

Robotics Master

Presentation Outline

- Microengineering section and program offer
- Microengineering and Robotics – Historical and technological background
- Robotics Master - detailed program structure
- Minors of the section
 - Photonics
 - Biomedical technologies
 - Imaging
- Semester projects, industry internships, master thesis
- Beyond your studies
- Testimonies and teaser movies
- General student info and contacts

Welcome to Robotics !

Download the
«FULL»
Presentation

QR



Prof. Francesco Mondada
Conseiller d'étude
Master Robotique



Prof. Christophe Moser
Directeur de section
Microtechnique

Robotics master



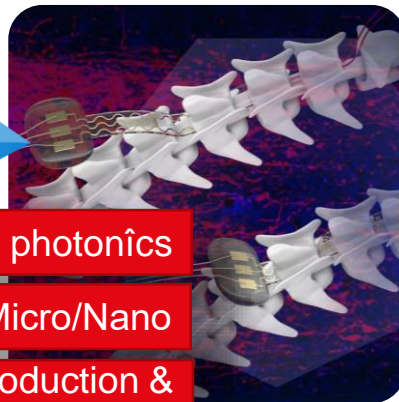
Industrial

Mobile

Medical



Microengineering master



Optics & photonics

Micro/Nano

Advanced production & manufacturing

Minors

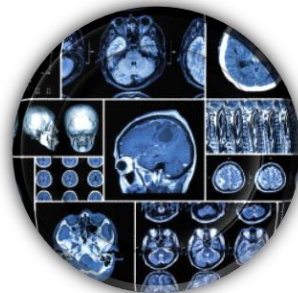
Optics & Photonics



Biomedical Technologies



Imaging



Microengineering and Robotics

Historical and technological background

History of Microengineering

The Jaquet-Droz Automata
(*La Chaux-de-Fonds* - 1768 and 1774)



«The earliest ancestors of Modern Robotics»

Le dessinateur
(2000 pieces)



History of Microengineering

2009 – Spiral made of Silicon

Institut de Microtechnique, Patek-Philippe, *Neuchâtel*

Adapt advanced Microfabrication techniques
to build Watchpieces made of Silicon

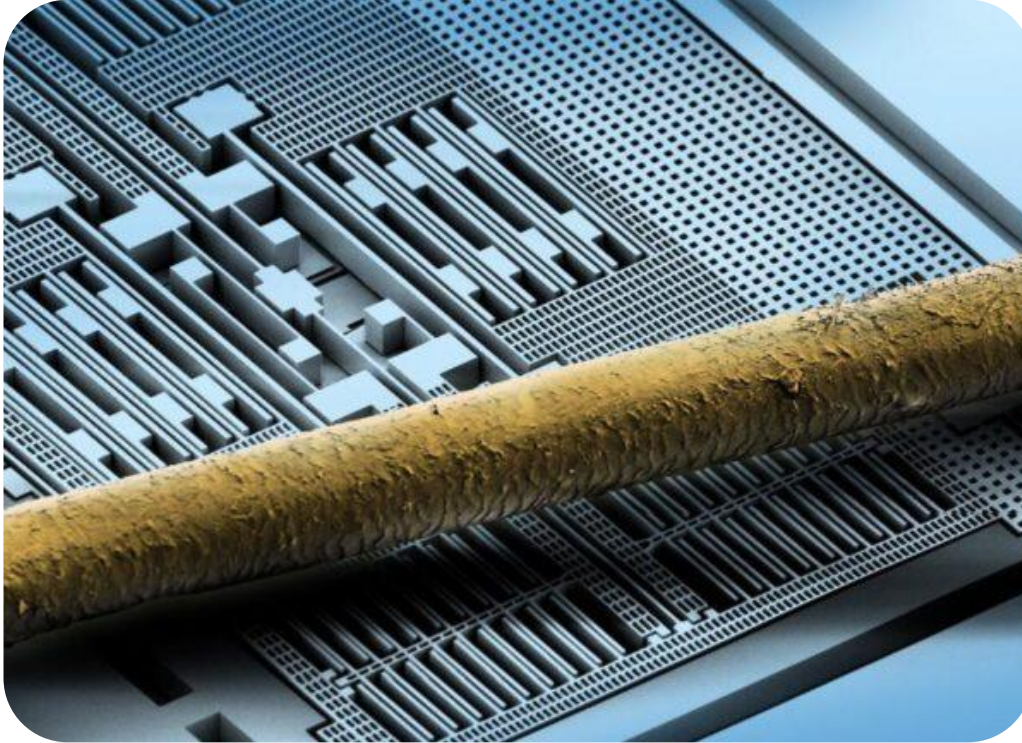
Spot Magn 5.6 27x Det SE WD 14.4 IMT-SAMLAB 1 mm



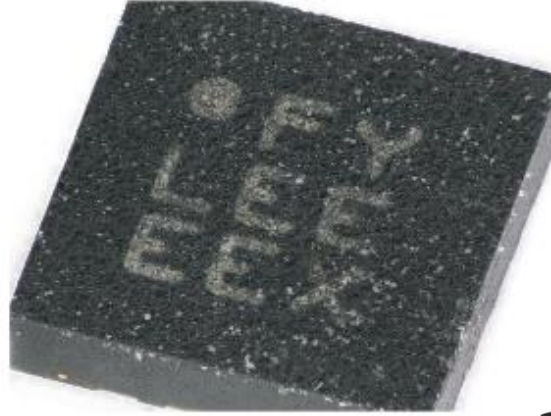
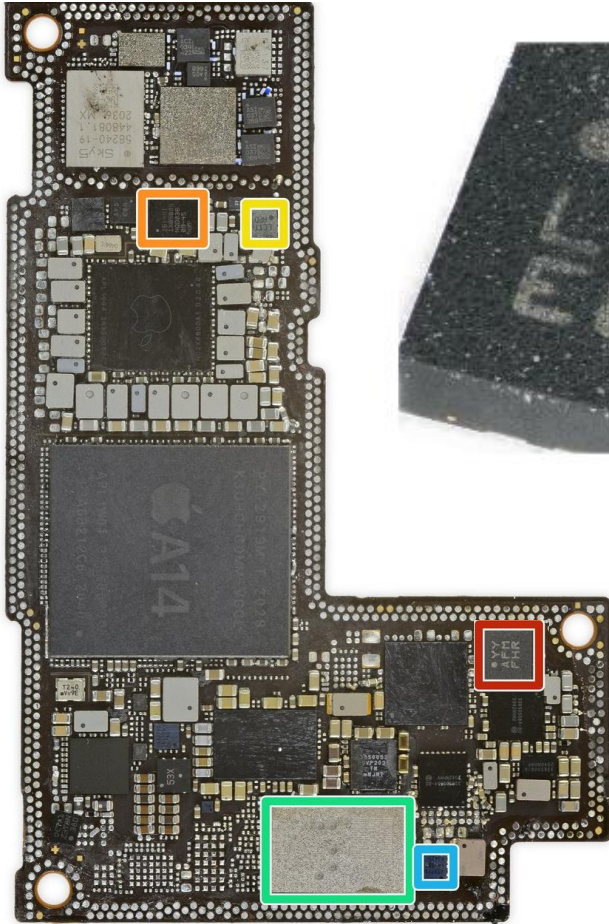
PATEK PHILIPPE
GENEVE



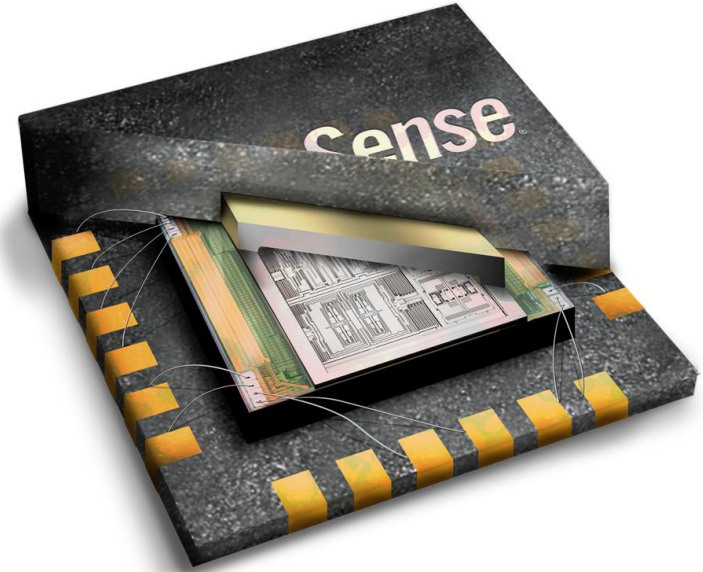
Microsystems



Microsystems and Motion Sensors

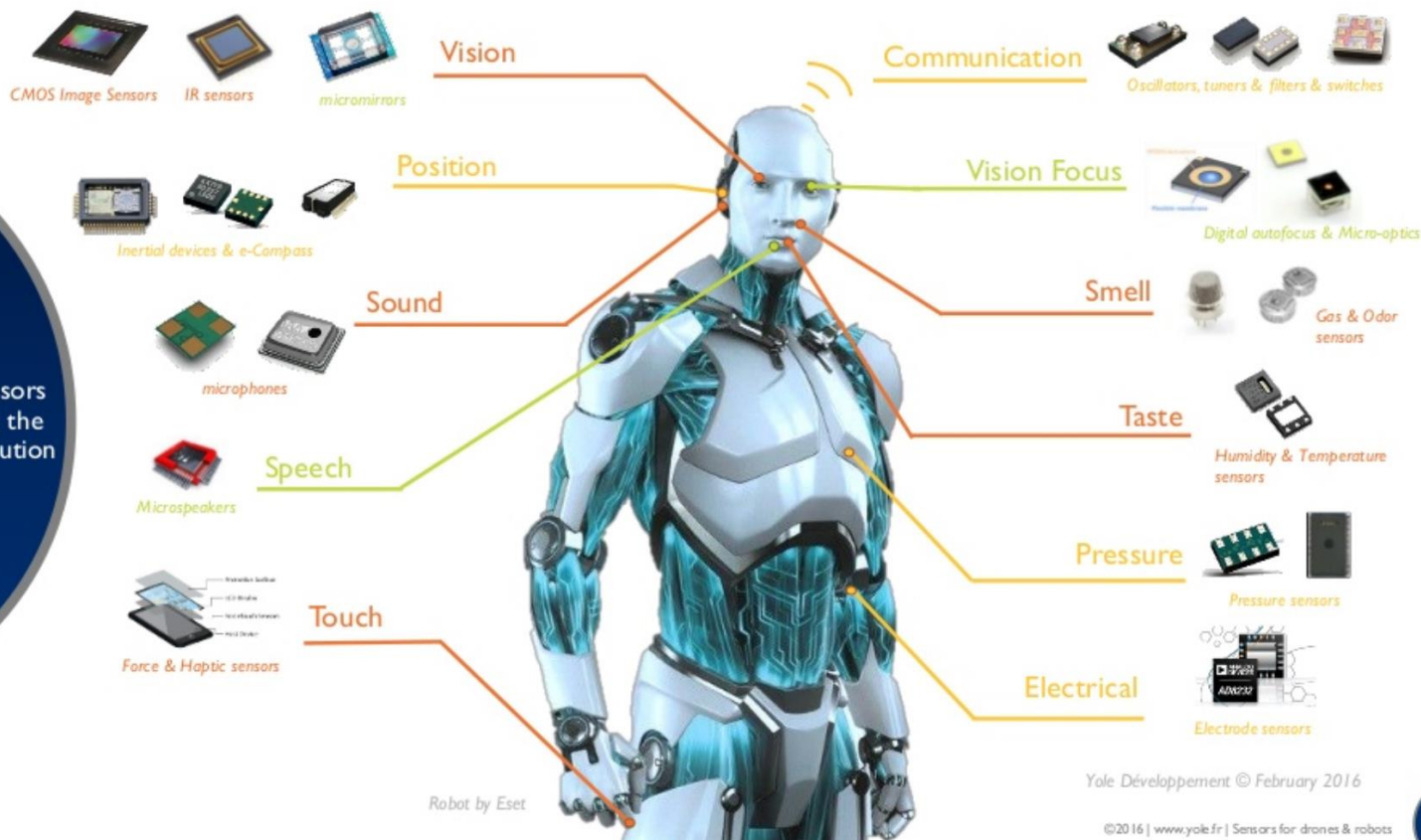


- Accelerometers: X, Y, Z
- Gyroscope: Roll, Pitch, Yaw
- Magnetometer: X, Y, Z
- GPS



Robotics and Sensing

Mems & sensors
 are enabling the
 robotic revolution



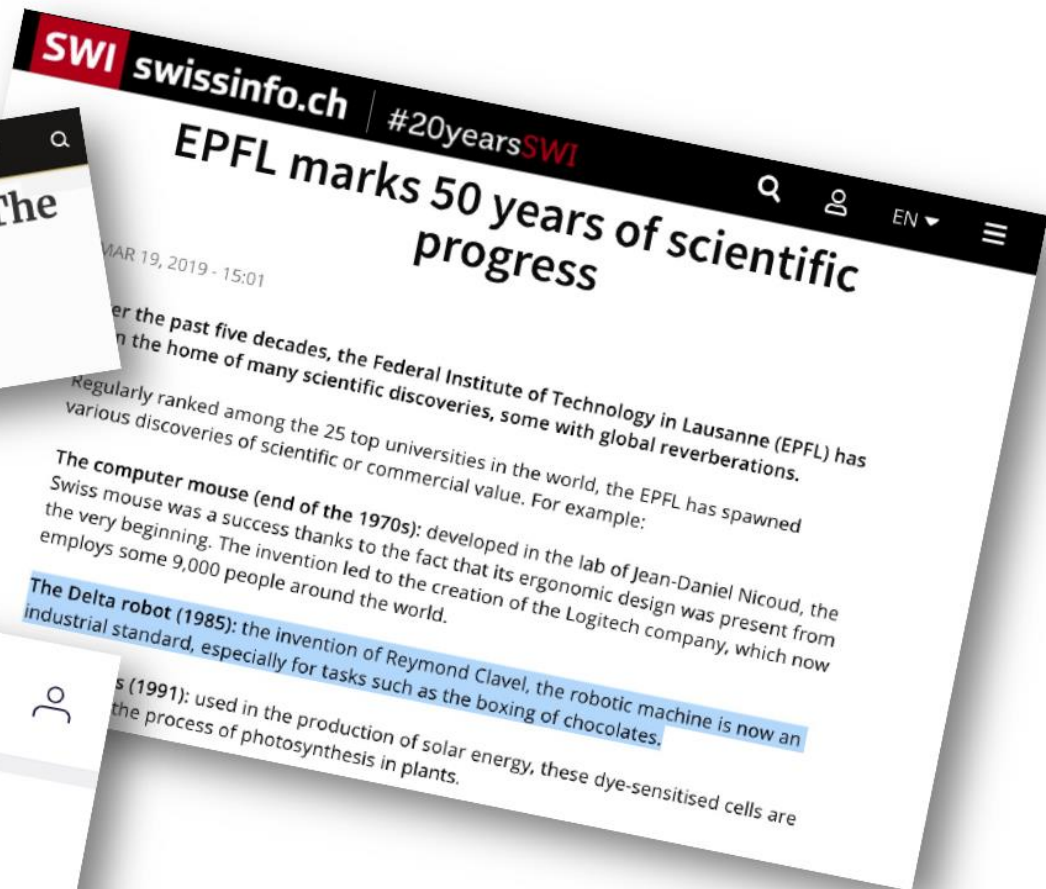
Stabilized drones, stabilized cameras



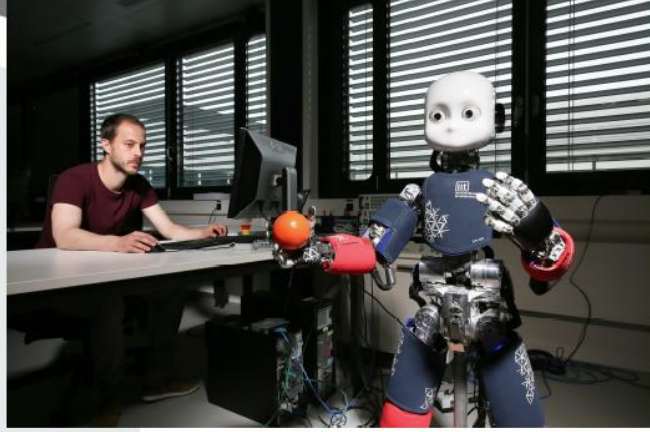
Machine Learning, Artificial Intelligence

Mind controlled Robots





Robotics



Prof. Aude Billard



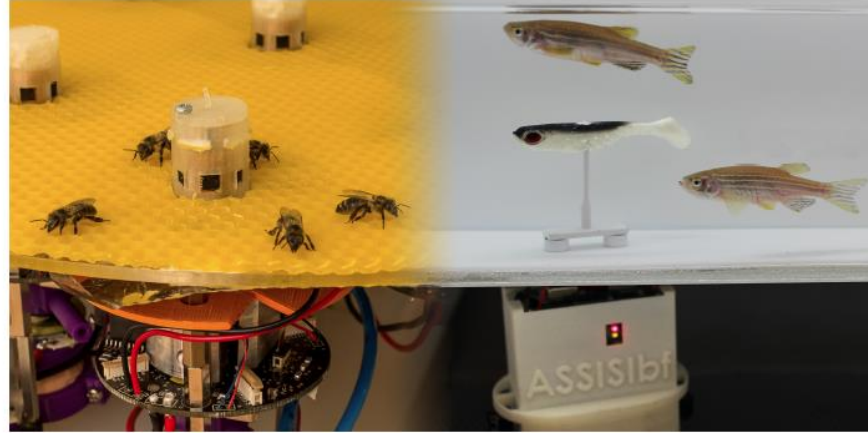
Prof. Dario Floreano



Prof. Auke Ijspeert

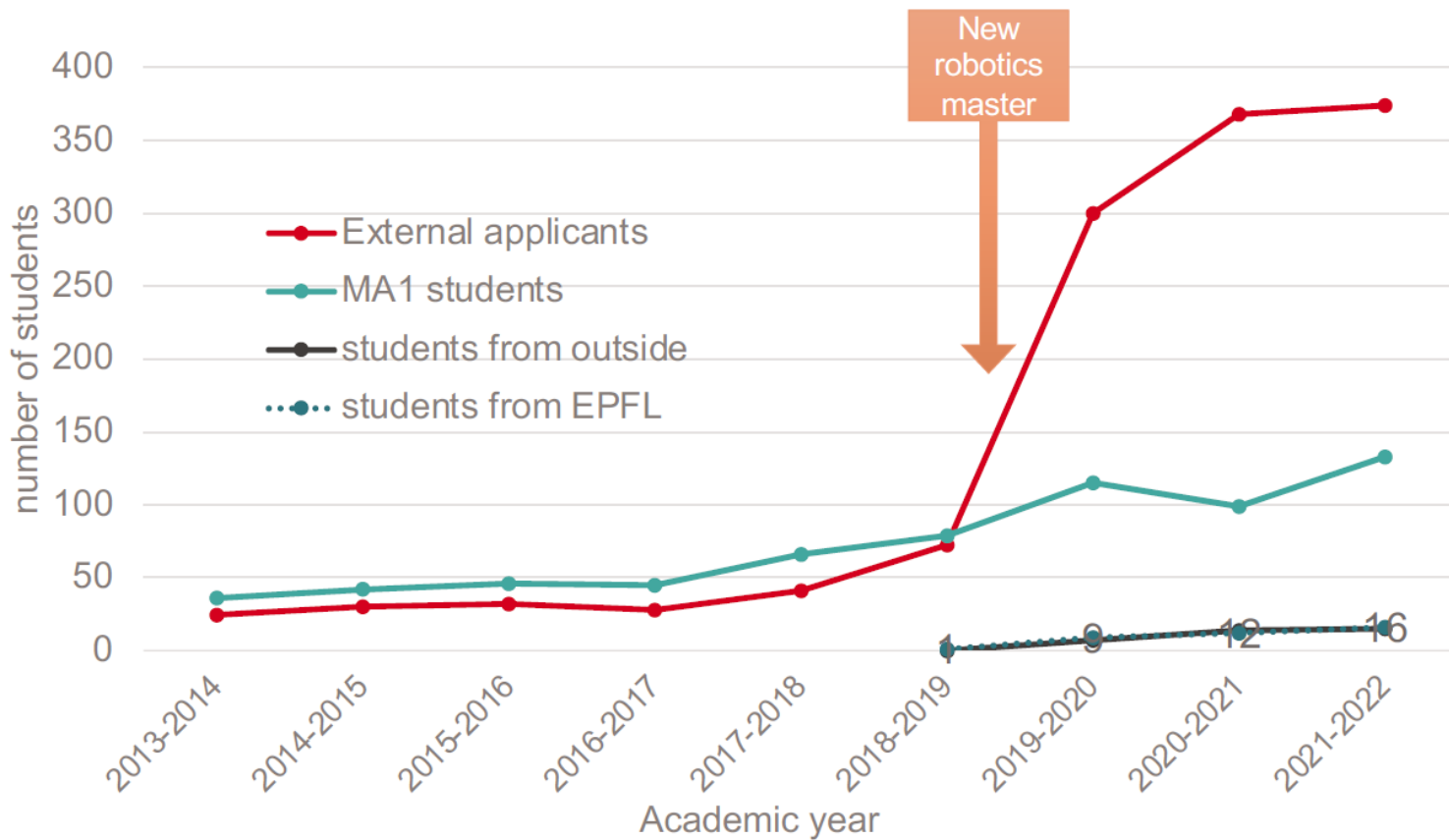


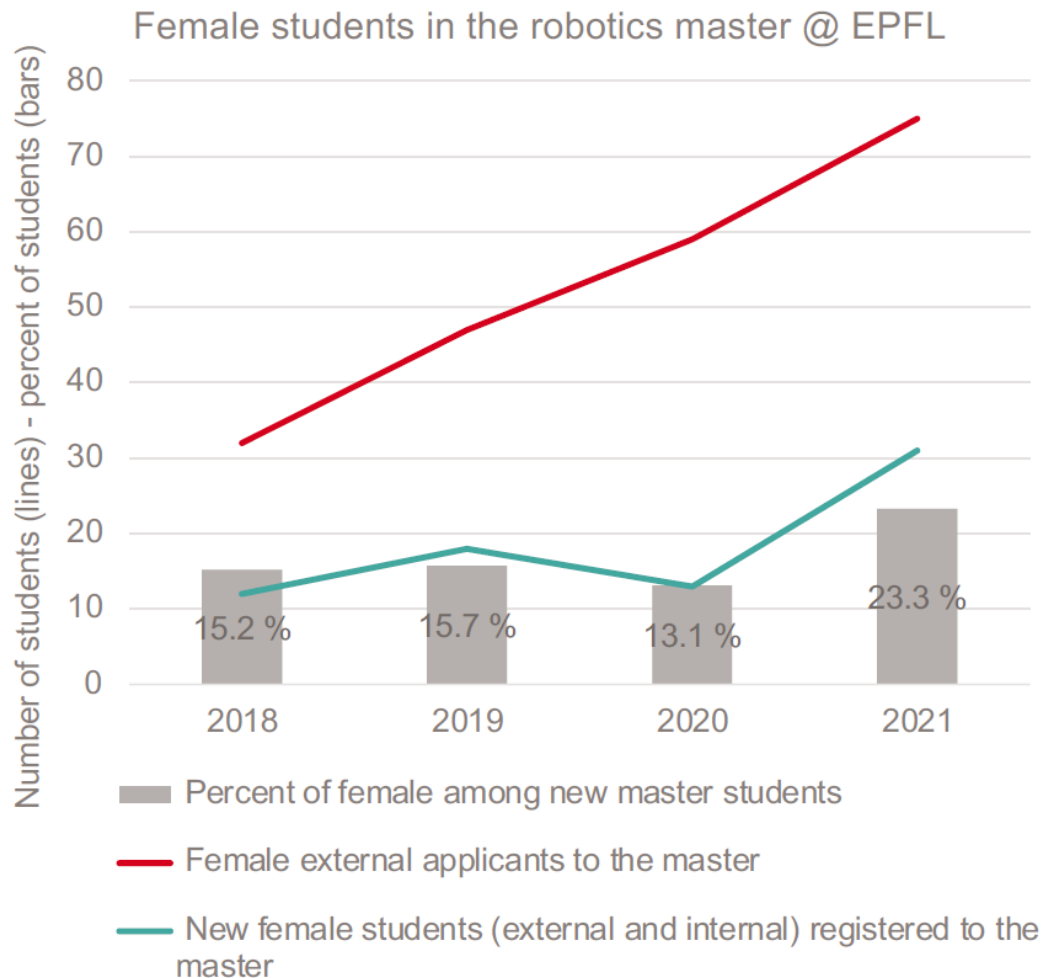
Prof. Silvestro Micera



Prof. Francesco Mondada

Robotics master numbers





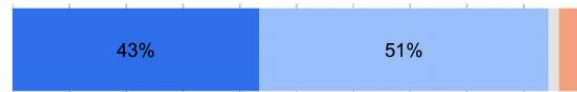
Diversité (écoles de provenance de nos candidats externes)

Technische Universität München	Allemagne
Technische Universität Wien	Autriche
Université Catholique de Louvain	Belgique
McGill University, Montreal	Canada
University of British Columbia, Vancouver	Canada
University of Toronto	Canada
University of Waterloo	Canada
Shanghai Jiao Tong University	Chine
The Hong Kong University of Science and Technology	Chine
Tsinghua University, Beijing	Chine
Universitat Politècnica de Catalunya, Barcelona	Espagne
Cornell University, Ithaca	Etats-Unis
Harvard University, Cambridge	Etats-Unis
University of California, Santa Barbara	Etats-Unis
University of Illinois at Urbana-Champaign	Etats-Unis
Ecole Polytechnique, Palaiseau	France
National Technical University of Athens	Grèce
Indian Institute of Technology Delhi	Inde
Indian Institute of Technology Kanpur	Inde
Indian Institute of Technology Madras	Inde
Politecnico di Milano	Italie
Politecnico di Torino	Italie
Università degli Studi di Roma "La Sapienza"	Italie
Delft University of Technology	Pays-Bas
Imperial College London	Royaume-Uni
University of Edinburgh	Royaume-Uni
Nanyang Technological University	Singapour
National University of Singapore	Singapour
Bogazici University, Istanbul	Turquie

Quality

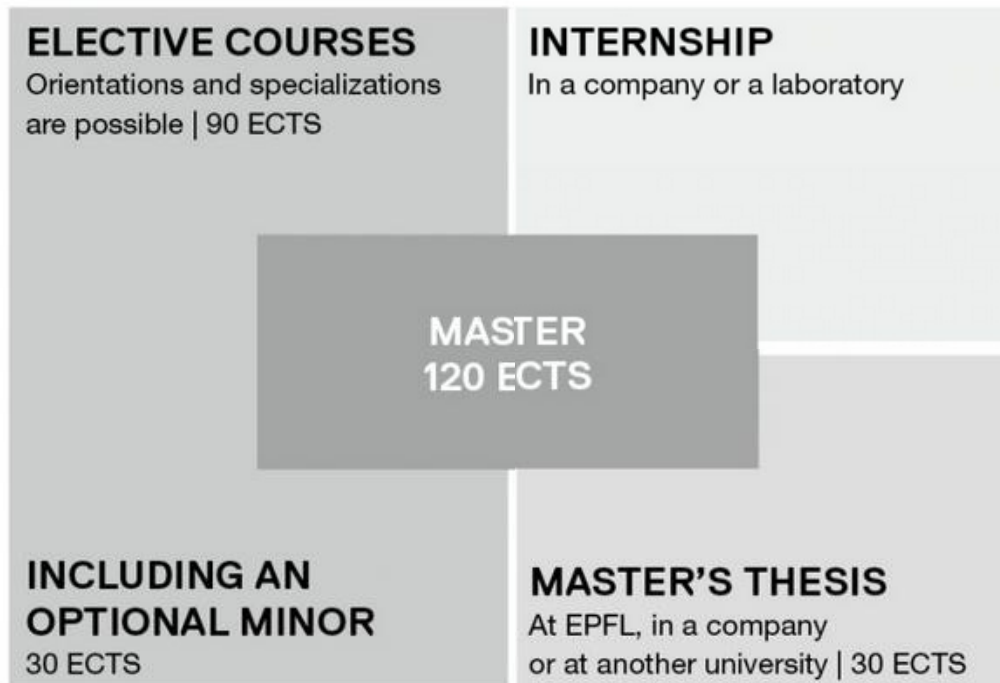
8. Please give your general appreciation and comments on the Robotics Master

8.1) Overall, I find the Robotics Master of high quality



Robotics Master - detailed program structure

Master program structure



Microengineering/Robotics Passerelle program

Puis-je commencer le cycle Master sans avoir terminé la passerelle HES ?

Oui, mais seulement si :

- vous avez obtenu au moins 30 crédits ECTS de passerelle HES et
- vous n'êtes pas en échec définitif à la passerelle HES.

La période durant laquelle vous avez commencé votre cycle Master mais pas encore terminé la passerelle HES compte à la fois dans la durée maximale de la passerelle HES et dans celle du cycle Master.

Microengineering/Robotics Passerelle program

validé par la vice-présidence pour les affaires académiques le 25 mai 2022

Code	Matières	Enseignants sous réserve de modification	Sections	Semestres						Crédits	Période des épreuves	Type exam.
				AUT			PRI					
				c	e	p	c	e	p			
	Bloc 1 "Branches de base"									30		
MATH-203(a)	Analyse III	Michelat	MA	2	2					4	H	écrit
MATH-207(a)	Analysis IV (for SV, MT)	Licht	MA				2	2		4	E	écrit
ME-326	Automatique et commande numérique	Karimi + Salzmann	GM	4	1	1				6	H	écrit
MICRO-321	Ingénierie optique	Achouri K./Martin O.	MT	2	1	3				6	H	écrit
PHYS-201(c)	Physique générale : électromagnétisme	Boero	MT	4	2					6	H	écrit
MICRO-310(a)	Signaux et systèmes I (pour MT)	Unser	MT	2	2					4	H	écrit
	Bloc 2 "Branches d'approfondissement"									27		
MICRO-313/314	Actionneurs et systèmes électromagnétiques I, II	Köchli/Perriard + Hodder/Köchli/Perriard	MT	2			2	1	2	7	E	écrit
MICRO-330	Capteurs	Boero/Shea	MT				5			5	E	écrit
MICRO-312	Physique des composants semiconducteurs	Besse	MT	4						4	H	écrit
MICRO-311(a)	Signaux et systèmes II (pour MT)	Unser	EL				2	2		4	E	écrit
MICRO-315	Systèmes embarqués et robotique	Mondada	MT				2		4	7	sem P	sans retrait
	Totaux :			20	8	4	13	5	6			
	Totaux par semaine :				32			24		57		

Pour **réussir la passerelle HES**, un étudiant doit :

- avoir acquis **au moins 30 crédits à la fin du deuxième semestre** de la passerelle HES et
- avoir acquis **tous les crédits requis à la fin du quatrième semestre** de la passerelle HES.

https://www.epfl.ch/education/studies/reglement-et-procedure/conditions_reussite/reussite-passerelle/

Reading a study plan

2022-2023

MICROTECHNIQUE

Cycle Master

validé par la vice-présidence pour les affaires académiques le 25 mai 2022

Code	Matières	Enseignants sous réserve de modification	Sections	Semestres						Crédits	Nbre places	Période des épreuves *	Type examen *
				MA1 / MA3			MA2						
				c	e	p	c	e	p				
	Bloc 1									26			
MICRO-406	Products design & systems engineering	Bellouard/Charbon	MT	5		5				10		sem A	sans retrait
MICRO-498	Projet microtechnique I	Divers enseignants	Divers	←----- 10 -----→						10		sem A ou P	sans retrait
HUM-nnn	SHS : introduction au projet	Divers enseignants	CDH	2		1				3		sem A	
HUM-nnn	SHS : projet	Divers enseignants	CDH					1	2	3		sem P	sans retrait
	Bloc 2									15			
MICRO-534	Advanced MEMS & microsystems	Briand	MT				3			3		E	oral
MICRO-451	Applied and industrial robotics	Bouri	MT				2			2		E	écrit
MICRO-455	Applied machine learning	Billard	MT	4						4		H	écrit
EE-311	Apprentissage et intelligence artificielle	Liebling	EL				2		2	4		E	écrit
MICRO-421	Imaging optics	Psaltis	MT	2	1					3		sem A	sans retrait
ME-413	Introduction to additive manufacturing	Boillat + Boillat/Brugger/Moser	GM/MT	2		1				3		H	écrit
MICRO-426	Laser fundamentals and applications for engineers	Moser	MT				2	1		3		E	oral
MICRO-448	Manufacturing systems and supply chain dynamics	Filliger/Gallay	MT				2	1		3		E	oral
MICRO-431	Materials and technology of microfabrication	Gijs/Lehnert	MT	2	1					3		H	oral
MICRO-457	Materials processing with intelligent systems	Hoffmann/Wasmer	MT	2	1					3		H	oral
MICRO-428	Metrology	Bruschini/Charbon/Fantner	MT/SV				3			3		E	oral
MICRO-530	Nanotechnology	Boero/Brugger	MT				3			3		E	oral
MICRO-523	Optical detectors	Besse	MT	3						3		H	oral
MICRO-470	Scaling laws & simulations in micro & nanosystems	Renaud/Shea	MT	3	1					4		H	oral
MICRO-420	Selected topics in advanced optics	Martin O.	MT	3						3		H	oral
EE-594	Smart sensors for IoT	Enz/Ionescu	MT/EL	2	1					3		H	écrit
	Groupe 3 "Options"									49			
	Voir liste d'options ci-après												
	Total des crédits du cycle master									90			

Requirements for obtaining the master's degree

- Block

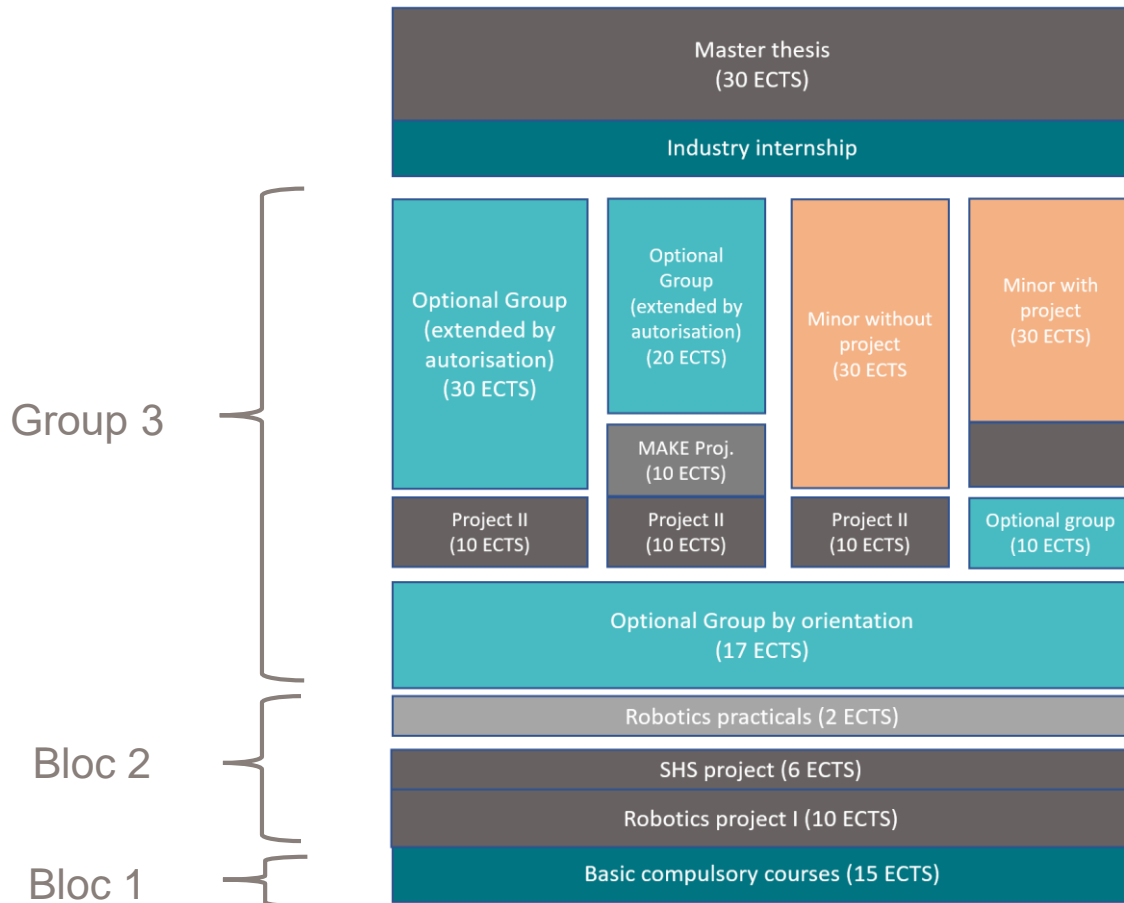
A **block is passed** (and thus all the credits associated with the block are acquired) when all the subjects it contains have been examined at least once and the **weighted average of the block is 4,00 or above**.

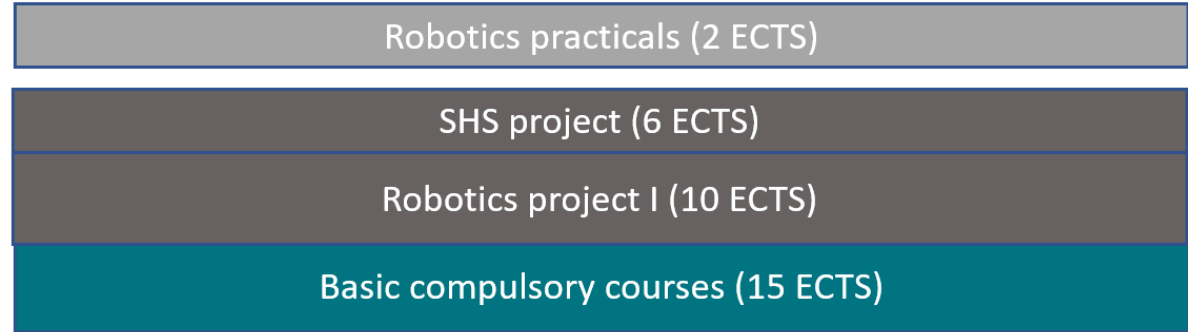
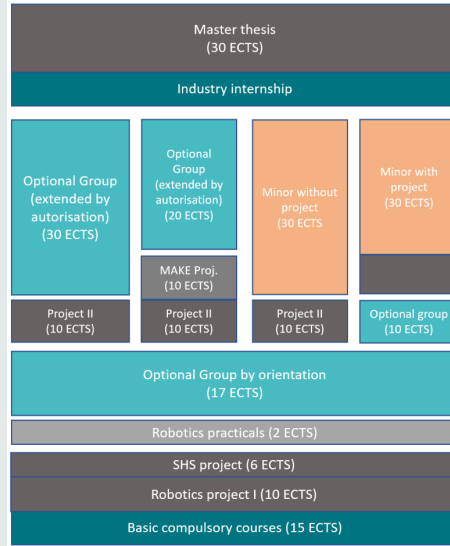
- Group

A **group is passed** when **enough subjects in the group are passed** (final grade 4,00 or above) **to reach the number of credits** associated with the group. Although an average is calculated, it has no bearing on the passing of the group.



Master Program structure





Compulsory courses

Foundations :

- Basics of Mobile Robotics (4 ECTS; Mondada) – fall
- Basics of robotics for manipulation (3 ECTS; Bouri) – fall

Algorithms and Methods for Robotics :

- Applied machine learning (4 ECTS; Billard) – fall
- Model Predictive Control (4 ECTS; Jones) – fall

Practicals:

- Robotics Practicals (2 ECTS; Mondada + all) - spring

Orientations

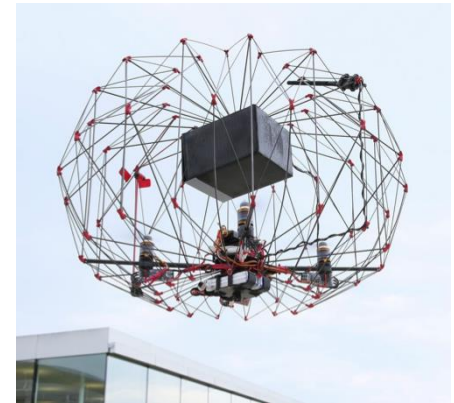
17 optional credits chosen among the optional courses of the chosen orientation, then free choice in robotics options.



Industrial Robotics



Medical Robotics

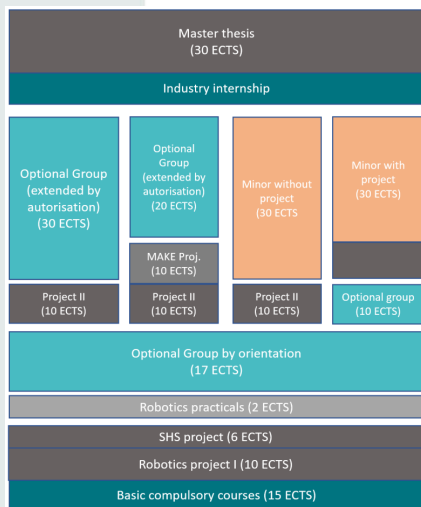


Mobile robotics

Orientations

Students must choose 17 ECTS of optional courses in one of these three orientations:

- A Industrial robotics
- B Medical robotics
- C Mobile robotics



Groupe à options
 Grand choix de cours
 (17 ECTS)

Optional courses and orientation	A	B	C	59
Advanced control systems	A	B	C	3
Advanced machine learning	A	B	C	4
Advanced MEMS & microsystems			C	3
Advanced satellite positioning			C	4
Analyse de produits et systèmes	A			2
Analysis and modeling of locomotion		B	C	4
Biomaterials		B		4
Commande embarquée de moteurs	A			2
Computational motor control		B	C	4
Computer vision	A	B	C	4
Conception mécanique intégrée	A			3
Continuous improvement of manufacturing systems	A			4
Controlling behavior in animal and robots		B	C	4
Deep learning	A	B	C	4
Distributed intelligent systems			C	5
Embedded systems	A	B	C	4
Evolutionary robotics			C	3
Flexible bioelectronics		B		4
Flying robots			C	4
Fundamentals of computer aided manufacturing	A			5
Fundamentals of neuroengineering			C	4
Haptic human robot interfaces	A			3
How technology shapes the workplace of the future	A	B	C	3
Image analysis and pattern recognition		B	C	4
Image processing I		B		3
Image processing II		B		3
Industrial automation	A			3
Industry dynamics, models & trends	A			4
Intelligent agents	A		C	6
Interdisciplinary project				10
				4
				3
				2
				5
				3
				4
				3
				3
				4
				2
				5
Production management	A			5
Real-time embedded systems	A	B	C	4
Robotique industrielle et appliquée	A			2
Sensorimotor neuroprosthetics		B		4
Sensor orientation			C	4
Sensors in medical instrumentation		B		3
Signal processing for functional brain imaging		B		3
System identification	A	B	C	3
Systèmes mécatroniques	A	B	C	5

Master in Robotics - Orientations

Group 3 : Fall

17-47

Group 3 : Spring

A: Industrial robotics

Commande
embarqués moteurs

Intelligent agents

Production management

Image processing I

Applied data analysis
Commande non-linéaire
Systems programming for systems on a chip

Machine learning programming
Managment de projet et analyse du risque
Mechanical product design and development

Analyse de produits
et systèmes

Applied and
industrial robotics

Industrial
automation

Optimal decision
making

Haptic human robot
interfaces

Image processing II

Continuouse improvement
of manufacturing systems

Advanced control systems
Advanced machine learning
Computer vision
Convex optimization

B: Medical robotics

Basics of
Bioinstrumentation

Neural interfaces

Neural signals and
signal processing

Numerical methods
in biomechanics

Introduction to
bioengineering

Sensors in medical
instrumentation

Advanced mecanisms for extreme
environments
Controlling behavior of animals and robots
Computational motor control

Deep learning for optical imaging
Machine learning programming
Micro/nanorobotics
Embedded systems design

C: Mobile robotics

Multivariable control

Intelligent agents

Legged robots

Networked control
systems

Principles of finance

Deep learning for
autonomous vehicles

Advanced MEMS
and microsystems

Deep learning

Lifecycle performance of
products systems

Sensor orientation

Advanced Satellite
positioning

Learning and adaptive
control for robots

Aerial robotics

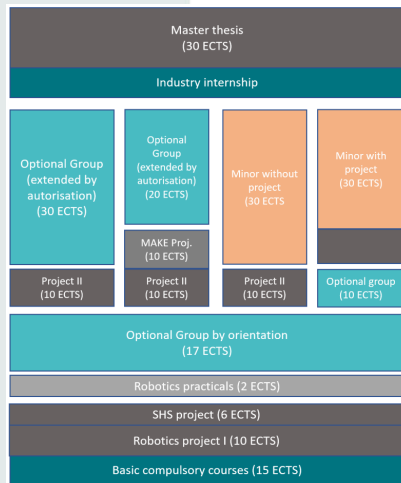
Evolutionary robotics

Distributed intelligent
systems

Image analysis and pattern recognition
Organic and printed electronics
Translational neuroengineering

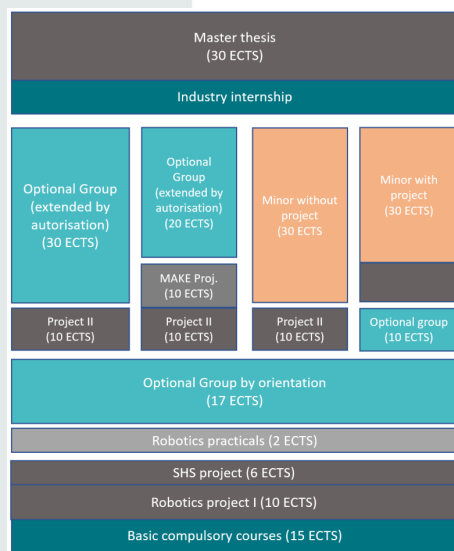
Reinforcement learning
Software architecture
Systèmes mécatroniques
System identification

Orientation courses examples



2021-2022	ROBOTICS - Options		
Code	Matières	Enseignants	Crédits
MICRO-502	Aerial robotics	Floreano	3
MICRO-515	Evolutionary robotics	Floreano	3
MICRO-570	Advanced machine learning	Billard	4
EE-559	Deep learning	Fleuret	4
MICRO-514	Flexible bioelectronics	Lacour S.	4
EE-451	Image analysis and pattern recognition	Thiran J.-P.	4
MICRO-462	Learning and adaptative control for robots	Billard	4
MICRO-455	Applied machine learning	Billard	4
MICRO-553	Haptic human robot interfaces	Bouri	3
MICRO-401	Machine learning programming	Billard	2
BIOENG-404	Analysis and modelling of locomotion	Aminian/Ijspeert/Courtine	4
BIOENG-456	Controlling behavior in animals and robots	Ramdya	4
CIVIL-459	Deep learning for autonomous vehicles	Alexandre Alahi	6
ENG-466	Distributed intelligent systems	Martinoli	5
CS-487	Industrial automation	Tournier/Sommer	3
MICRO-507	Legged robots	Ijspeert	3
ENV-548	Sensor orientation	Skaloud	4

Free options



Optional Group
(extended by
autorisation)
(30 ECTS)

Project II
(10 ECTS)

Optional
Group
(extended by
autorisation)
(20 ECTS)

MAKE Proj.
(10 ECTS)

Project II
(10 ECTS)

Minor without
project
(30 ECTS)

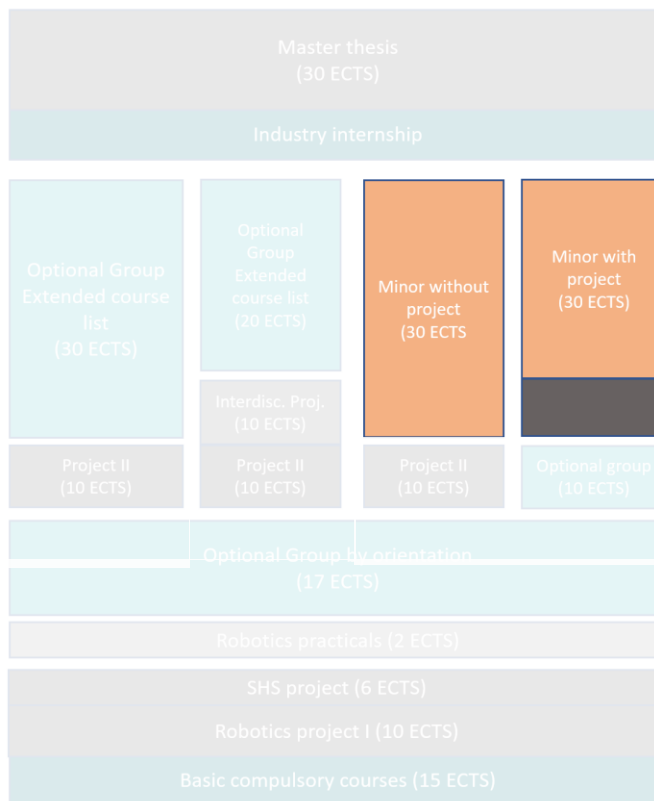
Project II
(10 ECTS)

Minor with
project
(30 ECTS)

Optional group
(10 ECTS)

Minors of the section

- **Photonics**
- **Biomedical technologies**
- **Imaging**



Minors

A minor is a group of compulsory and optional courses from one or more Master's programs.

EPFL offers a wide choice of **disciplinary** and **interdisciplinary** minors.

Interdisciplinary minors

Interdisciplinary minors often group together courses from several Master's programs. Some consist of a multidisciplinary topic (I.E. photonics minor) , others offer complementary education to the classical engineering curriculum (Management, Technology and Entrepreneurship)

Rules and procedures:

<https://www.epfl.ch/education/studies/en/rules-and-procedures/minors/>

Registering a Minor

The student **informs the section of his choice of minor** and **selects it in the course-registration screen on IS-Academia, no later than the end of the first semester** of his Master's studies.

The **selection of courses** making up a minor is done **with the approval of the student's program and the person in charge of the minor**. The student registers for these courses on IS-Academia, following the normal procedure.

A minor is successfully completed when **30 credits at minimum have been gained** among the approved subjects. Each subject must be successfully completed on its own merits: there is no possible compensation between the subjects. These 30 credits **add to the total for a 90-credit Master's program**.

Recommended and possible Minors

			MT	
			MT	MT-Ro
			120	120
Mineurs / Minors	Type	Section		
Imaging	Interdiscipl.	MT	r	r
Technologies biomédicales / Biomedical technologies	Interdiscipl.	MT	r	r
Photonique / Photonics	Interdiscipl.	MT	r	r
Energie / Energy	Interdiscipl.	GM	r	r
Ingénierie pour la durabilité / Engineering for sustainability	Interdiscipl.	SIE	r	r
Neuro-X	Discipl.	NX	r	r
Physique des systèmes vivants / Physics of living systems	Interdiscipl.	SV	r	r
Science et ingénierie quantiques / Quantum science and engineering	Discipl.	SIQ	r	r
Technologies spatiales / Spatial technologies	Interdiscipl.	EL	r	r
Data and internet of things	Interdiscipl.	EL	r	c
Management, technologie et entrepreneuriat / Technology management and entrepreneurship	Interdiscipl.	MTE	r	c
Science et ingénierie computationnelles / Computational science and engineering	Discipl.	MA	r	c
Architecture	Discipl.	AR	c	c
Computational Biology	Interdiscipl.	IN	c	c
Biotechnologie / Biotechnology	Interdiscipl.	CGC	c	c
Chimie et génie chimique / Chemistry and chemical engineering	Discipl.	CGC	c	c
Cyber security	Discipl.	IN	c	c
Data science	Discipl.	SC	c	c
Design intégré, architecture et durabilité / Integrated Design, Architecture and Sustainability	Interdiscipl.	AR	c	c
Génie civil / Civil engineering	Discipl.	GC	c	c
Génie électrique et électronique / Electrical and electronic engineering	Discipl.	EL	c	c
Génie mécanique / Mechanical engineering	Discipl.	GM	c	c
Ingénierie des systèmes / Systems Engineering	Interdiscipl.	MTE	c	c
Informatique / Computer science	Discipl.	IN	c	c
Ingénierie des sciences du vivant / Life sciences engineering	Discipl.	SV	c	c
Ingénierie financière / Financial engineering	Discipl.	IF	c	c
Mathématiques / Mathematics	Discipl.	MA	c	c
Physique / Physics	Discipl.	PH	c	c
Science et génie des matériaux / Materials science and engineering	Discipl.	MX	c	c
Sciences et ingénierie de l'environnement / Environmental sciences and engineering	Discipl.	SIE	c	c
Statistique / Statistics	Discipl.	MA	c	c
Systèmes de communication / Communication systems	Discipl.	SC	c	c

r recommended in the study plans

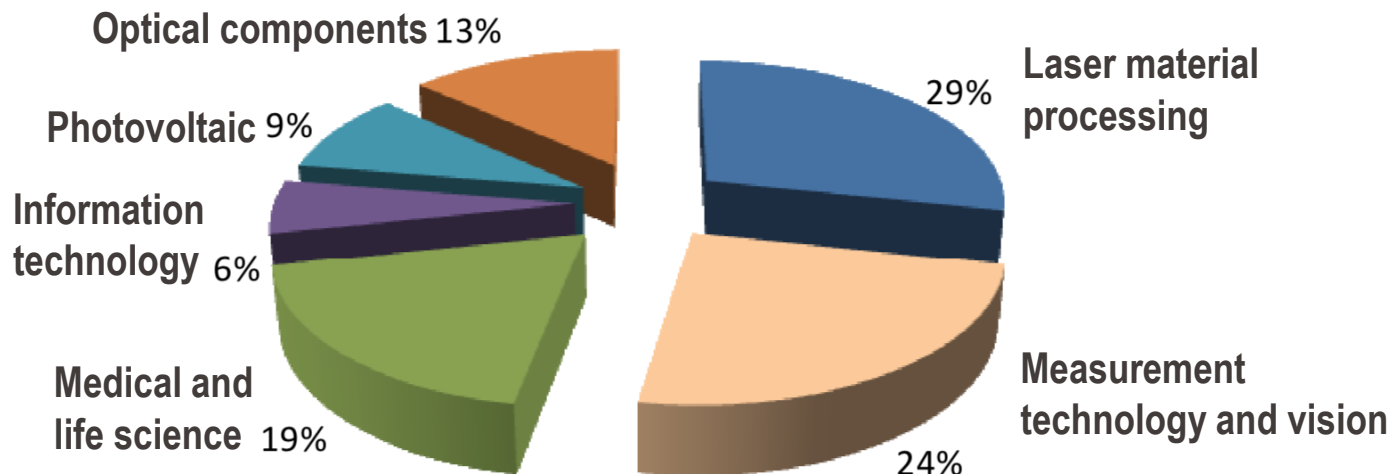
c choice of the courses with the advice of the initiating section and the person in charge of the minor

7 mars
2022

Mineur en Photonique

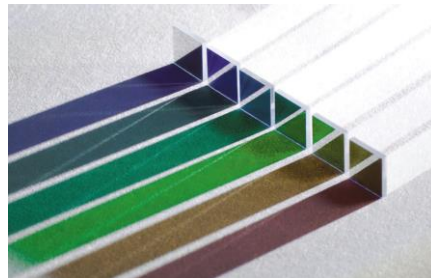
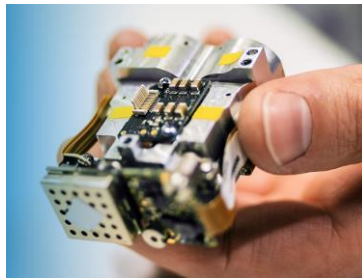
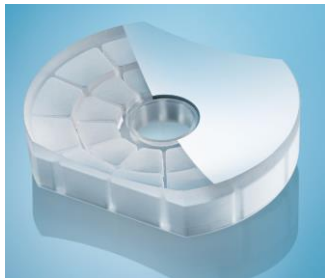
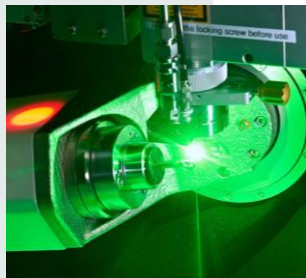
Photonics and industry

- One of the five key enabling technologies identified by the European Commission
- € 447 billion world market, growing at a rate of 6.2%
- CHF >4 billions Swiss photonics industry, ~ 100 companies, >10'000 highly skilled collaborators:



Photonics in Switzerland – e.g. Optical components⁴⁰

- CHF 400 Mio turnover
- Some large companies and many Small & Medium Enterprises:
ABB, Alpes Laser, ams-OSRAM, Axetris, Balzers Optics, Lumentum Ultrafast Lasers, Escatec, Exalos, Feinwerkoptik Zünd, Fiberoptic, FISBA, Fischer Connectors, Heptagon/AMS, id Quantique, IMT Masken und Teilungen, Industrial Laser Electronics and Engineering, Insolight, Leica, Leister, LESS, Logitech, Mikrop, Omnisens, Onefive, OVD-Kinegram, Silitec Fibers, Sinar, Rainbow Photonics, Schott Suisse, Spectros, Suss Microoptics, SwissOptic, Thin Film Physics, Time-Bandwidth Products, Victor Kyburz, Volpi, Vectronix WZW Optic, Xenlux, Zünd Precision Optics... ... and many, many more !



Context for the Minor in Photonics

- Photonics is widespread at EPFL: Physics, Chemistry, Microengineering, Electrical Engineering, Bioengineering, Architecture...
- Very successful Doctoral Program in Photonics
- Large photonics faculty body in the Microengineering Section, where photonics is one of the focuses
- The minor in photonics bundles these competencies to propose a high level photonics degree

Objectives

- Educate students in the science of optics and photonics
- Prepare the students for their future in industry or academia
- Propose a balanced study plan between theory and practical work

Proposed lectures in 2022/2023

Foundations of photonics

Laser fundam. and applications for engineers
Lasers: theory and modern applications
Nonlinear optics
Optical communications
Optics laboratories I and II
Optique III
Photonic systems and technology
Physics of photonic semiconductor devices
Quantum physics III and IV
Quantum electrodynamics and quantum optics
Quantum optics and quantum information
Selected topics in advanced optics
Semiconductor physics and fundamentals of electronic devices

Applied photonics

Advanced materials for photovoltaics and lighting
Fundamentals & processes for photovoltaic devices
Fundamentals of biophotonics
Imaging optics and design

Image processing I and II
Laser microprocessing
Laser fundam. and applications for engineers
Optical detectors
Optical communications
Optics laboratories I and II
Organic and printed electronics
Photonic micro- and nanosystems
Photonic systems and technology
Selected topics in advanced optics
Technologie des microstructures I

Biomedical photonics

Biomedical optics
Biomicroscopy I and II
Fundamentals of biophotonics
Image processing I and II
Imaging optics and design
Laser fundam. and applications for engineers
Optics laboratories I and II
Photomedicine

What, How and with Whom?

- Choose 20 ECTS (6-7 courses) from 98 ECTS (30 courses) and **a lot of freedom**
 + Project in photonics (10 ECTS)
- Three tracks: Foundations of photonics, Applied photonics, Biomedical photonics
- Key laboratories for each track:

Foundations of photonics

K-Lab – Kippenberg
 LAPD - Moser
 LASPE – Grandjean/Butté/...
 LBP - Roke
 LIB – Unser
 LWE – Fleury
 NAM – Martin
 PHOSL – Brès
 PVLAB – Ballif/Haug
 ...

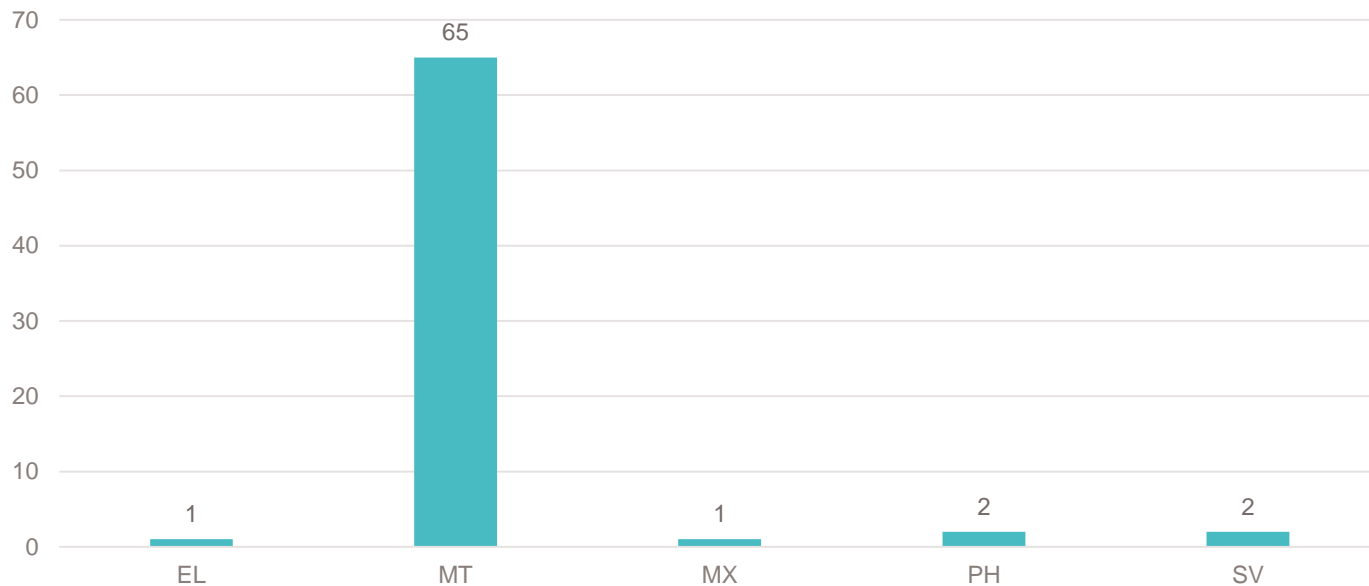
Applied photonics

EDMX – Hoffmann
 LAPD – Moser
 LO - Psaltis
 LMTS – Briand
 LNET – Tagliabue
 LT – Thévenaz
 LWE – Fleury
 NAM - Martin
 PHOSL - Brès
 PVLAB – Ballif/Haug

Biomedical photonics

BIOS - Altug
 EDCH - Wagnieres
 LAPD - Moser
 LBEN - Radenovic
 LIB - Unser
 LO - Psaltis
 MIPLAB – Van De Ville
 PTBIOP - Seitz
 LBP – Roke
 ...

Total cumulé d'étudiants par section pour le mineur en photonique
2019-2020



Further information

**please do not hesitate to
contact me
olivier.martin@epfl.ch**



... and don't forget, the photon makes life fun and colorful!



7 mars
2022

Mineur en Technologies Biomédicales

MEDTECH EN SUISSE

L'ESSENTIEL EN BREF

La Suisse est l'un des principaux sites pour l'industrie mondiale des technologies médicales (ou medtech). En effet, les techniques médicales y tiennent une place inégalée, tant dans le PIB qu'en proportion des actifs. La Suisse est dotée de sites de recherche de grande qualité et d'un système de santé très développé, qui attend des produits à la hauteur de ses exigences et stimule l'innovation. Elle est ainsi un pays extrêmement attractif pour la recherche, le développement et la production dans le secteur des technologies médicales.

Top 10 des entreprises en technologies médicales

par nombre d'employés en 2017

J&J Medical

Roche Diagnostics

Biotronik

Sonova

Medtronic

Zimmer Biomet

Straumann

B. Braun

Ypsomed

Dentsply Sirona

Source : SMTI, 2018

CHIFFRES-CLÉS



Sources : SMTI, 2018

MEDTECH

UNE INDUSTRIE ROMANDE

5000

chercheurs
sont actifs
dans le secteur

+ 10% par an

tel est le taux
de croissance
des secteurs
de la biotech
et de la medtech

80 à 90%

des technologies
médicales
produites
en Suisse sont
exportées

BIOTECH



450

entreprises
développent et/ou
produisent des
médicaments et
diverses substances
thérapeutiques
innovants, notamment
par génie génétique.

MEDTECH



300

sociétés développent
et/ou fabriquent
des implants,
prothèses, dispositifs
implantables,
équipements de
laboratoire et autres
technologies utiles
dans le secteur
de la santé.

RECHERCHE



500

laboratoires de sciences
de la vie sont implantés
dans les hautes
écoles, universités et
hôpitaux universitaires
de la région.
Rapporté au nombre
d'habitants, leur
taux de publications
scientifiques les place
au 3^e rang en Europe
(après Cambridge et
Oxford en Grande-
Bretagne).

INCUBATEURS



8 «pouponnières
d'entreprise»
et parcs

scientifiques favorisent
l'émergence et le
développement des
start-up en mettant
à leur disposition des
locaux et du coaching
et en les aidant à
obtenir les capitaux
nécessaires pour
démarrer leur activité.

FONDATIONS

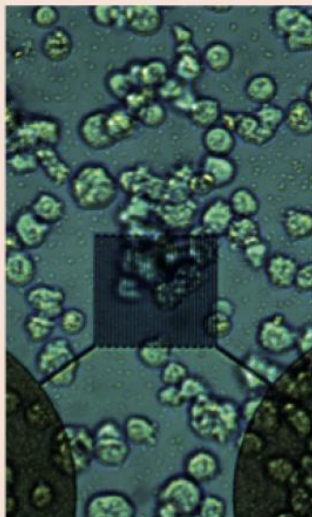


9 fondations
internationales
et suisses

sont implantées
dans la région.
Elles soutiennent
financièrement
les entreprises
et les centres de
recherche travaillant
dans les sciences de
la vie. La présence de
l'OMS (Organisation
mondiale de la santé)
à Genève participe
au rayonnement
de la région.

SCHOOL OF ENGINEERING

MINOR IN BIOMEDICAL TECHNOLOGY



The Minor in Biomedical Engineering complements the engineering programmes offered at EPFL, providing additional skills in the field of biomedical sciences and technologies.

The programme includes courses giving a general basis in biomedical sciences as well as a broad choice of engineering-related courses with special emphasis on applications in biomedical engineering.

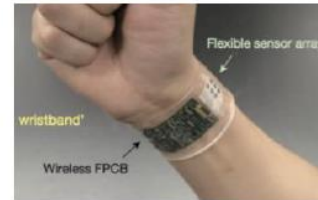
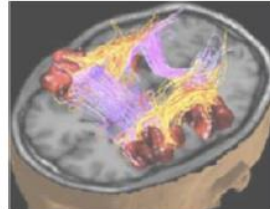
Students have the opportunity to carry out a research project (semester project, 8 ECTS) in one of the laboratories participating in the programme.

This Minor can be taken in addition to one of the following programmes:

- Mechanical Engineering
- Microengineering
- Materials Science and Engineering
- Electrical and Electronics Engineering
- Chemistry and Chemical Engineering
- Physics
- Life Sciences
- Civil Engineering

The 30 ECTS credits of the minor are added to the 90 ECTS of the Master (including the 30 ECTS of the Master's thesis) and duly mentioned in the Diploma Supplement.

- Mineur de complément proposé en STI, SV et SB
 - Acquérir les bases physiologie + bio (-logie, -physique, -chimie)
 - Applications biomédicale
 - Technologies spécifiques



Le mineur donne l'occasion d'acquérir des notions de bases essentielles en biophysique, biologie cellulaire et physiologie

The program includes **courses** (22 ECTS minimum, all optional) of basis in biomedical sciences as well as a broad choice of engineering-related courses with emphasis on applications in biomedical engineering.

A **semester project** (8 ECTS, mandatory) related to biomedical technology is included in the Minor.

For non-SV students (STI, SB...)

A core group of courses of biomedical basis is strongly recommended:

BIO-105	Cellular biology and biochemistry for engineers
PHYS-301	Biophysics I
MICRO-560	Séminaire en physiologie et instrumentation

For SV students

Considering their pre-existing background in biology, SV students can select some other courses from MT, EL, ME, MX programs (up to 10 ECTS, with agreement of the responsible of the Minor program)

DOMAINES D'ACTIVITE DES INGENIEURS « MEDTECH »

Réhabilitation

Neuroingénierie

Bioingénierie cardiovasculaire

Capteurs et instrumentation

Traitement des biosignaux

Imagerie

Bioinformatique

Protéomique

Télémédecine

Biomécanique

Robotique chirurgicale

BioMEMS

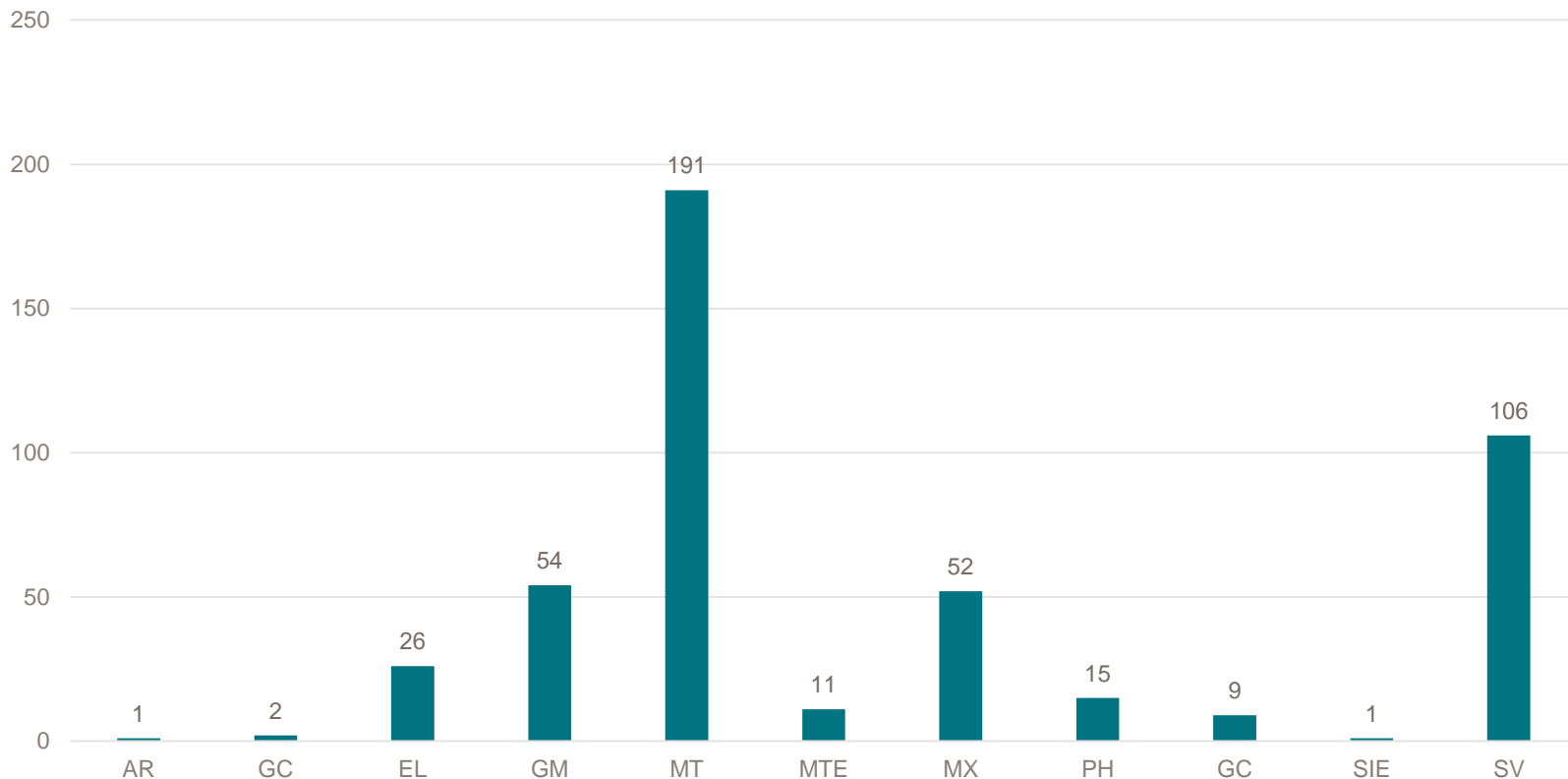
Biomatériaux

Biotechnologies

Génétique

Génie tissulaire

Total cumulé d'étudiants pour le mineur et technologie biomédicale 2015-2021





Minor in Imaging

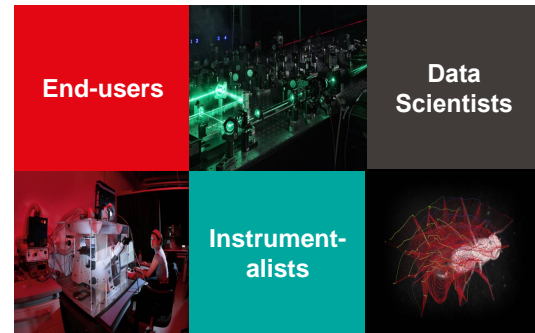
Context



Rich but scattered
imaging curriculum



Skills in high demand by
industry and academia



Interdisciplinary field
par excellence



EPFL: unique concentration
of academic strengths



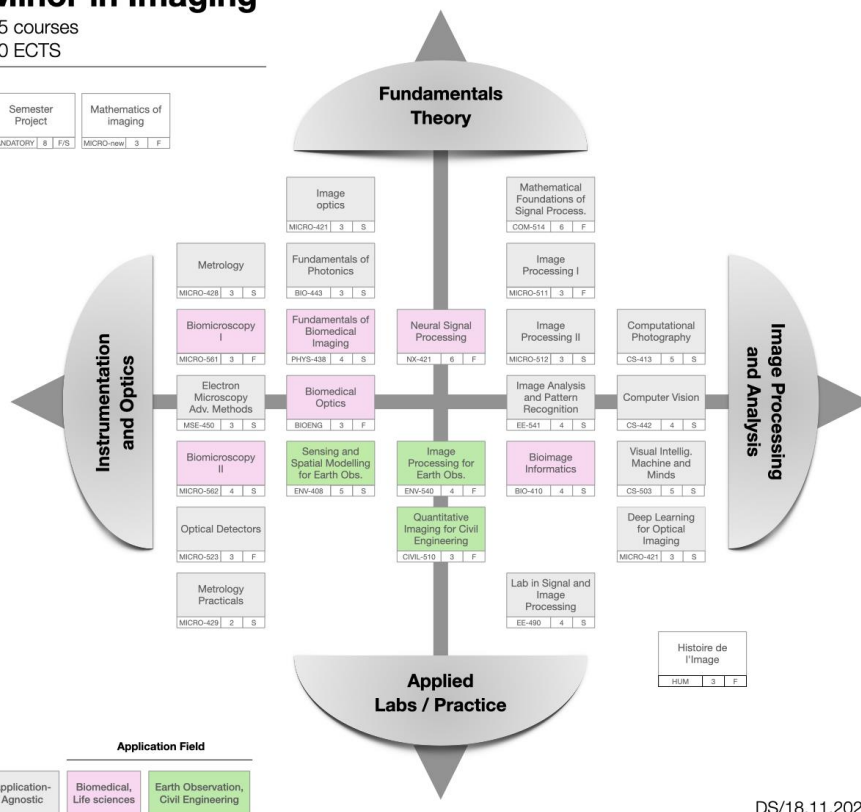
Strategical context

Structure of the Minor

Minor in Imaging

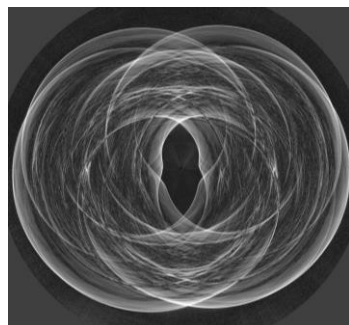
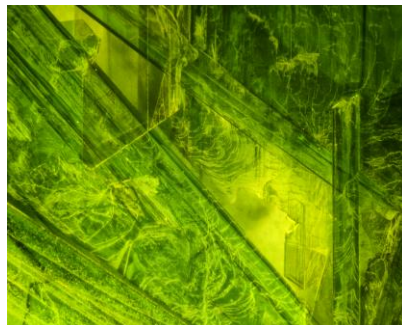
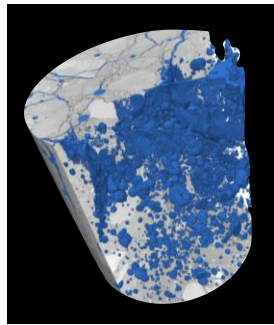
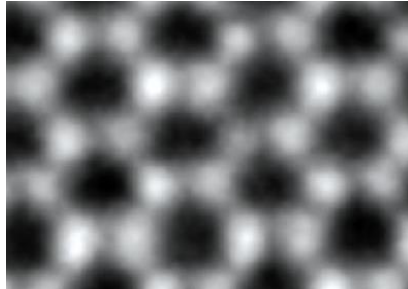
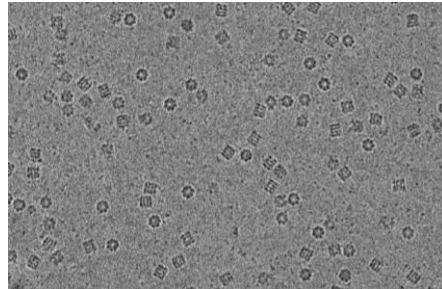
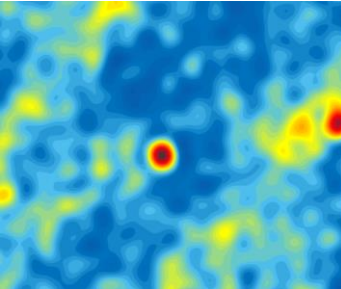
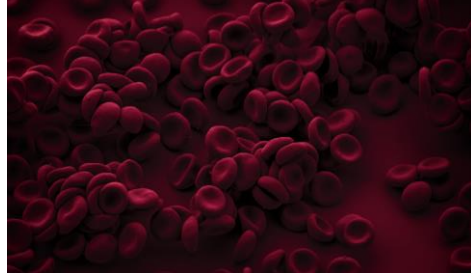
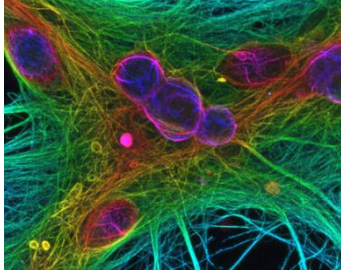
25 courses
90 ECTS

Semester Project	Mathematics of Imaging
MANDATORY 8 F/S	MICRO-new 3 F



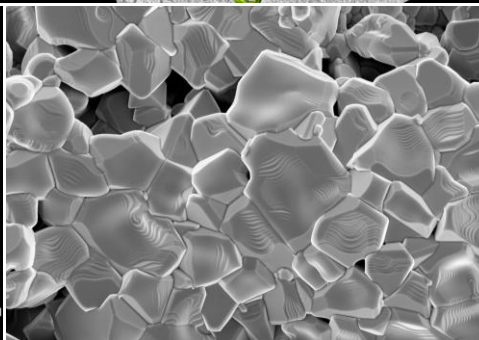
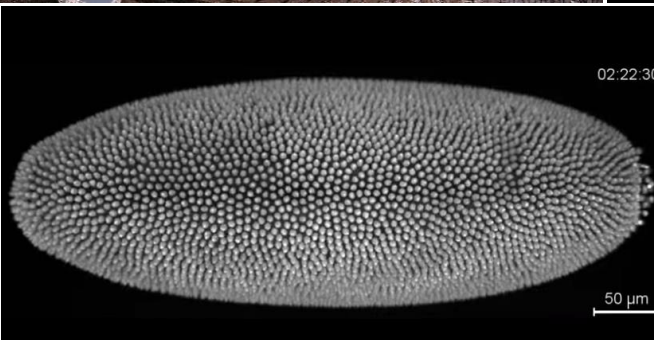
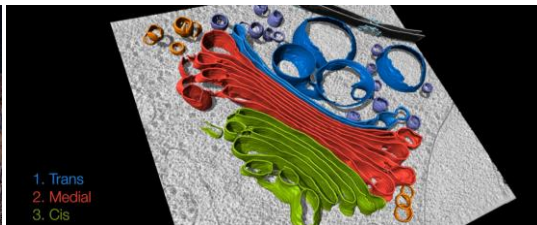
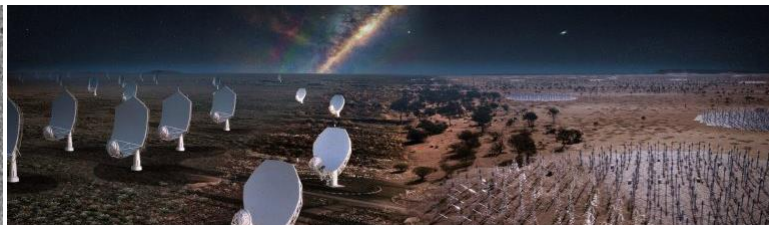
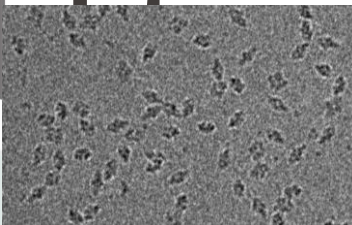
- **25 courses (90 ECTS)** from 12 Master programs
- Open to all EPFL MSc students
- Students select courses for a **minimum of 22 ECTS**
- Mandatory (interdisciplinary) **student project of 8 ECTS**
- **From Fall (September) 2023**

Imaging: from nano to macro



An explosion of (very large) image

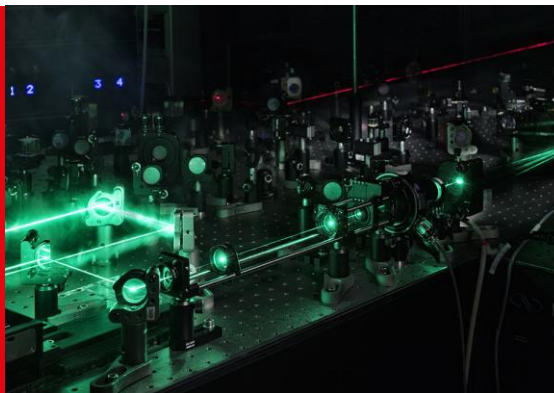
5
9



Imaging: a transversal field

Most of the future progress will likely result from **cross-fertilisation** between various disciplines.

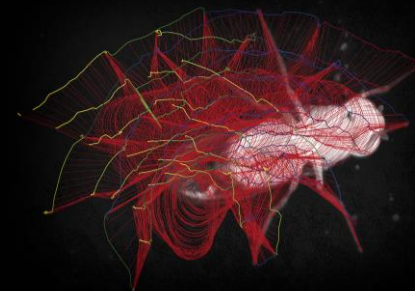
End-users



Data
Scientists

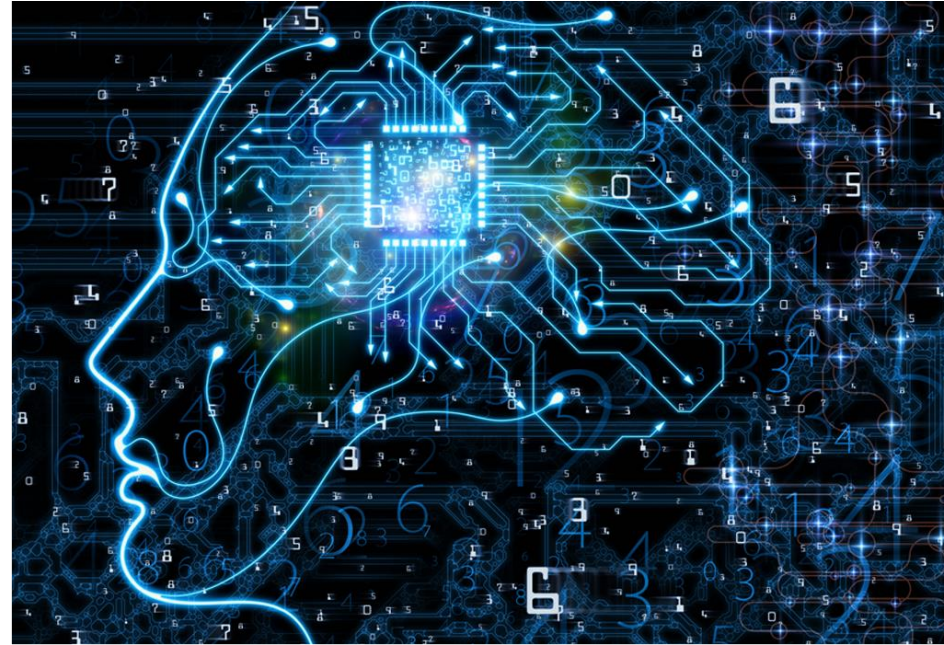


Instrumentalists



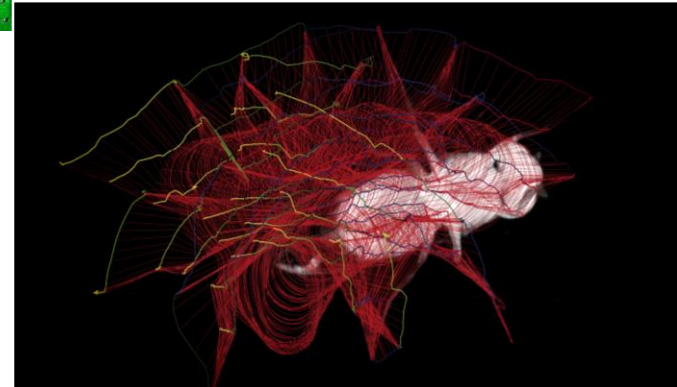
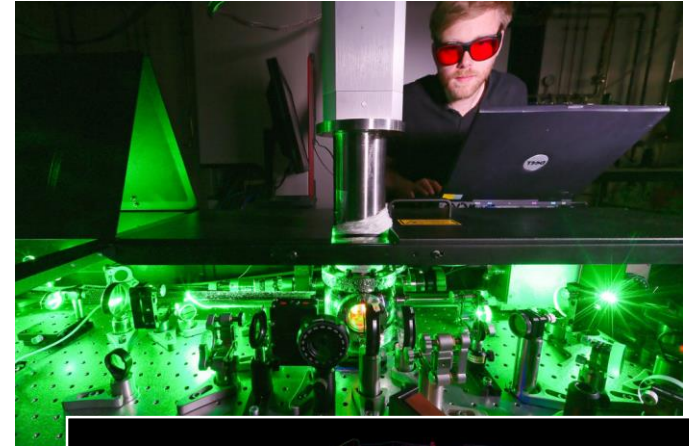
The deep learning revolution, a double-edge sword

- **Sophisticated frameworks**, often too technical for non-experts
- **Computationally demanding**: relies on massive GPU resources
- Necessitates a **huge amount of data** for training
- The number of new algorithms grows by the day
- Need for clear **good practice**

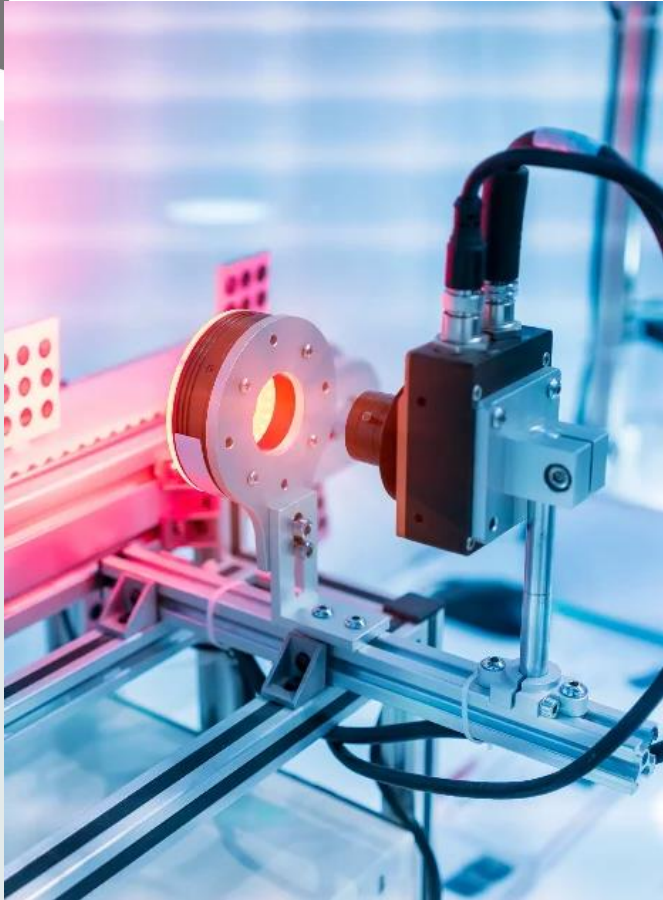


Pedagogical Concept

- Train students with a wide, transversal set of imaging skills.
- Bring greater visibility/coherency to the large offer of imaging-related classes at EPFL.
- **Holistic program: From acquisition** (optics, physics, sensors, etc.) **to computation** (image analysis, ML, computer vision, etc)
- Purely theoretical courses to fully applied ones.
- Mostly **application-agnostic**.



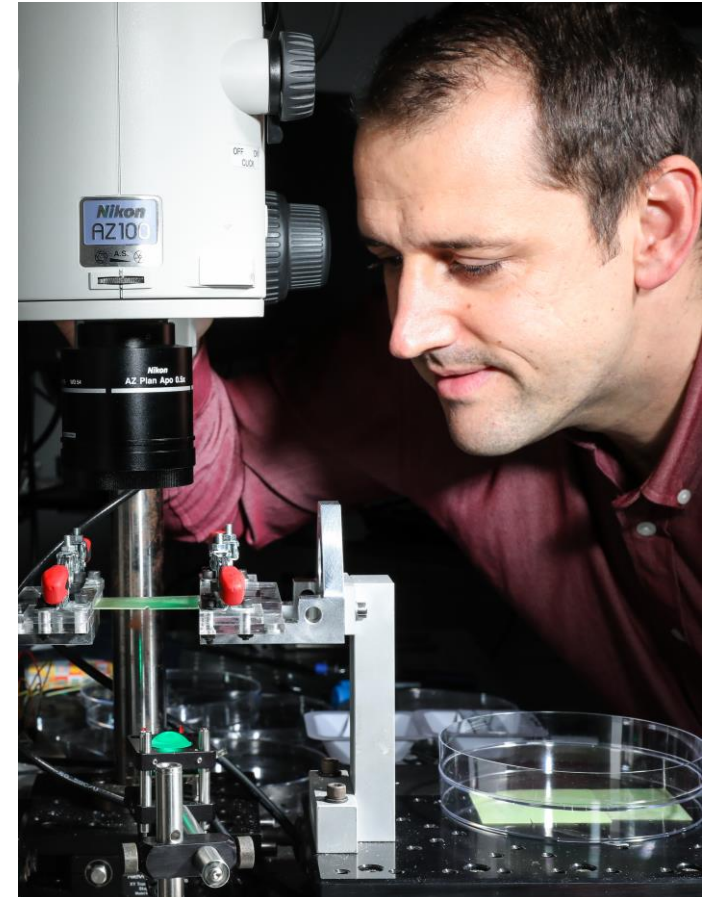
Interest from (Swiss) Industry



- Interdisciplinary imaging skills are in **increasing demand** from the Swiss industry and the academic world.
- **Unanimously-positive feedback** from contacted Swiss-based companies.
 - Nestlé CRN, Mikron, Rolex, Siemens Healthinners, NanoLive, etc.
- **Wealth of job offers in imaging** from major companies with offices in CH.
 - Apple CH, Novartis, Roche, Swatch, Google CH, Sony, etc.

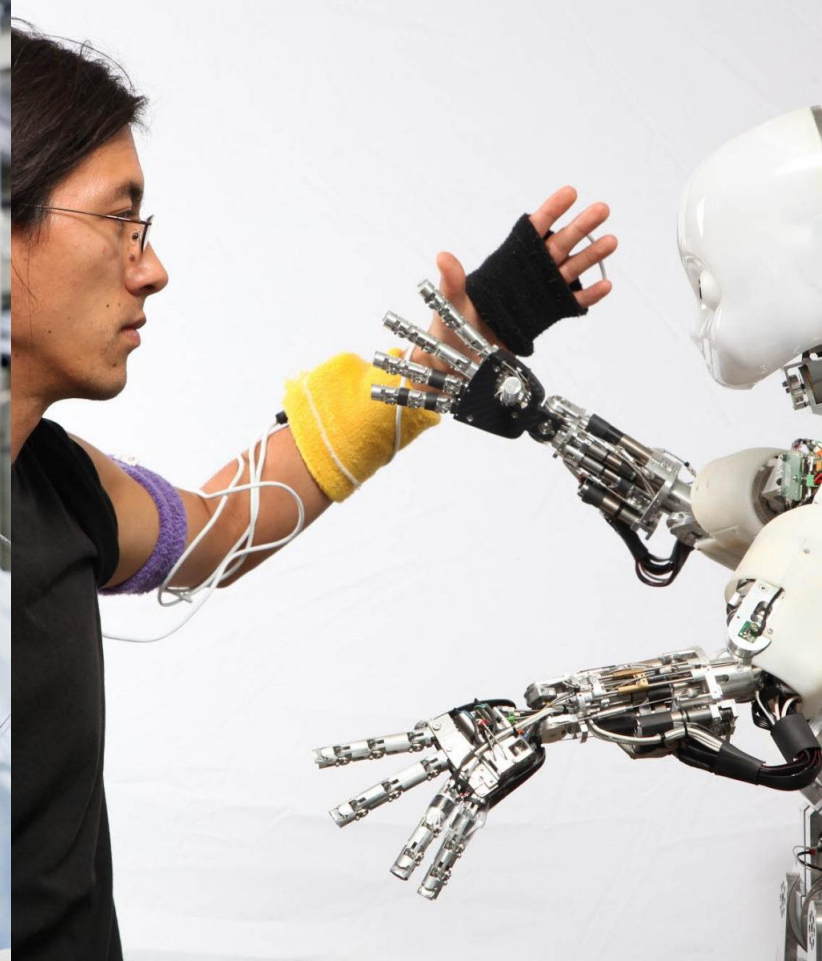
Interest from Academia and Students

- **Multiple positive indicators:**
 - Size of the EPFL imaging community (a quarter of the labs).
 - Exploding production of imaging data (in space and time) in research.
 - Very-high demand for continuous training in imaging at the PhD level, across almost all PhD programs.
- Imaging courses are numerous and typically **well attended** at EPFL.
- Important number of **student projects** in imaging is proposed every year by labs.



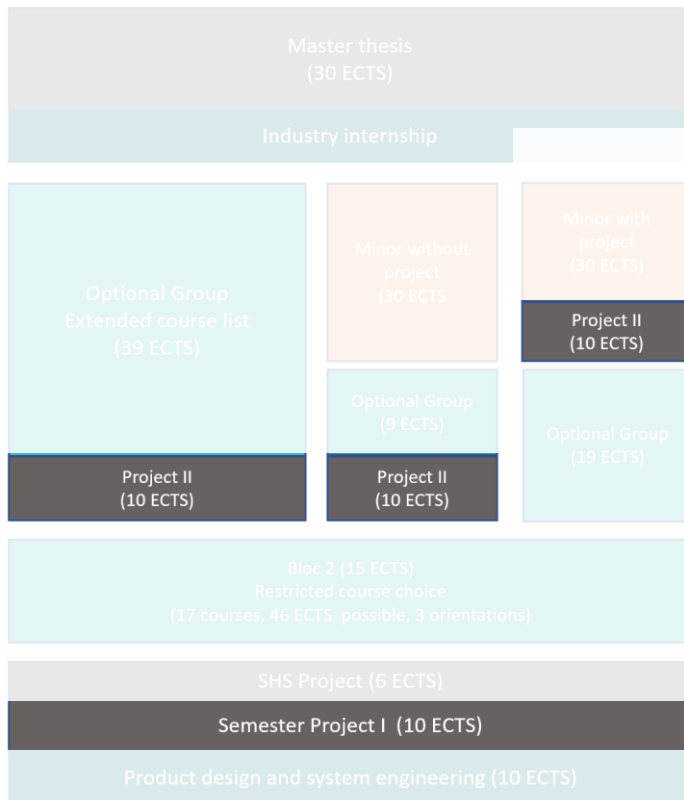
Semester projects, industry internships, master thesis

2 Semester projects

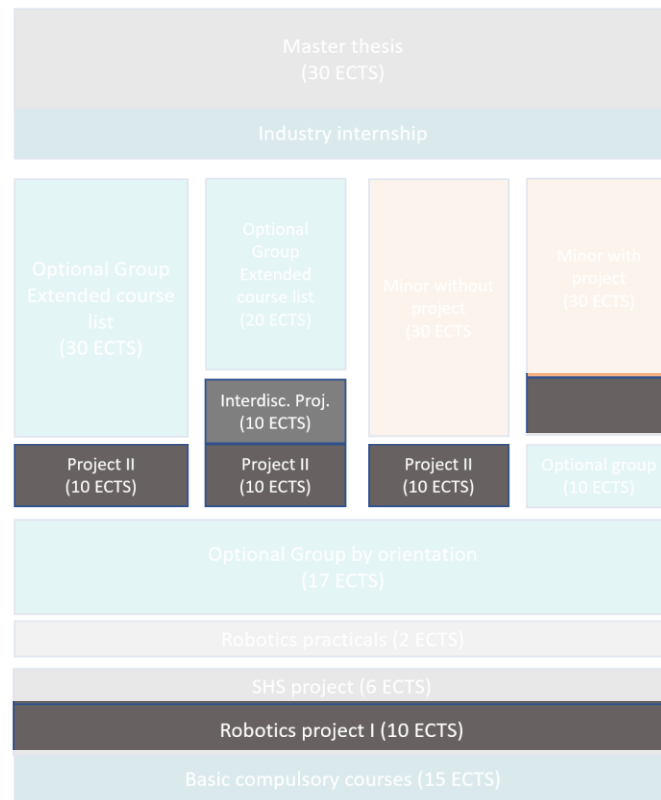


Semester projects ...

Microengineering



Robotics



Semester projects guidelines

EPFL

SCHOOL OF **ENGINEERING** >
ELECTRICAL AND MICRO
ENGINEERING

THE INSTITUTE

EDUCATION EL

EDUCATION MT

Semester project guidelines

- Find a project
- Registration
- Project description
- Dates
- Evaluation method

<https://sti.epfl.ch/research/institutes/iem/semester-project-guidelines/>



Finding a project

Lab websites with semester and master projects proposals ↗

LABORATOIRES

Institut	LAB	Laboratoire
ENAC-IIE	DISAL	Distributed Intelligent Systems and Algorithms Laboratory
STI-IBI	Biorob	Biorobotics Laboratory
STI-IBI	LBEN	Laboratory of Nanoscale Biology
STI-IBI	LMAM	Laboratory of Movement Analysis and Measurement
STI-IBI	LNE	Medtronic Chair in Neuroengineering
STI-IBI	MIPLAB	Medical Image Processing Laboratory
STI-IBI	TNE	Translational neuroengineering lab
STI-IBI/IMT	LBNI	Laboratory for Bio- and Nano-instrumentation
STI-IEL	EMC	Electromagnetic Compatibility
STI-IEL	INL	Integrated Neurotechnologies Laboratory
STI-IEL	LIONS	Laboratory for Information and Inference Systems
STI-IEL	TCL	Telecommunications Circuits Laboratory
STI-IEM	ICLAB	Bio/CMOS Interfaces group

RESPONSABLES

Prénom	Nom	Concerné(s)
Alcherio	Martinoli	MT&RO
Auke	Ijspeert	MT&RO
Aleksandra	Radenovic	MT
Kamiar	Aminian	MT&RO
Diego	Ghezzi	MT&RO
Dimitri	Van De Ville	MT&RO
Silvestro	Micera	MT&RO
Georg	Fantner	MT&RO
Farhad	Rachidi	MT&RO
Mahsa	Shoaran	MT&RO
Volkan	Cevher	MT&RO
Andreas	Burg	MT
Sandro	Carrara	MT&RO

IMPORTANT : If the Professor proposing the project is not affiliated with Microengineering section, the project has to be submitted for validation to sebastian.gautsch@epfl.ch

<https://sti.epfl.ch/research/institutes/iem/project-proposals-eng/>

Project registration

Register on IS-A as soon as the portal is opened by the Academic Service.

- This registration is official and mandatory, please respect the deadline: **2 weeks after semester start**



Important dates

Project starting date:

- Beginning of the semester

Report hand in

- Spring semester : at the latest on Friday of the **first** week after the end of the semester
- Fall semester : at the latest on Friday of the **second** week after the end of the semester

Your mark will be transferred to SAC 15 days after the report has been handed in.

IMPORTANT: The supervising Professor should confirm the exact dates to hand in the report and the oral presentation at the beginning of the project.

Project evaluation

An oral presentations of the work progress at mid-semester is **strongly recommended**. A final presentation at the end of the project **is mandatory**. The dates have to be defined with the Professor

- [Recommandations for intermediate and final presentations](#)
- [Template for intermediate presentation](#)
- [Template for final presentation](#)

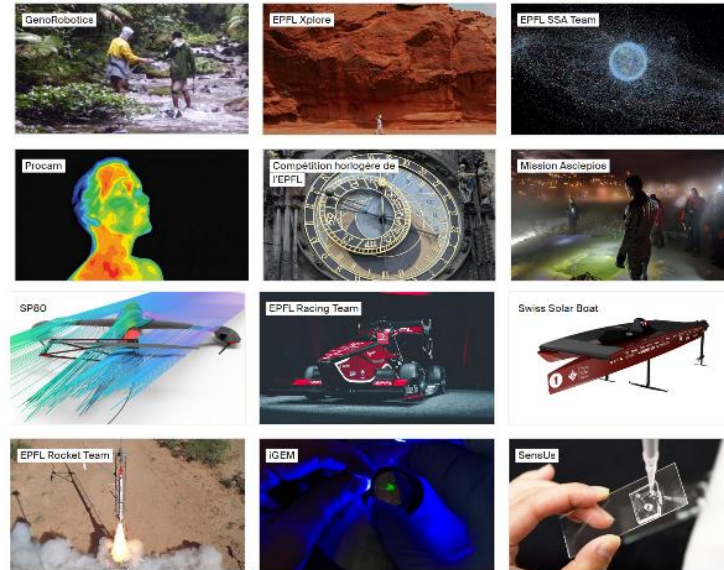
A written report is mandatory at the end of the project

- [Extensive Semester/Master thesis report template](#)
- [Example of a typical semester project report](#)

The written report will be followed by an oral defense, organized by the Professor. The section also recommends to complete the following form (which is a supplement to the evaluation) and to send the PDF [to the Section](#) for the student's file.

- [Project evaluation sheet \(template\)](#)

MAKE projects

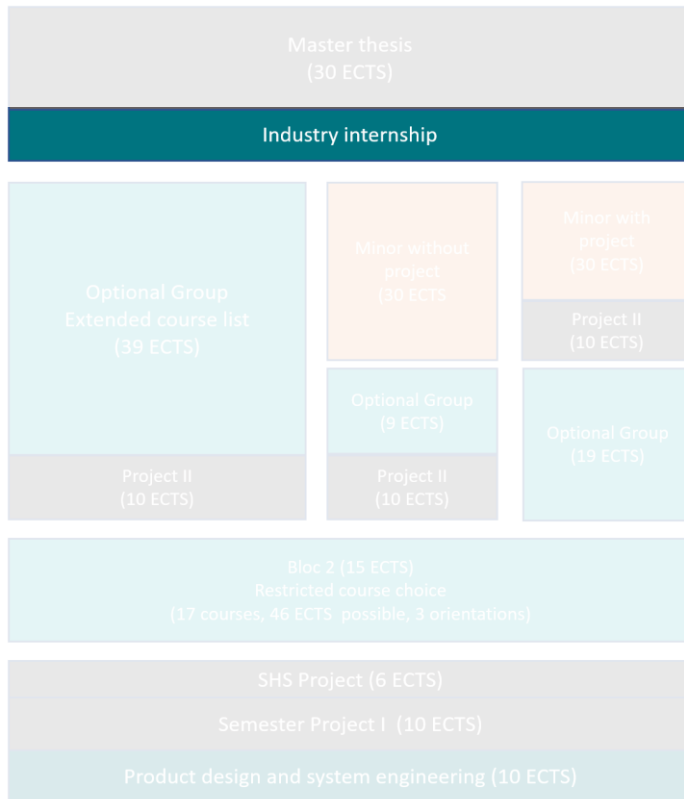


A dedicated procedure for MAKE projects as semester projects is being set-up. For now, please follow the same instructions as for regular semester projects.

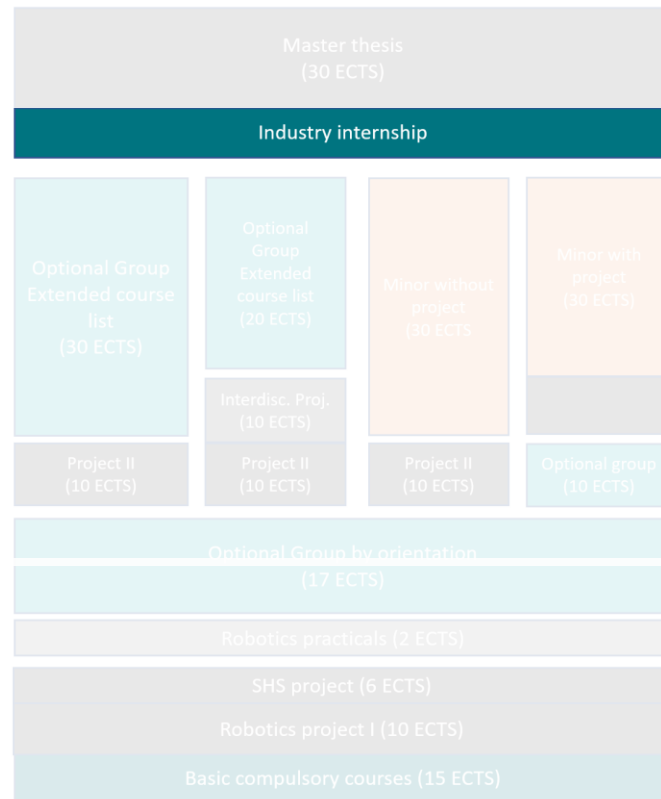
IMPORTANT : If the Professor proposing the project is not affiliated with Microengineering section, the project has to be submitted for validation to sebastian.gautsch@epfl.ch

Industry Internship

Microengineering



Robotics

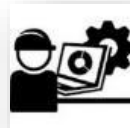


Mandatory Industry immersion: 2 options



Internship

- Minimum duration of 2 month, up to 6 months
- Immersion into industry
- Familiarize with company processes
- Acquire specific competences
- Apply transversal skills
- Evaluation report by student and industry supervisor



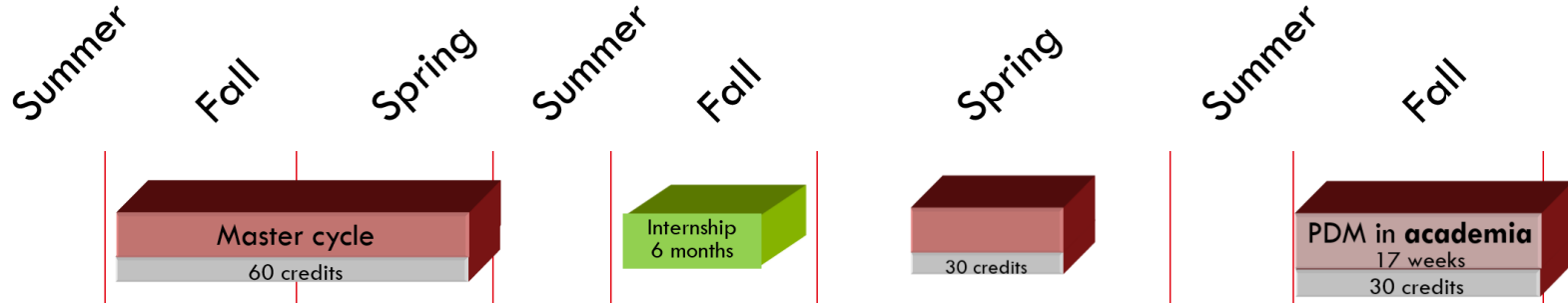
Master project in industry

- A research project in the company
- Student applies the competences acquired during his master
- Supervised by a Professor **from his section**
- Written report and oral defense
- **Monthly feedback to Professor**
- 25 week duration (+1 week vacation)

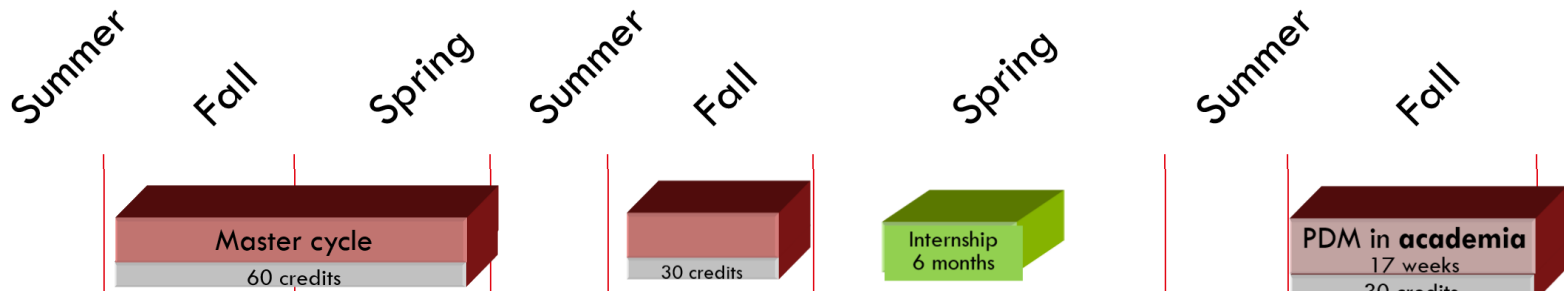




When to place your internship



When to place your internship



When to place your internship

Summer

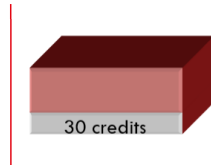
Fall

Spring



Summer

Fall

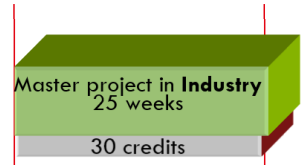


Spring



Summer

Fall



Industry internship

Detailed info session:
Wednesday November 2nd
12:00 – 13:15

STI Industry internship coordinator: Hind Klinke

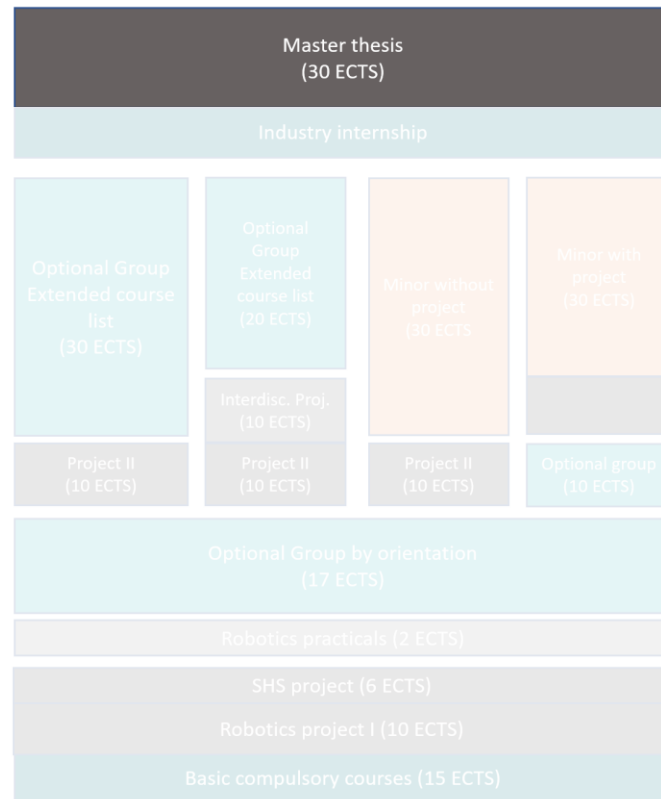


Master thesis

Microengineering



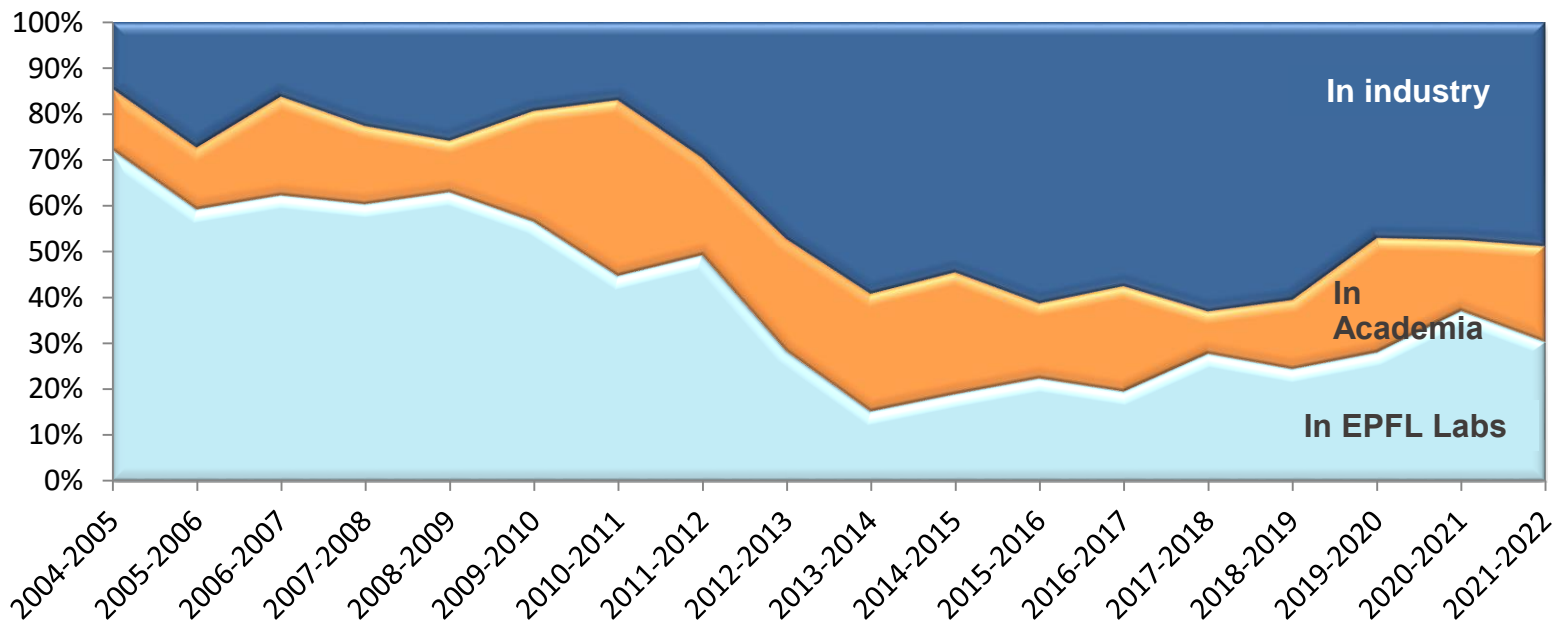
Robotics



Master thesis location

Students have different option to complete the Master thesis:

- In a lab @ EPFL
- In a foreign University, co-supervised by a Prof from EPFL
- In Industry, co-supervised by a Prof from EPFL



Academic outreach

Brigham and Women's Hospital (BWH), Harvard Medical School
 Brigham and Women's Hospital, Harvard Medical School
 California Institute of Technology
 Caltech - California Institute of Technology
 ETH (Robotics and Perception Group, with Prof. Scaramuzza) jointly with
 ETH Zürich
 ETHZ
 Georgia Institute of Technology
 Harvard
 Harvard John A. Paulson School of Engineering and Applied Sciences
 Harvard SEAS - Biodesign lab
 Harvard University - School of Engineering and Applied Sciences
 Imperial College
 Imperial College London
 Korea Advanced Institute of Sciences and Technology
 Max Planck Institute für Informatik
 National University Singapore
 Polytechnique Montreal
 Stanford
 Stanford University
 Technical University of Denmark
 Technical University of Denmark (DTU)
 UC Berkeley
 Université de Genève
 Universiteit van Amsterdam
 University of Basel
 University of British Columbia
 University of California, San Diego
 University of Geneva
 University of Illinois at Urbana-Champaign
 University of Oregon-Knight Campus

Industry outreach

Alpine Intuition Sàrl
 Alpiq SA
 Artiria Medical SA
 Astek
 autonomy
 Baracoda
 Bionomous Sàrl
 Bulgari Horlogerie
 Carevature Medical
 Carl Zeiss AG
 Cartier Opérations - Branch of Richemont International
 CleanGreens Solution SA
 CSEM - Centre suisse d'électronique et de microtechnique
 CSEM - Centre suisse d'électronique et de microtechnique
 CSEM S.A.
 Cyberbotics Ltd.
 Demareux SA
 ecoRobotix
 Empa
 European Southern Observatory
 Expedia Lodging Partner Services
 EyeOn Switzerland
 Fusion Lab Technologies SARL
 GSK
 Hublot S.A.
 Hydromea
 IBM Research GmbH
 ID Quantique SA
 IEP Innovation Park Foundation
 Illuin Technology
 Innovation Park Foundation (EIP)
 Isochronic AG
 KEP Innovation Center
 Logitech Europe SA
 London Centre for Nanotechnology
 Magma Learning
 Mantis Technologies GmbH
 Manufacture des Montres Rolex SA
 Medtronic Europe Sarl
 Melexis Technologies SA
 Merck Serono SA
 Metyos
 MotionTech
 Neurorestore
 Neurorestore (CHUV)
 Observatoire de Genève
 Omnisens SA
 Onward Medical SA
 opticode.ch
 Philips High Tech Campus Eindhoven
 Readily3D SA
 Rigi Technologies
 Rigitex
 Rolex
 Schindler Aufzüge AG
 Sensirion AG
 Technis SA
 Tecma Industrias
 TWIICE SA
 VLC Photonics
 Volocopter GmbH

Master projects guidelines

EPFL

SCHOOL OF **ENGINEERING** >
ELECTRICAL AND MICRO
ENGINEERING

THE INSTITUTE

EDUCATION EL

EDUCATION MT

Master projects guidelines

- **Calendar**
- **Choosing a master project in a laboratory**
- **Master project in another university**
- **Project's objectives**
- **Master projects in Industry (PDMe)**
- **Registration**
- **Hand-in procedure**
- **Evaluation method**
- **Student prizes**

<https://sti.epfl.ch/research/institutes/iem/master-project-guidelines/>



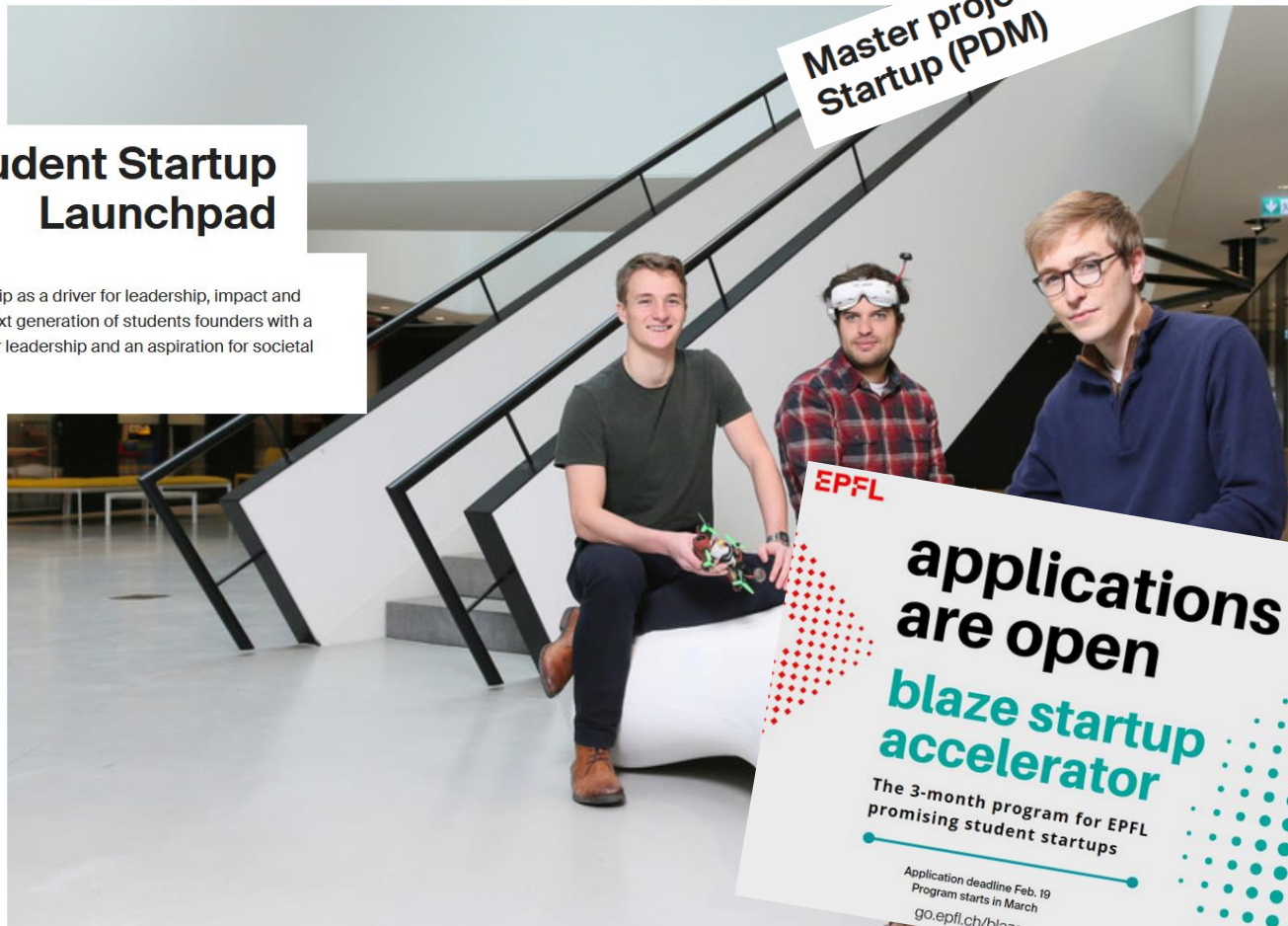
Beyond your studies

Entrepreneurship !

Student Startup Launchpad

We foster student entrepreneurship as a driver for leadership, impact and innovation. We are building the next generation of students founders with a drive for excellence, an instinct for leadership and an aspiration for societal impact.

Master project in your
Startup (PDM)



EPFL

**applications
are open**

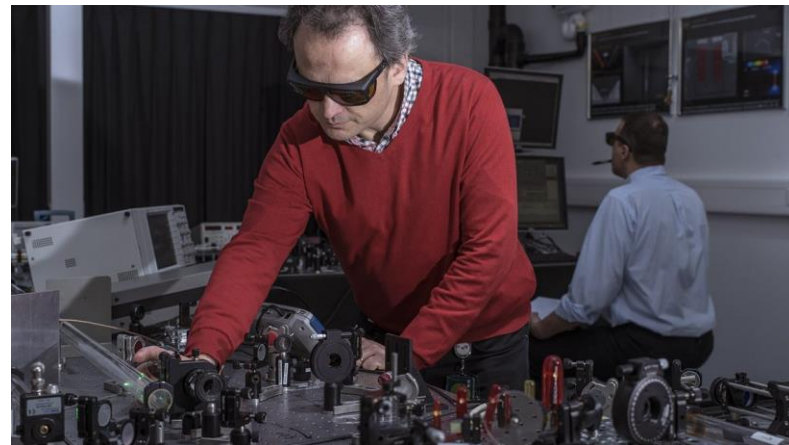
**blaze startup
accelerator**

The 3-month program for EPFL
promising student startups

Application deadline Feb. 19
Program starts in March

go.epfl.ch/blaze

Research - IEM to host your projects



IEM covers the following major technical fields:

- Electronic Circuits and Devices
- Micro-manufacturing and Micro- and Nano-technologies
- Robotics
- IoT, Computer & Communication Engineering
- Optics, Photonics and wave engineering
- Machine learning, Information Science and Systems
- Power and Energy

Research in IEM :

- 37 Full Professors / Associate Professors / Tenure-Track Assistant Professors
- 1 SNSF-funded Professor
- 13 Adjunct Professors
- 11 Senior Scientists
- 1 Member of the US National Academy of Engineering
- 1 Member of the American Academy of Arts & Sciences
- 1 Member of the Academia Europaea
- 2 Members of Swiss Academy of Engineering Sciences
- 25 ERC grants : 12 Advanced, 6 Consolidator and 7 Starting grants since 2008

One Institute on 3 campuses

EPFL
iem

■ institute of **electrical**
and **micro** engineering

Geneva - Campus Biotech

- Bio- and neuroengineering (Wyss center)
- Human Brain Project
- Center for neuroprosthetics

• 420 staff
• 9 chairs
• 3880 m²

Neuchâtel - Microcity

- Microengineering and nanotechnologies

• 230 staff
• 11 chairs
• 8035 m²



Beyond your studies ...

EPFL Spacecraft Team

EPFL Xplore



EPFL Rocket Team



**Projets
MAKE**

MAKE Projects: Fantastic team effort





Testimonies and teaser movies

Short Movie to learn more

Robotics at EPFL



Student Testimony



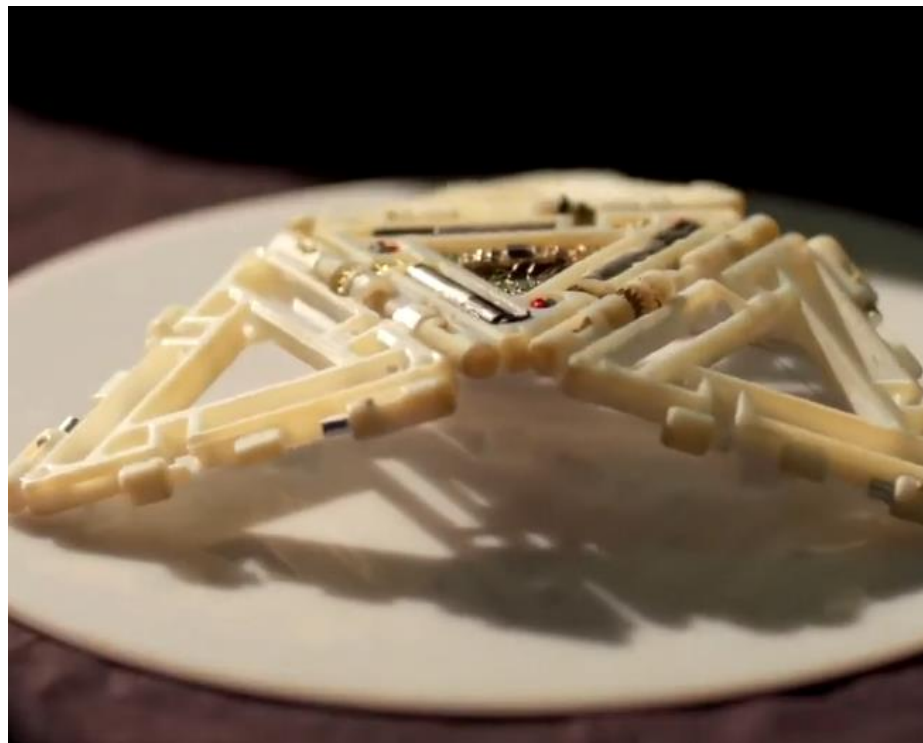
Sébastien de Rivaz
about the Robotics Master



Student Testimony



Arwen Blanche Giraud
about the Robotics Master



Alumni Testimonies



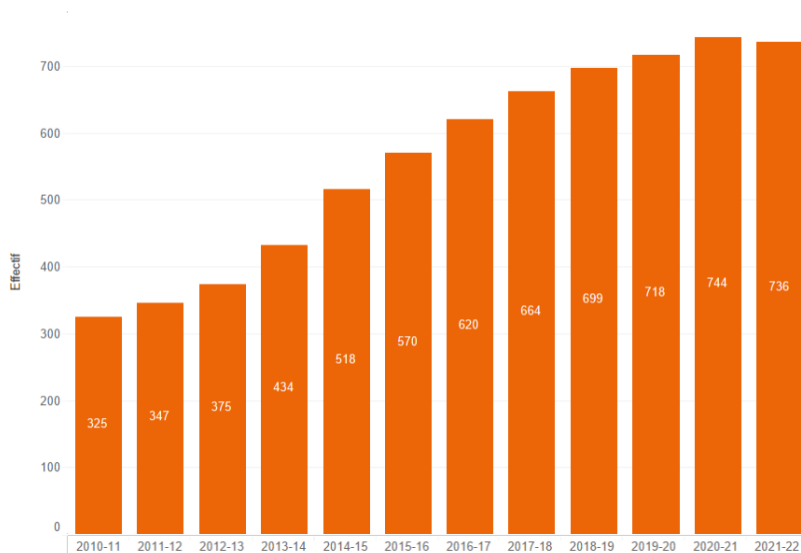
Adrien Briod
Founder and CTO
Master Microtechnique terminé en 2009
Thèse doctorat EPFL 2013



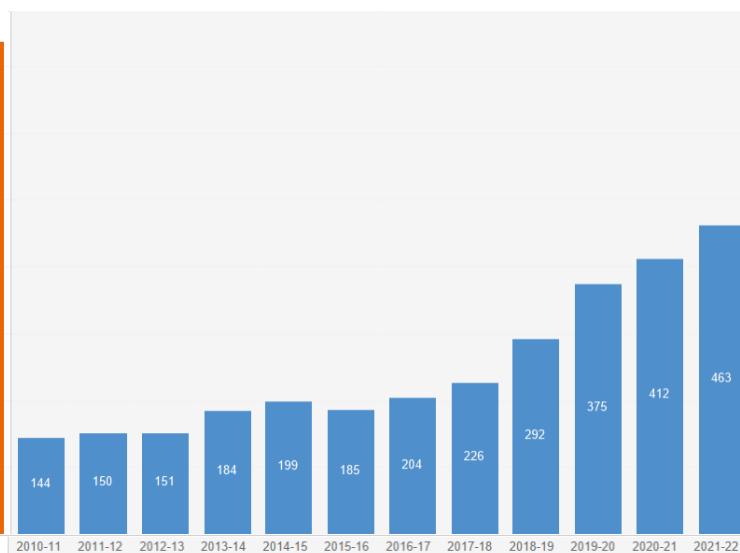
General student info and contacts

Successful curricula (>1100 students)

Bachelor

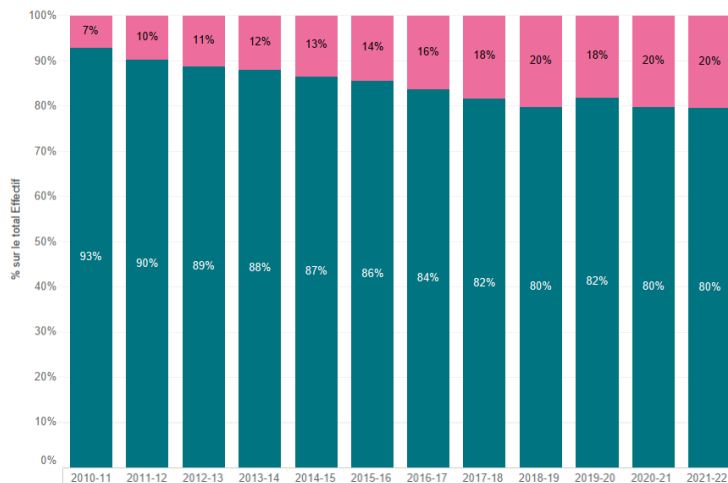


Master Microengineering and Robotics



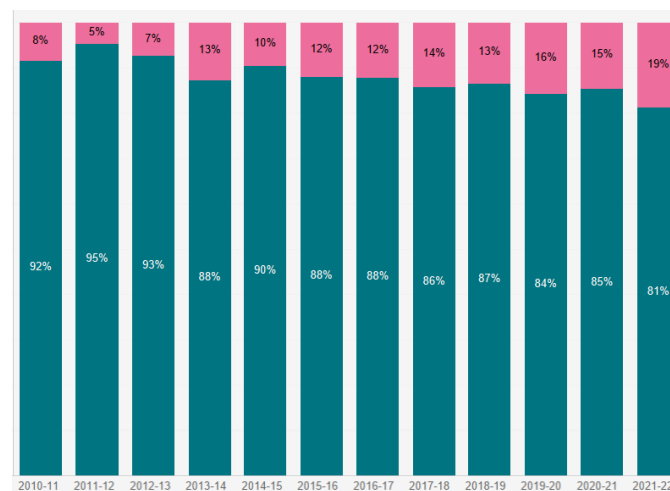
Gender balance

Bachelor



25% women this fall

Master (MT + RO)



23% women this fall

Your EPFL e-mail !!!

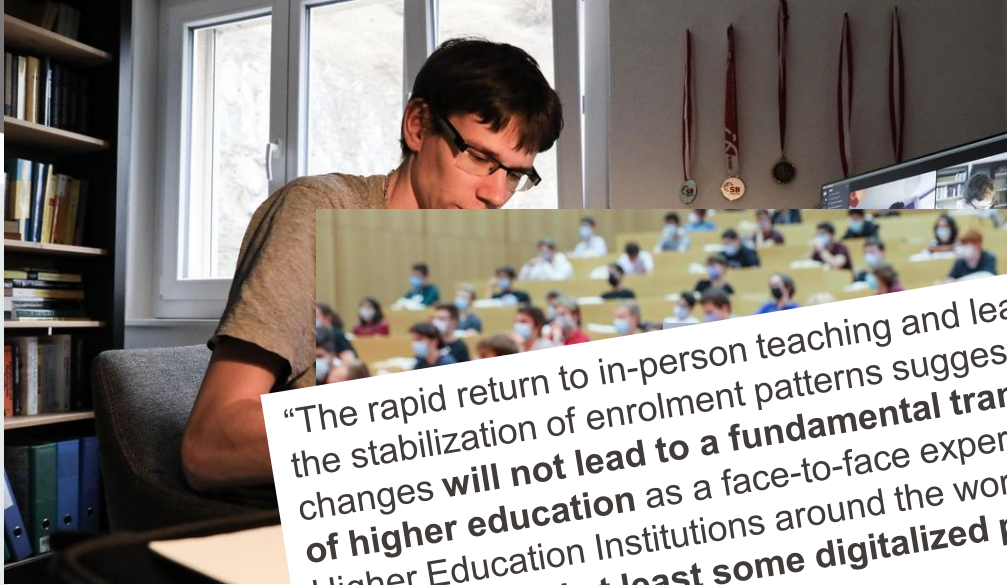
1stname.lastname@epfl.ch

- Should now become your reference account
- Important info regarding your studies will be sent to this address

«Ignorantia juris non excusat»

- In case of doubt, please consult official regulations for your studies

Remembering phases during COVID-19



"The rapid return to in-person teaching and learning and the stabilization of enrolment patterns suggest that the changes **will not lead to a fundamental transformation of higher education** as a face-to-face experience. Higher Education Institutions around the world are likely to **take forward at least some digitalized practices** in the long term. "

Unesco, May 2022



Course attendance and online offer

- Take profit as much as possible from **presential courses** and interact with teachers and assitants
 - Follow **live recordings** only if you have major impediments
 - Take profit of the **School's infrastructure** to be on campus
 - Make use of archived recordings to **revise, catch-up and strenghten** your knowledge
-
- All teachers look forward to welocme xou in class in order to have the best dynamic and pedagogical teaching style possible

Indicative course evaluations

- Each semester, all courses given at EPFL are evaluated by registered students
- Your **productive feedback** is essential to help teachers of the section to adapt and improve in a continuous way their lectures and teaching style.
- Only a high enough participation rate gives representative and useful information
- Your evaluations (and constructive recommendations) have a real impact on teaching

IT security

- Protect your passwords
- Beware of Phishing e-mails
- Protect your hardware and login credentials
- Update your software
- Minimize risks when surfing the web

→ <https://go.epfl.ch/ITSecure>



Let's set the example of a culture of respect

- Harassment, violence and discrimination are not tolerated here
- Provide and seek support
- Talk about it, bring up the problems



@ **EPFL**

- > go.epfl.ch/tsn (Trust and Support Network)
- > Take the online training on Moodle: « Promoting Respect »

EPFL student services

The EPFL “Student Services” desk is the main contact point for all academic queries

For EPFL students or doctoral students, whether recently arrives or recently graduated, whether you have a doubt, a question or a problem. The “Student Services” Hotline is the focal point to process all your requests.

A question ?

Please contact the Student Services Hotline preferably in the following order:

- Look up our information pages on the website [EPFL studies](#).
- Send an [e-mail](#)
- **Go to the Student Services desk** during office hours (see below)
- **Call** 021 693 43 45 (you will get voice mail outside office hours or if the office is busy)



Individual support

Social and psychotherapeutic consultations are available to students and doctoral students.

- Do you feel demotivated, isolated, depressed, anxious?
- Do you have problems related to your studies or finances or other kinds of personal problems?
- Are you in need of [accommodations for your studies](#)?
- Are you facing difficulties and need someone neutral to talk to?
- If you do not know which consultation to contact, do not hesitate to ask for an initial interview with the Social consultation or to refer to the [list of difficulties, advice and contacts](#).



Get in touch with your study advisors

- Microengineering Master: [Sebastian Gautsch](#)
 - *Advanced Manufacturing* : [Prof. Yves Bellouard](#)
 - *Micro/nanosystems* : [Prof. Herbert Shea](#)
 - *Photonics* : [Prof. Olivier Martin](#)
- Robotics Master: [Prof. Francesco Mondada](#)
- Minor in Biomedical Technologies: [Prof. Philippe Renaud](#)
- Minor in Photonics: [Prof. Olivier Martin](#)
- Passerelle HES : [Sebastian Gautsch](#)
- Industry internships: [Hind Klinke](#)

Administration : [Isabelle Schafer](#)

Before contacting the Section ...





SCIENTES ET TECHNIQUES DE L'INGÉNIER >

GÉNIE ÉLECTRIQUE

ET MICROTECHNIQUE

search

EN / FR

INSTITUT

ÉDUCATION EL

EDUCATION MT

RECHERCHE

INNOVATION

Aperçu

Bienvenue du directeur de la section de microtechnique

La direction (SMT)

Heures de bureau

Journée d'accueil SMT

Conseil consultatif

La section MT en chiffres

Plans et règles d'étude

Témoignages

Canal Switchtube de la section

Les prix en Microtechnique

Associations d'étudiants

Q&A des étudiants Covid-19

Directives Covid-19 EPFL

Stages d'ingénieur

A propos

Procédure pour les étudiants

FAQ pour étudiants

Documents

Bachelor

Accueil – Bachelor MT

Bachelor en Microtechnique

Critères d'admission et candidature

Règles de prérequis – Bachelor Microtechnique

Règles de prérequis

Cycle Bachelor (MT)

Cycle propédeutique (MT)

Mobilité horizontale

A propos

Master

Master en Microtechnique

Master en Robotique

Mineur en technologies biomédicales

Mineur en Photonique

Plan d'étude – Cycle master min

Plan d'étude

Ressources

Critères d'admission et candidature

Programme doctorale

EDMI – Microsystèmes et microélectronique

EDPO – Photonique

EDRS – Robotique, Contrôle et Systèmes intelligents

EDAM – Manufacturing

smt.epfl.ch

Memo sticker

Bienvenue !

*Le présent document utilise la forme masculine, étant précisé cependant qu'il vise aussi bien les femmes que les hommes.
Nos nouveaux étudiants Master trouveront quelques compléments d'information en bas de page.*

Bienvenue en Microtechnique

Vous avez, en toute objectivité, choisi la meilleure section !

Nous avons regroupé ici quelques éléments partagés par vos prédécesseurs

- **Guide de préparation** pour les nouveaux étudiants Bachelor
- **Règlements et procédures** : bien entendu, tous ces éléments sont à votre disposition
- **IS-Academia** : l'outil de gestion de vos études à l'EPFL ! Notez qu'il est très utile, mais faites attention aux nombres de places disponibles : pour les Master, ils sont limités.
- **Moodle** : vous serez automatiquement inscrit à certains cours ! Pour le moment, rien de prévu.
- **Courseware & SwitchTube**
- **BEAST** : le point d'accès à toutes les ressources de la Bibliothèque « Sciences de la Matière », demandées par les enseignants, sans qu'il ne soit forcément nécessaire de passer par le service de la Bibliothèque.
- **Poséidon** : le service de l'EPFL dédié au conseil d'achat et au support technique. C'est le plus performant du marché : la tâche la plus exigeante.
- **Drive des Microtechniciens** : vérifiez que vous êtes bien connecté à l'EPFL. Les instructions sur l'utilisation du drive sont disponibles dans le dossier « Drive ».
- **Discord des Microtechniciens** : pour communiquer et poser des questions dans le channel « Ressources » de ce serveur.
- A noter encore que les premières années ont un groupe **Telegram** « MT1-2-3 ».
- Et bien entendu, toujours à votre écoute pour vous soutenir et vous accompagner : **Johanne Pinel**
- Pour terminer, nous vous rappelons qu'il est très important de vérifier régulièrement vos emails.

Mais encore, pour nos étudiants Master :

- **Guide de préparation** pour les nouveaux étudiants Master
- Lignes directrices des **projets de semestre**
- Lignes directrices des **projets de master**
- **Stages en entreprise**
- **Procédure pour les étudiants**
- Lire la présentation des **stages SMT** (PDF)



EPFL
■ **section**
de microtechnique

**Welcome
on Board!**



MT Section office

The section office (BM1136) is open everyday for **administrative questions** from 8 AM to 2 PM

- [Isabelle Schafer](#) (administrative assistant)

For detailed questions regarding **your curriculum or study plan**, please **request an appointment**:

- [Sebastian Gautsch](#) (section adjunct)
- [Prof. Christophe Moser](#) (section director)

We wish you a succesful studies and hope that you will make the right choice for your Master !

