Restored machine to explore mysteries of Big Bang

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In this photo released by the European Organization for Nuclear Research (CERN) on Saturday, Nov. 21, 2009, scientists react in the CERN Control Center after successfully restarting the Large Hadron Collider, in Geneva, Switzerland, Friday, Nov. 20, 2009. Scientists moved Saturday to prepare the world's largest atom smasher for exploring the depths of matter after successfully restarting the $10 billion machine following more than a year of repairs. (AP Photo/Keystone, Brice, CERN)

(AP) -- Scientists are preparing the world's largest atom smasher to explore the depths of matter after successfully restarting the $10 billion machine following more than a year of repairs.

When the machine is fully operational, its magnets will control the beams of protons and send them in opposite directions through two

parallel tubes the size of fire hoses.

In rooms as large as cathedrals 300 feet (100 meters) under the Swiss-French border, the magnets will force them into huge detectors to record the reactions.

One goal is to unravel the mysteries of the Big Bang that many scientists theorize marked the creation of the universe billions of years ago.

The restart of the Large Hadron Collider late Friday was hailed as a significant leap forward in efforts to launch new experiments - probably in January - on the makeup of matter and the universe.

The machine was heavily damaged by a simple electrical fault in September last year.

The nuclear physicists working on it were surprised at how quickly they got beams of protons whizzing through the 17-mile (27-kilometer) circular tunnel underground late Friday.

"That was all wrapped up by midnight. They are going through the paces really very fast," said James Gillies, spokesman for the European Organization for Nuclear Research, also known by its French acronym, CERN.

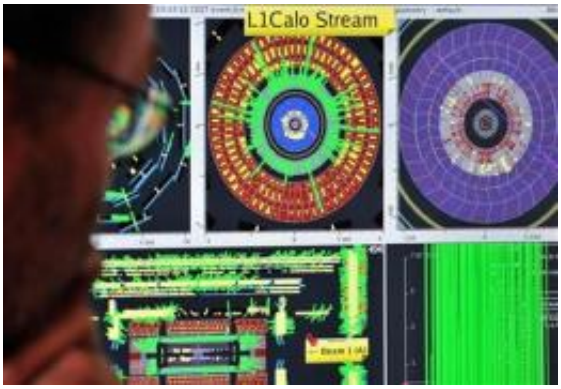
Things went so well Friday evening that scientists achieved the operation seven hours earlier than expected, he said. Some scientists had gone home early Friday and had to be called back as the project jumped ahead, Gillies added.

Praise from scientists around the world was quick.

"I congratulate the scientists and engineers that have worked to get the

LHC back up and running," said Dennis Kovar of the U.S. Department of Energy, which participates in the project. He called the machine "unprecedented in size, in complexity, and in the scope of the international collaboration that has built it over the last 15 years."

CERN decided Saturday to test all the protection equipment while there still is a very low intensity proton beam circulating in the collider. The tests will take 10 days, Gillies said.



In this Sept. 10, 2008 file photo, a European Center for Nuclear Research (CERN) scientist controls a computer screen showing traces on Atlas experiment of the first protons injected in the Large Hadron Collider (LHC) during its switch on operation at the Cern's press center near Geneva, Switzerland. Scientists switched on the world's largest atom smasher for the first time on Friday, Nov. 20, 2009 since the $10 billion machine suffered a spectacular failure more than a year ago, circulating beams of protons in a significant leap forward for the Large Hadron Collider. (AP Photo/Fabrice Coffrini, Pool, File)

He said CERN decided against immediately testing the collider's ability to speed up the beams to higher energy or to start with low-energy collisions that would help scientist calibrate their detection equipment.

In the meantime, CERN is using about 2,000 superconducting magnets - some of them 15 meters (50 feet) long - to improve control of the beams of billions of protons so they will remain tightly bunched and stay clear of sensitive equipment.

Officials said Friday evening's progress was an important step on the road toward scientific discoveries at the Large Hadron Collider, which are expected in 2010.

"We've still got some way to go before physics can begin, but with this milestone we're well on the way," CERN Director General Rolf Heuer said.

With great fanfare, CERN circulated its first beams Sept. 10, 2008. But the machine was sidetracked nine days later when a badly soldered electrical splice overheated and set off a chain of damage to the magnets and other parts of the collider.

Steve Myers, CERN's director for accelerators, said the improvements since then have made the collider a far better understood machine than it was a year ago.

It is expected soon to be running with more energy than the world's most powerful accelerator, the Tevatron at Fermilab near Chicago. It is supposed to keep ramping up to seven times the energy of Fermilab in coming years.

This will allow the collisions between protons to give insights into dark matter and what gives mass to other particles, and to show what matter was in the microseconds of rapid cooling after the Big Bang.

The Large Hadron Collider operates at nearly absolute zero temperature, colder than outer space, which allows the superconducting magnets to

guide the protons most efficiently.

Physicists have used smaller, room-temperature colliders for decades to study the atom. They once thought protons and neutrons were the smallest components of the atom's nucleus, but the colliders showed that they are made of quarks and gluons and that there are other forces and particles. And scientists still have other questions about antimatter, dark matter and supersymmetry they want to answer with CERN's new collider.

The Superconducting Super Collider being built in Texas would have been bigger than the Large Hadron Collider, but in 1993 the U.S. Congress canceled it after costs soared and questions were raised about its scientific value.

Gillies said the Large Hadron Collider should be ramped up to 3.5 trillion electron volts some time next year, which will be 3 1/2 times as powerful as Fermilab. The two laboratories are friendly rivals, working on equipment and sharing scientists.

But each would be delighted to make the discovery of the elusive Higgs boson, the particle or field that theoretically gives mass to other particles. That is widely expected to deserve the Nobel Prize for physics.

More than 8,000 physicists from other labs around the world also have work planned for the Large Hadron Collider. The organization is run by its 20 European member nations, with support from other countries, including observers Japan, India, Russia and the U.S. that have made big contributions.