



# Nuclear Engineering and Reactor Programs at OSU

Brian Woods

Associate Professor

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# OSU Nuclear History

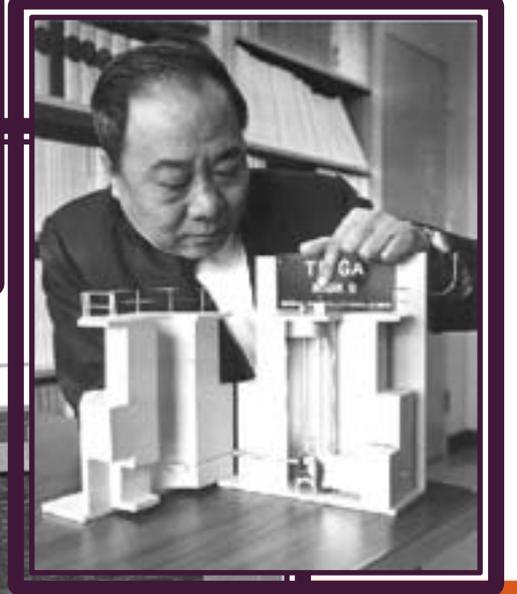
- Long tradition of nuclear related research:
  - Nuclear Engineering at OSU for 50 years
  - TRIGA reactor at OSU for ~ 40 years
- Research spans many decades & disciplines:
  - Fundamental nuclear science
  - Nuclear power design
  - Radiation safety
  - Medical applications
  - Environmental protection
  - National security and defense
- *DOE and the National Labs have played a significant role*



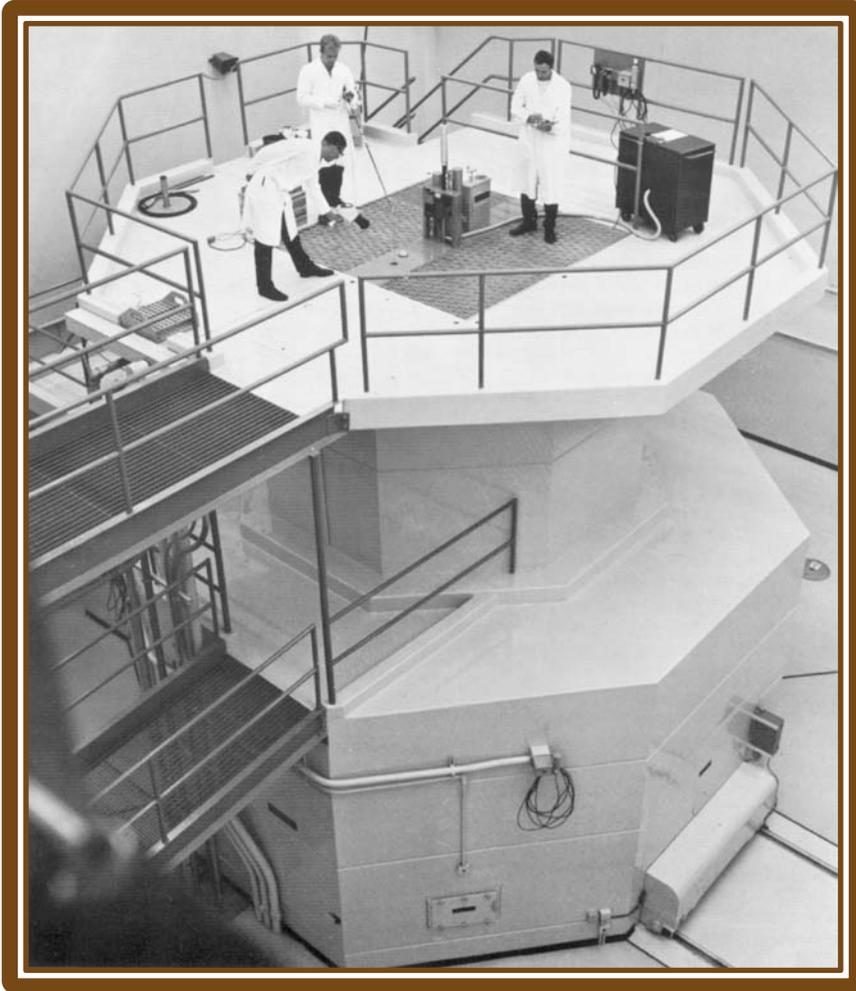
AGN-201 Nuclear Training Reactor

# A Brief History, continued

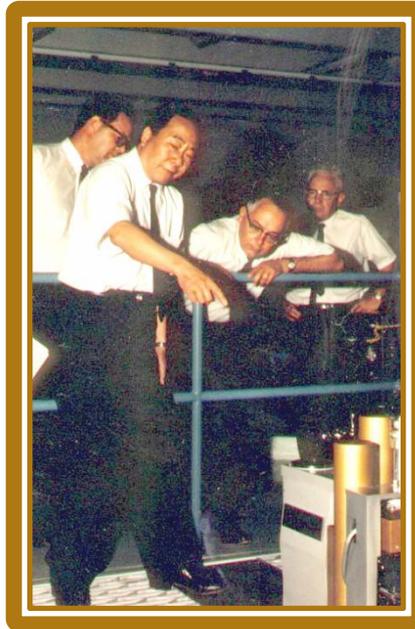
- 1964 Radiation Center established
- 1967 TRIGA reactor completed



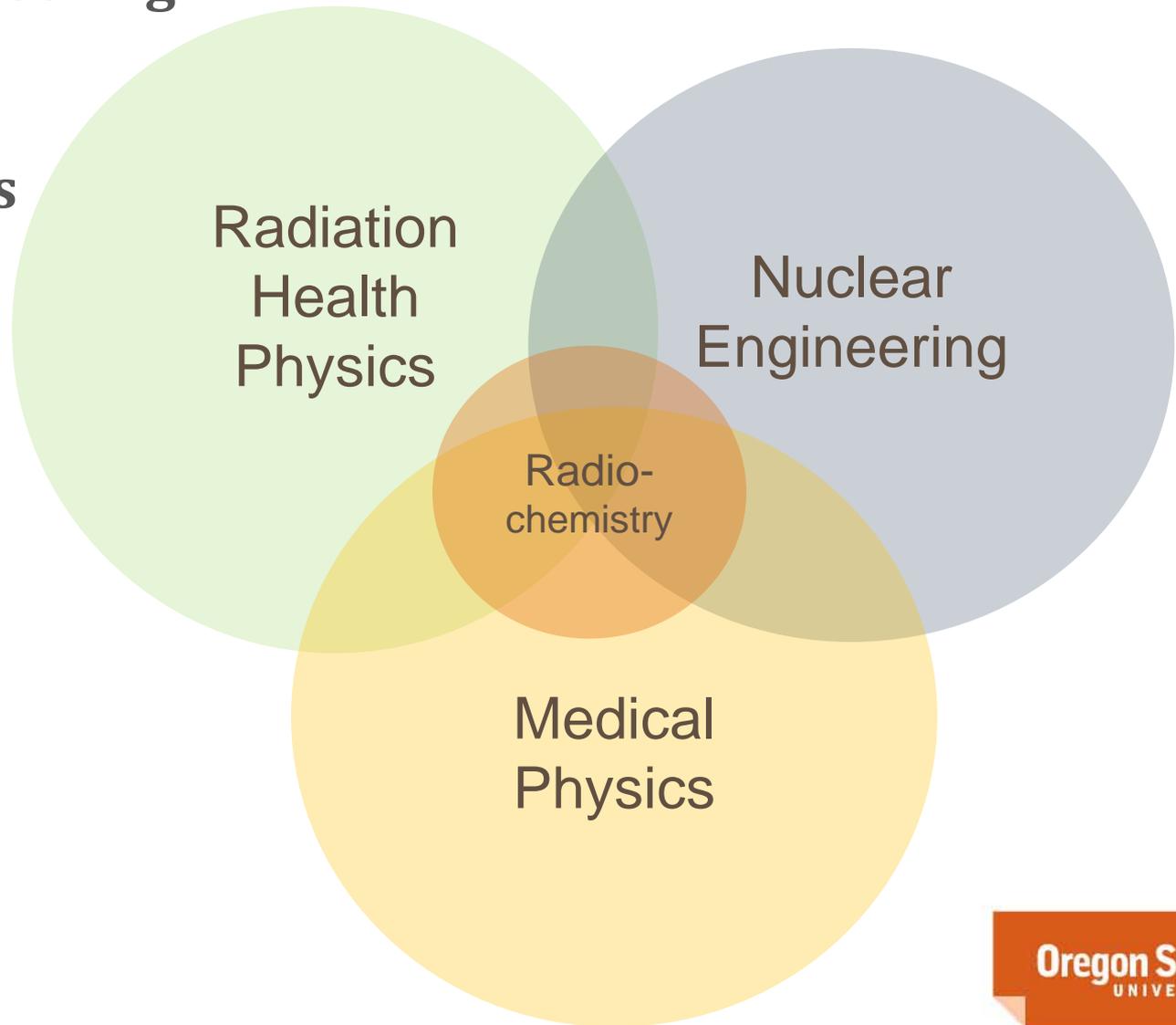
# A Brief History, continued



OSU among 1<sup>st</sup> in nation to offer undergraduate curriculum in nuclear engineering



**Organizational Structure  
Nuclear Engineering  
&  
Radiation  
Health Physics**



# Thermal Hydraulics

- OSU's ongoing research is instrumental in the design and licensing of new reactors.
- The U.S. Nuclear Regulatory Commission and the U.S. Department of Energy chose OSU for thermal hydraulic testing of nuclear power plant designs.
  - Designed, constructed, and operate large-scale, state-of-the-art, integral thermal hydraulic test facilities for reactor safety tests.
  - OSU was an integral part of the certification testing program for the Westinghouse AP600 and AP1000 nuclear plant designs, which received NRC design approval.
  - **New research bay brought online April 2010**

Qiao Wu  
Brian Woods  
Wade Marcum  
Jose Reyes

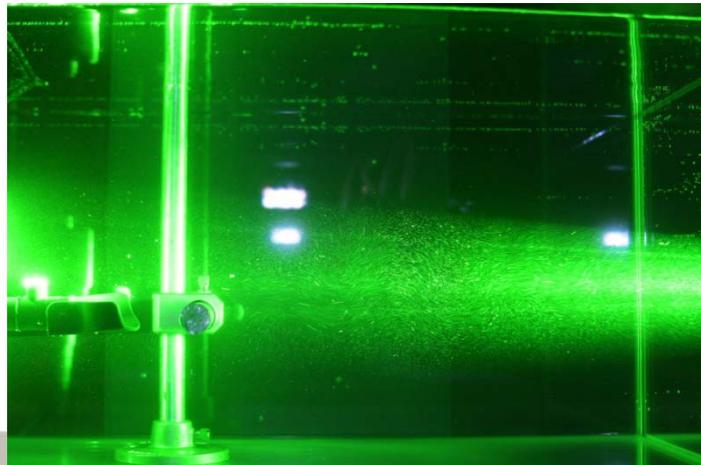


# Reactor Hydro-Mechanics & Flow Visualization



Wade Marcum

- **Hydro-Mechanical Fuel Test Facility (HMFTF)**
  - Separate effects thermal hydraulic test facility to examine performance of proposed fuel products for the five U.S. high performance research reactors' fuel elements.
- **Laser Imaging of Fluids and Thermal (LIFT) Lab**
  - Time Resolved Particle Image Velocimetry (TR-PIV) System to investigate advanced reactor flow fields and interfacial area concentration.

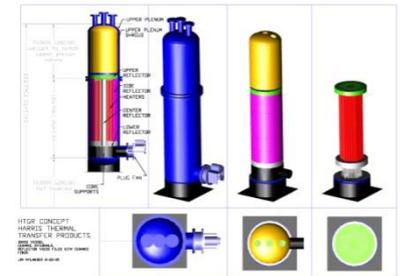


# Advanced Plant Thermal Fluids



Brian Woods

- **High Temperature Reactor Test Facility**
  - Cooperative agreement with US NRC and DOE to construct and operate a Very High Temperature Reactor Test Facility to explore integral and local phenomena.
- **Multi-application Small Light Water Reactor (MASLWR) Test Facility.**
  - IAEA International Collaborative Standard Problem to examine natural circulation phenomena in integral reactors.
  - NuScale design certification testing.
- **High Performance Research Reactor Fuel Test Facility.**
  - High temperature, high pressure, hydro-mechanical test facility to examine performance of proposed fuel products for the five U.S. high performance research reactors' fuel elements



# Computational Methods / Reactor Physics

Methods/software development research

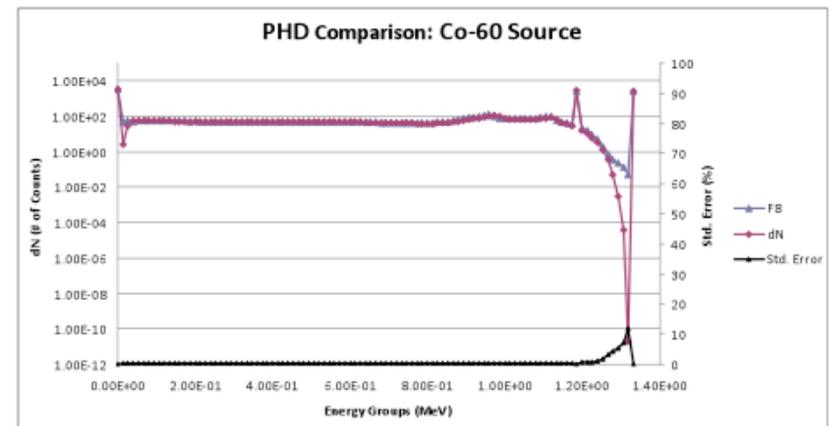


Todd Palmer

- CMFD acceleration of r-z- $\theta$  fine mesh diffusion in PARCS (**NRC VHTR**)
- Evaluation of preconditioners in JFNK/deterministic transport solution of time-dependent radiative transfer (**INL**)
- Quasi-diffusion acceleration of Monte Carlo eigenvalue calculations (**NRC VHTR**)
- Monte-Carlo and diffusion solvers for radiative heat transfer: oxy-combustion of coal (**NETL**)
- Improving calculation of dose to skin tissue in a point-kernel code (VARSKIN4) (**NRC**)
- Tetrahedral mesh hybrid Monte Carlo/deterministic transport solver for source/detector problems (**DOE NA-22**)
- Deterministic calculations of pulse height distributions (**PNNL**)

Nuclear engineering design research

- Small modular reactor core design
- Antineutrino source term calculation for assessment of detection technologies (**DOE NA-22**)
- Neutronic analysis of the Reed University TRIGA reactor using MCNP5 (**RERTR**)
- Design of a target assembly for Mo-99 production in university TRIGA reactors (**Industrial funding**)

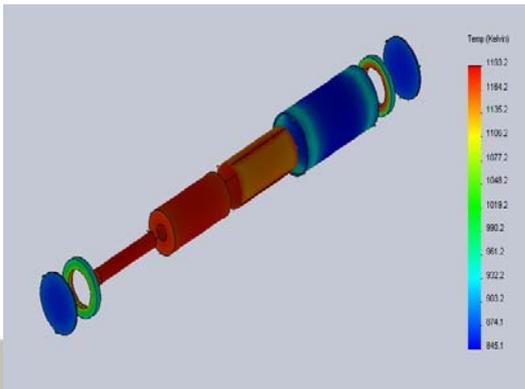
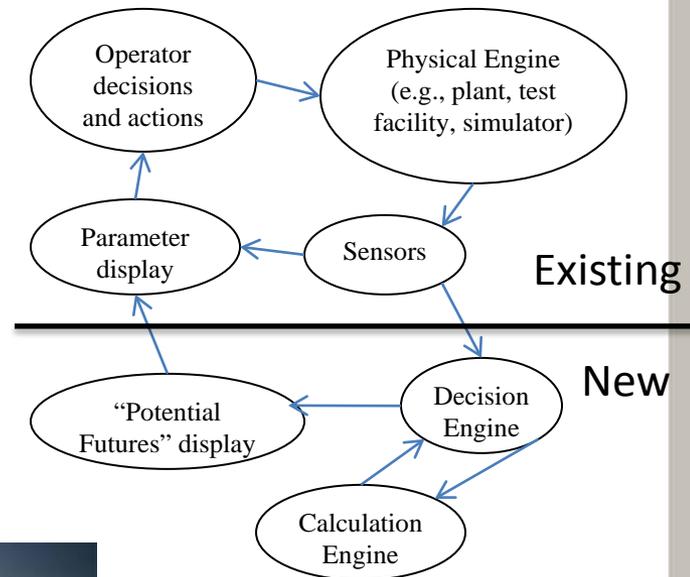


# Advanced Nuclear Systems Analysis



Andy Klein

- Analysis of advanced nuclear reactor and radioisotope systems for utilization on Earth and in space
- Ongoing work:
  - Analysis of Mars Hopper concept for space exploration utilizing in situ resources and radioisotope power systems
  - Development of electrically heated space power system simulator
  - Development of a tool to enhance reactor operations understanding Run-Ahead Predictive Simulation (RAPS)



# Radiation Center Facilities

- Supports research & development in nuclear science and engineering, radiation protection, and related disciplines.
- Provides a place for use and handling of radioisotopes and other sources of ionizing radiation.
- Research projects include:
  - Neutron activation analysis
  - Neutron depth profiling for hydrogen storage
  - Medical isotope development and production
  - Geological age dating (fission track and Ar/Ar age dating)
  - Neutron radiography
  - Radiation sterilization
  - Radiation dosimeter testing

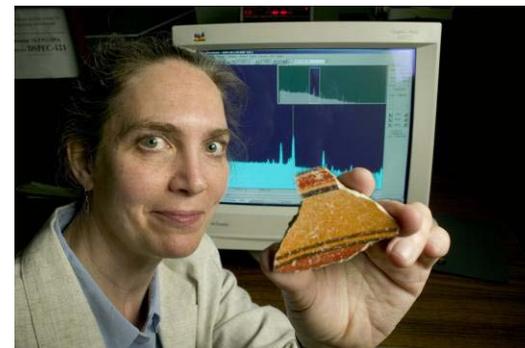
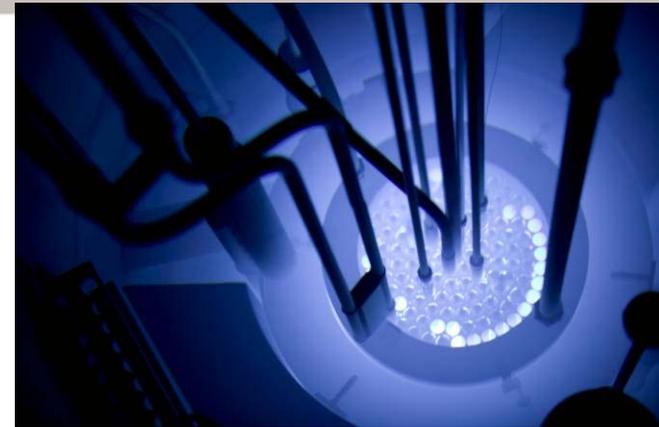


Steve Reese  
RC Director



# Facilities

- 1.1 MW<sub>th</sub> TRIGA Reactor
- Advanced Thermal Hydraulic Testing Laboratories
- <sup>90</sup>Sr-<sup>90</sup>Y irradiator
- Subcritical assembly
- Radiochemistry labs
- Radioecology Greenhouse
- and more.....



# OS TRIGA Reactor

