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Fuel and Core Testing Plan for a Target Fueled Isotope Production Reactor

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TA-V LEADING NUCLEAR TECHNOLOGIES

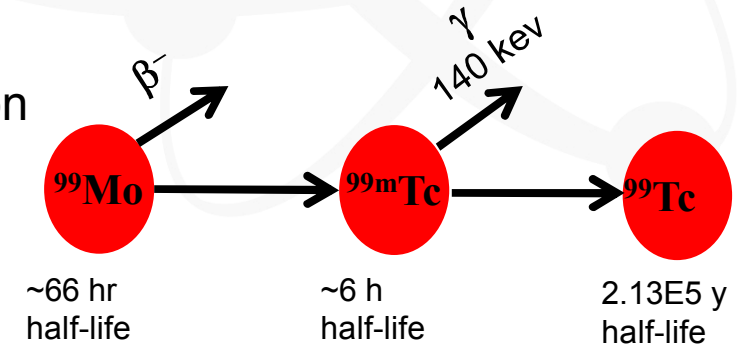
Fuel and Core Testing Plan for a Target Fueled Isotope Production Reactor

Topics

- Introduction/Reactor Concept Design
- Approach to Critical/Low Power Experiments
- Fuel Thermo-Hydraulic Tests
- Burnup and Transient Fuel Tests
- Conclusions

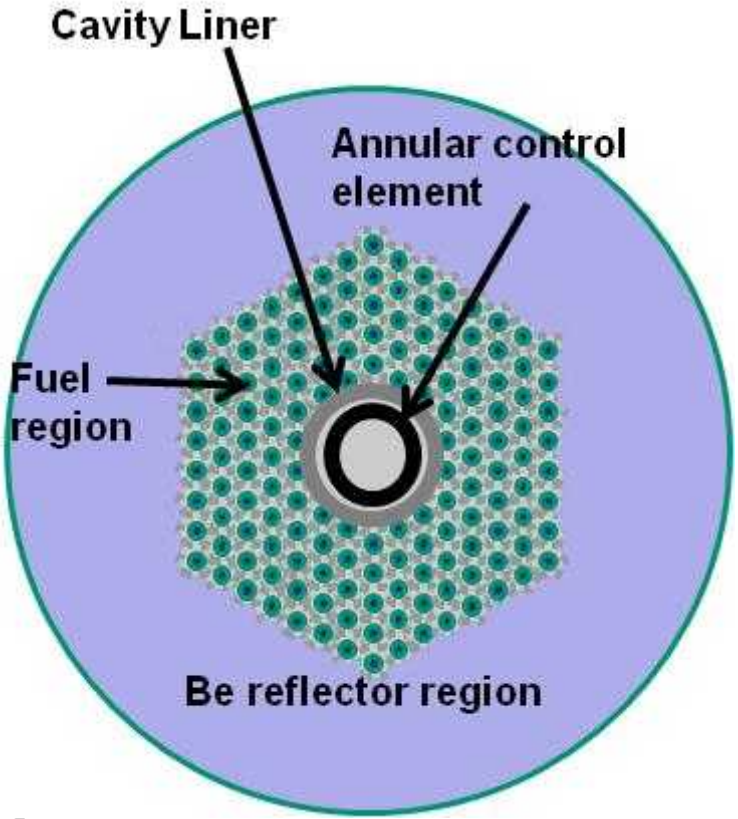
Introduction/Reactor Concept Design

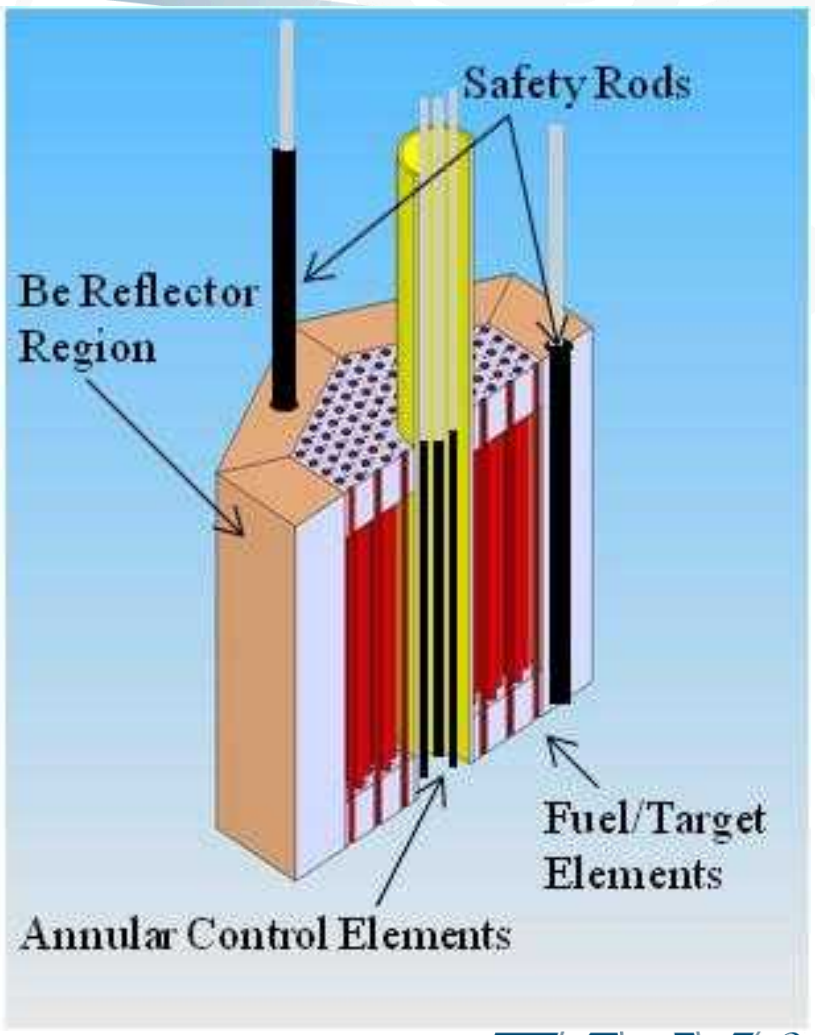
- **The world supply of 99Mo has become destabilized in recent years**
  - ^{99}Mo is parent nuclide of key medical diagnostic isotope ^{99m}Tc used in Single Photon Emission Computed Tomography
  - Nominal world demand of ^{99}Mo is ≈ 12,000 six day Curies per week
  - To satisfy half the world demand 1.1 MW of continuous isotope target fission power is required, assuming 2 days, post-irradiation for processing and shipping
  - A target fueled isotope reactor deign has been proposed to meet half the world demand using Low Enriched Uranium (LEU) oxide fuel-targets
  - Reactor is in an open pool and relies on natural convection cooling



Introduction/Reactor Concept Design

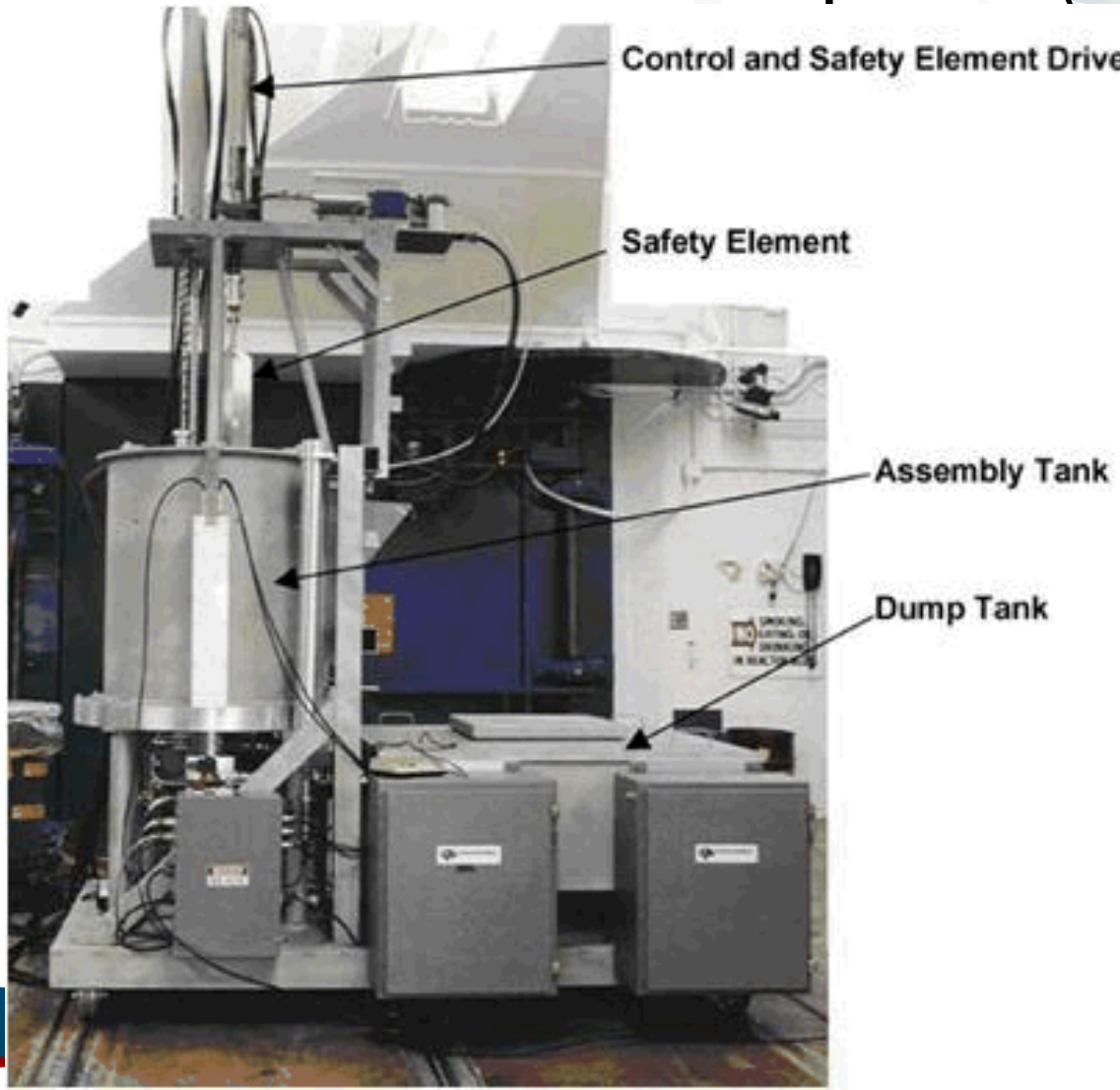
- **Fuel-Target Reactor Design**





Approach to Critical Low Power Experiments

- **Sandia National Laboratories' Critical Experiment (CX) Assembly**



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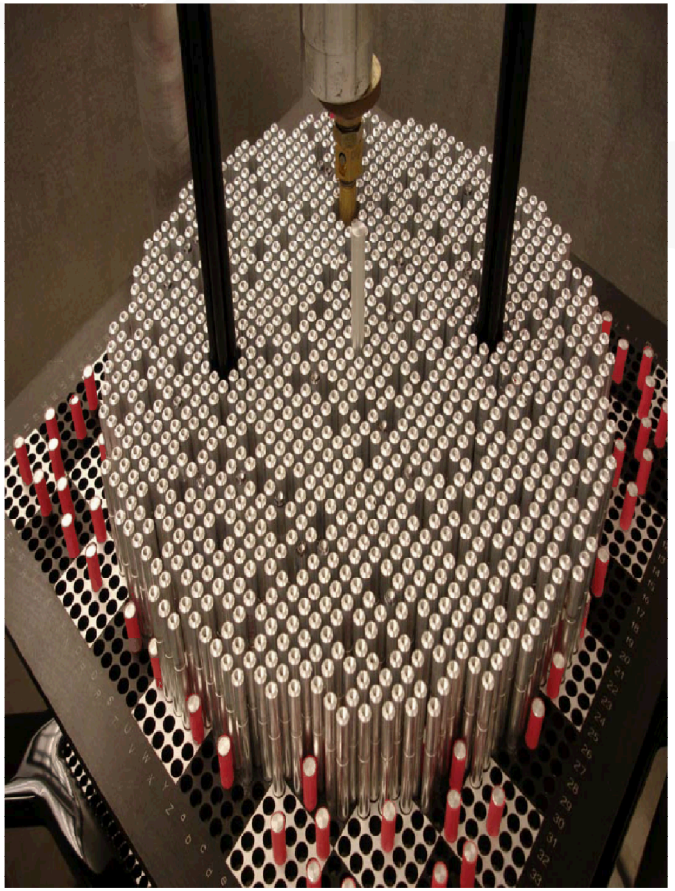
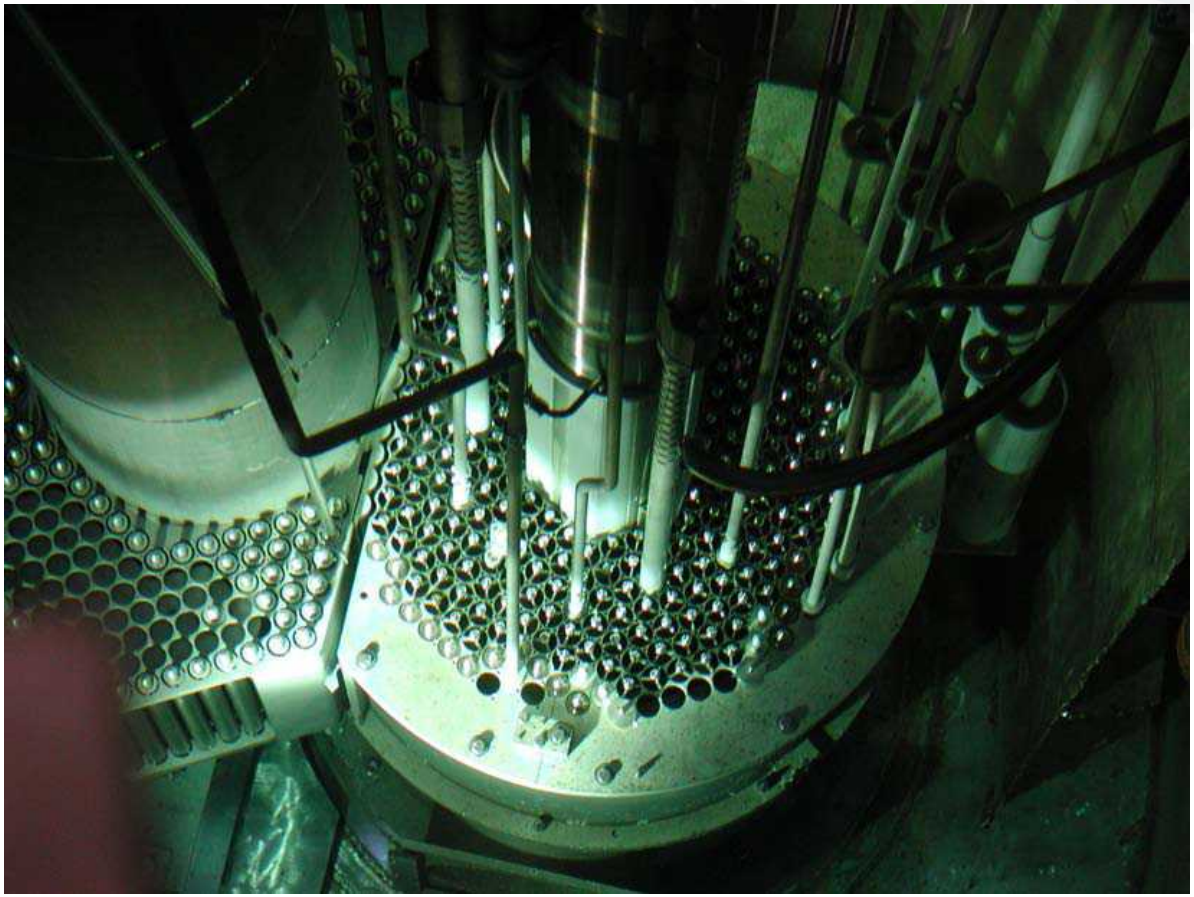


Fuel Thermo-Hydraulic Tests

- **Open pool reactor power is limited by heat transfer from fuel/targets to pool water**
  - Confirming the calculated Minimum Critical Heat Flux can be supported experimentally outside of a reactor core.
  - A tri-lattice of inert (i.e. no fissile material) fuel/target elements will be setup in a deep (~6 m) pool.
  - The elements will be electrically heated to the range of peak element power calculated to occur during normal and accident conditions.
  - The average fuel/target element power is anticipated to be 10 kW per element up to a maximum of 38 kW. Based on calculations this would equate to a UO_2 matrix temperature of about 1200º C.
  - The coolant channel inlet temperature will be controlled to simulate a coolant loop return and the coolant channel outlet temperature will be measured. Optical data will be collected and analyzed to estimate outlet channel coolant density.

Burnup and Transient Fuel Tests

- **Sandia Annular Core Research Reactor (ACRR)**



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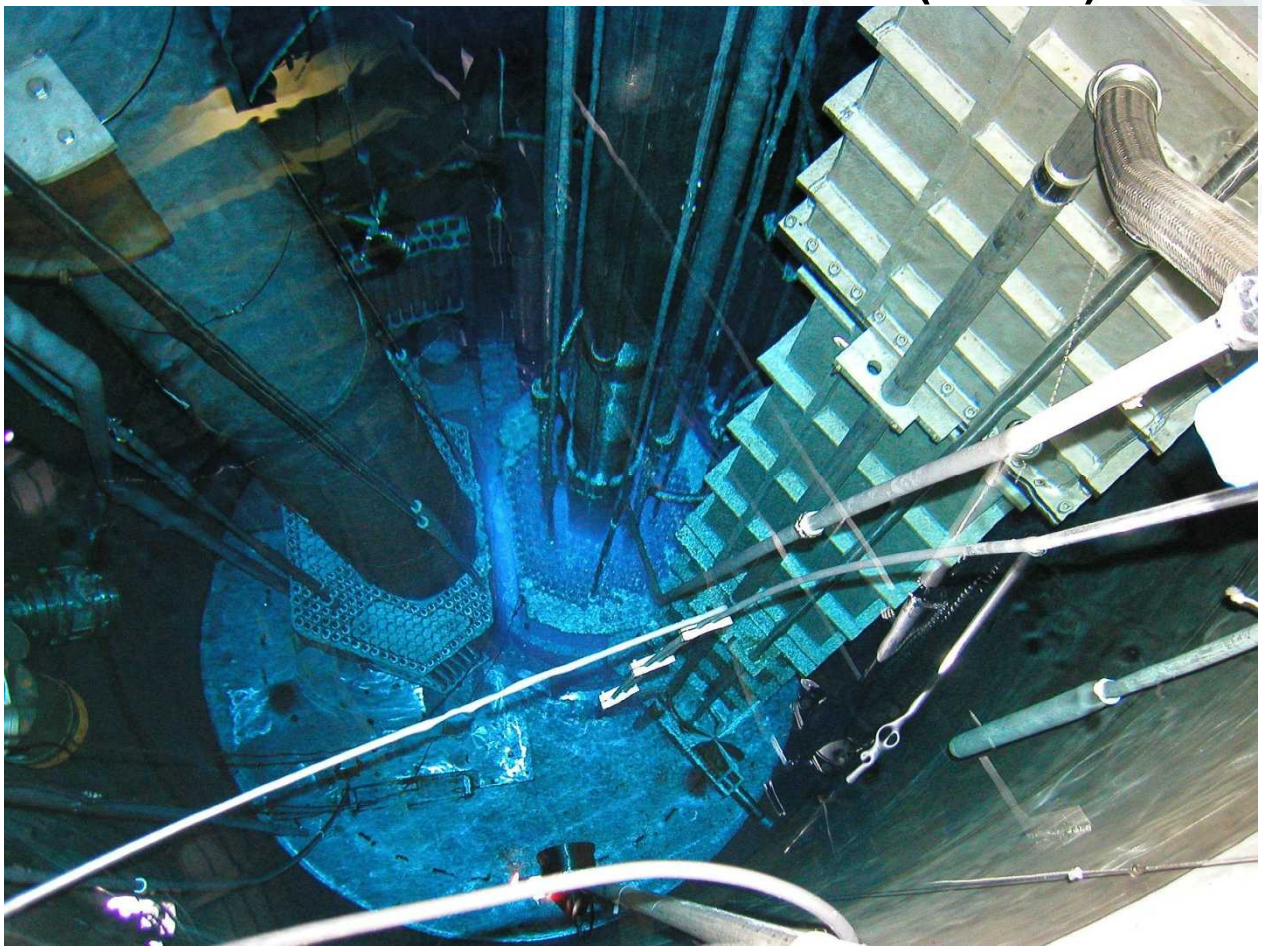

Conclusions

- A thorough and planned testing schedule for a medical isotope production reactor can be executed at Sandia National Laboratories in the US.
- Approach to critical and low power testing will help establish key operating parameters of the reactor system.
- Out of core thermo-hydraulic tests will help establish reactor power limits.
- Burnup and transient tests can be conducted at Sandia's research reactor.
- The tests will validate design calculations, inform the final design choices and support the licensing process.

Questions

- **Contact:**

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