CESAR

Cryogenic Electronics for Space Applications and Research

A COOL, SHARPER LOOK AT OUR UNIVERSE

The space environment is a major challenge for the development of cryogenic electronics used for high precision sensors. The CESAR project explores new solutions in this domain.

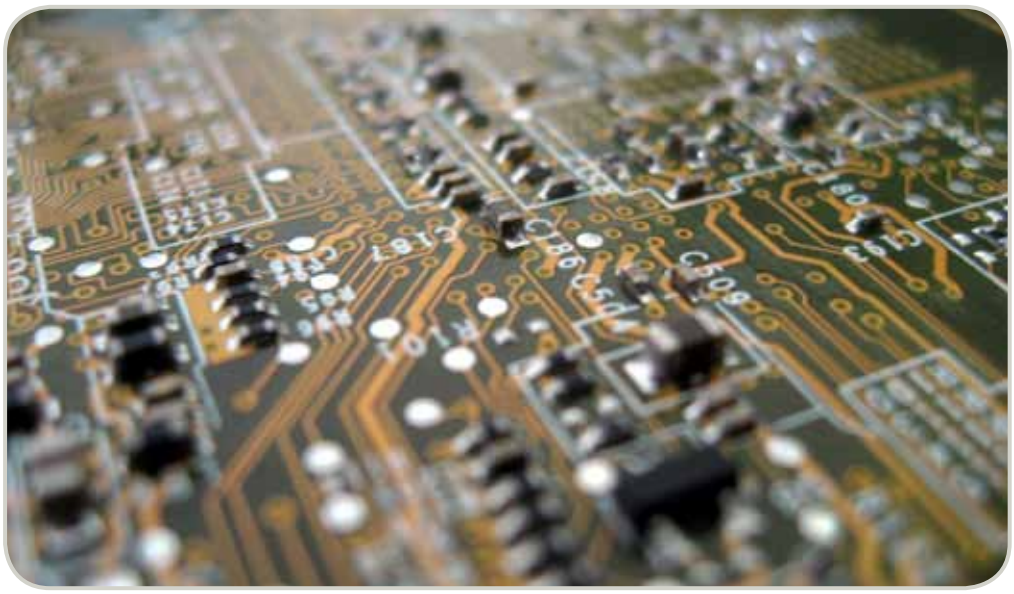
Today, Ultra-Low temperature sensors (T<0.1K) provide unprecedented performances in X-ray and far Infrared astronomy by taking advantage of physical properties of matter close to absolute zero. In the coming decade, the European Space Agency has scheduled programs in both fields with improved detector arrays, enhancing the number of pixels and signal sensitivity. This is a consequence of the great successes of the XMM-Newton, Planck and Herschel missions launched by ESA in 1999 and 2009.

Nevertheless these developments are slowed down by the restricted amount of available power, at low temperature, in space conditions. The power budget is mainly consumed by the ever-growing number of wires, linking the cooled detectors to the distant (10 m) warm electronics.

The only solution is the development of the signal processing at the heart, or close to the detectors themselves. The development of such cryogenic and complex electronics is the "three steps" goal of CESAR.

The first step is the manufacture of front-end electronics with intrinsic properties as good as detector ones. The second step is the development of ultralow dissipation complex electronics circuits - amplifiers, filters, multiplexers, DACs and ADCs - working below 4K. The third step is a combination of both developments and end-to-end tests.

CESAR developments have found applications to the medical and scientific domain through the magnetometric brain imaging. The association of the cold electronics circuits with giant magnetoresistive sensors could efficiently compete with current techniques.



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CESAR will provide new ultra-low temperature detector arrays with signal processing capabilities at the heart of the detectors.

LOUIS **RODRIGUEZ**
IS PROJECT COORDINATOR

QUESTIONS & ANSWERS

What do you want to achieve with this project?

Because signal is degraded by transport, our aim is the integration of electronics functions as close as possible to the signal generation. For cryogenic detectors, this must be done by electronics working at very low temperature; this is not the case for the conventional one.

Why is this project important for Europe?

It offers a toolbox in many fields to detector developers, not only in fundamental science, but also in advanced technology and medical applications. As everyday new cryogenic systems enter the public domain - MRI, superconductivity -, CESAR will provide a new expertise in Europe.

How does your work benefit European citizens?

A step in human knowledge is often the consequence of a technological development. With the CESAR development we will contribute to better sensors for astronomy, sharper images for MRI diagnostics, and in integrated electronics for plasma control inside future fusion plants.

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LIST OF PARTNERS

- Commissariat à l'Energie Atomique et Energies Alternatives (CEA), France
- Interuniversity MicroElectronics Centre (IMEC), Belgium
- Centre National de la Recherche Scientifique (CNRS), France
- University of Palermo (UNIPA), Italy
- Konkoly Observatory (KO), Hungary
- Imperial College (IC), United Kingdom

COORDINATOR

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PROJECT INFORMATION

Cryogenic Electronics for Space Applications and Research (CESAR)
Contract no: 263455
Duration: 36 months
EU Contribution: € 1.998.050,10
Estimated total cost: € 2.633.933,80

DEVELOPING CRITICAL TECHNOLOGIES