A Final Smash For America's Giant Particle Collider

by Nell Greenfieldboyce

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Morning Edition

Reidar Hahn/Fermilab
Vehicle lights and shooting stars illuminate the four-mile-long Tevatron ring.

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A physicist named Dmitri Denisov walks up wooden steps to the top of something that looks sort of like an abandoned railroad bed.

"Wow, look, it's beautiful," Denisov says, gazing out at a pond. "I didn't even know about these flowers."

The tall mound of dirt he's standing on stretches off into the distance, forming a huge circle nearly four miles around — and the inside of this ring is filled with acres of restored prairie.

"The first time I came here was 1989," recalls Denisov. At the time, he was a young scientist from the Soviet Union. "I remember sort of coming to this point and looking and saying, 'Wow, that's really a big machine!'"

The machine, which Denisov is standing on, is called the Tevatron. Beneath this earthen berm is a tunnel that serves as a high-tech racetrack for protons and anti-protons. They accelerate to almost the speed of light, and then slam together in collisions that spew out the hidden particles that make up matter.

Enlarge Reider Hahn/Fermilab
A view inside the Tevatron ring, currently in its final days as a particle superhighway.

No Longer On Top

The Tevatron has been the pride of the Fermi National Accelerator Laboratory, near Chicago, for a quarter of a century. But at the end of this month, the Tevatron is shutting down.

It's no longer the most powerful machine in the world for smashing bits of atoms together so that scientists can search through the sub-atomic rubble.

That title belongs to the Large Hadron Collider near Geneva. Its circular racetrack for particles is 17 miles around, and this new collider is now the big draw for the world's physicists.

"And many people, including people who work here at the Tevatron, are moving where the science is," Denisov says.

We want to go out sprinting across the finish line, not crawling.

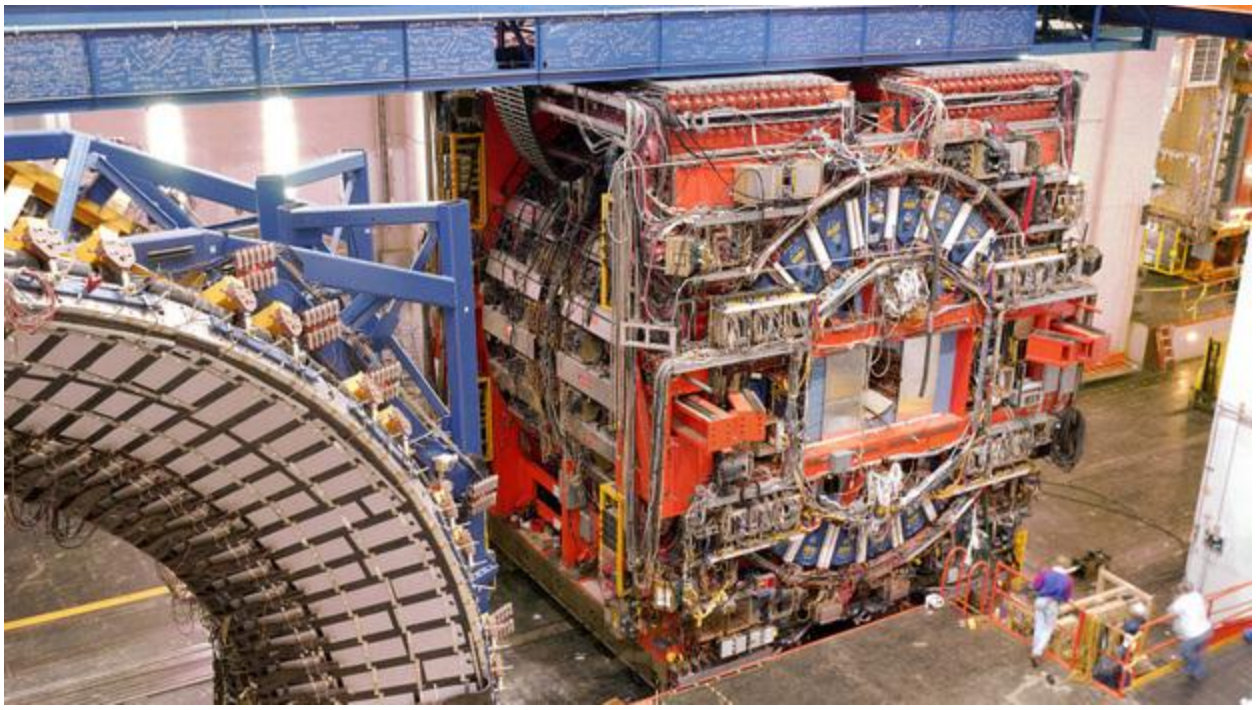
- Rob Roser, physicist at Fermilab

In the past, the Tevatron has been the destination for scientists who wanted to probe the building blocks of the universe. In one windowless control room, a number of clocks hang on a cinderblock wall — that's because so many scientists came here from abroad that they needed a quick way to check the time zone back home in case they wanted to call friends or family.

In the Tevatron's control rooms, subatomic collisions are monitored 24 hours a day. This is where the elusive "top quark" was discovered. And scientists here do still hope to make one last big discovery in the few weeks the Tevatron has left — about a particle also being chased in Europe.

"The big thing going on right now in terms of particle physics is the so-called race for the Higgs boson," says Fermilab physicist Rob Roser, who explains that the Higgs is a particle that could answer one of the big mysteries of science: why things have mass. "So we're just hanging on, trying to get every last collision we can before we turn off to see whether we can make a statement, an important statement about it."

"We want to go out sprinting across the finish line, not crawling," Roser adds.



Enlarge Reidar Hahn/Fermilab
One of the detectors used in the discovery of top quarks at the Fermilab Tevatron

A Unique Time In History

Even so, the end is looming for the Tevatron. Researchers here are reminded of that every time they go to have lunch.

Right next to the main cafeteria at Fermilab is a new control room with a glass wall. People walking by can look in and see computer monitors linked to the Large Hadron Collider. This is so scientists can run experiments remotely on the huge European machine, which the United States contributed money to help build.

"It's a very important part of the American program, to actually exploit the Large Hadron Collider," says Pier Oddone, the director of Fermilab. "I would say the mood of the community is that this is a unique time in the history, that we're opening a regime where all of a sudden, we have access to 10 times the energy that we could produce here at the Tevatron."

That doesn't mean American scientists aren't sad at losing the status that comes with having the world's best physics machine. Oddone would like to see the next big physics machine built right here. But that's no easy task when budgets are shrinking for the physical sciences. After all, Europe's Large Hadron Collider cost around $10 billion.

"It just simply seems very difficult, given debt issues, deficits and all of that, to ask for the required increases that we would need to build the biggest machine," says Oddone.

Getting Back To No. 1

So instead of a bigger machine that can produce even more powerful collisions, folks at Fermilab hope to build something different: a new machine that would produce a record number of collisions. Having lots and lots, even if they're less powerful, should let scientists see rare events that hardly ever happen.

The proposed new accelerator is called Project X. In a concrete bunker painted mint green, researchers at Fermilab are already testing new technologies that would be needed for Project X, which would cost a couple billion dollars and would do things the collider in Europe can't. It would be the best facility in the world for studying tricky particles like neutrinos.

"As long as, you know, there's a commitment in the U.S. to be a world player in particle physics, which I gotta believe there is, Project X is going to have to be built," says Steve Holmes, who manages the Project X effort.

If Project X gets funding, it could be built by the end of this decade — and Holmes hopes it will.

"You know, we don't always have to be no. 1. It's natural that the lead goes back and forth across the ocean," says Holmes. "But I think we've always got to be in a position, when the lead went some place else, we've got to plan to get it back here."

Once the Tevatron shuts down, officials say it won't be disassembled right away. Instead, its tunnel will be opened up to the public as a kind of museum — to let people see the vast equipment that once revealed incredibly tiny parts of the universe.