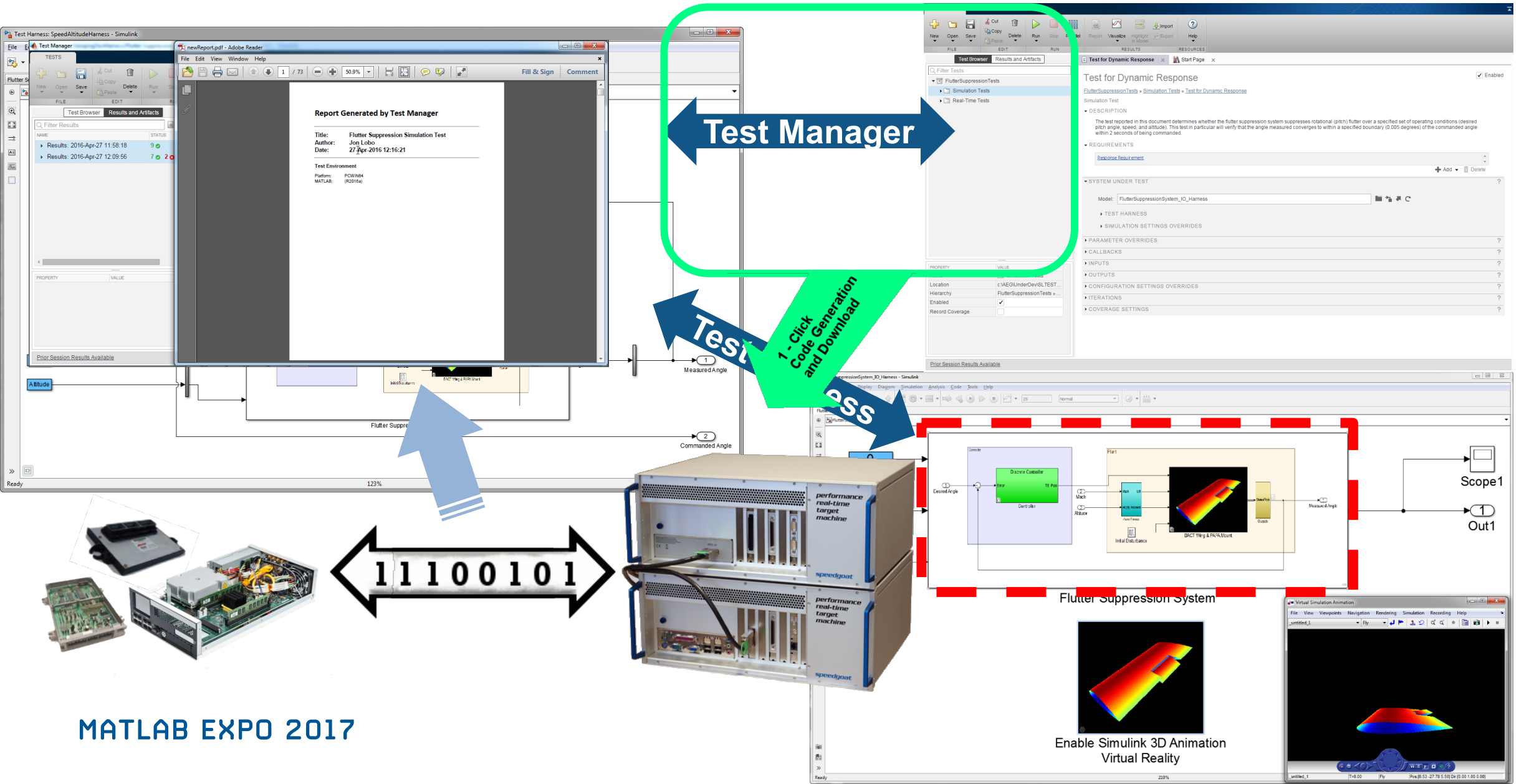


Test Manager

Test Harness



Fully Tested Algorithm in Simulink Test



Key Takeaways

- **Easy-to-use, integrated simulation testing framework**
- Complete testing workflow from **desktop simulation** to SIL, PIL, and **HIL**
- Interactive and fully **Automated testing** workflows

