Current complex

CERN operates a network of six accelerators and a decelerator. Each machine in the chain increases the energy of particle beams before delivering them to experiments or to the next more powerful accelerator. Currently active machines are:

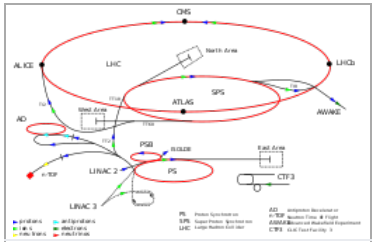
This NeXT Computer used by British scientist Sir Tim Berners-Lee at CERN became the first Web server.

This Cisco Systems router at CERN was one of the first IP routers deployed in Europe.

A plaque at CERN commemorating the invention of the World Wide Web by Tim Berners-Lee and Robert Cailliau

- Two linear accelerators generate low energy particles. LINAC 2 accelerates protons to 50 MeV for injection into the Proton Synchrotron Booster (PSB), and LINAC 3 provides heavy ions at 4.2 MeV/u for injection into the Low Energy Ion Ring (LEIR).[24]
- The Proton Synchrotron Booster increases the energy of particles generated by the proton linear accelerator before they are transferred to the other accelerators.
- The Low Energy Ion Ring (LEIR) accelerates the ions from the ion linear accelerator, before transferring them to the Proton Synchrotron (PS). This accelerator was commissioned in 2005, after having been reconfigured from the previous Low Energy Antiproton Ring (LEAR).
- The 28 GeV Proton Synchrotron (PS), built during 1954—1959 and still operating as a feeder to the more powerful SPS.
- The Super Proton Synchrotron (SPS), a circular accelerator with a diameter of 2 kilometres built in a tunnel, which started operation in 1976. It was designed to deliver an energy of 300 GeV and was gradually upgraded to 450 GeV. As well as having its own beamlines for fixed-target experiments (currently COMPASS and NA62), it has been operated as a proton–antiproton collider (the SppS collider), and for accelerating high energy electrons and positrons which were injected into the Large Electron–Positron Collider (LEP). Since 2008, it has been used to inject protons and heavy ions into the Large Hadron Collider (LHC).
- The On-Line Isotope Mass Separator (ISOLDE), which is used to study unstable nuclei. The radioactive ions are produced by the impact of protons at an energy of 1.0–1.4 GeV from the Proton Synchrotron Booster. It was first commissioned in 1967 and was rebuilt with major upgrades in 1974 and 1992.
- The Antiproton Decelerator (AD), which reduces the velocity of antiprotons to about 10% of the speed of light for research of antimatter.
- The Compact Linear Collider Test Facility, which studies feasibility for the future normal conducting linear collider project.
- The AWAKE experiment, which is a proof-of-principle plasma wakefield accelerator.

CERN accelerator complex



List of current particle accelerators at CERN	
Linac 2	Accelerates protons
Linac 3	Accelerates ions
Linac 4	Accelerates negative hydrogen ions
AD	Decelerates antiprotons
LHC	Collides protons or heavy ions
LEIR	Accelerates ions
PSB	Accelerates protons or ions
PS	Accelerates protons or ions
SPS	Accelerates protons or ions

Large Hadron Collider

Many activities at CERN currently involve operating the Large Hadron Collider (LHC) and the experiments for it. The LHC represents a large-scale, worldwide scientific cooperation project.

The LHC tunnel is located 100 metres underground, in the region between the Geneva International Airport and the nearby Jura mountains. The majority of its length is on the French side of the border. It uses the 27 km circumference circular tunnel previously occupied by the Large Electron–Positron Collider (LEP), which was shut down in November 2000. CERN's existing PS/SPS accelerator complexes are used to pre-accelerate protons and lead ions which are then injected into the LHC.

Seven experiments (CMS, ATLAS, LHCb, MoEDAL,[25] TOTEM, LHC-forward and ALICE) are located along the collider; each of them studies particle collisions from a different aspect, and with different technologies. Construction for these experiments required an extraordinary engineering effort. For example, a special crane was rented from Belgium to lower pieces of the CMS detector into its underground cavern, since each piece weighed nearly 2,000 tons. The first of the approximately 5,000 magnets necessary for construction was lowered down a special shaft at 13:00 GMT on 7 March 2005.

The LHC has begun to generate vast quantities of data, which CERN streams to laboratories around the world for distributed processing (making use of a specialized grid infrastructure, the LHC Computing Grid). During April 2005, a trial successfully streamed 600 MB/s to seven different sites across the world.

The initial particle beams were injected into the LHC August 2008.[26] The first beam was circulated through the entire LHC on 10 September 2008,[27] but the system failed 10 days later because of a faulty magnet connection, and it was stopped for repairs on 19 September 2008.

The LHC resumed operation on 20 November 2009 by successfully circulating two beams, each with an energy of 3.5 teraelectronvolts (TeV). The challenge for the engineers was then to try to line up the two beams so that they smashed into each other. This is like "firing two needles across the Atlantic and getting them to hit each other" according to Steve Myers, director for accelerators and technology.

On 30 March 2010, the LHC successfully collided two proton beams with 3.5 TeV of energy per proton, resulting in a 7 TeV collision energy. However, this was just the start of what was needed for the expected discovery of the Higgs boson. When the 7 TeV experimental period ended, the LHC revved to 8 TeV (4 TeV per proton) starting March 2012, and soon began particle collisions at that energy. In July 2012, CERN scientists announced the discovery of a new sub-atomic particle that was later confirmed to be the Higgs boson.[28] In March 2013, CERN announced that the measurements performed on the newly found particle allowed it to conclude that this is a Higgs boson.[29] In early 2013, the LHC was deactivated for a two-year maintenance period, to strengthen the electrical connections between magnets inside the accelerator and for other upgrades.