July 13, 2021

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AGR PIE Technical Lead

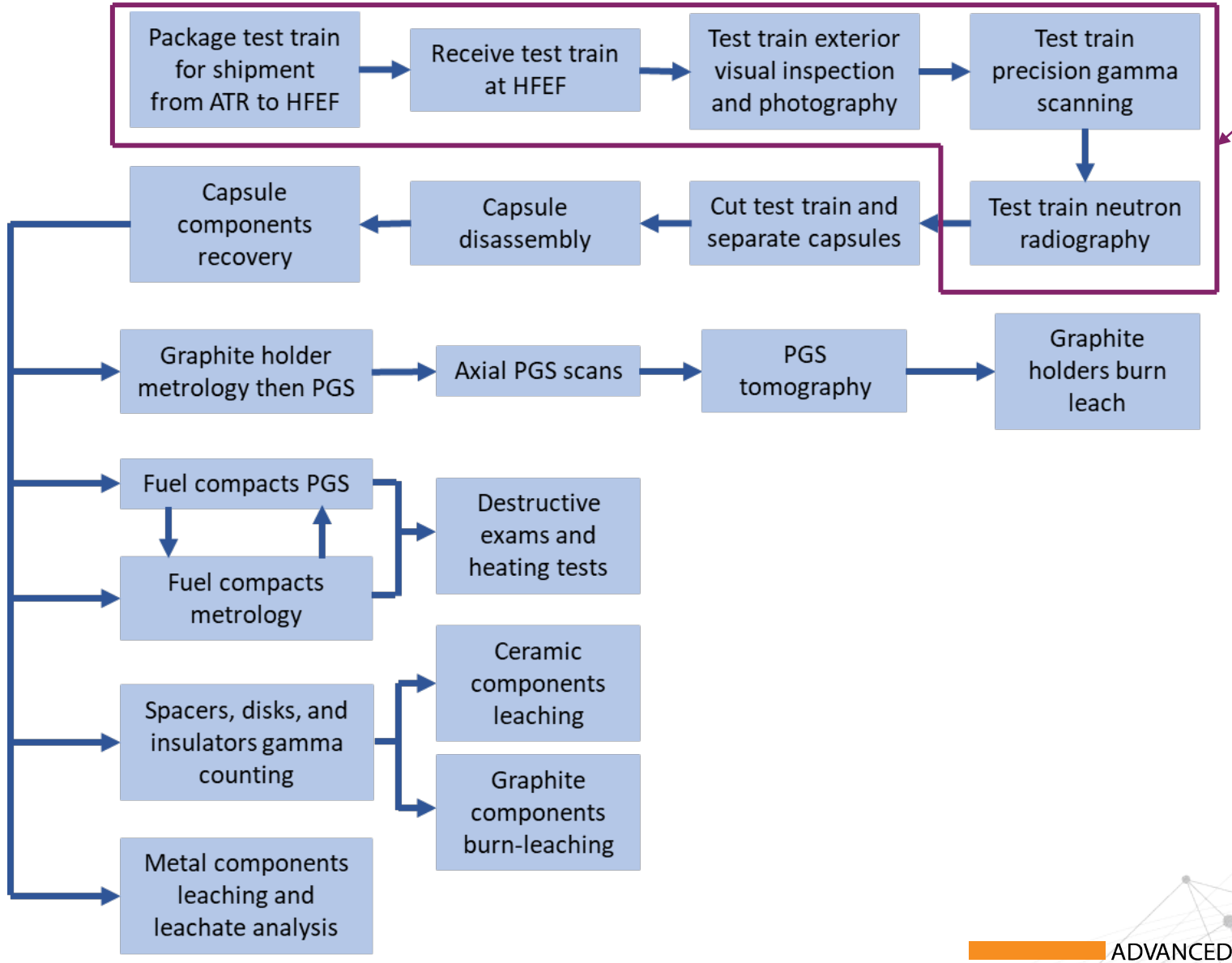
AGR-5/6/7 PIE Updates

Advanced Reactor Technologies

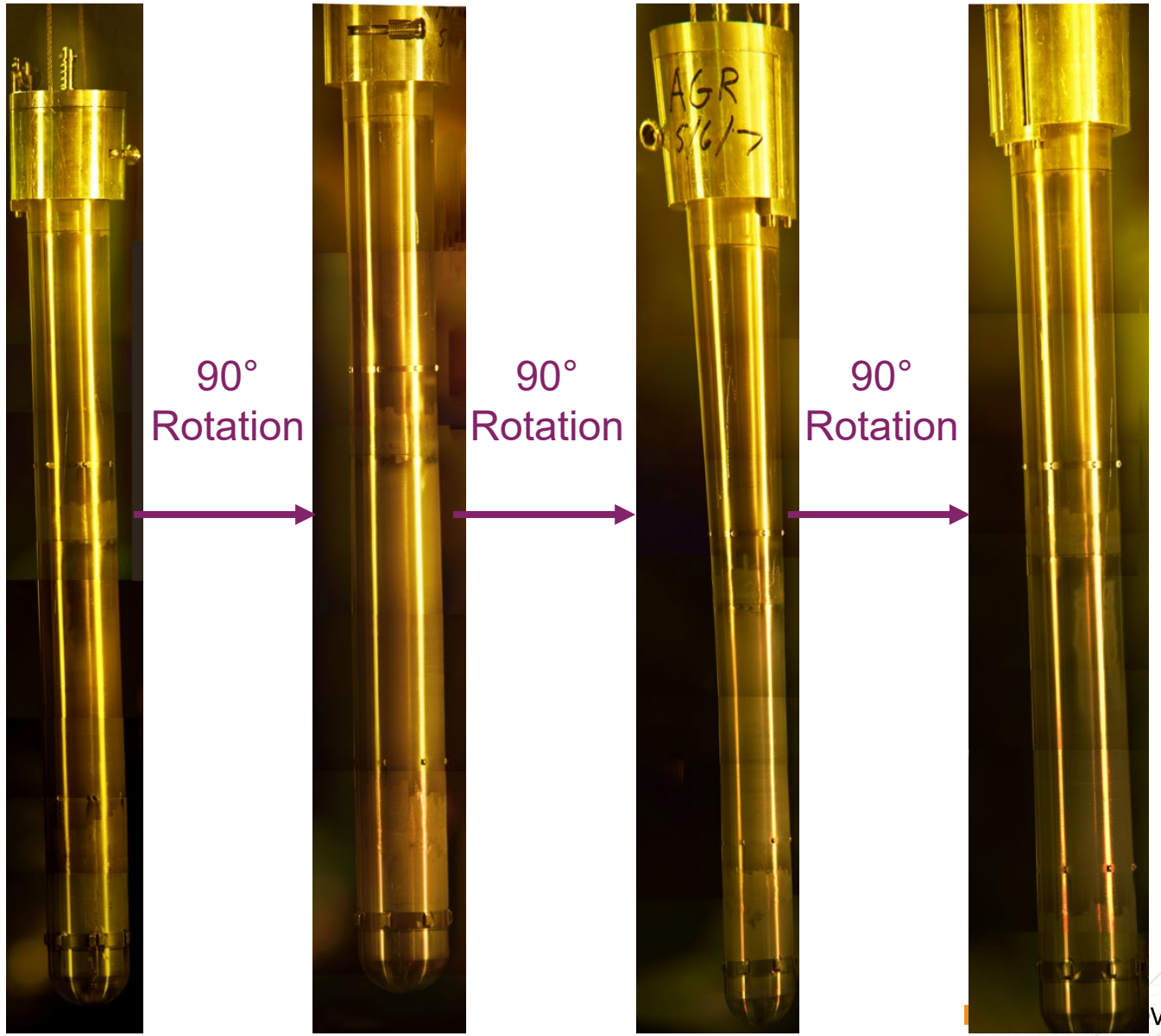
Major PIE Objectives

1. Evaluate and characterize unexpected Capsule 1 behavior.
2. Determine if there was acceptable performance and behavior of the fuel under normal irradiation conditions (Capsules 2, 4, and 5).
3. Evaluate performance and characterize behavior of fuel under high irradiation temperatures (Capsule 3: TAVA 1380°C, TA Peak 1480°C).
4. Conduct post-irradiation high-temperature testing in helium to verify acceptable fuel performance under conduction cool-down accidents. (CCCTF and FACS)
5. Perform oxidation testing to characterize fuel behavior during exposure to air or moisture at nominal and accident temperatures. (AMIX)

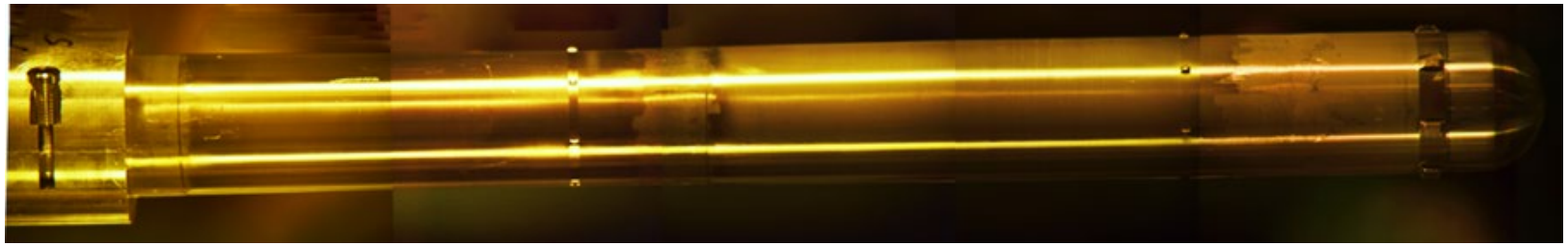
Process Flow of Major PIE Activities

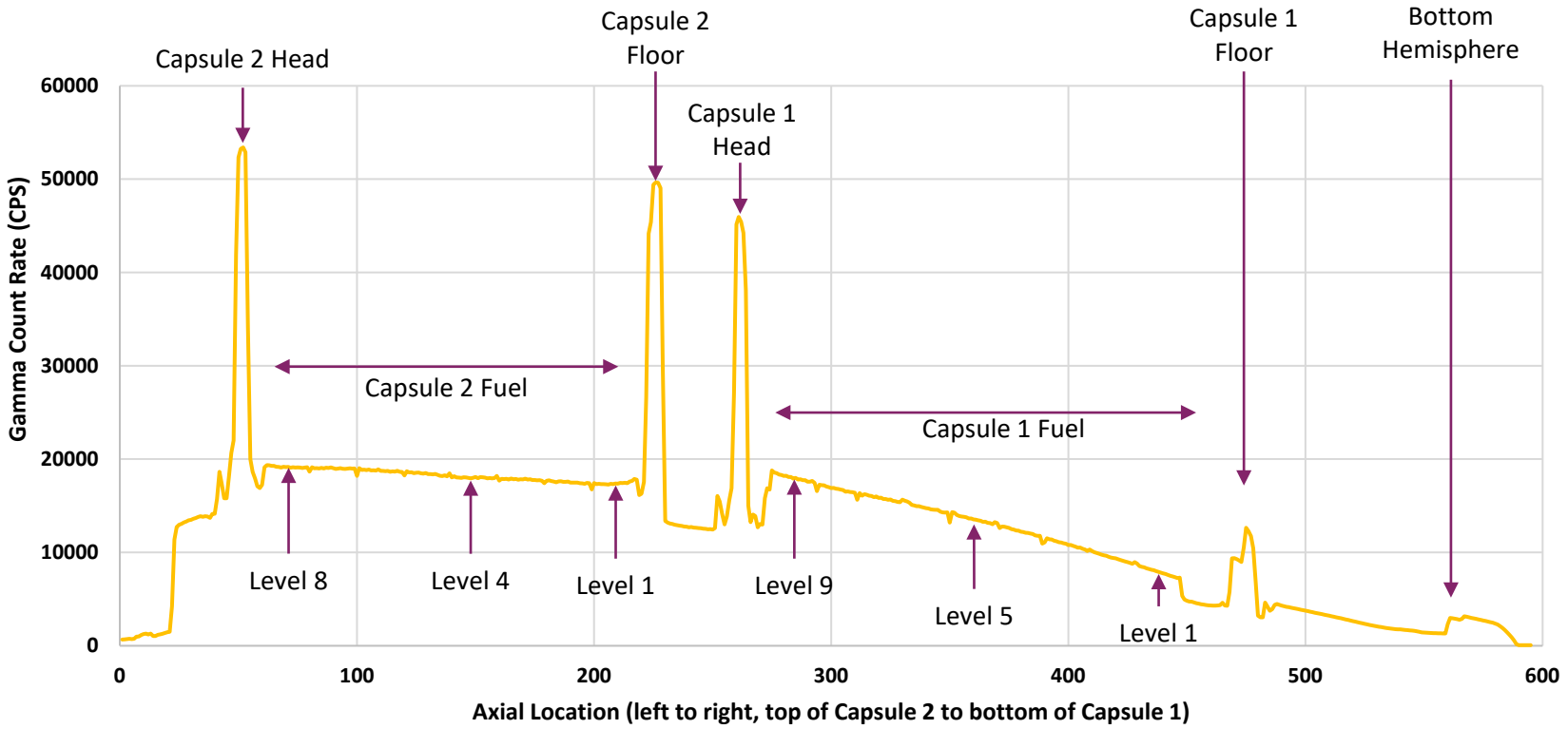


Capsules 1 and 2 Exterior Visual Exams

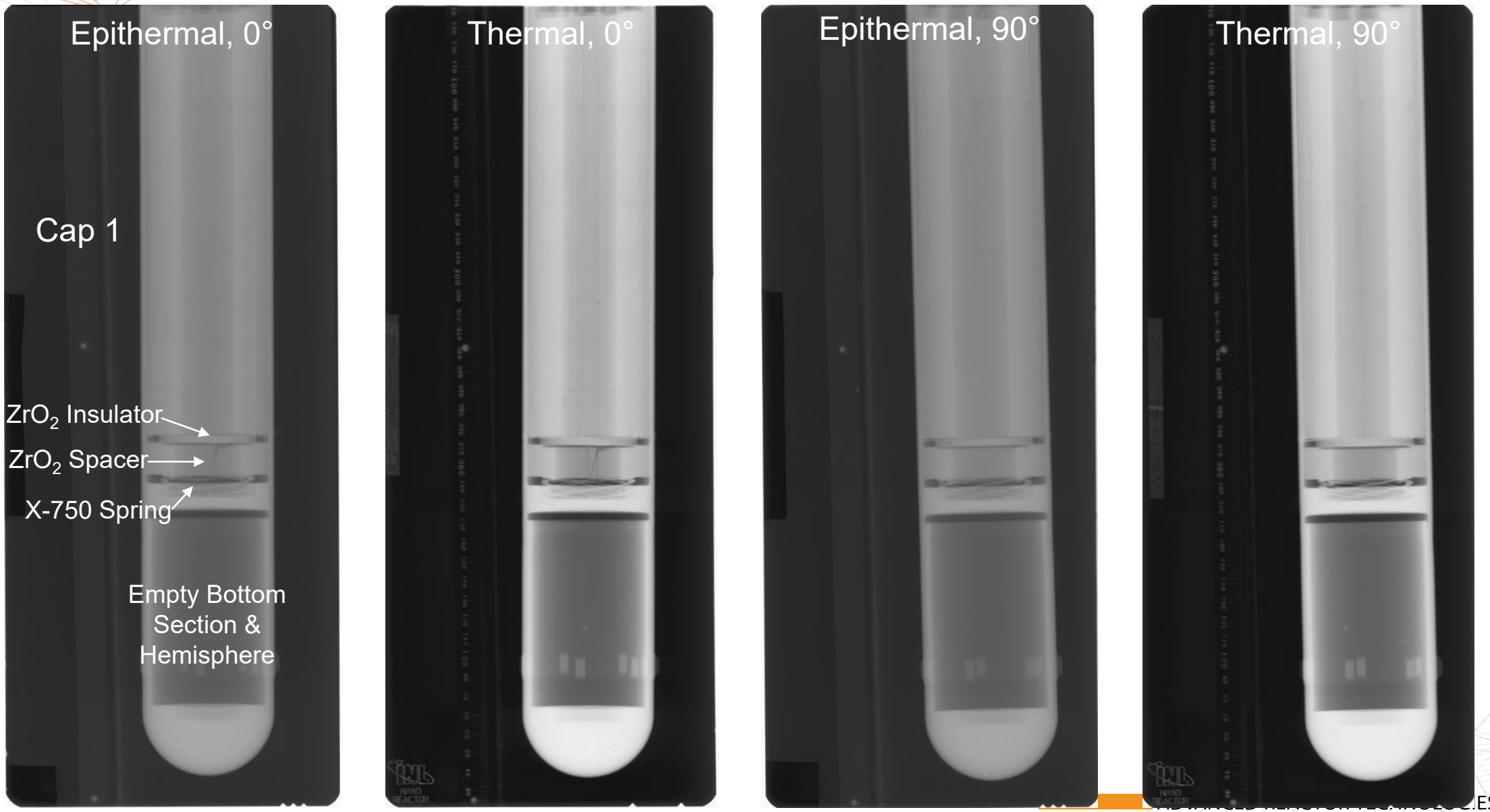


Capsules 1 and 2 Precision Gamma Scanning

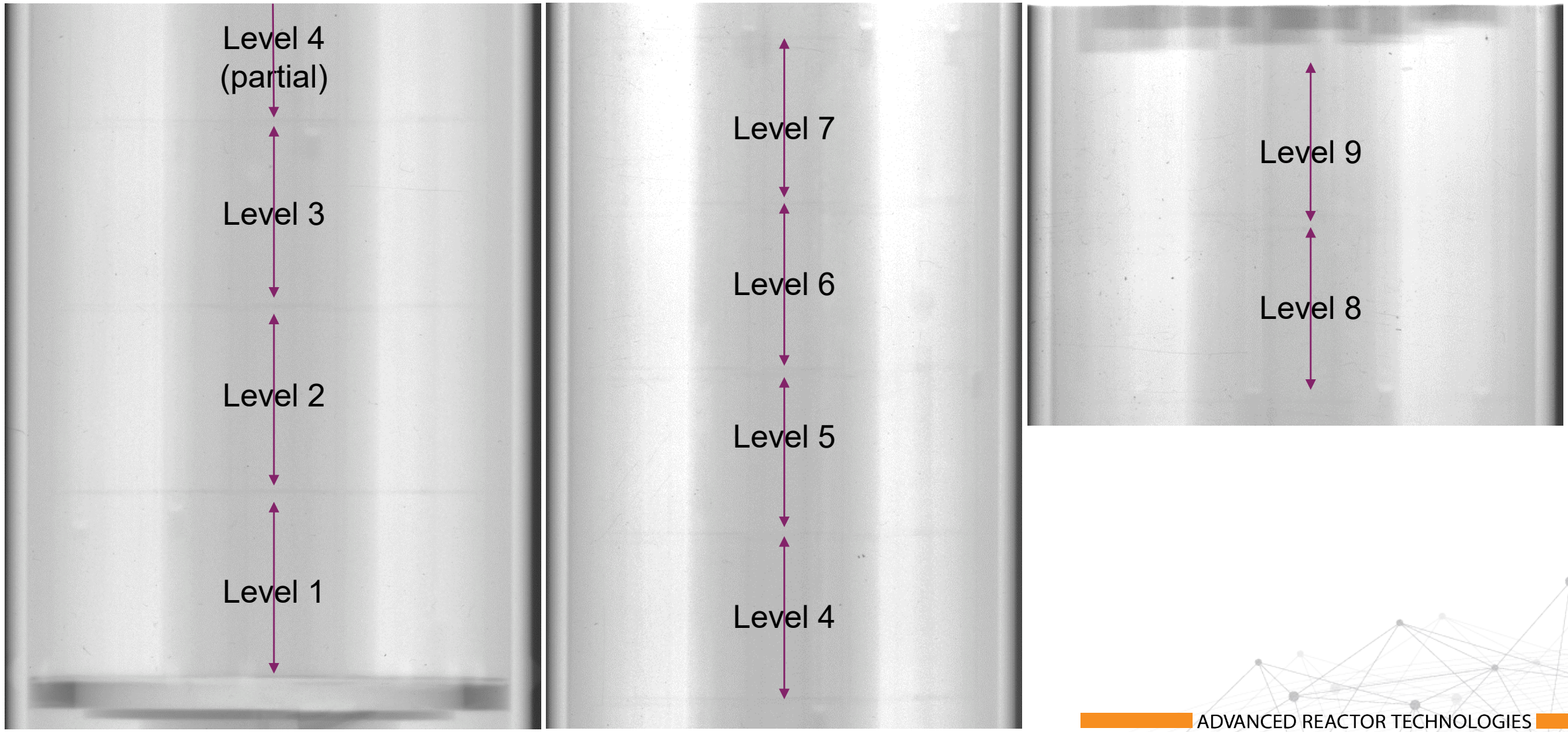




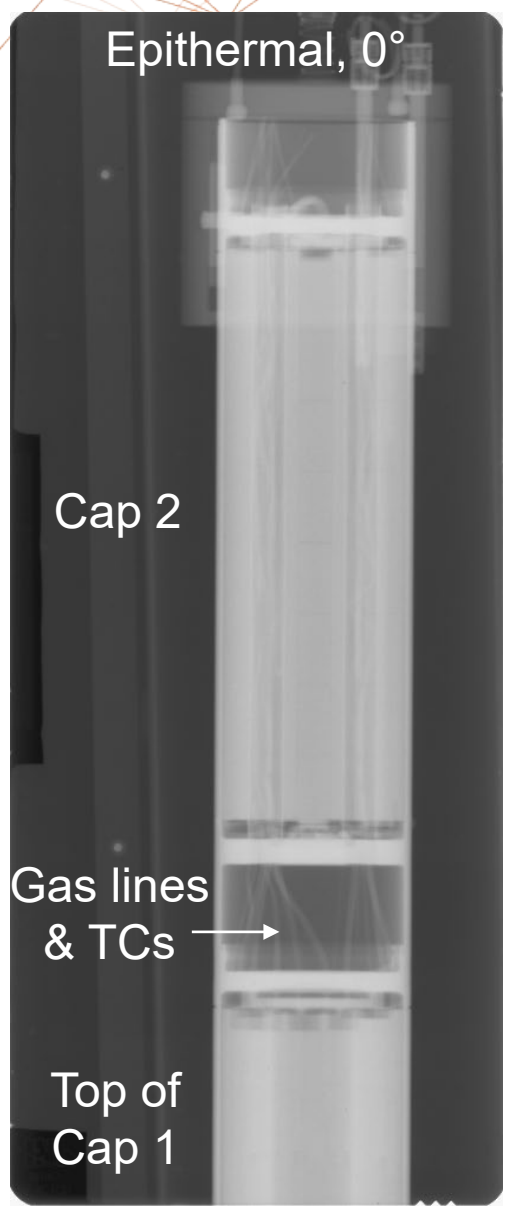
Capsule 1 Neutron Radiography

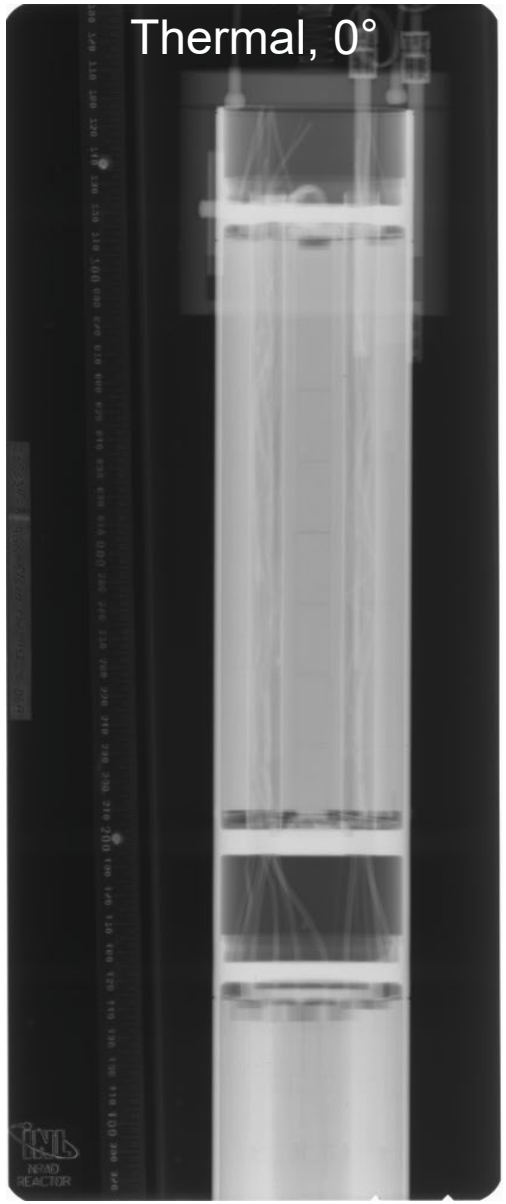


Capsule 1 Neutron Radiography Closeup: No obvious signs of fuel damage

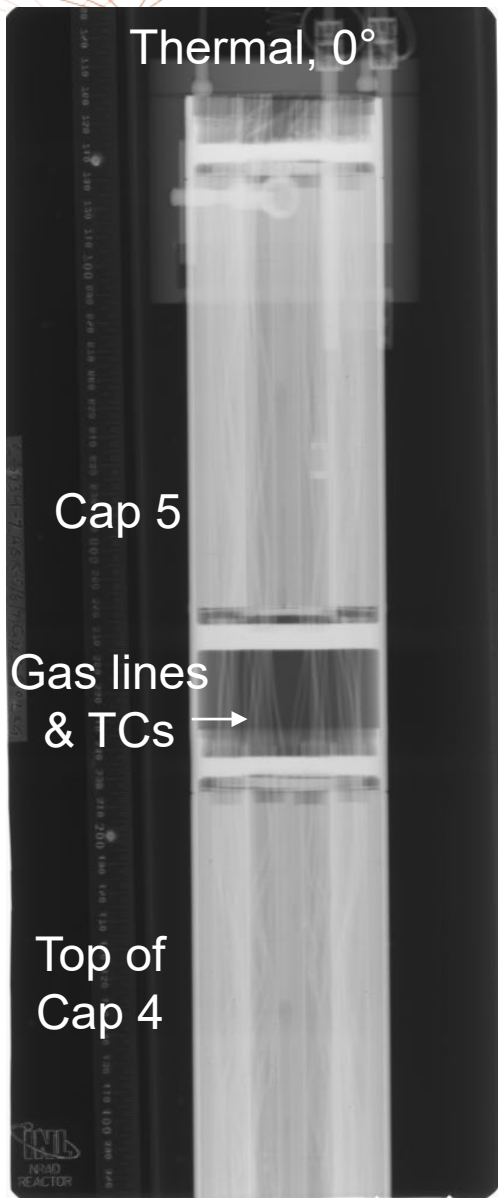


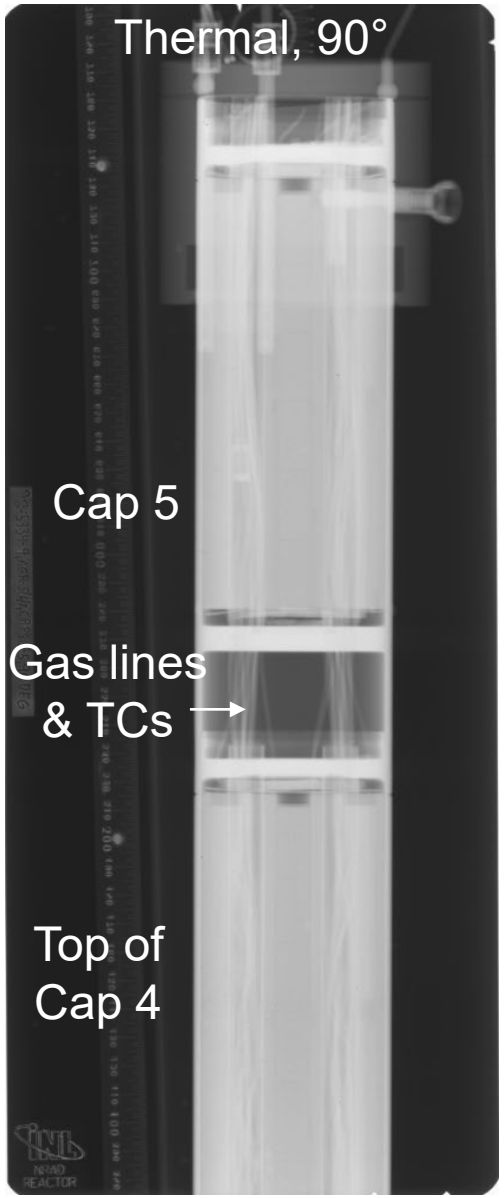
Capsule 2 Neutron Radiography

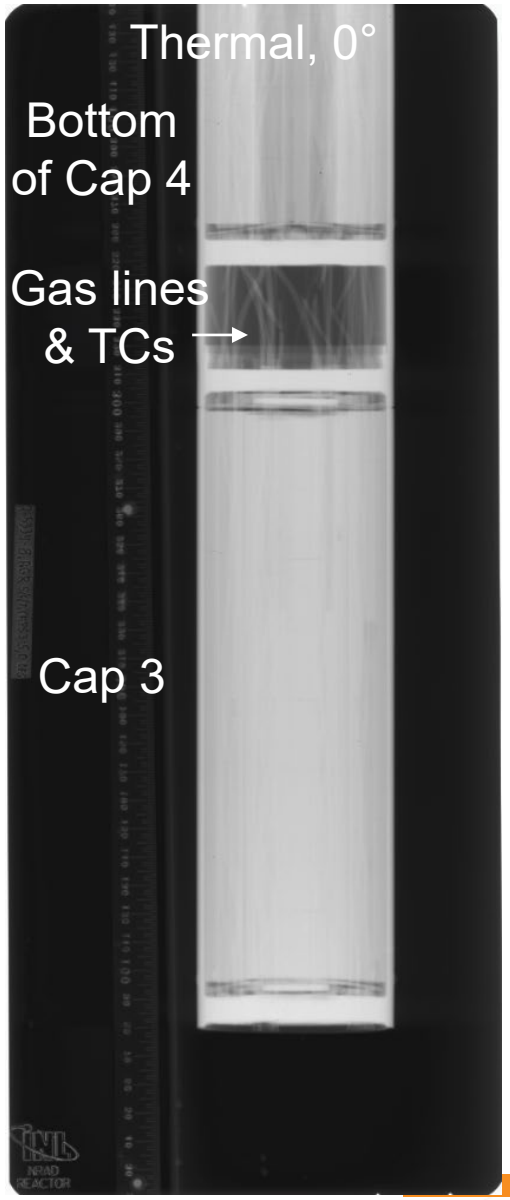


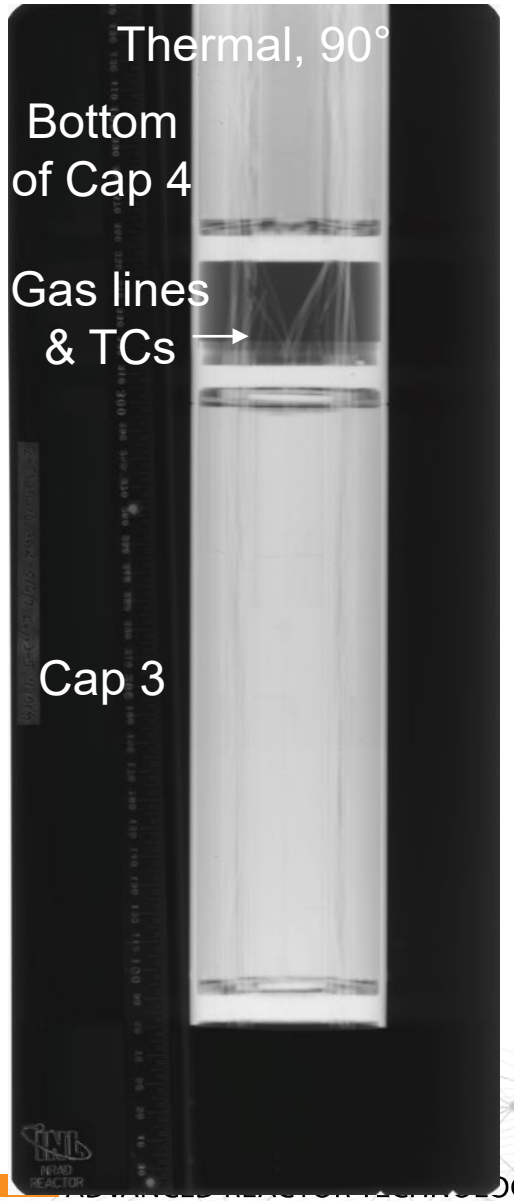


Capsules 3, 4, and 5 Neutron Radiography

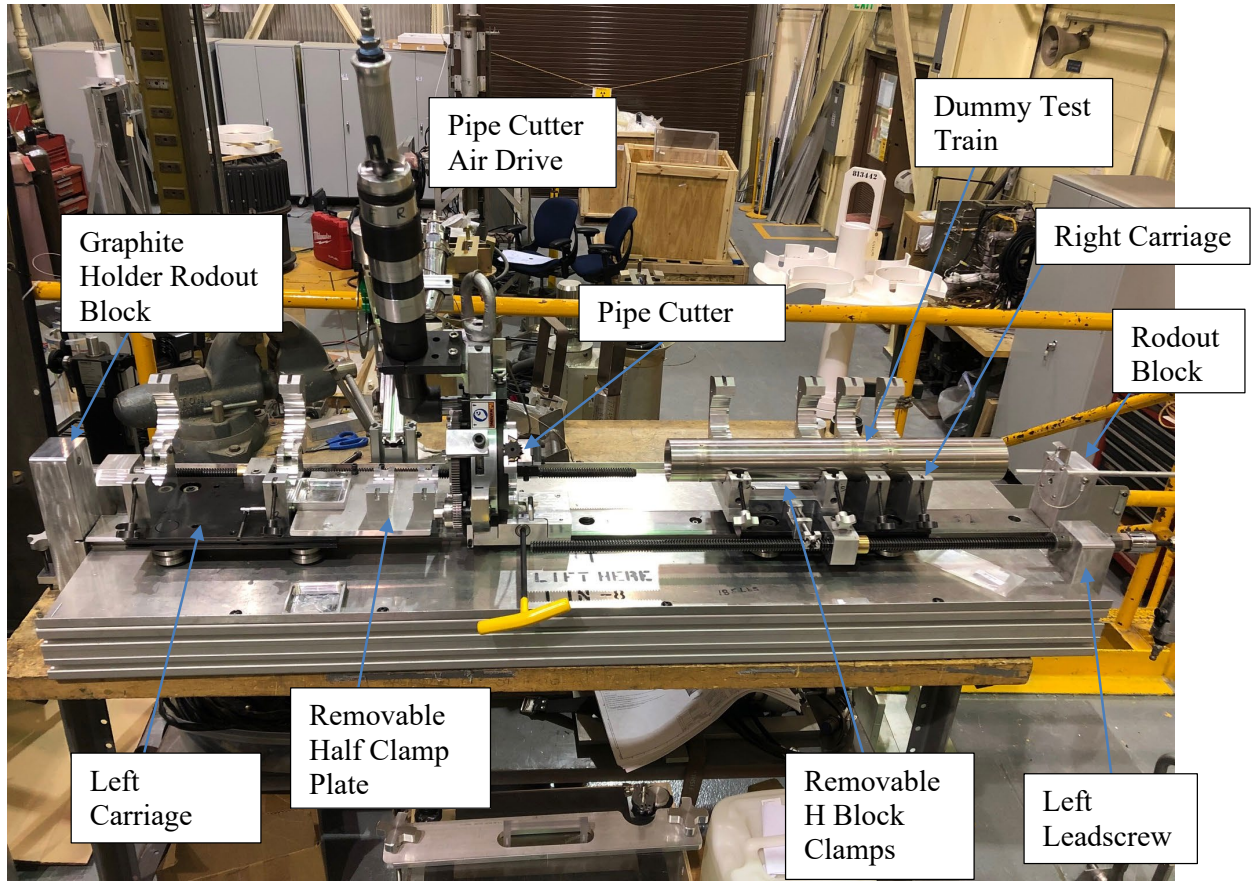


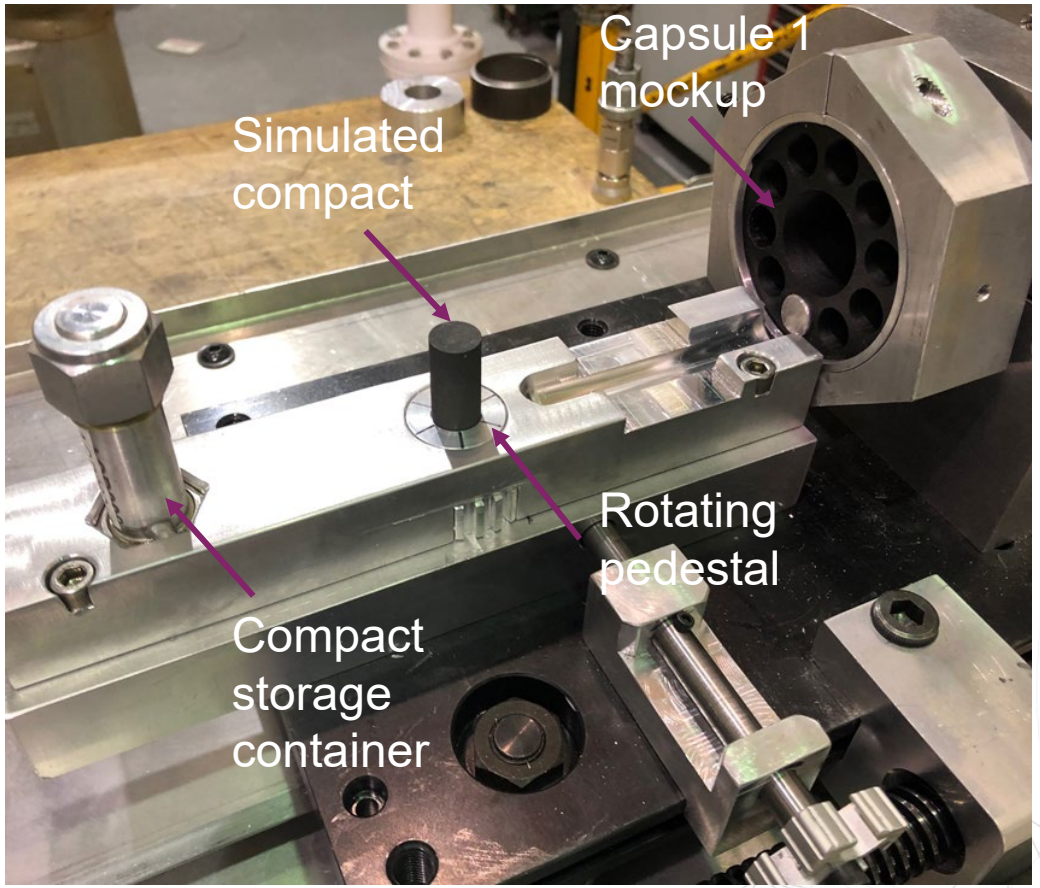






AGR-5/6/7 Capsule Disassembly Equipment Qualifications

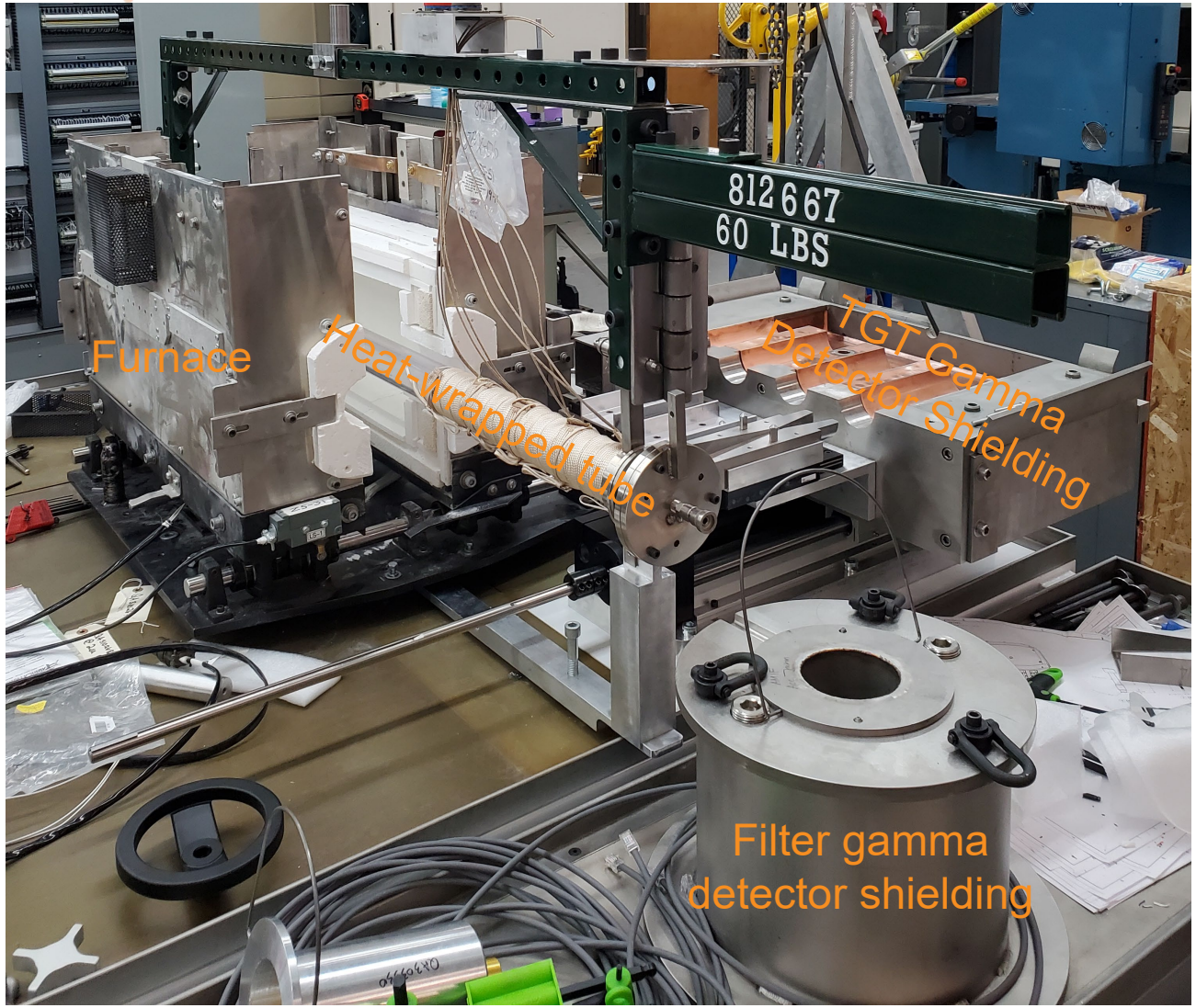


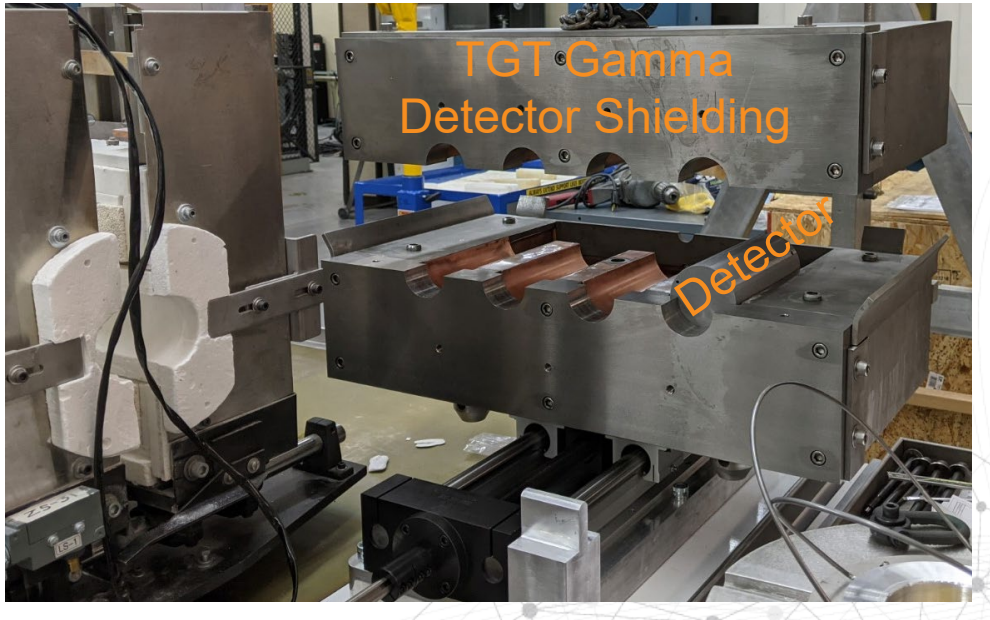


Air/Moisture Ingress Experiment (AMIX) - Goals

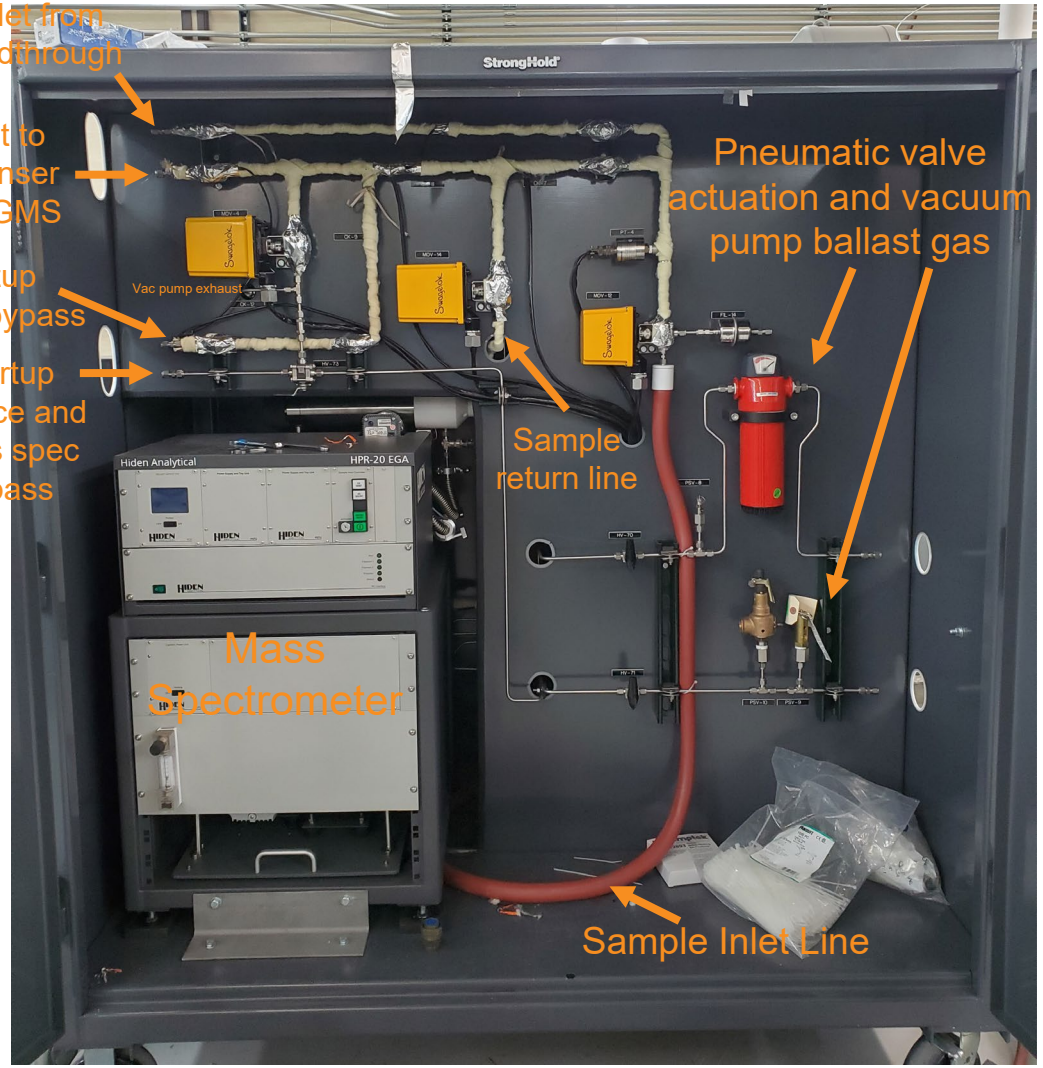
- To date, safety testing AGR fuel compacts has only been conducted under helium. AMIX will test irradiated TRISO fuels in oxidizing environments representative of air and moisture ingress accidents in HTGRs
- Measure fission product releases as a function of time
- Relate fission product releases and release rates to fuel irradiation history, test conditions, and extent of fuel oxidation
- Use collected data for:
  - Fuel qualification and licensing
  - Input to and comparisons with predictive models and simulations
  - Reactor accident source term analysis (design-basis and/or beyond-design-basis)

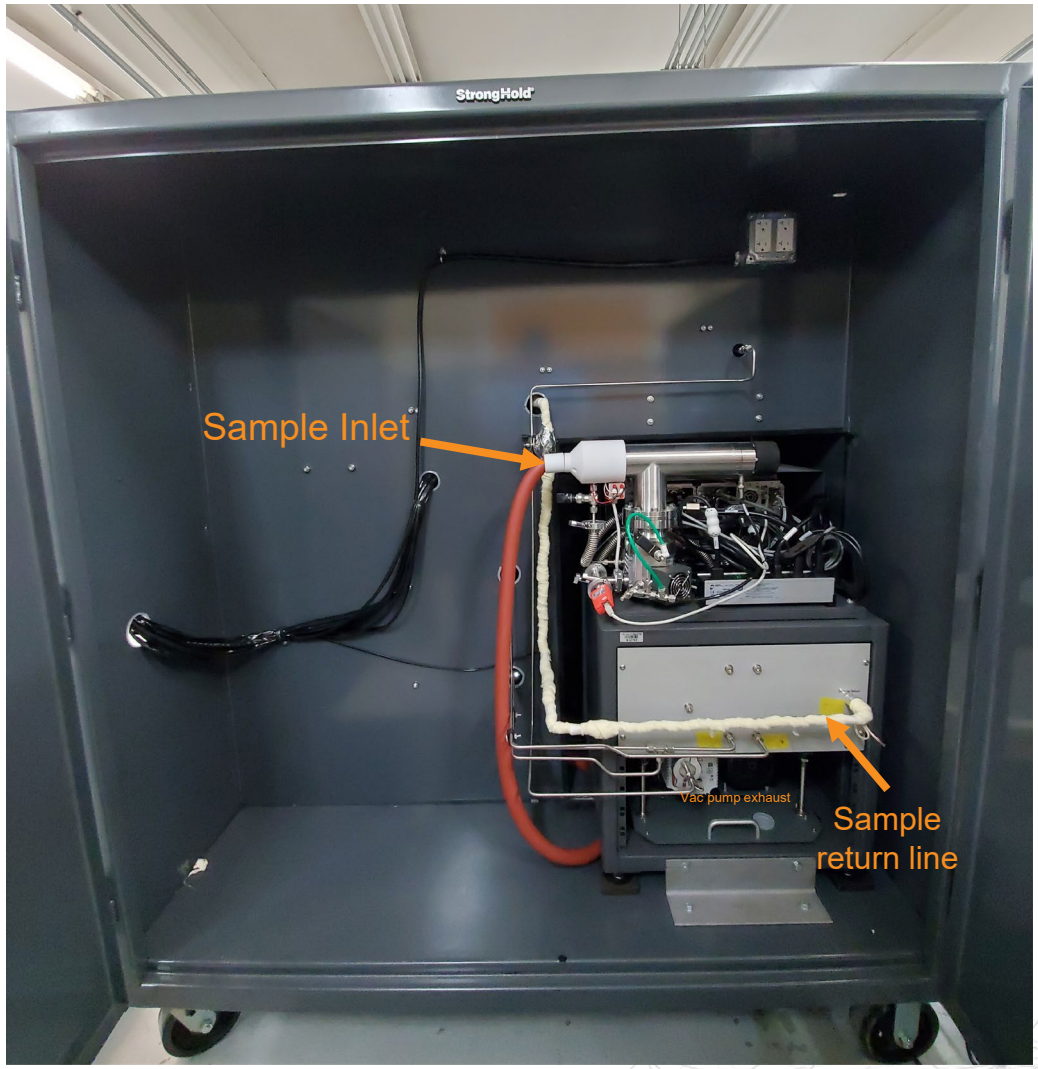
Furnace with TGT and Filter Gamma Systems





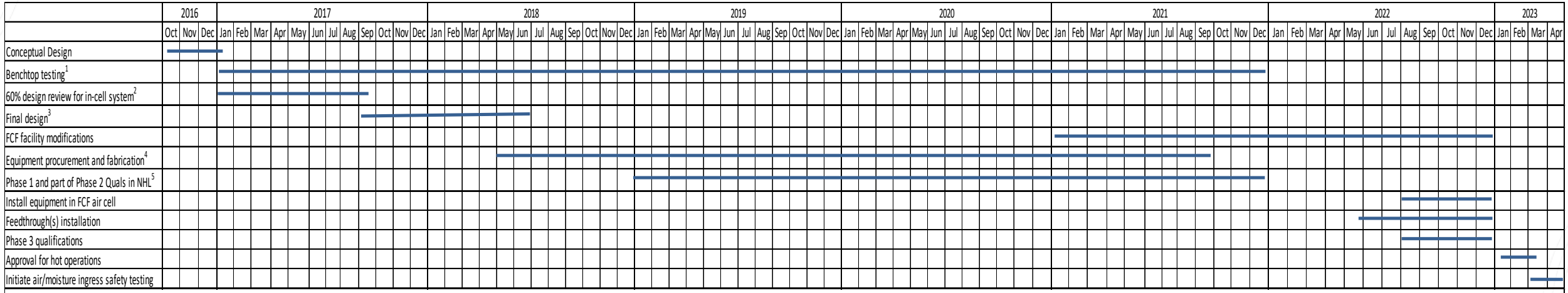
Completed Mass Spectrometer System





Updated AMIX Schedule

- $1 million budget cut in 2019 and supplier delays in 2020 have pushed estimated AMIX testing start date to early 2023.



1. L4 milestone to initiate testing by 3/31/17
2. L2 milestone to complete by 9/15/17
3. L2 milestone completed 7/7/2018
4. L2 milestone completed 8/2019 to complete construction of gas supply system and receive furnace
5. L2 milestone to complete Phase I qualifications at NHL shifted from 9/2019 to 9/2020 to 9/2021 (first shift was due to $1 million budget cut, second shift is due to pandemic and supplier issues.)

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