

IMI

amU

Mechanical engineering  
institute  
Aix Marseille Université



*Forming a community*

*Training through and for research*

*Connecting disciplines*

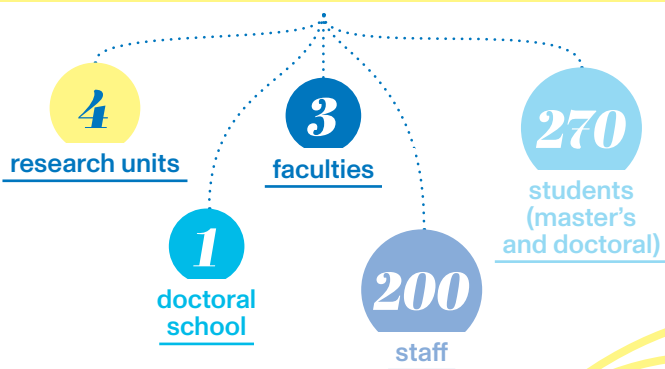
*Strengthening partnerships*

*Acting internationally*

## A major centre for understanding and predicting deformation, movement and transfer mechanisms in fluids and solids

Understanding and predicting the mechanisms of deformation, movement and transfer in fluids and solids is a major challenge in the study and design of many complex physical systems found in nature or manufactured by humans. The institute for mechanical engineering (IMI) is a major national and international centre with nearly 200 researchers in four laboratories committed to top-level research and training in mechanics, acoustics, heat and power, and process engineering. The development of innovative diagnostics and advanced numerical models and methods enables us to tackle a wide range of complex multidisciplinary problems, from fundamental science to applications in industry, health and living systems, as well as natural flows for the environment.

### Forming a community



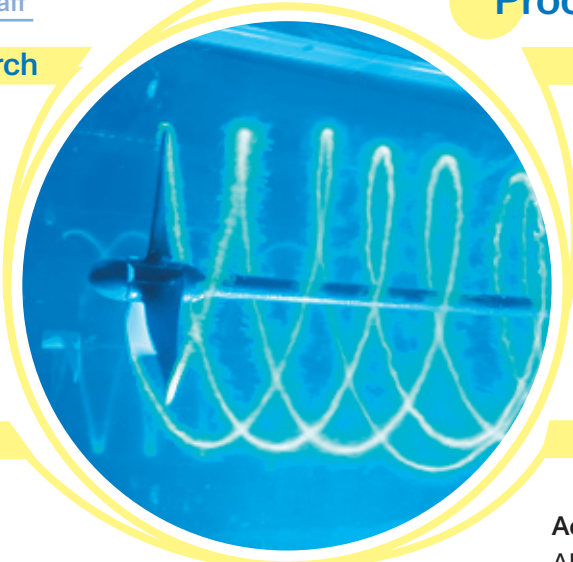
Acoustics  
Fluid mechanics and physics  
Materials  
Solid mechanics  
Heat and energy  
Process engineering

### Training through and for research

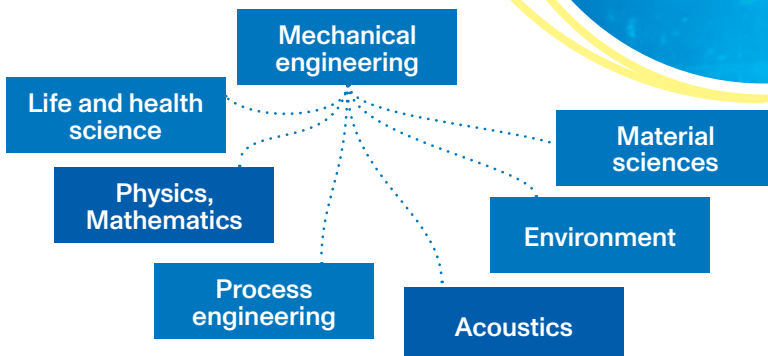
- ▶ Laboratory immersion internships for master's students
- ▶ Support for laboratory → training transfer initiatives
- ▶ Doctoral programme

### Acting internationally

- ▶ International student mobility grants
- ▶ Hosting international researchers



### Connecting disciplines



### Strengthening partnerships

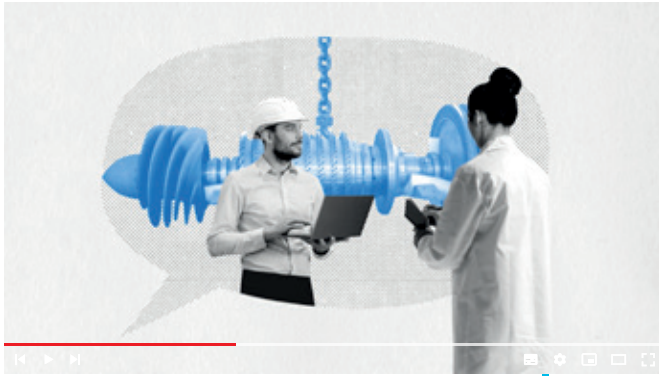
#### Academic partnerships:

AP-HM, Centrale Méditerranée, CEA, CNES, INRAE, IRSN, ONERA...

#### Industrial partnerships:

Airbus, Buffet-Crampon, CMA-CGM, Fives-Pillard, MERCK Santé, Safran, St Gobain Recherche Provence, VEOLIA, VINCI, Yamaha...

Inter-laboratory and interdisciplinary research and postdoctorate calls



Watch the institute's animated film



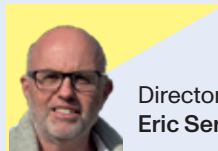
The institute as seen by its members



## Meet our executive office



Deputy research director:  
**Michael Le Bars**



Director:  
**Eric Serre**



Deputy training director:  
**Fabien Candelier**



Project manager:  
**Cédric Fagès**



Deputy partnership director:  
**Pierre Boivin**

Discover the entire governance team:  
<http://url.univ-amu.fr/institut-IMI-gouvernance>

## Focus on our network of platforms

IMI offers access to a network of research platforms that it is working to develop. We provide students, researchers and partners with equipment, skills, tools and services via 11 platforms, 6 of which have the Aix-Marseille Technology Platform label:

- ▶ Process engineering (M2P2)
- ▶ Computational Fluid Dynamics (M2P2)
- ▶ Fire platform (IUSTI)
- ▶ Mechanical characterisation of materials and structures (LMA)
- ▶ Innovative processes for composites and thermoplastics (LMA)
- ▶ Measurement and control of acoustic sources (LMA)

## Contact

Director: Eric Serre

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[www.univ-amu.fr/imi](http://www.univ-amu.fr/imi)



@IMI\_amu



# Training at IMI

**amU** Mechanical engineering  
institute  
Aix Marseille Université

*Training for, through and in research,  
with continuity from master's to doctorate level*

Training for, through and in research,  
with continuity from master's to doctorate level

## Our ecosystem

more than  
**150**

Students in master's and engineering<sup>1</sup>

**120**

PhD students<sup>2</sup>

**6**

key master's

- ▶ Polytech Mechanical, Energy and Civil Engineering course
- ▶ Master's in Mechanics
- ▶ Master's in Mechanical Engineering
- ▶ Master's in Process Engineering
- ▶ Master's in Complex Systems Engineering (Ecole Centrale Méditerranée)
- ▶ Master's in physics

**1**

interdisciplinary doctoral programme

Consult all master's degree specialisations:



**3**

partner faculties

- ▶ Institute of technology (IUT)
- ▶ Faculty of sciences (FS)
- ▶ Marseille polytech

**1**

partner doctoral schools

- ▶ Engineering sciences (ED 353)

<sup>1</sup> students enrolled on master's specialisations attached to the institute  
<sup>2</sup> doctoral students enrolled in our partner doctoral schools

## Our key actions

- ▶ Immersion internships in a research laboratory from 10 to 14 weeks
- ▶ Proposals for CIFRE theses that offer PhD grants in collaboration with socio-economic partners
- ▶ Development of an educational platform for student research and development projects
- ▶ Funding for innovative TP resulting from research initiatives
- ▶ Students supported for international mobility
- ▶ Development of a doctoral programme in conjunction with the "Engineering Sciences" doctoral school (ED 353)

2021-2023

**33**

students supported

**20**

CIFRE theses proposed

**1**

funded platform

**4**

lab transfers

**8**

international mobilities

"An IMI grant enabled me to take part in a unique 3-month internship that gave me a real insight into the world of research. This first positive experience convinced me to choose a research-oriented M2 and then go on to do a PhD."

Joséphine Gissinger  
PhD student

## Our international training initiatives

CIVIS alliance  
European civic university

Master Erasmus Mundus Master Waves  
(Aix Marseille Université, École Centrale Méditerranée, Univ. Coimbra, Univ Polytechnica Valencia)

Master's double degree in  
Mechanical Engineering  
with Univ. Ferrara

## Contact

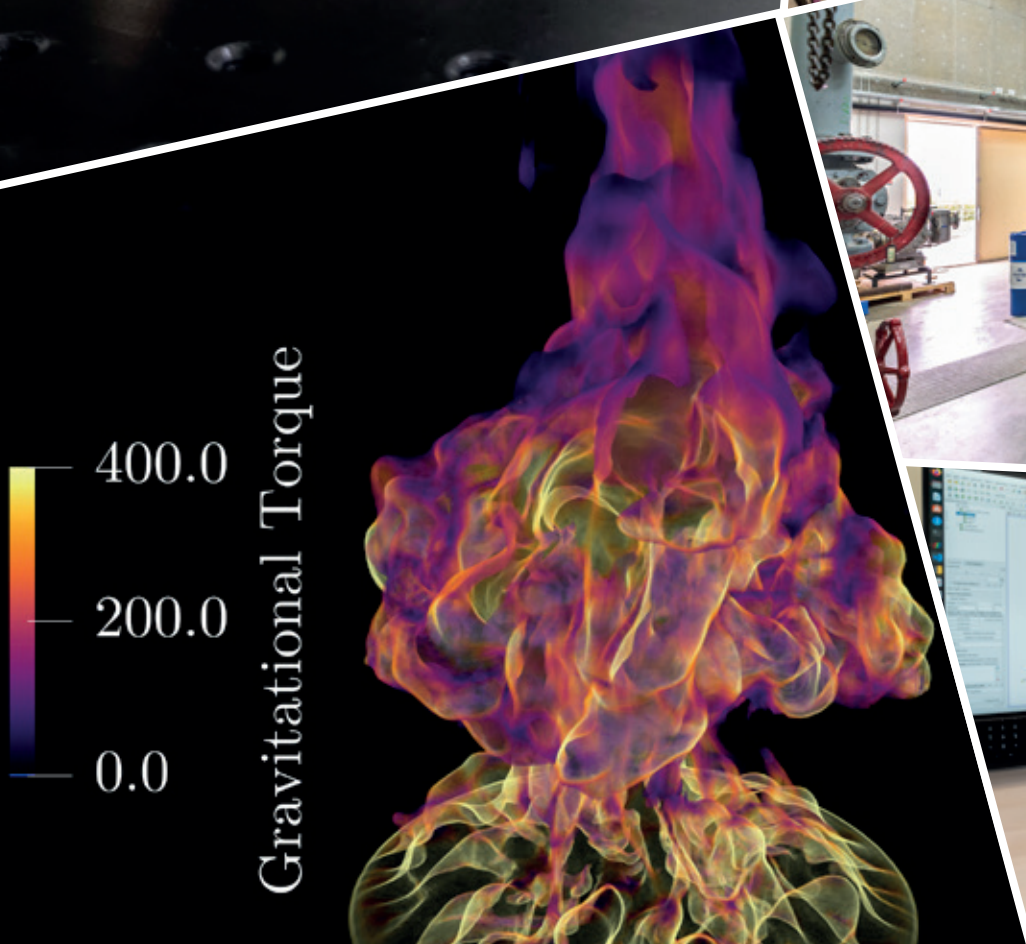
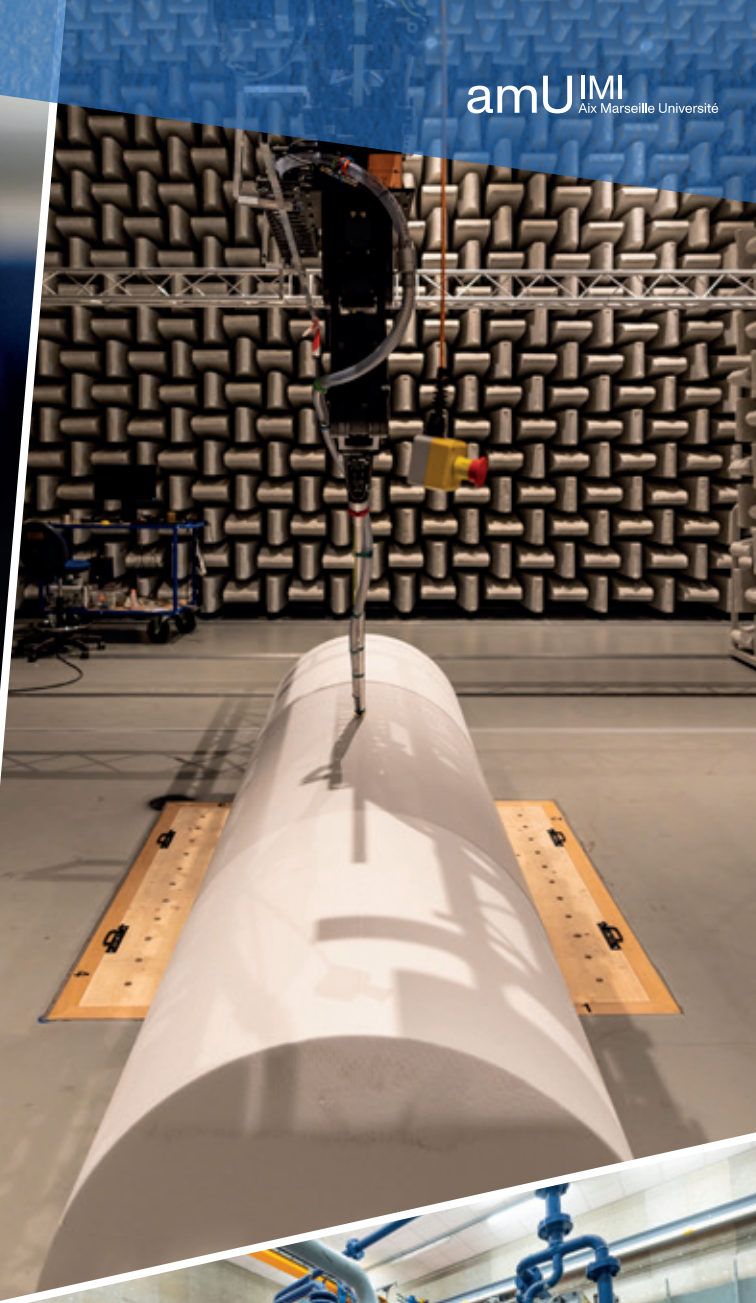




# Research at IMI

**amU** Mechanical engineering  
institute  
Aix Marseille Université

*Bringing together the mechanical and engineering strengths of the Aix-Marseille site to consolidate our international scientific position*



**Bringing together the mechanical and engineering strengths of the Aix-Marseille site to consolidate our international scientific position**

## Research ecosystem



research units

### Advanced science and technology

- ▶ Institute for research into non-equilibrium phenomena (IRPHE)
- ▶ University institute for industrial thermal systems (IUSTI)
- ▶ Mechanics and acoustics laboratory (LMA)
- ▶ Mechanics, modelling and clean processes laboratory (M2P2)



## Our main areas of research

- ▶ Engineering for health (biomechanics, pharmaceutical processes, etc.)
- ▶ Energy transition (wind, nuclear, solar, biomass, etc.)
- ▶ Transport and sustainable mobility (aeronautics, space, automotive)
- ▶ Natural and living environments (fire, geophysics, granular, water treatment, plants, etc.)
- ▶ Urban environments and sustainable cities (building heating and acoustics, pollutant dispersion, civil engineering, etc.)

## Our approaches to modelling and experimentation

The institute brings together diverse and complementary approaches in its four laboratories, focusing on theoretical and numerical modelling as well as experimentation. This is a key focus for our institute, which aims to strengthen development synergies and the sharing of tools and platforms, both digital and experimental, from fundamental to applied research:

- ▶ A wide range of experiments, from fundamental research to large-scale facilities linked to industrial issues or related scientific fields.
- ▶ Modelling ranges from the development of physical models to advanced numerical methods in simulation codes for complex flows.

*"The aim of the IMI-funded project I'm working on is to understand how ultrasound affects the microenvironment of bone cells. The long-term objective will be to be able to personalise treatment for bone diseases such as osteoporosis. I chose this subject because improving techniques for medicine is close to my heart and, more specifically, it was going to help me in my specialisation in imaging and microfluidic techniques. My work is shared between two of the Institute's four laboratories, the IRPHE and the LMA, which enables me to carry out interdisciplinary research and to acquire in-depth knowledge of microfluidics, on the one hand, and acoustics on the other, which is essential to the success of this research. After this postdoctorate in Marseille, I hope to be able to gain some research experience abroad, and why not, outside Europe."*

**Elisa Ghiringhelli**  
Postdoctoral student  
IMI-IRPHE

## Our key actions

- ▶ Funding for research projects
- ▶ Research grants for M1 students
- ▶ Recruitment of postdoctoral students
- ▶ Invitation to international researchers

2021-2023

**7**  
calls for research projects

**€100**  
thousand  
per year

**16**  
awardee projects

**8**  
funded postdoctoral students

**11**  
guest researchers

## Contact



## Strengthening and developing special links with academic and institutional players and the socio-economic and cultural world

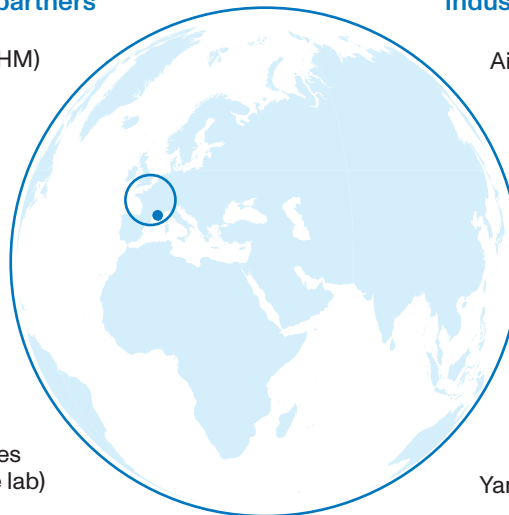
"We have been working with the M2P2 laboratory and the IMI institute for several years. Fives Pillard's move to the Technopôle de Château-Gombert in 2020 has accelerated our collaboration thanks to its geographical proximity. The collaboration took on concrete form in 2021 with the setting up of a CIFRE thesis for the development of numerical methods for the H2 transition of our premix burners. This R&D work will enable us to address our customers' decarbonisation issues while continuing to offer ultra-low NOx technologies. The M2P2 laboratory, with its links to the IMI Institute, brings a genuinely scientific approach to our approach, with staff who very quickly understood our industrial challenges."

Fives Pillard, a subsidiary of the Fives group and market leader in burners and combustion systems

### Our key partners include

#### Academic partners

Marseille public university hospital system (AP-HM)  
Centrale Méditerranée School  
French atomic energy commission (CEA)  
National centre for scientific research (CNRS)  
French national research institute for agriculture, food and the environment (INRAE)  
Institute for radiological protection and nuclear safety (IRSN)  
Office national d'études et recherches aérospatiales (ONERA - French aerospace lab)



#### Industrial partners

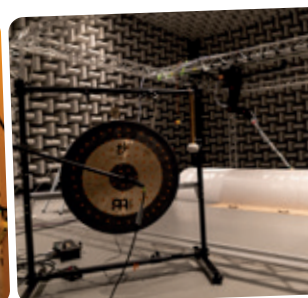
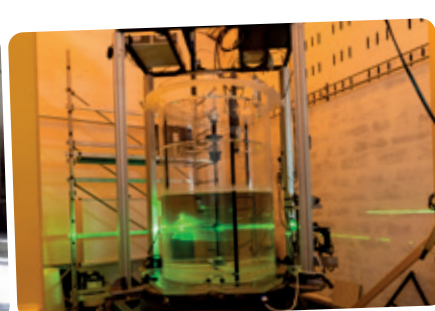
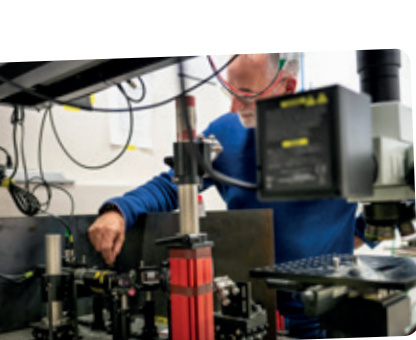
Airbus, aircraft manufacturer  
Buffet-Crampon, instrument manufacturer  
CMA-CGM  
Fives-Pillard, burners and combustion systems  
Merck Santé  
Safran  
Saint-Gobain Recherche Provence  
VEOLIA  
VINCI  
Yamaha

### Our key actions

CIFRE Thesis Day, to present and develop grants in collaboration with socio-economic partners

Doctoral training activities with partners from the socio-economic world

Provision of equipment and skills via 11 platforms, 6 of which have been accredited



### Contact

Deputy partnership director: Pierre Boivin

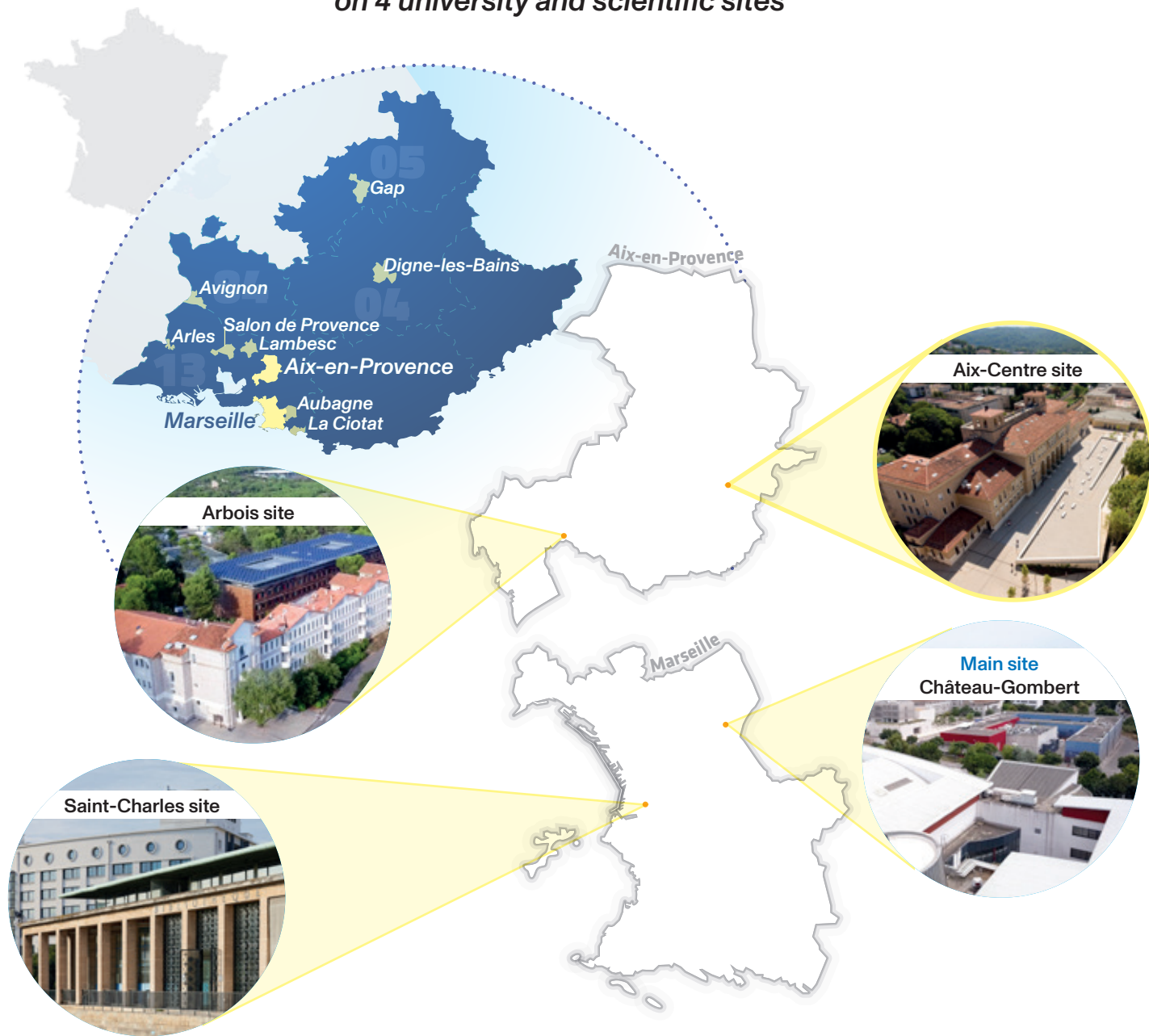
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*The IMI institute brings together teams  
on 4 university and scientific sites*



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The Aix Marseille Université institutes are coordinated by the Amidex foundation



The Aix-Marseille Excellence Initiative, a consortium between Aix Marseille Université and 8 partners