LABORATORY UPDATE for ALUMNI

NSCL FRIB

July 2016

FRIB Project marks 50-percent completion

A view of the FRIB construction site on 12 July 2016.

The FRIB Project has hit a significant milestone—50-percent completion.

Civil construction is continuing 10 weeks ahead of schedule (see construction-update story below), with the front-end building being more than a year ahead of schedule with technical-equipment installation underway (see story below about the installation of the first accelerator component). The project team is on track to make the first beam in 2016—12 months earlier than planned.

FRIB civil construction is 10 weeks ahead of schedule

Above is a video showing the progress of the FRIB civil construction.

As noted in the first story of this edition, construction at FRIB continues to advance rapidly, with civil construction still 10 weeks ahead of schedule.

Marking a significant civil-construction milestone, the "topping out" occurred on 24 May, meaning the last piece of structural steel on the project was installed. Additional exterior progress includes metal-panel installation and masonry work along the southwest corner of the building, and roofing installation on the east end.

On the lower second floor, condenser water piping is ongoing in the chiller room. Block walls and structural steel are being painted at the east end, and masonry wall construction continues in that area as well. Slab concrete has been poured through the east end, and total concrete placement for the project is currently 88 percent complete. Chilled water headers have been installed in the cryoplant mechanical room. On the upper second floor, fire-suppression piping is ongoing. Mechanical, electrical, and plumbing hangers are also being installed on the upper sub floor. Overhead cranes have also been powered up and commissioned in several areas.

Non-conventional utilities (NCU) are at 60-percent completion, and NCU piping is proceeding on the lower sub floor of the target facility. Ductwork installation is underway in the remote-handling gallery. Underground electrical work has been completed in the cryogenic cold box area as well as for the east end of the building.

The technical divisions are carrying forward the schedule float created by civil construction, with the Advanced Room TEMperature Ion Source (ARTEMIS) set in place in April. It marked the installation of FRIB's first accelerator component. (See story below.)

Additionally, all six helium compressors have been placed. The compressors are a component in the helium system, which processes the helium so that it can be superconducting when it reaches the beamline. Additionally, coalescer tanks have been delivered and installed. The coalescer tanks will be used to eliminate impurities in the helium used for the compressors.

On 24 May, the last piece of structural steel on the civil-construction project was installed, marking a significant milestone.

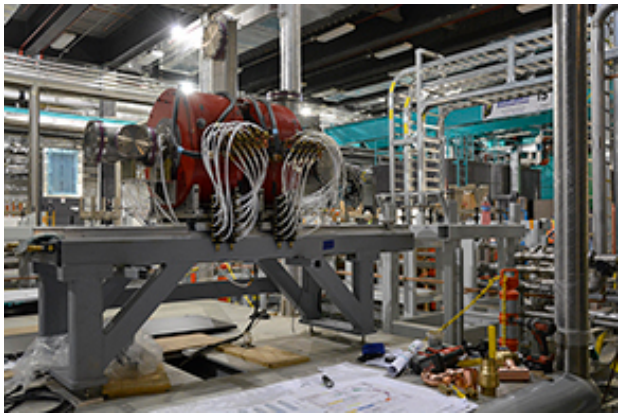
This photo shows three of six helium compressors installed in the FRIB construction site.

ASD installs FRIB's first accelerator component

The Accelerator Systems Division installed front-end accelerator components early thanks to the Conventional Facilities and Infrastructure Division completing the front-end building ahead of schedule.

The Accelerator Systems Division is carrying forward the schedule float created by the Conventional Facilities and Infrastructure Division. CFID completing the front-end building 16 months ahead of schedule is enabling ASD to start installing front-end accelerator components early.

As a result, the area is a hub of intense activity, and FRIB's first accelerator component, the Advanced



The ARTEMIS ion source is now installed on the platform in the front-end building.

To enable installation and testing activities, utilities were also moved earlier in the schedule. They include power, water, compressed air, crane, and air circulation. In some cases, temporary utilities have been or will be installed in order to proceed with work uninterrupted.

Work on supporting components and infrastructure also was accelerated to make it possible to install accelerator components in place. For example:

- The stands for the beamline have been installed and aligned.

Room-TEMperature Ion Source (ARTEMIS), was installed in early April.

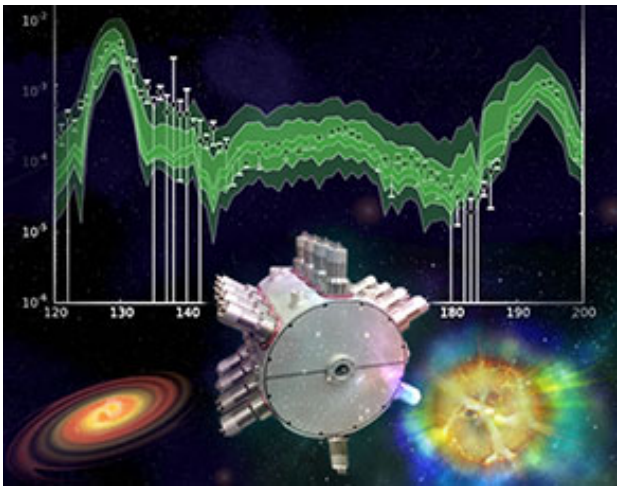
The installation was truly a laboratory-wide effort, which included the design and integration of the front-end area, equipment installation, and coordination with the contractors. Those involved in the work included: the front-end department; the ion source group; the mechanical-engineering department; the electrical engineering department; the hardware controls department; the power supplies group; the installation group; and the Conventional Facilities and Infrastructure Division.

It has taken months of preparation and coordination to be ready for technical-equipment installation and that level of effort will continue through integrated testing of the upper low-energy beam transport (LEBT) system scheduled for September.

- Pipes for cooling water have been installed.
- Cable trays are now being installed in the stands.
- The high-voltage platforms for the two ion sources were installed about two months ago.
- High-voltage transformers were also installed and tested.
- Cooling water systems for the high-voltage platforms have been installed.
- The overhead crane is now operational.

With the above work completed, we were able to move ARTEMIS in place the week of 11 April, marking the installation of FRIB's first accelerator component.

NSCL experiment targets exploding stars and their elusive nuclear reactions



An NSCL experiment demonstrated that rare-isotope beams can be used to constrain elusive neutron-capture reactions indirectly.

The origin of the elements in the universe is one of the big unsolved questions in science. Nuclear fusion reactions in stars are responsible for creating most of the light elements up to iron. Heavier elements are produced in a network of nuclear reactions and decays, mainly involving the capture of neutrons by unstable nuclei that only exist for fractions of a

Therefore, it is essentially impossible to measure the majority of these rates directly in the laboratory because the unstable nuclei involved cannot be made into targets for irradiation with neutrons.

An experiment performed at NSCL revealed that these challenging reactions can be conquered by an indirect approach that exploits the formation of unstable nuclei in beta decay and the detection of the gamma-ray radiation liberated in the process with the SuN detector (see image).

The experiment reported by Sean Liddick, et al., demonstrated that one can use the rare-isotope beams to constrain the elusive neutron-capture reactions indirectly.

Accurate nuclear reaction rates are crucial for answering the question on the origin of the heavy elements, and the pioneering NSCL experimental approach provides a new pathway.

second.

Meeting marks FRIB Theory Alliance creation

Approximately 100 participants attended a meeting marking the creation of the FRIB Theory Alliance.

A meeting marking the creation of the FRIB Theory Alliance was held on 31 March and 1 April at Michigan State University.

Approximately 100 participants attended, with many FRIB-TA members present and others observing by videocast. A list of participants is posted on the FRIB-TA website.

MSU and FRIB scientific management started the day with a warm welcome, followed by gratifying support from DOE and NSF representatives and presentations from past and present FRIB Theory Fellows, illustrating their achievements and potential. After a view of the FRIB-TA from the experimental side, an overview summary of the FRIB-TA goals and initiatives led into a general open discussion. The FRIB-TA Charter was ratified by those present (plus some electronic votes from those unable to attend). Important feedback has been received on the bridge faculty program, the theory fellow program, outreach to other scientific communities, and other initiatives.

The second day was devoted to an excellent series of talks covering the full depth and breadth of FRIB-related science. These presentations particularly highlighted the young researchers in the Theory Alliance and the many possibilities for synergies between different theory efforts and with the FRIB experimental program. Slides for the talks are available online.

FRIB/NSCL public open house planned for 20 August

Mark your calendar now and plan to return to the laboratory on 20 August for the FRIB/NSCL public open house! The

open house is scheduled for 1 to 4 p.m. on Saturday, 20 August. The free event titled “Rare Access” will offer the opportunity to learn more about FRIB and view FRIB construction progress.

The planned program includes:

- **Demonstrations.** Hands-on scientific demonstrations and activities, appropriate for all ages.
- **Presentations.** A few presentations will be given, focused on explaining how FRIB will work, the science of FRIB, and the potential scientific discoveries that will be possible once FRIB is complete.
- **Self-guided tours of FRIB.** FRIB subject-matter experts will line the tour route in the linac tunnel and surface building to explain key areas/elements and field questions.
- **Self-guided tours of NSCL.** Following the format of past NSCL open houses, attendees will be able to visit experimental areas in NSCL that will be used in FRIB experiments. Subject matter experts stationed at tour stops will explain the science and the equipment and answer questions.
- **FRIB movie theater.** Several short FRIB-related videos will run on a loop for people to view at their leisure.

The open house is open to all ages, and no appointment is necessary to participate. The last tours will start at 4 p.m., meaning attendees will have until 5 p.m. to tour and participate in the events. Free parking will be available in both the Shaw Lane and Wharton Center parking ramps.

Questions? Visit frib.msu.edu/openhouse2016 or email events@frib.msu.edu.

FRIB office tower fully enclosed

The FRIB office tower addition is advancing quickly toward August 2016 completion.

The FRIB office tower addition is advancing quickly toward August 2016 completion.

The building is now fully enclosed as glass curtain wall and exterior metal panels have been installed. The sidewalk enclosure has been removed along South Shaw Lane, and final grading, curb and gutter, asphalt, and site concrete have been completed.

The Phase III Office Addition will be commissioned, balanced, and inspected during July, with project completion slated for August.

Wood paneling and fiberglass-reinforced gypsum cloud panels have been installed in the auditorium on the first floor. Auditorium seating will be installed starting mid-July.

Terrazzo flooring installation started at the end of May in the pre-function space outside the first-floor auditorium, and was completed in June. Final

Acoustical ceiling tile has been installed from the sixth floor down through the second floor, and vinyl tile flooring has been installed on floors two through six. Building finishes are currently ongoing and near completion.

inspection of both elevators is scheduled for July. Doors and hardware were installed in June as well, and occupant furniture will arrive during July.

The Phase III Office Addition will be commissioned, balanced, and inspected during July, with completion slated for August.

MSU member of new $25M science and security consortium

Michigan State University is a member of a consortium that recently received a $25 million grant from the National Nuclear Security Administration (NNSA) focused on research that supports nuclear science, national security and nuclear nonproliferation.

The five-year grant establishes the Nuclear Science and Engineering Nonproliferation Research Consortium, which consists of eight universities and five national laboratories. The other universities of the consortium, which is led by University of California, Berkeley, are University of California, Davis; University of California, Irvine; the University of Nevada, Las Vegas; George Washington University; Texas A&M University; and the University of Tennessee, Knoxville. The five national laboratories are Los Alamos National Laboratory, Lawrence Berkeley National Laboratory, Lawrence Livermore National Laboratory, Oak Ridge National Laboratory, and Sandia National Laboratories.

“I am confident that more basic research efforts in academia will complement the applied efforts of the national laboratories and industry in supporting the critically important national security goals of our country,” said Anne Harrington, NNSA deputy administrator for defense nuclear nonproliferation, in an NNSA press release announcing the award.

The new consortium will carry out cutting-edge research and development in four technical areas: nuclear and particle physics; radiochemistry and forensics; nuclear engineering; and nuclear instrumentation and radiation detection. In order to accomplish this goal, four crossover areas were added: nuclear data, modeling and simulation, nuclear security policy, and education and training.

This is the second time MSU has been part of a nuclear security consortium. Five years ago, the NNSA awarded $25 million to UC Berkeley to establish the National Science and Security Consortium (NSSC).

A key mission of the NSSC and the new consortium is to educate and train future experts in national nuclear security. Since 2011, the NSSC has trained about 350 students and postdoctoral scholars through a multidisciplinary program that provides hands-on training in nuclear science, technology and policy. Students and scholars spent considerable time working at partnering national laboratories through collaboration with more than 60 lab scientists.

FRIB’s Thoennessen publishes isotope-discovery book

Associate Director for User Relations Michael Thoennessen has published a book describing the discovery of every

isotope observed on earth to date. "The Discovery of Isotopes: A Complete Compilation" arranges the discoveries in chapters according to the observation techniques or production methods.

The book is based on individual paragraphs for each isotope, which were published over the last few years as separate articles in the "Atomic Data and Nuclear Data Tables" journal. Each chapter contains tables listing the first authors of the first publication as well as details about the production and detection methods used. At the end, a comprehensive table lists all isotopes sorted by elements.

Thoennessen is a University Distinguished Professor in the Department of Physics and Astronomy at MSU and Associate Director for User Relations at the Facility for Rare Isotope Beams.

Alumni spotlight: Mike Lisa

Mike Lisa

Mike Lisa received his Ph.D. from Michigan State University in 1993, under the mentorship of Professor Konrad Gelbke. His research at the National Superconducting Cyclotron Lab focused on nuclear reactions at "intermediate" energies.

After graduation, he became a postdoctoral fellow at Lawrence Berkeley National Lab, where he performed experimental studies of nuclear reactions at much higher energy, with data taken at the LBL Bevalac.

In 1996, Mike joined the faculty at The Ohio State University as an assistant professor, where his research focus shifted to still higher energies, in the His current research involves collisions between very heavy nuclei at the highest attainable energies.

For 20 years, he has been a leader in the STAR experiment at the Relativistic Heavy Ion Collider (RHIC) at Brookhaven, and has worked on the ALICE experiment at the Large Hadron Collider. Still at Ohio State, Mike's current research program involves the Beam Energy Scan program at RHIC, in which the collision energy is systematically being "reduced."

This is an unusual approach in high-energy physics; it is much more in the spirit of studies performed at the NSCL and MSU. It is no surprise that Mike and other MSU grads are leaders in this novel program.

Mike is co-author of more than 400 research publications. He is widely recognized as an authority on the use of intensity interferometry as a means to extract space-time information on highly dynamic subatomic systems, and has written two major review articles on the subject. He has given more than 150 talks on his research at universities and conferences, and has recently published an undergraduate textbook on the physics of sports.

He lives with his wife and three children in Columbus, Ohio.

E895 experiment at the Alternating Gradient Synchrotron at Brookhaven National Lab.

We want to hear from you

Send us your story ideas!

Like this issue's story about NSCL alumnus Mike Lisa, we want to feature at least one story each issue about you—our FRIB/NSCL alumni. Let us know what you are up to!

Email story tips about you and/or your fellow alumni to alumni@frib.msu.edu. Tell us about discoveries, business ventures, partnerships, awards, and other professional developments, and we may feature them in a future issue. Also let us know if there are other types of laboratory updates you'd like to see in future alumni issues.

Contributors this issue

- Brad Bull
- Farshid Feyzi
- Thomas Glasmacher
- Jessica Kolp
- Sean Liddick
- Mike Lisa
- Witek Nazarewicz
- Artemis Spyrou
- Michael Thoennessen

LOOKING AHEAD

24-29 July	Nuclear Structure 2016 Conference, Knoxville, TN
11-13 August	Low Energy Community Meeting, South Bend, IN
20 August	FRIB Public Open House
1 September	President's Project Advisory Committee (PPAC) of FRIB
9-11 November	Accelerator Systems Advisory Committee (ASAC) of FRIB
6-8 December	DOE Office of Project Assessment Review of FRIB

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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.