Global collaborations
The CLIC accelerator concept and the CLIC physics experiments are each being developed within world-wide collaborations with partner institutes from many countries. The CLIC accelerator project currently involves more than 40 institutes from over 20 countries. The research and development are carried out in synergy with the International Linear Collider (ILC) project, in which a global collaboration is developing a linear collider based on a different technology. The ILC and CLIC share very similar concepts for the physics experiment and detector technologies, which are being developed in a world-wide collaborative context.

CLIC Test Facility CTF3
The new technologies envisioned by the CLIC design are being examined at the CTF3 test facility at CERN. CTF3 is a scaled-down version of the CLIC facility, which allows the feasibility of this novel scheme and technology to be studied.

Exploration
The world’s biggest and most powerful accelerator, the LHC at CERN, is mapping the route of particle physics for the future. The next step, to complement the LHC in exploring this new region, is most likely to be a linear electron–positron collider.

Innovation
The Compact Linear Collider (CLIC) is a novel approach to such a collider. It is currently under development by the CLIC collaboration, which is hosted at CERN.

Precision
Precise measurements from CLIC would probe new physics uncovered by the LHC – from the Higgs boson to dark matter – allowing current theories to be tested and new ideas to evolve.
LHC: a discovery machine

The LHC accelerates two beams of protons to energies of up to 7 TeV. By studying collisions between protons, physicists at the LHC are exploring new territory in matter, energy and time. Protons contain smaller particles, called quarks and gluons, which share the energy of the colliding protons. While ideal for a discovery machine, as it allows a variety of collisions between quarks and gluons over a range of energies, this complexity makes it difficult to pinpoint the fine details of discoveries.

CLIC: a precision machine

CLIC will accelerate electrons and their antimatter twins, positrons. These are fundamental particles – they are not made up of any smaller components. When they collide, they annihilate into a burst of energy that is known with great accuracy. This makes it much easier to pick out the right data from the huge amount of background information. The intense energy materializes in the formation of many new particles thus opening a doorway to novel physics. CLIC would be used to probe in detail new physics discovered at the LHC, for example by measuring precisely properties such as the mass of the new particles.

Linear acceleration

The LHC is based on a circular accelerator. However, when high-energy electrons and positrons are forced on a curved track they emit electromagnetic radiation and lose energy. To overcome this limitation and reach high energies similar to the LHC, electrons and positrons must accelerate along a straight line. As a linear collider, CLIC will use two linear accelerators: one for electrons, the other for positrons. The two accelerators will point straight at each other, simultaneously shooting beams of particles aimed so precisely that they collide head on at the centre of a detector.

The detector

The detector at CLIC will surround the collision point, where bursts of particles are produced in the electron–positron interactions. The detector has the shape of a huge can, with a cylinder and two caps, filled with successive detection layers. The particles traverse the different detector layers and the signals generated by their passage allows the collection of detailed knowledge about each particle, such as its electric charge, energy and type.

Push-pull detector

CLIC is designed to have two detectors. Only one can be used at a time, so the detectors will sit on a huge ‘push-pull’ platform that can be moved across the collision point. With two experiments, one will be able to verify the results of the other. This will be crucial for confirming new discoveries.

Particle signals

Many particles traverse the detector at the same time and leave overlapping signals. The goal is to separate and identify each particle individually. This allows the most precise reconstruction possible of the original conditions of the collision, which may have produced new and, so far, undiscovered particles.

Two-beam acceleration

CLIC is based on a novel ‘two-beam acceleration’ scheme in which the electron and positron beams of the main accelerators are supplied with radio-frequency (RF) power by a high-intensity electron ‘drive beam’ accelerator. This scheme develops strong accelerating fields and allows electrons and positrons to reach the high energies required for new physics, but over a shorter distance. CLIC’s novel design is the only possible approach to reach the multi-TeV energies of the LHC with the precision required for detailed analysis.
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