



LABORATORY UPDATE for USERS

▼
June
2016



FRIB Project marks 50-percent completion



A view of the FRIB construction site on 13 June 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.



Meeting marks FRIB Theory Alliance creation

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



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](#).

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-CSC research fellow program launched; first fellows selected

Following the Memorandum of Understanding between FRIB and Peking University (PKU), the National FRIB-CSC (China Scholarship Council) research fellow program has been launched. The program will support five fellows every year for two-year visits at U.S. labs and universities involved in FRIB science. The program is intended to last three years (resulting in 15 fellows total), and can be extended if successful. The fellow candidates are selected by the joint U.S.-China committee and placed in the U.S. research groups interested in hosting a fellow.

Following the solicitation distributed in China, applications were received from PKU and Institute of Modern Physics (IMP), Chinese Academy of Sciences, and internet-based interviews were conducted on 14 and 16 April 2016. The joint committee was impressed with the high level of science presented and enthusiasm of the candidates. Five young scientists were selected in the 2016 call and their application folders were made available to researchers involved in FRIB science. The groups interested in hosting a fellow submitted statements of interest that were made available to the applicants on 7 May. In the last step, the candidates choose from their hosts. The final outcome of the 2016 call is: Bingshui Gao (IMP, Exp), Shilun Jin (IMP, Exp), and Ningtao Zhang (IMP, Exp) will be hosted by NSCL; Jie Chen (PKU, Exp) will join the experimental effort at ANL; and Yinu Zhang (PKU, Th) will join the theory group at OSU. We hope that the FRIB-CSC program will offer numerous career-building learning opportunities to the newly appointed fellows, and will greatly benefit FRIB science. The next FRIB-CSC call is anticipated late 2016 or early 2017.

The joint U.S.-China 2016 FRIB-CSC Fellow Committee is:

- U.S.: Georg Bollen and Wittek Nazarewicz (MSU), Robert Janssens (ANL), Bao-An Li (TAMUC), Michael Smith/Steven Pain (ORNL)
- China: Xiaodong Tang (IMP), Furong Xu (PKU), Yanlin Ye (PKU), Yuhu Zhang (IMP), Xiaohong Zhou (IMP), Junchen Pei (PKU, secretary)



Annual Nuclear Physics DC Day held 14 March

This year about 70 nuclear scientists from 26 states participated in the Nuclear Physics DC Day, which took place on 14 March. More than 90 meetings were scheduled, equally distributed between staffers from representatives and senators. Overall, they met with 46 representatives and 47 senators from 26 states. The main “ask” was to support the President’s FY 2017 budget request for the U.S. Department of Energy Office of Science, particularly the \$635.7 million requested for nuclear physics.

We received a lot of positive feedback from the meetings, and the staffers were in general very supportive of basic science research. These meetings are very important as they show the senators and representatives the direct impact that funding for basic science has on researchers and students from their states and districts.

Please consider participating next year. Also encourage your graduate students and postdocs as it is a valuable experience for them.



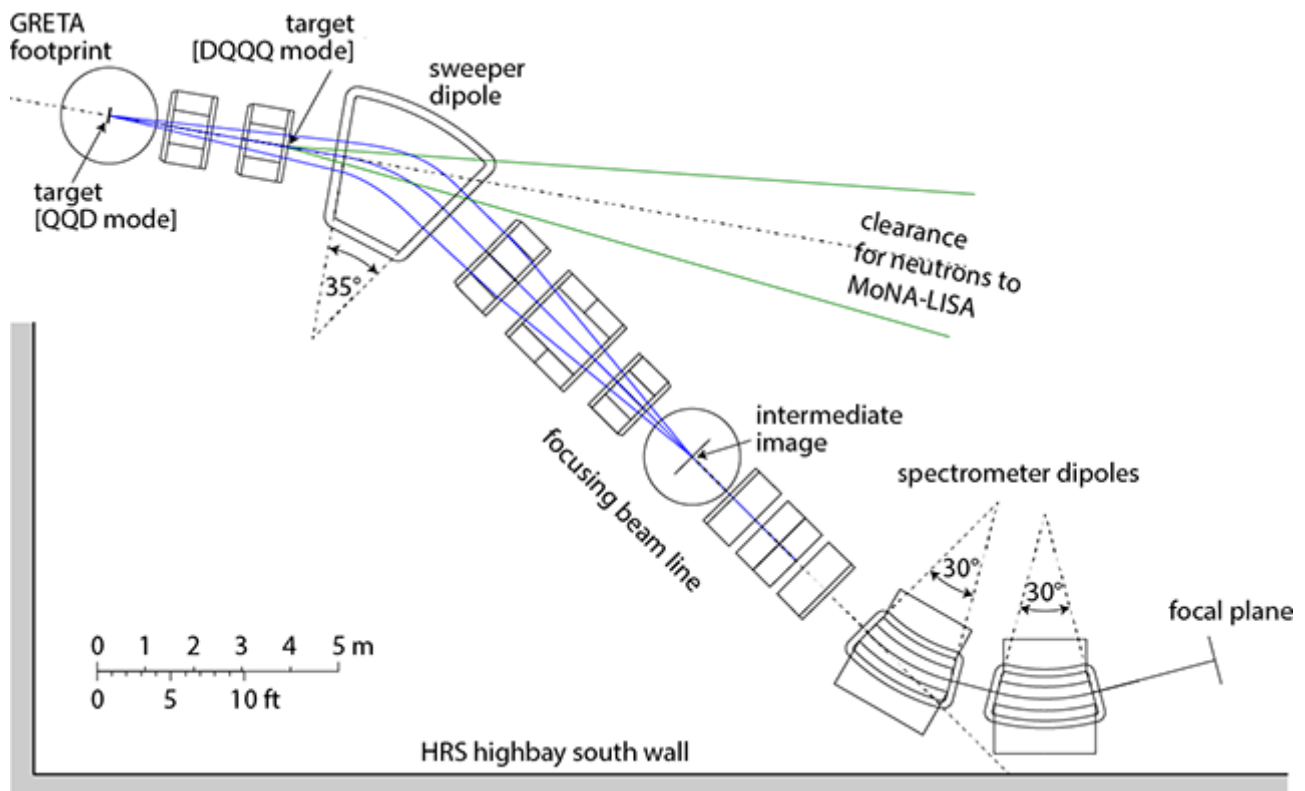
News from the FRIBUO Executive Committee

by Heather Crawford, FRIB Users Organization Chair, Lawrence Berkeley National Laboratory

The FRIB Users Organization Executive Committee is excited to join the FRIB Laboratory Update Newsletter with our own section to keep users up to date with activities of the FRIBUO. We plan to engage with the users and the project as we move toward first physics at FRIB, and this is one way to help keep you in the loop. Please also visit the updated [FRIBUO website](#) for the latest on the FRIB working groups, and upcoming meetings. We’ll see you all at the [Low Energy Community Meeting](#) in August!



High Rigidity Spectrometer will enable experiments at neutron-rich FRIB frontier



Above is the layout of the High Rigidity Spectrometer (HRS) as studied in the present ion-optical and magnet-feasibility studies. It has two stages: a sweeper stage, in which charged particles are separated by neutrons, allowing the latter to pass unperturbed to the MoNA-LISA neutron detector array, and a spectrometer stage for high-resolution analysis of charged fragments. The Gamma-Ray Energy Tracking Array (GRETA), as well as other detectors, can be placed around the target station in front of the HRS.

With the FRIB Project having passed the 50-percent completion mark, the development of new devices and techniques for experiments at FRIB is in full progress. The planning for the construction of a High Rigidity Spectrometer (HRS), which will be the flagship device for the fast-beam program at FRIB, has created a lot of excitement in the user community.

The most important characteristic of the HRS is the ability to bend nuclei produced at a magnetic rigidity for which their production rate through in-flight fragmentation is maximum (up to 8 Tm - the limits for the existing S800 Spectrograph and the sweeper magnet are 4 Tm). Operating at such high rigidities also allows for the use of thick reaction targets and limits the losses due to charge-state production. Gain factors in luminosity of factors of 10 or more can be achieved, with the largest gains for experiments with the most exotic neutron-rich species (e.g. a factor of 30 for the key nucleus of Calcium-60). The HRS will also greatly increase the scientific reach from other state-of-the-art and community-priority devices, such as the Gamma-Ray Energy Tracking Array (GRETA) and the Modular Neutron Array (MoNA-LISA), in addition to other ancillary detectors.

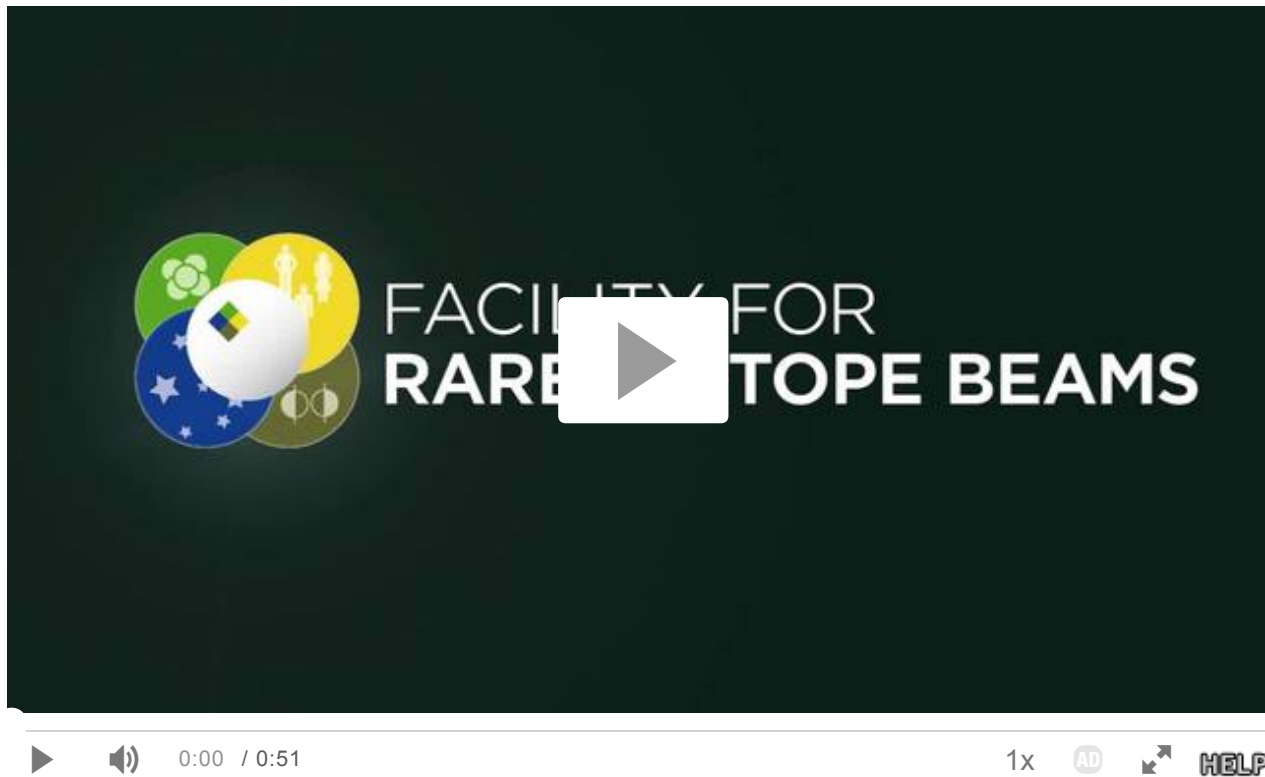
The importance of the HRS was highlighted in the 2015 Nuclear Science Advisory Committee's Long Range Plan to the U.S. National Science Foundation and the U.S. Department of Energy and marked as being essential for realizing the scientific reach of FRIB. As input for the long-range plan, a [whitepaper](#) with contributions from researchers from 21 US institutions and additional institutions from abroad was drafted.

Since the summer of 2015, detailed ion-optical and magnet feasibility studies are being performed with support from a grant from the Department of Energy, Office of Science for Nuclear Physics. These studies are aimed at generating a realistic concept based on high-order ion-optical calculations and aim to optimize the layout and to compare and weigh alternatives. The calculations and ion-optical design are guided through evaluation of the performance with respect to benchmark experiments. To that end, input from the user community has been very beneficial to generate a concept that enables the envisioned scientific program.

More information about the HRS can be found on the [working group website](#).



Civil construction continues 10 weeks ahead of schedule; last structural steel placed in May



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

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.

floor. Overhead cranes have also been powered up and commissioned in several areas.



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.



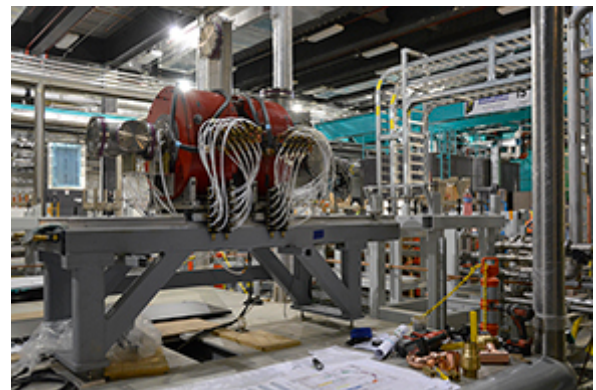
ASD installs FRIB's first accelerator component



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



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.
- Pipes for cooling water have been installed.

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.

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.

- 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.



Summer schools underway and upcoming

U.S. Particle Accelerator School is 13-24 June

Particle accelerators are an important driver of advances in science, technology, industry, and medicine. [The U.S. Particle Accelerator School \(USPAS\)](#) is an established intensive school that supports training in accelerator science and technology to meet the needs of the field. The next session of the U.S. Particle Accelerator School Summer 2016 session is 13-24 June, hosted by Colorado State University.

Seven physics and astronomy students at the National Superconducting Cyclotron Laboratory will attend – three with fellowship support. Professor Steve Lund (MSU Physics Astronomy, FRIB) will teach in the session. The USPAS provides intensive training in accelerator physics in two semester-equivalent sessions per year. Sessions have both graduate- and undergraduate-level courses and are hosted by major U.S. research universities. Each host university vets all course offerings, grants academic credit, and maintains student transcripts. MSU students can receive MSU credit from the courses toward their degrees. USPAS faculty are drawn from national laboratories, universities and private industry. The result is a rich variety of courses with forefront knowledge and methods. Offerings range from fundamentals of accelerator science to advanced physics and engineering topics.

The curriculum is meant not only to meet the workforce needs of accelerator laboratories, but also to educate future contributors to the field, document advances, and to cultivate the many technological opportunities in key accelerator science and technology.

Exotic Beam Summer School scheduled for 17-24 July

[The 2016 Exotic Beam Summer School](#) will be held from 17-24 July at the National Superconducting Cyclotron Laboratory (NSCL) at Michigan State University. The aim of this annual school is to introduce students and young researchers to the various facets of the science of exotic nuclei including nuclear structure, nuclear astrophysics, fundamental interactions, and the application of nuclear science and technology. Through these schools, the research community will be able to more fully exploit the opportunities created by the next-generation exotic-beam facilities, such as FRIB. The format of the school is unique: in the mornings, students will receive lectures from leading researchers in the field of nuclear physics with exotic beams. Lectures will focus on theoretical, experimental, technical, and applied topics. In the afternoons, the students participate in hands-on activities, learning about the techniques and instrumentation needed to carry out experiments with exotic beams.

The EBSS series is sponsored by the U.S. Department of Energy and National Science Foundation, and the following laboratories: Argonne National Laboratory, Lawrence Berkeley National Laboratory, Oak Ridge National Laboratory, Lawrence Livermore National Laboratory, the National Superconducting Cyclotron Laboratory at Michigan State University, and Association for Research at University Nuclear Accelerators (ARUNA).

2016 National Nuclear Physics Summer School set for 18-29 July

[The 2016 National Nuclear Physics Summer School \(NNPSS\)](#) will be held 18-29 July at the Massachusetts Institute of Technology. The summer school is open to graduate students and postdocs within a few years of their PhD (on either side) with a strong interest in experimental and theoretical nuclear physics.

The lecturers of the summer school will give pedagogical reviews of topics in theoretical and experimental nuclear physics, including hadronic spectroscopy and structure, QCD, heavy-ion physics, nuclear structure, nuclear astrophysics, fundamental symmetries, and neutrinos. The school is an excellent opportunity for junior researchers to get a broad perspective on current and future research in nuclear physics, and to network with other researchers.

FRIB and NSCL are proud co-sponsors of the 2016 NNPSS.



FRIB office tower fully approaching completion in August

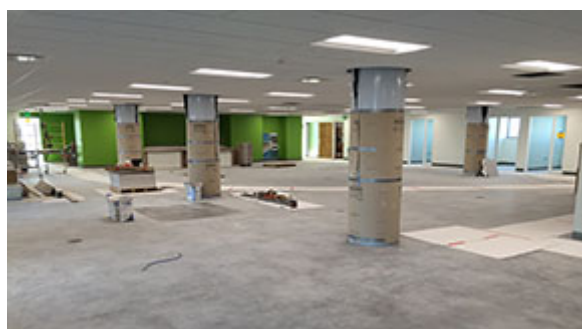


The FRIB office tower addition is advancing quickly toward August 2016 completion.

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 will take place during June.

Acoustical ceiling tile has been installed from the sixth floor down through the fourth floor, and vinyl tile flooring has been installed on the fifth and sixth floors.



The FRIB office tower addition will be commissioned, balanced, and inspected during July, with project completion slated for August.

Countertops and building finishes are currently ongoing on the upper floors. The installation of wood paneling and fiberglass-reinforced gypsum cloud panels have commenced in the auditorium on the first floor.

Terrazzo flooring installation started at the end of May in the gathering space outside the first-floor auditorium, and will be completed in June. One of the elevators is operational, and the final inspection of both elevators is scheduled for June. Doors and hardware will be installed in June as well, and furniture will arrive during July.

The addition will be commissioned, balanced, and inspected during July, with completion slated for August.



Low Energy Community Meeting and Nuclear Data Workshop set for August

The program of the annual [Low Energy Community Meeting](#) scheduled to take place from 11-13 August at the University of Notre Dame is taking shape. In addition to the one-and-a-half day satellite workshop on “Nuclear Data Needs and Capabilities for Basic Nuclear Physics Research” starting on Wednesday, 10 August, two FRIB-related workshops are scheduled for Thursday afternoon, one on data acquisition and one on tracking detectors. In addition, SECAR will hold a collaboration meeting. Further details about the Low Energy Community Meeting can be found [online](#).

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LOOKING AHEAD

- 28-30 June** DOE Office of Project Assessment Review of FRIB
- 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](#)
- 6-8 December** DOE Office of Project Assessment Review of FRIB

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Michigan State University is establishing FRIB as a scientific user facility for the [Office of Nuclear Physics](#) in the [U.S. Department of Energy Office of Science](#).