Empowering the Digital Twin with Integrated Modeling and Simulation

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Topics

- Master Model: Requirements/Interface Management
- Functional Simulation
- Rapid Prototyping
- Hardware/Software In the Loop

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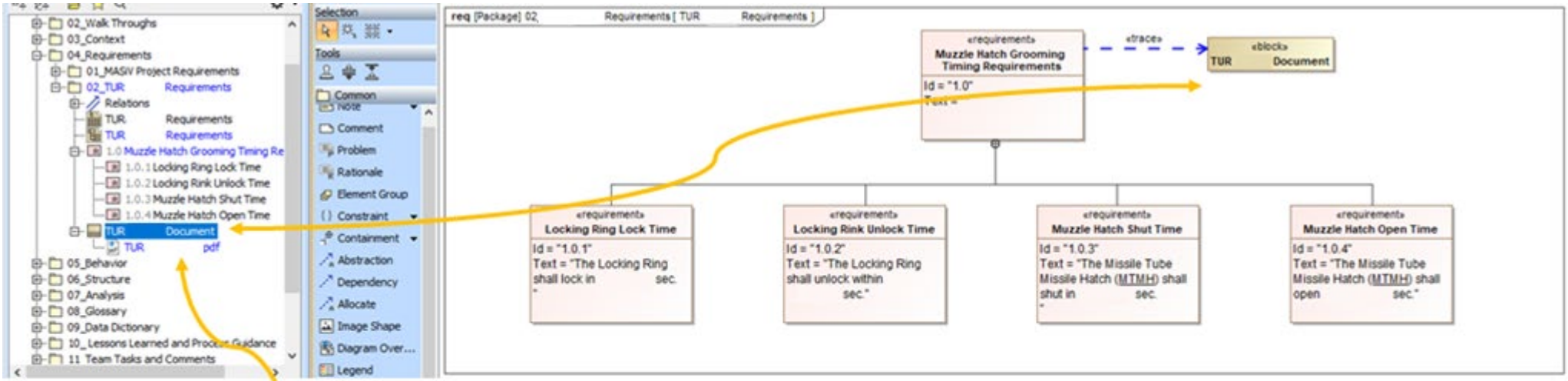
Requirements/Interface Management

- **Requirements for this Descriptive System Model (DSM) were derived from the Shipyard Installation Test Program (SITP) test procedure**



The SITP Test document that the requirements were derived from is attached to the model and can be opened from the tree if needed.

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Requirements/Interface Management

- **The requirements table displays the satisfy relationship from the Trident US/UK Replacement (TUR) Simulation Block to the requirements.**

Criteria

Scope (optional): Drag elements from the Model Browser ... Filter:

#	Name	Text	Traced To	Satisfied By
1	1.0 Muzzle Hatch Grooming Timing Requireme		TUR Document	
2	1.0.1 Locking Ring Lock Time	The Locking Ring shall lock in sec.	TUR Document	TUR Simulation
3	1.0.2 Locking Rink Unlock Time	The Locking Ring shall unlock within sec.	TUR Document	TUR Simulation
4	1.0.3 Muzzle Hatch Shut Time	The Missile Tube Missile Hatch (MTMH) shall shut in sec.	TUR Document	TUR Simulation
5	1.0.4 Muzzle Hatch Open Time	The Missile Tube Missile Hatch (MTMH) shall open in sec.	TUR Document	TUR Simulation

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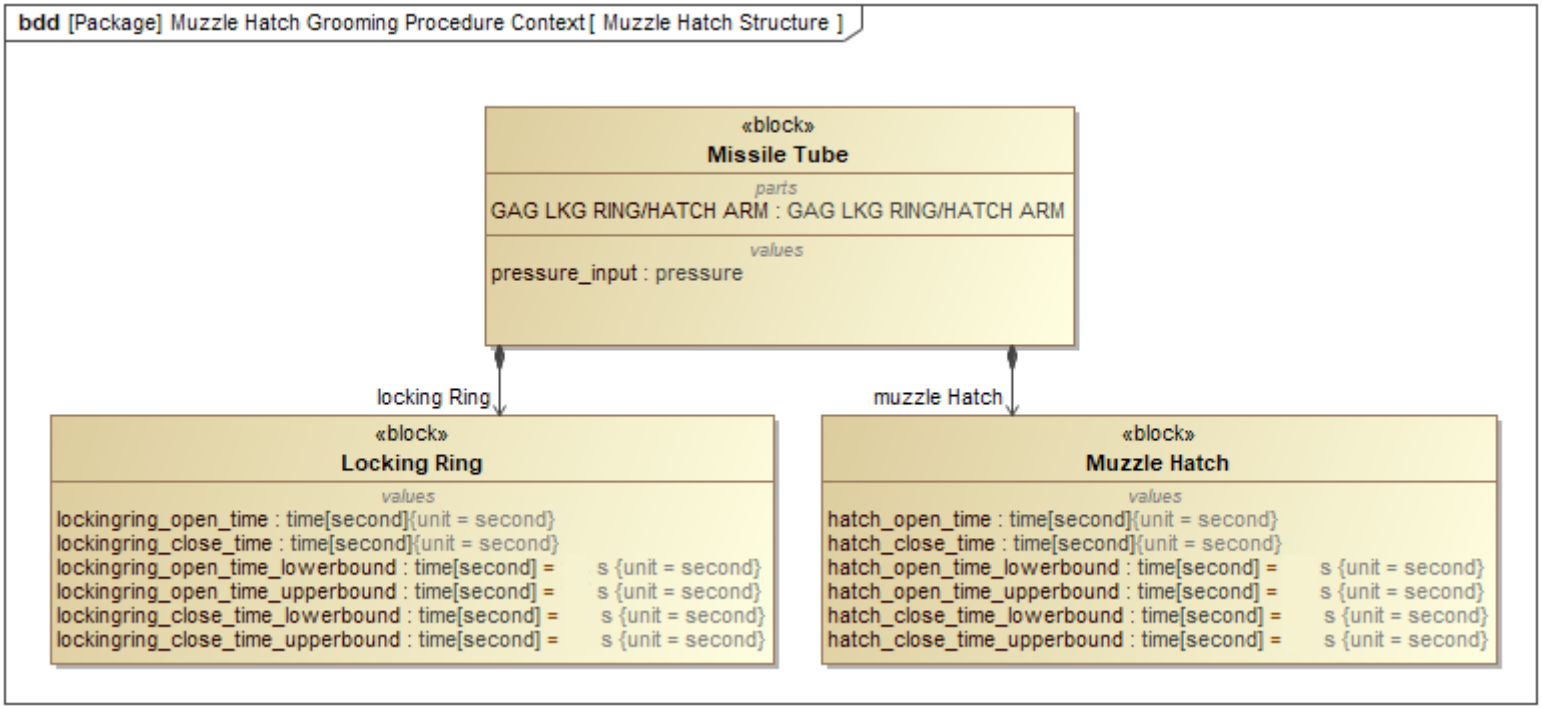
Requirements/Interface Management

- **Block Definition Diagram (BDD) shows blocks and their value properties that will be used by Phoenix ModelCenter.**



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Functional Simulation

- Phoenix ModelCenter integrates the simulation and DSM
  - Passes input of pressure from the DSM to Simscape
  - Receives output of closing/opening times from simulation
  - Compares against constraints (from DSM)
  - Displays metrics
- Two examples to follow: 1 fail and 1 pass

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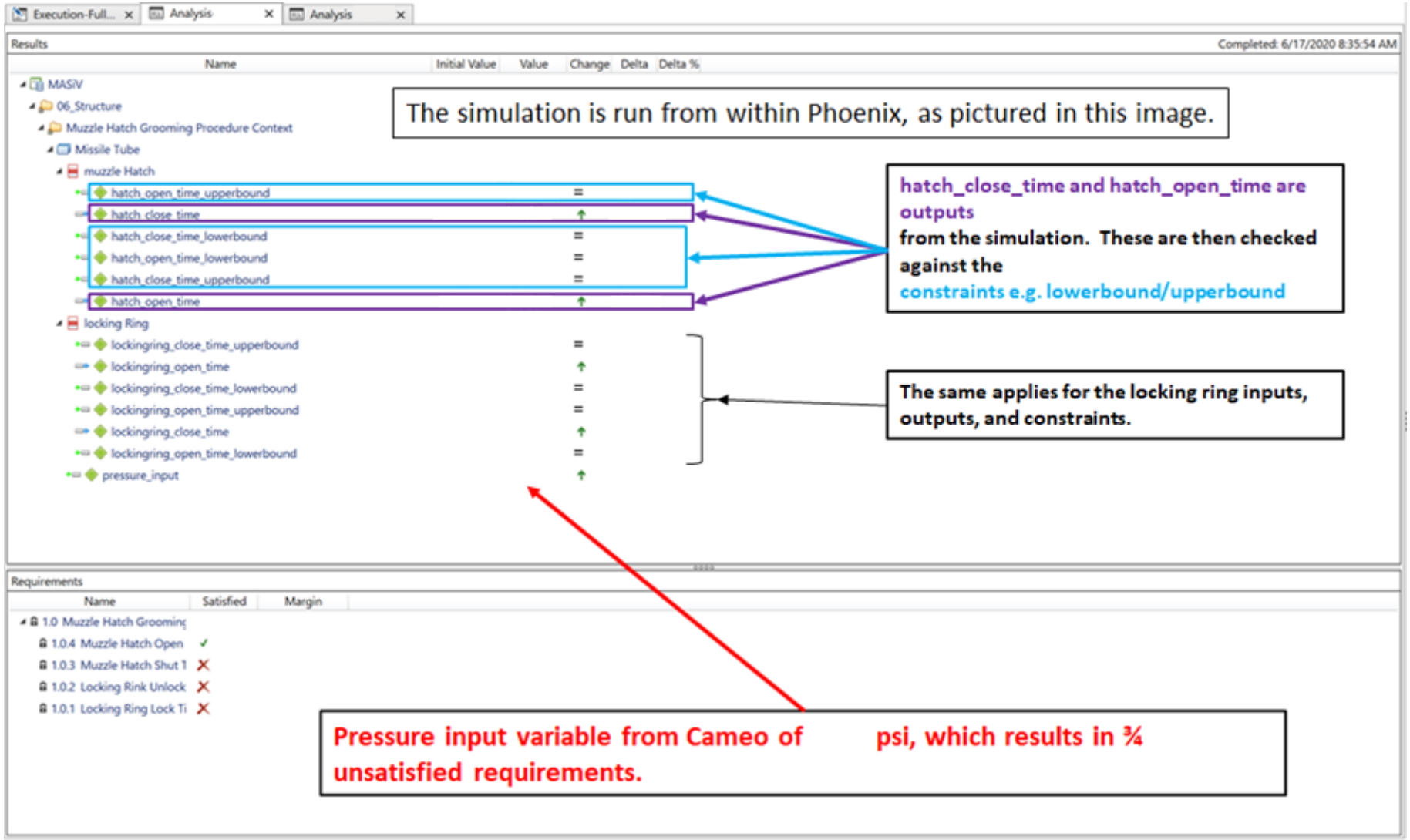
Unsuccessful Simulation Metrics



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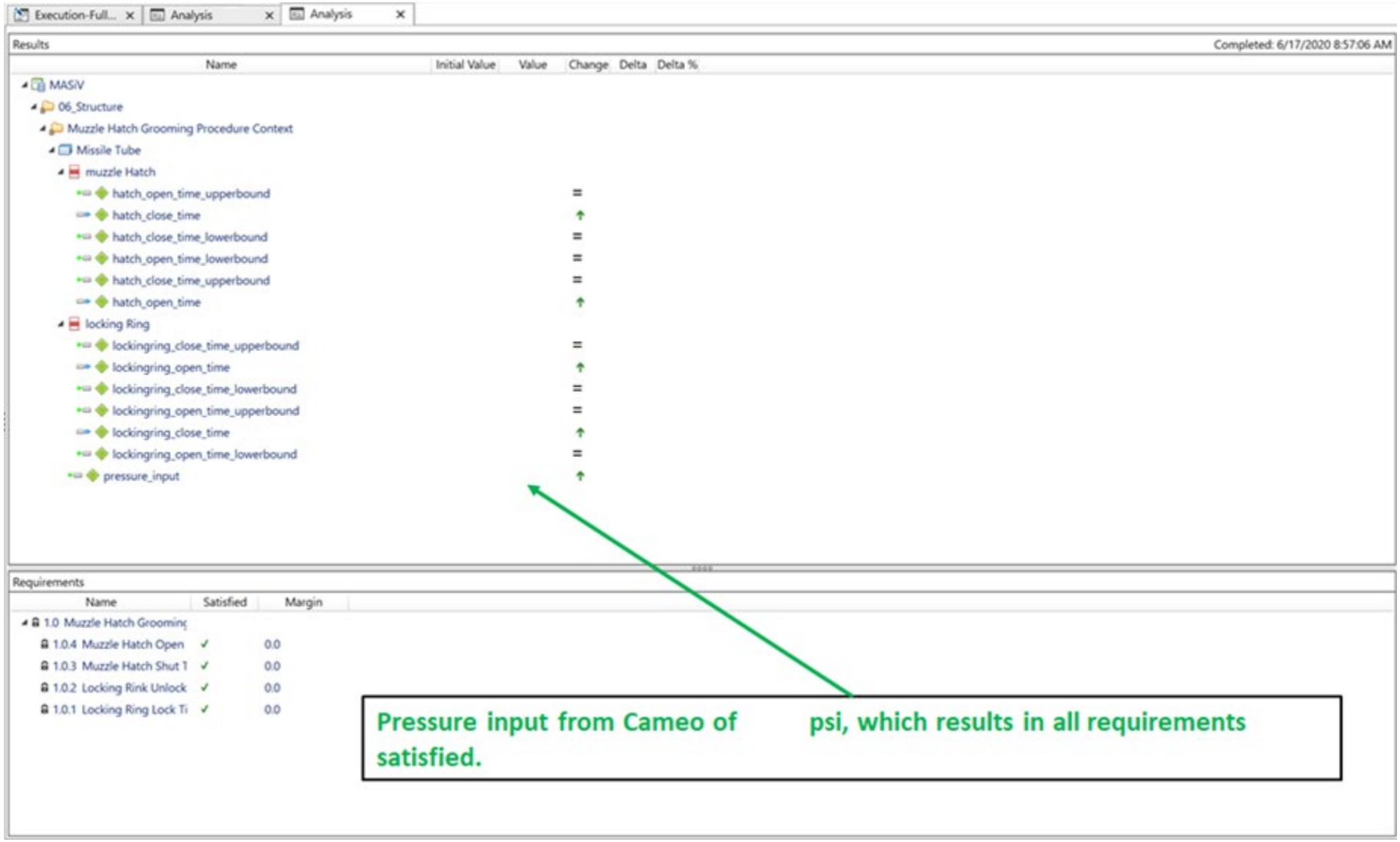
Successful Simulation Metrics



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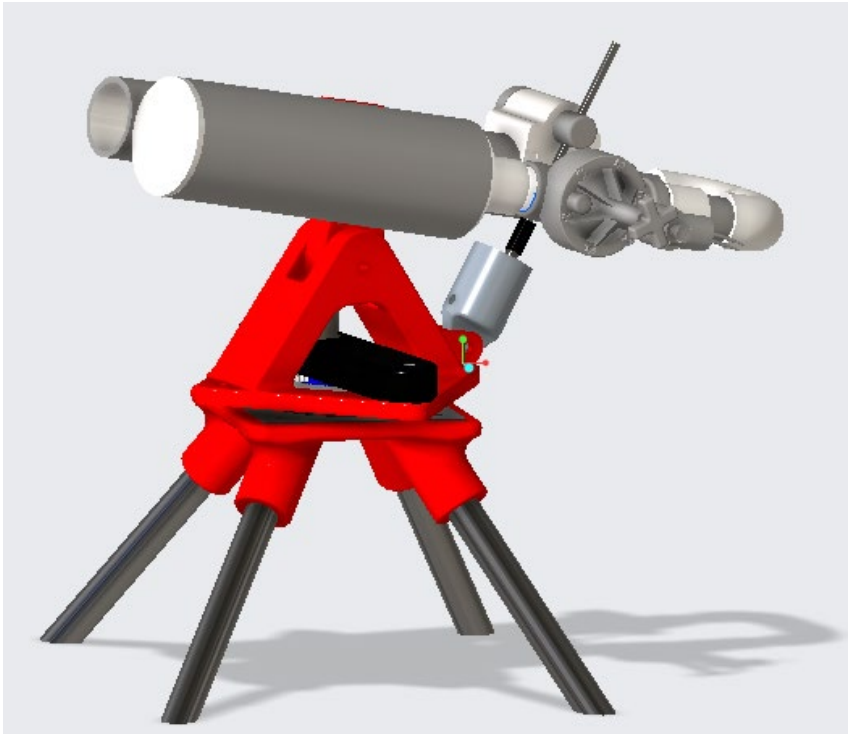
Rapid Prototyping

- 3D print/build prototype for testing remote data acquisition over Defense Research and Engineering Network (DREN) network.



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Hardware/Software In the Loop

- Use LabVIEW RT (Real Time) software for remote connection to prototype
  - User Interface
    - Control from both Client & Server side
  - Data acquisition from microcontroller

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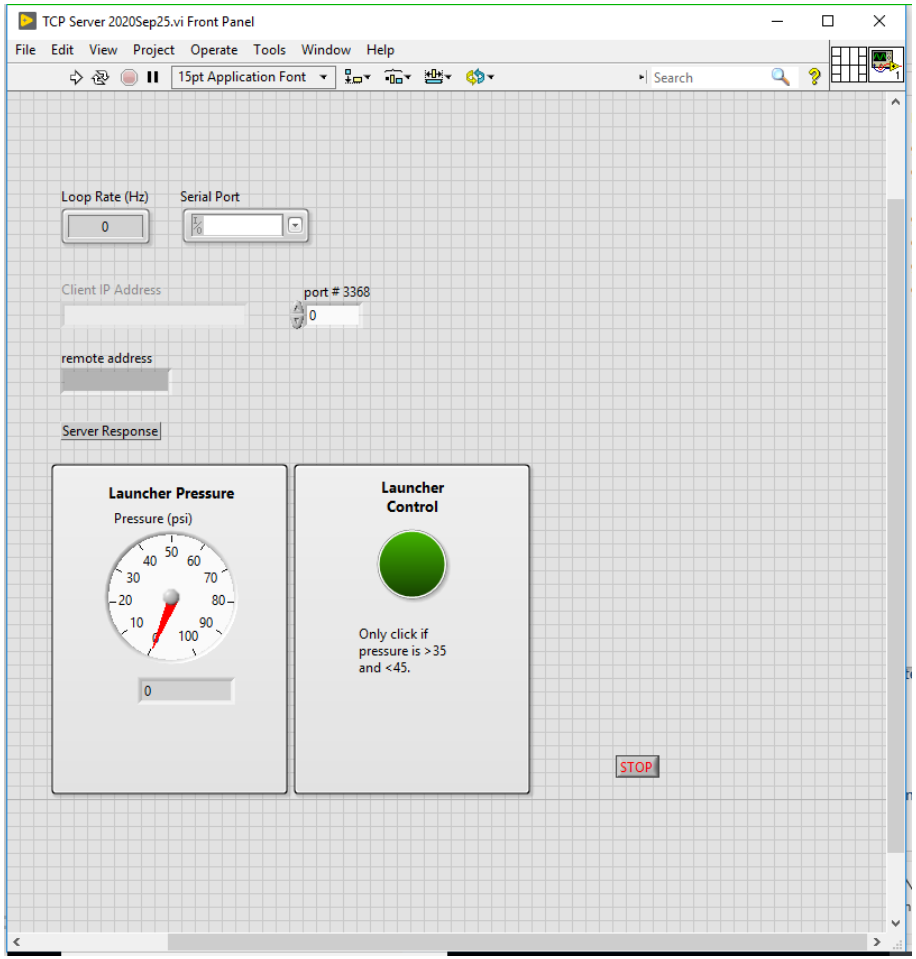
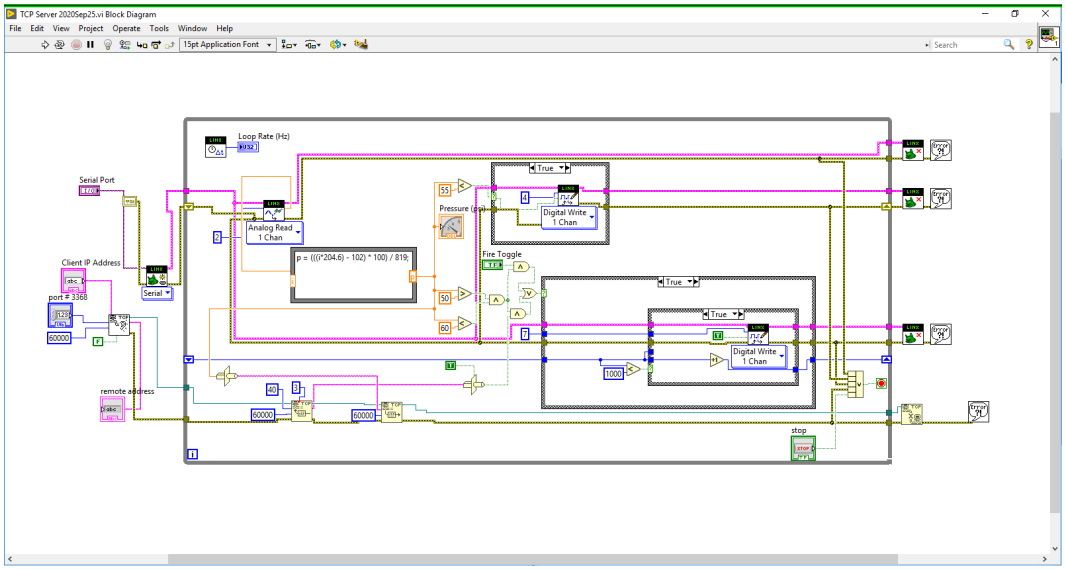
LabVIEW Server Front Panel/GUI

Graphical User Interface (GUI) at hardware side



Block Diagram



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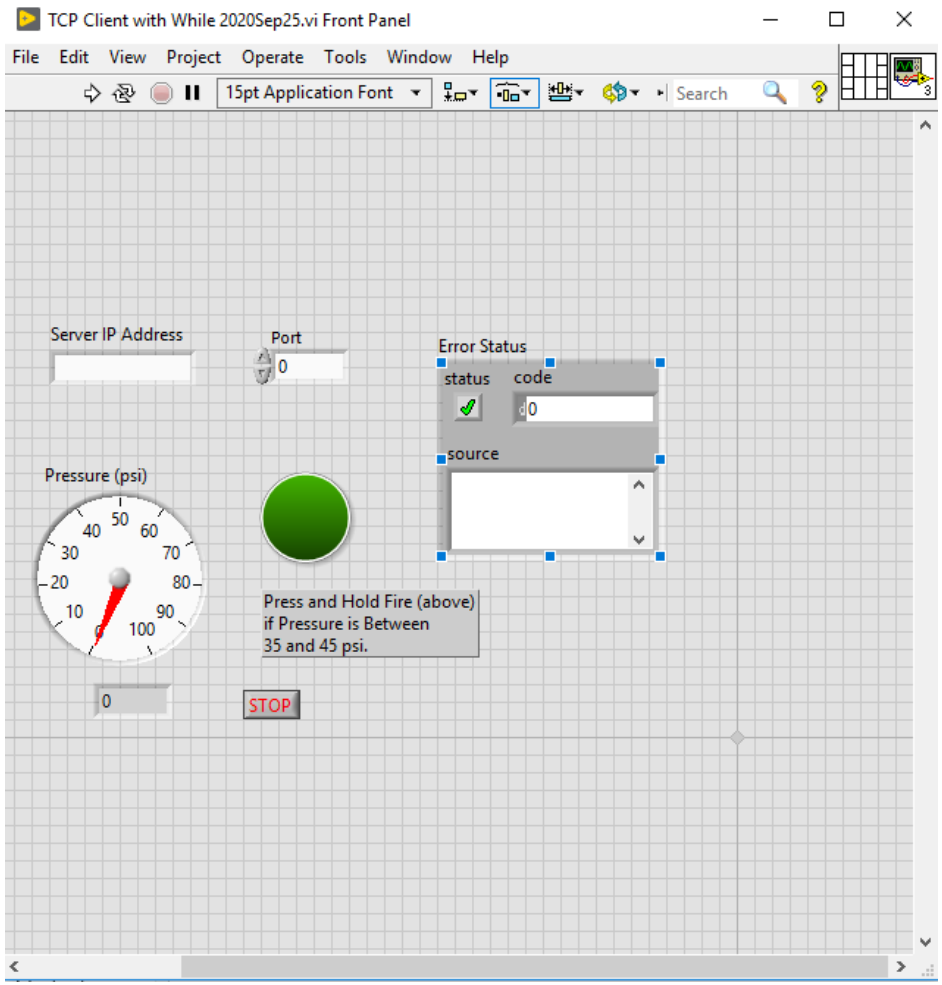
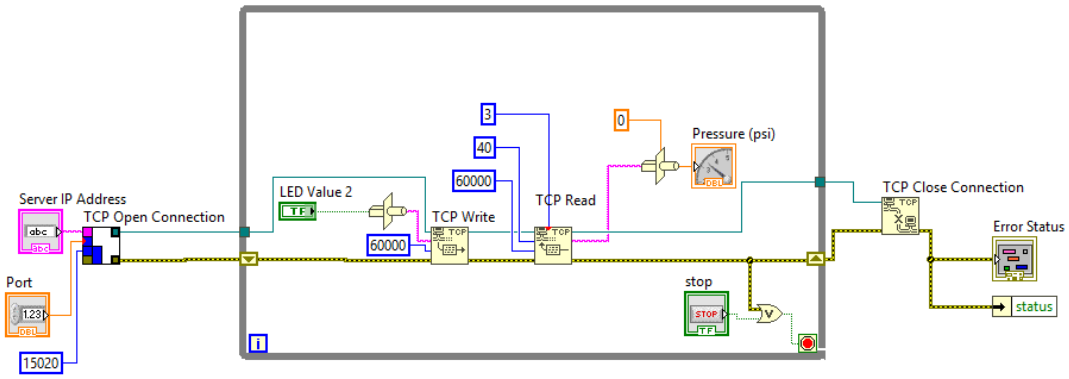
LabVIEW Client GUI

GUI at remote end



Block Diagram



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