TRTR
National Organization of Test, Research and Training Reactors

Kairos Power

Hermes Demo Reactor, Modeling and Startup Physics Testing Synergism

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30 SEPTEMBER 2024

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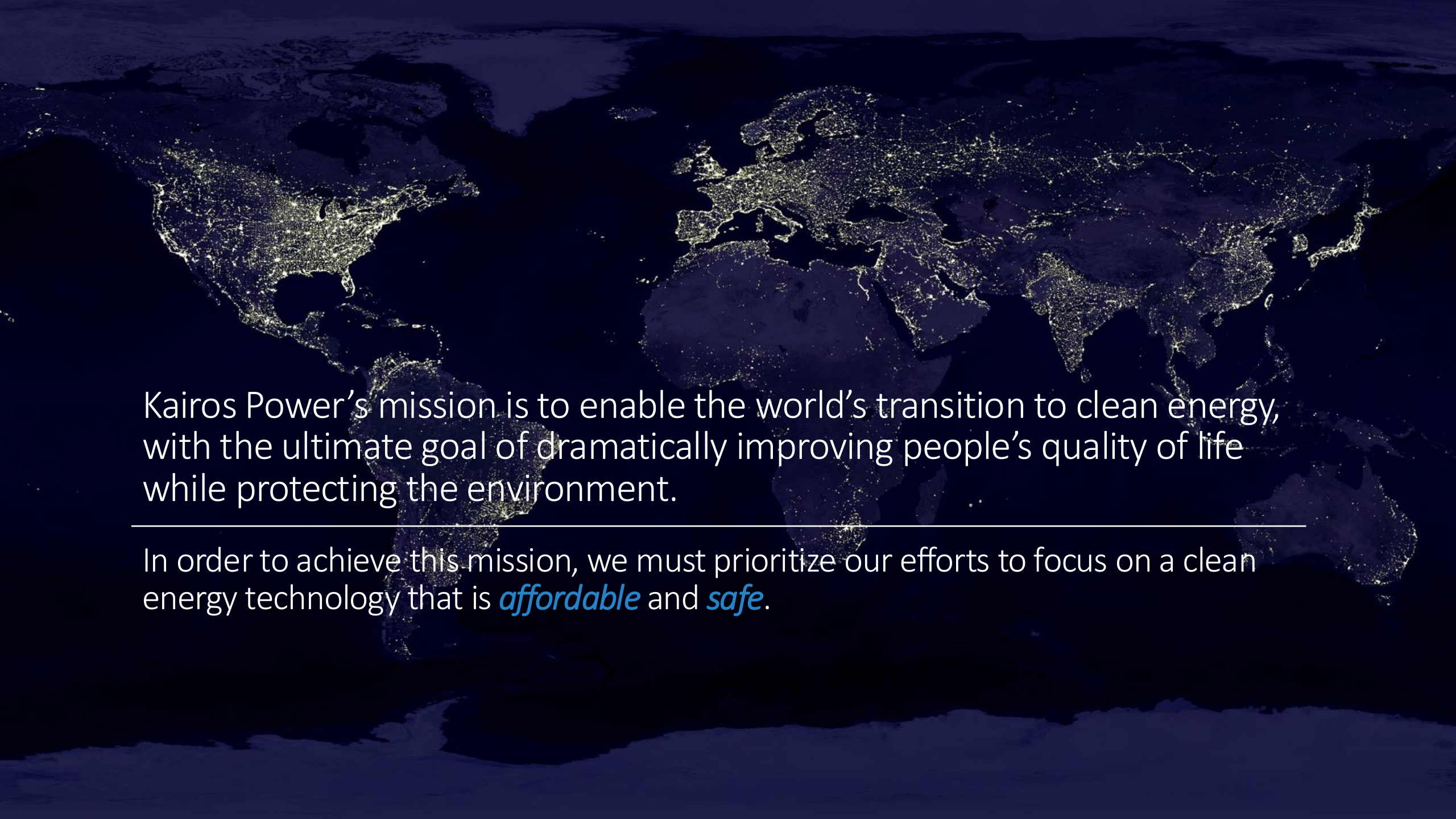


Kairos Power's mission is to enable the world's transition to clean energy, with the ultimate goal of dramatically improving people's quality of life while protecting the environment.

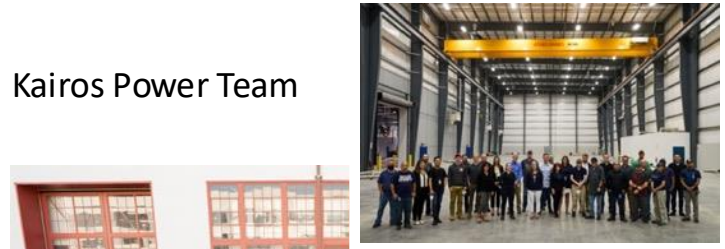
In order to achieve this mission, we must prioritize our efforts to focus on a clean energy technology that is *affordable* and *safe*.

Overview of Kairos Power

- Nuclear energy engineering, design, and manufacturing company ***singularly focused*** on the commercialization of the fluoride salt-cooled high-temperature reactor (FHR)
  - Founded in 2016
  - ~400 Employees
- Novel approach to nuclear development that includes iterative hardware demonstrations and in-house manufacturing to achieve disruptive cost reduction and provide true cost certainty
- Schedule driven by US demonstration by 2030 (***or earlier***) and rapid deployment ramp in 2030s
- Cost targets set to be competitive with natural gas in the US electricity market

Kairos Power Headquarters

Kairos Power Team



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Kairos Power Path to Commercialization

Successive Large-Scale Integrated Demonstrations

PLAN DESIGN BUILD TEST

KP-X
Commercial Plant

KP-X

PLAN DESIGN BUILD TEST

User Facility
Reactor Demonstration Unit
(Non-Nuclear)

U-Facility

PLAN DESIGN BUILD TEST

Hermes Demonstration Reactor Series

Hermes Hermes 2

PLAN DESIGN BUILD TEST

Engineering Test Units
(Non-Nuclear)

ETU 1.0 ETU 2.0 ETU 3.0

Nuclear

Produces electricity and connected to grid

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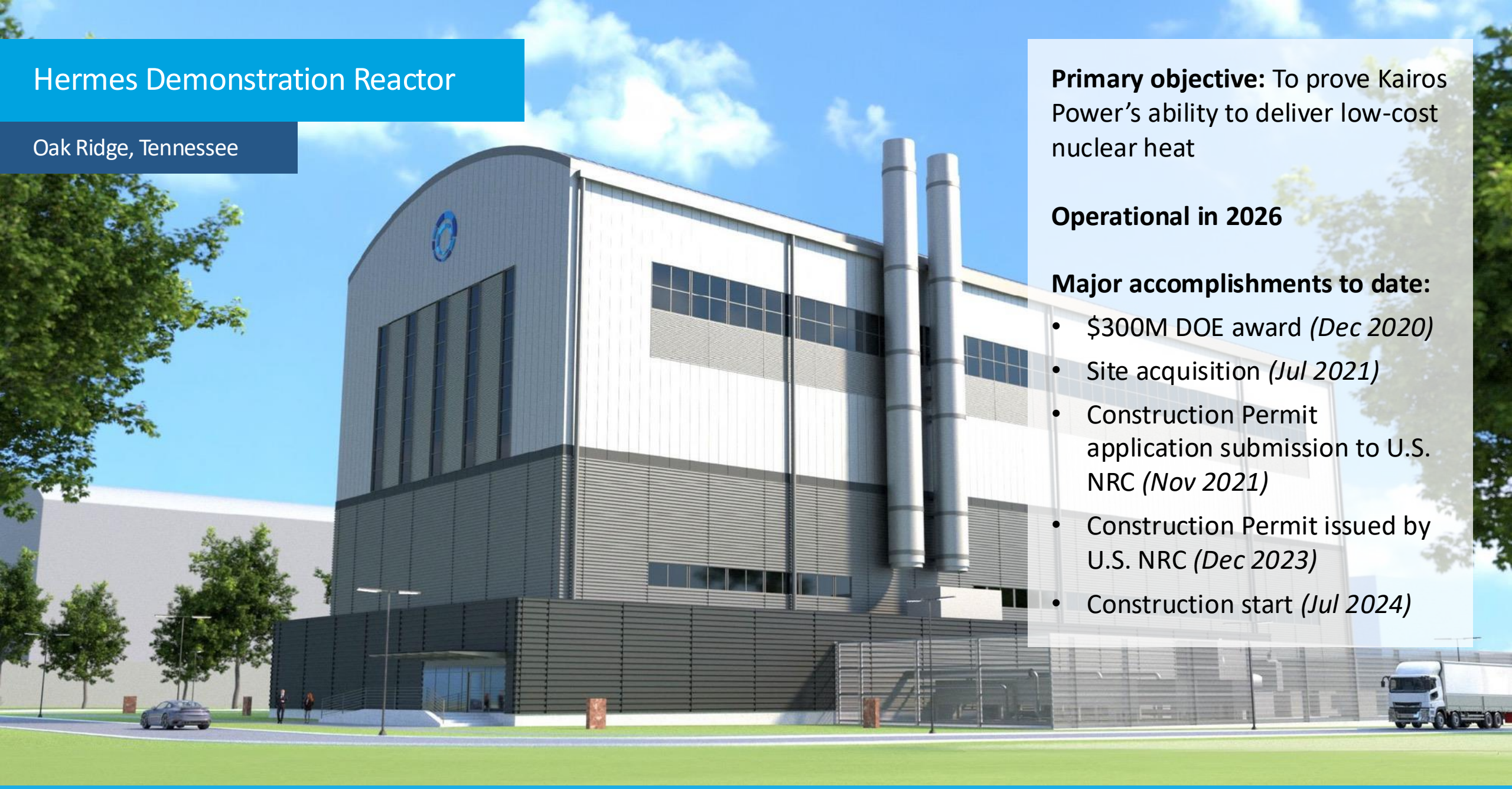
Hermes Demonstration Reactor

Oak Ridge, Tennessee



Primary objective: To prove Kairos Power's ability to deliver low-cost nuclear heat

Operational in 2026

Major accomplishments to date:

- $300M DOE award *(Dec 2020)*
- Site acquisition *(Jul 2021)*
- Construction Permit application submission to U.S. NRC *(Nov 2021)*
- Construction Permit issued by U.S. NRC *(Dec 2023)*
- Construction start *(Jul 2024)*

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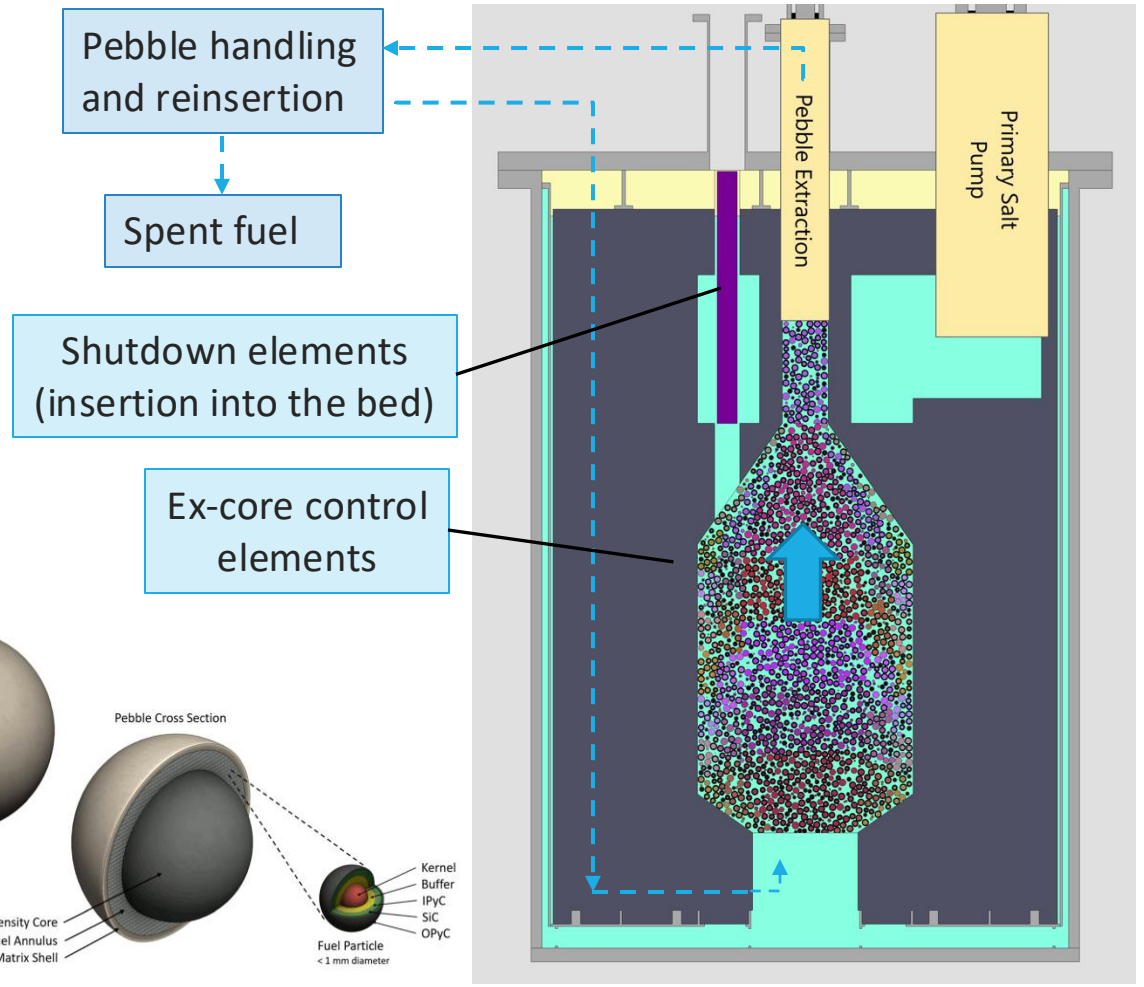
Hermes Reactor Description

Licensing following non-power regulations in 10 CFR 50, using guidance in NUREG-1537

- Graphite reflector
  - Machined graphite blocks
  - Penetrations for flow, control rods, instrumentation, etc.
- Flibe coolant
  - High temperature, low pressure system (550-650°C, <2 bars)
- Pebble bed core:
  - 4-cm diameter graphite pebbles
  - Fuel: ~6 g U in TRISO, < 20% U-235
  - Pebbles move through the core in 30-50 days
  - Reinserted or discharged once design burnup limit is reached
- Core design methodology described in "KP-FHR Core Design and Analysis Methodology" (KP-TR-017) and recent submission of Core Design Topical Report to USNRC on 3/4/24.



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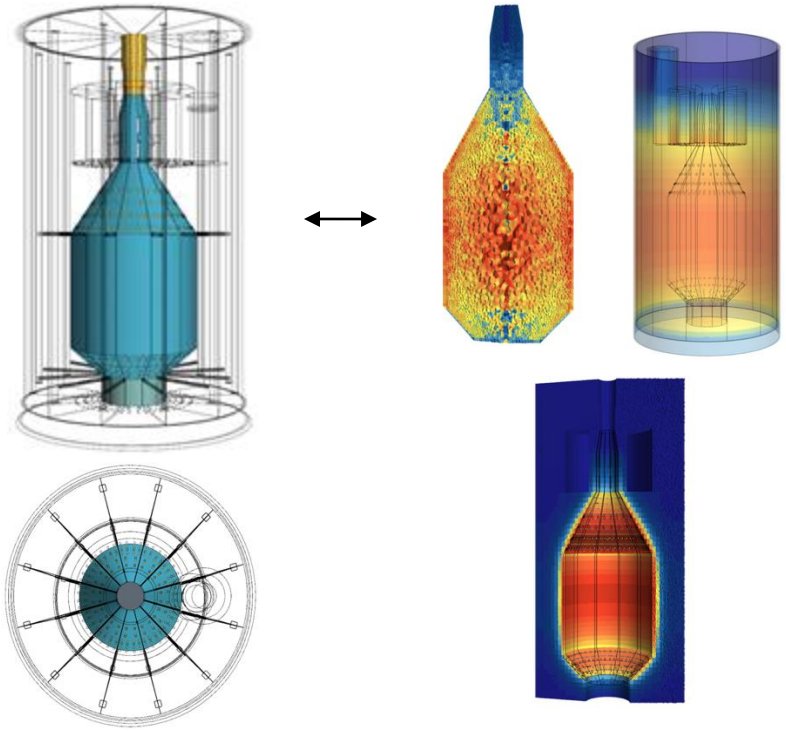
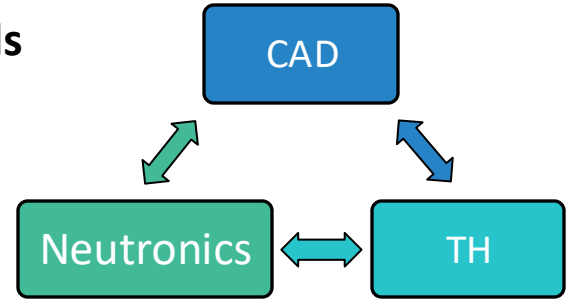
Hermes Nuclear Design

- Iterative Multiphysics Modeling to provide rapid and informed system design updates
- Coupled Methodology tools for safety analysis
  - Reactor kinetics parameters
  - Control rod worth and shutdown margin
  - Reactivity coefficients
  - Power distribution
- Design verification and Method validation through operational testing
  - 1/M approach to criticality via fuel loading and via control rods
  - Zero & Lower power testing
  - Power ascension and system/plant responses

System Design (CAD)

Nuclear Design & Methods (Neutronics, DEM, TH)





Figures of Merit:

Neutronics
- Power profile
- Radiation transport

Thermal Hydraulics
- Temperature profiles
- Flow characteristics

Pebble Dynamics
- Pebble motion
- Packing fraction

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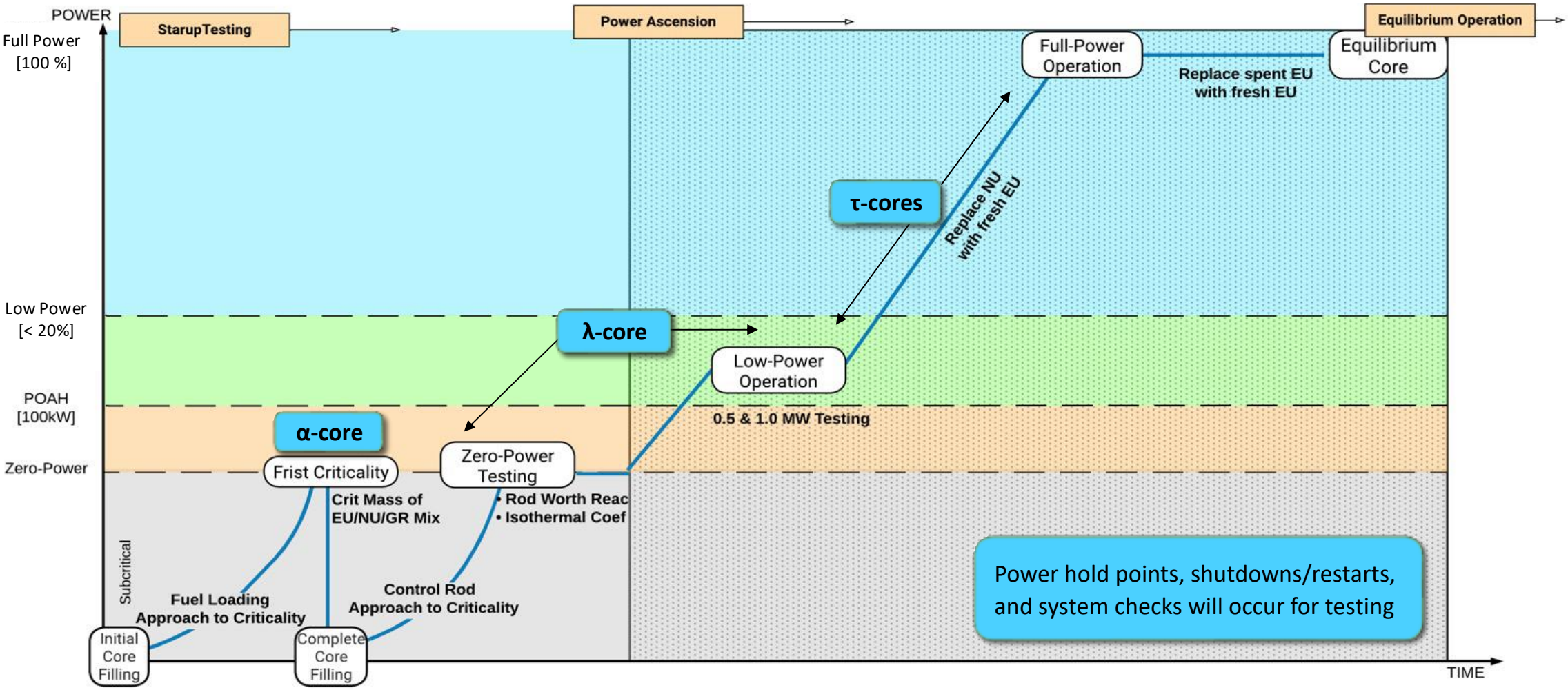
Hermes Startup Narrative



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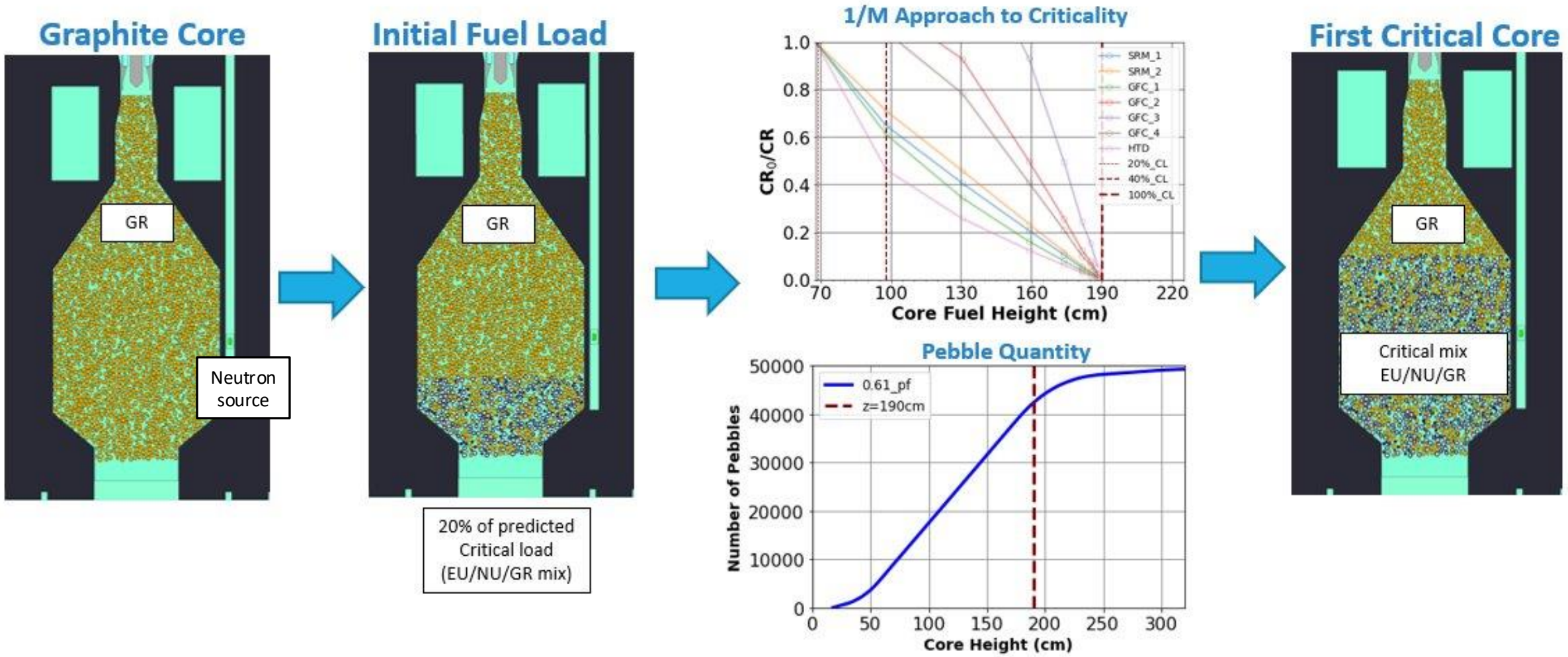
Hermes Initial Fuel Load



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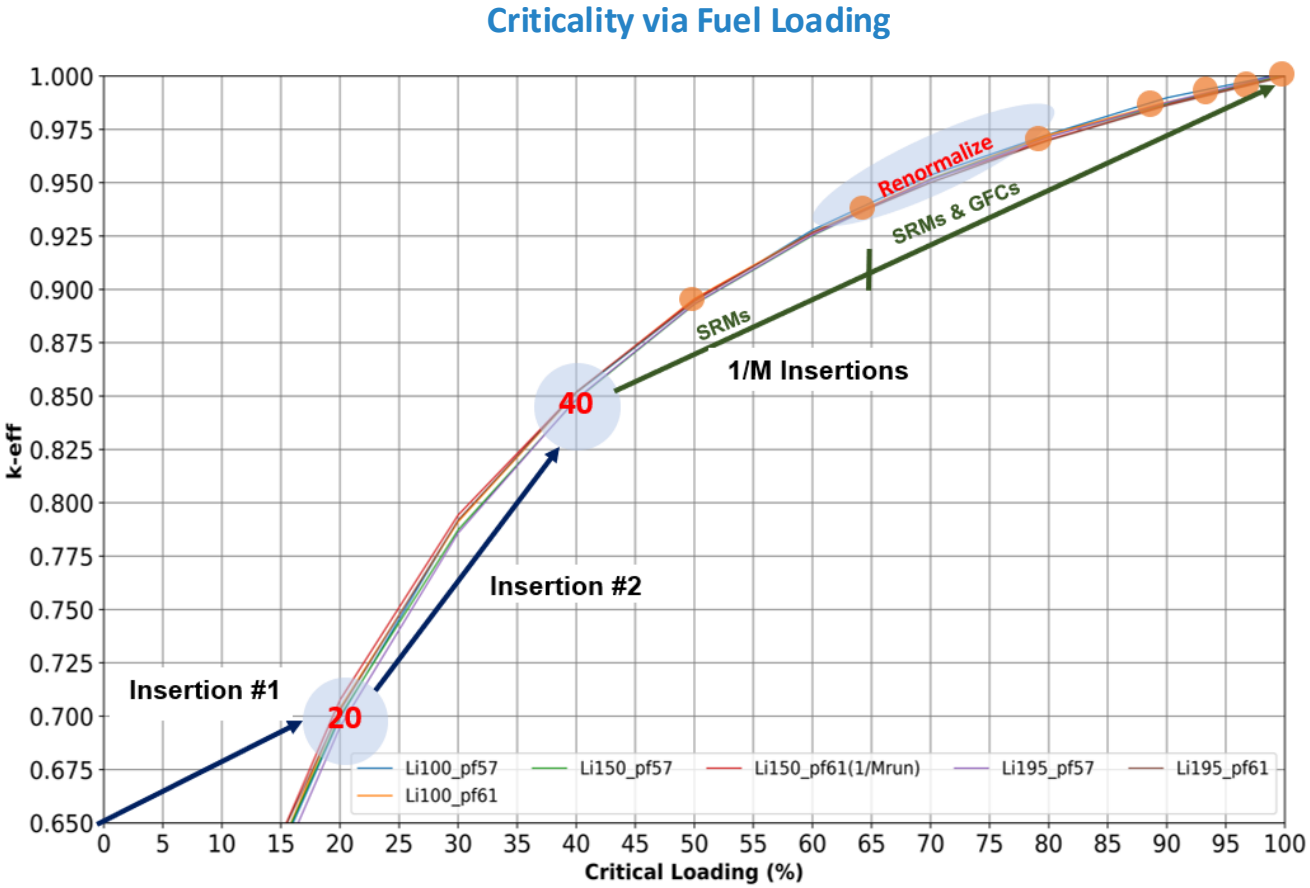
Hermes Initial Fuel Load

- Sensitivity studies on critical mass (pebble count) to ensure a safe and conservative approach to criticality
- FOAK reactor fuel load: 1/M count rates from neutron detectors at multiple axial, radial and azimuthal positions
  - In-vessel source range monitors (SRMs)
  - Ex-vessel guarded fission chambers (GFCs)
- After first criticality, comparison with predictions and model adjustments are performed for benchmarking analysis and design.



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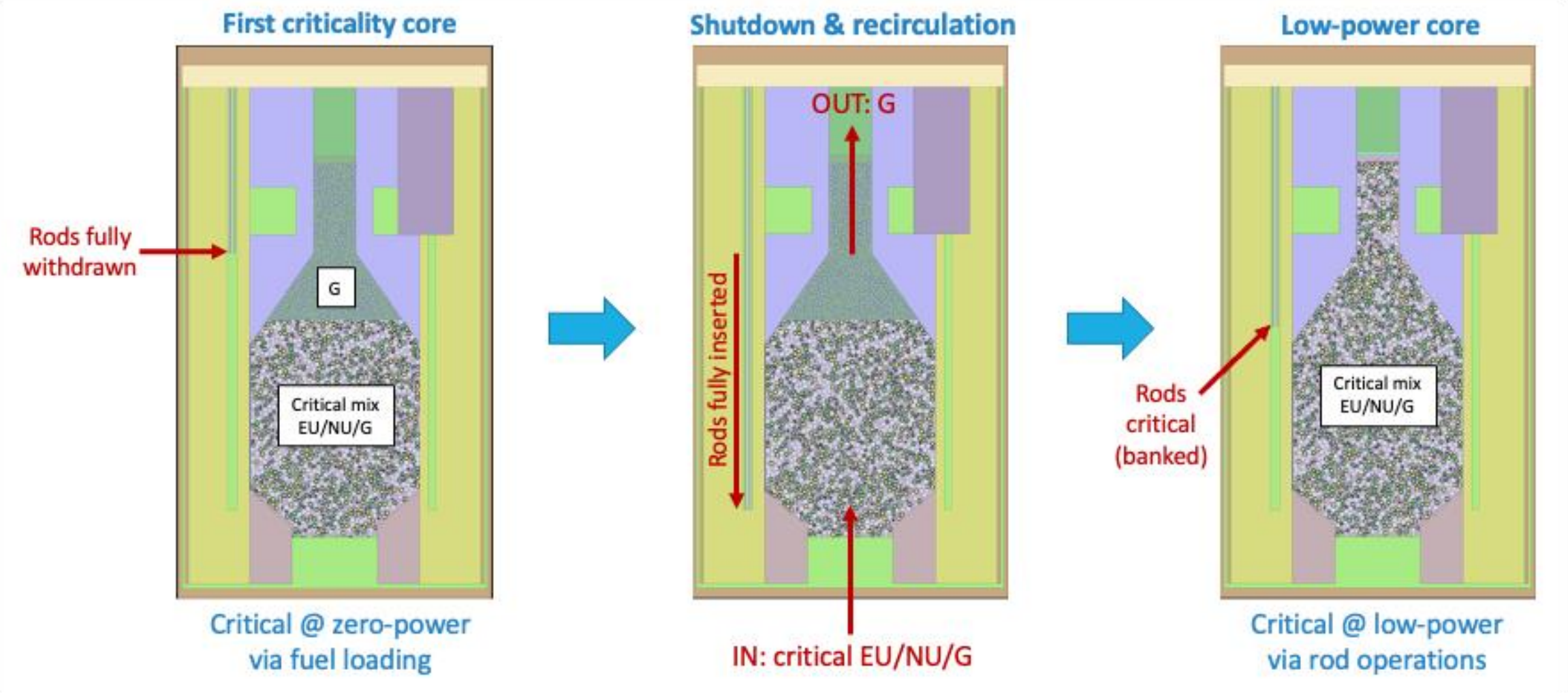
Hermes Low Power



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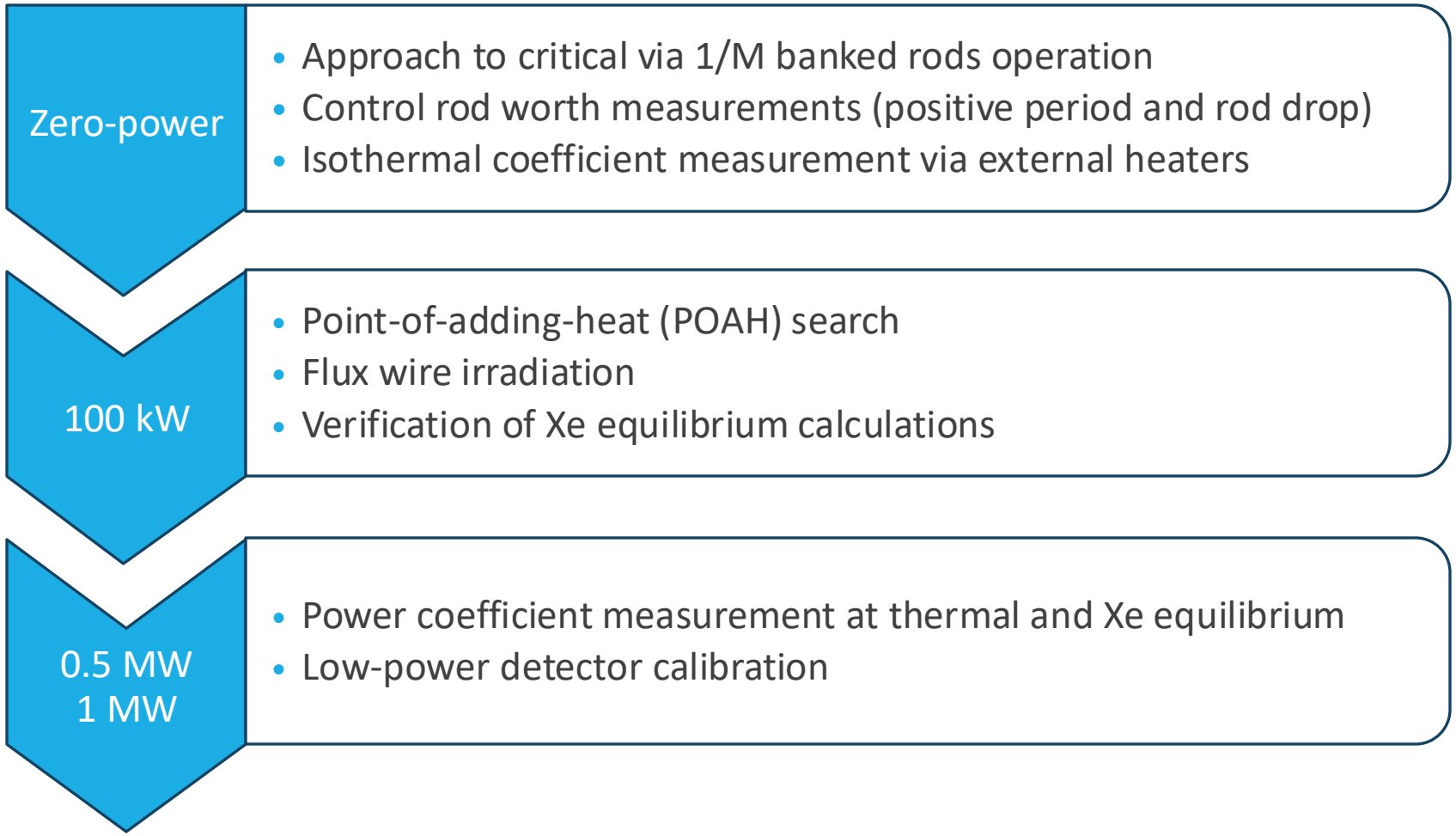
Hermes Startup Physics Testing



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