INL/EXT-21-64161-Revision-0

FY2021 July Monthly Status Report for the Versatile Test Reactor

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Project Highlights

Jordi Roglans-Ribas, Program Overview

Budget planning for Fiscal Year (FY) 2022 continued, including discussions regarding the scope of work during a potential $45M continuing resolution. An initial set of milestones will also be developed. The released FY22 House mark does not provide any finding for VTR, and the Project will need to wait for the Senate mark to anticipate funding levels for FY22. A potential planning scenario will be developed on the assumption that FY22 will start with only carryover funds, and the planning scenarios will be better defined as additional guidance is received from the U.S. Department of Energy (DOE).

After the successful completion of negotiations on the terms and conditions with the preferred offeror (a team led by Bechtel National Inc. [BNI]) for the design-build contract, the blanket master contract (BMC) package has been completed at Battelle Energy Alliance, LLC (BEA) and submitted to DOE in July for their review and approval. DOE approval is expected in late August, and it is anticipated that the BMC could then be signed by BEA and BNI in September.

The implementation of the memorandum of understanding (MOU) established between the VTR Project and the Natrium (a sodium-cooled reactor demonstration project) consortium started in July with discussions on the identification of component/system testing needs for each project and the test plans and test facility requirements. Testing may be one of the key areas offering significant synergies between the two projects.

The VTR team supported the DOE review and revision of the concurrence draft of the Environmental Impact Statement (EIS). It is anticipated that with the completion of the review of the concurrence draft, the final EIS will be ready for publication in August/September.

Two project milestones were completed, one milestone within the plant design area and the other in the fuels area. Additional detail will be provided later in this report.

For outreach activities, Jordi Roglans presented an overview of the VTR during the Modeling, Experimentation, and Validation (MeV) School held at Argonne National Laboratory (ANL).

Nuclear Design

Continued evaluating the nature of gallium impurities in the U-Pu-Zr ternary fuel, while progress is being made on process modeling of the fuel fabrication staging requirements, material flows, and throughput. Quantification of uncertainties in cross-section and core design parameters are being evaluated to provide for overall design resilience and versatility, establish and justify the safety basis, and provide an understandable and quantifiable reserve of the margin necessary to support the eventual operating reactor. Demonstrated functionality of a new electromagnetic pump (EMP) modeling capability. Once fully integrated into the SAS4A/SASSYS-1 safety analysis code, it will be used to perform more representative assessments of pump coast-down requirements and pump heating impacts. Continued verification and validation (V&V) of the sodium fire analysis codes and documentation of those activities is ongoing.

Completed a Level 3 milestone documenting progress on the VTR Probabilistic Risk Assessment (PRA) of all hazards and operating modes. Continued planning and development of work scope and budget for FY22 funding scenarios.

VTR Plant Engineering

Identified the need to perform a formal study using an optioneering process to identify an optimal refueling system and process. This work stream is a top priority for the project and will be executed immediately in FY22, depending on congressional budget appropriation.

Completed the milestone *Spent Fuel Pretreatment Storage and Transfer*. It was necessary to define a spent fuel strategy that outlined the lifecycle of used fuel as it leaves the reactor vessel until it is ultimately stored at a spent fuel repository.

VTR Reactor Building (U11) Optimization design workflow poses a risk to project schedule and continues to be worked. There are approximately 17 engineering items that could potentially impact the design and layout of the U11. Identified configuration improvements which centered on relocating M21 Primary Sodium Purification System components west of the reactor vessel. This will allow easier access to system components through the experiment hall using the overhead crane instead of using hatches and temporary lifting structures in vestibules in U11 that pose an operational and radiation risk, as well as increased Operations and Maintenance (O&M) cost over the life of the plant. This orientation also allows favorable placement of other systems and components, such as the Gaseous Radwaste System (K40). The formal decision will be made in August as the design team compiles more information on impacts and risks associated with the change.

GE-Hitachi Nuclear Energy Americas, LLC (GEH) hosted a strategy meeting in Wilmington, NC, on July 12-16, 2021, to discuss the FY22 Engineering Approach. The meeting was very productive and resulted in strong alignment among GEH, BNI, TerraPower (TP), and BEA for the scope and approach for FY22 work.

VTR Experiments

The experiment vehicle (EV) teams (the J23 system) collaborated with the engineering and plant design teams to develop and review interface requirements, which will support advancement of the VTR design. Additional one-on-one meetings will be held for more detailed requirements development, including input/output diagrams that specify each interface. Began discussions on safety requirements for the cartridge loops, and what parameters should be monitored for plant safety.

Upcoming Events:

American Nuclear Society Winter Meeting, November 30 – December 3, 2021, Washington DC.

NURETH-19, 19th International Meeting on Nuclear Reactor Thermal Hydraulics, March 2022, Brussels, Belgium.

IAEA International Conference on Fast Reactors and Related Fuel Cycles (FR22), April 2022, China

Social Media

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Technical Highlights

George Malone, Reactor Technical Integration

Completed the milestone *Spent Fuel Pretreatment Storage and Transfer*. It was necessary to define a spent fuel strategy that outlined the lifecycle of used fuel as it leaves the reactor vessel until it is ultimately stored at a spent fuel repository. The VTR Spent Fuel Treatment Strategic Plan presents a viable disposition strategy for VTR spent fuel. The priority of actions, in order, are:

1. Treat the spent fuel to remove reactive sodium and reduce the attractiveness of the material.
2. Package the treated spent fuel to accommodate the desires of the State of Idaho to protect the environment by storing it in a road-ready package that can leave the state at the earliest opportunity.
3. Enable the "disposability" of the spent fuel waste form by choosing packaging that allows multiple disposal paths (e.g., interim storage, mined repository, or borehole disposal).
4. Accommodate as many current design requirements as possible from existing guidance, recognizing that the proposed geologic high-level waste repository at Yucca Mountain has been deemed not viable by two Presidential administrations and was not acted upon by a third.

The strategy also describes likely storage container concepts and interim dry-cask storage sites at INL where spent fuel will reside prior to treatment and ultimate shipment off-site. Report INL/EXT-21-63317, Rev 0, *VTR Spent Fuel Treatment Strategic Plan*, documents the spent fuel strategy.

Prepared two new project documents, *VTR Technical Pre-Job and Post-Job Briefings* and *Versatile Test Reactor Optioneering Evaluations*. These documents will help improve team performance and reduce rework, therefore reducing engineering costs. The new documents are being processed and will be issued in August. The documents incorporate nuclear industry best practices and fill process gaps in existing guidance for briefs and methods for selecting technical solutions.

GEH/BNI Design Engineering Support

Continued Analysis-Design Interface discussions. This initiative aims to increase the integration of analysis works performed by BEA with the design work performed by GEH, BNI, and TP. The objectives to ensure needed inputs and outputs are scheduled and planned, and interfaces activities and impacts on ongoing work in various organization are well understood. The initiative will streamline work and reduce iterations and rework between analysis and design teams. The short-term goal is to capture key interface activities within the L3 Master Control Schedule (MCS). The long-term goal is to facilitate implementation of a fully integrated schedule among all organizations performing VTR project work.

Continued work on VTR risk reduction efforts, including:

- Continued work on Intermediate Heat Exchanger (IHX) Technology Maturation Plan (TMP).

- Continued U11 bi-weekly meeting series to review and assess optimization and proposed changes.
- Reactor Facility (U11) discussions on Sodium Purification System (M21) location.
- Continued progress on the Secondary Heat Rejection System (B24) Special Purpose Review (SPR) action items to finalize conceptual design and support value engineering.
- Developed a BEA approved list of FY21 tasks utilizing capital funding. Continued preliminary design of selected components under M21 and B24 systems, such as the Cold Trap design.

GEH hosted a strategy meeting in Wilmington, NC, on July 12-16, 2021, to discuss the FY22 Engineering Approach. Topics included:

- Stabilizing and advancing the conceptual design,
- Establishment of an effective project schedule,
- Advancing the design of high-risk components,
- Building the VTR Engineering organization,
- Establishing the Natrium/VTR Public/Private Partnership structure and understanding synergies between the two projects.

Other technical and tactical areas included:

- Optioneering for the VTR Refueling Systems and Approach,
- Pre-job briefs and optioneering procedure creation, use, and reinforcement,
- VTR requirements for Station Blackout (SBO) relative to the standby diesel generators and station batteries,
- Metrics for design and project status,
- Establishing configuration control for the VTR design and for the VTR Code of Record,
- Creating a culture of delivery and accountability,
- Prioritization of engineering work for different funding scenarios.

ANL

Continued to finalize shield and reflector assembly drawings with tolerancing. Completed an initial meeting with TP to discuss core component identification (handling socket notches) to support handling socket design.

Pacific Northwest National Laboratory (PNNL): Fast Flux Test Facility (FFTF) Documentation and Data Recovery

A Design Information Request (DIR) requesting design documents and drawings on the Control Rod Drive Mechanisms (CRDMs) used in the FFTF is nearly complete, as all possible documents have been located . Found and converted into electronic format all 14 H-4- drawings and nearly all 243 Royal Industries' drawings. When completed, the documents and drawings will be reviewed by Export Control and Information Release, and the entire package will be placed on the VTR Confluence Site.

The second DIR requesting design documents and drawings on the FFTF Dump Heat Exchangers (DHXs) is nearly complete. This DIR requests drawings, Operating and Maintenance Manuals (OMMs), design specifications, and design and test reports. Located almost all documents that can be found and are working to retrieve and convert the documents into electronic format. To facilitate the search process for the drawings, a hierarchical top-down search process starting with top-level drawings and proceeding toward lower-tier drawings was developed. Found and converted into electronic format a total of 44 top-level drawings. As soon as the retrieval and collection process is complete, the entire package of documents/drawings will be sent reviewed by Export Control and Information Release and placed on the VTR Confluence Site.

Thomas Fanning, Nuclear Technical Integration

Fuel Design and Analysis

Continued Scanning Electron Microscope (SEM) characterization of samples from the Experimental Breeder Reactor-II (EBR-II) X521 U-Pu-Zr-Ga irradiation test. Results indicate that Ga migrates to form small particles (~1 micron) with Zr, which are expected to be confirmed to be Zr-Ga intermetallic precipitates. This feature was not observed in as-cast X521 U-Pu-Zr-Ga archive samples, indicating the feature forms from long time at irradiation temperature and/or in the neutron environment. SEM characterization of one of the U-Pu-Zr-Ga/HT9 diffusion couples (with 5 wt.% Ga) similarly revealed a Zr-Ga interaction phase (structure to be determined), which appeared dendritic. Thermodynamic investigation at Oak Ridge National Laboratory (ORNL) using CALPHAD is expected to provide insight on phase stability at fuel operating temperatures and will provide values to use with BISON evaluation of U-Pu-Zr-Ga fuel. Completed a literature search and working CALPHAD models of the U-Pu-Zr established system for incorporation of gallium components. Constructed a preliminary BISON benchmark for EBR-II experiment X521 and shows reasonable agreement with predictions obtained from the SE2-ANL thermal-hydraulics (TH) code and post-irradiation examination (PIE) data.

ORNL made progress with several publications, including an internal VTR report on the BISON Benchmarking Plan for VTR fuel application, a journal article on assessment of the metallic fuel performance models available in BISON and on the X430 BISON metallic fuel benchmark case. Completed a comprehensive sensitivity analysis of the BISON metallic fuel benchmark case based on the Integral Fast Reactor (IFR)-1 experiment.

Fuel Manufacturing

Continued design of the prototype casting furnace and glovebox. To reduce design costs, the design is being leveraged from an almost identical multi-mission glovebox being procured by INL. Requested procurement of long lead government furnished items that will be needed during fabrication ($350K), but no action is being taken at this time due to funding uncertainties.

Continued process modeling efforts to determine process flow, staging requirements, throughput requirements, etc. Continued to mature the model as equipment designs mature and processing data is developed. To increase throughput to meet fabrication demand, robotics will aid in material handling. Engineers are working with robotics software to plan for programming/interface needs. A request was also made to acquire a robot for programming and testing but is held off due to funding uncertainties.

Drafted and submitted for review a fuel material structural (bend testing) report through a university capstone project. Looking into other potential capstone projects related to rod loading.

VTR Reactor Design Uncertainty and Conservatism Assessment

The determination and application of uncertainties and conservatisms is an integral component of reactor design to ensure safe and effective operations. These uncertainties and conservatisms are applied to design products and the corresponding design limits to account for the presence of unknown knowns, known unknowns, and unknown unknowns. This provides for overall design resilience and versatility, establishes and justifies the safety basis, and provides an understandable and quantifiable reserve of margin that is necessary for support of the eventual operating reactor.

Early phases of design generally apply significant amounts of conservatism and use uncertainties borrowed from similar projects, when available. This provides margin to somewhat reduce the risk of rework and increases the chance that a design will successfully perform its mission. However, these initial conservatisms and uncertainties still pose project challenges, as they are either over-conservative (reducing performance and/or increasing costs) or not entirely applicable to the current design (challenging the safety basis). Therefore, effort is expended to replace these early assessments over time with more explicitly derived uncertainties and with conservatisms appropriate for the overall safety philosophy as the design, manufacturing, and operational plans converge. Replacement of early assessments is typically performed as early as possible and iteratively to ensure that the risk of unforeseen consequences remains low.

This approach is being used for VTR core design efforts. For example, the project so far has been evaluating thermal performance using hot channel factors derived from those used in the FFTF and EBR-II designs. However, given the maturity of the design and decisions regarding safety basis, manufacturing, and operations are beginning to be made, these initial uncertainties and conservatisms are in the process of being updated as well. In the core design area, this includes performing sensitivity studies to evaluate the effect of known uncertain parameters on key reactor performance attributes. This has been performed with comparative studies of the effect of nuclear data library selection on reactivity and reactivity coefficients, and evaluations of the reactivity error due to fuel region homogenization in the cross-section generation procedure. This will be performed next to evaluate the sensitivity of reactor performance attributes (e.g., reactivity/critical rod positions, peak powers, test volume fluxes) on driver fuel manufacturing tolerances via perturbations to the Argonne Reactor Code (ARC) design model. This information will then be used to provide information to fuel manufacturers regarding the reactor's sensitivities to their decisions regarding manufacturing technique and tolerances and factored into the uncertainty and conservatism assessment.

Transient Safety Analysis

Updated the EMP heating routines to better align with the existing temperature group nodalization in SAS. Implemented volumetric coolant and wall heating in the Eulerian temperature formulation, allowing for faster running null transients. Successfully demonstrated a SAS4A/SASSYS-1 transient using the Simple and Detailed EMP model with pump heat.

Completed analysis for a special assessment to determine how long power needs to be provided to the primary pumps during coast down. This assessment evaluated an assumption in the pump power supply optioneering study that power only needs to be provided for 30 seconds, which may be too short. When power to the coast-down is lost, temperatures increase during the final transition to natural circulation. The longer that power is maintained, the smaller the temperatures increase. Preliminary analysis suggests that power should be provided to the pumps for longer than 100 seconds to reduce temperature increases. Shared preliminary results with the pump design and analysis team, who are assessing the power needed to extend the coast-down beyond 30s and how low the pumping power and pump head can be.

Continued confirmatory safety analysis using TRACE, with the current focus on the primary system flow coast-down. Implemented corrections to the coast-down profile into the models, with preliminary results showing better agreement with the SAS4A/SASSYS-1 results. More work is needed to identify and resolve differences.

SAS V&V

Continued Mixing Components Test Facility (MCTF) validation as well as examination and review of the compressible volumes and the discrepancies of the thermal ramp up. Modeled heat losses to the environment using the component-to-component heat transfer model. Calculations confirmed that losses to the environment have little impact on the system heat-up rate. Additional sources of discrepancy are under review.

Input for two of the core radial expansion shapes in SAS were not leading to the expected calculation of the radial displacement. The detailed radial core expansion model in SAS is being reviewed to understand the logic that triggers the condition where contact is made with both the above core load pads and top of assembly at the same time.

Safety Basis

Resolved comments for the ex-vessel dose consequence Engineering Calculation and Analysis Report (ECAR) that incorporates the VTR waste streams. Completed a draft of the VTR ex-vessel hazard evaluation Technical Evaluation (TEV) revision for the VTR facility and started initial reviews of the document. Continued working with digital engineering to integrate the Safety Structure, System, and Component (SSC) classification list into IBM Doors Next Generation (DNG).

Sodium Fire Hazard Analysis and Software V&V

Continued sodium fire software V&V efforts by making improvements in the source code to increase code consistency. Continued reviewing constants, correlations, and functions utilized in the software to ensure traceability.

Began drafting an FY21 status report documenting sodium fire analysis code development efforts. The report will provide an overview of software improvements made during FY21 as well as updated validation results.

Probabilistic Risk Assessment (PRA)

Completed milestone *Extension of PRA Structure to Reflect External Hazards and All Modes Scoping Analyses* which summarizes progress on PRA external hazard and all-modes analyses, outlines necessary next steps for both activities, and contains an overview of assessments performed by both GEH and the lab team which will aid in FY22 planning. Continued processing the VTR PRA model and associated files into the new PRA repository. Prepared trial cases to test the new repository quality assurance (QA) protocol. The new structure allows certain approval requirements to be imposed by the repository structure, rather than through administrative checks. Continued validation of the Simplified Radionuclide Transport (SRT) source term analysis code aerosol models, with a further comparison to over 30 past experiments. The results will be formally documented in an upcoming SRT Software Quality Assurance (SQA) report.

Kevan Weaver, Experiments Technical Integration

Selected key accomplishments within the four experiment vehicle types and support areas are included below.

ELTA – Sodium Cartridge Loop Development
Technical Lead: Mitch Farmer, ANL
Partners: University of Wisconsin, Purdue, Framatome

All team members contributed to a draft article for Nuclear Science and Engineering (NSE) on development of a sodium cartridge loop testing capability for VTR. The paper was completed, reviewed by VTR management, and submitted to the journal.

- University of Wisconsin:
  - Advanced the development of an experiment design to test the Sodium Fast Reactor (SFR) cartridge purification system prototype in an existing sodium loop at University of Wisconsin . The system uses a hot trapping method and a vanadium wire technique for monitoring average impurity levels in the cartridge sodium coolant.
- Purdue:
  - Hydrodynamic similarity experiments are underway in a facility scaled to mockup flow conditions in the SFR cartridge. Initial pressure drop data have been collected for a range of Reynolds numbers spanning from 1000 to 12500. Data are being used to benchmark computational fluid dynamics (CFD) simulations. CFD modeling approaches, including turbulence models, are being evaluated. Transient simulations of off-normal boundary conditions of the sodium cartridge loop are scheduled to begin, given inputs from ANL.
- Framatome:
  - Continued the SFR cartridge design evolution, including integration of the sodium purification and monitoring system developed in collaboration with the University of Wisconsin.
  - Continued to develop a CARLITA input file for the current cartridge design to support steady state and transient modeling of the cartridge performance under both normal and off-normal operating conditions.
- ANL:
  - Completed testing of a 2-inch OD pump impeller design. The size was reduced from 3 inches to 2 inches to accommodate the in-situ sodium purification system. Results indicate that the current design will not be able to meet pumping requirements for a seven-pin test assembly. ANL is working collaboratively to up-scale the size (displacement) to meet pump requirements and will retest the modified version to verify that the needed pump head can be supplied.

- Continued facility modifications to test the SFR cartridge pump shaft magnetic coupler at the expected operating temperature (i.e., ~ 550ºC). Testing should be complete by the end of FY21.
- Additional validation of the CARLITA model for analysis of cartridge loop TH performance was wrapped up and a series of calculations to assess cartridge performance under off-normal operating conditions was initiated. The results will be used to inform the Instrumentation & Controls (I&C) team on the expected signal responses during off normal conditions triggered by failure of the cartridge pump.

ELTA – Lead/Lead Bismuth Cartridge Loop Development
Technical Lead: Cetin Unal, Los Alamos National Laboratory (LANL)
Partners: University of New Mexico, Westinghouse

- Pump Test Rig
  - Tested a 3-stage axial flow pump in the water test loop and results, shown Figure 1. The 2-stage pump results and the system curve are also shown. The 3 points indicated on the system curve correspond to 1, 2 and 3 m/s maximum flow rate in the 3-pin fuel test configuration. The 2 m/s operating condition is our near-term goal, 6.8 gpm and 1.11 m of head.

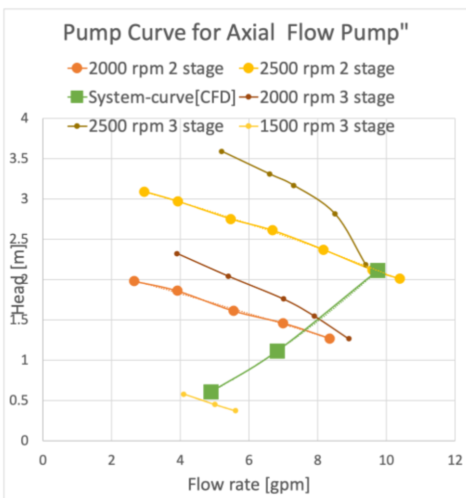

Figure 1. Pump Curve for Axial Flow Pump

- ELTA-CL Conceptual Design
  - Venturi Test: The Pb cartridge loop has a helium pocket inside in the new design. The new design leaves a 1.5 mm space between the two surfaces for liquid lead flow at ~1 m/s in that section. As the flow channel is narrowed down around the helium pocket section, it acts as a Venturi tube. To find out whether liquid lead can flow through that small space, a mock-up model has been designed for a water test. If a specific differential pressure is achieved between the restricted narrow section and unrestricted wider section in the water test, theoretically the Pb should flow through the narrow channel around the helium pocket in the new cartridge design.

- Westinghouse
  - Liquid metal embrittlement: Resolved design issues by providing additional heat input to the system. Completed testing of a Type 316 stainless steel specimen and further tests are in progress.
- UNM Pb-loop
  - Completed corrosion testing at 2 m/s and 500ºC for 3 weeks (668 hrs).
  - Designed and machined a Venturi to measure the flow. Instrumentation and associated parts will be incorporated and tested later before incorporating the Venturi to the loop.
  - Added a digital regulator for better Ar cover gas pressure control.
  - Continued analysis of previously welded specimens using different heat treatments. Found that no matter what pre- and post-heat treatment method is used, MA956 always developed porosity. However, APMT welds were free of porosity despite some small cracks.
  - Completed fractography on 3D-printed FeCrAl.
  - Conducted sensitivity analyses to assess the dependence of shear stress estimates on turbulence closure model.

ELTA – Molten Salt Cartridge Loop Development
Technical Lead: Joel McDuffee, Oak Ridge National Laboratory (ORNL)
Partners: University of Utah, University of Idaho, MIT, TerraPower

- Annular Flow Characterization
  - Finalized a technical memo on the development of models to simulate the VTR annular design. (Wysocki, A., Huning, A., and McDuffee, J. *RELAP5-3D and TRANSFORM Analyses for the VTR MSR-EV Annular Design*. ORNL/TM-2021/2116 [In review], 2021)
- VTR Cartridge Loop Experiment
  - Delivered the annular flow test section to ORNL, shown in Figure 2, Coordinating with riggers and pipe-fitters to install the test section and the experiment instrumentation.

Figure 2. Annular Flow Test Section

- Pressure and corrosion sensor development
  - Received all parts required to fabricate a miniature stainless steel corrosion sensor. Welding of the miniature sensor is scheduled for the end of July.
  - Received and approved higher pressure relief valves and all that remains to increase the maximum pressure of the control system is to order long lengths of metal tubing to replace the existing plastic tubing.
  - The spectral interrogation system is operational and only requires final debugging during functional pressurization of a corrosion sensor.

ELTA – Gas Cartridge Loop Development
Technical Lead: Piyush Sabharwall, INL
Partners: Texas A&M, University of Michigan, General Atomics

- Installed high-pressure, high-temperature loop for particle studies.
- Started parametric runs on low-pressure/low-temperature facility.
- Developed numerical models using OpenFOAM.
- Performed Low-Reynolds SiC simulations using ANSYS.
- Performed surface emissivity measurements for SiC samples provided by GA using the UH's measurement platform at 300ºC under 700 kev C ion irradiation.
- Completed initial physical evaluation for irradiated sapphire fiber using SEM. No visible damage from before/after under SEM inspection.
- Continued shakedown/validation tests to confirm the validity of the test procedures and methodology for TAMU's emissivity measurements for higher temperatures (> 400ºC) using a new method based on a specialized pyrometer.
- Continued performing emissivity measurements for SiC samples at UI.
- Continued constructing a high-temperature and high-pressure test chamber to investigate LIBS performance in VTR-relevant environment.
- Completing a report on the GCL CFD simulations.

RTA – Rabbit Capability Development
Technical Lead: David Wootan, PNNL
Partners: Texas A&M

- Completed an update of the Rabbit schedule for FY21. Developed a FY22 schedule for the Rabbit.
- To ensure coordinated progress by the Rabbit design team, weekly team meetings continue to be held with the Texas A&M team thereby coordinating neutronics, TH, and mechanical, aspects of the VTR Rabbit.

- Developed and completed two papers on the VTR Rabbit. One paper will be presented at the NURETH-19 thermohydraulic conference and the other paper will be published in NS&E.
- Designed a ribbed capsule for the Rabbit which will replace the smooth capsule design. This ribbed system is being installed in the laboratory system to assess potential benefits.

DTA
Technical Lead: Nick Woolstenhulme, INL

- Completed first iteration of an optioneering study for mounting/dismounting hardware design, necessary for the DTA. (Note that this work will also be used for the NTA-PC.)

Support Area – Instrumentation and Controls
Technical Lead: Sacit Cetiner, INL-ORNL
Partners: ACU, Georgia Tech, MIT, University of Pittsburgh, Cosylab

- Self-Powered Neutron Detector (SPND).
  - Working to finalize report, completing internal milestone due September 30 documenting all FY21 work on SPND.

Support Area – Digital Engineering + Virtual Design and Construction + M&S
Technical Lead: Chris Ritter, INL
Partners: North Carolina State University, Virginia Commonwealth University, TerraPower

- NCSU
  - Upgrading the conversion code to work with more complex geometry, shown in Figure 3.

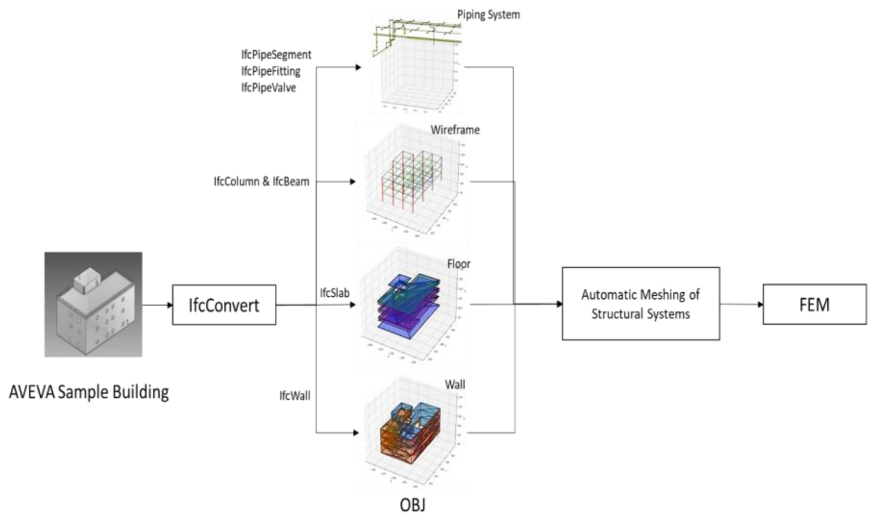

Figure 3. Upgraded Conversion Code

  - Working with INL team to access a VDI with better specs and HPC for accessing VTR models.

- VCU
  - Repurposed INL Deep Lynx authentication code to be token-based.
  - Created transformations and type mappings for data being fed into INL Deep Lynx.
  - Continued testing deployment of the Jazz to Deep Lynx pipeline code.