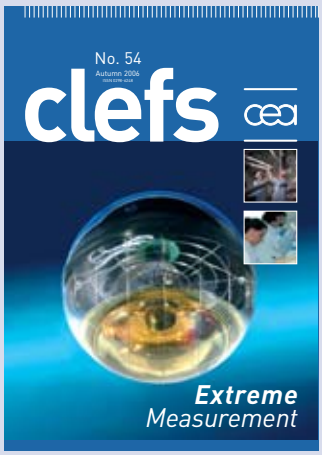

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Main picture:
A photomultiplier for the ANTARES experiment, seeking to detect high-energy neutrinos by means of the Cerenkov light generated by muons yielded by the interaction of neutrinos with the ambient environment, at the bottom of the Mediterranean sea. This experiment is one of many examples (not included in those presented in this issue) of "extreme measurement," carried out by CEA and its partners.
CEA/DAPNIA/J.-J. Bigot

Inset (top): Checking diagnostics inside the Laser Integration Line (LIL) experiment chamber, at CEA's CESTA Center, at Le Barp (Gironde *département*, southwestern France). LIL is the prototype installation, consisting in one elementary line, ultimately comprising eight beams, as intended for the Megajoule Laser (LMJ), being constructed on the same site, under the aegis of the Simulation Program of CEA's Military Applications Division.
P. Stroppa/CEA

(bottom): Analyzing unknown samples by immunoassay, at the Pharmacology and Immunology Department (SPI) of the Life Sciences Division, at CEA's Saclay Center (Essonne *département*, near Paris).
L. Godart/CEA

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Editorial

If there is one feature that is common to all of CEA's activities, it has to be the use of measurement, in all of the forms this takes, implementing any number of methods, in conditions that are often extreme, or novel, for the purposes of confronting theory and reality. The idea of preparing an issue of *Clefs CEA* on this theme was a natural one. The difficulty lay in the choice of examples to be presented, bearing in mind how long the list is, of topics worth covering.

From the outset, the area of fundamental research, with its forays into the infinitely large, the infinitely small, and the infinitely complex, provides impressive illustrations of the advances that had to be achieved, whether it be with respect to measuring distant processes – which, in astrophysics, also means they occurred in the distant past – or entities hitherto extant only in imagined form. Such is the case with the quest for the Higgs boson, or the constituents of the mysterious dark matter. Particle physics, at the same time, with parity violation in the weak interaction, provides both an instance of astonishingly precise measurement, and of the use of a quirk of nature, to measure another object of interest: the proton.

Earth and environmental sciences are not to be outdone, providing as they do outstanding examples, with the indirect measurement of past temperatures, and the investigation of large-scale atmospheric processes by means of infrasounds. In the former instance, nuclear science supplies an irreplaceable "isotopic thermometer." While fission nuclear energy is barely represented in this survey, this is hardly for want of involving extreme measurements: examples of this kind alone would suffice to fill an entire issue. Nevertheless, it is indeed nuclear energy specialists who are contributing to improvements in optical microscope resolution, to examine "nuclear glasses," or taking part – on the strength of their experience with measurement in exacting conditions, exposed to radiation – in the development of a method allowing the "doubly remote" analysis of rocks: away on Mars, and at a distance of several meters from the robot carrying out the measurement.

Thermonuclear fusion, characterized as this is by extreme density, pressure, and temperature conditions (and extremely short durations), offers extensive scope for measurement. In magnetic-confinement fusion, due to be tested in ITER, extreme measurements form but one of the many challenges set to the designers. With inertial-confinement fusion, as implemented in the Megajoule Laser, for the purposes of nuclear weapons simulation, and for other scientific programs, hot, dense plasmas will be measured in conditions hitherto never brought together. During the initial phase in the functioning of a nuclear device, flash radiography of materials compressed by the action of chemical explosives is likewise pushing measurement techniques to the limits of their resources.

In another area, the convergence of biotechnologies and information technologies is opening up prospects for personalized diagnosis, and therapy, for every patient. The performance exhibited in detection of a single molecule, or receptor, is equally found in the trace measurement of explosives, or toxic gases in the environment, to ensure the safety of citizens, in particular. The health and security of humans are, first and foremost, the beneficiaries of advances achieved in measurement. Which duly brings us round full circle, bearing in mind, as the Greek sophist philosopher Protagoras is held to have said, that "Man is the measure of all things.

> Bernard Bouquin

CEA is one of the foremost technological research organizations in Europe, with respect to energy, defense, security, and new information and medical technologies. Through the gamut of its diverse programs, it pursues two major goals: that of becoming the leading technological research organization in Europe, and ensuring the continuing viability of the French nuclear deterrent, one of its historic briefs, as Atomic Energy Commission.
The organization's assets are a meeting of cultures, bringing together engineers and research scientists, conducive to synergies between fundamental research and technological innovation; outstanding facilities; and actual involvement in the industrial and economic fabric, with a portfolio of 2,203 currently valid patents, including 332 priority patents, at the end of 2005.
With sites in France accommodating nine research centers, distributed across the country, CEA, with a workforce of 15,000 and an annual budget of €3.2 billion, benefits from its strong involvement at regional level, and sound partnerships with other research organizations, local authorities, and universities.
Internationally recognized for its expertise in its areas of competence, CEA, operating as a public-sector establishment of industrial and commercial character under French law (EPIC), while itself forming a unique category of public-sector establishment, is fully involved in the European Research Area.
A major player in the field of research, development and innovation, the organization, since 1984, has presided over the setting up of 97 new companies in the high-technology sector.