

KAESER compressors support basic research

## HSD-V CERN-LHC

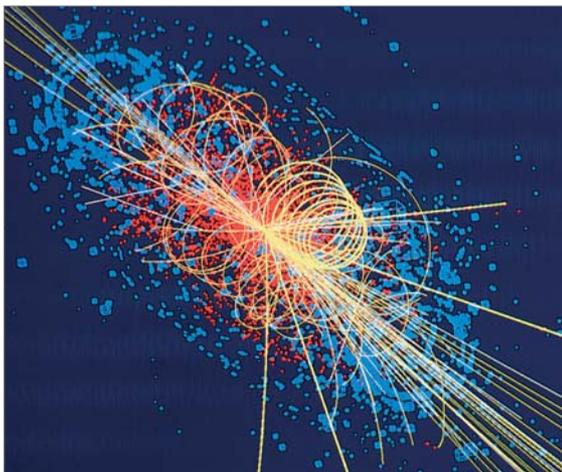


Two KAESER rotary screw vacuum pumps are part of the cryogenic plant of the new, gigantic experimental installation for CERN, the European Organisation for Nuclear Research. CERN is located on the border between France and Switzerland, just outside Geneva.

Large Hadron Collider (LHC) is the term used for the new particle accelerator being built on the fringe of the Swiss metropolis by the Centre Européenne pour la Recherche Nucléaire (CERN). "Large" is certainly no exaggeration because the circular particle accelerator measures 27 kilometres around and is housed in a tunnel 100 m underground. On this elementary particle 'race-course', 3,500 super conductive magnets are the building blocks that keep matter on course. Superconductivity, the complete disappearance of electrical resistance in a substance, is only possible close to absolute zero (0 Kelvin, -273.16 °C). The working temperature of the magnets is

**Traces made by an elementary particle collision in a CERN accelerator**

1.9 Kelvin, significantly lower than the mean temperature in space, which, as one explanation goes, does not fall below 3 Kelvin because of the residual heat of the big bang. In the Large Hadron Collider, to be commissioned in 2006, the CERN scientists want to study the head-on collisions of particles. The LHC machine is an accelerator which brings protons into collision at higher energies than ever achieved before. This will allow scientists to recreate the conditions prevailing in the early universe immediately after the big bang and penetrate still further into the structure of matter. In keeping with the times, the provision, operation and maintenance of the world's largest cryogenic plant to extract liquid helium needed to achieve such extremely

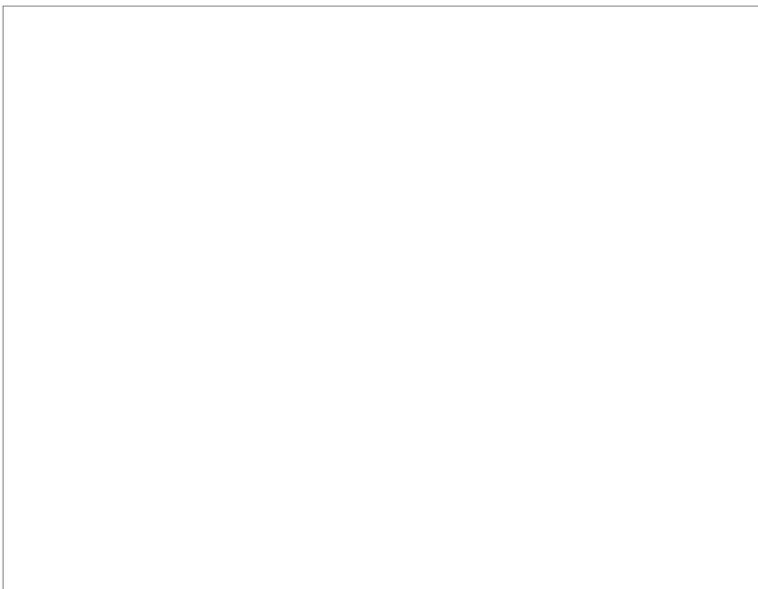




low temperatures was outsourced to specialists. A consortium made up of Air Liquide, Linde Kryotechnik AG and the Service and Project Management Company Serco GmbH, in Bonn has been awarded the contract and construction is now in full swing with KAESER's contribution already installed. Air Liquide purchased two KAESER rotary screw HSD-V vacuum pumps for the project, which places highest demands on efficiency and reliability. The decision to use these machines which, to quote Managing Director Thomas Kaeser, "... embody everything we know about extracting gases with rotary screw compressors", bears

witness to the competence and leadership of this family enterprise in its own field of engineering.

**Handover in the test facility at Kaeser: Herbert Wahl (KAESER) with Gilles Gaillard and Eric Walter from Air Liquide (from left)**



**One of the two KAESER rotary screw vacuum pumps at its final location 100 metres under the Earth's surface**

### Hadrons?

In text on the website of the University of Freiburg's faculty of physics involved in an important CERN research project, the following remarks are made with reference to the definition of elementary particles, "Mesons are the 'medium' and baryons the 'heavy' particles. Together, these two form the hadrons (from the Greek word for strong) so named because they participate in the so called strong interaction. Emperor Hadrian's name is derived from this word, as is in turn the Adriatic Sea.

It is because of the fact that atomic nuclei (which are made up only of positively charged protons and neutral neutrons) do not explode because of electrostatic repulsion (nuclear bombs being the exception to the rule, of course) that one can assume that between the nucleons [nuclear particles, Ed.] forces of other origin (nuclear forces) are acting to bind the protons and neutrons to each other in the nucleus. This intermediary interactive nuclear force is called the 'strong' interaction.

[...] interaction between particles [could be] described by the exchange of field quanta. A descriptive analogy would be two ice skaters throwing a ball at each other and moving apart because of the reaction. Australian aborigines throwing their traditional boomerang at each other could even establish a potential of 'attraction'. But, like every other well-intended exemplification, this has been simplified too far, apart from ignoring the question as to where frozen lakes are to be found in Australia."

Internet address:  
<http://hpfrs6.physik.uni-freiburg.de/opal/fp11/node12.html>