The LHC protons originate from the small red hydrogen tank.

electrons are stripped of the hydrogen ions leaving only the nucleus containing one proton. Protons are then accelerated to 2 GeV and injected into the Proton Synchrotron (PS), where they are accelerated to 26 GeV. Finally, the Super Proton Synchrotron (SPS) is used to increase their energy further to 450 GeV before they are at last injected (over a period of several minutes) into the main ring. Here, the proton bunches are accumulated, accelerated (over a period of 20 minutes) to their peak energy, and finally circulated for 5 to 24 hours while collisions occur at the four intersection points.[41]

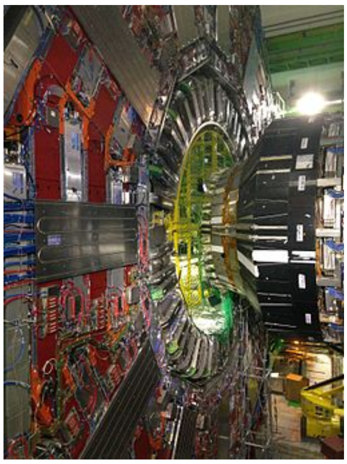
The LHC physics programme is mainly based on proton–proton collisions. However, shorter running periods, typically one month per year, heavy-ion collisions are included in the programme. While lighter ions are considered as well, the baseline scheme deals with lead ions[42] (see A Large Ion Collider Experiment). The lead ions are first accelerated by the linear accelerator LINAC 3, and the Low Energy Ion Ring (LEIR) is used as an ion storage and cooler unit. The ions are then further accelerated by the PS and SPS before being injected into LHC ring, where they reach an energy of 2.3 TeV per nucleon (or 522 TeV per ion),[43] higher than the energies reached by the Relativistic Heavy Ion Collider. The aim of the heavy-ion programme is to investigate quark–gluon plasma, which existed in the early universe.[44]

Detectors

Seven detectors have been constructed at the LHC, located underground in large caverns excavated at the LHC's intersection points. Two of them, the ATLAS experiment and the Compact Muon Solenoid (CMS), are large general-purpose particle detectors.[2] ALICE and LHCb have more specific roles and the last three, TOTEM, MoEDAL and LHCf, are very much smaller and are for very specialized research. The ATLAS and CMS experiments discovered the Higgs boson, which is strong evidence that the Standard Model has the correct mechanism of giving mass to elementary particles.[45]

The BBC's summary of the main detectors is:[46]

Detector	Description
ATLAS	One of two general-purpose detectors. ATLAS studies the Higgs boson and looks for signs of new physics, including the origins of mass and extra dimensions.
CMS	The other general-purpose detector, like ATLAS, studies the Higgs boson and look for clues of new physics.
ALICE	ALICE is studying a "fluid" form of matter called quark–gluon plasma that existed shortly after the Big Bang.
LHCb	LHCb investigates what happened to the "missing" antimatter from when equal amounts of matter and antimatter were created in the Big Bang.


CMS detector for LHC

Computing and analysis facilities

Data produced by LHC, as well as LHC-related simulation, were estimated at approximately 15 petabytes per year (max throughput while running is not stated)[47]—a major challenge in its own right at the time.

The LHC Computing Grid[48] was constructed as part of the LHC design, to handle the massive amounts of data expected for its collisions. It is an international collaborative project that consists of a grid-based