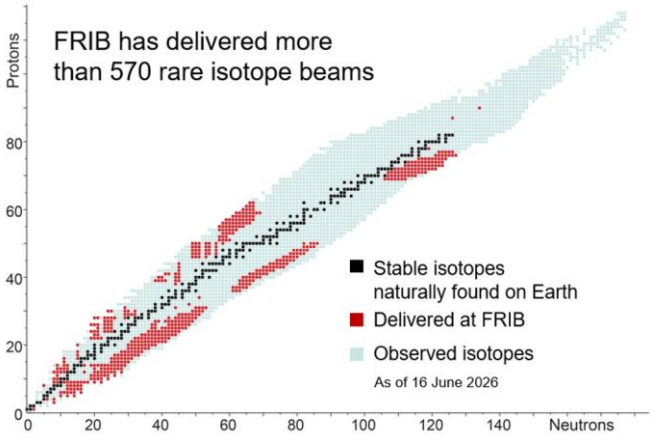
FACILITY FOR
RARE ISOTOPE BEAMS

July 2026

FRIB Quick Facts

Delivering Impact for the U.S. and the World

- Michigan State University 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.
- User facility operation is supported by the DOE-SC Office of Nuclear Physics as one of 28 DOE-SC user facilities.



FRIB Operates Reliably

- FRIB operates with 93% availability for scientific user experiments.
- FRIB's automation control system uses 22,000 input/output points to send and receive information for various machine functions.
- The controls network connects over 3,000 devices and tracks 1.3 million control values as fast as every few milliseconds, which are backed up every second for operators and experts to manage FRIB.

Delivering Measurable Scientific Output at Scale

- Since user operations began in May 2022, FRIB has delivered more than 570 rare isotope beams to experiments (frib.msu.edu/beams), and supported 1,093 participants, including 335 students, from 186 institutions and companies.
- FRIB enhances capability based on scientific needs in a safe manner and consistent with available resources.
- FRIB User Organization (fribusers.org) represents approximately 1,800 scientists.
- Published results are available at frib.msu.edu/publications.

Integrating Artificial Intelligence, Quantum Science

- As a DOE-SC user facility based at a university, FRIB advances the goals of the DOE Genesis Mission (genesis.energy.gov) by harnessing artificial intelligence (AI) to accelerate discovery in nuclear science and develop the workforce.
- By integrating advanced AI into its research infrastructure, FRIB strengthens U.S. leadership in nuclear science and transforms scientific practice by applying machine learning to shorten discovery timelines and drive advances in experimental nuclear science,

The Science

- An isotope is one form of a specific element. Only a few are found naturally on Earth.
- Rare isotopes are not normally found on Earth but comprise the vast majority of possible isotopes and are important for understanding the universe and technical applications like nuclear power.

The Process

- At the beginning of the process, the ion sources heat the element to be studied, knock off electrons, and push the ionized atoms around with electric and magnetic fields to create beams that are injected into the linear accelerator.
- The 400 kW superconducting radio-frequency linear accelerator drives these charged particles down the track at ever-increasing speed, providing the highest intensity beams at half the speed of light.
- The beams arrive at the rare isotope production area where they strike a target and, when their nuclei collide, produce the rare isotopes.
- The isotopes advance to the experimental area where scientists conduct experiments with fast, stopped, and reaccelerated beams to measure the rare properties.

High Demand for High-Merit Science

- FRIB's scientific program is forged with input from the FRIB Program Advisory Committee (PAC), a group of international world-leading scientists who review non-proprietary beam-time requests submitted to FRIB for merit and make recommendations to the FRIB Laboratory director. FRIB is open to all interested researchers, subject to applicable laws and regulations.
- FRIB is oversubscribed by a factor of 3 and can only accommodate around 30% of requested beam-time. Since 2022, FRIB has received 251 proposals for beam time use.

World-Leading Scientific Capability

- FRIB designed, built, and now operates the most powerful heavy-ion accelerator, providing researchers intense beams of rare isotopes.
- FRIB enables scientists to make discoveries about rare isotopes, nuclear astrophysics, fundamental interactions, and applications for society.

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theoretical nuclear science, and accelerator science (frib.msu.edu/ai).
- Quantum science offers new ways to address the most difficult challenges in nuclear science.
- FRIB researchers integrate quantum science to advance nuclear physics. FRIB experimentalists use new techniques to enhance quantum measurements and probe nuclear system entanglement. FRIB theorists are developing quantum algorithms to study nuclear many-body systems on quantum computers.

FRIB Adds Value to Nation

Chip Testing Addresses Critical National Need

- Leveraging FRIB's accelerator expertise, FRIB's heavy-ion chip-testing facilities – FRIB Single Event Effects Facility (FSEE) and K500 Chip Testing Facility (KSEE) – address the national shortage of testing capacity for advanced microelectronics used in industries like spaceflight, wireless technology, and autonomous vehicles (frib.msu.edu/see).
- FRIB's facilities provide high-energy heavy-ion beams that allow testers to estimate, within minutes, the likelihood of malfunctions or failures caused by decades of cosmic ray exposure on electronic components.
- MSU Space Electronics Initiative (space-electronics.msu.edu) positions MSU as a national leader in chip design and testing by developing the nation's workforce in these fields.
- FRIB's chip-testing capability is enabled by the DOE-SC investment but is a self-supporting program.

Isotope Harvesting Benefits Society

- FRIB's isotope harvesting infrastructure enables the production of high-purity radionuclides for research applications, including nuclear physics, astrophysics, materials science, biology, and nuclear medicine.
- During routine operation—without interfering with FRIB's primary users—extra, unused isotopes can be "harvested."
- DOE Isotope Program provided funding to establish the capability and now supports operations and research.

Scaling Capability to Meet National Needs

- The High Rigidity Spectrometer (HRS) (hrs.lbl.gov), a scientific instrument, will serve as the core of FRIB's fast-beam basic research program. With HRS, luminosity for experiments with the most neutron-rich nuclei will increase by up to a factor of 100. Construction is underway on the High Transmission Beam Line (HRS-HTBL), one of two HRS subprojcts, to be completed in 2029.
- The FRIB400 upgrade (frib.msu.edu/frib400) will double FRIB's beam energy to 400 MeV/nucleon and expand the laboratory's scientific impact by increasing the yield of many key rare isotopes tenfold. The community laid out the scientific case for the energy upgrade in the FRIB400 whitepaper.
- These investments will significantly expand U.S. capacity for discovery, application, and scientific leadership.

ISO Programs Keep Public Trust

- FRIB maintains management systems externally registered by NSF International Strategic Registrations (NSF-ISR) to the ISO 9001 (since 2008), ISO 14001 (since 2006), ISO 27001 (since 2018), and ISO 45001 (since 2007) standards. ISO registration ensures compliance and quality to external international standards.

Attracting, Training Next Generation

- FRIB, located on the campus of a research-intensive university, attracts the best students to study nuclear science, accelerator science, cryogenic engineering, and radiochemistry, areas in which workforce development is in short supply and critical to U.S. economic competitiveness, energy security, nuclear security, and nonproliferation efforts. University setting enables hands-on training in a world-class facility.
- Between 2018–2024, MSU awarded 17% of U.S. nuclear physics PhDs. Median time to degree is 5.33 years (U.S. median is 6 years) and 81% PhD completion rate (U.S. average is 60%).
- FRIB employs 453 employees, plus 132 graduate students and 79 undergraduate students.

Research, Student Taining Supports National Security

- FRIB offers students hands-on experience, engaging in cutting-edge research supported by the DOE-SC and the National Nuclear Security Administration.
- Students explore pathways in nuclear science that directly contribute to national security and prepare them for future success in the Nuclear Security Enterprise.

Significant Dates

- September 2025 – K500 Chip Testing Facility completed
- December 2024 – Isotope harvesting project completed
- May 2022 – FRIB's first experiment commenced
- May 2022 – DOE officially opened FRIB with ribbon cutting
- January 2022 – FRIB completed on budget, ahead of schedule
- May 2009 – Project started
- December 2008 – DOE-SC selects MSU to establish FRIB

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