Shutdown looms at pioneering American atom smasher

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In this Tuesday, Sept. 20, 2011 photo, physicist Dmitri Denisov, who works on one of two huge particle detectors at the Fermi National Accelerator Laboratory in Batavia, Ill., that gather data from the lab's Tevatron collider, looks over the area that houses the lab's four mile underground track. Inside the track, beams of protons and anti-protons race around at nearly the speed of light before smashing them to dislodge hidden particles that make up matter. On Friday, Sept. 30, physicists will shut down the Tevatron, a once-unrivaled atom smasher that has been eclipsed by the Large Hadron Collider buried beneath the border of France and Switzerland. (AP Photo/M. Spencer Green)

(AP) -- Aside from the slogan on the water tower that reads "City of Energy," there is little in this leafy Chicago suburb of gently rolling hills to indicate that it has been the center of the universe when it comes to studying, well - the universe.

This is the home of the Fermi National Accelerator Laboratory, or

Fermilab, where for a quarter-century scientists have worked on the world's most powerful particle accelerator to try to recreate conditions that existed just after the Big Bang.

In the coming months, the eyes of the physics world will be focused here to see if researchers can confirm the startling findings announced last week in Europe - that subatomic particles called neutrinos traveled faster than the speed of light.

But this is also a time of transition for Fermilab. On Friday, physicists will shut down the facility's accelerator called the Tevatron, a once-unrivaled atom smasher that has been eclipsed by the Large Hadron Collider buried beneath the border of France and Switzerland.

For some in Batavia, it will be a somber moment, akin to losing a family member. Others wonder whether it signals a lack of commitment to high-level particle science on U.S. soil.

Fermilab leaders say they hope that's not the case, because there's plenty of research to keep Batavia at the cutting edge.

That point was underscored after researchers using equipment at CERN, the European Organization for Nuclear Research, revealed their finding that cast doubt on Einstein's theory of relativity.

Fermilab - named after Enrico Fermi, who helped develop atomic energy at the University of Chicago - is one of only two other labs in the world that could try to replicate the work. The other, in Japan, has been slowed by the earthquake and tsunami.

Fermilab saw similar faster-than-light results in 2007 while shooting a beam of neutrinos to a lab in northern Minnesota. But the scientific significance of that observation was undercut by a large margin of error.

Now the lab hopes to upgrade its own "clock" to see if it can confirm or debunk the European findings.

But long after the light-speed question has been answered, Fermilab hopes to make neutrino research one of the centerpieces of the post-Tevatron era - and retain its standing as one of the world's premier research labs.

That would involve building a new accelerator to study the universe in a new way - by producing the most collisions, rather than the most powerful. The accelerator also would be capable of producing neutrino beams more intense than anywhere else to help study the particles that scientists theorize helped tip the cosmic scales toward a universe made of matter.

"The idea is to look for things that happen very rarely, and the way to find them is to create lots of examples and see if you find something," said Steve Holmes, who's in charge of the new venture, called Project X.

The proposal could cost up to $2 billion, but has no funding yet. Even if the project goes unfunded, Fermilab has programs to last through the coming decade, "but beyond that, we really need to enhance the capabilities of the complex here if we are going to have an accelerator-based particle physics program in the U.S," Holmes said.

Though work that began with the Tevatron will continue in Europe, Fermilab won't be left out. Physicists in Batavia are able to conduct remote, computer-aided research on the LHC at the same time as their counterparts at that facility. And some of the 600 scientists working on the Tevatron will travel to Europe to work on the new collider, just as physicists from around the world flocked to Batavia after the Tevatron was built 28 years ago.

Still, the end is disappointing, said former congressman Bill Foster, a physicist who worked for 22 years on the Tevatron, which sends beams of protons and anti-protons racing around a four-mile underground track at nearly the speed of light before smashing them together to dislodge hidden particles that make up matter.

The LHC makes a 17-mile loop and is seven times more powerful. Neither of the colliders is directly connected to the light-speed experiments. The U.S. began building an accelerator that would have been even bigger - a 54-mile Superconducting Super Collider - in Texas, but that project was canceled in 1993 when funding fell through.

"The decline of particle physics in the U.S. is really a symptom of the erratic and sometimes anti-scientific attitudes in Washington and the incompetence of Congress in managing science," said Foster, a Democrat who is running again for Congress next year. "And it's sad for Batavia."

It's difficult to overstate the role Fermilab played in the world of high-energy particle physics. It was at the 6,800-acre facility on restored prairie that physicists working with the Tevatron in 1995 confirmed the existence of the long-elusive top quark, the last building block of matter to be discovered.

"Now we are going levels deeper in trying to understand the most important laws that regulate the universe," said Giovani Punzi, a physicist who moved to Illinois from Italy three years ago.

But there also have been more immediate benefits from the Tevatron: Its powerful magnets led to MRIs and are used in superconducting. Neutron therapy helps treat cancer patients. And the collider has changed the way science analyzes data.

Lately, Tevatron researchers have been squeezing as many collisions as possible from the machine, hoping their years of effort still yield clues to the most prized particle of all: the theoretical Higgs boson, or "God particle," which could explain why matter has mass - and therefor the existence of everything from planets to people.

By early next year, Fermilab hopes to be able to conclude from Tevatron data that either the Higgs boson does not exist or that it's still a plausible theory. Even if there's evidence of the Higgs boson, it would have to be confirmed, and that would probably happen in Switzerland.

But that's OK, says Fermilab Director Pier Oddone.

"It's not a competition, it's about the science," Oddone says.

Then he pauses.

"There is some competition, but also a huge amount of collaboration," he explains, noting that Fermilab expertise helped build the LHC and the U.S. invested heavily in it. "My wish for the LHC is that it would have as wonderful and productive a life as Tevatron."

As for the Tevatron, it will probably become a stop on the lab's visitor tour, Oddone said.

But first, it will come to a quiet and respectful end.

On Friday, one of its founding physicists, Helen Edwards, will abort the beam of particles and shut down the accelerator before joining others outside the main control room for a celebration.

"We're thinking of it as if we're pulling the plug on our favorite uncle," said Roger Dixon, who heads the accelerator division at Fermilab.

That day will be bittersweet, but "it's not the end of the world," Denisov says. "It's the next frontier."