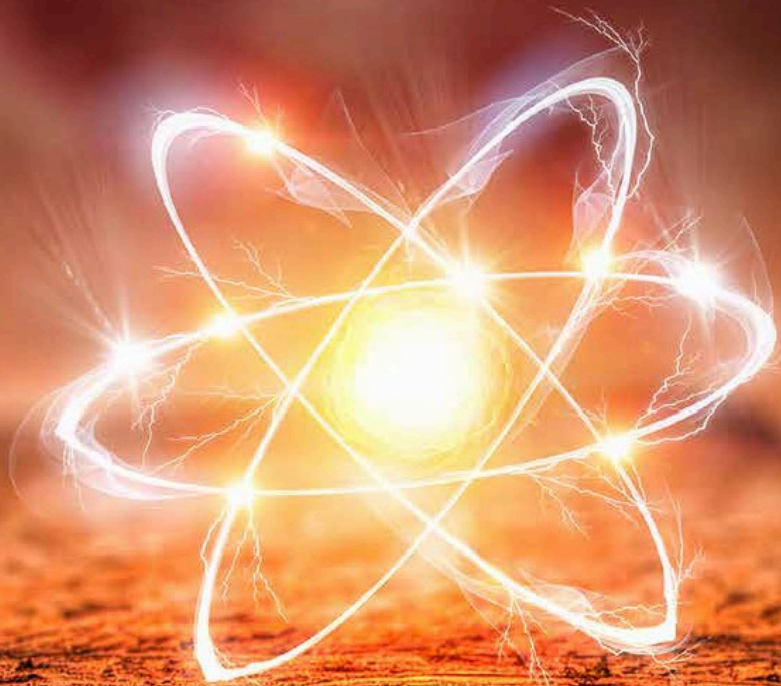


Introduction to

NUCLEAR ENGINEERING



COLLEGE OF ENGINEERING
MECHANICAL ENGINEERING
VIRGINIA TECH.

Degrees

PhD, MS & MENG in Nuclear Engineering (2014)

Accelerated MENG in NE for the US Naval Academy (2017)

Certificate in Nuclear Engineering

Certificate in Nuclear Science, Technology and Policy (NSTP) (2019)
(with the STS Department and SPIA)

Undergraduate minor in NE (fall 2019)

On-line MENG in NE (Spring 2022)

Campus

Blacksburg

Greater Washington DC Metro Area

<https://nuclear.ncr.vt.edu>

Program Focus

- Address application of Nuclear Science and Engineering to:

Power, Security, Medicine and Policy

- Subject areas include:

- Particle Transport Methods & Codes and their applications to modeling nuclear systems, with ML methods & Immersive visualization (Reactor Physics; Reactor Shielding; reactor design, reactor monitoring and detection systems)
- Nuclear Materials & Fuel (experimental & theoretical);
- Nuclear Fuel Cycle
- Thermal-Hydraulics & Reactor Safety (experimental & modeling)
- Radiation detection
- Nuclear nonproliferation and policy

Core Faculty

Dr. Juliana Duarte, Assistant Professor
Dr. Alireza Haghighat, Professor and Director
Dr. Celine Hin, Associate Professor
Dr. Yang Liu, Associate Professor
Dr. Mark Pierson, Associate Professor of Practice
Dr. Jinsuo Zhang, Professor

Affiliate Faculty

Mechanical Engineering

Dr. Roop Mahajan, Lewis A. Hester Chair Professor; Dr. Ranga Pitchumani, George R. Goodson Professor; Dr. Danesh Tafti, William, S. Cross Professor; Dr. Michael Von Spakovsky, Robert E. Hord Professor

Material Science & Engineering

Dr. Xianming (David) Bai, Assistant Professor

Physics

Dr. Patrick Huber, Professor; Dr. Jon Link, Professor; Dr. Camilla Mariani, Associate Professor; Dr. Ganpati Myneni, Adjunct Professor; Dr. Bruce Vogelaar, Professor.

Policy

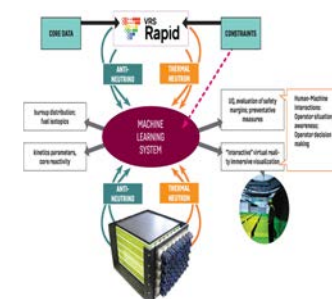
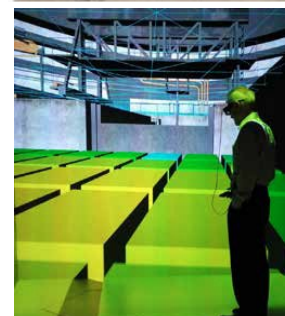
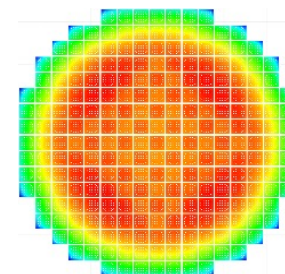
Dr. Patrick Roberts, Associate Prof. of Policy; Dr. Sonja Schmid, Associate Prof. of STS

Adjunct Faculty

Dr. Luka Snoj, Head of Reactor Physics, JSI, Slovenia; Dr. James Turso, Newport News Shipbuilding; Dr. Magda Caro, LANL

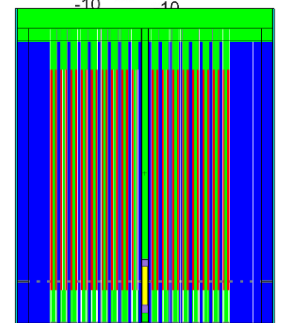
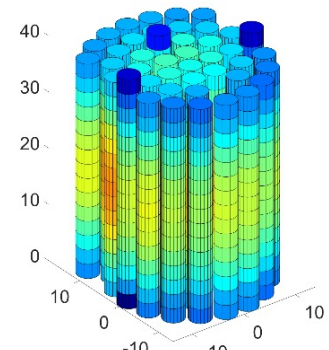
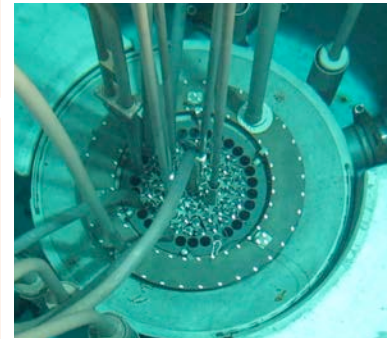
Research & Educational Collaborations

- **Multiphysics for Advanced Reactor Simulation (MARS) Center – ICTAS**
 - Development of (Real-time Simulation in a collaborative Virtual Reality environment)
 - Georgia Tech, Jozef Stefan Institute, Ljubljana University, Penn State, NC State, Turin Polytechnic University of Turin, VT – ME, MSE & Physics
- **Center for Neutrino Physics (CNP) – VT Department Physics**
 - CHANDLER antineutrino detection system development, optimization and its application
 - in monitoring and safeguards of nuclear reactors without the need for in-core detectors
- **Nuclear Materials and Fuel Cycle Center**
 - Corrosion laboratory (Molten Salt loops, high-temperature water loops)
 - INL, Georgia Tech, Oregon State, RPI, MIT, ANL, ORNL
- **Reactor Thermal Hydraulics and Safety Groups**
 - Heat transfer and safety lab (HEAT)
 - Multiphase flow and thermal-hydraulics lab (MFTL) includes a two-phase flow experimental loop
 - These groups collaborate with private organizations and national labs.
- **Virginia Tech Transport Theory Group (VT³G)**
 - Develops particle transport methodologies and codes high-fidelity modeling for real-time simulation of nuclear systems in power, security, and medicine. Currently, working on the RAPID code system and its applications.
- **Virtual Reality Systems for Scientific Computing; VRS-RAPID code system**
 - In collaborative with the VT visionarium developed the collaborative web-application for high-fidelity 3-D neutronics modeling in real-time
- **Physic-based ML with Real-time modeling & multi-modal detection using a research reactor (V&V) and a power reactor**
 - A multi-campus, multidisciplinary project involving NE, Physics and industrial and System engineering, with support from Dominion and Jozef Stefan Institute



Research & Educational Collaborations

- **Signed a MOU with the Jozef Stefan Institute (JSI), Slovenia**
 - V&V of the RAPID code system;
 - Research collaboration & visiting scholars
 - Semester abroad program for reactor phys. experiments & operator training
- **Cross-discipline graduate program in nuclear Policy**
 - Established NSTP graduate certification in collaboration with the School of Public & International Affairs (SPIA) and Department of Science, Technology & Society (STS).
- **Signed Agreement with the US Naval Academy**
 - Use of USNA's facilities, CRADA, MENG degree & Internship)
- **Virginia Nuclear Energy Consortium (VNEC) Nonprofit Organization**
 - Prof. Haghighat is the founding Chair of VNEC; currently, he is Vice-Chair
 - Members: Dominion, Enfission, GE, Liberty U., Newport News Shipbuilding, UVA, VCU & VT
 - Received state funding to form the Virginia Nuclear Innovation Hub
- **Nuclear Education Hub (NEH) – (joint with GWU)**
 - Funded by DOE, educate Ukrainian Citizens; Establishing MOUs



Facilities

- **Computing and immersive virtual reality environment**
 - Dedicated high performance computer cluster for parallel computing
 - Dedicated Server for VRS-RAPID immersive virtual reality software
 - Visionarium Hypercube Immersive environment
- **CHANDLER antineutrino detection system and related laboratories**
- **Nuclear Materials & Fuel Cycle Lab**
 - Molten Salt Chemistry Loop
- **Thermal Hydraulics Lab**
 - Two-phase Flow Visualization and Measurement Loop
 - High-Temperature Water Loops
- **Radiation Measurement Lab**
- **Access to:**
 - USNA nuclear facilities
 - JSI's TRIGA research reactor

