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### **Wrapping up 2024 and embracing the opportunities of 2025**

As 2024 comes to a close, we hope this message finds you well. Before we dive into 2025, we take a moment to look back at the year and to highlight some developments toward advancing FRIB's science program.

First, a snapshot of FRIB operation as of 1 December:

- Since the start of user operation in May 2022, FRIB has delivered more than 280 rare isotope beams to experiments and supported 758 participants, including 195 students, across 128 experiments, 141 institutions, and 21 countries.
- We delivered 4,006 beam hours with 94% availability in FY24, meeting our stated FY24 goal for operations. In FY2025, the plan is subject to federal FY25 appropriations.

We issued the third call for proposals in June 2024, and received 84 proposals and 22 letters of intent for beam time – representing 632 participants – more than ever before – to be considered at the third FRIB Program Advisory Committee (PAC3) meeting in January 2025. Since 2022, FRIB has received

250 proposals for beam-time use.

Thank you for your ongoing interest in and commitment to science at FRIB.

**To support the user community with broadened discovery opportunities, we:**

- have increased rare isotope production rates by 40 since the start of operation in May 2022.
- accelerated a uranium beam up to 10 kW onto target. The updated beam list is available at [frib.msu.edu/beams](http://frib.msu.edu/beams). This is another milestone of FRIB's ramp-up plan to enhance capabilities safely to serve users in line with available resources.
- accomplished near-completion of the two experimental vaults hosting the FRIB Decay Station Initiator (FDSi) and the fast-beam reactions program centered around the Sweeper Magnet, respectively. Beam transport to both vaults will be commissioned in early 2025 and the availability of these two locations for experiments will enhance the facility scheduling experience in addition to enabling new science programs.
- supported reaccelerated beam experiments.

**Accelerator goals for 2025 include to:**

- safely operate accelerators to support FRIB laboratory's missions with high availability (>85%) and user satisfaction; and
- deliver 15 - 20 kW primary beams onto target.

**Science highlights in the past year include:**

- The first search for new isotopes at FRIB [discovered five never-before-seen nuclides](#): thulium-182 and 183, ytterbium-186 and 187, and lutetium-190.
- A collaboration led by researchers from the University of Tennessee, Knoxville, [studied proton configurations via the beta-delayed neutron emission of chlorine-45, which transforms into argon-45 in under a second](#).
- An [experiment measuring the mass of aluminum-22, the lightest aluminum isotope and a proton-halo candidate, with high precision](#).
- In an experiment-theory tango, the first in-beam gamma-ray spectroscopy at FRIB unraveled [early evidence that the rare isotope chromium-62 exhibits two distinct shapes at low excitation energy](#).

## **DOE-SC ongoing financial support enables forefront science and invests in the future**

We appreciate the continued confidence the U.S. Department of Energy Office of Science (DOE-SC) has in our ability to operate FRIB as a DOE-SC user facility, advancing the mission of the DOE-SC Office of Nuclear Physics (ONP). DOE-SC operating funds enable us to support the discovery opportunities envisioned by FRIB's user community. We take very seriously the responsibility to manage the funding we receive from American taxpayers through the U.S. government. The yearly ONP budget that supports FRIB is subject to approval by the U.S. Congress. Funds provided to FRIB help advance the development of community-requested beams, expand its experimental capabilities, and support the creation and operation of scientific instruments.

The High Rigidity Spectrometer (HRS) cooperative agreement provides funding over seven years to establish and operate HRS, which will support a user community of more than 500 scientists. This fall we concluded a successful review for the High Transmission Beam Line (HTBL) of the HRS. The DOE-SC Office of Project Assessment (OPA) review committee concluded that the HRS-HTBL subproject of the HRS project is ready to seek Critical Decision 2/3 approval. The other subproject of the HRS project – the Spectrometer Section (HRS-SPS) – is tentatively scheduled for an OPA review in October 2025.

## **Overcoming challenges to better serve users**

We apologize for the occasional challenges in meeting user expectations, and we are actively working to address them. A recent experiment led by Lawrence Livermore National Laboratory, which aimed to measure the selenium-85 to krypton-89 ( $\alpha, n$ ) reaction rate using ANL's MUSIC detector at ReA6, was not completed successfully. The issue stemmed from a significant, stable rubidium-85 contamination originating from the gas stopper, which reduced the selenium-85 rate after purification, making it impossible to measure the reaction rate with sufficient precision at various energy points. Rubidium-85 was a residual from an earlier operation of a stable-beam ion source inside the gas stopper. A few hours of beam time were used to better understand why the issue was not present when the beam was developed originally and to develop possible mitigation strategies. One promising observation was the suppression of rubidium-85 when operating the ion guide after gas stopper differently. The experiment will be rescheduled once sufficient rate and purity can be guaranteed. We are committed to learning from such setbacks to better anticipate and prevent similar issues in the future.

## Synergistic activities support national needs

DOE-SC's core investment in fundamental rare isotope research and the operation of the FRIB user facility fosters additional important and complementary activities that serve the nation. New and ongoing initiatives help FRIB serve more users and tackle societal challenges with lasting impact through public investment:

1. Isotope harvesting: we concluded successfully the Isotope Harvesting Technical, Cost, Schedule and Management Review, and isotope harvesting at FRIB will be operational within the 2025 calendar year;
2. Chip testing capacity: We continue operating the fee-for-service program with the [FRIB Single Event Effects facility](#), and we are establishing the K500 Chip Testing Facility at FRIB, which includes the refurbishment of the world's first superconducting cyclotron K500—built at MSU in the 1980s—into a heavy-ion chip testing facility scheduled for completion in August 2025.

## Strengthening FRIB's international collaboration and global impact:

- In July, the Ambassador of France to the United States, [Laurent Bili](#), [visited FRIB](#) to celebrate the one-year anniversary of the establishment of the International Research Laboratory on Nuclear Physics and Astrophysics (IRL NPA). Among other activities, this past year the IRL-NPA supported nine physicists from France who participated in experiments at FRIB as well as the visit of a theorist. The IRL-NPA also supported a workshop at FRIB on “Dense Matter Equation-of-State.”
- FRIB will host the [16th International Conference on Heavy Ion Accelerator Technology](#) (HIAT 2025) on 22-27 June 2025 in East Lansing. In addition, FRIB was selected as the host of the 18th International Particle Accelerator Conference (IPAC 2027), which will be held in Detroit. IPAC is the largest gathering of the accelerator community, with over 1,000 delegates expected to attend this significant event.

## FRIB in the news

In 2024, FRIB's science and initiatives were highlighted by state, national, and international media, showcasing the value of FRIB discoveries and helping to maintain public support. See some examples here and read all the FRIB-related articles on the [In the News page](#) of the FRIB website.

- [Five new isotopes is just the beginning](#), 15 February 2024, Physics
- [Fighting prostate cancer, from farm to table, at MSU](#), 10 December 2024, MSU Today

- [Into the islands of inversion](#), 12 December 2024, Nature Physics

### **Supporting and sustaining a vibrant community**

We are committed to creating an inclusive and welcoming FRIB that reflects the global community we serve. The PAC3 call for proposals required adherence to the [FRIB Research Code of Conduct](#), which ensures research is conducted with the highest scientific, professional, and ethical standards. This code along with the [FRIB Code of Conduct](#) fosters a supportive environment, enhances the reputation of researchers and FRIB, and emphasizes the importance of professionalism and respect. Our shared responsibility to uphold these standards strengthens our collective goal of contributing to society through scientific discovery.

We wish you a joyful, restful holiday season filled with peace, good health, and a fantastic start to the new year.

Sincerely,

Thomas Glasmacher  
FRIB Laboratory Director

Alexandra Gade  
FRIB Scientific Director

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## **News**

### **Put the reaction into action: A nuclear-physics boot camp on reaction methods**

FRIB hosted the 2024 FRIB Theory Alliance (FRIB-TA) summer school (“Put the reaction into action”) 12-14 August. The school brought together 50 participants from several U.S. and international institutions to learn about key theoretical methods used in studying nuclear reactions. [Read more](#)

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## **Public Outreach**

## Dancing with isotopes: How science and art collide at MSU

Stability and instability, measurement, acceleration, fragmentation, and navigating mystery—these are shared themes in both nuclear science and dance. At first glance, these concepts might seem best understood in isolation, but there is much to learn by bringing these two seemingly disparate fields together. [Read more](#)



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## In The News

Below are some recent FRIB-focused articles from selected outlets. For more, visit the [FRIB website](#).

- **DOE makes additional investment in FRIB**  
*MSN.com via Lansing State Journal:* [MSU rare isotope facility, in demand by scientists worldwide, awarded \\$529M](#)
- **Significant milestone in isotope study**  
*MSN.com:* [US scientists shatter high-power uranium beam record, unlock new isotopes](#)
- **A profile of three Nobel Prize winners**  
*theconversation.com:* [You can count female physics Nobel laureates on one hand – recent winners have wisdom for young women in the field](#)





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## Upcoming Events

Below is a list of upcoming events. For more, visit the [FRIB website](#).

- 11-17 May 2024 - [Nuclear Science Summer School \(NS<sup>3</sup>\)](#) - East Lansing, Michigan
- 22-27 June 2025 - [16th International Conference on Heavy Ion Accelerator Technology \(HIAT'25\)](#) - East Lansing, Michigan



*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.*

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