Programme Inter Carnot-Fraunhofer
PICF

- Edition 2009 -

List of the financed projects :

Acronym and title of the project	Institutes
3µP : Multi-Reaction, Multi-Sample Microfluidic Platform	Fraunhofer IZM and IZI Institut Carnot FEMTO-Innovation
APUS : Auspicious high-Performant Ultrafast laser System	Fraunhofer IOF Institut Carnot ESP
ARTEMIS : Antennas aRrays for Terahertz Material Identification and Security Applications	Fraunhofer IPM Institut Carnot IEMN
BIOCAPABILI : Investigation of new anti-bacterial biomaterials based on biomimetic calcium phosphates to prevent bone infections – Comparative critical study in view of industrial developments	Institut Carnot CIRIMAT Fraunhofer IGB
DeeptCity3D : Integrated 3D visualisation for urban surface and underground data	Institut Carnot BRGM Fraunhofer IGD
DEVICE : Downsized hybrid Diesel Engine for Very low fuel consumptIon and CO2 Emission	Institut Carnot IFP-Moteurs Fraunhofer LFB Volkswagen AG
DEVICE-SOFT : DEductive Verification for Industrial Critical Embedded Software	Institut Carnot LIST Fraunhofer FIRST
RT-DESCRIBE : Iterative Design Process for Self-Describing Real Time Embedded Software Components	Fraunhofer ESK Institut Carnot LIST
SOLARBOND : Development of multi-junctions high efficiency solar cells on reclaimable substrates	Fraunhofer ISE Institut Carnot LETI
TOTEM : Theory and Tools for Distributed Authoring of Mobile Mixed Reality Games	Fraunhofer FIT Institut Carnot EURECOM-TELECOM

Acronym and title of the project	**Institutes**
VERTIGAN : Vertical-Cavity emitters based-on GaN for optical fiber sensors	Institut Carnot C3S Fraunhofer IAF

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Programme Inter Carnot-Fraunhofer

Edition 2009

Titre du projet	3µP – Multi-Reaction, Multi-Sample Microfluidic Platform
Résumé	The health sector has been identified as a very promising field for future applications of microtechnology. Demographic development, global spreading of diseases, DNA based therapies as well as developments in personalized medicine can be addressed only, if the respective diagnostic methods allow an easy, ubiquitous and cost efficient use for the targeted Microfluidics has progressed significantly and many of today´s analytical technologies can be scaled down onto a "lab on chip" (LOC) device which brings decisive advantages in term of reagent and sample consumption, speed analysis and portability. Merging state of the art lab-on-chip technology with modern fabrication techniques and electronics innovation is perceived as enabling to overcome the difficulties, leading to a higher versatility, lower overall cost and improved applicability. Using scalable technologies for fabrication and a hybrid integration of single-use and multi-use components, is another key factor to drive costs down for market acceptance. The project proposes developing a hybrid platform composed of, on one hand, a reagent storage and dispensing unit based on a classical, microfluidic LoC platform, and on the other hand, a reaction plate for droplets based on EWOD principle interfaced with a fluorescence detection system. The originality of this platform consists in coupling a classical microfluidic platform with a droplet platform, enabling both multiple usage at the diagnostic level (multiple reagents) and single use per patient (droplet level). This platform will be implemented and demonstrated on various RNA analyses.
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Aide de l'ANR	125424 euros
Début et durée	Septembre 2009 - 36 mois
Référence	ANR-09-CARN-001

Titre du projet	**APUS** : Auspicious high-Performant Ultrafast laser System

Résumé

Sources of ultrashort and high peak power optical pulses have become extremely important for numerous applications such as spectroscopy, remote sensing and medical treatments. In fact, considerable progress has been made over the last decade to obtain femtosecond sources based on numerous gain architectures and gain media. However, ultrashort laser systems still suffer from the reputation to be laboratory curiosities, which are sensitive, expensive and need a PhD to be operated.

The proposed technology possessed technology has outstanding advantages of canonical approaches of pulsed laser systems. Therefore, the goal of the proposed project is to develop affordable and alignment-free ultrafast laser source with a performance qualified for a large variety of scientific and industrial applications. Such a source would be able to address a manifold market possessing a significant growing potential.

The two research groups involved – the CORIA laboratory group at the University of Rouen and fiber laser group of the Fraunhofer-Institute for Applied Optics and Precision Engineering (Fraunhofer IOF Jena) – have a world-leading reputation for their excellent contributions in the field of rare-earth-doped fiber oscillators and amplifiers over the recent decade. Hence, the two partners form a promising consortium to reach the projects goals. Both institutions have excellent connections to industrial partners which eventually will bring the developed technology to the market.

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Aide de l'ANR

263 120 euros

Début et durée

Septembre 2009 - 36 mois

Référence

ANR-09-CARN-010

Titre du projet	**ARTEMIS :** Antennas aRrays for Terahertz Material Identification and Security Applications
Résumé	For civil security application Terahertz (THz) technique has an unique features that make THz technique very promising for this application: identification of concealed hazardous substances like explosives and drugs from a safe distance (standoff identification). The most promising approach for spectroscopic measurements is Terahertz Time domain spectroscopy, because this technique covers the spectral range of 0.1 THz to more than 3 THz in a single measurement. This spectral range is particularly well suited for this application. THz technologies have experienced rapid progress during recent years towards a mature technique for off-line applications. For standoff identification, however, high power THz emitters and high sensitive THz detectors are required which are actually are not available. We propose to fulfill these requirements by using arrays of photoconductive switches which are designed as either stripline antenna, dipole antenna or horn antenna due to their different characteristics.
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Aide de l'ANR	334 010 euros
Début et durée	Septembre 2009 - 36 mois
Référence	ANR-09-CARN-002

Titre du projet	BIOCAPABILI : Investigation of new anti-bacterial biomaterials based on biomimetic calcium phosphates to prevent bone infections – Comparative critical study in view of industrial developments

| Résumé | Post-surgery bone infections (orthopedics, cranial and maxillo-facial surgeries, arthoplasty...) represent nowadays a major socio-economical issue, including in Europe. Taking into account the severity of the consequences of bone infections for the patients (prosthesis loosening, risks for amputation, extreme difficulty to eradicate infectious germs within bone tissue...), the prevention of such infections is now being considered by clinicians as a crucial necessity. In this context, the Bio-capabili project aims at elaborating, studying and pre-developing innovative biomaterials for bone tissue engineering, based on novel biomimetic calcium phosphates analogous to bone mineral and capable of inhibiting post-surgery bone infections thanks to the incorporation of intrinsic anti-bacterial properties. |

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Aide de l'ANR	283 318 euros
Début et durée	Septembre 2009 - 36 mois
Référence	ANR-09-CARN-003

Titre du projet	DeeptCity3D : Integrated 3D visualisation for urban surface and underground data

Résumé

Europe cities and their hinterlands are major foci of business, heritage, culture and development. Many have geological issues that inhibit economic and sustainable development. Moreover, underneath today's city streets exists a labyrinth of caves, quarries and lifelines (sewer, gas, electric and telecommunication lines). The knowledge about the location of these buried infrastructures represents crucial information for a continuous utility management, including quick response to emergencies, efficient repair working and planned extensions of existing networks.

The 3D visualisation of all buried utilities as well as geoscientific information is technically feasible. However, an application integrating and visualising the subsoil components into a city model (i.e. buried networks and geoscientific information like geological models, drill-holes, hydrogeological models ...) does not yet exist. Such tools may prove to be very useful in the management of underground related issues (e.g. maintenance of networks, underground water levels, mechanical properties of soils, presence of cavities, etc), which is at the moment less intuitive due to the lack of underground information in City Models. DeepCity3D project intends to develop application-adaptive 3D visualisation tools that integrate for the first time underground data and City models (provided in standardised formats) with advanced functionalities to support decision making in Urban Planning, Construction Companies, Insurance Companies, Architects, Environmental Protection.

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255 880 euros

Début et durée

Septembre 2009 - 36 mois

Référence

ANR-09-CARN-004

Titre du projet	**DEVICE** : Downsized hybrid Diesel Engine for Very low fuel consumptIon and CO2 Emission

Résumé

The target of this project is to reduce CO_2 emissions of a Diesel city vehicle, and more precisely to raise the technological locks of an innovating concept of small capacity Diesel engine applied to the automobile and ultra-low CO_2 emissions, using an efficient global methodology.

In the last decades, downsizing technology allows to deeply decrease CO_2 emission of Diesel engines, but these benefits are very reduced while the engine displacement is lower than around 1.5 liter. Indeed, decreasing the unit displacement of Diesel engines generally reduces the overall energy efficiency, related to the reduction in piston swept volume for a given number of cylinders. In addition, it is currently impossible to reduce the number of cylinders due to the very high acyclism and vibration levels with this type of architecture, especially in Diesel engines, incompatible with current customer expectations.

The innovating approach consists in combining "mild hybrid" type hybridisation with a 2-cylinder engine not only to further reduce the CO_2 emissions by recovering energy during use, but also to use electric tractive force (in pure traction or to assist the thermal engine) to considerably attenuate or even eliminate the vibrations and compensate for the supercharging deficit.

Partenaires

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599 978 euros

Début et durée

Septembre 2009 - 36 mois

Référence

ANR-09-CARN-005

Titre du projet	**DEVICE-SOFT** : DEductive Verification for Industrial Critical Embedded Software

Résumé	It is widely believed and accepted that embedded systems will continue to rise in their applicability and usage across numerous market sectors However, in some cases, systems must satisfy stringent assurances i.e. safety-critical requirements. In particular, these sectors include the aerospace, medical, railway, and potentially the automotive industry. In such systems, consequence of a failure can be disastrous e.g. financially or even in terms of human life. Consequently, in these instances, it is very important that products demonstrate adherence to higher safety assurance levels. Traditional testing methods have been shown to be too expensive for these classes of systems. With traditional methods, reaching test-coverage that is appropriate when lives are at stake requires an ever bigger part of the development budget as embedded software grows in size and complexity. At these higher assurance levels, it can become more efficient to rely on mathematically rigorous methods that formally prove desired safety properties in software.
	While such methods, particularly, Hoare-logic-based deductive verification have been successfully studied from an academic point of view, their use in real-world applications developed in contemporary programming languages for embedded software remains largely undone. In this context, the main goal of the DEVICES project will be to disseminate, improve, integrate, and deploy deductive verification technologies into the industrial domain of safety-critical embedded systems. It is thus an industrial research project. It is mainly based on the Frama-C framework for the analysis of C programs and its associated specification language ACSL.

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Aide de l'ANR	158 756 euros
Début et durée	Septembre 2009 - 36 mois
Référence	ANR-09-CARN-006

Titre du projet	**RT-DESCRIBE** : Iterative Design Process for Self-Describing Real Time Embedded Software Components

Résumé

The rapid and large expansion of software in embedded systems has triggered similar or larger demands of more rich, complex and new sets of embedded functions. Even if the increase of power of the processors and dedicated electronic systems is continuous and rapid, the embedded system domain remains still characterized by the need to deal with fixed amount of resources. This constraint is an important competitive element for mass products, such as automotive systems. In this sector it is foreseen a rising number of replacement of, often safety related, mechanical functions by electronics ones and of addition of new functions (e.g. for driver assistance, infotainment or new power train concepts) is expected. Today's embedded software systems dominates a fixed assignment of functions to resources. This paradigm has led to very complex networked embedded systems. There is an increasing risk, that the resulting complexity will not be mastered in the engineering of new car models. New paradigms are required to overcome this challenge. Particularly interesting candidates for are self-adaptive software systems incorporating description of contextual needs of the resource. This includes questions of (re-)configuration, organization, healing and protection among others.

Many advantages are expected with a self-adaptive approach: on one side, the capability to integrate new functions in existing or even in running systems; and, on the other side, the capability to ensure better balance between higher resource efficiency and higher reliability. This is of particular importance for the "tomorrow" generations of cars and embedded systems.

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Aide de l'ANR

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Début et durée

Septembre 2009 - 36 mois

Référence

ANR-09-CARN-007

Titre du projet	**SOLARBOND** : Development of multi-junctions high efficiency solar cells on reclaimable substrates

Résumé

The overall Photovoltaic (PV) industry grows by more than 30 % per year and the market volume is expected to reach over 20 billion Euros in 2010. Most of the technology in the field is based on silicon solar cells today. On the other hand, III-V multi-junction solar cells are reaching significantly higher solar to electric conversion efficiencies exceeding 40 %. These solar cells are widely used for powering satellites and recently also the promising terrestrial market of concentrator PV is starting to grow rapidly. These systems make use of the highest efficiency III-V multi-junction solar cells under an optical concentrator such as a Fresnel lens, concentrating the sunlight by a factor of 500-1000. In this way the area of expensive III-V semiconductor material is greatly reduced by the use of cheaper optical elements. Still, the solar cell accounts for approximately 20 % of the system costs. Therefore, reducing the cost of the multi-junction solar cell as well as increasing their conversion efficiency are important strategies for achieving the goal of making this technology competitive to conventional energy sources in the future.

In the project "SolarBond", we are aiming to develop and demonstrate a new alternative substrate technology which allows growing high-efficiency GaAs based solar cells with excellent crystal quality and to remove the substrate afterwards in a simple lift off process. To achieve this, the alternative substrate will provide a thin monocrystalline layer, i.e. an epitaxial template for the solar cell, on top of a temporary handle substrate. In between, a buried lift off layer will be incorporated allowing removing the solar cell after its growth from the substrate. Both the initial substrate, providing the thin monocrystalline layer, and temporary handle will be recycled, thus saving expensive material and allowing reducing the substrate cost.

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443 685 euros

Début et durée

Septembre 2009 - 36 mois

Référence

ANR-09-CARN-008

Titre du projet	TOTEM : Theory and Tools for Distributed Authoring of Mobile Mixed Reality Games

Résumé

The computing and communication performances of nowadays mobile phones make them an appropriate interface used by any real person to connect to the digital-virtual world. They may serve as input interface - images and sounds from the real world can be processed, interpreted and have an effect in the digital one, or as an output interface - elements from the digital world may be superposed (mixed) to the real one, enriching it with information and semantics.. The objective of this project is developing a complete framework for enabling easy creation of mobile mixed reality games that generate pervasive gaming experiences for the players. Unlike with traditional video games, the game is not imprisoned onto the screen but interacts with the real world. They incorporate real locations and objects into the game, therefore tapping into already existing thoughts and emotions of the player, which in turn creates a potentially much richer gaming world and experience. The goal of this project is to further foster this potential and enable users to create their own Mobile Mixed Reality games for mobile devices and easily share these with others. The project will provide the necessary tools and also research game design related questions feeding the findings back into the technical parts of the project. One important part of the project is the aim of not only developing tools for creating such games, but also to immediately start building a community around it. Working with this community will ensure a high visibility of the project as well as provide valuable user experiences for improving the system

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Aide de l'ANR

490 888 euros

Début et durée

Septembre 2009 - 36 mois

Référence

ANR-09-CARN-009

Titre du projet	VERTIGAN : Vertical-Cavity emitters based-on GaN for optical fiber sensors
Résumé	One of the major challenges in environmental control is at present the monitoring of air and water quality as a prerequisite effectively controlling and counteracting pollution and enforcing new more stringent legislation. This requires highly selective, sensitive, fast, and low-costs sensors for efficient pollution monitoring. Many pollutants including hydrocarbons, oxides of nitrogen and sulphur generated through the combustion of fossil fuels, exhibit strong absorption lines in the Ultra-Violet (UV) spectral range which allows optical techniques to be used for rapid, sensitive and contactless gas sensing and monitoring exploiting this wavelength range. Spectroscopic optical sensing offers a range of significant advantages over other sensor concepts such as high selectivity and specificity, high sampling rate, real-time and on-line monitoring, as well as the capability of stand-off sensing and detection. Among the different available optical sensors, fiber coupled systems are most promising due to their compactness and robustness, inertness to chemical or electromagnetic interferences and multiplexing capabilities. In this project, we propose to develop a practical electrically-injected RC-LED emitting in the 380-400 nm range build on a epitaxially grown AlGaN/GaN DBR underneath an active GaInN/GaN MQW active region. The top DBR will be based on UV-transparent dielectric oxide layers. Specific variations in device design will allow to adjust the device emission wavelength to match the precise emission wavelengths for specific application, such as the absorption lines of the different polluting gases. The availability of such RC-LEDs coupled to an optical fiber for relaying the UV-light as well as for sensing will be of strong interest for spectroscopy community where European companies and research laboratories are strongly involved.
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Aide de l'ANR	483 670 euros
Début et durée	Septembre 2009 - 36 mois
Référence	ANR-09-CARN-011