Fermilab's Tevatron

The Tevatron operated for 28 years at the forefront of discovery and innovation, informing some of the most important fundamental physics discoveries of our time.

Collider program

The Tevatron became the world's highest-energy proton-antiproton collider in 1985. The CDF and DZero collider experiments generated about 1,000 Ph.D. degrees and one scientific journal article a week describing their world-leading discoveries, observations and measurements.

CDF and DZero experiments

- Discovered the top quark, determined its mass to high precision, and recorded two distinct top-quark production mechanisms
- Explored a new mass range for the Higgs boson and constrained its mass through top-quark and W-boson mass measurements
- Observed the strongest evidence yet for violation of matter-antimatter asymmetry in particles containing bottom quarks
- Discovered five B baryons and the B_c meson
- Made the world's most precise W-boson mass measurment

Fixed-target program

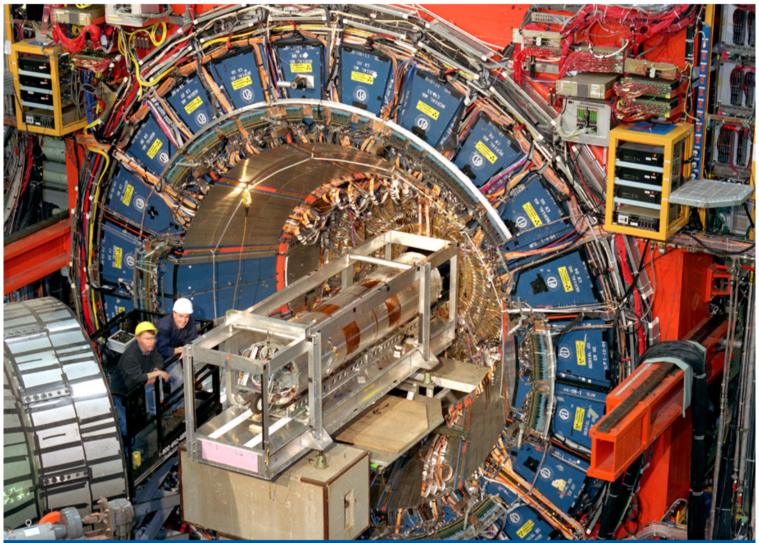
The Tevatron's fixed target program included 43 experiments from 1983 to 2000. About 400 Ph.D. degrees and more than 300 scientific papers were generated through these pioneering experiments that tested and refined the Standard Model of particle physics.

Fixed-target experiments

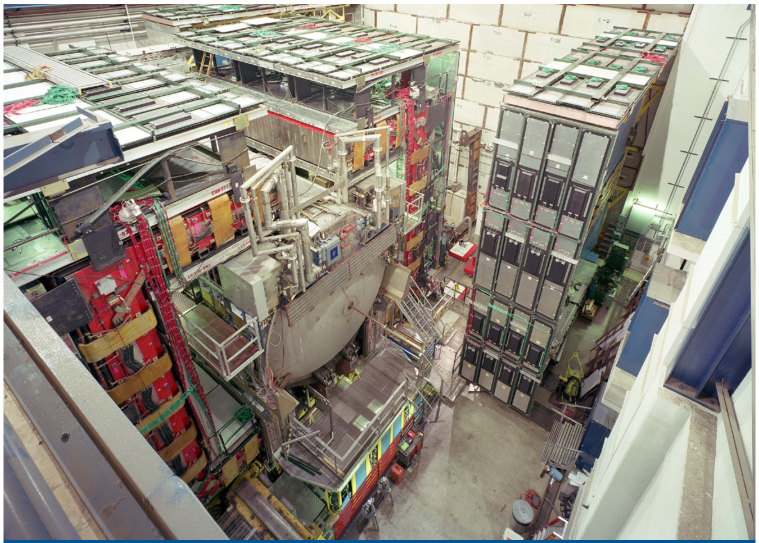
- Discovered the tau neutrino
- Observed direct CP violation in kaon decays
- Made pioneering measurements of charm-quark physics
- Recorded some of the earliest evidence of particle jets
- Measured the quark content and structure of the proton and neutron
- Observed the first atoms of antihydrogen using Fermilab's antiproton source

Photo: Fermilab's Tevatron Accelerator

The Tevatron research program yielded transformational achievements in accelerator, detector and computing technology.



The three-story, 6,000-ton Collider Detector Facility observed the Tevatron's first proton-antiproton collisions in 1985.



Over the course of 20 years, 1500 scientists from 90 institutions in 21 countries used the DZero detector.

Particle accelerator technology

The Tevatron was the world's first superconducting synchrotron. Superconducting magnet technology was developed to double the energy of Fermilab's existing Main Ring accelerator while cutting its energy use by one-third. Because the Tevatron required such a large amount of superconducting wire, it provided the motivation for the expansion of the superconducting wire technology, hastening the commercialization of MRI machines. The innovative design work on the Tevatron earned four scientists the National Medal of Technology in 1989.

The Tevatron's antiproton source was the most intense, consistent source of antiprotons in the world. Scientists working on the Tevatron also pioneered new radio-frequency manipulation techniques and developed the first electron-cooling system.

Aerial photo of Fermilab's fixed-target experimental area.

Particle detector technology

Tevatron experiments pioneered the use of silicon vertex detectors in a hadron collider environment and developed the cesium iodide photon calorimeter. Scientists on Tevatron experiments developed silicon micro-vertex detectors for heavy-quark physics and advanced several types of integrated circuits, transition-radiation detector technology and Ring Imaging Cerenkov Counters. The Tevatron spurred significant advances in triggering, tracking and calorimetry systems that continue to inform the next generation of detectors for particle-physics experiments.

All of Fermilab's particle accelerators are operated and monitored from Fermilab's Main Control Room.

Computing technology

The data analysis and storage needs of Tevatron experiments advanced the use of computing farms and pushed the development of the distributed computing systems that now form the basis for Large Hadron Collider computing. Tevatron experiments pioneered the analysis systems that are now used by experiments around the world to select, analyze and store petabytes of data.