Université Paris-Saclay

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Distributed and Parallel Computing (M2 DiPaC)

Master's degree
Specialisation Computer Science
Enrolment type
Formation initiale
Language(s) of instruction
English

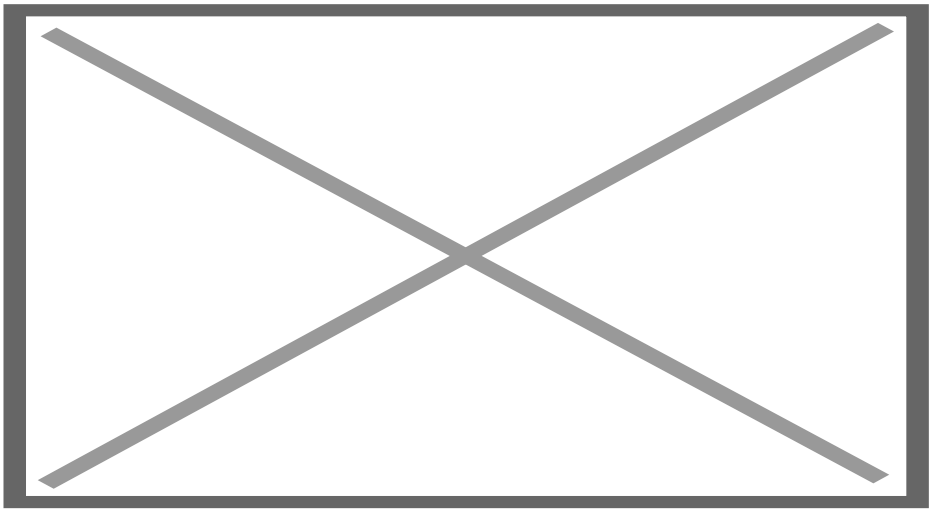
The **M2 DiPaC** master's program focuses on advanced topics in **high-performance computing (HPC)** and **distributed computing** on large-scale systems. Students learn to **design fast, scalable, and robust solutions** that address the heavy computational demands of applications in **artificial intelligence (AI)**, **big data analytics**, and **scientific** and **quantum computing**. The program prepares graduates for careers in **engineering** and **Ramp;D**, or **doctoral studies** in parallel and distributed computing.

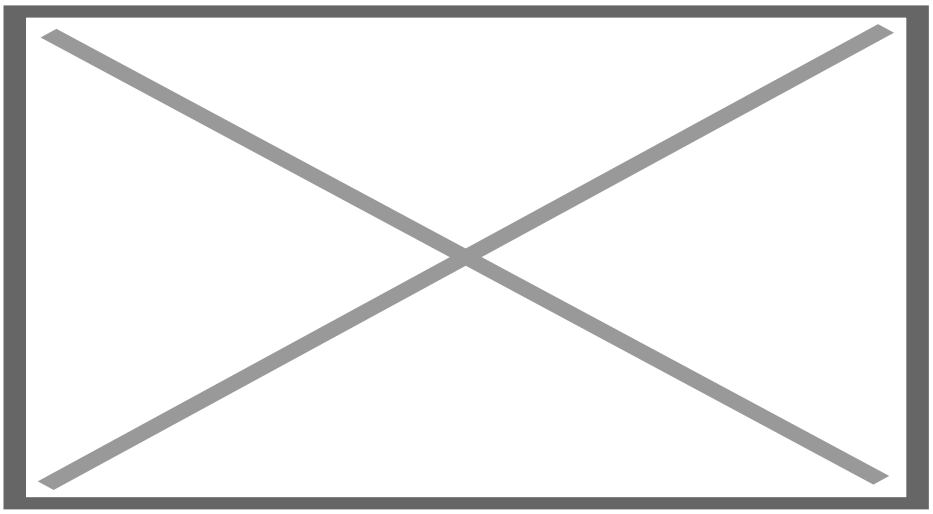
The curriculum includes **seven core disciplinary courses** in **high performance**, **parallel**, and **distributed computing**. In addition, students choose **two elective courses** to further **specialize** either in **high performance data analysis and AI (HPDA)** or in **hybrid high performance/quantum computing (HQI)**. In addition, **one soft-skill course** from the university catalog reinforces transferable **professional skills** that support their long-term career development. A **mandatory 6 month internship** on M2 DiPaC-related themes completes the program.

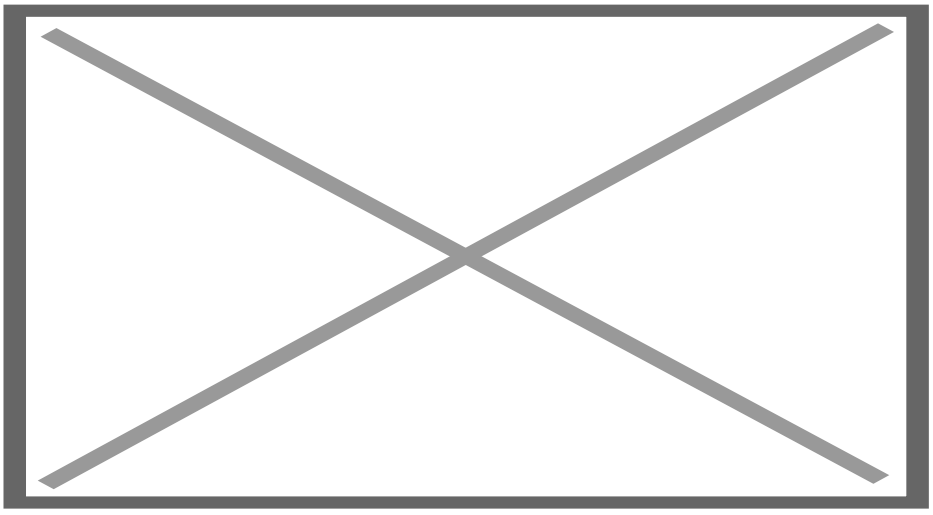
The program's **official language is English**; all courses take place and course materials are provided in **English**. Most of our faculty are also fluent in **French**; hence interaction in French is possible in the courses and assignments (homework, exams, etc.) if needed.

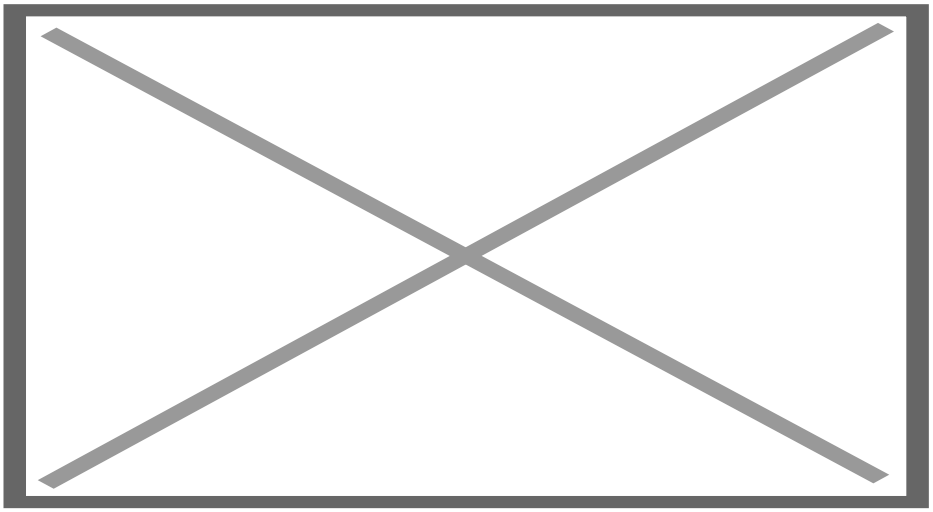
The program is closely integrated within the Paris-Saclay ecosystem of research laboratories and industrial partners.

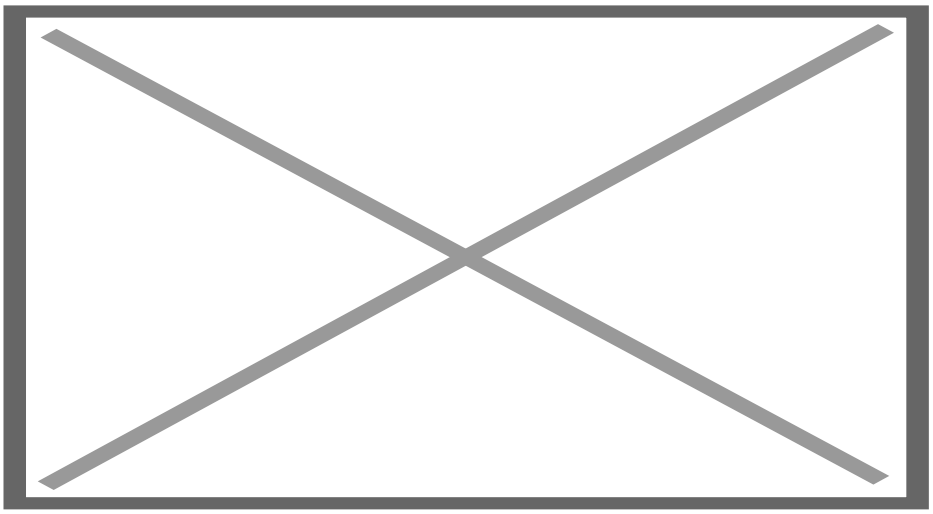
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Information

- Overview
- Application requirements
- Schedule

Présentation

Skills

M2 DiPaC students will gain competency and skills in:

- Parallel programming models and performance engineering on CPUs/GPUs and distributed clusters/supercomputers.
- Design and analysis of distributed algorithms with theoretical guarantees.
- Scalable data analysis and AI skills: training, inference, large-scale distributed data analytics.
- Hybrid HPC+quantum simulation through exact and approximation techniques.
- Scheduling and load balancing of parallel workloads on clusters and clouds.
- Code profiling, tracing, bottleneck diagnosis, performance tuning techniques.
- Software engineering for HPC: modern C++, testing, CI, reproducibility.

- Version control with Git and rigorous documentation.
- Technical communication and project scoping in research and industry contexts.
- Responsible, reliable, and sustainable computing practices.

Objectives

Computer systems are evolving toward higher efficiency and richer functionality across three major, interconnected scientific fields:

- **Distributed systems** deliver connectivity and dependable operation across the Internet, clouds, clusters, and sensors, addressing hard problems in synchronization, security, concurrency, and robustness.
- **High-performance and parallel computing (HPC)** tackles intensive workloads in science and AI by exploiting supercomputing architectures and rigorous performance engineering.
- **Quantum computing** provides algorithms and hardware that exploit quantum parallelism to achieve gains unreachable by classical paradigms.

Building on the foundations that **M1 DiPaQ** establishes in HPC, distributed systems, and quantum computing, **M2 DiPaC** specializes on **advanced topics** in **HPC** and **distributed algorithms for large-scale systems**. Students learn to design **fast**, **scalable**, and **robust solutions** for applications in AI, big data analytics, scientific simulations, and quantum-enabled workflows. Students have the opportunity to specialize either in **high performance data analysis (HPDA)** or **hybrid HPC/quantum computing (HQI)** through elective courses.

Knowledge objectives:

- Parallel programming models and performance engineering on modern supercomputers and accelerators.
- Large-scale distributed algorithms and systems: replication, consensus, consistency, mobile agents, and nature-inspired algorithms with robustness and performance guarantees.
- Big data analysis, machine learning, and AI algorithms with massive computational challenges (HPDA)
- Quantum algorithms and simulation using both classical/HPC or quantum workflows (HQI)

Skill objectives:

- Building high-quality parallel and distributed algorithms and software that meet latency, throughput, and performance targets on target HPC architectures.
- Developing and analyzing scalable, robust algorithms with theoretical guarantees on scalability, consensus, termination, and fault tolerance.
- Optimizing HPC code across the stack: complexity, memory locality, vectorization, accelerator use, communication, I/O, and networks.

Resources and practice:

- Access to university clusters and partner supercomputers for hands-on labs, course projects, code development, and tuning.
- Use of open-source toolchains and libraries widely adopted by the HPC community.
- Acquiring modern HPC software engineering practices with advanced C++, IDEs, version control (git), documentation, and continuous integration.

Débouchés

Career prospects

After a Master's + PhD: researcher or lecturer
R&D Engineer
maintenance engineer
Subject to successfully completing a civil service competitive exam, graduates will be eligible for positions as design engineers or researchers in national research organisations.
Lecturer (after a PhD)
Research Engineer
Data scientist
Development engineer
Technical support engineer
After Master and PhD : reseacher or assistant professor or professor

Further Study Opportunities

Engineering, research and development
Data Scientist, Data Analyst, Ingénieur·e en Machine Learning dans des secteurs innovants (tech, finance, santé, énergie, etc.) ;
PhD

Calendar

Start of programme (indicative date)
04/09/2026
End of programme (indicative date)
30/09/2027
Admission

Admission Route

Computer Science

Capacity

Available Places

20

Target Audience and Entry Requirements

- **Audience.** M2 DiPaC is the natural continuation of M1 DiPaQ for students aiming to specialize in advanced high-performance, parallel, and distributed computing.
- **Prerequisites.** Strong computer science background with basics in parallel programming and distributed systems. Solid mathematics (especially linear algebra) and programming skills are expected.
- **Admissions from other related tracks.** Outstanding students from related master tracks can be admitted if they already have some fundamentals in parallel or distributed computing. If needed, they will be allowed to take selected M1 DiPaQ courses as electives to close gaps.
- **Double-degree pathway.** We routinely admit exceptional engineering students finishing their fourth year (M1 equivalent) at nearby Paris-Saclay schools (CentraleSupélec, Polytech Paris-Saclay, ENSTA Paris, ...) as double-degree students, who desire to complete their fifth year at the engineering school in parallel with M2 DiPaC. A dedicated arrangement between two programs allows to study in both, with possible course waivers subject to approval by the master's coordinators on each side. If you plan to apply, please contact the M2 DiPaC coordinator and your academic coordinator at the engineering school in advance.
- **Positioning with respect to M2 QMI.** While M2 DiPaC offers some optional quantum computing courses aligned with classical/HPC workflows, applicants seeking an exclusive focus on advanced quantum information science are encouraged to apply to our partner program M2 QMI.

A limited number of scholarships (Eiffel, IDEX, Quantum Saclay) are available for exceptional candidates.

Période(s) de candidature

Inception Platform

From 15/04/2026 to 30/05/2026

Supporting documents

Compulsory supporting documents

Motivation letter.

A letter detailing the motivation and reasons for willing to study parallel and distributed computing in the M2 DiPaC master's program in the light of previous studies and experiences as well as future career plans.

All transcripts of the years / semesters validated since the high school diploma at the date of application.

Grades of all courses since high school.

Curriculum Vitae.

A CV detailing all previous studies, internships, trainings, work experience (if any), distinctions and awards, as well as other personal interests and activities.

Additional supporting documents

Copy diplomas.

Letter of recommendation or internship evaluation.

Document at your convenience.

VAP file (obligatory for all persons requesting a valuation of the assets to enter the diploma).

only needed in case you have officially validated your prior professional experience to count as equivalent to a university degree

Supporting documents :
- Residence permit stating the country of residence of the first country
- Or receipt of request stating the country of first asylum
- Or document from the UNHCR granting refugee status
- Or receipt of refugee status request delivered in France
- Or residence permit stating the refugee status delivered in France
- Or document stating subsidiary protection in France or abroad
- Or document stating temporary protection in France or abroad.

Programme

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di le c
[M2 DiPaC] GPU programming	3	Semester 1	10.5		10.5				
Charger le détail									
[M2 DiPaC] Data-parallel C++ programming	3	Semester 2	10.5		10.5				
Charger le détail									
[M2 DiPaC] Mobile agent algorithms	3	Semester 1	10.5	10.5					
Charger le détail									

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	di le c
[M2 DiPaC] Natural algorithms	3	Semester 1	10.5	10.5					
Charger le détail									
[M2 DiPaC] Tensor computations	3	Semester 1	10.5		10.5				
Charger le détail									
[M2 DiPaC] Scientific computing	3	Semester 2	10.5		10.5				
Charger le détail									

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d l
UE disciplinaire d'ouverture obligatoire									
[DKAI] Large-Scale Data Management and Data Quality	3	Semestre 1	12	9					
Charger le détail									
Specialization course to choose from a list									
[M2 DiPaC] ZX calculus	3	Semester 1	10.5	10.5					
Charger le détail									
[AI] Machine Learning Basics 1	3	Semestre 1							
Charger le détail									
[AI] Machine Learning Basics 2	3	Semestre 2	15	6					
Charger le détail									
[AI] Signal Processing	3	Semester 2							

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	d l
Charger le détail [DKAI] Graph Analytics	3	Semestre 2	12	9					
Charger le détail [M2 DiPaC] Course from other master's program	3	Annualized	10.5	10.5					
Charger le détail									

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practic class
Elective course								
English	3	Semester 2	10.5	10.5				
Charger le détail								
French language	3	Semester 2	10.5	10.5				
Charger le détail								
UE libre	3	Semestre 2						
Charger le détail								
Elective soft-skill course								
The art of fabricating tangible surfaces	3	Semestre 2	10.5	10.5				
Charger le détail								
CAD design for 3D printing	3	Semestre 2	10.5	10.5				
Charger le détail								
Computer Science and Environment	3	Semester 2	10.5	10.5				
Charger le détail								
Entrepreneurship and innovation	3	Semester 2	10.5	10.5				
Charger le détail								
French language	3	Semester 2	10.5	10.5				

Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practic class
Charger le détail English	3	Semester 2	10.5	10.5				
Charger le détail [M2 DiPaC] Elective soft-skill course	3	Annualized	10.5	10.5				
Charger le détail								

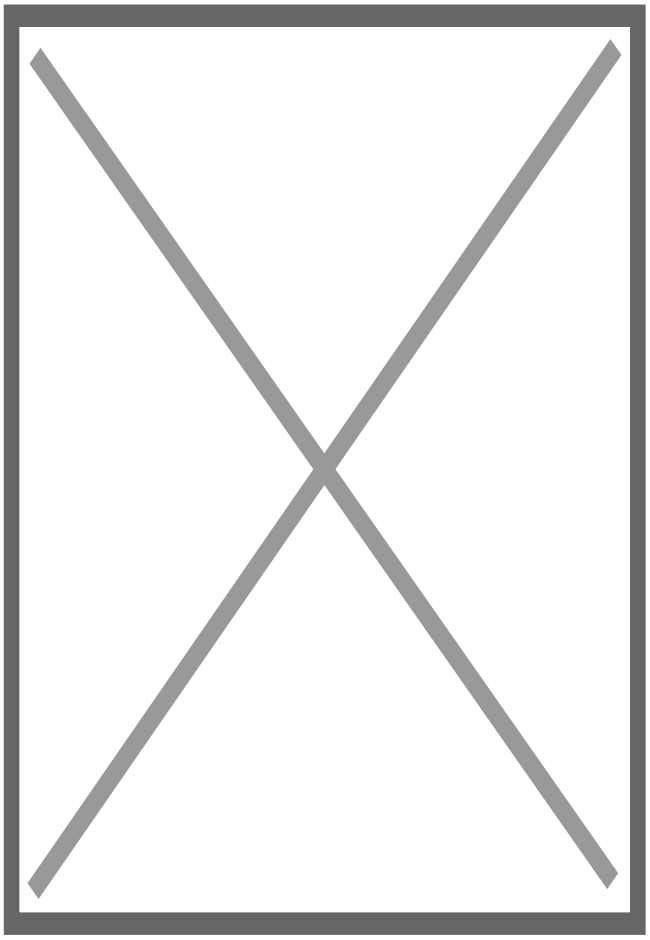
Subjects	ECTS	Semester	Lecture	directed study	practical class	Lecture/directed study	Lecture/practical class	directed study/practical class	distan learn cour
[M2 DiPaC] Internship	30	Semester 2							
Charger le détail									

Teaching Location(s)

ORSAY
GIF SUR YVETTE

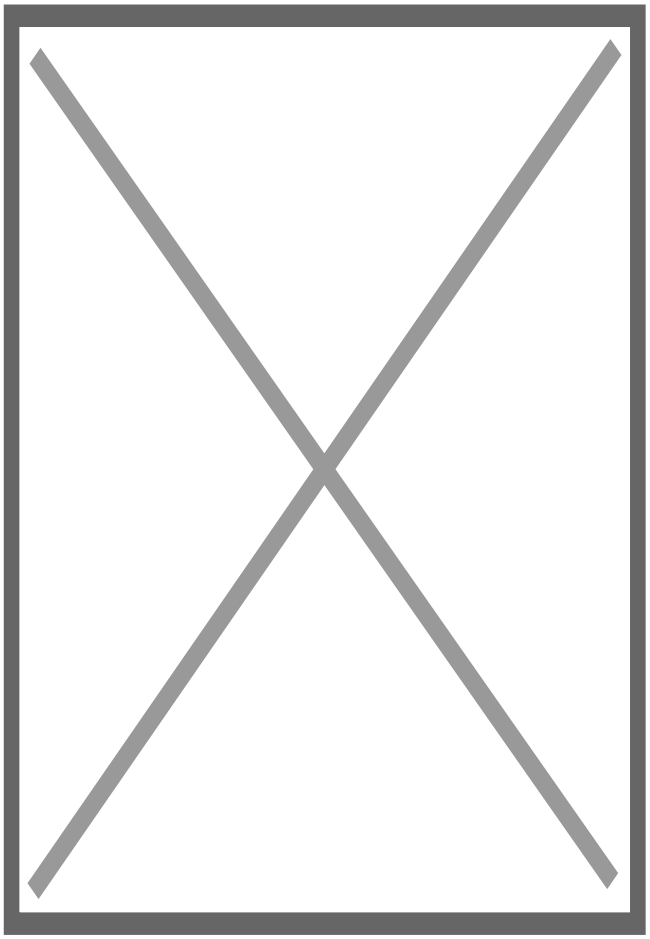
Training campus

Javascript est requis pour visualiser cette carte.



Orsay Bures

Orsay / Bures-sur-Yvette
Bus 4607, 4626
RER B Orsay ville ou Bures-sur-Yvette
Voir
Library
Community center



Saclay Moulon

Saclay / Gif-sur-Yvette / Orsay
Bus 4606 / 4609 / 4611 / 5154
RER B Le guichet
Voir
Student restaurant (CROUS)
Library
Sports facilities
Student residence

Contact

- **Janna Burman**

  PR
- **Oguz KAYA**

http://www.universite-paris-saclay.fr/formation/master/informatique/distributed-and-parallel-computing-m2-dipac