mechanics and general relativity.[15]

Data are also needed from high-energy particle experiments to suggest which versions of current scientific models are more likely to be correct – in particular to choose between the Standard Model and Higgsless model and to validate their predictions and allow further theoretical development.

PS	Accelerates protons or ions
SPS	Accelerates protons or ions

Issues explored by LHC collisions include:[16][17]

- is the mass of elementary particles being generated by the Higgs mechanism via electroweak symmetry breaking?[18] It was expected that the collider experiments will either demonstrate or rule out the existence of the elusive Higgs boson, thereby allowing physicists to consider whether the Standard Model or its Higgsless alternatives are more likely to be correct.[19][20]
- is supersymmetry, an extension of the Standard Model and Poincaré symmetry, realized in nature, implying that all known particles have supersymmetric partners? [21][22][23]
- Are there extra dimensions,[24] as predicted by various models based on string theory, and can we detect them?[25]
- What is the nature of the dark matter that appears to account for 27% of the mass-energy of the universe?

Other open questions that may be explored using high-energy particle collisions:

- It is already known that electromagnetism and the weak nuclear force are different manifestations of a single force called the electroweak force. The LHC may clarify whether the electroweak force and the strong nuclear force are similarly just different manifestations of one universal unified force, as predicted by various Grand Unification Theories.
- Why is the fourth fundamental force (gravity) so many orders of magnitude weaker than the other three fundamental forces? See also Hierarchy problem.
- Are there additional sources of quark flavour mixing, beyond those already present within the Standard Model?
- Why are there apparent violations of the symmetry between matter and antimatter? See also CP violation.
- What are the nature and properties of quark–gluon plasma, thought to have existed in the early universe and in certain compact and strange astronomical objects today? This will be investigated by *heavy ion collisions*, mainly in ALICE, but also in CMS, ATLAS and LHCb. First observed in 2010, findings published in 2012 confirmed the phenomenon of jet quenching in heavy-ion collisions.[26][27][28]

Design

The collider is contained in a circular tunnel, with a circumference of 26.7 kilometres (16.6 mi), at a depth ranging from 50 to 175 metres (164 to 574 ft) underground. The variation in depth was deliberate, to reduce the amount of tunnel that lies under the Jura Mountains to avoid having to excavate a vertical access shaft there. A tunnel was chosen to avoid having to purchase expensive land on the surface, which would also have an impact on the landscape and to take advantage of the shielding against background radiation that the earth's crust provides.[29]