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DOE Microreactor Program

Control Systems

Technology Maturation Panel

GAIN-EPRI-NEI Microreactor Program Workshop

August 18, 2020

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Background - Reactor Control Systems

- Nuclear reactors (including microreactors) require reactivity and neutron flux control
- Example control systems:

Control Rods

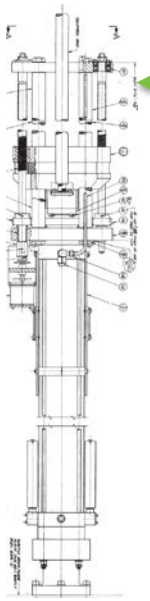
Control Drums

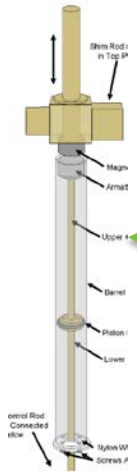
ATR

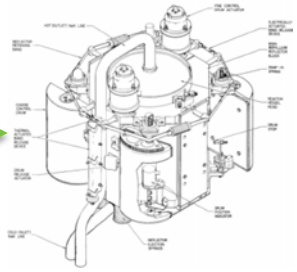
TREAT

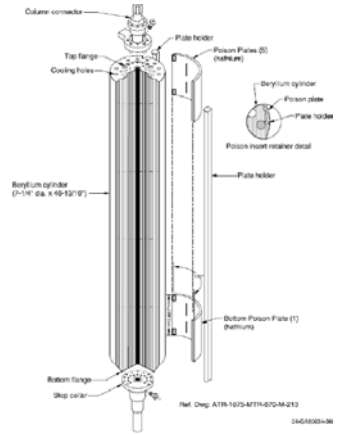
NRAD

Snap-10



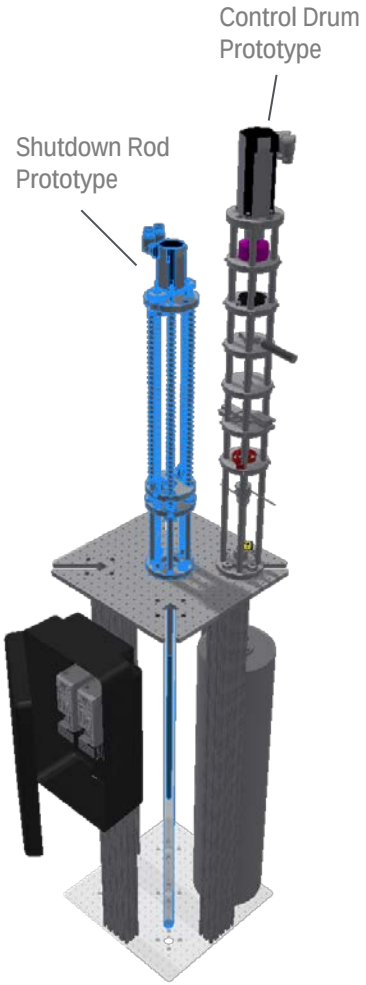






Program Activities and Accomplishments

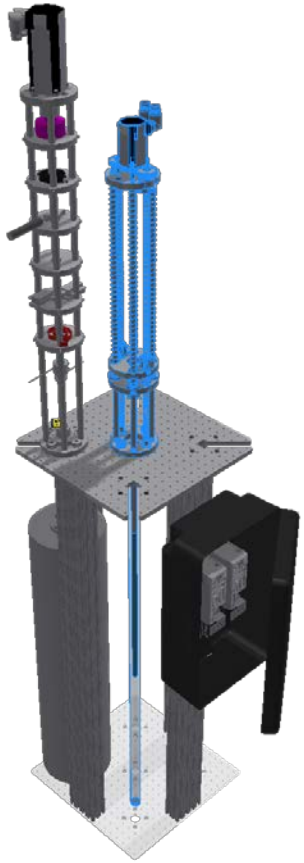
- Control Rod and Control Drum Technologies are being investigated for MARVEL:
  - Function based design
    - Direct flux control
    - Safety requirements
      - Passive shutdown mechanics
    - Environment compatibility
      - Rad tolerance
      - Thermal compatibility
  - Iterative prototype centric based development
- Key Accomplishments:
  - Control Drum prototype
  - Shutdown Rod Prototype

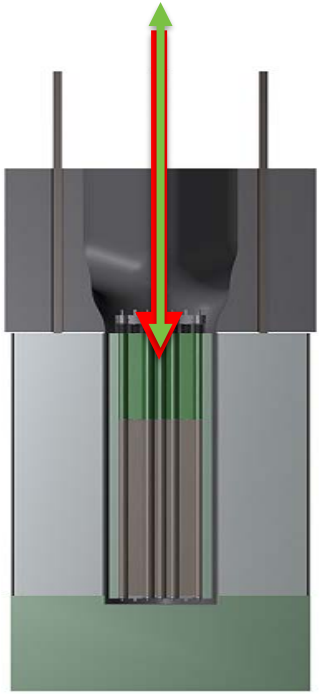


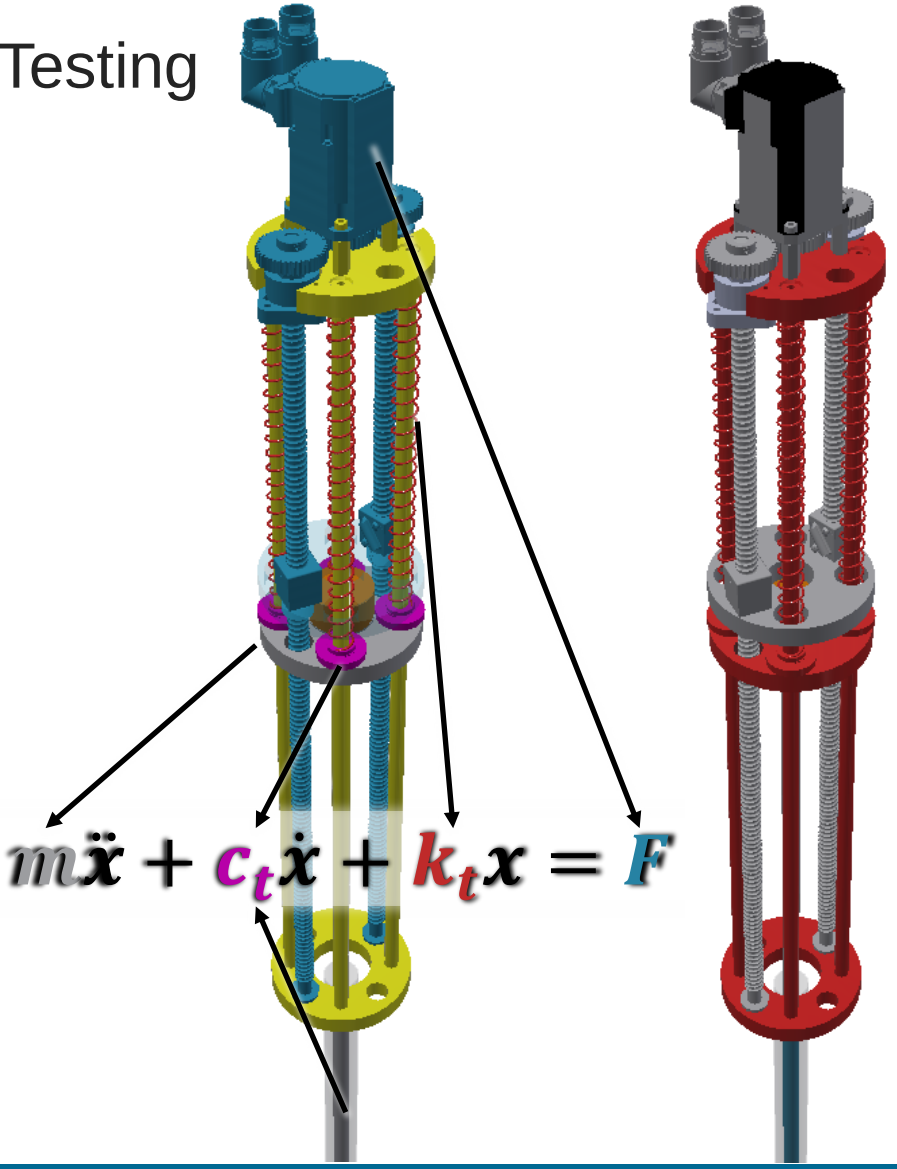
Controls Test Stand

Program Activities and Accomplishments

- Control Rod Prototyping and Testing
  - Validate dynamic performance
  - Validate safety performance







Program Activities and Accomplishments

- Control Drum Prototyping and Testing
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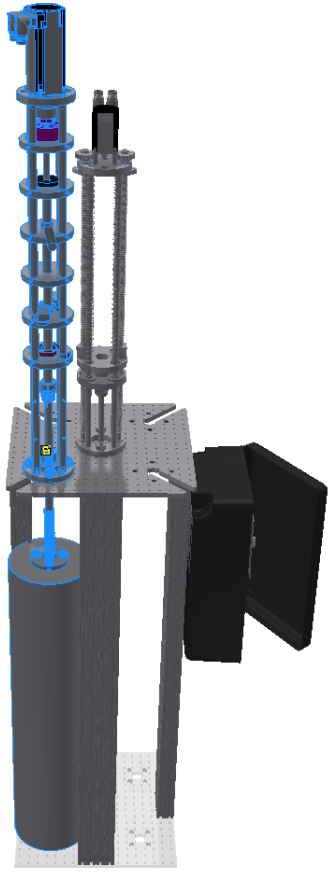
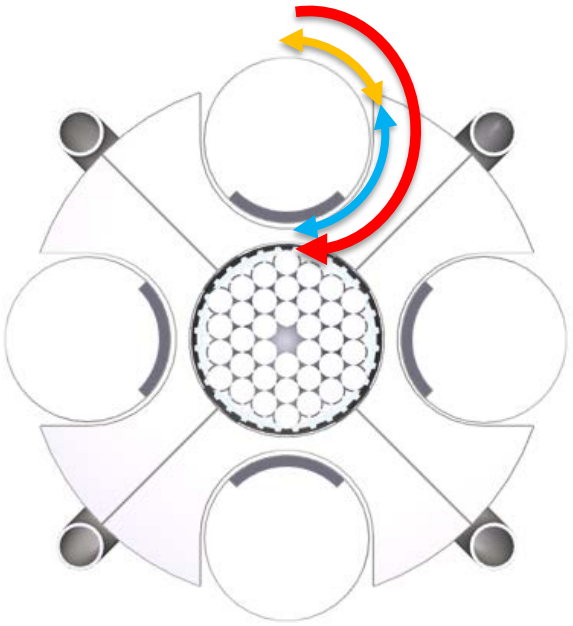
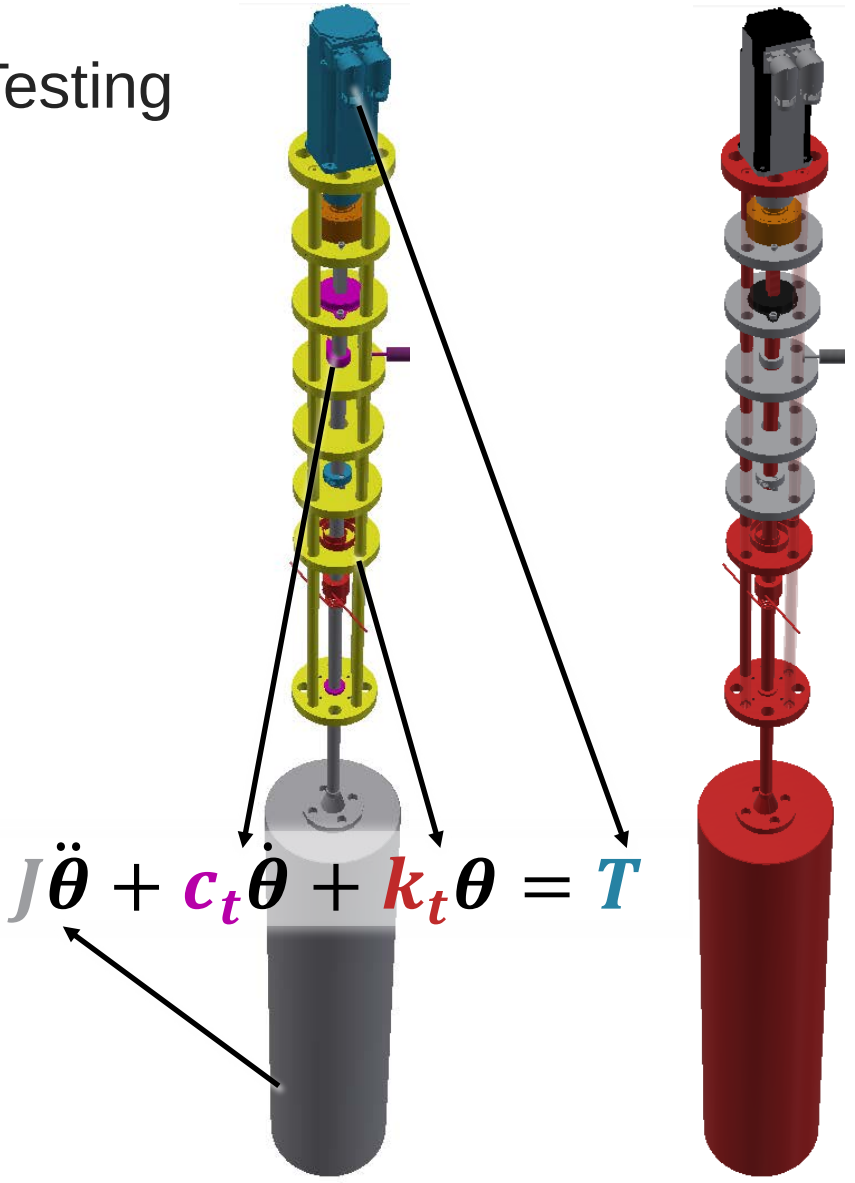
  - Validate safety performance

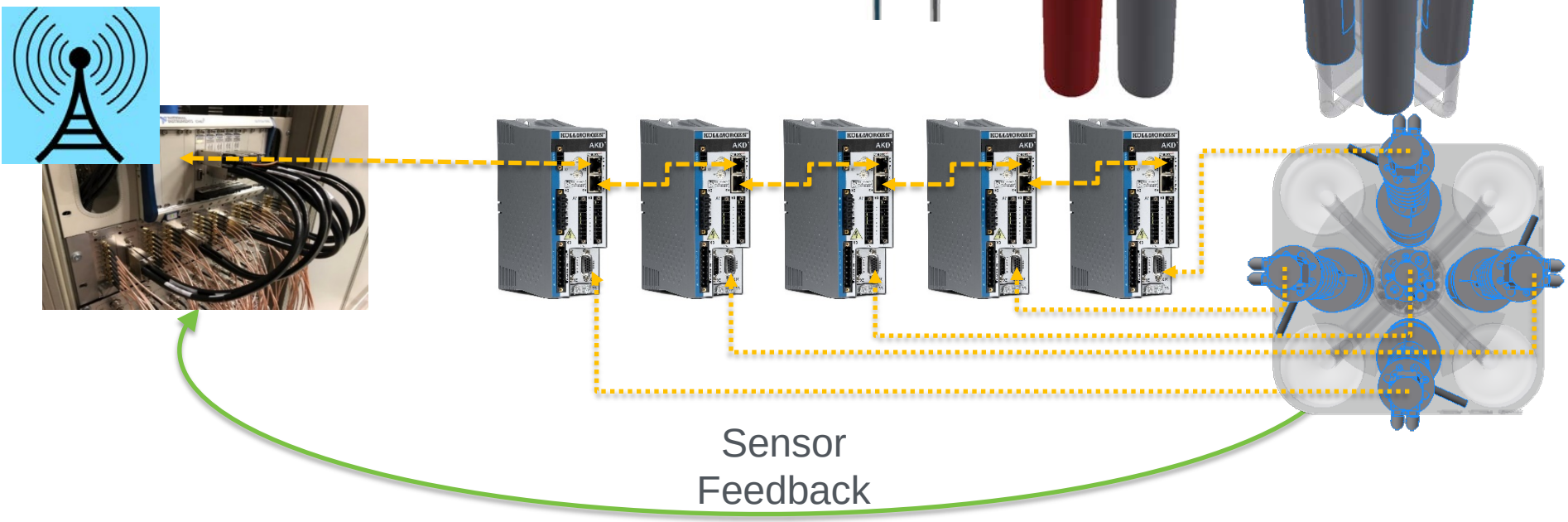






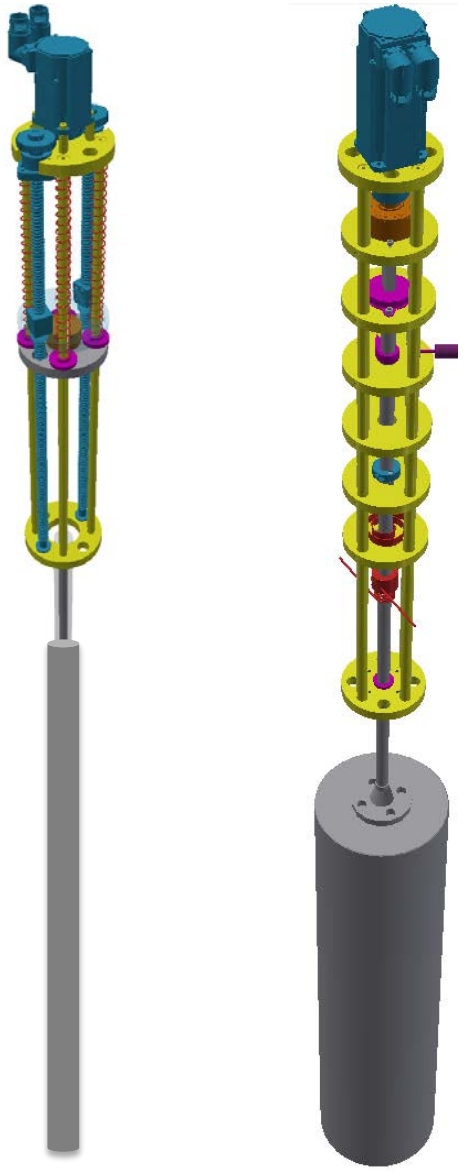
Next Steps: Validation Tests of Control Modes

- Refining/Adapting Integrated Systems:
  - Passive control (SR)
  - Manual control
  - Semi-automated control
- Provides Platform for Future Tests:
  - Fully-automated control
  - Remote monitoring
  - Cyber security



Benefits to Microreactor Developers

- Integrable in Test Platforms: MAGNET, MARVEL prototypes, MARVEL reactor for:
  - Separate Effects Tests (SETs)
  - Integral Effects Tests (IETs)
- Controls systems are generally applicable and adaptable to other designs
- Easily scalable to megawatt size microreactors
- Microreactor program can share design, engineering, supplier, fabrication and assembly information



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