Dr. Mark Pierson Research Activities

Ongoing projects:

• **Nano-Nuclear Science** - Irradiation of graphene sheets and carbon nanotubes to measure properties for applications in radiation measurement and shielding. Development of novel detection devices for nuclear safeguards applications.

• **Radioisotope batteries** - Modeling and simulation of betavoltaic radioisotope batteries using MCNP6 and semiconductor theory.

• **Nuclear Fuel Cycle**:
  - Developing improved uranium milling process that removes radium from mining tailings to minimize radioactivity and radiation monitoring of subsequent uranium tailing impoundment cells
  - Developing an alternative back end fuel cycle to minimize long-term radioactive waste disposal through the use of accelerator-driven subcritical systems (ADS) that produce electricity from used nuclear LWR fuel and transmute long-lived actinides. Analysis of reactor physics for ADS.
  - Developing MOX recycle strategy to deal with used MOX fuel

• **Medical Isotope Production** - Development of a medical isotope production method for cancer therapy using a high-energy electron accelerator

• **Nuclear Security, Nonproliferation and Safeguards** –
  - Emphasis on eliminating nuclear weapon proliferation on the back-end of the fuel cycle by analyzing risk and safeguards for back-end systems
  - Safeguards-by-design and export controls for small modular reactors (SMRs)

• **Fusion Demonstration Reactor** - Undergraduate research project that uses inertial electrostatic confinement deuterium-deuterium fusion to create a star-like plasma and generate neutrons for activation experiments. Used for research and educational outreach.

• **Weld Pool Modeling** - Simulation of weld pool dynamics and subsequent thermal stress analysis of welded joint under gas tungsten arc welding

![Neutron damage to carbon](image)

![Accelerator target](image)

![Weld pool analysis](image)