About the Higgs boson

It is an elementary particle, which is the smallest unit in nature. Modern physics considers that all phenomena in the natural world can be explained in 17 elementary particles.

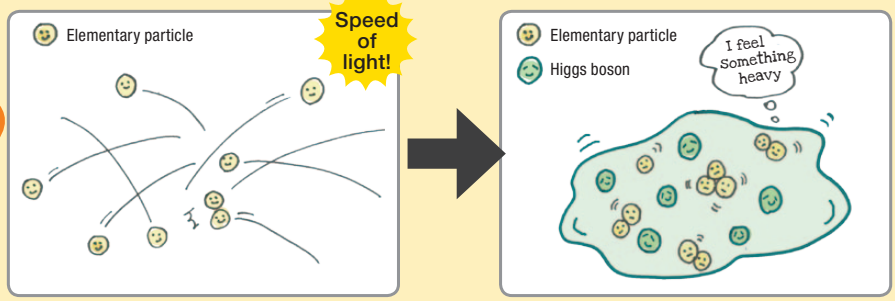
Sixteen of the 17 particles, including those that constitute substances and those that transmit forces, had already been discovered. Only the Higgs boson, which functions to provide mass (weight) to substances, had remained unidentified.

Furukawa's technology contributed to the discovery of the Higgs boson

On July 4, the discovery of the Higgs boson called "God particle" received extensive coverage in the press. The European Council for Nuclear Research (Conseil Européen pour la Recherche Nucléaire: CERN), headquartered in Geneva, Switzerland, announced the discovery of a new particle that it deemed to be the Higgs boson, which for many years has been the target of a search by physicists around the world. Furukawa Electric contributed significantly to what some are calling the discovery of the century.

The Higgs boson is referred to as the "God particle" because it has a significant role in the formation of the universe and substances.

The birth of the universe



No mass

Generated in the Big Bang, the elementary particles originally had no mass. They moved about at the speed of light without sticking to one another, even if they collided.

With mass

The Higgs boson particles clung to other elementary particles like starch syrup and acquired mass by applying a brake to the movements of the elementary particles.

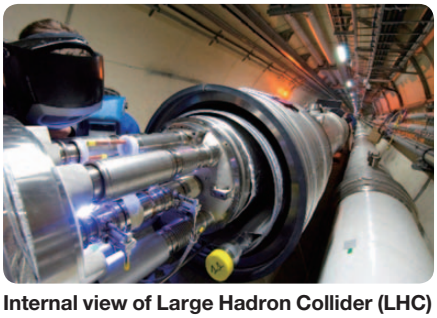
This made it easier for elementary particles with mass to gather. Some of these particles stuck to one another to form the origin of atoms. This is how the Earth, all substances in the universe and humankind are believed to have originated.

It is said that if it were no Higgs boson, the human body would be torn apart in one billionth of a second.

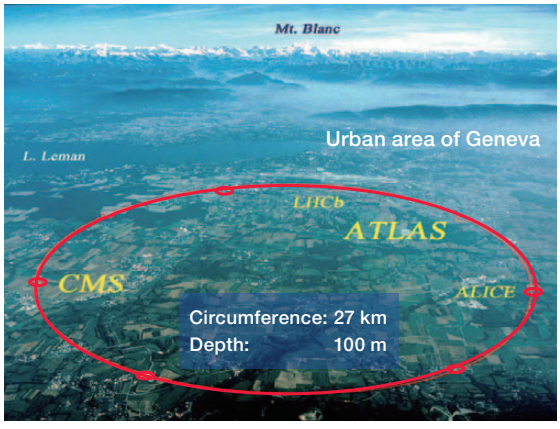
The ongoing study of the Higgs boson is expected to reveal the mysteries of our world and our lives.

CERN's great experiment

To confirm the existence of the Higgs boson, CERN has undertaken repeated experiments using an ultra-large particle accelerator called the Large Hadron Collider (LHC). In these experiments, a high-energy state is created that is similar to the state that existed immediately after the Big Bang state, and the movements of particles are observed within this state. In a 27-kilometer pipe, rotating protons travel and accelerate close to the speed of light. They are made to collide with other protons that are traveling in the opposite direction to artificially recreate the Big Bang state. Every time this occurs, elementary particles are generated by collision, and identified by the detector.



Internal view of Large Hadron Collider (LHC)



Area of operation of Large Hadron Collider (LHC) (Switzerland)

Furukawa's contribution

CERN's Large Hadron Collider (LHC) utilizes strong magnetic forces for accelerating protons to almost the speed of light and to bend well them along the circular curve. A superconducting magnet is used to generate a strong magnetic force. The pipe in which the protons travel is located in the center of the superconducting magnet. Further, a special, gigantic superconducting magnet is used as the device for detecting the elementary particles generated from the collided protons.

The enormous quantity of superconducting wires for the magnet is manufactured by Furukawa. An unprecedented level of technological subtlety is required, and there is reportedly no other manufacturer capable of producing it.

Furukawa have took charge that is considered the "heart" of the experimental device, which requires an extraordinary level of technology.

In the manufacturing process, even a minute foreign material like dust could cause wire breakage, so the thorough removal of impurities is required. In addition, the technology for assembling wires into a cable was difficult and entailed numerous requirements and challenges. After a process of trial and error with various devices, however, Furukawa became the first company in the world to fully satisfy the requirements. It is said that the discovery of the Higgs boson would have been significantly delayed without Furukawa's superconducting wires.
In recognition of this achievement, Furukawa was awarded the Golden Hadron Award by CERN in September 2004.

LHC cable

Right:
Mr. L. Evans
(LHC Project Leader)

Wins the Golden Hadron Award
(at CERN in September 2004)

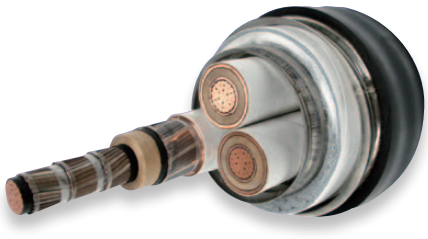
Structure

More than 6,000 copper-covered, rod-like superconducting substances are forced tightly into a tube of around one meter in length, which is then heated to a maximum temperature of 900 degrees and extruded so that the substances stick together. It is then stretched more than 100 times until it becomes a wire with a maximum diameter of 0.8 mm. It may be as long as 55 km. Thirty-six of these wires are assembled and flatten shaped into a 750-meter cable.

About superconductivity

Superconductivity is a phenomenon whereby electrical resistance completely disappears at a certain temperature (critical temperature) or lower, thereby allowing a permanent current to flow and a strong magnetic field to origin.

Furukawa is manufacturing Low Temperature Superconductor(LTS) that is in superconductive state at minus 269 degrees and High Temperature Superconductor, (HTS) at minus 196 degrees. HTS cables were used in discovery of the Higgs boson, while HTS power cables are expected to be effective worldwide to significantly reduce transmission loss.



Three-phase, high-temperature superconducting power cable

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