Design Flaw Could Delay Collider

A magnet for the Large Hadron Collider (LHC) failed during a key test at the European particle physics laboratory CERN last week. Physicists and engineers will have to repair the damaged magnet and retrofit others to correct the underlying design flaw, which could delay the start-up of the mammoth subterranean machine near Geneva, Switzerland, from November until the spring of 2008. That would eliminate a 1-month "engineering run" with which physicists had hoped to shake the bugs out of the machine before shutting down for the winter, when power becomes prohibitively expensive.

Laboratory officials aren't giving up hope just yet, however. "We are pretty well along on finding a fix that can be implemented in

the tunnel without having to bring [the magnets] up to the surface," says CERN's Lyndon Evans, who leads the construction of the accelerator. Only the damaged magnet will have to come out of the tunnel, he says.

The faulty magnets are designed to focus the LHC's beams of protons just before they collide. The beams will run through three such quadrupoles on either side of each of four collision points spaced around the 27-kilometer ring. The LHC's four massive particle detectors will sit at the collision points.

Designed and built at Fermi National Accelerator Laboratory (Fermilab) in Batavia, Illinois, the magnet failed when

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researchers tried to pressurize its cylindrical casing to 25 times atmospheric pressure. The test was supposed to simulate the buildup of helium gas during a "quench," an event in which the superconducting wire in the magnet temporarily loses its superconducting properties and starts acting like a giant heating coil, boiling the liquid helium coolant that fills the volume between magnet and casing. The pressure pushed the innards of the magnet through the cylindrical container like a piston as a key support broke. The support was not designed to take a lengthwise push, says Stephen Holmes, an accelerator physicist at Fermilab.

"It's better to catch it now than a year

from now when the LHC has its first quench," Holmes says. But, he adds, "we should have caught this before we got this far." Researchers at Fermilab and CERN already have ideas for modifying the mag-

Overlooked. Faulty support was not designed to resist a force pushing the magnet's innards through its casing.

nets and will meet at CERN at the end of the month to finalize the plan and start the fix.

The schedule for starting the LHC in November was already extremely tight. Workers have lowered all but a handful of the LHC's 1624 main magnets into the tunnel and are busy connecting the equipment. Even so, they are currently about 5 weeks behind schedule and pushing to catch up, Evans says. "If it goes into 2008, then there is no question of having an engineering run and 3-month shutdown," Evans says. "We'll have to do without it."

-ADRIAN CHO

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