FRIB PROJECT
UPDATE FOR USERS

NOVEMBER 2013

DOE-SC Reviews FRIB Project, Approves CD-2 and CD-3a

Story Contributed by Thomas Glasmacher, Project Manager

On August 1, 2013, following the bi-annual review by the DOE Office of Science (DOE-SC) Office of Project Assessment, an official statement announced the approval of Critical Decision-2 (CD-2) and Critical Decision-3a (CD-3a) for the FRIB Project. According to the DOE-SC statement:

> "*On August 1, 2013, the Department of Energy's Office of Science approved Critical Decision-2 (CD-2), Approve Performance Baseline, and Critical Decision-3a (CD-3a), Approve Start of Civil Construction and Long Lead Procurements, for the Facility for Rare Isotope Beams (FRIB) construction project*."

The statement goes on to acknowledge that upon completion, FRIB will allow research in 'completely uncharted territory' with reference to nuclear stability, structure of nuclei, origins of elements, and astrophysical processes.

An architectural rendering of the completed Facility for Rare Isotope Beams

With CD-2 and CD-3a approval, the FRIB project is one step closer to delivering FRIB, realizing the nuclear science community's aspirations and DOE-SC expectations. This is a responsibility the whole FRIB Project team takes most seriously and we will continue to communicate our progress as we take future steps forward.

FRIB Final Design Plan Complete, Moving Toward CD-3b

Story Contributed by Dan Stout, Chief Engineer

Moving toward the Critical Decision-3b (CD-3b) review planned for June 2014, the FRIB Project team has completed a final design plan that defines the status of the FRIB final technical design at the time of the review, in preparation for a CD-3b determination by the DOE-SC Acquisition Executive.

CD-3b will authorize the start of technical construction, namely the accelerator systems and experimental systems, and marks the transition from technical design into technical construction.

The plan identifies CD-3b review design deliverables and identifies limited post-review design work and associated risks, which are low. Final design progress is being tracked monthly to ensure goals set for CD-3b are achieved.

An artist's rendering of the completed Facility for Rare Isotope Beams

Nearly 300 Participate in Low-Energy Community Meeting

Story Contributed by Brad Sherrill, FRIB Laboratory Chief Scientist

The 3rd annual Low-Energy Community Meeting was held August 23-24, 2013 at Michigan State University. Tim Hallman from DOE-SC and Bradley Keister from NSF addressed the community meeting. Plenary talks included ATLAS at ANL and NSCL at MSU, as well as an update on progress in nuclear theory and talks from two Association for Research at University Nuclear Accelerators (ARUNA) members Notre Dame and HIGS at Duke.

Among 274 participants were 49 that joined by webinar, and the meeting consisted of 17 separate collaboration/working group meetings that were held with short summaries presented to the full gathering on the last day. Also presented to the full group were talks on nuclear data and work force issues.

The low-energy community meetings are organized by a committee of representatives from the U.S. low-energy national laboratories, JINA, user groups and major research equipment collaborations. Current representatives are Baha Balantekin, Carl Gross, Paul Fallon, Rod Clark, Witek Nazarewicz, Guy Savard, Hendrik Schatz, Bradley Sherrill, Michael Smith, Ingo Wiedenhoever. The group will shortly begin planning for next year's meeting–so if you have any comments or suggestions (or would like to help organize the meeting) please contact any of the organizing committee members. More information about the meeting, including details of the 2013 meeting program and links to the talks, can be found in the full story at frib.msu.edu.

The 3rd Annual Low-Energy Community Meeting at MSU

Two Major Steps Forward for Driver Accelerator

Story Contributed by Jie Wei, Accelerator Systems Division Director

This Fall, the accelerator systems division achieved two major accomplishments. First, 13 electrostatic quadrupoles (eight triplets, three doublets, and two singlets) for the front end of the accelerator were completed and delivered to FRIB. Electrostatic quadrupoles focus and transport low-energy ion beams, and each one consists of four electrode plates (in a vacuum) biased up to 10 kV. Individual quadrupoles are combined in triplets and doublets to simplify mechanical handling and alignment.

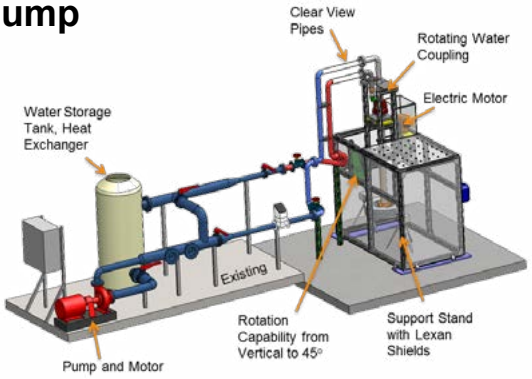
Second, the liquid-lithium charge stripper passed the intermediate design review, with test results from ANL. The charge stripper improves accelerator efficiency by removing electrons from the ion beam and achieving greater acceleration for a given electrical potential. Without charge stripping, more cryomodules would be necessary and the efficiency of FRIB would increase significantly, said Felix Marti, a senior physicist at FRIB. Extensive tests were performed successfully at ANL to study liquid film formation and demonstrate film uniformity.

Charge stripping tests include a nozzle test stand using liquids with different properties to simulate film formation

This is the first time charge stripping has been attempted with liquid-lithium, and test results have been positive. In current accelerators, charge stripping is done with solid metals and gasses. However, FRIB beams will dissipate too much energy in the stripping material for any solid film to withstand, and therefore the FRIB baseline design incorporates the liquid lithium film stripper idea conceived by Jerry Nolen and proposed by ANL.

Beads Help Validate Flow Calculations for Beam Dump

Story Contributed by Georg Bollen, Experimental Systems Division Director



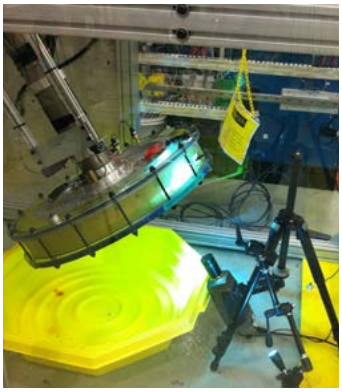
A graphic showing the beam dump prototype, currently housed at Oak Ridge National Laboratory (ORNL).

The FRIB beam dump stops the primary beam after the FRIB production target. The stopped primary beam may still have beam power of nearly 400 kW and can be focused into a beam spot as small as a millimeter wide.

The baseline design is a water-filled rotating drum. Understanding the water cooling of the beam dump shell and the temperature of the water in the path of the beam are critical to validate the design. Validating the baseline design directly is impossible since no 400 kW heavy-ion beams at the FRIB beam energy currently exist in the world. FRIB engineers have to rely on simulations and need to assure the predictive power of their simulations. To this end, the experimental systems division engaged in a second series of flow studies using a transparent drum and polystyrene beads to simulate the flow. This took place in the actual beam dump prototype that has already been constructed and is currently being tested at ORNL.

The experience of ORNL staff and lessons learned from the Spallation Neutron Source project (at ORNL) have been essential to the process. The work of Van Graves (beam dump design), Joe DeVore (non-conventional utilities), and Tom Burgess (engineering and coordination) have proven invaluable.

This is the second round of tests being conducted at ORNL, with a support structure built by ORNL and the existing flow test bench at the laboratory. By tracking the motion of the beads in water with a high-speed camera, velocity profiles were determined and found to be in good agreement with the flow simulations performed by the FRIB target group. This gives credence to the simulation approach and allows us to further optimize the design of the drum.



The beam dump prototype is built with transparent walls so the camera can record trajectories of the polystyrene beads.

FRIB Laboratory Science Advisory Committee Status Update

Story Contributed by Brad Sherrill, FRIB Laboratory Chief Scientist

The FRIB Laboratory Science Advisory Committee met October 29 to review the status of FRIB equipment-planning and recommend near-term actions to assist users in equipment development. Prior to the meeting, 15 updates were received from working groups which continue to make good progress. Many are planning major activities in 2014 including workshops, finishing preliminary designs, and writing scientific white papers. A report from the committee will be submitted to the FRIB Laboratory director and, based on this report, feedback will be provided to working groups.

Looking Ahead for FRIB Project

Through March 2014 – Completion of 22 peer (technical design) reviews counting from August 2013

April 1, 2014 – Planned start of civil construction

April 23-25 – MSU President's independent review to assess readiness for CD-3b

June 24-26 – DOE-SC Office of Project Assessessment review to assess readiness for CD-3b

For more FRIB News and Events, please visit www.frib.msu.edu

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