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Department of Nuclear Engineering

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Clean Energy and Hydrogen-Powered Transportation Supplied by Advanced Nuclear Reactors

Aalo

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Aalo's Vision

To untether humanity's growth from its impact on Earth, by ushering in the *Second Atomic Age.*

Project Mission

Achieve 3¢ / kWh cost of electricity, maintaining safety while making nuclear cheap enough to power the majority of the world's clean energy needs.

Motivation

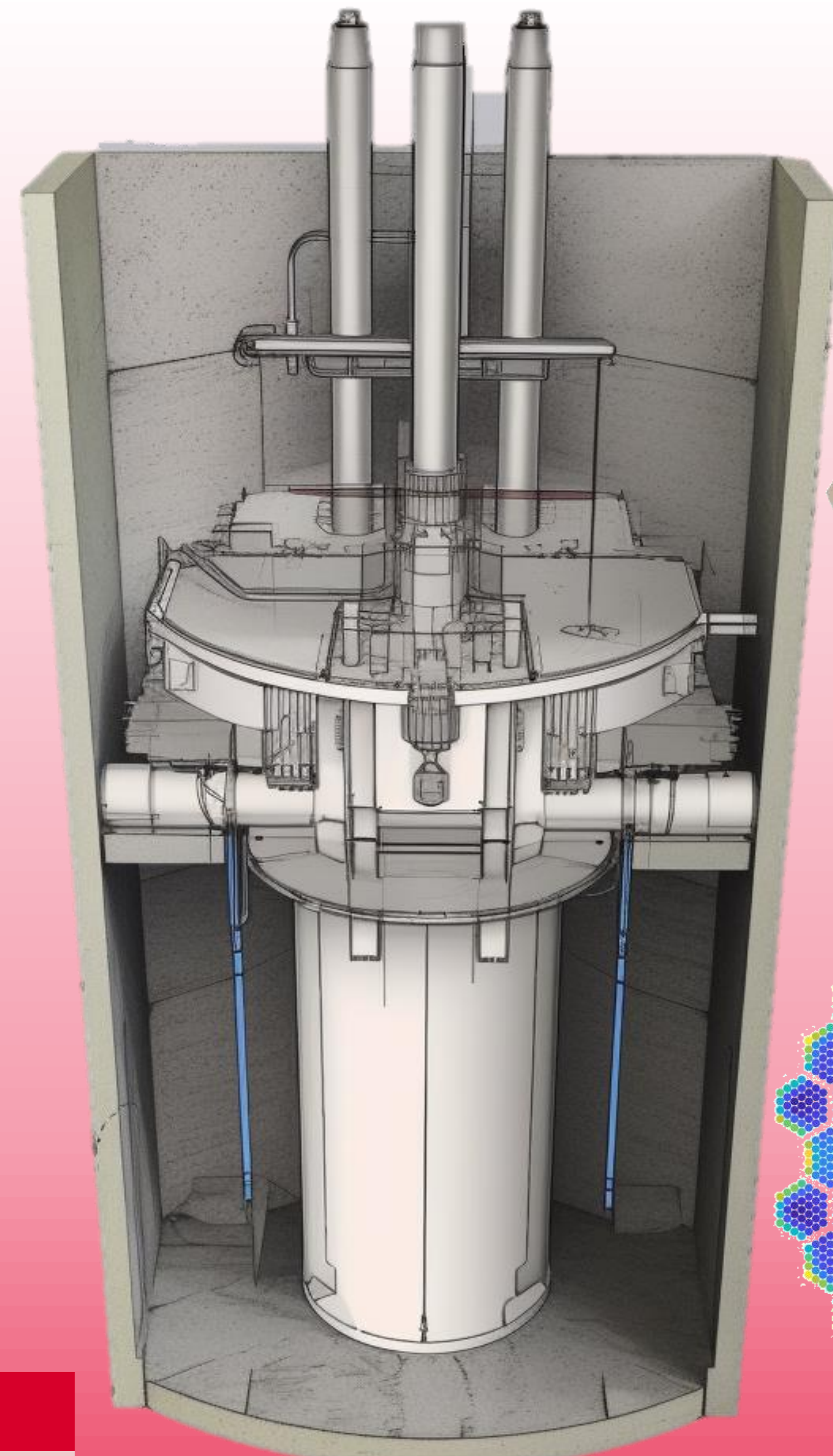
Nuclear fission power is more than capable of addressing the current global energy needs with a net-zero carbon footprint. High-temperature reactors coupled to a hydrogen conversion cycle can provide both truly clean electricity and hydrogen for transportation.

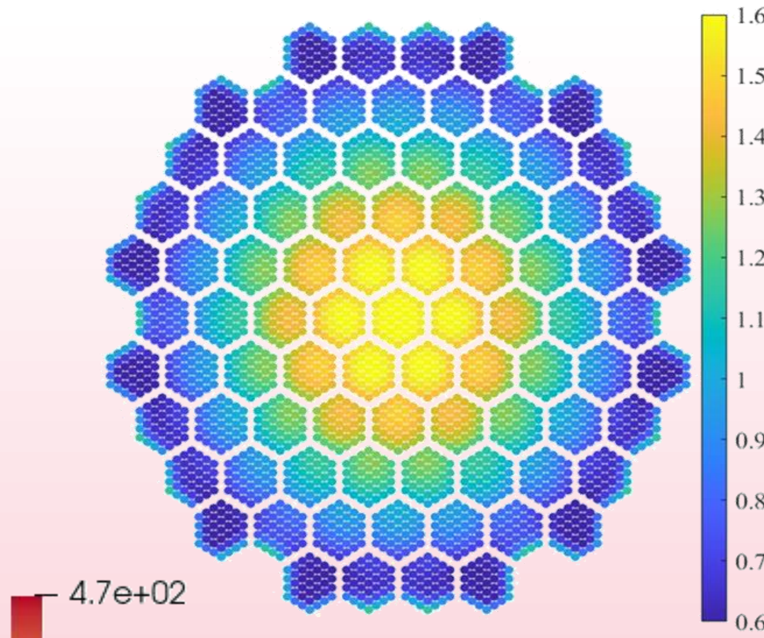
Feasibility

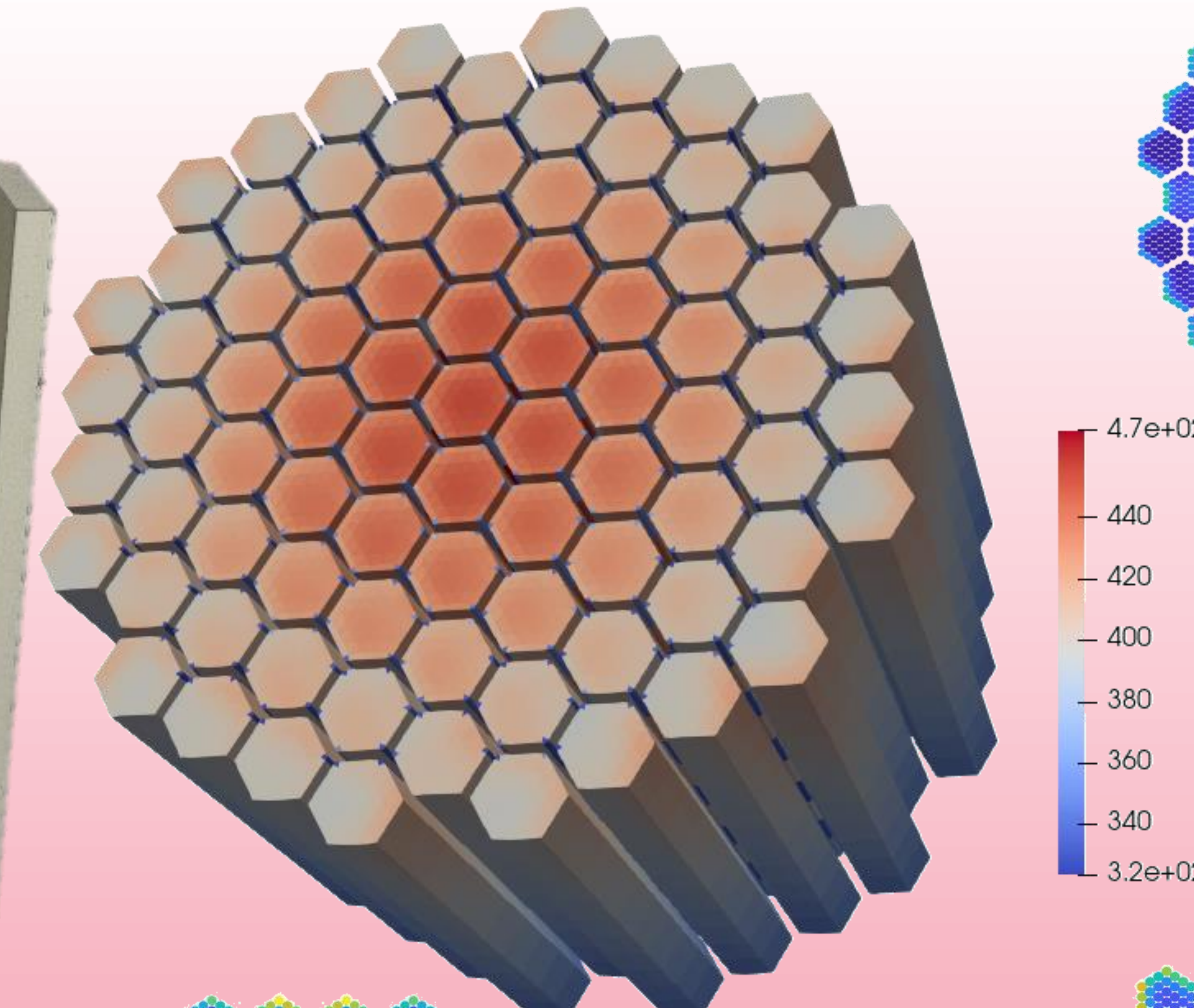
Feasibility and optimization studies with Monte Carlo neutron transport (Serpent 2.2) and subchannel thermal-hydraulics (CTF 4.0+) are ongoing. Further studies involving coupled multi-physics and uncertainty quantification are planned.

Initial Reactor Design Specifications

Reactor Type	Sodium-cooled thermal reactor
Thermal Power	20 MW
Electrical Power	7 MW
Fuel	Uranium Zirconium Hydride (TRIGA-based, Zr / H = 1.6)
^{235}*U Enrichment*	10% maximum
Coolant	Liquid sodium, forced convection
Moderator	Hydrogen (in fuel and reflector as ZrH), Graphite
Refueling Interval	Approximately 5 years
Structural Materials	304, 316H Stainless Steel
Reactivity Control	Integral Erbium and B_4C control rods
Power Conversion	Rankine Steam Cycle

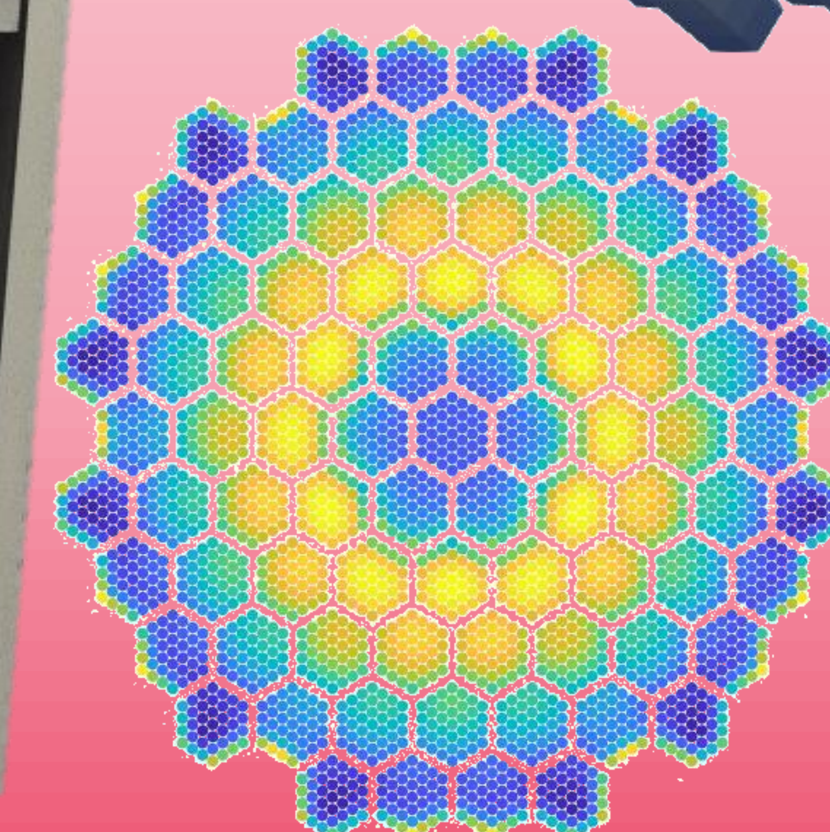




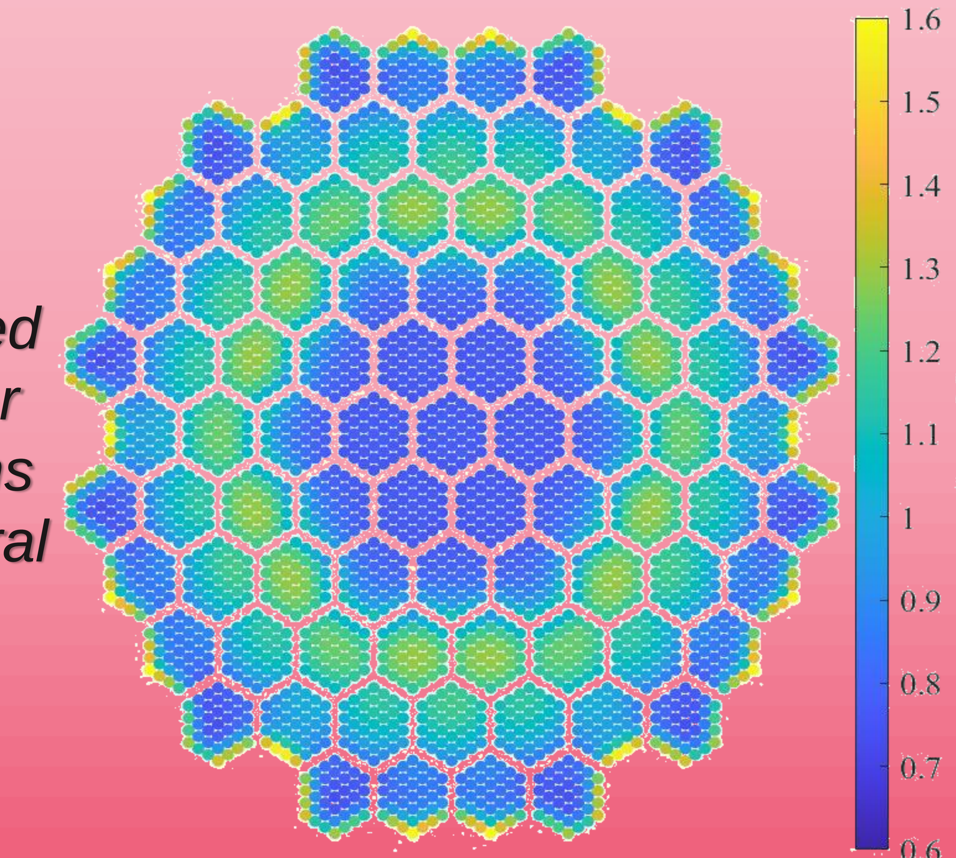


Temperature (left) and normalized pin power predictions (above) of initial design

Normalized pin power predictions with integral erbium



Integral erbium in center 7 assemblies



Integral erbium in center 19 assemblies

Demonstration

A full demonstration pilot plant is planned at the Idaho National Laboratory desert site. This plant is perfectly sized to power INL's motorcoach fleet.

Timeline

2023	Foundations & Feasibility
2024	Preliminary Design
2025	90% Final Design
2026	Criticality
2027	Hydrogen Production

For more information visit **www.aalo.com** *and* **www.ne.ncsu.edu/rdfmg/**

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