

Byron Shipment Update

LINE Commission meeting, October 26th 2023
College of Southern Idaho, Twin Falls, Idaho

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Characterization and Advanced PIE division

Outline

- What is “the” Byron shipment?
 - R&D plans and significance for the industry and nuclear community
 - Integrated Recycling Test (IRT) for Joint Fuel Cycle Studies (JFCS)
 - Accident Tolerant Fuels (ATF)
 - Burnup extension (HBu)
 - Transportation Logistics
- } Advanced Fuel Campaign (AFC)

“The” Byron shipment

25 total rods



NAC-LWT cask held with the crane in HFEF high bay during qualification efforts

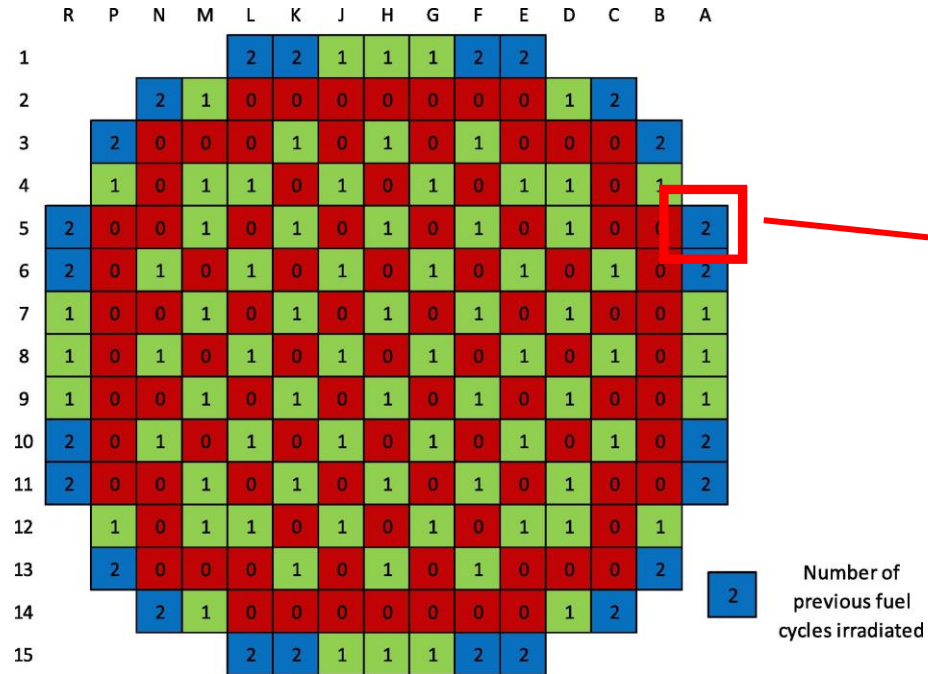
Leading program/company	# Rods	Activities
JFCS	12	<ul style="list-style-type: none"> Limited PIE to support program objectives Demonstration of integrated recycling test
AFC	4	<ul style="list-style-type: none"> Comprehensive PIE pre and post testing LOCA testing in TREAT and SATS HERA testing in TREAT
ATF	5	<ul style="list-style-type: none"> Comprehensive PIE to support WEC-led licensing efforts HERA testing in TREAT (segments)
Westinghouse (Strategic Partnership)	4	<ul style="list-style-type: none"> Comprehensive PIE scope to support licensing efforts of their product



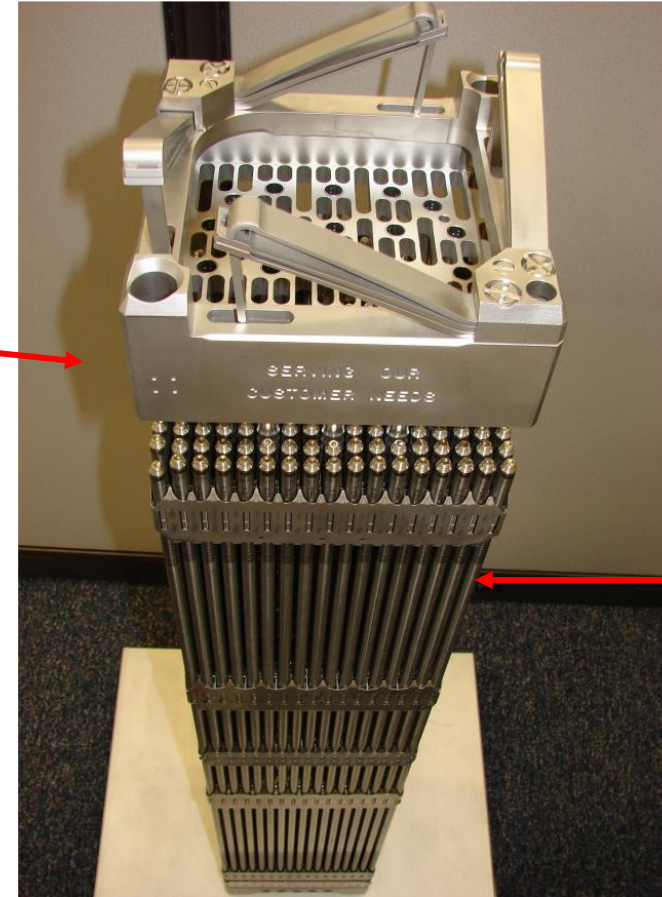
Shipping container where rods are loaded within the NAC-LWT cavity

Additional synergies with other programs possible to maximize PIE data harvesting (e.g., used fuel program, NSUF etc)

“The” Byron shipment quantities in perspective



Typical core loading strategy for a 4-loop WEC PWR
Capps et al., NED 379



17x17 PWR fuel assembly

JFCS and the IRT scope (1/2)

- The Joint Fuel Cycle Studies (JFCS) program is a cooperative research effort between the U.S. DOE and the Republic of Korea (ROK)
- A key component of the collaboration is an evaluation of the recycling of used Light Water Reactor (LWR) oxide fuels via electrochemical technologies and a fast reactor. Unutilized resources in the spent LWR fuel are casted into fuels for fast reactors
- The Integrated Recycling Tests (IRT) were planned at INL as part of the JFCS

Integrated Recycling Tests (IRT) at INL

- Kg-scale integrated testing activity
- Test bed for demonstration of safeguards and security technologies



Feedstock not available within the DOE complex



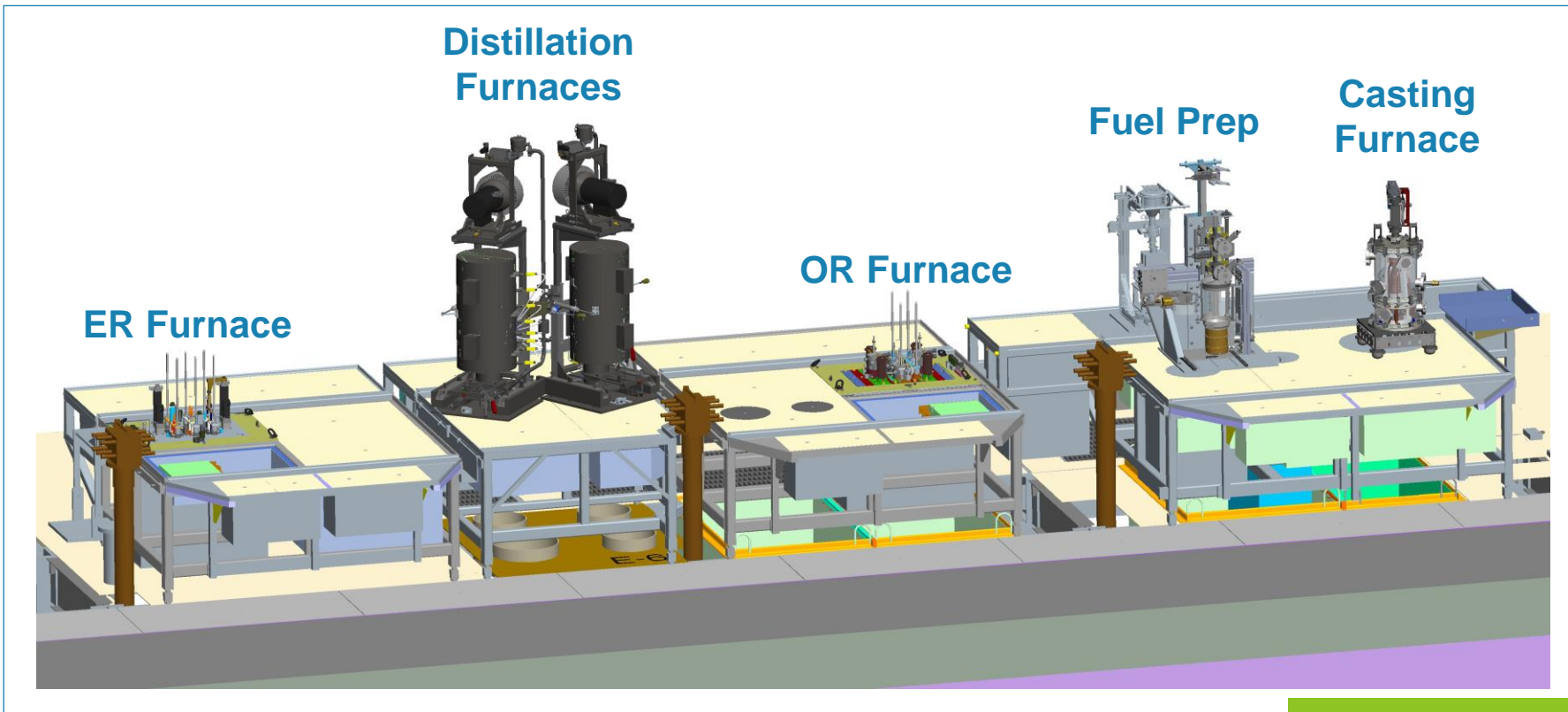
Byron shipment

- LWR rods identified as ideal base material
- Receipt of used LWR could be synergized with other programs goals

JFCS and the IRT scope (2/2)

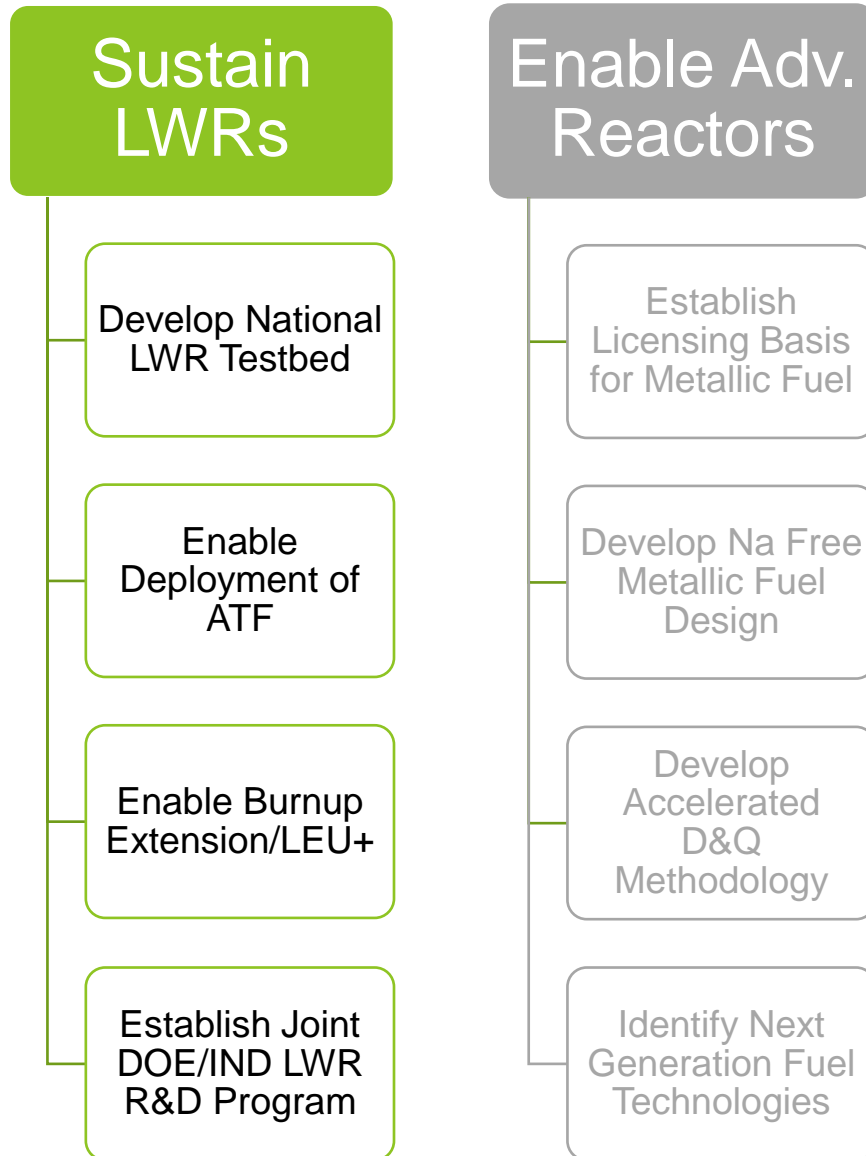
- **Key outcomes of IRT:**

- Improvement of process knowledge of electrochemical technologies
- Evaluation of associated safeguards and security methods and technologies



CAD model of the equipment installed in the hot cells to accomplish the IRT goals

Advanced Fuel Campaign (AFC): ATF and HBU (1/2)



- The mission of the Fuel Cycle Research and Development (FCRD) program of the U.S. DOE Nuclear Energy is to conduct research and development to help develop sustainable fuel cycles, i.e., cycles that:
 - improve uranium resource utilization
 - maximize energy generation
 - minimize waste generation
 - improve safety
 - limit proliferation risk
- The Advanced Fuel Campaign (AFC) focuses on LWR fuels and advanced fuels for fast reactors (mainly metallic)

Advanced Fuel Campaign (AFC): ATF and HBu (2/2)

▪ Key outcomes of ATF/HBu:

- Qualification of state-of-the-art LWR fuel technology, meeting industry's goal to deploy by mid 2020s
- Extension of fuel cycles (18 to 24 months for BWR and 18 months and beyond for PWR) saving \$M from reduced outages and used fuel costs

ATF/HBu

- Address industry testing needs and priorities
- Provide expertise and independent testing to address data gaps (e.g., LOCA)



Limited material from ATF program, but not fully prototypical of a commercial plant

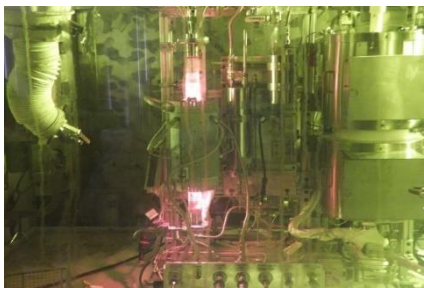


Byron shipment

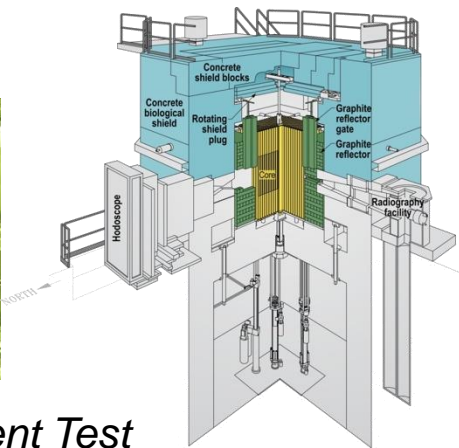
- LWR rods identified as ideal base material to fill the gap
- Critical data in the most prototypical conditions for base irradiation and safety testing

LWR industry priorities and importance of the Byron shipment

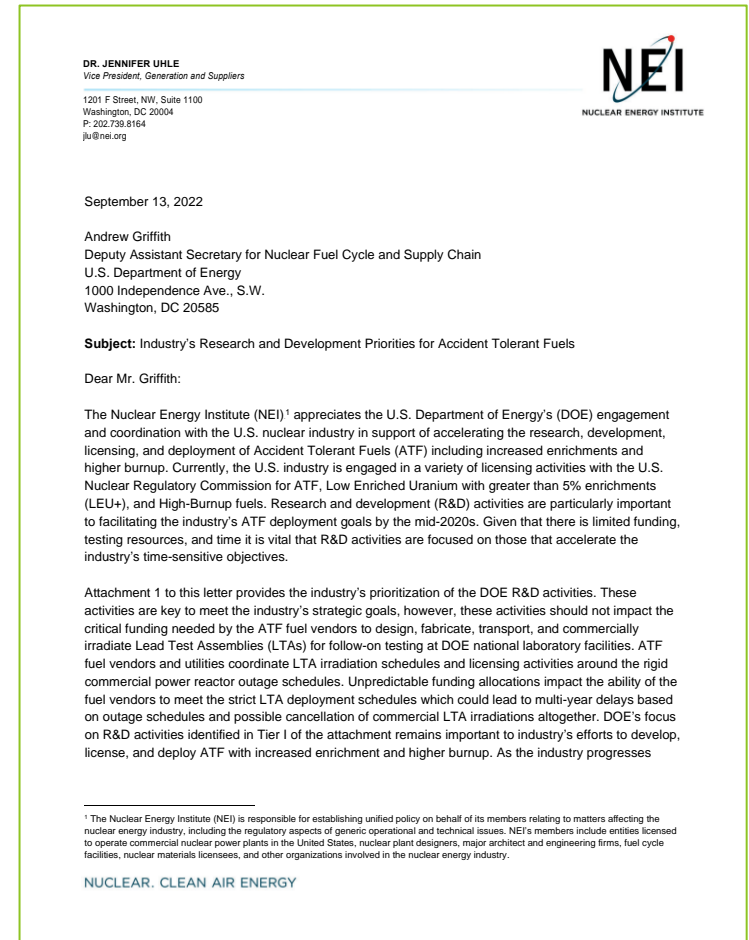
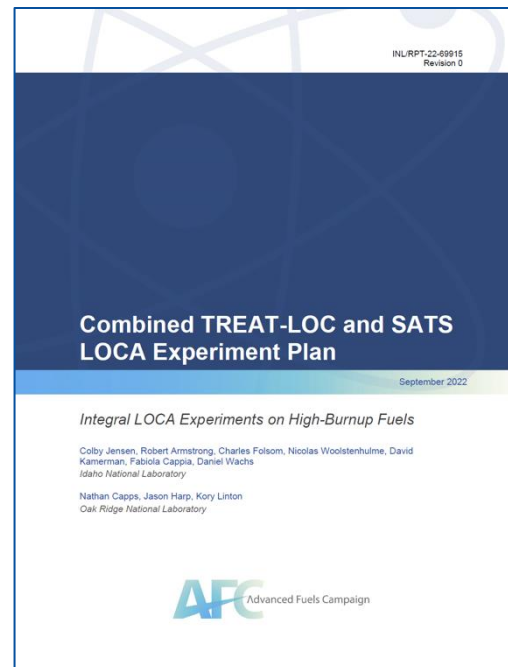
- Tier 1 Industry Priorities
 - Establish a transportation network for irradiated materials between commercial plants and national labs
 - Develop and maintain facilities and capabilities to support industry needs (e.g. LWR Test Bed)
 - Develop and Execute LOCA Test Plan for FFRD resolution
 - Establish BWR/PWR Ramp testing capability



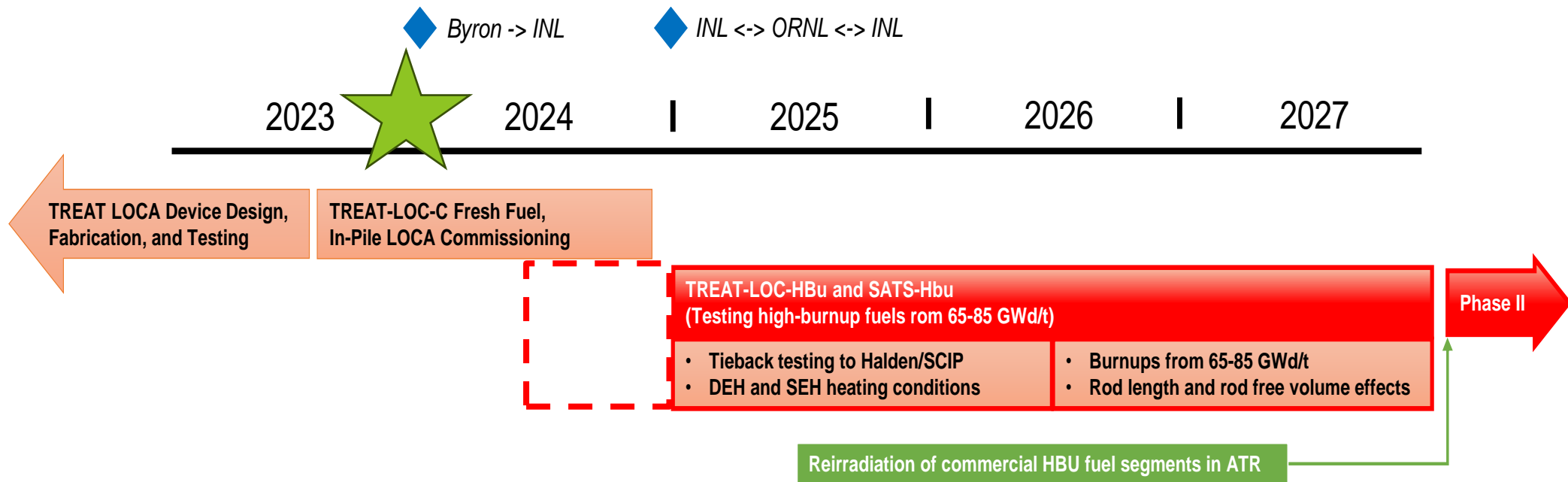
ORNL Severe Accident Test Station



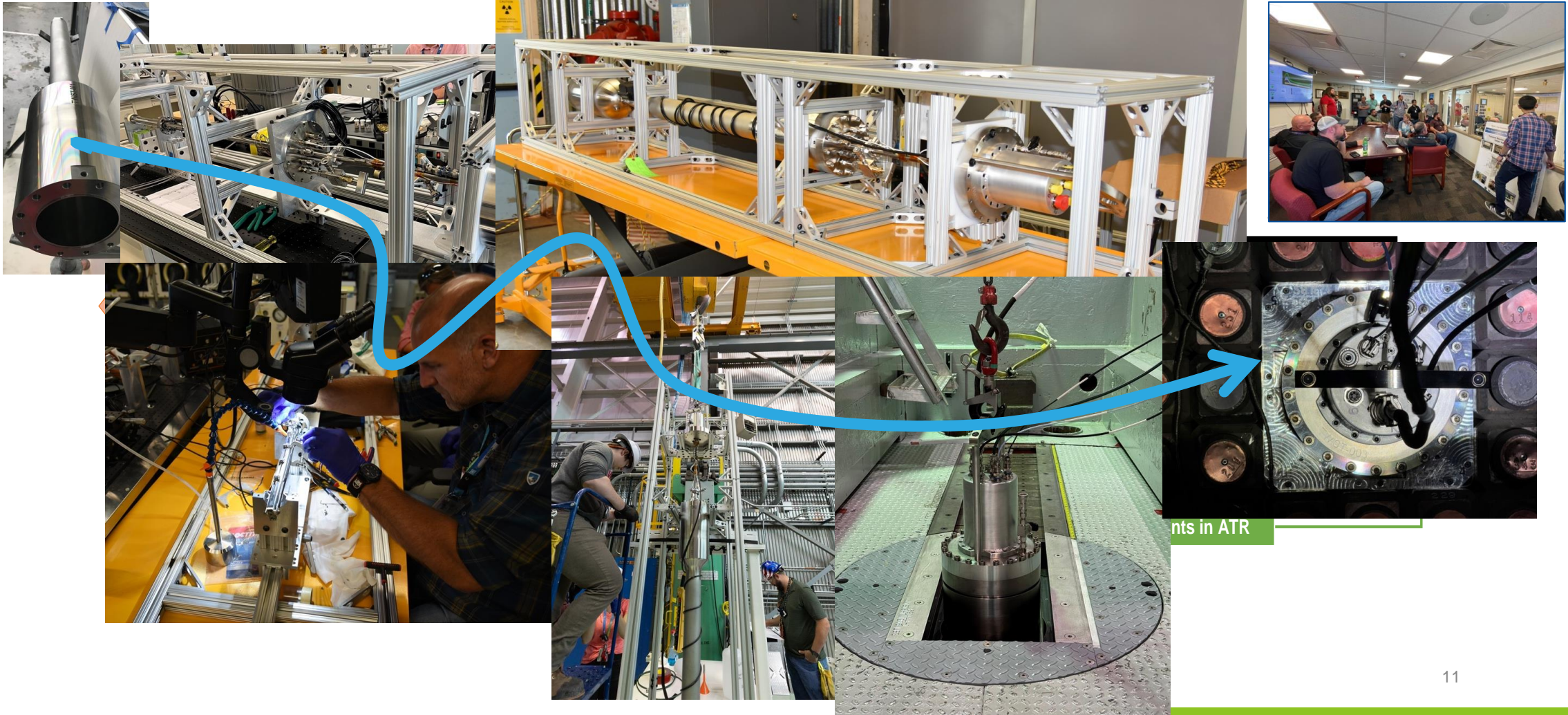
INL TREAT



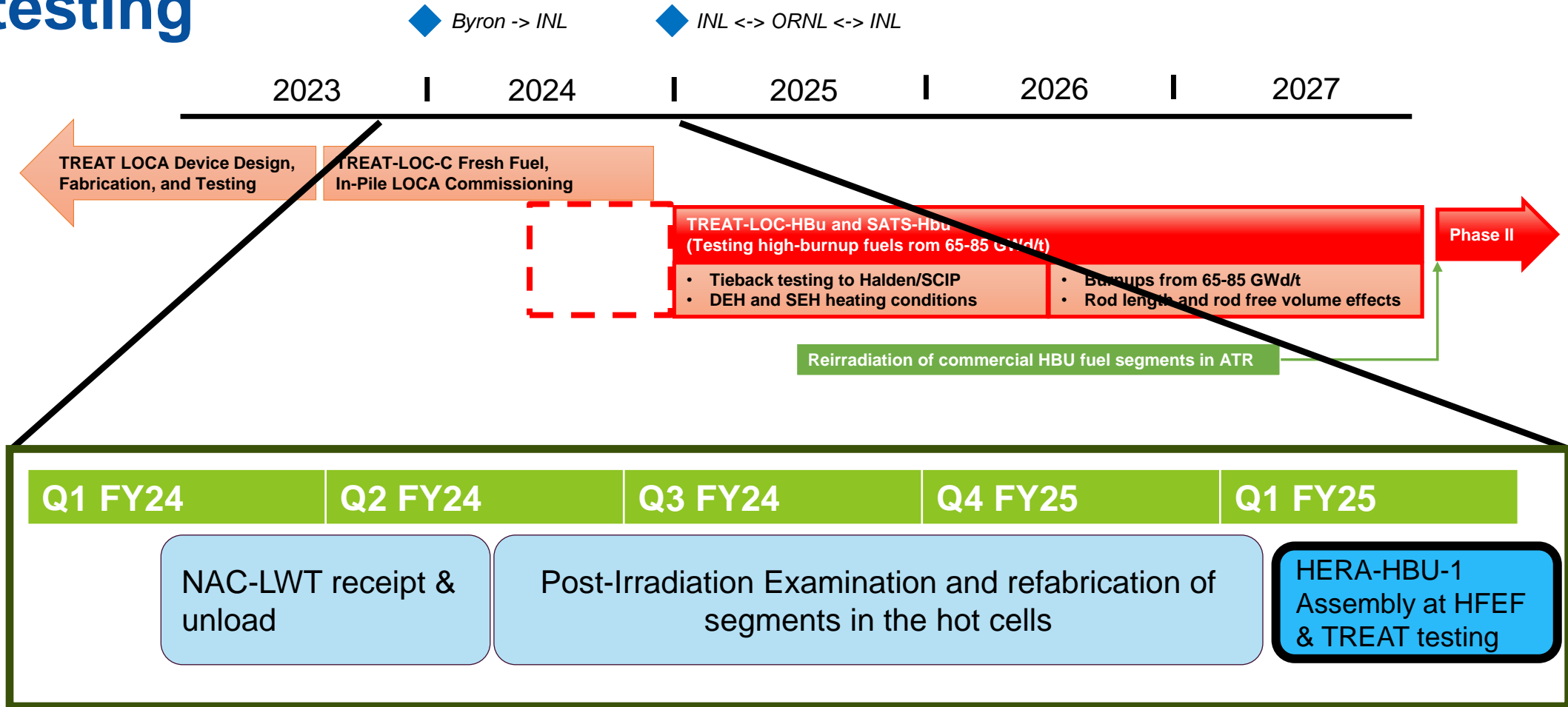
Overall medium-term schedule of the LOCA and HERA safety testing



LOC-C safety testing executed in September 2023



Receipt and first campaign timeline for TREAT testing





Idaho National Laboratory

Battelle Energy Alliance manages INL for the U.S. Department of Energy's Office of Nuclear Energy. INL is the nation's center for nuclear energy research and development, and also performs research in each of DOE's strategic goal areas: energy, national security, science and the environment.