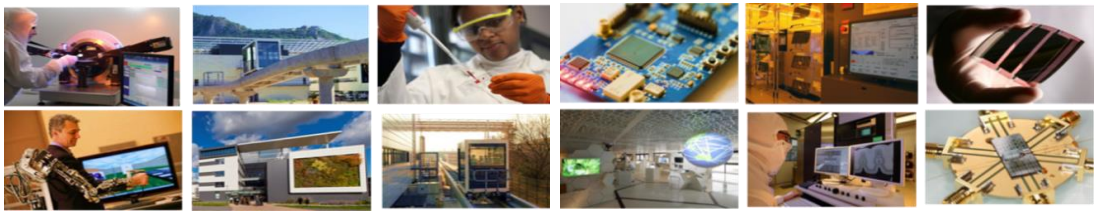
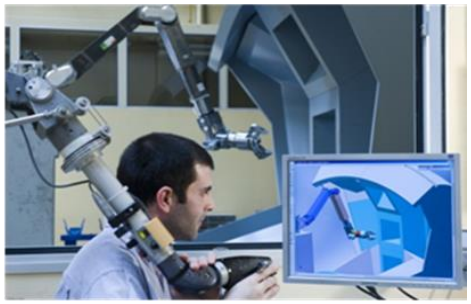
FROM RESEARCH TO INDUSTRY

cea tech



Driving innovation through technological research

10th Anniversary PSP Symposium
Warsaw, Poland



18 Mai 2018

Margaux TKATCHENKO
Scientific Direction, CEA Tech

A French key player in technological research

Alternative Energies and Atomic Energy Commission

CEA

Technologies

Defense Security

Military Applications Division

4500 pers.

Nuclear Energy

Nuclear Energy Division

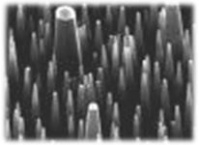
4500 pers.

cea tech

Technological Research Division

4500 pers.

Science



Fundamental research

Materials Sciences Division
Life Sciences Division

- *Mission DAM : **strategic independence** of France*
- *Mission DEN : **energy independence** of France*
- *Mission DRT : **economic competitiveness** of France*

A french key player in technological research

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cea tech

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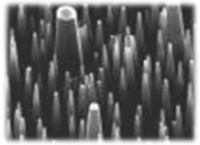
Science

Fundamental research



Physical Sciences Division
Life Sciences Division

- *Mission DAM : **strategic independence** of France*
- *Mission DEN : **energy independence** of France*
- *Mission DRT : **economic competitiveness** of France*

*Payroll Staff : **16000***

***10** Research centers*

*Budget: **4,7 B€***

***1000** PhD*

*Publications: **4740 /year***

***4670** priority patent portfolio*

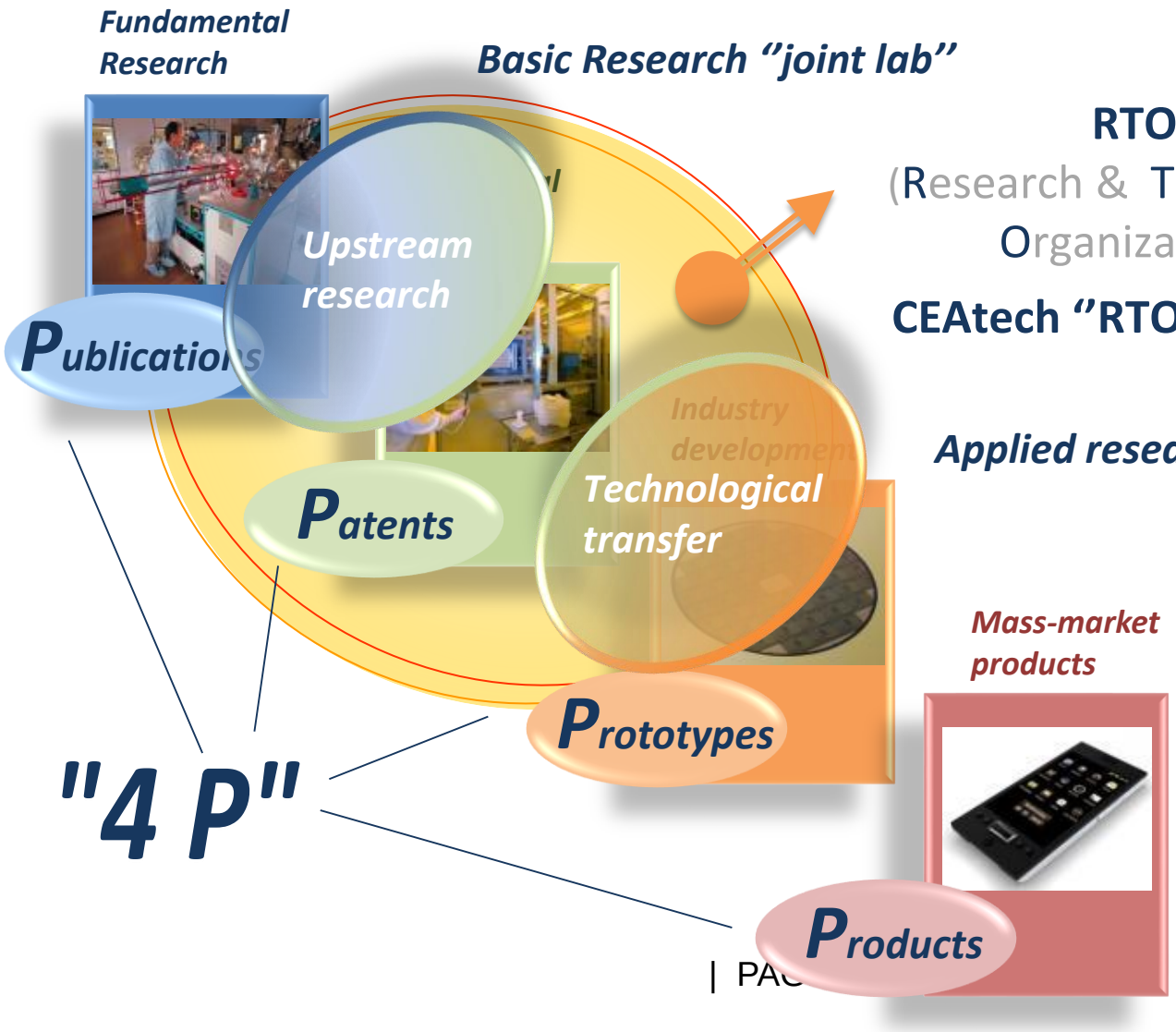
***700** priority patents per year*

***150** new companies established since 1984 in the high-tech industry*

***53** Joint research laboratories*

A french key player in technological research

Innovation process : CEA-TECH positioning



RTO
(Research & Technology Organization)

CEAtech "RTO's french model"

At the heart of the Grenoble innovation ecosystem...
...from MINATEC to GIANT

From MINATEC to GIANT

2015

2010

From LETI to MINATEC

2006

2000

1967

leti

MINATEC®

GIANT
INNOVATION CAMPUS

CEA member of GIANT campus

Model and Key Figures

An unique model based on the ability to :

- *Operate technology platforms*
- Co-develop new products with industrial partners
- Protect the results of Research
- Ensure knowledge resourcing

The CEA-Tech model : our structure

cea tech — FROM RESEARCH TO INDUSTRY

3 research institutes for 3 important technology fields

- **leti** (1967) Grenoble
- **list** (2003) Saclay
- **liten** (2005) Grenoble / Chambéry

An Institute for developing technological research across France's regions

- **CEA Tech Regions** (2012)

→ Micro/nanotechnologies and their integration in systems

— **€280 million - Staff: 2,100 (1800 CEA)**

→ Software-intensive systems

— **€80 million - Staff: 1,000 (800 CEA)**

→ New energy technologies and nanomaterials

— **€180 million - Staff: 1,200 (1000 CEA)**

→ Région PACA · RÉGION MIDI-PYRÉNÉES · RÉGION AQUITAINE · Région PAYS DE LA LOIRE · La Région Lorraine · RÉGION NORD PAS DE CALAIS

Key CEA Tech activities

leti

1967 - Grenoble

Laboratory of Electronics and Information Technologies

Staff: 2,100 Budget: €280 million

Micro-nanotechnologies and their integration in systems

list

2003 - South of Paris

Laboratory of Integrated Systems and Technologies

Staff: 1000 Budget: €80 million

Software-intensive systems

liten

2005 - Grenoble-Chambéry

Laboratory of Innovation for new Technologies for Energy and Nanomaterial

Staff: 1,200 Budget: €180 million

New energy technologies and nanomaterials

Solar

ines
INSTITUT NATIONAL DE L'ENERGIE SOLAIRE

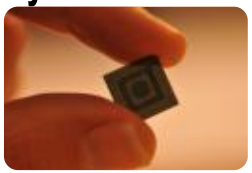
leti

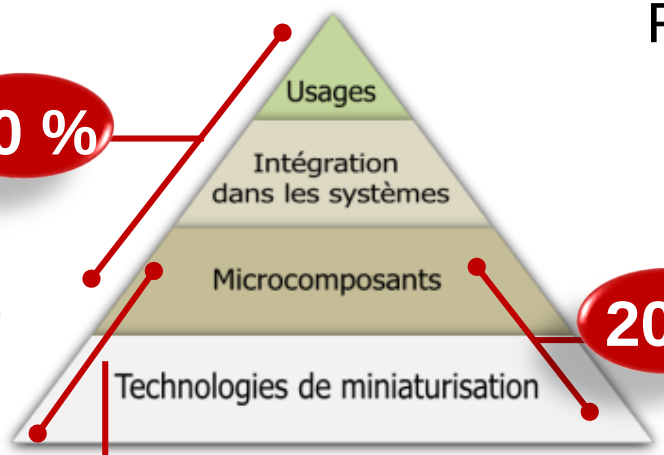
cea tech

Systems for Biotechnologies & Health

30 %

Systems for information technologies



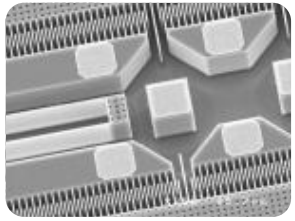


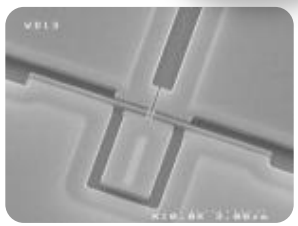
Photonics

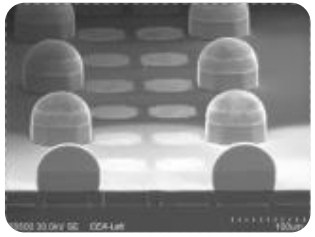
20 %

Microsystems

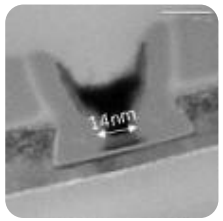
50 %

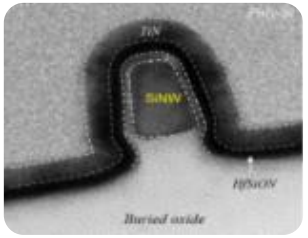


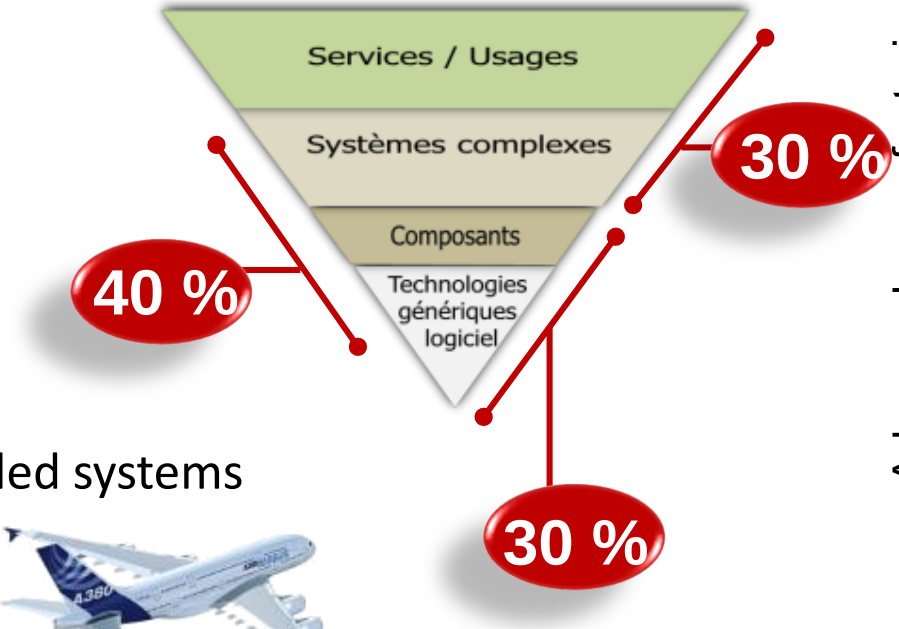




Nanoelectronics







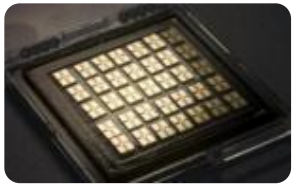
Nondestructive testing, virtual reality, robotics, cobotics

Advanced manufacturing

Interactive systems

Embedded systems

Sensors – Big data

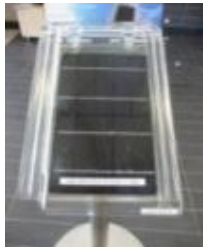


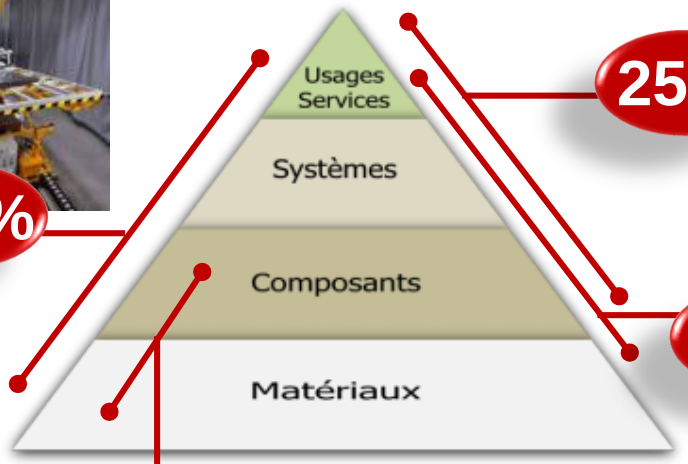
liten

cea tech

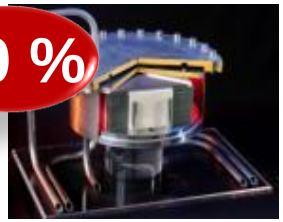
Carbon-free transportation

Photovoltaics, housing



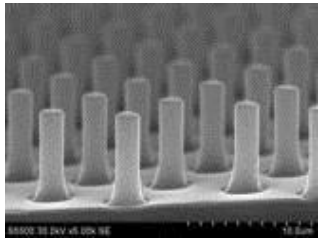


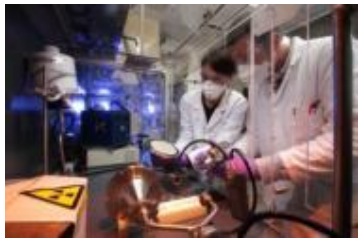
Biomass- Hydrogen



Stack d'électrolyseur EHT

Nano materials - nanotechnologies





Key figures

Human resources

4500 total staff

→ 3000 CEA employees

→ 1500 contractual

Patents

650 Patents/year → 1900 In portfolio

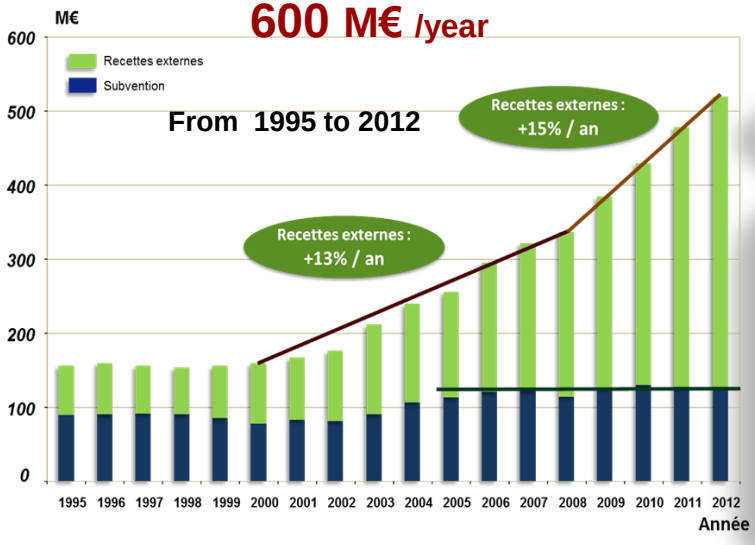
Program ressources

→ 25 % Internal funding

→ 40 % External funding (industrial)

→ 35 % Incentives

600 M€ /year



Program expenses

→ 75 % R&D for Industry

→ 25 % Resourcing

→ 47 % Staff costs

→ 33 % Operating costs

→ 20 % Investment

Activities & business model

Intellectual property portfolio

Public research organizations Table 3: Top 10 PCT applicants in 2011:

Rank	Applicant
1	Commissariat a L'Energie Atomique et aux Energies Alternatives
2	Fraunhofer-Gesellschaft Zur Forderung der Angewandten Forschung E.V.
3	Centre National de la Recherche Scientifique (CNRS)

In-house staff of 80 + 60 consultants)

Lead generation

120 people

Timeframe: 1–3 years

Research partnerships with manufacturers

75% of research activities

Timeframe: 3–10 years

Technology pump priming

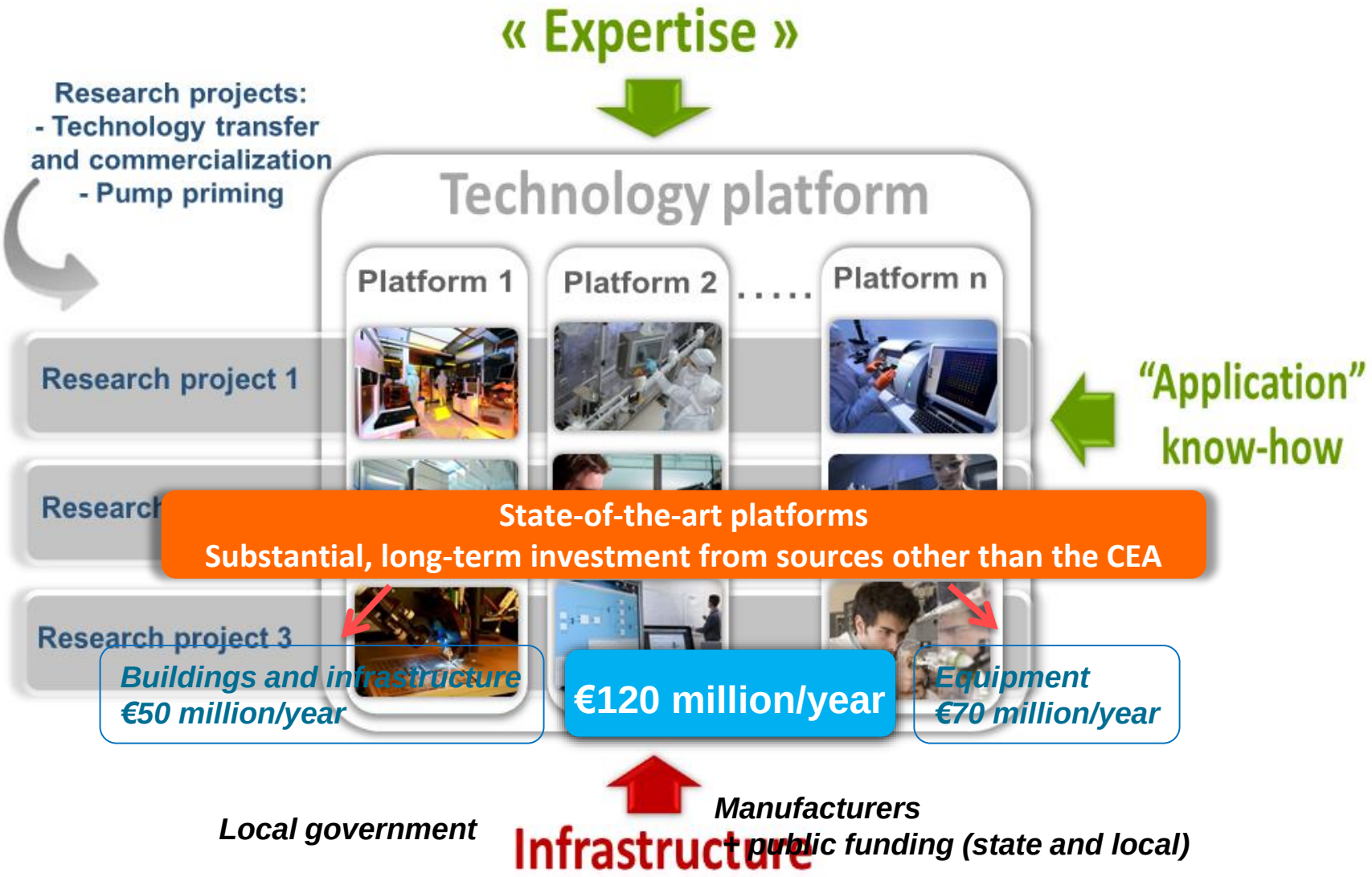
25% of research activities

FROM RESEARCH TO INDUSTRY
cea tech

An unique model based on the ability to :

- ***Operate technology platforms***
- Co-develop new products with industrial partners
- Protect the results of Research
- Ensure knowledge resourcing

Operating technology platforms



Operating technology platforms

✓ **Example of microelectronic PLATFORMS**

NANOTEC 300

MEMS 200

Nanocharacterization

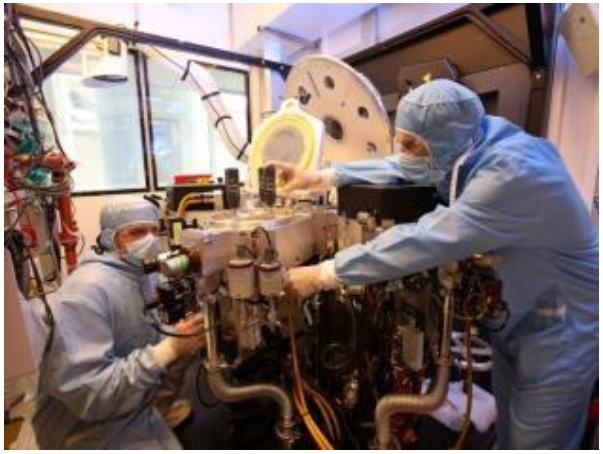
PTA

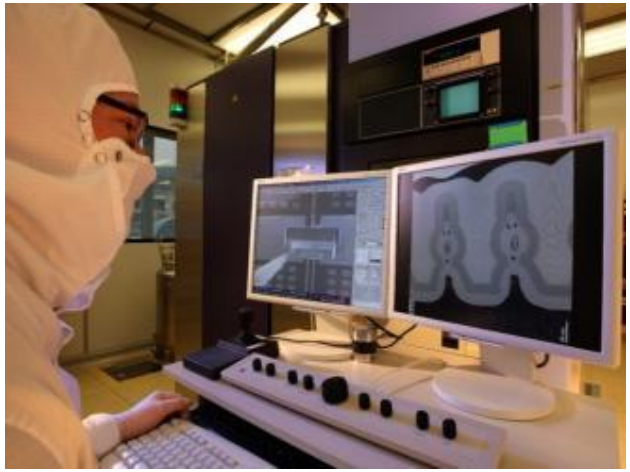
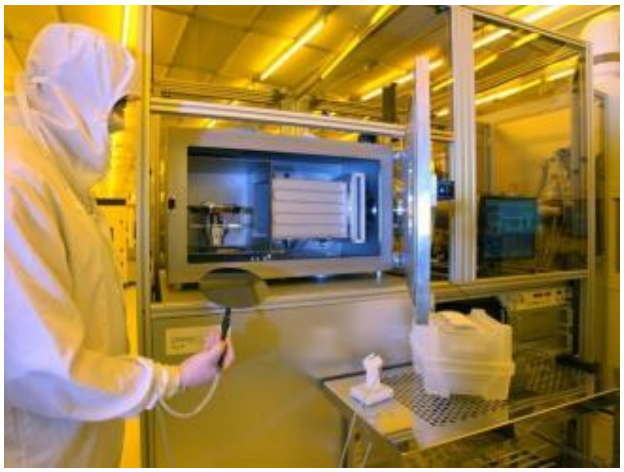
CIME

Operating technology platforms

- ✓ **Leti NANOTECH 300 mm platform**

300mm clean room

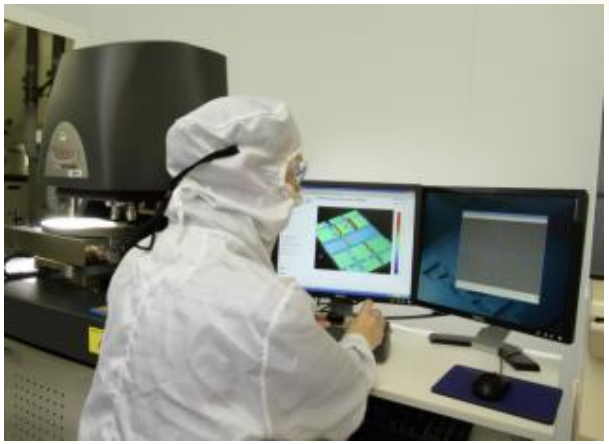




Operating technology platforms

- ✓ **Leti MEMS 200 plaftorm**

200 mm clean room



Operating technology platforms

✓ Nanocharacterisation platform (PFNC)

~60 researchers & engineers
40 large-scale installations
2500m² laboratories
7 Competence centers

X-ray diffraction

Microscopy

Opérer des plateformes technologiques

Nuclear magnetic resonnance

Near-field

Ion beams analysis

Surface analysis

Sample preparation

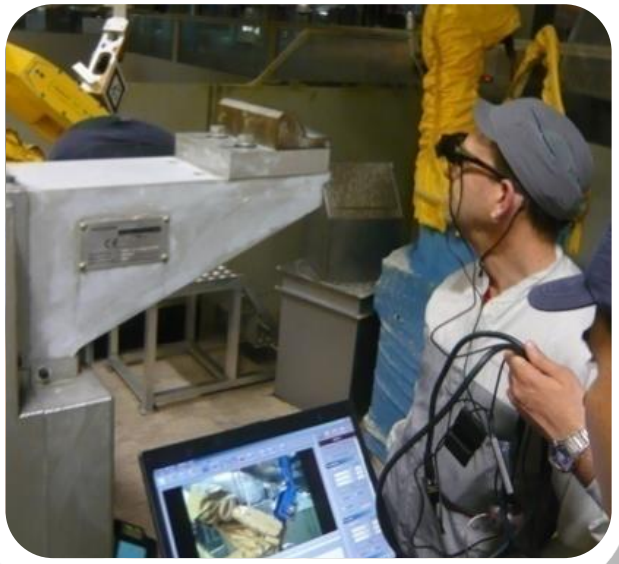
Access to ESRF facilities

Operating technology platforms

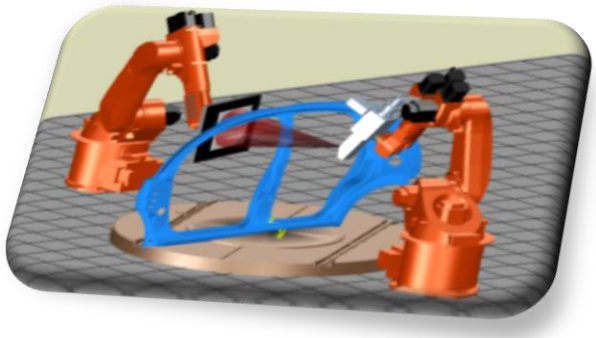
✓ **MANUFACTURING**

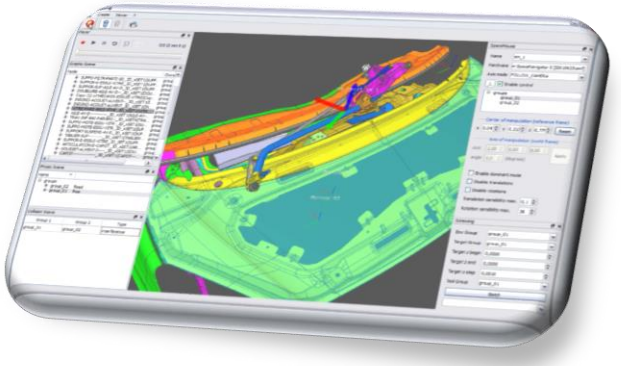
Non-destructive testing (NDT)

Robotics



Virtual Reality



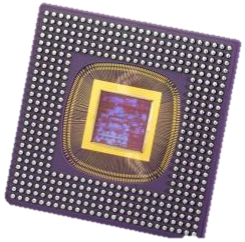
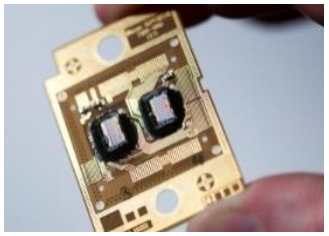


Operating technology platforms

✓ Embedded systems

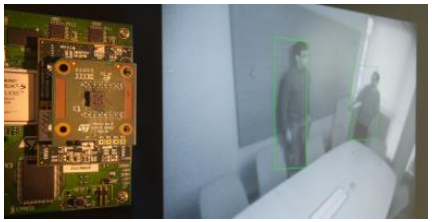
Architectures and systems-on-chip



- Manycore processor
- Safe RT OS
- IC Architecture
- IC & SOC simulation
- Imaging
- EMC / RF Reliability
- Smart Sensors

Systems engineering tools



AUTOSAR

ISO 2626-2

- Green IT
- Wire diagnostic
- Pedestrian detection
- Vision-based geolocation
- Safe command-control
- Hardened camera
- Energy management

Safety, reliability, and standards

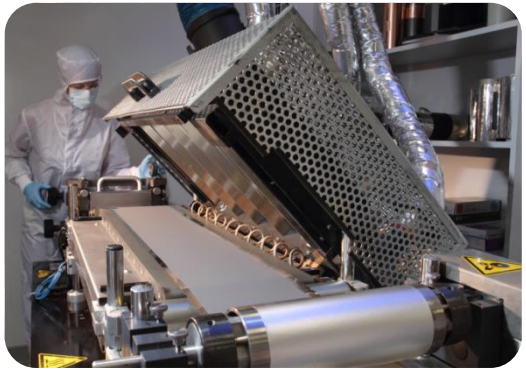
KALRAY

KRONO-SAFE

WINMS

Operating technology platforms

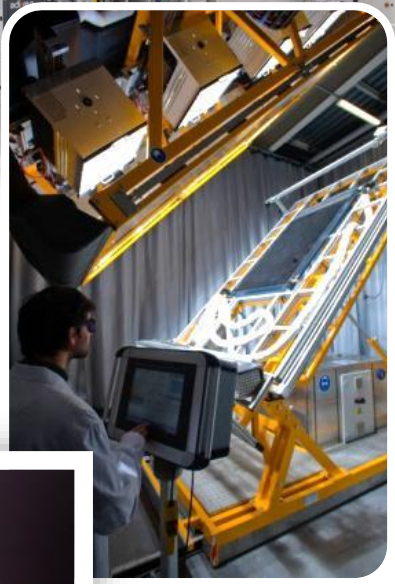
✓ The Liten batteries platform

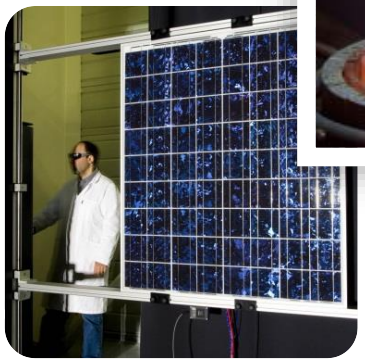


Operating technology platforms

✓ The Liten Energy platform

ines
INSTITUT NATIONAL
DE L'ENERGIE SOLAIRE





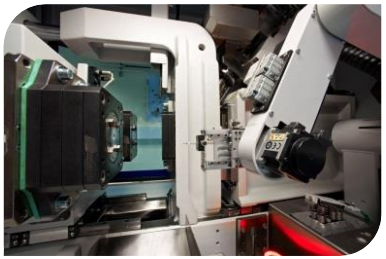
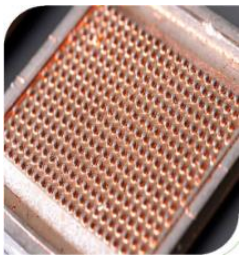
Operating technology platforms

✓ Powder metallurgy platform

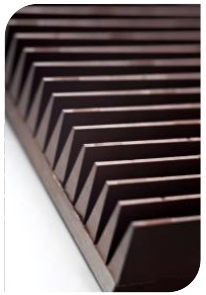
Master powder formulation and preparation



Injection/molding

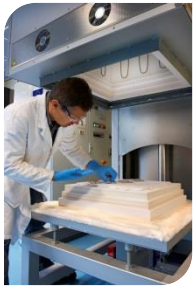



Debinding and sintering



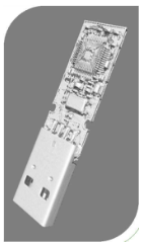
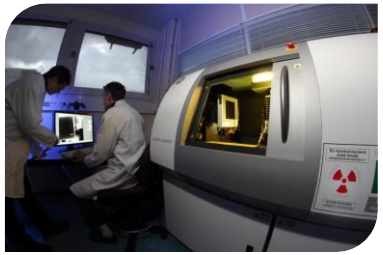

Lab furnaces


Sintering furnaces

X-ray µ-tomography characterization



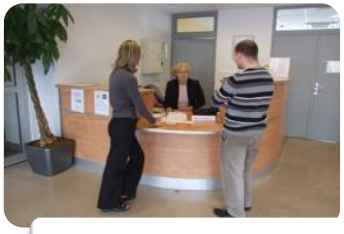
Material characterization



Operating technology platforms

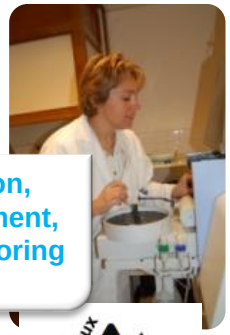
✓ Nanosafety platform

A 5,000 m2 building with 1,000 m2 of lab space, 7 training rooms, and 50 nanosafety experts and researchers



Front desk, communications, offices

Detection, measurement, and monitoring unit



Healthcare and biology unit

Training unit

R&D unit

Intervention unit

LABM, FLS, LCSN, SST, SPR, INSTN

Operating technology platforms

clinatec®

leti

UNIVERSITE JOSEPH FOURIER SCIENCES TECHNOLOGIE MEDECINE

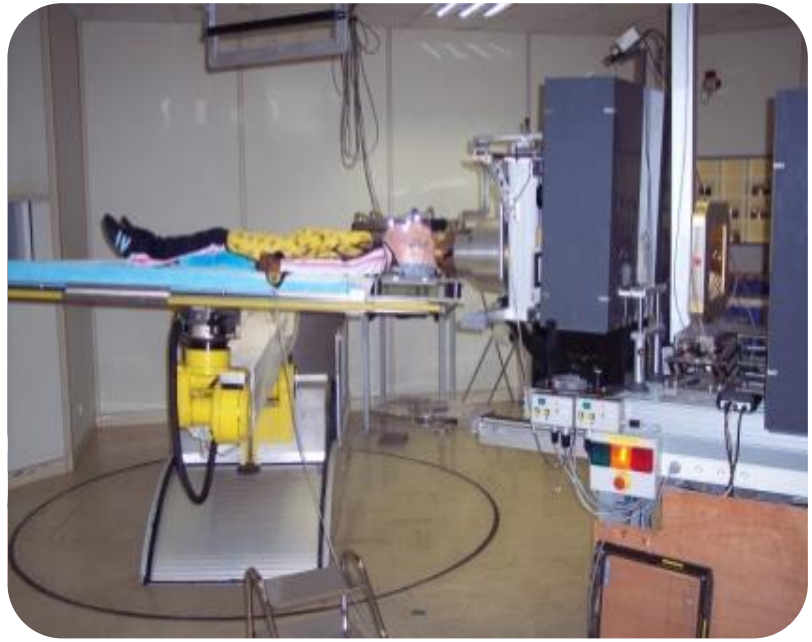
CHU GRENOBLE

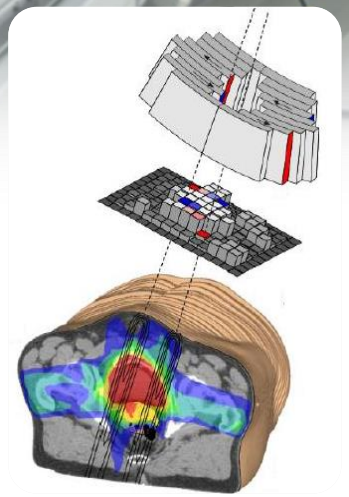
Prototype d'implant en cours de développement au Léti.

Operating technology platforms

✓ DOSEO platform

development of technical solutions for radiotherapy technologies & imagery.





✓ The CEA Tech show room

LE SHOWROOM
catalyseur d'innovations

R&D
OFFRE DE SERVICE

INDUSTRIES
HIGH TECH
TRADITIONNELLES

Operating technology platforms

✓ Design Platform

200 designers

35 patents / year

- Analog design
- Digital design
- Embedded software

Broad range of designed testing tools

- CAD tools from Cadence, Mentor Graphics, Synopsys, Agilent…
- Joint Lab with CAD vendors
- Automatic test equipement , RF prober..
- Access to advanced technology:

CMOS, 3D, photonics, MEMS, THz..and MPW

✓ Technology transfer and user-driven innovation platform

User-driven creativity sessions

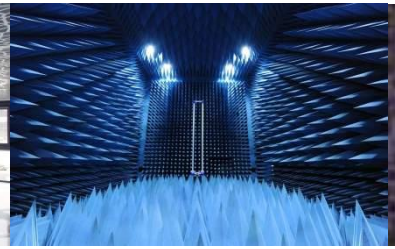
Operating technology platforms

Industries Integratives

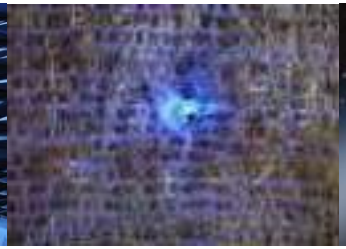
An environment
dedicated to innovation in SMEs

Showroom

Chambre anéchoïde



laboratories



Innovation platform for SMEs

An unique model based on the ability to :

- Operate technology platforms
- ***Co-develop new products with industrial partners***
- Protect the results of Research
- Ensure knowledge resourcing

Co-developing new products with industrial partners

Sport & leisure

Civil engineering, roads

Safety, security, industrial control

Energy

Transport

System integration Micro-nanotechnologies

Textiles, clothing, shoes

Telecommunications

Games, paper, retail, every-day objects

Health

Materials, wood, plastics

Homes, electrical appliances

Competitiveness:
CEA Tech operations aligned with industrial standards

Staff

- Experience in manufacturing and research
- Constant acquisition of new skills

Methods

- Compatibility with industrial standards
  - Results-based culture
  - Execution speed
  - Clear reporting
  - ISO 9001 certification based on customer satisfaction
  - Technology transfer phase aligned with standards (TRL, FMECA)

Competitiveness on global markets

- Exposure to international customers (10% of industrial revenue)
- Constant benchmarking with other technological research organizations
- Contributions from leading innovation campuses (MINATEC, GIANT)

An unique model based on the ability to :

- Operate technology platforms
- Co-develop new products with industrial partners
- ***Protect the results of Research***
- Ensure knowledge resourcing

Protecting the results of Research

CEA: Top patent filer among research centers worldwide

Published PCT international applications by top applicants

Ranking	Applicant's name	Country	2012
1	ZTE	China	3906
2	Panasonic	Japan	2951
3	Sharp	Japan	2001
4	Huawei	China	1801
5	Bosch	Germany	1775
6	Toyota	Japan	1652
7	Qualcomm	USA	1305
8	Siemens	Germany	1272
9	Philips	Netherlands	1230
10	Ericsson	Sweden	1197
11	LG Electronics	Korea	1094
12	Mitsubishi Electric	Japan	1042
13	NEC	Japan	999
14	Fujifilm	Japan	891
15	Hitachi	Japan	745
16	Samsung	Korea	683
17	Fujitsu	Japan	671
18	Nokia	Finland	670
19	BASF	Germany	644
20	Intel	USA	640
21	HP	USA	620
22	3M	USA	586
23	Sony	Japan	578
24	Mitsubishi Heavy Indus	Japan	566
25	Sumitomo	Japan	558
26	Sanyo	Japan	537
27	Microsoft	USA	531
28	IBM	USA	528
29	Canon	Japan	480
30	Murata Manufacturing	Japan	462
38	CEA	France	391
44	Alcatel Lucent	France	346

Japan: 14

USA: 6

Germany: 3

China : 2

Korea: 2

Netherlands : 1

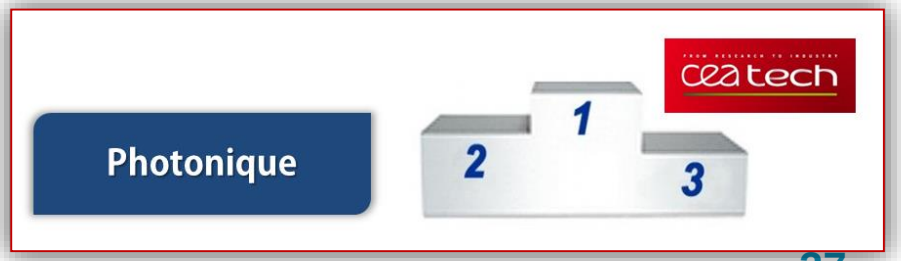
Finland: 1

Sweden:1

France: 0

CEA in top-ranking position worldwide in KETs « hardware »

Ranking of European public R&D institutions on patent application



37

An unique model based on the ability to :

- Operate technology platforms
- Co-develop new products with industrial partners
- Protect the results of Research
- ***Ensure knowledge resourcing***

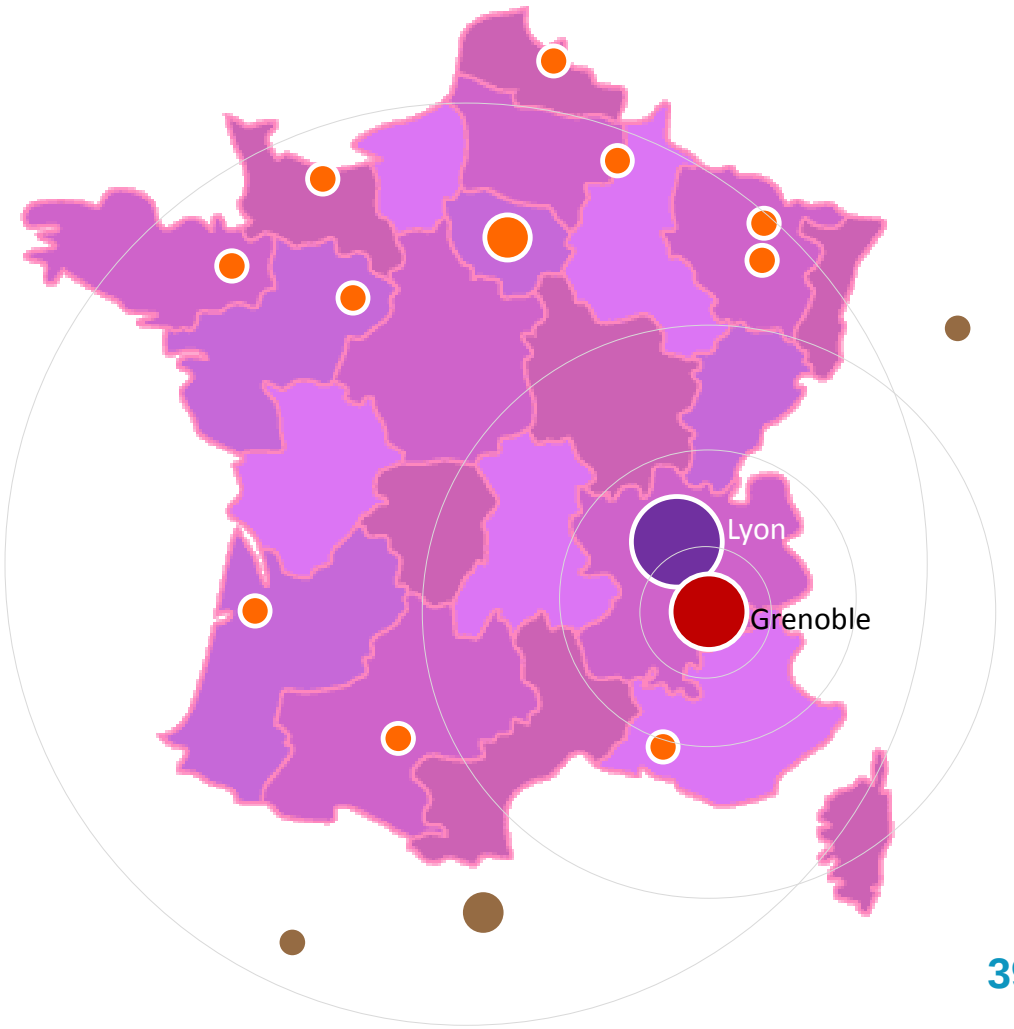
Ensuring knowledge resourcing

15% of PhDs are outsourced

Proximity effect: 40% of PhDs in the labs located in the Rhône-Alpes area

450 PhDs (150 per year) 75 PhDs funded by CEATech in academic laboratories (25 annually)

PhDs in academic labs funded by CEATech

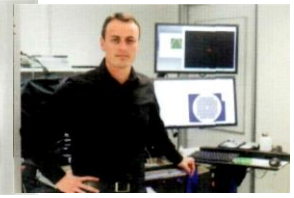
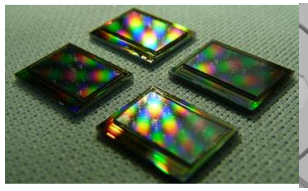
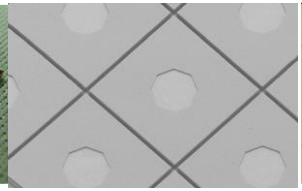
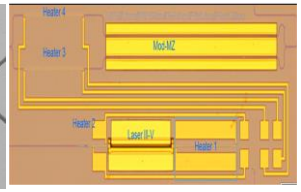


LETI, TECHNOLOGY RESEARCH INSTITUTE

Founded in 1967, based in France (Grenoble) / offices in USA and Japan

Optics and Photonics Division



Created in 1978
300 researchers, engineers and PhD students

~55 M€ budget
90% from external revenue

500 patents in portfolio
91 new patents in 2017

OUR RESEARCH FACILITIES

NEW in 2017 : PHOTONICS BUILDING

Dedicated clean rooms for III-V and II-VI materials (growth, epitaxy, process and packaging) on versatile substrate geometries up to 150 mm

Electro-optical test and characterization facilities

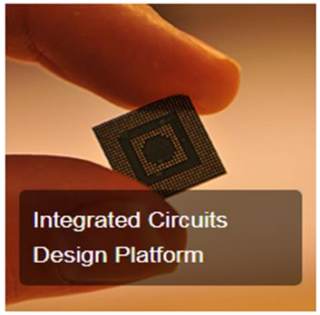
Design and simulation capabilities (process, growth, optics …)

Other facilities and research activities in Leti

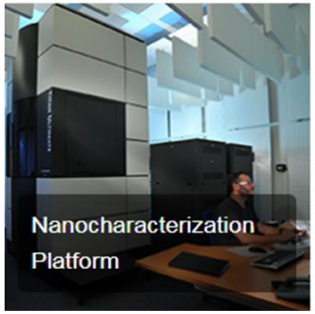
CMOS, 3D

MEMS

IC DESIGN



CHARACTERIZATION



HEALTHCARE

COMPLEX SYSTEMS

PHOTONICS, A KEY ENABLING TECHNOLOGY

Display

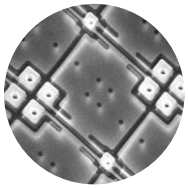
New technologies and systems to display digital information in the physical world

Communicate

Silicon photonics enabling rich digital information anywhere, anytime

Sense

Optical sensors bring digital insight in our environment



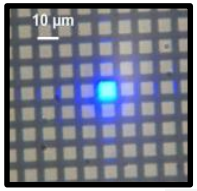
Image

Seeing the unseen over the whole spectrum

OUR MAIN RESEARCH PROGRAMS

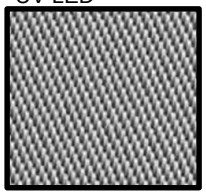
Displays

High brightness microdisplays
Innovative solutions for augmented reality



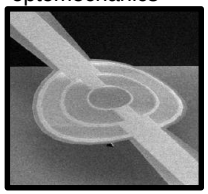
Solid-state light emission

Integrated smart LEDs
LEDs on Si
UV LED



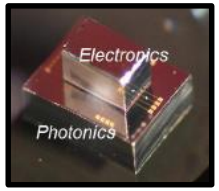
Optical sensors

Integrated optical gas and particle sensors
Explore biophotonics and optomechanics



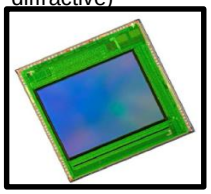
Silicon photonics

Laser integration
Integrate photonic circuits in electronic chips and boards



Visible imaging

Innovative pixels (Global shutter, SPAD)
Integrated filters (thin films, nanostructured)
Integrated optics (refractive or diffractive)

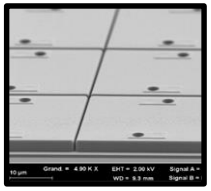


Cooled IR imaging

Increase resolution and size of image sensors (MCT, InSb)
Increase operating T

Bolometer imaging

Decrease sensor cost and size
Develop THz cameras and applications



Technologies for imaging

Photonic materials and technologies (III-V, II-VI, Si)
Small pitch hybridation
Wafer level packaging