FRIB Single Event Effects (SEE) Facilities



Responding to National Need for Chip Testing

FRIB's heavy-ion facilities, including the FRIB Single Event Effects Facility (FSEE) and the K500 Chip Testing Facility (KSEE), address the national shortage of testing capacity for advanced microelectronics.

SEE testing helps identify potential failures or errors in electronic or photonic systems used on Earth, in aircraft, and spacecraft caused by high energy ion impacts from cosmic rays or solar events. By conducting tests in air rather than in vacuum, challenges such as cooling and component access are simplified.

FSEE and KSEE are essential for testing the advanced microelectronics used in spaceflight, autonomous vehicles, wireless communications, and other high-radiation environments.

Both facilities provide high-energy heavy-ion beams that allow testers to estimate, within minutes, the likelihood of malfunctions or failures caused by decades of exposure on electronic components.

With FSEE and KSEE, FRIB has strengthened the nation's capacity for microelectronics reliability testing, while also positioning itself as a hub for innovation and talent development in the semiconductor field.

These developments enhance U.S. competitiveness in aerospace, defense, and commercial electronics and contribute directly to national efforts to build a resilient and secure technology infrastructure.

With existing facilities oversubscribed, FRIB offers up to 6,000 testing hours per year.

KSEE and FSEE offer a timely response to this critical shortfall, first identified in the 2018 National Academies report "Testing at the Speed of Light" (www.nationalacademies.org/read/24993).

Student Opportunities

- FRIB's facilities are key in workforce development training with academic and industrial partners for training in radiation effects.
- Through the MSU Space Electronics Initiative (space-electronics.msu.edu), a collaboration between FRIB and the MSU College of Engineering (engineering.msu.edu), students gain hands-on experience in chip design and radiation testing.
- This initiative connects industry, government, and academia to address the anticipated need for semiconductor professionals in the United States.

Funding

- FRIB operates FSEE as a service to the nation. FSEE was established with financial support from the federal government.
- KSEE is supported by approximately $14 million in federal funding for the cyclotron refurbishment project. The heavy-ion chip testing facility applies FRIB expertise to address the national need for chip-testing. It is the refurbishment of the first superconducting cyclotron—the K500 built at MSU in the 1980s.
- MSU funded the construction of the KSEE high-bay addition that triples the facility's testing capacity.
- FRIB's chip-testing capability is enabled by the DOE-SC investment but is a self-supporting program.

For More Information

- Visit frib.msu.edu/see
- Contact the SEE User Manager (SEE_info@frib.msu.edu)

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.