MATLAB EXPO

CI for Simulink: Speed Up Model-Based Design with Automated Pipelines

Sameer Muckatira, MathWorks

Dr. Jason Ghidella, MathWorks

MathWorks

CI for Simulink: Speed Up Model-Based Design with Automated Pipelines

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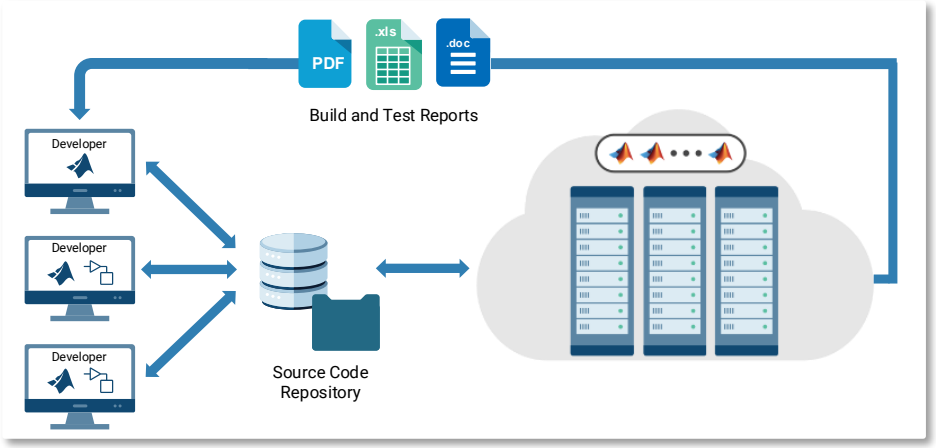
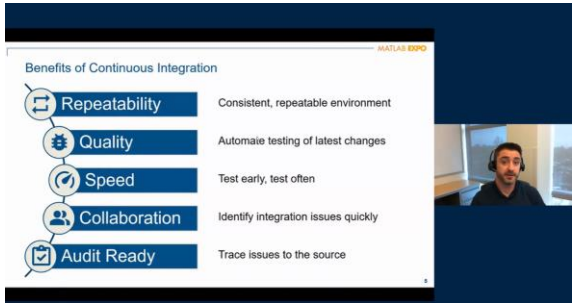
What is Continuous Integration (CI)? Do I need CI for my work?

What is Continuous Integration (CI)?

- **Frequent integration**: Developers regularly merge code changes into a shared repository
- **Automated testing**: Each merge triggers an automated build and test process
- **Early error detection**: CI identifies issues early, keeping the codebase stable and release-ready

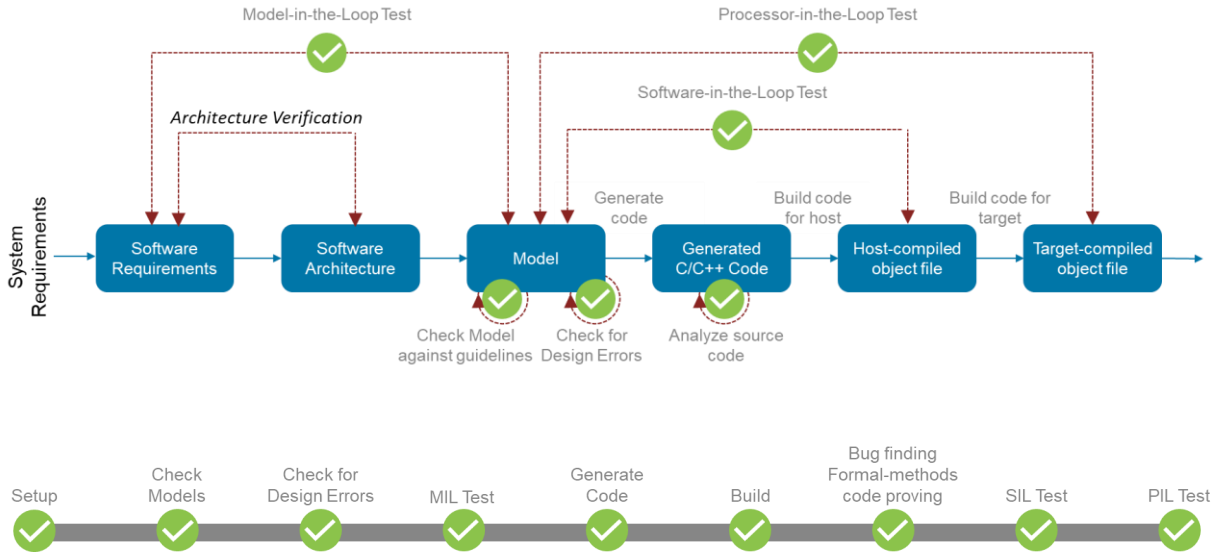




Continuous Integration with MATLAB and Simulink

Can CI be applied to Model-Based Design?

- **CI for models**: CI applies to models too, triggering automated pipelines on each commit
- **Automate model tests**: Model updates can trigger quality checks and simulation tests
- **Generate & verify code**: CI pipelines can also generate and verify code
- **Maintain quality**: CI catches modeling and code generation errors early, ensuring reliability



CI in Action
Let's look at an example

- **"Launch Mode" for an Electric Vehicle**

Driver Activates "Launch Mode"

↓

Increase Battery Current by 70%

A typical MBD workflow starts by implementing requirements through modeling, testing, and code generation.

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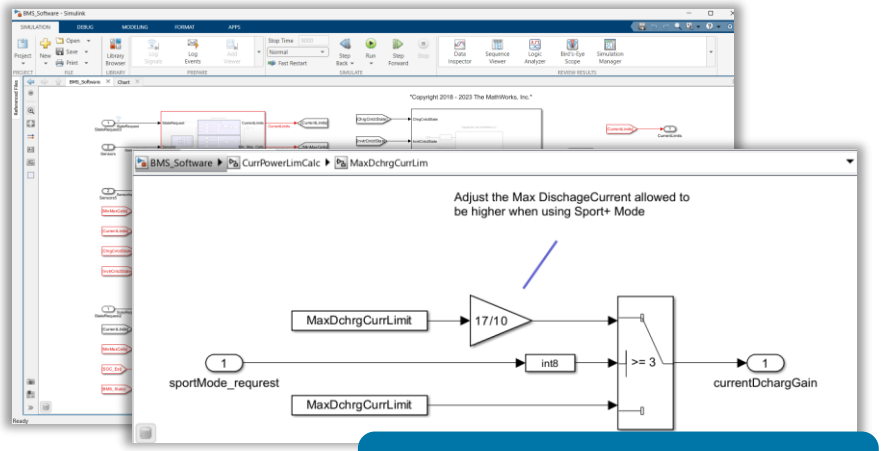
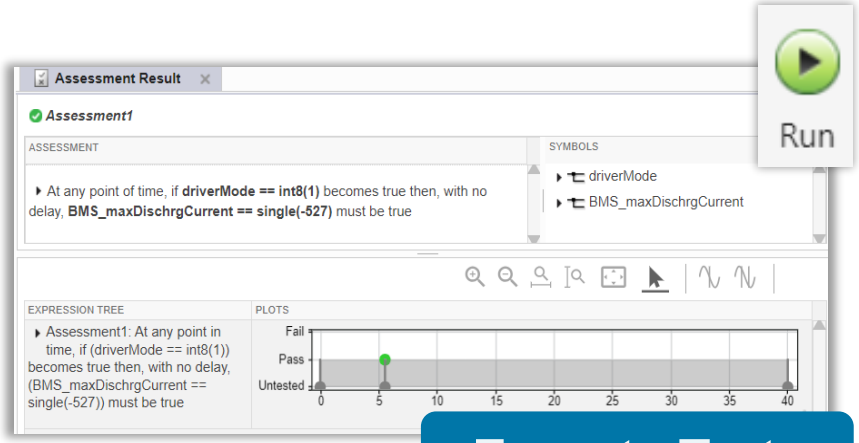
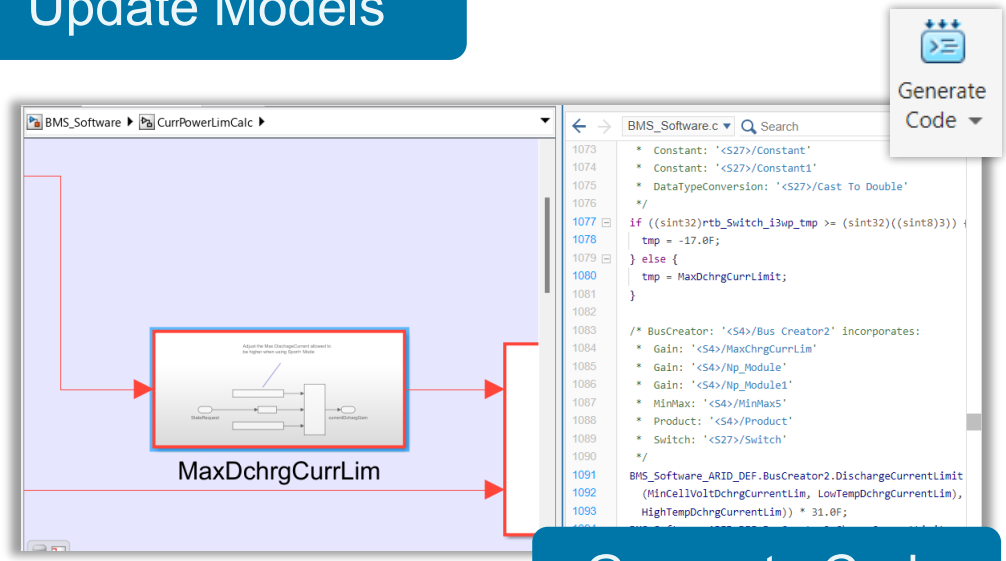


Update Models



Execute Tests



Generate Code

Is my development work complete?

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Meeting requirements is not enough
Many tasks remain before a model is release-ready

- Create Diff Reports
- MiL Tests
- Run Model Checks
- Generate C/C++ Code
- Check Design Errors
- SiL Tests
- Build
- Look for Dead Logic / DBZ errors
- Polyspace Code Prover
- PiL Tests
- Generate Model Web Views
- Generate Standalone Apps
- Update Testing/Quality Dashboards
- Deploy to production servers

Can we automate these tasks ?

CI Turns Manual Effort into an Automated Flow

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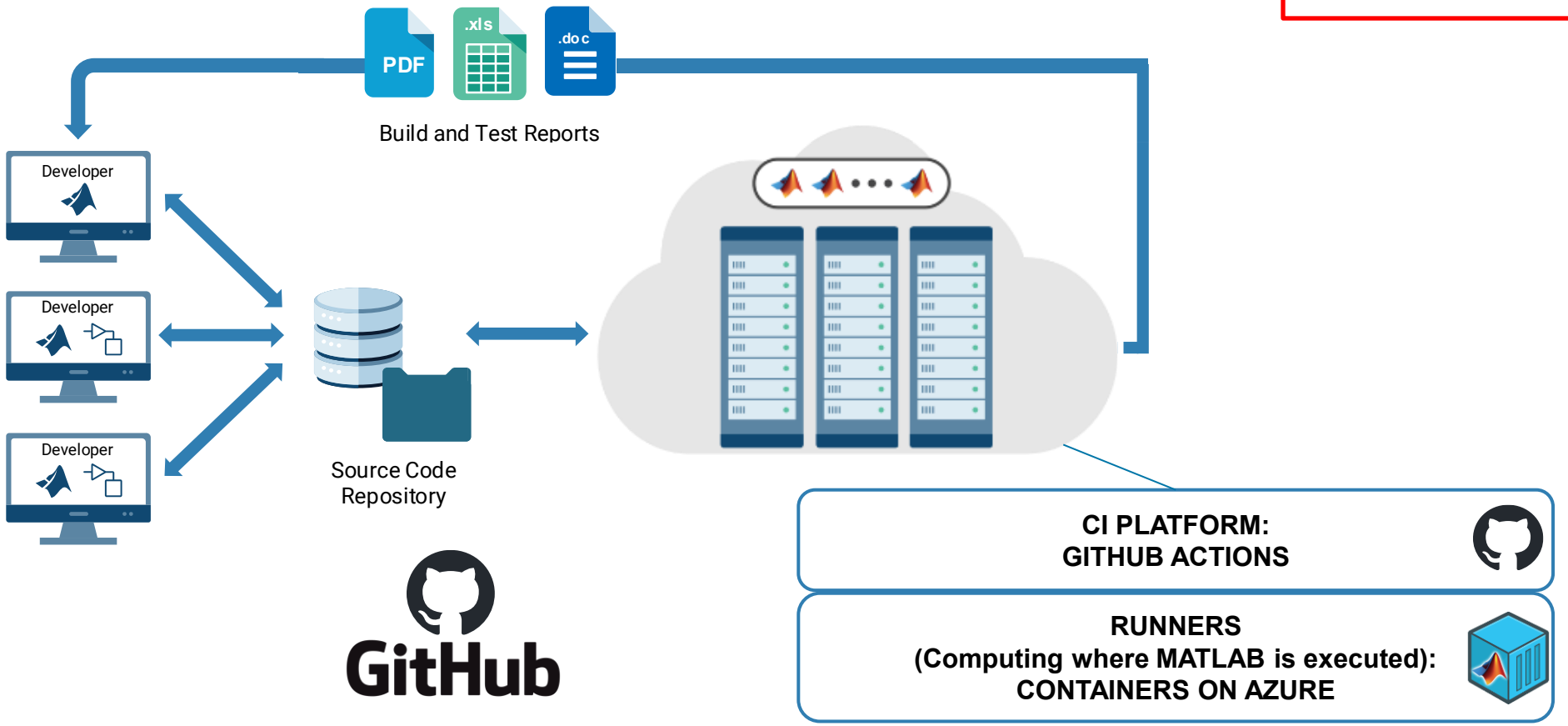
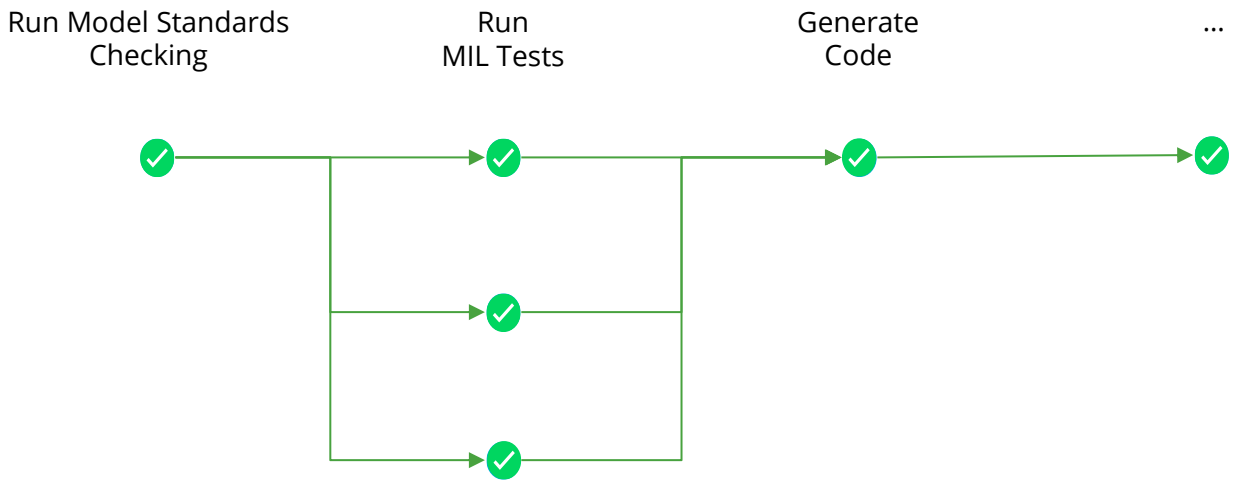


How to setup a Pipeline for Model-Based Design Tasks

Identify tasks and define the process

- Which tasks need to be performed first?
- Which tasks are dependent?
- What can be executed simultaneously?



How do I execute Model-Based Design tasks?

- Model-Based Design products have APIs

```
>> slbuild('mymodel'); % to generate code
```

- You can run MATLAB in a "headless" mode to run commands

matlab -batch "RunYourCommand"

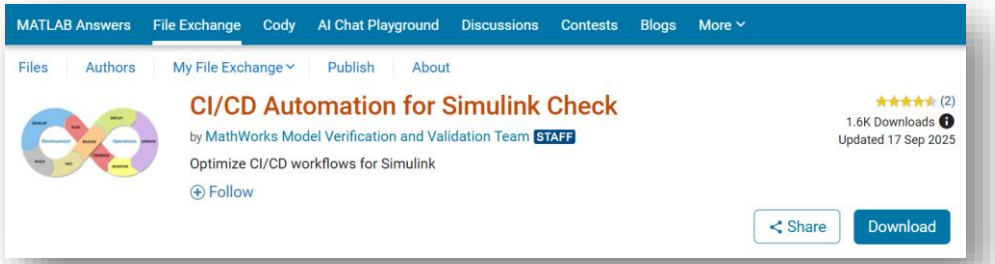
- But how do I build a pipeline?
  - A lot more scripting is needed
  - Keep updating as I add more models/tests
  - Need to manage outputs, scheduling, and more…

build.m

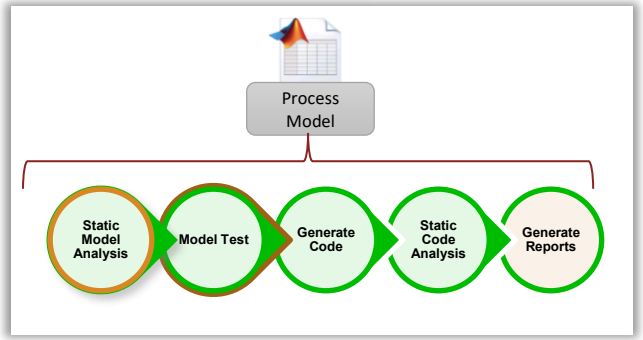
genCode.m

- This is why we introduced the CI Support package for Simulink

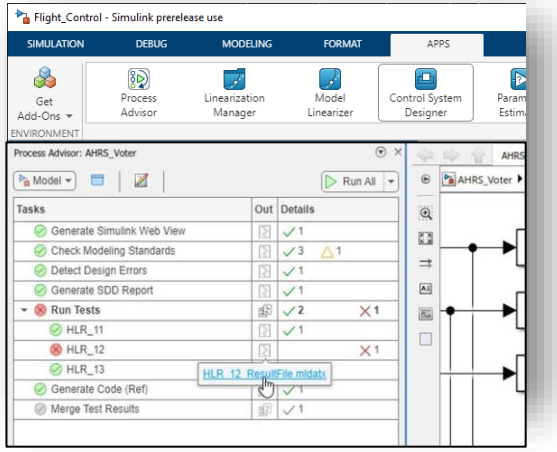
CI Support Package for Simulink

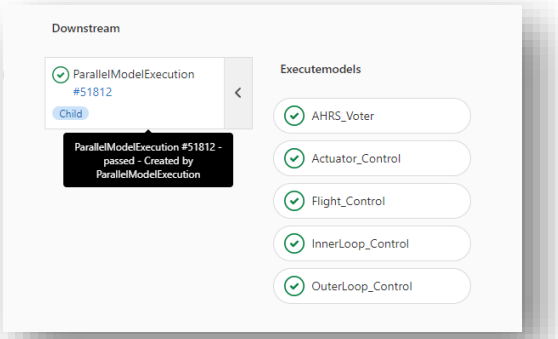


1) Simple to Setup
   - Prebuilt classes for common Model-Based Design tasks
   - Single file to define the process
   - Tailorable – add in your own tasks/variations



2) Desktop Integration with Process Advisor app
   - Local prequalification, debugging
   - Automatically recognizes changes





3) CI Integration
   - Easy to integrate into CI platforms
   - Automatic YAML generation for:
     - Jenkins/Gitlab/GitHub Actions/Azure DevOps
   - CI Results Integration

Demo

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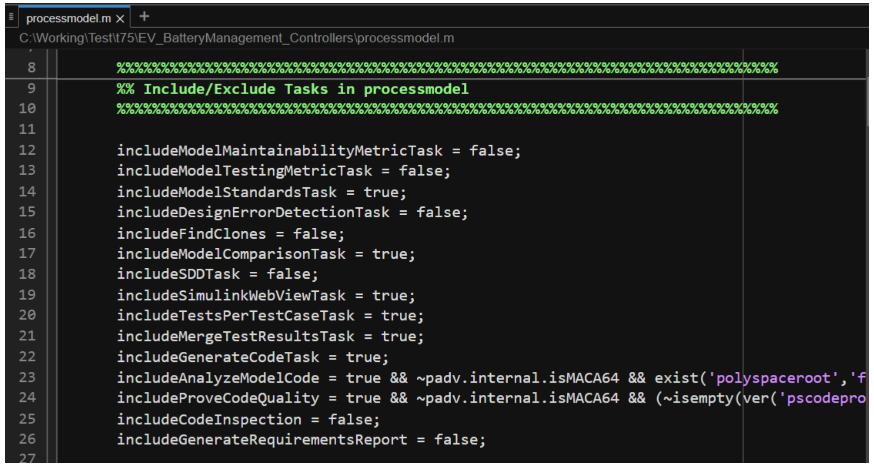

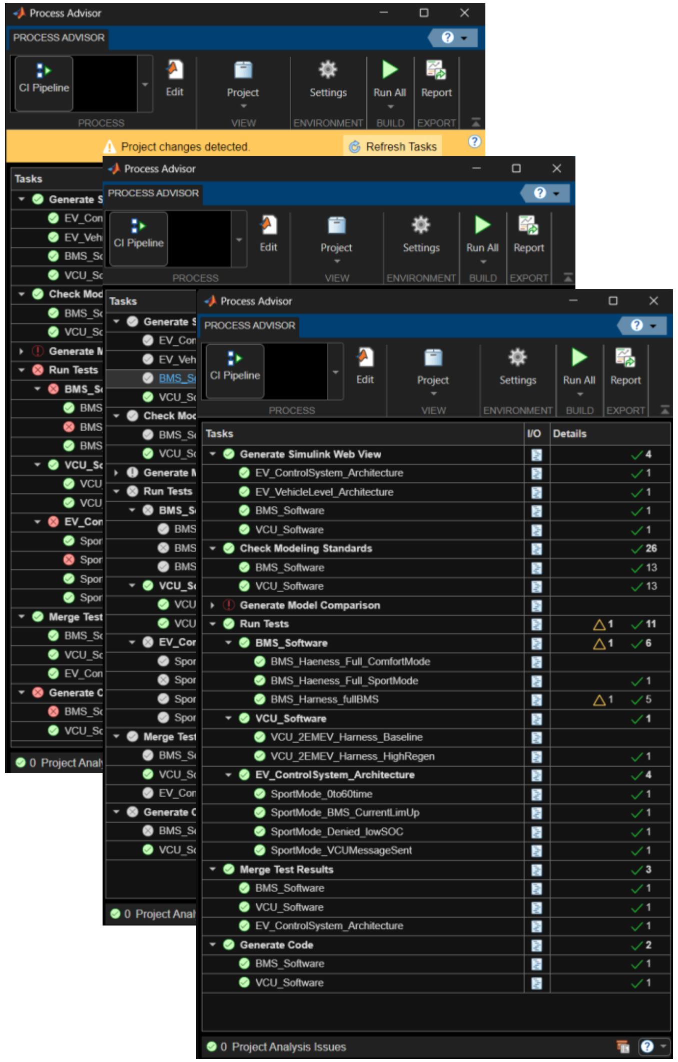

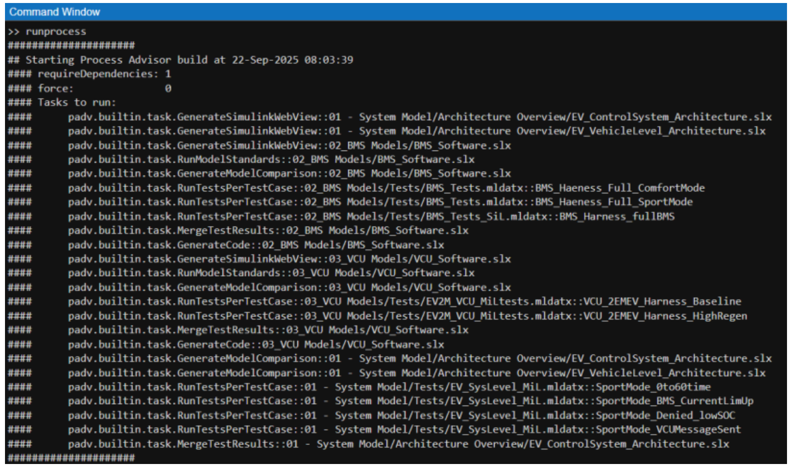

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How do I execute Model-Based Design tasks **in CI?**

- We can support for small groups to enterprise levels
- Individual runner in GitHub Actions for small groups

Continuous Integration with MATLAB on CI Platforms

ON THIS PAGE

Azure DevOps

Bamboo

CircleCI

GitHub Actions

GitLab CI/CD

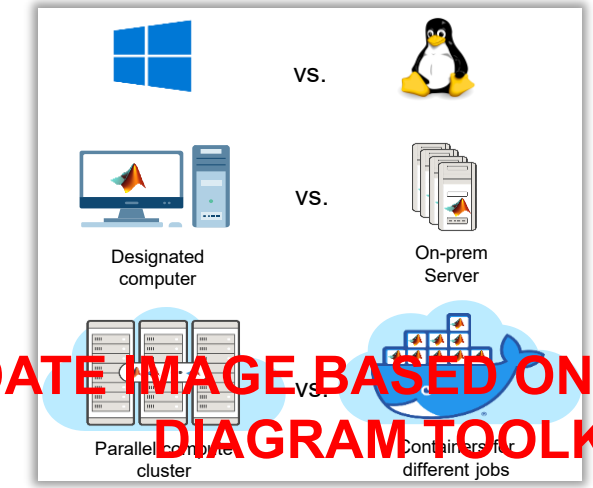
Jenkins

TeamCity

Other Platforms

See Also

[MATLAB Support for CI Platforms]



UPDATE IMAGE BASED ON TECHNICAL DIAGRAM TOOLKIT

[Dockerfile for creating a MATLAB container for CI]

[MATLAB containers on Docker Hub]

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Demo

<YAML File>

GHA running

<Small to large scaling is possible>

Extend-Right from Desktop to Pipeline

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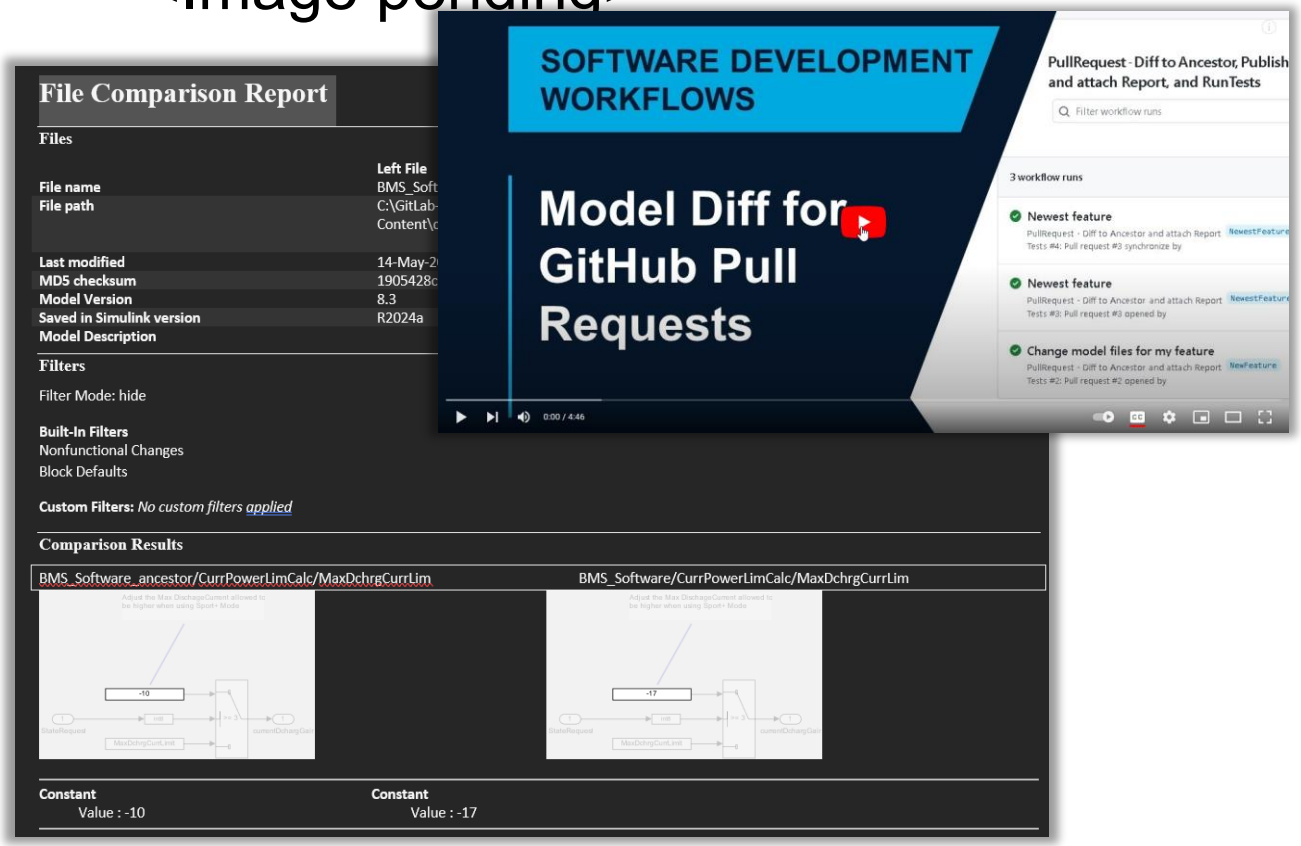
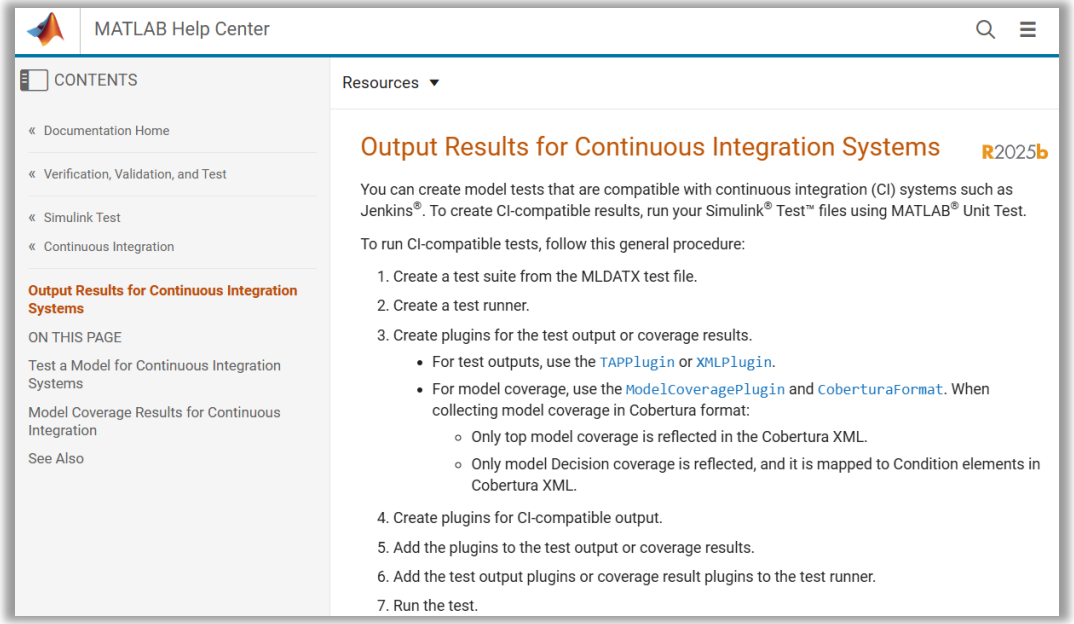
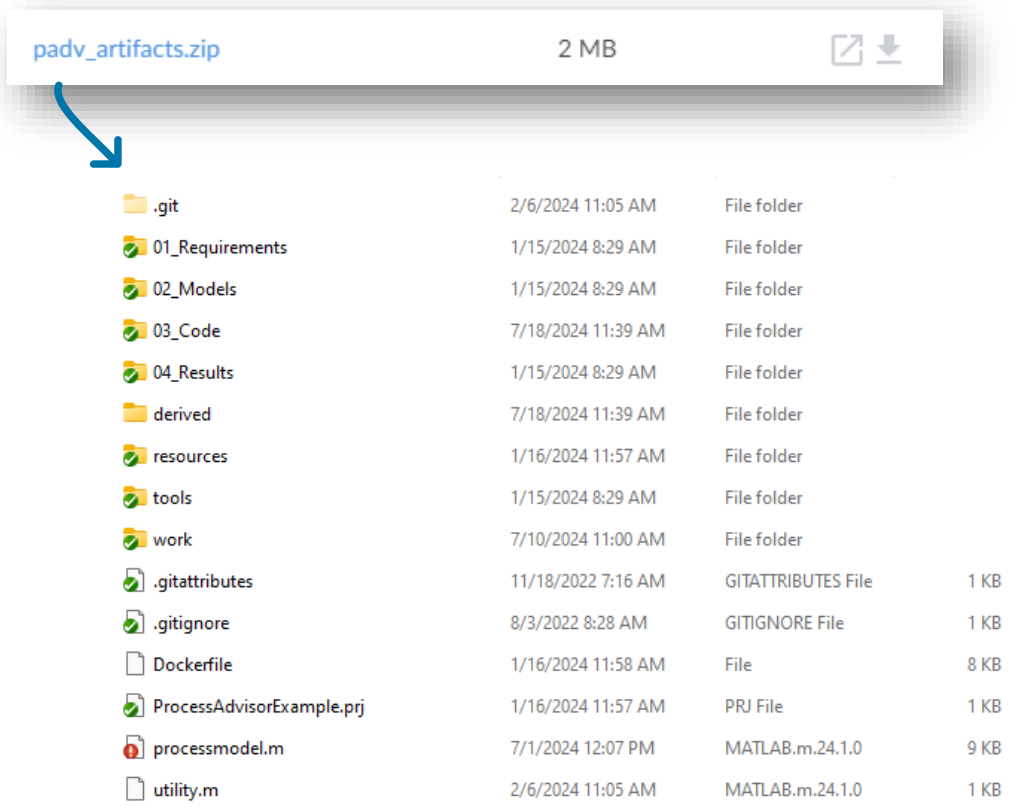
- Publish your test results and coverage in open-source formats
- <Image pending>

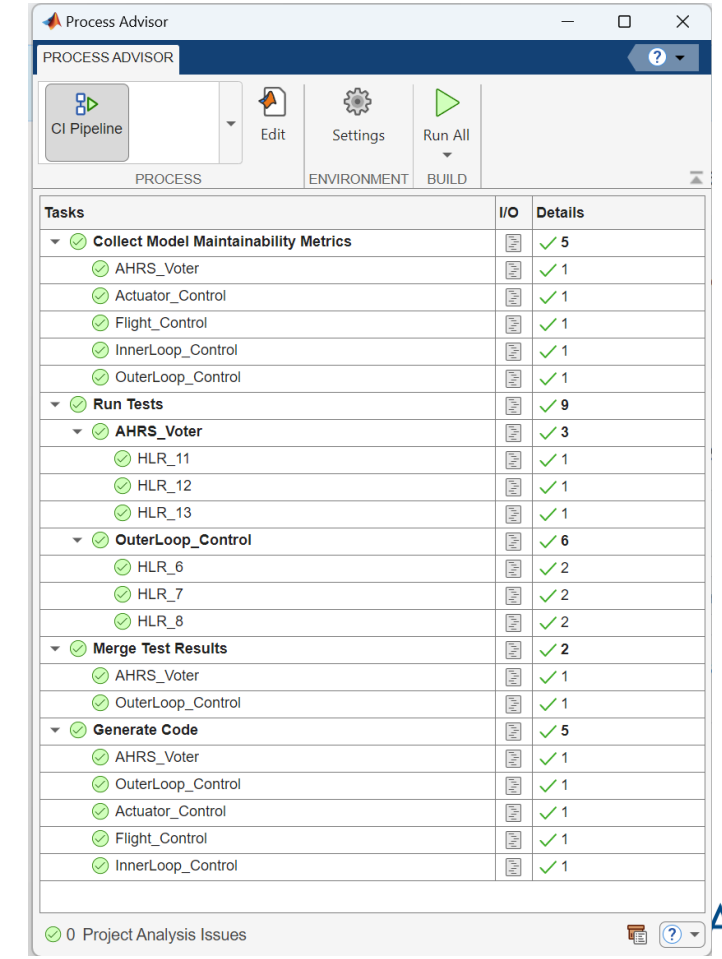




Extend-Right from Desktop to Pipeline

- Engineers can Review and Debug pipeline, Results in desktop MATLAB





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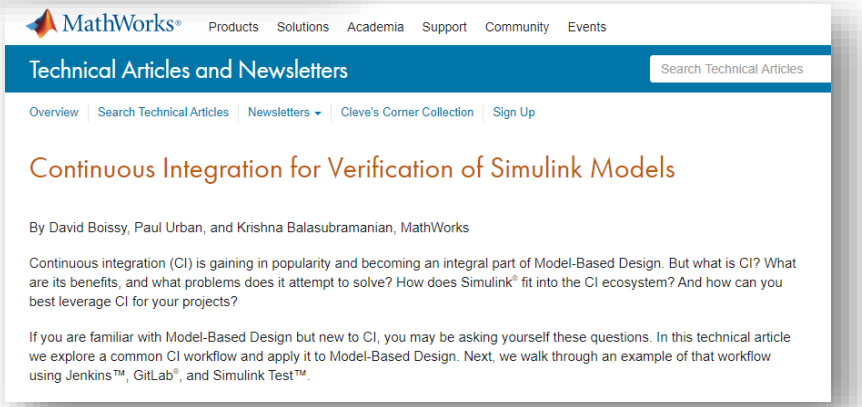
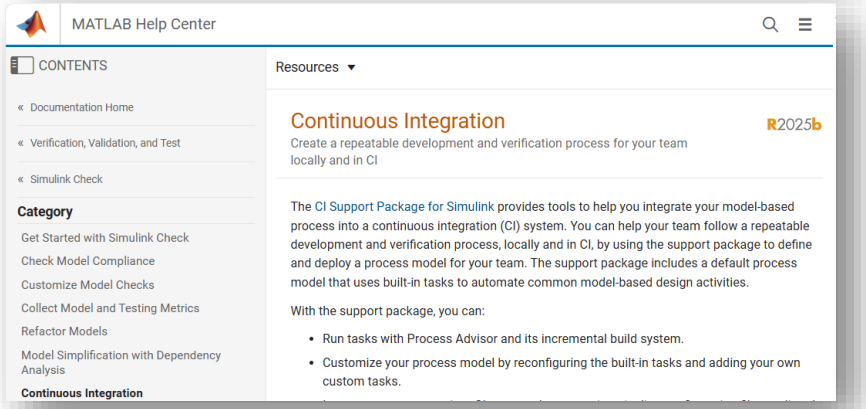
MathWorks Support Resources

Resources for you

- Continuous Integration Solution Page
- Continuous Integration for Model-Based Design

- Customer Videos:
  - CI/CD 2.0: From Scripted Jenkins Pipelines to Process Advisor
  - The Software Factory Approach: Model-Based Design for Safety-Critical Application
  - Accelerating Model-Based Design Through Continuous Integration
  - Automotive DevOps for Model-Based Design with AWS
- Technical Articles:
  - Integrating Cloud-Based Continuous Integration
  - Zeekr Innovates Software-Defined Vehicle Engineering
  - Continuous Integration for Verification of Simulink Models
  - Continuous Integration for Verification of Simulink Models Using GitLab
  - Agile Model-Based Design: Accelerating Simulink Simulations in CI Workflows
- Documentation:
  - CI Support Package for Simulink
  - Continuous Integration Documentation Hub
  - Tests for Continuous Integration
- Developer Zone: Continuous Integration





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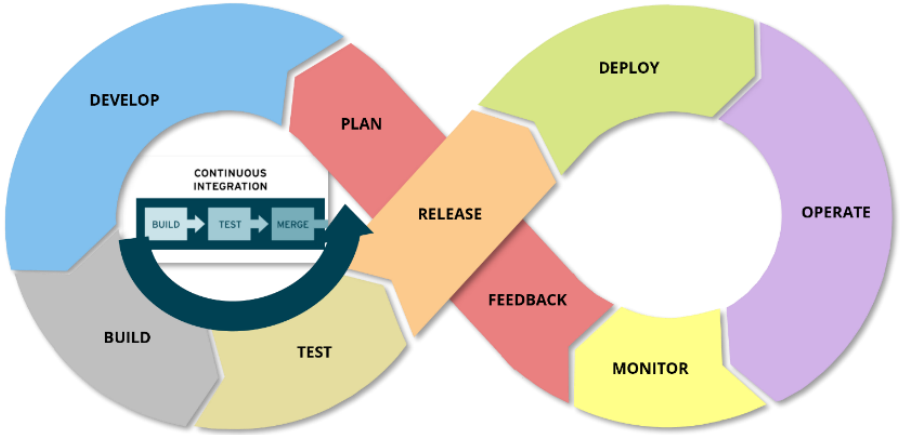
contact us at: continuous-integration@mathworks.com

We are here to support you on this journey

- Continuous Integration Advisory Service
  - Leverage our expertise in workflow and tool integration
  - Implement best practices for more efficient workflows
  - Receive expedited support from our experts



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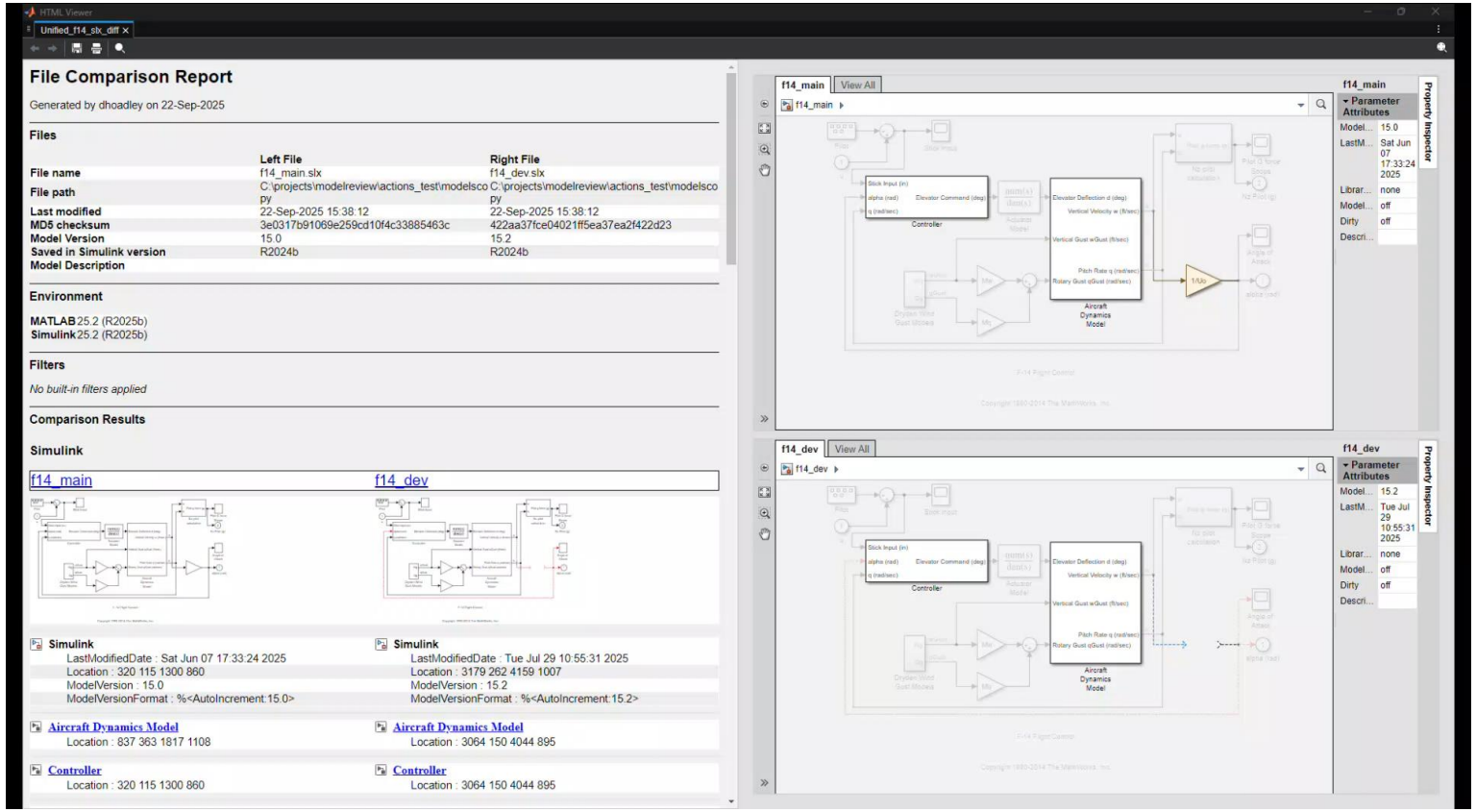
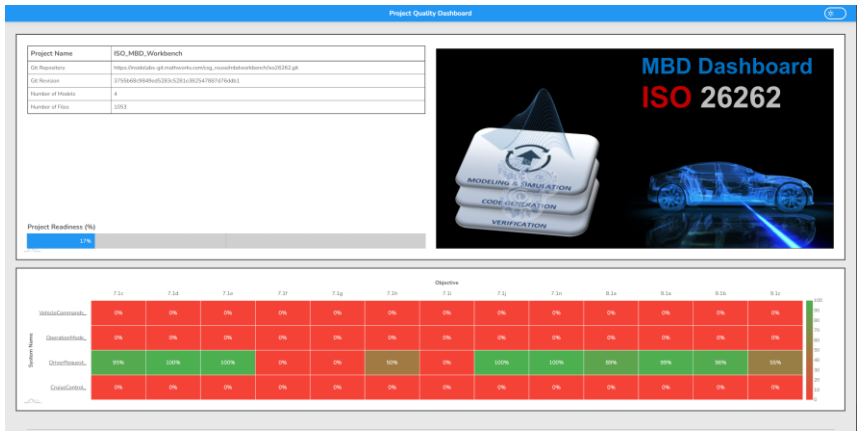
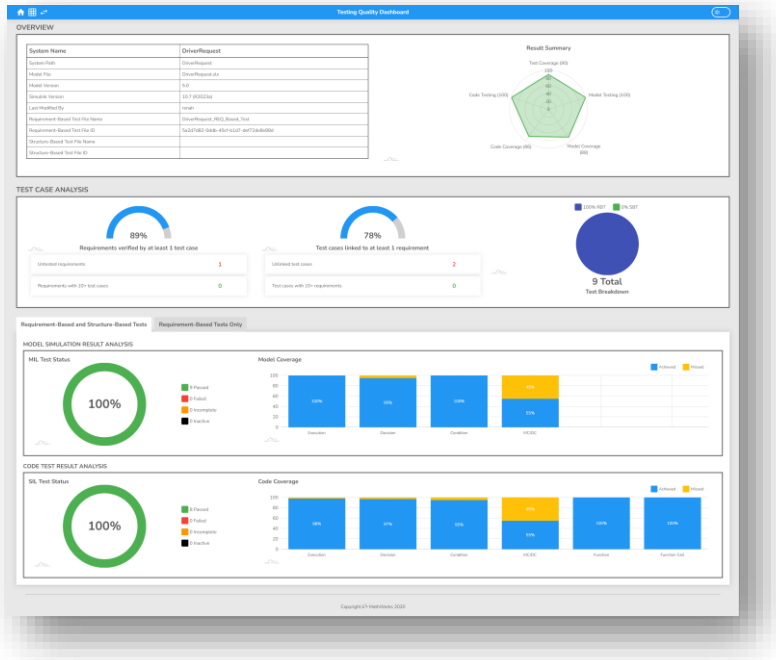
- Fast reviews with improved Unified Diff Report



We are here to support you on this journey

- Continuous Integration Advisory Service
- Fast reviews with improved Unified Diff Report
- End-to-end software development environment for Model-Based Design





Key Takeaways

- Continuous integration helps you develop high quality software, faster!
- MATLAB and Simulink support you through all stages of CI
- Getting started with CI is easy with the CI support package, CI plugins and examples
- MathWorks Services can help you structure and scale your development work!

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Share the EXPO experience
#MATLABEXPO

sameer-k-muckatira

jason-ghidella

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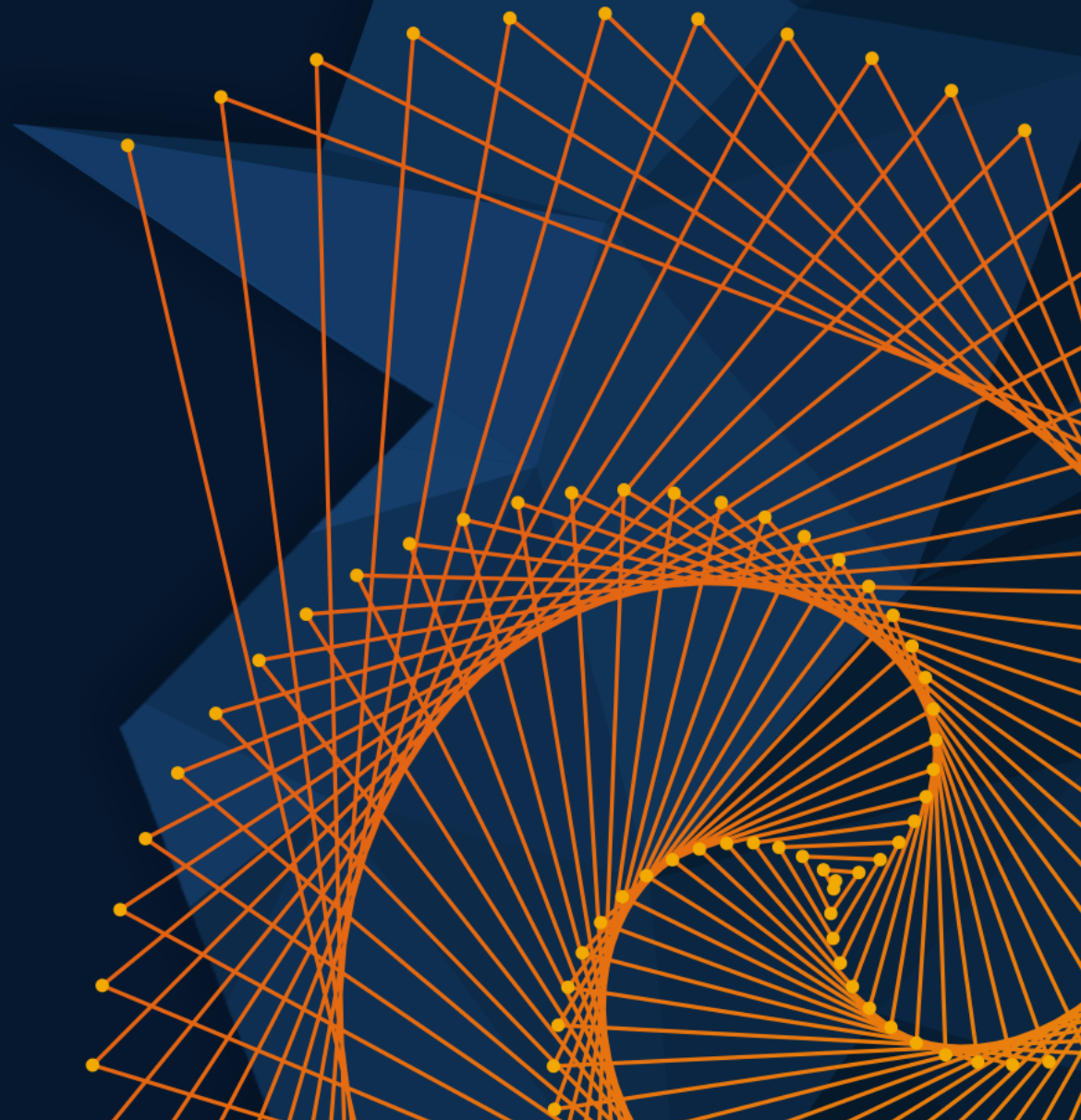
Thank you



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