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2025 ART-GCR Annual Review Methods Area Overview

July 2025

David Alan Reger

Changing the World's Energy Future

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GAS-COOLED REACTOR

ADVANCED REACTOR TECHNOLOGIES PROGRAM

July 30, 2025

ART-GCR Design, Methods, and Validation Overview

David Reger

ART-GCR Methods Lead

INL/MIS-25-86095

DOE ART GCR Review Meeting

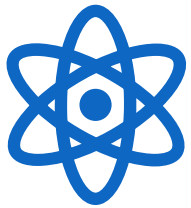
Annual Review Meeting

July 29-30, 2025

ART-GCR Methods Area

Experimental Validation Methods

Support experiments such as HTTF, NSTF, and HTGR-related NEUP projects to fill validation gaps for HTGR modeling and simulation tools



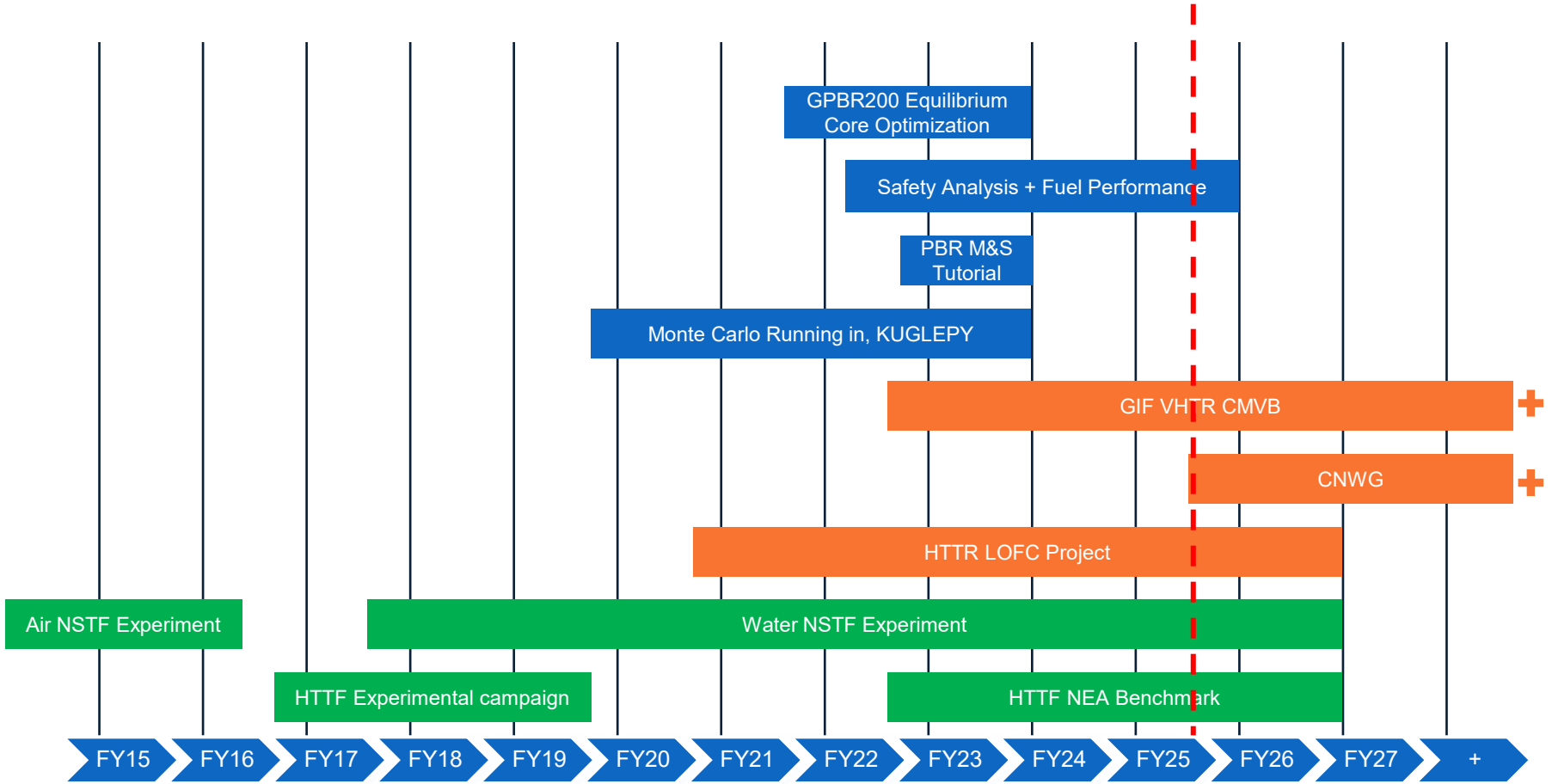
Reactor Analysis

Development and application of modeling and simulation tools for HTGR analysis

International Collaborations

Leveraging international collaborations to exchange data for validation of HTGR modeling and simulation tools. Includes valuable data from operational reactors such as HTR-PM and HTTR.

ART Methods Timeline



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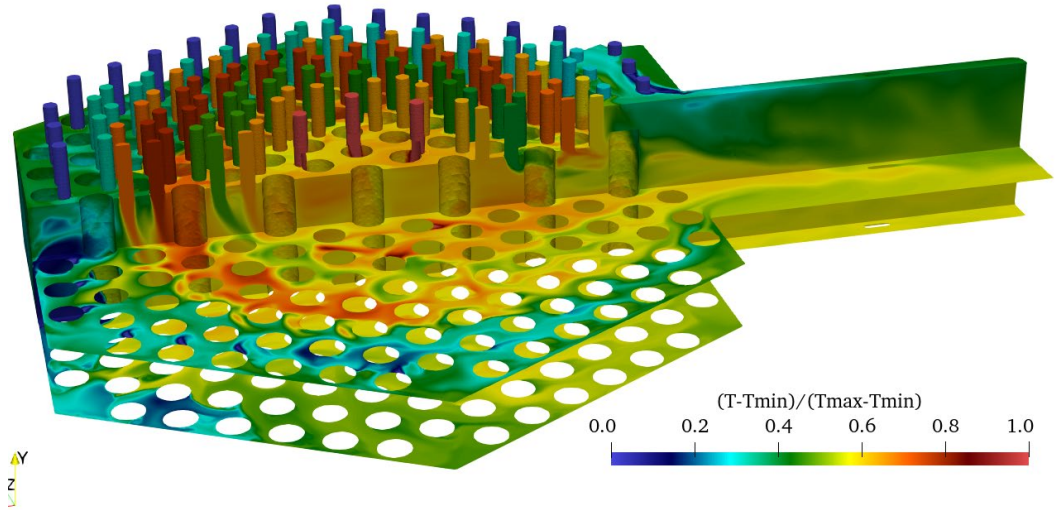
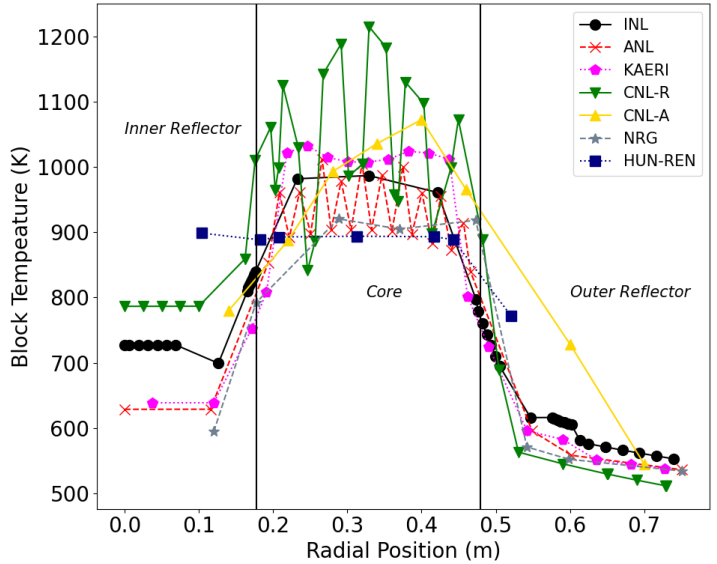
Experimental Validation - HTTF

- Leading an OECD-NEA benchmark for thermal fluid verification and validation



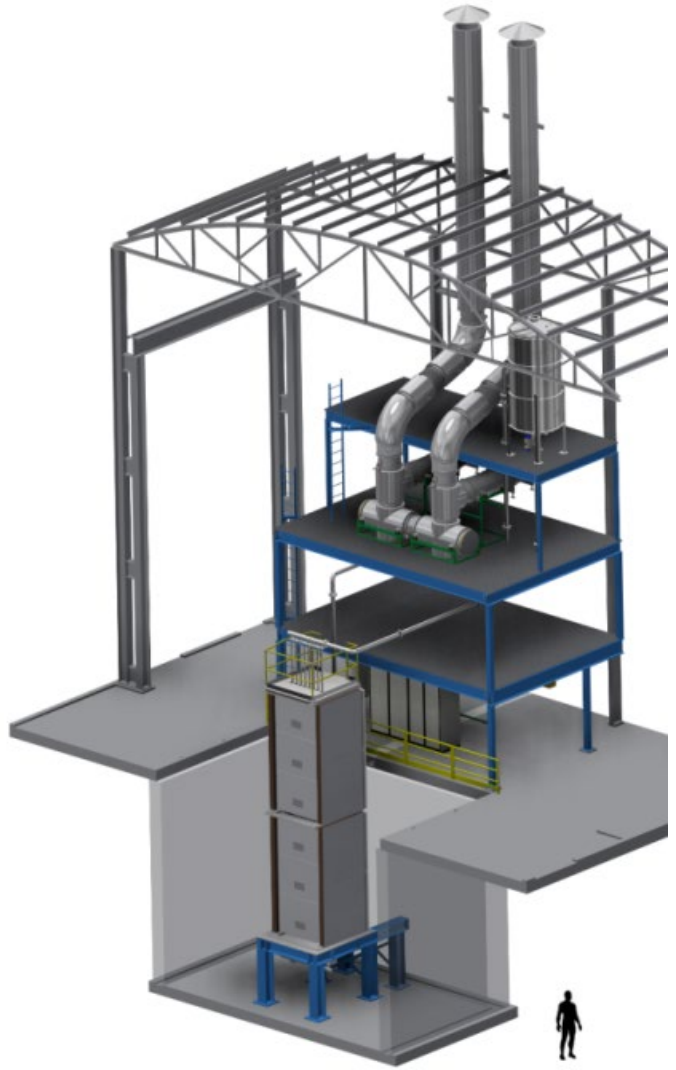
- Lower plenum mixing (CFD)
- Depressurized Conduction Cooldown
- Pressurized Conduction Cooldown



Experimental Validation - NSTF

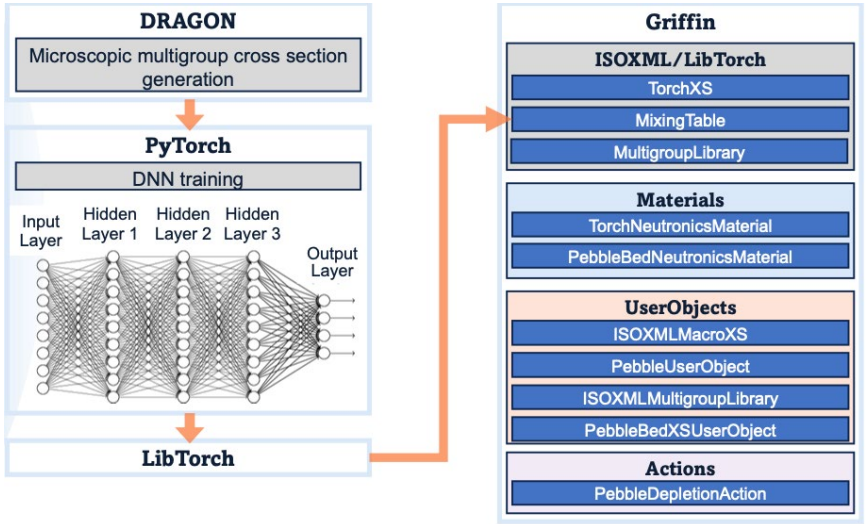
- Experimental facility at ANL to generate NQA-1 data for RCCS performance and other relevant phenomena

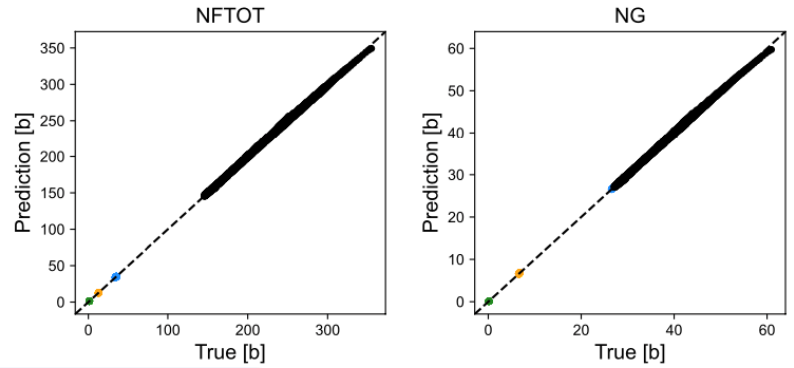
- Several-accident heat removal experiments, currently with water as the working fluid. Previous experiments were performed with air



Reactor Analysis – Machine Learning

- Current XS tabulations are large and computationally expensive
- Developing a framework to generate XS's, train a neural network, and apply the neural network within the NEAMS code suite.
- Neural network has been demonstrated to effectively predict XS's in a number of test cases

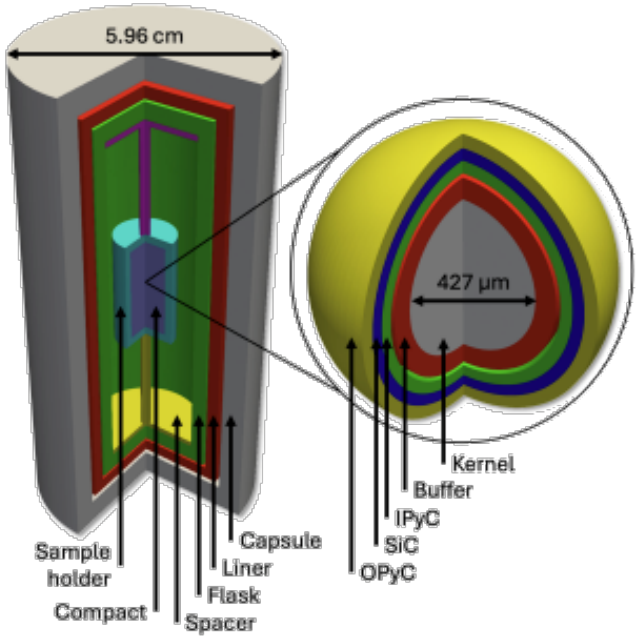


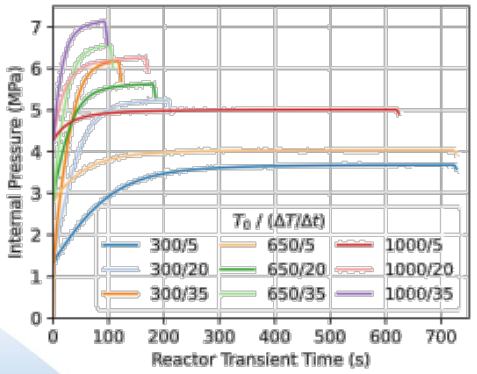


Reactor Analysis – Transient Testing

- Bison-Griffin coupled models have been utilized to evaluate the feasibility of TREAT for testing TRISO fuel and to inform the design of experiments

- Simulations allow for investigations of temperature and heat rate

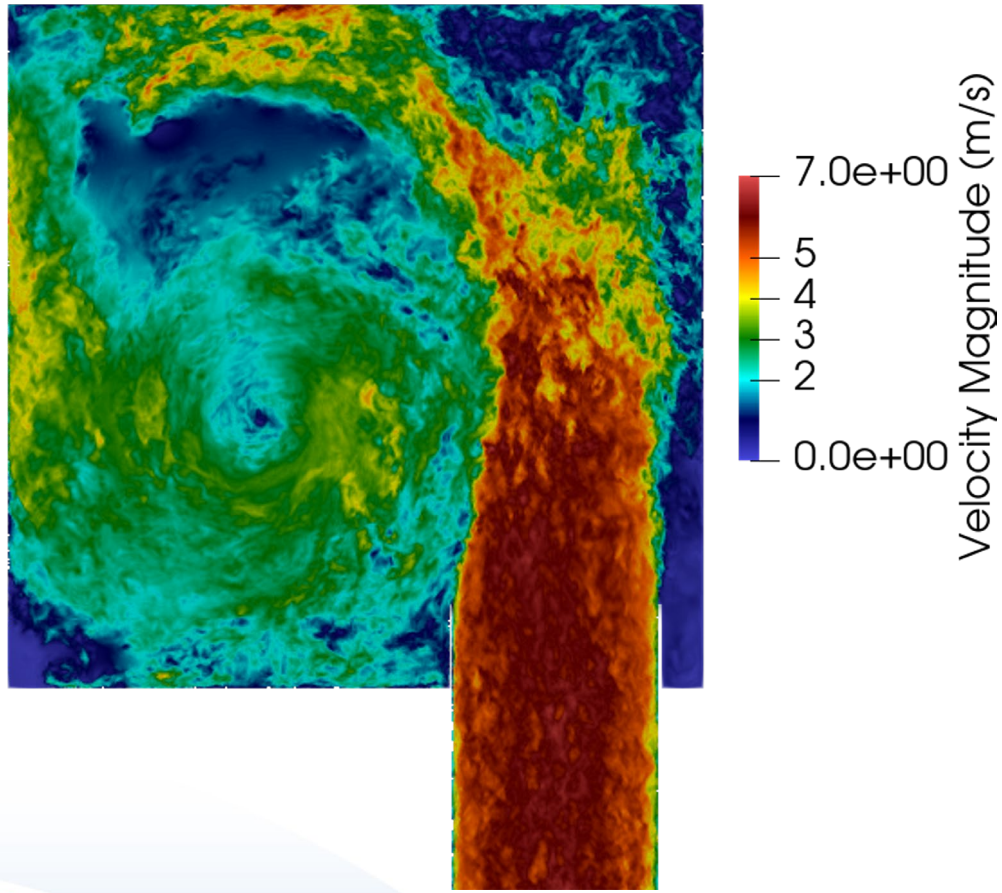




International Collaborations - CFD

- Utilizing data from domestic and international facilities to validate high-fidelity CFD tools for HTGR phenomena of interest

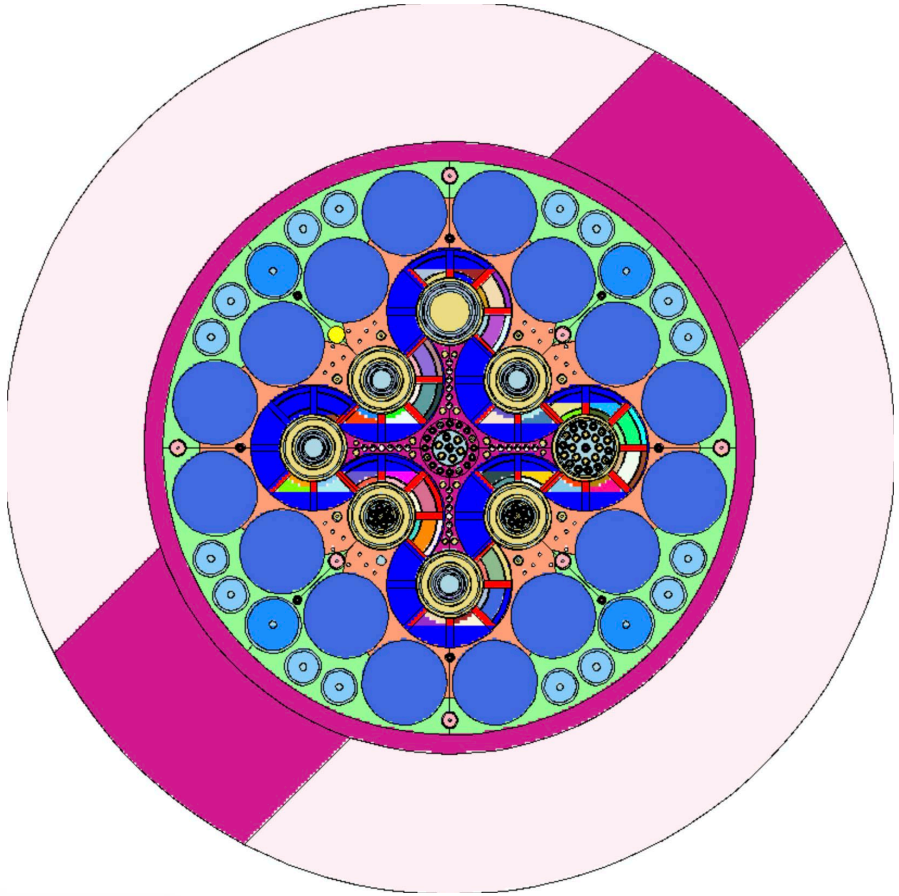
- Lower plenum mixing, bypass flow, RCCS performance



International Collaborations – Reactor Physics

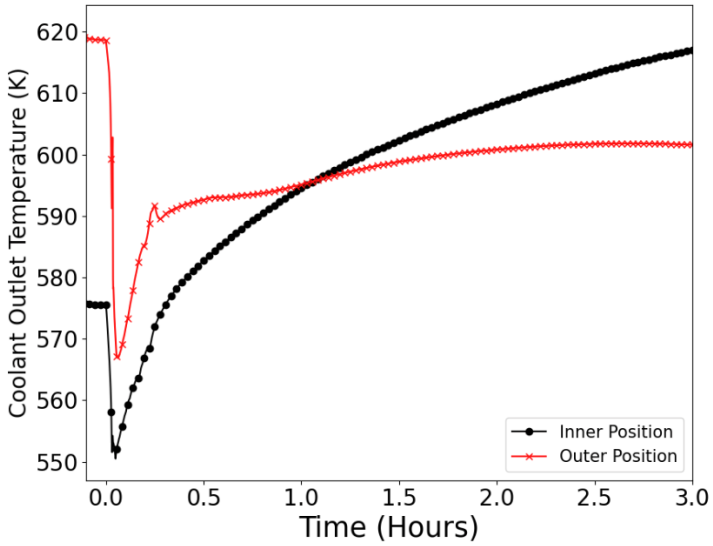
- Validating and benchmarking common reactor physics tools such as Serpent, Shift, and Griffin with international and domestic experimental data

- HTR-Proteus, AGR 1 and 2, HTR-PM first criticality



International Collaborations - HTTR

- Multiphysics simulation of LOFC tests 1,2, and 3 using NEAMS tools (Pronghorn, Griffin, etc.)
- Tritium transport with MELCOR in the Civil Nuclear Energy Working Group (CNWG)
- LOFC tests video: https://www.youtube.com/watch?v=Lrb0ci5xmwA



Thank You

Questions?

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