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# NuScale's Microreactor for Research Reactor Applications

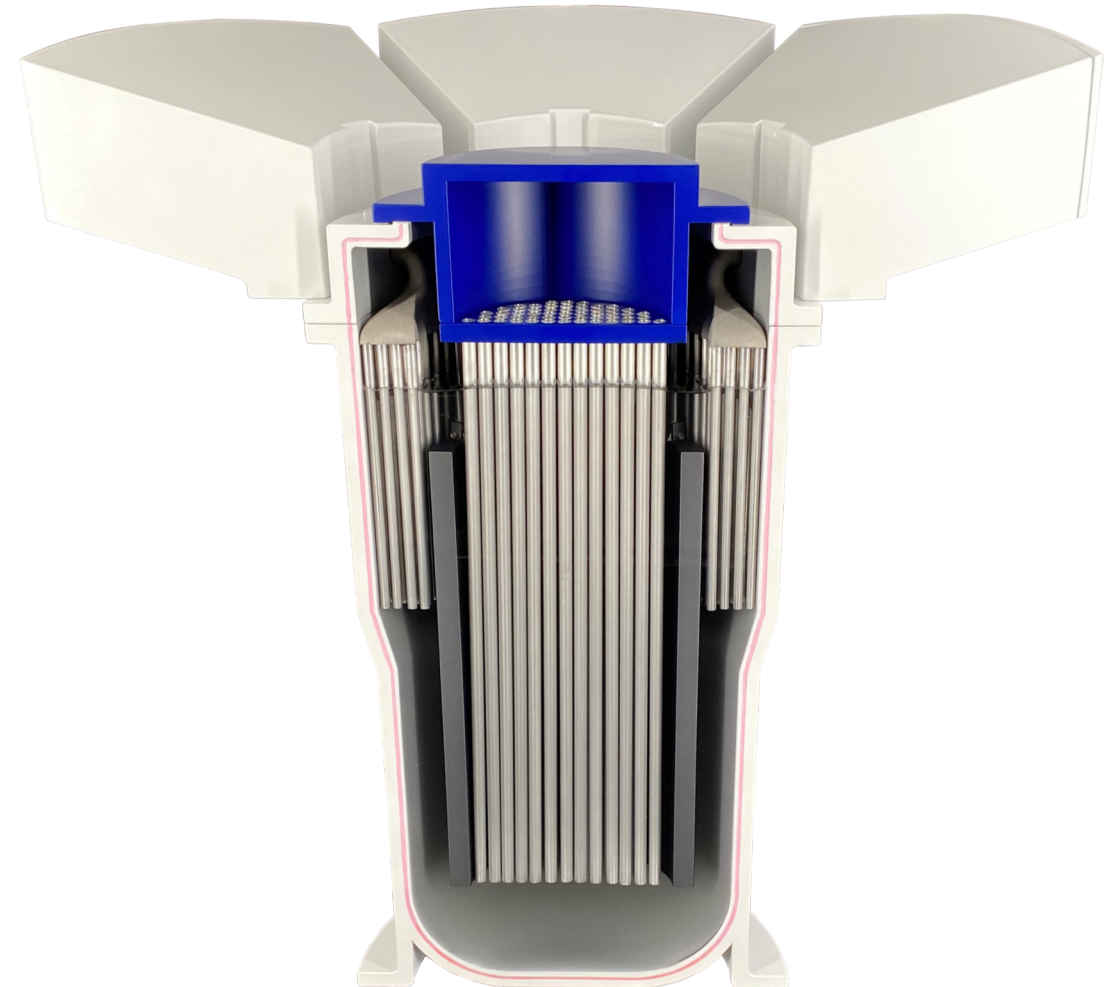
TRTR & IGORR Research Reactor Conference  
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Jackson Keppen

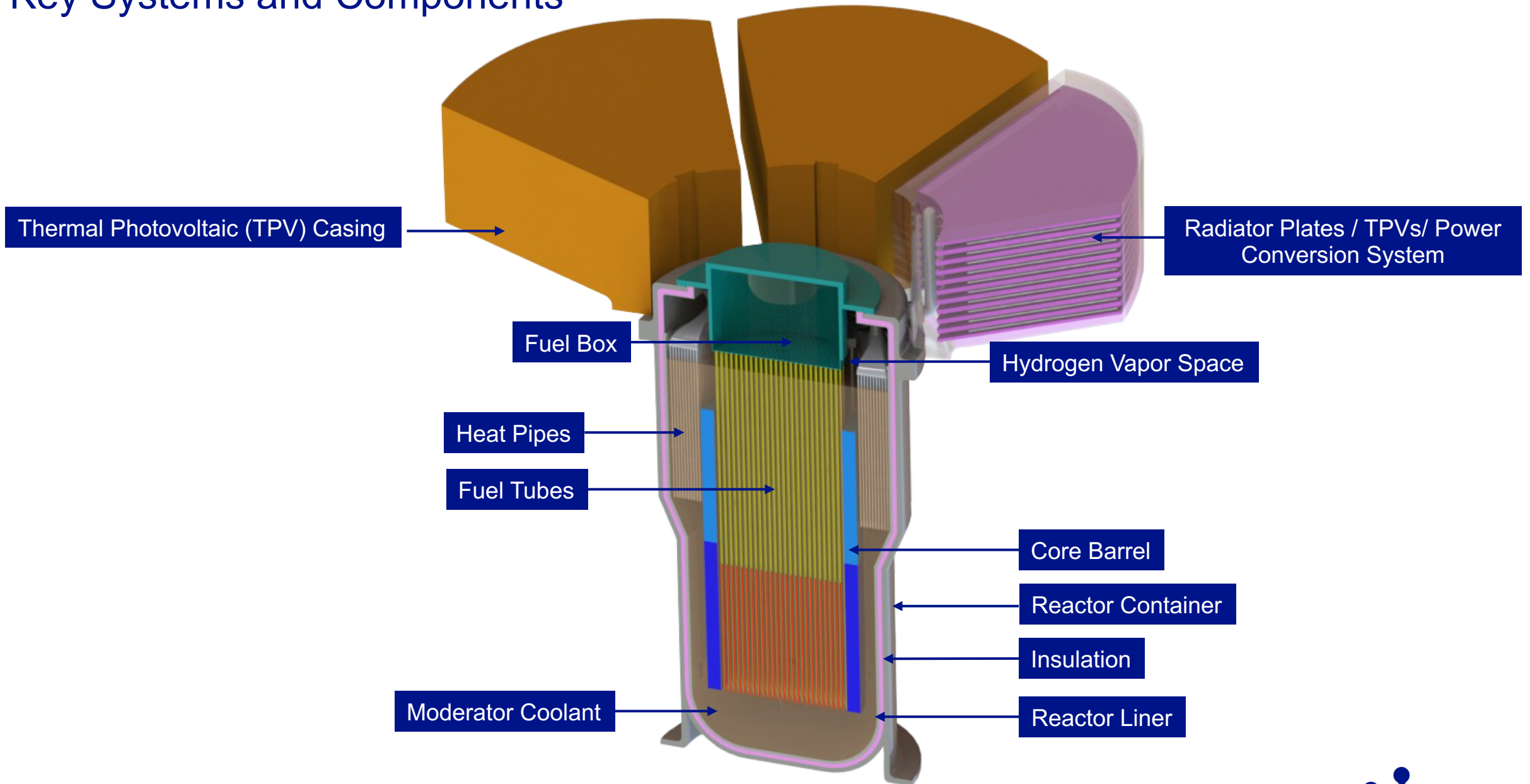
*Research and Development Engineer, NuScale Power, LLC*

# NuScale Microreactor Technology

- Liquid metal cooled thermal-spectrum nuclear reactor
- 8 to 40 MWth size range
- Up to 10 year core life
- Liquid uranium alloy fuel
- Passive fission product removal system (FPRS)
- Liquid metal moderator-coolant
  - Metal Alloy in Calcium-Hydride Calcium: MACH-C
  - Hydrogen-based power control system
- Fully passive system available
  - Pumped system potential for high power density systems
- Low pressure system
  - Eliminates the cost and licensing effort for pressure vessels

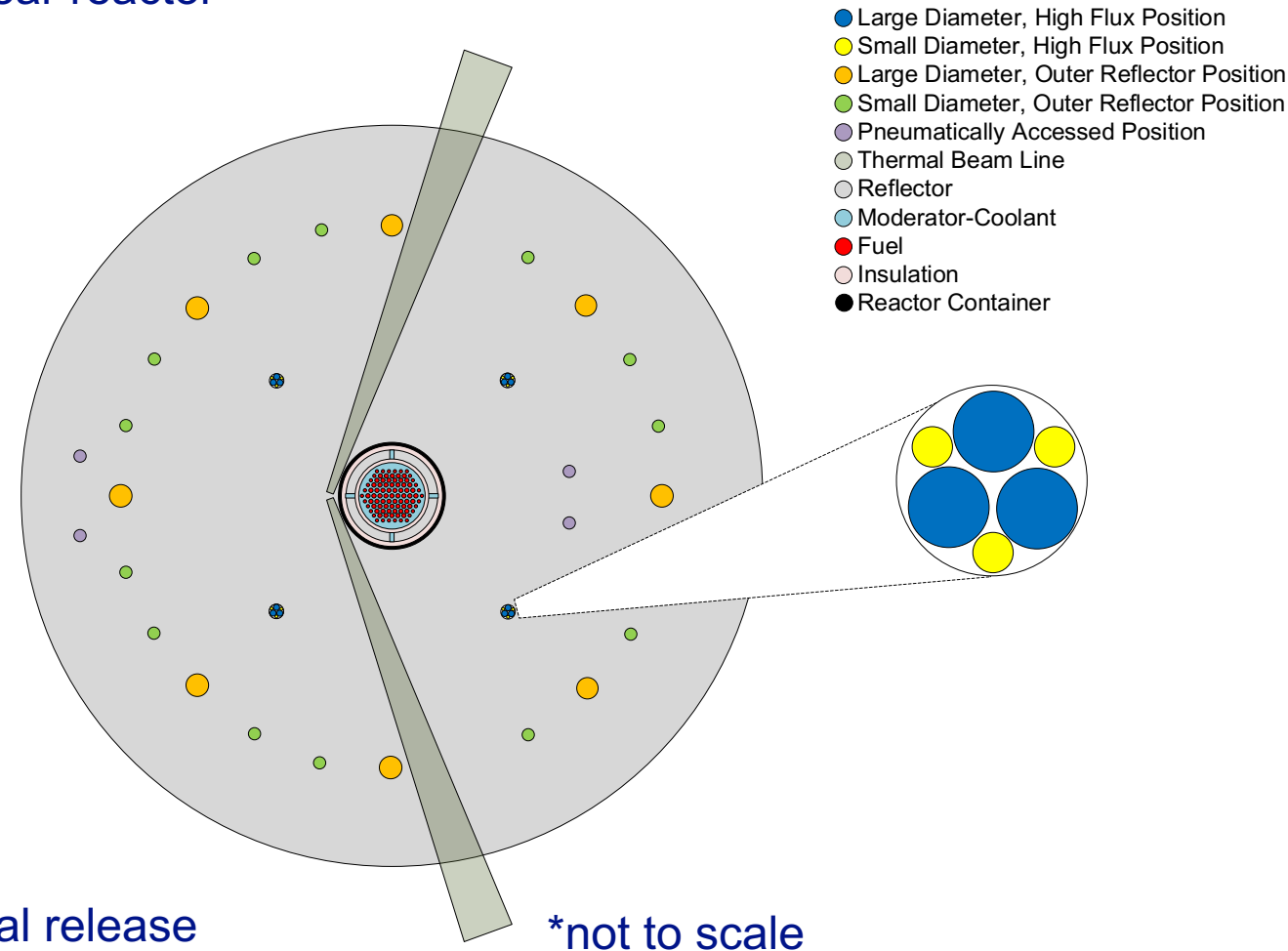


# Key Systems and Components



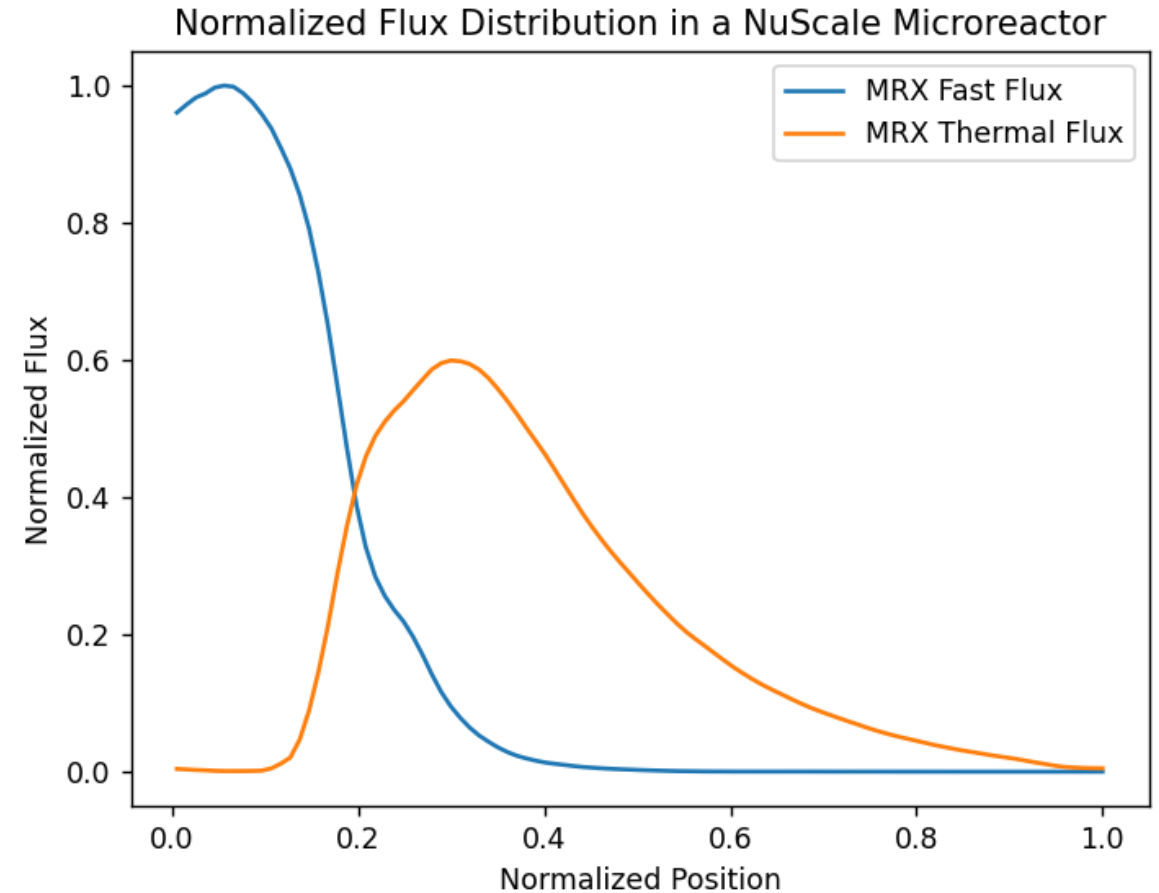
# The NuScale Advanced Research Reactor – Broad Spectrum Capability

- 20MWth liquid metal cooled, thermal spectrum nuclear reactor
- High magnitude thermal flux
  - Up to  $5E14 \frac{n}{cm^2-s}$
- Multiple reflector-based irradiation positions
  - Up to 8 within highest flux region
- Online target movement
- LEU capable with lower performance
- 1 to 2 year refueling cycle
- Low available source term limits potential radiological release



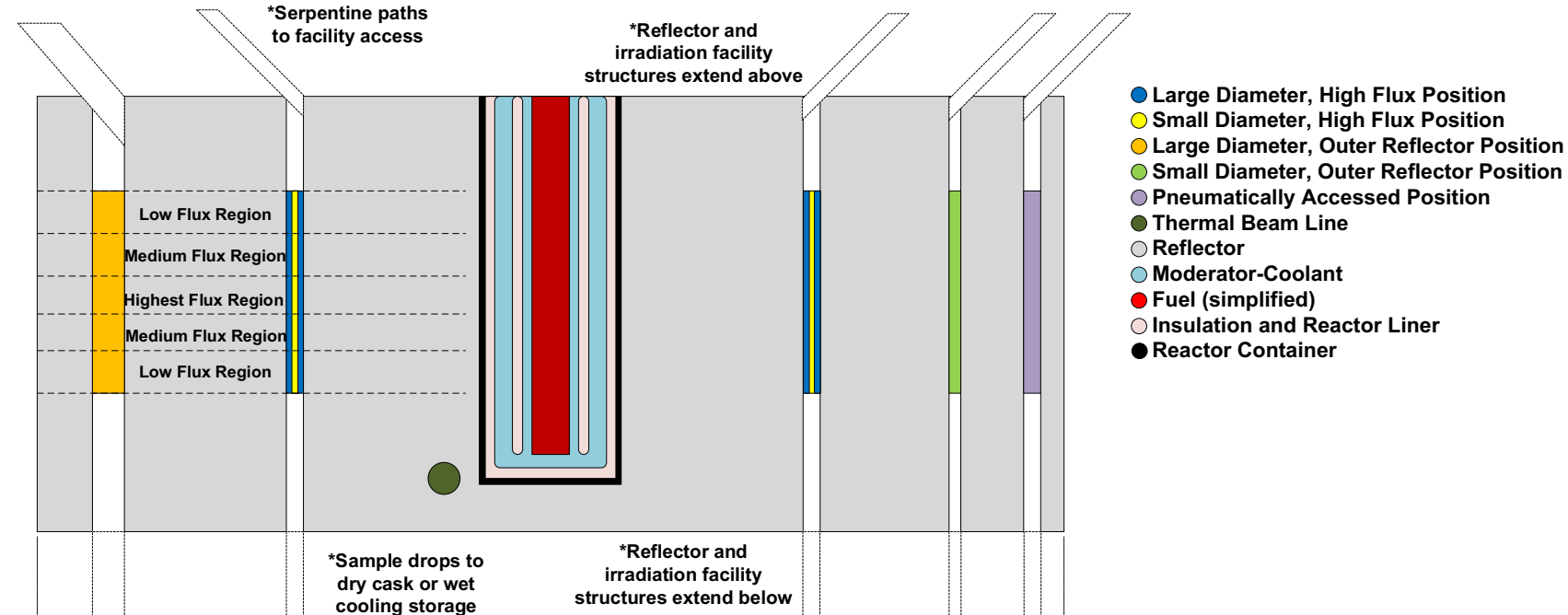
# Fuel Cycle and Flux Magnitudes

- 1 year HALEU fuel cycle:
  - Thermal flux: approximately  $5e14 \frac{n}{cm^2-s}$
- 2 year HALEU fuel cycle:
  - Thermal flux: approximately  $4.5e14 \frac{n}{cm^2-s}$
- 1 year LEU+ cycle:
  - Enrichment: 10% or less
  - Thermal flux: approximately  $2.5e14 \frac{n}{cm^2-s}$



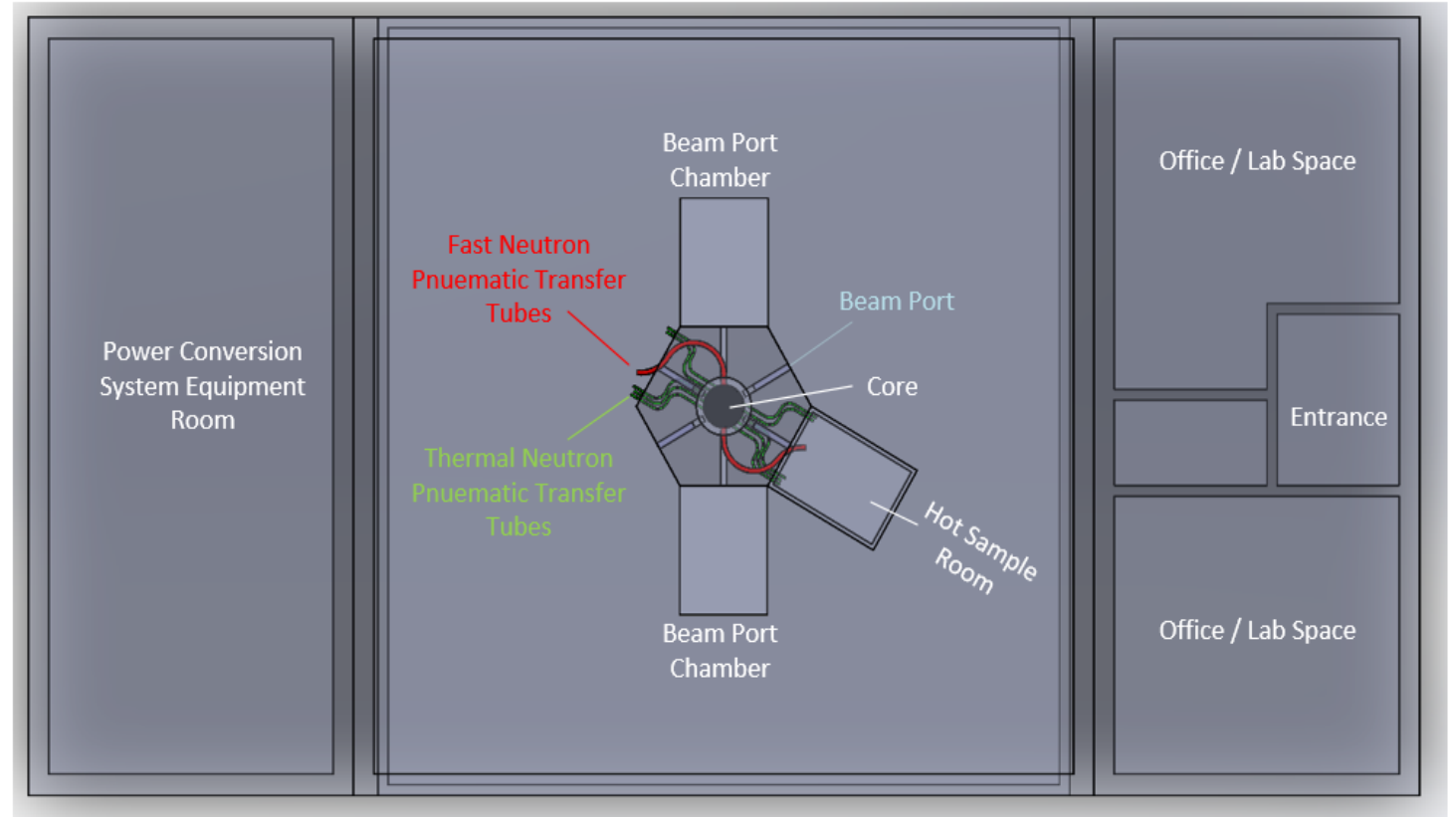
# Proposed Generic Layout for ARR Configuration

- All irradiation facilities outside of core volume
- Pneumatic or remote handling
- Accessible to multiple users simultaneously
- Up to 8 locations in highest flux region
  - Reactivity insertion from removing all 8 is within safe limits

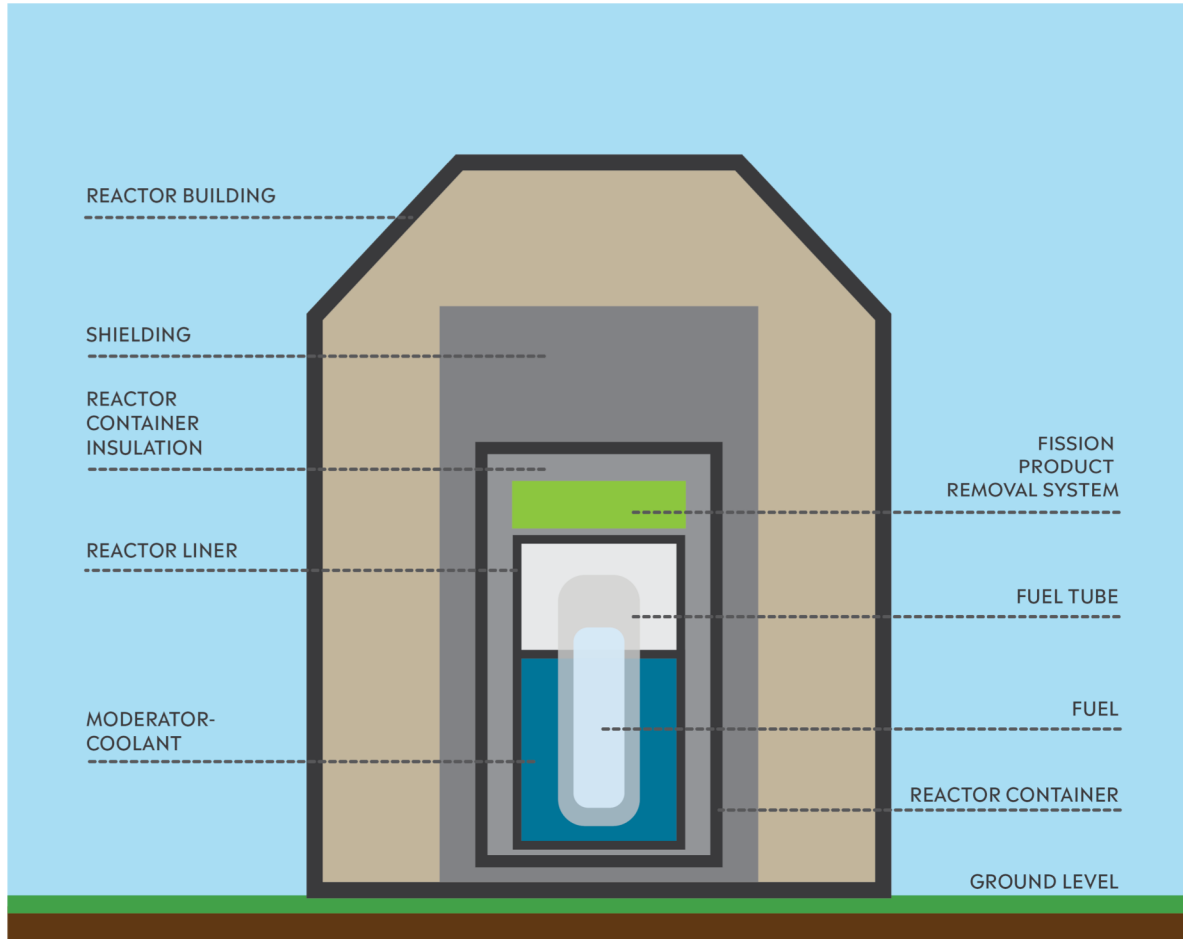


## Reactor Facilities – Facilitating Flexibility

- Beam Ports
- Lab space
- Fission product storage
- Power conversion or heat rejection equipment
- Low-grade heat use



# Safety Features

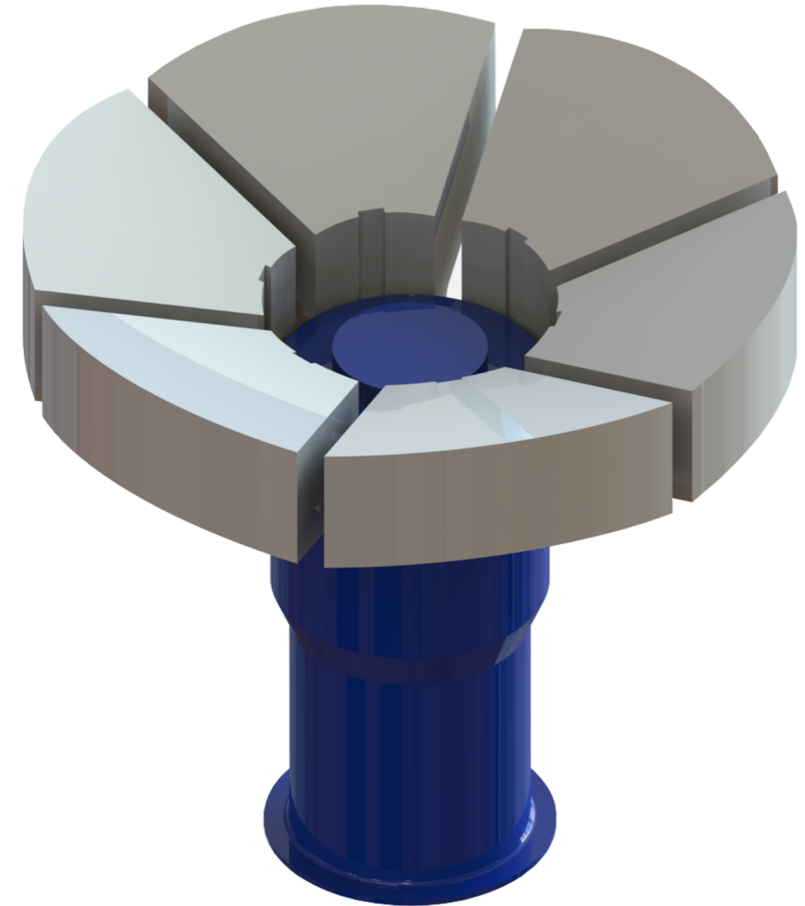


- Electric power is not required to shut down or indefinitely maintain the safety of the reactor
- Reactivity is controlled through the addition or removal of hydrogen gas
- Small normal operation and accident source term
- FPRS further reduces source term



# The NuScale Microreactor Adaptable Design Recap

- Flexibility in design for performance needs
  - $5E14 \frac{n}{cm^2-s}$  fluxes
  - LEU capable
- Flexibility in operations
  - 8 high-flux locations
  - 20+ broad-spectrum locations
- Safety by design
- Flexibility to meet user needs
  - Feedback welcomed and appreciated





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