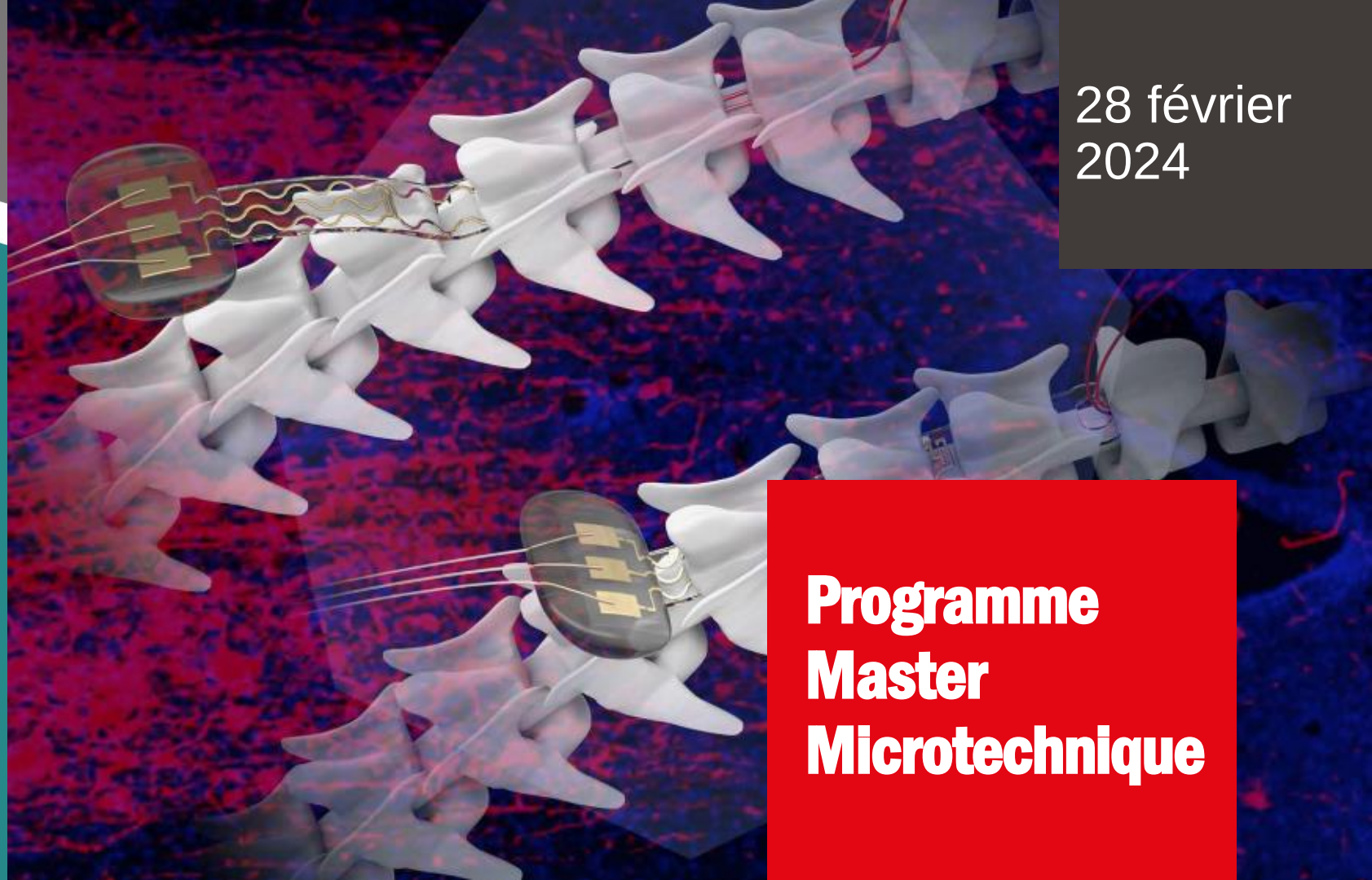
EPFL
mt
microtechnique
microengineering
section



28 février
2024

Programme Master Microtechnique

Faculté des Sciences
et Techniques
de l'Ingénieur (STI)

Welcome to Microengineering !

Download the presentation

Prof. Christophe Moser
Section Director

Dr. Sebastian Gautsch
Adjunct

What is Microengineering ?

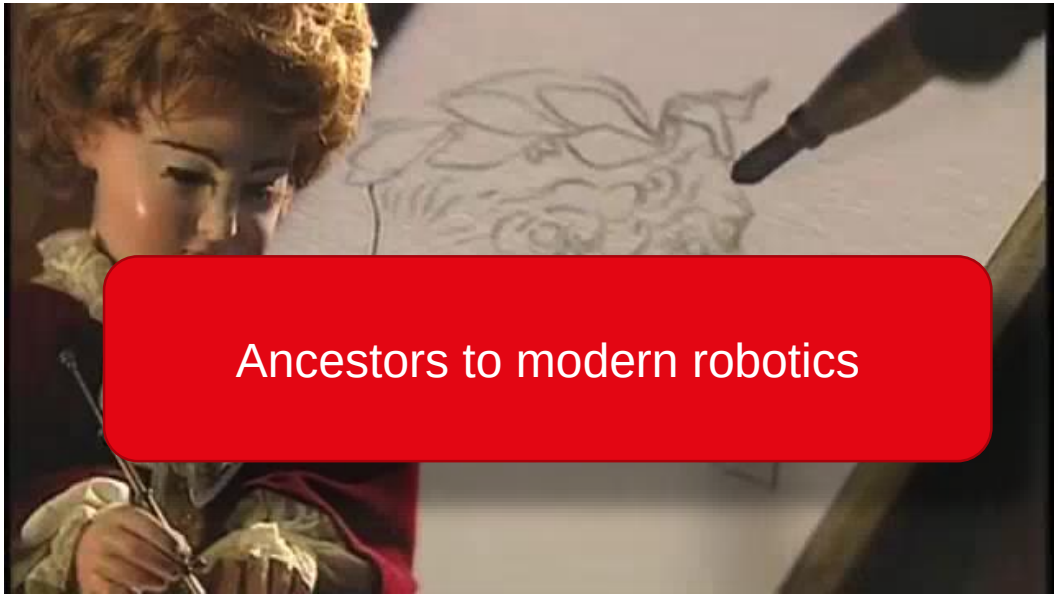
Microengineering is a branch of engineering that deals with the design and fabrication of very small structures and devices, typically on the scale of micrometers or smaller. It involves the use of microfabrication techniques to create complex systems and machines with dimensions that are often measured in microns.

Microengineering encompasses a wide range of applications, including micro-electronics, micro-electromechanical systems (MEMS), microfluidics, nanotechnology, and bioengineering. Some examples of microengineering products include microsensors, micro-actuators, micro-optics, microfluidic chips, and microelectronic devices.

Microengineering plays an increasingly important role in many fields, including medicine, electronics, materials science, and environmental monitoring. By creating devices that are small, efficient, and precise, microengineering is enabling new applications and advancing scientific understanding in a variety of areas.

Historical background

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



Le dessinateur
(2000 pièces)

Watch Valley: Birthplace of Swiss Watchmaking

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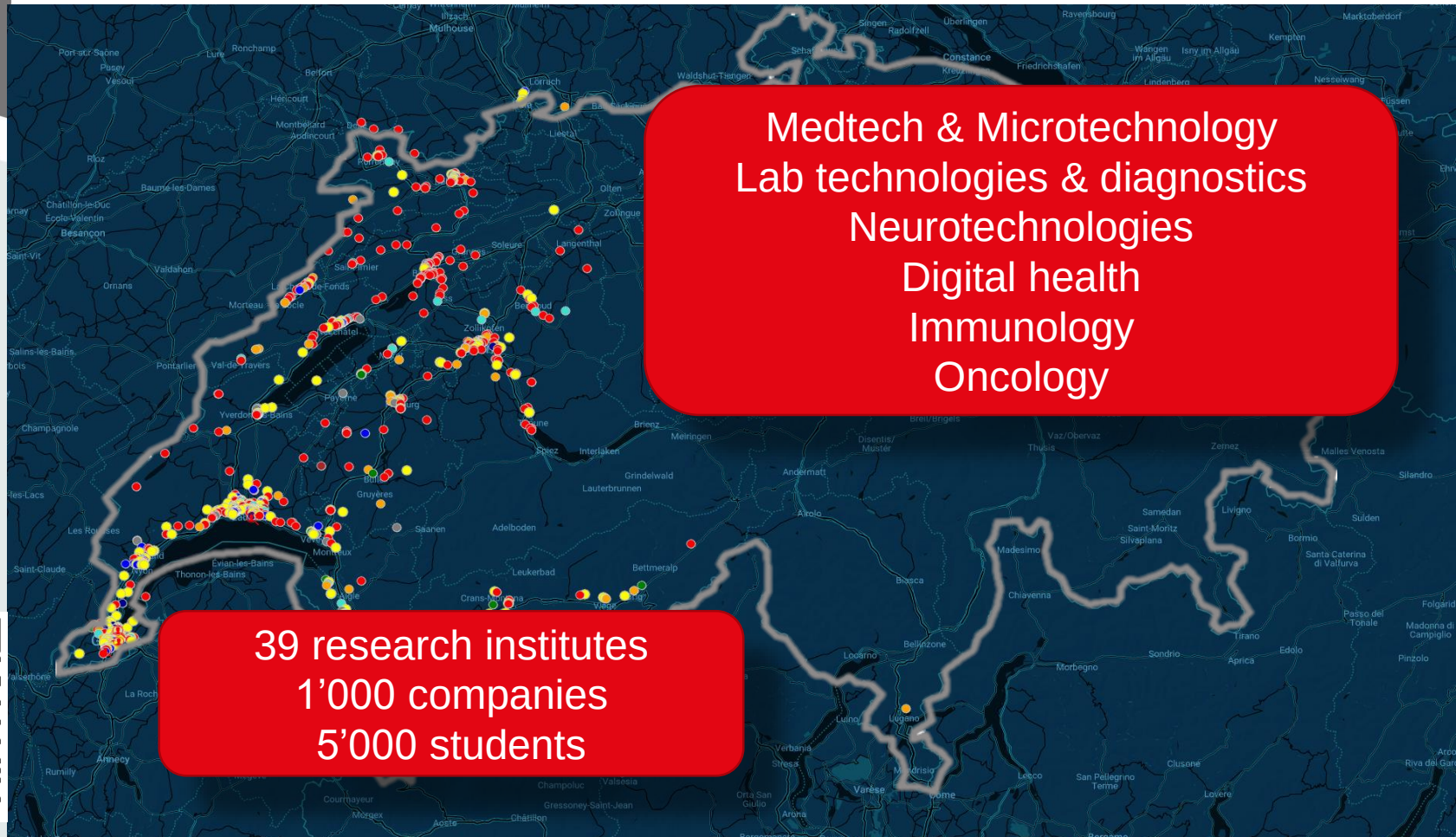
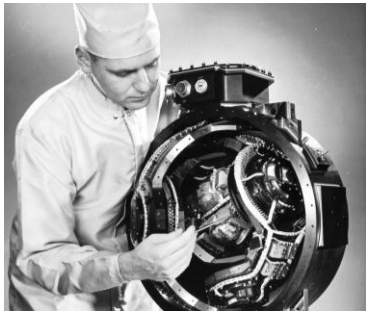
Building on history

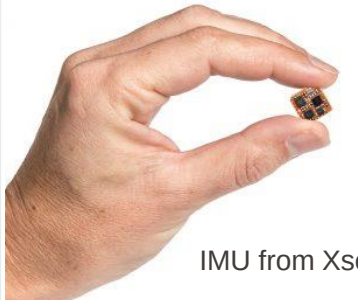


Why go Small ???

Size and Mass



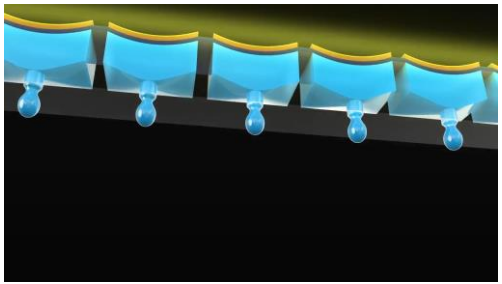
IMU on Saturn V (1960)



IMU from Xsens (2019)

Speed

40’000 droplets per second



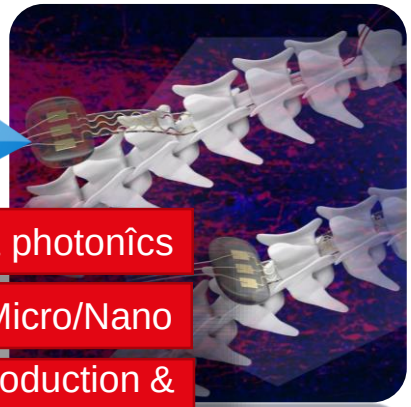
Energy consumption

Bachelor Microtechnique

Robotics master

- Industrial
- Mobile
- Medical

Microengineering master



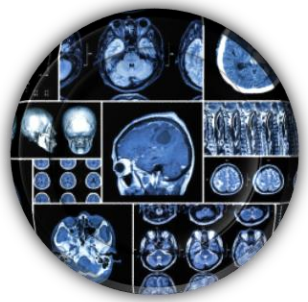
- Optics & photonîcs
- Micro/Nano
- Advanced production & manufacturing

Minors

Optics & Photonics

Biomedical Technologies

Imaging



Other EPFL BaS programs

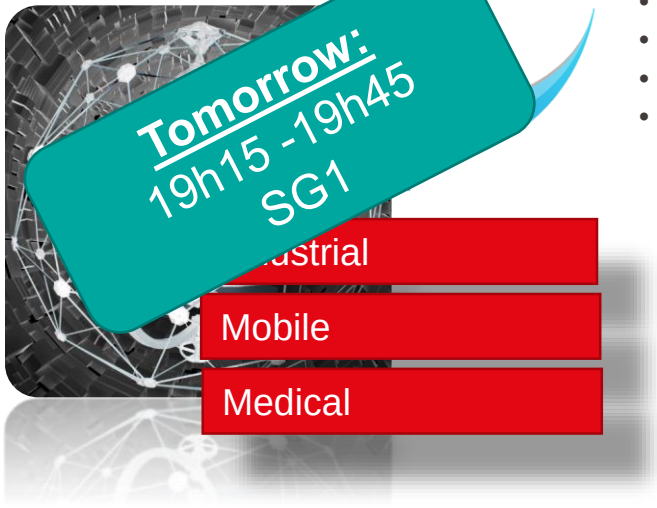
4.50 average

No mandatory prerequisit rules

Recommended background:

- Electronics
- Programming
- Mechanical design
- Microfab

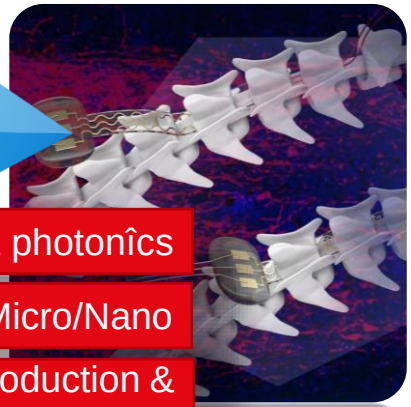
Robotics master



Tomorrow:
19h15 -19h45
SG1

- ...dustrial
- Mobile
- Medical

Microengineering master



- Optics & photonîcs
- Micro/Nano
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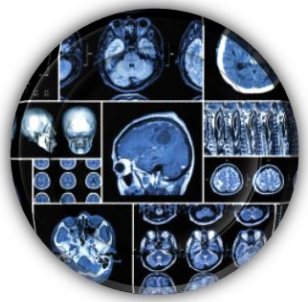
Minors

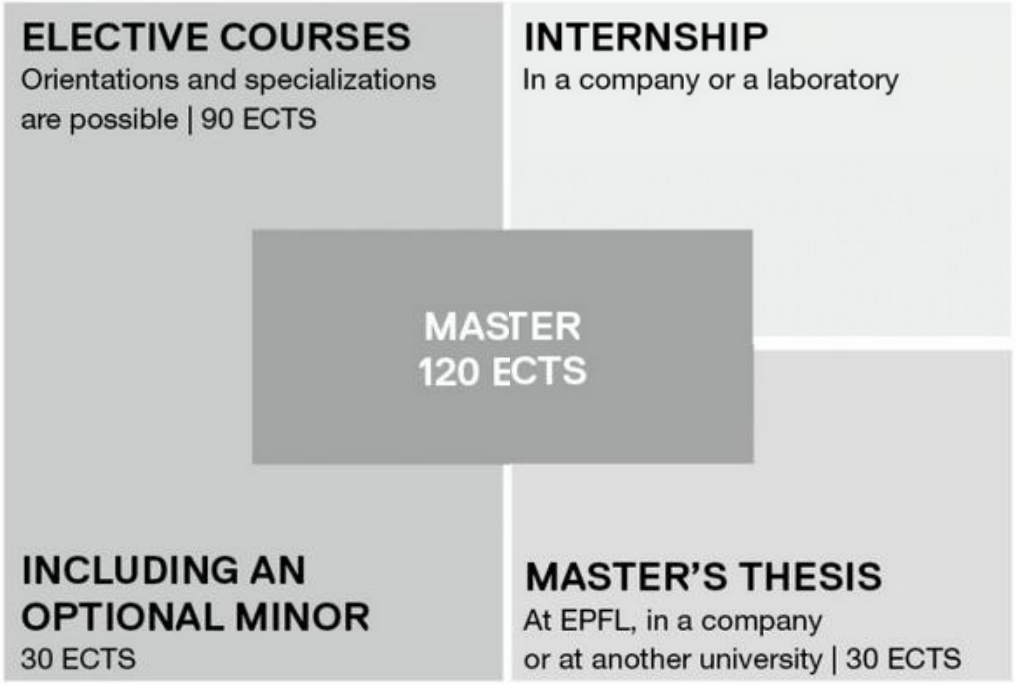
Optics & Photonics

Biomedical Technologies

Imaging

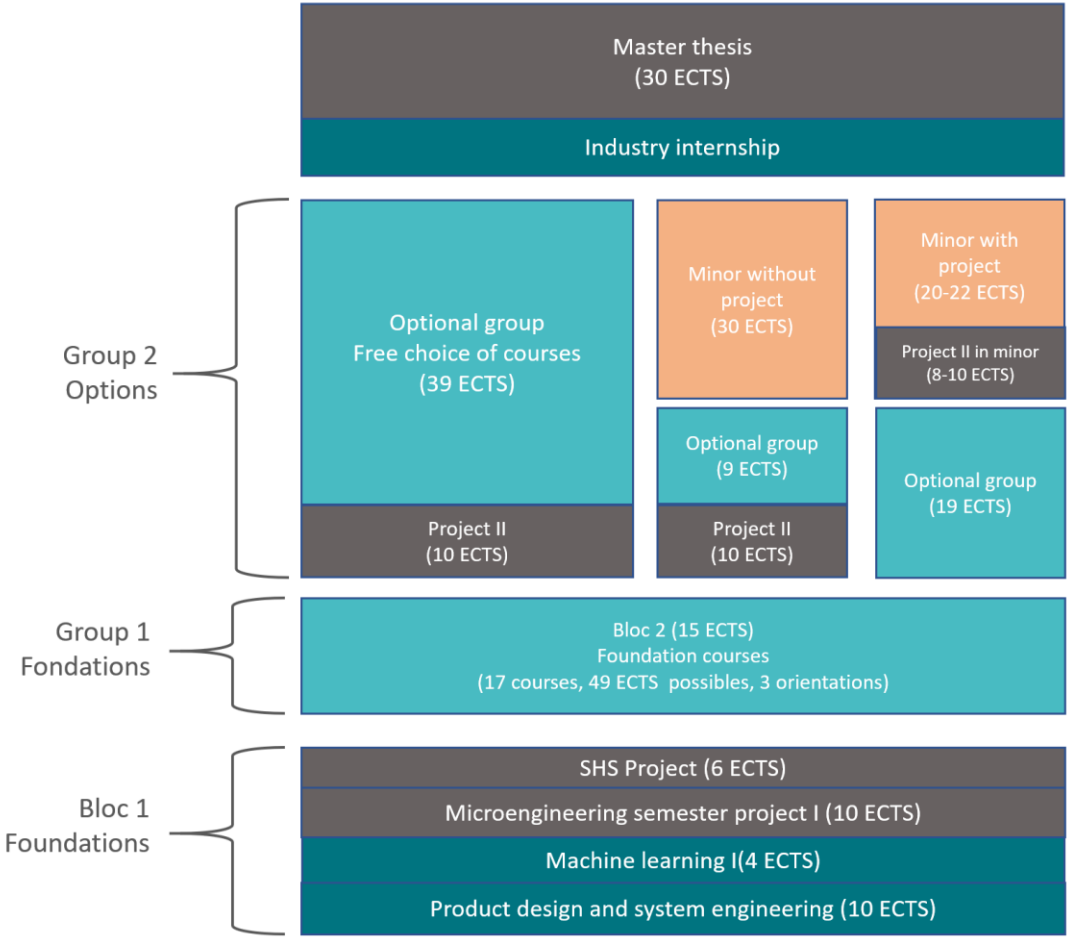


Master program structure



https://www.epfl.ch/education/master/study-programs-structure/

Master Program structure



Products Design and Systems Engineering

Foundational course in the first semester letting groups of students create their own product from concept to prototype, including a first marketing plan.
With invite speakers from Academia and Industry.

Fred
Electrical

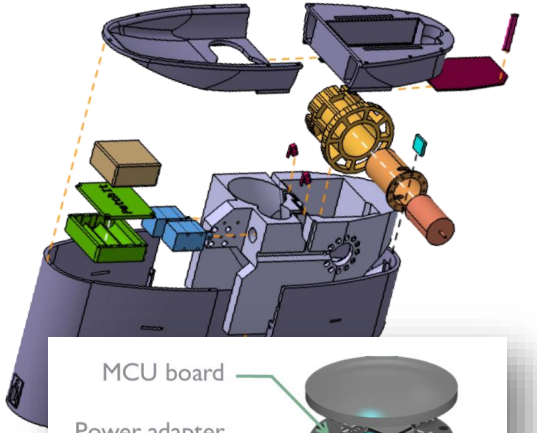
Pablo
Propulsion Designer

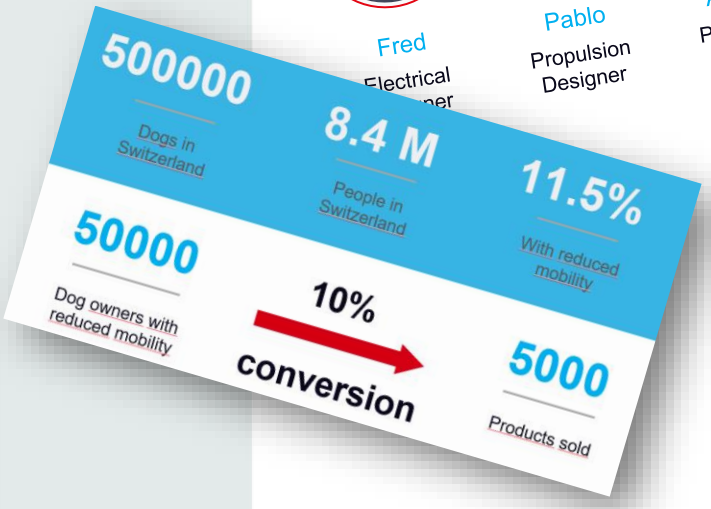
Andrea
Propulsion Designer

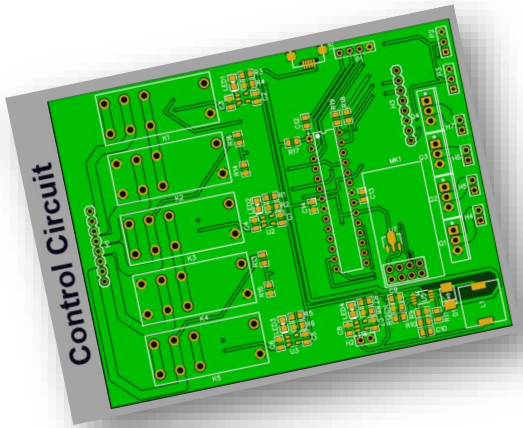
Charlotte
CAD designer

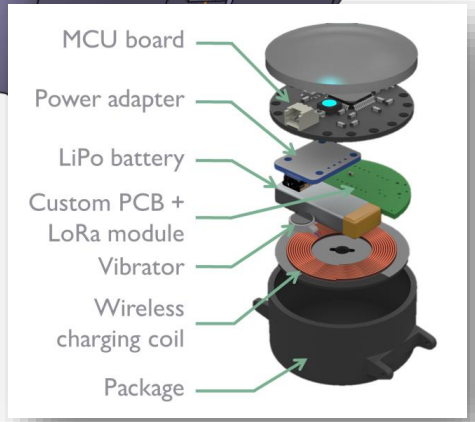
Hugo
Programmer

Florian
Business developer





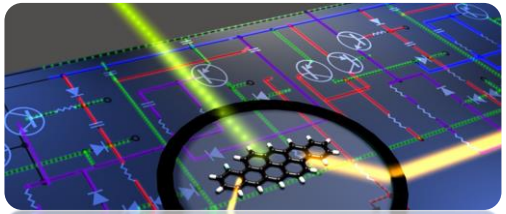


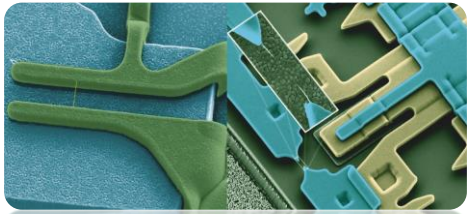


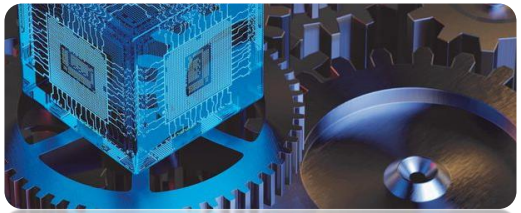
Orientations – Microengineering Master

Orientations are meant as **guidelines** to help students choose their courses

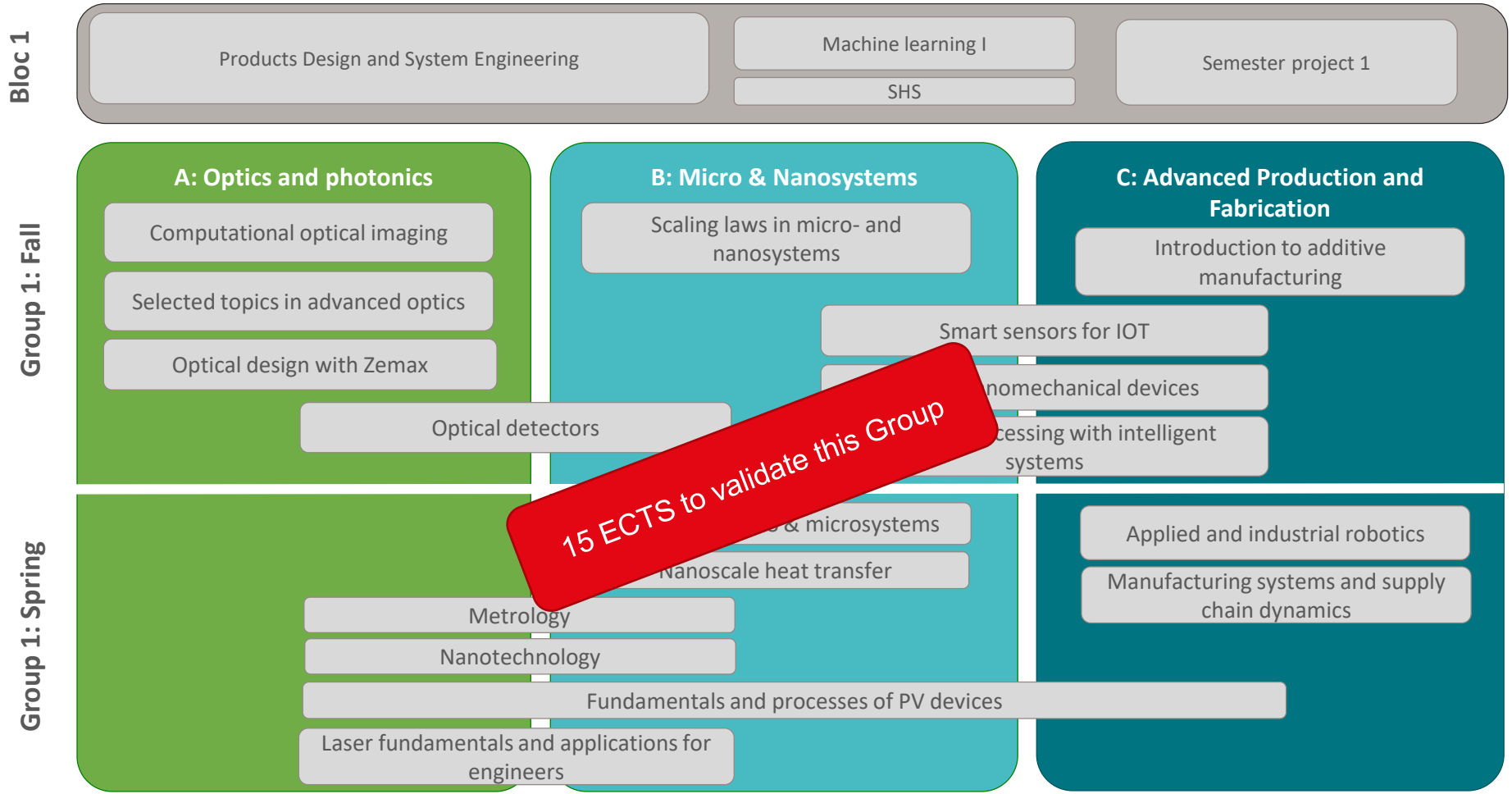
A Optics and Photonics	B Micro ans Nanosystems	C Advanced and Production and Fabrication



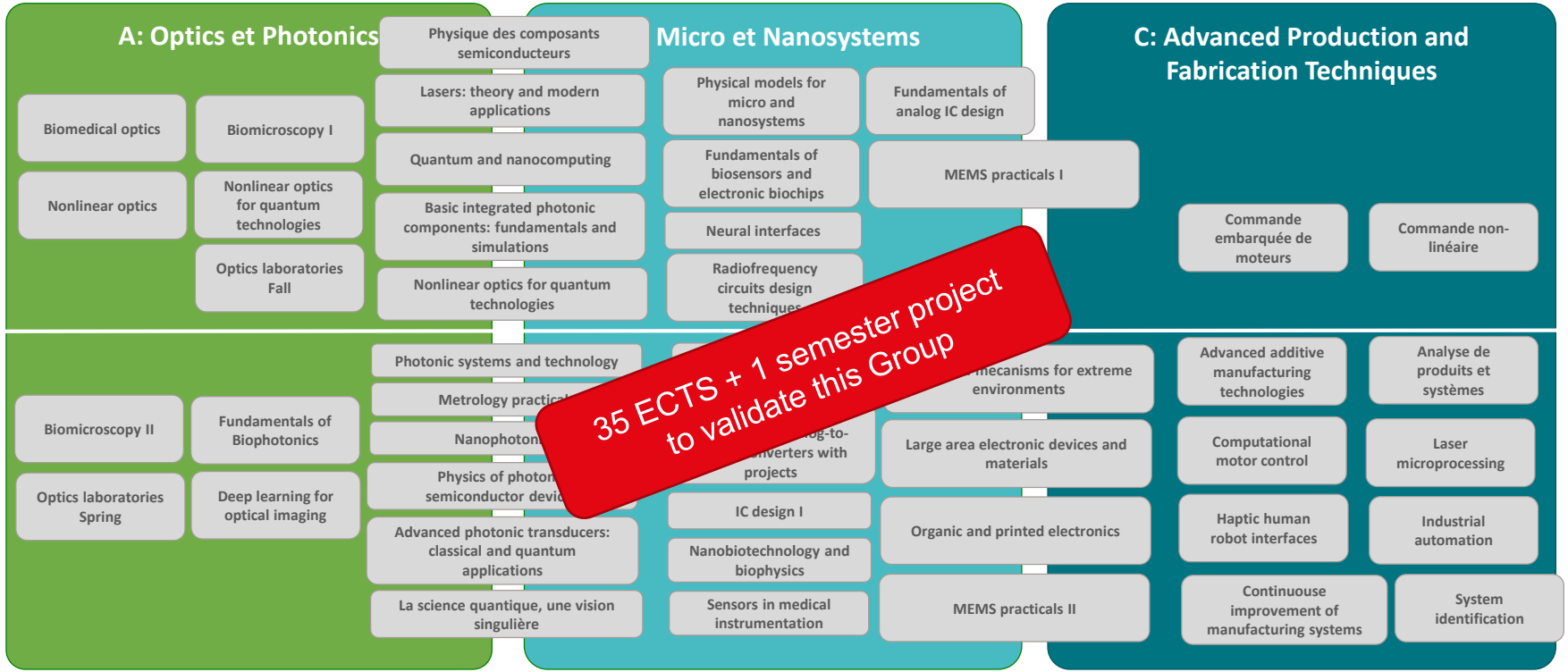




Orientations - Master Microengineering



Orientations - Master Microengineering



And more ...

AI / ML
Software architecture
Machine learning II
Machine learning programming:
Distributed intelligent systems
Model predictive control
Advanced control systems

Signals & Bio
Image processing I
Image processing II
Bio-image informatic, Audio
Neural signal and signal processing
Translational neuroengineering
Applied biomedical signal processing
Introduction to Bioengineering

Systems
Embedded systems
Systems engineering
Lab on app development for tablets and smartphones
Management de projet et analyse du risque
Space mission design and operations

Robotics
Basics of mobile robotics
Legged robots
Aerial robotics
Evolutionary robotics
Intercultural presentation skills

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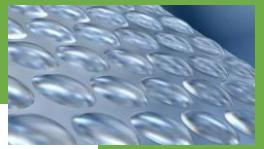
Imaging

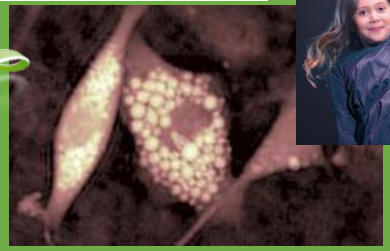


REGENT LIGHTING

SÜSS MicroOptics

lyncée tec

NANOLIVE Looking inside life

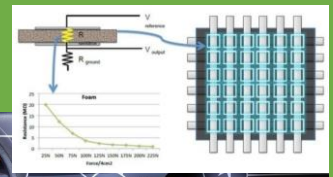


photon focus

Example of
Industry Players
Optics & Photonics

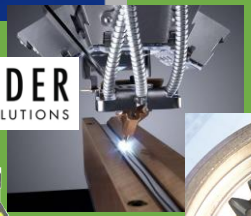
Smart fabric printing

SEFAR



TRUMPF

SYNOVA



SCHNYDER GEAR CUTTING SOLUTIONS

COHERENT

LUMENTUM

Laser cutting

teltec systems ag

Laser marking

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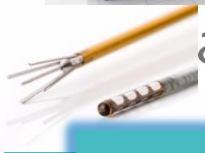
Example of Industry Players **Micro & Nanosystems**

Microfab, MEMS, Sensors and Packaging

SUSS MicroOptics

csem

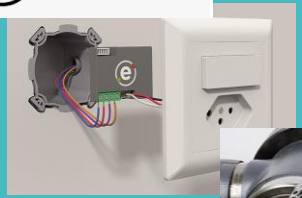
life.augmented



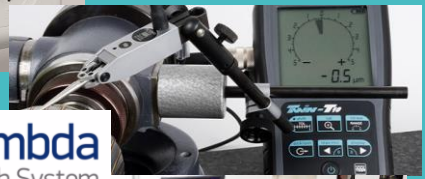
aleva NEUROTHERAPEUTICS

Systems Engineering

esmart



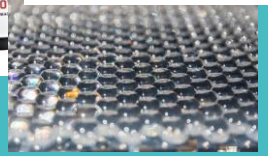
TESA TECHNOLOGY



Lambda Health System

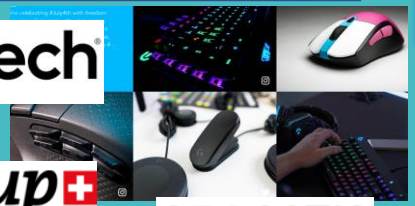
EMS ELECTRO MEDICAL SYSTEMS

insolight



Sensors, Wireless and IOT

logitech



Gaitup

GEOSATIS securing people

Watchmaking

BVLGARI

ROLEX

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Advanced manufacturing

BÜHLER

csem

Supply chain

ROLEX

Nestlé NESPRESSO

Cartier

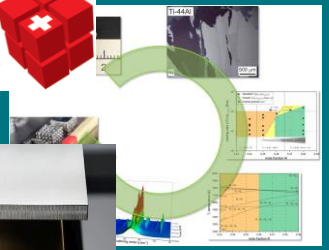
PHILIP MORRIS INTERNATIONAL

BOBST

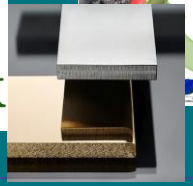
Example of Industry players

Advanced Manufacturing & Production

EMPA



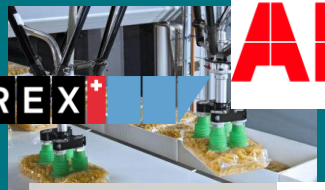
ROLEX



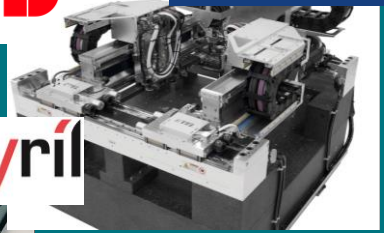
Materials processing

DEMAUREX

ABB



ETEL



AICA

Asycube
Flexible feeders

asyril

Industrial robotics

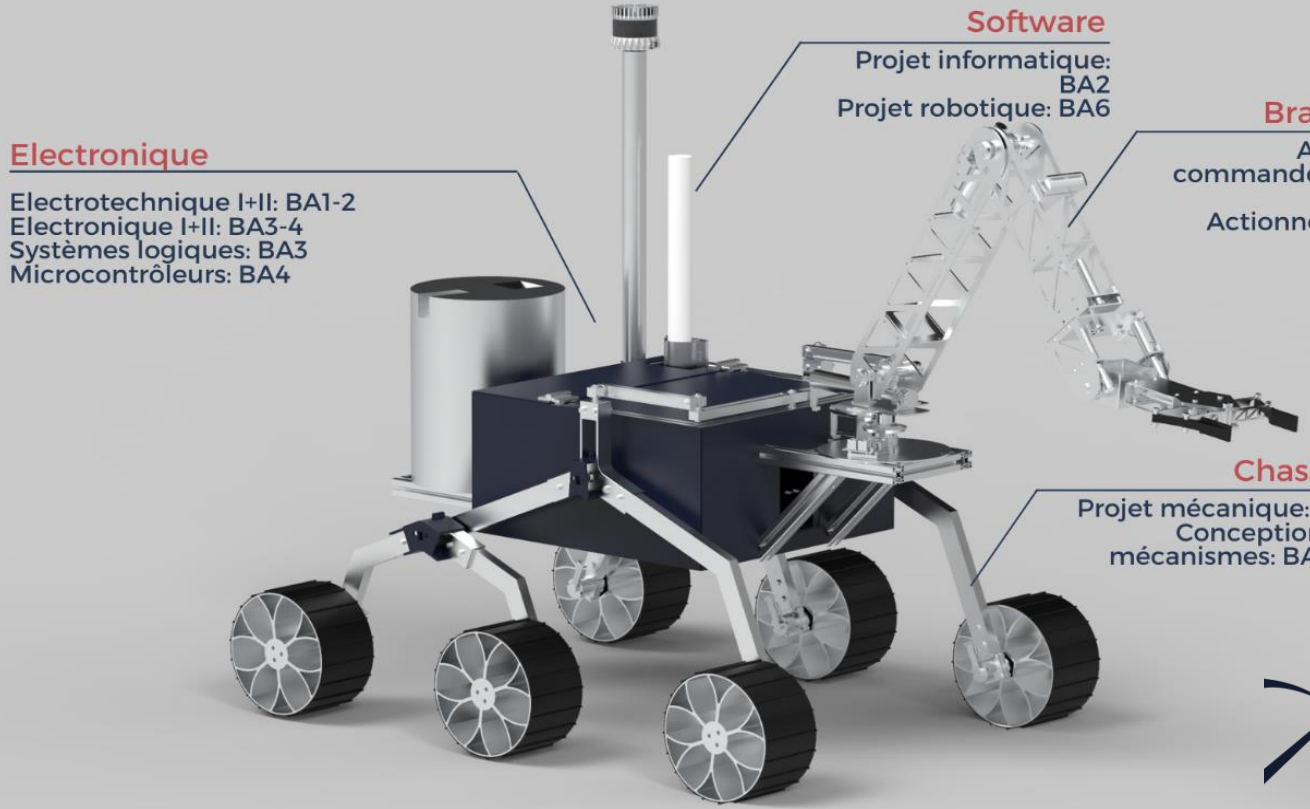
Master internship evaluations

Company evaluation (August '21 – August '23, 403 MT & RO students)

Speaker

What is Microenginering onboard a Rover ?

22



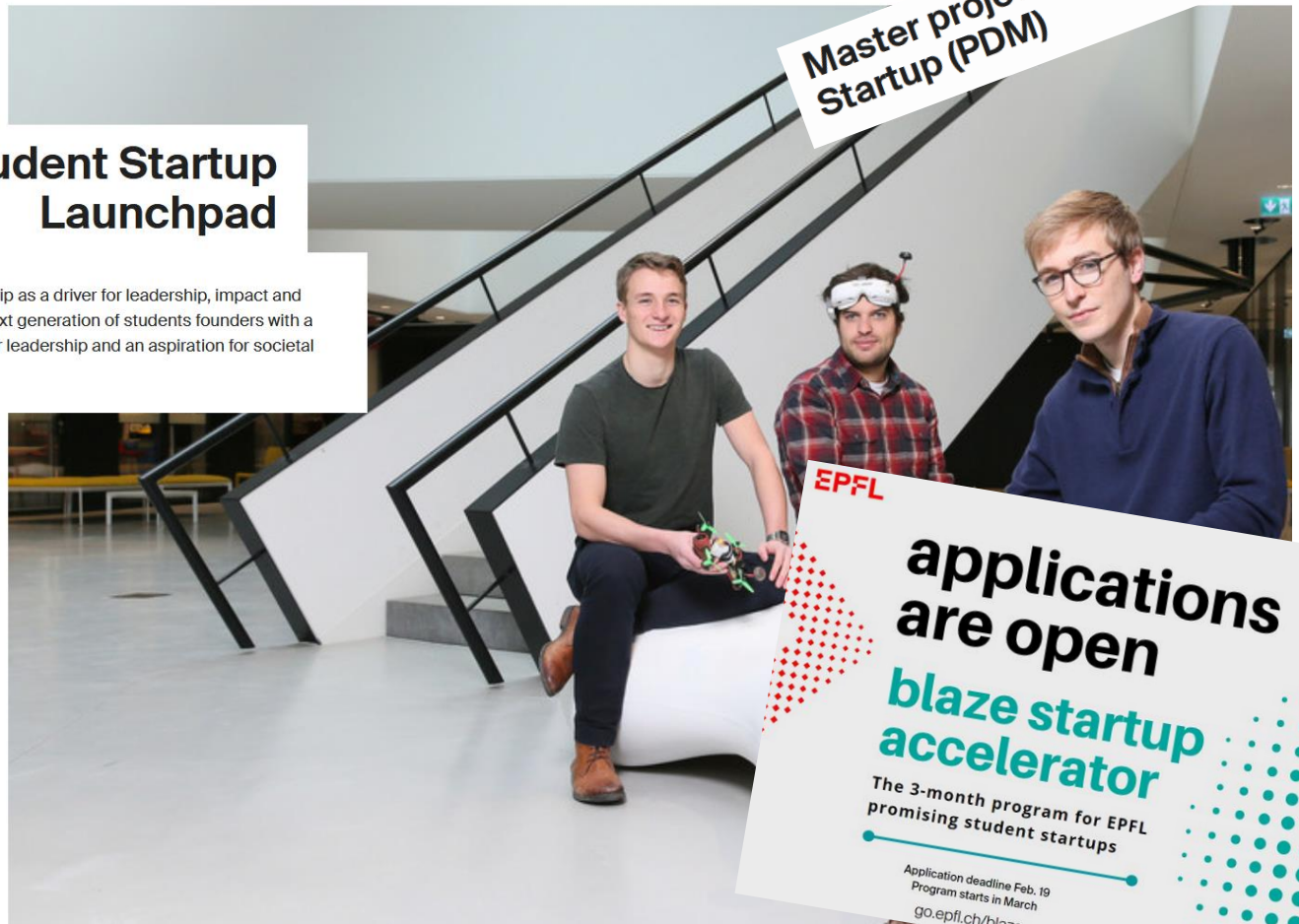
xplore

EPFL
mt
microtechnique
microengineering
section

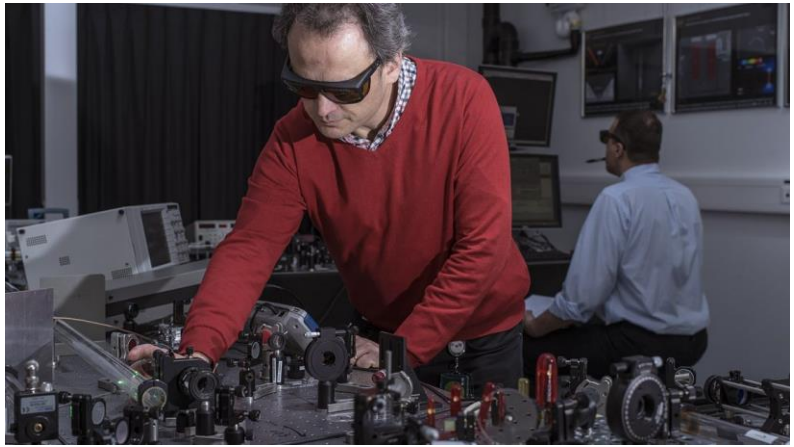
Entrepreneurship !

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.



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

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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

Minors...


Master thesis
(30 ECTS)
Industry internship
Optional Group
Extended course list
(39 ECTS)
Project II
(10 ECTS)
Minor without
project
(30 ECTS
Optional Group
(9 ECTS)
Project II
(10 ECTS)
Minor with
project
(30 ECTS)
Project II
(10 ECTS)
Optional Group
(19 ECTS)
Bloc 2 (15 ECTS)
Restricted course choice
(17 courses, 46 ECTS possible, 3 orientations)
SHS Project (6 ECTS)
Semester Project I (10 ECTS)
Product design and system engineering (10 ECTS)

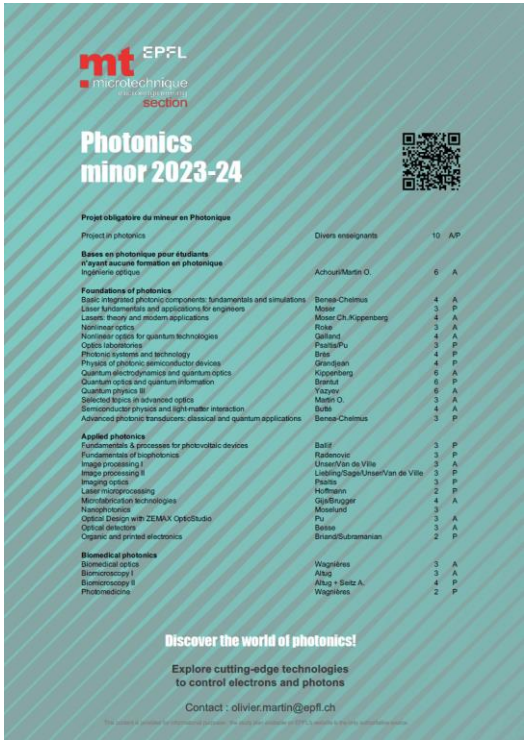
Recommended and possible Minors

Data and internet of things	Interdiscipl.	EL	Atienza D.	r
Energy	Interdiscipl.	GM	Maréchal F.	r
Imaging	Interdiscipl.	MT	Sage Daniel	r
Engineering for sustainability	Interdiscipl.	SIE	Gilliéron P.Y. , Leterrier	r
Technology management and entrepreneurship	Interdiscipl.	MTE	de Rassenfosse G.	r
Neuro-X	Discipl.	NX	Hummel F, Micera S.	r
Photonics	Interdiscipl.	MT	Martin O.	r
Physics of living systems	Interdiscipl.	SV	Persat A.	r
Quantum science and engineering	Discipl.	SIQ	Macris N. et Klinke H.	r
Biomedical technologies	Interdiscipl.	MT	Guiducci C.	r
Spacial technologies	Interdiscipl.	EL	Kneib J.-P.	r
Computational science and engineering	Discipl.	MA	Pouchon O.	r
Architecture	Discipl.	AR	Kochnitzky Palluel L.	c
Computational Biology	Interdiscipl.	IN	Salathé M.	c
Biotechnology	Interdiscipl.	CGC	Pick H.	c
Chemistry and chemical engineering	Discipl.	CGC	Marendaz J.-L.	c
Cyber security	Discipl.	IN	Hazboun E.	c
Data science	Discipl.	SC	Hazboun E.	c
Integrated Design, Architecture and Sustainability	Interdiscipl.	AR	Andersen M., Rey E.	c
Territories in transformation and climate	Interdiscipl.	AR	Joost St.	c
Civil engineering	Discipl.	GC	Turberg P.	c
Electrical and electronic engineering	Discipl.	EL	Gay-Balmaz Ph.	c
Mechanical engineering	Discipl.	GM	Prenleloup A.	c
Systems Engineering	Interdiscipl.	MTE	Weber Th.	c
Computer science	Discipl.	IN	Hazboun E.	c
Life sciences engineering	Discipl.	SV	Grisoni B.	c
Financial engineering	Discipl.	IF	Fahlenbrach R.	c
Mathematics	Discipl.	MA	Pouchon O.	c
Physics	Discipl.	PH	Mari D.	c
Materials science and engineering	Discipl.	MX	Marselli B.	c
Environmental sciences and engineering	Discipl.	SIE	Gilliéron P.-Y	c
Statistics	Discipl.	MA	Mhalla L.	c
Communication systems	Discipl.	SC	Hazboun E.	c

r Recommanded in the study plans

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

Minors administrated by our section



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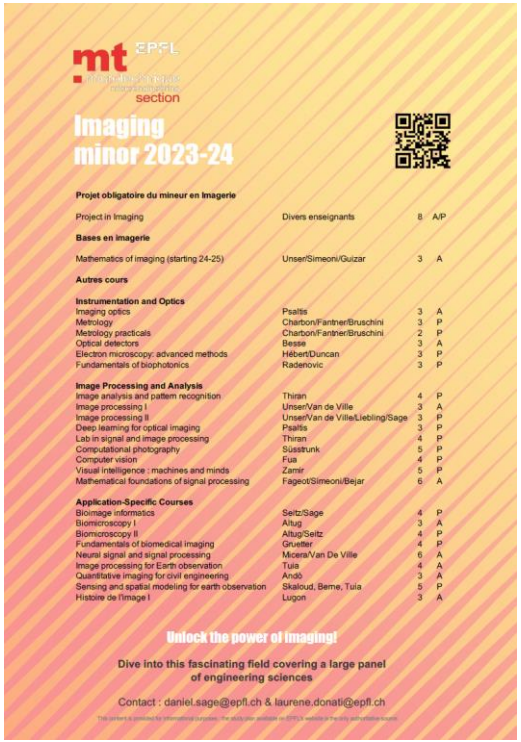
Photonics minor 2023-24

Projet obligatoire du mineur en Photonique			
Project in photonics	Divers enseignants	10	A/P
Bases en photonique pour étudiants n'ayant aucune formation en photonique			
Ingénierie optique	Achouri/Martin O.	6	A
Foundations of photonics			
Basic integrated photonic components: fundamentals and simulations	Benea-Chelmus	4	A
Laser fundamentals and applications for engineers	Moser	3	P
Lasers: theory and modern applications	Moser Ch./Kippenberg	4	A
Nonlinear optics	Roke	3	A
Nonlinear optics for quantum technologies	Galland	4	A
Optics laboratories	Psaltis/Pu	3	P
Photonic systems and technology	Brès	4	P
Physics of photonic semiconductor devices	Grandjean	4	P
Quantum electrodynamics and quantum optics	Kippenberg	6	A
Quantum optics and quantum information	Beaniut	6	P
Quantum physics III	Yazyev	6	A
Selected topics in advanced optics	Martin O.	3	A
Semiconductor physics and light-matter interaction	Buttè	4	A
Advanced photonic transducers: classical and quantum applications	Benea-Chelmus	3	P
Applied photonics			
Fundamentals & processes for photovoltaic devices	Ballif	3	P
Fundamentals of biophotonics	Radenovic	3	P
Image processing I	Unser/Van de Ville	3	A
Image processing II	Liebling/Sage/Unser/Van de Ville	3	P
Imaging optics	Psaltis	3	P
Laser microprocessing	Hoffmann	2	P
Microfabrication technologies	Gijs/Brugger	4	A
Nanophotonics	Moselund	3	
Optical Design with ZEMAX OpticStudio	Pu	3	A
Optical detectors	Beiise	3	A
Organic and printed electronics	Briand/Subramanian	2	P
Biomedical photonics			
Biomedical optics	Wagnières	3	A
Biomicroscopy I	Altug	3	A
Biomicroscopy II	Altug + Seitz A.	4	P
Photomedicine	Wagnières	2	P

Discover the world of photonics!

Explore cutting-edge technologies to control electrons and photons

Contact : olivier.martin@epfl.ch



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Imaging minor 2023-24

Projet obligatoire du mineur en Imagerie			
Project in Imaging	Divers enseignants	8	A/P
Bases en imagerie			
Mathematics of imaging (starting 24-25)	Unser/Simeoni/Guizar	3	A
Autres cours			
Instrumentation and Optics			
Imaging optics	Psaltis	3	A
Metrology	Charbon/Fantner/Bruschini	3	P
Metrology practicals	Charbon/Fantner/Bruschini	2	P
Optical detectors	Besse	3	A
Electron microscopy: advanced methods	Hébert/Duncan	3	P
Fundamentals of biophotonics	Radenovic	3	P
Image Processing and Analysis			
Image analysis and pattern recognition	Thiran	4	P
Image processing I	Unser/Van de Ville	3	A
Image processing II	Unser/Van de Ville/Liebling/Sage	3	P
Deep learning for optical imaging	Psaltis	3	P
Lab in signal and image processing	Thiran	4	P
Computational photography	Süsstrunk	5	P
Computer vision	Fua	4	P
Visual intelligence : machines and minds	Zamir	5	P
Mathematical foundations of signal processing	Fageot/Simeoni/Bejar	6	A
Application-Specific Courses			
Bioimage informatics	Seitz/Sage	4	P
Biomicroscopy I	Altug	3	A
Biomicroscopy II	Altug/Seitz	4	P
Fundamentals of biomedical imaging	Gruetter	4	P
Neural signal and signal processing	Micera/Van De Ville	6	A
Image processing for Earth observation	Tuia	4	A
Quantitative imaging for civil engineering	Andò	3	A
Sensing and spatial modeling for earth observation	Skaloud, Berne, Tuia	5	P
Histoire de l'image I	Lugon	3	A

Unlock the power of imaging!

Dive into this fascinating field covering a large panel of engineering sciences

Contact : daniel.sage@epfl.ch & laurene.donati@epfl.ch

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Biomedical technologies minor 2023-24

Projet obligatoire du mineur en Technologies biomédicales			
Project in biomedical technologies	Divers enseignants	8	A/P
Bases biomédicales			
Biophysics : physics of the cell	Manley	3	P
Cellular biology and biochemistry for engineers	Zufferey	4	A
Physiologie par systèmes	Roy	4	P
Seminar in physiology and instrumentation	Radenovic	2	A
Autres cours			
Analog circuits for biochip	Carrara/Schmid/Skrivervik	3	P
Applied biomedical signal processing	Lemay	4	A
Bioelectronics and biomedical microelectronics	Schmid	3	A
Bioimage informatics	Sage/Seitz	4	P
Basics in Bioinstrumentation *	Merten	4	A
Computational neurosciences : neuronal dynamics	Gerstner	5	P
Biomechanics of the cardiovascular system	Stergiopulos	3	P
Biomechanics of the musculoskeletal system	Pioletti	5	P
Biomedical optics	Wagnières G.	3	A
Biomicroscopy I	Altug	3	A
Biomicroscopy II	Altug+Seitz A.	4	P
Bio-nano-chip design	Carrara	3	A
Biophysics : physics of biological systems	Rahi Sahand J.	4	A
Fundamentals of biomedical imaging	Gruetter	4	P
Fundamentals of biophotonics	Radenovic A.	3	P
Fundamentals of biosensors and electronic biochips	C. Guiducci	3	A
Ingénierie optique	Achouri/Martin O.	6	A
Light, liquids and interfaces	Roke S.	4	A
Mechanobiology: how mechanics regulate life	Persat/Sakar	3	A
Microfabrication technologies	Brugger/Gijs	4	A
Nanobiotechnology and biophysics	Fletz B.	3	P
Neural interfaces	Lacour	6	A
Neural signals and signal processing	Micera/Van De Ville	6	A
Neuroscience: cellular and circuit mechanisms	Crochet/Petersen	5	A
New tools & research strategies in personalized health	Trono	4	P
Numerical methods in biomechanics	Terrier A.	3	P
Sensors in medical instrumentation	Chételat/Ionescu	3	P
Translational neuroengineering	Blanke/Courtine/Hummel/Micera	6	P

Experience the future of biomedical technologies !

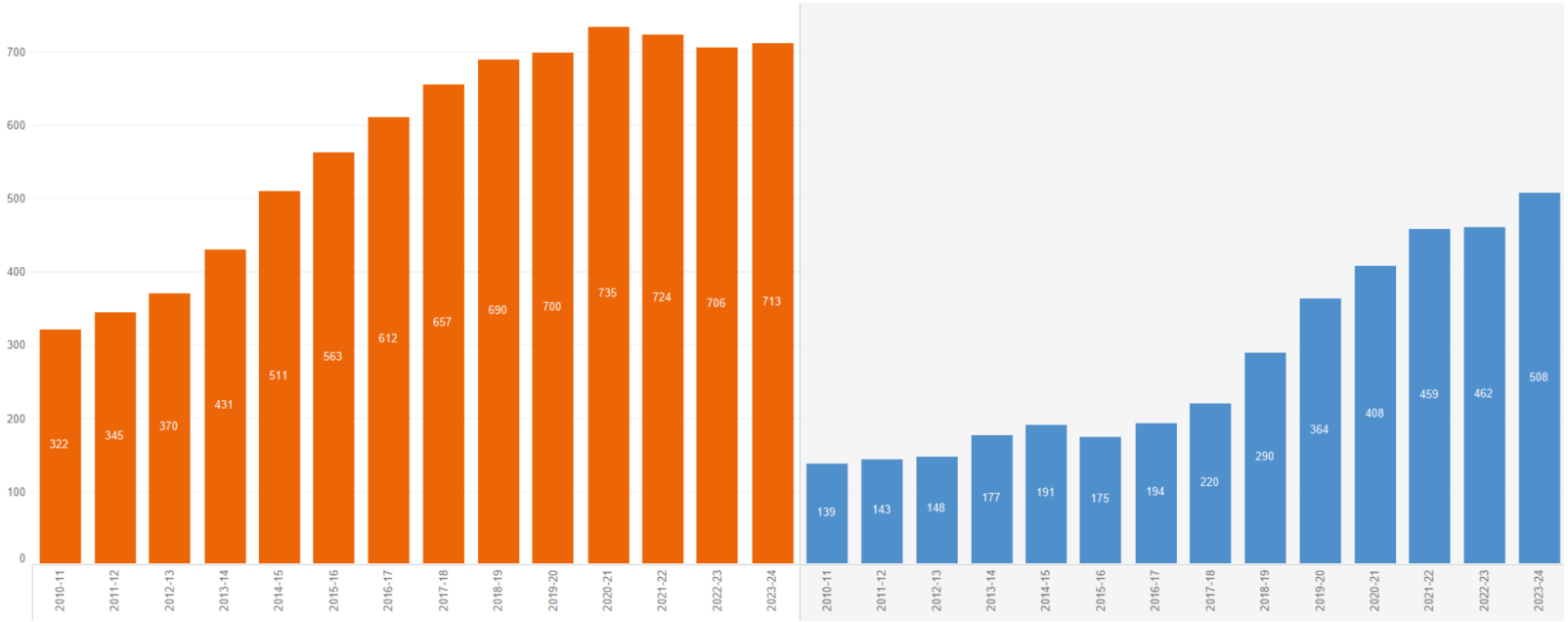
Join this program to transform the way we understand and treat the human body

Contact : carlotta.guiducci@epfl.ch

Successful curricula (>1200 students)

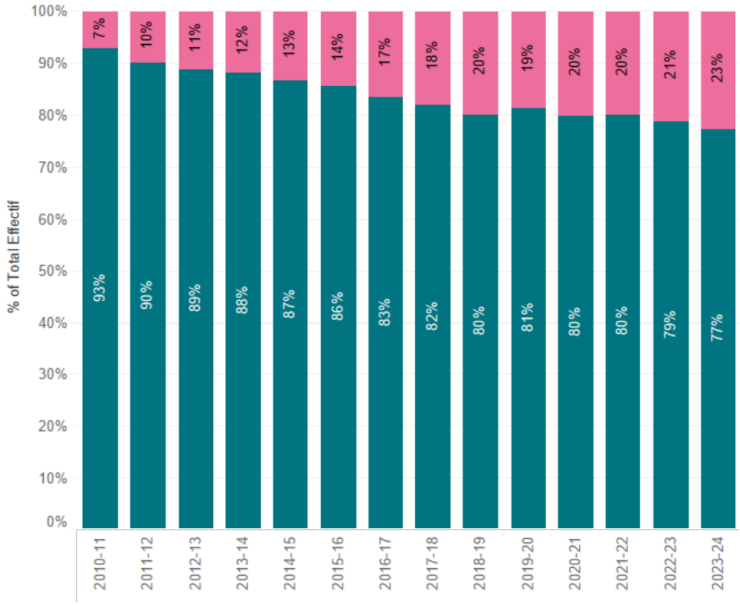
Bachelor

Master
Microengineering & Robotics

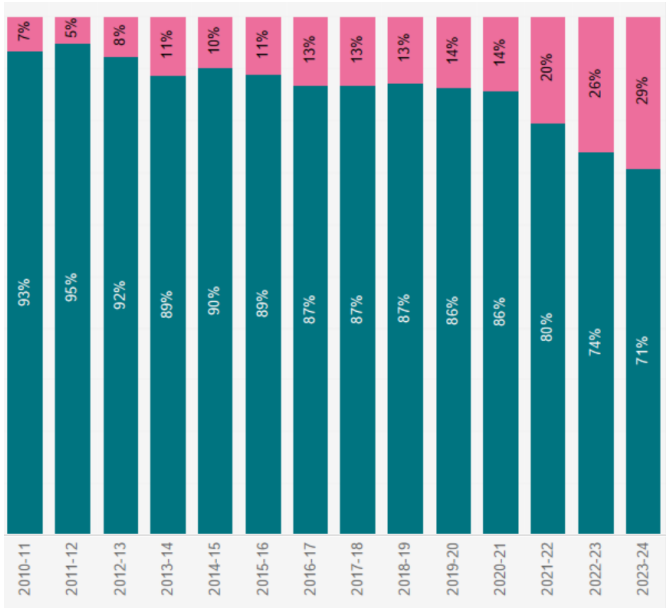


Gender balance

Bachelor



Microengineering Master



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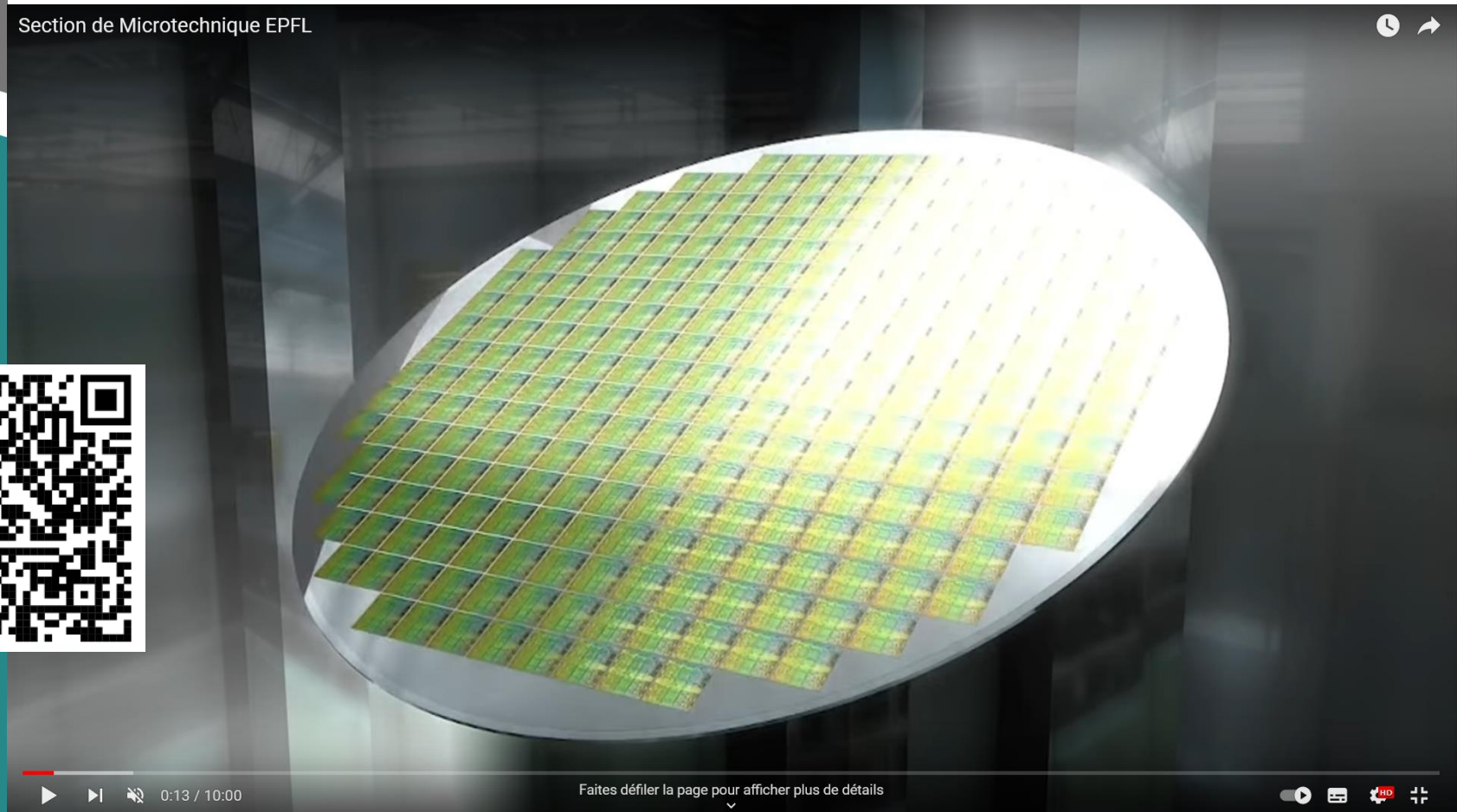
Short Movie to learn more



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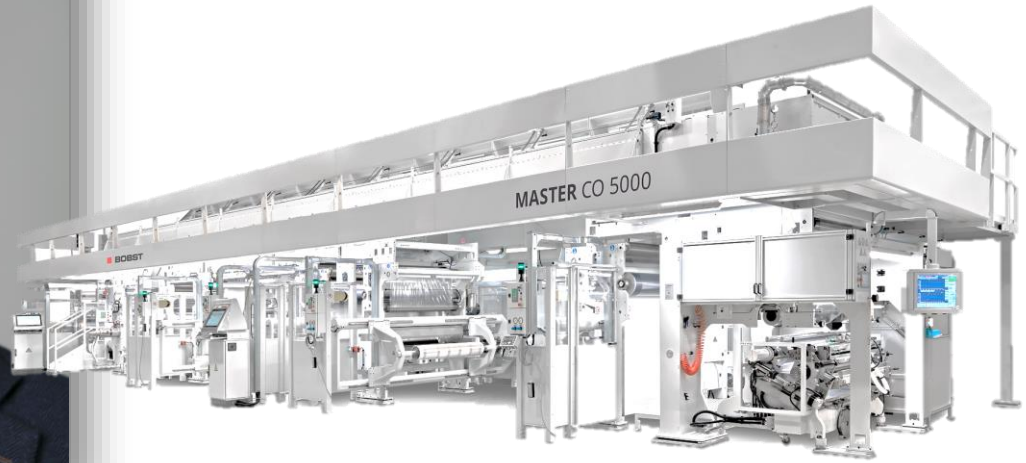
Alumni Testimonies



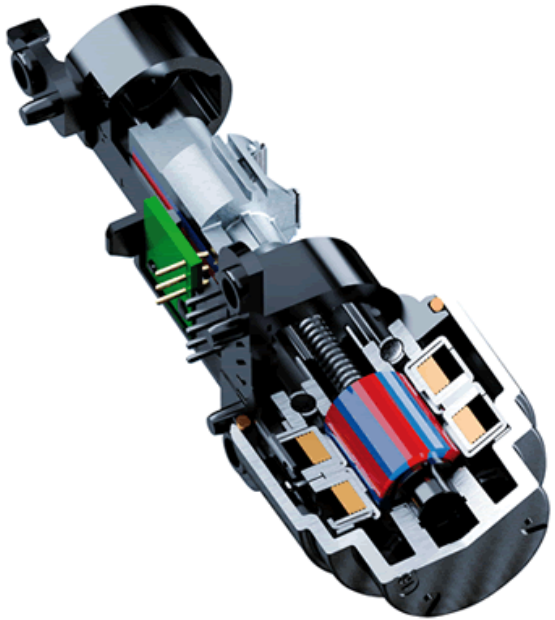
Léonard Badet
Head of Group Technology – Bobst
Master Microtechnique terminé en 2017

BOBST

Alumni Testimonies

Damien Wittwer
Business Unit Manager Associate
Master Microtechnique terminé en 2010

SONCEBOZ



https://tube.switch.ch/videos/J6tEwLIxYr

Alumni Testimonies

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

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#1 in Switzerland

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For Nanotechnology

#2 in Europe

#1 in Switzerland

Enrollment 12,576

8. Federal Institute of Technology Lausanne

Switzerland | Lausanne

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#1 in Europe

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https://edurank.org/engineering/nanotechnology/

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We wish you a successful continuation of your Bachelor studies and hope that you will make the right choice for your Master !