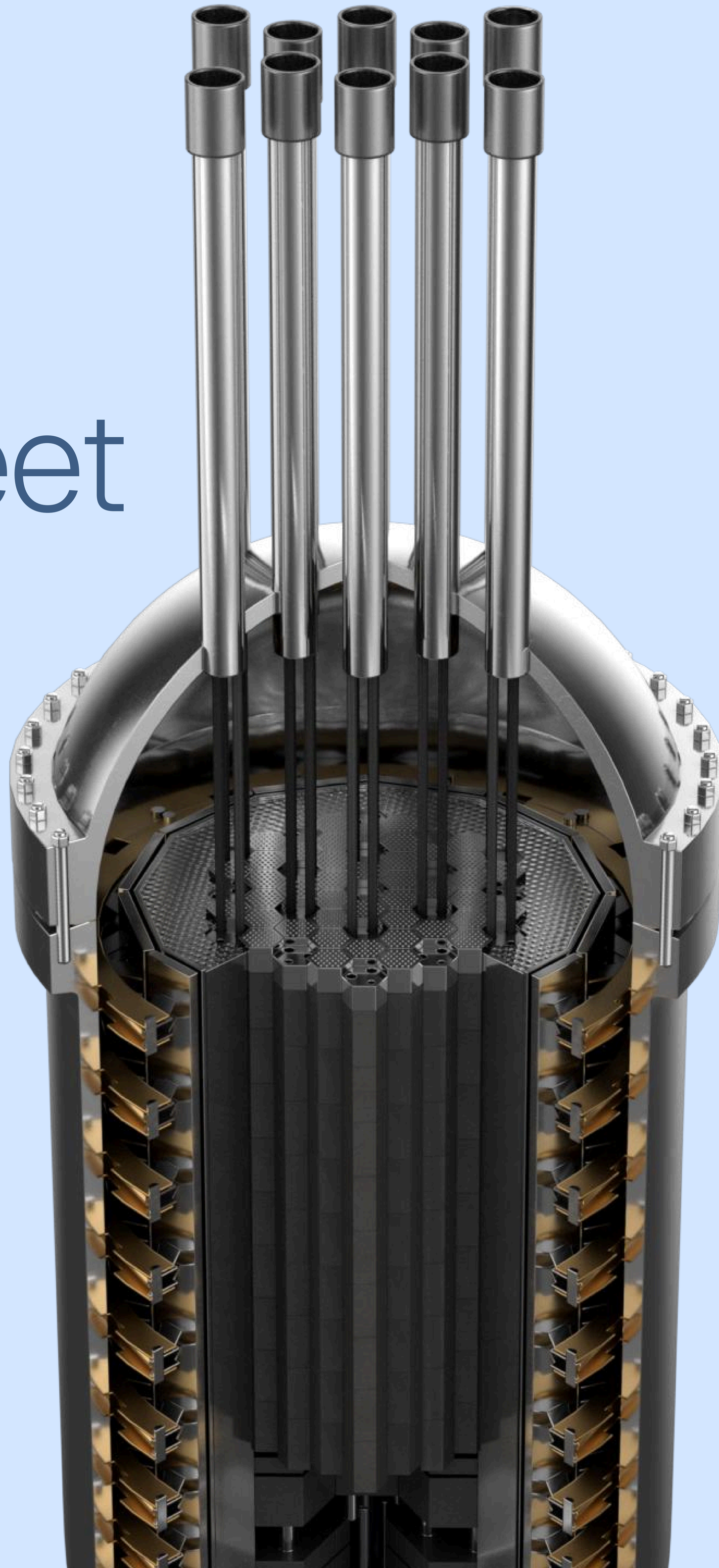
ZettaJoule

Safety fact sheet



ZettaJoule stands alone among Western advanced small modular reactor companies in its modernization of the Japan Atomic Energy Agency's High Temperature Engineering Test Reactor (HTTR).

Foundational Safety Demonstrated in Testing

The following tests were successfully completed at the HTTR and provide a strong safety foundation for ZettaJoule's ZJ reactor:

2010	During a test simulating total Loss of Forced Cooling with all helium gas circulators shut off while the reactor was operating at 30%, its passive safety mechanisms performed as designed. The results confirmed that passive safety features are sufficient for safely removing decay heat and preventing overheating.
2022	During a Loss of Core Cooling test while the reactor was operating at 30% power with all helium gas circulators plus the vessel cooling system shut off, the HTTR demonstrated the ability to safely manage decay heat via passive cooling mechanisms. Test results confirmed that the reactor design inhibits overheating during loss of core cooling, maintaining fuel integrity without reliance on active cooling systems.
2024	During testing at 100% power, with helium gas circulators shut down, power automatically decreased as soon as the core cooling flow rate decreased. The reactor remained within safe temperature limits, demonstrating the inherently safe design and its reliance on fundamental reactor physics and passive heat removal to prevent core damage and fuel overheating during loss of forced cooling conditions.

What Makes Our Reactors Safe

Like the HTTR, our ZJ reactor will be graphite-moderated and helium-cooled, using TRISO fuel – uranium particles individually encapsulated in multiple protective layers of pyrocarbon and silicon carbide – that retains fission products even at temperatures as high as 1600 °C.

Graphite	Graphite slows down neutrons and serves as heat-resistant structural material, contributing to core stability even at extremely elevated temperatures.
Helium	Helium is used as the reactor’s primary coolant because it does not react with core materials, remaining chemically inert and non-radioactive.
TRISO Particles	In 2019, a U.S. Department of Energy article, “TRISO Particles: The Most Robust Nuclear Fuel on Earth,” stated, “simply put, TRISO particles cannot melt in a commercial high-temperature reactor, and can withstand extreme temperatures that are well beyond the threshold of current nuclear fuels.” Additionally, TRISO fuel presents a low proliferation risk due to its robust encapsulation and dispersed fuel form, making it unsuitable for weapons-grade material production.