

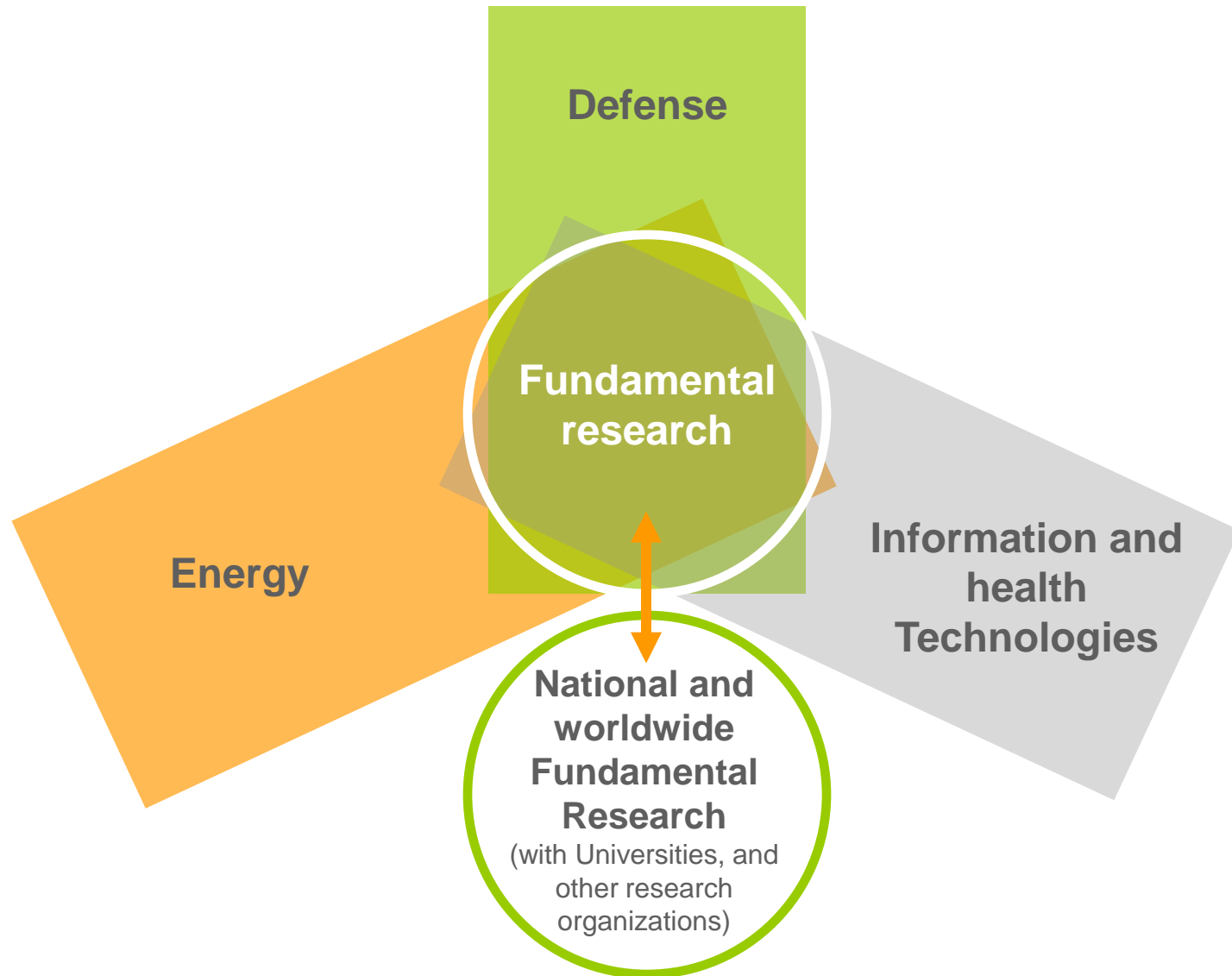
## CEA and DSM

Yves Caristan

Director of the Physical Sciences Division  
and CEA/Saclay Research Centre

# Scientific organization of CEA

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# CEA main activities

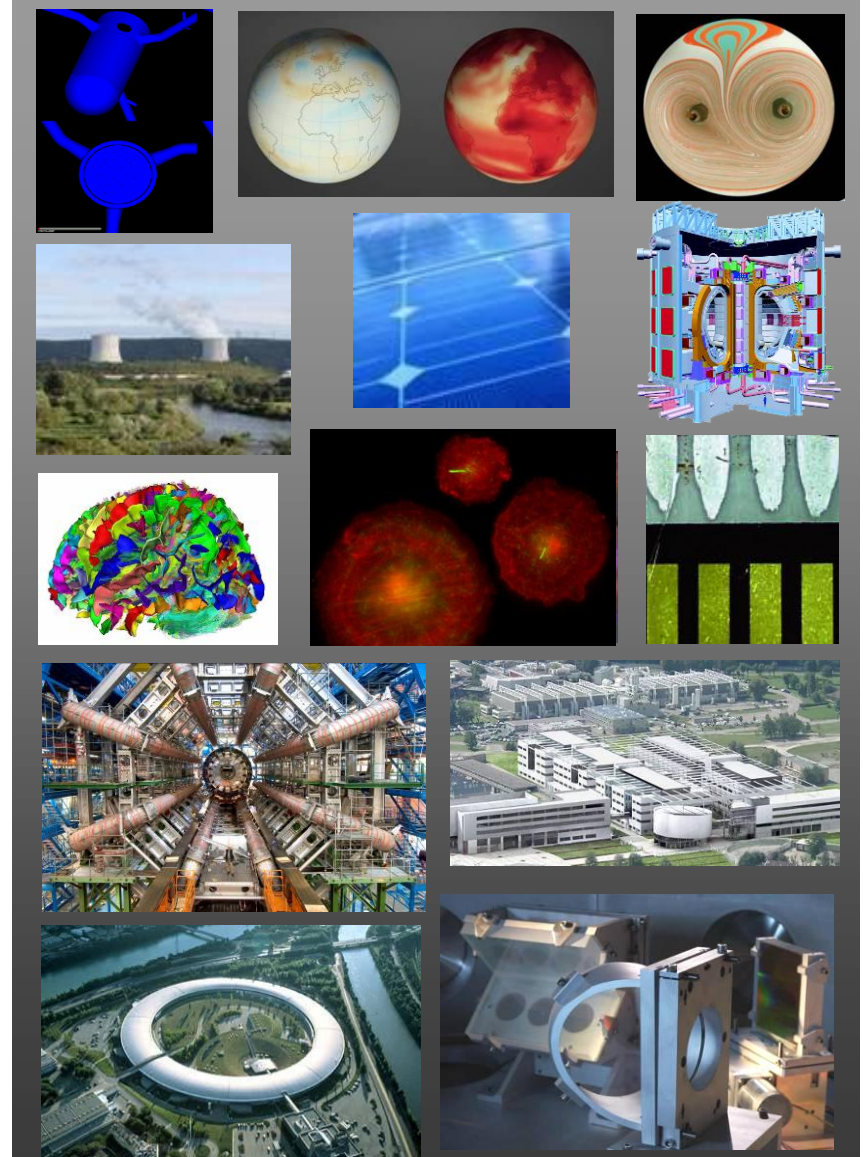
## Low carbon Energies

- Nuclear
- Fusion
- basic sciences for energy
- New technologies for energy
- Climate & environmental sciences
- Radiobiology - nuclear toxicology

## Information and Health technologies

- Micro & nanotechnologies
- Software and information system technologies
- Fundamental Research for industrial innovation
- Nuclear-based technologies for health and biotechnologies

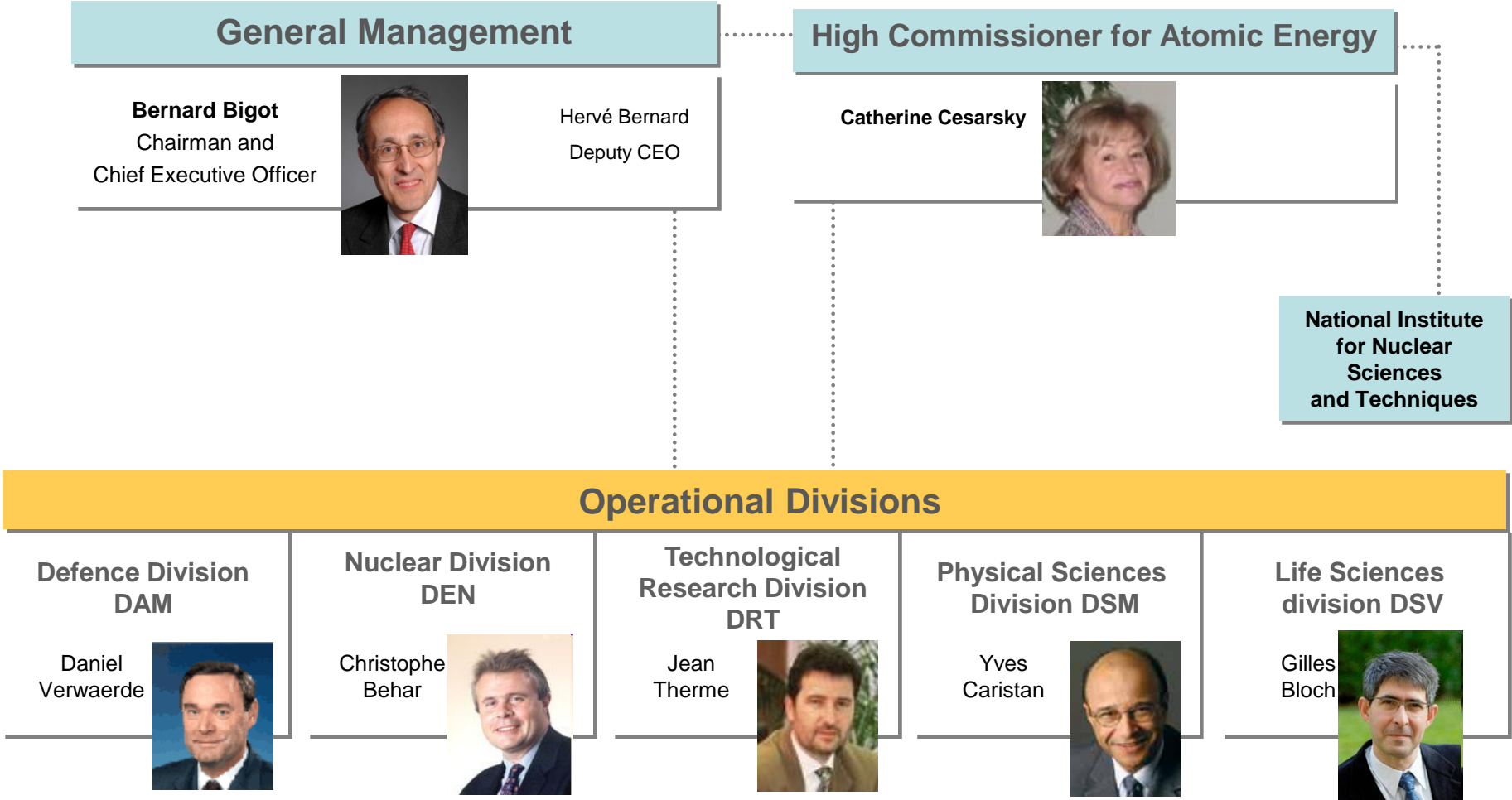
## Large scale research Infrastructures and related research



# DSM in the CEA

	Civil	Defense	Total	DSM
<b>Permanent staff</b>	11 280	4 480	15 760	<b>2 331</b> (dont 603 Saclay)
Funding (Millions € in 2010)	2 305	1 589	3 894	<b>399</b> (dont 90 Saclay)
Publications (2009)	3 839	360	4257	<b>2248</b>
Active Patents (2009)	3 148	260	3400	<b>275</b>
Joint labs (2009)	45	5	50	<b>21</b>
PhD (2009)	1 259	101	1 360	<b>440</b>

# CEA : Organization





# The Physical Science Division

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## Main research activities

Climate and environment

Sustainable energy : fusion and Iter

Nanosciences

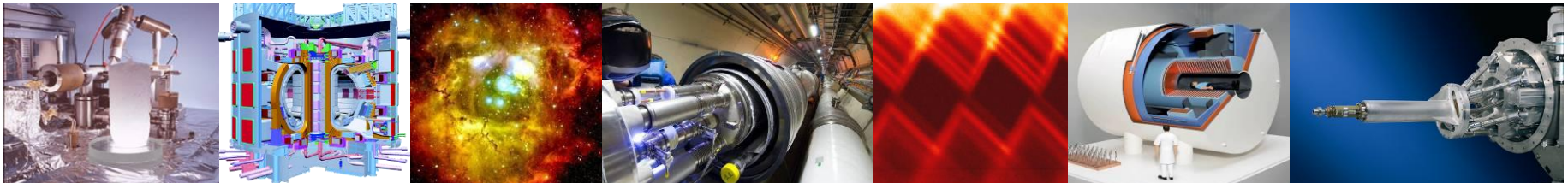
Light and Condensed matter

Fundamental laws : Nuclear and high energy physics, astrophysics

## Other missions

Cross research for other divisions support

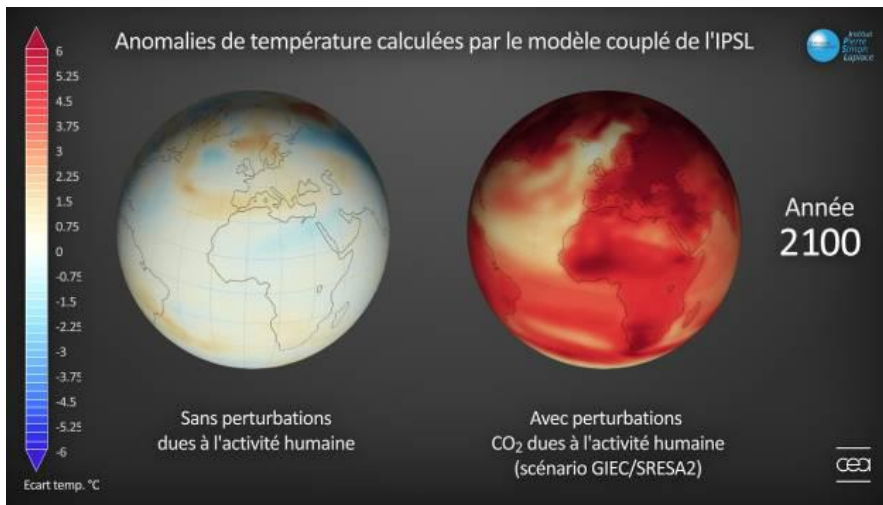
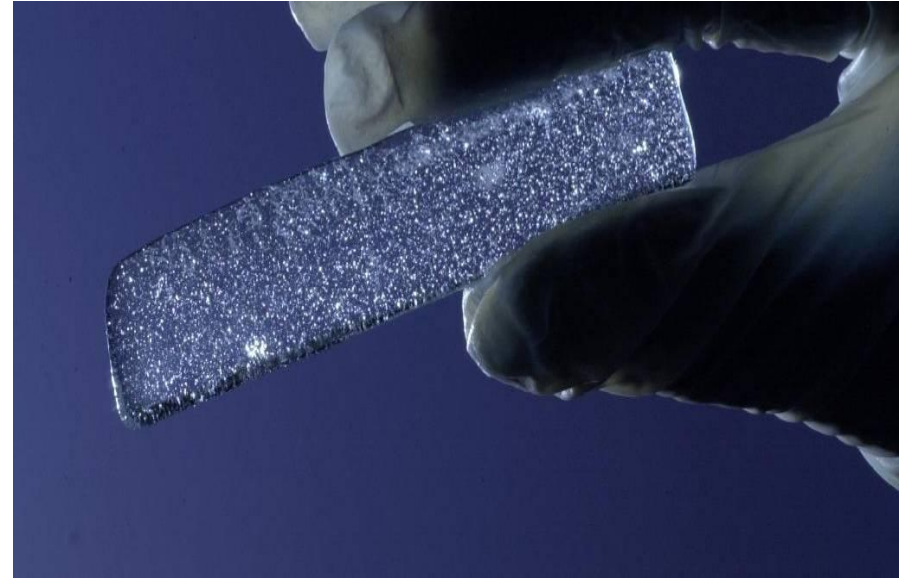
National mission in support of Large scale facilities



# Climate sciences at DSM

Reconstructing past climatic changes to understand its mechanisms....

Observing bio-geochemical cycles....



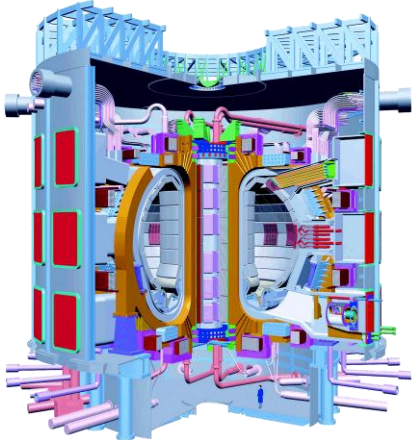
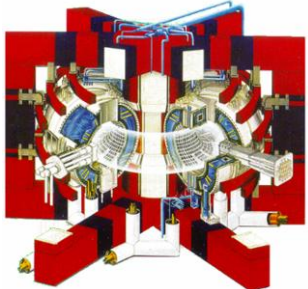
Modeling the future...

Clarify the debate on climate and energy

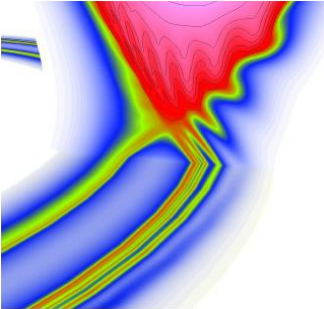
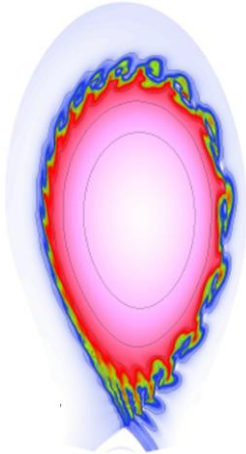
# CEA activities in magnetically confined fusion

Preparing ITER construction and exploitation with:

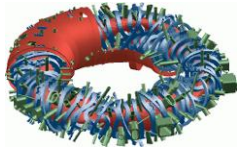
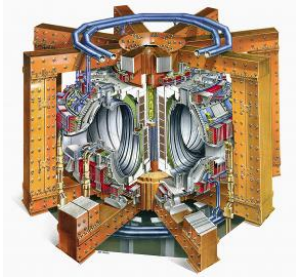
- Tore Supra in Cadarache (world record for long high energy pulses): plasma diagnosis and heating. And collaboration on other machines: Jet, W7X...



- Modelling and simulation programs.



Jorek





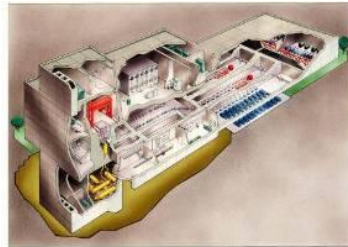
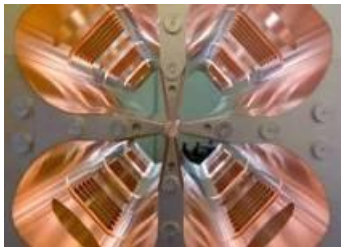
# CEA activities in magnetically confined fusion

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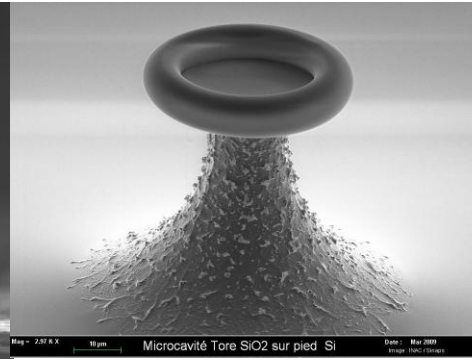
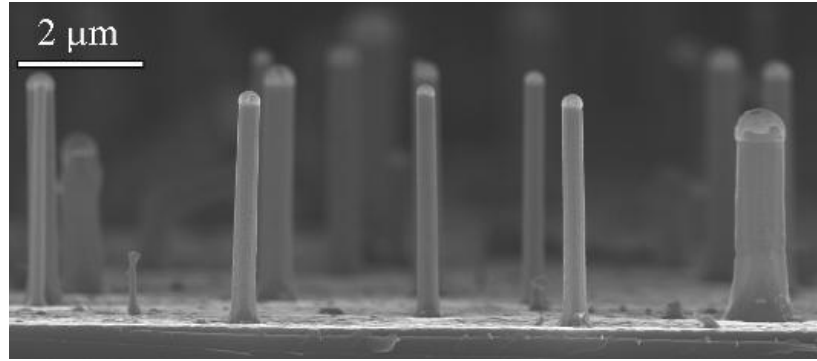
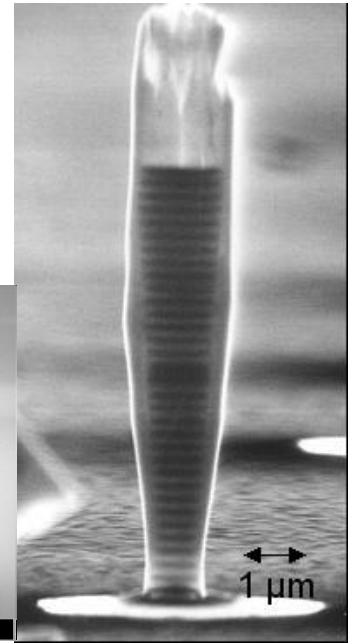
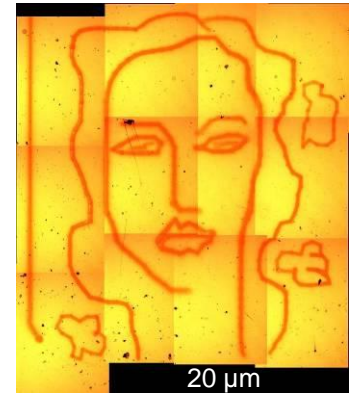
A major support to ITER program and to the Broader approach

- R&D for DEMO
- IFMIF-EVEDA : International Fusion Materials Irradiation Facility, Engineering Validation Engineering Design Activity (Rokkasho)
- JT60 – SA : Japan Tokamak Super Advanced (Naka): upgrade of the supraconducteur JT60SA.
- IFERC : International Fusion Energy Research Center (Rokkasho)

$\frac{1}{4}$  of the Broader approach supported by DSM



Study matter properties at nano scale  
Conceive and elaborate nano objects  
Accompany silicon technology  
Prepare future technological paths



# Fundamental laws of the Universe, Nuclear and Particle Physics, Astrophysics

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Explore the ultimate constituents of the Universe,

- Using high technology instruments,
- Conceived and carried out in partnership, on a worldwide scale,
- Bringing cutting edge technologies usable for other disciplines or industrial fields.

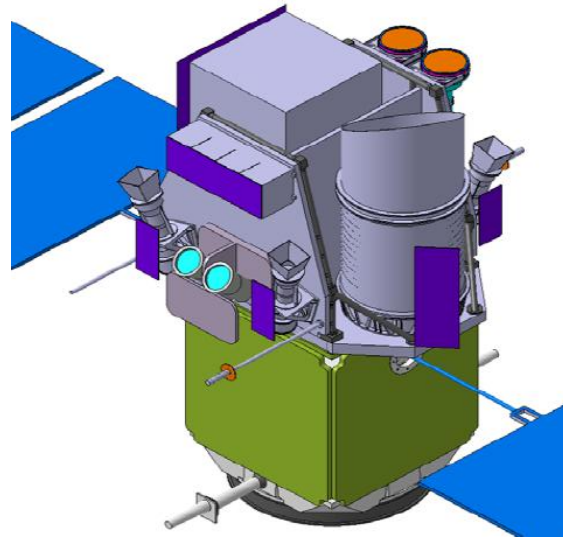


# The Space Mission SVOM

**CEA Dapnia**  
*French SVOM PI*  
*ECLAIRs Management*

**CNRS and Universities**  
*Contribution to scientific devices*

**CNES**  
*French Space Agency*



**CAS**

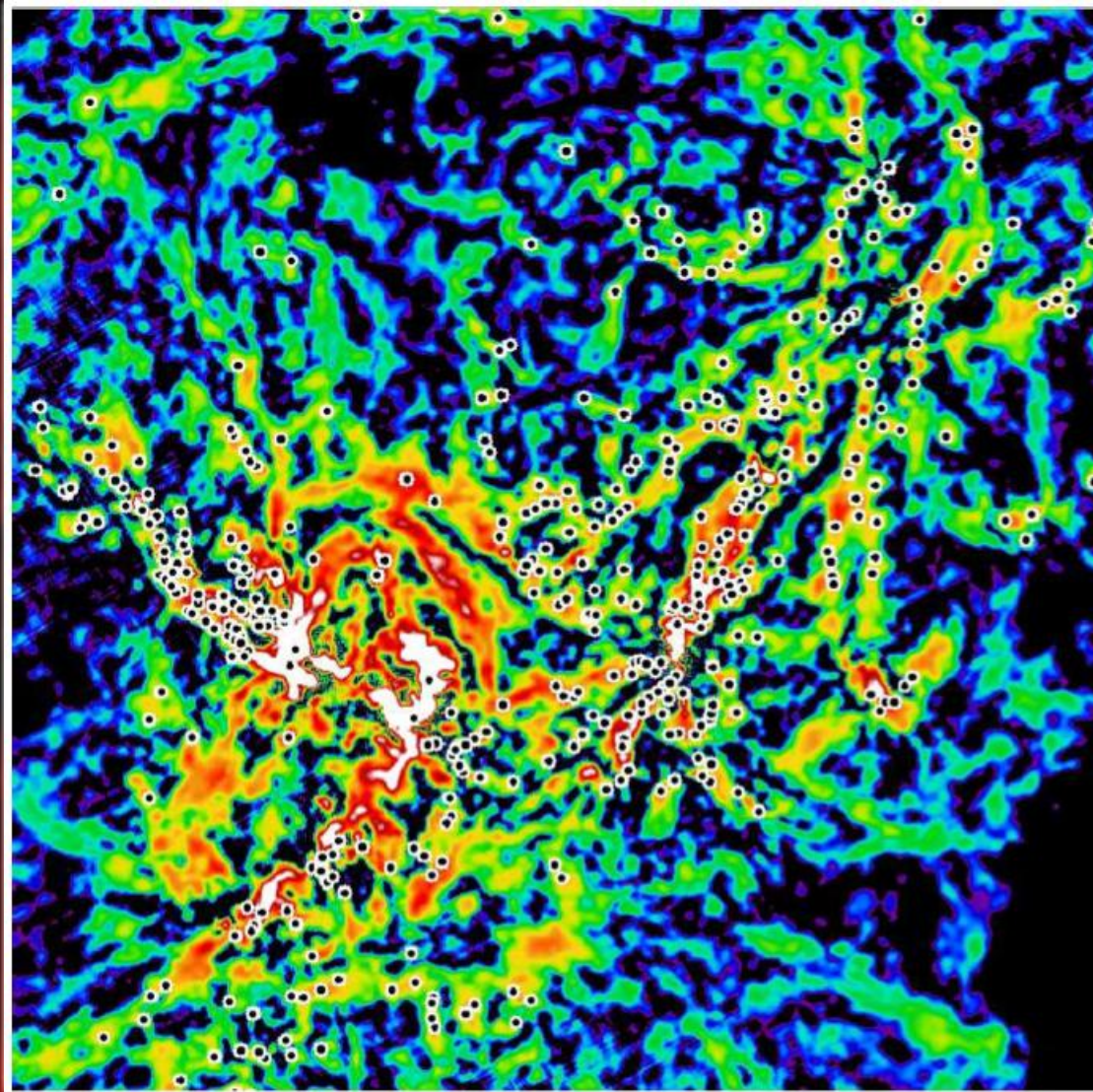
**SECM**

**CNSA**

DSM/Dapnia and Shanghai Institute of Microsystem and Information Technology, National Astronomical Observatories, IHEP, Xi'an Institute of Optics and Precision Mechanics, ISCAS, Beijing Bureau of High-Technology Research and Development, working together on SVOM : Astrophysical satellite to search for Gamma Ray Bursts, Sino-French satellite, which is foreseen to be launched between 2010 and 2011.



# Basic Research with large research facilities dedicated to explore the Universe



Aquila as  
seen by  
Herschel

Herschel, the birth of stars in filaments

May 14th 2009,  
Launch of Herschel  
and Planck  
Satellites :  
Understanding star  
formation and  
galaxy evolution.  
Herschel:  
Biggest mirror on  
an astrophysical  
satellite



**CEA:**  
Involved in  
camera  
development

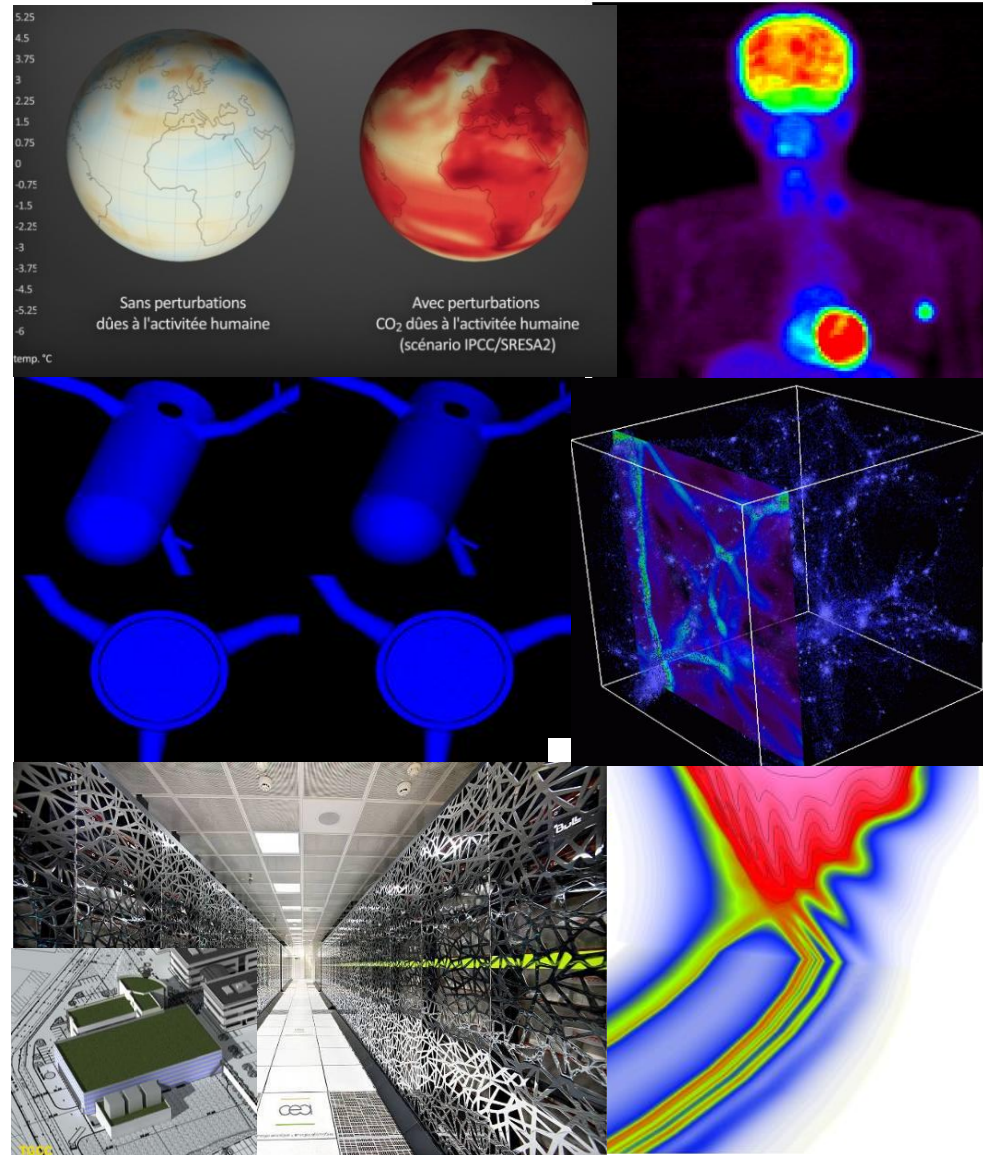


# High performance computing in CEA for scientific research

## Main applications fields:

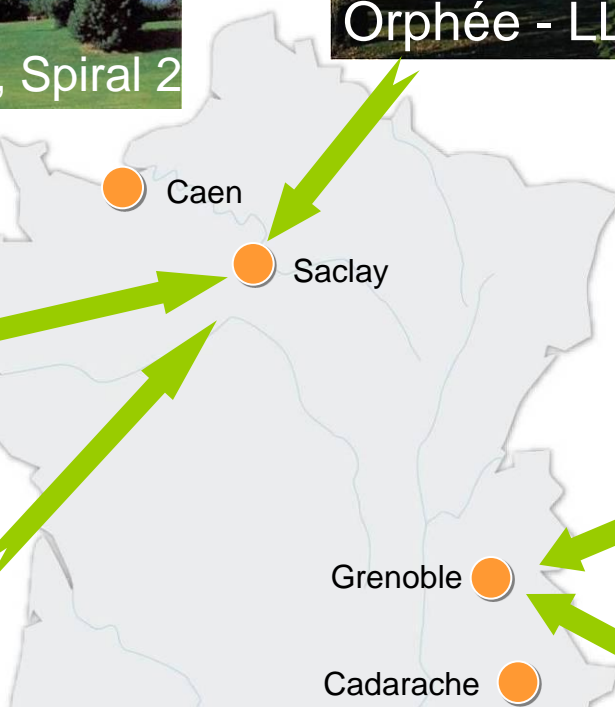
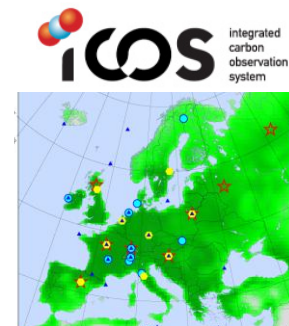
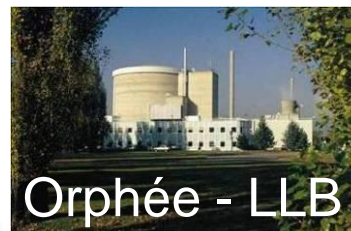
- Climate and environment
- Neurosciences and biomedical imaging
- Nuclear energy

A strategy gathering  
hardware infrastructure and  
software development



# Large scale facilities

*Participation in the construction, operation and funding of national and international large Research infrastructures*

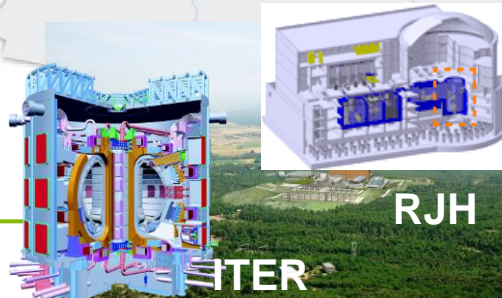


European monitoring of GHG



Grenoble

Cadarache





# DSM involvement in Large scale facilities through the World

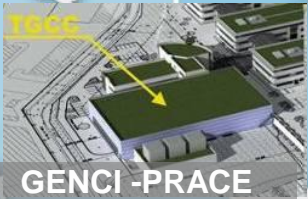
Source européenne de spallation



Laser à électron libre



Faisceau d'ions lourds radioactifs

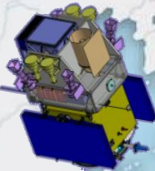


CERN, LHC



FAIR

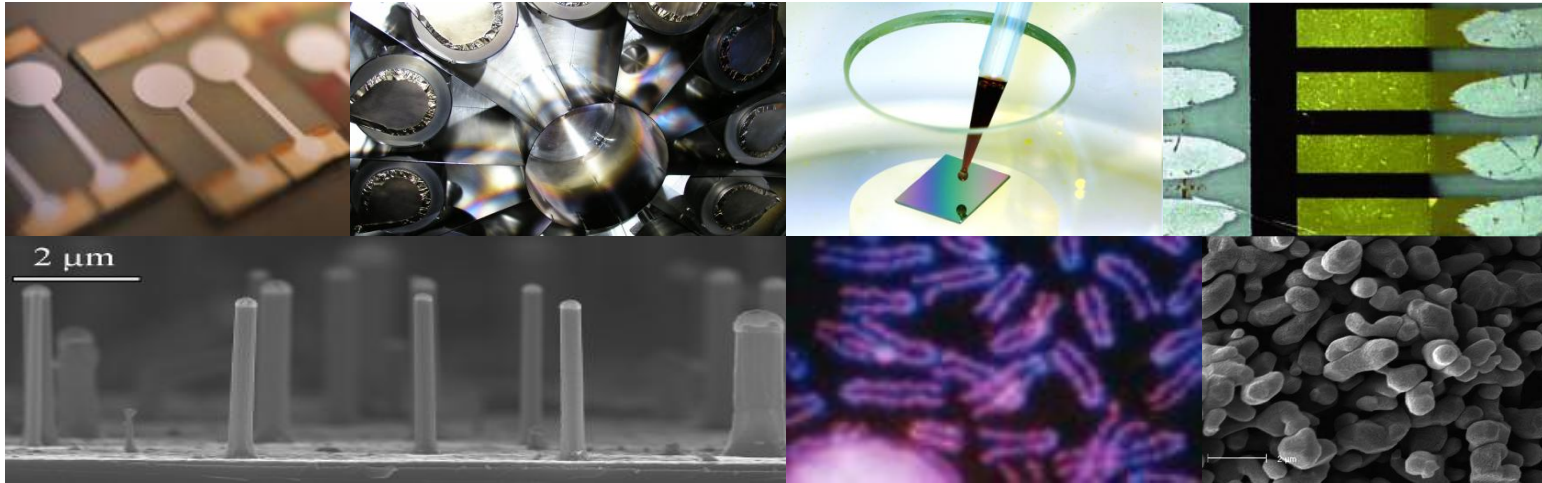
SVOM



HEFEI



Réseau de mesure des gaz à effet de serre



CEA Saclay center

# CEA Saclay

## Total staff in Saclay:

About 7 000 employees

4 400 CEA

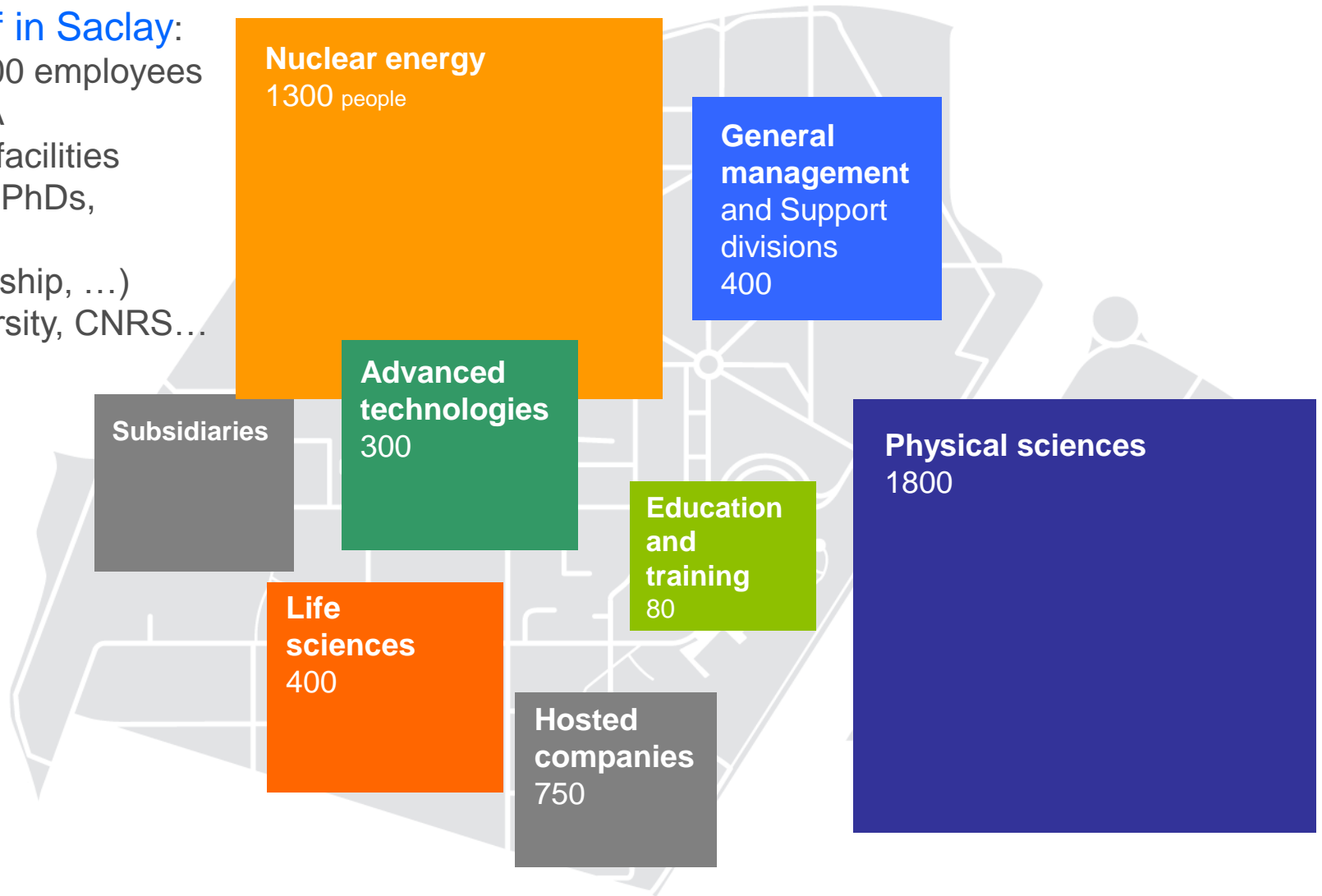
8 Nuclear facilities

980 CDD (PhDs,

postdocs,

apprenticeship, ...)

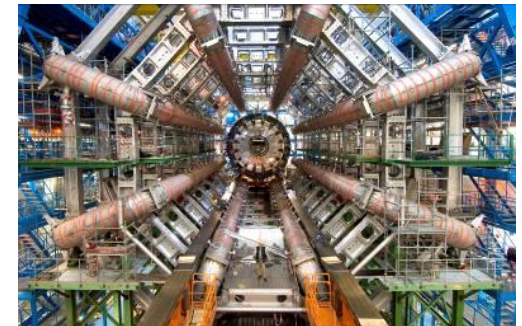
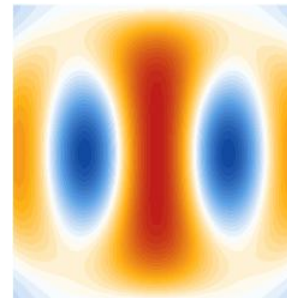
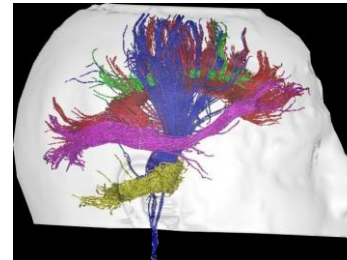
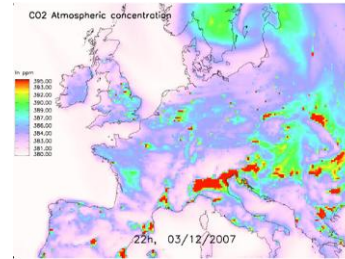
580 University, CNRS...





# Saclay, main research domains

- Climate and environment
- Simulation
- New technologies for energy
- Theoretical Physics
- Physics of the 2 infinities (high energy, astrophysics...)
- Nanosciences
- Interaction Laser-matter
- Nuclear energy
- Health technologies
- Proteins engineering
- Genome integrity and expression
- Neurosciences



# Science and innovation in Saclay, Key figures (2006- 2008)

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Nobel Peace prize in 2007 for IPCC (9 CEA authors)

17 European Research Council grants (2007-2009)

515 PhDs

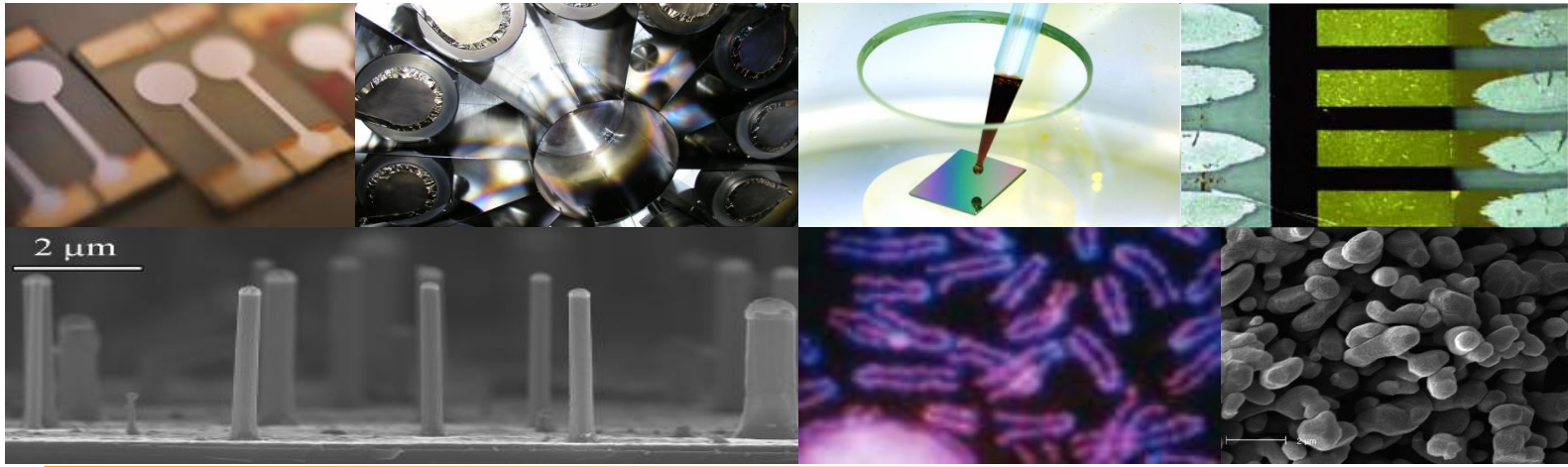
2400 Publications

240 European Contracts (FP6 et 7), € 16.5M

270 Contracts ANR in process, € 45 M (175 contracts for € 7.6 M in 2008).

74 Patents submitted in 2010

41 Start-ups since 1978



Campus Paris Saclay

# The knowledge community on the “Plateau de Saclay” area

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Advanced research thematic network  
(RTRA)

Research



Innovation

Competitiveness cluster  
System@tic, Medicen

Education

Universities and  
Engineering Schools  
federation

# Campus Paris - Saclay

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A presidential project preparing the XXI<sup>st</sup> research and education system, able to boost French innovation and competitiveness.

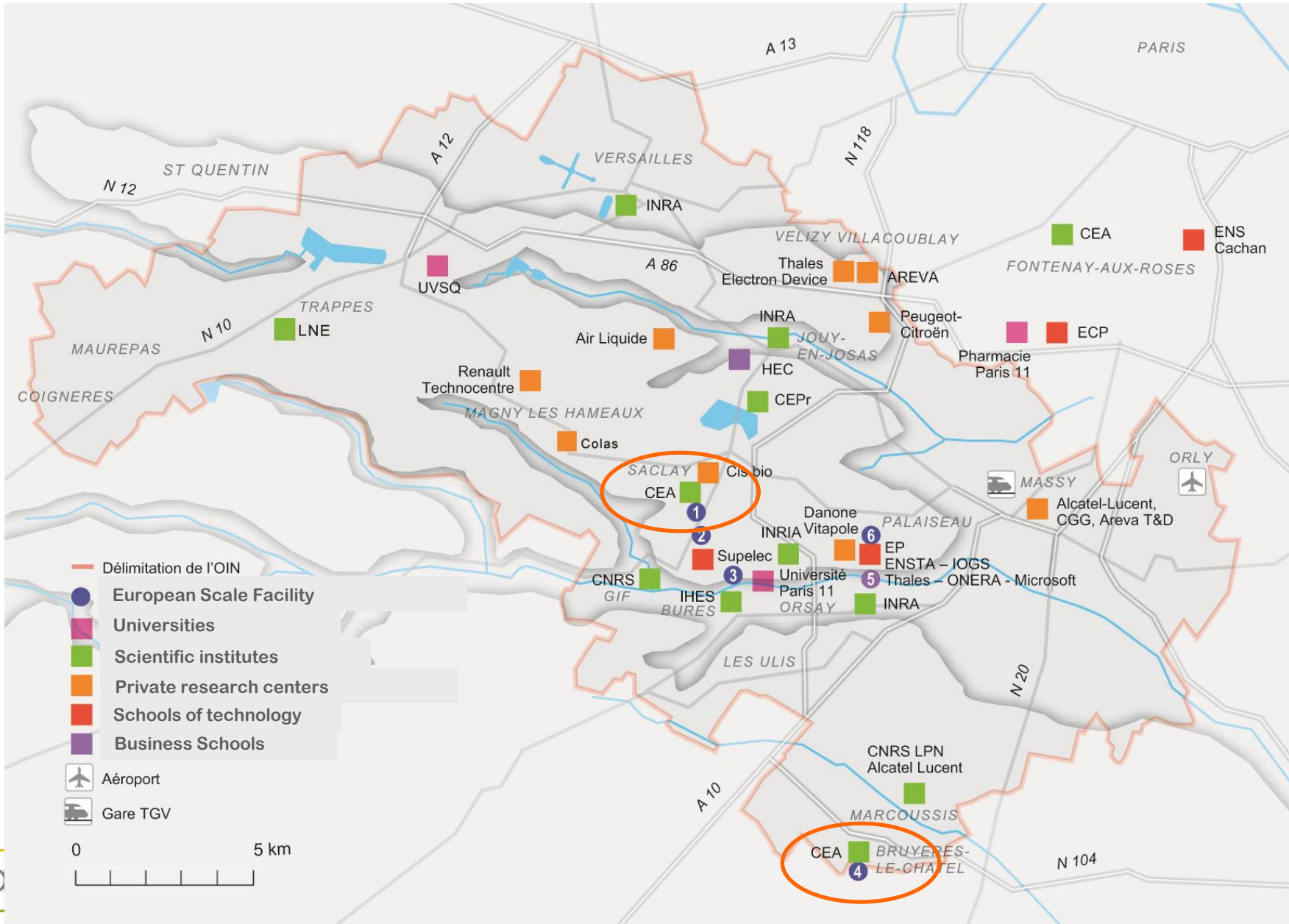


Plateau de Saclay, 24//09/2010

- Reach international research top level
- Answer major society challenge such as energy, climate, environment, new technologies...
- Gathering academics and industrials
- Create a new scientific urbanism.



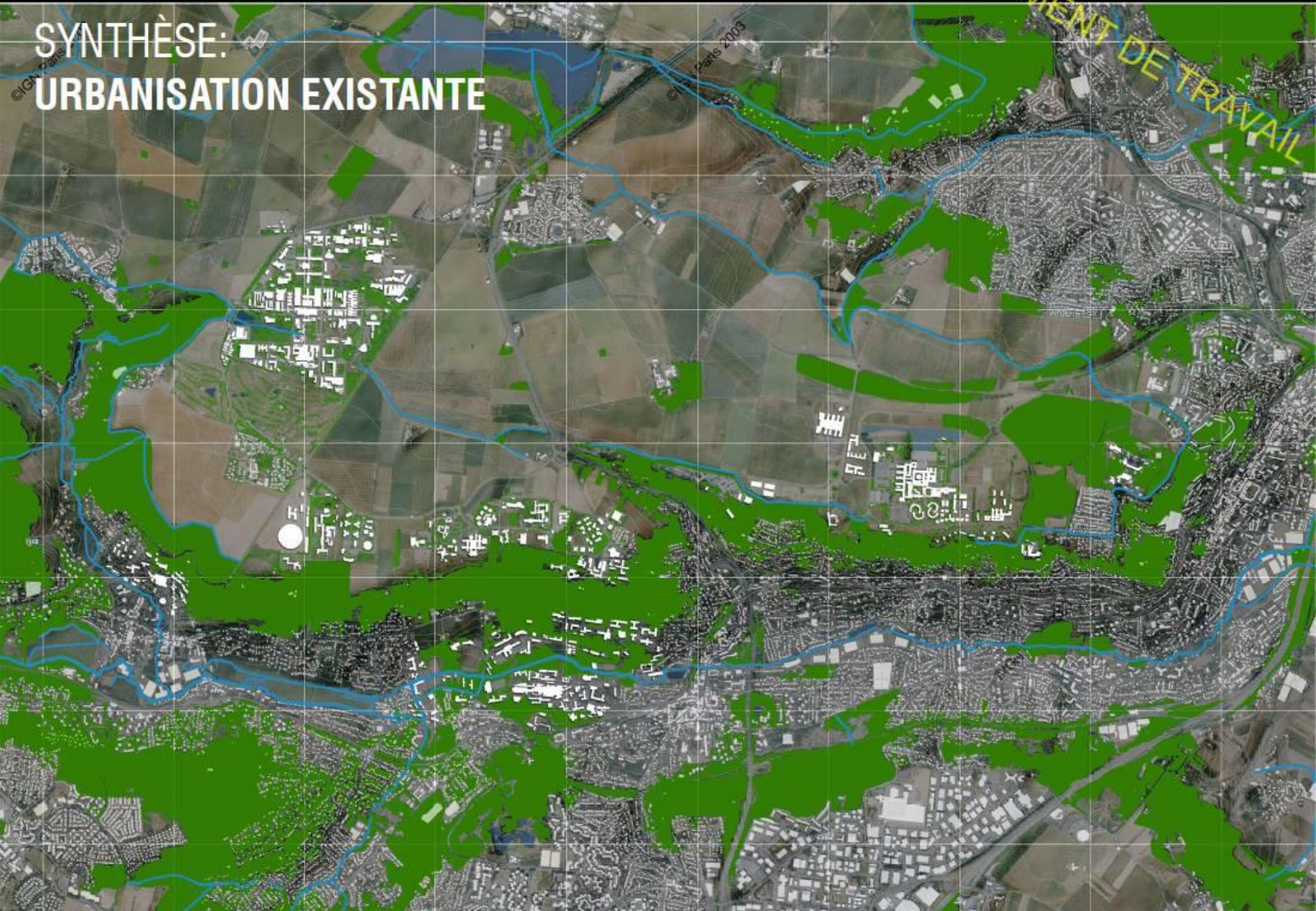
# The « Plateau de Saclay », a unique concentration in Europe





©IGN Paris  
© Paris 2003

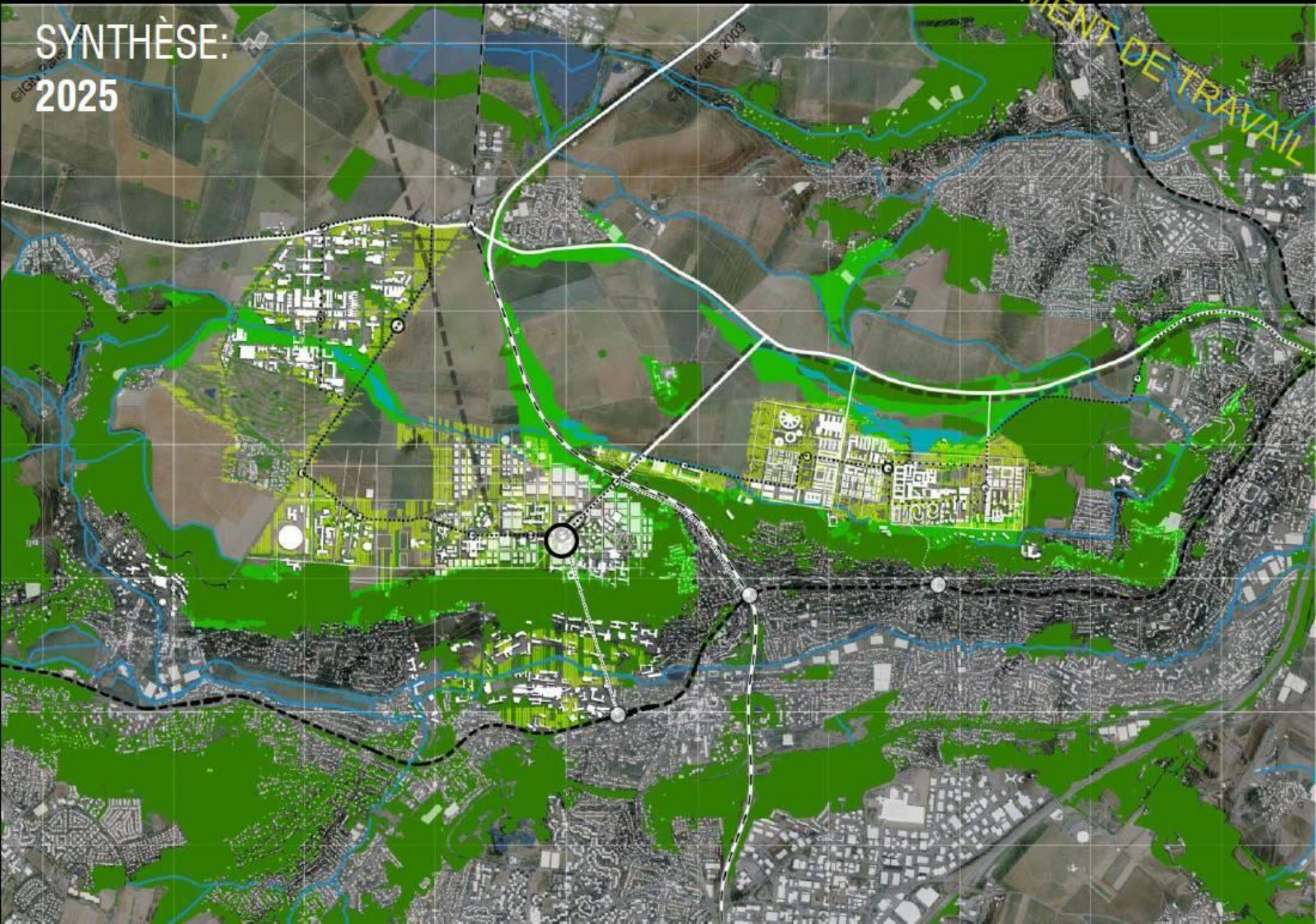
# SYNTHÈSE: URBANISATION EXISTANTE





SYNTHÈSE:  
2025

DOCUMENT DE TRAVAIL



# A campus potentially among the most prestigious

	MIT	Stanford	Cambridge	Saclay 2009
<b>Surface</b>	<b>0,7 km<sup>2</sup></b>	<b>33,1 km<sup>2</sup></b>	<b>16 km<sup>2</sup></b>	<b>9 km<sup>2</sup></b>
<b>Students (LMD)</b>	<b>10 220</b>	<b>19 800</b>	<b>18 500</b>	<b>22 000</b>
<b>PhD/ year</b>	<b>599</b>	<b>720</b>	<b>997</b>	<b>1 300</b>
<b>Researchers &amp; teachers</b>	<b>4 500</b>	<b>nc</b>	<b>5 500</b>	<b>9 500</b>
<b>Publications</b>	<b>4 530</b>	<b>6 503</b>	<b>9 610</b>	<b>5 991</b>



# The scientific cooperation foundation



Fondation de coopération scientifique



INSTITUT NATIONAL DE RECHERCHE EN INFORMATIQUE ET EN AUTOMATIQUE



**CNRS, CEA, Ecole Centrale Paris, HEC, ENSAE ParisTech, MINES ParisTech, ENSTA Paris Tech, ENS Cachan, Ecole Polytechnique, Supélec, Digiteo Triangle de la Physique, IHES, INRA, INRIA, IOGS, AgroParisTech, Institut TELECOM, ONERA, SYSTEM@TIC PARIS-REGION, Université Paris-Sud 11, Université de Versailles Saint Quentin-en-Yvelines.**

**ParisTech et UniverSud Paris, associated to the project.**

# 12 Scientific fields

Chemistry

Maths

Social Sciences and humanities

Engineering

Physics

Biology and health

**Climate and environmental studies**

Economy, finance and management

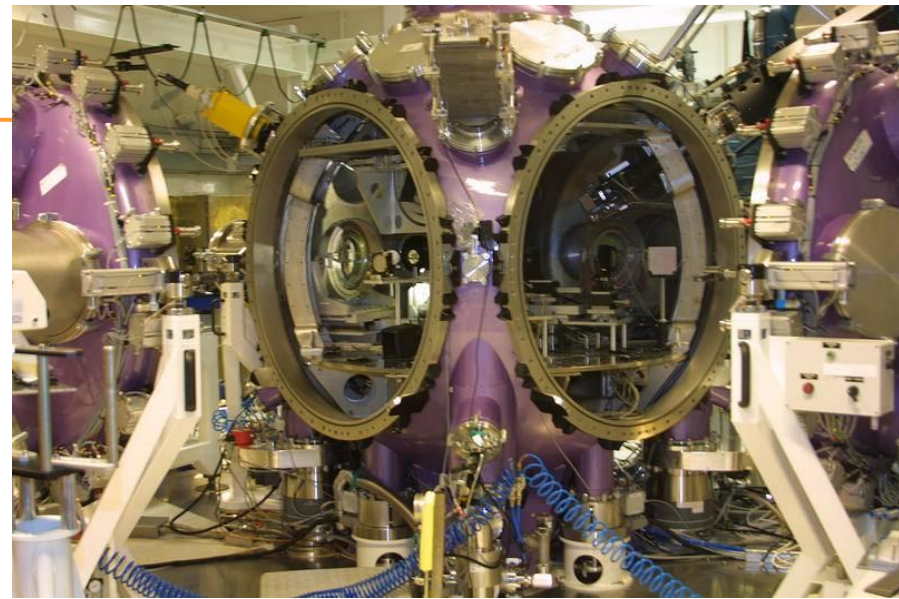
**Low Carbone energy**

Nano-sciences & Nano-Innov

Sciences and engineering for agriculture, food and environment

Sciences and technologies for information and communication

- Increase knowledge, answer major society issues, innovate
- Use transversal processes for all issues
- Stimulate interdisciplinarity and prospective thinking



**Creation of a new cluster focused on climate-energy- environment : knowledge and innovation for preparing the zero- CO2 society**

# Climate KIC a EU innovating cluster on climate mitigation and adaptation

## Four value propositions

## Five centers for excellence

Climate-KIC  
***Innovations***

...creates promising new collaborations and pioneers new value-chain configurations.

Climate-KIC  
***Education***

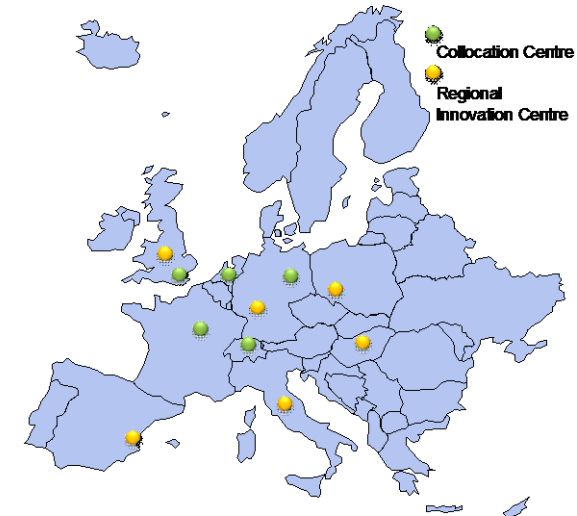
...attracts and develops future climate entrepreneurs and change agents.

Climate-KIC  
***Entrepreneurs***

...builds platforms to connect and support the wider climate entrepreneurship community.

Climate-KIC  
***Pathfinder***

... creates new pathways to low-carbon prosperity by fostering the conditions for ongoing innovation.



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END



# Joint CAS-CEA/DRT research programs

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## Telecommunication

LETI and The Shanghai Research Center for Wireless Communications (WirelessCoRe).

- 3rd generation partnership project Joint evaluation for standardization within the 3GPP Long Term Evolution

## Microprocessors

LIST - Institute of Computing Technology (ICT) - TONGJI university

- Joint collaboration on the development and the improvement of microprocessors based on the Godson architecture.

## Nanosciences

LITEN - Institute of High Energy Physics - Lab for Biological Effects of Nanomaterials & Nanosafety

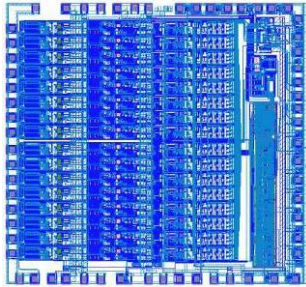
- Joint cooperation on the development of new processes of preparation of ceramic nano particles within the Nanosafe European project.

# Joint CAS-CEA/DSM research programs

## Hadron physics

CEA/DSM/DAPNIA Saclay and IHEP, Beijing

- Collaboration on theory of Hadron Physics (Alice).



## Nuclear Physics and accelerators

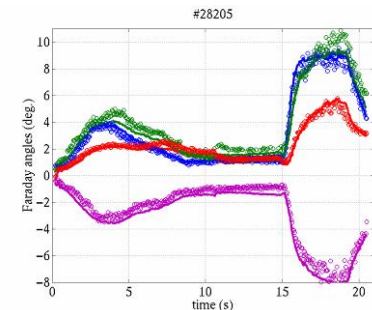
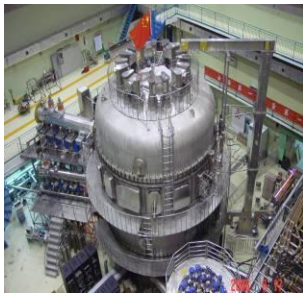
CEA/DSM/DAPNIA Saclay and IMP, Lanzhou

- ASICs development (integrated electronic circuits) and collaboration on nuclear physics (1 PhD student).

## Fusion Research

CEA/DSM/DRFC Cadarache and IPP, Hefei

- Research on fusion Licence on CRONOS (numerical code for fusion simulation) awarded to IPP, involving exchange of personal and collaboration on unloading stationary physics.



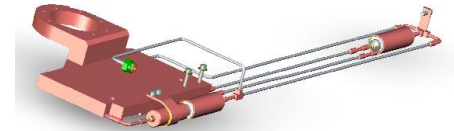
# Joint CAS-CEA/DSM research programs

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## Cryogenics

CEA/DSM/DRFMC Grenoble and IPC, Beijing  
Cryogenics Laboratory

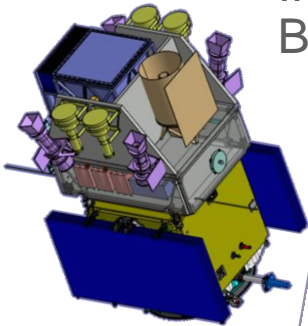
- Recent exchange of CAS researcher visiting CEA/Grenoble for 3 months



## Astrophysics

CEA/DSM/DAPNIA Saclay and Shanghai Institute of Microsystem and Information Technology, National Astronomical Observatories, IHEP, Xi'an Institute of Optics and Precision Mechanics, ISCAS, Beijing Bureau of High-Technology Research and Development

- SVOM : Gamma Astrophysics satellite to search for Gamma Ray Bursts origin. Sino-French satellite, which is foreseen to be launched between 2010 and 2011.



# A campus potentially among the most prestigious

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<b>Publications</b>	<b>4 530</b>	<b>6 503</b>	<b>9 610</b>	<b>5 991</b>	



# The CEA Energy Initiative

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## CEA actions on **current sustainable energies** :

- Nuclear energy (fission)
- New technologies for new energies (solar, nomad devices, building, transportation)
- *Technological research division (DRT/Liten)*

## CEA actions on **future energy solutions** :

- Fusion
- Breakthrough research for energy (new generation photovoltaics, thermoelectricity, hydrogen, bio-fuels, batteries, lighting...)
- *Fundamental research division (DSM)*

*Fundamental research will be critical to the development of new, long-term energy solutions over the next 50 years.*

# The CEA Energy Initiative : A knowledge-oriented approach

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## 3 Grand Challenges



Mastering  
Quantum physics,  
Materials at the nano scale,  
Excited states

Developing  
Bio-inspired systems

Understanding  
Complex systems,  
Non-equilibrium  
thermodynamics

## 6 Fundamental Research Axes

Materials science for energy

Research in complex  
systems for energy

Nanosciences

Research for energy-efficient  
information and communication  
technology (ICT)

Bio-energies

Simulation for energy

# Paris plans science in the suburbs

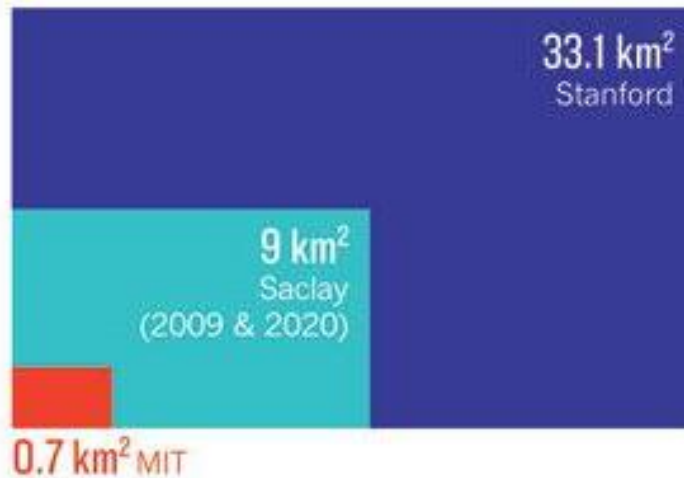
Euros flow in to boost French goal of creating critical mass of cross-agency researchers.

## SACLAY SIZED UP

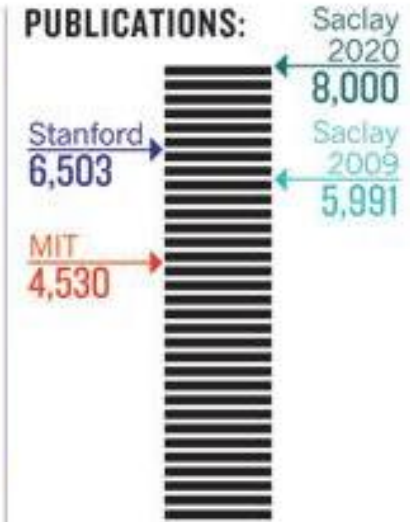
French researchers hope that Paris-Saclay can surpass the output of other leading science campuses.



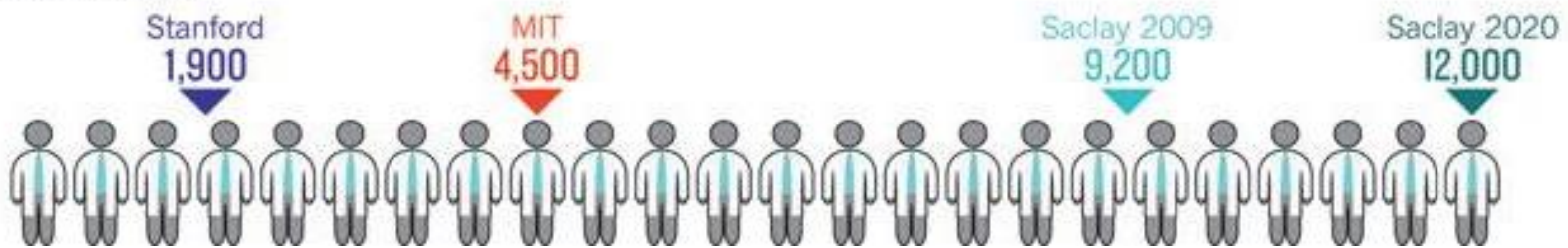
### CAMPUS AREA:



### PUBLICATIONS:



### RESEARCHERS:



Nature, Vol 467, 21/10/2010

# French research stimulus package

NATURE|Vol 462|17 December 2009

