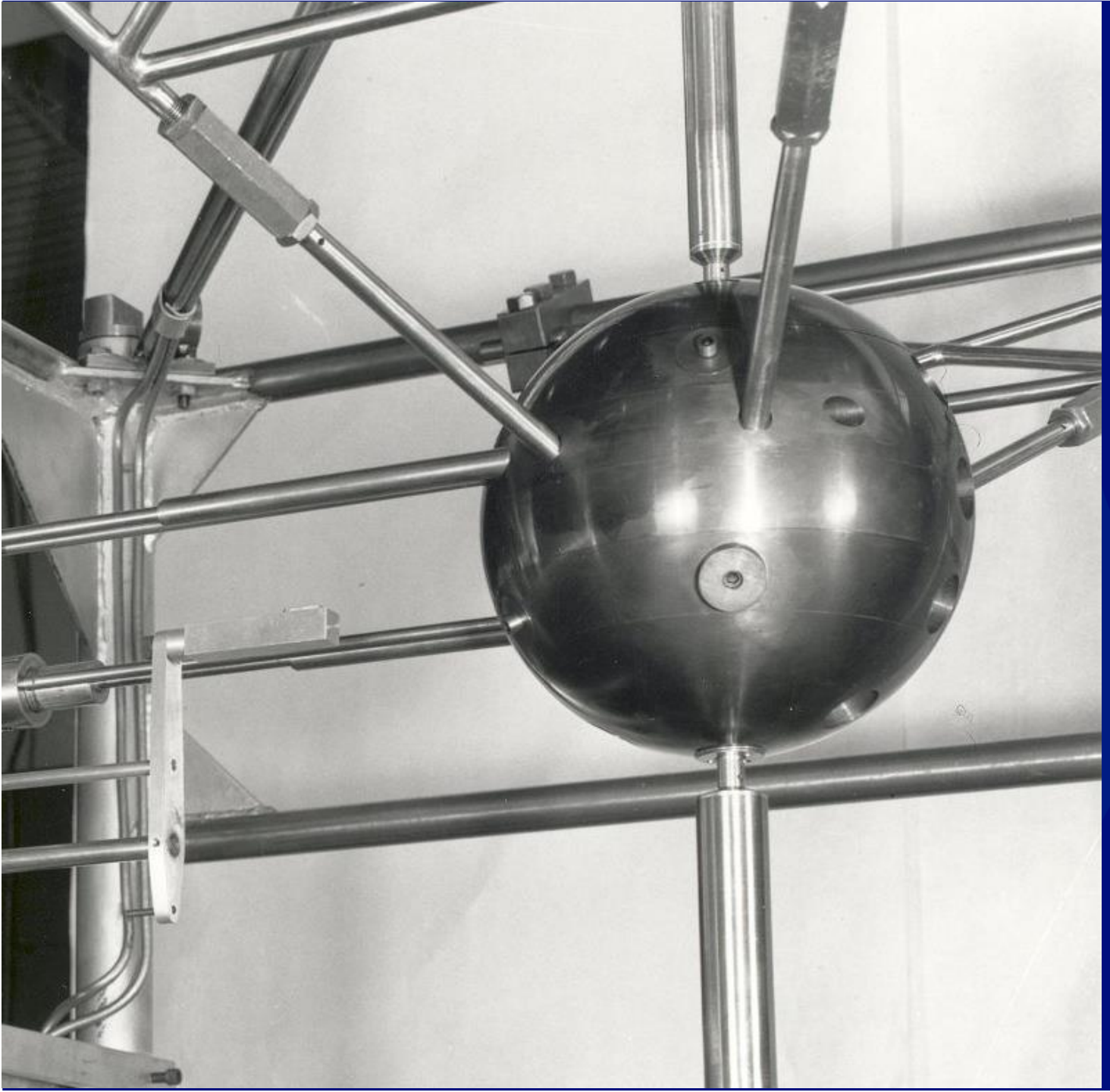

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The Deimos Testbed

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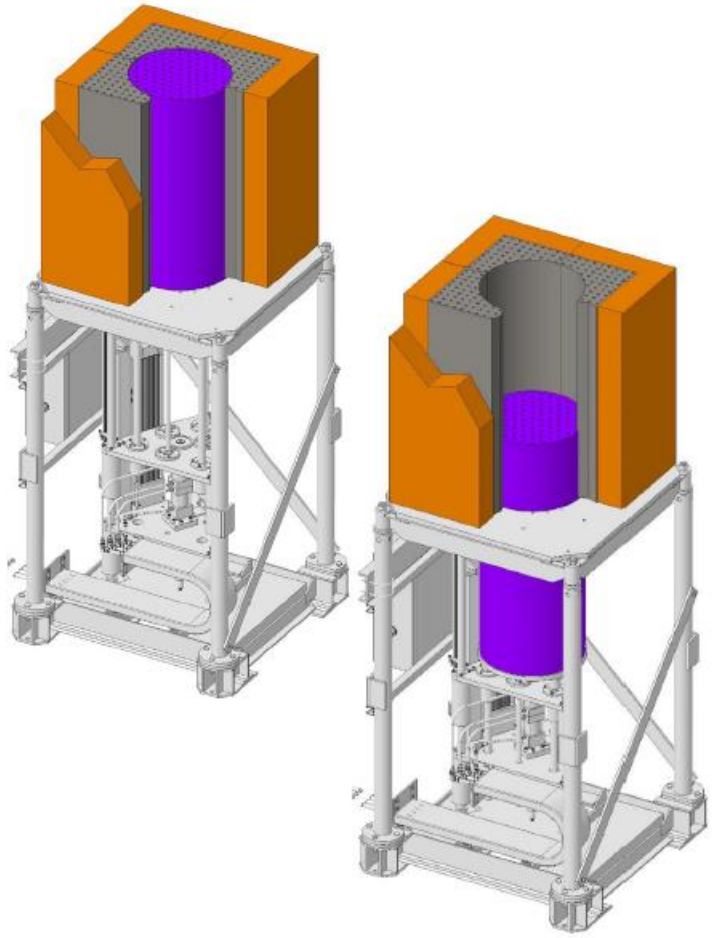
Deimos Experiment

Advanced Reactor Testbed

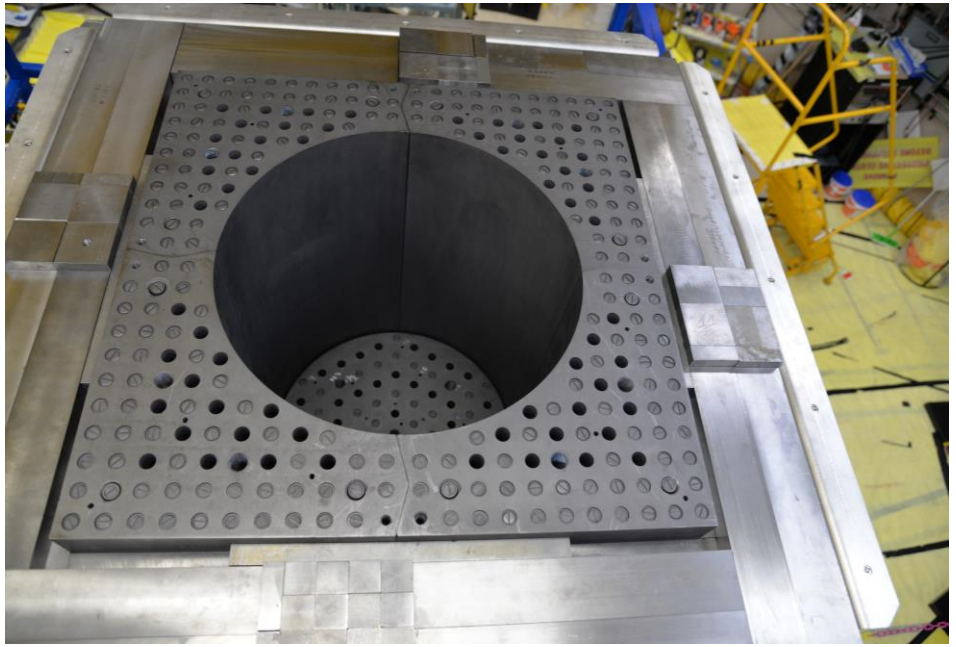
- Los Alamos National Laboratory (LANL) Laboratory Directed Research and Development (LDRD) for advanced reactor testbed performed at National Criticality Experiments Research Center (NCERC) in 2024
- Graphite-moderated, beryllium reflected, HALEU TRi-structural ISOtropic (TRISO) critical assembly
- Utilizes fuel from the Compact Nuclear Power Source (CNPS) experiments from LANL circa 1990s



Deimos Experiment

Advanced Reactor Testbed Targeting Thermal Spectra

- Deimos is a 3’ graphite cube, two-region core, the inner 21” cylinder controls remote criticality and outer core provides much of the fuel.
- Reflected by 6”+ of Be metal, the reflector is made of 1,000+ pieces of Be.

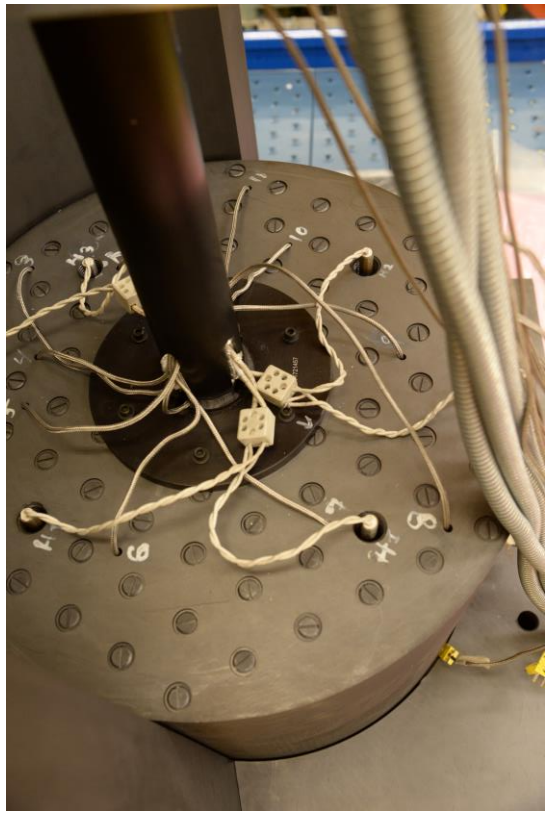


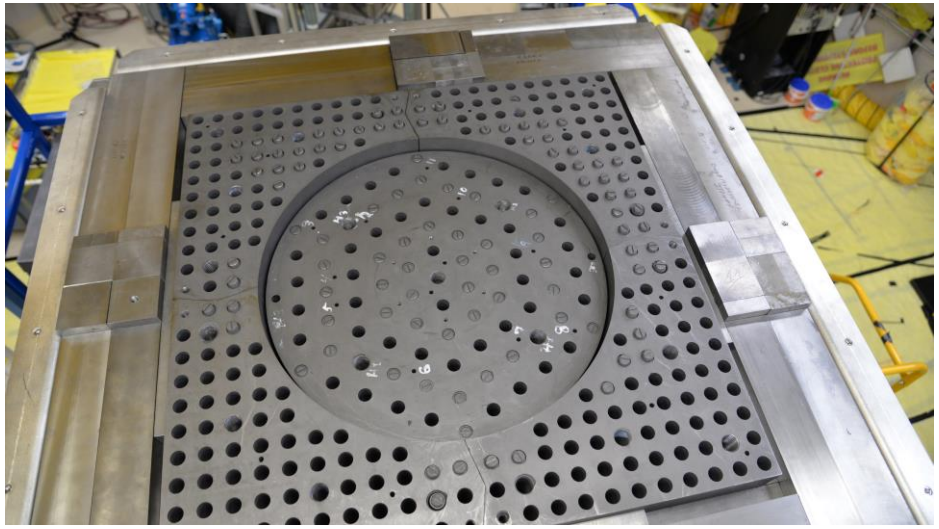

2 TON
WARNING

Deimos Experimental Setup

Hot and Cold Critical Capabilities

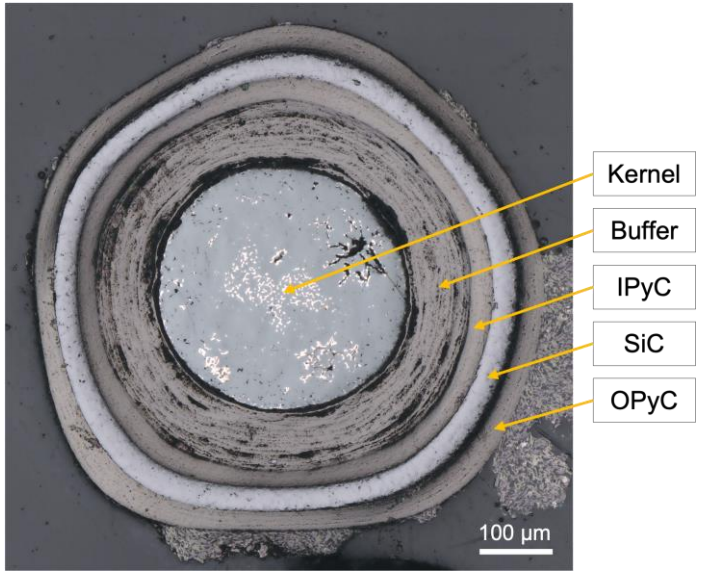
- Both heated and unheated experiments performed (up to 110˚C)
- DOE/NRC Collaboration for Criticality Safety Support for Commercial-Scale HALEU Fuel Cycles and Transportation (DNCSH) funded benchmarking of unheated core
- 5 critical configurations + 2 reproduction measurements (swap fuel cups) and 1 reconfiguration measurement (full core rebuild)





HALEU Fuel at NCERC

NCERC has HALEU material found nowhere else in the world



- TRISO particles are comprised of 5 concentric layers
- Innermost fuel kernel is 0.5 mm in diameter

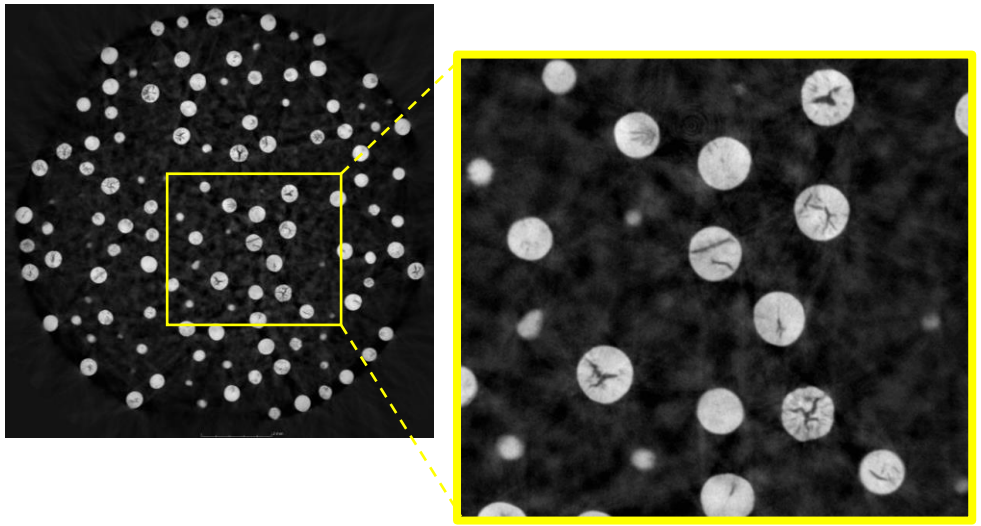
- ~11,500 TRISO particles are placed into a green graphite matrix and fired to form compact

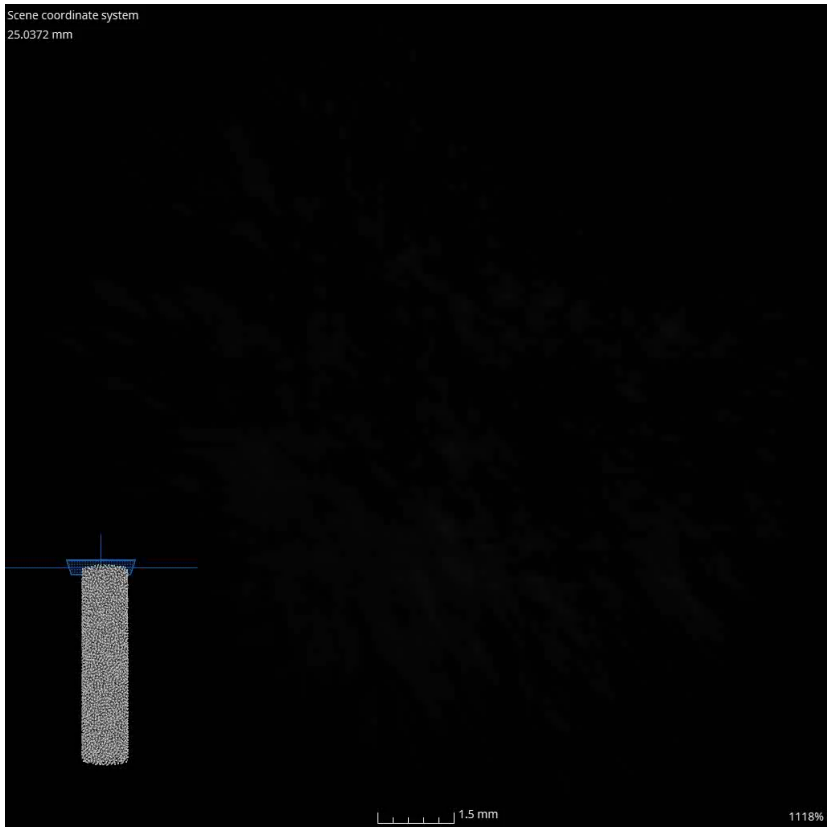
- 19 CNPS compacts are then stacked into a fuel cup (fuel rod) made of graphite
- These cups serve as the discrete fuel for Deimos

CNPS Fuel Required New Data for Benchmarking

Internal LANL collaboration with LEFFF

- CT scans show that almost all particles
  - Are not perfectly spherical
  - Can give direct packing fraction measurement
- Average dimensions fall within previous literature (no major surprises)





Beyond Deimos

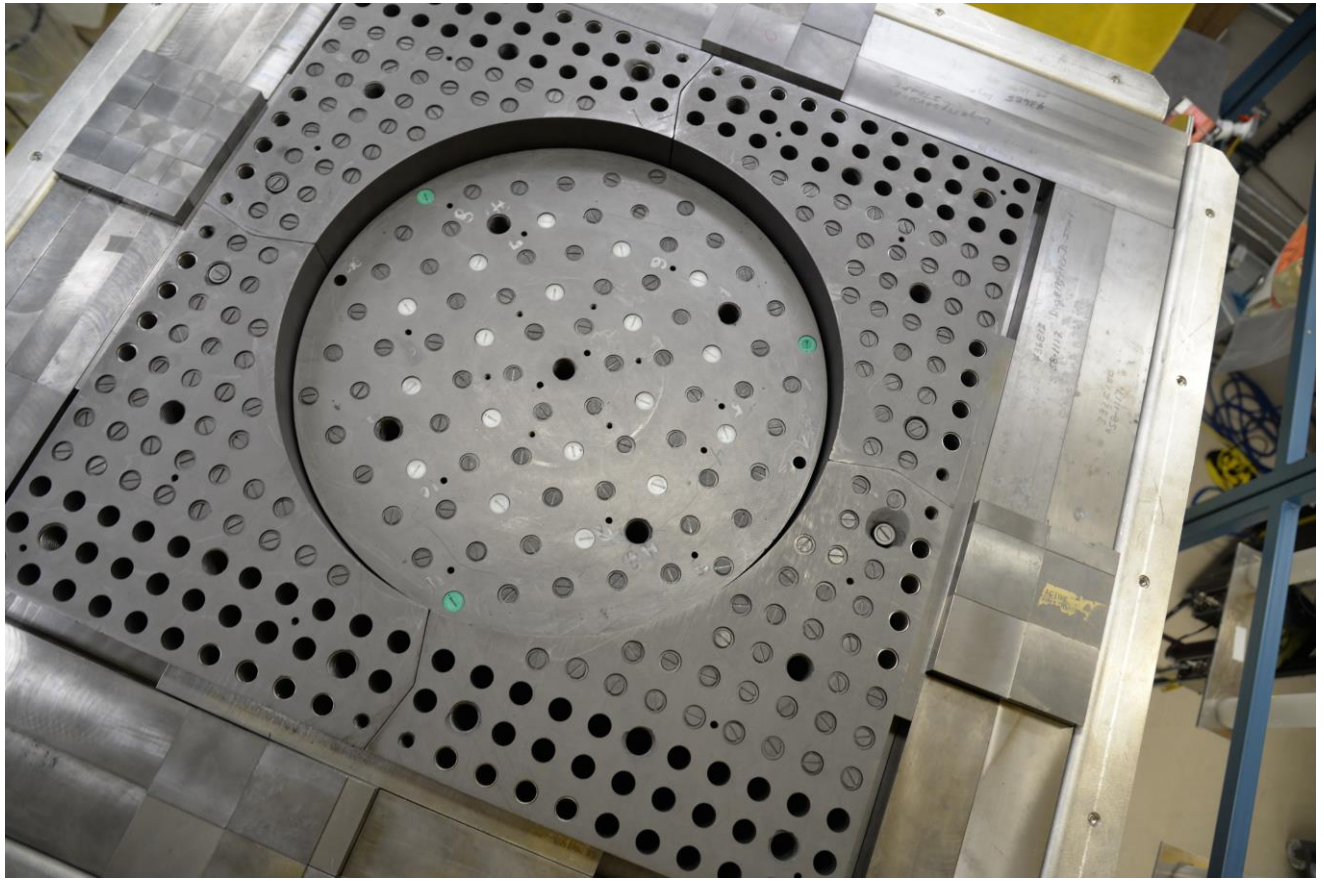
- THETA
- NOVA

Deimos was executed in FY24 and taken apart. However, it's been rebuilt for several experiments, thereby achieving its testbed purpose

Beyond Deimos

- THETA
- NOVA

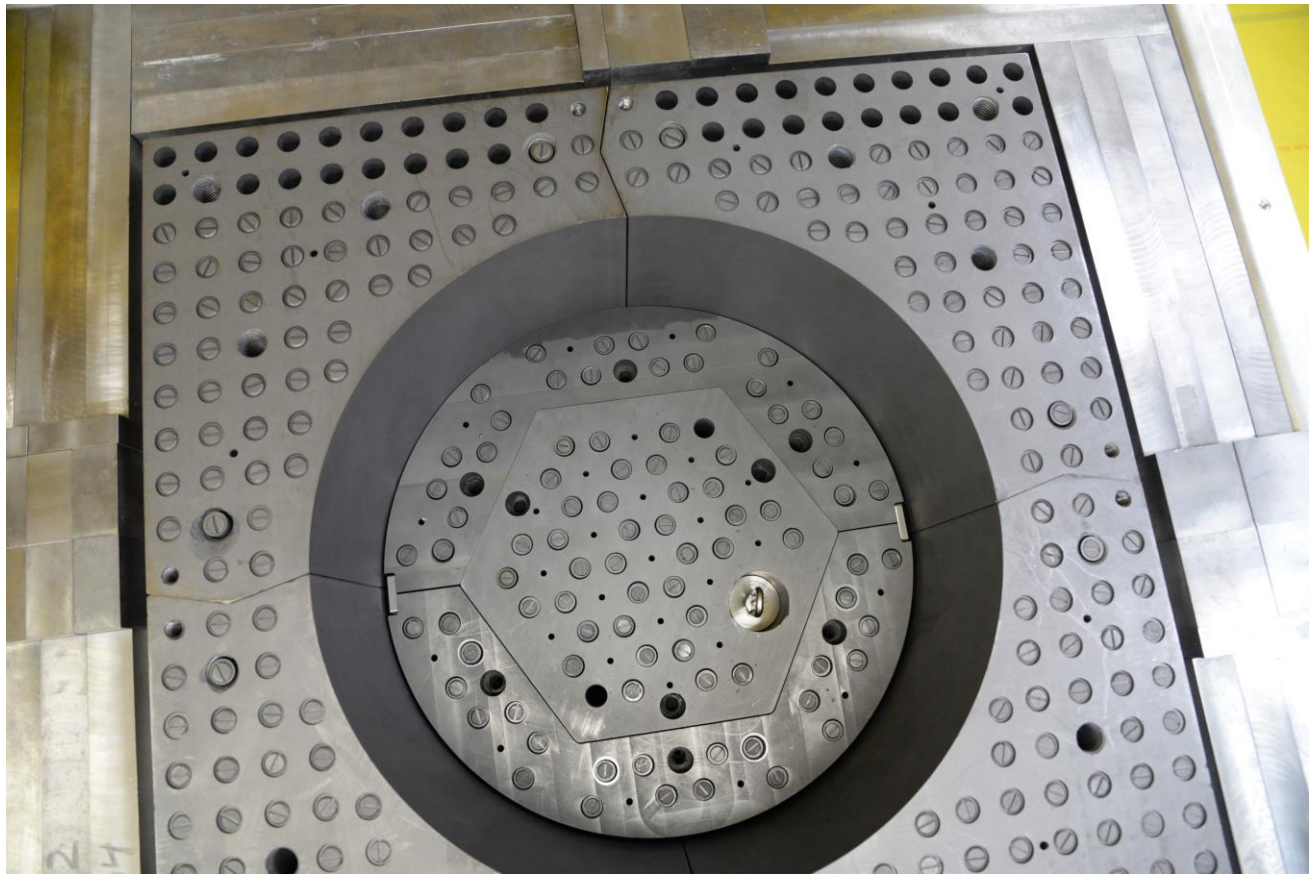
Kairos Power collaboration to explore absorber worth and mixed moderator for TRISO shipments (poly, borated poly, stainless steel)



Beyond Deimos

- THETA
- NOVA

Valar Atomics collaboration for reactor physics and control rod worth – first commercially provided inner core



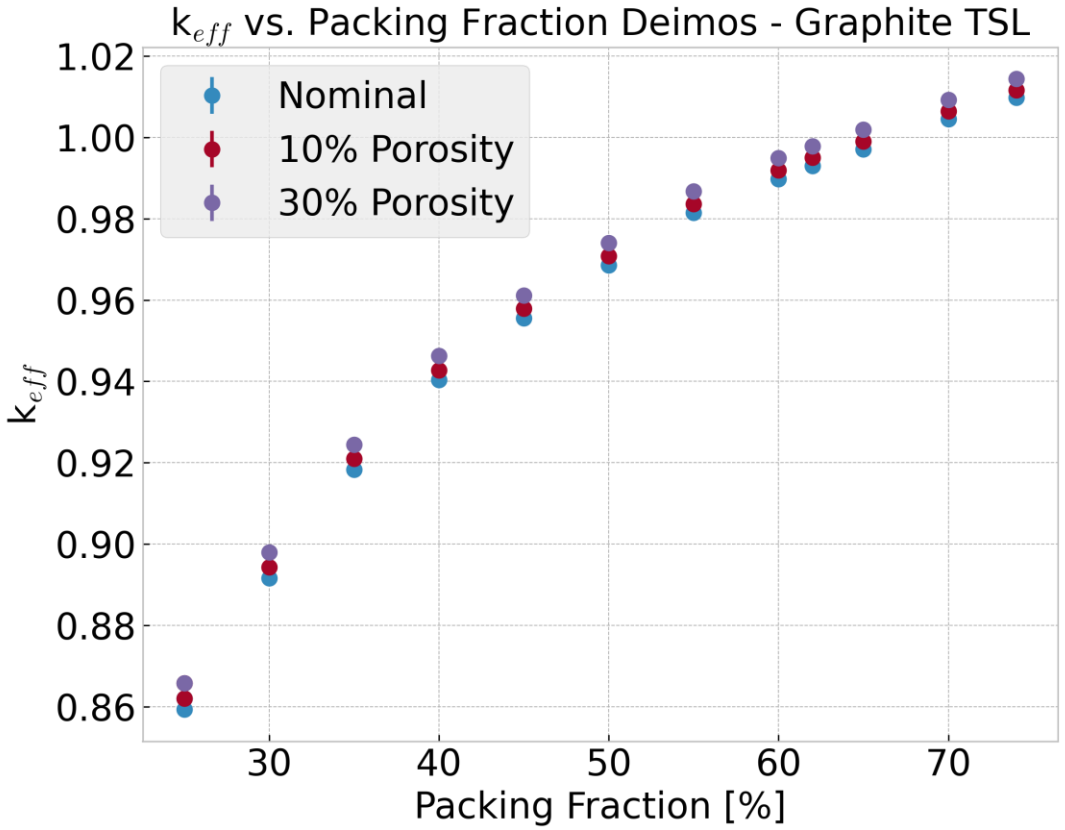
Safeguard Applications

- Several avenues of research are ongoing with Deimos Testbed, measured gamma and neutron characteristics with in-core and ex-core detectors
- Several projects for subcritical measurements to verifying fuel diversion in-progress of sponsor submission
  - Advanced Reactor International Safeguards Engagement (ARISE) work for data analysis of previous measurements

Nuclear Data Applications

Deimos is sensitive to graphite, beryllium, and uranium ND

- Graphite TSLs show significant impact to calculations
  - 15-20 pcm/ % porosity for Deimos
- Beryllium photo-neutrons are visible post shutdown



Conclusion

Deimos is Here to Meet Safeguard and Advanced Reactor Needs

- Heated and room-temp experiments of HALEU TRISO in graphite moderator
- Benchmark of original configurations enroute to ICSBEP
- Interest from commercial companies for experiments on Deimos/alternate platforms
- NCERC TRISO fuel and Deimos platform provide testbed for material diversion and nuclear data validation

Acknowledgements

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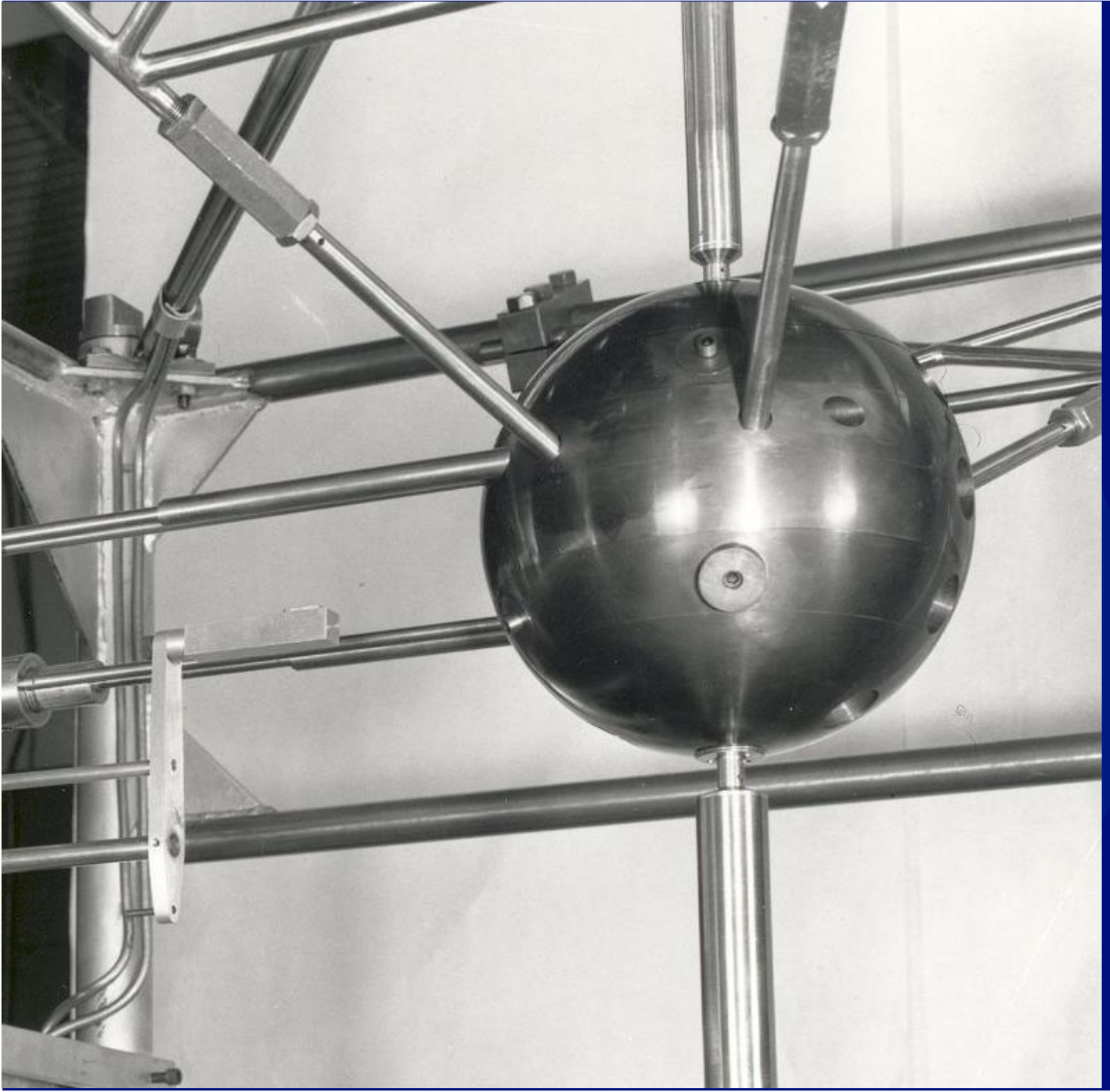

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