10,000th shot

Workhorse gamma ray generator HERMES III reaches significant milestone

By Neal Singer
Photos by Randy Montoya

The High-Energy Radiation Megavolt Electron Source, better known as HERMES III, fired its 10,000th shot on July 14. HERMES III is the world's most powerful gamma ray generator. It produces a highly energetic beam that tests the capability of electronics to survive a burst of radiation that approximates the output of a nuclear weapon. The machine can accommodate targets that range in size from a single transistor to large vehicles.

The machine does its work by generating an intense electron beam at energies approaching 20 mega-electron volts. The electron beam is then guided into a high atomic-number target, where it is slowed down and produces copious amounts of gamma rays. The thinness of the target permits the majority of the beam's energy to pass through it; thus, the passage causes minimum damage. This enables HERMES to fire multiple shots at a time without breaking vacuum. "HERMES III has gone hundreds of shots without any damage to the tantalum Bremsstrahlung diode," says manager Ray Thomas (1342).

To achieve its high voltage, HERMES III uses 20 inductively isolated modules arranged in series. The machine resembles a short subway train in size and shape — 17 feet wide, 50 feet long, and 16.5 feet high. Each "car," or unit, adds 1 million volts in series, reaching a total of 20 million volts. Its linear, voltage-adding geometry is distinct from the wagon-wheel shaped architecture favored by Saturn and Z, which is useful for adding current.

Also, HERMES III places its targets at an end of the machine rather than its center.

"Our customers bring their own targets, place them at the front of the machine as we request, and then remove them after the shot," says technician Gary Tilley (1342), who's worked on HERMES III for 20 years. The other two facilities have to clean up the remnants of exploded targets placed at the center of their energy flows.

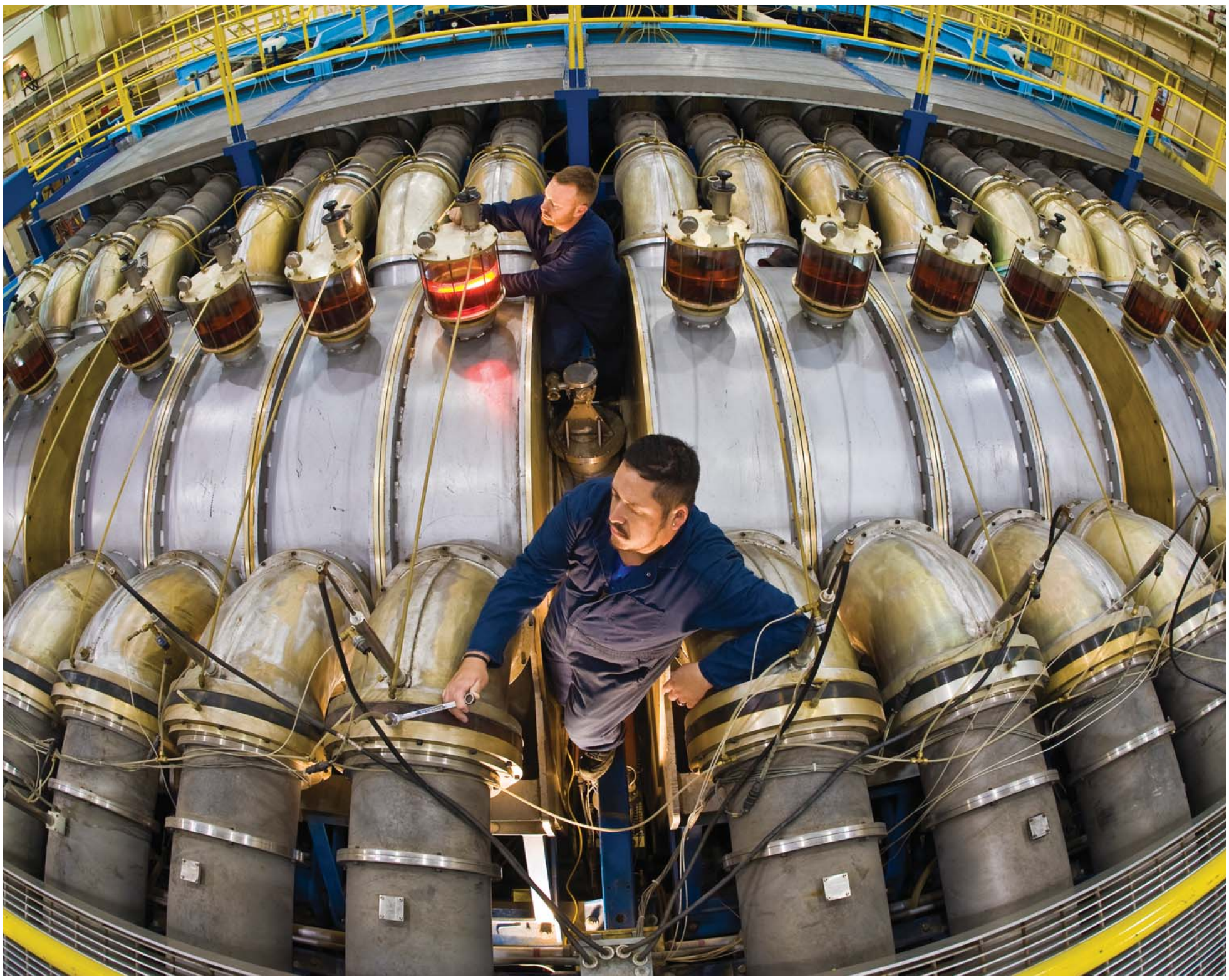
Juan Diego Salazar (1342) is part of the team that watches to make sure each module receives the proper dose of power, at the right moment in time, to accelerate the beam.

"Every firing is different," he says. "The targets always change."

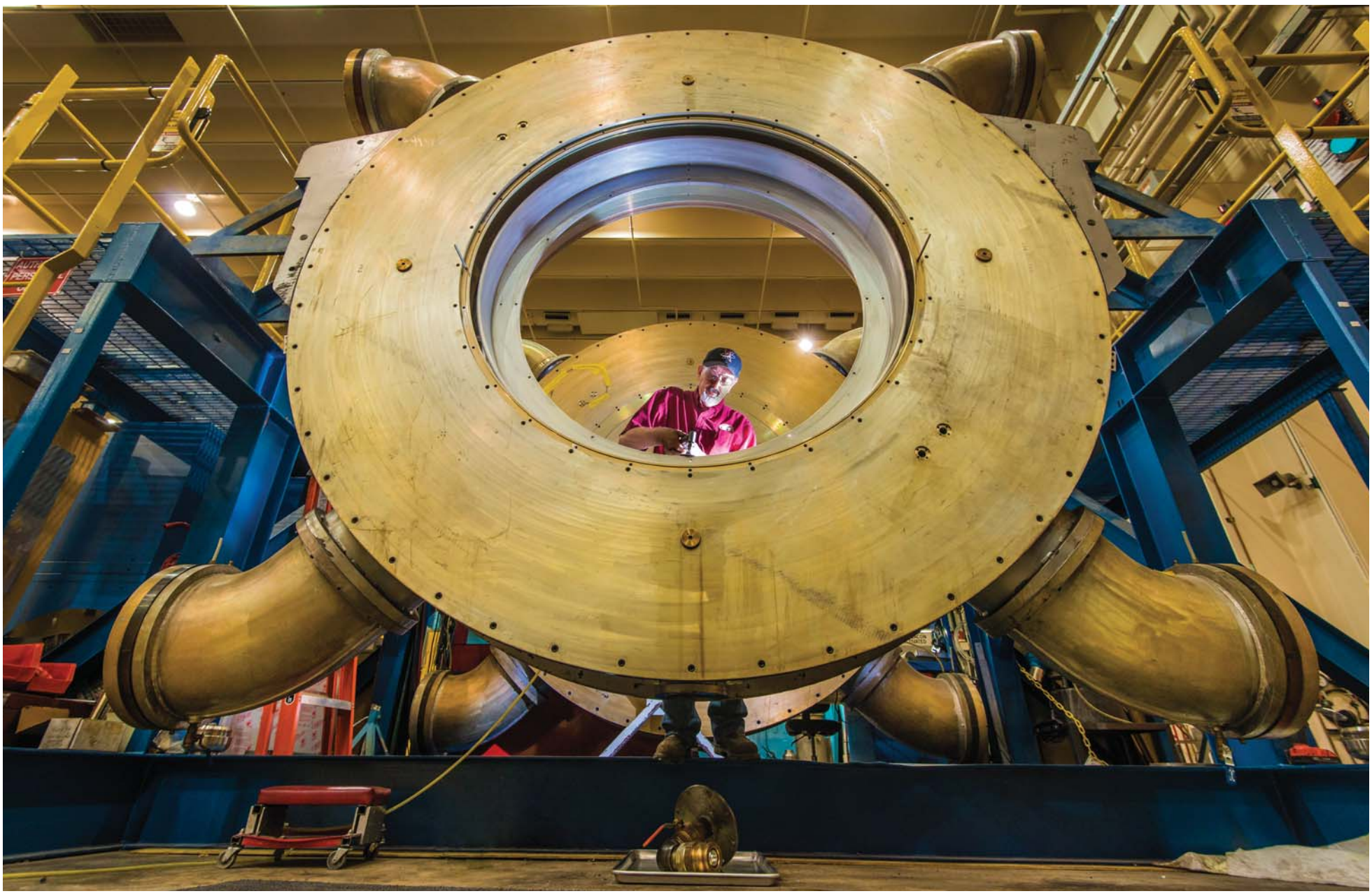
Continual reevaluation of the electrical power feeding the beam as it flows through its modules, and continual recalibration of the beam's line of sight to the target, are necessary because an unobserved power or alignment failure somewhere within the system could mistakenly show a target more radiation-resistant than it actually is.

Real-time adjustments would be too late: The achieved beam flashes for 20 billionths of a second, about the time it takes light to travel 20 feet.

"Accurate results are important," says Ray. "That's what we're about."



FORMER CONTRACTOR JJ Montoya (foreground) and Chris Kirtley (1342) work atop the HERMES III Accelerator, making final adjustments on a newly rebuilt cavity.



GARY TILLEY (1342) repairs a HERMES III cavity.

CHRIS KIRTLEY (right) and Aaron Bowers (both 1342) sand the inner vacuum surface of a HERMES III cavity.

PAT LAKE (1675) (left) and Ray Thomas (1342) examine the vacuum test fixture for the HERMES III insulator stack.

IN THIS PHOTO taken around 1989, Steve Neely (left) and Jimmy Flores service the machine.