

# Fermilab, partners break ground on particle accelerator to study ghostly particles, new forces

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This new complex of buildings, located near Fermilab's Wilson Hall, will host the 215-meter-long (700-foot-long) PIP-II particle accelerator, the new heart of the Fermilab accelerator complex. Credit: Fermi National Accelerator Laboratory

Fermi National Accelerator Laboratory officially broke ground March 15 on a major new particle accelerator project that will power cutting-edge physics experiments for many decades to come.

The new 700-foot-long linear accelerator, part of the laboratory's Proton Improvement Plan II (PIP-II), will be the first accelerator project built in the United States with significant contributions from international partners. When complete, the new machine will become the heart of the laboratory's accelerator complex, vastly improving what is already the world's most powerful particle beam for [neutrino experiments](#) and providing for the long-term future of the diverse research program at Fermilab, which is affiliated with the University of Chicago.

The new PIP-II accelerator's flexible design will enable it to work as a new first stage for Fermilab's chain of accelerators, powering both the

laboratory's flagship project – the international Deep Underground Neutrino Experiment (DUNE), hosted by Fermilab – and its extensive suite of on-site particle physics experiments, including searches for new [particles](#) and new forces in our universe.

DUNE is under construction now, and will be the most advanced experiment in the world studying ghostly, invisible particles called neutrinos. These particles may hold the key to cosmic mysteries that have baffled scientists for decades. The DUNE collaboration brings together more than 1,000 scientists from over 180 institutions in more than 30 countries, all with a single goal: to better understand these elusive particles and what they can tell us about the universe.

"Breaking ground on the PIP-II accelerator today signals the start of a new era at Fermilab, one of new construction, new experiments and new excitement around the laboratory's research program," said Fermilab Director Nigel Lockyer. "I'm pleased and proud to begin this era with the people of this laboratory, and our partners around the world."

The PIP-II accelerator will enable the beam that will send trillions of neutrino particles 800 miles (1300 km) through the earth to the four-story-high DUNE detector, to be built a mile beneath the surface at the Sanford Underground Research Facility in Lead, South Dakota. With the improved particle beam enabled by PIP-II, scientists will use the DUNE detector to capture the most vivid 3-D images of neutrino interactions ever seen.

"The particle accelerator project at Fermilab will provide for new paths of inquiry into fundamental questions about the universe and its makeup. The project builds upon the important relationship between Fermilab and the University of Chicago,

creating new opportunities for collaborations between the laboratory, the University and researchers around the world," said University of Chicago President Robert J. Zimmer, chairman of the Board of Directors of Fermi Research Alliance, LLC.

PIP-II is itself a groundbreaking scientific instrument, and its construction is pioneering a new paradigm for accelerator projects supported by the U.S. Department of Energy. The accelerator would not be possible without the contributions and world-leading expertise of partners in France, India, Italy and the UK. Scientists in each country are building components of the accelerator, to be assembled at Fermilab. This will be the first accelerator project in the U.S. completed using this approach.

With PIP-II at the center of the laboratory's accelerator complex, Fermilab will remain at the forefront of particle physics research and accelerator science for the foreseeable future.

"This is a very exciting day for the entire international PIP-II team. We are proud to begin construction of a highly capable, state-of-the-art superconducting radio-frequency [accelerator](#) that will serve particle physics for decades to come," said Fermilab PIP-II Project Director Lia Merminga. "Our international partners are essential to the success of PIP-II, and we look forward to engaging in a mutually rewarding adventure."

Provided by Fermi National Accelerator Laboratory

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