



**Experience of an
industry-oriented
Master degree in France
based on a strong research and
international background**



Prof. Alain BOUSCAYROL
(Head of Master ACES,
Univ. Lille, France)



Outline

1

European “Bachelor Master Doctorate” system

2

Master “Automatic Control & Electrical Systems”

3

Master option “Smart Electric Vehicles”



1. European “Bachelor Master Doctorate” system

European Higher Education Area

Since 2010, European Higher Education Area
collaboration on higher education
of 48 countries

- progressive structural reforms
- common framework
- shared tools

Objectives:

- increase student mobility
- increase staff mobility
- facilitate employability



European Credit Transfer System (ECTS)

standard means for comparison of academic credits and mobility increase

1 ECTS credit = 25 to 30 working hours
(personal and training)

1 year = 2 semesters = 2 x 30 ECTS credits

Key of mobility

- **Grading**
- A top 10% of the students
- B 10% to 35%
- C 35% to 65%
- D 65% to 90%
- E 90% to 100%
- F Fail

ECTS Users' Guide



Bachelor Master Doctorate (BMD) system

Higher Education (after secondary School)

since 2000
progressive change
within Europe



Bachelor

3 years

3 x 60 = 180 ECTS

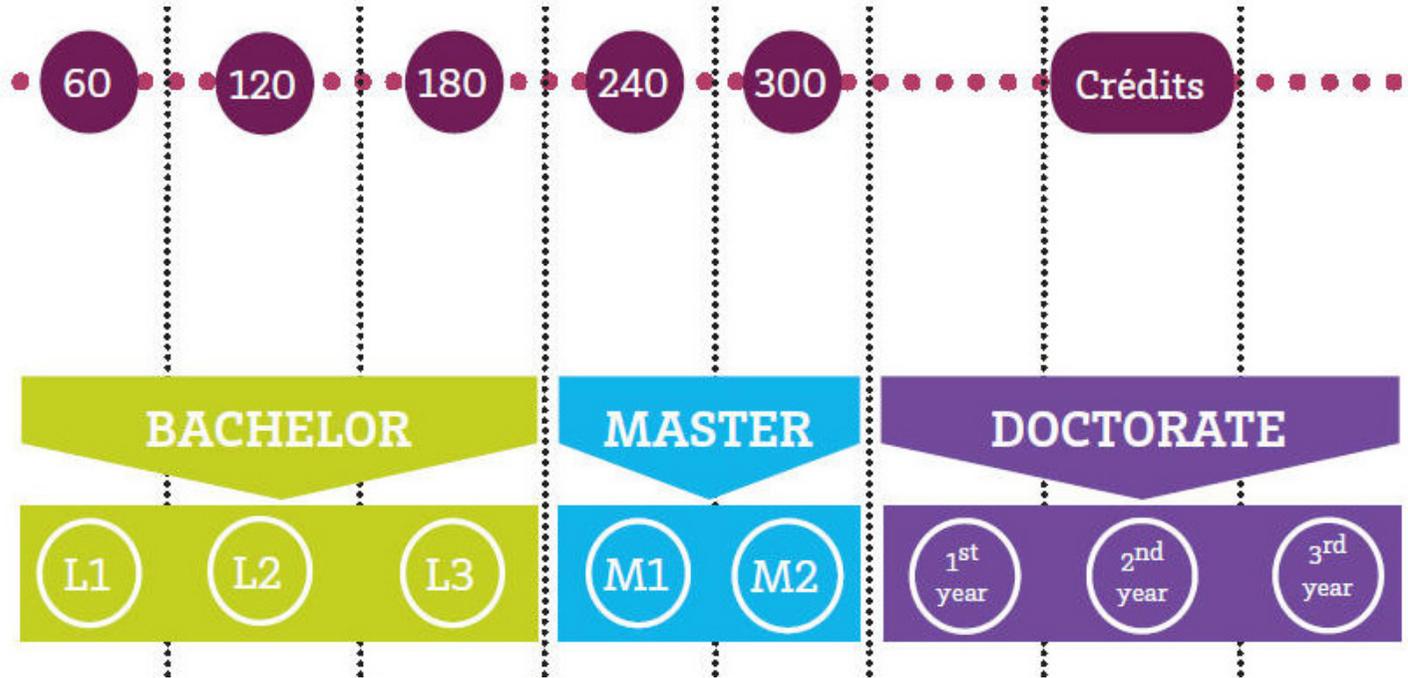
Master

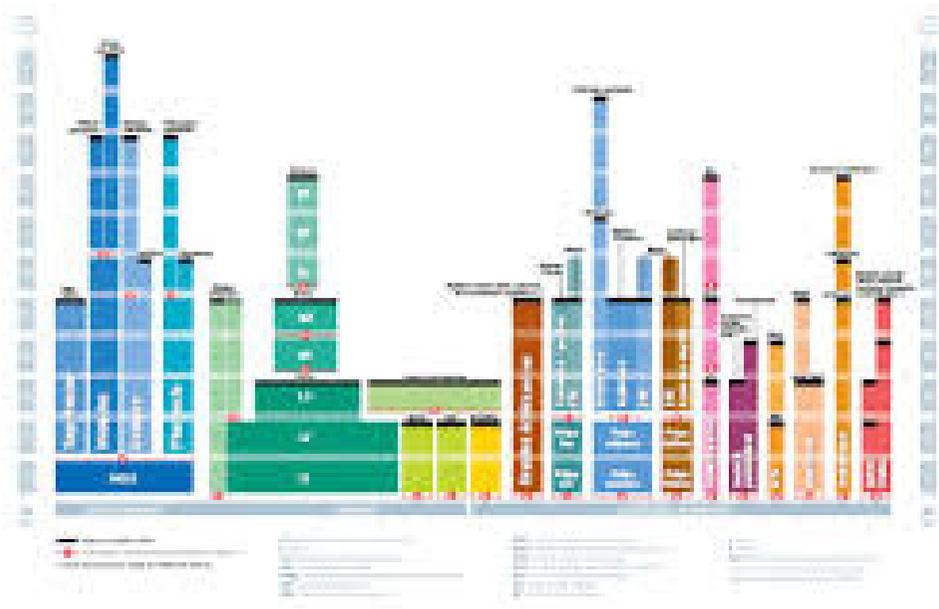
2 years

2 x 60 = 120 ECTS

Doctorate

3 years



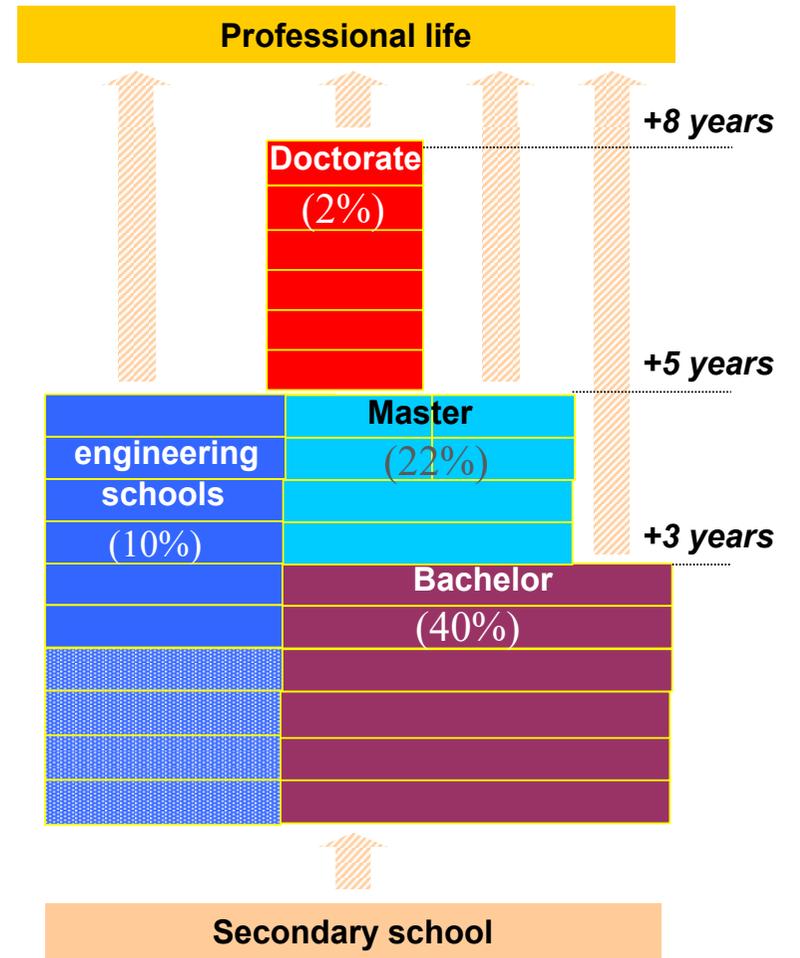


2.7 Millions students in 2019

<https://www.enseignementsup-recherche.gouv.fr>

French case

from 2003



* 26% of students in technical training or other

French Master degrees

600,000 Master students in 2019

Master = 2 years = 4 semesters = 120 ECTS
 (generally 1 semester of internship)



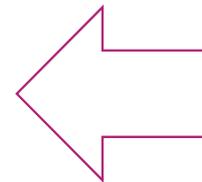
industry-oriented
Master
 (more application
 courses + internship
 in industry)



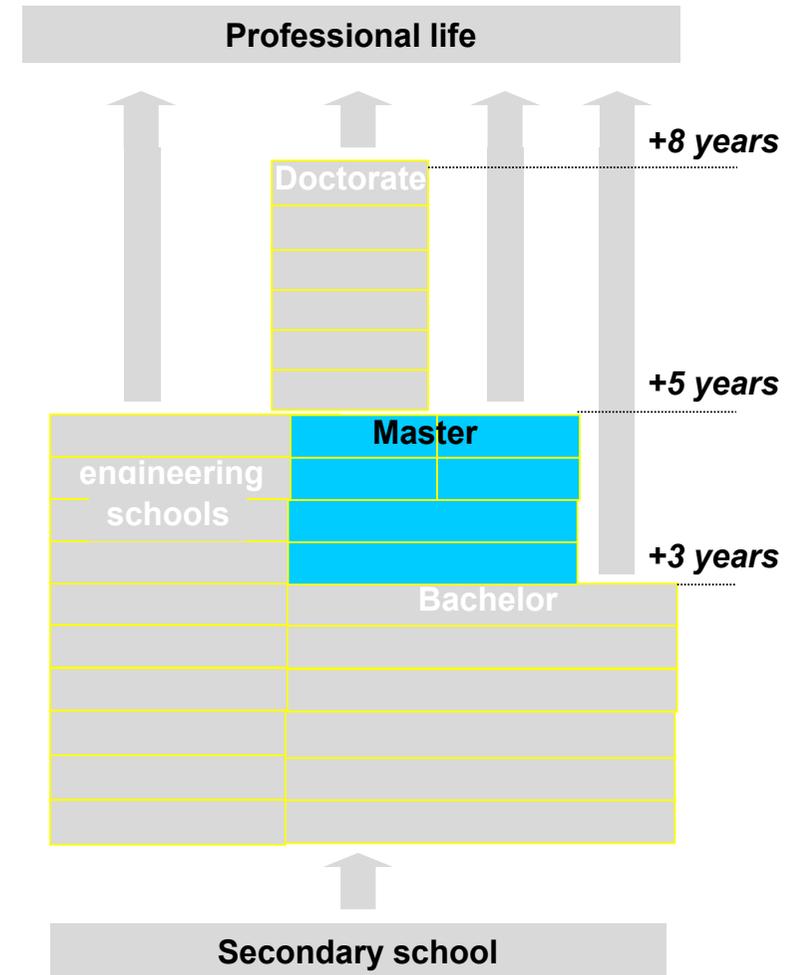
general
Master



research-oriented
Master
 (more scientific courses
 + internship in research Lab)



**But any master should have
 a link with research Labs**



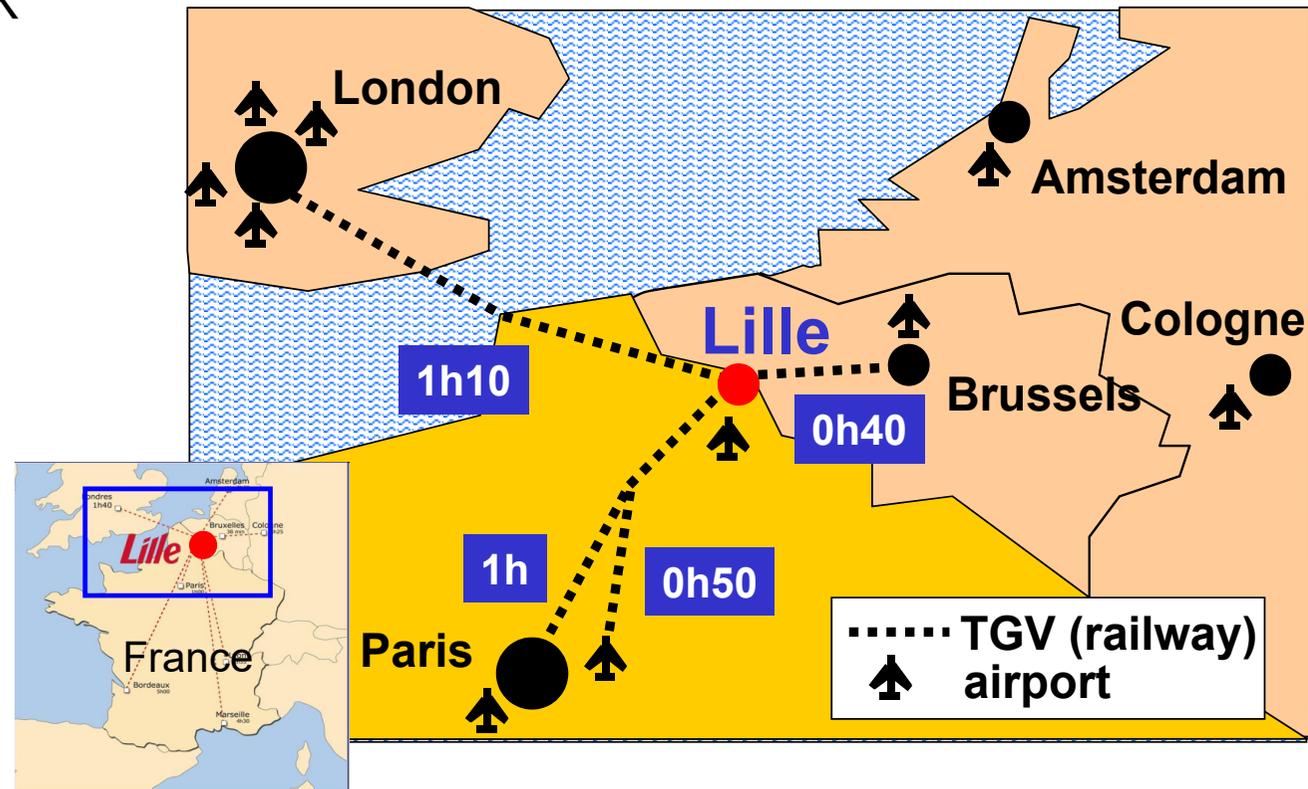
University of Lille – general figures

Lille and suburbs more than 1.5 million inhabitants
 at the crossroad of France / Belgium / UK



University of Lille in 2020

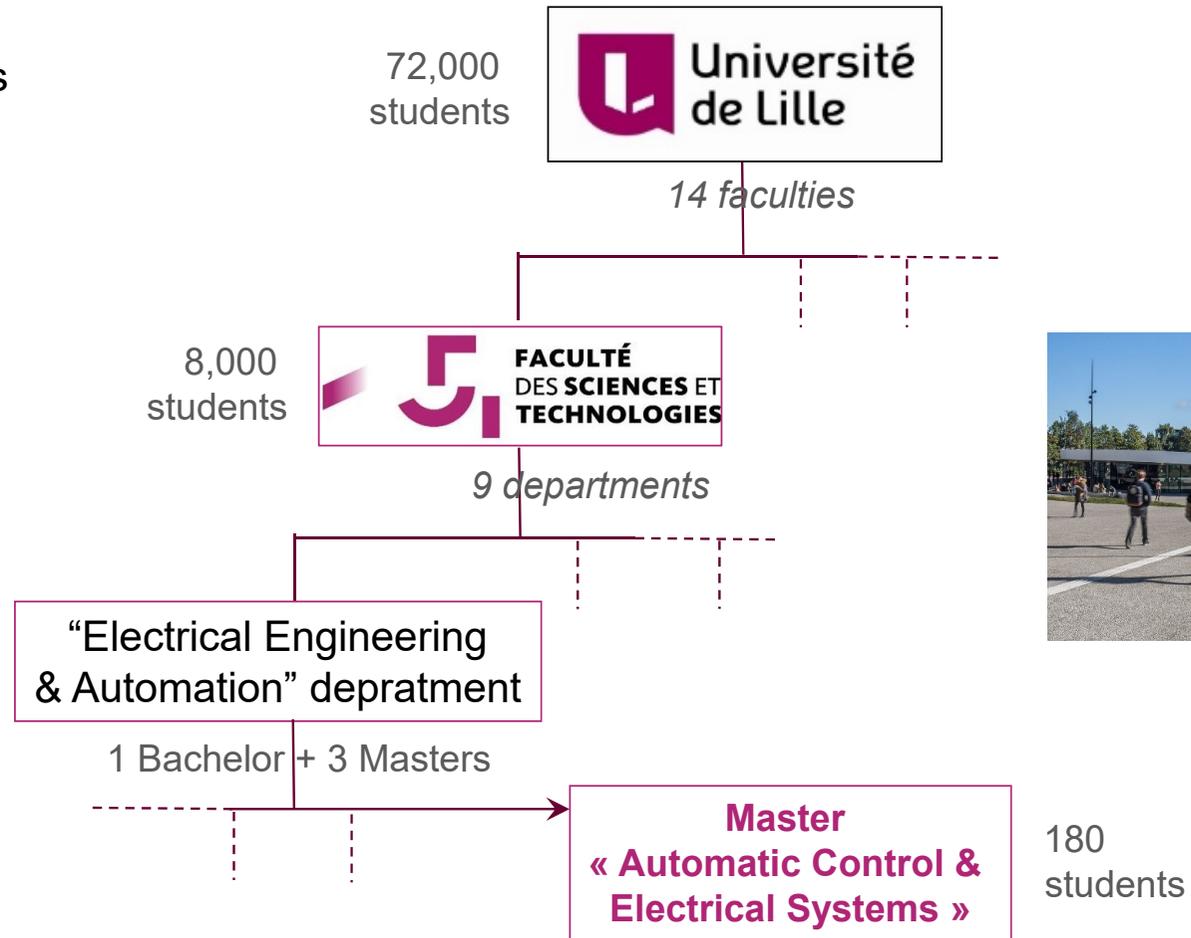
- 72,000 students (12% foreign students)
- 6,700 staff
- 66 research Labs



University of Lille – education organization

Multidisciplinary university:

- Social & human sciences
- Economy & laws
- Health & medicine
- Sciences & technologies
- etc.

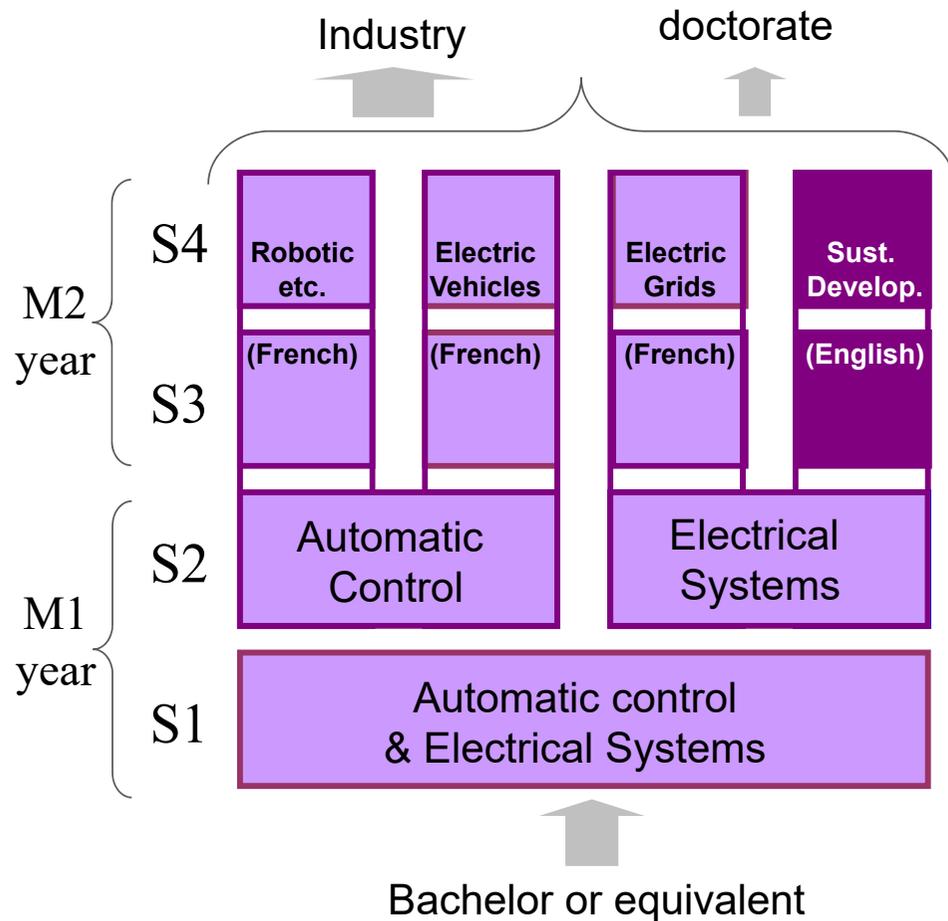




2. Master “Automatic Control & Electrical Systems” (ACES)

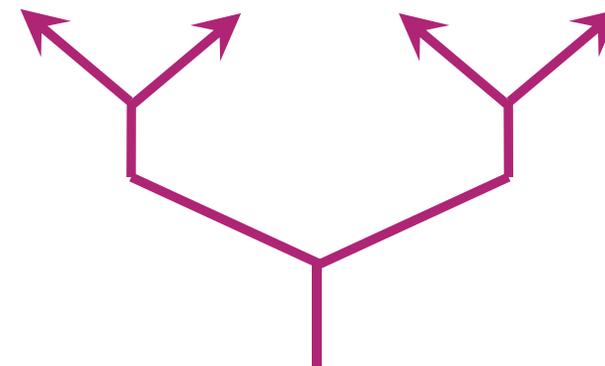
Our students will be actors of tomorrow’s world
to contribute to the society challenges!

Master ACES & organization



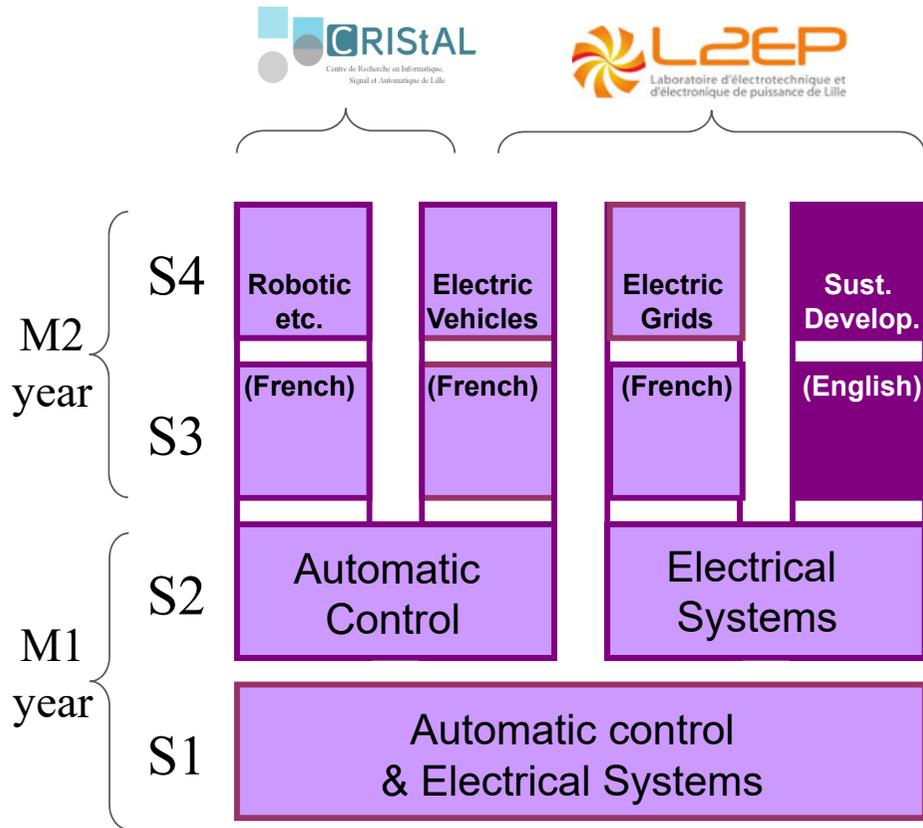
Master = 4 semesters = 2 years = 120 ECTS

towards a progressive specialization to train experts



From common semester S1 to a specialty in M2

Master ACES & research supports




Lab of Electrical Engineering & Power electronics
 (design & control of innovative e-systems, 100 members)


Centre de Recherche en Informatique Signal Automatique de Lille
 (computer sciences and automatic control, 300 members)

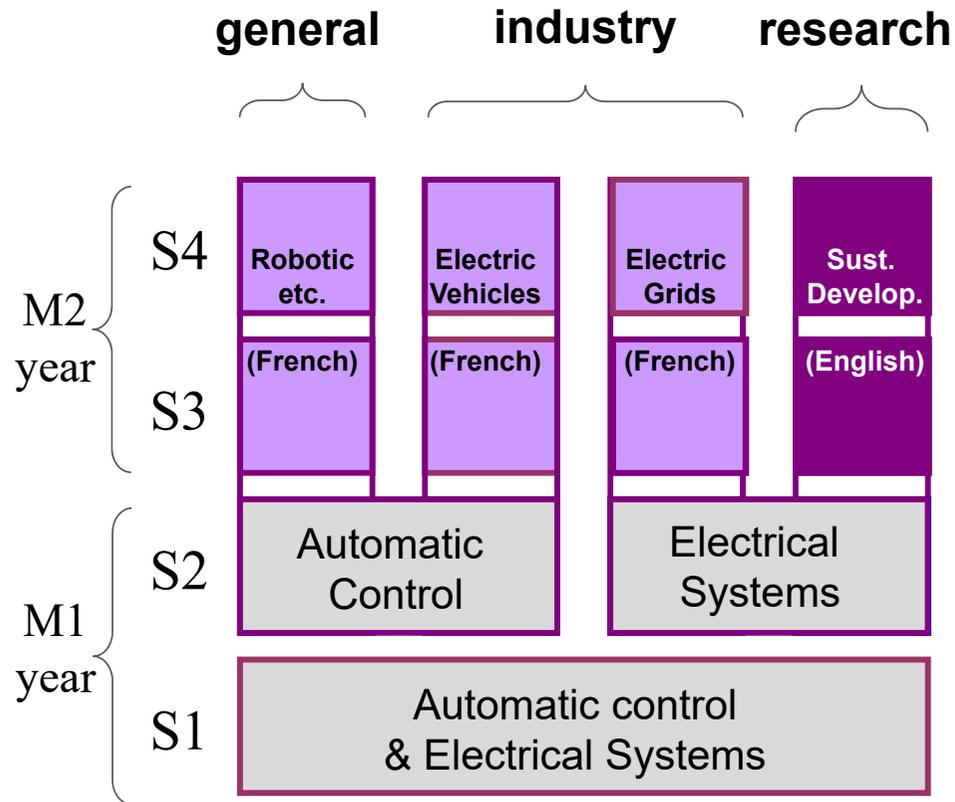
with their scientific networks, international collaborations and industrial partners



<http://l2ep.univ-lille.fr/>

<https://www.cristal.univ-lille.fr/>

Master ACES & options



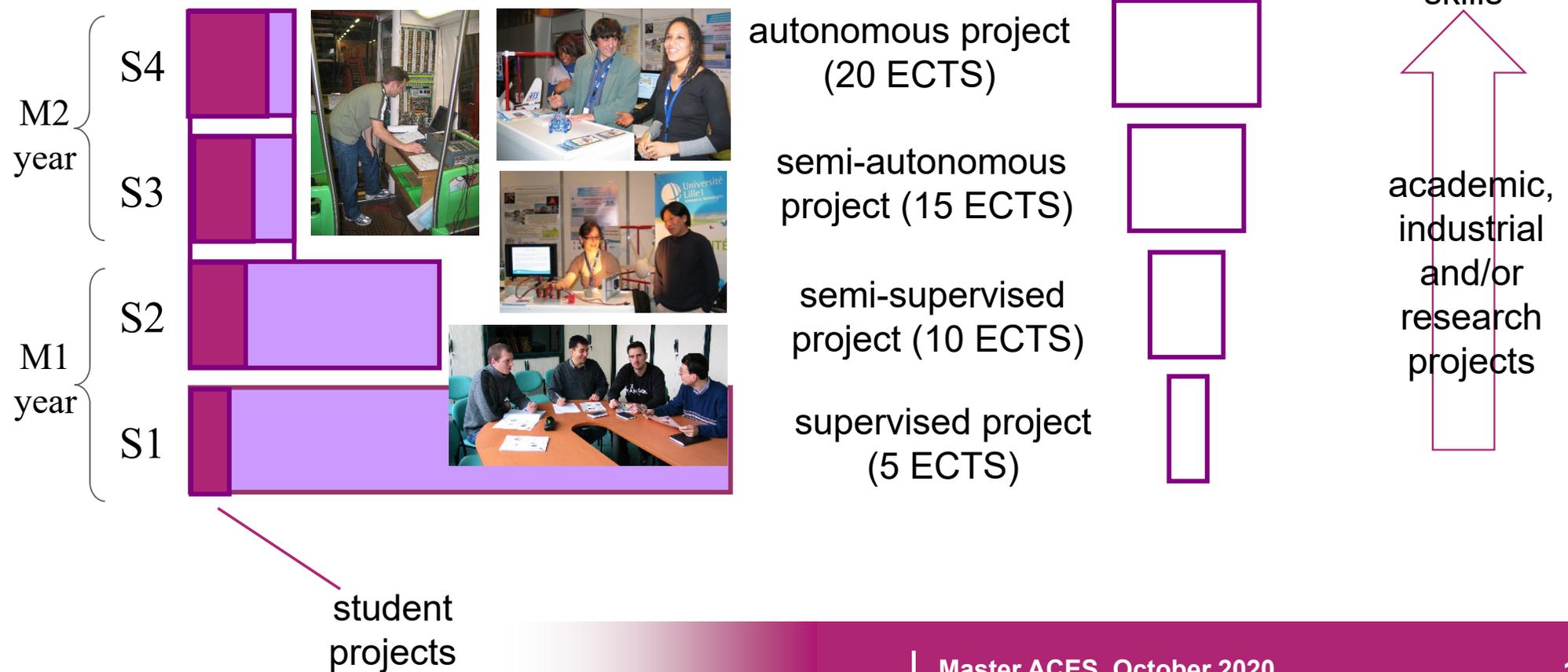
Industry-oriented and research-oriented defined in M2 (second year)

- M2 Automation & robotics (general)
- M2 Smart Electric Vehicles (industry)
- M2 Electrical Grids (industry)
- M2 Sustainable Development (research)

in the philosophy of a progressive specialization and thanks to the research Lab's partners

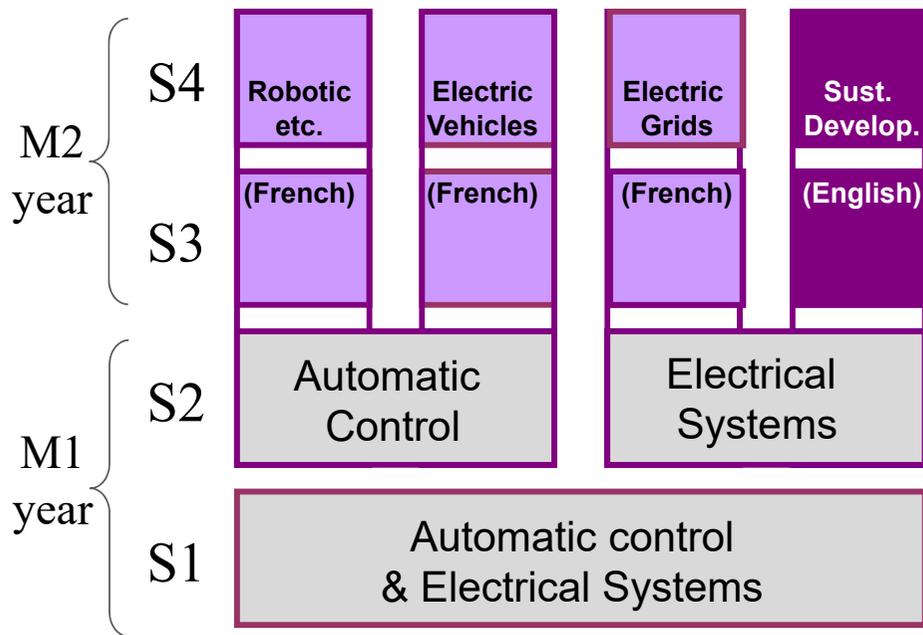
Master ACES & project-based training

The projects at the core of the Master ACES

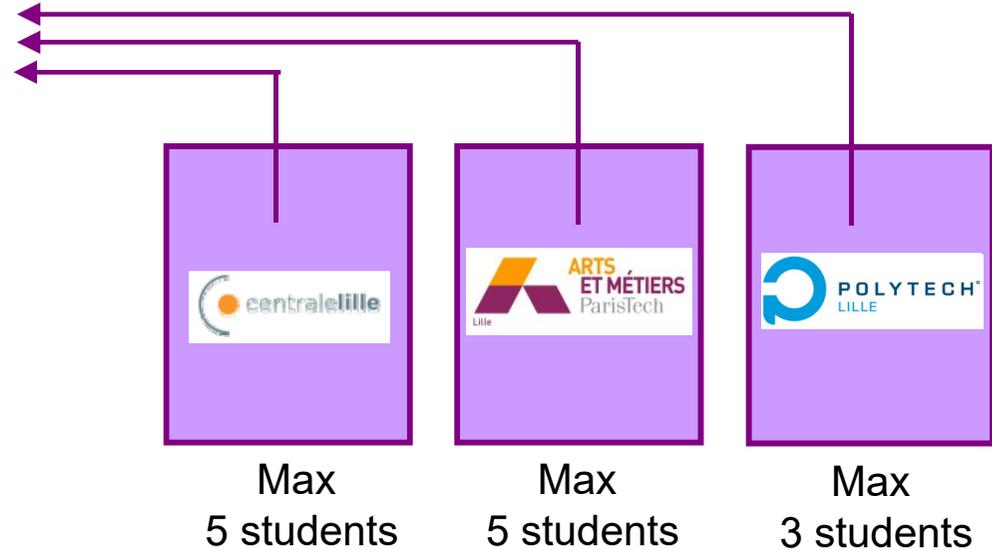


Master ACES & engineering schools

Common M2 with A&M ParisTech, Centrale Lille and Polytech'Lille
(French Engineering Schools)



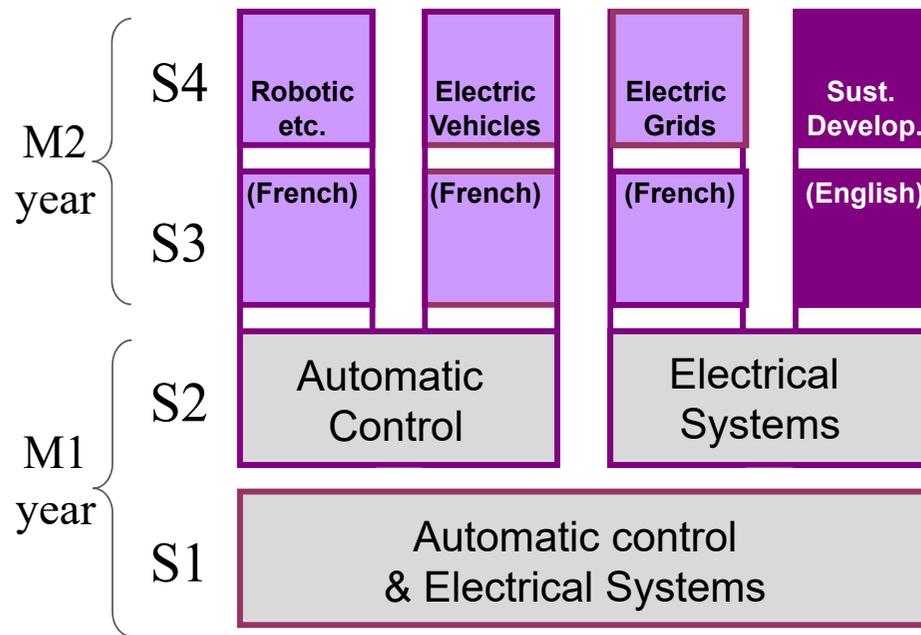
- attractiveness of high-level students
- sharing educational skills and teams



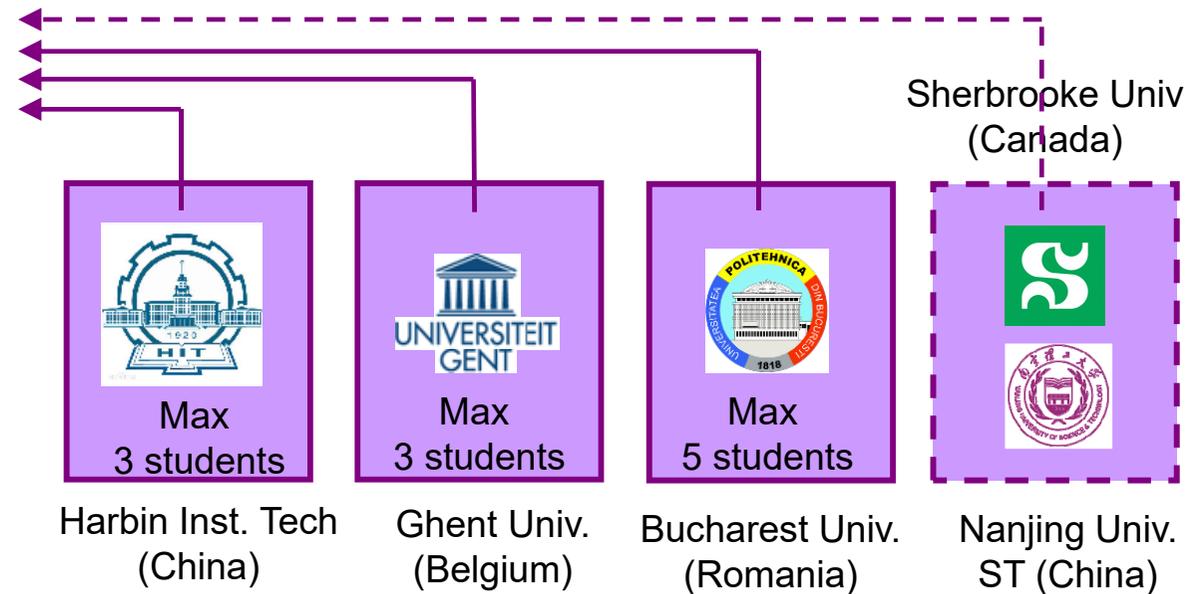
M1 in their Engineering Schools
M2 in Master ACES

Master ACES & international degrees

Double degrees with international universities with M2 mobility in France

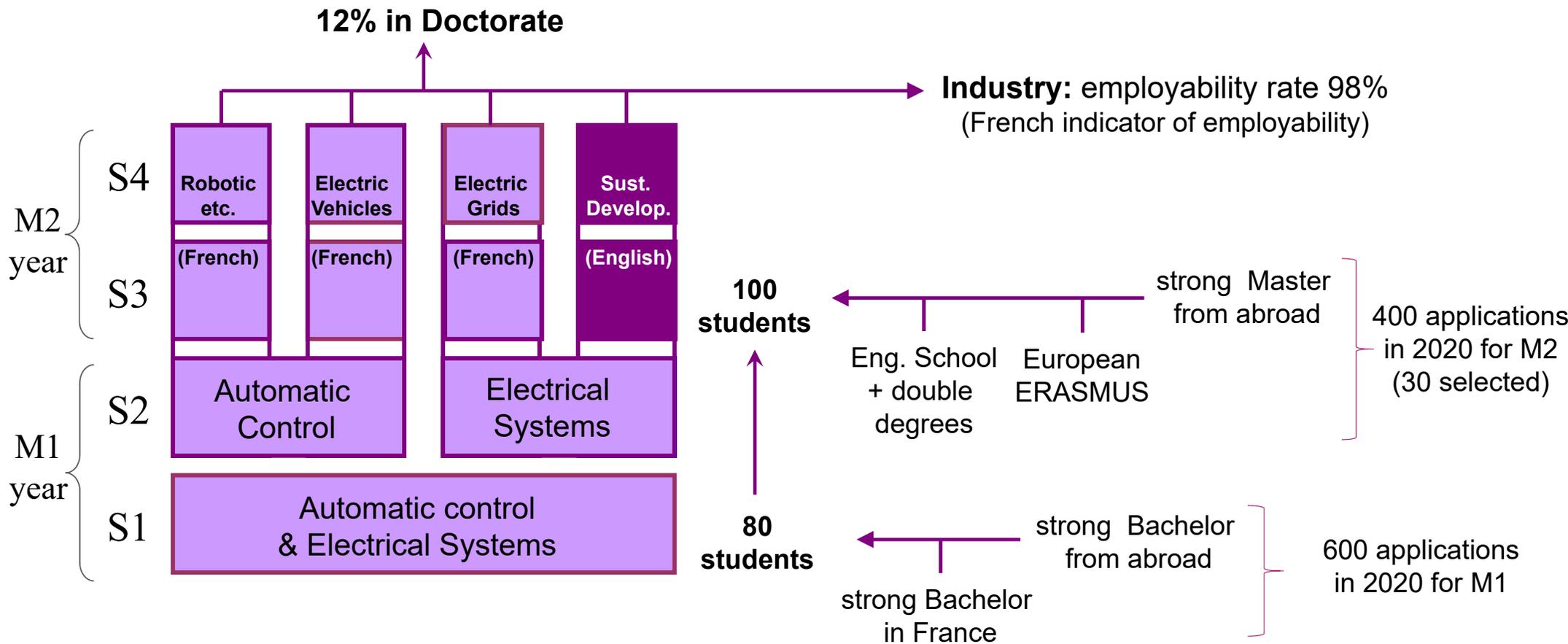


dynamical international mix of students and academic staff
strengthen European semester mobility (ERASMUS)
strengthen attractiveness from other countries *



* since 2015: Argentina, Algeria, Brazil, China, Colombia, Germany, Greece, Iran, Italy, Jamaica, Kampuchea, Kazakhstan, Mauritius, Morocco, Pakistan, Portugal, Romania, Russia, Serbia, Spain, Turkey, Tunisia, UK, Uzbekistan, Vietnam, etc.

Master ACES & inputs/outputs



Strong attractiveness and selection,
high-level of employability

Master ACES & attractiveness actions

AUTOMATIC CONTROL & ELECTRICAL SYSTEMS

ÉCOLE D'ÉTÉ FRANCE EXCELLENCE 2018

LILLE • 2nd-27th JULY • **FRANCE**

Discovering & Networking into your PhD in France!



International Academy
Lille Nord de France



1-month Summer School
50% on technical lectures
50% on culture and language

Scholarships from French embassy

**Industrial seminars from
Peugeot and Valeo companies**



Driving test of the L2EP electric vehicle



Master ACES & attractiveness actions

Annual Energetic Macroscopic Representation international summer school

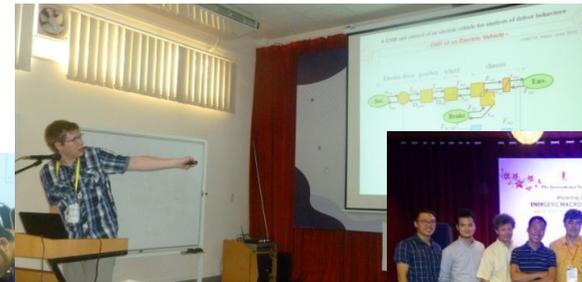
- since 2016, joint organization with a partner university
- odd year in Lille / even year abroad (Canada, China, Spain, Portugal, Vietnam, etc.)
- 3 days on this modelling tool with application to electrified vehicles and other
- more that **60 attendees in average**
- 5 lectures on concepts, 16 lectures on applications
- 3 simulation sessions (EV, Wind Energy, PV panels)
- 1 practical session + 1 vehicle demonstration in France

EMR'2008
was in Harbin



Strong support of industry in France: Siemens, SNCF, Peugeot, Valeo, dSPACE, etc.

EMR'2018, Hanoi (Vietnam)





3. Master option “Smart Electric Vehicles” (M2)

M2 "Smart Electric Vehicles"

- **Objective:**

train engineers for the challenge of the development of more electrified, sustainable and autonomous vehicles

- **Developed skills:**

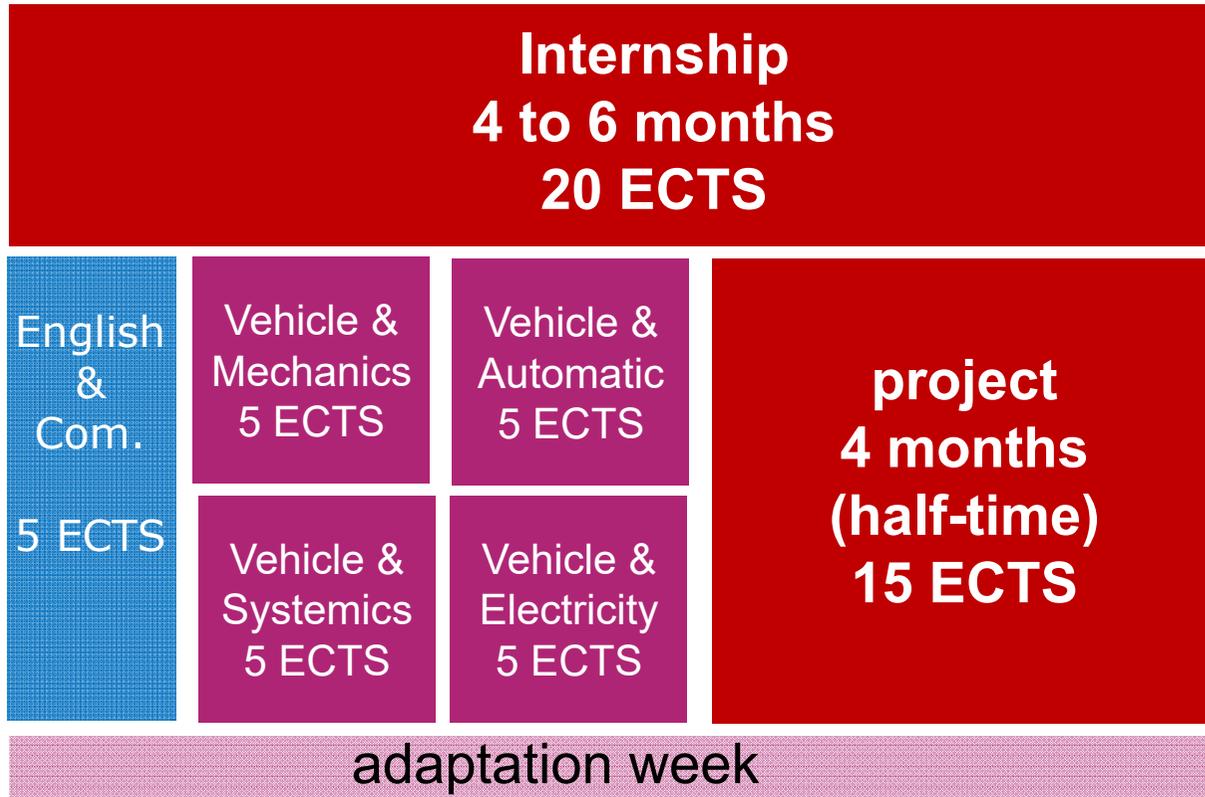
interaction between Electrical Engineering, Mechanical Engineering and Control Science (involvement of 3 departments)

Applications:

- road vehicles (pure electric or hybrid cars/buses/trucks)
- guided transports (more efficient subways/tramways/trains)



M2 "Smart Electric Vehicles" & general frame



1 semester of training
1 semester of internship

Promotion 2020-2021
 21 students (3 from abroad)

Common M2 with Polytech'Lille



Future double degree with
Sherbrooke University (Canada)



M2 “Smart Electric Vehicles” & industry

Internship
4 to 6 months
20 ECTS

English
&
Com.

5 ECTS

Vehicle &
Mechanics
5 ECTS

Vehicle &
Automatic
5 ECTS

Vehicle &
Systemics
5 ECTS

Vehicle &
Electricity
5 ECTS

project
4 months
(half-time)
15 ECTS

“Industry contract”

- (project + Internship) in industry
 - individual contract
- in 2020-2021 : 2 students (10%)*

“industrial project”

- collaboration industry – research Lab
 - a way to preselect student for internship
 - towards industrial PhDs
- in 2020-2021: 3 industrial projects*

“industrial internship”

- 90% of the students



“Smart Electric Vehicles” & research

Internship
4 to 6 months
20 ECTS

English
&
Com.

5 ECTS

Vehicle &
Mechanics
5 ECTS

Vehicle &
Automatic
5 ECTS

Vehicle &
Systemics
5 ECTS

Vehicle &
Electricity
5 ECTS

project
4 months
(half-time)
15 ECTS

adaptation week

“Mater thesis”

- (project + Internship) in research Lab
in 2020-2021: 1 students (5%)

“academic project”

- with a research Lab
- 2 students in the project
- on hot industrial topics
- often valuable experiences

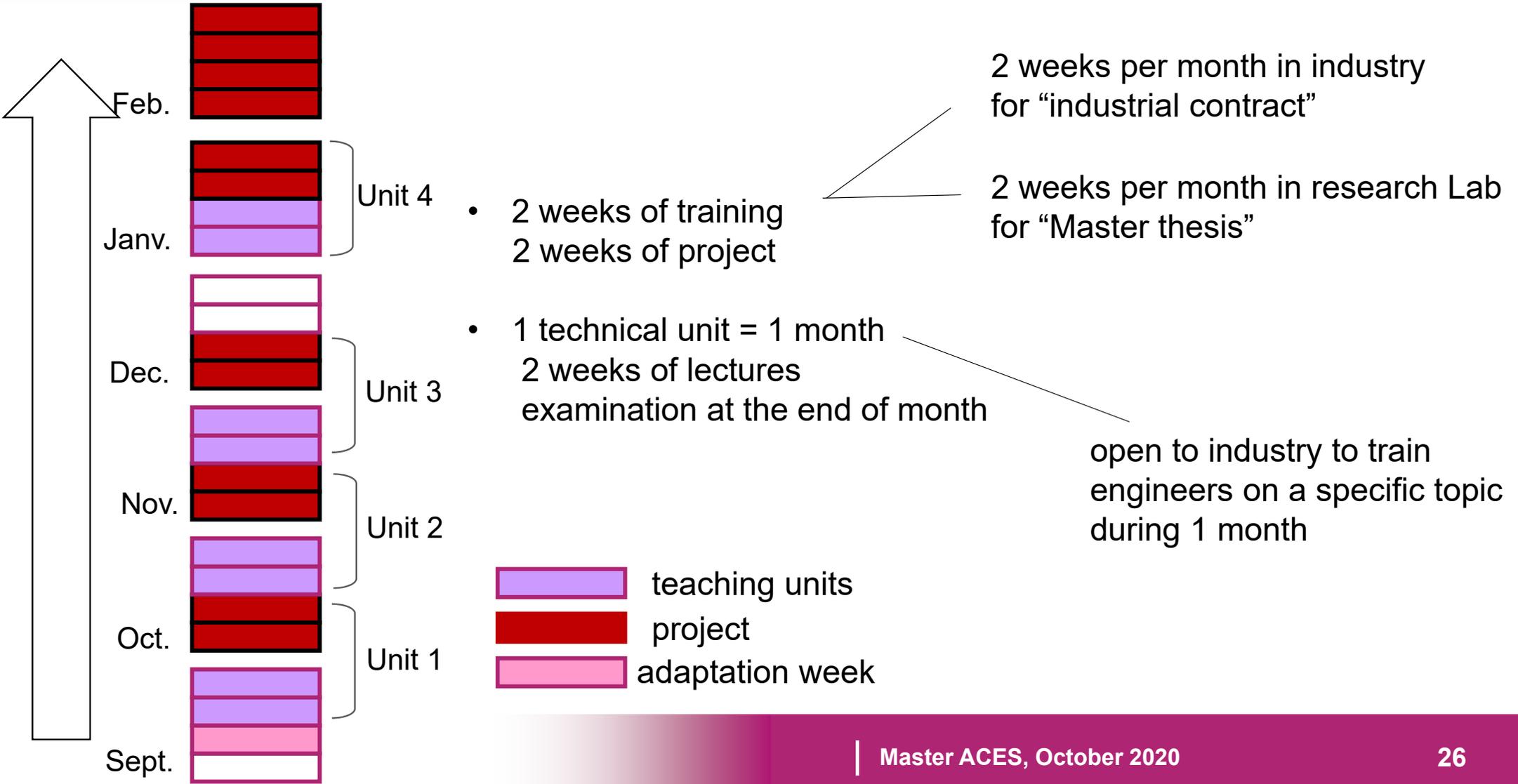
“Research Lab internship”

- 10% of the students

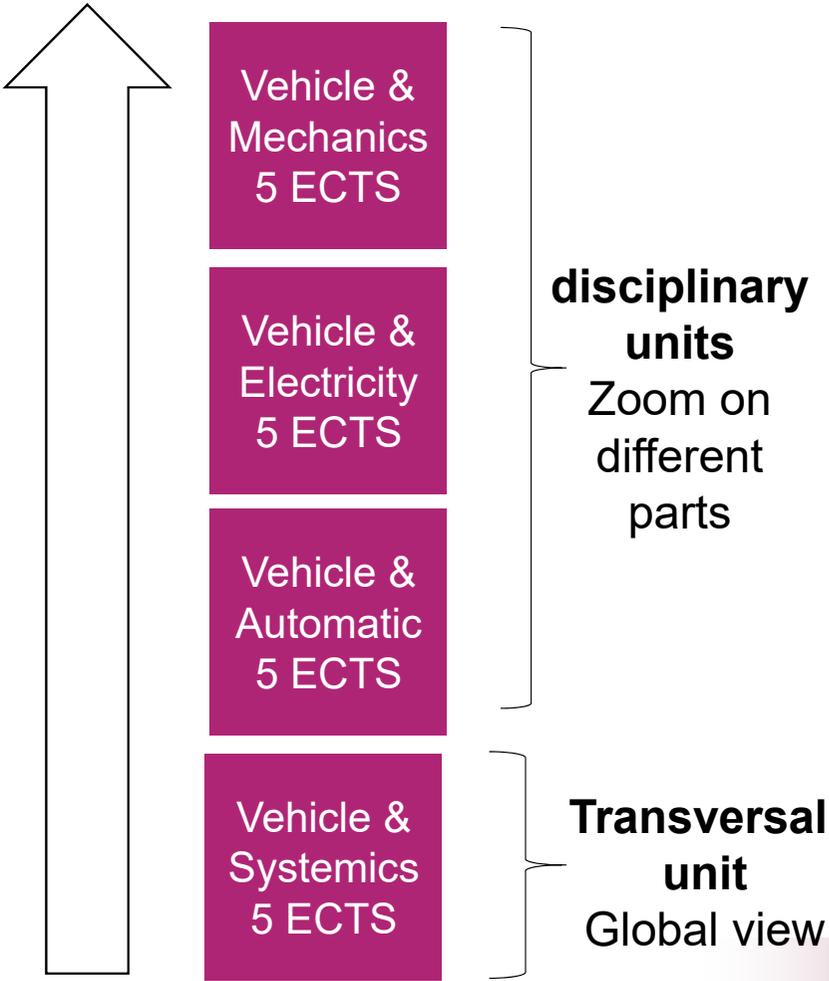


First research experiences
 are also appreciated by industry

M2 "Smart Electric Vehicles" & schedule



M2 "Smart Electric Vehicles" & technical units



zoom on actual and future batteries

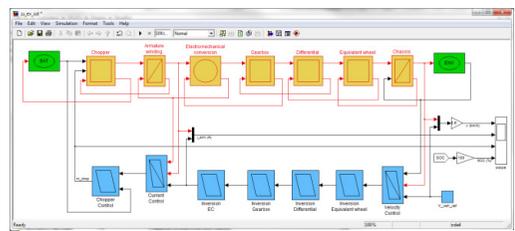
zoom on advanced control laws

zoom on innovative transmissions

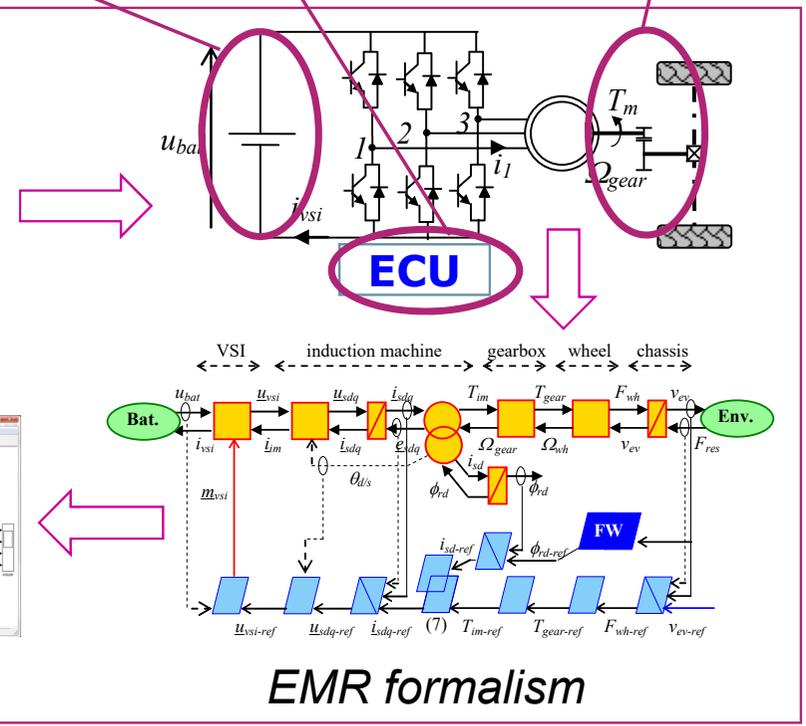
Example of an EV



Tazzari EV



Matlab-Simulink ©



EMR formalism

M2 “Smart Electric Vehicles” & seminars

Seminars of international or industrial speakers



Seminars of Prof. K. Li



- **Prof. C.C. Chan (Univ. Hong-Kong, China)**
- Prof. L. Boulon (IRH, Canada)
- Dr. R. Trigui (IFSTTAR, MEGEVH)
- Prof. P. Barrade (HE Sion, Switzerland)
- **Prof. Y. Li (Tsinghua Univ. China)**
- Prof. T. Hofman (TU/e, Netherlands)
- Prof. E. Hlttinger (RIT, USA)
- Prof. J. Trovao (Univ. Sherbrooke, Canada)
- Prof. K. Li (Univ. Notthigham, UK)
- etc.

- common to other M2 if common topic
- 1-page abstract for each seminar

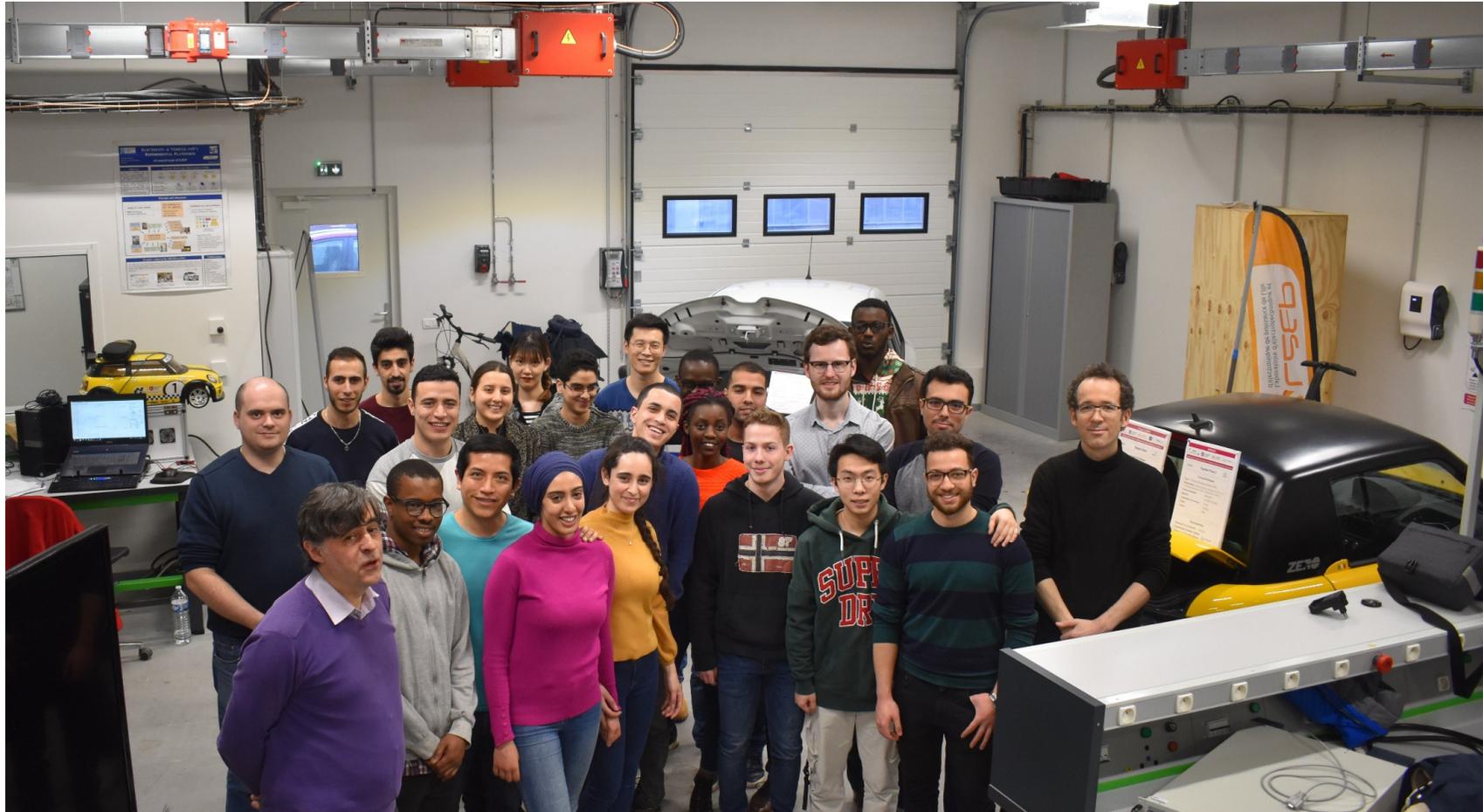
Seminar of Prof. C.C. Chan



- Dr. A. Bassel (**Ferrari F1**, Italie)
- Dr. T. Letrouvé (**SNCF**, MEGEVH)
- S. Hibon (**Alstom**, MEGEVH)
- Dr. C. Mayet (**Siemens Mobility**)
- Dr. Y. Cheng (**PSA**, MEGEVH)
- C. Jivan (**Valeo**)
- C. Brocart (**MEL**)
- etc.

M2 "Smart Electric Vehicles" & L2EP

Promotion 2020 in the "eV" Lab of L2EP



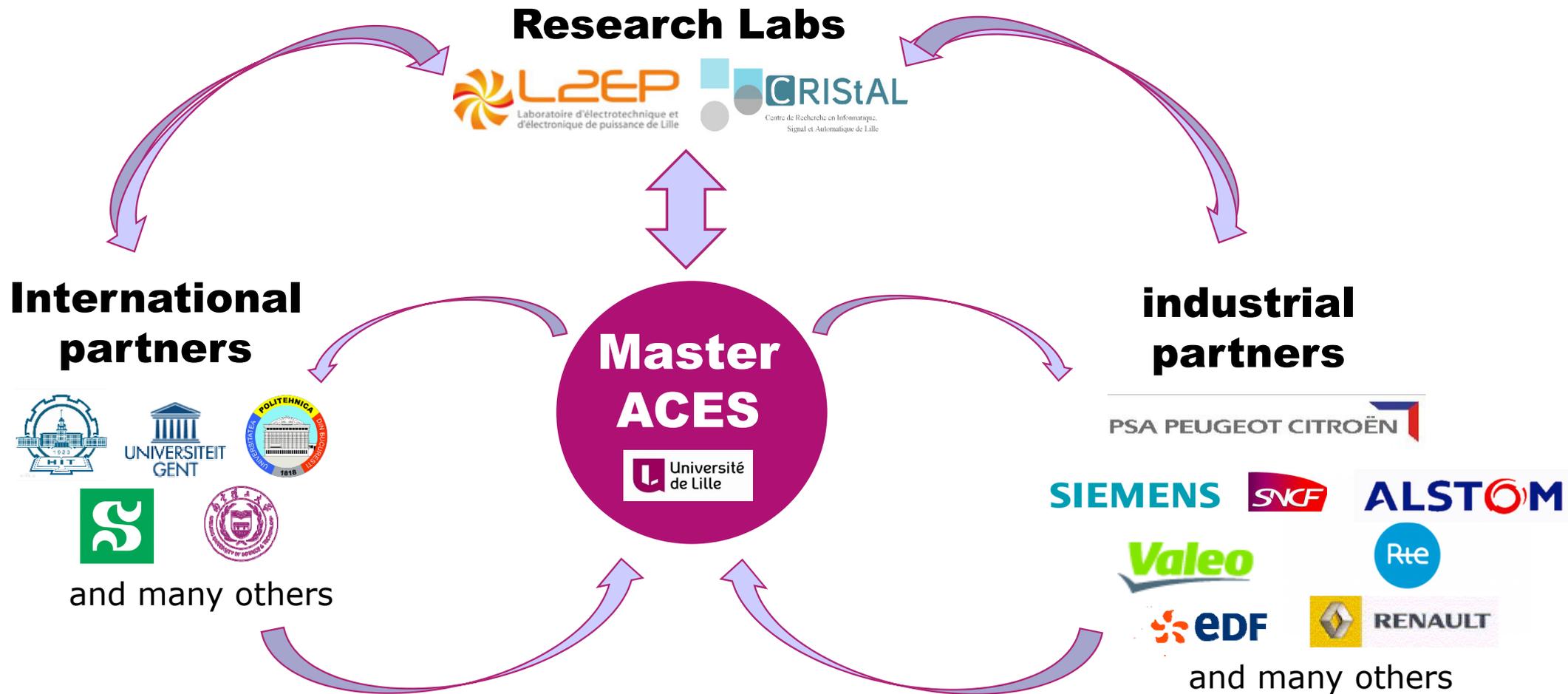
Highly motivated Master
students from 8 nationalities

Master ACES, October 2020



Conclusion

A virtuous circle thanks to research Labs!





**our students,
our best ambassadors!**



Thanks for your attention!

**Any questions/comments:
Alain.Bouscayrol@univ-lille.fr**