MATLAB EXPO

UNITED KINGDOM

Developing Architectures with System Composer

Mark Walker, MathWorks

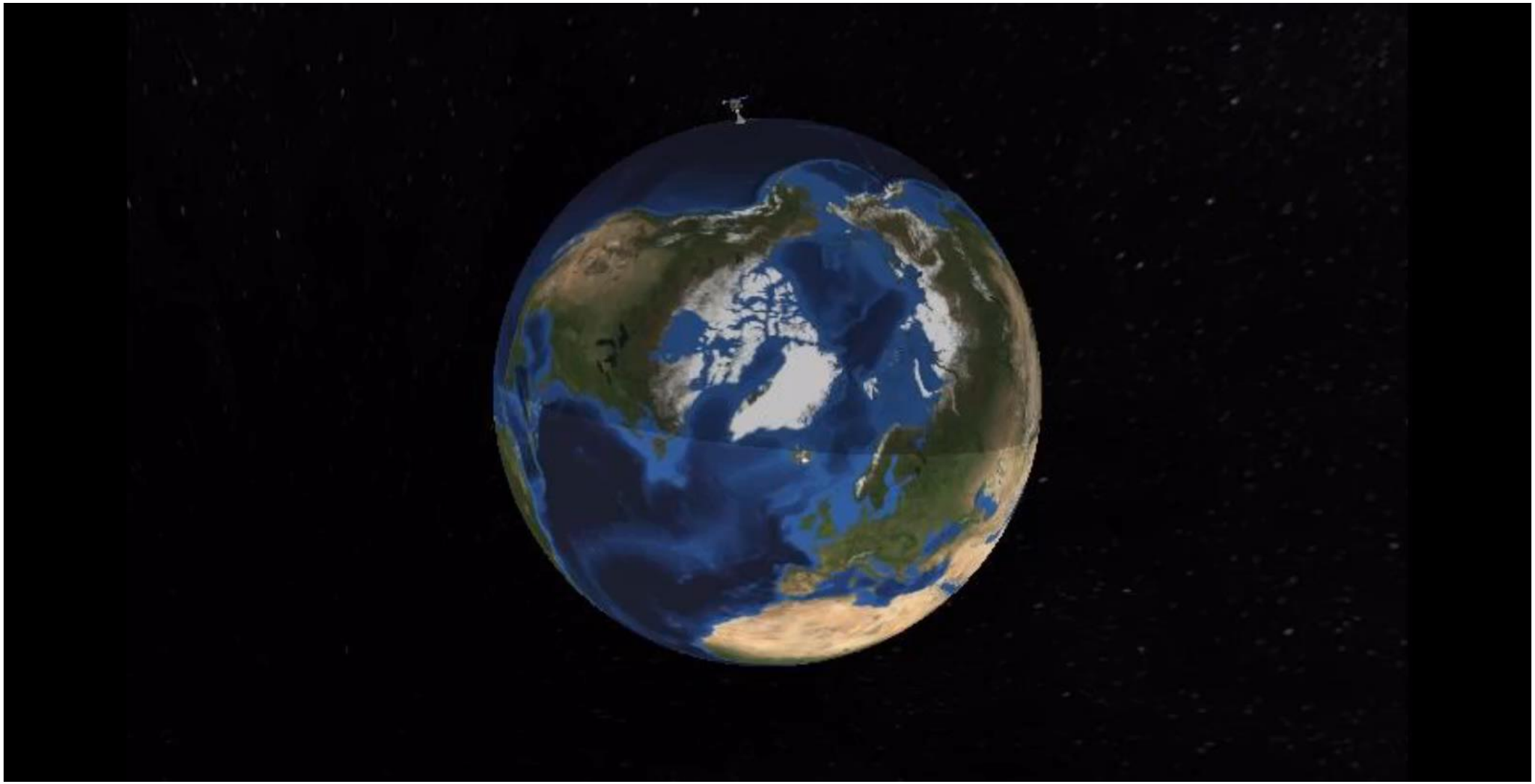
MathWorks

Mission

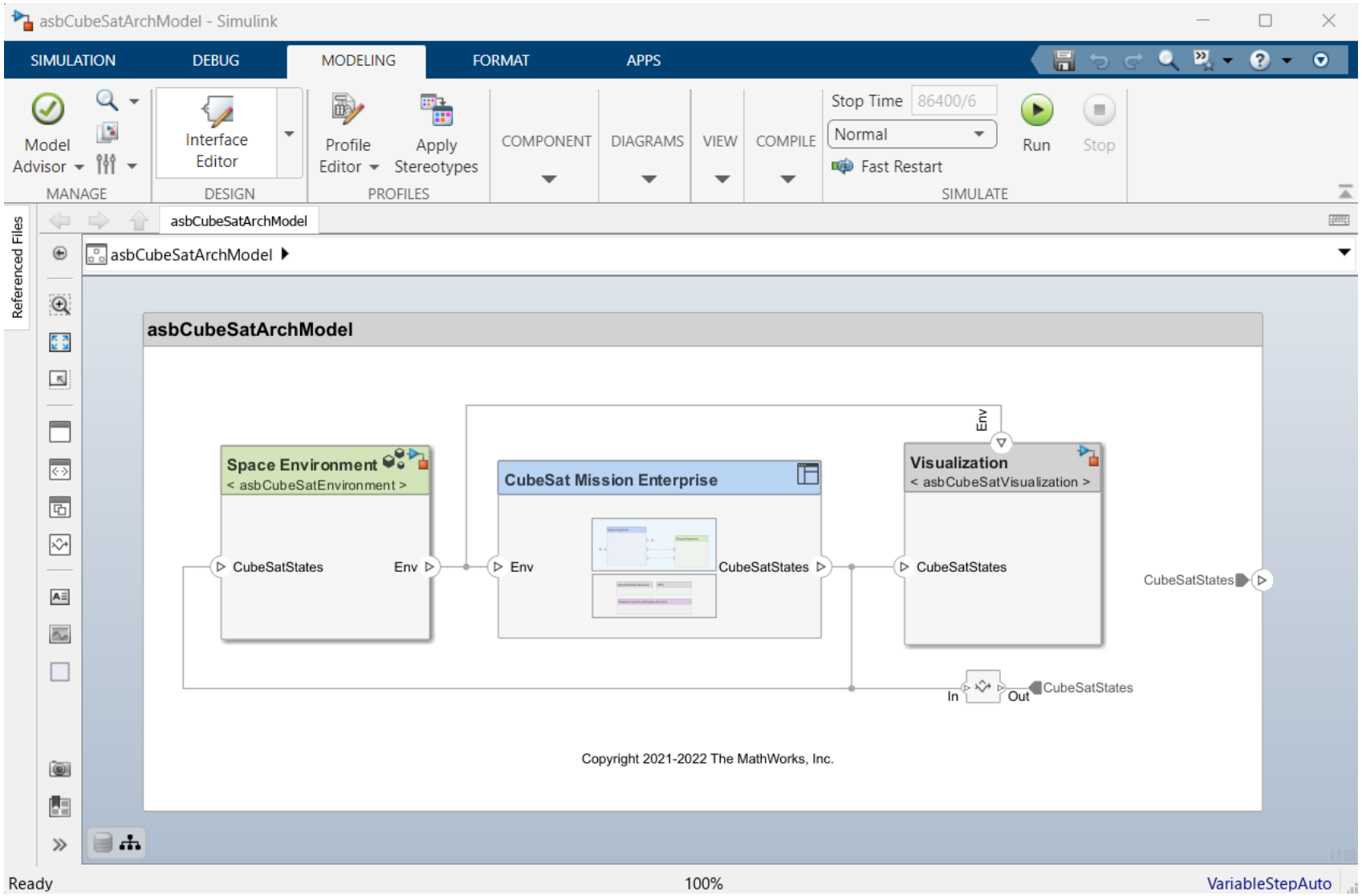
The system shall provide and store visual imagery of MathWorks headquarters [42.2775 N, 71.2468 W] 1 times daily at 10 metres resolution.

Mission

Mission



System Composer



System Composer

- …a tool for describing architectures
- …but what is an architecture?
  - It describes how something works and why.
  - It will contain levels of details.
  - It will be traceable.
  - It may exist alongside other levels – each is a candidate design.

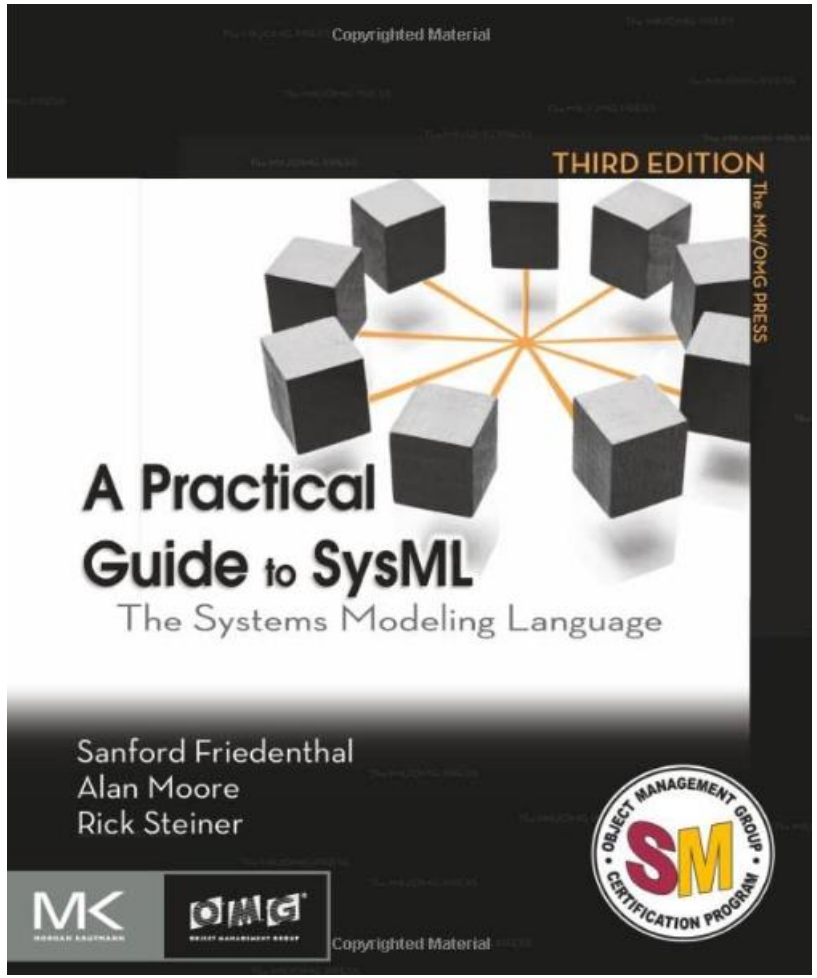
Systems Engineering

- From incose.org:

Systems Engineering *is a* ***transdisciplinary*** *and* ***integrative*** *approach to enable the successful realization, use, and retirement of* ***engineered systems****, using* ***systems principles and concepts,*** *and scientific, technological, and management methods.*

  - Multi-disciplinary
  - Combines business and technical
  - Uses formalisms such as SysML

SysML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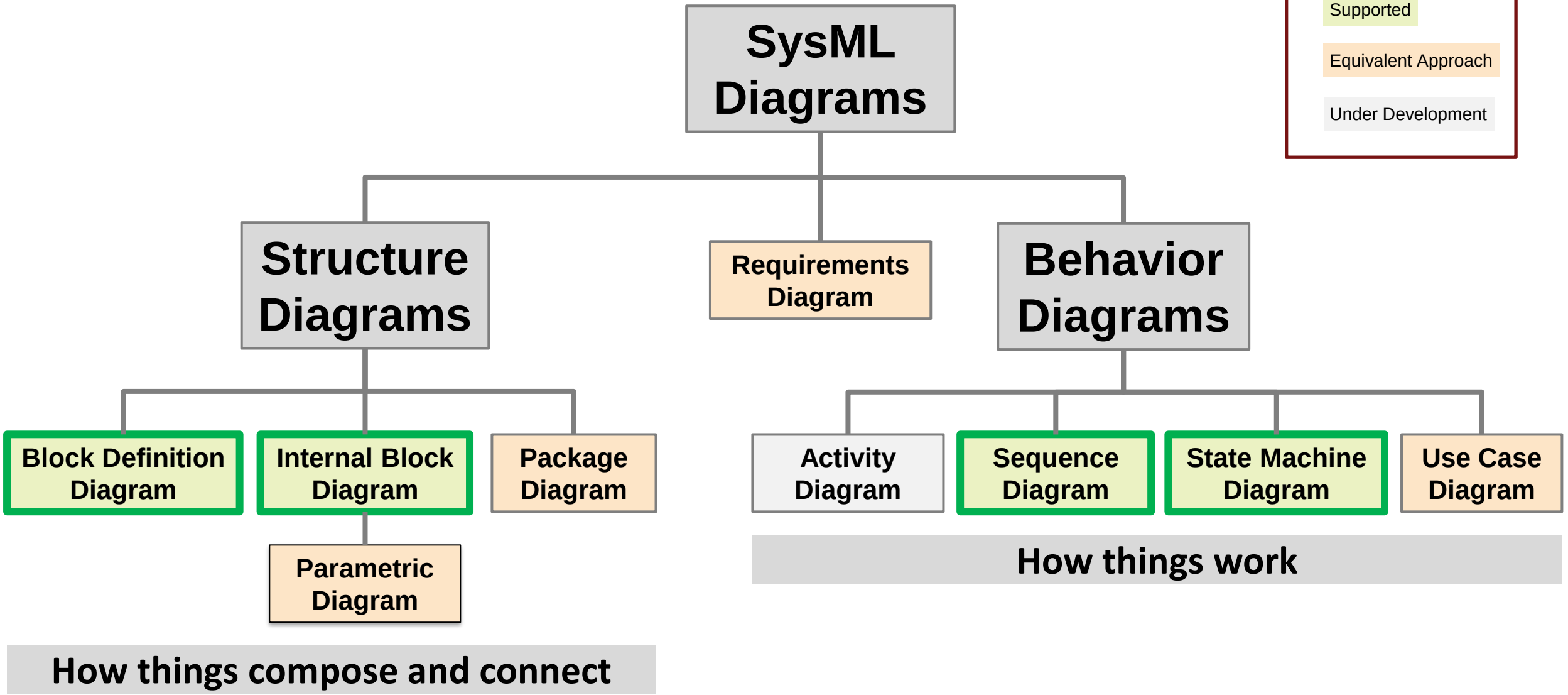
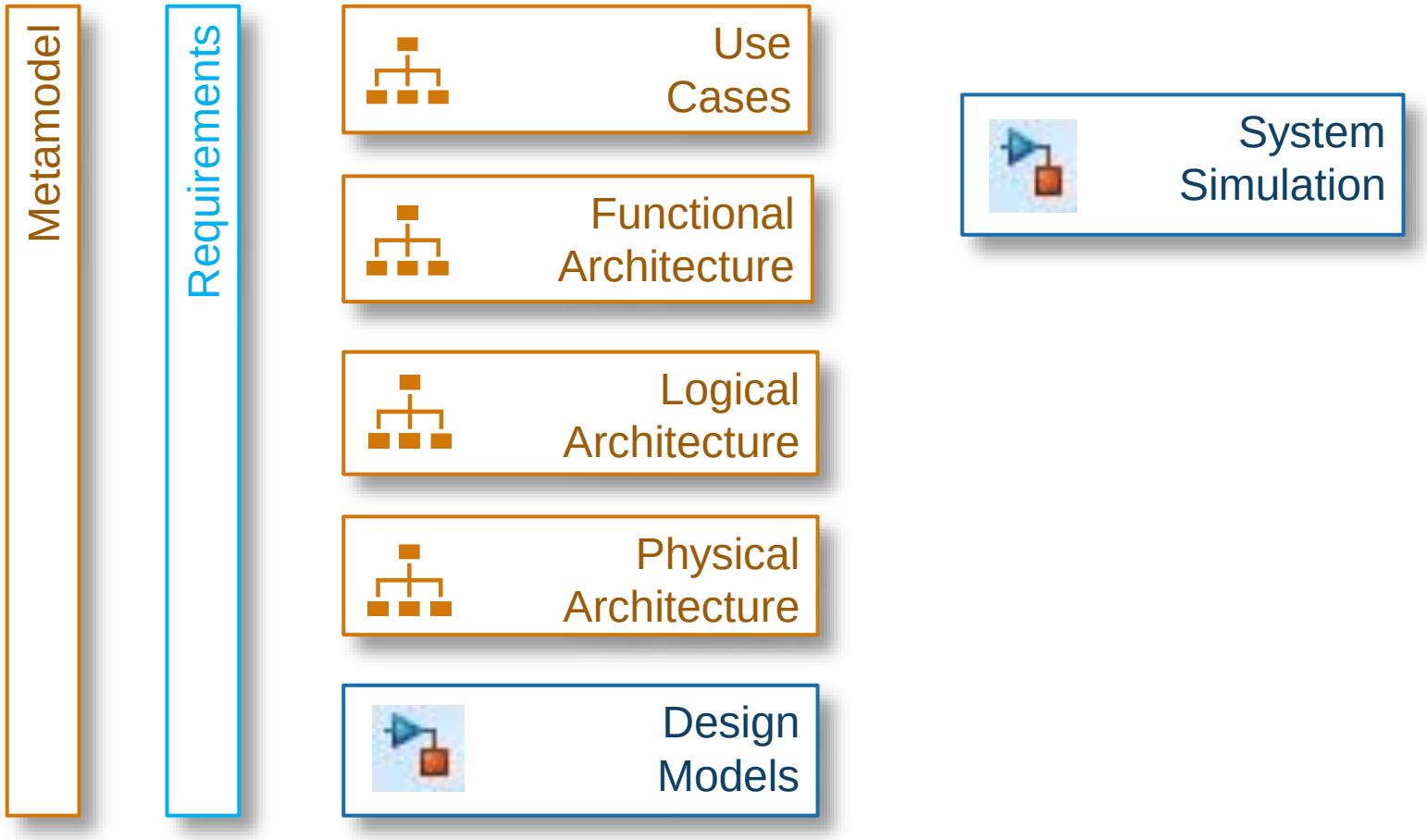
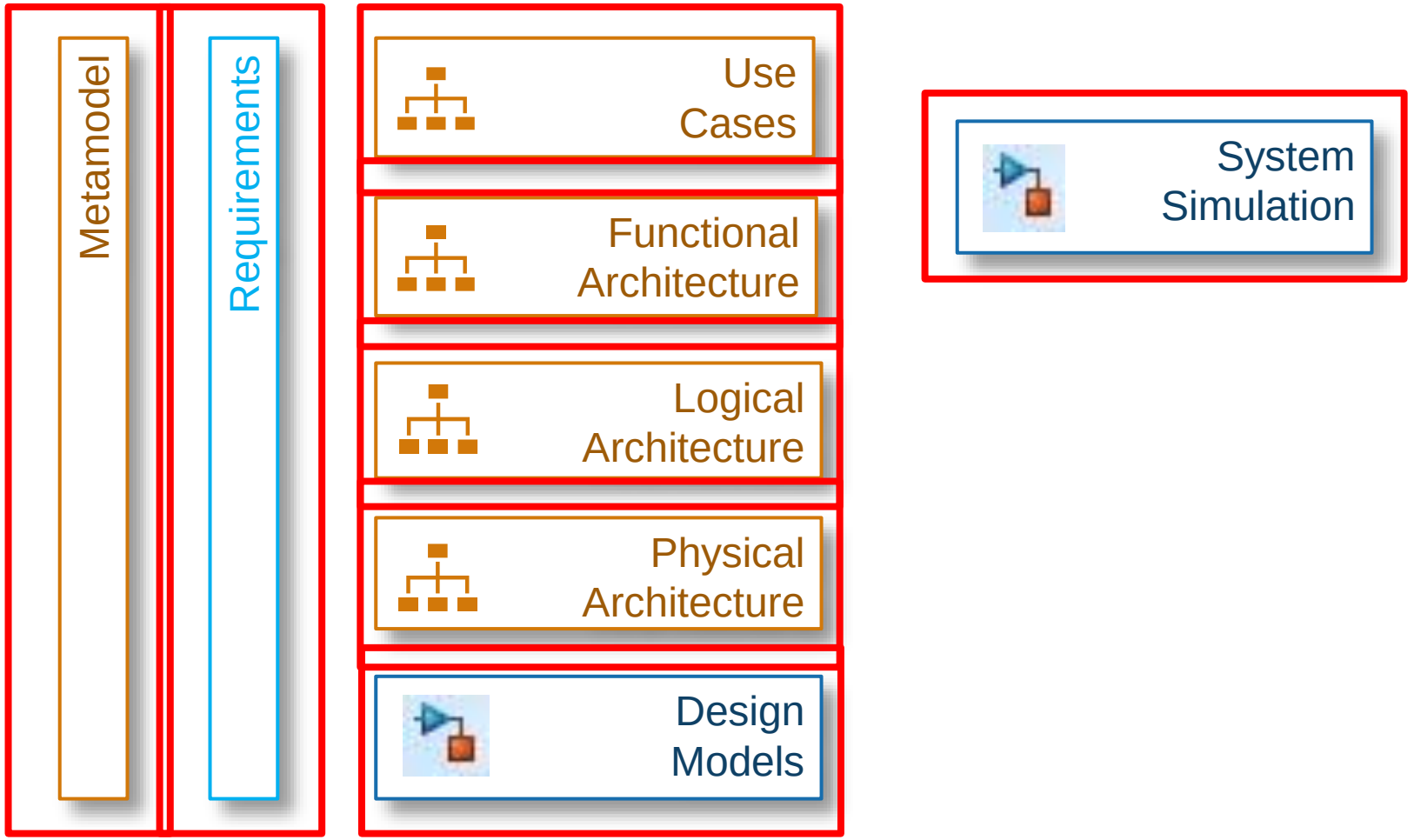
System Composer and SysML



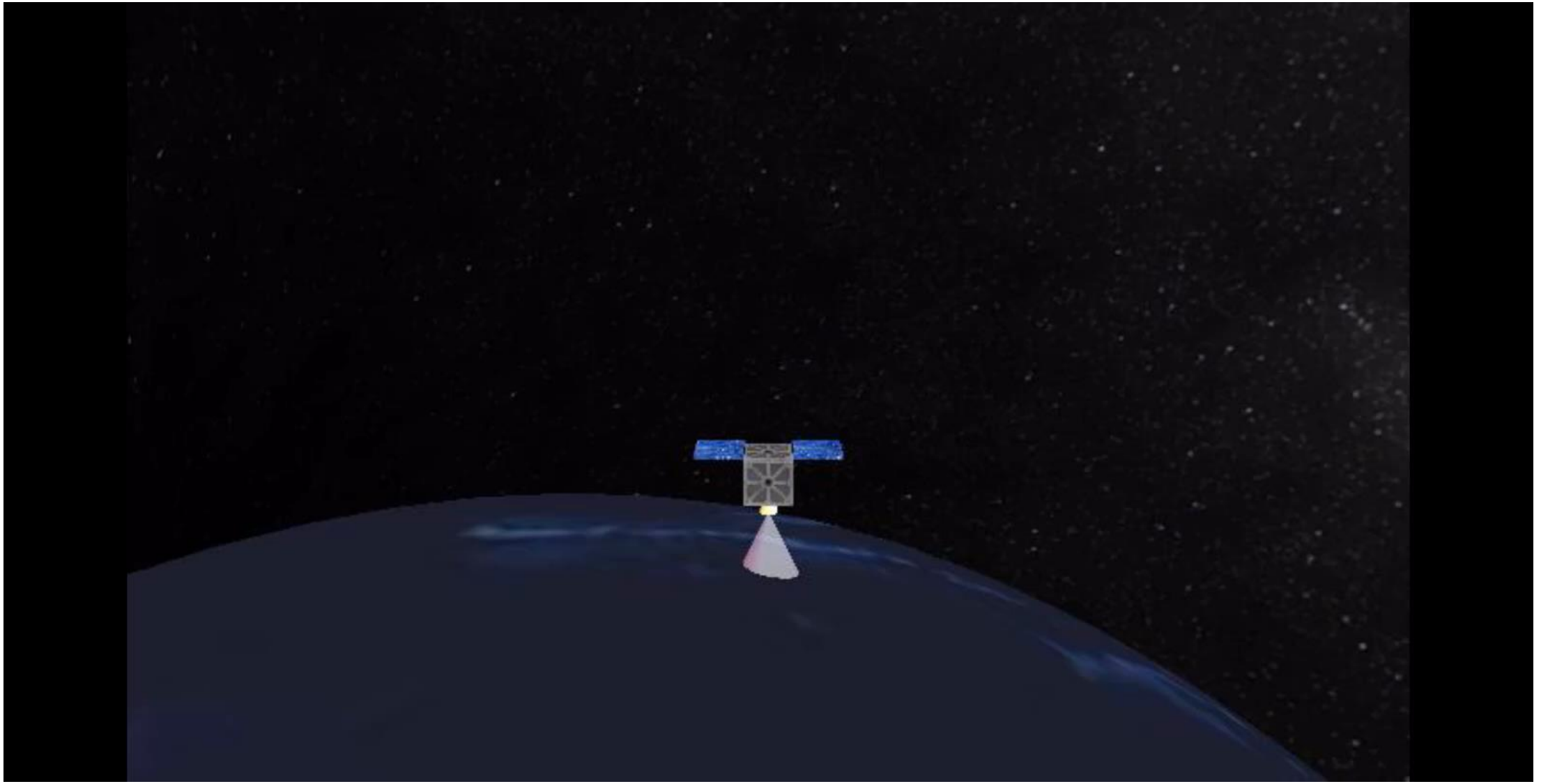
Bringing it all Together



Bringing it all Together



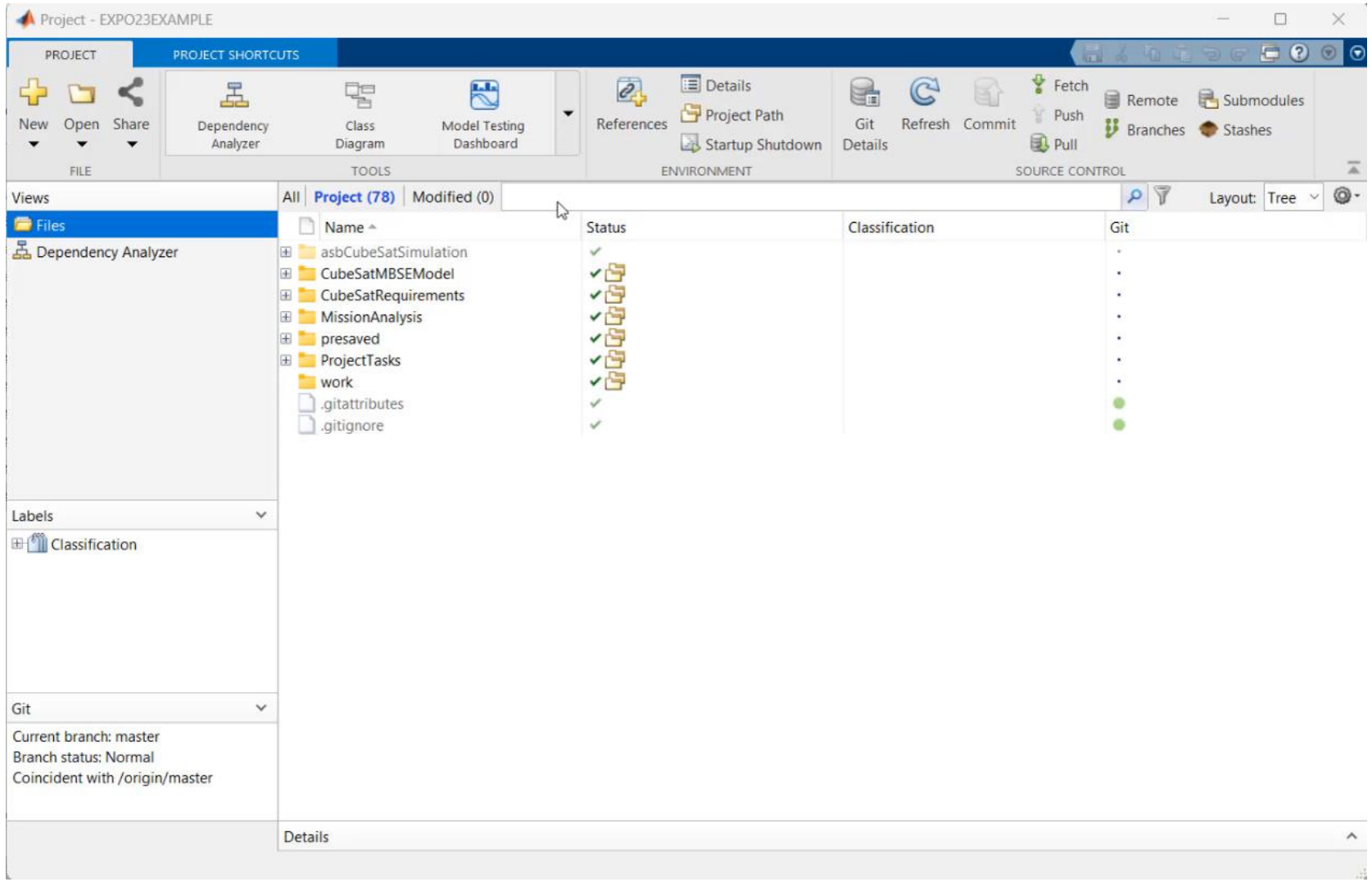
Mission



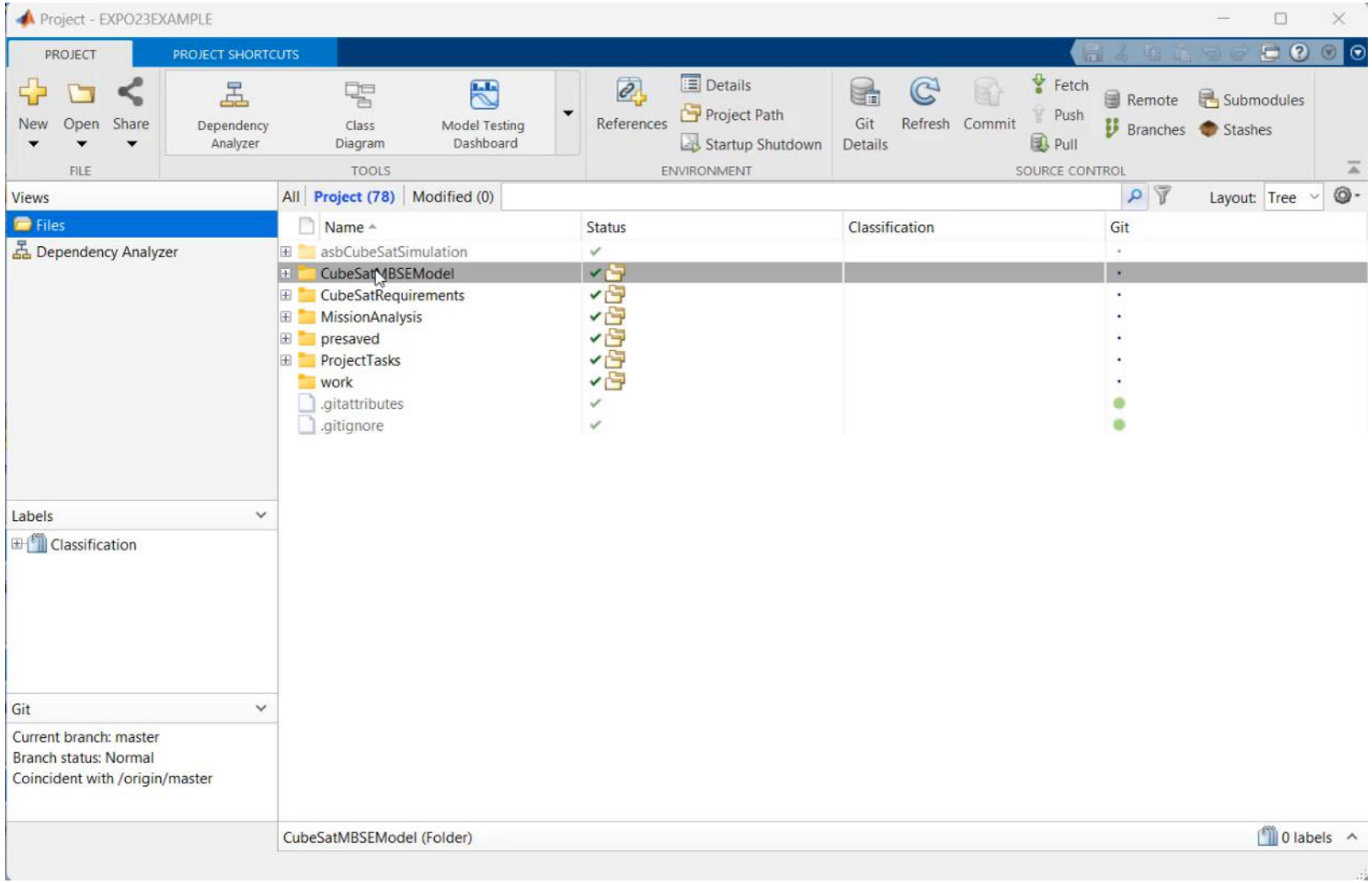
Core Concept: Projects

- ~~MBSE~~ PBSE: Project-Based Systems Engineering
- “Project” = a container for the design
  - Models
  - Data
  - Definitions
  - Requirements
  - Links
  - Tests
  - Reports
  - Code
- All items backed by a version control system (Git)

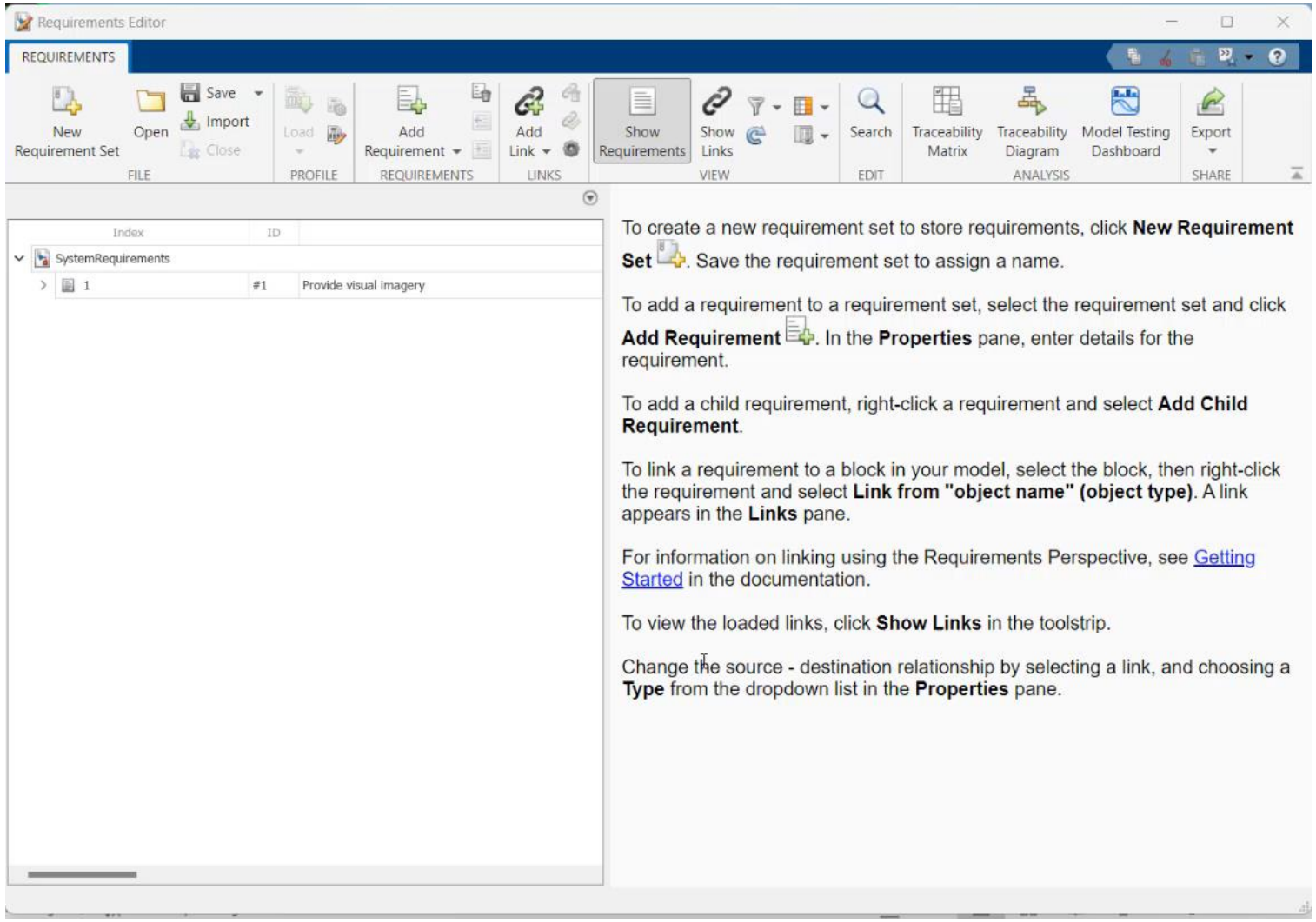
The Project


Project - EXPO23EXAMPLE
PROJECT
PROJECT SHORTCUTS
New
Open
Share
FILE
Dependency Analyzer
Class Diagram
Model Testing Dashboard
TOOLS
References
Details
Project Path
Startup Shutdown
ENVIRONMENT
Git Details
Refresh
Commit
Fetch
Push
Pull
Remote
Branches
Submodules
Stashes
SOURCE CONTROL
Views
Files
Dependency Analyzer
All
Project (78)
Modified (0)
Layout:
Tree
Name
Status
Classification
Git
asbCubeSatSimulation
CubeSatMBSEModel
CubeSatRequirements
MissionAnalysis
presaved
ProjectTasks
work
.gitattributes
.gitignore
Labels
Classification
Git
Current branch: master
Branch status: Normal
Coincident with /origin/master
Details

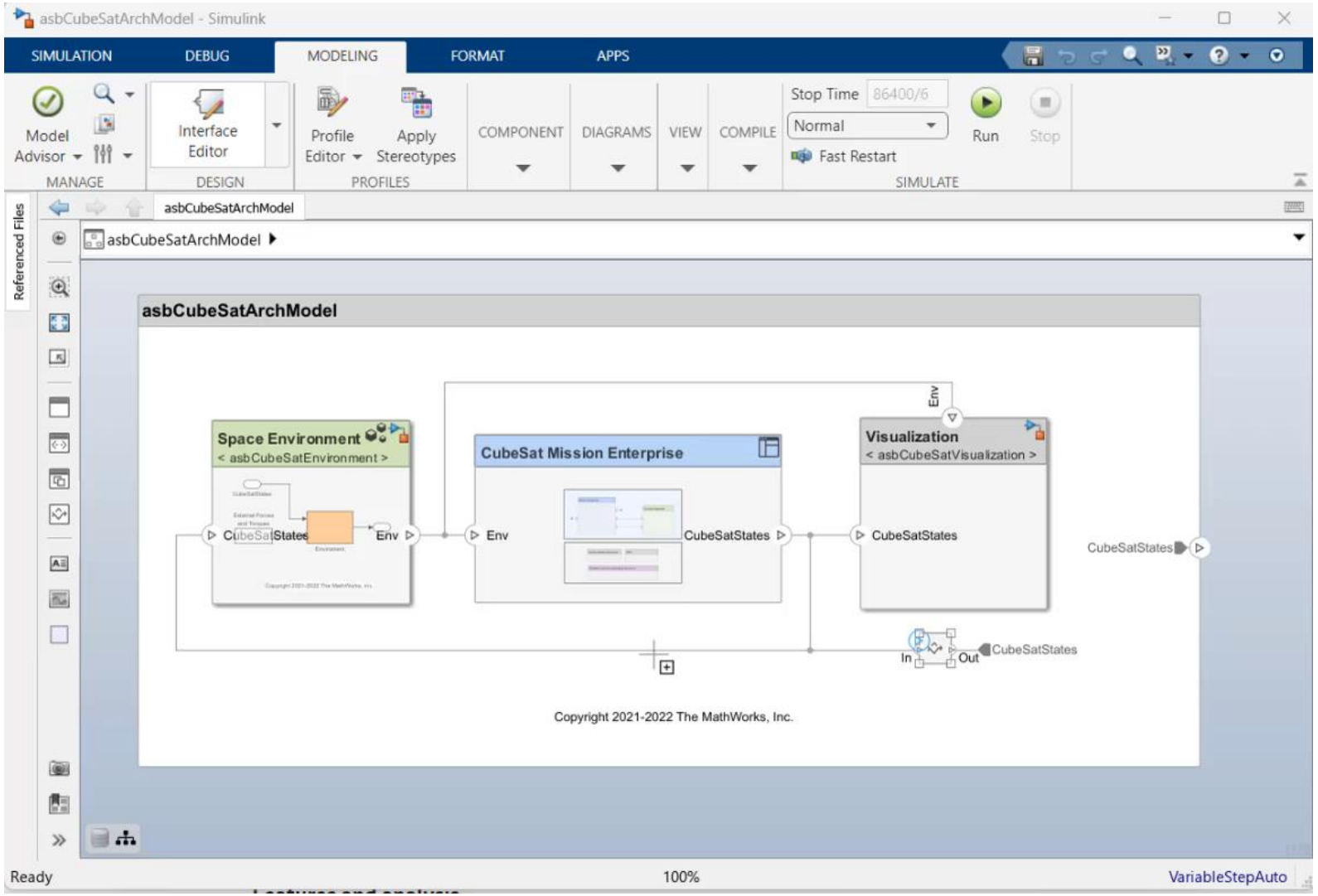
Project Dependencies



System Requirements

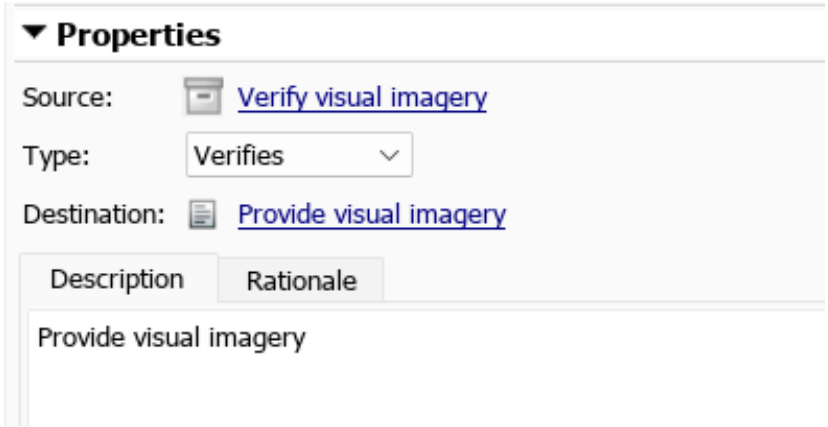


System Model

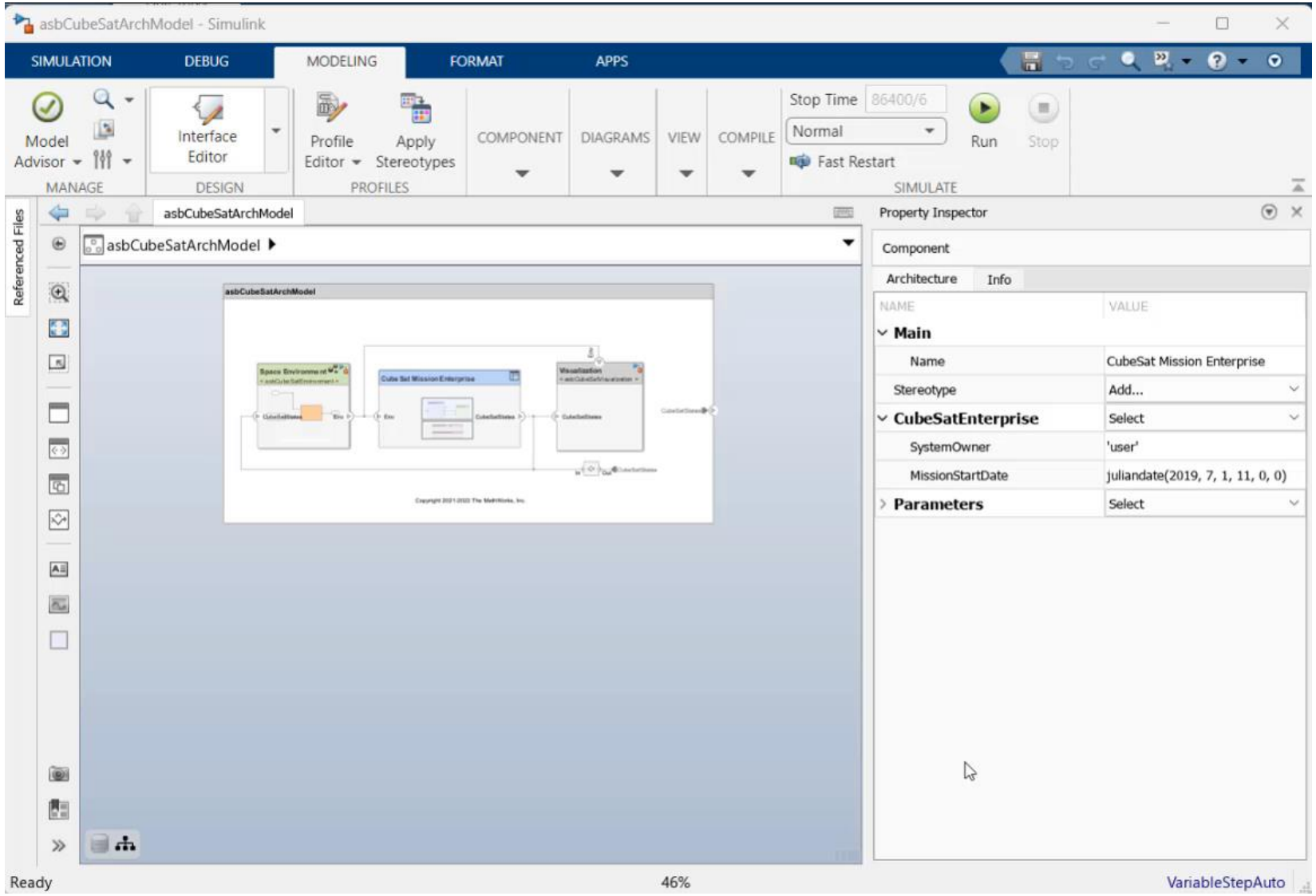


Traceability

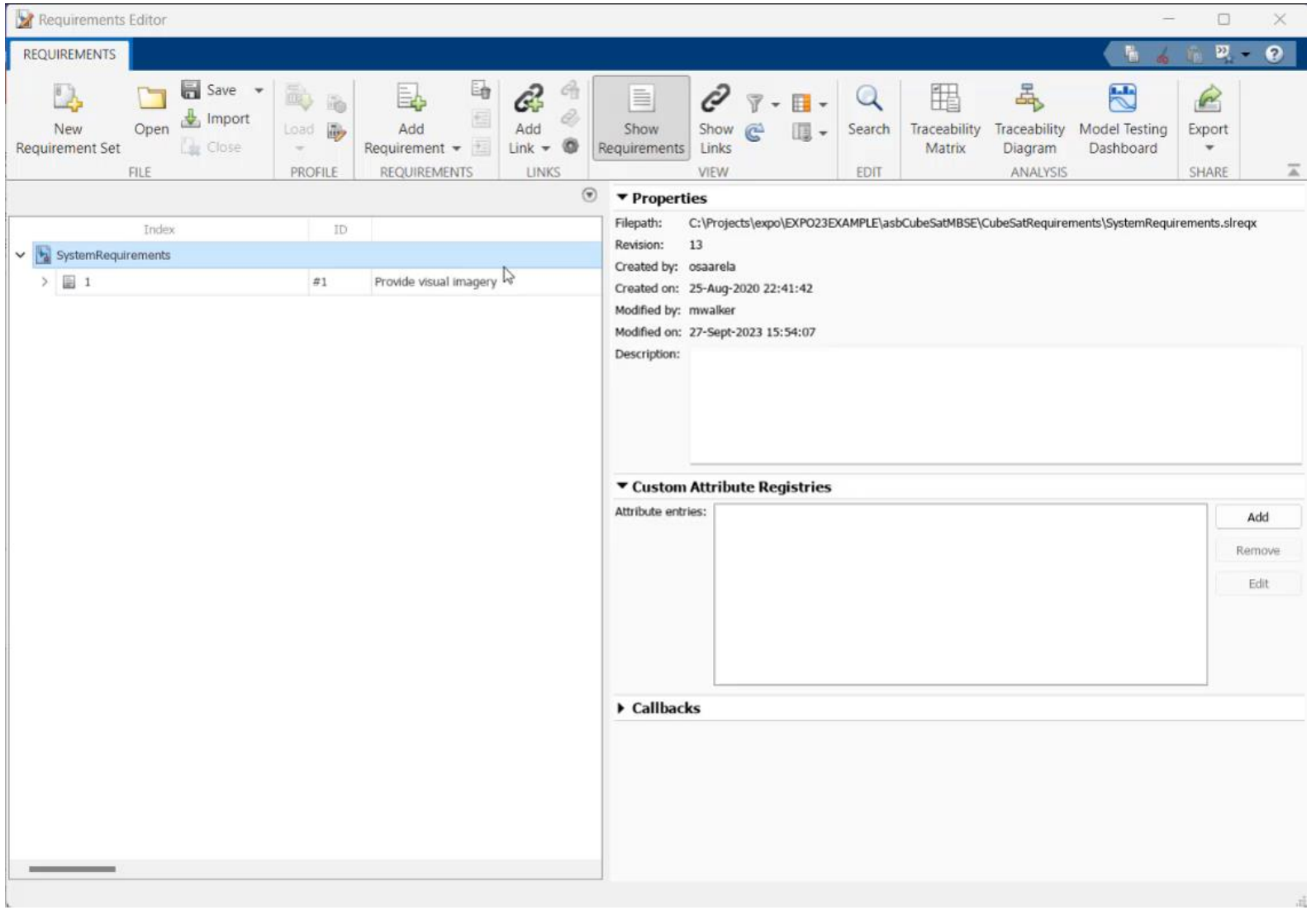
- The “Digital Thread” is built on a link primitive
  - Relates arbitrary things
    - Requirement, model, model element, test case, MATLAB code, C/C++ code
    - Custom targets, e.g. external SysML tool
  - Special types
    - Simulink or Stateflow implementation
    - Allocation
  - Categorised
    - Relate, Implement, Verify, Derive, Refine, Confirm
    - Custom
  - Directional
  - Traceable / reportable
  - Mergeable



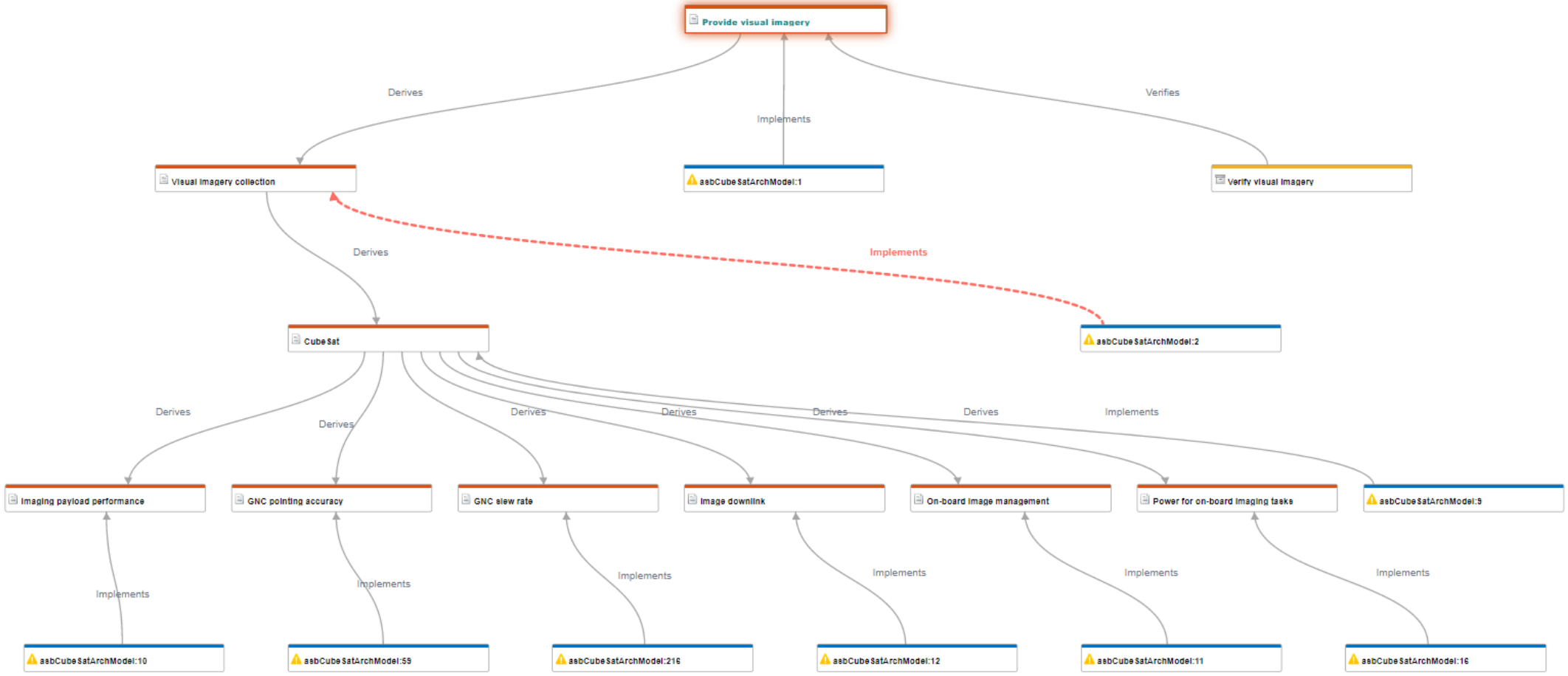
Links


asbCubeSatArchModel - Simulink
SIMULATION
DEBUG
MODELING
FORMAT
APPS
Model Advisor
Interface Editor
Profile Editor
Apply Stereotypes
COMPONENT
DIAGRAMS
VIEW
COMPILE
Stop Time
86400/6
Normal
Fast Restart
Run
Stop
MANAGE
DESIGN
PROFILES
SIMULATE
Referenced Files
asbCubeSatArchModel
Property Inspector
Component
Architecture
Info
NAME
VALUE
Main
Name
CubeSat Mission Enterprise
Stereotype
Add...
CubeSatEnterprise
Select
SystemOwner
'user'
MissionStartDate
juliandate(2019, 7, 1, 11, 0, 0)
Parameters
Select
Ready
46%
VariableStepAuto

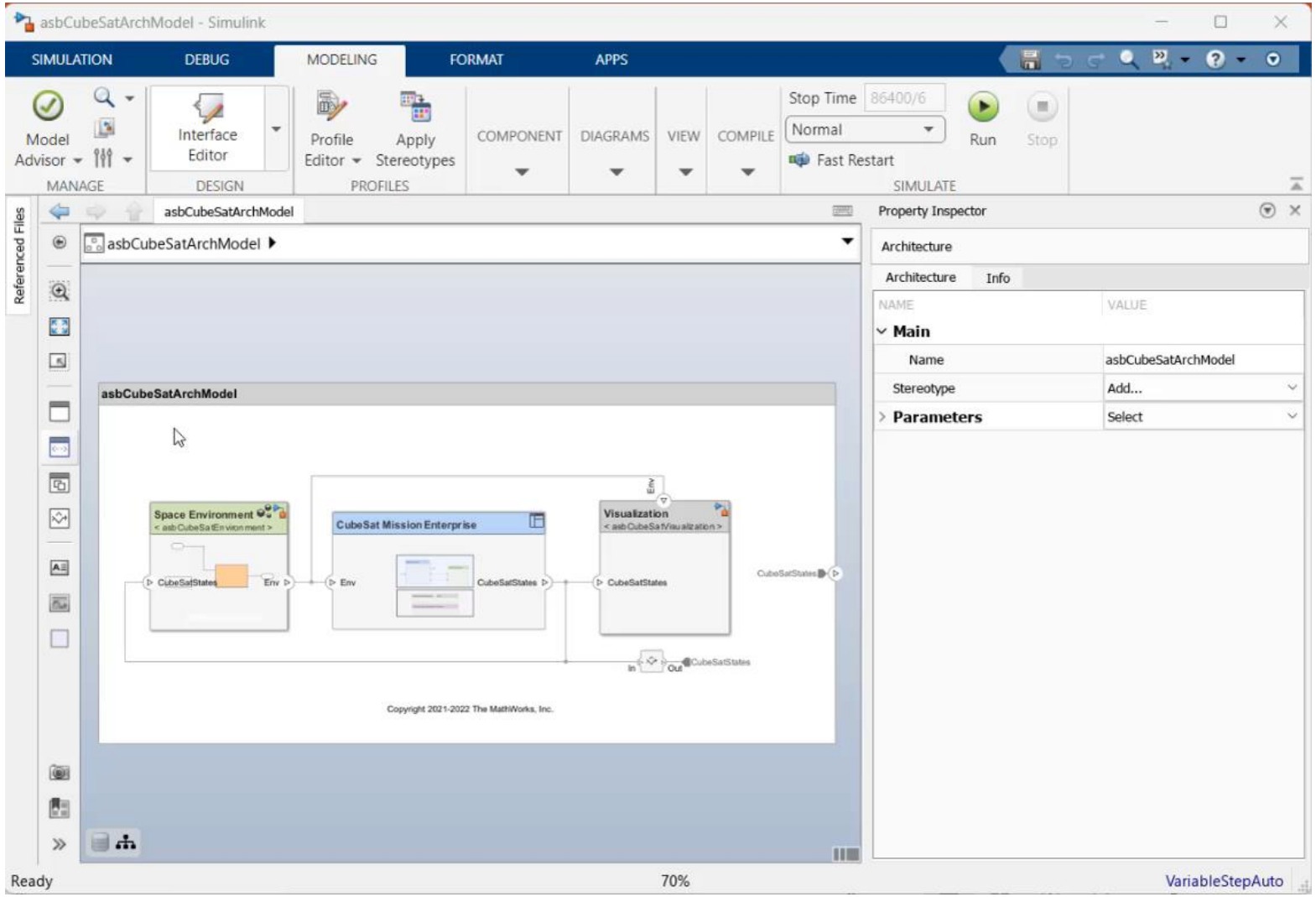
Link Traceability



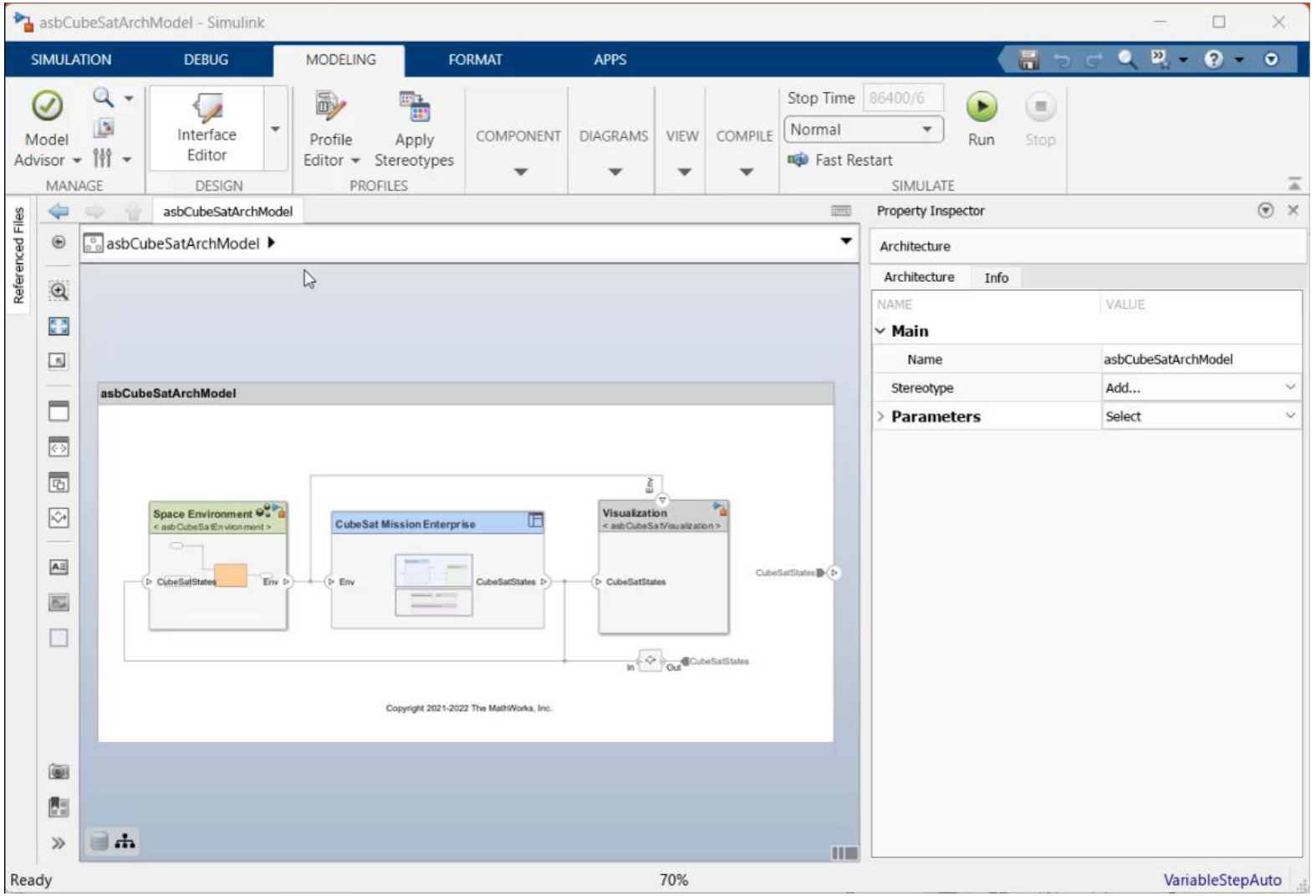
Link Traceability



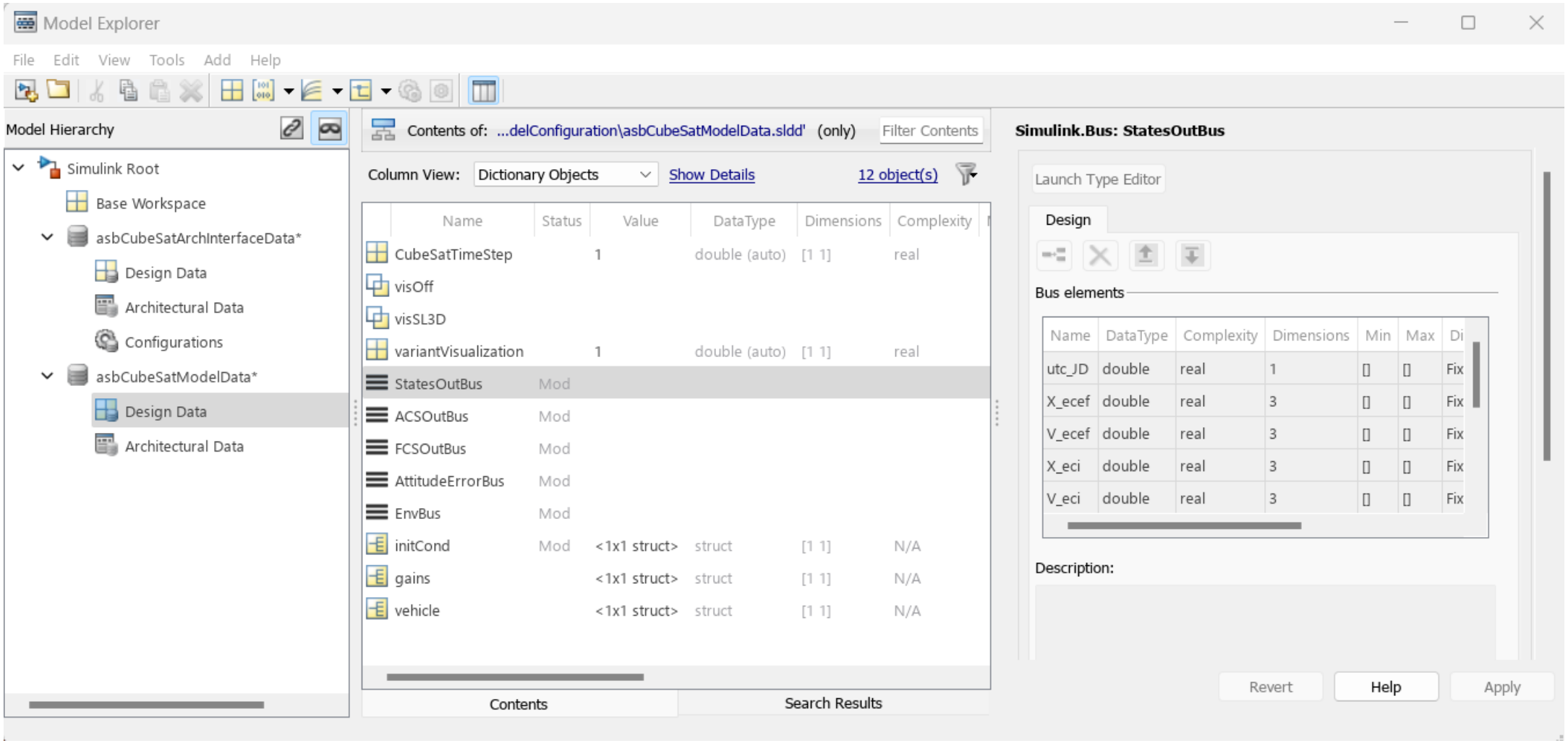
Stereotypes



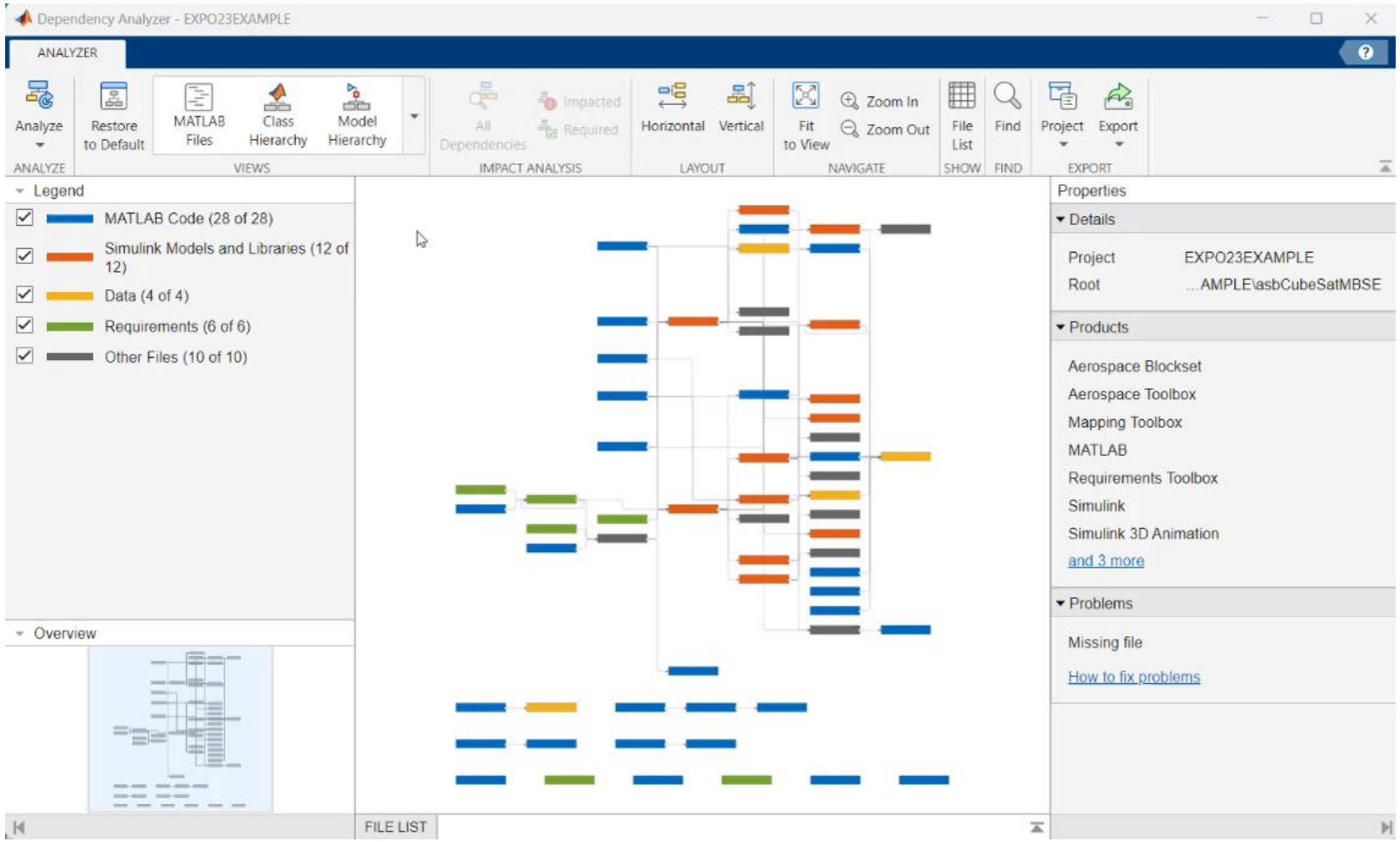
Shared Interfaces



Shared Interfaces

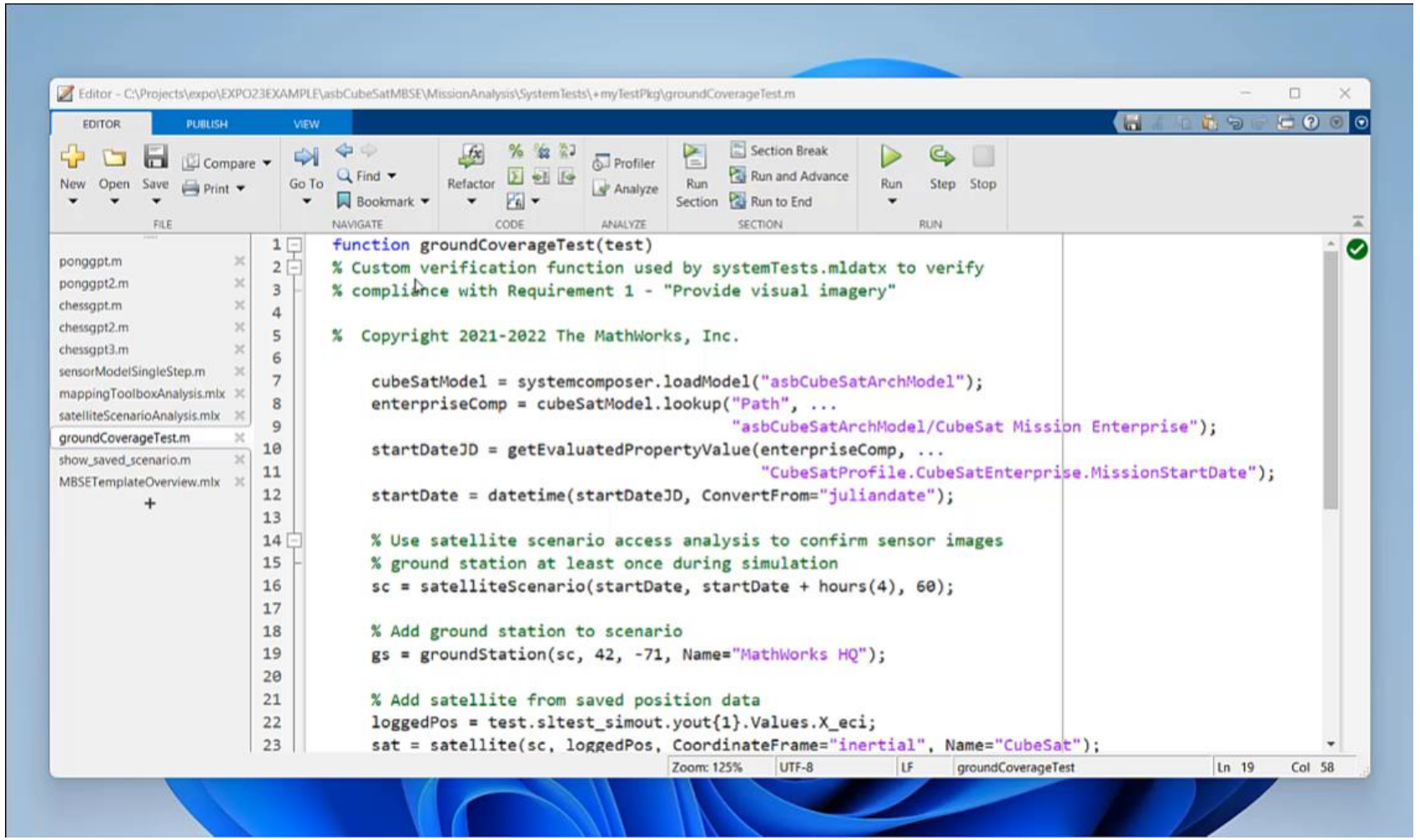


Shared Interfaces

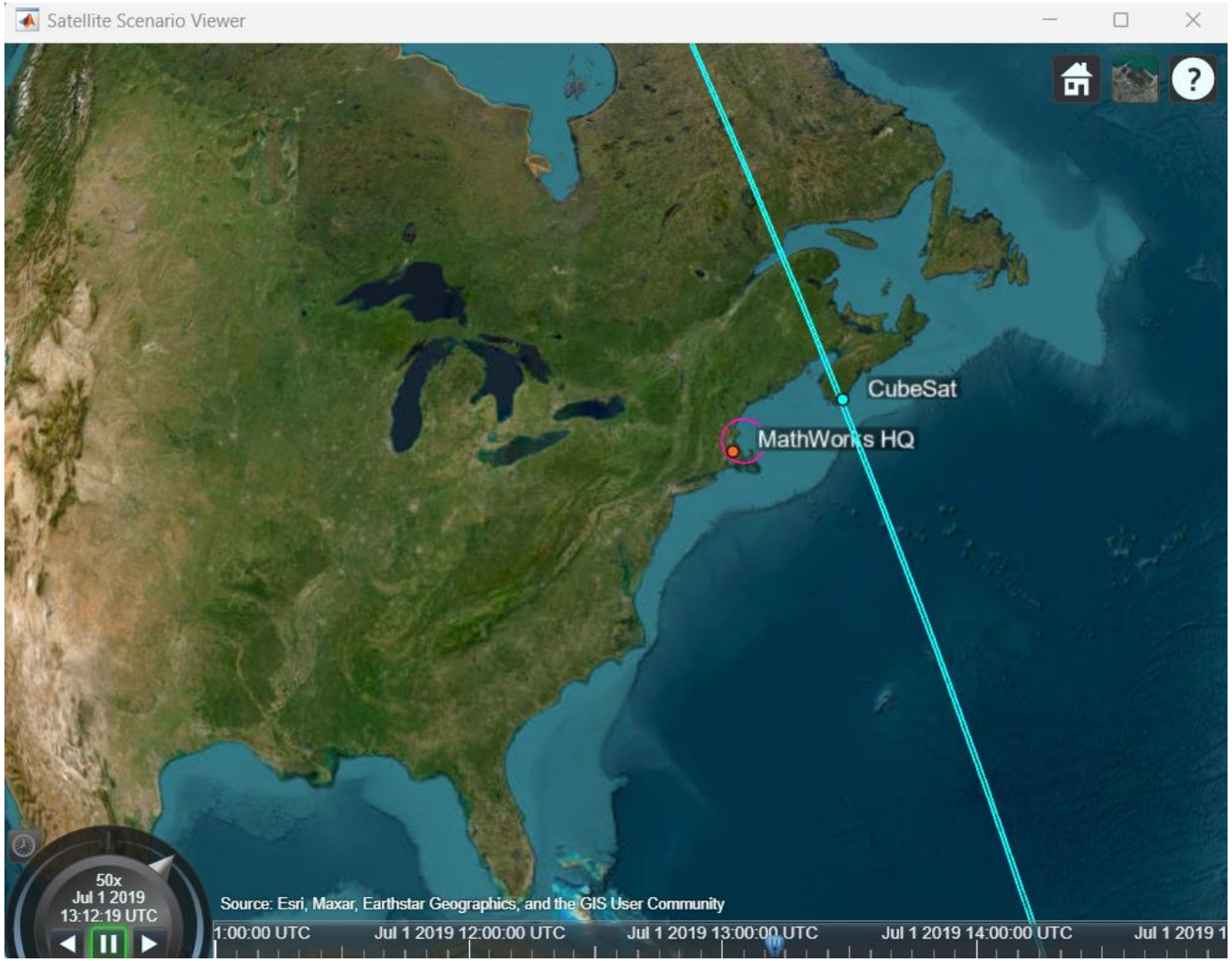


Parametric Studies / Analysis

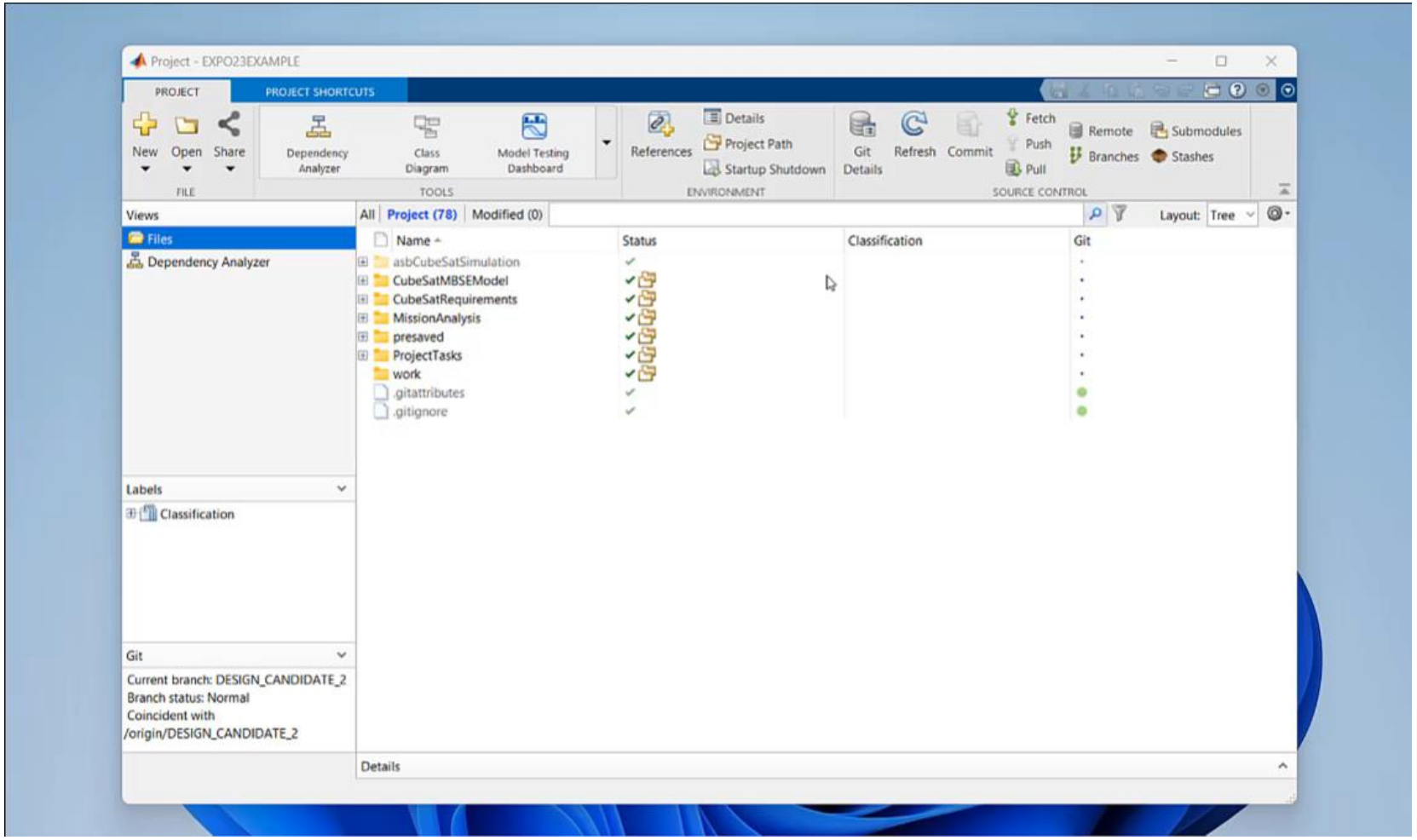
Parametric Studies / Analysis



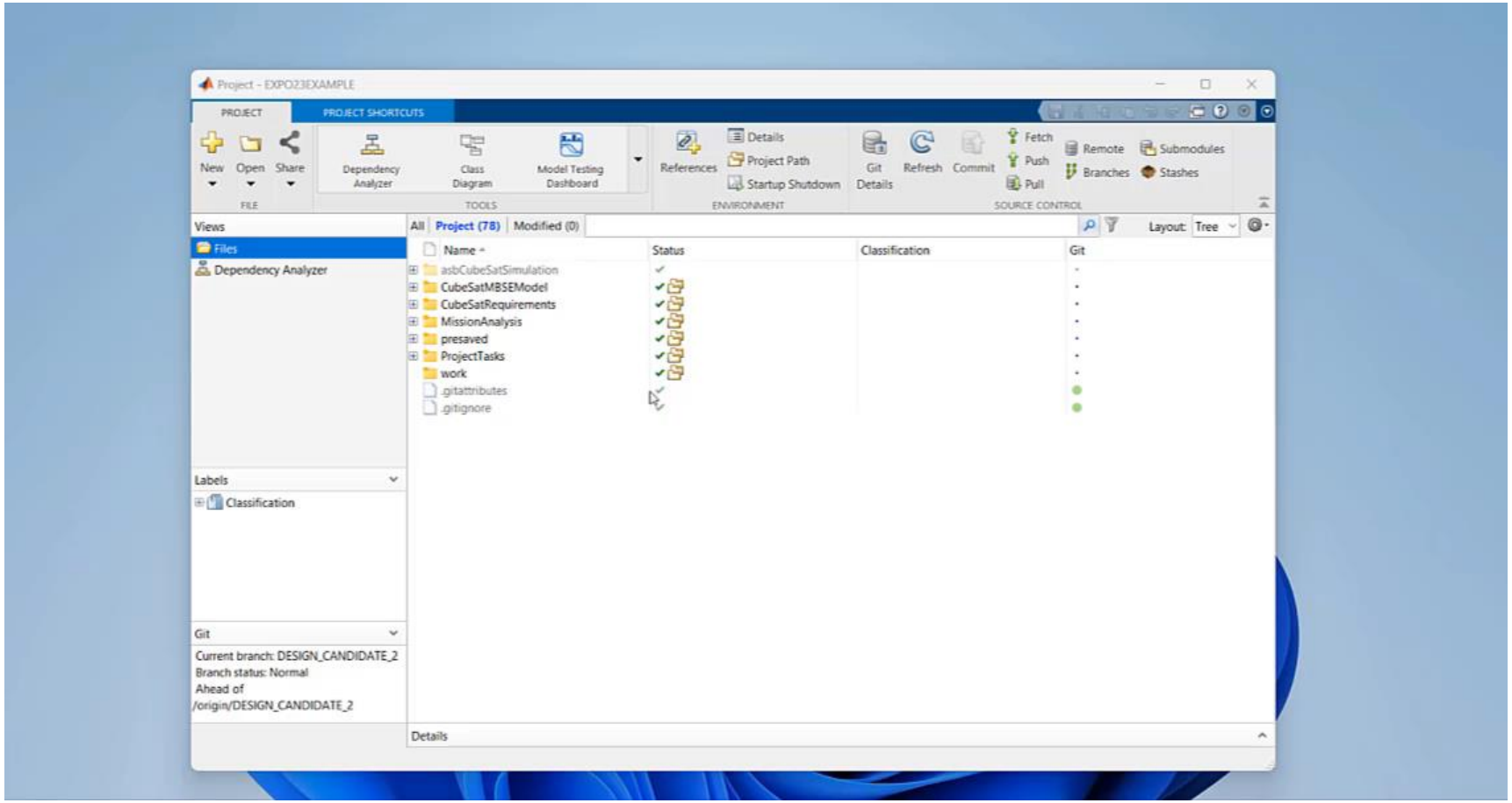
Parametric Studies / Analysis



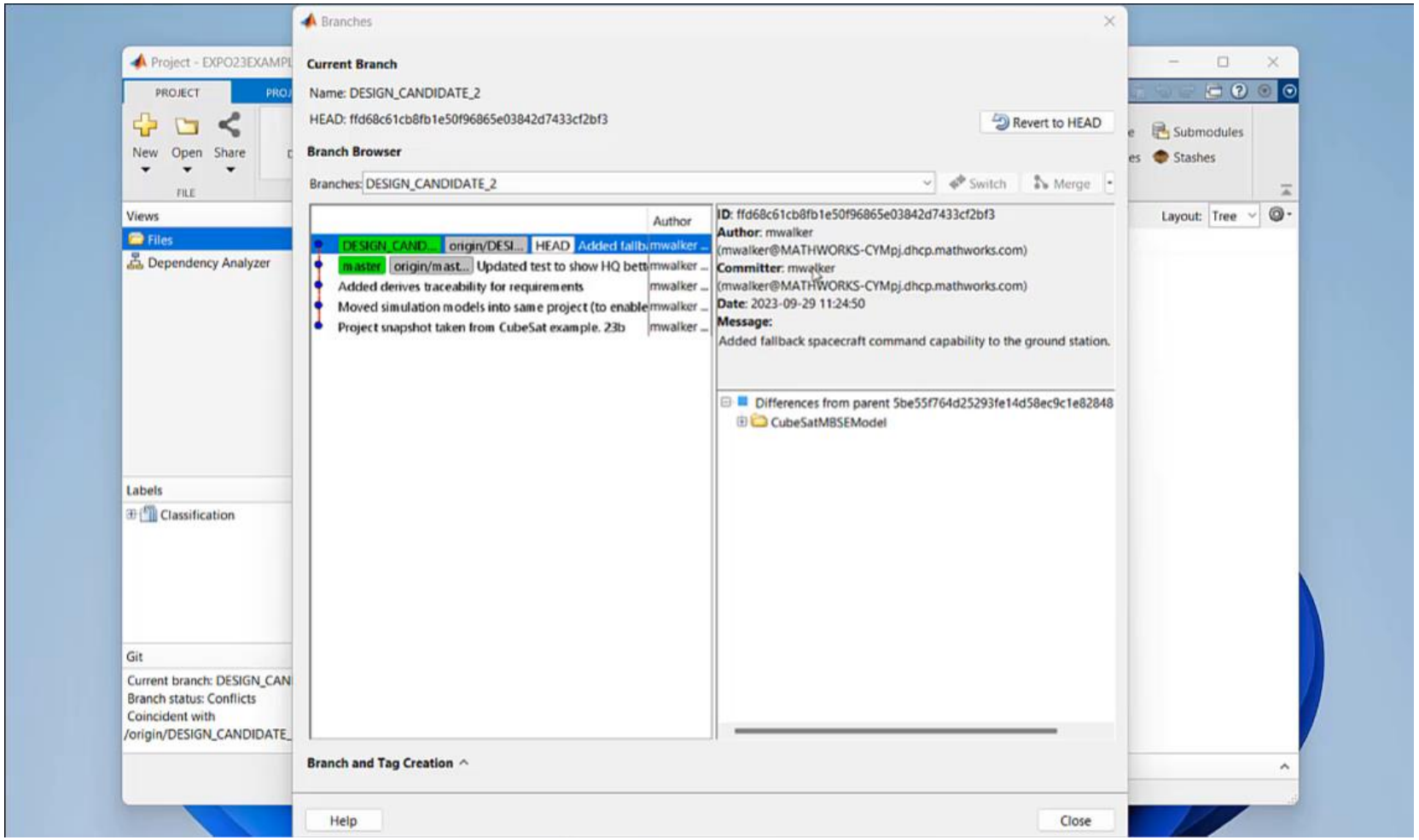
Concurrent Working



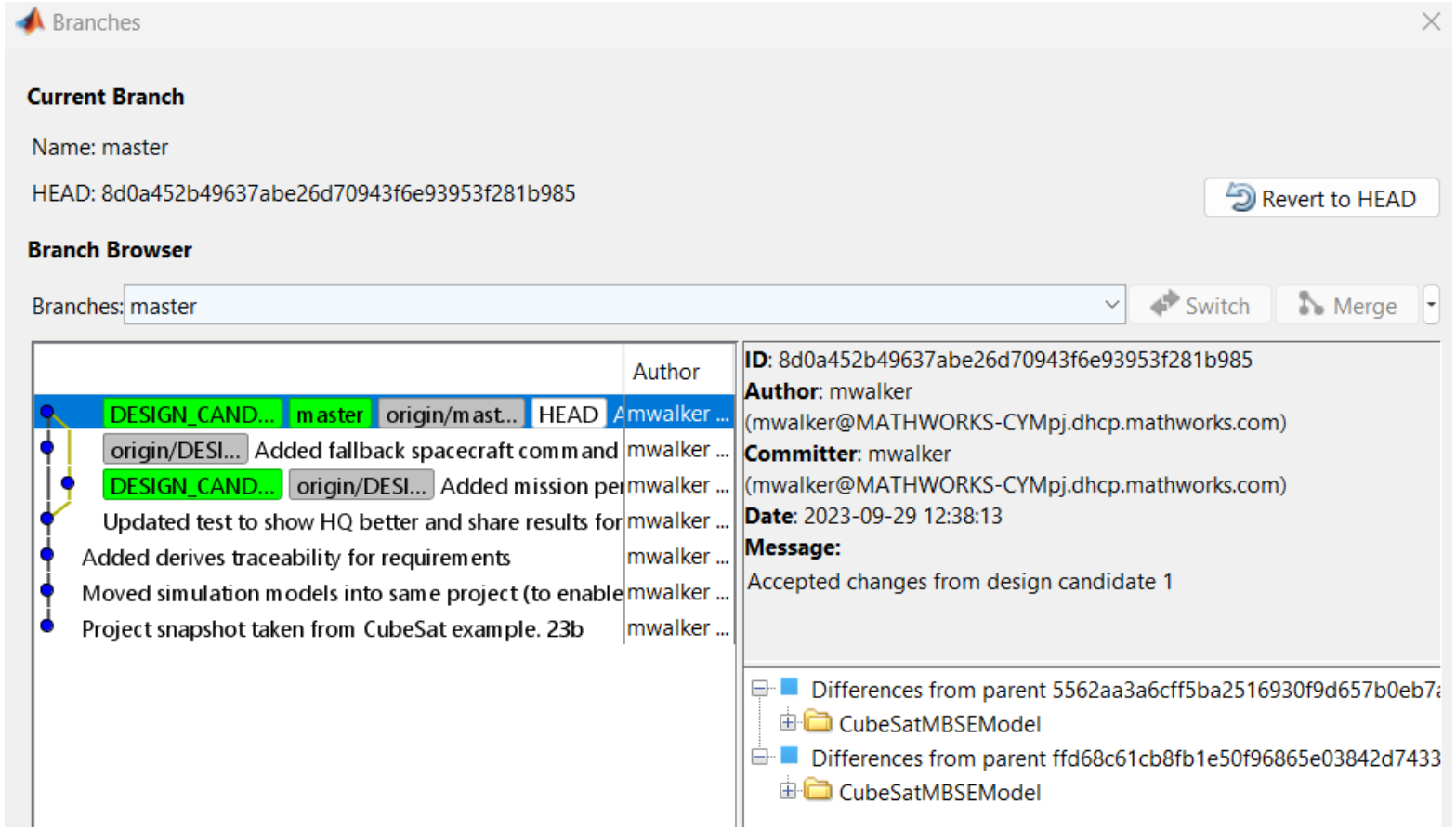
Comparisons



Concurrent Working



Concurrent Working



Multiple Systems Tools

Capella

integrity

ARTiSAN SOFTWARE

MagicDraw

CAMEO SYSTEMS MODELER

Ansys

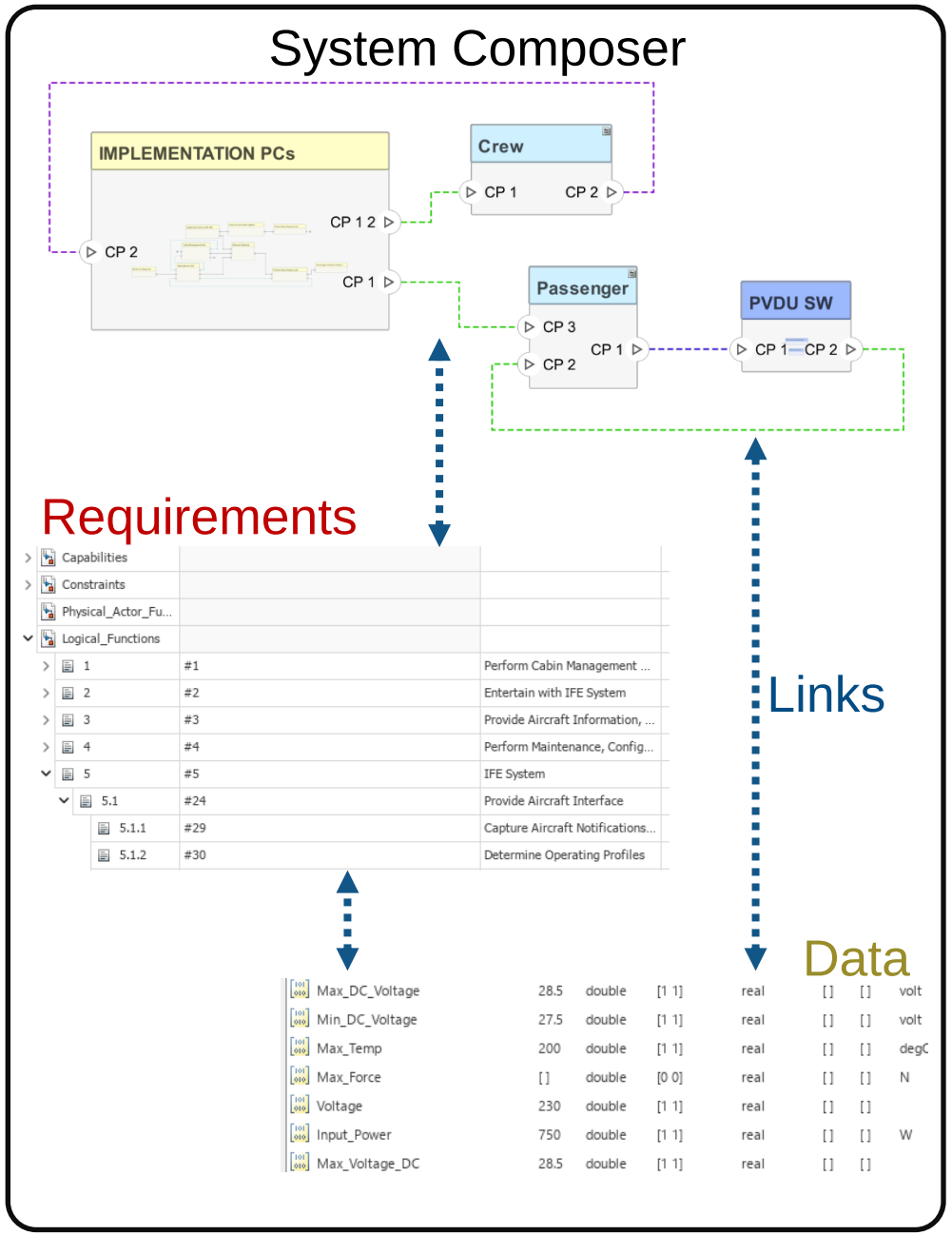
ENTERPRISE ARCHITECT SPARX SYSTEMS

CORE

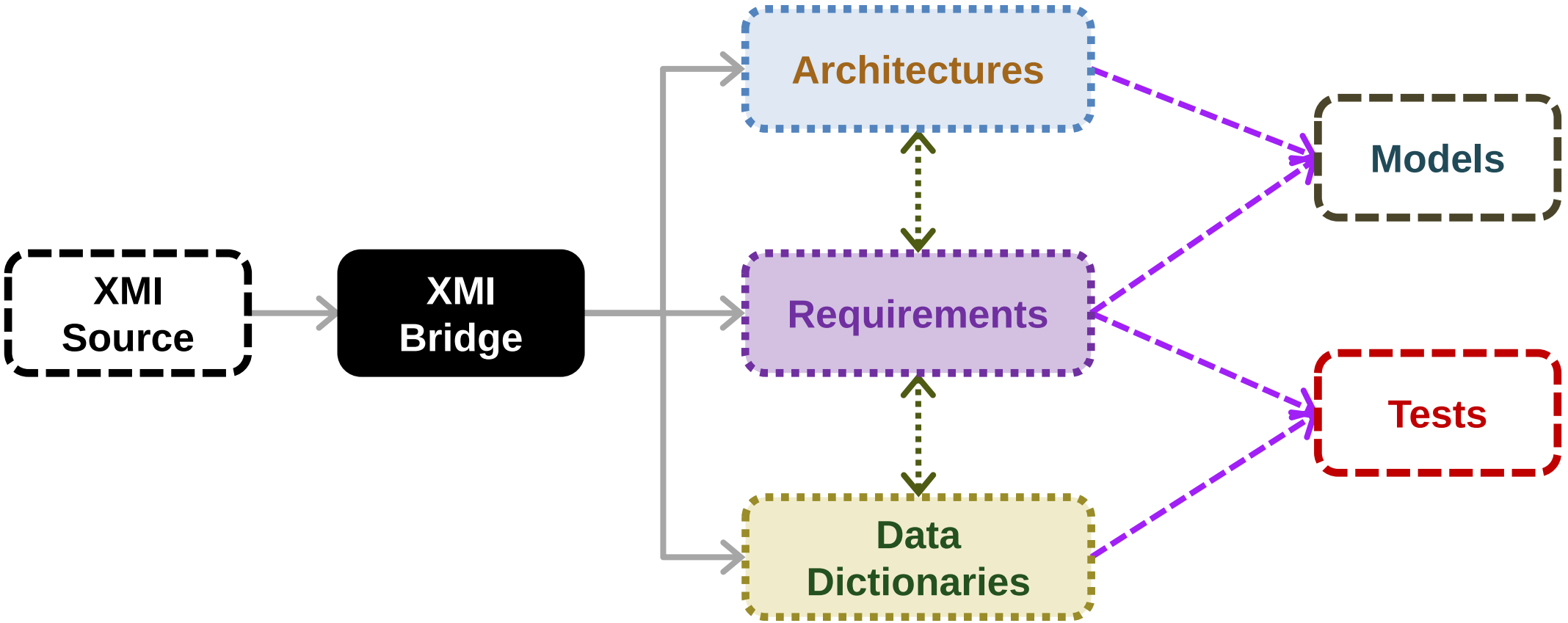
GENESYS 6.0

ReqIF Requirements Interchange Format

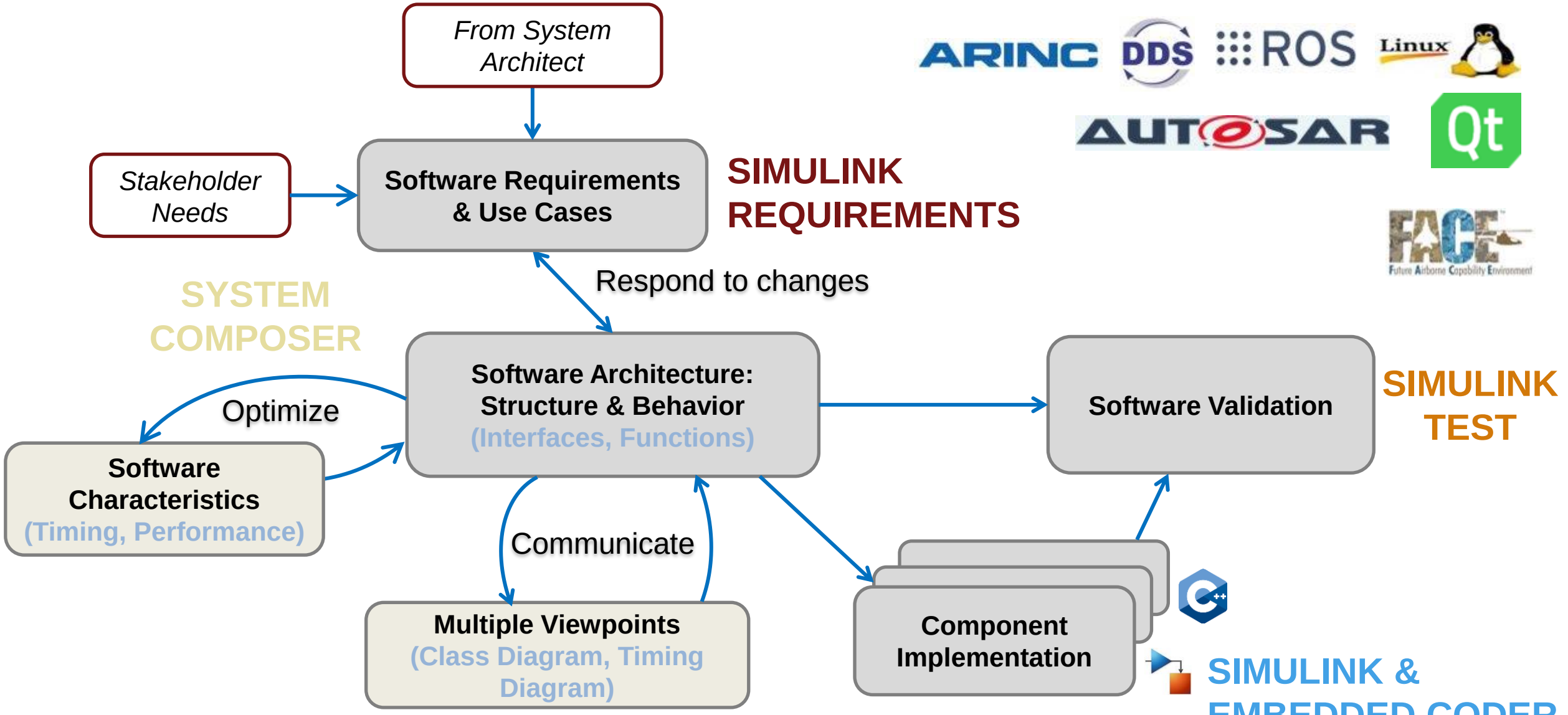
XMI



Linking Apples with Apples

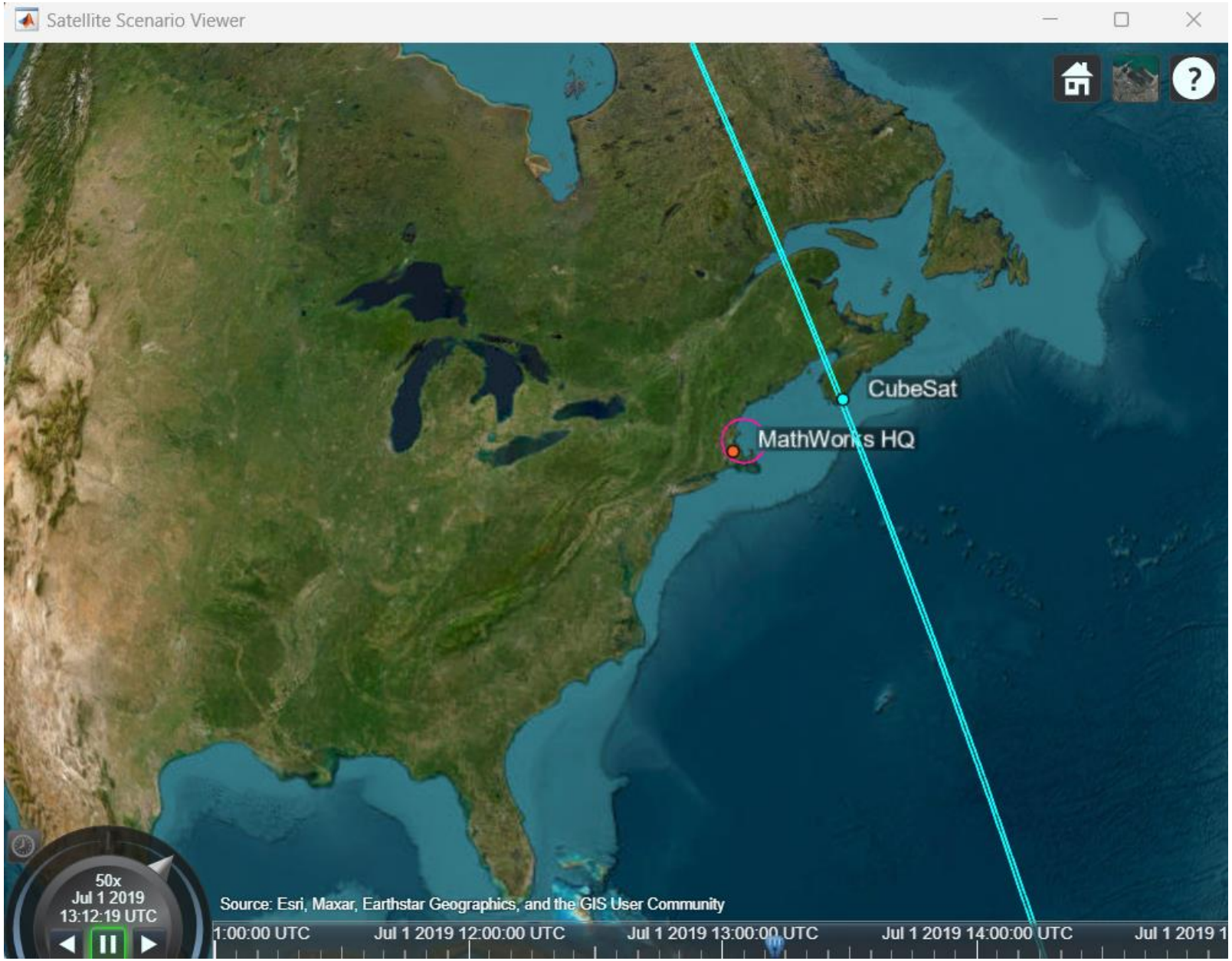


System Composer for Software Architectures



We Have Seen…

- Systems engineering and notation
- A top-down walk through the levels
- Traceability
- Versioning
- System simulation
- Concurrent working
- Connections to external tools


Satellite Scenario Viewer
CubeSat
MathWorks HQ
50x
Jul 1 2019
13:12:19 UTC
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community
1:00:00 UTC
Jul 1 2019 12:00:00 UTC
Jul 1 2019 13:00:00 UTC
Jul 1 2019 14:00:00 UTC
Jul 1 2019 1

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Thank you