ParisTech

PARISTECH – CSC PHD PROGRAM

NOVEMBER 8, 2022

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Presentation – table of content 2/2

Webinar GUESTS

Arts et Métiers Sciences et Technologies – Ali Siadat, scientific advisor for China at Arts et Métiers
Arts et Métiers Sciences et Technologies – LIFSE : Samir Garbaya
Arts et Métiers Sciences et Technologies – LISPEN Lab: : Jean-Philippe Pernot, Nathalie Klement, Ruding Lou, Frédéric Mérienne, Mathias Kleiner, Arnaud Polette, Lionel Roucoules, Esma Yahia, Pierre Garambois, Florian Huet
Arts et Métiers Sciences et Technologies – Laboratoire de Mécanique des Fluides de Lille : Francesco Romano, Shuo Liu, HuiWang
Arts et Métiers Sciences et Technologies – LAMPA : Sylvain Fleury, Simon Richir
Arts et Métiers Sciences et Technologies – MSMP : Mourad Elhadrouz, Jean-Patrick Goulmy, Dorian Depriester
Arts et Métiers Sciences et Technologies – LABOMAP : Louis Denaud, Mariem Yaich, Stéphane Girardon

Chimie ParisTech – PSL – Ilaria Ciofini, VP Research
Chimie ParisTech – PSL – IRCP : Dominique Costa
Chimie ParisTech – PSL – I-CleHS : Anne Varenne , Jean-François Soulé

Ecole des Ponts ParisTech – YuJun Cui, Research deputy director
Ecole des Ponts ParisTech – Laboratoire NAVIER : YuJun Cui

ESPCI Paris – PSL – Joshua McGraw
ESPCI Paris – PSL – LPEM : Zhuoying Chen, Cheryl Feuillet-Palma, Lionel Aigouy
ESPCI Paris – PSL – GULLIVER : Joshua McGraw
ESPCI Paris – PSL – CBI : Annie Colin

Mines Paris– PSL – Alexandra Belus, scientific advisor for China at Mines Paris
Mines Paris – PSL – CRI - Claude Tadonki
Mines Paris – PSL – CAOR -Alina Glushkova

Institut d'Optique Graduate School – Denis Boiron, Deputy head of Doctoral School Waves and Matter (EDOM)
Institut d'Optique Graduate School – LP2N : Philippe Tamarat , Dylan Banahene-Sabulsky

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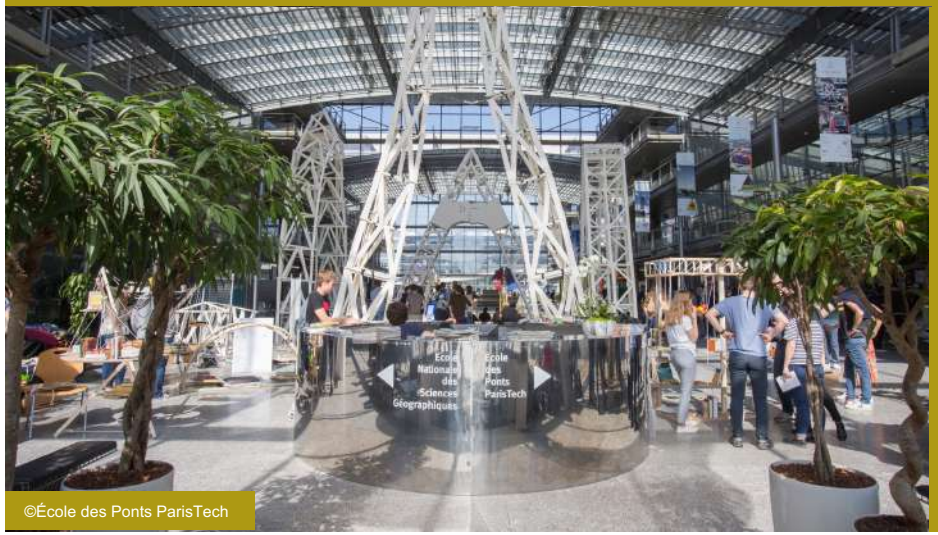

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1. ParisTech introduction

ParisTech
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ParisTech schools

7

« Grandes Écoles »
In Engineering & Science

AgroParisTech

Arts et Métiers Sciences et Technologies

Chimie Paris ParisTech | PSL

École des Ponts ParisTech

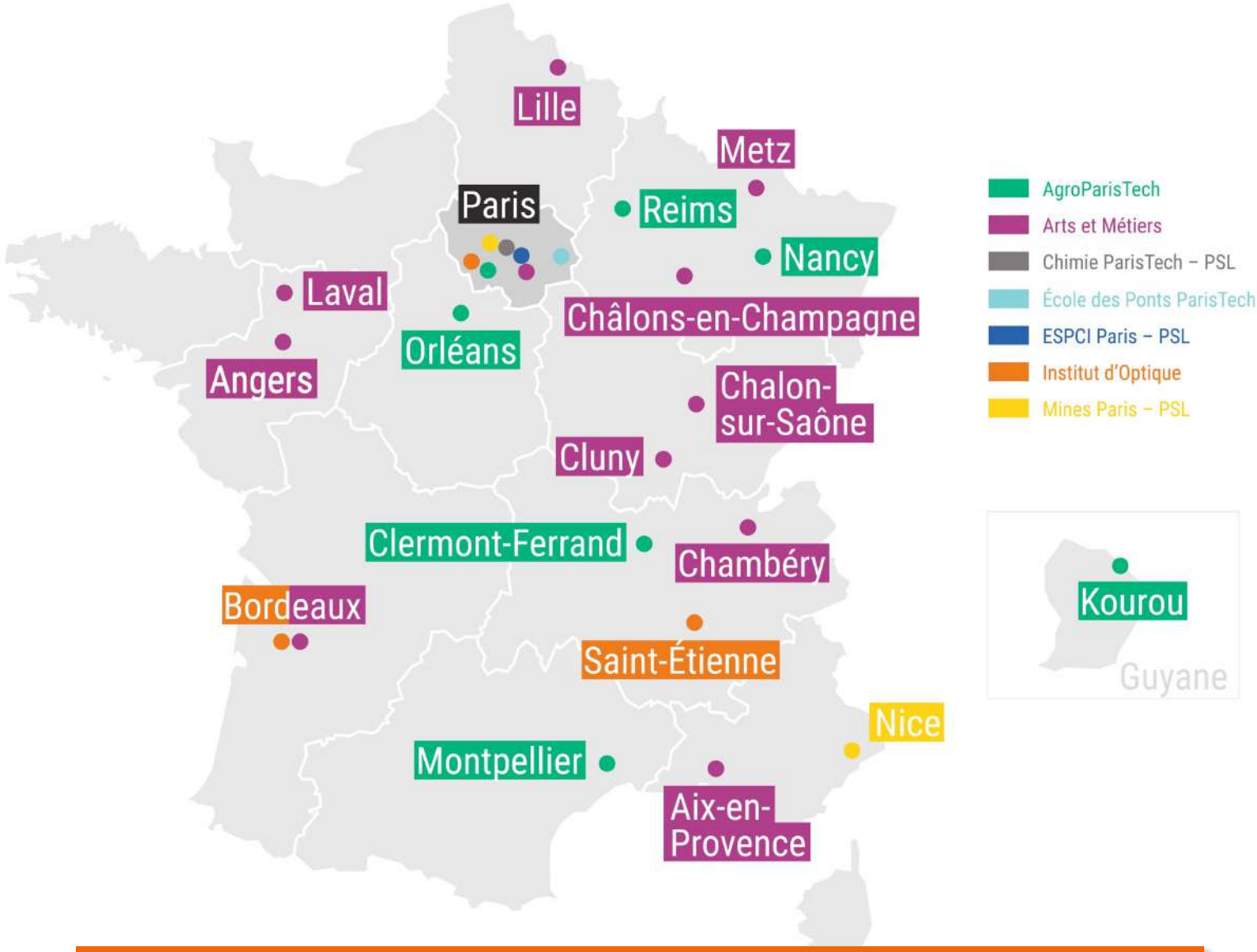
ESPCI PARIS | PSL
EDUCATION SCIENCE INNOVATION

INSTITUT d'OPTIQUE GRADUATE SCHOOL ParisTech

université PARIS-SACLAY

MINES PARIS | PSL

ParisTech – a brand for excellence in France



The 7 schools' laboratories are located all around France, not only in Paris.

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ParisTech’s consortium key numbers

12 500
students

1 700
PhD candidates

70 international agreements

85 laboratories

1 500
professors

30%
international students

90 000
alumni

History

Mines Paris – PSL

Chimie ParisTech – PSL

Arts et métiers

AgroParisTech

ESPCI Paris – PSL

Institut d'Optique

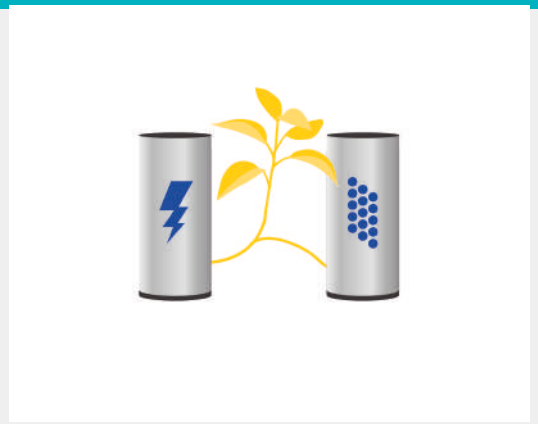
École des Ponts ParisTech

1747 1780 1783 1824 1882 1896 1917 2000

Leaving a mark in history…

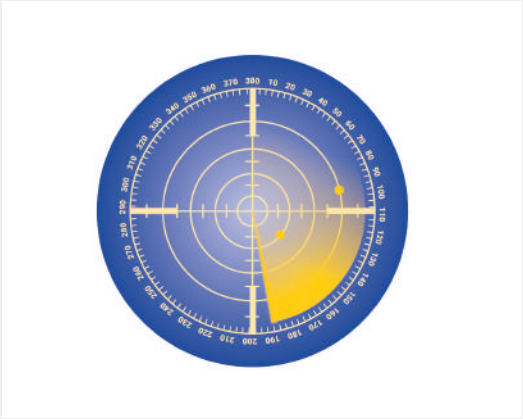
Molecular cuisine
Hervé This & Nicholas Kurti (1988)
AgroParisTech

Quartz clock
Marius Lavet (1949)
Arts et Métiers



Catalytic methanation reactor
Vincent Piepiora (2018)
Chimie ParisTech - PSL

Lenticular device for video projectors, headlights lighting and some photovoltaic cells
Augustin Fresnel (1822)
École des Ponts ParisTech



Sonar
Paul Langevin (1915)
ESPCI Paris - PSL

Progressive lenses for visual correction
Bernard Maitenaz (1959)
Institut d'Optique Graduate School

Sound-based tracking system
Ferdinand Daussy (1915)
MINES Paris - PSL

Permament connections with companies

ParisTech alumni – key players of the economic world

Philippe Knoche
MINES Paris - PSL

Antoine Frérot
École des Ponts ParisTech

Benoît de Ruffray
École des Ponts ParisTech

Christel Heydemann
École des Ponts ParisTech

Béatrice Foucher
AgroParisTech

Éric Carreel
ESPCI Paris - PSL

Nicolas Brusson
Institut d'Optique Graduate School

Patrice Caine
MINES Paris- PSL

Xavier Huillard
École des Ponts ParisTech

Jean-Marc Chéry
Arts et Métiers

Éric Niedziela
Arts et Métiers

Marion Dewagenaere
École des Ponts ParisTech

Jean-Laurent Bonnafé
MINES Paris - PSL

Anne Rigail
MINES Paris - PSL

Mostafa Terrab
École des Ponts ParisTech

Laurence Piketty
Chimie ParisTech - PSL

Jean-Philippe Puig
Chimie ParisTech - PSL

… or to create your start-up

Ynsect

[Breeding and processing insects](#) to contribute to the major challenges of our time: feeding the world's population, preserving resources and biodiversity, and fighting global warming

Zozio

[Zozio](#) turns a factory into a connected factory with its Robin.Connect service. Robin.Connect makes your data speak through its collection, structuring, storage and protection.

AZA Electrically Rechargeable Zinc-Air Batteries

[Aza Battery](#) is developing new systems by improving all components (bi-functional air electrodes, separating membrane and zinc electrode)

URBAN CANOPEE

[Canopy solutions](#) to cover the city's landscape with a modular, reversible, natural and light-weight vegetation mesh

HOLOGIC SUPERSONIC imagine

[Ultrasound medical imaging](#)
An innovative medical technology company primarily focused on improving women's health and well-being through early detection and treatment

effiLux Efficient Led Lighting

[EFFILUX](#)
specializes in designing, manufacturing and selling powerful, flexible and easy-to-use LED lighting solutions for machine vision, quality control, scientific imaging, biomedical, optical measuring devices, and many other applications.

legalstart.fr

[Legalstart](#) is leader in online legal and administrative services for start-ups, SMEs and associations

AgroParisTech

Arts et Métiers Sciences et Technologies

Chimie Paris ParisTech | PSL

École des Ponts ParisTech

ESPCI PARIS | PSL

INSTITUT d'OPTIQUE GRADUATE SCHOOL ParisTech

université PARIS-SACLAY

MINES ParisTech | PSL

Why choose France?

Excellence in S&T and business

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©Daniel Coutelier / Terra


©Arnaud Bouissou / Terra

- **6th economic power in the world**
  - R&D spending = 2.2% of GDP
  - International company leaders in their sector (materials, building, cosmetics, energy, transport…)
  - Paris area: a dynamic region (a lot of companies, high employability rate, numerous R&D centers)
  - Anation of entrepreneurs: 3.5 days to create a business in France

- **Excellence of the Higher Education system**
  - 5th destination in the world for international students
  - Scholarships and support for international mobility
  - A lot of international academic partners
  - Tuition fees lower than in most of the Western countries

- **A S&T leader worldwide**
  - The country of mathematicians (Viète, Laplace, Cauchy, Poincaré, Louis Bachelier…)
  - Excellence in a lot of domains, e.g. chemistry, civil engineering, physics (Marie & Pierre Curie, Ampère, Laplace, Freyssinet, Coriolis, Fourier…)
  - 65 Nobel prizes and 13 Fields Medals
  - World famous research organizations (CNRS, INRAE, INSERM, CEA…)

A country of culture

- **Tradition / Art & History / Quality of Life**
  - Arts (museums, movies, literature, philosophy…)
  - Romantism, impressionism, surrealism…
  - Food
- **Values**
  - Freedom, equality, brotherhood
  - Inclusion
  - Cosmopolitanism
  - Critical thinking, strong attachment to sciences and innovation
- **A key role in ecological transition and climate change**
- **French language**
  - Official language of more than 300 million people (5th in the world)
  - 3th most important language for business in the world after English and Mandarin Chinese

What international students are saying

- *9 out of 10 international students recommend France as first study destination*
- *93 % believe that studying in France has been a self-enrichment*
- *86 % believe that studying in France have highlighted their university curriculum*

2. ParisTech – CSC PhD program

ParisTech
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Applicant’s Profile

Prerequisites

Find all relevant information on:

Applicants must be citizens of the People's Republic of China at the time of application.
Applicants should not hold a foreign permanent residence permit.
Applicants should be at least 18 years old at the time of application.

Studying in China

- At final year of Master degree
- In the 1st PhD year, recommended by your home university (for co-supervised PhD)

Studying in France (or in one of the 41 partner countries of the CSC)

- Second/Last year Master's (M2) students or students graduated within less than a year at the time of application for the CSC scholarship.

- *Applicants who have studied for a "Diplôme d'ingénieur" in France, and especially those who have received funding from the CSC - ParisTech "9+9" Program project are also encouraged to apply to this PhD program.*

Working

You are **a master holder** and you work in a company that agrees with your PhD project

Prerequisites:

Excellence, for a highly-selective competition

- You have **excellent academic records, especially in the relevant discipline.**
- You should have **good command of written and spoken English.**
- **You should have a coherent personal and professional plan.**
- You are willing to learn minimal French for basic communication.

Tips

- *Learn as much as you can about the labs, the PhD advisors, their past and present work.*
- *Carefully select PhD proposals that are relevant with your personal profile.*
- *Then build a coherent, clear professional plan around the information you gather.*

The CSC scholarship – funding scheme

- 1350€ / month (for the duration specified on your admission letter, starting when you arrive in France) + one-time round-trip international travel expenses by the most economical route

- Duration :
  - 36-48 months for full PhD
  - 6-24 months for co-supervised PhD

- You are committed to go back to China at then end of your PhD (exceptions to be found on the CSC website).

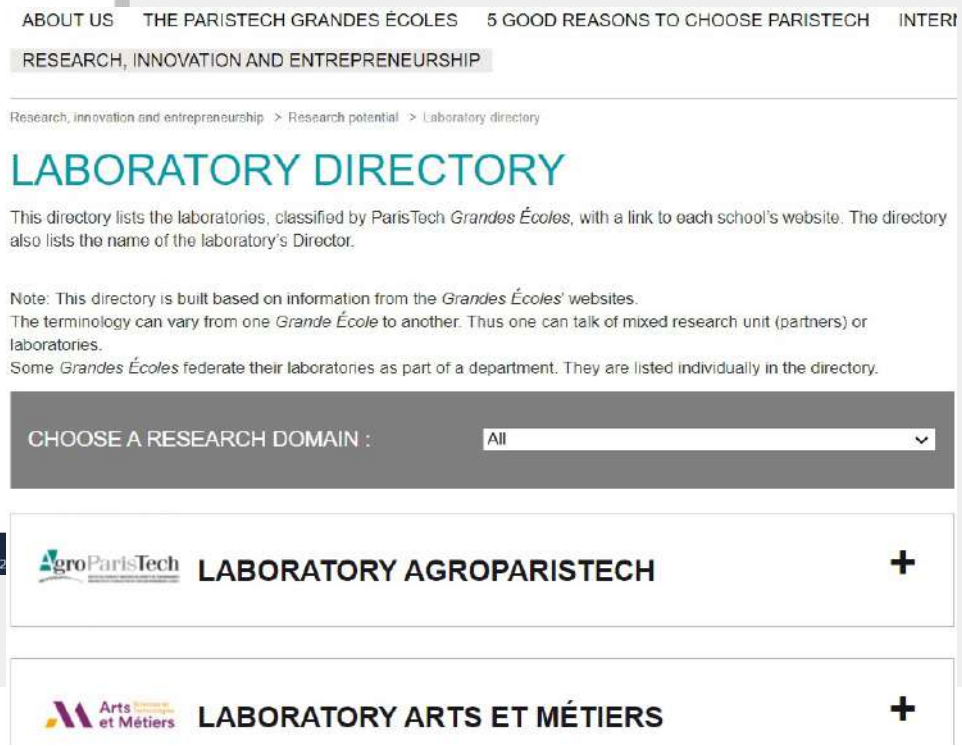
Calendar & Steps

Where to find relevant information?

PARISTECH WEBSITES

https://www.paristech.fr/en/homepage

To learn more about the ParisTech – CSC PhD program, about the ParisTech labs, etc.



2022-2023 Campaign

6 SCHOOLS

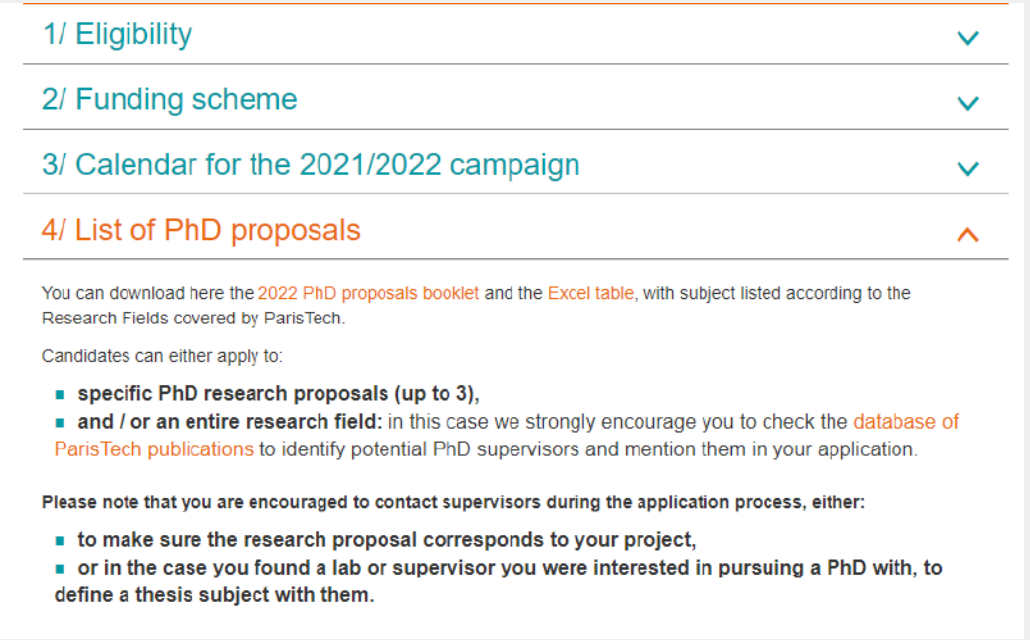
95 PHD PROPOSALS

in

11 FIELDS OF ENGINEERING

+11 CITIES IN FRANCE

You can check them on the excel table, or download them all here: https://www.paristech.fr/en/international/china/paristech-csc/how-apply



1/ Eligibility

2/ Funding scheme

3/ Calendar for the 2021/2022 campaign

4/ List of PhD proposals

You can download here the 2022 PhD proposals booklet and the Excel table, with subject listed according to the Research Fields covered by ParisTech.

Candidates can either apply to:

- **specific PhD research proposals (up to 3),**
- **and / or an entire research field:** in this case we strongly encourage you to check the database of ParisTech publications to identify potential PhD supervisors and mention them in your application.

Please note that you are encouraged to contact supervisors during the application process, either:

- **to make sure the research proposal corresponds to your project,**
- **or in the case you found a lab or supervisor you were interested in pursuing a PhD with, to define a thesis subject with them.**

Where to get relevant information?

PARISTECH SOCIAL MEDIA ACCOUNTS

For videos, information on research and innovation in ParisTech schools…

GLOBAL ACCOUNTS

LinkedIn

Instagram

Twitter

Facebook

YouTube

CHINESE ACCOUNTS

LinkedIn

Wechat

Twitter

Weibo

Bilibili

International admission process

17 October 2022: Publication of the PhD proposals

October 17, 2022 – December 11, 2022 (23.59 Paris Time) : Application

December 23, 2022: Invitation to the interview

January 09 – 20, 2023: Interview with ParisTech

Late January – February 2023: Interview with the PhD supervisor(s)

Conditional Admission letter

March 2023: CSC scholarship application

Application

Step 1- Publication of the PhD proposals on ParisTech website on October 17, 2022

Step 2- Online application from October 17 to December 11 (23:59 Paris Time), 2022

DOCUMENTS TO BE UPLOADED (*ARE MANDATORY)	
2 recommendation forms*	Student ranking certificates (at bachelor and master level)*
Academic transcripts (at bachelor and master level)*	English certificate (IELTS, TOEFL, CET-6/4, etc.)*
A personal statement including motivation and rough research plan (1-2 pages)*	A scan of your passport or resident ID card*
An ID photo*	An English summary of your master thesis
French certificate	Any further document proving your academic or scientific achievement / excellence (ex. university prize, published work, previously awarded scholarship)

Step 4- Selection based on the application files and if selected, invitation to an interview (December 23, 2022)

Step 5- Online interviews from January 09 to 20, 2023

Step 6- Interview with the potential PhD supervisor(s) from end of January to end of February 2023

Step 7- Conditional admission letter provided to the selected applicants by the PhD supervisors (conditions: obtention of master degree and CSC scholarship) (before March 2023)

Step 8- Application for the CSC scholarship by the student (March 2023)

Step 9- Results of the CSC process (May-June 2023)

ParisTech China will ensure a follow-up process of the CSC scholars til the arrival in France, in relation with the ParisTech schools.

How will your application be evaluated?

In your application file

- **The file you submit should be complete**
- Excellence of academic transcripts
- Ranking: personal ranking and ranking of your university at national and international level
- Referrals

During the interview

- Your capacity to communicate in English, and even in French if you are able to
- Your capacity to present and explain clearly your personal and professional project

During the interview with the potential PhD supervisor

- The relevance of your profile with the lab's requirements and the thesis
- Your scientific level in relevant fields

Tuition Fees

The doctoral training program total cost in France is between 100k & 150k Euros per year.

PhD candidates are only asked for tuition fees:

Admitted students may benefit from a partial or full tuition fee waiver for the duration of their studies at their host ParisTech Grande École.

ParisTech Schools	Tuition fees
AgroParisTech	380€ + 92€ CVEC* each year
Arts et Métiers Sciences et Technologies	
Chimie ParisTech - PSL	
Ecole des Ponts ParisTech	
ESPCI Paris - PSL	
Institut d'Optique Graduate School	
MINES ParisTech - PSL	

**CVEC : access to health and social services, sport facilities etc. in the schools.*
Learn more about it: https://www.campusfrance.org/en/10-things-you-need-to-know-about-the-student-and-campus-life-contribution-cvec

Results

By the end of May 2023 – June 2023, the CSC will announce the list of successful candidates.

Each year, over 100 candidates apply to this program, half get a proposal from a ParisTech school lab.
In 2020, 33 scholarships were granted by the CSC.

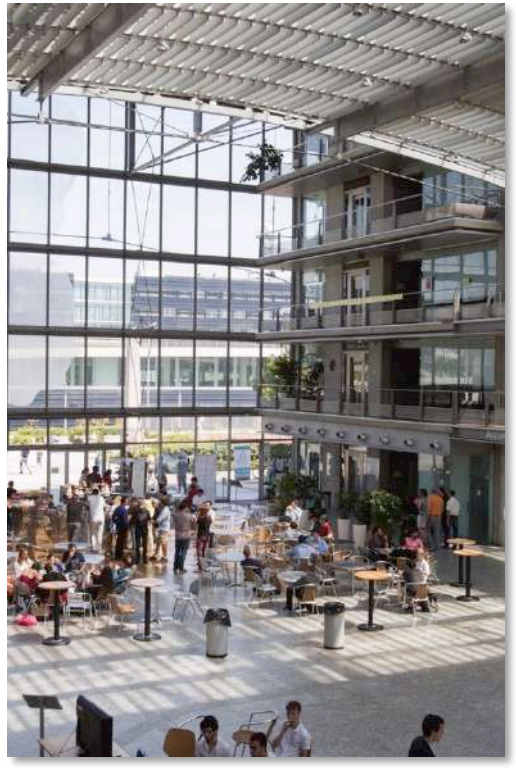
Successful applicants will then receive their official admission letters, and be informed by the CSC about all the administrative procedures to follow before departure for France.

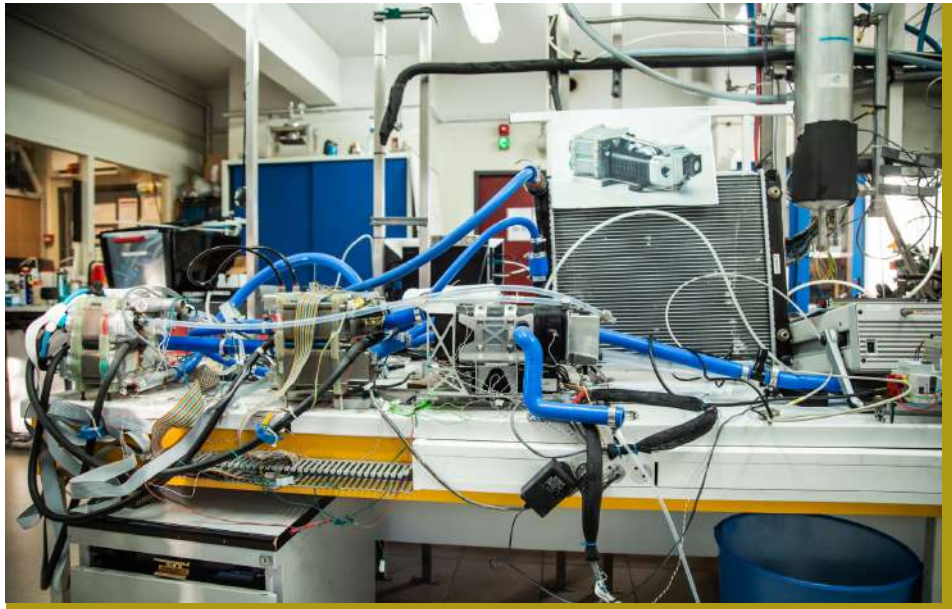
Once all administrative procedures over, and their visas obtained, PhD candidates will be expected to arrive in France in September – October 2023.

Studying at Paristech:

INTERNATIONAL STUDENTS SERVICES

- Accommodations
  - Help to find accommodation
  - Possibility of accommodation allowance
  - Average living costs in Paris: ~ 800 € /month
- Assistance with visa procedure

3. Research in ParisTech's Higher Education Institutions

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Excellence in Research


Henri Moissan • Chemistry
Henri Becquerel • Physics
Marie Curie • Chemistry
Pierre & Marie Curie • Physics
Frédéric & Irène Joliot-Curie • Chemistry
Maurice Allais • Economics
Pierre-Gilles de Gennes • Physics *1
Georges Charpak • Physics
Alain Aspect • Physics
Jean Tirole • Economics *2
Nobel Prizes
1903
1906
1911
1935
1988
1991
1992
2014
2022
*1 © Dominique Morisseau
*2 © P. Renault/École des Ponts ParisTech

RANKINGS

From 2020, in the international rankings

AgroParisTech

INSTITUT d'OPTIQUE GRADUATE SCHOOL ParisTech | université PARIS-SACLAY

université PARIS-SACLAY

Chimie ParisTech | PSL

ESPCI PARIS | PSL

MINES ParisTech | PSL

PSL UNIVERSITÉ PARIS

Arts et Métiers Sciences et Technologies

École des Ponts ParisTech

are ranked on their own

ParisTech
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Shanghai Ranking (ARWU) 2022

University Paris-Saclay: 16th (1st) **University PSL: 40th** (2nd)

THE 2023

PSL: 47th
University UPSaclay: 93th
Ecole des Ponts ParisTech: 251–300

QS 2023

PSL: 26th
University UPSaclay: 69th
Ecole des Ponts ParisTech: 174th

Shanghai Ranking (ARWU) 2022 – by subject

Physics
#9 UPSaclay
#10 PSL

Mathematics
#1 UPSaclay
#12 PSL

Chemistry
#51-75 UPSaclay
#101-150 PSL

Earth sciences
#41 PSL
#48 UPSaclay
#151-200 Ecole des Ponts PT

Atmospheric science
#76-100 Ecole des Ponts PT

Chemical Eng.
#301-400 PSL
#301-400 UPSaclay

Civil Eng.
#201-300 Ecole des Ponts PT

Environmental Sc. & Eng.
#151-200 UPSaclay
#301-400 Ecole des Ponts PT

Ecology
#5 PSL
#76-100 UPSaclay

Materials Sc. & Eng.
#101-150 PSL

Nanoscience & Nanotechnology
#101-150 UPSaclay
#151-200 PSL

Energy Sc & Eng
#201-300 PSL

Mechanical Eng.
#76-100 PSL
#151-200 A&M S&T

Electrical and Electronic eng.
51-75 UPSaclay

Water resources
#101-150 UPSaclay
#151-200 PSL

Automation & Control
#101-150 PSL

Metallurgical Eng.
#37 PSL
#101-150 A&M S&T

Medical Technology
#151-200 PSL

Food S&T
#76-100 UPSaclay

Biotechnology
#30 UPSaclay
#51-75 PSL

Remote sensing
#76-100 UPSaclay

Economics
#51-75 PSL
#101-150 UPSaclay
#301-400 Ponts PT

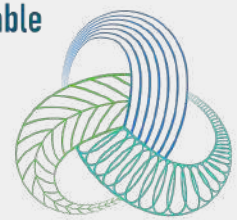
Agricultural Sc.
#11 UPSaclay

Biological sciences
#76-100 UPSaclay
#101-150 PSL

Human Biological Sciences
#76-100 UPSaclay

Veterinary Sciences
#51-75 UPSaclay

Partner national research institutes



IFSTTAR

ParisTech

INRAE

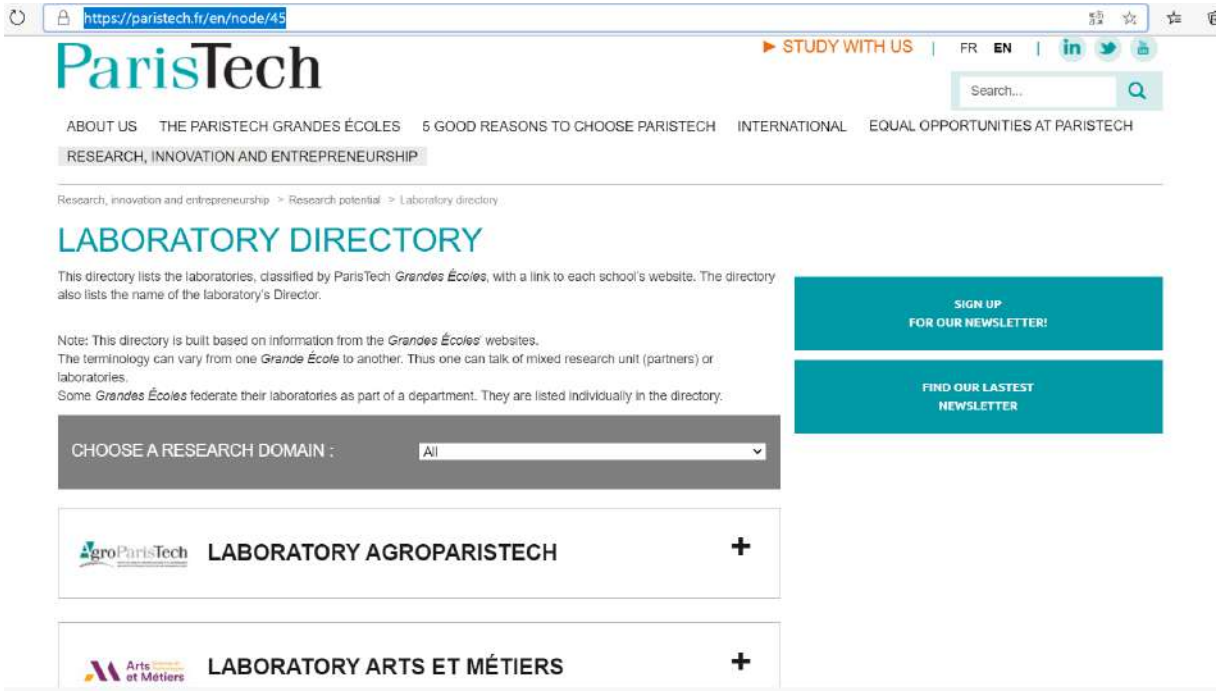
Research Domains

Research Domains

- **C**hemistry, physico-chemistry, mechanical engineering
- **D**esign, industrialization
- **E**conomics, management and social sciences
- **E**nergy, process
- **E**nvironmental S&T, sustainable development, geosciences
- **I**nformation and communication S&T
- **L**ife and health S&T
- **L**ife science and engineering for agriculture, food and environment
- **M**athematics and applications
- **M**aterial sciences, mechanics and fluids
- **P**hysics, optics
- **U**rban planning, transport

ParisTech's Labs

Learn more about the labs in each school:



RESEARCH AT CHIMIE PARISTECH - PSL

ILARIA CIOFINI

ParisTech

ParisTech – CSC PhD Program

Chimie Paris ParisTech | PSL

19 PhD proposals **3** Fields of research **2** Labs

i-CLeHS

IRCP Institut de Recherche de Chimie Paris

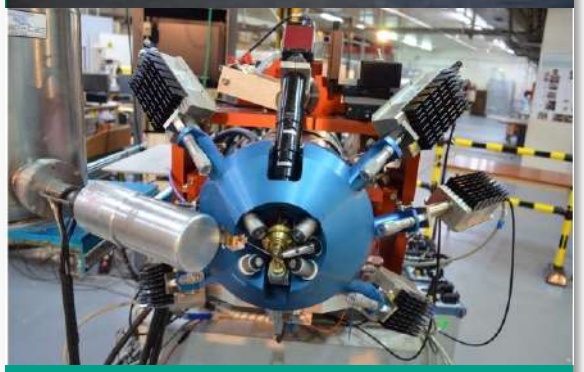
cnrs

Research at Chimie ParisTech – PSL

Laboratories	Research domains
I-CLeHS	The I-CLeHS laboratory, composed of 4 research teams, focuses on **Chemistry** for **Health** and **Life Sciences** with research spanning from fundamental to applied in theoretical and physical chemistry to organic and bio-inorganic chemistry
IPVF	IPVF focuses on energy production (**photovoltaics**)
IRCP	The 8 teams of the IRCP laboratory cover a wide variety of domains of chemistry going from **material science** to **energy production and storage**.

RESEARCH AT CHIMIE PARISTECH – PSL

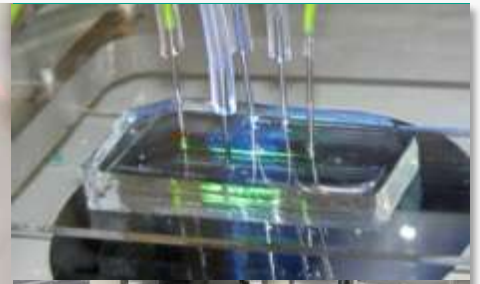
RESEARCH INFRASTRUCTURES IN PARIS CITY CENTER



New Aglae (Louvre)

NMR/Mass/HPC facilities

Characterization (spectroscopy, microscopy)



Chemistry

Optics

ParisTech
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RESEARCH AT CHIMIE PARISTECH – PSL

KEY FACTS / FIGURES

140 researchers & teacher-researchers
100 PhD candidates 50 % of international PhD candidates

300 publication a year

7 patents a year

Industrial Chairs
Prestigious partnerships with academic laboratories & industrial partners
Co-directed thesis with international partners (Italy, Mexico, South Africa…)

and many others…

5 ERC (1 Starting, 2 Consolidator, 2 Advanced)
2 ITN (European Training Networks)
1 IUF (Senior)
1 CNRS Silver Medal
Several international prices (France-Berkeley Funds Award, Swiss National Science Foundation ….)

RESEARCH AT ARTS ET MÉTIERS INSTITUTE OF TECHNOLOGY

ALI SIADAT

ARTS ET MÉTIERS INSTITUTE OF TECHNOLOGY

Shaping tomorrow's technology

Arts et Métiers Institute of Technology

RESEARCH AND INNOVATION

Arts et Métiers Institute of Technology

ARTS ET MÉTIERS **IN NUMBERS**

1780
Founded by the Duke
Of Rochefoucault-Liancourt

11
SITES
located all over France
dedicated to Teaching & Research

270
PhD STUDENTS
at our Doctoral School
"Sciences des Métiers de l'Ingénieur"

1
BACHELOR OF TECHNOLOGY

6254
STUDENTS
all programs included

15
LABORATORIES
and research teams

11
ENGINEERING PROGRAMS
1 broad-based 10 specialized

1011
PERSONNEL
Teachers, Technicians & Administrative Staff

7 MILLIONS €
income

+20
RESEARCH MASTERS

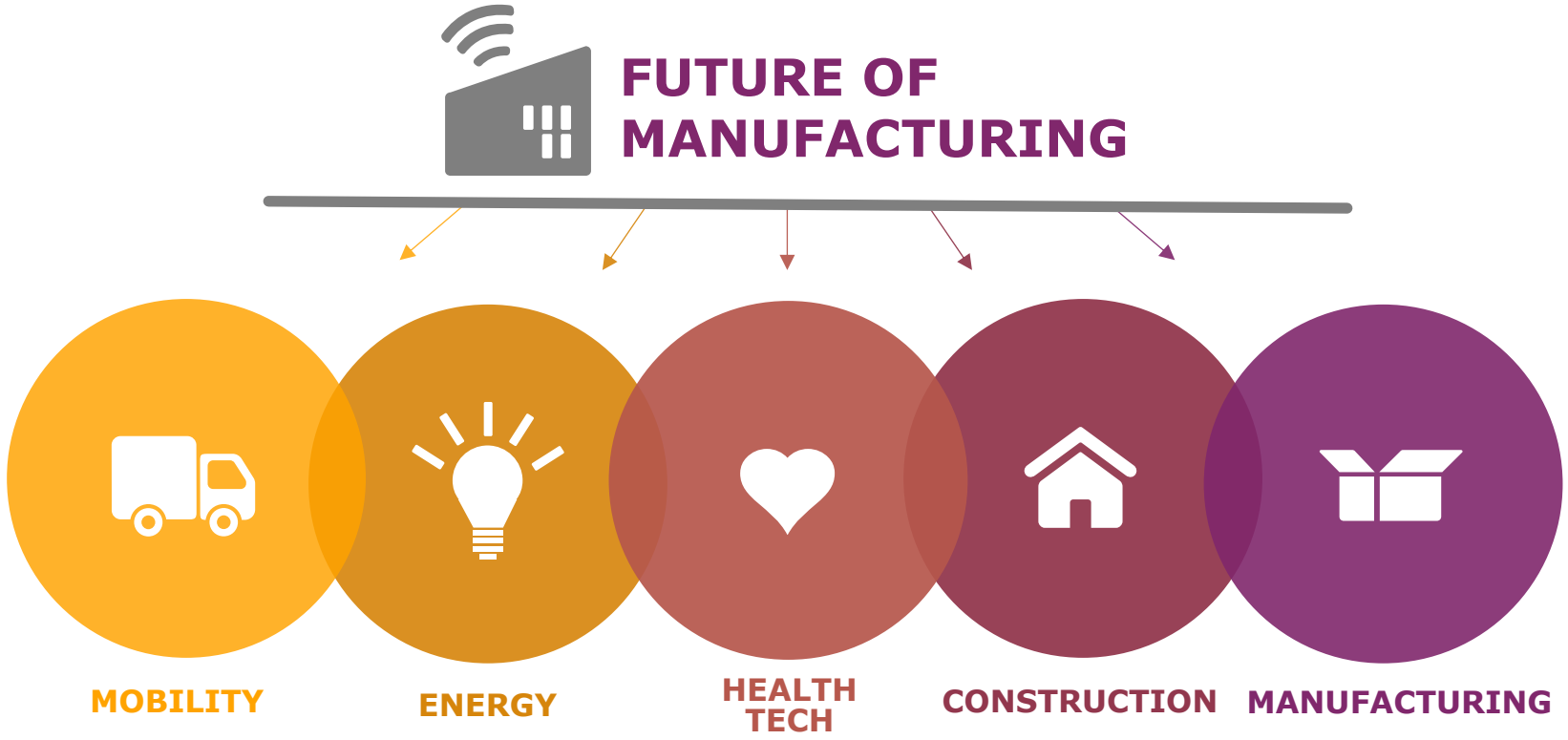
15 MILLIONS €
income generated
by industry contracts

2000
CONTINUING EDUCATION
auditors

17
EXECUTIVE MASTER PROGRAMS

Arts et Métiers Institute of Technology

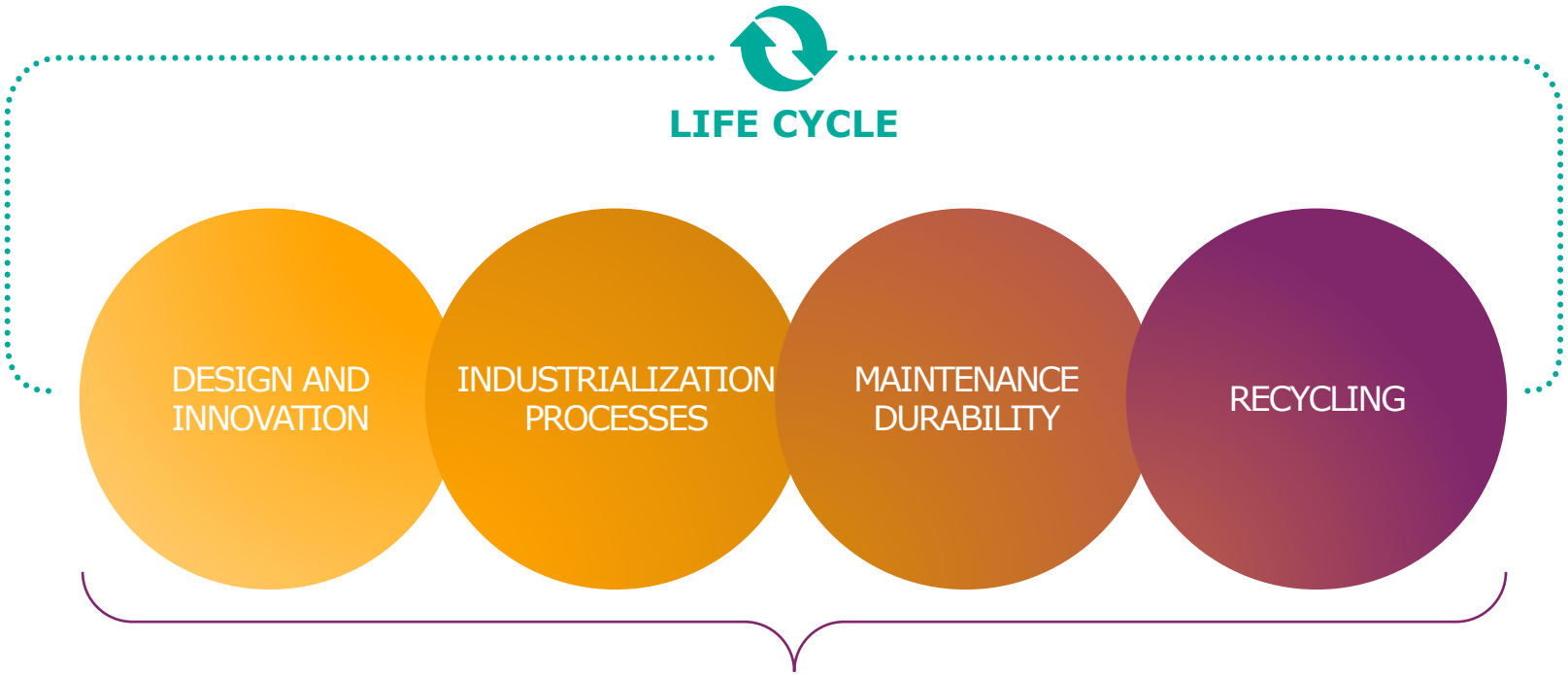
5 STRATEGIC INDUSTRIAL FIELDS TO MEET FRENCH AND INTERNATIONAL INDUSTRIAL EXPECTATIONS



Arts et Métiers Institute of Technology

OUR SPECIALTY: RESEARCH ON THE **FULL PRODUCT LIFE CYCLE**

➔ FROM DESIGN TO RECYCLING, THROUGH EVERY INTERMEDIATE STAGE



- Environmental and societal impact approach
- Development of groundbreaking digital tools with real world applications

cdio
CONCEIVE DESIGN IMPLEMENT OPERATE
CDIO program member

Arts et Métiers Institute of Technology

3 TASKFORCES: LIFECYCLE DIGITALIZATION

Taskforce 1: Lifecycle digitization (CDIO)

1.1 Data: measurements, collection, treatment, including data reduction
1.2 Data-improved physical models
1.3 Human machine interface, VR/AR
1.4 Digital twin/product lifecycle management/digital model: Lifecycle digitalization (CDIO)

Taskforce 2: Smart materials, structures and systems

Advances in IoT tools, modelling and real-time control offer new opportunities to increase self-control/self-repair/self-diagnosis capacity on all system levels. Digital, electronic, and sensors technologies contribute to the development of new materials/structures/systems.

Targeted application domains:

- 2.1: Robotics and cobotics
- 2.2: Smart materials
- 2.3: Smart process control
- 2.4: Smart systems

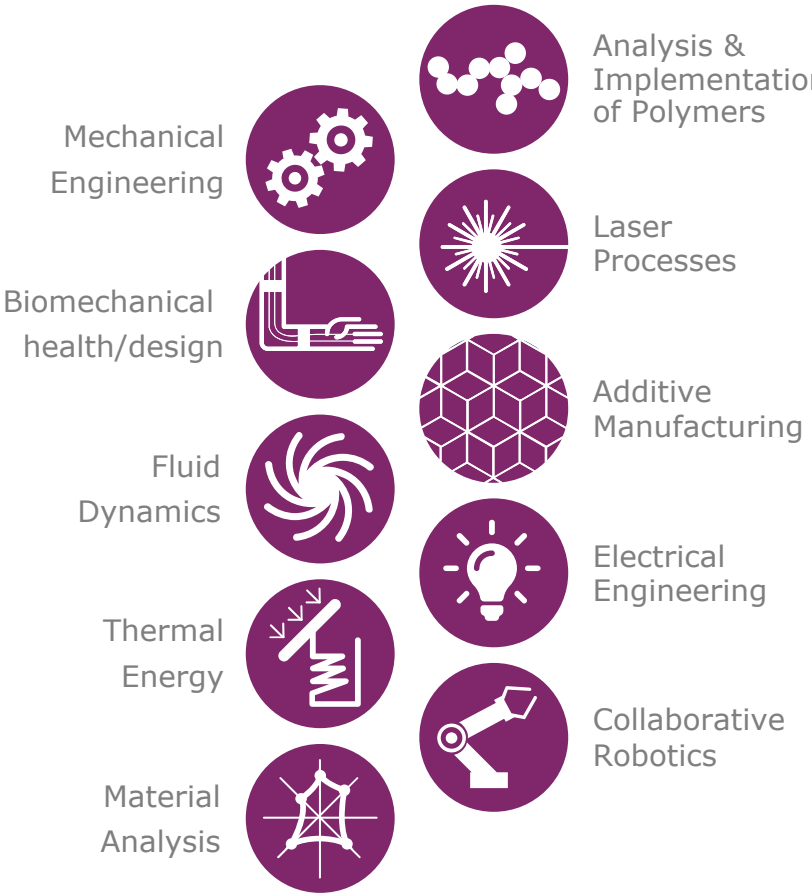
3 TASKFORCES: SUSTAINABLE ENGINEERING AT LOW CARBON IMPACT

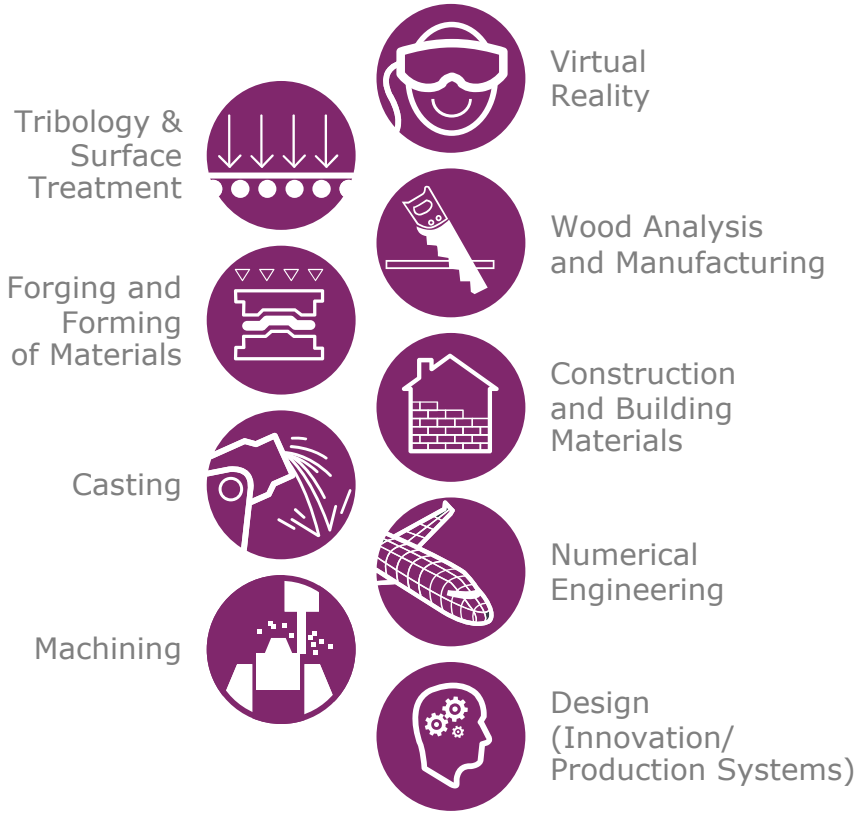
Taskforce 3: Eco-engineering and carbon impact management

3.1 Lifecycle analysis
3.2 Eco innovation/design
3.3 Energy management of systems and industry
3.4 Convergence of digital and carbon impact (link to Taskforce 1)

Arts et Métiers Institute of Technology

ARTS ET MÉTIERS **RESEARCH** IS CONDUCTED IN **19 DIFFERENT DOMAINS**





Arts et Métiers Institute of Technology

1 INSTITUTION WITH
8 CAMPUSES AND **3 SATELLITE LOCATIONS**
15 LABORATORIES CLOSE TO LOCAL ECONOMIC PLAYERS

- 350 researchers
- Enhanced by our partnerships with local universities and institutions
- A strong national presence

Arts et Métiers Institute of Technology

DIFFERENT AREAS OF **EXPERTISE PER SITE**

Lille

Fluid Mechanics, Electrical Engineering, Collaborative Robotics, Tribology & Surface Treatment

Paris

Mechanical Design, Design (including Innovation), Biomechanics/Health, Fluid Mechanics, Thermal Energy, Materials Analysis, Testing & Implementation of polymers, Laser Processes, Additive Manufacturing

Laval

Virtual and augmented Reality,

Angers

Mechanical Studies, Machining Assistance, Virtual Reality, Fluid Mechanics

Bordeaux-Talence

Mechanical Studies, Design, Thermal Energetic, Additive Manufacturing, Sustainable Engineering

Châlons-en-Champagne

Mechanical Studies, Tribology & Surface Treatment, Casting

Metz

Mechanical Design, Design (Production of Systems), Materials Analysis, Forge & Forming of Materials

Cluny

Machining/Assistance, Wood, Construction & Materials for Construction, Surface Treatment

Chalon-sur-Saône

Virtual Reality

Chambéry

Environmental Innovation, Eco-design, Recycling

Aix-en-Provence

Design (of production systems), Numerical engineering, Tribology & Surface Treatment, Casting

Campus

Satellite location

Arts et Métiers Institute of Technology

INTERNATIONAL STRATEGIC PARTNERSHIPS

Arts et Métiers Institute of Technology

AM²
TRANSATLANTIC PARTNERSHIP WITH TEXAS A&M

Contact
Mohamed El Mansori
Mohamed.ElMansori@ensam.eu

AM² Transatlantic Partnership FOR INDUSTRY OF THE FUTURE

Partnership with **Texas A&M**, College of Engineering and TEES in the USA, founded in 2017 after 20+ yrs. of collaboration

Collaboration in the area of **advanced manufacturing and material science**:

- Extensive research collaborations
- Education programs (student exchanges, internships, and collaborative degrees)
- Mutual faculty and faculty exchanges
- Consortium plan with key industrial partners aims to address the key industry challenges in the emerging industry 4.0

Website

TEXAS A&M UNIVERSITY Engineering

TEES Texas A&M Engineering Experiment Station

Arts et Métiers Institute of Technology

FRENCH-GERMAN INSTITUTE FOR INDUSTRY OF THE FUTURE

EUROPEAN PARTNERSHIP WITH KIT

Contact

Jean-Yves Dantan

Jean-Yves.Dantan@ensam.eu

Partnership with **Karlsruhe Institute of Technology** in Germany, founded in 2016, after 20+ yrs. of collaboration.

4 research axes, all based on a human-centered approach:

- Advanced Manufacturing Processes
- Production Systems
- Virtual & Augmented Reality
- Robotics

Collaboration in:

- Research (collaborative grant submissions and projects)
- Education (exchanges, joint PhD doctoral school, dual Eng and MA double degree program)
- Innovation

Website

Karlsruher Institut für Technologie

Arts et Métiers Institute of Technology

DESCARTES: A CREATE PROGRAM ON INTELLIGENT MODELLING FOR **DE**CI**S**ION-MAKING IN **C**RITIC**A**L U**R**BAN SYS**TE**M**S**

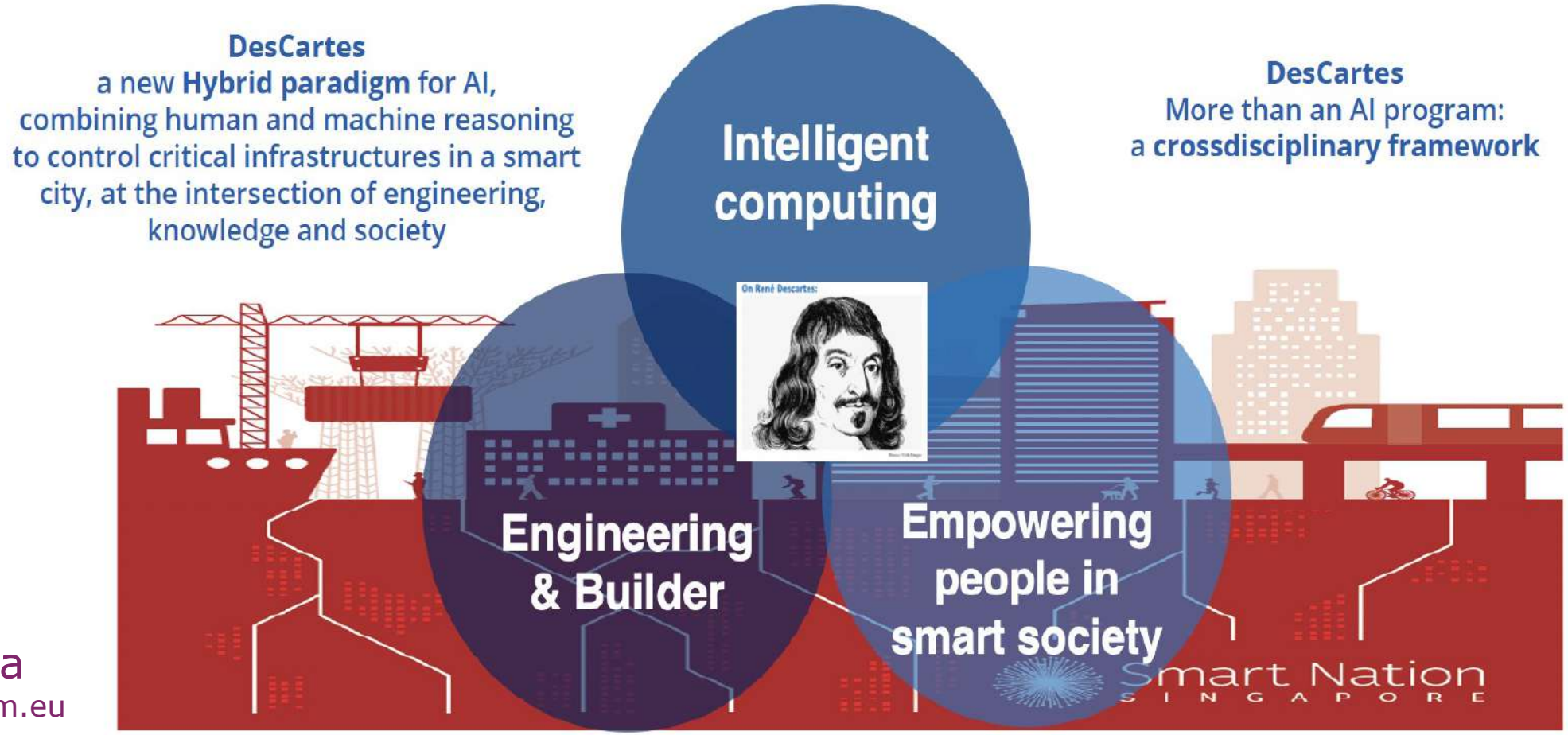
Since: 2021

Grant: 35M

Host institution:

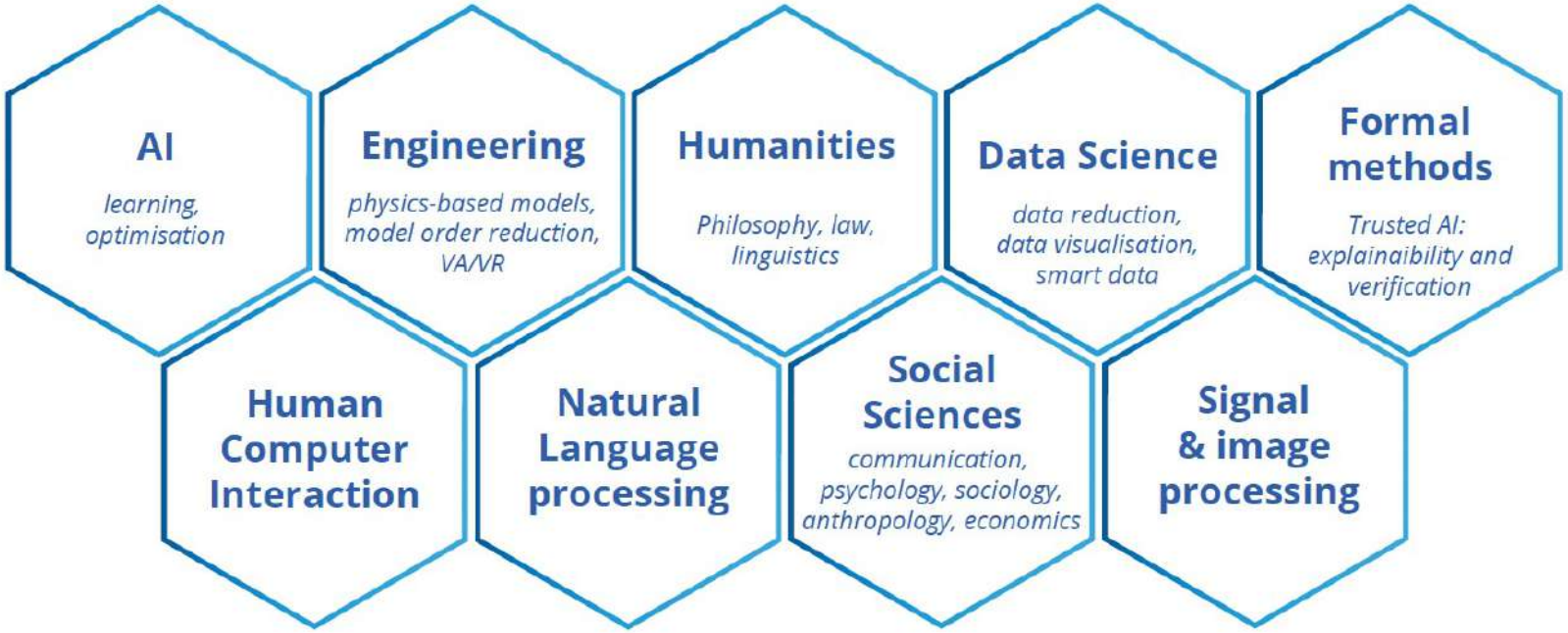
160 researchers

Director: F. Chinesta
Francisco.CHINESTA@ensam.eu



DESCARTES: A CREATE PROGRAM ON INTELLIGENT MODELLING FOR **DE**CI**S**ION-MAKING IN **C**RITIC**A**L U**R**BAN SYS**TE**M**S**

DESCARTES IS A CROSS DISCIPLINARY PROGRAM INVOLVING STEM AND NON-STEM RESEARCH WITH ARTIFICIAL INTELLIGENCE AT ITS CORE AND EXPERTISES IN:



Arts et Métiers Institute of Technology

RESEARCH AT MINES PARIS - PSL

ALEXANDRA BELUS

ParisTech

PARISTECH – CSC PHD PROGRAM

MINES PARIS | PSL

2 PhD proposals **3** Fields of research **2** Labs

Centre de Recherche en Informatique

CENTRE FOR ROBOTICS

- Founded in 1783 to train engineers, now **a graduate school in Science, Engineering and Economics**
- **Founding member of ParisTech & PSL – Université Paris Sciences et Lettres**
- **Founding and prime member of Institut Carnot M.I.N.E.S.**
- **Member of IMT – Institut Mines Télécom**
- **5 sites**: Paris, Evry, Fontainebleau, Palaiseau and Sophia Antipolis
- ~240 professors, ~1000 students, ~400 PhD candidates
- **17 research centres & 2 institutes within 5 departments**
- **More than 50% of graduated PhD work in industry**
- **2022 Launching of the Transition Institute 1.5 (TTI.5) –** pluri disciplinary intitute for low carbon transition

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RESEARCH UNITS / INSTITUTES

Research domains at MINES ParisTech – PSL:

Energy and process engineering
- Centre for Energy Efficiency of Systems (CES)
- Centre Thermodynamics of Processes (CTP)
- Centre Observation, Impacts, Energy (O.I.E.)
- Centre for Processes, Renewable Energies and Energy Systems (PERSEE)

Earth sciences and environment
- Centre for Geosciences (GEOSCIENCES)
- Higher Institute for Environmental Engineering and Management (ISIGE)

Mathematics and complex systems
- Centre of robotics (CAOR)
- Centre for bio-informatics (CBIO)
- Centre Automatic Control and Systems (CAS)
- Centre of Applied Mathematics (CMA)
- Centre of Mathemacial Morphology (CMM)
- Centre of Computer Sciences (CRI)

Materials and mechanics
- Centre of Material Transformation (CEMEF)
- Centre of Material Engineering (MAT)

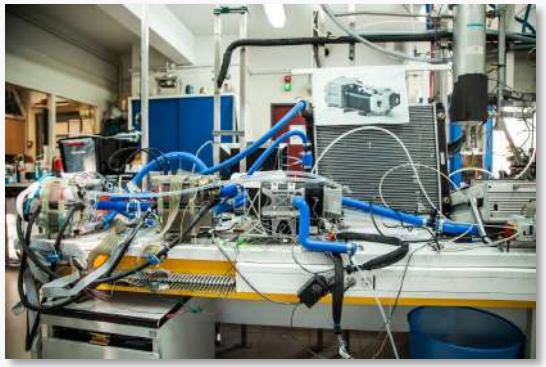
Economy, management and society
- Centre for Industrial Economics (CERNA)
- Centre for Management Science (CGS)
- Research Center on Risks and Crisis (CRC)
- Centre for the Sociology of Innovation (CSI)

IHEIE

Institute of Higher Education for Innovation and Entrepreneurship

RESEARCH UNITS / INSTITUTES

RESEARCHER AT MINES PARISTECH – PSL
RECENT AWARD / GRANT RECIPIENTS



Name

Name

ELIE HACHEM- CEMEF
ERC CONSOLIDATOR GRANT 2022

TATIANA BUDTOVA - CEMEF
CNRS SILVER MEDAL 2020

PIERRE ROUCHON - CAS
ERC ADVANCED GRANT 2020

ZAKI LEGHTAS - CAS
ERC STARTING GRANT 2019

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RESEARCH UNITS / INSTITUTES

KEY FACTS / FIGURES

~100 PhDs awarded annually (25 % of women, 30 % of foreigners (~50 nationalities), 50 % engineers)
232 teaching researchers (15% recruited abroad)

400+ scientific publications rank A / year

300+ patents & softwares in 2019

2 Nobel prizes
Maurice ALLAIS - Economics - 1988
Georges CHARPAK – Physics – 1992
3 ERC in the past 4 years

Prestigious partnerships with academic laboratories, companies:

20 % of research contracts completed with international partners.
Partnerships with: MIT, CalTech, Jülich, CERN, Stanford

25 industrial chairs / 200 industrial partners
MINES ParisTech ranks number one in France for the volume of contractual research with companies.
1000 /year Research contracts – 30 M

DASSAULT SYSTEMES · Microsoft · Air Liquide · SAFRAN · VINCI · ArcelorMittal · AREVA · AIRBUS · PSA GROUPE · RENAULT Passion for life · HUTCHINSON · Valeo · ecosystem · cea · ADEME · LE GROUPE LA POSTE · EDF · RATP

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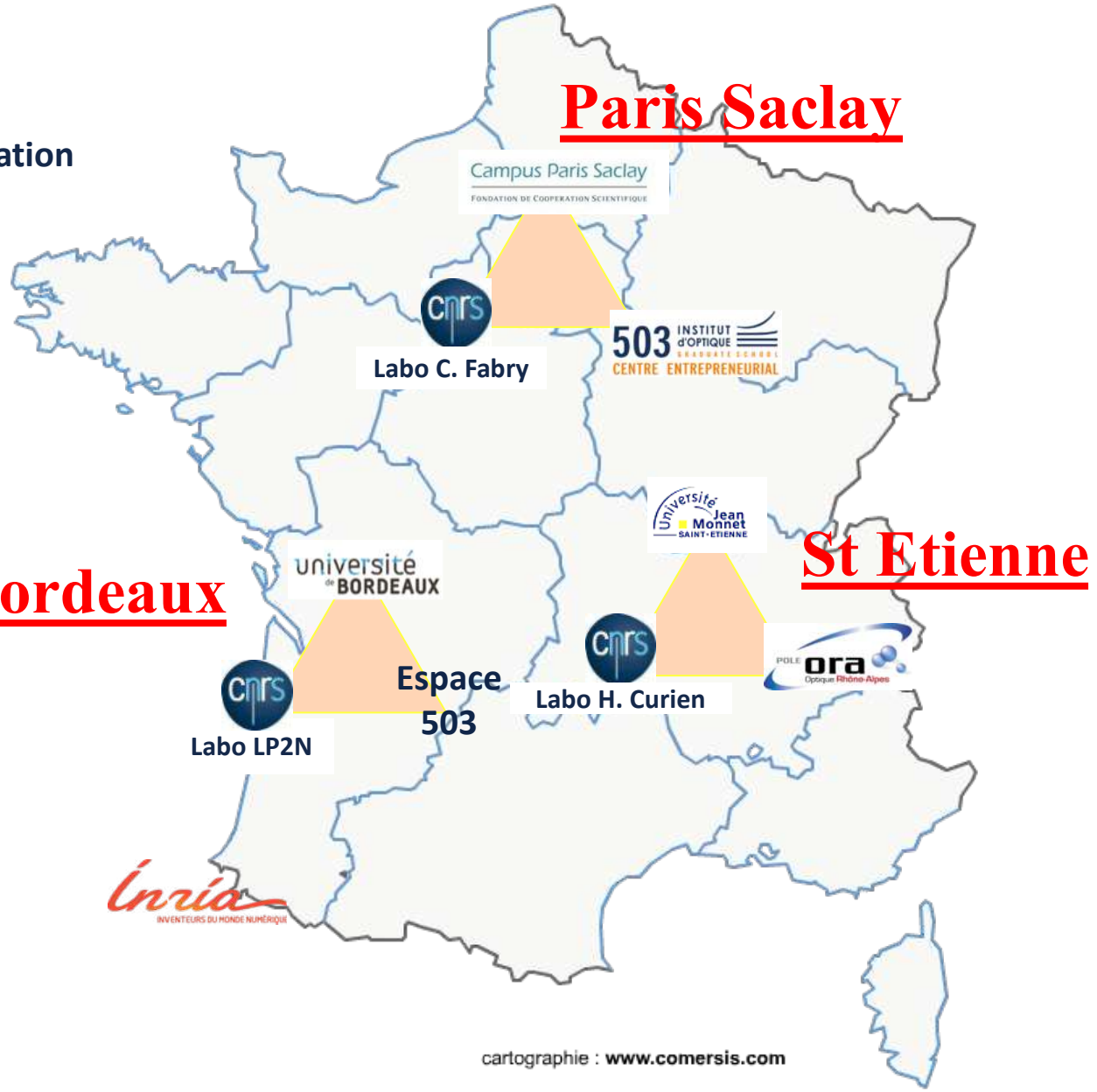
RESEARCH AT INSTITUT D'OPTIQUE GRADUATE SCHOOL

DENIS BOIRON

Institut d'Optique – 3 locations

Education

Research Innovation



RESEARCHERS AT INSTITUT D'OPTIQUE GRADUATE SCHOOL

ALAIN ASPECT

Holweck Medal (1991)
Wolf Prize in Physics (2010)
Albert Einstein Medal (2012)
ForMemRS (2015)

PHILIPPE GRANGIER

Léon Brillouin Grand Prix (2013)
Jean-Ricard Prize (2008)
Lazare Carnot Prize (2005)
CNRS Silver medal (2002)

JEAN-JACQUES GREFFET

OSA fellow
Recipient of the Servant prize of the French Academy of Science

Laurent COGNET

Jean Jerphagnon Prize (2010)
Pierre Faurre Prize (2011)
ERC synergiy awardee (2020)

Start up: Muquans, Pasqal, Stereolabs, Damae Medical …

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INSTITUT d'OPTIQUE GRADUATE SCHOOL ParisTech | université PARIS-SACLAY

RESEARCHERS AT INSTITUT D'OPTIQUE GRADUATE SCHOOL

ALAIN ASPECT

Holweck Medal (19
Wolf Prize in Physics (
Albert Einstein Medal (
ForMemRS (2015

Alain Aspect: **Nobel laureate 2022 in physics**

"For experiments with entangled photons, establishing the violation of Bell inequalities and pioneering quantum information science"

Start up: **Muquans, Pasqal, Stereolabs, Damae Medical …**

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LP2N

Photonics, Numerical and Nanosciences Laboratory (LP2N) is a Joint Research Unit (UMR 5298) between the Institut d'Optique Graduate School, the University of Bordeaux and the CNRS.

20 researchers
30 PhD/Post-doc

- Bordeaux Nanophotonics Group
- Light in Complex Nanostructures (COS) group
- "Cold Atoms in Bordeaux" (CAB) group
- BioImaging & OptoFluidics group
- Nano-BioMicroscopy team (NabLab)
- Computational Imaging and Display
- Photonics systems

Laboratoire Photonique, Numérique et Nanosciences (LP2N)

LCF
Laboratoire Charles Fabry

40 researchers
60 PhD/Post-doc

Quantum Gases group

Quantum Optics group

Laser group

Nanophotonics group

Biophtonics group

Imaging & Information group

Nonlinear optics group

XUV optics group

LHC
Laboratoire Hubert Curien

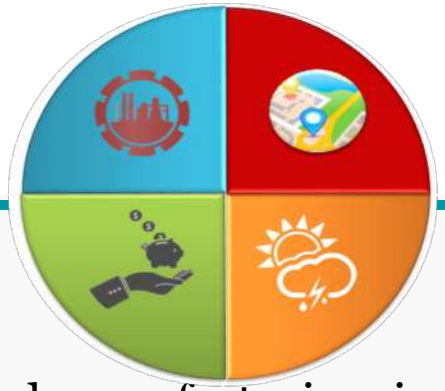
90 researchers
110 PhD/Post-doc

- Micro & nano structuring group
- Materials for optics and photonics in extreme environments group
- Laser-matter interaction group
- Image science & computer vision group
- Secure embedded systems & hardware architecture group
- Data intelligence group

RESEARCH AT ÉCOLE DES PONTS PARISTECH

YU JUN CUI

Research domains at Ecole des Ponts ParisTech



École des Ponts ParisTech

Industry of the future

NAVIER – ecomaterials, digital manufacturing, innovative structures, geomechanics
CERMICS – modelisation of uncertainty, digital simulation, systems optimisation
LIGM – data processing, 3D vision, big data

City and mobility systems

LVMT – sustainable mobility, territorial dynamics
LEESU – urban waters, alternative resources
CEREA – atmospheric environment, air quality, renewable energy

Management of risks, resources and milieus

HM&Co – hydro-meteorological risks, resilient cities
LMD – physics of atmosphere, climate
LHSV – renewable energy, natural risks

Economy, practices and society

LATTS – cities of future, infrastructures, policies
PjSE – public policies, environmental economy, markets and governance
CIRED – sustainable development, climate change

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RESEARCH INFRASTRUCTURES

Fresnel

Build'In

X- band radar

Platform TARANIS

Blue-Green Wave

Multi-Hydro, RadX@HMo

EDF'lab Chatou

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RESEARCH AT ECOLE DES PONTS PARISTECH : KEY FACTS/FIGURES

465 researchers / teacher-researchers
540 PhD and post doctoral students including
46 % of international doctoral students

968 international publications in 2020
including 47% international co-publications

10 M€ contracts with companies

51% of research sponsored by industry

... and much more

3 ERC, a lot of PhD prizes, 1 For Women in science L'Oréal-UNESCO Young researcher etc.

RESEARCH AT ESPCI PARIS - PSL

JOSHUA MCGRAW
XIAOPING JIA
COSTANTINO CRETON

ParisTech

ParisTech – CSC PhD Program

ESPCI PARIS | PSL

16 PhD proposals **5** Fields of research **6** Labs

LPEM

CHIMIE BIOLOGIE INNOVATION CBI

UMR 7083 Gulliver

Institut Langevin
ONDES ET IMAGES

Physique et Mécanique
des Milieux Hétérogènes
UMR 7636

Plasticité du Cerveau

Find the video on ParisTech China Bilibili account!

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RESEARCH UNITS / INSTITUTES

Research domains at ESPCI Paris – PSL:

Biology

- **Brain Plasticity Lab** – neurosciences + proteomics
- **Physics for Medicine** – wave physics for medicine

Chemistry

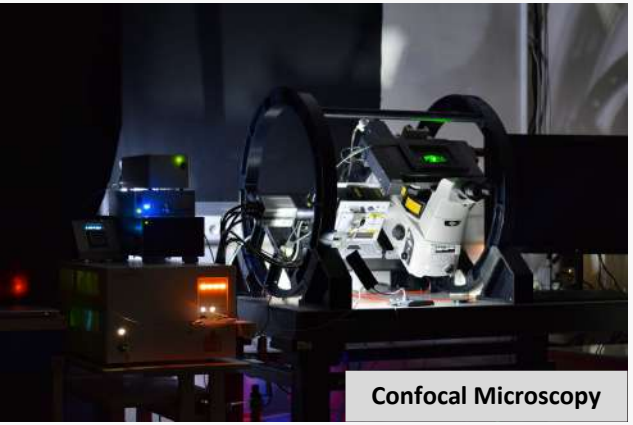
- **Chemistry of Molecules and Materials** – chemistry of molecules and materials
- **Soft Matter Science and Engineering, Institute of Porous Materials (IPM)** – Soft Matter, Materials Science & Complex Fluids
- **CBI** – microfluidics for physical chemistry and pharmaceutics

Physics

- **Institut Langevin, Physics for Medicine** – wave physics and applications
- **Physics & Materials Lab** – solid state physics, nanosciences
- **PMMH** – hydrodynamics and solid mechanics
- **Gulliver** – Soft Matter Physics

RESEARCH UNITS / INSTITUTES

RESEARCH INFRASTRUCTURES



Confocal Microscopy

3D Printing

Microfluidic

SOME KEY RESEARCHERS ESPCI PARIS - PSL

MATHIAS FINK
ULTRASOUNDS (ERC)

MICKAEL TANTER
IMAGERY FOR MEDICINE (ERC)

CHRISTIAN SERRE
METAL ORGANIC FRAMEWORKS

ANKE LINDNER
COMPLEX FLUIDS
CNRS SILVER MEDAL

ANDREW GRIFFITHS
MICROFLUIDICS FOR PHARMA (ERC)

SANDRINE ITHURRIA
QUANTUM DOTS (ERC)

RESEARCH UNITS / INSTITUTES

KEY FACTS / FIGURES

ca. 500 researchers / teacher-researchers
ca. 300 PhD candidates

Prestigious partnerships with academic laboratories and companies

About 500 publications per year including 10-15% in journals with impact factor > 10

30 patents per year
3 startups created each year

6 Nobel Prizes, 17 ERC grants, CNRS Silver Medals, UNESCO-L'Oréal For Women in Science awardees Young Researchers

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Information & Contact

ParisTech
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Tel: +86 21 65 98 23 36

WECHAT WEIBO BILIBILI

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4. Labs and PhD proposals

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ROOMS / THEMES

ROOM 1	→ Chemistry, Physical chemistry and Chemical Engineering + Life and Health science
ROOM 2	→ Information and Communication Science and Technology + Mathematics and their applications + Energy, Processes + Design, Industrialization
ROOM 3	→ Material science, Mechanics and Fluids
ROOM 4	→ Physics, Optics

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6. LABS AND PHD PROPOSALS

ROOM 1 / CHEMISTRY, PHYSICAL CHEMISTRY AND CHEMICAL ENGINEERING + LIFE AND HEALTH SCIENCE

ROOM1 - Chemistry, Physical chemistry and Chemical Engineering + Life and Health science - PROPOSALS/LABS 1/2

File Number	School	Title	Advisors	Lab
2022_001	Chimie ParisTech - PSL	Synthesis of Organometallic Complexes of Medicinal Relevance	Gilles Gasser, Kevin Cariou	I-CLEHS - Institute of chemistry for life and health
2022_002	Chimie ParisTech - PSL	Electrochemical Activation of Ynamides	Kevin Cariou, Gilles Gasser	I-CLEHS - Institute of chemistry for life and health
2022_006	Chimie ParisTech - PSL	Modeling the electronic and optical properties of van der Waals heterostructures	FREDERIC LABAT	I-CLEHS - Institute of chemistry for life and health
2022_049	Chimie ParisTech - PSL	In-silico design and optimization of molecular systems for Aggregation-Induced Emission (AIE)	Ilaria Ciofini, Carlo Adamo	I-CLEHS - Institute of chemistry for life and health
2022_050	Chimie ParisTech - PSL	Construction of Chiral Diphosphines through Rh(III)-catalyzed Atroposelective C□H Bond Functionalization and Use thereof in Asymmetric Catalysis	Jean-François Soulé, Phannarath Phansavath , Virginie Vidal	I-CLEHS - Institute of chemistry for life and health
2022_052	Chimie ParisTech - PSL	Mechanochemistry-Assisted Continuous Synthesis of Organometallic Complexes of Medicinal Relevance	CHRISTOPHE LEN, KEVIN CARIOU, GILLES GASSER	I-CLEHS - Institute of chemistry for life and health
2022_069	Chimie ParisTech - PSL	Instrumental and methodological developments for the on-line coupling of microfluidic capillary electrophoresis to surface enhanced Raman spectroscopy (MCE-SERS) applied to the separation and identification of submico- and nanoplastics in water	Anne Varenne, Fanny d'Orlyé, Laura Trapiella Alfonso	I-CLEHS - Institute of chemistry for life and health
2022_074	Chimie ParisTech - PSL	Radical arylations for the production of active pharmaceutical ingredients in batch and flow mechanochemistry	CHRISTOPHE LEN	I-CLEHS - Institute of chemistry for life and health

ROOM1 - Chemistry, Physical chemistry and Chemical Engineering + Life and Health science - PROPOSALS/LABS 2/2

File Number	School	Title	Advisors	Lab
2022_060	ESPCI Paris - PSL	Self-Assembled Molecular Layers for Perovskite Solar Cells	Zhuoying CHEN, Philippe Lang, Laurent Billot	LPEM - Laboratoire Physique et d'études des matériaux
2022_062	Chimie ParisTech - PSL	Enhanced Passivity and Corrosion Resistance of Multi Principal Element Alloys	Dimitri Mercier	IRCP - Institut de Recherche de Chimie de Paris
2022_064	Chimie ParisTech - PSL	Novel green organic inhibitors for the corrosion protection of metals and alloys	Dimitri Mercier, Dominique Costa	IRCP - Institut de Recherche de Chimie de Paris
2022_063	ESPCI Paris - PSL	The Glass Transition Challenge Tackled with Nano-Colloids	Paddy Royall	GULLIVER - Voyages expérimentaux et théoriques en matière molle
2022_008	Chimie ParisTech - PSL	Synthesis and Formulation of Biodegradable Polymers from Renewable Resources	Kawthar BOUCHEMAL, Christophe THOMAS	IRCP - Institut de Recherche de Chimie de Paris
2022_009	Chimie ParisTech - PSL	Smart Material Design for Vectorization of Biocompatible and Biodegradable Polymer-Coated Nanoparticles	Régis GAUVIN, Christophe THOMAS	IRCP - Institut de Recherche de Chimie de Paris
2022_010	Chimie ParisTech - PSL	Production of Sustainable Polymers by One-Pot Catalysis	Christophe THOMAS, Régis GAUVIN	IRCP - Institut de Recherche de Chimie de Paris
2022_012	Chimie ParisTech - PSL	Oxide-based crystals doped by Pr3+, Dy3+ or Tb3+ for solid-state visible laser : crystal growth and optical spectroscopic properties	AKA Gerard, LOISEAU Pascal	IRCP - Institut de Recherche de Chimie de Paris
2022_055	Chimie ParisTech - PSL	Chemical Bonding of Graphene on TiO2 for Boosted Interfacial Charge Transfer in Optoelectronic Devices	Thierry Pauporté	IRCP - Institut de Recherche de Chimie de Paris
2022_096	Chimie ParisTech - PSL	Molten Salt Conversion of Plastics into Hydrogen	Virginie LAIR, Vincent SEMETEY	IRCP - Institut de Recherche de Chimie de Paris
2022_097	Chimie ParisTech - PSL	3D two-photon polymerization of smart materials	Vincent SEMETEY	IRCP - Institut de Recherche de Chimie de Paris
2022_091	ESPCI Paris - PSL	Investigating the role of LRRK2 in the gut-brain axis in Parkinson's disease using Drosophila	Serge Birman	Plasticité du cerveau

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Catalysis, Synthesis of Biomolecules and Sustainable Development Team (CSB2D)

#homogeneous catalysis;
#enantioselectivity

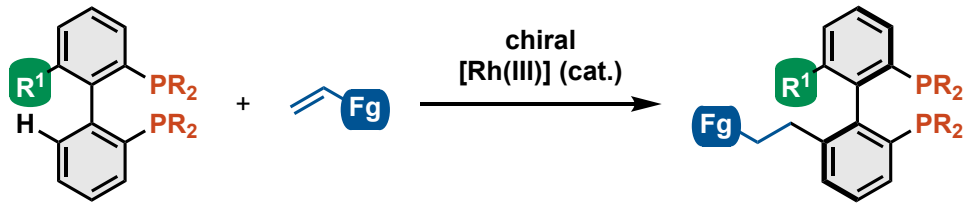
Pr. J.-F. Soulé

Dr. P. Phansavath

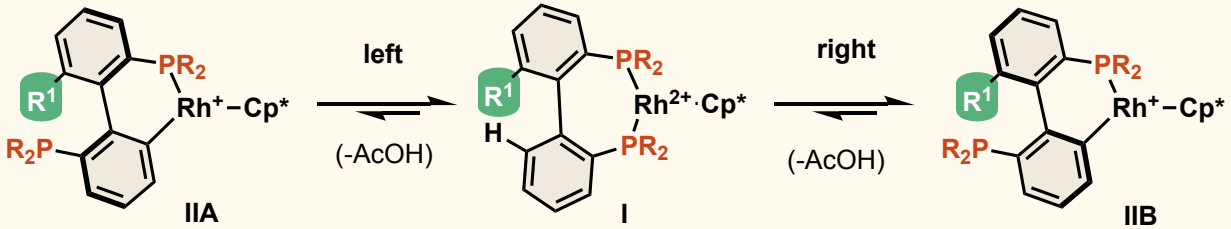
Dr. V. Vidal

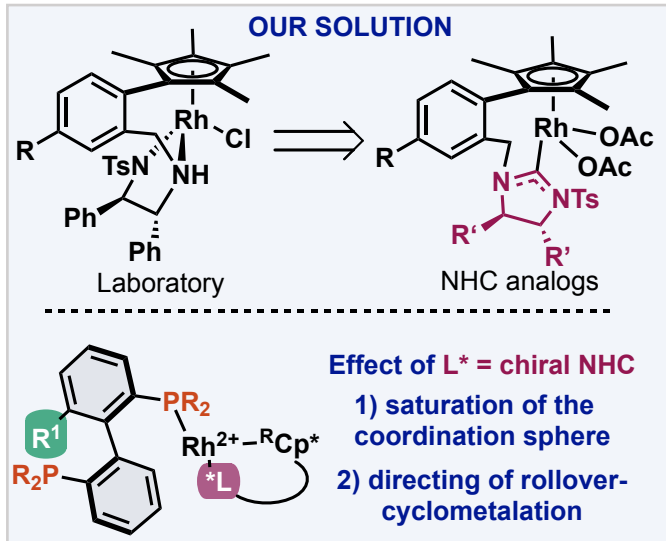
Project N° 2022_050

Construction of Chiral Diphosphines through Rh(III)-catalyzed Atroposelective C–H Bond Functionalization and Use thereof in Asymmetric Catalysis



PROBLEMATIC: How to induce rollover C–H bond cleavage and to control the way (left or right)





Soulé, J.-F. *et al. : Angew. Chem. Int. Ed.* **2019**, *58*, 14110. *Org. Lett.* **2022**, *24*, 6755.
Phansavath, P.; Ratovelomanana-Vidal, V. *et al.: J. Org. Chem.* **2017**, *82*, 5615. *Org. Lett.* **2019**, *21*, 3276 *Isr. J. Chem.* **2021**, 409.

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I-CLEHS LABORATORY: SEISAD TEAM

KEY THEMATICS

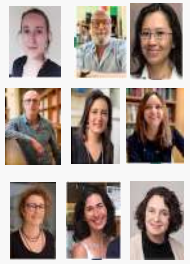
Synthesis of functionalized (bio)molecules using microwaves, plasma gas & continuous flow in liquid milli- and micro-reactors

Analytical electrochemistry, biosensors

Synthesis and physico-chemical characterization of nanoplatforms for theranostic

Lab-on-a-chip (μTAS)

Imaging and diagnosis



PHD PROPOSALS (1)

DESIGN OF NEW LAB-ON-A-CHIP DEVICE FOR SUBMICRO- AND NANOPLASTIC ANALYSIS

Instrumental and methodological developments for the on-line coupling of microfluidic capillary electrophoresis to surface enhanced Raman spectroscopy (MCE-SERS) applied to the separation and identification of submicro - and nanoplastics in water

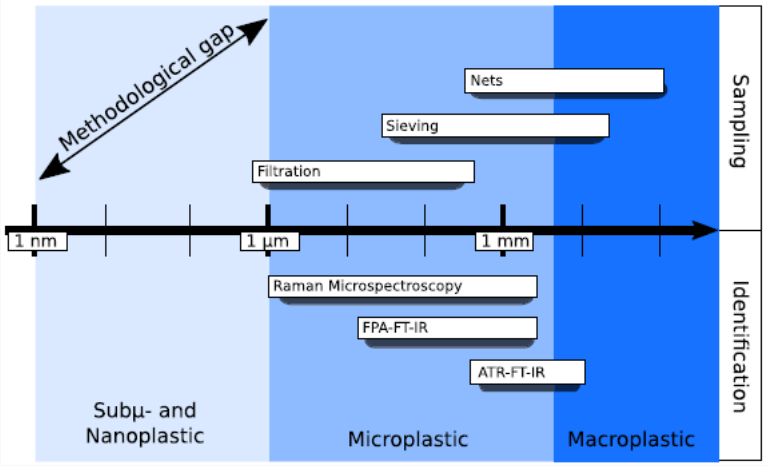
A. Varenne,
F. d'Orlyé, L. Trapiella

Topic number : ***2022_069***

DESIGN OF NEW LAB-ON-A-CHIP DEVICE FOR SUBMICRO- AND NANOPLASTIC ANALYSIS

Societal issues:
→ *Environmental fate*
→ *Risk assesment for living organisms and human health*

→ **Analytical and technological developments**

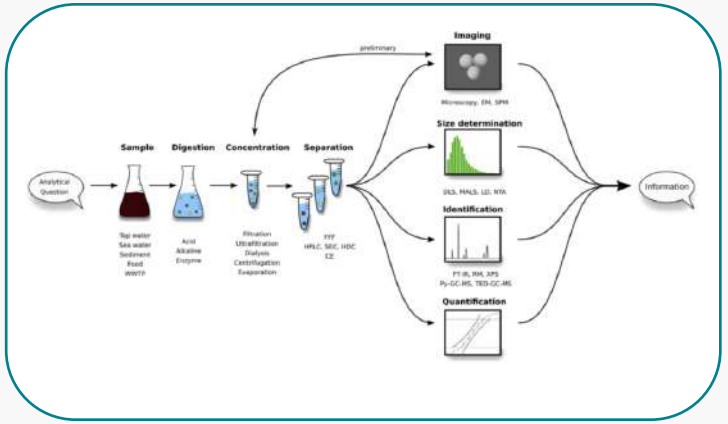


Trends in Analytical Chemistry 112 (2019) 52-65

The analysis of plastic particles is established for particles down to 1 mm.

Below, there is a methodological gap!

Physico-chemical characterization, identification and quantification of nanoplastics up to toxicity and biodistribution assessments



Trends in Analytical Chemistry 112 (2019) 52-65

Main analytical and technological challenges:

→ *Electrokinetic separations for nanoplastic*
- *preconcentration*
- *separation into fractions of specific size and surface chemistry*
- *evaluation of non specific interactions with plasmatic proteins*

→ *Surface Enhanced Raman Scattering (SERS) detection for nanoplastic*
- *label-free detection*
- *structural description*
- *sensitive and quantitative detection*

→ *Microfabrication and surface engeneering processes for*
- *the miniaturization and integration of the SERS detection on a microelectrophoresis chip*
- *the fully automated analysis of micro- and nanoplastic in water samples*

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LABORATOIRE DE PHYSIQUE ET D'ETUDE DES MATÉRIAUX

(LPEM)

HTTPS://WWW.LPEM.ESPCI.FR/SPIP.PHP?RUBRIQUE4

LPEM

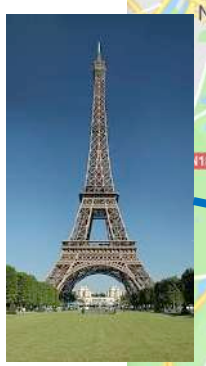
Laboratoire de Physique et d'Etude des Matériaux

ESPCI PARIS | PSL

LPEM
Laboratoire de Physique et d'Etude des Matériaux

Located in the center of Paris





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Laboratoire de Physique et d'Etude des Matériaux (LPEM)

– **Nanophysics, Nanostructures and Nanomaterials,**

– **Strongly correlated and low dimensionality electronic systems,**

– **Technical instrumentalles**

9 Research teams

About 34 permanants

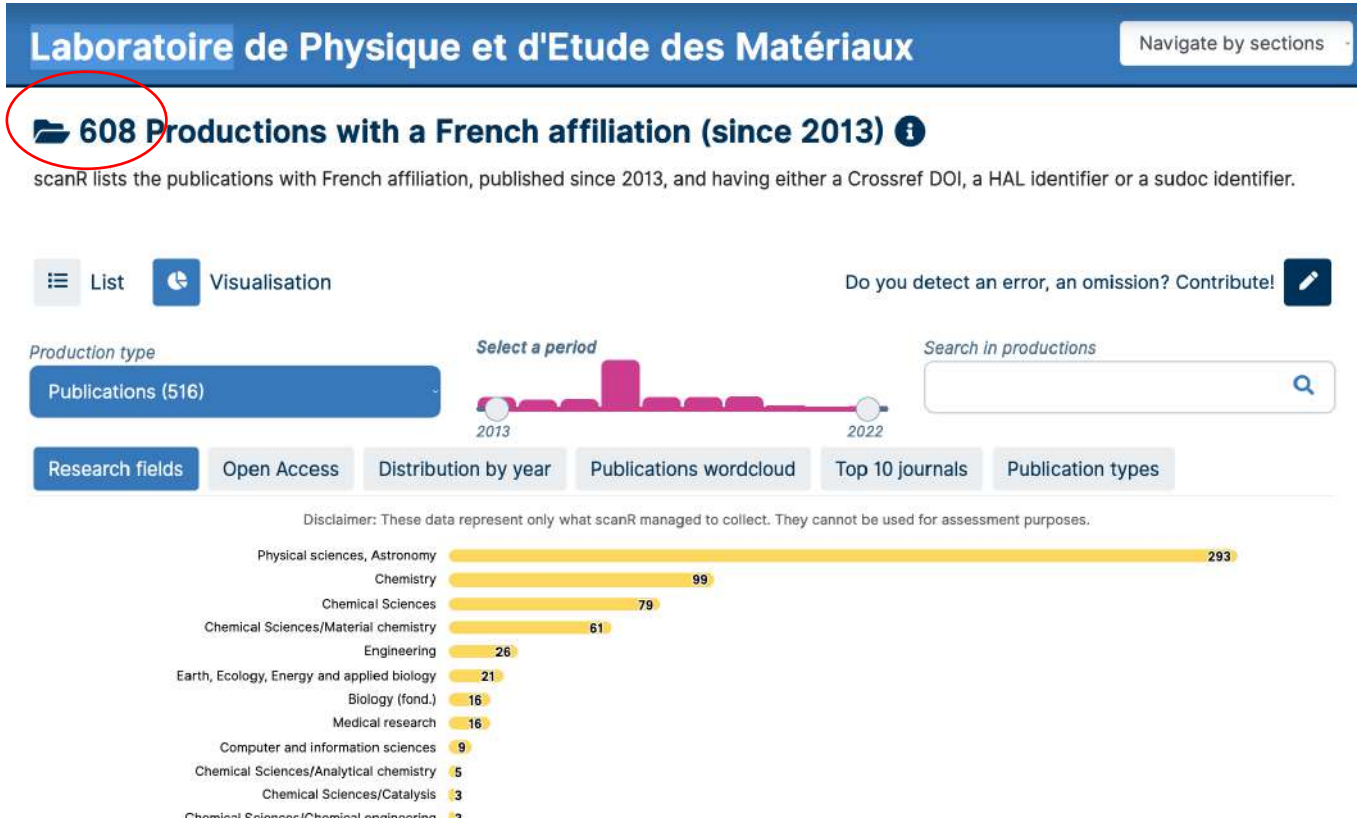
About 35 PhD students, post-docs

- Conductivité Optique
- Elemag
- Instrumentation
- MNC group
- PHASME group
- Quantum Matter Group
- QuantumSpecs
- Synthesis and Imaging of Inorganic Nanoprobes
- Theory of Strongly Correlated Materials

Laboratoire de Physique et d'Etude des Matériaux (LPEM)

KEY FACTS / FIGURES

30 researchers / teacher-researchers (10 % of international researchers / teacher-researchers)
23 doctoral students including > 50 % of international doctoral students



Prestigious partnerships

Cleanroom networks "Paris Centre"

And many others !

Since 2004: 2 ERC Awards; 27+ ANR projects, 10 PHC projects, 4 H2020 awards...

Laboratoire de Physique et d'Etude des Matériaux (LPEM)

2023 CSC-ParisTech 4 proposals from LPEM

Physics

TITLE: HIGH TEMPERATURE SUPERCONDUCTORS FOR SINGLE PHOTON DETECTION

Topic number : ***2022_043***

Field : Physics, Optics, Material science, Mechanics and Fluids, Information and Communication Science and Technology

Physics

TITLE: ELECTRONIC STRUCTURE OF THE INTERCALATED GRAPHENE-GE INTERFACES

Topic number : ***2022_051***

Field : Physics, Optics, Material science, Mechanics and Fluids,

Subfield: Surface Science,

Chemistry, engineering

TITLE: SELF-ASSEMBLED MOLECULAR LAYERS FOR PEROVSKITE SOLAR CELLS

Topic number : ***2022_060***

Field : Chemistry, Physical chemistry and Chemical Engineering, Energy, Processes, Material science, Mechanics and Fluids

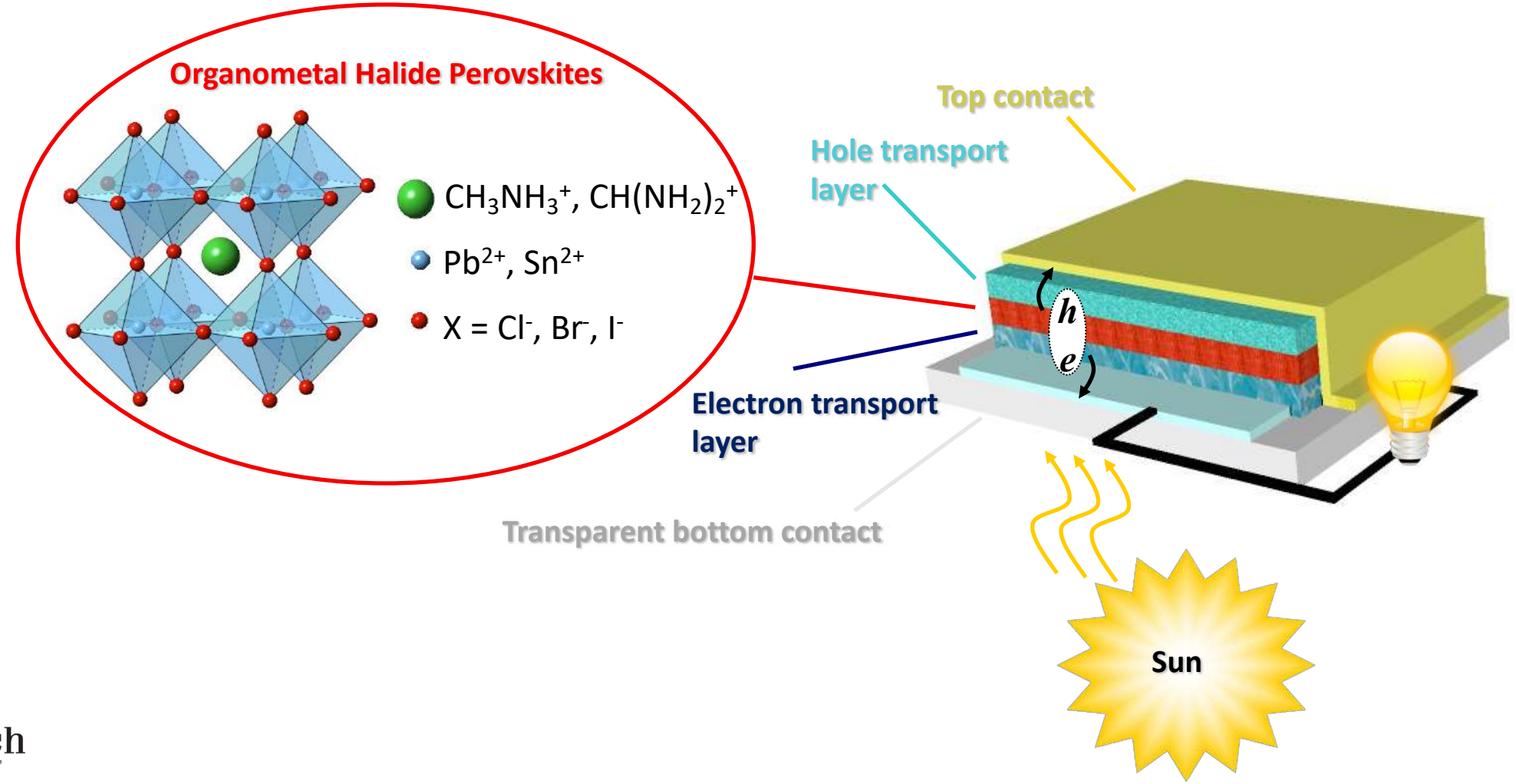
Physics

TITLE: VO2-BASED PLASMONIC HYBRID NANOSTRUCTURES FOR TUNABLE OPTICAL SENSORS

Topic number : ***2022_081***

Field : Physics, Optics, Chemistry, Physical chemistry and Chemical Engineering,

PhD thesis project no. 2022_060: Self-assembled Molecular Layers for Perovskite Solar Cells

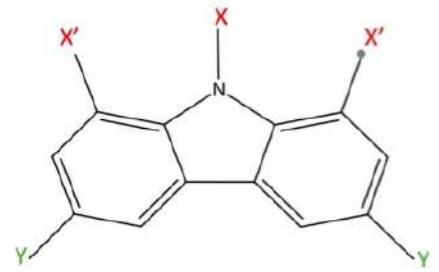


no. 2022_060: Self-assembled Molecular Layers for Perovskite Solar Cells

Problems: state-of-the-art e/h transport layer costly; requring energy-demanding processing !

Project :

X' = -(CH2)n-Z ; n=0-2
X = -(CH2)m-Z ; m=0-2
Z group having affinity towards perovskite cristal

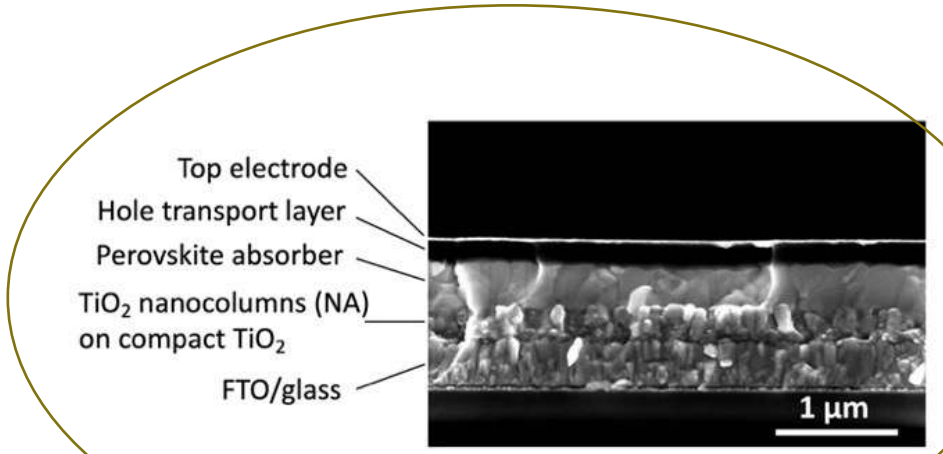


Y= attracting or donor group

Philippe Lang

ITODYS

Univ. Paris Cité



Zhuoying Chen

Laurent Billot

Univ. PSL

- Design, synthesis of (self-assembled) molecular transport layers
- Device fabrication, transport and photovoltaic property evaluation

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CONTACT: zhuoying.chen@espci.fr ; lang@univ-paris-diderot.fr

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IR CP | Institut de Recherche de Chimie Paris

Physico Chemistry of Surfaces

Research domain(s): Surface Science applied to Corrosion protection

Research team (name) and its research axis (ex. Integrated product & process design)

Team leader

P. Marcus (DRCE)

Philippe Marcus

Understanding and control the relationships between the structure and chemical composition of metal and alloy surfaces and the properties of metal/gas and metal/liquid interfaces, from nanoscale to macroscopic properties, with applications in the fields of materials and energy.

Surface atomic scale charachterization

Modelling (oxidized) metal surfaces and interaction with the environment

Electrochemistry, passivation and corrosion resistance of metals and alloys

Biointerfaces

Physico-Chimie des Surfaces

RESEARCH INFRASTRUCTURES

- X-Ray Photoelectron Spectroscopy (XPS)
- Time of Flight Secondary Ion Mass Spectroscopy (ToF-SIMS)
- Auger Electron Spectroscopy (AES)
- Low Energy Electron Difraction (LEED)
- Scanning Tunneling Microscopy (UHV STM)
- Scanning Tunneling Spectroscopy (STS)
- Atomic Force Microscopy (AFM)
- Current Sensing Atomic Force Microscopy (CS-AFM)
- Electrochemical techniques : cyclic voltammetry, electrochemical impedance spectroscopy, photocurrent spectroscopy, electrochemical quartz crystral microbalance
- Electrochemical Scanning Tunneling Microscopy (EC-STM)
- Electrochemical Atomic Force Microscopy (EC-AFM)
- DFT calculations

RESEARCHER (S)

P. Marcus (DRCE)

V. Maurice (DR2)

D. COSTA (DR2)

J. Swiatowska (DR2)

D. Mercier (CR)

S. ZANNA (IRHC)

A. Galtayries (MC)

F. Wiame (MC)

E. Protopopoff (MC)

A. Seyeux (IR2)

L. Klein (IR1)

Physico Chemistry of Surfaces

KEY FACTS / FIGURES

5 researchers / 3 teacher-researchers
6 doctoral students, 100% of international doctoral students
3 post-docs

More than 200 pubs.
Many international co-publications

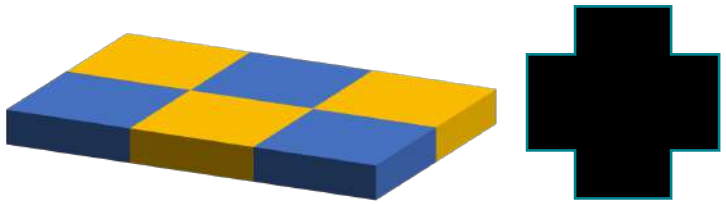
New International Award for Pr. Philippe Marcus

Pr.Philippe Marcus, Head of the Physical Chemistry of Surfaces Research Group at IRCP/Chimie ParisTech, elected member of the Academy of Europe (Academia Europaea).

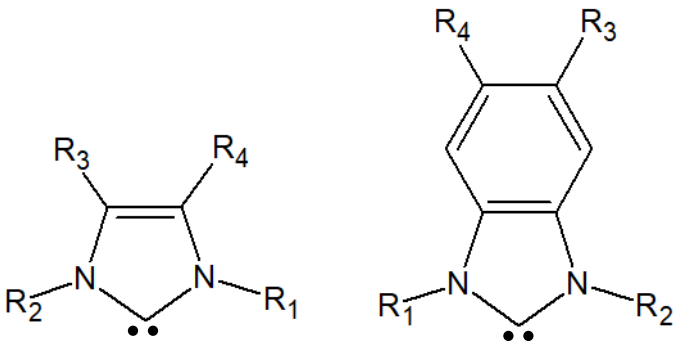
ERC Consolidated Grant CIMNAS

Need for environmental friendly Corrosion Inhibitors of Al alloys

Heterogeneous Surface



N-Heterocyclic Carbens



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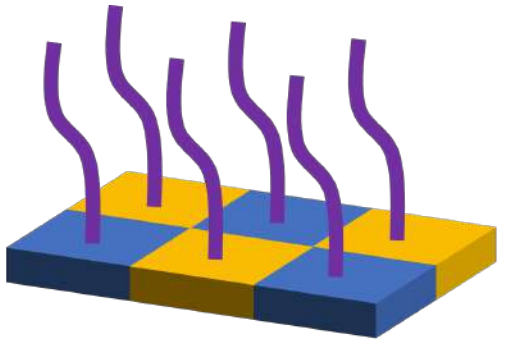
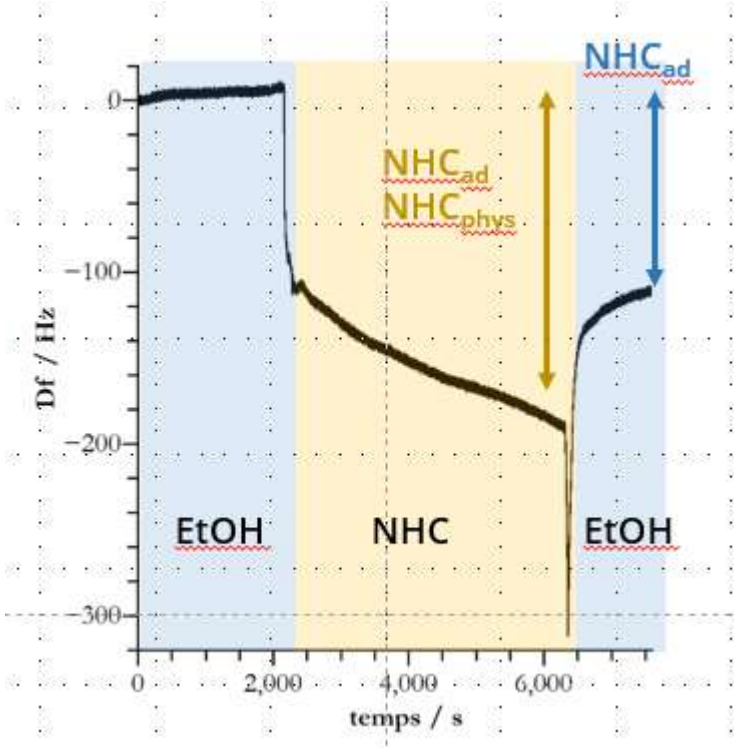
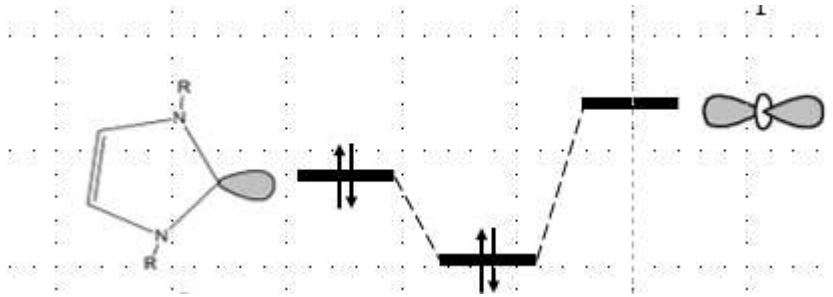
Universal protection

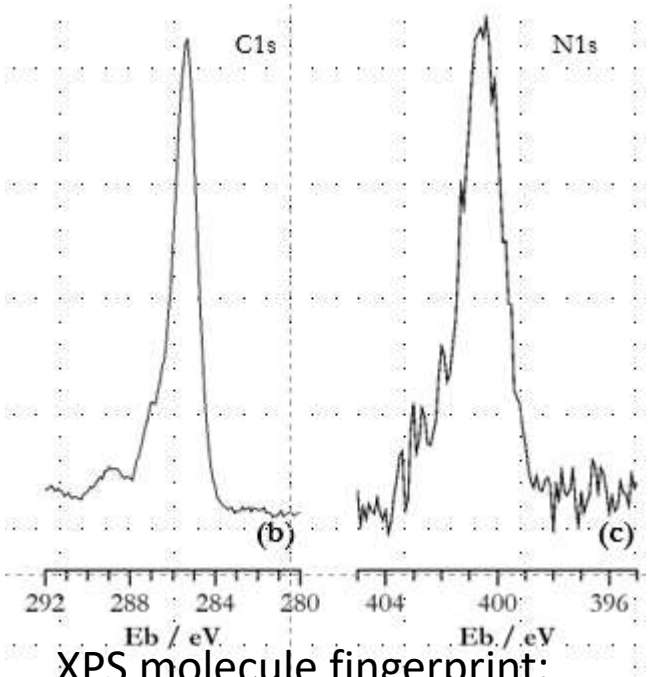




QCM: adsorption kinetics



DFT: understanding of molecule/surface interactions



XPS molecule fingerprint:
layer by layer charachterization

Electrochemistry:
corrosion inhibition ??

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6. Labs and PhD PROPOSALS

ROOM 2 /Information and Communication Science and Technology + Mathematics and their applications + Energy, Processes + Design, Industrialization

ROOM2 - Information and Communication Science and Technology + Mathematics and their applications + Energy, Processes + Design, Industrialization- PROPOSALS/LABS 1/2

File Number	School	Title	Advisors	Lab
2022_056	Arts et Métiers	Intelligent Haptics for the Perception of Fluid Properties	Samir GARBAYA, Sofiane KHELLADI	LIFSE - Laboratoire Ingénierie des Fluides Systèmes Energétiques
2022_018	Arts et Métiers	Optimization of an overspray system for turbomachines applications	Khelladi Sofiane, Capurso Tommaso	LIFSE - Laboratoire Ingénierie des Fluides Systèmes Energétiques
2022_047	Arts et Métiers	Experimental investigation of Cavitation vs. Degassing phenomena in a symmetrical Venturi channel	FLORENT RAVELET, AMELIE DANLOS, MICHAEL PEREIRA	LIFSE - Laboratoire Ingénierie des Fluides Systèmes Energétiques
2022_070	Arts et Métiers	Development of Data-Driven Physic-Guided Modelling Methodology For Hydrogen Energy Systems	Michaël DELIGANT	LIFSE - Laboratoire Ingénierie des Fluides Systèmes Energétiques
2022_036	Arts et Métiers	MOOC in Virtual Reality: learning through volumetric capture of lecture	Sylvain Fleury, Simon Richir	LAMPA - Laboratoire angevin de mécanique, procédés et innovation
2022_098	Arts et Métiers	Development of a digital twin of the Robotized Incremental Sheet Forming process using Virtual Reality	Philippe Dal Santo, Idriss Tiba, Sandra Chevret, Yessine Ayed	LAMPA - Laboratoire angevin de mécanique, procédés et innovation
2022_013	Arts et Métiers	Geometry processing for reducing cybersickness in VR	Ruding Lou, Frédéric Mérienne	LISPEN - Laboratoire d'ingénierie des systèmes physiques et numériques
2022_045	Arts et Métiers	Graph-based unbounded constrained models search for high-level logical reasoning	Mathias KLEINER, Jean-Philippe PERNOT	LISPEN - Laboratoire d'ingénierie des systèmes physiques et numériques
2022_058	Arts et Métiers	Reinforcement learning-based 3D reconstruction of CAD models from dead models for smart manufacturing applications	Jean-Philippe PERNOT, Arnaud POLETTE	LISPEN - Laboratoire d'ingénierie des systèmes physiques et numériques
2022_059	Arts et Métiers	Topology-preserving non-rigid deformation of CAD models from point clouds for first-time-right production in smart manufacturing	Jean-Philippe PERNOT, Arnaud POLETTE	LISPEN - Laboratoire d'ingénierie des systèmes physiques et numériques
2022_065	Arts et Métiers	A decision aid system based on a decentralized architecture to faster the management of hazards occurring under production and logistics systems	Lionel Roucoules, Esma YAHIA, Nathalie Klement	LISPEN - Laboratoire d'ingénierie des systèmes physiques et numériques
2022_099	Arts et Métiers	Hybridization of PEM hydrogen fuel cell and supercapacitors for maritime applications	Pierre Garambois, Lionel Roucoules, Florian HUET	LISPEN - Laboratoire d'ingénierie des systèmes physiques et numériques
2022_073	Mines Paris - PSL	Modelling and Optimization of Memory Accesses on Multi-level Memory Parallel CPUs	Claude TADONKI	CRI - Centre de recherche en informatique
2022_082	Mines Paris - PSL	Wearable Sensing and Movement Analytics for the Monitoring of Operators/Experts in industry and crafts	Alina Glushkova	CAOR - Centre de Robotique

ROOM2 - Information and Communication Science and Technology + Mathematics and their applications + Energy, Processes + Design, Industrialization- PROPOSALS/LABS 2/2

File Number	School	Title	Advisors	Lab
2022_014	ESPCI Paris - PSL	Intelligent Reflecting Surfaces for Backscatter telecommunications	Julien de Rosny, Abdelwaheb Ourir	Institut Langevin
2022_019	Arts et Métiers	Developing serious games for teaching interactive product design	Camille JEAN, Lou Ruding, Frédéric SEGONDS	LCPI - Laboratoire conception de produits et innovation
2022_021	Arts et Métiers	Data-Driven Adaptive Statistical Process Control for Smart Manufacturing	Jean-Yves DANTAN, Lazhar HOMRI, Wahb ZOUHRI	LCFC - Laboratoire de conception, fabrication, commande
2022_041	Arts et Métiers	Innovative Design for Additive Manufacturing through Knowledge Management and Artificial Intelligence	Ali Siadat, Alaa Hassan	LCFC - Laboratoire de conception, fabrication, commande
2022_046	Arts et Métiers	How adapt reconfigurable production systems to product variability and improve scalability and reusability of RMS	Jean-Yves Dantan, Paul Stief, Ali SIADAT	LCFC - Laboratoire de conception, fabrication, commande
2022_071	Arts et Métiers	Design a safe work-cell for human-robot co-activity in industry	Thibaut RAHARIJAONA, Adrien KOESSLER, Paul STIEF	LCFC - Laboratoire de conception, fabrication, commande
2022_087	Arts et Métiers	Dynamic behavior models for industrial forging processes	Régis Bigot, Durand Camille	LCFC - Laboratoire de conception, fabrication, commande
2022_088	Arts et Métiers	Surrogate models for industrial metal forming processes optimization	Tudor Balan, Cyrille Baudouin, Lazhar Homri	LCFC - Laboratoire de conception, fabrication, commande
2022_089	Arts et Métiers	Real-time model development for incremental sheet metal forming	Tudor Balan, Sandra Chevret	LCFC - Laboratoire de conception, fabrication, commande
2022_093	Arts et Métiers	How to integrate robots to the co-design of product variety and its reconfigurable manufacturing systems (RMS)	Jean-Yves DANTAN, Paul STIEF, Adrien KOESSLER	LCFC - Laboratoire de conception, fabrication, commande
2022_101	Arts et Métiers	Risk management of engineering products driven by artificial intelligence	Ali SIADAT, Jelena PETRONIJEVIC, Alain ETIENNE	LCFC - Laboratoire de conception, fabrication, commande
2022_037	Arts et Métiers	Improving formability of lightweight metallic materials using process chaining: Incremental Forming and Friction Stir Welding	Philippe Dal Santo, Idriss Tiba, Sandra Chevret, Tudor Balan	LAMPA - Laboratoire angevin de mécanique, procédés et innovation
2022_048	Chimie ParisTech - PSL	Charge Tranport in Organic Photovoltaics: from modeling to rationale design	Carlo Adamo	I-CLEHS - Institute of chemistry for life and health

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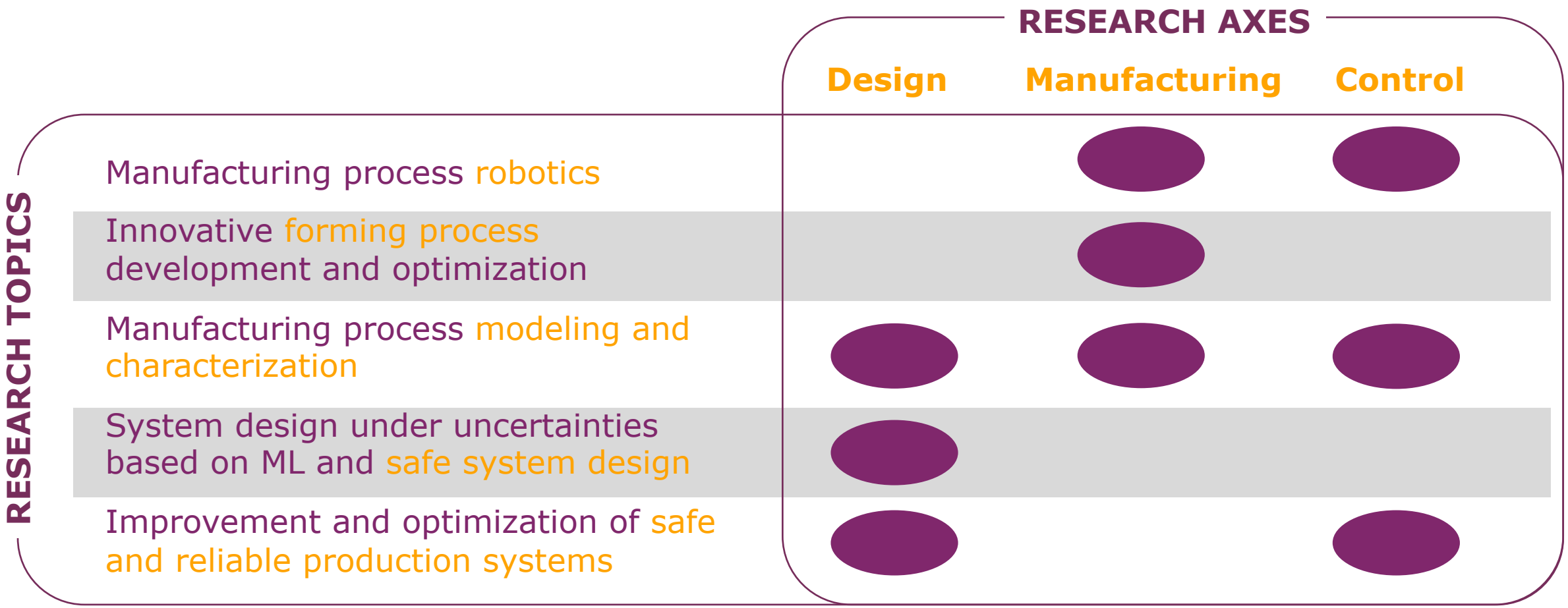
ENSAM LAB: **LCFC - LABORATOIRE DE CONCEPTION FABRICATION COMMANDE**

Lab Director :
Ali SIADAT
Ali.SIADAT@ensam.eu



LCFC Conception Fabrication Commande

UNIVERSITÉ DE LORRAINE

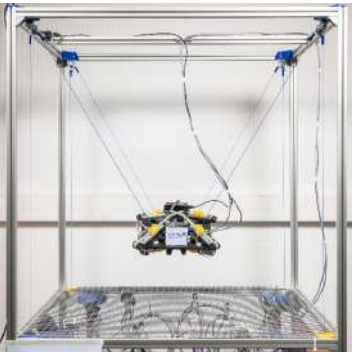
Arts et Métiers Institute of Technology

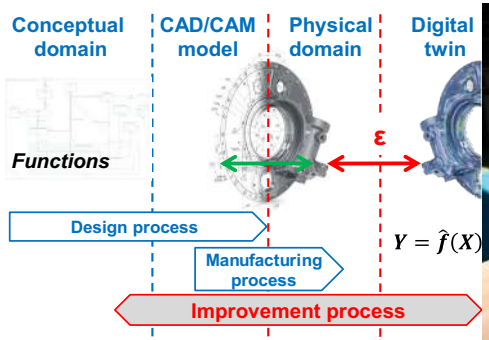
ENSAM LAB: **LCFC - LABORATOIRE DE CONCEPTION FABRICATION COMMANDE**

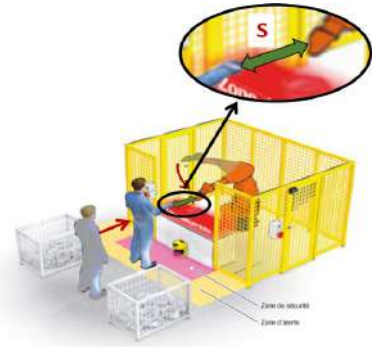
Lab Director :

Ali SIADAT

Ali.SIADAT@ensam.eu







Major ongoing projects:

- 5 ANR projects (4 × coordinator)
- 7 CIFRE/industrial theses
- 1 IC Arts structural project
- 2 RDI projects
- 1 Industrial chair

Key indicators:

- 7 prof + 20 ass prof (2 HDR) + 2 prag dr
- 24 PhD students
- annual budget ~1M€ (65% industrial partnership)
- 2 joint labs (LC2S/INRS, LAMFM/CETIM)
- 20…25 articles in international journals / year
- Int. conf organizer (2022: “CIRP” conf CA tolerancing)

LCFC Conception Fabrication Commande

UNIVERSITÉ DE LORRAINE

Arts et Métiers Institute of Technology

ENSAM LAB: **LCFC - LABORATOIRE DE CONCEPTION FABRICATION COMMANDE**

Lab Director :

Ali SIADAT

Ali.SIADAT@ensam.eu

Industrial partners:

MANOIR INDUSTRIES · Setforge · thyssenkrupp · ACM ABS CENTRE MÉTALLURGIQUE ABSOLUTE STEEL QUALITY

life.augmented · PHIMECA · TATA · PIERBURG PUMP TECHNOLOGY

Radiall · RENAULT · AUBERT&DUVAL · Valeo

BOURGUIGNON BARRE · AMI Ardennes • Machining • Industries · ASCOMETAL

PSA PEUGEOT CITROËN · framatome · ArcelorMittal

burkert · SAFRAN · MARLE GROUP · ATELIERS DES JANVES

Iso-Top étanchéité · lisi

Public institutions/ RTO/ academic :

La Région Grand Est · Département Moselle Conseil Général · EUROMÉTROPOLE METZ · UIMM LA FABRIQUE DE L'AVENIR

cetim · inrs Institut National de Recherche et de Sécurité · ceatech · IS INSTITUT DE SOUDURE · IRT m2p

CRAN · LEM3 · G-SCOP · I2M Procédés et Ingénierie en Mécanique et Matériaux · lcms · I2M BORDEAUX · lispen · GRESPI Groupe de Recherche En Sciences Pour l'Ingénieur · INSTITUT PASCAL

DTU · KIT Karlsruhe Institute of Technology · LIST · KTH VETENSKAP OCH KONST · TECHNICAL UNIVERSITY OF CLUJ-NAPOCA ROMANIA · ENSAM

University of Tehran · TIANJIN UNIVERSITY (PEIYANG UNIVERSITY) · BEIJING UNIVERSITY OF TECHNOLOGY

eit Manufacturing

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Arts et Métiers Sciences et Technologies

LABORATOIRE D'INGÉNIERIE DES FLUIDES ET DES SYSTÈMES ÉNERGÉTIQUES - LIFSE

LIFSE Laboratoire Ingénierie des Fluides Systèmes Énergétiques

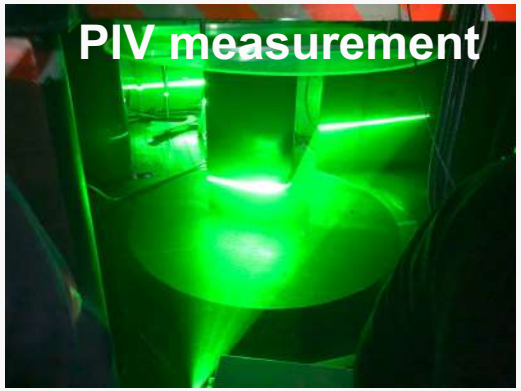
LIFSE Laboratory Fluids Engineering Energy Systems

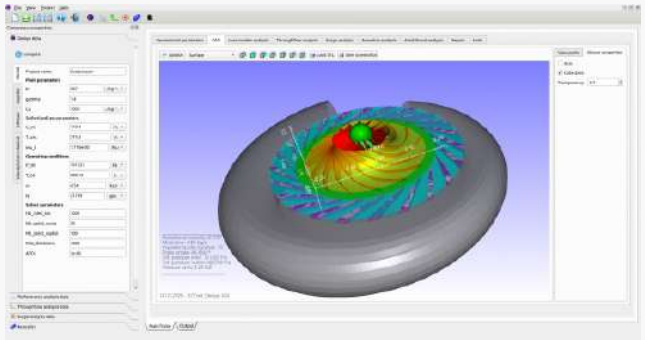
Research domain(s): The LIFSE's main research areas revolve around hydrodynamics, aerodynamics, acoustics, thermics and thermodynamics, implemented for the turbomachines development as well. These research areas are a part of the renewable energy fields, sustainable mobility, aerospace, processes and health.

Turbomachines	Topic leaders	Dr Amélie DANLOS Pr Sofiane KHELLADI
Energy systems and thermal management	Topic leaders	Dr Michael DELIGANT Dr Christelle PERILHON
Multi-spacies flows and rheology	Topic leaders	Pr farid BAKIR Dr Mathieu SPECKLIN
Physical aero-hydrodynamics	Topic leaders	Dr Florent RAVELET Dr Michael PEREIRA

RESEARCH INFRASTRUCTURES
(Confluence Platform)

Name





Component design codes

KEY FACTS / FIGURES

15 researchers / 16 teacher-researchers
(including 80% of international researchers / 37% of teacher-researchers)
24 doctoral students including 75% of international doctoral students

35-45 publications/year
50% international co-publications

22 patents

Sample typical research projects:

see more details on

https://lifse.artsetmetiers.fr/

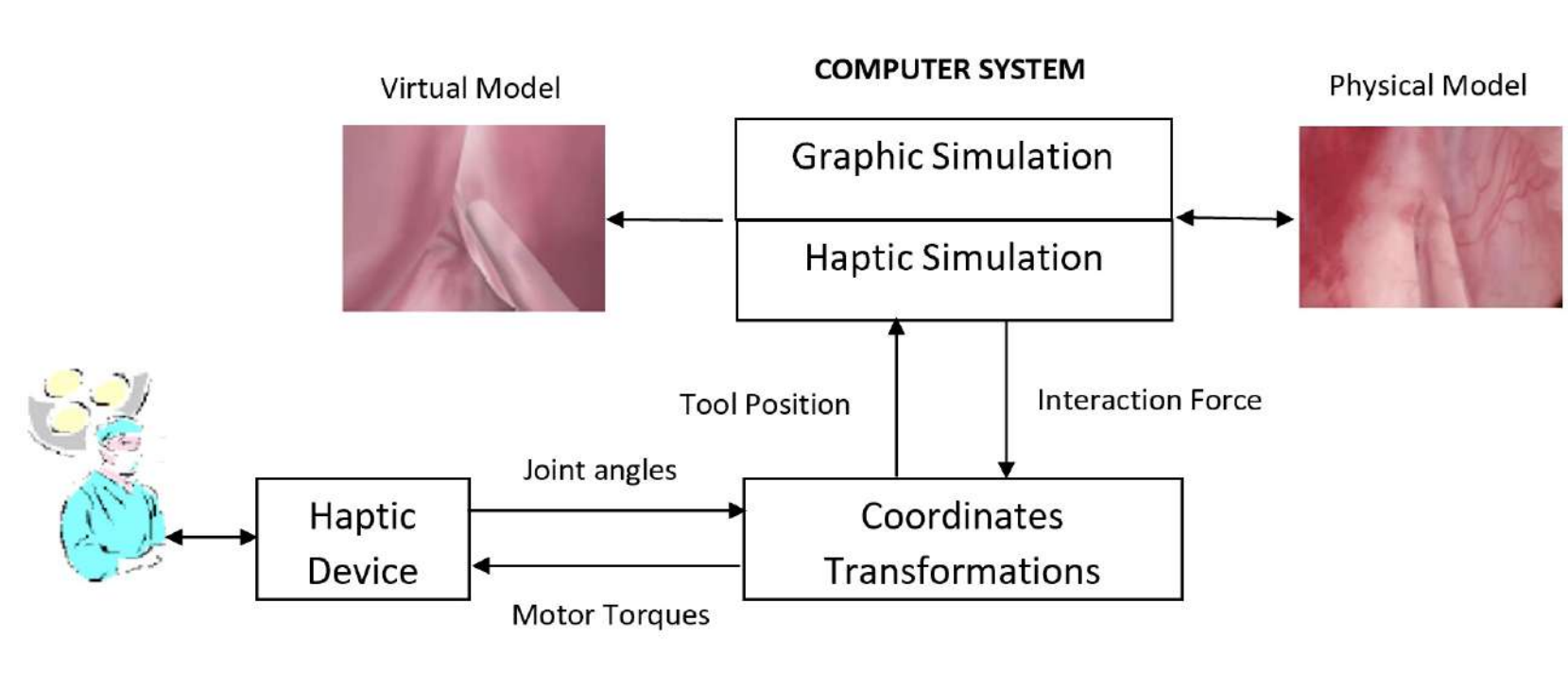
PhD subject : Intelligent Haptics for the Perception of Fluid Properties

Advisors:

- **Dr. Samir GARBAYA**
- **Pr. Sofiane KHELLADI**

- **Context**:
  - Haptic sensation is important for the perception of the physical properties of virtual objects. Natural user interfaces allowing high fidelity of haptic sensation of fluids' properties still not available
- **Objectives:**
  - This PhD will focus on the development of modeling methodologies of virtual fluids and the design novel 3D interaction techniques for haptic feedback
  - This research includes :
    - Integration machine learning and Extended-Realty in the Human-Computer Interaction
    - Development of new methods of hydrodynamics modeling and of mechanisms of sensory integration for the perception of fluids' properties
    - Validation of the research results with the application in medical domain

HAPTIC RENDERING



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- Germanico Gonzalez-Badillo, Hugo Medellin-Castillo, Theodore Lim, James Ritchie, Samir Garbaya, "The development of a physics and constraint-based haptic virtual assembly system", Assembly Automation, Vol. 34 Iss: 1, pp.41 - 55, 2014
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- Lundin, Karljohan & Sillén, Mattias & Cooper, Matthew & Ynnerman, Anders & Visualization, Norrköping & Studio, Interaction & Sweden, (2005). Haptic visualization of computational fluid dynamics data using reactive forces. Proceedings of SPIE - The International Society for Optical Engineering. 5669. 10.1117/12.587029.
- Liu, S., Ma, C. & Feng, G. Haptic rendering for the coupling between fluid and deformable object. Virtual Reality 23, 33–44 (2019),

CSC programme

Optimization of an overspray system for turbomachines applications

Prof. Sofiane Khelladi, Professeur des Universités
Dr. Tommaso Capurso, Enseignant-chercheur

Laboratory of Fluid Engineering and Energy Systems (LIFSE lab)
Arts et Métiers Institute of Technology, LIFSE

sofiane.khelladi@ensam.eu
tommaso.capurso@ensam.eu

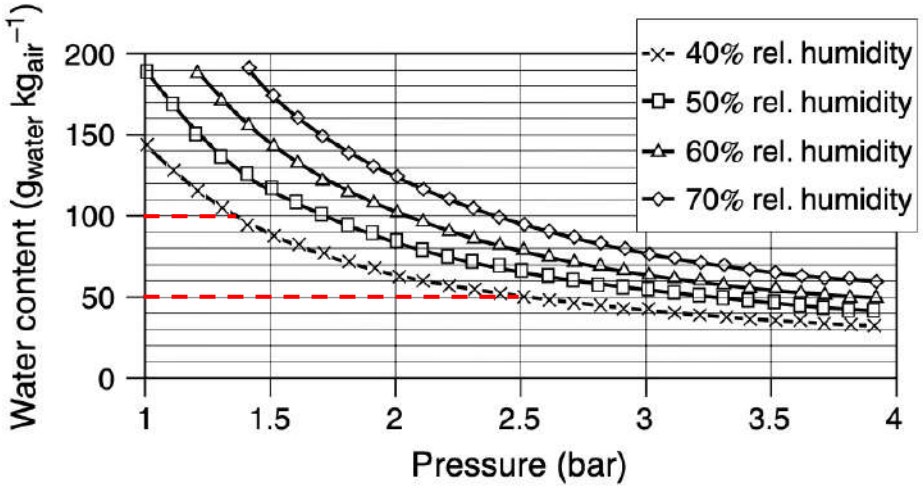
Arts et Métiers Sciences et Technologies

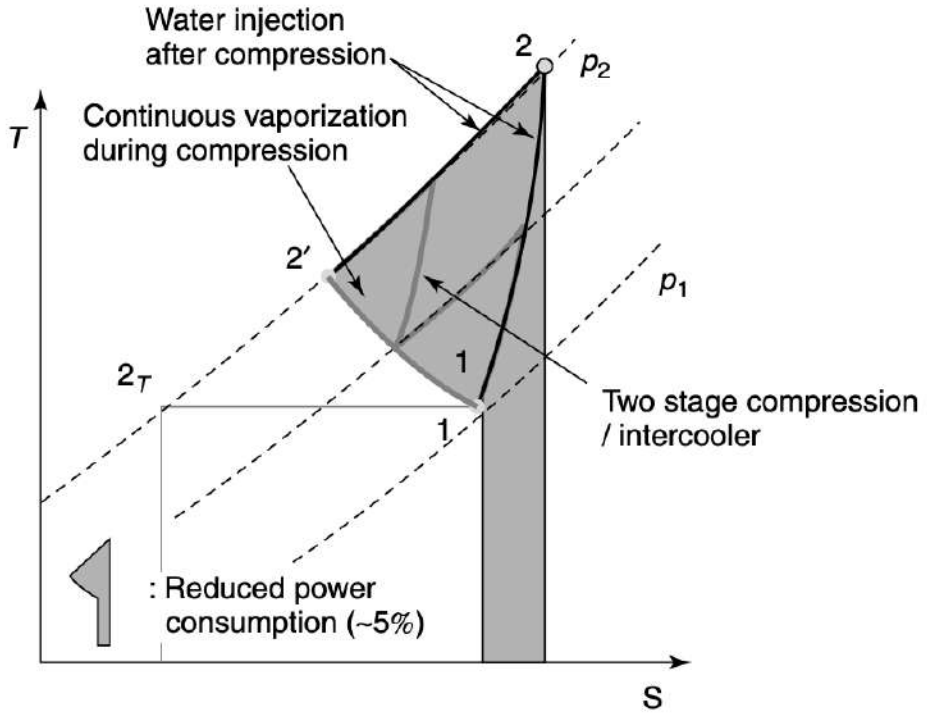
LIFSE Laboratoire Ingénierie des Fluides Systèmes Energétiques

Centrifugal compressor - Humidification

Cooling by water injection.

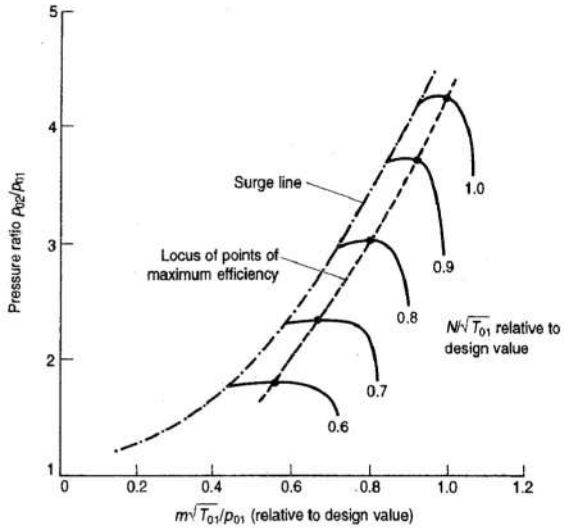
Pros: reduction of the inlet air temperature (T_{in}).

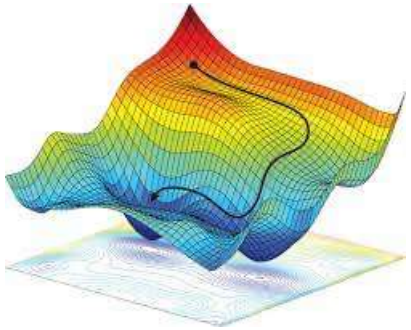


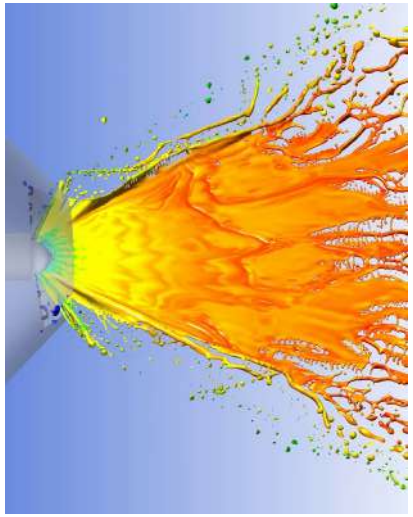


Work flow

Definition of the design parameters → Thermodynamic analysis and geometric optimization → Advanced CFD simulations of overspray → 3D printing and experiments







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MINES PARIS | PSL

CENTRE DE RECHERCHE EN INFORMATIQUE

CRI

Centre de Recherche en Informatique CRI

Research domain(s): *Program transformations; high-performance computing; proof; cryptography; database*

High-Performance Computing
(Parallel programing and supercomputers)

Team

François Irigoin
Corinne Ancourt
Claude Tadonki

Security
(Proof and checking)

Team

Pierre Jouvelot
Olivier Hermant

Languages
(Cryptography and database)

Team

Fabien Coelho
Laurent Daverio
Claire Medrala

Centre de Recherche en Informatique CRI

RESEARCH INFRASTRUCTURES

CALCUTTA PowerEdge T640

BUENAVISTA Precision 3650

KEY RESEARCHER (S)

FRANÇOIS IRIGOIN
H-INDEX: 25
#CITATIONS: 3467

PIERRE JOUVELOT
H-INDEX: 26
#CITATIONS: 3901

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Centre de Recherche en Informatique CRI

KEY FACTS / FIGURES

6 researchers
12 doctoral students including 30% of international doctoral students

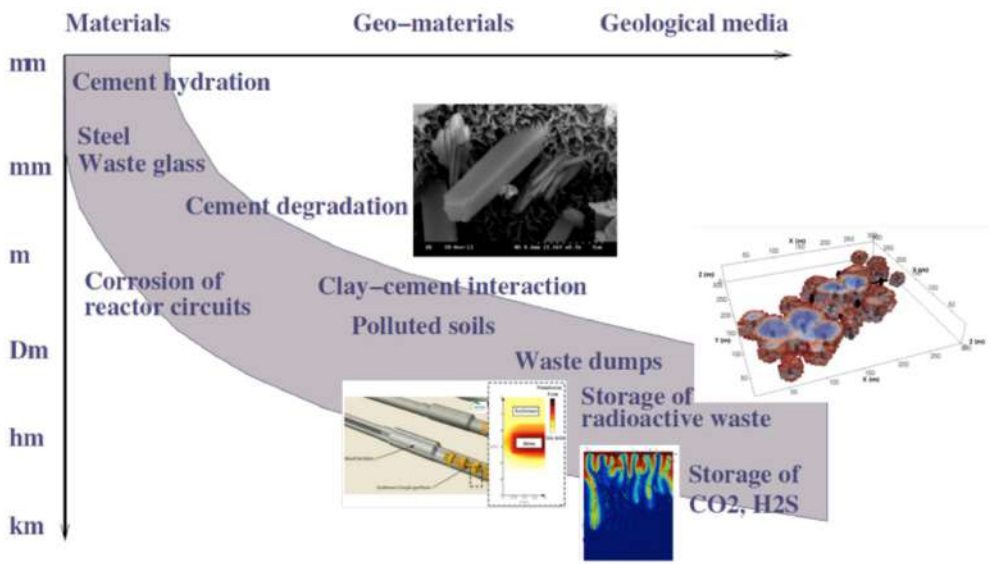
Prestigious partnerships

Number of publications: 330
Number of international co-publications: 300

International collaboration: *UK; USA; Brazil; Morocco; Poland; …*

Centre de Recherche en Informatique CRI

Sample typical research projects



Theme: Transports of reagants (simulation)
HPC in material sciences

Theme: Autonomous vehicles
Proof in artificial intelligence

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Wearable sensing and movement analytics for the monitoring of operators/experts in industry and crafts

Professional gestures

Operators:

> embody dexterity and technicality

However they are:

> exposed to ergonomics risks (loading charge, uncomfortable postures, repetitive gestures etc.)

Monitoring & analyzing their activity contribute to the prevention of MSDs

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Pic from: https://asiagarmenthub.net/Members/33508c647ab4412d985d608b47f02bcb/what-you-should-know-about-ilos-newest-worker-manual
https://www.portlandworks.co.uk/portfolio/wilebore-hand-made-leather-goods/

Wearable sensing and movement analytics for the monitoring of operators/experts in industry and crafts

Capture professional gestures with wearable sensing

Capture signal from various multi sensing technologies such as

- **IMUs (gyroscopes, accelerometers, magnetometers)**
- **Heart rating sensors**
- **Electromyographs**
- **Breath monitoring belts**

By using

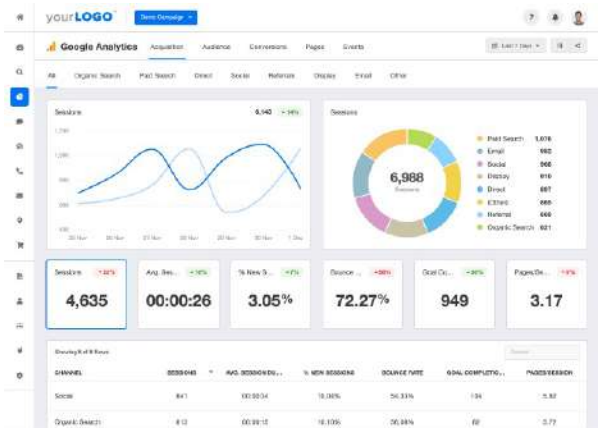
- **Smartphones**
- **Smartwatches**
- **etc.**

#signal processing #timeseries #datafusion

Pic from https://agencyanalytics.com/feature/google-analytics-dashboard

Wearable sensing and movement analytics for the monitoring of operators/experts in industry and crafts

Develop a methodology for the analysis of professional gestures
Develop a platform for ergonomists/trainers to better understand motor performance



Use of machine learning and pattern recognition techniques

Detect automatically the correlations between:
>motion features
> internal/external human factors (time pressure, emotional state etc.)

#signal processing #timeseries #datafusion

Pic from: https://asiagarmenthub.net/Members/33508c647ab4412d985d608b47f02bcb/what-you-should-know-about-ilos-newest-worker-manual
https://www.portlandworks.co.uk/portfolio/wilebore-hand-made-leather-goods/

Indicative bibliography

Stefana, E., Marciano, F., Rossi, D., Cocca, P., & Tomasoni, G. (2021). Wearable devices for ergonomics: A systematic literature review. *Sensors*, *21*(3), 777.

Metcalf, C. D., Irvine, T. A., Sims, J. L., Wang, Y. L., Su, A. W., & Norris, D. O. (2014). Complex hand dexterity: a review of biomechanical methods for measuring musical performance. Frontiers in psychology, 5, 414.

Ju, Z., & Liu, H. (2013). Human hand motion analysis with multisensory information. IEEE/AsMe Transactions on Mechatronics, 19(2), 456-466.

Chen, Q., Albarakati, A., & Gui, L. (2021). Research on motion capture of dance training pose based on statistical analysis of mathematical similarity matching. Applied Mathematics and Nonlinear Sciences.

Dingwell, J. B., & Cusumano, J. P. (2000). Nonlinear time series analysis of normal and pathological human walking. Chaos: An Interdisciplinary Journal of Nonlinear Science, 10(4), 848-863.

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Arts et Métiers Sciences et Technologies

LABORATOIRE ANGEVIN DE MÉCANIQUE, PROCÉDÉS ET INNOVATION / INSTITUTE OF LAVAL

LAMPA

Laboratoire Angevin de Mécanique, Procédés et innovAtion

Laboratory of mechanics, processes and innovation

LAMPA
Laboratoire Angevin de Mécanique, Procédés et innovAtion

KEY FACTS / FIGURES

44 researchers including 7 foreigners
22 doctoral students including 10 foreigners

MANN+HUMMEL AIRBUS

124 publications in scientific review since 2018

MONDRAGON UNIBERTSITATEA

UNIVERSITI TEKNOLOGI PETRONAS

Three filed patents

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Laboratory of mechanics, processes and innovation

LAMPA
Laboratoire Angevin de Mécanique, Procédés et innovAtion

Future manufacturing processes

Complex structures and flows

Team leader

Laurent Guillaumat

Metal structures and alloys

Team leader

Guénaël Germain

Presence & Innovation

Team leader

Simon Richir

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Team « Presence & Innovation »

LAMPA
Laboratoire Angevin de Mécanique, Procédés et innovAtion

RESEARCH INFRASTRUCTURES
(Laval Virtual Center)

KEY RESEARCHERS

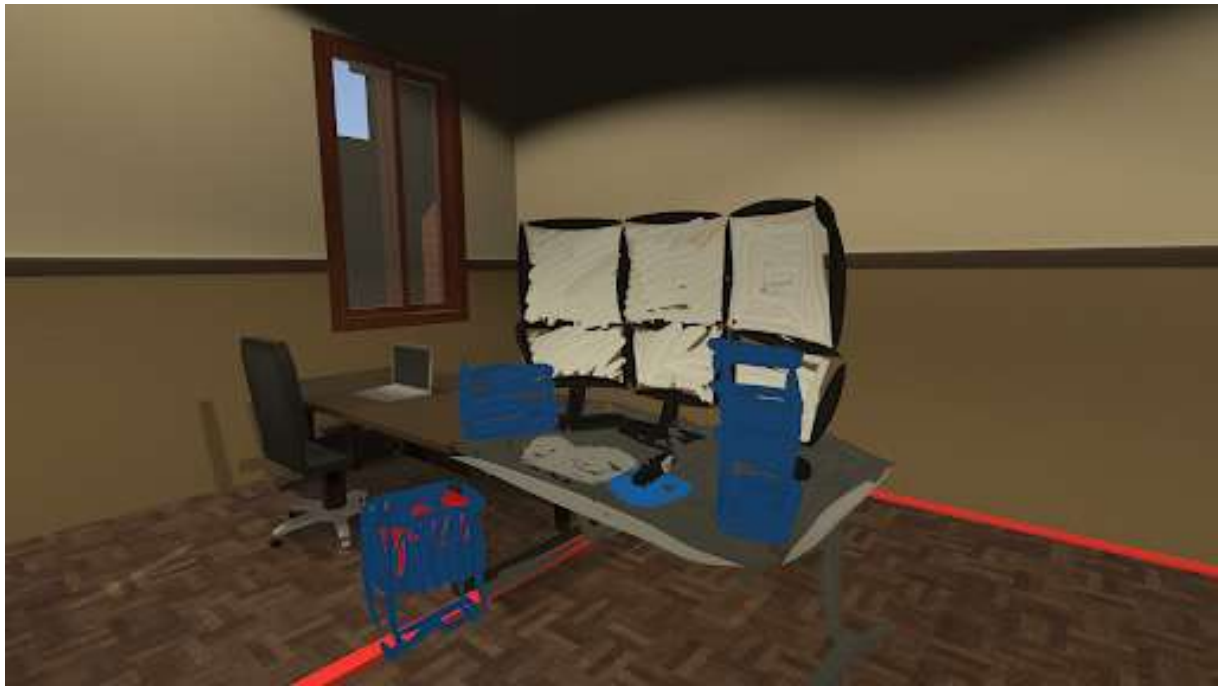
SIMON RICHIR / *impact factor 21*

SYLVAIN FLEURY / *impact factor 9*

Team « Presence & Innovation »

LAMPA
Laboratoire Angevin de Mécanique, Procédés et innovAtion

INEDIT Project



Development of virtual reality applications for furniture design.
Assessment of VR tools to improve creativity process and to make design of furtniture possible for non-professional designers

- Fleury, S., Blanchard, P., & Richir, S. (2021). A study of the effects of a natural virtual environment on creativity during a product design activity. *Thinking Skill and Creativity*.
- Fleury, S., Poussard, B., Blanchard, P., Dupont, L., Meister Broekema, P., & Richir, S. (2022). Innovative process for furniture design: contribution of 3D scan and virtual reality. Computer-Aided Design and Applications, 868-878, doi: 10.14733/cadaps.2022.868-878
- Fleury, S., Dupont, L., Chaniaud, N., Tamazart, S, Poussard, B., Gorisse, G., & Richir, S. (2022). An investigation of design in virtual reality across the variation of training degree and visual realism. International Conference on Engineering Technology and Innovation.
- Pallot, M., Fleury, S. Poussard, B., & Richir, S. (2022). What are the Challenges and Enabling Technologies to Implement the Do-It-Together Approach, its Benefits and Drawbacks? Journal of Innovation Economics & Management.

Team « Presence & Innovation »

LAMPA
Laboratoire Angevin de Mécanique, Procédés et innovAtion

JENII Project

- Development of virtual reality applications for engineers students training.
- Assessment of VR simulators as way to learn processes and concepts.

Team « Presence & Innovation »

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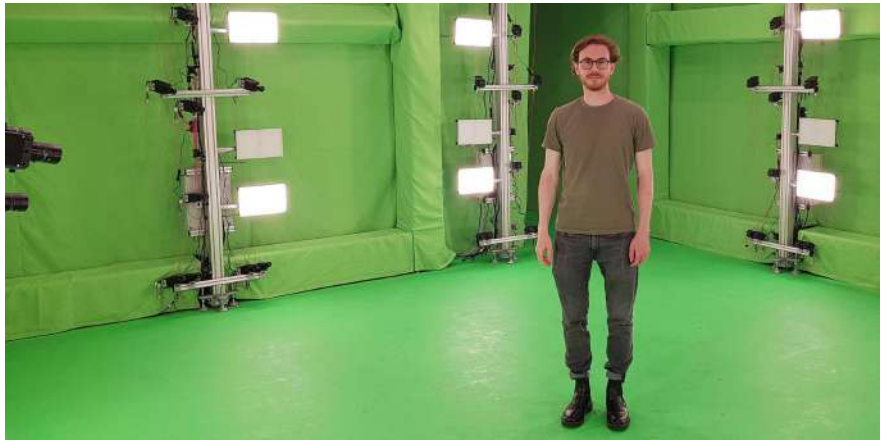
Laboratoire Angevin de Mécanique, Procédés et innovAtion



We will acquire volumetric capture equipment

We want to develop **the first MOOC in VR** by capturing a teacher giving a lesson.

The thesis is **about the way to enhance the MOOC VR** by adding highlights, guidings or other improvements and **to evaluate its efficacy for learning**.

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Arts et Métiers Sciences et Technologies

LABORATOIRE D'INGÉNIERIE DES SYSTÈMES PHYSIQUES ET NUMÉRIQUES – LISPEN

PHYSICAL AND DIGITAL SYSTEMS ENGINEERING LABORATORY

lispen

Prof. Jean-Philippe PERNOT

Laboratoire d'Ingénierie des Systèmes Physiques Et Numériques

lispen

Research domain(s): Multi-physics, multi-scale and virtual dynamical systems for industry

Robotics, HRI, industrial engineering
Nonlinear dynamics and smart systems

Team leader

Prof. Richard Béarée

System engineering and digital model, industrial engineering

Team leader

Prof. Lionel Roucoules

Virtual Immersion technologies and uses

Team leader

Prof. Frédéric Merienne

ParisTech
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RESEARCH INFRASTRUCTURES

Lille

Chalon-sur- Saône

Aix-en-Provence

Laboratoire d'Ingénierie des Systèmes Physiques Et Numériques

lispen

KEY FACTS / FIGURES

Number of researchers / teachers : 31
Number of doctoral students : 42 including
25% of international doctoral students
Number of post-docs : 3

Prestigious partnerships with academic laboratories

Number of publications > 600
Number of international co-publications >40

Number of filed patents > 20

Lab's or staff's' recent Awards

- Automotive News PACE Award 2022 (Chaire Valéo)
- Active and funded member of 2 EQUIPEX+ (CONTINUUM & TIRREX)
- H2020 EU project leader – Colrobot 2015-2019
- Safran innovation award 2018

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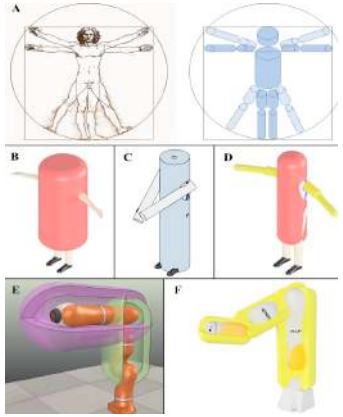
Sample typical research projects :



Mohammad Safeea's Joint PhD supervision with Univ. Of Coimbra (Portugal)

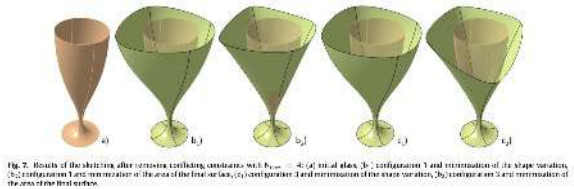
« *Safe Collaborative Robotic Manipulators* » 2017-2020

7 papers in top10 Robotic's journals;
4 communications in int. conf. (ICRA, IROS), 6 book chapters

Yuyang Wang – PhD granted by CSC

« *Smart navigation in virtual environment* »
2018-2021

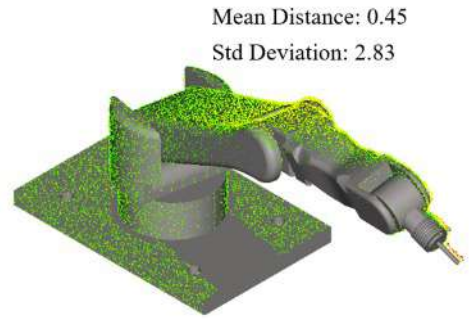
1 paper (IEEE Access)
3 Communications in int. conf. (IEEE VR, ICITS)



Hao HU – PhD granted by CSC

« *Over-constraints detection and resolution in geometric equation systems* »
2014-2017

2 papers in high impact factor journals (Computer-Aided Design, Archives of Computational Methods in Engineering)



Sijie HU – PhD granted by CSC

« *Deep learning-based identification and fitting of CAD models from point clouds* »
2019 - 2020

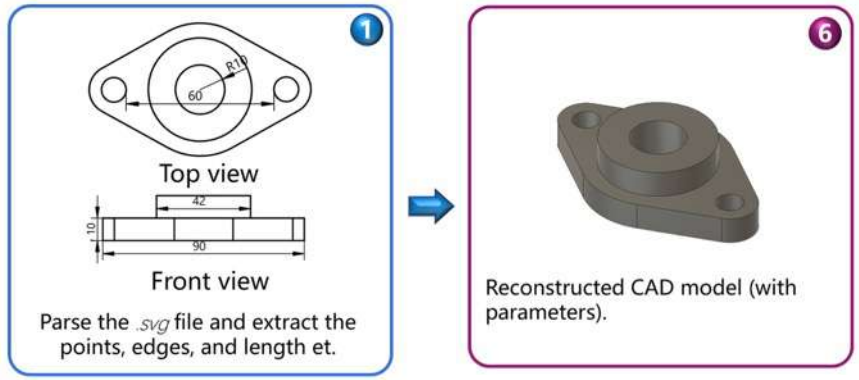
1 paper (Engineering with computers)

Ongoing research projects :

Tingcheng LI – PhD granted by CSC

« *Deep Learning for 3D Scanning Strategies Quality Estimation* » 2020-2024

1 paper (Computer-Aided Design) and 1 to be submitted



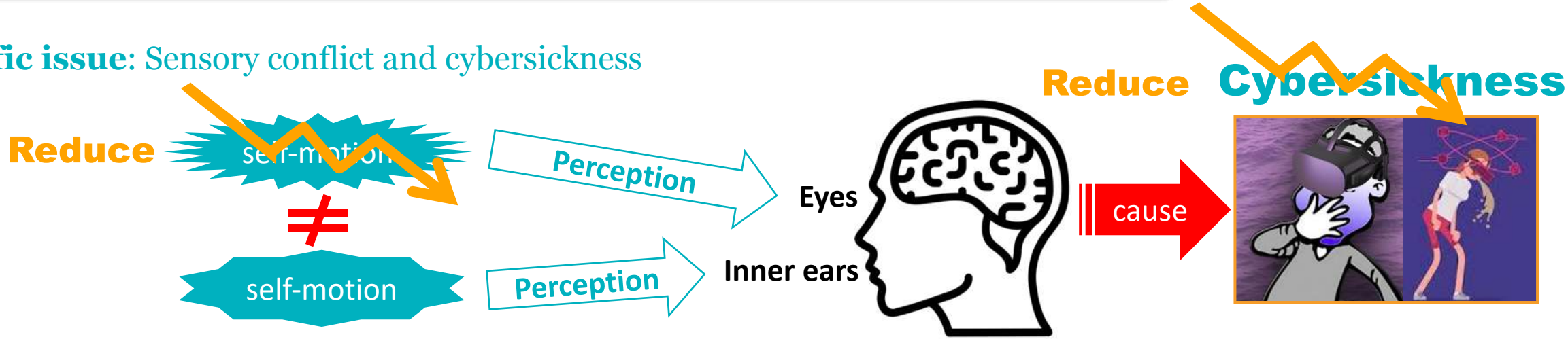
Chao ZHANG – PhD granted by CSC

« *Deep-learning based 3D CAD models reconstruction from 2D drawings* » 2021-2025

1 paper under submission

PhD subject: Geometry processing for reducing cybersickness in VR

Scientific issue: Sensory conflict and cybersickness



Proposed approach: apply geometry processing on the virtual scene

- Pilot studies: manual geometric **deformation** and **simplification** proposed in the literature (papers below)
- For this **PhD subject**:
  - How to **analyze** geometrically the virtual scene regarding to potential cybersickness ?
  - How to automatically **process** geometrically the virtual scene for reducing cybersickness ?
    - which strategy (simplification, deformation or others) ?
    - What are the algorithms for each strategy ?
  - What are the **parameters** that users can set up ?

Dr. Ruding Lou
Prof. Frédéric Mérienne

- R. Lou, R.H.Y. So, and D. Bechmann, " *Geometric **Deformation** for Reducing Optic Flow and Cybersickness Dose Value in VR* ", Eurographics, France, 2022.
- R. Lou, F. Merienne, R. H. Y. So, T-T. Chan and D. Bechmann, " *Geometric **Simplification** for Reducing Optic Flow in VR* ", IEEE ISMAR, Singapour, 2022.

Laboratoire d'Ingénierie des Systèmes Physiques Et Numériques

lispen

PhD 2022_013

PhD subject: Geometry processing for reducing cybersickness in VR

Team: Virtual Immersion
- **Dr. Ruding Lou**
- Prof. Frédéric Mérienne

Context

Immersive visualization => visually induced self-motion (vection)

≈

Physically statistic: Using VR input device to move in virtual environment

Scientific issue: Sensory conflict and cybersickness

Reduce self-motion ≠ self-motion

Perception

Perception

Eyes

Inner ears

cause

Reduce Cybersickness

Objective

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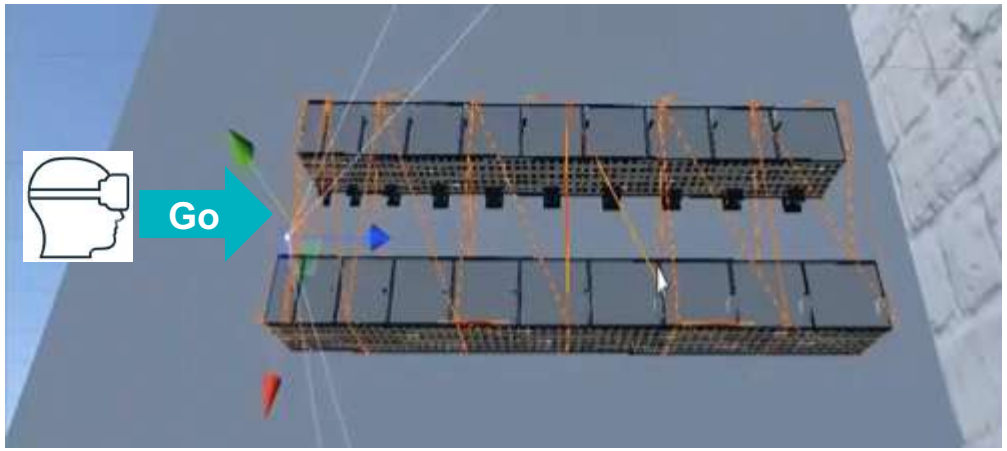
VR: Virtual reality, CAVE: Cave automatic virtual environment, HMD: Head-mounted display

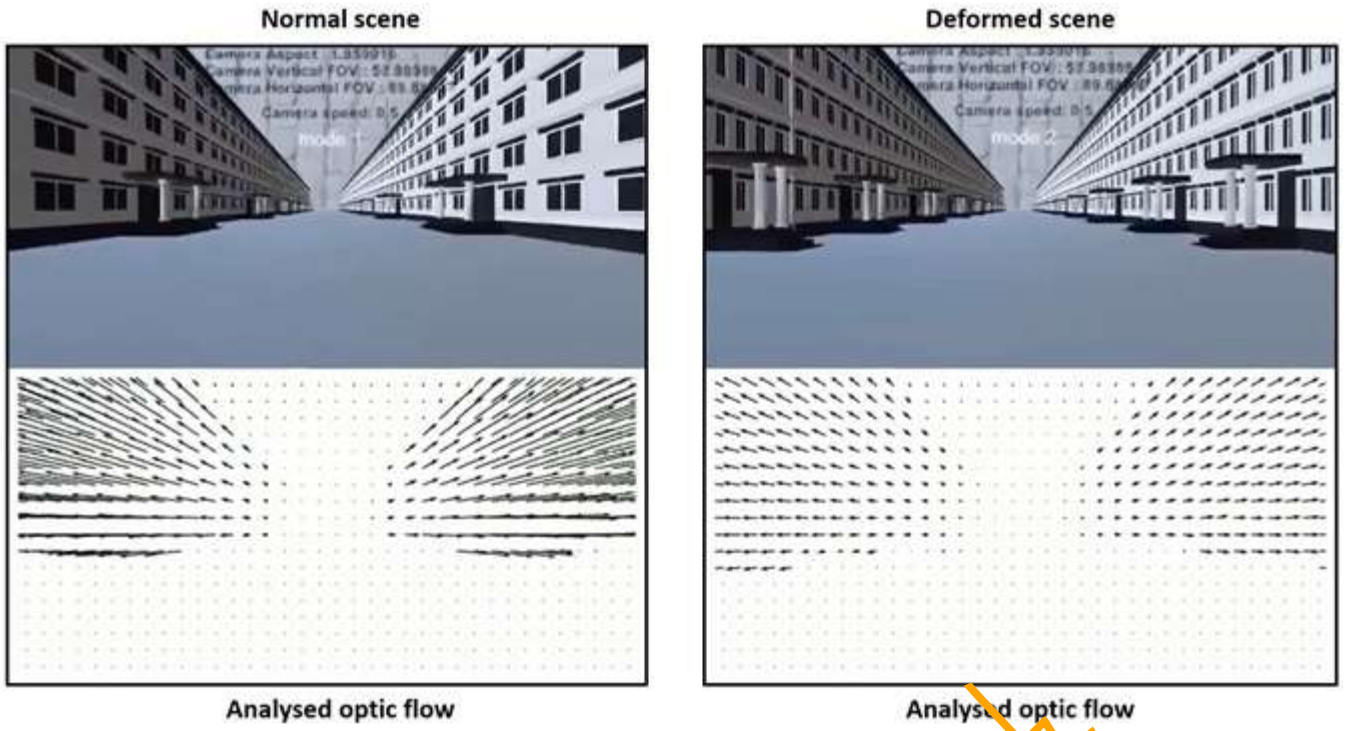
PhD subject: Geometry processing for reducing cybersickness in VR

Team: Virtual Immersion
- **Dr. Ruding Lou**
- Prof. Frédéric Mérienne

Proposed approach: geometry processing of the virtual scene

- Pilot studies through manual processing proposed in the literature (papers below)
  - **deformation** (Eurographics'22)





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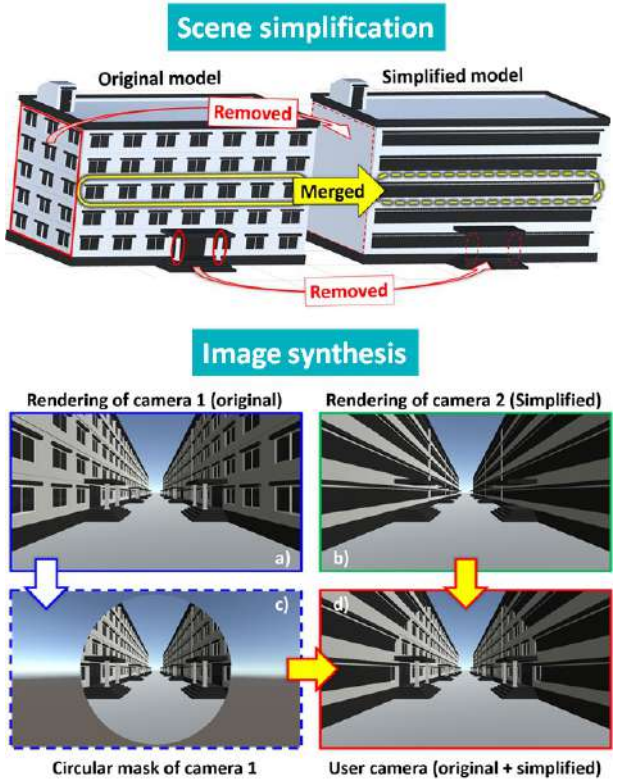
- R. Lou, F. Merienne, R. H. Y. So, T-T. Chan and D. Bechmann, " *Geometric **Simplification** for Reducing Optic Flow in VR* ", IEEE ISMAR, Singapour, 2022.

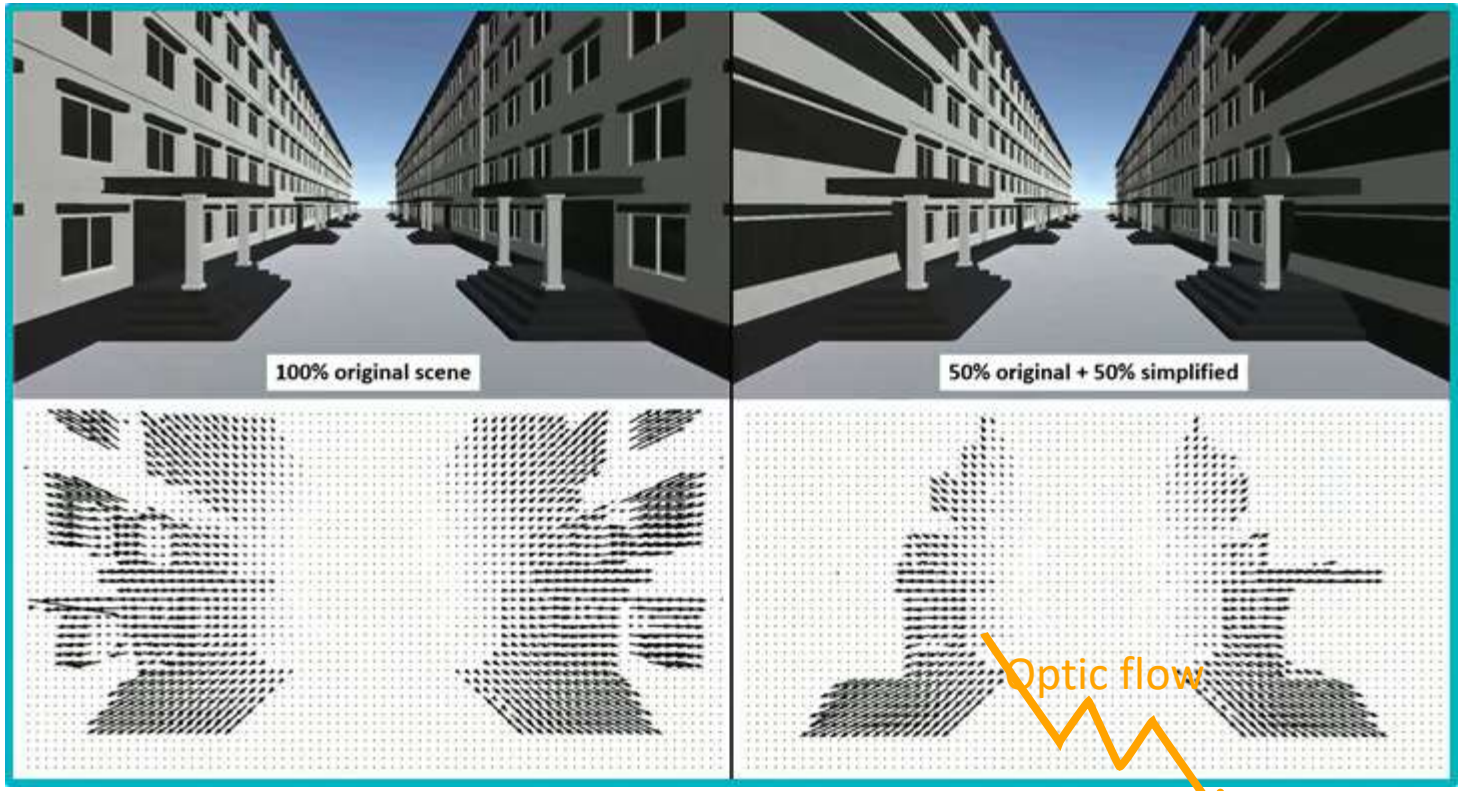
PhD subject: Geometry processing for reducing cybersickness in VR

Team: Virtual Immersion
- **Dr. Ruding Lou**
- Prof. Frédéric Mérienne

Proposed approach: geometry processing of the virtual scene

- Pilot studies through manual processing proposed in the literature (papers below)
  - **Simplification** (ISMAR'22)





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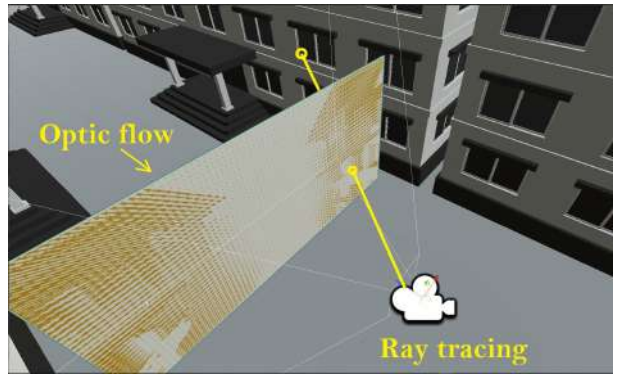
- R. Lou, R.H.Y. So, and D. Bechmann, " *Geometric **Deformation** for Reducing Optic Flow and Cybersickness Dose Value in VR* ", Eurographics, France, 2022.
- R. Lou, F. Merienne, R. H. Y. So, T-T. Chan and D. Bechmann, " *Geometric **Simplification** for Reducing Optic Flow in VR* ", IEEE ISMAR, Singapour, 2022.

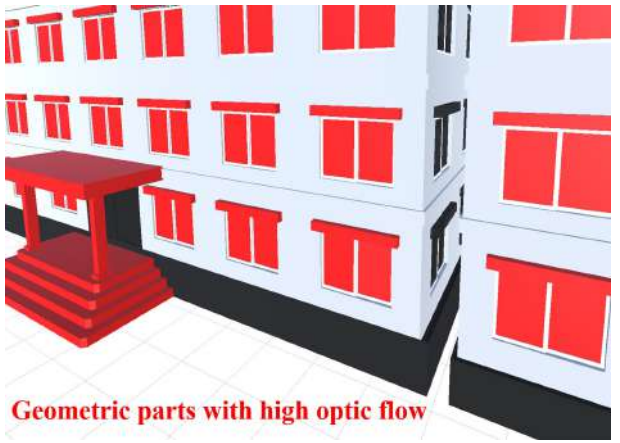
PhD subject: Geometry processing for reducing cybersickness in VR

Team: Virtual Immersion
- **Dr. Ruding Lou**
- Prof. Frédéric Mérienne

Aim of this PhD subject

- Automation of **analysis** and **segmentation** of virtual scene regarding to optic flow.
- Automation of geometry **processing** of the virtual scene for reducing optic flow ?
  - which strategy (simplification, deformation, ...) ?
  - What are the algorithms for each strategy ?
- How the geometry processing can **mitigate the cybersickness**
  - Experimentation
  - Psychological and physiological analysis
  - Data analysis
- What are the **parameters** that users can set up ?
  - Level of sensitivity to cybersickness
  - Degree of geometry processing





Thanks

PhD subject : Graph-based unbounded constrained models search for high-level logical reasoning

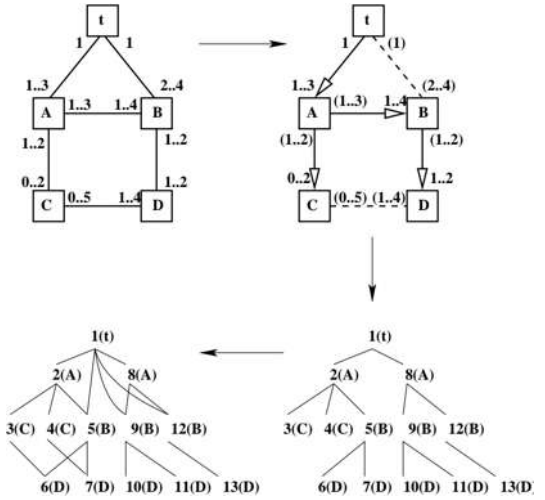
- formal AI theoretical, algorithmic and programming subject

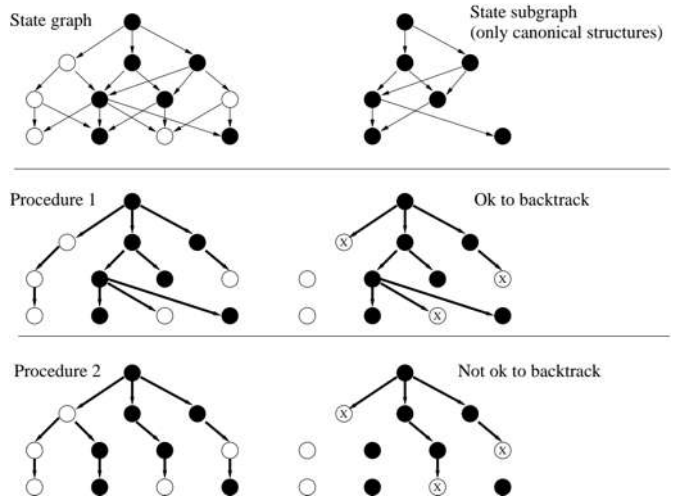
- applications to cyber-physical systems & software engineering, natural language parsing & generation, etc.

Advisors : Prof. Jean-Philippe Pernot, Dr. Mathias Kleiner

Requirements : Strong algorithmic and programming (C, Java) skills, knowledge of formal AI

· Laurent Hénocque, Mathias Kleiner, Nicolas Prcovic, “Advances in polytime isomorph elimination for configuration”, Principles and Practice of Constraint Programming-CP 2005, p. 301-313, Springer, 2005.
· Mathias Kleiner, Marcos Didonet Del Fabro, “A generic approach to model generation operations”, Journal of Systems and Software, p 136-155, Elsevier, 2018.



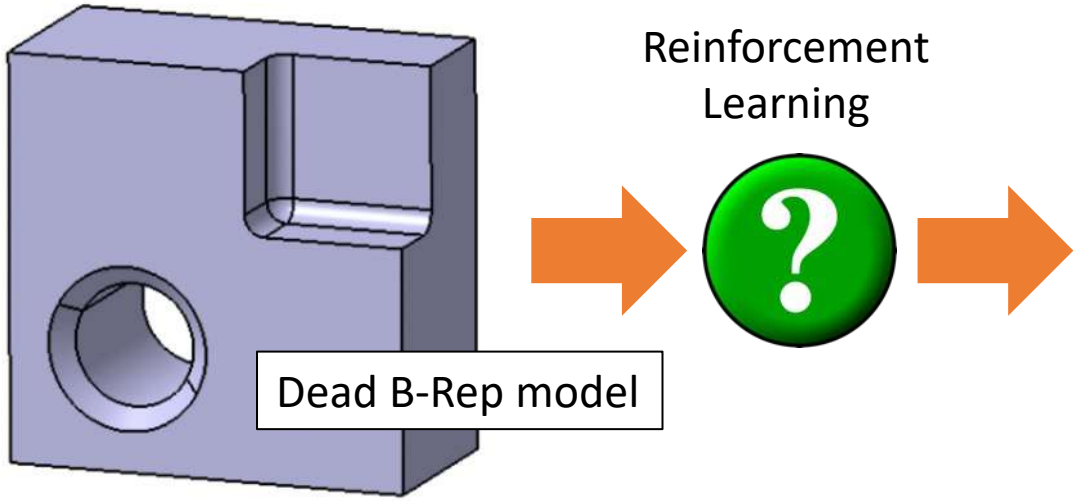


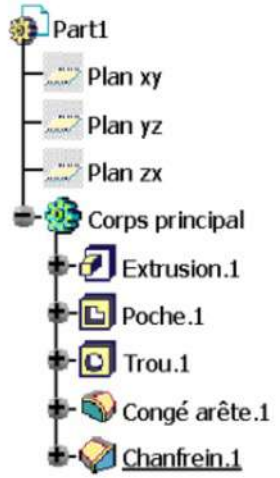
PhD subject : Reinforcement learning-based 3D reconstruction of CAD models from dead models for smart manufacturing applications

Research question : How to reverse engineer a dead CAD model to identify the building tree ready for manufacturing ?

Methodology : Make use of reinforcement learning to learn how to define such building tree with a small dataset

- How to define the environment ?
- Which actions for the agent ?
- Rewards ?
- Etc.





Building tree ready for manufacturing process planning

In collaboration with

Required background: Computer science, geometric modeling, computer-aided design.

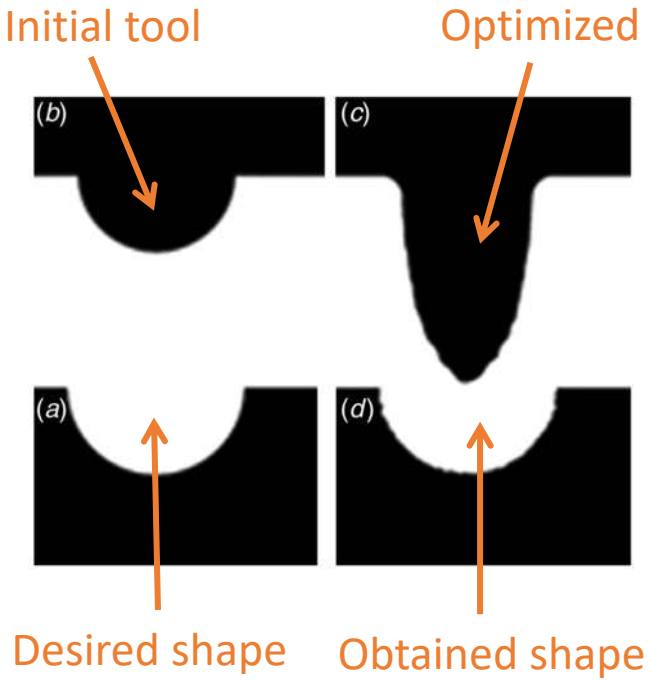
ParisTech

PhD subject : Topology-preserving non-rigid deformation of CAD models from point clouds for first-time-right production in smart manufacturing

Research question : How a CAD model can be adapted and deformed to capture the manufacturing defaults and thus maintain the coherence between the digital model and its physical and manufactured counterpart ? And how this can be used to compensate the shape deviations and allow first-time-right production ?

Methodology :

- Definition of new deformation operators to simulate and reproduce various state-of-the-art manufacturing behaviors and deviations, including free-form and non-rigid deformations, and preserving the topology
- Use of a reinforcement learning strategy, wherein an autonomous agent will learn how to define the deformation sequence to be applied to compensate the coming shape deviations between the theoretical model and its manufactured counterpart.



In collaboration with

Surleraux A., Lepert R., Pernot J-P., Kerfriden P., Bigot S., Machine Learning-based reverse model-ling approach for rapid tool shape optimization in die-sinking micro Electro Discharge Machining, Journal of Computing and Information Science in Engineering, vol. 20(3), pp. 031002-1 à 11, 2020.

ZOOM ON INDUSTRIAL ENGINEERING

Mass customization: Reconfigurable Manufacturing System
1 PhD + 1 ongoing PhD (1 journal)

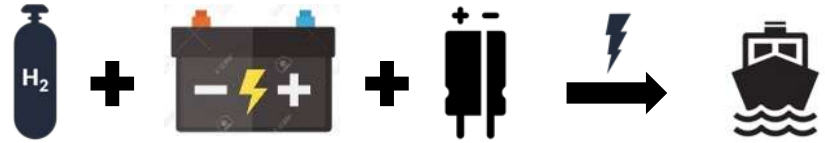
Operational efficiency: lean manufacturing
1 PhD (2 journals)

4.0 Information system: data connectivity to improve the productivity
2 PhD (1 journal)

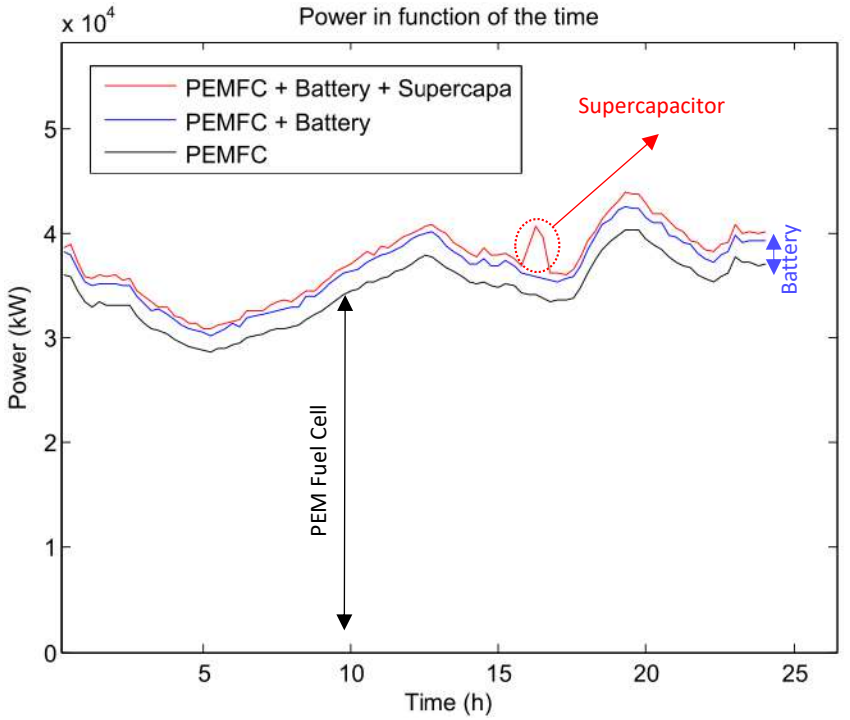
Current partnerships:
- Research activities with Coimbra and Karlsruhe
- Academic activities with industrial partners

PhD subject : A decision aid system based on a decentralized architecture to faster the management of hazards occurring under production and logistics systems

"Hybridization of PEM hydrogen fuel cell and supercapacitors for maritime applications"



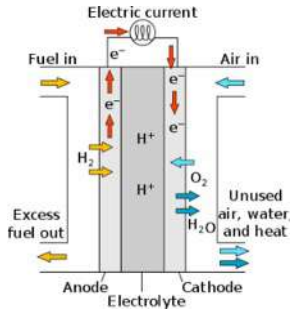
Context :
- Global warming
- Impact of maritime activities
- Growing green hydrogen production



Objectives and scientific challenges :

- Ensure the **autonomy of maritime transportation** and being able to respond to the energy demand (steady-state functionning + sudden peaks)
- Coupling of both **short-term** modelization of **supercapacitors**, **mid-term** modelization of **PEM Fuel Cell functioning,** as well as long-term **durability** of the PEM Fuel Cell
- Using **metaheuristic optimization methods** to find the best combinations of technology and physical parameters

Main skills :
- Hydrogen technologies knowledges
- Numerical electrical and chemical modeling
- Computational optimization method
- Energy Management system



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6. LABS AND PHD PROPOSALS

ROOM 3 / MATERIAL SCIENCE, MECHANICS AND FLUIDS

ROOM3 - Material science, Mechanics and Fluids PROPOSALS/LABS 1/3

File Number	School	Title	Advisors	Lab
2022_011	Arts et Métiers	Development of a high order model for Fluid-Structure interaction : application to soft solids	Mathieu Specklin, Sofiane Khelladi	LIFSE - Laboratoire Ingénierie des Fluides Systèmes Energétiques
2022_007	Arts et Métiers	Multiscale stress/strain analysis of polycrystalline silicon for photovoltaic applications	Laurent BARRALLIER	MSMP - Laboratoire Mécanique, Surface, matériaux et Procédés
2022_017	Arts et Métiers	Study of the microstructure, mechanical and fatigue properties of Ti-6Al-4V and Al-Co-Cr-Fe-Ni high entropy alloys components fabricated by wire-arc additive manufacturing	Laurent Barrallier, Mohamed Fares Slim	MSMP - Laboratoire Mécanique, Surface, matériaux et Procédés
2022_020	Arts et Métiers	Multiscale simulation of plastic strain localization in High Entropy Alloys	Dorian Depriester, Laurent Barrallier	MSMP - Laboratoire Mécanique, Surface, matériaux et Procédés
2022_022	Arts et Métiers	Optimized set-up to characterize the contact fatigue damage of material with gradient properties	Jean-Patrick Goulmy, Laurent Barrallier	MSMP - Laboratoire Mécanique, Surface, matériaux et Procédés
2022_023	Arts et Métiers	A smart manufacturing project: Digital Image Correlation characterization of residual stresses induced during the shot peening process	Jean-Patrick Goulmy, Laurent Barrallier	MSMP - Laboratoire Mécanique, Surface, matériaux et Procédés
2022_024	Arts et Métiers	Characterization of the evolution of mechanical properties of materials during in-situ SEM tests in temperature: implementation of the HRDIC technique	Jean-Patrick Goulmy, Laurent Barrallier	MSMP - Laboratoire Mécanique, Surface, matériaux et Procédés
2022_027	Arts et Métiers	Mechanical and functional fatigue behavior of laser powder bed fusion processed NiTi Shape Memory Alloy	Mohamed EL Mansori, Nan KANG, Tianyu YU	MSMP - Laboratoire Mécanique, Surface, matériaux et Procédés
2022_028	Arts et Métiers	Investigation on microstructure and strengthen mechanism of laser powder bed fusion high temperature multi-reinforced Al matrix composite	Nan KANG, Mohamed El Mansori, Biao CHEN	MSMP - Laboratoire Mécanique, Surface, matériaux et Procédés
2022_042	Ecole des Ponts ParisTech	Stability of dikes built with lime-treated soils under marine loading	Yujun CUI	Laboratoire NAVIER (mécanique, physique des matériaux et des structures, géotechnique)
2022_068	Ecole des Ponts ParisTech	Hydromechanical behavior of compacted sand-bentonite mixture under hydraulic, gas and chemical loadings	Yujun Cui, Nadia Mokni	Laboratoire NAVIER (mécanique, physique des matériaux et des structures, géotechnique)
2022_025	Arts et Métiers	Study of the low frequency dynamics of compressible separations	Jean-Christophe ROBINET, Ismaïl BEN HASSAN SAïDI, Christian TENAUD	DynFluid
2022_085	Arts et Métiers	Finite elements analysis for optimum peeling conditions and higher veneer quality: Case of the rotary peeling process of European wood species	Louis Denaud, Mariem Yaich, Stéphane Girardon	LABOMAP - Laboratoire Bourguignon des matériaux et procédés
2022_032	Arts et Métiers	Dynamic crack propagation in multidirectional functionally graded materials under mechanical and thermal loadings	Amine Ammar, Mohammad-Javad KAZEMZADEHPARSI, Saber EL AREM	LAMPA - Laboratoire angevin de mécanique, procédés et innovation
2022_054	Arts et Métiers	PGD solution of beam, plate and shell structures made of functionally graded materials in thermal environment	Amine AMMAR, Mohammadjavad Kazemzadeh-Parsi	LAMPA - Laboratoire angevin de mécanique, procédés et innovation

ROOM3 - Material science, Mechanics and Fluids PROPOSALS/LABS 2/3

File Number	School	Title	Advisors	Lab
2022_086	Arts et Métiers	Seismic cycle characteristics and dependence on rock rheology and friction	Amine AMMAR, saber EL AREM, Soumaya Latour	LAMPA - Laboratoire angevin de mécanique, procédés et innovation
2022_057	Arts et Métiers	Multi-physical/multi-scale modelling and experimental analysis of surface integrity in machining of Inconel 718 alloy using advanced cutting tools materials	Hélène Birembaux, José OUTEIRO, Frédéric ROSSI	LABOMAP - Laboratoire Bourguignon des matériaux et procédés
2022_016	ESPCI Paris - PSL	Active Colloidal Gels	Olivier Dauchot	GULLIVER - Voyages expérimentaux et théoriques en matière molle
2022_038	ESPCI Paris - PSL	Dynamical soft hydraulics of complex fluids	Joshua MCGRAW, Frédéric Restagno	GULLIVER - Voyages expérimentaux et théoriques en matière molle
2022_039	ESPCI Paris - PSL	Diffusive and hydrodynamic motion near soft and porous media	Joshua MCGRAW, Thomas SALEZ	GULLIVER - Voyages expérimentaux et théoriques en matière molle
2022_090	ESPCI Paris - PSL	Violation of Bell's inequalities in softmatter systems	Matthieu Labousse	GULLIVER - Voyages expérimentaux et théoriques en matière molle
2022_075	Arts et Métiers	Direct Numerical Simulation (DNS) of oil/water flows representative of oil spills	Olivier Coutier-Delgosha, Annie-Claude Bayeul-Lainé, Sophie Simonet	LMFL - Laboratoire de mécanique des fluides de Lille
2022_076	Arts et Métiers	Direct Numerical Simulation (DNS) of bubble bursting	Olivier Coutier-Delgosha, Annie-Claude Bayeul-Lainé, Sophie Simonet	LMFL - Laboratoire de mécanique des fluides de Lille
2022_031	Arts et Métiers	Elastic Turbulence in Curvilinear Geometries	Antoine DAZIN, Francesco ROMANO, Stefano BERTI	LMFL - Laboratoire de mécanique des fluides de Lille
2022_040	Arts et Métiers	Instabilities in the vaneless diffuser of a centrifugal pump	Antoine DAZIN, Francesco ROMANO, Gérard BOIS	LMFL - Laboratoire de mécanique des fluides de Lille
2022_015	ESPCI Paris - PSL	Aerodynamic and Elastic Response of Dragonfly-inspired Flapping Wings	Ramiro Godoy-Diana, Benjamin Thiria	PMMH - Physique et mécanique des Milieux Hétérogènes

ROOM3 - Material science, Mechanics and Fluids PROPOSALS/LABS 3/3

File Number	School	Title	Advisors	Lab
2022_026	Arts et Métiers	Experimental and numerical study of the forgeability of a Wire Arc Additive Manufactured (WAAM) preform, Application to large multi-material parts	~~Régis Bigot~~, Laurent Langlois, Sandra Zimmer-Chevret	LCFC - Laboratoire de conception, fabrication, commande
2022_029	Arts et Métiers	Multi-scale data-driven modelling of short-fibre reinforced composites for automotive applications	Fodil Meraghni, Francis Praud	LEM3 - Laboratoire d'étude des microstructures et de mécanique des matériaux
2022_033	ESPCI Paris - PSL	Bio-inspired flexible plates for surface wave energy conversion	Ramiro Godoy-Diana, Benjamin Thiria	PMMH - Physique et mécanique des Milieux Hétérogènes
2022_034	Arts et Métiers	Towards digital twins for the optimization of the copper based shape memory alloys with high entropy	Fodil MERAGHNI, Léo THIERCELIN, Laurent PELTIER	LEM3 - Laboratoire d'étude des microstructures et de mécanique des matériaux
2022_035	Arts et Métiers	Development of advanced multiscale computational tools and data-driven techniques for the multiphysics prediction of carbon nanotubes (CNTs) fuzzy fiber composites	George Chatzigeorgiou, Fodil Meraghni	LEM3 - Laboratoire d'étude des microstructures et de mécanique des matériaux
2022_066	Chimie ParisTech - PSL	Deformation mechanisms study of TWIP and TRIP metastable titanium alloy	Philippe Vermaut, Fan SUN	IRCP - Institut de Recherche de Chimie de Paris
2022_072	Arts et Métiers	Very-high-cycle fatigue strength of metals under multiaxial stress state	Thierry PALIN-LUC, Matthieu BONNERIC, Youshi HONG, Guian QIAN	I2M - Institut de mécanique et d'ingénierie
2022_083	Arts et Métiers	Integrated Human-Machine interface for automation of a flexible and agile grinding process of forged workpieces with industrial robots	Régis BIGOT, Cyrille BAUDOUIN, Sandra CHEVRET	LCFC - Laboratoire de conception, fabrication, commande
2022_084	Arts et Métiers	Robust robotic grinding: process identification and improvement of the control	Régis BIGOT, Thibaut Raharijaona, Sandra CHEVRET	LCFC - Laboratoire de conception, fabrication, commande
2022_094	Arts et Métiers	Efficient computational framework to model size effects in miniaturized products	Farid Abed-Meraim, Mohamed Jebahi	LEM3 - Laboratoire d'étude des microstructures et de mécanique des matériaux
2022_079	Ecole des Ponts ParisTech	Automatic Capture of Visual Data for Digital Twins of Worksites	Vincent Lepetit, Chaohui Wang	LIGM - Laboratoire d'Informatique Gaspard Monge
2022_067	ESPCI Paris - PSL	Using good vibrations to decrease the viscosity of non brownian suspensions	Annie COLIN , Jia Xiaoping , Arnaud Tourin	CBI - Chimie, Biologie et Innovation

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Philipp Braun


Jean Canou


Alain Corfdir


Patrick Dangla

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Jean-Claude Dupla

Chercheur émérite


Roger Frank


Siavash Ghabezloo


Lina Maria Guayacán Carillo


Mathias Lebihain


Jean-Michel Pereira


Amade Pouya


Jean Sulem


Anh-Minh Tang

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MSA

Responsable


Jean-François Caron

Adjoint


Gilles Foret


Olivier Baverel


Karim Benzarti


Jérémy Bleyer


Sabine Caré


Cyrille Douthe


Denis Duhamel


Adelaïde Féraille


Tien Hoang


Arthur Lebée


Robert Le Roy


Romain Mesnil


Michael Peigney


Myriam Saadé


Karam Sab


Honoré Yin

Multi-échelle

ME

Responsable


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Denis Garnier


Sébastien Brisard


Laurent Brochard

Chercheur émérite


Patrick De Buhan


Camille Chateau


Gwendal Cumunel


Luc Dormieux


Ghazi Hassen


Emmanuel Keita


Mathias Lebihain


Frédéric Legoll


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Rhéophysique et milieux poreux

MAP

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Xavier Chateau


François Chevoir


Philippe Coussot


Abdoulaye Fall


Julie Goyon


Yacine Khidas


Vincent Langlois


Anaël Lemaître


Julien Léopoldès


Francesco Puosi


Nicolas Roussel


Jean-Noël Roux


Brice Saint-Michel


Rahima Sidi-Boulenouar

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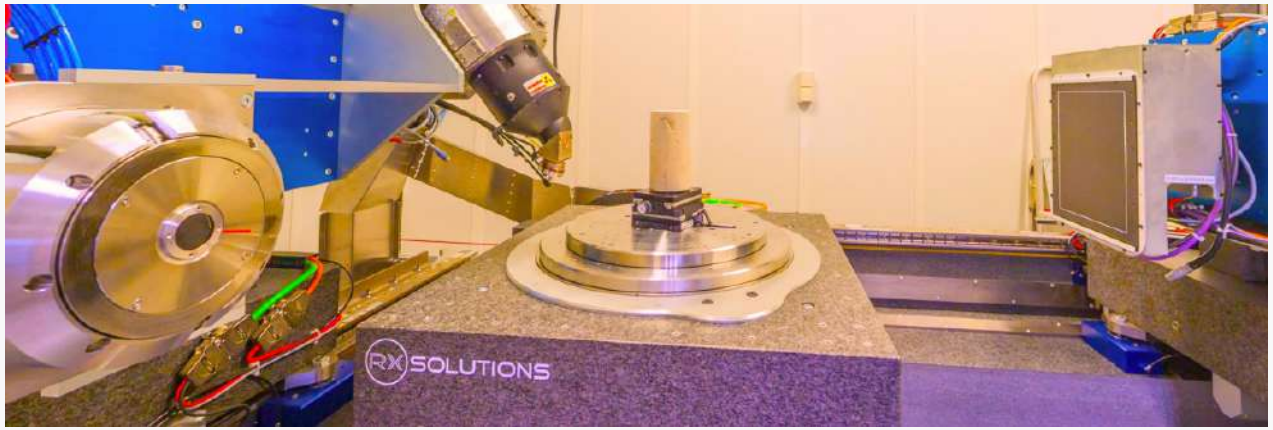
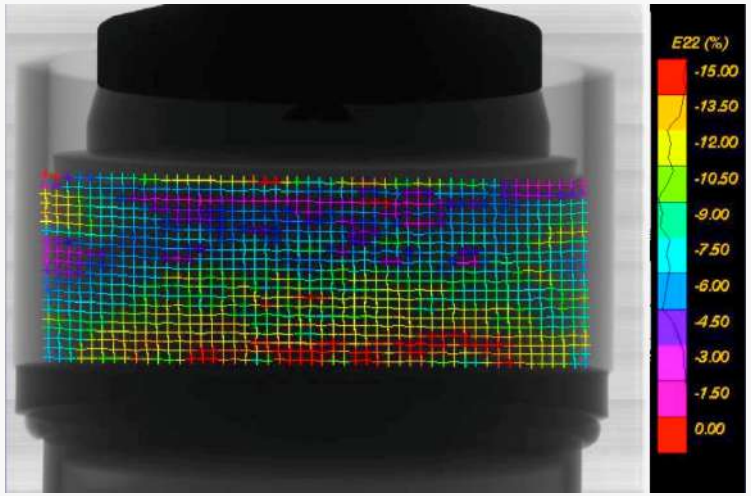
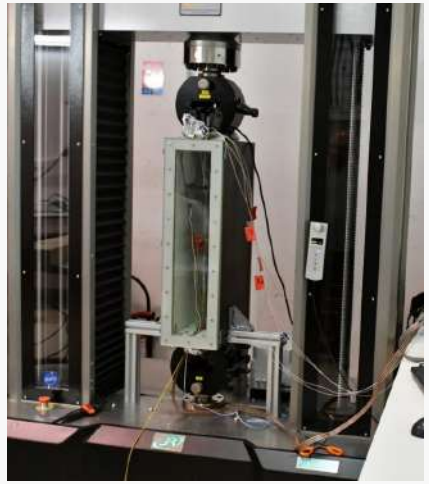
RESEARCH INFRASTRUCTURES







RESEARCH AT NAVIER LABORATORY

Geotechnic (CERMES) research team

Research axis:
Unsaturated soils
Storage of radioactive waste
Railway geotechnics
Soil-atmosphere interaction

Yu Jun CUI
Researcher
Professor at Ecole des Ponts ParisTech

PhD title 1: Stability of dikes built with lime-treated soils under marine loading

PhD title 2: Hydromechanical behavior of compacted sand-bentonite mixture under hydraulic, gas and chemical loadings

A 3rd PhD proposed by my colleagues of ENPC: Vincent Lepetit, Chaohui Wang
in the field of Information and Communication Science and Technology

PhD title 3: Automatic Capture of Visual Data for Digital Twins of Worksites

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Arts Sciences et Technologies et Métiers

LABORATOIRE DE MÉCANIQUE DES FLUIDES DE LILLE

ARTS ET MÉTIERS, CAMPUS OF LILLE

Laboratoire de Mécanique des Fluides de Lille Kampé de Fériet

Laboratoire de Mécanique des Fluides de Lille
Kampé de Fériet

NAME: LABORATOIRE DE MÉCANIQUE DES FLUIDES DE LILLE

Research domain(s): Turbulence, Rotating Flows, Flight Dynamics in Unsteady and Non Uniform Environments

Turbulence:
study and model turbulent flows

Team leader

Christos VASSILICOS

Rotating Flows:
analysis and modeling of internal or external flows linked to rotating machines

Team leader

Antoine DAZIN

Flight Dynamics:
development of tools and methods to determine dynamics of aircrafts flying

Team leader

Olivier RENIER

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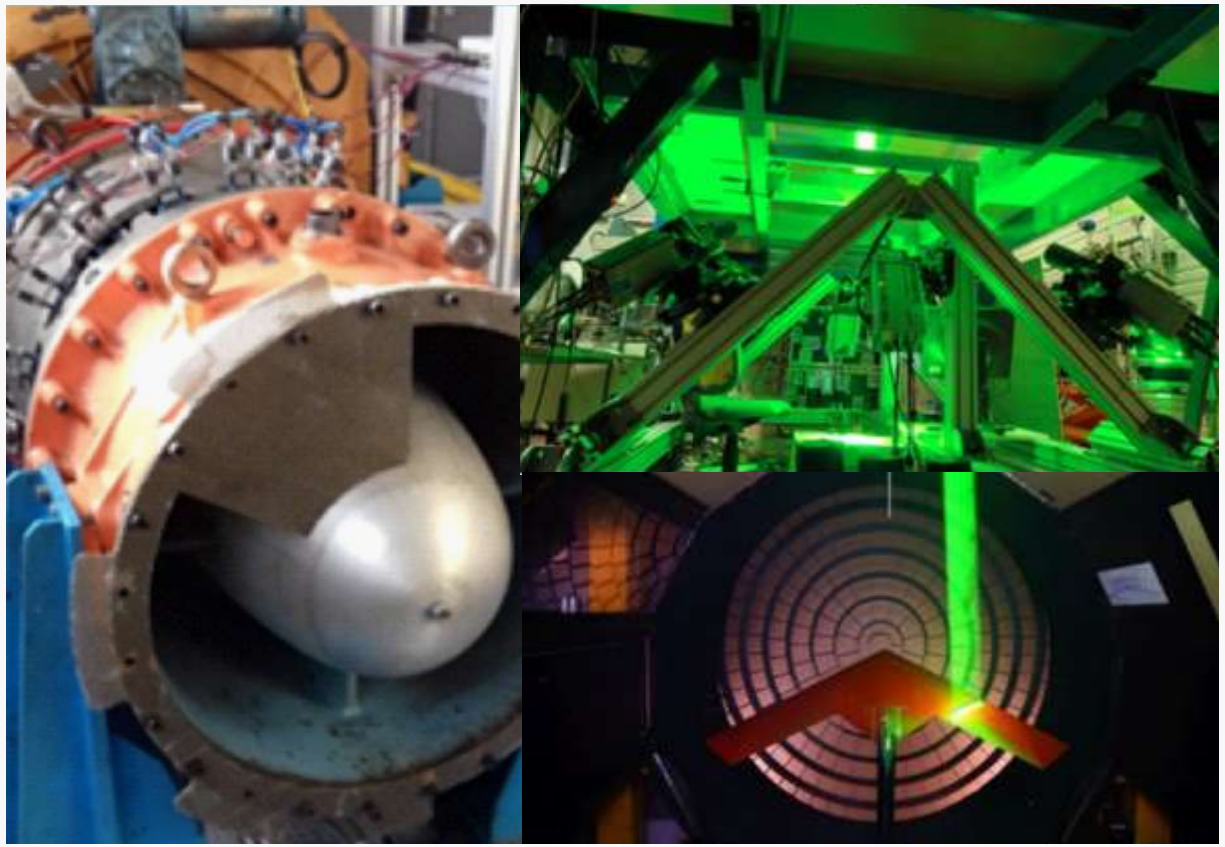
Laboratoire de Mécanique des Fluides de Lille
Kampé de Fériet

NAME: LABORATOIRE DE MÉCANIQUE DES FLUIDES DE LILLE

RESEARCH INFRASTRUCTURES

Rotating Flows, Turbulence, Flight Dynamics



KEY RESEARCHER (S)

CHRISTOS VASSILICOS /
h index 50

JEAN-PHILIPPE LAVAL /
h index 21

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NAME: LABORATOIRE DE MÉCANIQUE DES FLUIDES DE LILLE

KEY FACTS / FIGURES

37 permanent people (researchers, research professors, engineers and technicians) and 25 non-permanent researchers (doctoral students and post-doctocs).

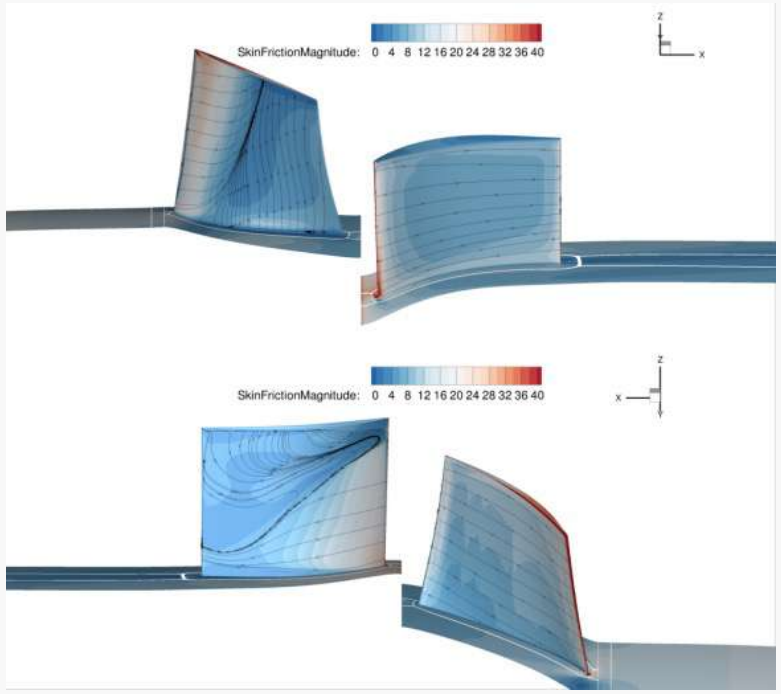
Partnerships with academic laboratories (universities, research organizations), companies (logos)

20 publications in high-impact international journals during 2022
List of publications:
https://lmfl.cnrs.fr/en/articles_en/

LMFL is a member of EUHITT : Euopean Consortium that aims at integrating cutting-edge European facilities for turbulence research

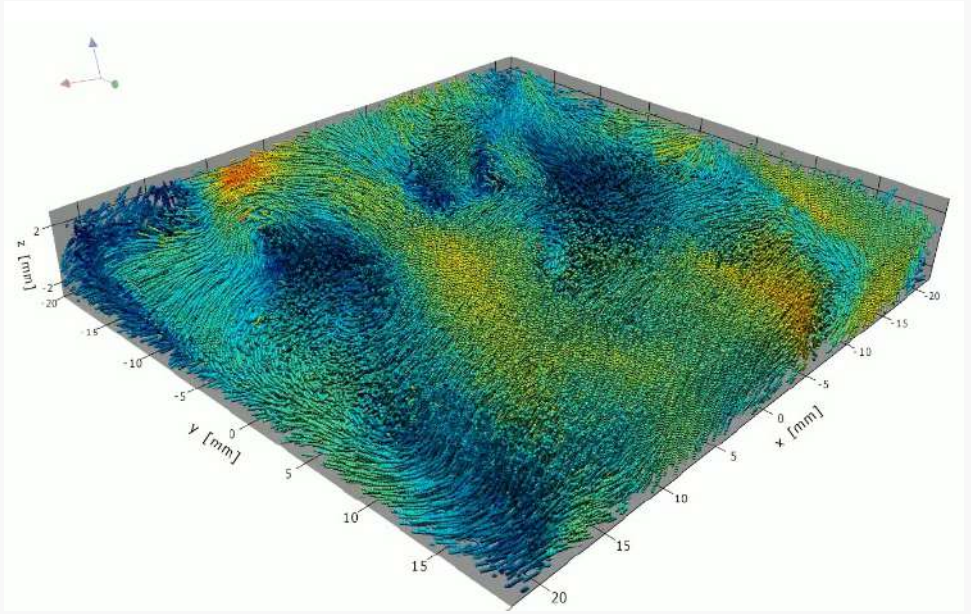
NAME: LABORATOIRE DE MÉCANIQUE DES FLUIDES DE LILLE

European Project ACONIT : Design and test high level actuators for flow control in aeronautical compressors. https://aconit.ensam.eu/



CFD in an axial compressor

ANR Project EXPLOIT : Experimental study of **dissipative structures in Turbulence**. https://lmfl.cnrs.fr/actualite/campagne-de-mesure-4d-ptv-dans-le-projet-anr-exploit/



High speed, high resolution PTV results of a turbulent flow

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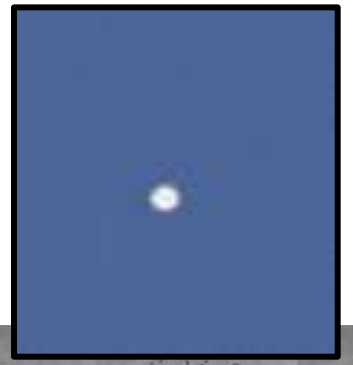
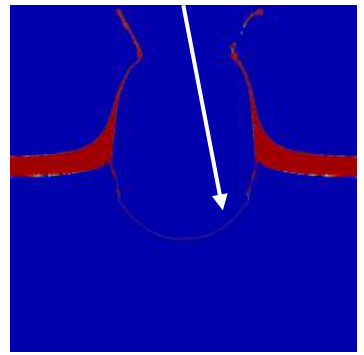
Direct Numerical Simulation (DNS) of oil/water flows representative of oil spills

Objective: investigate the interaction between the see water and the oil slicks and how the oil is mixed with the water and the atmosphere (creation of aerosols)

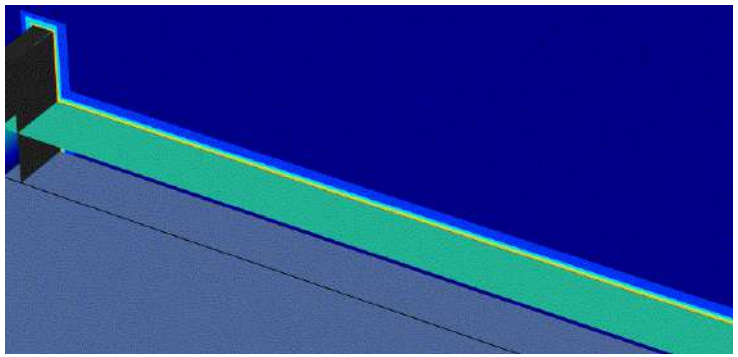


Simulation of the impact of a droplet at the surface of water

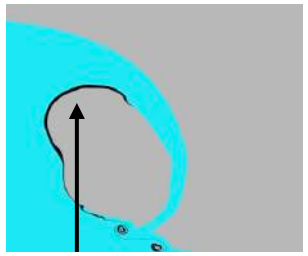
Layer of oil



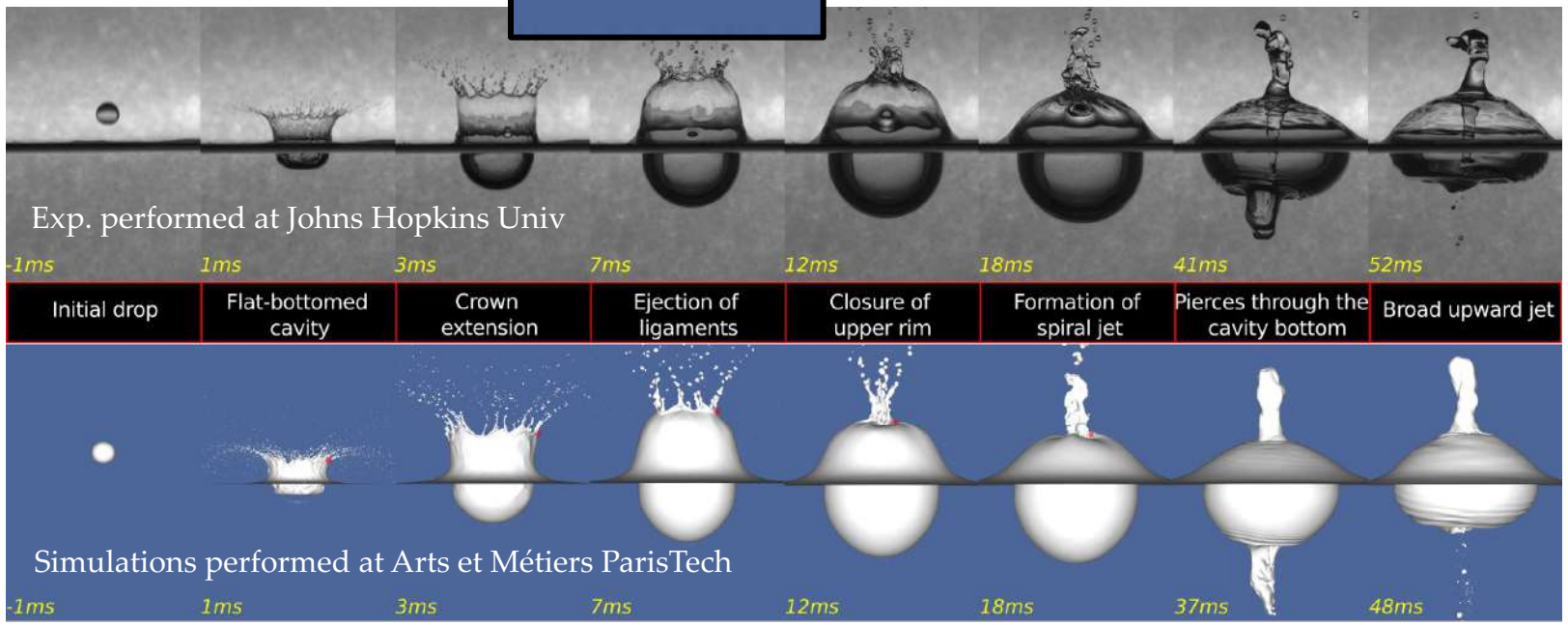
Simulation of a breaking wave



total of 230,000 core hours



oil slick at impact



Maximum number of cells more than 6.5×10^7, performed on 1024 cores for 33.5 days (8.21×10^5 CPU-hour), Advanced Research Computing(ARC), Virginia Tech

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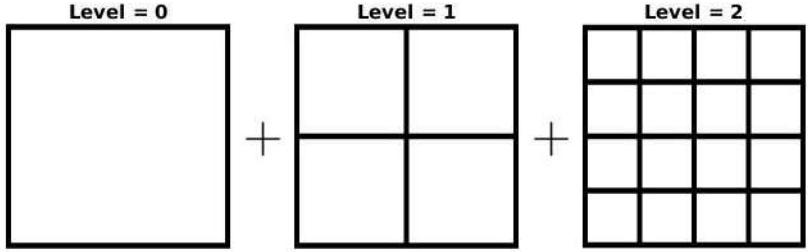
Arts et Métiers Sciences et Technologies

Direct Numerical Simulation (DNS) of Bubble Bursting

Objective: investigate by Direct Numerical Simulation (DNS) the gas jet released by bubbles bursting at the air-sea interface and the capacity of this flow to transport newly formed film droplets up into the atmosphere.

Tool: BASILISK code to solve multiphase and/or multicomponents flows by using the Volume of Fluid (VoF) technique

Adaptive Mesh Refinement (AMR)



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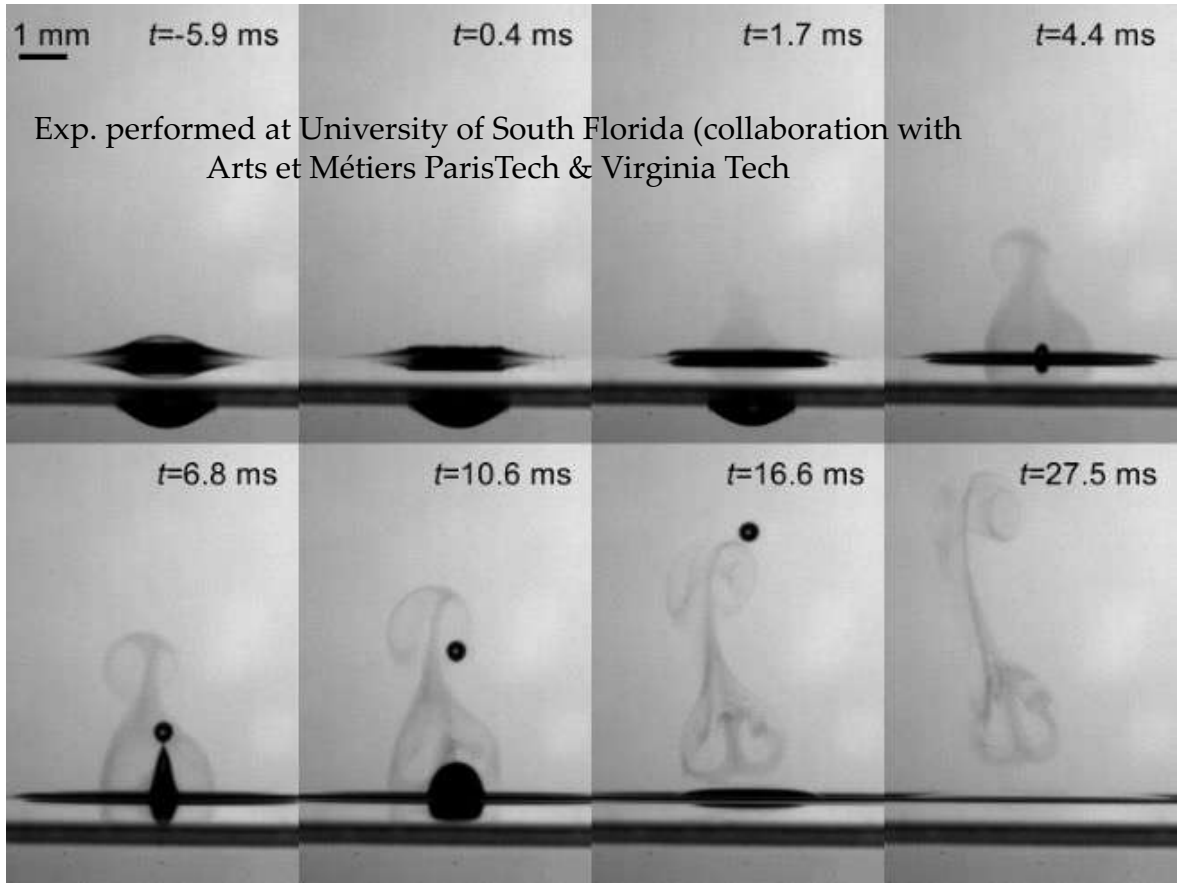
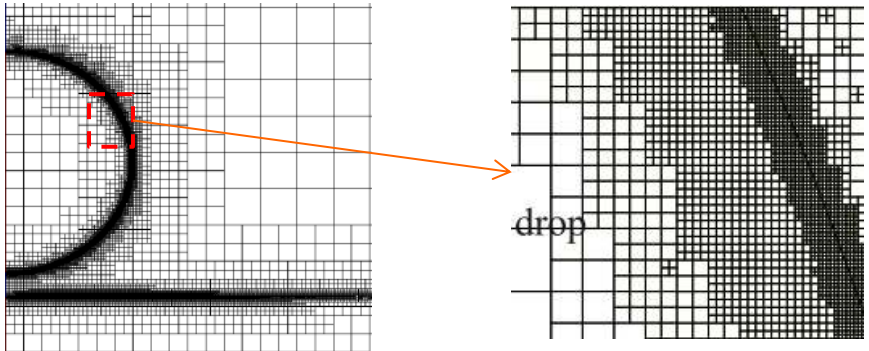


Exp. performed at University of South Florida (collaboration with Arts et Métiers ParisTech & Virginia Tech



Shuo Liu, Hui Wang, Annie-Claude Bayeul-Lainé, Olivier Coutier-Delgosha (2022), Direct Numerical Simulation of Shallow Water Breaking Waves Generated by Wave Plate, Conference on Modelling Fluid Flow CMFF'22, pp 206-214.

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Jaime-Elias Gil Roca


Benjamin Maillet


Laurent Tocquer

Géotechnique

GERMES

Responsable


Yu-Jun Cui


Philipp Braun


Jean Canou


Alain Corfdir


Patrick Dangla

Chercheur émérite


Pierre Delage


Jean-Claude Dupla

Chercheur émérite


Roger Frank


Siavash Ghabezloo


Lina Maria Guayacán Carillo


Mathias Lebihain


Jean-Michel Pereira


Amade Pouya


Jean Sulem


Anh-Minh Tang

Matériaux et structures architecturés

MSA

Responsable


Jean-François Caron

Adjoint


Gilles Foret


Olivier Baverel


Karim Benzarti


Jérémy Bleyer


Sabine Caré


Cyrille Douthe


Denis Duhamel


Adelaïde Féraille


Tien Hoang


Arthur Lebée


Robert Le Roy


Romain Mesnil


Michael Peigney


Myriam Saadé


Karam Sab


Honoré Yin

Multi-échelle

ME

Responsable


Michel Bornert

Adjoint


Denis Garnier


Sébastien Brisard


Laurent Brochard

Chercheur émérite


Patrick De Buhan


Camille Chateau


Gwendal Cumunel


Luc Dormieux


Ghazi Hassen


Emmanuel Keita


Mathias Lebihain


Frédéric Legoll


Eric Lemarchand


Matthieu Vandamme

Rhéophysique et milieux poreux

MAP

Responsable


Olivier Pitois

Adjointe


Florence Rouyer


Xavier Chateau


François Chevoir


Philippe Coussot


Abdoulaye Fall


Julie Goyon


Yacine Khidas


Vincent Langlois


Anaël Lemaître


Julien Léopoldès


Francesco Puosi


Nicolas Roussel

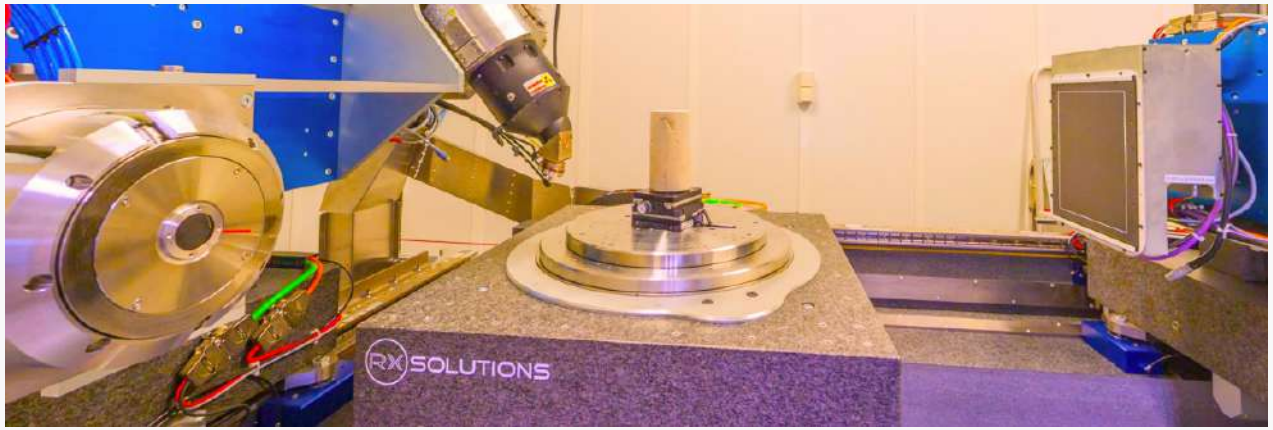

Jean-Noël Roux

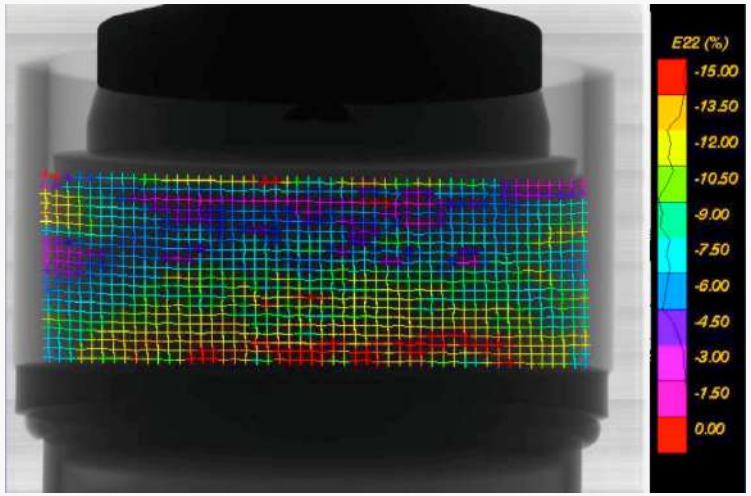

Brice Saint-Michel

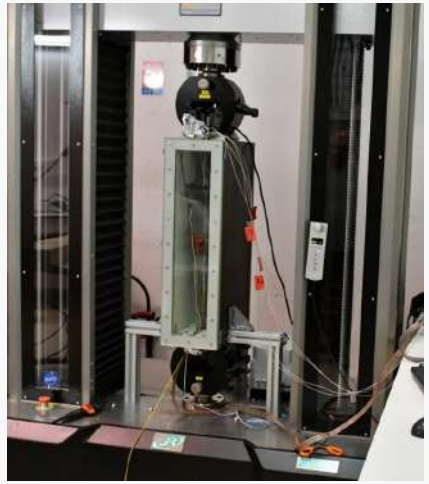

Rahima Sidi-Boulenouar

NAVIER Laboratory

RESEARCH INFRASTRUCTURES







RESEARCH AT NAVIER LABORATORY

Geotechnic (CERMES) research team

Research axis:
Unsaturated soils
Storage of radioactive waste
Railway geotechnics
Soil-atmosphere interaction

Yu Jun CUI
Researcher
Professor at Ecole des Ponts ParisTech

PhD title 1: Stability of dikes built with lime-treated soils under marine loading

PhD title 2: Hydromechanical behavior of compacted sand-bentonite mixture under hydraulic, gas and chemical loa

A 3rd PhD proposed by my colleagues of ENPC: Vincent Lepetit, Chaohui Wang
in the field of Information and Communication Science and Technology

PhD title 3: Automatic Capture of Visual Data for Digital Twins of Worksites

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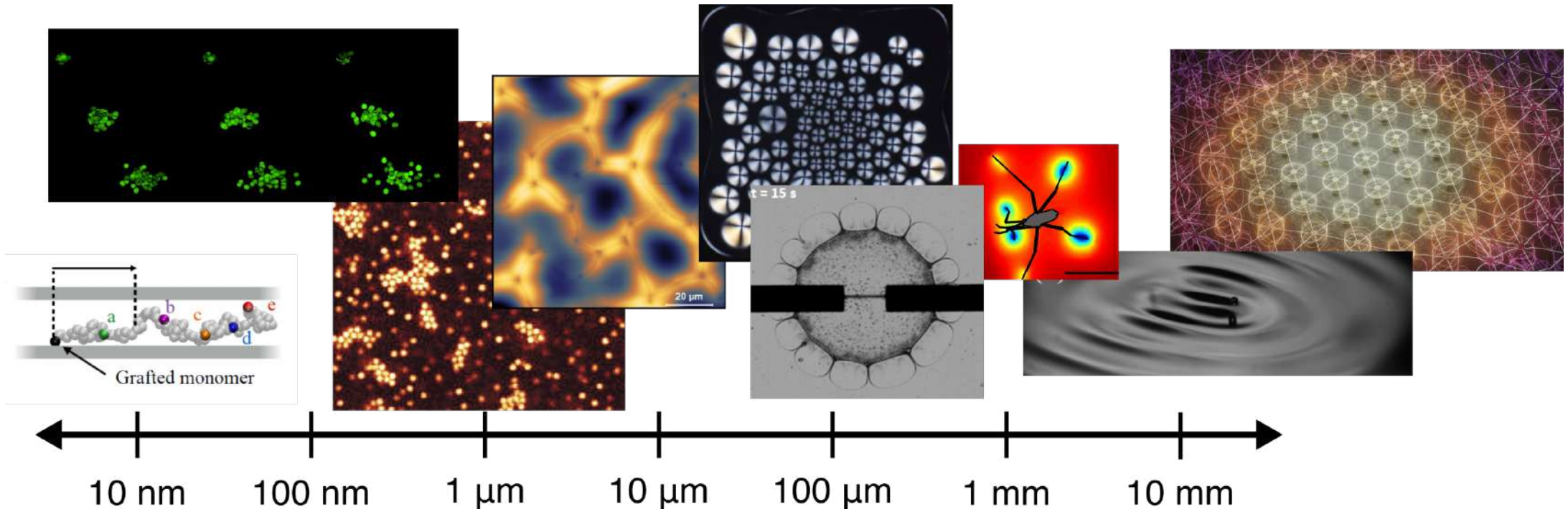
ESPCI PARIS | PSL

LABORATOIRE GULLIVER / IPGG

UMR 7083 Gulliver

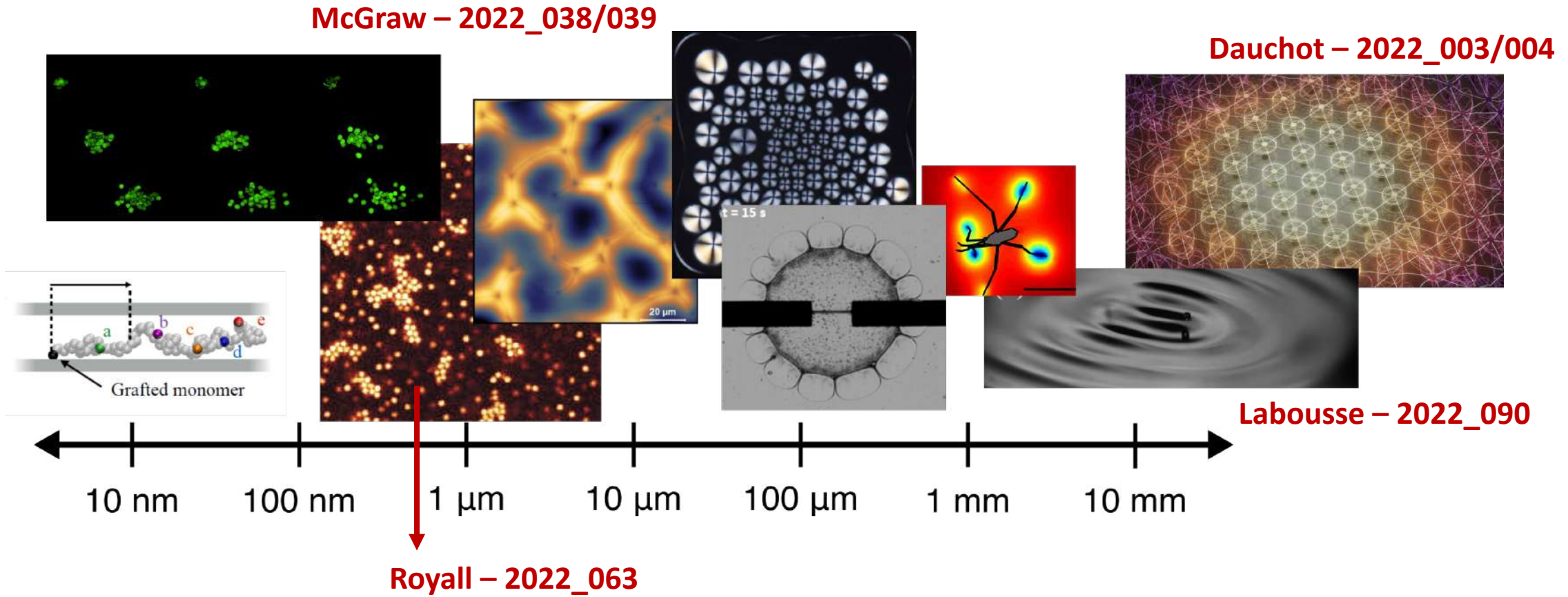
INSTITUT PIERRE-GILLES DE GENNES
Pour la microfluidique

Decades of soft matter at Gulliver



UMR 7083 Gulliver

Decades of soft matter at Gulliver



UMR 7083 Gulliver

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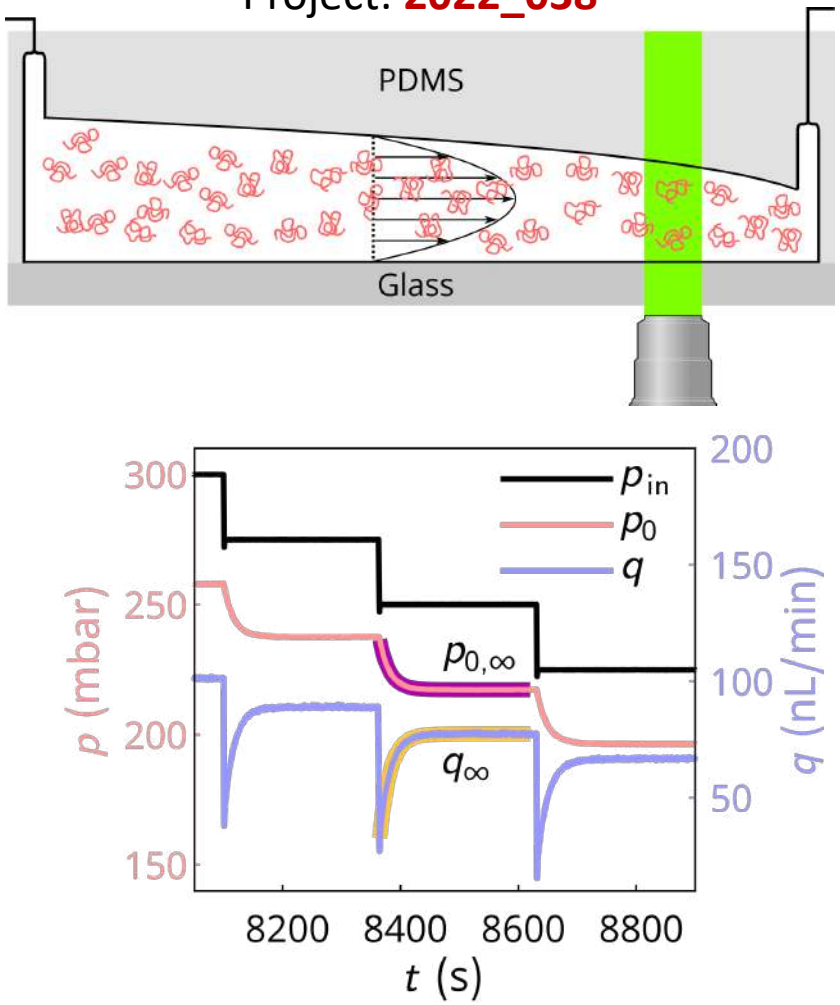
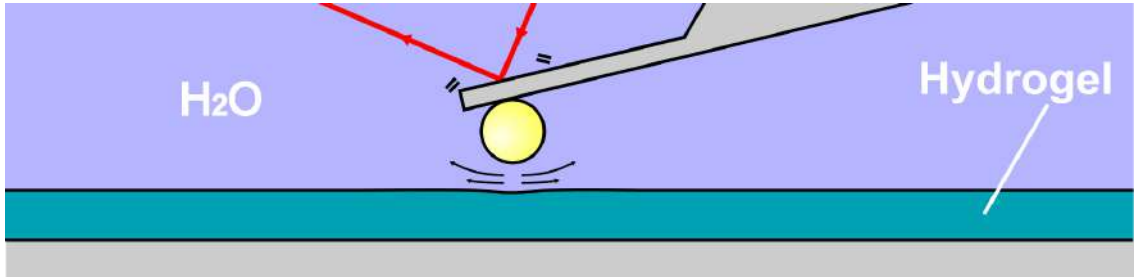
IndySoft: Interfacial Dynamics of Soft Condensed Matter

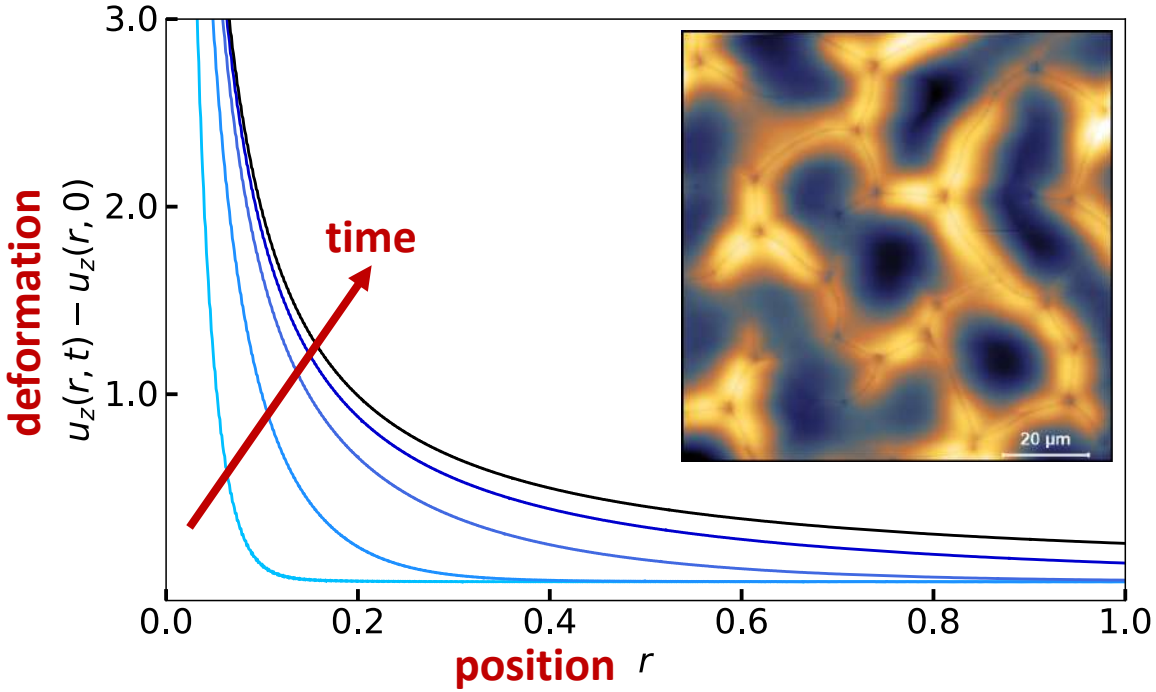
Project: **2022_038**



Guyard *et al.*,
Soft Matter 2021; Phys. Rev. Lett. **2022**

Project: **2022_039**





Kopecz-Muller *et al.* In prep.
Zheng *et al.*, Phys. Rev. Research **2022**

IndySoft @ Gulliver, ESPCI Paris - PSL

Soft Matter at Interfaces : colloids, polymers, micro/nanofluidics

IndySoft: Interfacial dynamics of Soft Matter

Advisor

UMR 7083 Gulliver

Joshua D. McGraw

MMOI: Matière molle aux interfaces

Co-advisor (2022_038)

LPS ORSAY

Frédéric Restagno

EMetBrown: Brownian motion near soft interfaces

Co-advisor (2022_039)

UMR5798 Laboratoire Ondes et Matière d'Aquitaine

Thomas Salez

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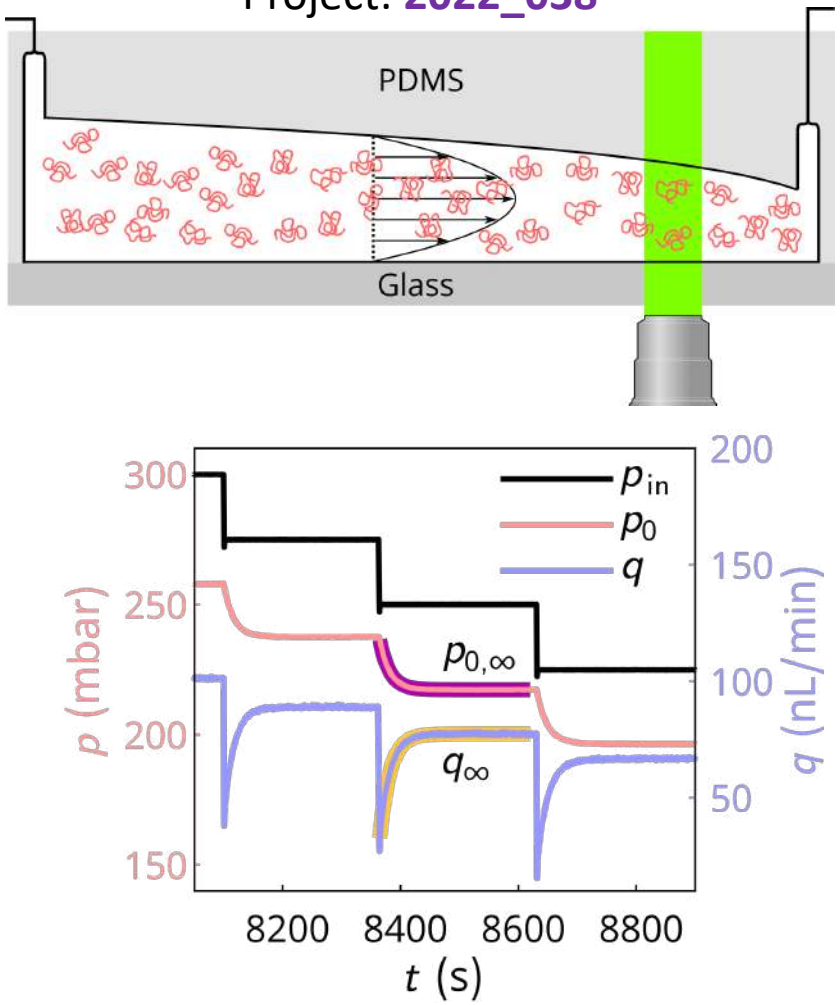
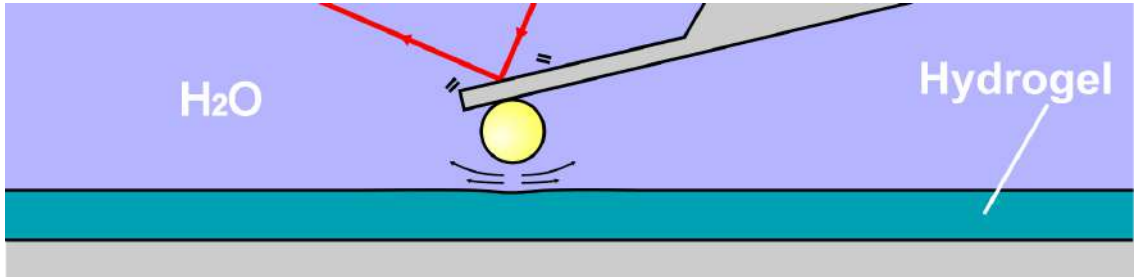
IndySoft: Interfacial Dynamics of Soft Condensed Matter

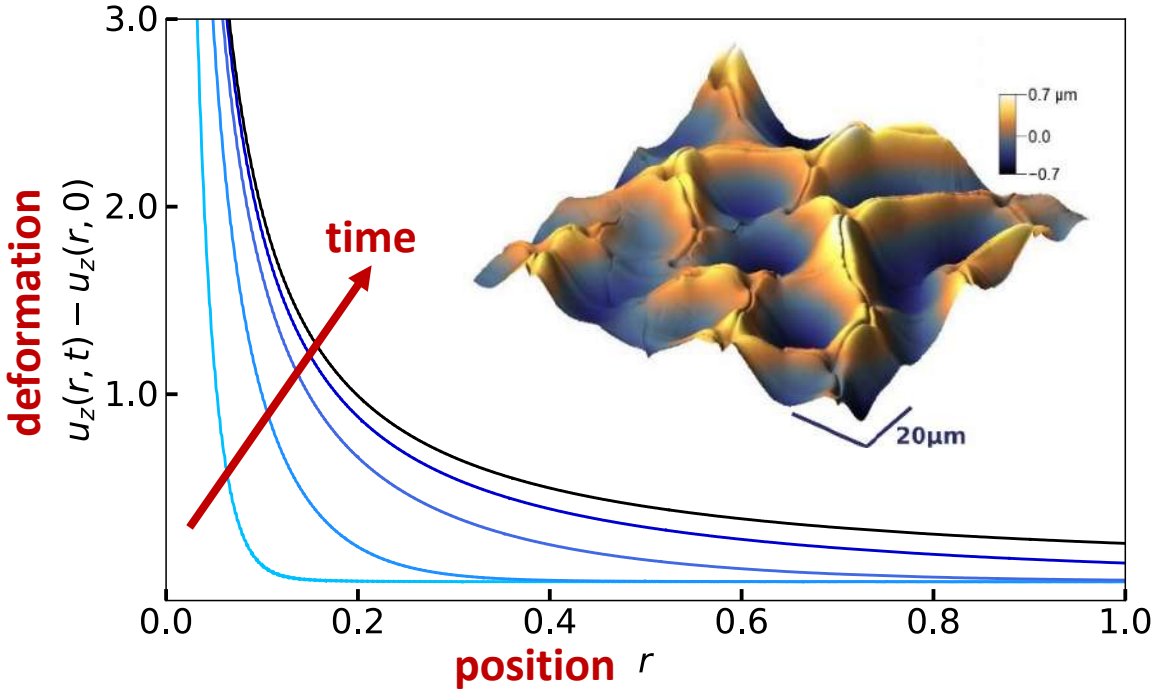
Project: **2022_038**



Guyard *et al.*,
Soft Matter 2021; Phys. Rev. Lett. **2022**

Project: **2022_039**





Kopecz-Muller *et al.* In prep.
Zheng *et al.*, Phys. Rev. Research **2022**

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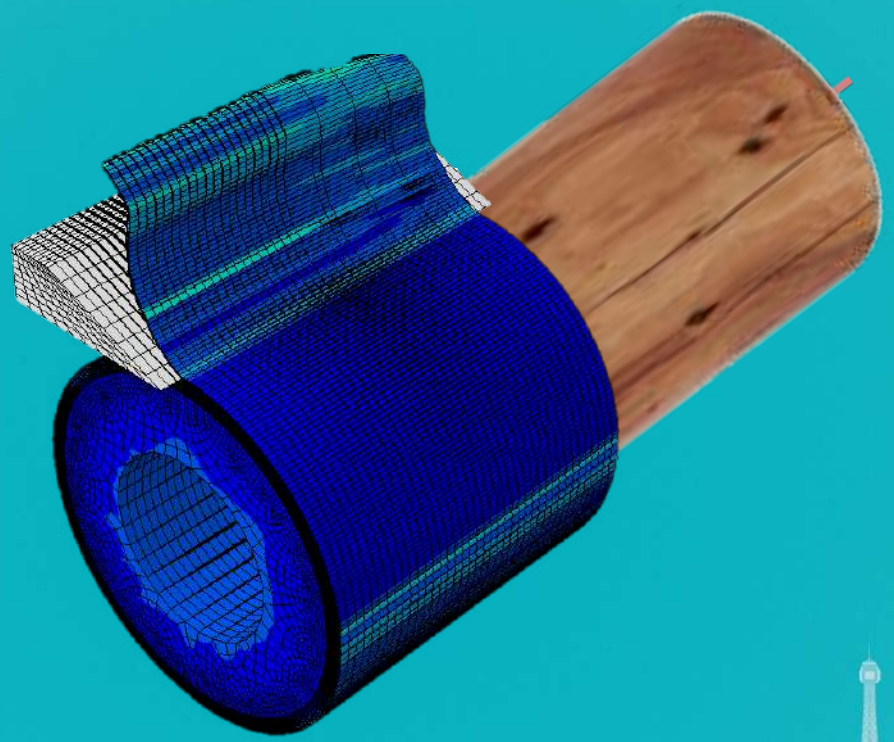

Paristech – CSC PhD program

FINITE ELEMENT ANALYSIS FOR OPTIMUM PEELING CONDITIONS AND HIGHER VENEER QUALITY
(TOPIC NUMBER: 2022_085)

Novembre 2022

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Arts et Métiers Sciences et Technologies

PARISTECH

LABORATORY OF MATERIALS AND PROCESSES

DIRECTOR: PR. GERARD POULACHON

LaBoMaP

LaBoratoire des Matériaux et Procédés

RESEARCH AT LABORATORY OF MATERIALS AND PROCESSES

Arts et Métiers Sciences et Technologies / LaBoMaP LaBoratoire des Matériaux et Procédés

Research domains: Manufacturing processes, Materials, Thermomechanical treatments

Wood Material Machining (WMM):
Wood machining, Mechanical properties of the wood, elaboration and characterization of engineered wood products

Team leader

Associate Pr-HDR.
Louis DENAUD

High Speed Machining (HSM):
Machining processes of difficult to cut materials, Generation of complexes surfaces

Team leader

Associate Pr-HDR.
Guillaume FROMENTIN

Materials and Surfaces Engineering (MSE) :
Improvement of mechanical properties of metals and alloys, Thermomechanical treatments and PVD coating

Team leader

Associate Pr-HDR.
Corrine NOUVEU

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Research At Laboratory Of Materials and Processes

Wood Material Machining (WMM) Team

Rémy Marchal
Emeritus Pr.

Robert Collet
Associate Pr. -HDR

Louis Denaud
Associate Pr.-HDR

Stéphane Girardon
Associate Pr.

Guillaume Pot
Associate Pr.

Joffrey Viguier
Associate Pr.

Mariem Yaich
Associate Pr.

Juliette Boivin
PhD Student

Leyne Demoulin
PhD Student

Lucie Heim
PhD Student

Caroline Marc
PhD Student

Hélène Penvern
PhD Student

Xiaolin LI
Post-doctoral + Former CSC PhD Student

Jean-Claude Butaud
Research Eng.

Fabrice Cottin
Assistant Eng.

Roger Letourneau
Technician

Marie-Laure Louvrier
Management Assistante of LaBoMaP

Pascal Filipek
Assistant Eng.

Bertrand Marcon
Research Eng.

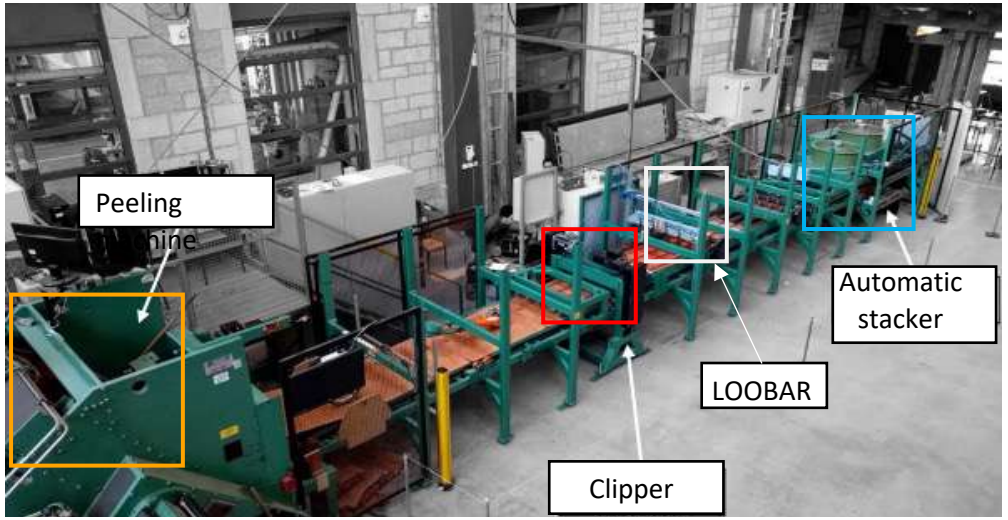
Isabelle Bordonnet
Management Assistante of AMValor

Benjamin Roux
AMValor Eng.

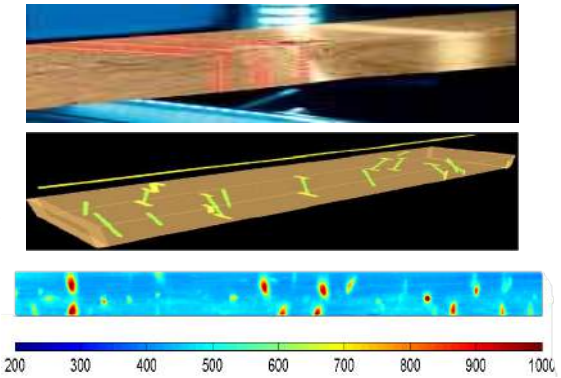
Guillaume Lacondemine
AMValor Eng.

- 7 Associate Pr. / HDR / Pr.
- 2 Research Eng.
- 2 AMValor Eng.
- 2 Assistant Eng.
- 1 Technician
- 5 PhD students
- 1 Post-doctoral

WMM RESEARCH INFRASTRUCTURES: PEELING & WOOD CHARACTERIZATION

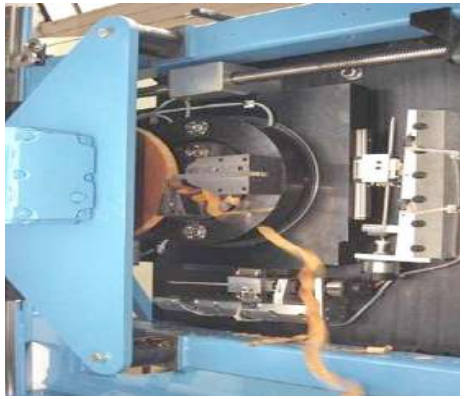


Industrial rotary peeling line

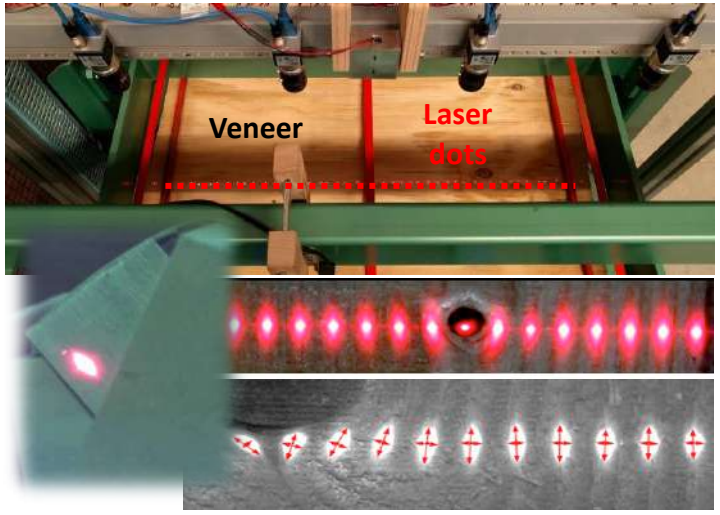


X-ray Scanner "COMBISCAN" (Post-mortem measurement of local densities)

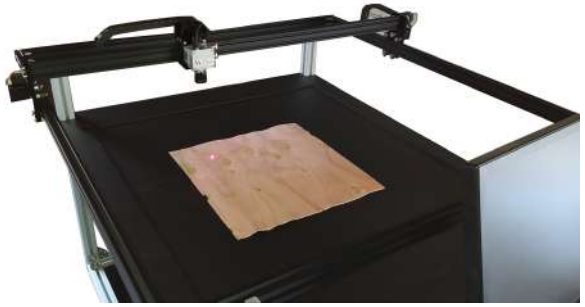
Universal Testing Machine "ZWICK" (compression, tensile and pressure tests)

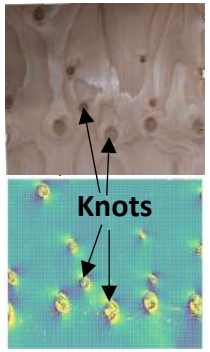


Instrumented micro-peeling



Laser scanner "LOOBAR" (In-Situ measurement of local fiber orientation)





Laser scanner "JORUK" (Post-mortem measurement of local fiber orientation)

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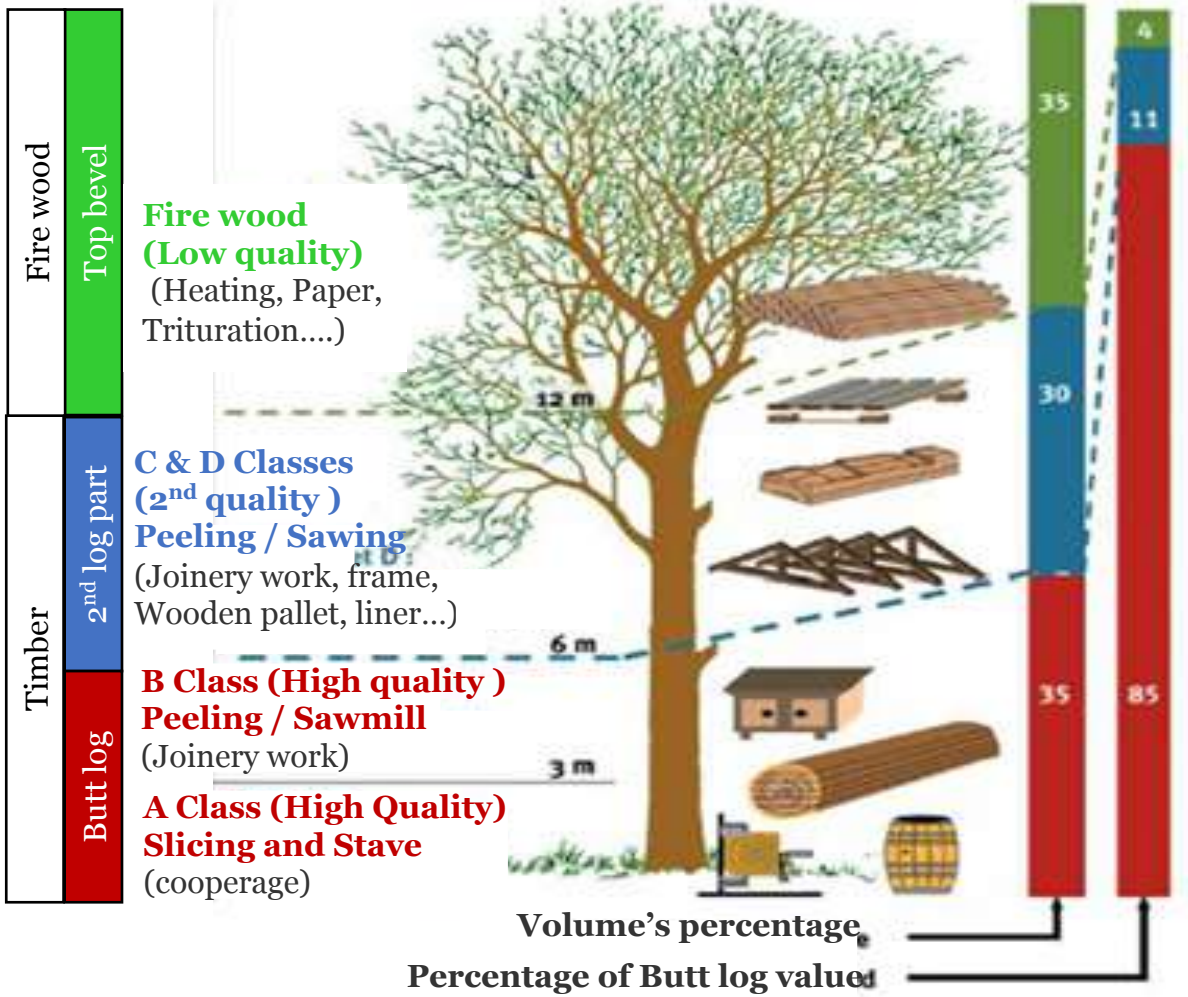
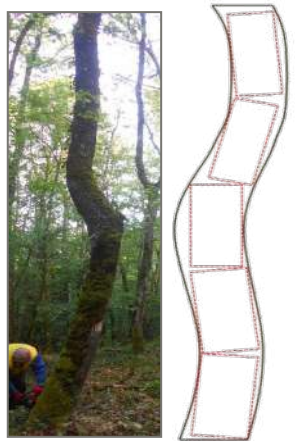
WMM RESEARCH DOMAINS





- Integration of local hardwood (oak, beech, poplar...) and softwood (Douglas fir, Spruce,...) species in industrial applications
- Efficient use of fast-growing trees

1st axis: Pre-machining

- ❑ Silvicultural / Forestry stations
- ❑ Wood species and heterogeneity
- ❑ Hygrothermal wood preparation

2nd axis: Machining processes

- ❑ Wood Peeling
- ❑ Wood Sawing

3rd axis: Post-machining

- ❑ Elaboration and characterization of engineered wood products

CSC – PHD TOPIC: FINITE ELEMENT ANALYSIS FOR OPTIMUM PEELING CONDITIONS AND HIGHER VENEER QUALITY

Steaming

Peeling

Clipping

Stacking

Drying

Gluing

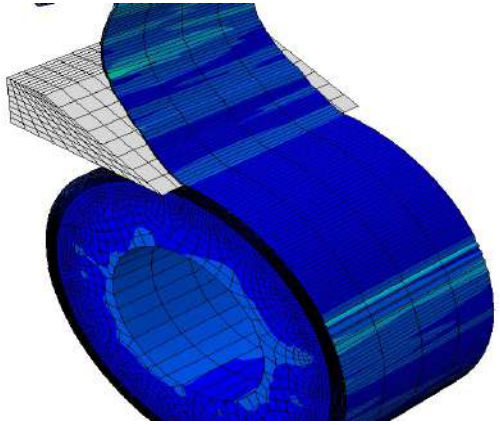
Wood peeling

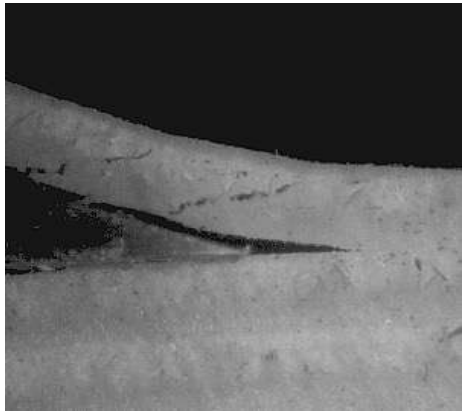
CSC – PHD TOPIC: FINITE ELEMENT ANALYSIS FOR OPTIMUM PEELING CONDITIONS AND HIGHER VENEER QUALITY

1. Multi-scale approach: Numerical analysis

Step 1

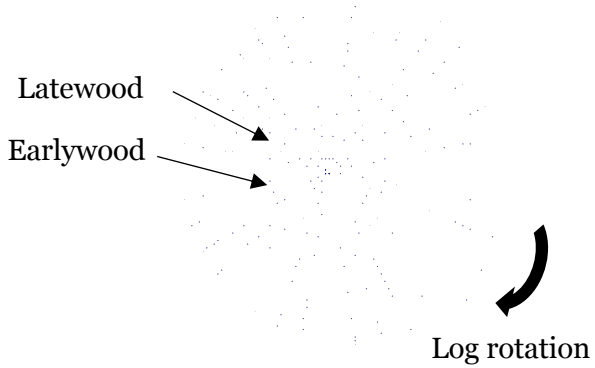
- ✓ Heterogeneous material
- ✓ No pressure bar

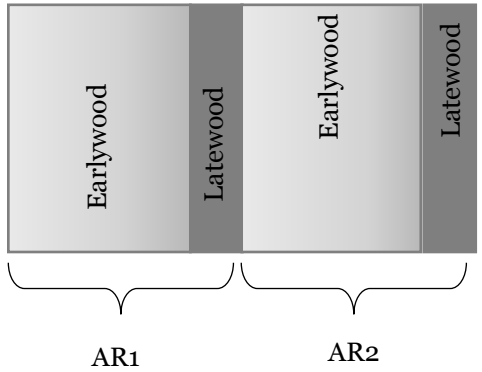




Step 2

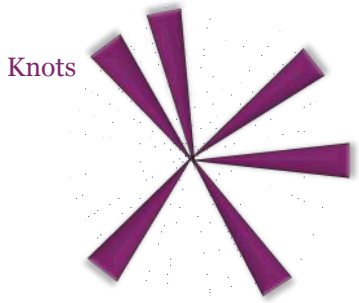
- ✓ Material heterogeneity
- ✓ Consideration of annual rings
- ✓ Cutting along / against annual ring



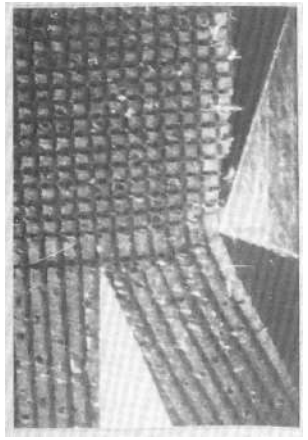


Step3

- ✓ Knots and pressure bar effects



Log

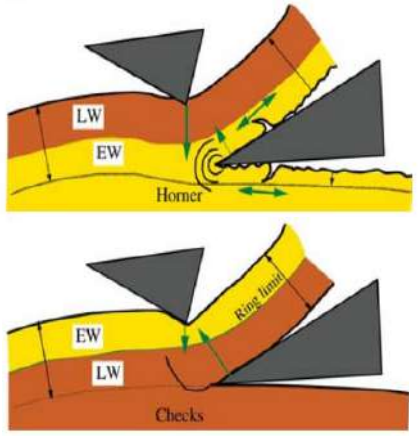


Pressure bar

Knife Veneer

Accurate prediction of real wood behavior during the peeling process

Controlled lathe checks phenomenon

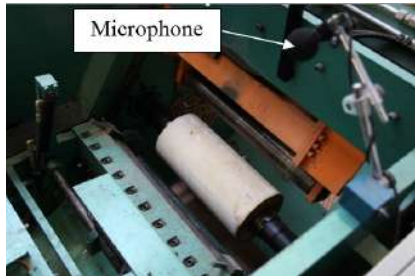


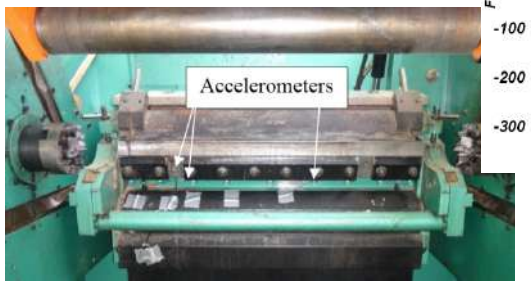
CSC – PHD TOPIC: FINITE ELEMENT ANALYSIS FOR OPTIMUM PEELING CONDITIONS AND HIGHER VENEER QUALITY

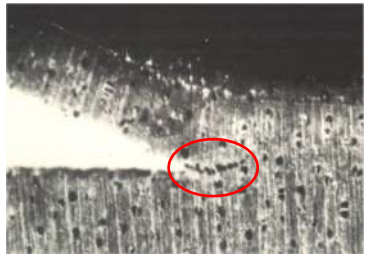
2. Experimental validation

Vibro-acoustic Analysis

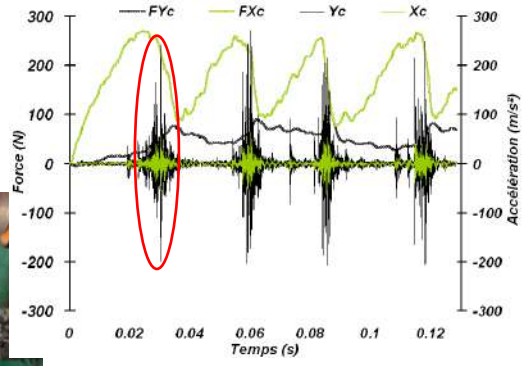
- ✓ Cutting forces
- ✓ Vibrations
- ✓ Sounds







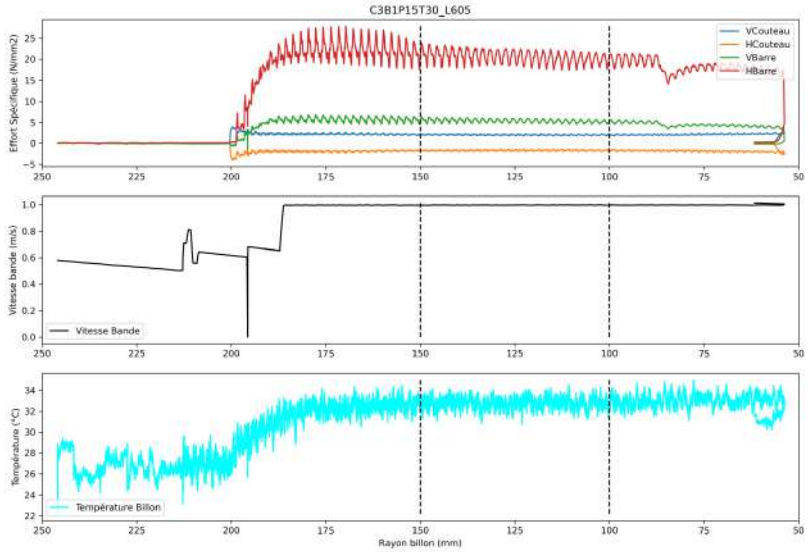
Lathe check initiation



Thermo-mechanical Analysis

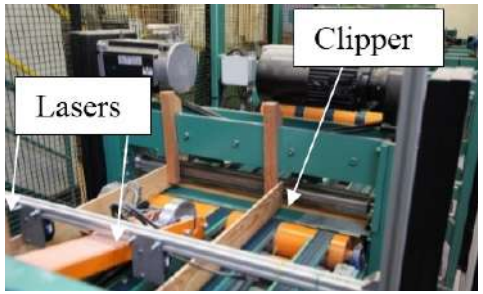
Measurement of:

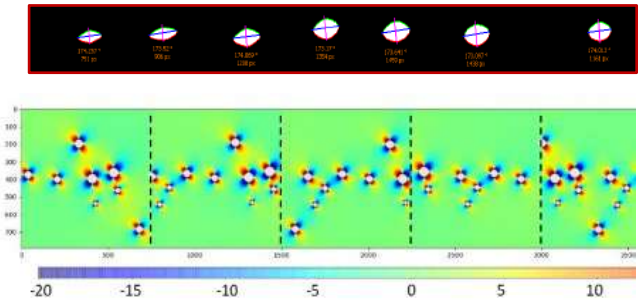
- ✓ Forces applied to the knife and the pressure bar
- ✓ Log temperature
- ✓ Knife angle variation



Analysis of veneer properties

- ✓ Veneer thickness
- ✓ Surface roughness





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Arts et Métiers Sciences et Technologies

MSMP/ ARTS ET MÉTIERS

MECHANICS, SURFACES AND MATERIALS PROCESSING

DIRECTOR: MOHAMED EL MANSORI

MSMP Mechanics, Surfaces and Materials Processing

Mechanics, Surfaces and Materials Processing

Research domains: Future manufacturing processes, material science, mechanics

Multiphysical and multiscale approach to manufacturing processes - I2MP

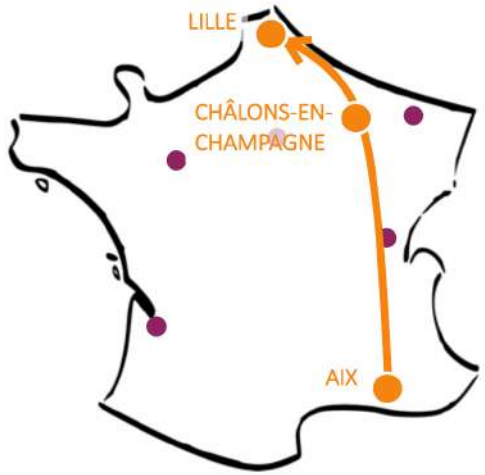
Team leader

Prof. Mohamed El Mansori
h-index : 37

Mechanics, Materials and Surfaces - MMS

Team leader

Prof. Laurent Barrallier
h-index : 18



MSMP
Mechanics, Surfaces and Materials Processing

KEY FACTS / FIGURES

Number of teacher-researchers : 33 (20% international)
Number of PhD candidates : 11 including 25 % of international PhD candidates
Number of engineers & administratives :10
Number of post-docs: 2

Number of publications > 200

Number of filed patents > 5

Prestigious partnerships with academic laboratories, companies:

SAFRAN, AIRBUS, lisi AUTOMOTIVE, EDF, RENAULT, STELLANTIS, ESSILOR SEEING THE WORLD BETTER, thyssenkrupp, SIEMENS Ingenuity for life, Association INSTITUTS CARNOT, TEXAS A&M UNIVERSITY at QATAR, NORTHWESTERN POLYTECHNICAL UNIVERSITY 1938, SHANGHAI JIAO TONG UNIVERSITY 1896, HIT 1920, l'Europe s'engage en France, FULBRIGHT VISITING SCHOLAR PROGRAM

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Mechanics, Surfaces and Materials Processing

MSMP Mechanics, Surfaces and Materials Processing

Research domains I2MP : Multiphysical and multiscale approach to manufacturing processes

Functional qualification of industrial surfaces by metrology, advanced modelling, and intelligent sensing

Full scale manufacturing platforms:

- Foundry and Die-casting
- Additive Manufacturing 3D Printing
- Machining Process
- Assembly and Forming
- …

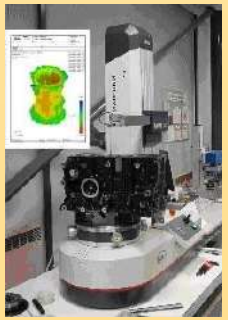
Foundry/3D printer

Sand Casting Foundry

Wire Arc Additive Manufacturing

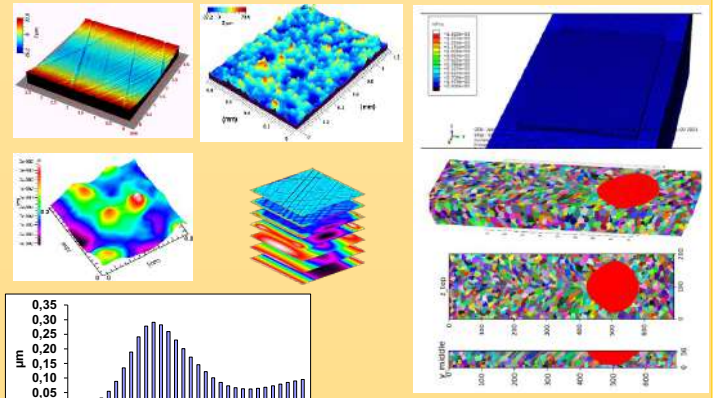
Machining Process

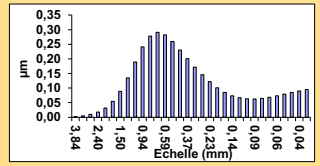
Surface characterization

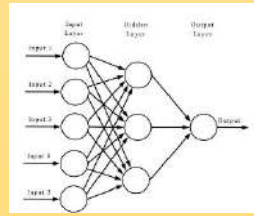


- Atomic force microscopy
- Interferometer
- SEM
- Nanoindentor
- …

Advanced multiscale modelling







- Multi-scale surface analysis
- Advanced simulation techniques
- Artificial Intelligence
- …

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MSMP Mechanics, Surfaces and Materials Processing

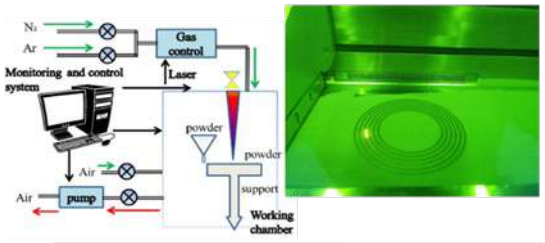
I2MP PhD projects:

Prof. Mohamed El Mansori
https://www.researchgate.net/profile/Mohamed-El-Mansori
h-index : 37

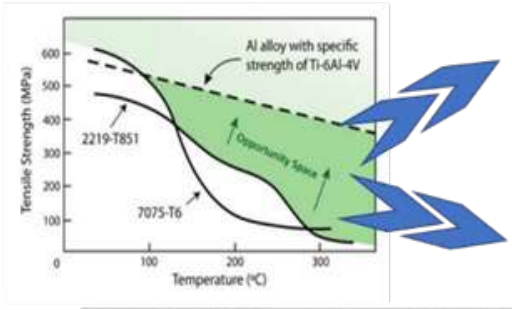
Nan Kang – Associate Professor
https://www.researchgate.net/profile/Nan-Kang-7
h-index : 24

Subject 27
Mechanical and functional fatigue behaviour of laser powder bed fusion processed Ni-Ti shape memory alloy

SMA tire (NASA)



Subject 28
Investigation on microstructure and strengthen mechanism of laser powder bed fusion high temperature multi-reinforced Al matrix compo



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Mechanics, Surfaces and Materials Processing

MSMP
Mechanics, Surfaces and Materials Processing

Research domains MMS : Optimization of the microstructure
to improve the performance of mechanical parts

From the microstructure to the mechanical properties of materials

AXIS 1: Mechanics of the surfaces and materials with microstructure gradient

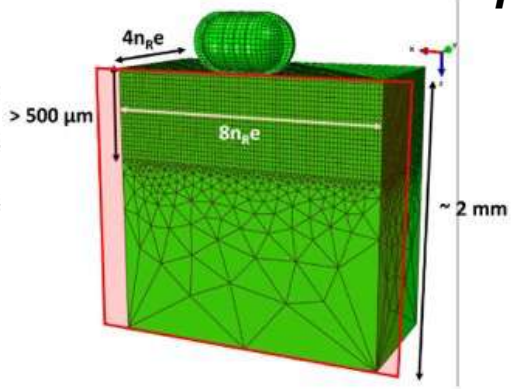
AXIS 2: Residual stresses generation and mechanical fields

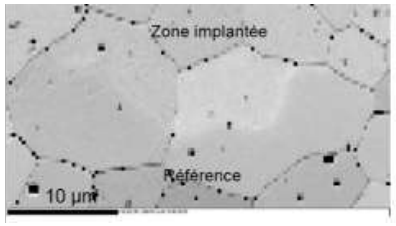
AXIS 3: Thermochemical and mechanical surface treatments

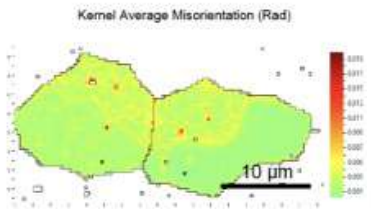
Diffraction methods for the mechanical states analysis

Full kinematic field measurements / mechanical tests, identification methods

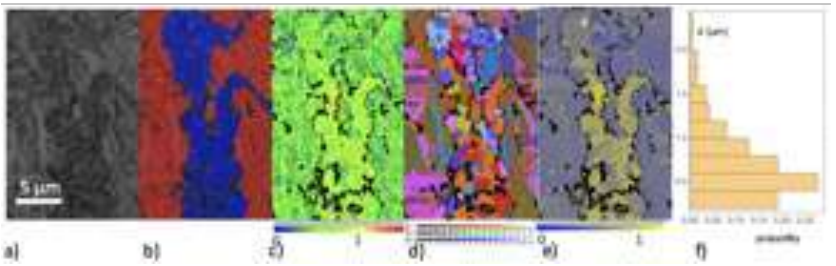
Digital materials

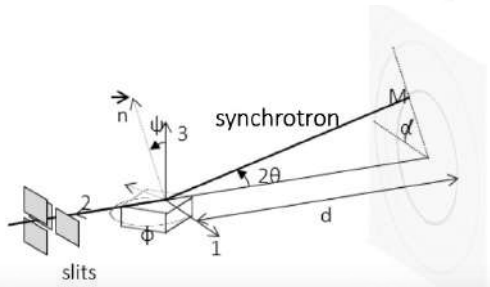






HREBSD





Some application fields:

- Nuclear Energy (UO2), mechanical behavior, irradiation effect \\ CEA
- Shot peening (15 PhD thesis): from the mechanical surface treatment to the fatigue life \\ PSA, Safran, AREVA, EDF, INSA, UTT, Onera
- Nitriding (11 PhD thesis): from the process parameters to the use \\ Airbus, Safran, Aubert & Duval, Bodycote, Transvalor, DTU
- Diffraction method for mechanical states analysis (X-ray, neutron, synchrotron, electron)
- …

Gases reactive facilities | SEM | Mono impact | X-ray diffractometer | Dig.mat.

Mechanics, Surfaces and Materials Processing

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Mechanics, Surfaces and Materials Processing

MMS PhD projects:

Prof. Laurent Barrallier
https://www.researchgate.net/profile/Laurent-Barrallier

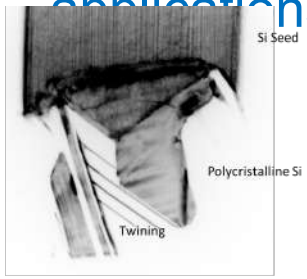
Dr. Mohamed Fares Slim
https://www.researchgate.net/profile/Mohamed-Fares-Slim

Dr. Dorian Depriester
https://www.researchgate.net/profile/Dorian-Depriester

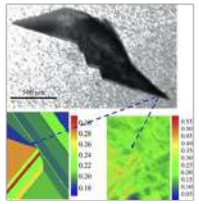
Subject 7

Multiscale stress/strain analysis of polycrystalline silicon for photovoltaic applications

Polycrystalline Si process "CZ"



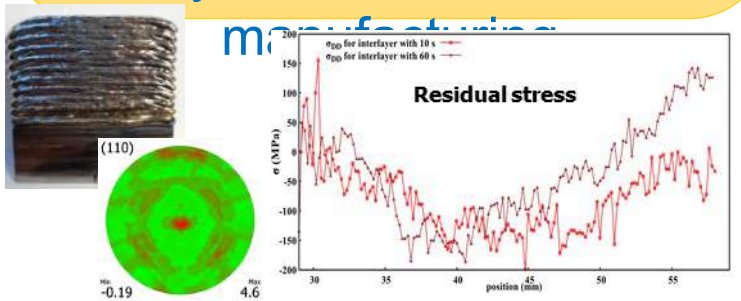
Strain/stress is inducing during solidification → electrical properties are affected



Strain/stress analysis using:
- HR-EDBS and XRD (local)
- EF modeling from melting temperature to room temperature

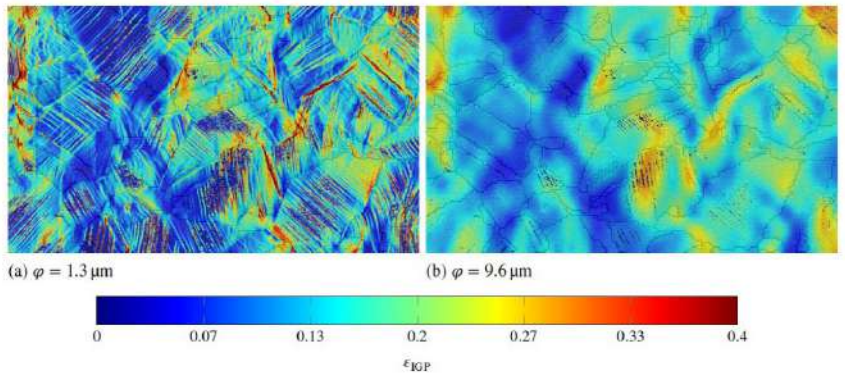
Subject 17

Study of the microstructure, mechanical and fatigue properties of Ti-6Al-4V and AL-Co-Cr-Fe-Ni high entropy alloys components fabricated by wire-arc additive manufacturing



Subject 20

Multiscale simulation of plastic strain localization in high entropy alloys



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Mechanics, Surfaces and Materials Processing

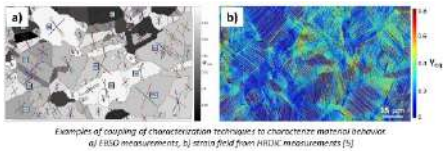
MMS PhD projects:

Prof. Laurent Barrallier
https://www.researchgate.net/profile/Laurent-Barrallier

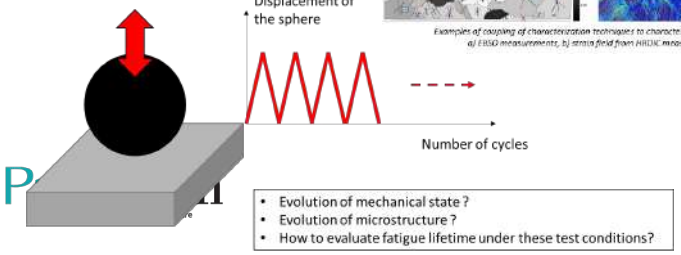
Dr. Jean-Patrick Goulmy
https://www.researchgate.net/profile/Jean-Patrick-Goulmy

Subject 22

Optimized set-up to characterize the contact fatigue damage of material with gradient properties



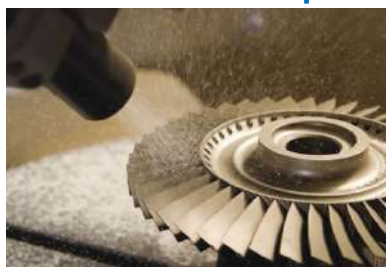
Examples of coupling of characterization techniques to characterize material behavior. a) EBSD measurements, b) strain field from HRDIC measurements [5]

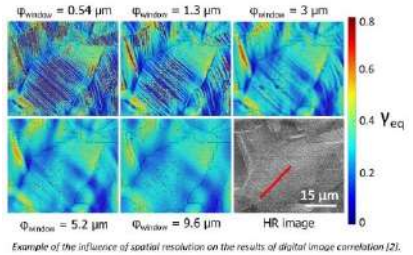


- Evolution of mechanical state ?
- Evolution of microstructure ?
- How to evaluate fatigue lifetime under these test conditions?

Subject 23

A smart manufacturing project: Digital Image Correlation characterization of residual stresses induced during the shot peening process

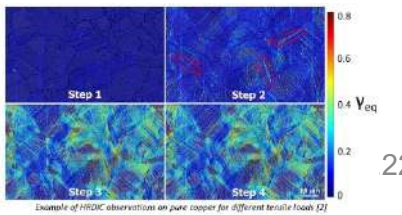




Example of the influence of spatial resolution on the results of digital image correlation [2].

Subject 24

Characterization of the evolution of mechanical properties of materials during in-situ SEM tests in temperature: implementation of the HRDIC technique



Example of HRDIC observations on pure copper for different tensile loads [2]

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ENSAM LAB: **DYNFLUID - DYNAMIQUE DES FLUIDES**

Lab Director :
Jean-Christophe ROBINET
Jean-christophe.ROBINET@ensam.eu

Pictures / Logos

RESEARCH TOPICS: at DynFluid, research is organized into 4 themes:

Topic 1: Multi-Species and Complex Thermodynamics

Topic 2: Compressible, Turbulence and Acoustics

Topic 3: Machine Learning and Uncertainty Quantification

Topic 4: Transition, Instability, Transition and Control

Website

ENSAM LAB: **DYNFLUID - DYNAMIQUE DES FLUIDES**

Lab Director :
Jean-Christophe ROBINET
Jean-christophe.ROBINET@ensam.eu

DynFluid
Fluid Dynamics Laboratory

Main Project :

ANR- REGAL/ORC (REal-GAs effects on loss mechanisms of ORC turbine flows)

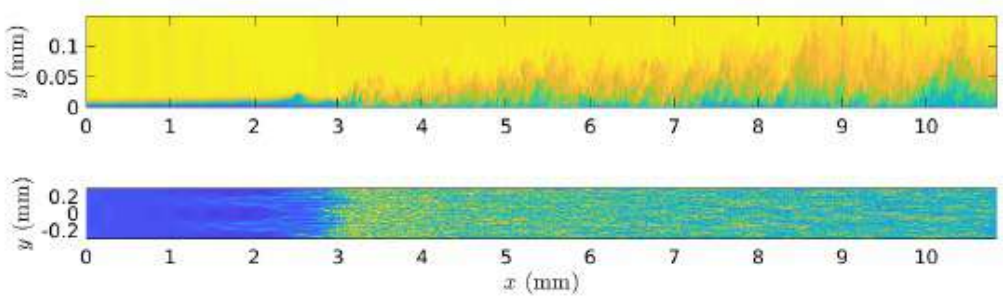
Partner:

- TUI Technische Universität Ilmenau
- ENSAM -- DynFluid
- FH MS Muenster University of Applied Sciences
- IJLRDA Institut Jean Le Rond D'Alembert

Grants: 200k€

Objectives :

- Understand and predict the dynamics of dense gas flows
- Describe transition mechanisms
- The physical properties of turbulence



Methods :

- High order numerical simulations,
- Synthetic turbulence generation
- Advanced signal post-processing

Website

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Arts et Métiers Institute of Technology

ENSAM LAB: **DYNFLUID - DYNAMIQUE DES FLUIDES**

Lab Director :
Jean-Christophe ROBINET
Jean-christophe.ROBINET@ensam.eu

DynFluid
Fluid Dynamics Laboratory

PERSEUS

Clean Sky

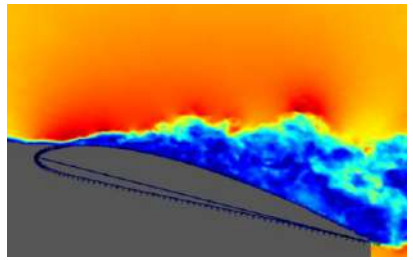
Main Project :

CleanSky (H2020) PERSEUS (Pulsed jEt actuatoRs for SEparation control of tUrbulent owS)

Partner:

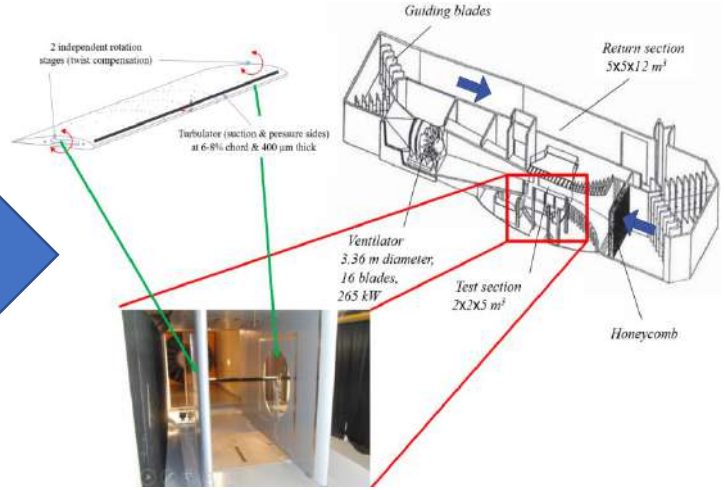
- University of Orléans (Prisme Institute)
- INSA Toulouse (Clément Ader)
- Arts et Métiers Inst. of Tech. / DynFluid

Grants: 180k€



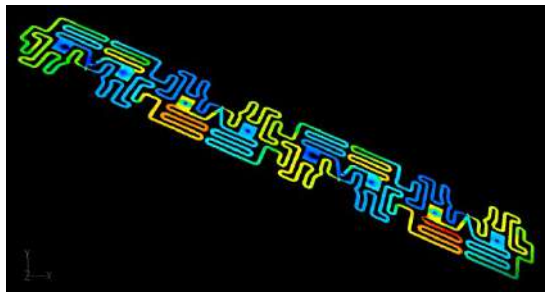
Internal & external high-fidelity simulations

Sensitivity analysis



Well control experiments – high lift configurations

Innovative design of pulsed Jet actuators



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ENSAM LAB: **DYNFLUID - DYNAMIQUE DES FLUIDES**

Lab Director :
Jean-Christophe ROBINET
Jean-christophe.ROBINET@ensam.eu

DynFluid
Fluid Dynamics Laboratory

Main Project :

DGAC/Airbus MAMBO
(Méthodes Avancées pour la Modélisation du Bruit moteur et aviOn)

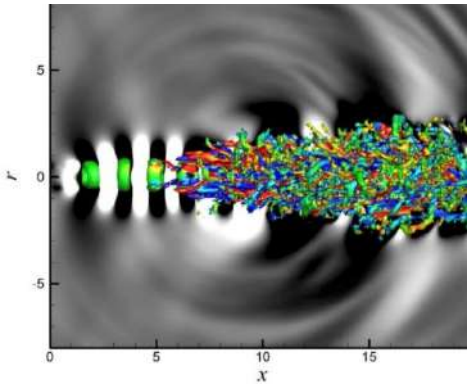
Partners:

- Airbus SAS, Airbus OP
- ArianeGroup
- ONERA / DAAA / DMPE
- ISAE-Supaéro / DAEP
- ISAE-ENSMA Poitiers / Institute Pprime
- Arts et Métiers Inst. of Tech. / DynFluid
- Sorbonne Univ. / IJLDA
- Ecole Centrale de Lyon / LMFA
- Safran Aircraft Engine

Grants: 200 k€

Objectives :

Understand, predict and reduced the noise radiation of supersonic jet



Methods :

- High order numerical simulations,
- Automatic differentiation,
- Modal decompositions
- Optimal control by adjoint methods

Website

le cnam

Arts et Métiers Institute of Technology

PhD subject

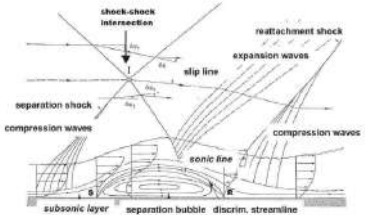
Study of the low frequency dynamics of compressible separations

Ismaïl BEN HASSAN SAÏDI (DynFluid, Arts et Métiers)
Jean-Christophe ROBINET (DynFluid, Arts et Métiers)
Christian TENAUD (EM2C, CentraleSupelec, CNRS)

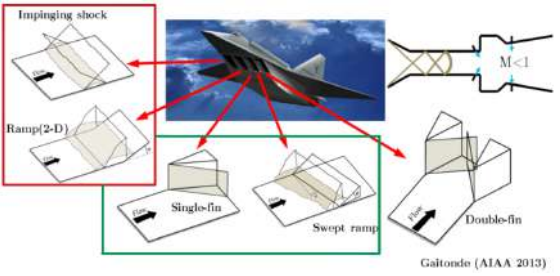
08th november 2022

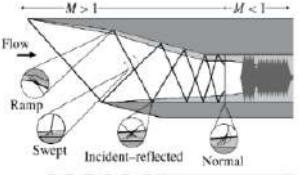
Study of the low frequency dynamics of compressible separations

- **Industrial context**: supersonic aerodynamics



[Arnal and Delery, 1971]





- **Physical issues**:
  - broadband dynamics

  $\longrightarrow$ **low frequency oscillations** of shock / recirculation bubble system
  - what **physical mechanism** explains the low-frequency dynamics?

[Grossman and Bruce, 2018]

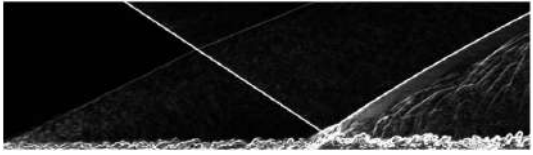
Study of the low frequency dynamics of compressible separations

- **Goal of the PhD**: Physical analysis $\longrightarrow$ describe the physical mechanism at play for low frequency dynamics
- **Outline**: Focus on **laminar and transitional** SWBLIs
  - High-fidelity **numerical simulation** of SWBLIs (LES)

    $\longrightarrow$ In-house code, parallel computing (**HPC**), statistical convergence, shock-capturing procedures, etc.
  - Physical analysis:

    $\longrightarrow$ Modal decompositions: SPOD, DMD, BSMD

    $\longrightarrow$ Stability analysis
  - Comparison with turbulent SWBLIs



[Ben Hassan Saïdi, PhD Thesis, 2019]

- **Candidate profile**:
  - Specialized in fluid mechanics or applied mathematics
  - Interested in: supersonic aerodynamics, physical analysis, dynamical systems
  - Skill in programming (Fortran, python ...), experience in HPC appreciated.
- **PhD location**: at DynFluid, Arts et Métiers institute of Technology. National and international collaborations

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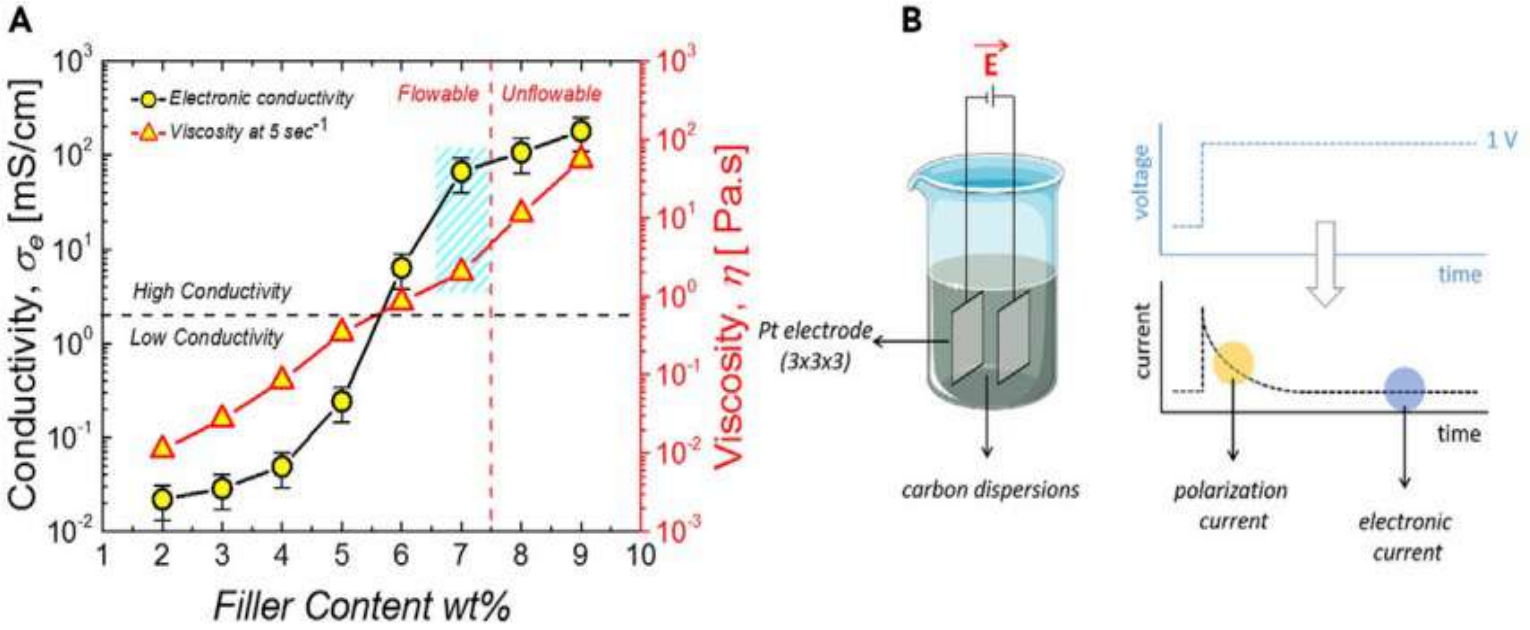
Acoustic lubrication of dense non-Brownian suspensions

X. JIA, A. TOURIN, A. COLIN

Background: non-Brownian suspensions

- Made of hard particles + Newtonian fluid
- Display a wide variety of behaviors:

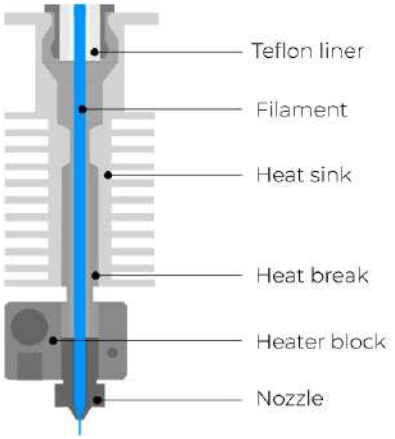
Carbon black suspensions



Potential applications

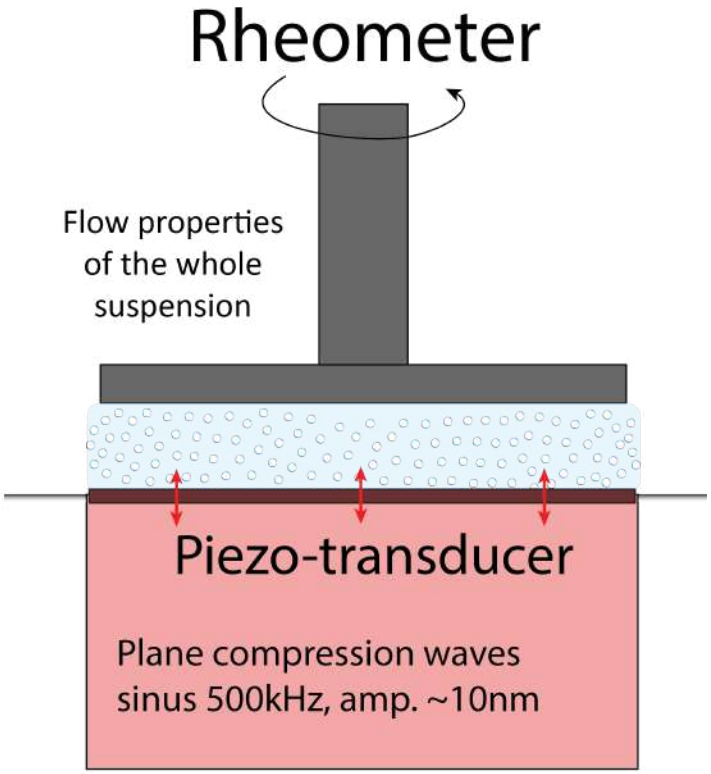
Ex: 3D printing of composite materials

Printing fuse:

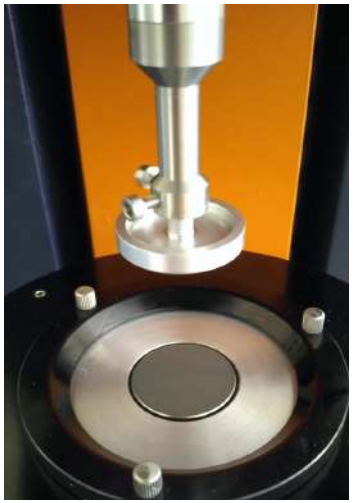


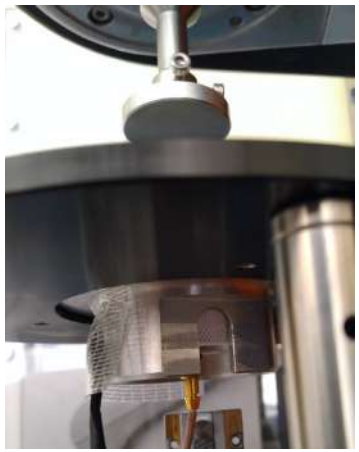
Or fluidize any suspension flow in microfluidics…

Acoustic lubrication



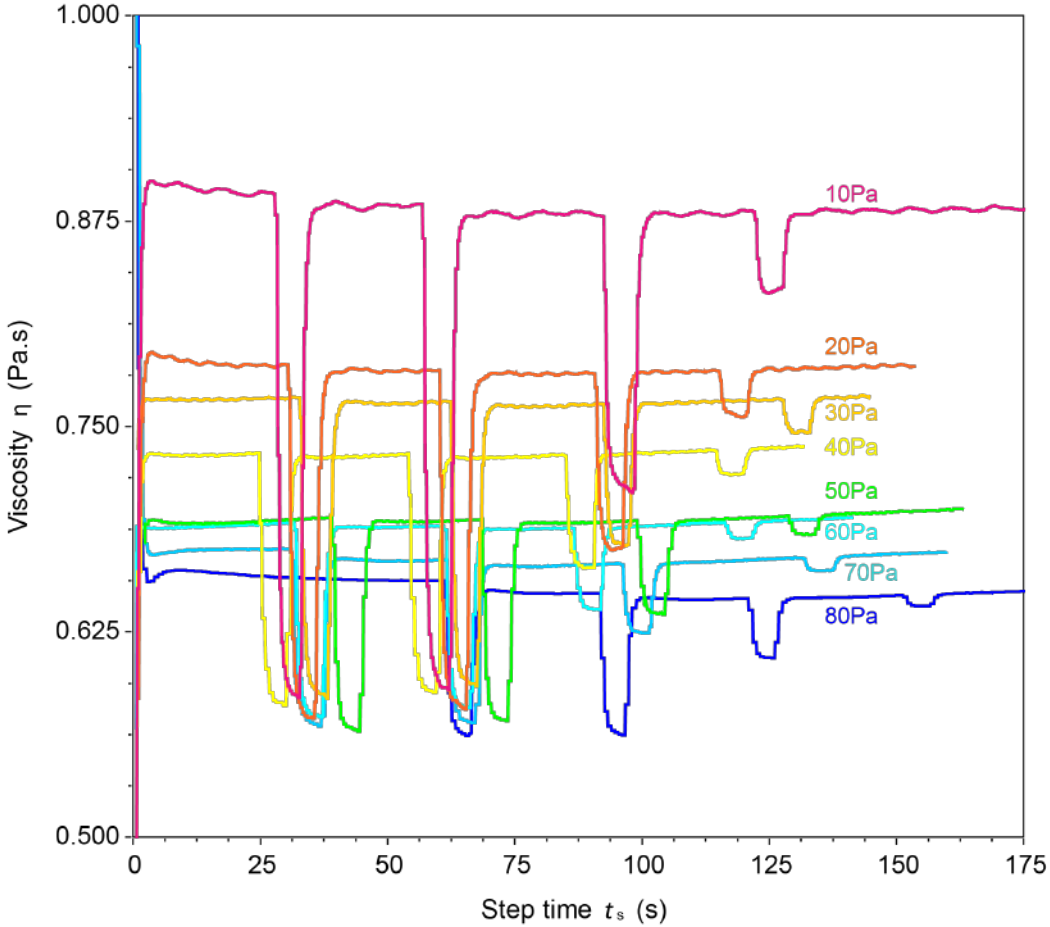
Top view





Bottom view

Effect of ultrasounds on dilute model suspensions

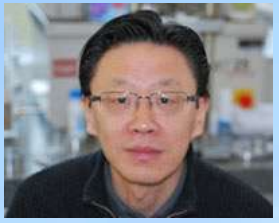


Acknowledgments

Agence Nationale de la Recherche ANR
INSTITUT PIERRE-GILLES DE GENNES | PSL
ESPCI PARIS | PSL

Arnaud Tourin

Xiaoping Jia



Guillaume Ovarlez

The whole MIE team at ESPCI:

Annie Colin
@adrienizzet

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6. LABS AND PHD PROPOSALS

ROOM 4 /PHYSICS, OPTICS

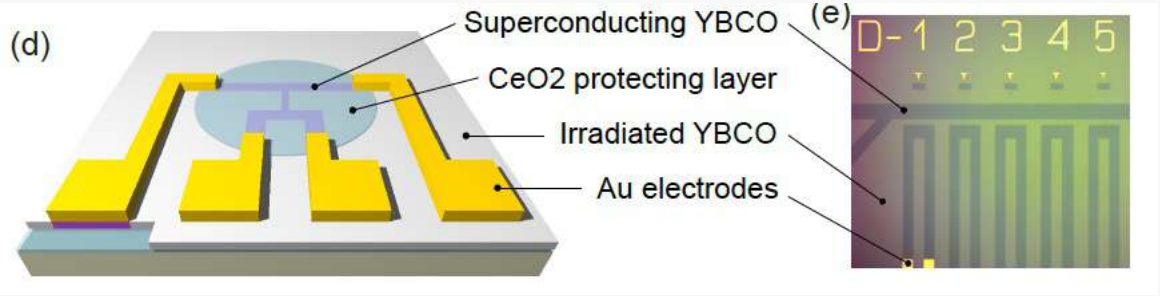
ROOM4 - Physics, Optics PROPOSALS/LABS

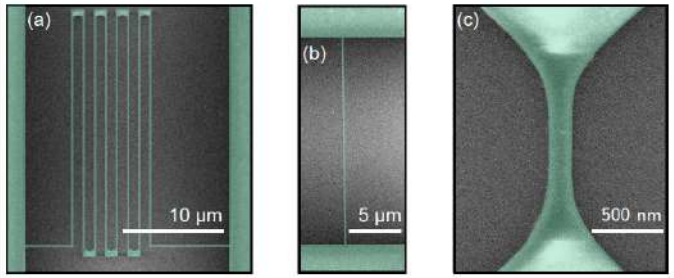
File Number	School	Title	Advisors	Lab
2022_043	ESPCI Paris - PSL	High temperature superconductors for single photon detection	Cheryl FEUILLET-PALMA	LPEM - Laboratoire Physique et d'études des matériaux
2022_051	ESPCI Paris - PSL	Electronic structure of the intercalated graphene-Ge interfaces	Dimitri Roditchev, Yuriy Dedkov, Sergio Vlaic	LPEM - Laboratoire Physique et d'études des matériaux
2022_081	ESPCI Paris - PSL	VO2-based Plasmonic Hybrid Nanostructures for Tunable Optical Sensors	Lionel Aigouy, Alexandre Zimmers, Zhuoying Chen	LPEM - Laboratoire Physique et d'études des matériaux
2022_077	Institut d'Optique Graduate School	Coherent manipulation of entangled emitters	Brahim LOUNIS, Jean-Baptiste TREBBIA	LP2N - Laboratoire Photonique, numérique et nanosciences
2022_078	Institut d'Optique Graduate School	Quantum optics with perovskite single nanocrystals and superlattices	Brahim LOUNIS, Philippe TAMARAT	LP2N - Laboratoire Photonique, numérique et nanosciences
2022_080	Institut d'Optique Graduate School	Fast Josephson-junction control by optical manipulation of a flux quantum	Brahim LOUNIS, Philippe TAMARAT	LP2N - Laboratoire Photonique, numérique et nanosciences
2022_061	Institut d'Optique Graduate School	High sensitivity Atom Interferometry using multi-photon interrogation in an optical cavity	Benjamin Canuel	LP2N - Laboratoire Photonique, numérique et nanosciences
2022_003	ESPCI Paris - PSL	Active Solids	Olivier Dauchot	GULLIVER - Voyages expérimentaux et théoriques en matière molle
2022_004	ESPCI Paris - PSL	Morpho-Functional Swarm Robotics	Olivier Dauchot	GULLIVER - Voyages expérimentaux et théoriques en matière molle
2022_100	Institut d'Optique Graduate School	Production of striking visual appearance with disordered metasurfaces	philippe Lalanne	LP2N - Laboratoire Photonique, numérique et nanosciences

Collaboration:

Optical conductivity and Qdev Groups

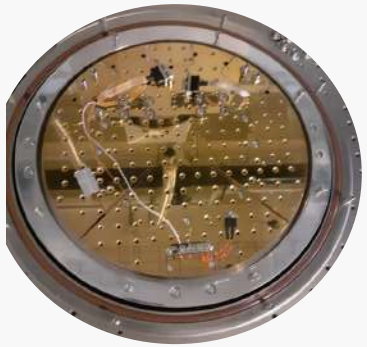
High Temperature Superconductors for Single Photon Detector

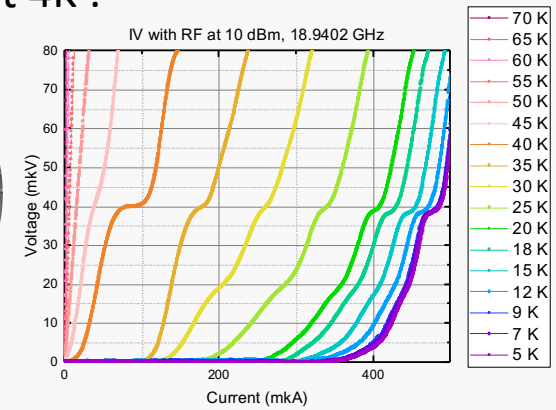




SEM images of several nanowire

Quantum Transport 4K :





Key researchers
Optical conductivity / Qdev Group

Cheryl Feuillet-Palma

Ricardo Lobo

https://phasme.lpem.espci.fr/

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CSC PhD proposal:
High sensitivity Atom Interferometry using multi-photon interrogation in an optical cavity

Context and team presentation

LP2N
Laboratoire Photonique Numérique & Nanosciences

INSTITUT d'OPTIQUE GRADUATE SCHOOL ParisTech

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Team Large Scale Atom Interferometry to study gravity

Study atom gradiometry techniques for new class of research Infrastructures

- Fundamental physics (Relativity, Gravitational Waves, dark matter…)
- Geoscience (geology, seismology, hydrogeology…)

Activities:

- Leading the MIGA antenna
- Experimental developments at LP2N:
  - In cavity Atom Interferometry
  - 6 m gradiometer
- Noise Models, metrology and further developments: ELGAR

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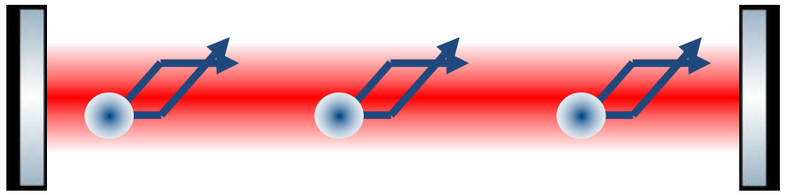
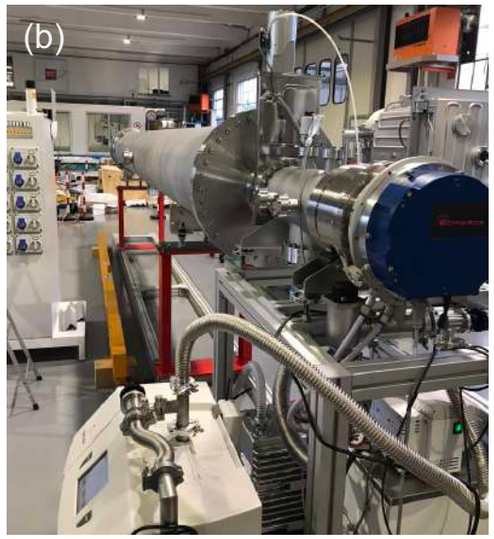
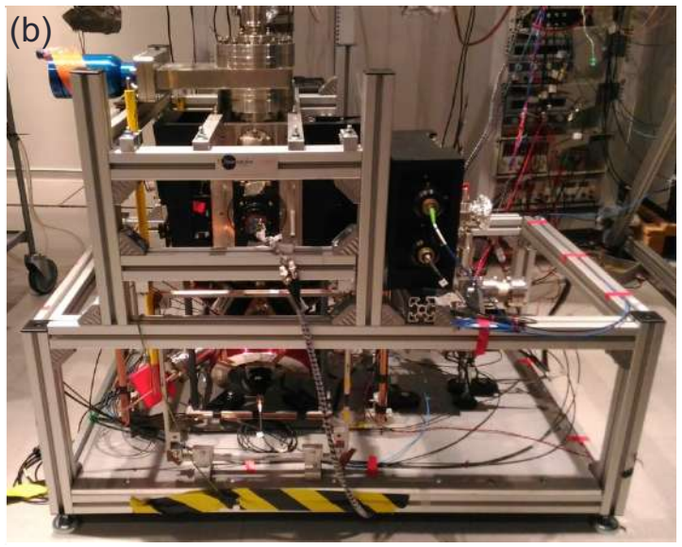
The MIGA antenna

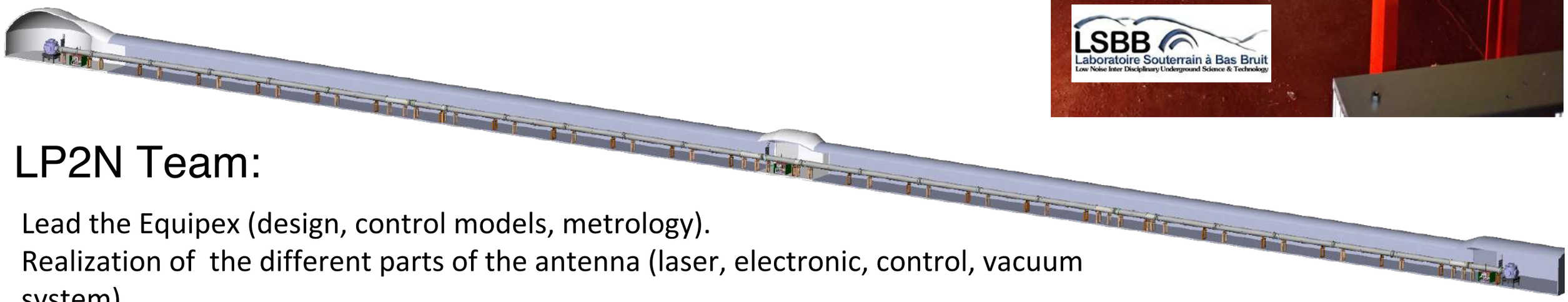
Build a new instrument combining matter-wave and laser interferometry



A Large research infrastructure hosted in a low noise laboratory





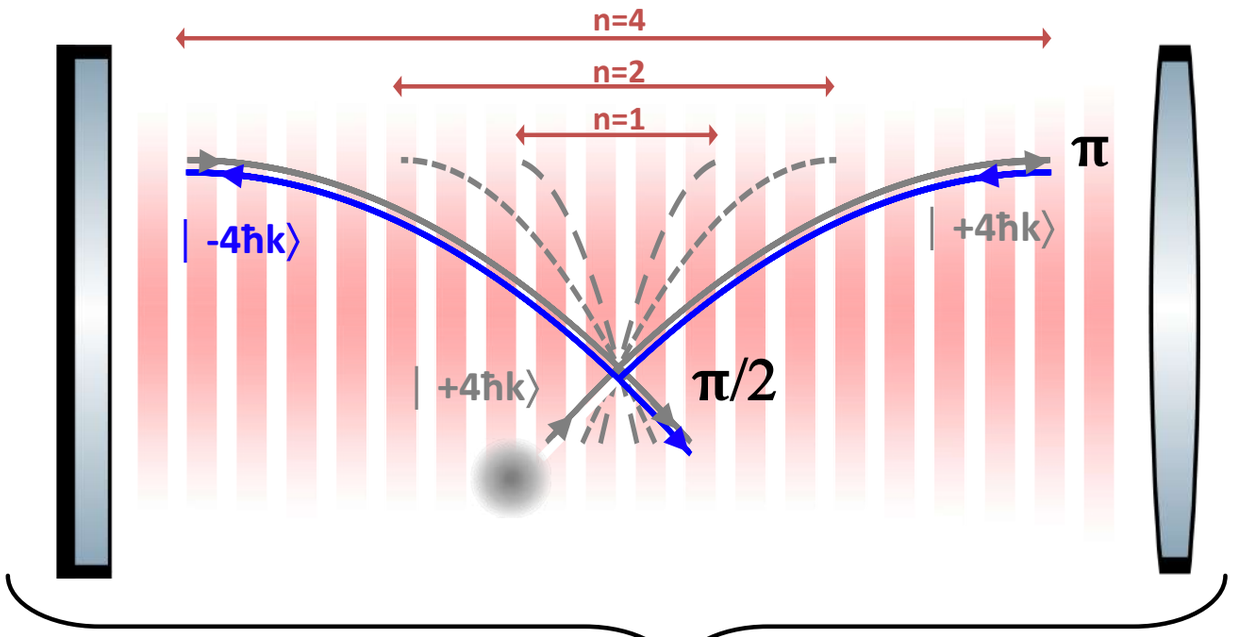


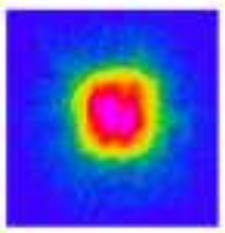
LP2N Team:

- Lead the Equipex (design, control models, metrology).
- Realization of the different parts of the antenna (laser, electronic, control, vacuum system).
- Responsible for installing and commissioning.
- Prepare further developments: study advanced atom interferometry techniques

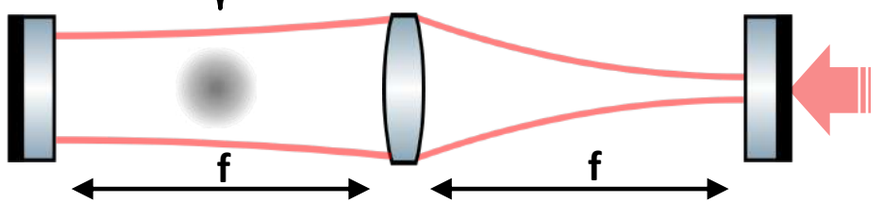
Atom interferometry in cavity

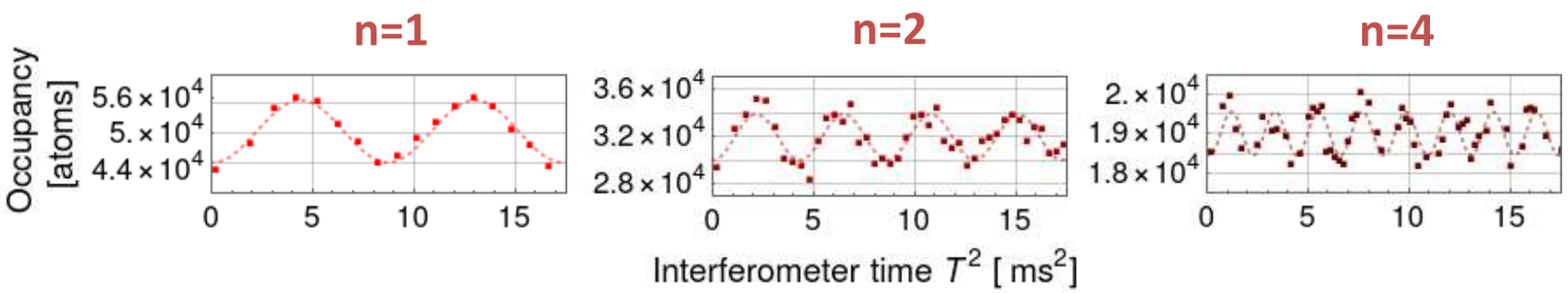
- Test atom cavity interrogation on a reduced scale of 80 cm using a MIGA Rb source.
- Uses degenerate resonator geometry enabling a large resonating mode.

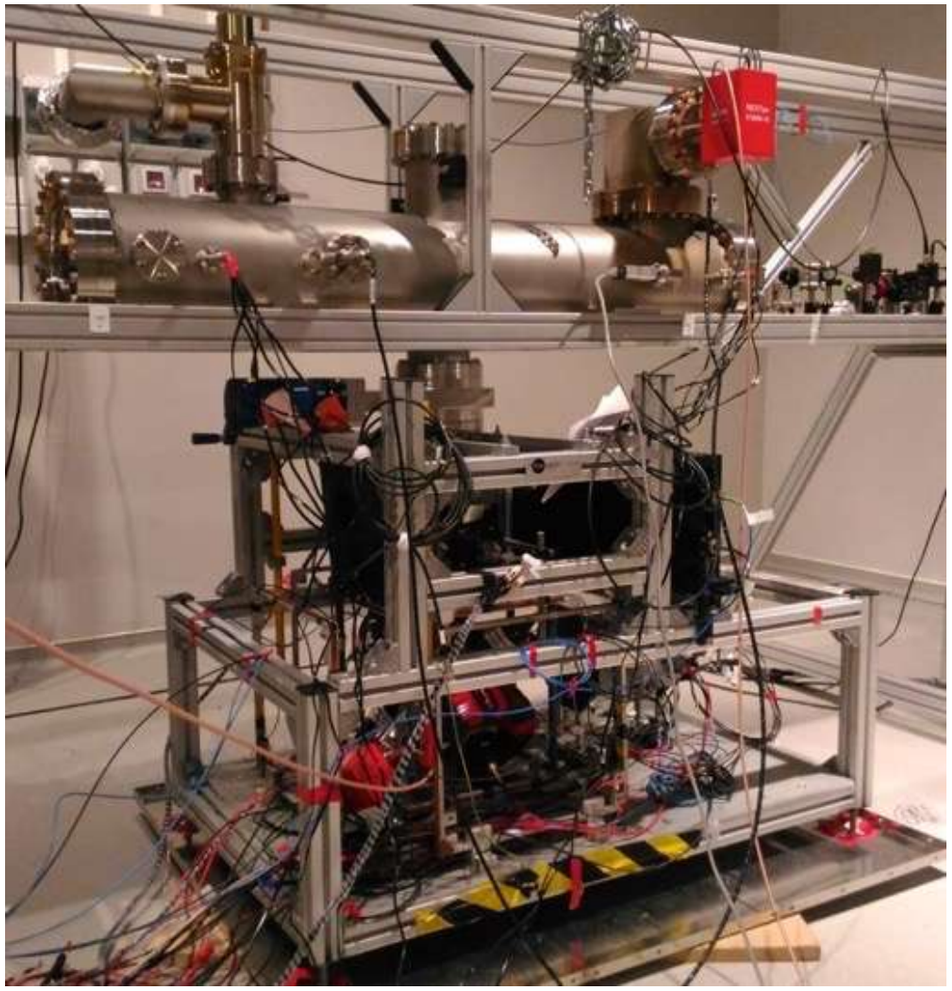




Resonant field diameter 4 mm



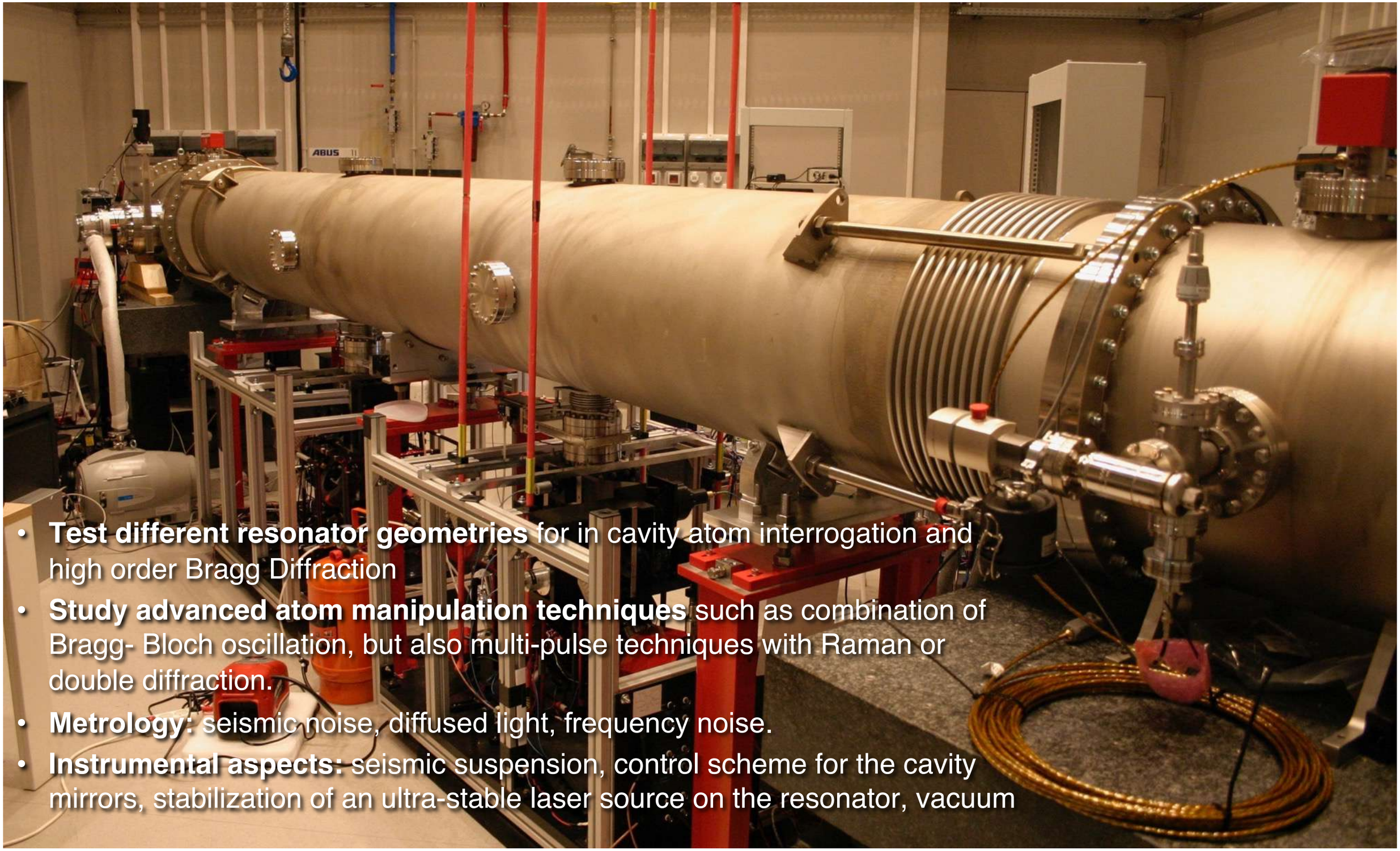




- Study of advanced atom manipulation techniques.
- Cavity build up help to reach high order Bragg diffraction: increase the separation of matter waves – ie sensitivity.

6 m gradiometer

A short-sized version of MIGA to study advanced atom interferometry techniques.



- **Test different resonator geometries** for in cavity atom interrogation and high order Bragg Diffraction
- **Study advanced atom manipulation techniques** such as combination of Bragg- Bloch oscillation, but also multi-pulse techniques with Raman or double diffraction.
- **Metrology:** seismic noise, diffused light, frequency noise.
- **Instrumental aspects:** seismic suspension, control scheme for the cavity mirrors, stabilization of an ultra-stable laser source on the resonator, vacuum

CSC PhD proposal

PhD proposal

High sensitivity Atom Interferometry using multi-photon interrogation in an optical cavity

Advisor: Canuel Benjamin, benjamin.canuel@institutoptique.fr

This PhD project seeks to exploit the promising potential of large momentum transferring beam splitters to boost the sensitivity of atom interferometer based experiments and heralds a new class of applications in fundamental physics such as studies of Dark Matter or Gravitational Waves. This project relies on the potential of optical resonators as a key technique for sensitivity improvement. Developments achieved by a few groups worldwide have recently led to multiple breakthroughs bought about by bespoke resonators designed for atom interferometry.

After pioneering results, obtained in the frame of "MIGA" project [1], with the demonstration of a matter wave interferometer in a 1 m marginally stable resonator [2] (see Fig. 1), this PhD project will focus the development of such
a baseline of a few meters. Bas
separated atom interferometers in
an important immunity to common
bricks to build future high sensitivi

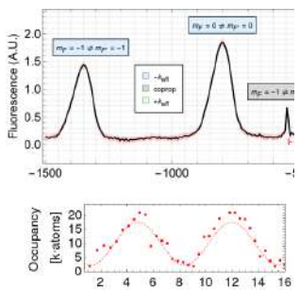


**Figure 1: Atomic data. Top: Quai
ballistic flight toward the interrc
from left to right, interference p**

The PhD project will benefit from
the "MIGA project" at the LP2N lal
of ^{87}Rb launched on a vertical tra
mode of horizontal cavities are us
geometry.

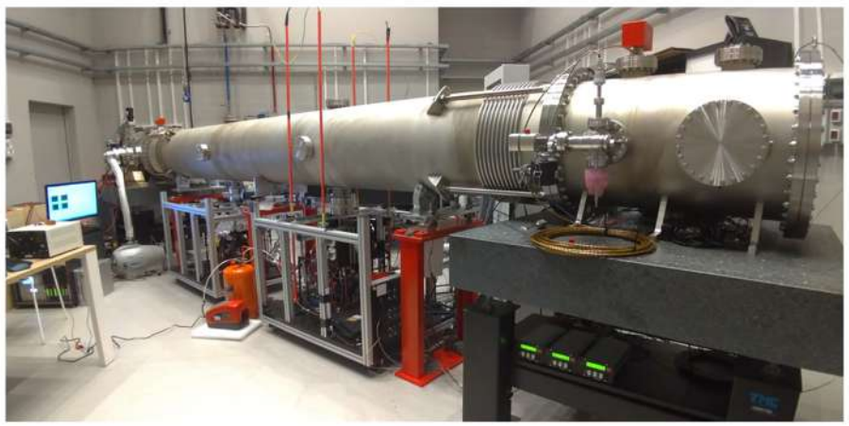


Figure 2: Atom gradiometer experiment at LP2N laboratory.

While cavities are now considered as disruptive tools to improve atom interferometer sensitivity, the efficiency of this method scales with resonator finesse, for both scale factor improvement and future implementation of sub shot-noise measurement schemes. This PhD will therefore focus on the study of different atom interferometry geometries using high-finesse resonators with the scope of demonstrating an improved measurement scale factor thanks to the use of the cavity. A specific configuration will be studied for future GW detectors based on matter-wave interferometry [3].

Based on such developments, the perspective for this PhD project is to enable new applications for fundamental physics by extending atom gradiometry applications to the study of Dark Matter. The use of an interrogation cavity could for example enable new parameter space studies for virialized ultralight field candidates.

[1] B. Canuel, A. Bertoldi, L. Amand et al. **Exploring gravity with the MIGA large scale atom interferometer**. Sci Rep 8, 14064 (2018). https://doi.org/10.1038/s41598-018-32165-z

[2] D. O. Sabulsky, J. Junca, X. Zou, A. Bertoldi, M. Prevedelli, Q. Beaufils, R. Geiger, A. Landragin, P. Bouyer, B. Canuel, **Multi-photon Atom Interferometry via cavity-enhanced Bragg Diffraction**, arXiv:2201.11693 [physics.atom-ph] (2022), https://doi.org/10.48550/arXiv.2201.11693

[3] B. Canuel, S. Abend, P. Amaro-Seoane, et al. **ELGAR - a European Laboratory for Gravitation and Atom-interferometric Research**, Class. Quantum Grav. 37 225017 (2020), https://doi.org/10.1088/1361-6382/aba80e

- Exploit the promising potential of large momentum transferring beam splitters to boost the sensitivity of AI based experiments for a **new class of applications in fundamental physics**.
- Rely on the potential of **optical resonators** as a key technique for sensitivity improvement
- Study of different AI geometries using **high-finesse resonators** with the scope of demonstrating an improved measurement scale factor. A specific configuration will be studied for **future GW detectors** based on matter-wave interferometry
- Extend atom gradiometry applications to the **study of Dark Matter**. The use of an interrogation cavity could for example enable new parameter space studies for virialized ultralight field candidates.

Contact: Canuel Benjamin, benjamin.canuel@institutoptique.fr

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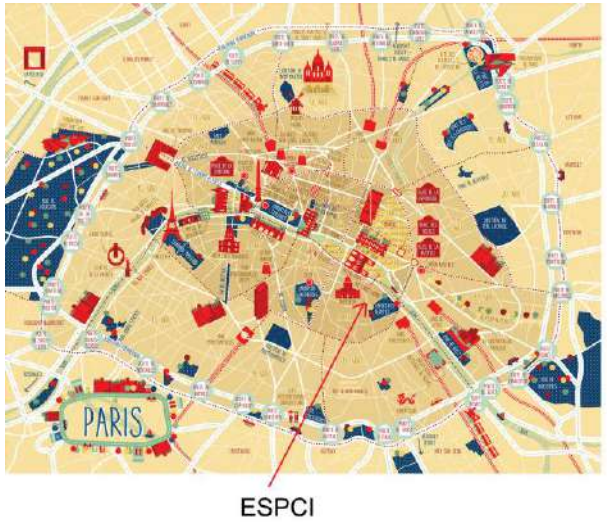
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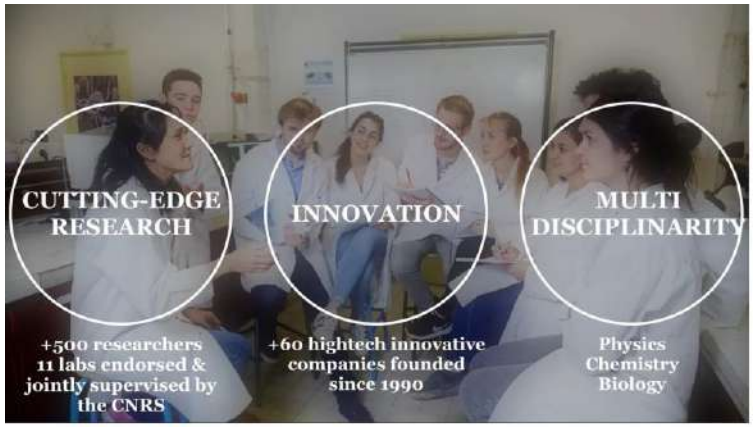
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Micro & Nano Characterization Group (MNC)

- **Near-field optics** with fluorescent nanoprobes. Our activities concern the study of dielectric and plasmonic nanostructures using a scanning fluorescent probe that detects the near-field. We also study the interactions between fluorescent particles and the local environment.

- **Micro and nanothermics**. We study thermal properties of compounds and devices using a fluorescent scanning probe microscope. The particle acts as a nanothermometer. By analyzing fluorescence variations we can determine the temperature with a sub-micron lateral resolution.

- **Optoelectronics.** We develop and characterize new optoelectronic devices with new organic/inorganic hybrid materials : solar cells and light emitting devices.

Lionel Aigouy

Alexandre Zimmers

Zhuoying Chen

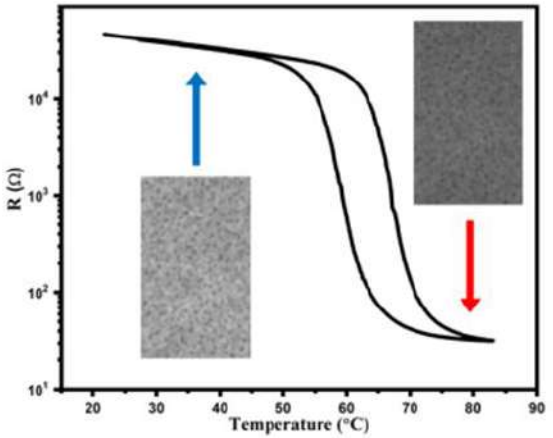
VO_2-BASED PLASMONIC HYBRID NANOSTRUCTURES FOR TUNABLE OPTICAL SENSORS

Vanadium dioxide (VO_2) is a material that undergoes an Insulator to Metal phase Transition (IMT) very close to **room temperature** (T_c = 68 °C). This transition is accompanied by a change **in electrical resistance** of several orders of magnitude, but also by strong variations of the **refractive index**, making it very interesting for developing a wide variety of **electronic and optical devices**. The objective of this project is to benefit from these unique properties and to use VO_2 in emerging applications:

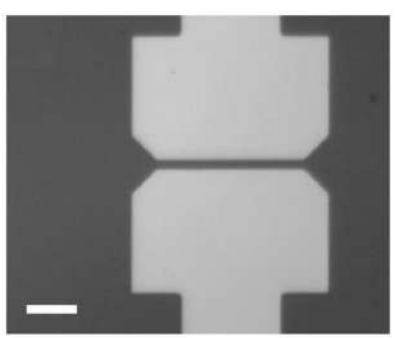
i) **Near-infrared photothermal detectors**.

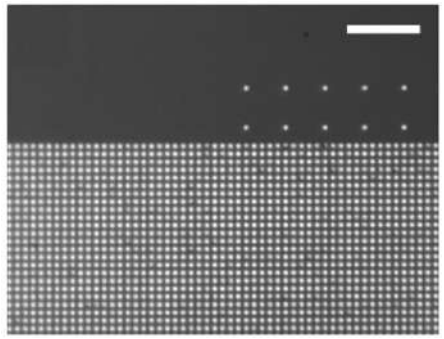
ii) **New micro-optoelectronic devices**. In contrast with previous studies, we will use focused **laser beams** to thermally induces the IMT at sub-micron scales.

VO_2 insulator to metal transition

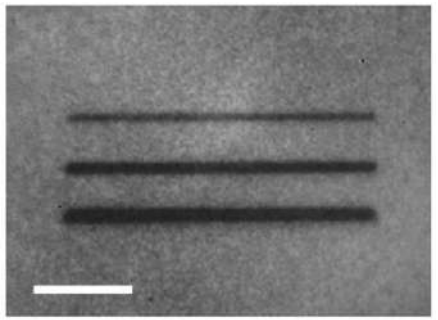


Near-infrared photothermal detectors





New micro-optoelectronic devices using focused laser-induced heating



All white scale bars are 10µm long

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