EAST LANSING — The machine at the nucleus of the Facility for Rare Isotope Beams will be a superconducting linear accelerator able to accelerate beams of heavy ions to more than half the speed of light.

Those beams will strike a set of graphite targets spinning at 5,000 rotations per minute with enough power to create the same rare isotopes found in the thermonuclear explosions of dying stars.

"Like a snowball through a fence," said Georg Bollen, director of FRIB’s experimental systems division. "You have many small snowballs afterward."

The technical systems that will make the work of the $730 million nuclear science research facility possible will be built around
one-of-kind machines. They will require a unique building.

MSU broke ground on that building Monday morning. The ceremony was an opportunity for congratulations and grand predictions and frequent acknowledgments of the fact that MSU had accomplished the unlikely. Six members of Michigan’s Congressional delegation were there to toss ceremonial shovels-full of dirt.

Working out the final form of the 227,000-square-foot structure was not the project’s thorniest challenge, but it was hardly simple. “The trick with these one-of-a-kind science facilities is, because they’re one of a kind, there isn’t anybody who can go sit down and write down all the requirements,” said Thomas Glasmacher, the project manager for FRIB. “It’s too complicated. Nobody’s done it.”

But the final product still needed to be “integrated like a hand and a glove,” he said, “so you need to expose the accelerator people’s ideas and the civil construction people’s ideas and progressively elaborate.”

The construction team started by asking the scientists to lay out their requirements. “We quickly learned that they didn’t necessarily know all their requirements,” said Brad Bull, director of FRIB’s conventional facilities division. “Some of the things they’re still sort of inventing.”

So they adopted a different tack, optimizing the design for cost and asking one key question: “Why won’t this work?”

Bull described an agile process, rough plans and quick revisions with finer details worked out in marathon meetings off site at the James B. Henry Center for Executive Development. No cell phones allowed.

The accelerator and target facility will live in a tunnel 40 feet below the surface with concrete walls three feet thick or thicker. The $165 million building will have 10 electrical rooms and not a single office. The elaborate grounding system will require contractors to pour four-and-a-half feet of concrete over a copper mesh without snapping a single strand.

“What’s going to be the toughest thing for us is to not deviate from any of the standards for our drawings,” Bull said. “In a typical office...
building, if you were to move a door an inch or two, big deal. Here, things are so well thought out that we cannot allow any movement."

For the scientists creating the FRIB’s technical systems, the design process was about getting as close as possible to the moving target of those systems’ final form.

Work on the building starts officially today with the excavation of a very deep hole. Technical construction likely won’t begin until the fall and the machine will evolve in the meantime.

“Our box needs to be well enough defined that we can do what we need to do, because we cannot go back in two years and say remove this three-meter-thick concrete wall,” Bollen said.

But he believes it is.

“When the civil construction is finished, we have then to put this technical equipment into the facility. Then we find out if everything fits,” he said, “which I’m absolutely confident that it will.”