Automated Generation Of Code From Simulink To An Event-Based Simulation Framework

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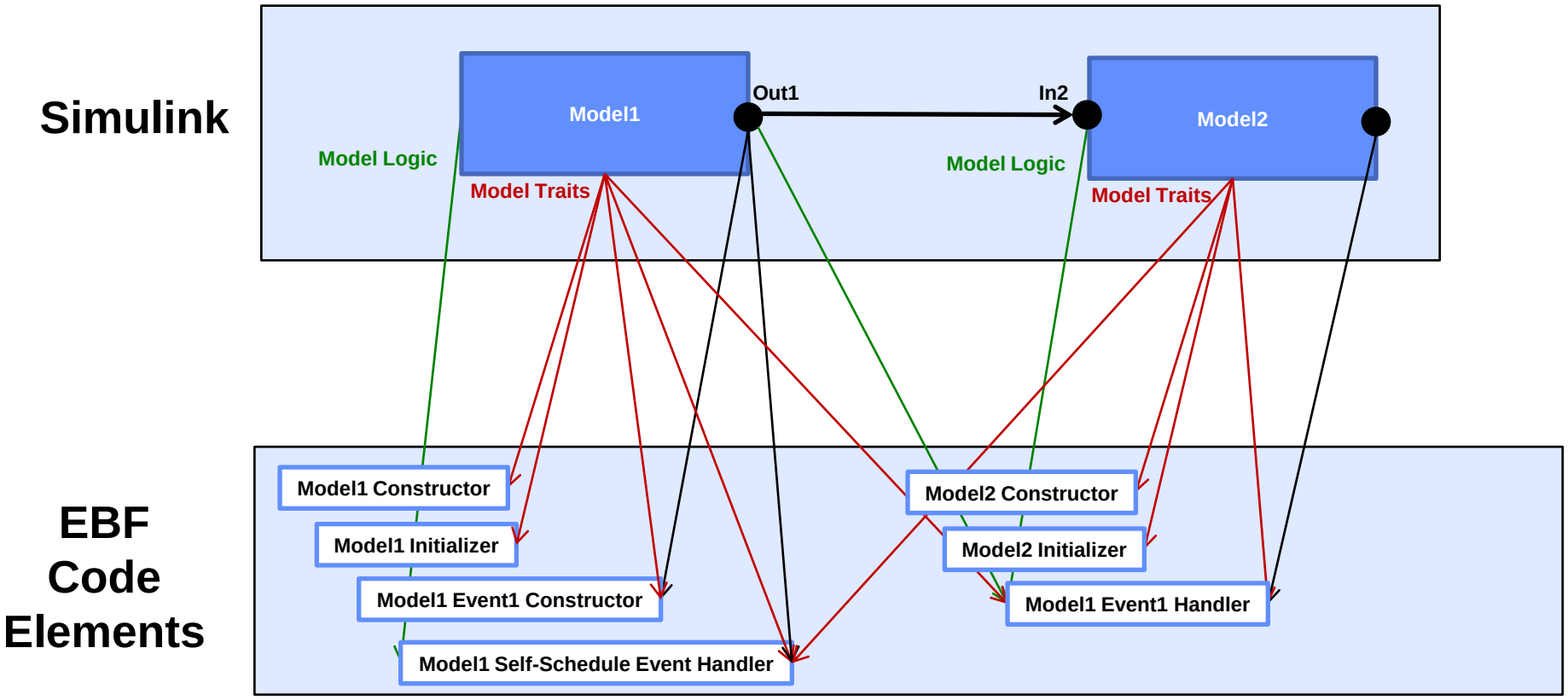
Simulation Environments Used By MEI

- Simulink
  - Dynamic System Modeling/Simulations
  - Graphical Block-Diagramming Tool
  - Tightly Integrated With Matlab Command Library
  - Means To Generate Time-Driven Code
- Event-based Framework (EBF)
  - Discrete Event Messaging
  - Models created with compiled code
  - Componentized Simulation Layers
    - Middleware, Controller Layers
    - User Components; Simulation Engine & Model Layers

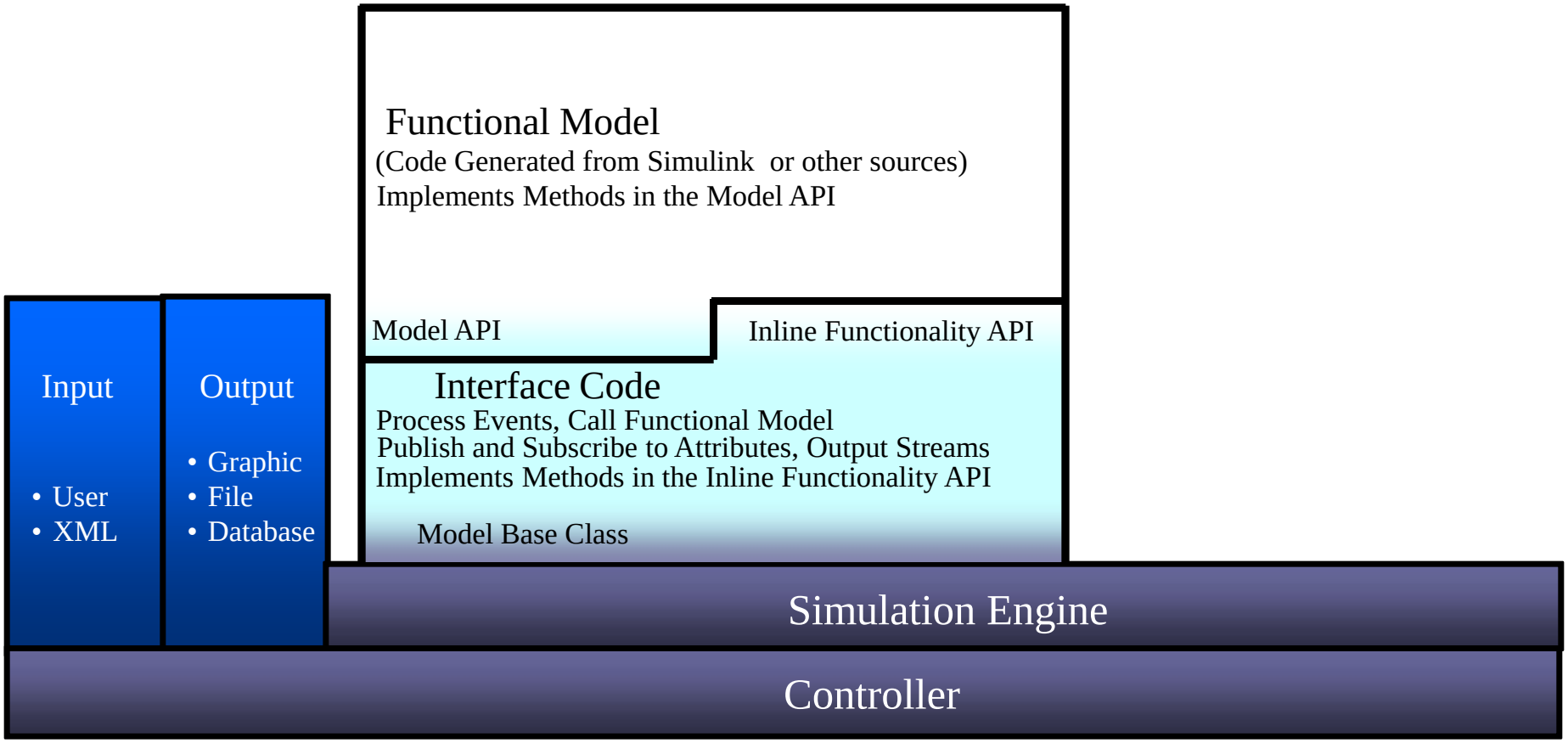
Benefit Derived From Porting Simulink-Developed Models Into EBF Simulations

Required Information Flow From Simulink To EBF During Code Generation



Time-consuming Manual Approach Initially Used

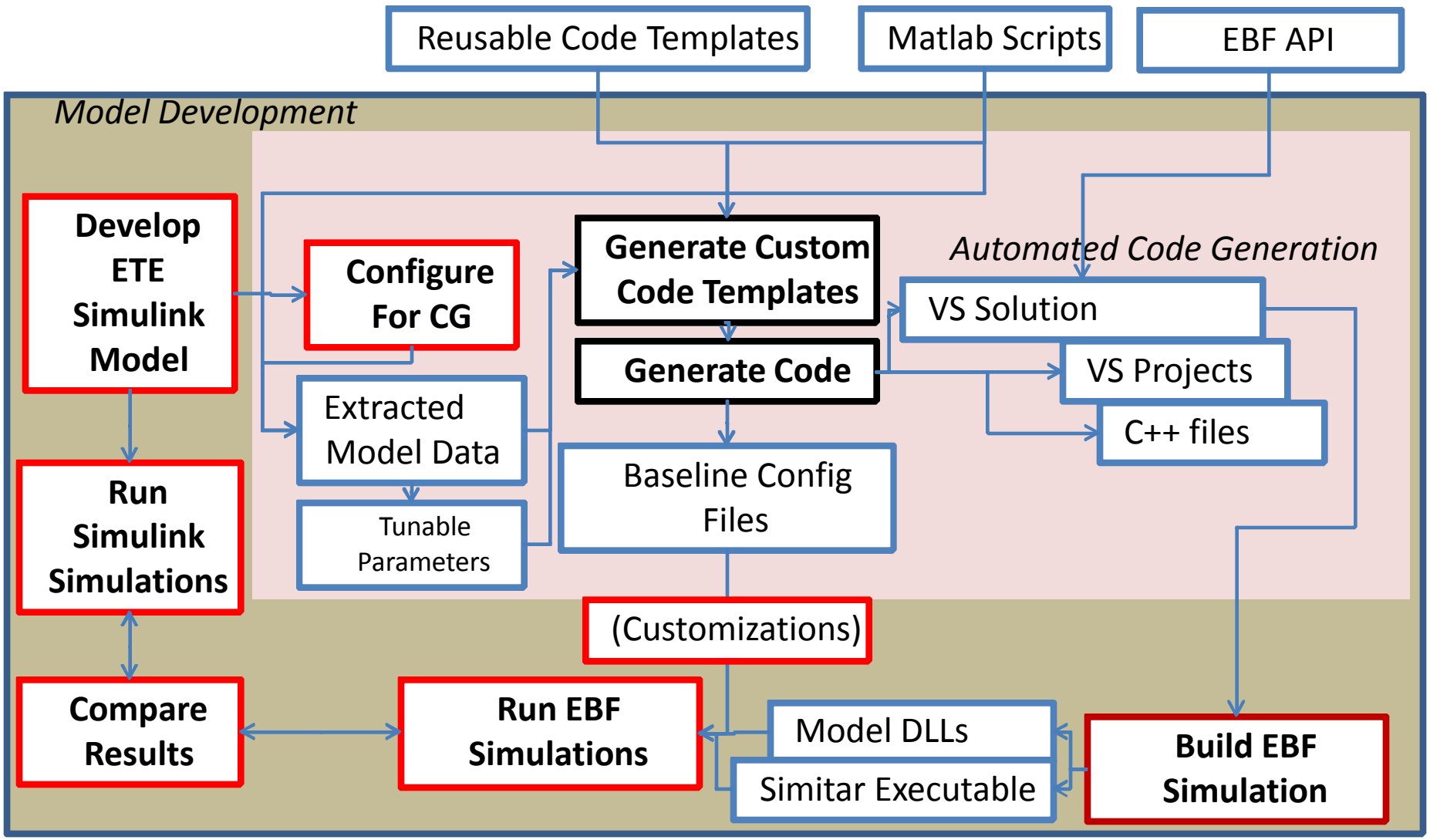
- Functional model code generated from Simulink
- Other components hand-written



Tasks For Automation

- Extract Information About Targeted Models And Their I/O
- Store Information In A .MAT file
- Generate Functional Model Code From Simulink Using Standard Templates
- Generate Additional Interface Code Using Custom Code Templates
  - Model classes, including Event Handling Methods
  - Attribute classes
  - Event classes
- Generate Makefile Or Visual Studio Projects/Solution
- Compile & Build EBF code
- Generate Prototype Run-Time Configuration Files
  - Incorporate Simulink Tunable Parameters

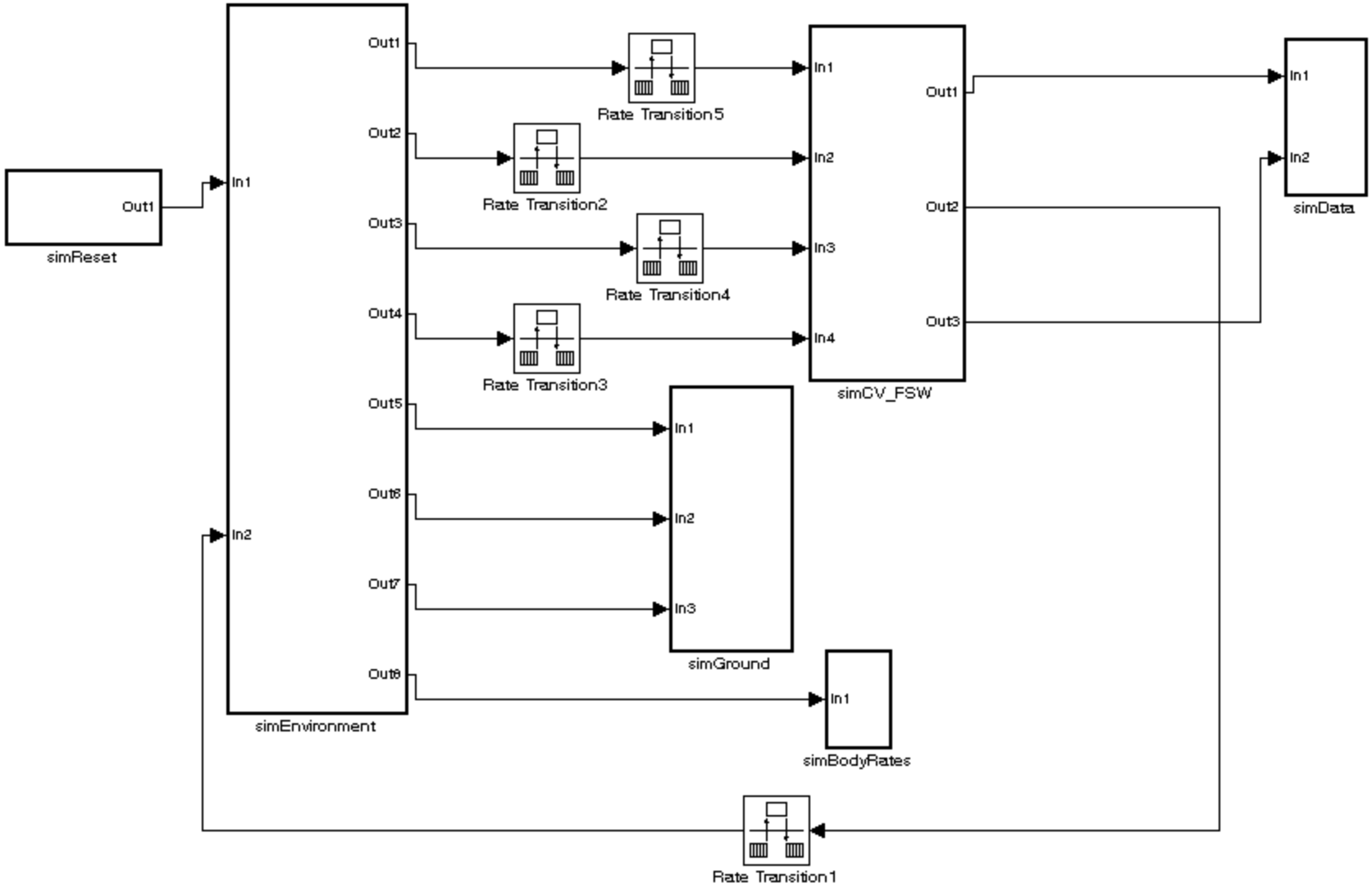
Automated EBF Code Generation Implemented



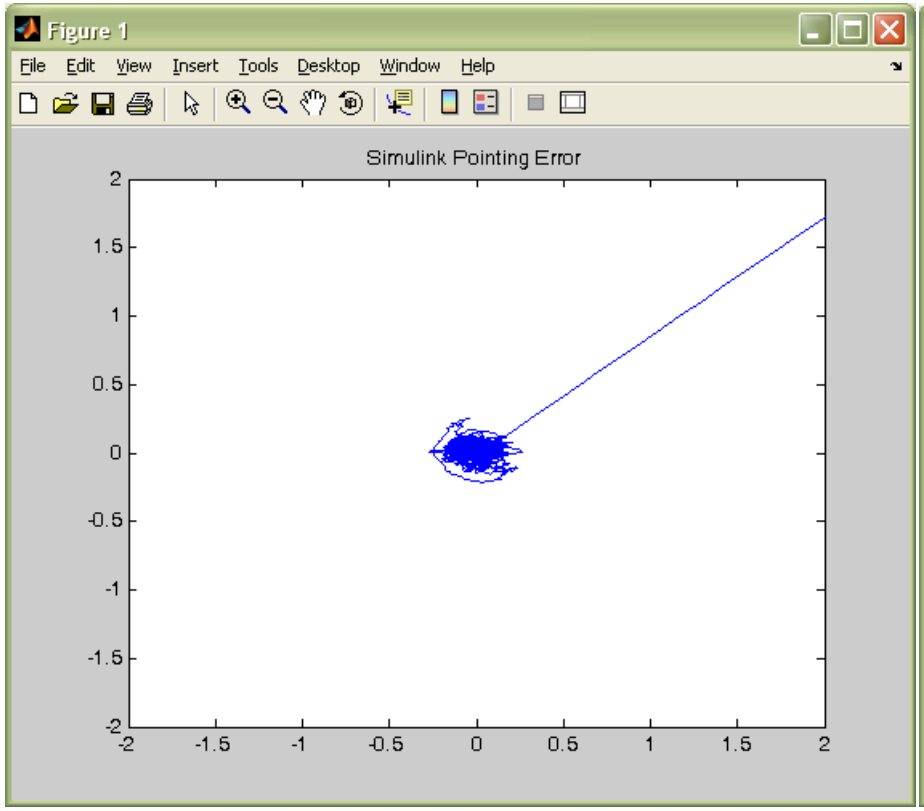
Testing Performed To Verify Fidelity Of Generated Code

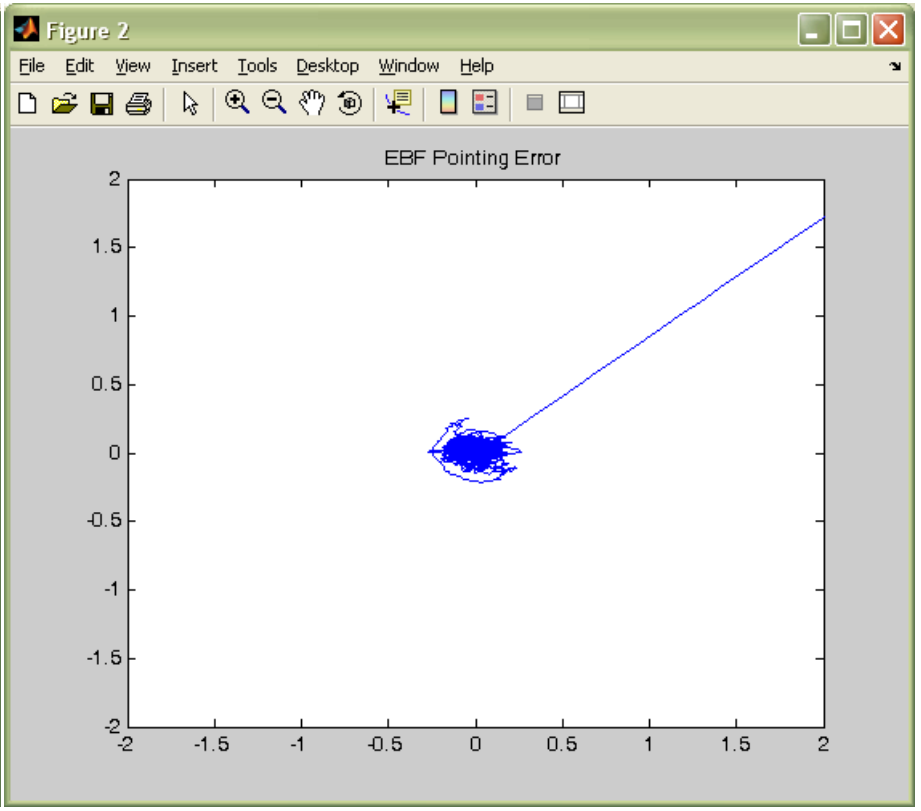
- 4 Synthetic Test Cases
  - varied I/O schemes
  - varied feedback schemes
  - multiple rates
- 4 Simulink Models Developed In-House or By MEI Partners
  - Representation of Sensors, Association, State Estimation, Control, Actuators, and Flight Dynamics
- Output data from Simulink & EBF Simulations Compared

Example Scenario Targeted For Code Generation

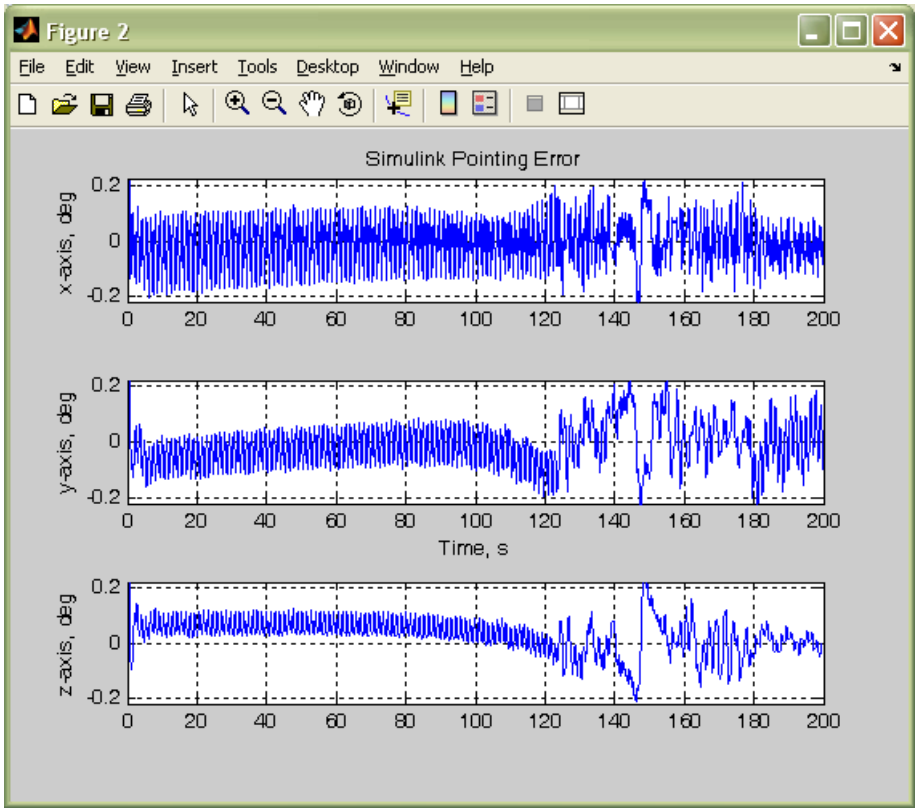


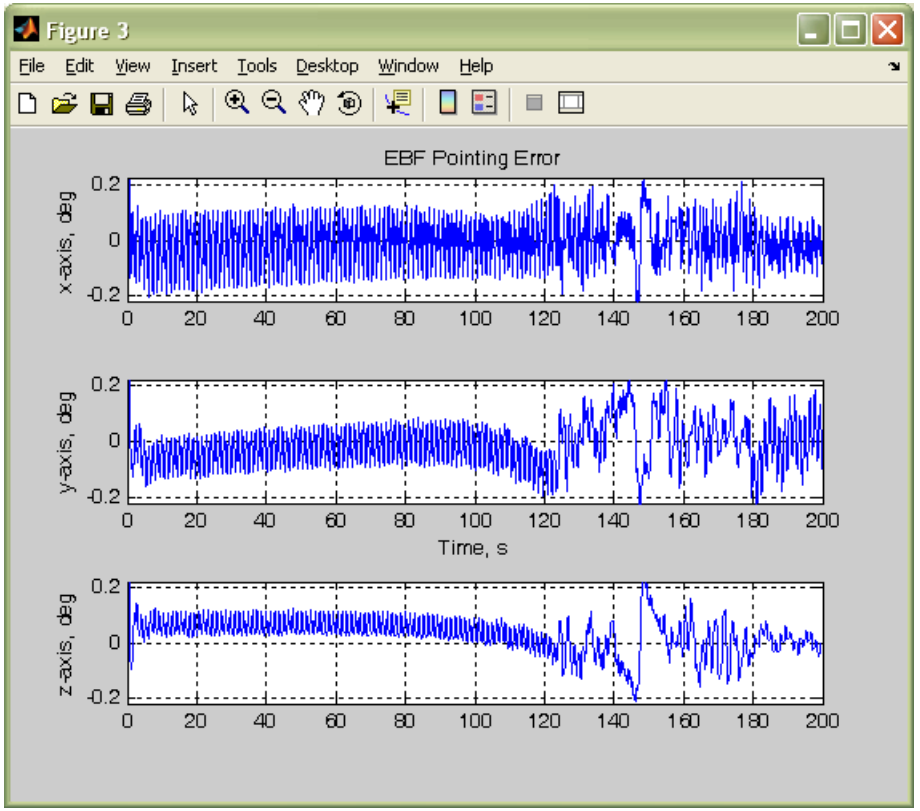
Example Parameter Compared: Pointing Error



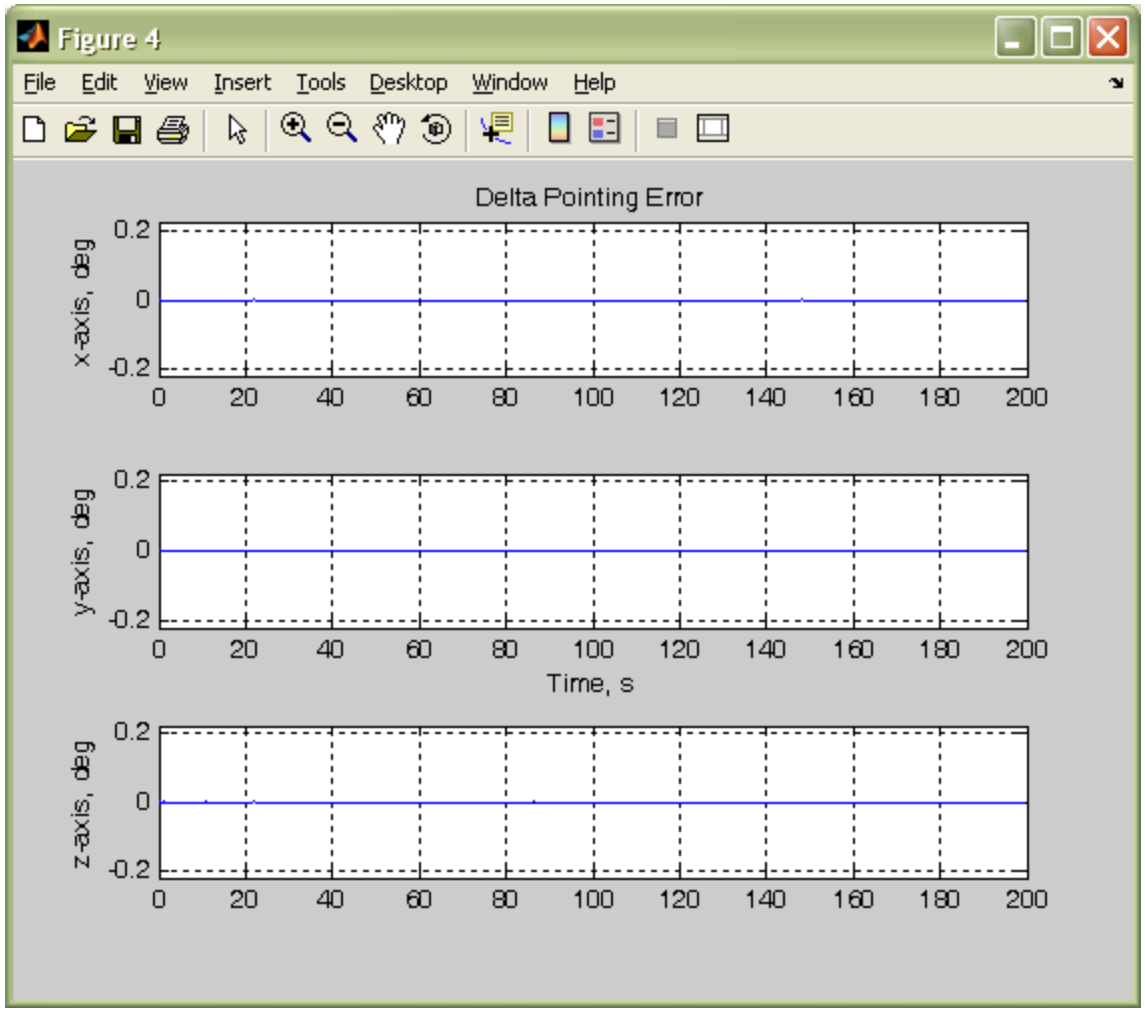


Pointing Error Time Plots Compared





Pointing Errors Compare Well



Summary

- Customized scripts and templates used to generate EBF scenario
  - Inputs/Outputs Characterized and Adapted
  - Model Traits Captured And Incorporated
- Templates Structured With EBF-Specific Code
  - Model, Event, Attribute Classes
  - Model Initialization and Event Handling Methods
  - Communication, Event Scheduling, Data Handling
- Code Generation Interface Tested and Validated With Several Scenarios