



# Microreactor Program Review Technology Maturation Technical Area

Technical Area Lead: Holly Trelue  
Los Alamos National Laboratory  
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# Technology Maturation Conclusions

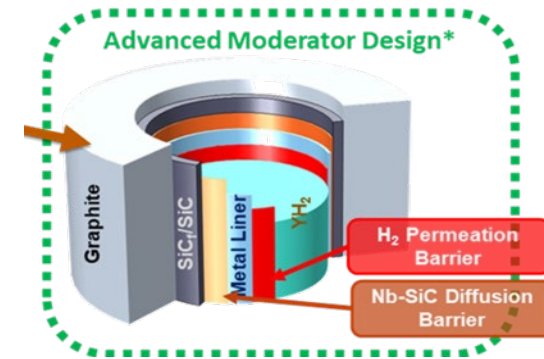
- As vendors are interested in small reactors for a variety of purposes and nuclear energy becomes a larger portion of the overall energy portfolio in the US, Microreactor technology will become increasingly valuable to develop.
- In parallel to building a Microreactor demonstration, other non-nuclear demonstrations, fabrication capabilities and critical experiments can offer a wealth of knowledge.
- Other technology that needs to be developed in conjunction with other programs includes:
  - fuels,
  - safeguards and security,
  - shielding,
  - reflector,
  - control mechanisms,
  - electronics/detectors,
  - power conversion units,
  - thermal energy usage,
  - more.

# ADVANCED MODERATOR MODULE (AMM) CONCEPT

## Advantages of the AMM design:

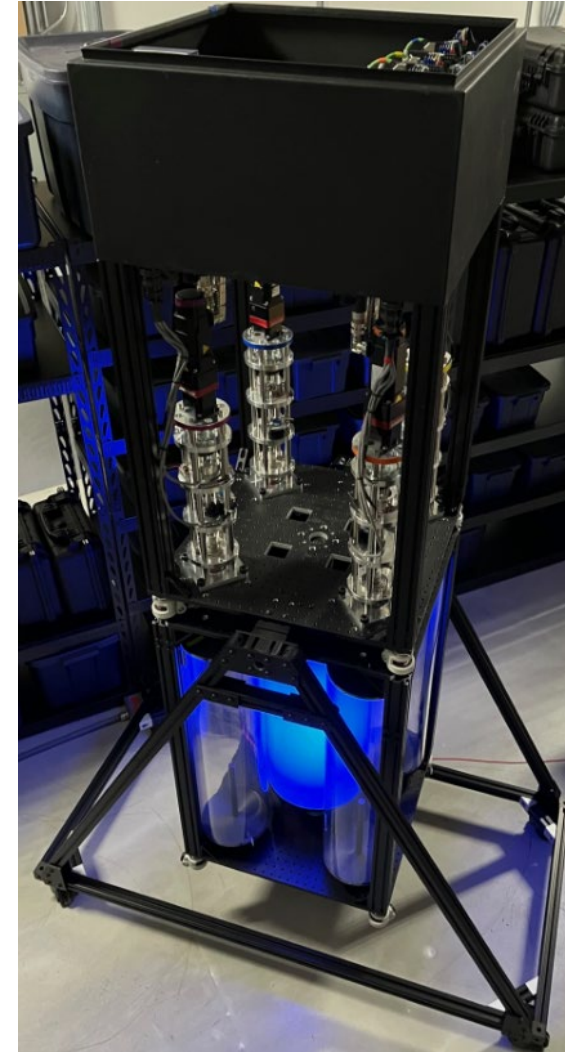
- AMM's encapsulation method promises improved performance:
  - Improved H<sub>2</sub> retention.
  - Reduced thermal neutron absorption compared to other approaches (e.g., SS, high temp. alloys, ..).
  - Successful deployment will support small microreactor cores with extended operational lifetimes.

**Thermal Testing at LANL this year will verify robustness and hydrogen retention of the concept.**

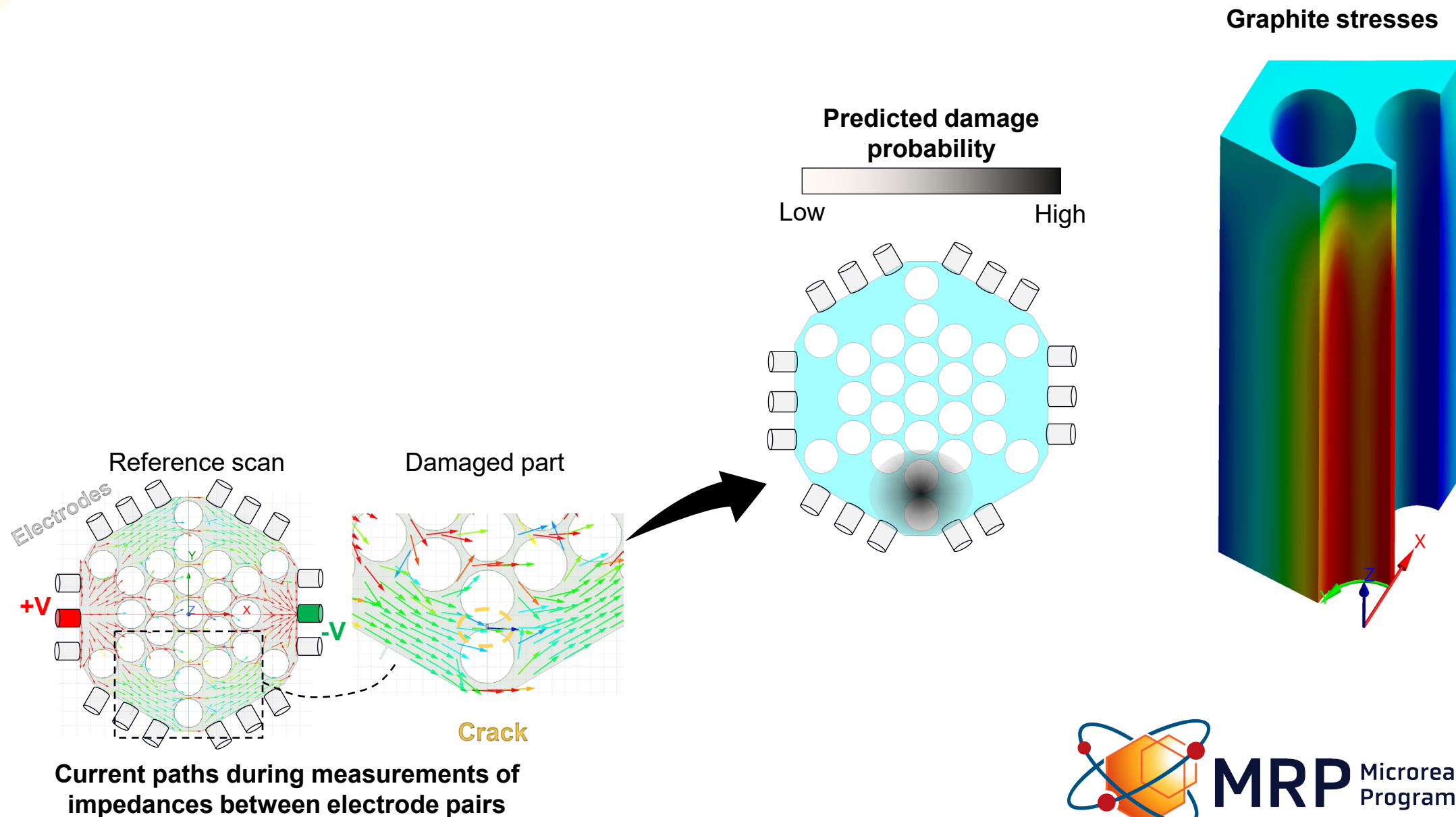


# Instrumentation and Sensors - Microreactor Automatic Control System (MACS)

- **Advancements in MACS hardware and software give examples to industry in developing control systems for their own microreactors.**

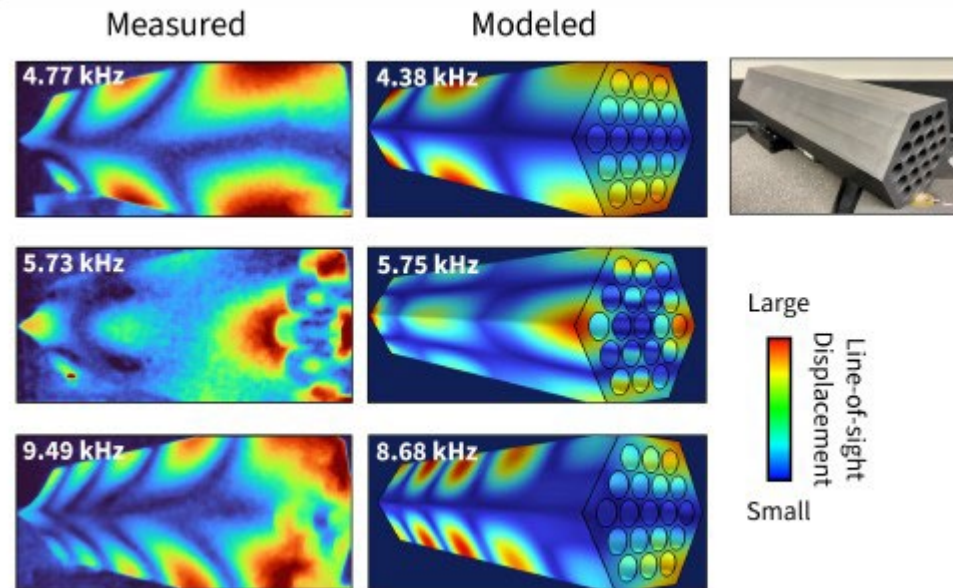


# Electrical impedance tomography (EIT) used for measuring damage localization in graphite microreactor components



# Acoustic Structural Health Monitoring

- Laser Doppler Vibrometer measurements can determine defects in structural materials.
- Graphite test article below demonstrates technique.



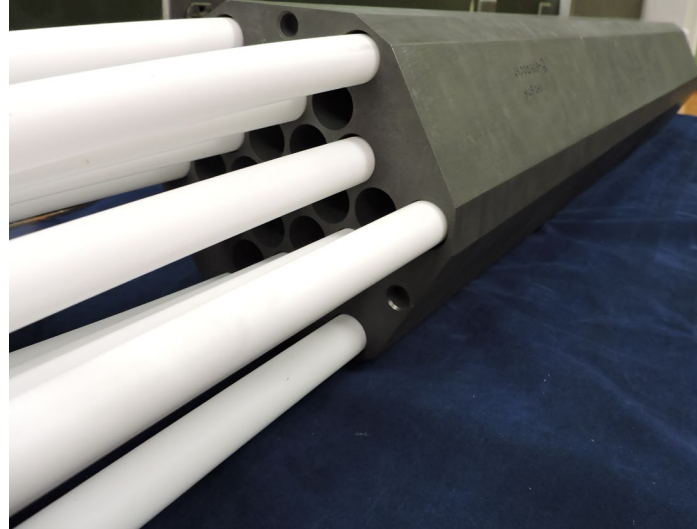
# Heat Transfer

Heat pipe-cooled-microreactors with graphite cores are of interest in industry, however little experimental data exists for these systems.

## Objective:

- Fabricate a 26 kWth heat pipe-cooled-graphite core non-nuclear demonstration unit that will act as industry relevant analog.
- Fabricate individual molybdenum walled/SS wicked/sodium heat pipes plus test article with 13 molybdenum walled/SS wicked/sodium heat pipes.

### Graphite Test Article Fit Test



### Modular Heat Extraction System



### System to Fill Heat Pipe Arrays



### Molybdenum Welding

Parameters Under Development:  
Inconsistently Passes Leak Requirement

Recommended Parameters: Fails Leak Requirement



**MRP** Microreactor Program