

LABORATORY UPDATE for ALUMNI



January
2020

Celebrating a successful 2019 as we look forward to a new year, decade, and FRIB user operations

by FRIB Laboratory Director Thomas Glasmacher and NSCL Director Brad Sherrill

Happy new year! We had a successful year as the FRIB Laboratory, as we continued to deliver the FRIB Project while operating NSCL and educating the next generation of nuclear scientists. As we start a new year we want to take a moment to celebrate all we accomplished together in 2019 and look ahead with excitement to the start of a new decade – one that will mark the start of FRIB user operation to support our scientific users in making discoveries.

Technical installation progressing toward early completion

The FRIB Project remains on track for early completion in 2021 and is about 92 percent complete. We have consolidated our efforts by organizing all remaining technical work under the Accelerator Systems Division after the Experimental System Division scope was substantially completed; this evolution enhances our likelihood of successful early project delivery. We started out the year on a high note by accelerating beams through the first third of the linear accelerator – [15 of 46 total cryomodules](#) – to 10 percent of FRIB's final beam energy. This was a critical demonstration of the integration of the commissioned cryogenic plant, superconducting RF cryomodules, controls system, and accelerator physics modeling. In this phase of commissioning, FRIB became the [world's highest-energy continuous-wave hadron linear accelerator](#) (linac). In August 2019, the [radio-frequency quadrupole was conditioned above 100 kW](#), the CW power needed to achieve the FRIB mission goal of accelerating uranium beams. Our next major commissioning milestone – the second third of the FRIB linear accelerator – is slated for early 2020 following completion of our fourth Accelerator Readiness Review (ARR04). In September 2019, the thickness of the liquid lithium film in the charge stripper was [measured for the first time by the online electron-beam diagnostics system](#). The electron beam traverses the lithium film simultaneously with the heavy-ion beam, allowing a continuous and online thickness measurement. FRIB is the first accelerator to use liquid lithium as a charge stripper.

FRIB [site-restoration work and construction on two MSU-funded building additions](#) are nearing completion. The High Rigidity Spectrometer (HRS) and Isotope Harvesting Vault will house research equipment for isotope harvesting and provide experimental space for the FRIB science program. The Cryogenic Assembly Building will provide additional research and maintenance space.

FRIB science community engaged and preparing for science

Looking back on 2019, we are thankful for the nuclear science community's continued support of FRIB, NSCL, and engagement in determining the laboratory's future. In August, more than 170 members of the low-energy nuclear physics community attended the [Low Energy Community Meeting \(LECM\) at Duke University](#). They resolved that FRIB and FRIB instrumentation are the community's top priorities. NSCL users made a strong case to NSF, with more than 350 signing a letter in support of stand-alone ReA operation once the Coupled Cyclotron Facility (CCF) is turned off. The

user community also made the [science case for the 400 MeV/u energy upgrade of FRIB](#) in 2019 in the [FRIB400 whitepaper](#). The energy upgrade was subsequently endorsed at the LECM where the resolution stated it was “extremely compelling and would significantly expand the science opportunities at FRIB.”

The “[FRIB First Experiments: Proposal Preparation](#)” workshop in May 2020 and the first FRIB Call for Proposals later in the year signal that we are approaching FRIB user operations.

At NSCL we are making a number of user-requested improvements. We start using the cycstopper in N2, build the new electron beam ion trap (EBIT) for ReA, and complete the ReA6 upgrade. In 2019 we operated CCF for more than 5,000 hours and plan for more hours for the last year of CCF operation in 2020. Users also have big plans for this beam time. Reliable operation will be a challenge, but we have a great opportunity, to help users realize important science. Every experiment, new detector test, beam line development, and improvement will be an important step toward FRIB and allow FRIB to start that much further ahead.

Outreach, education, and workforce training

The [FRIB Laboratory again hosted several summer schools](#) and programs for science education and exploration. Fourteen undergraduate students from thirteen universities spent a week at NSCL learning about nuclear science at Nuclear Science Summer School (NS3), funded by NSF and JINA-CEE. JINA-CEE also hosted the First Frontiers Summer School for early-career scientists in nuclear physics, astrophysics, or astronomy, and partnered with the University of Notre Dame in the week-long Physics of Atomic Nuclei program for high school students and teachers. The second Training in Advanced Low Energy Nuclear Theory (TALENT) course was held at FRIB, and The FRIB Theory Alliance hosted a summer school on machine learning in physics applications, and a two-week topical program on hadronic electric dipole moments in the FRIB era. We are proud to leverage FRIB to help meet the nation’s workforce development needs. [The Accelerator Science and Engineering Traineeship \(ASET\) program](#) and the [MSU Cryogenic Initiative](#) continue at FRIB. We are fortunate to work with so many talented students at MSU and in the user community. There were approximately 25 PhDs this year based on NSCL research and more than 250 graduate and undergraduate students are involved in laboratory research or support activities.

In exciting local outreach efforts, we supported the opening of [an FRIB-inspired interactive exhibit in August](#) at Impression 5 Science Center in Lansing. “SMASH: A Nuclear Adventure” is the first long-term permanent exhibit between MSU and Impression 5. We also partnered with the MSU Science Communication student organization to present YouTube star “Physics Girl” Dianna Cowern at MSU’s Wharton Center earlier this fall. In March 2020, our next local outreach initiative “[Of Equal Place: Isotopes in Motion](#)” takes center stage next at the Wharton Center. The show combines dance, physics, and video. Michigan grade-school students will attend special performance and then participate in activities exploring dance, physics, and FRIB. One public show is also planned.

The [Advanced Studies Gateway at FRIB](#) marked its second year, with twice as many events as last year, including public talks featuring distinguished speakers and musical performances. If you are in the area, we hope to see you at a future event.

On track for future success

The DOE-SC Office of Project Assessment (OPA) held its independent project reviews of the FRIB Project in May and November and found the FRIB project is making appropriate progress toward completion.

An exciting development this year was the National Science Foundation endorsing stand-alone ReA6 operation in 2021. This was a recommendation of the NSCL Site Visit panel in August. ReA6 operation will offer a variety of long-lived isotope beams, with the development priorities set by a Program Advisory Committee Meeting in March. There is about one year left of operation of the NSCL Coupled Cyclotron Facility. Now with the NSF’s decision, the user program will continue into 2021 up to almost when FRIB is ready to start its user program.

At the DOE-OPA review closeout, DOE-SC Associate Director for Nuclear Physics Tim Hallman commented that we are

getting to the most exciting part of the FRIB project – the final sprint where we have to stay on our toes to bring FRIB home for the nation. We have about 100 weeks till project completion, so the countdown is on. There is no longer the luxury of time or resources to make adjustments as there was earlier in the project. Hallman spoke about the future – envisioning the FRIB ribbon cutting and the scientific discoveries that lie ahead. He reminded that it will continue requiring everyone working together to deliver on the promise to taxpayers, and what a shared accomplishment it will be.

To realize that accomplishment, we are committed to staying humbled by the trust placed in us, and will work together safely to deliver on that trust for the nation and the nuclear science community. Practically, we will stay the course and mind the details in line with our laboratory priorities of safety and inclusion.

Thank you for your support of the FRIB Laboratory. We are nearing the end of the NSCL chapter of our laboratory's story, and the start of the FRIB one. We will write the story together, building on our history and shaped by the discoveries FRIB users will make here. [Best wishes for a happy new year!](#)

The FRIB Laboratory Update for Alumni is published by the FRIB Laboratory and distributed via email. Please e-mail questions, comments, address changes, story tips, contributions, or requests to unsubscribe from this list to alumni@frib.msu.edu. If you are in touch with other NSCL/FRIB alumni, please forward this to them and invite them to contact us to subscribe.



Facility for Rare Isotope Beams | Michigan State University | 640 South Shaw Lane | East Lansing, MI 48824 | (517) 355-9672 | frib.msu.edu | nscl.msu.edu

Michigan State University is establishing FRIB as a national user facility for the [Office of Nuclear Physics](#) in the [U.S. Department of Energy Office of Science](#).
Operation of NSCL as a national user facility is supported by the [Physics Division](#) of the [U.S. National Science Foundation](#).