FACILITY FOR
RARE ISOTOPE BEAMS

October 2026

Large-Scale High-Efficiency Helium Refrigeration and Recovery

The Facility for Rare Isotope Beams (FRIB) operates a state-of-the-art helium cryogenic plant—uninterrupted since 2018 and among the nation's most reliable and energy-efficient—powering a sustainable foundation for groundbreaking scientific discovery.



Vertically integrated from concept to execution, FRIB manages on-site liquefaction, cryoplant operation, distribution, recycling, and purification through collaborative, purpose-driven innovation to support nuclear physics, quantum computing, advanced detectors, fusion research, and other cutting-edge scientific applications.

Core Infrastructure and Advanced Engineering

- Operating scale and temperatures: The plant routinely operates at 4 kelvin (K) and can be further cooled to 2 K. It features dual cold boxes (upper and lower) working in tandem to support 46 cryomodules and more than 100 superconducting solenoid magnets operating with zero electrical resistance.
- Capacity and distribution: The facility maintains approximately 55,000 liters of liquid helium (expected to grow to ~80,000 liters as the facility expands). A cryogenic distribution system runs 10 meters underground and stretches the length of two football fields to supply ultra-cold helium to the linear accelerator.
- Patented Ganni Floating-Pressure Cycle: Automatically optimizes system performance, adapting seamlessly to dynamic operational demands to provide the highest efficiency and reliability across a wide range of capacities and operating modes.
- Zero-loss recovery system: Captures and purifies helium during superconducting quench events, achieving zero loss of helium inventory, significantly reducing waste, and boosting energy efficiency to drive meaningful environmental and operational progress.
- In-house capabilities: Full in-house design, fabrication, and system integration for small- to large-scale cryogenic components, including custom transfer lines, distribution systems, and the main compressor system which serves as the primary energy source for the entire plant.

National Collaborations and Competitiveness

FRIB's cryogenic expertise drives American competitiveness and technological transfer across the national laboratory complex and private industry by working together to achieve extraordinary outcomes:

- User facility partnerships: As a Department of Energy Office of Science user facility, FRIB hosts engineers and researchers from industry, government laboratories, and academia.
- DOE complex collaboration: Technology transfer opportunities benefit the broader DOE complex, including Brookhaven National Laboratory, Thomas Jefferson National Accelerator Facility, Fermi National Accelerator Laboratory, and Oak Ridge National Laboratory.



Workforce Development

Reflecting a deep commitment to human-centered learning and mentorship, FRIB provides hands-on training for students and researchers working alongside world-leading experts on unique, large-scale systems. This real-world experience equips the next generation of scientists and engineers with critical skills to lead through change, drive national innovation, and make a lasting difference in emerging industries.

For more information, visit the Large-Scale High-Efficiency Helium Refrigeration and Recovery page.

Michigan State University (MSU) operates the Facility for Rare Isotope Beams (FRIB) as a user facility for the U.S. Department of Energy Office of Science (DOE-SC), with financial support from and furthering the mission of the DOE-SC Office of Nuclear Physics.