SOLVING ENERGY CHALLENGES THROUGH SCIENCE

Versatile Test Reactor (VTR) Experimental Capabilities

22 APRIL 2022

INTERNATIONAL CONFERENCE ON FAST REACTORS AND RELATED FUEL CYCLES
FR22: SUSTAINABLE CLEAN ENERGY FOR THE FUTURE (CN-291)

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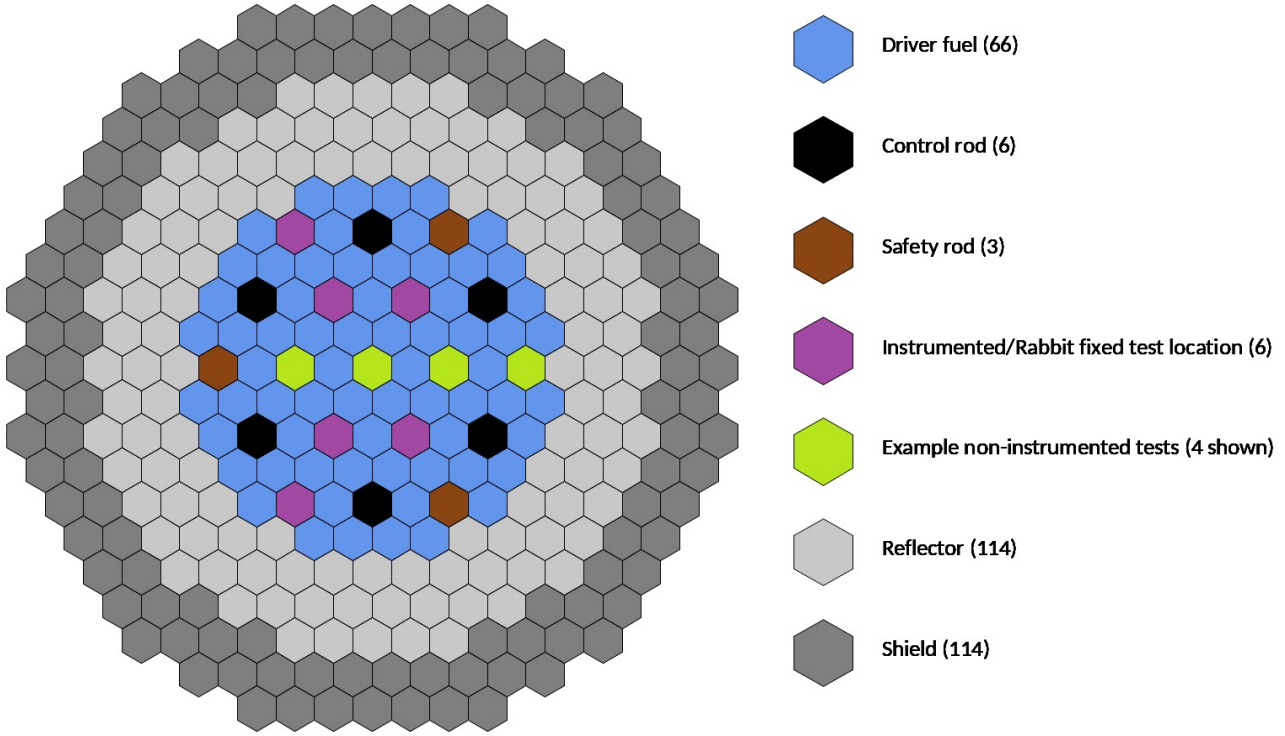
Note: Information regarding site location is **preliminary**. The decision for site location is determined via DOE acquisition processes that have not yet been completed.

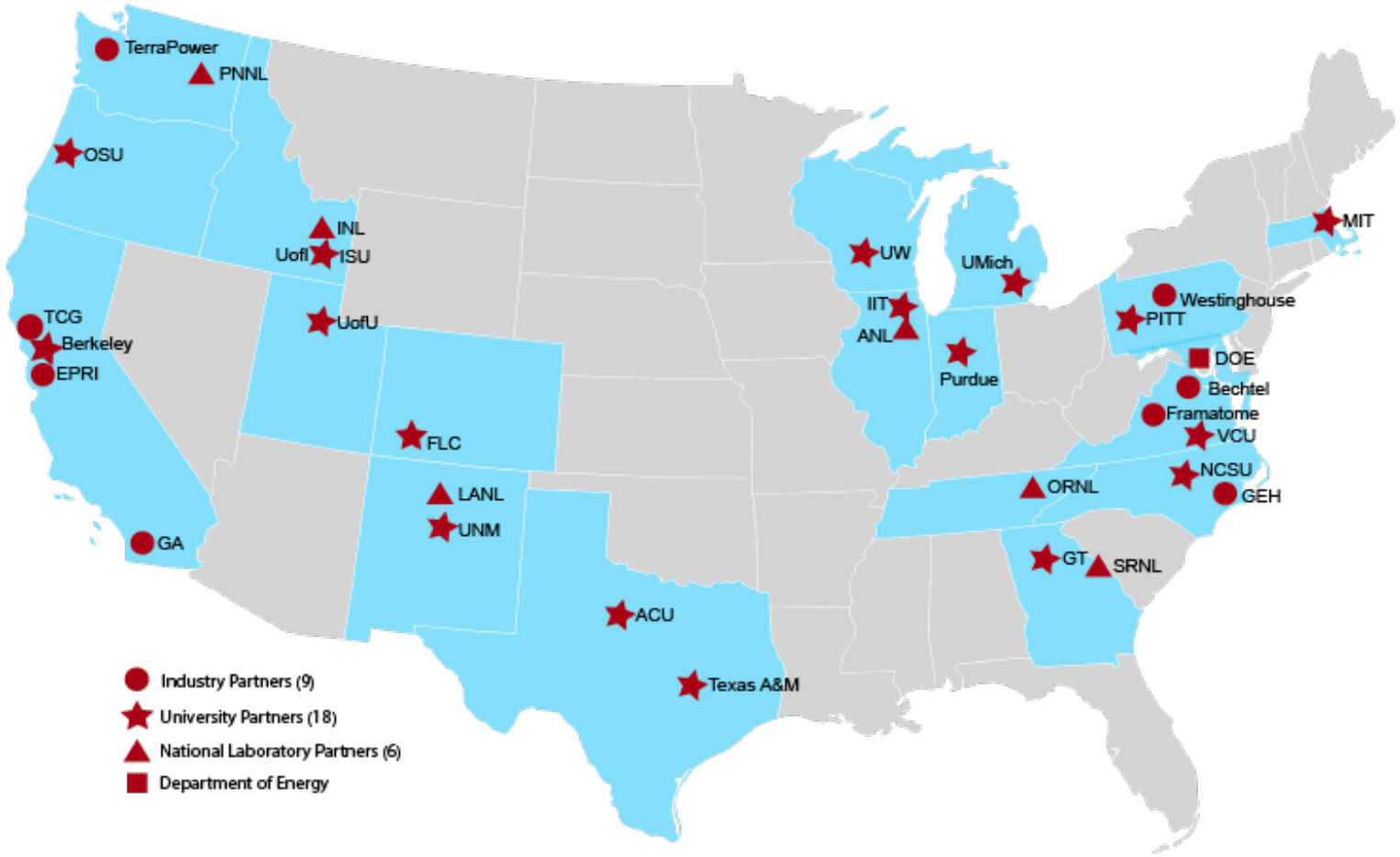
VTR Core

- Sodium-cooled, fast neutron spectrum reactor
- Planned experimental devices/vehicles:
  - Normal Test Assembly (NTA)
  - Dismountable Test Assembly (DTA)
  - Extended Length Test Assembly (ELTA)
  - Rabbit Test Assembly (RTA)
- Based on PRISM Mod A design, and experience from other fast reactors (e.g., EBR-II, FFTF, JOYO, BOR-60, etc.)



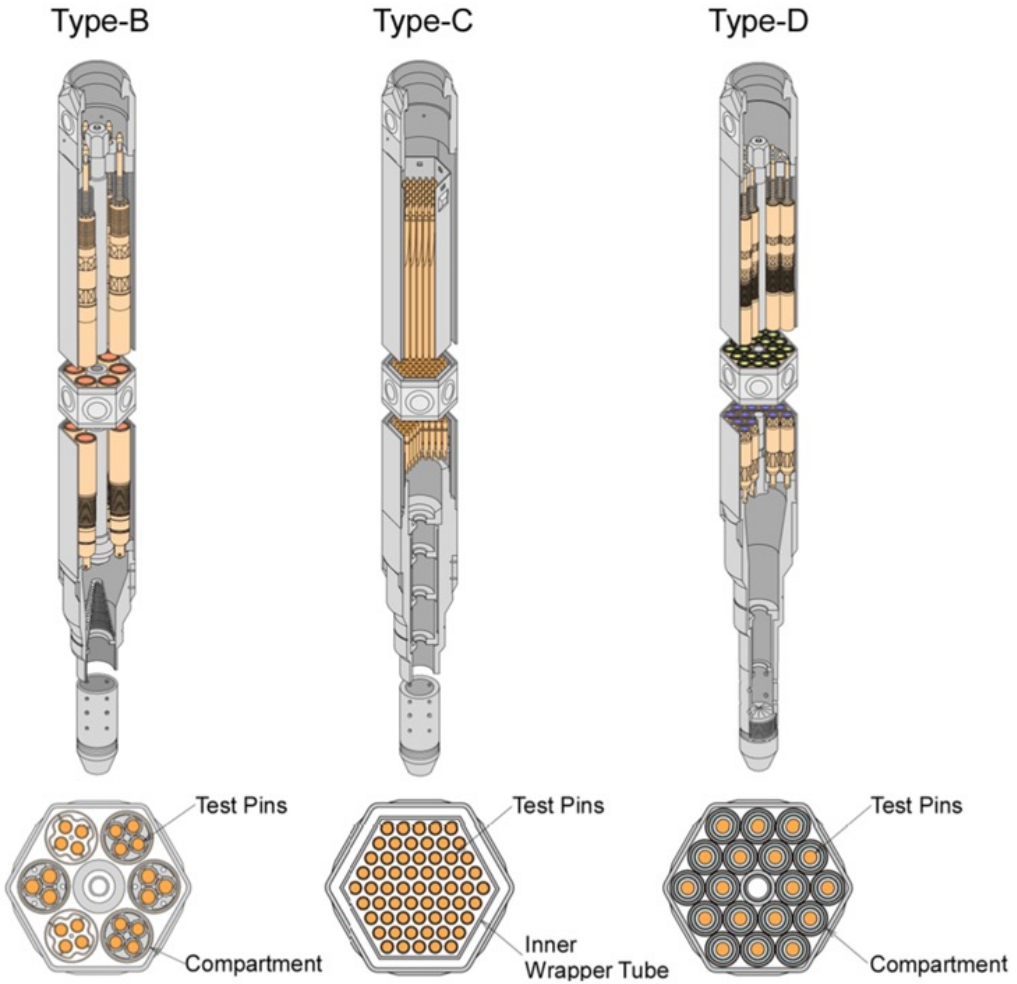
VTR Experiments Development Team

- 18 university partners (including co-PI's)
- 8 industry partners
- 5 national labs
  - VTR overall is supported by 6 national labs



Normal Test Assembly (NTA)

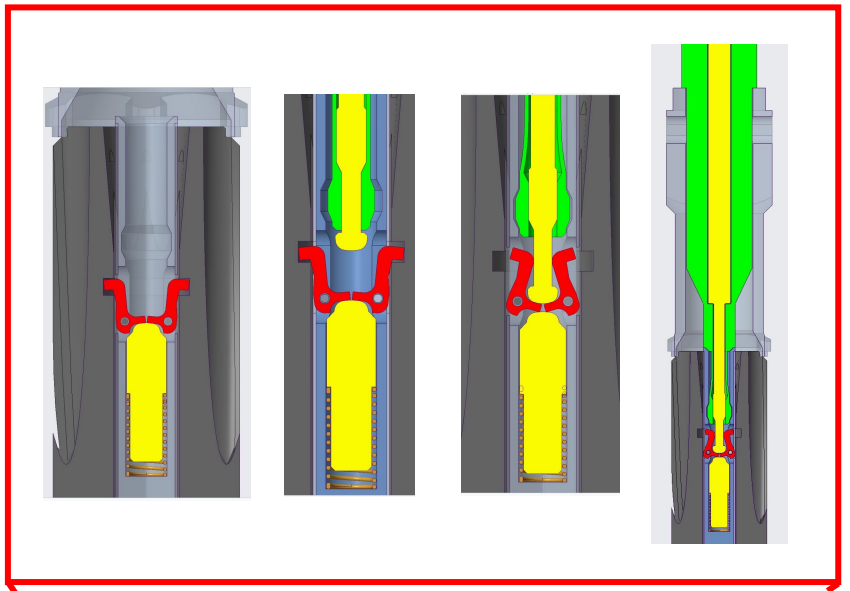
- Standard non-instrumented or passively instrumented open test assemblies that are the same size, flat-to-flat, as the driver fuel assemblies.
  - NTA's are similar to standard fuel assemblies, and handled the same way
- Can contain materials or fuel
- Similar examples come from the JOYO test reactor (see figures)

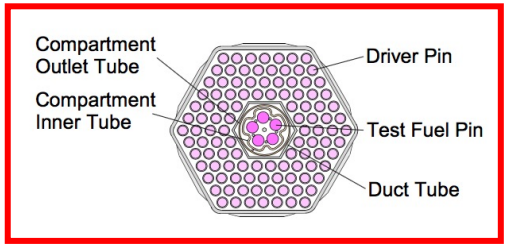


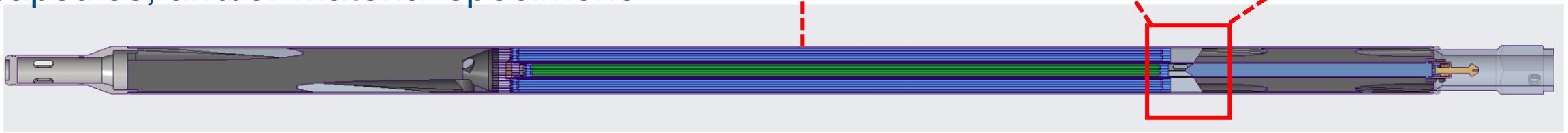
JOYO test assemblies

Dismountable Test Assembly (DTA)

- A modified driver fuel assembly that will have an insert (DTA insert) that replaces 7-19 pins of the driver fuel.
- The DTA insert can remain for one cycle, or for as many cycles as the material limits of the insert allow.
  - DTA insert can be removed during outage, and replaced with new insert.
- DTAs are non-instrumented or passively instrumented.
- Each DTA insert can contain fuel, capsules, and/or material specimens

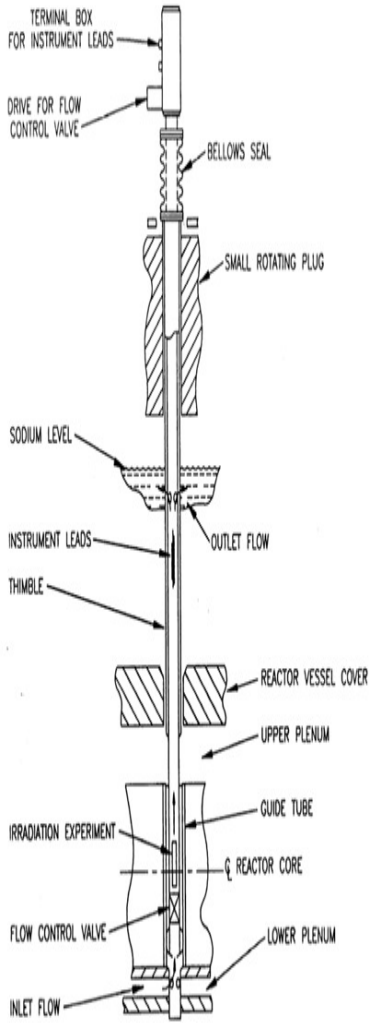


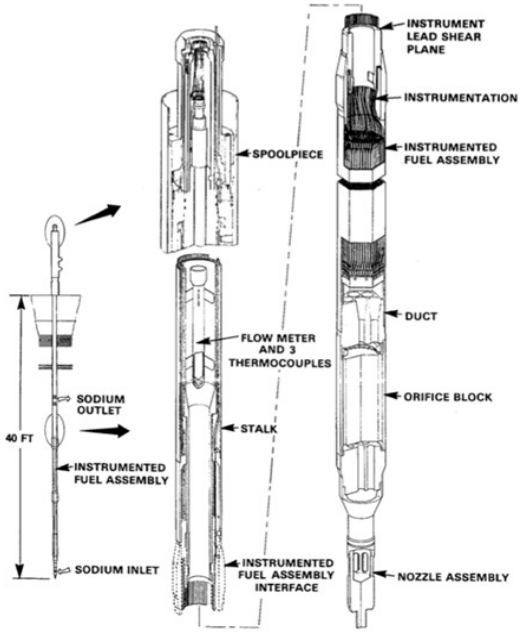




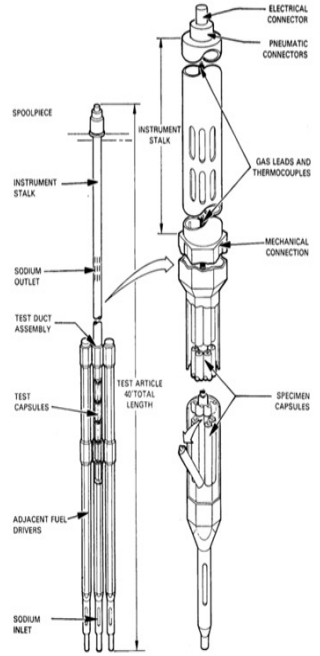
Extended Length Test Assemblies (ELTA)

- Test assemblies that have a long ”stalk” that extends through the reactor head, and typically have various instrumentation leads, etc., for monitoring and controlling thermal-hydraulic conditions.
- Contain various sensors to record the relevant physical conditions of the test article online, and may also manipulate the thermal-hydraulic environment during the test
  - Fuels
  - Materials
  - Includes cartridge loop experiments (4) with separate coolants.
    - Sodium
    - Pb/Pb-Bi
    - Molten salt
    - Gas





FOTA from FFTF



MOTA from FFTF

ELTA example – Molten Salt Cartridge Loop

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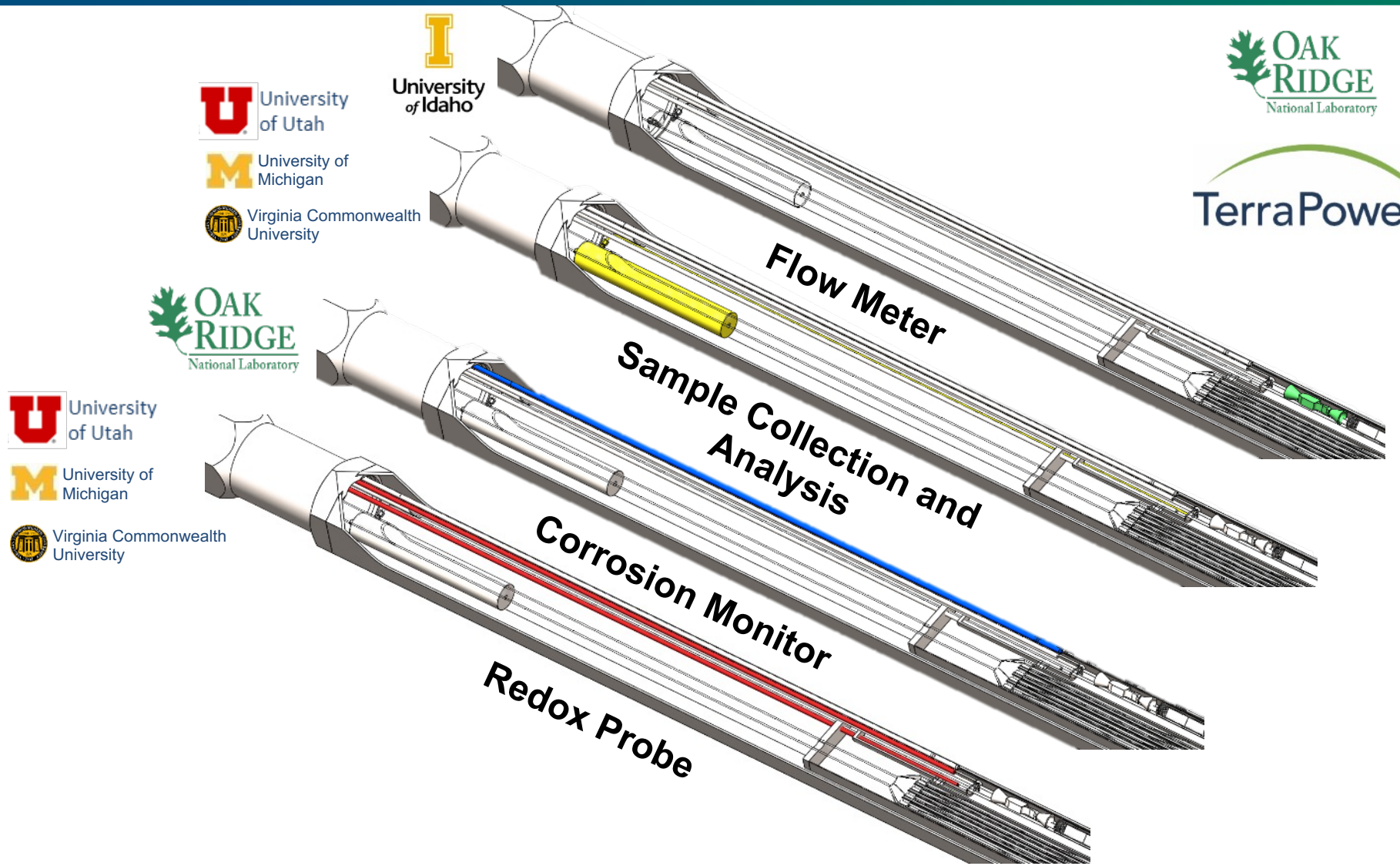
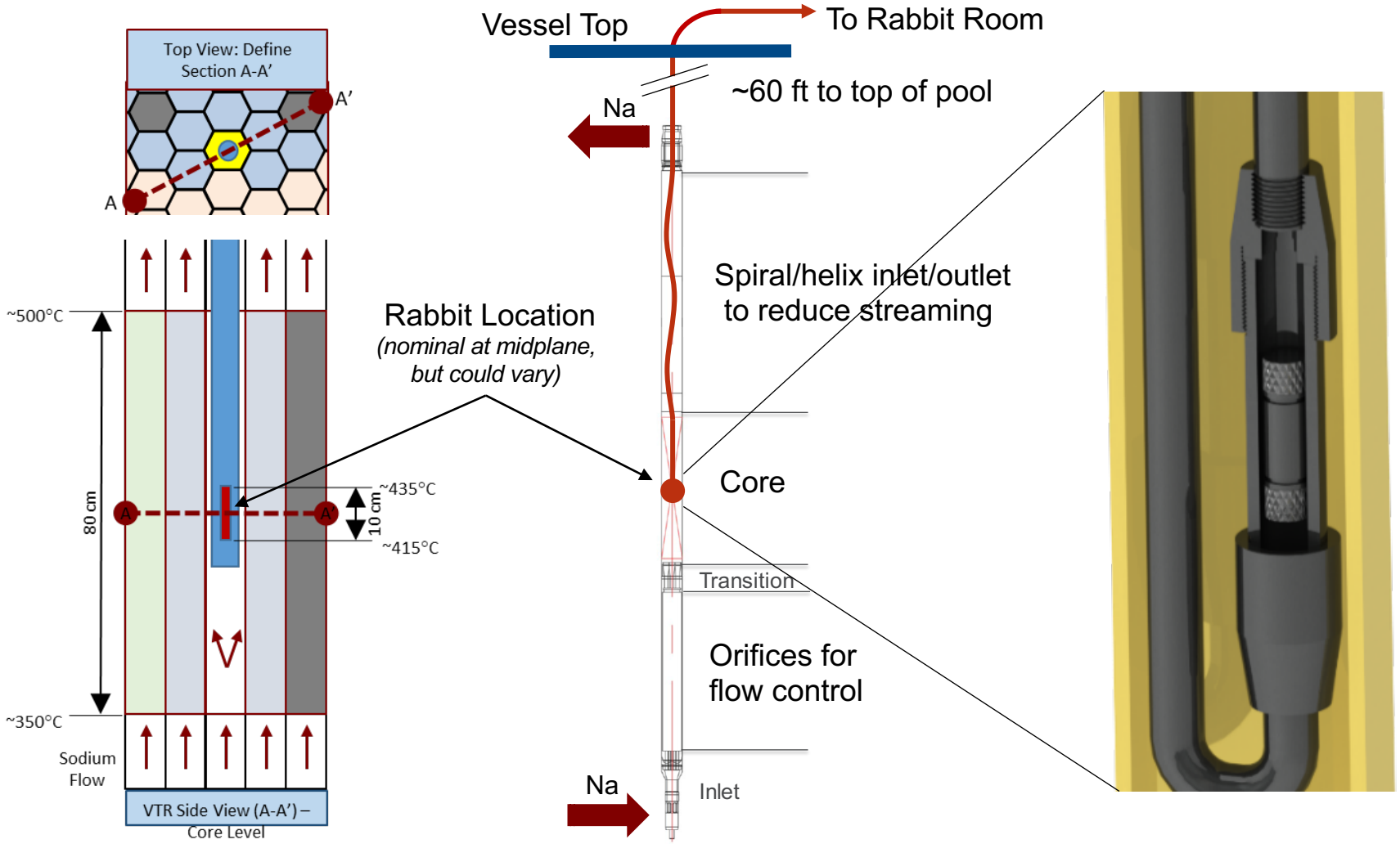
University of Utah
University of Michigan
Virginia Commonwealth University
University of Idaho
OAK RIDGE National Laboratory
TerraPower



Overall Integration and Design

Rabbit Test Assembly (RTA)

- Special test assembly for rapid transfer of capsules that contain experiment specimens, which are propelled down a tube into a thimble, irradiated, and recovered intra-cycle (short-term irradiations) or inter-cycle.



VTR – Designed for Testing

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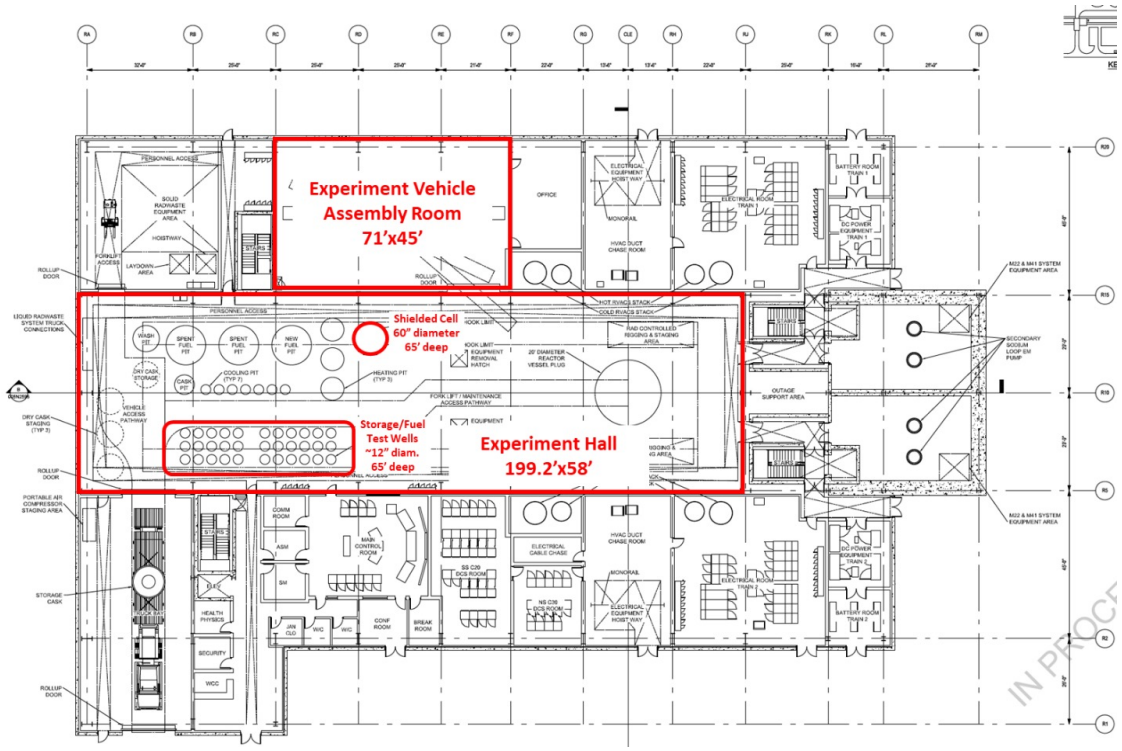

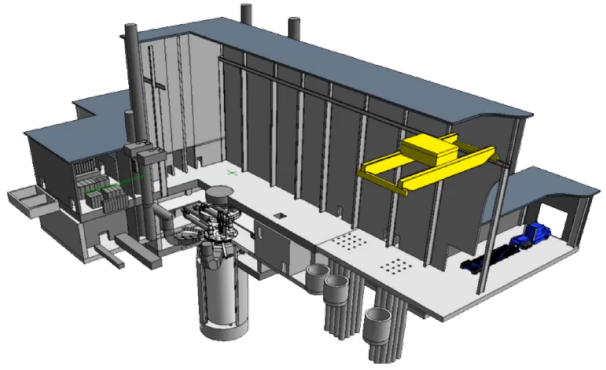

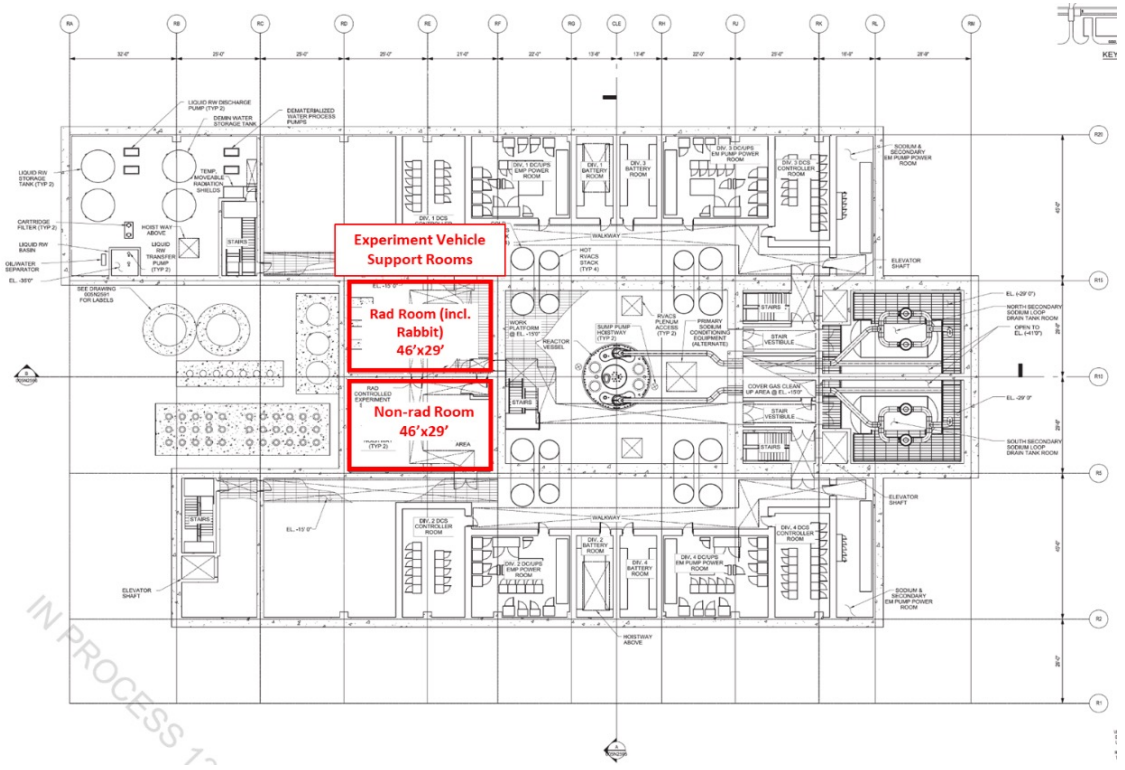

- PIE will be performed at existing hot cells

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