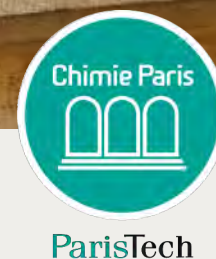


ECOLE
NATIONALE SUPERIEURE
DE CHIMIE



Chimie ParisTech – Université PSL

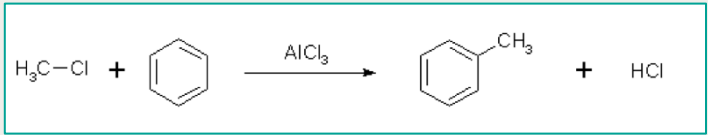
Chemistry to innovate and shape the world of
tomorrow

Chimie ParisTech | PSL general presentation

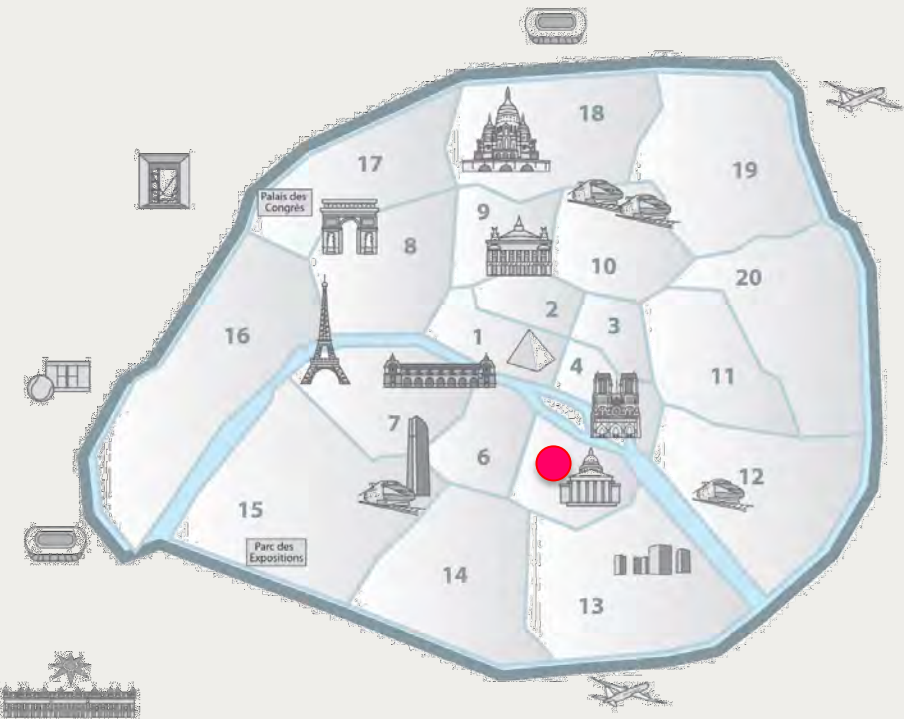
23/02/2021

Chemistry at the heart of Paris

1896: Founded by Charles Friedel



« Young chemists devoted to industrial careers should have a scientific back-ground as solid as that of those embracing purely academic ones »



- 1899-1907: Directed by Henri Moissan (Nobel Prize winner 1906)
- 1916: First woman embracing engineer career in France
- 1904: Eugène Schueller, founder of L'ORÉAL PARIS



ParisTech

Paris and its region



- **816 000 businesses**
- **1/3 of the foreign businesses in France**
- **1st European center for Fortune 500 multinational companies**
 - 1st European center for professional meetings
 - 30% of France's Gross Domestic Product (GDP)
- **Paris among World's Best Student City (QS)**
 - 17 Universities, 40 Graduate Schools of Engineering
 - > 70 000 foreign students (20% of the students of the area)
- **1st European region in R&D**
 - 40% of national investment in research and development
 - 95 500 researchers



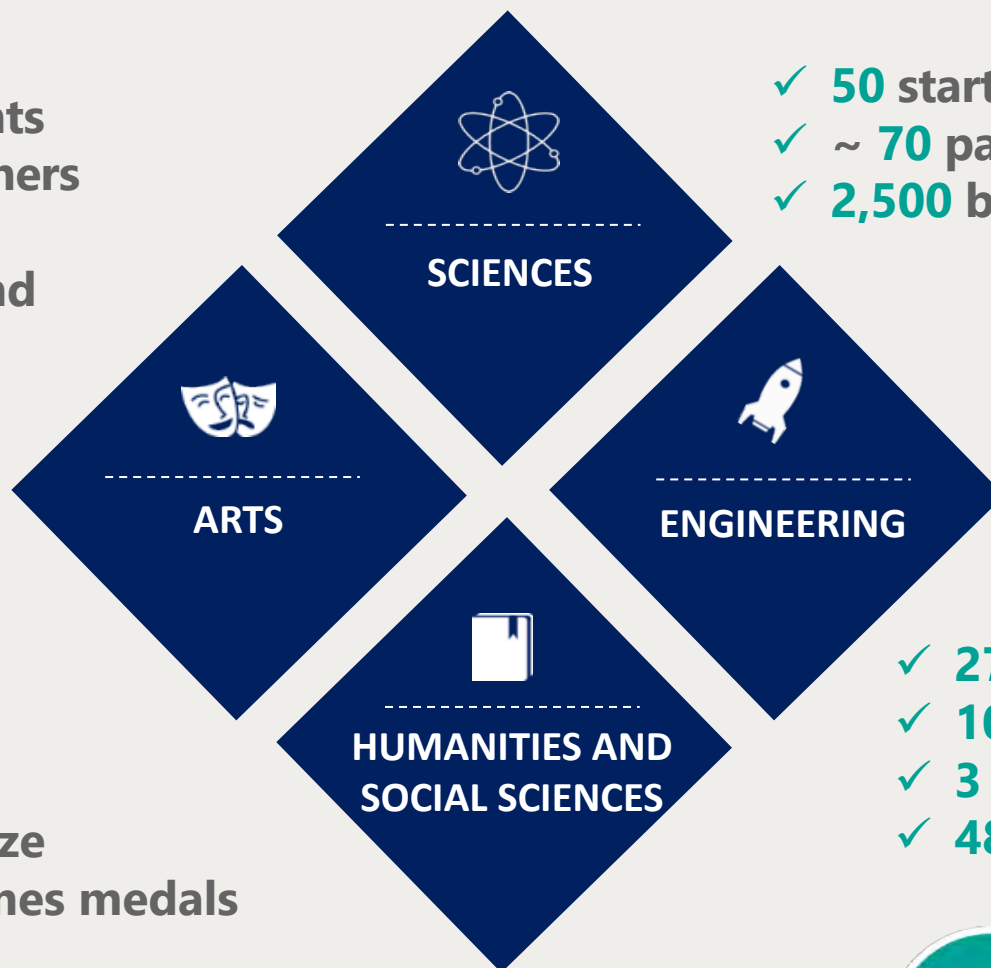
Chimie ParisTech | PSL belongs to a world class University



- ✓ TOP 50 worldwide (QS, THE, ARWU)
- ✓ TOP 5 University younger than 50-year-old (QS, THE)
- ✓ 1st University among Millennials (THE)
- ✓ TOP 100 Leiden – 1st in France

University PSL in a nutshell

- ✓ **17,000** students
- ✓ **4,500** researchers
- ✓ **181** labs
- ✓ **91** libraries and museums



- ✓ **50** startups founded
- ✓ **~ 70** patents/year
- ✓ **2,500** business partnerships

150 ERC
since 2011

- ✓ **50** César prize
- ✓ **79** Molière prize
- ✓ **2** Olympic games medals

- ✓ **27** Nobel
- ✓ **10** Fields Medal
- ✓ **3** Abel prize
- ✓ **48** CNRS Gold medal



ParisTech – Alliance of graduates schools in engineering

- An exceptional union enabling a unique transdisciplinarity network
- Each School is ranked #1 at the national level in its specific domain



Our shared-values

Excellence based on the model of French “Grandes Écoles”

Openness as a driver for growth: international openness, social diversity, openness to new pedagogical methods

The quest for **innovation**, key to future successes for our Schools



1 700
PhD candidates



70 international agreements



58 teaching and research chairs



1 500
professors



120
partner companies



90 000
alumni

EELISA – European Engineering Learning Innovation and Science Alliance

- The European University Alliance that will **transform engineering education and society**

- One of the 41 Alliance funded by  Erasmus+

- Make the engineering degree a **European degree**

- To facilitate international careers

- Develop **innovative engineering training**

- Apprenticeship, interdisciplinary...

- Strengthen & recognize **social engagement**

- links with non-academics via internships, projects...

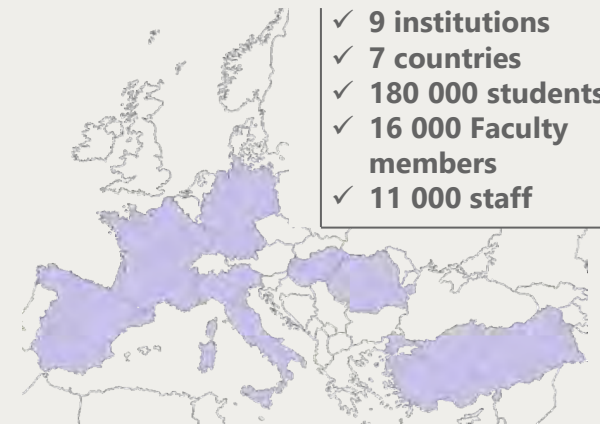
- Develop **inclusion**

- A European campus for everyone

- Gather forces within **communities** around **societal challenges**

- researchers, students, third parties working together on solutions

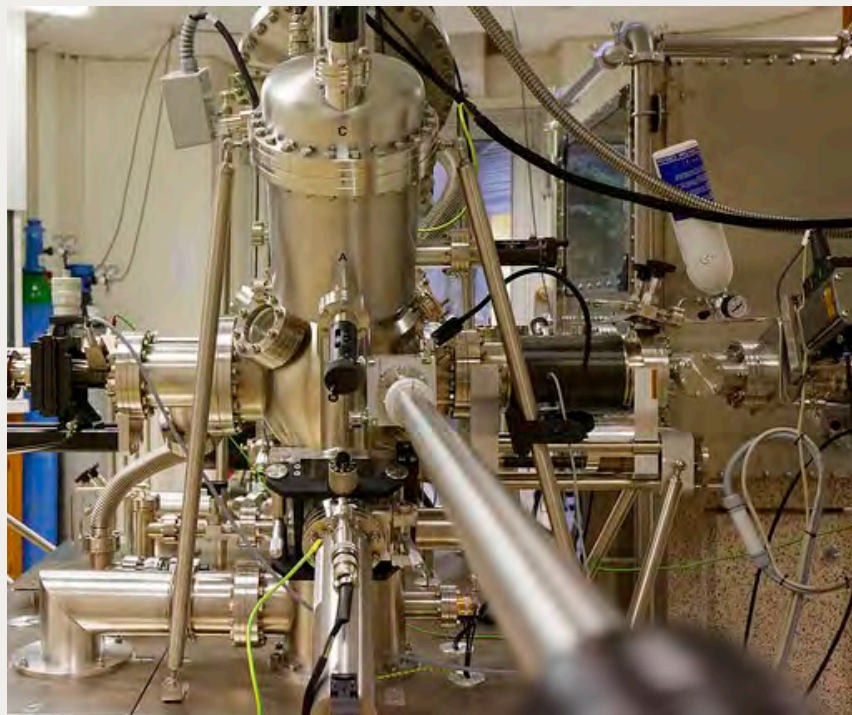
EELISA



www.eelisa.eu



Our Vision



Provide **basics
& fundamentals**
courses in all
fields of
chemistry
**illustrated by a
cutting-edge
research**

KEY FIGURES



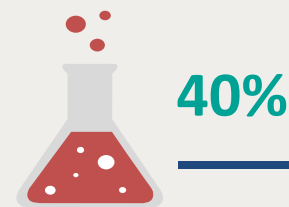
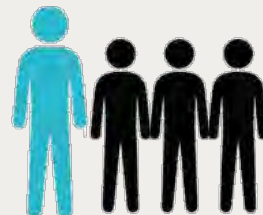
Training

Highly selected
students
(50% of women)



Researchers and
Professors & Associate
Professors

1 Prof for 3
students



40%

Practical training



20%

Business, management and
human skills

20%

international
students



abroad



12 months



Mandatory internship



Research



PhD and post-docs



Laboratories



Research Teams



Research & Development

Chair
With Eco-Systèmes



► 50% of PhD funded by
companies

2 **Labcom**
(joint lab with SMEs)



► Research
contracts
per year

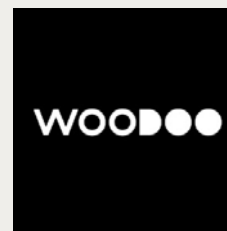


Chimie Paris Innov



Chimie Paris Innov our
incubator *cofunded by the
European Union*

- 700 000€ project
- Started in 2018
- +10 start-ups

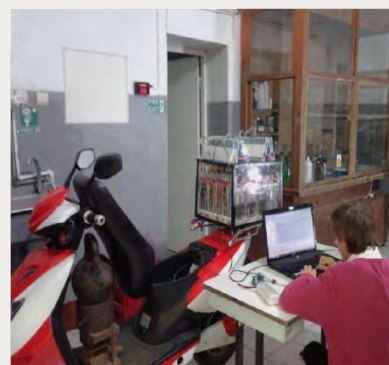


**Augmented Wood, and
next generation of
Human-to-Machine
Interfaces**



**Plasma catalysis technology for
methanation of CO₂**

European patent [[EP15202925.2](#)] 2015

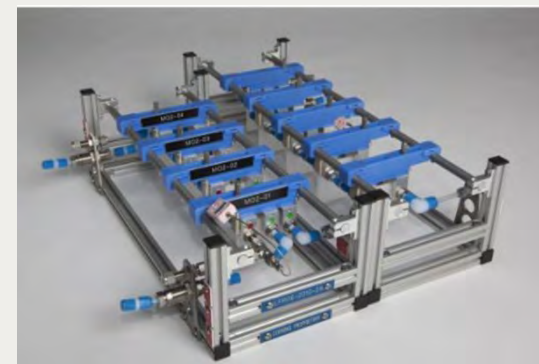


Zinc-Air

**Cheap and Safe Batteries
for Electrical Vehicles
& Stationary Electricity Storage**

Continuous Flow Chemistry Technology Platform

- All activations in one place
- Unique in Europe
- 1.7M€ project
- Business need driven



The Carnot network

- 39 Carnot Institutes in France
- Given by the French Ministry of Higher Education, Research & Innovation
- Ambition to foster public/private partnerships



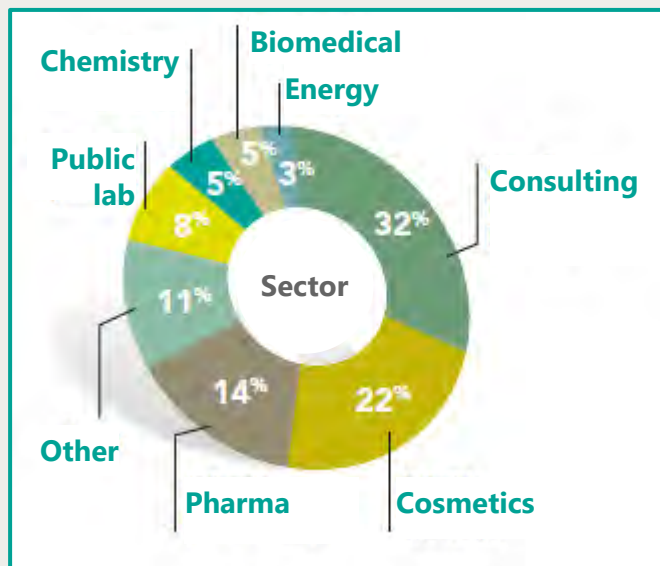
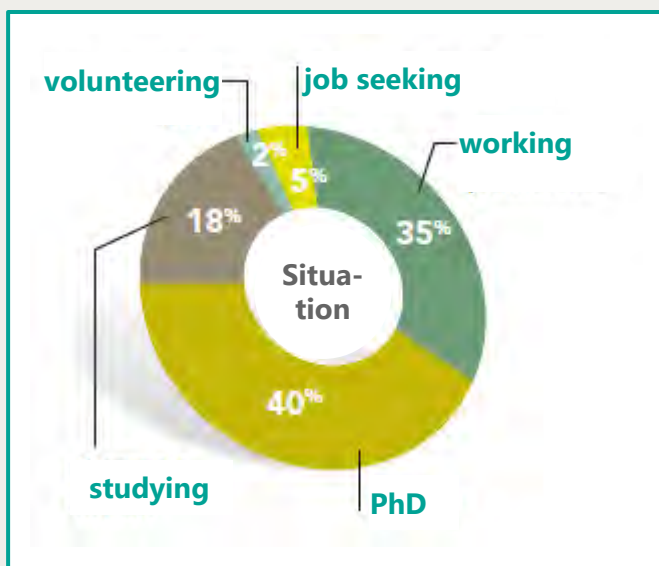
Institut Carnot IPGG

Microfluidique represents:

- **350** researchers
- Common theme: flow at tiny scale and its many applications (milli-micro-nano-fluidics)
- Member institutions: Chimie ParisTech | PSL, ENS | PSL, ESPCI Paris | PSL, PSL, CNRS
- Sectors
 - ✓ Chemistry
 - ✓ Pharmaceuticals
 - ✓ Life sciences
 - ✓ Energy
 - ✓ Environment
 - ✓ Luxury goods

Employability of our Engineers

+ 90 % of the students get a job or PhD before the graduation ceremony
(~66 % for all engineering schools)



Class 2018 (110 students)



L'ORÉAL



RESEARCH

**A world class
research made to
tackle global societal
challenges**

Our 3 research joint laboratories with CNRS

**Paris Research
Institute of
Chemistry
Materials &
Energies**



**Institute of
Chemistry
for
Life Sciences &
Health**



**Ile-de-France
Institute
for
photovoltaic**



Energy



Environment



Materials



Health



Our main research areas

Chemistry for Materials & Energies

- Materials Sciences
- Thin Films and Surfaces
- Chemical Engineering
- Organometallic Chemistry
- Polymerization Catalysis
- Energy
- Microsystems
- Heritage materials
- Nano materials & structures
- Modelisation

Chemistry for Life Sciences & Health

- Analytical physico-chemistry :
(electrochemistry, separative
methods & coupling of
detection techniques)
- Miniaturization
- Imagery
- Organic synthesis and methods
for imaging and screening
- Modeling & theoretical Chemistry
- Inorganic Biological Chemistry,
Medicinal Inorganic Chemistry,
Medicinal Organometallic
Chemistry
- Catalysis, Synthesis of
Biomolecules and Sustainable
Development

Energy



Environment



Materials



Health



Energy

Photovoltaic

Electrochemical Storage

Hydrogen Technology

Nanomaterials for Solar Cells

Chemistry for Health

Micro Flow & Diagnosis

Medicinal Chemistry

Structural Metallurgy

Optics & Optoelectronics

Physical Chemistry of Surfaces

Materials

Polymers & Catalysis

Ancient & Heritage materials

Chemical Engineering

Plasma Processes

Theoretical chemistry

Energy

Environment

Materials

Health

Chimie Paris



ParisTech

PSL



Selected examples of our research

- ✓ **Imaging and characterization**
- ✓ **Nano and smart materials**
- ✓ **Catalysis**
- ✓ **Chemical Engineering and flow chemistry**
- ✓ **Modeling and simulation**

Energy



Environment



Materials



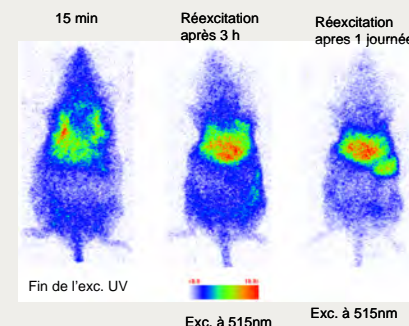
Health



Imaging and characterization

Design of new materials for Imaging and Biophotonic:

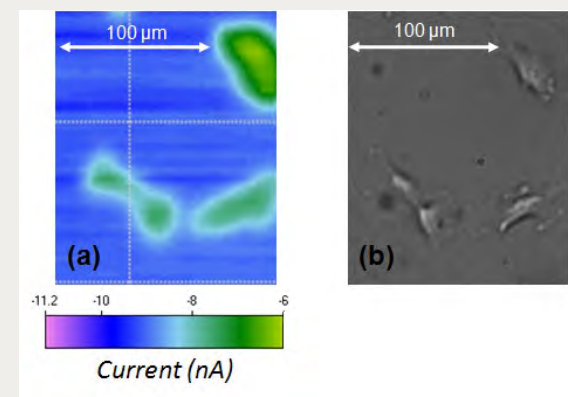
Focus on materials design, optical spectroscopy and mechanisms: Oxides and fluorides based nanomaterials used as nanosensors for thermal imaging at nanoscale, cell imaging and in-vivo bio-imaging.



Development of new bio imaging techniques

Methodological development of bimodal and multi-parametric imaging in MRI and optical contrast agents

Electrochemical microscopy for 3D Morphology and cartography of real time reactivity of biological systems



Characterization and imaging

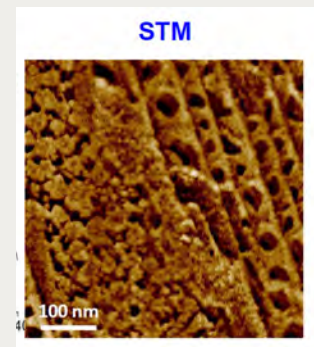
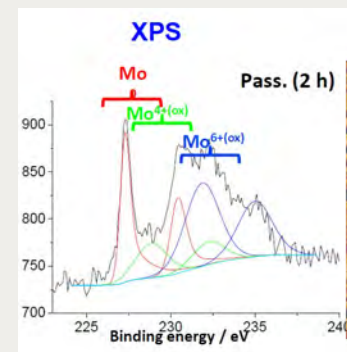
Characterization of surfaces

Surface spectroscopies and microscopies :
X-Ray photoelectron spectroscopy (XPS),
time-of-flight secondary ion mass spectrometry
(ToF-SIMS), scanning probe microscopes (STM, AFM).



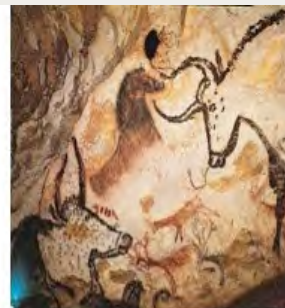
Structural Metallurgy

Investigation of microstructures/mechanical
properties relationships using advanced
characterization methods ("in situ" mechanical
testing, EBSD, TEM, high energy synchrotron X- rays
diffraction)



Ancient & Heritage materials

- **Authentication and conservation of cultural heritage artifacts**



Analytical techniques

Ion Beam

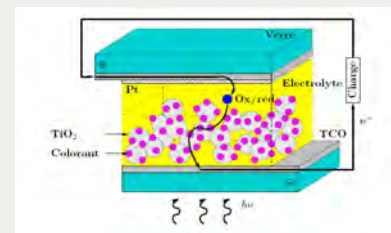
Analysis, X-Ray Fluorescence, Electron Magnet
Resonance, SEM-FEG-EDS,
X-Ray Diffraction & Structure Analysis,
Raman & UV/Vis/IR Spectroscopy,
multi-spectral imaging, BET Surface Desorption



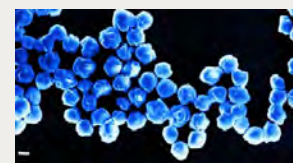
Nano & smart materials

Nanostructured Materials for photovoltaics & optoelectronics

Hybrid solar cells (perovskite/dye sensitized/Quantum Dot)



Crystals and Quantum State Dynamics: Control of non-classical optical & spin states in rare earth doped single crystals & nanoscale systems.



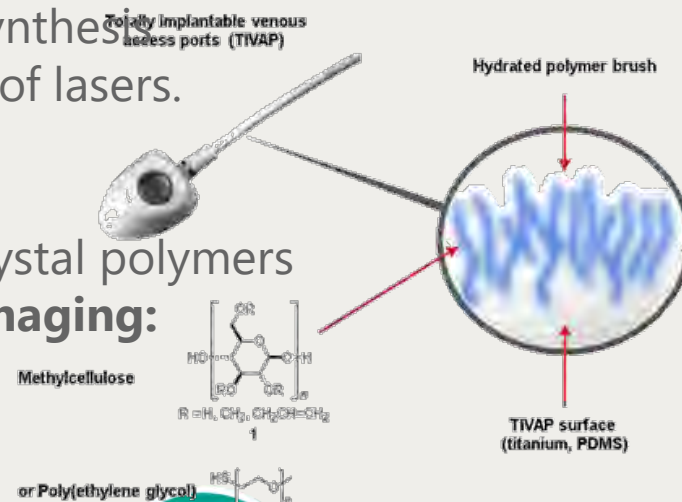
Laser and Nonlinear Optical Materials: Design & synthesis of new inorganic materials for photonics in the fields of lasers.

Smart Polymers

Self-assemblies: amphiphilic copolymers & liquid crystal polymers

Polymer nanoparticles for drug delivery and bioimaging:

fluorescent self-assemblies with aggregation induced emission



Nanoparticles for Biomedical diagnostic & therapy

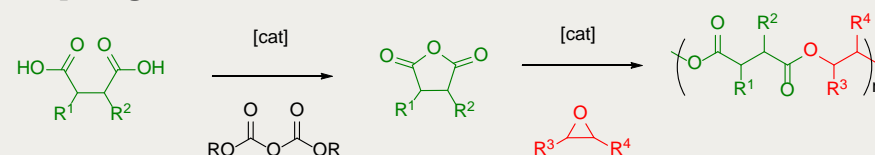
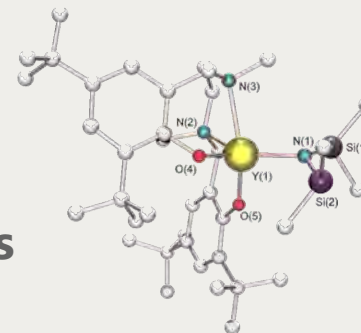


ParisTech

Catalysis

Monomers from renewable sources and **renewable monomers**

Organometallic catalysts for **stereoselective polymerisation**

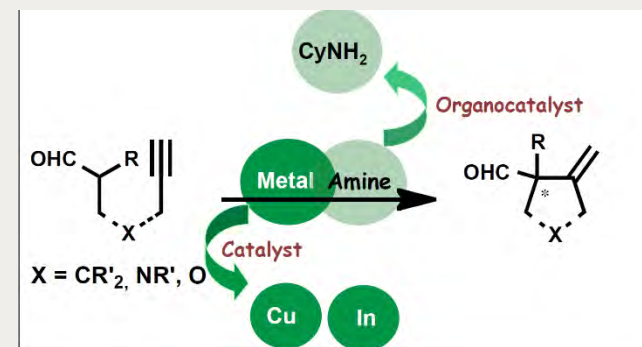


Control and synthesis of polymer based nano-objects

Catalysts for **tandem catalysis**

Catalysis & Metal-Organocatalysis

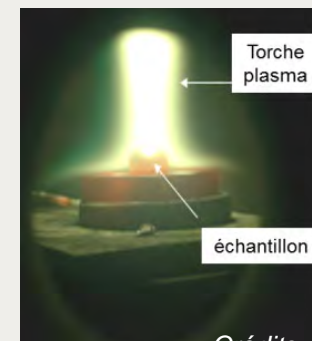
step and atom-economical processes; solventless reactions, chemistry in water; Fe, Ru, Rh, Pt, Cu, In, Pd-catalyzed reactions for C-H, C-C & C-N bond formation; asymmetric reduction



Total Synthesis of Biomolecules

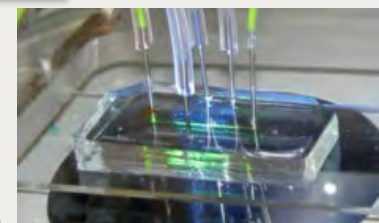
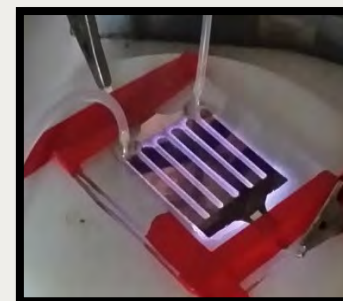
Chemical engineering and flow chemistry

- Deposition of coatings by innovative plasmas Processes
- Plasma Processes for depollution & recycling
- CO₂ methanisation by plasma assisted catalyst
- Flow chemistry for Functionalisation and Synthesis of molecules and polymers



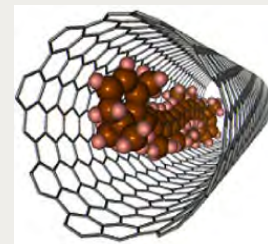
Crédits:

2PM-IRCP

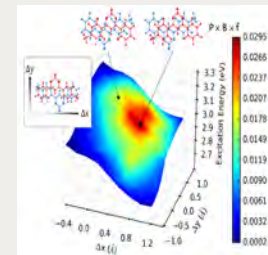


Modeling and theory

Development of new methods (electronic structure, environment): DFT approaches, embedding models, solvent models; Implementation in largely distributed codes



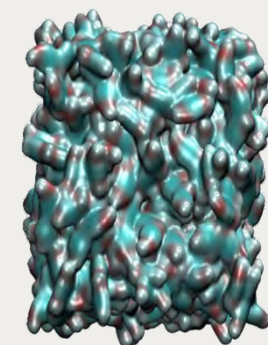
Modelling and design molecule based devices: photovoltaics, AIE, light activated devices



Properties of biologically relevant molecules: Photo Dynamic Therapy, 2 Photons Absorption, DNA intercalators...

Modeling of surfaces and materials : reactivity, properties

Modeling of soft and porous materials

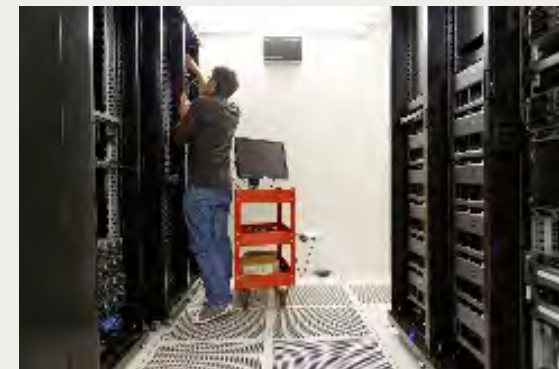
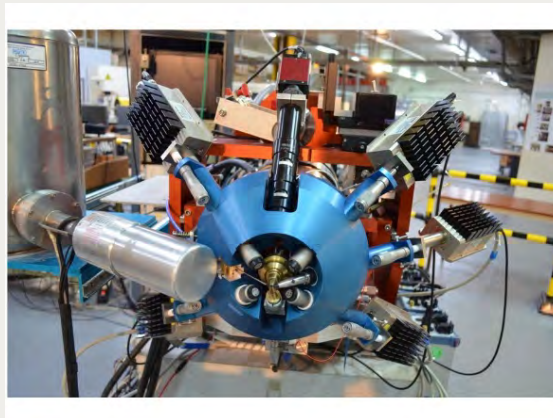


Modelling of catalytic reaction mechanisms and optimization (homogeneous & heterogeneous)



Excellent facilities for research within Paris

- NMR / Microscopy and spectroscopy...
- New AGLAE @ Musée du Louvre



Energy

Environment

Materials

Health



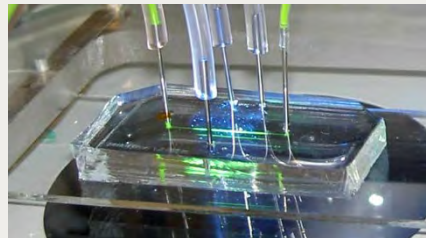
Pierre Gilles de Gennes

Institute for microfluidics



- National excellence laboratory
- Created in 2011
- € 28.2M project
- To bring together, in a cross-disciplinary domain, experts from various disciplines (Physics, biology, chemistry, technology)
- To develop both basic and applied research

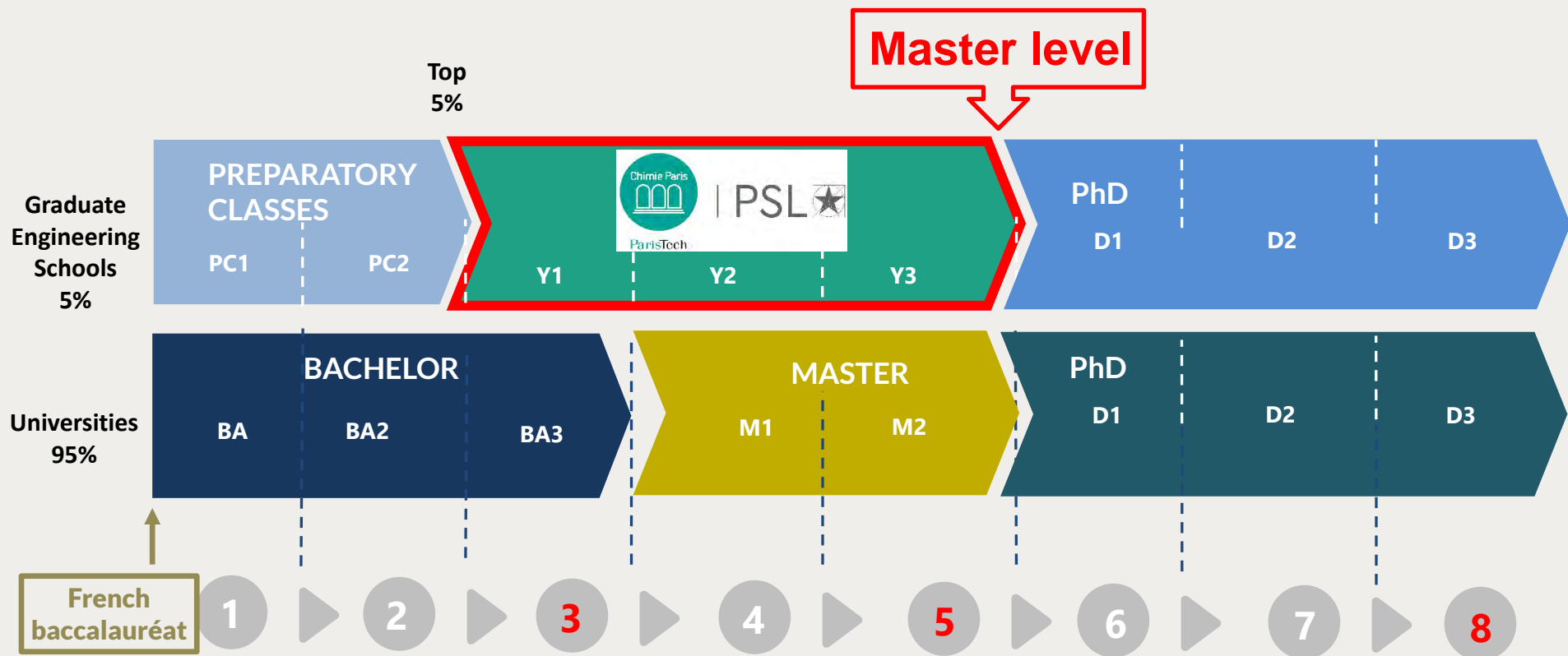
www.institut-pgg.com



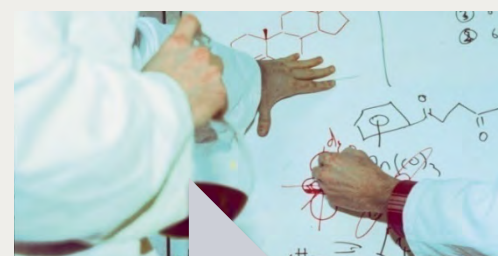
TRAINING



HIGHER EDUCATION SYSTEM



Training top level professionals in chemistry



Year 1

Towards engineering

Basic courses
Team projects
Management, Economy
Language and Cultures
Work internship 1-2 months

Year 2

Options

Basic courses & options
Projects (innovation)
Management, Economy
Language
Internship - 5 months

Year 3

Specialization

Projects (entrepreneurship)
Engineering or
Research master
Master internship - 6 months

• **12 months** of mandatory internship • Regular meetings with **industrials** (conferences, workshops, visits)

Training top level professionals in chemistry



- **12 months** of mandatory internship
- Regular meetings with **industrials** (conferences, workshops, visits)

First year: high level scientific skills

1 Sept-31 Dec

Courses
Chemical engineering,
Risks,
Physicochemistry,
analytical , organic
chemistry I,
Mathematics, quantum
mechanics, Computing
and programming,
Management economy

1 Jan-30 Apr

Courses
Organic chemistry,
Quantum chemistry,
spectroscopy,
Crystallography, solid
state chemistry,
organic chemistry II,
Numerical methods

1 May-30 Jul

Lab project
team work in a lab

Work internship
(1 or 2 months)

Transdisciplinary project
team work on social, economical or environmental issues

Second year: New applications

1 Sept-31 Dec



1 Jan-30 Mar



1 Apr-30 Aug

Common bases

Chemical engineering,
Metallurgy,
Polymers, Analytical chemistry II,
Biochemistry,
Nuclear energy and radioactivity,
Thermostatistics and modelization,
Inorganic chemistry

Options

Molecular chemistry
Materials
Chemical engineering
Analytical and Biological Chemistry
Biotechnologies

Techno Team project

(1/2 day per week)
teamwork Building of a prototype

Internship
(4-5 months)



Third year: specialization industrial innovation and/or research

1 Sept - 31 Jan

Engineering

Biotechnologies
Sustainable processes &
materials
Industrial processing
Green organic chemistry
Cosmetology and Formulation
Energies



1 Feb - 31 Jul

Internship
(6 months)



Masters @ Chimie ParisTech | PSL

• Master in Chemistry with SORBONNE UNIVERSITÉ

➤ 6 tracks


- Molecular Chemistry (FR)
- Chemistry of Materials (FR)
- Analytical, Physical and Theoretical Chemistry (FR)
- Chemical Engineering (FR)
- Chemistry and Life Sciences (EN)
- Chemistry & Innovation (EN) 

<https://www.psl.eu/en/education/masters-degree-chemistry>

Masters @ Chimie ParisTech | PSL

- **Material Science and engineering**
 - Materials and Engineering Sciences in Paris (EN)
 - Materials of the future, Design and Engineering (FR)
 - Microfluidics, fluid science engineering (FR)

<https://www.psl.eu/en/education/master-s-degree-materials-science-and-engineering>

- **Nuclear Energy with** 
 - Fuel Cycle (EN)

<https://psl.eu/en/education/master-s-degree-nuclear-energy>



Other Masters with Chimie ParisTech | PSL involvement

- **Energy (EN)**
 - Sustainable Energy & Materials
 - Energy Efficiency
 - Decarbonation of fuels
 - Renewable Energy, grids

<https://www.psl.eu/en/education/master-s-degree-energy>

- **BME BioMedical Engineering with**  **Université de Paris**
 - Bioimaging (EN)

<https://psl.eu/en/education/master-s-degree-biomedical-engineering>



Our PhD programmes

- **Chemical engineering and advanced technology**
- **Physical chemistry and analytical chemistry**
- **Molecular chemistry**
- **Material physics and chemistry**

<https://www.chimieparistech.psl.eu/en/programs/phd/>



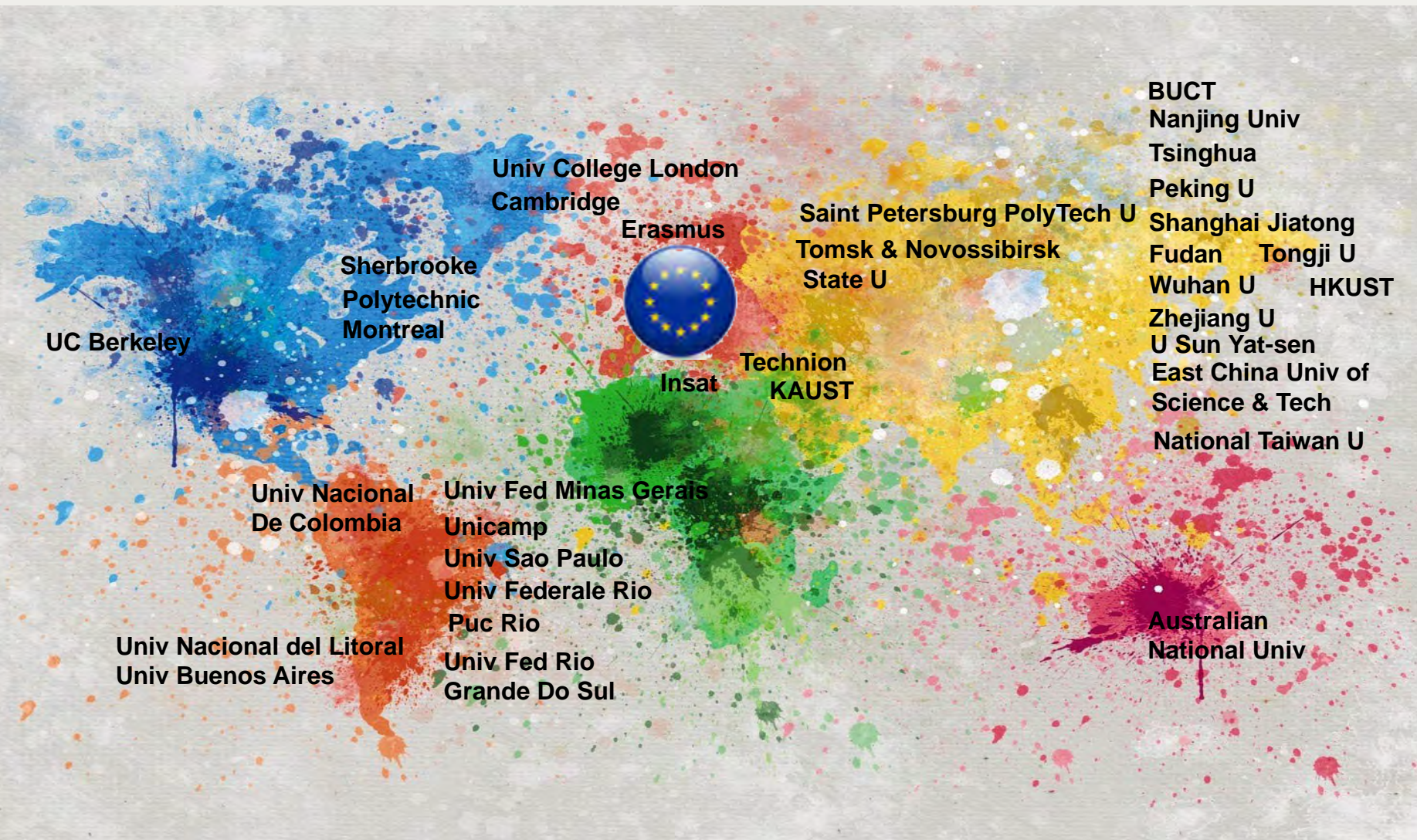
IMPLEMENTATION OF EXCHANGES



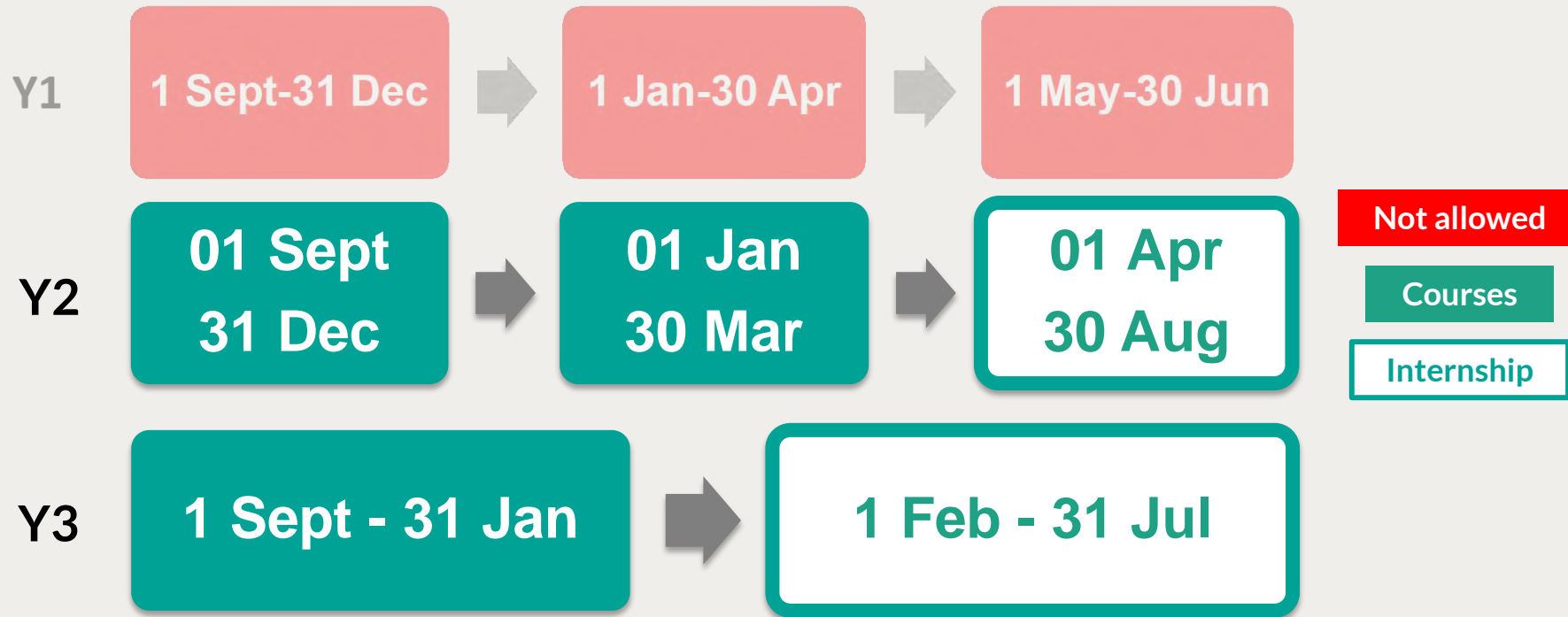
ParisTech



Our International network



Regular international mobility Exchange “engineering track”



<https://www.chimieparistech.psl.eu/erasmus/>



International mobility – “Master track”

M1

1 Sept-30 June
Including 3-4 months of Internship

M2

1 Sept-31 Jan

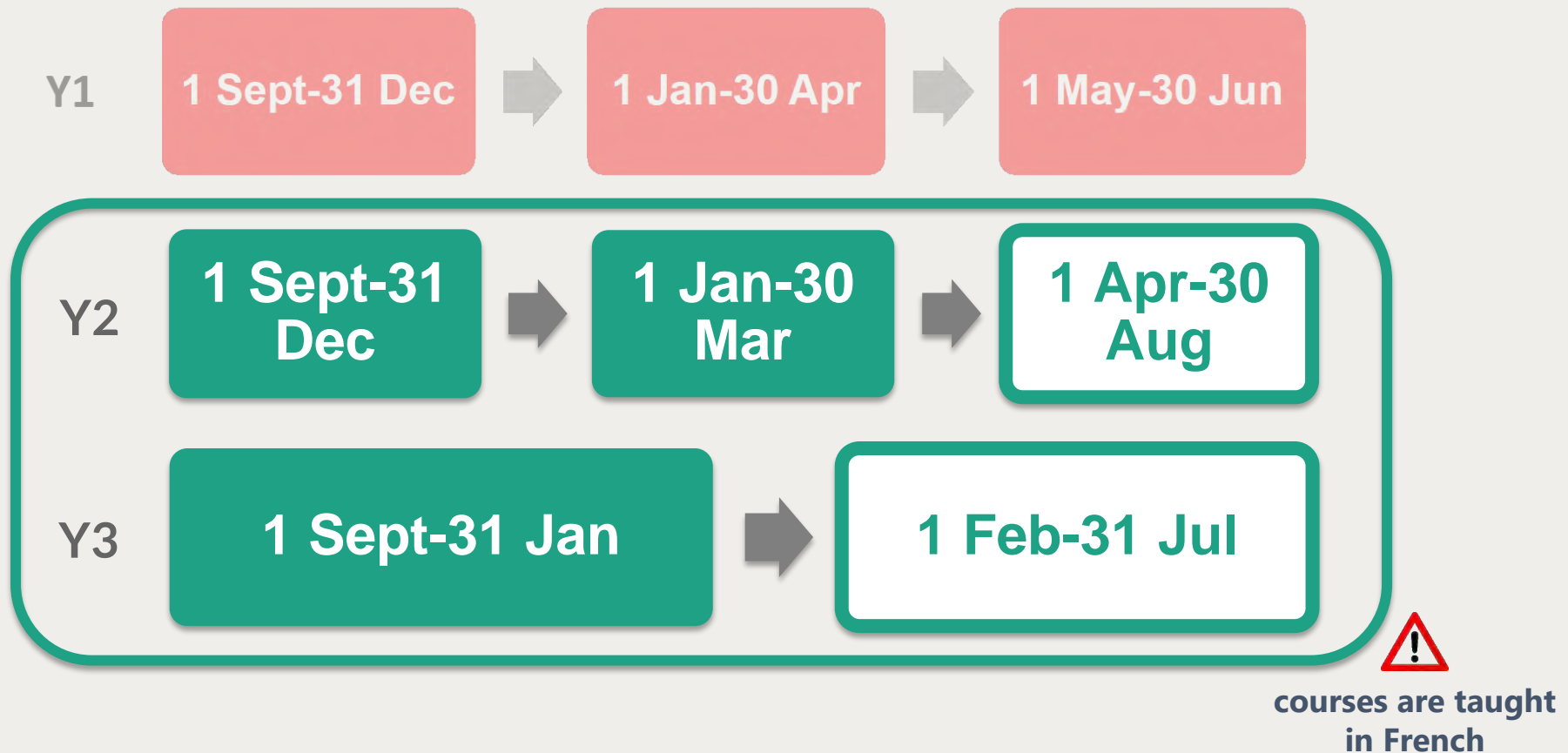


1 Feb-31 Jul
Internship

<https://www.chimieparistech.psl.eu/en/programs/masters-in-science-and-technology/>

Double Degree agreement

3 semesters @ Chimie ParisTech | PSL & 2 internships



International students services



- **Accommodation**
 - Provided for international students in double degree
 - Affordable rents: ~ €340 pm
 - Possibility of accommodation allowance
 - Average living costs in Paris: €800 pm

- **PSL Welcome Desk (visa...) & Student association**

- **Intensive Language Training Programs**

- **Mentoring by senior students**

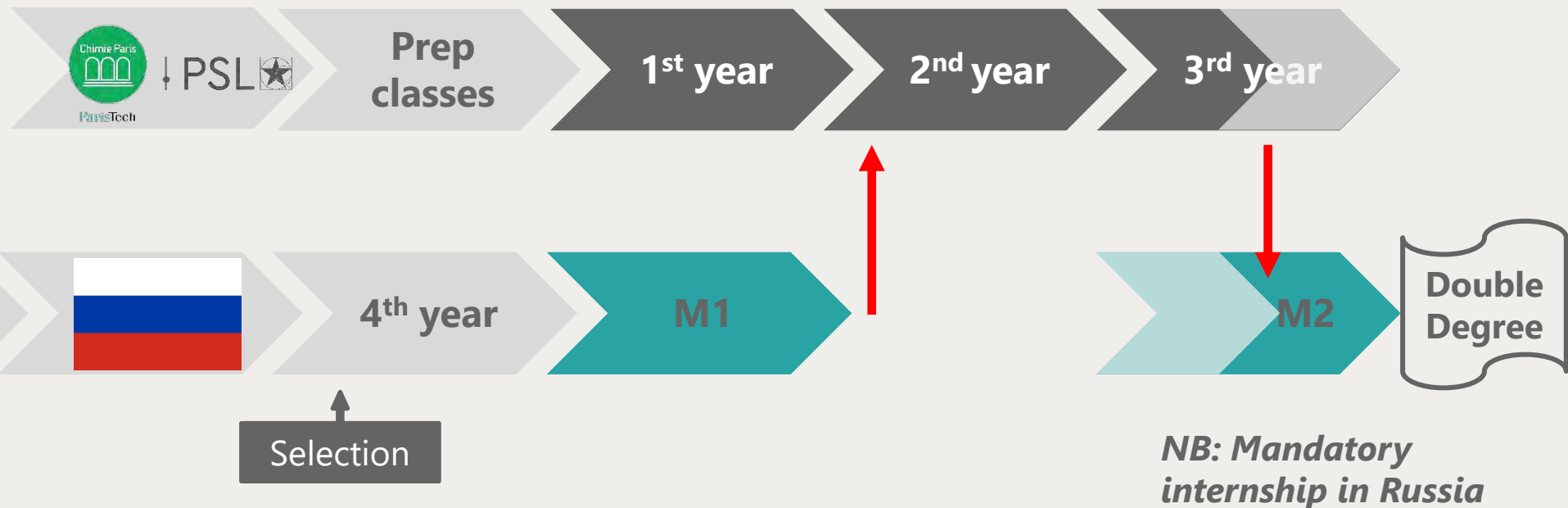
- **Active participation in student activities**



Chimie Paris International



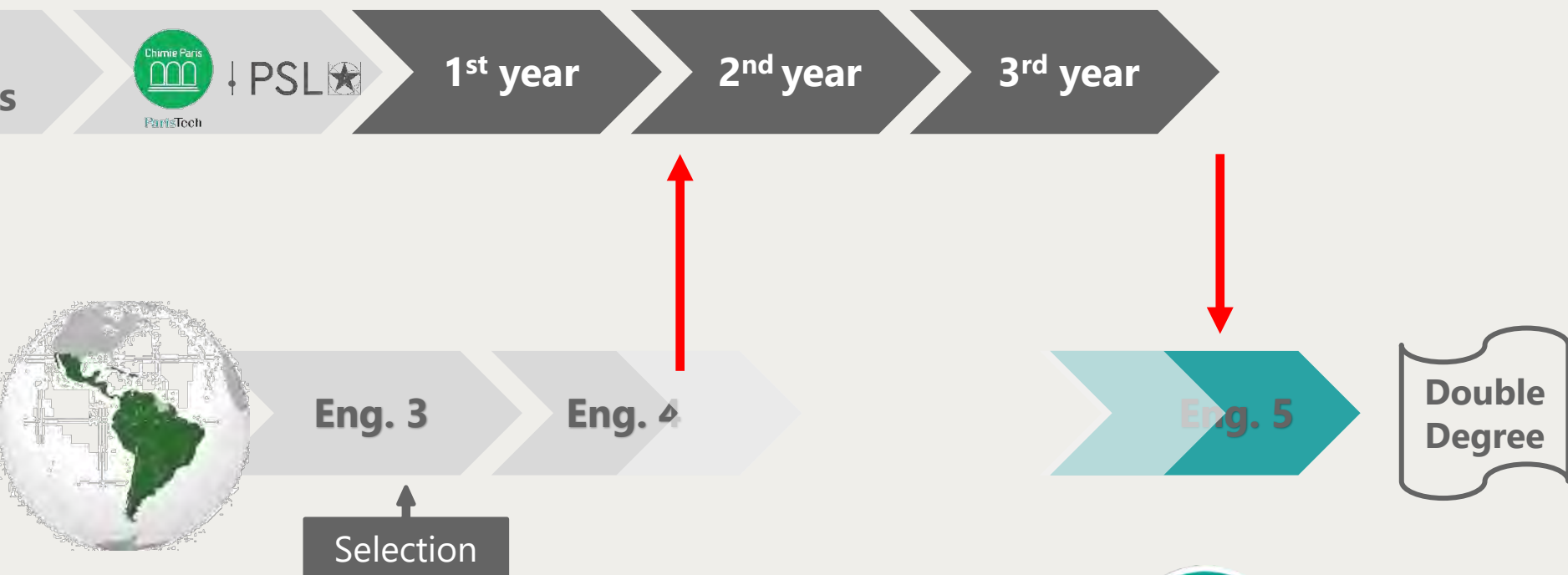
Double degree with Russian partners



Double degree with Russian partners



Double degree with Latin American partners



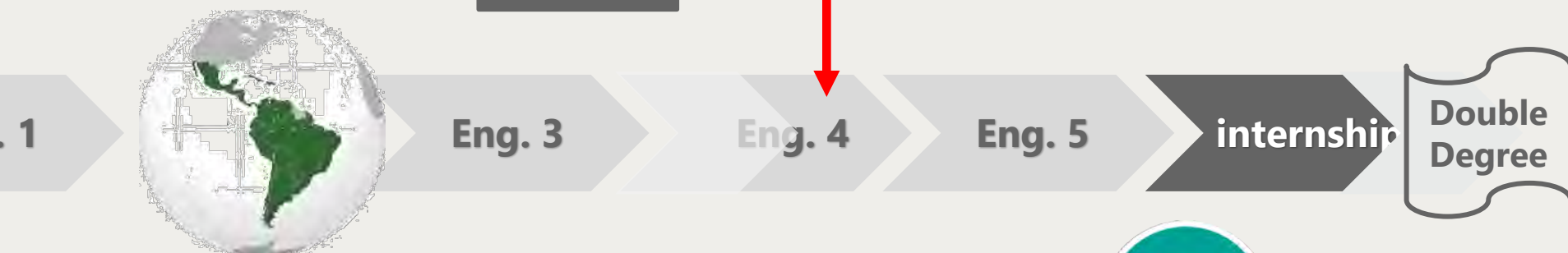
Double degree with Latin American partners



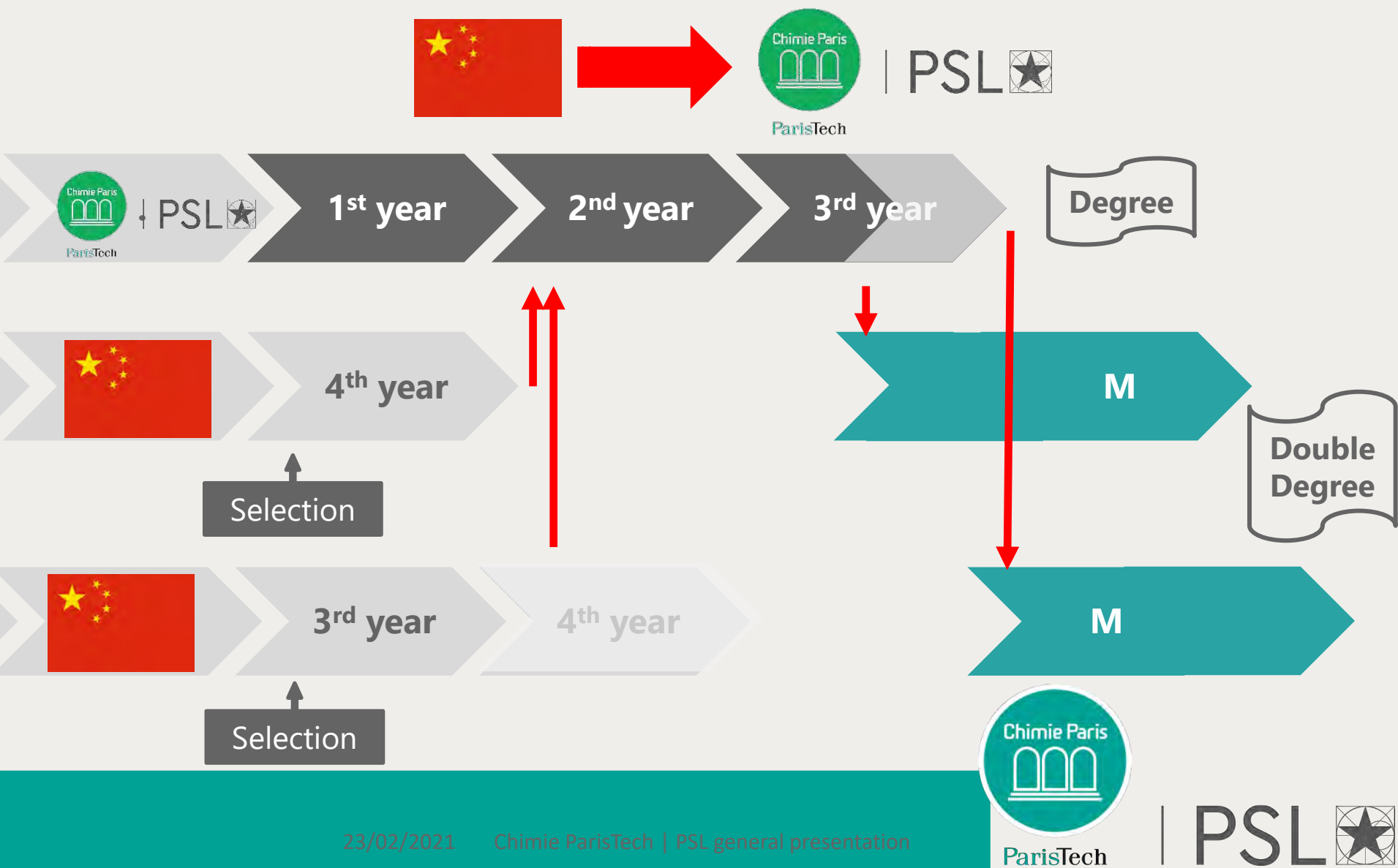
PSL 



Selection



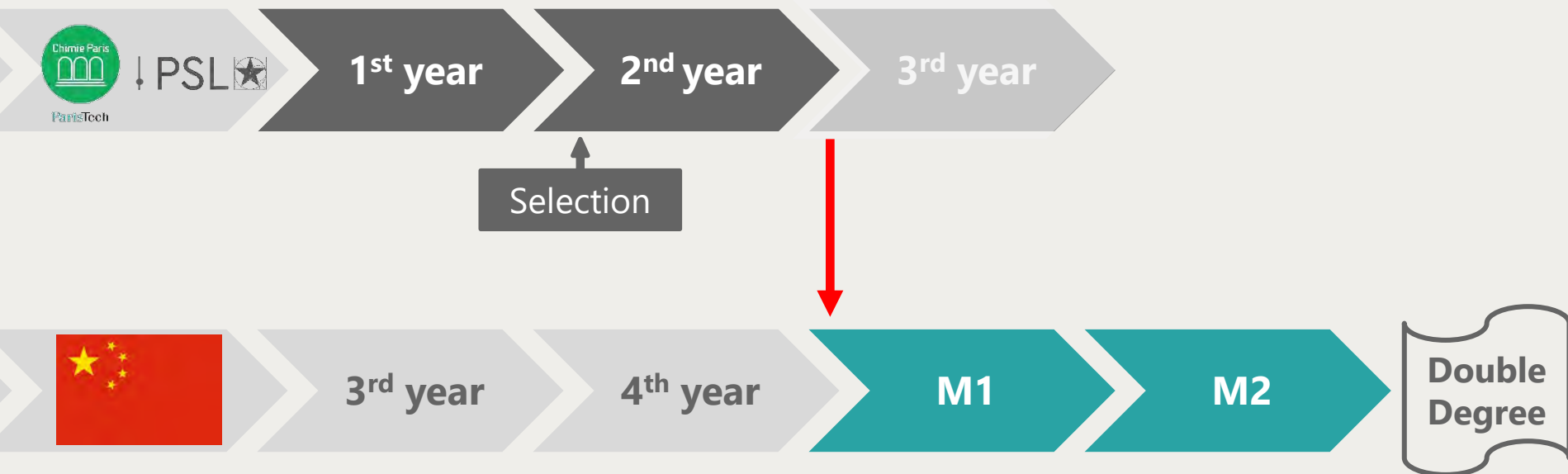
Double degree with Chinese partners



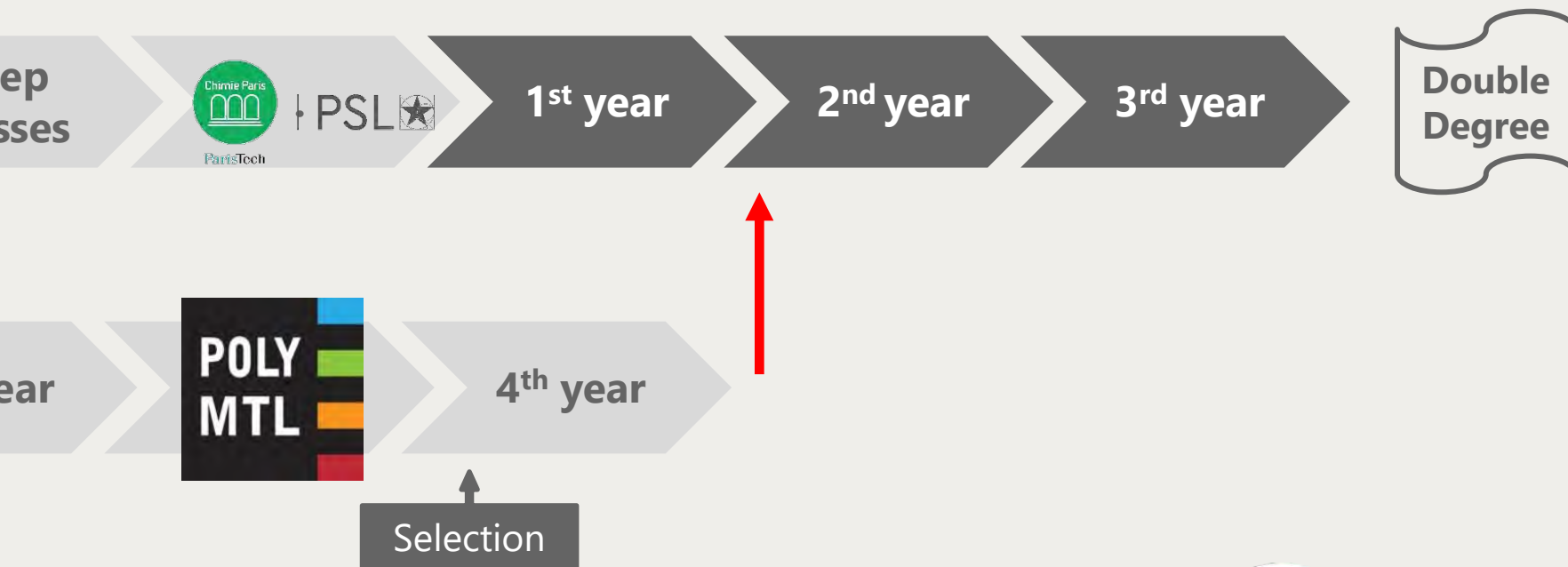
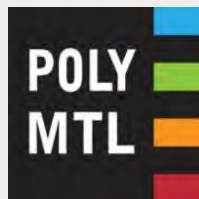
Double degree with Chinese partners



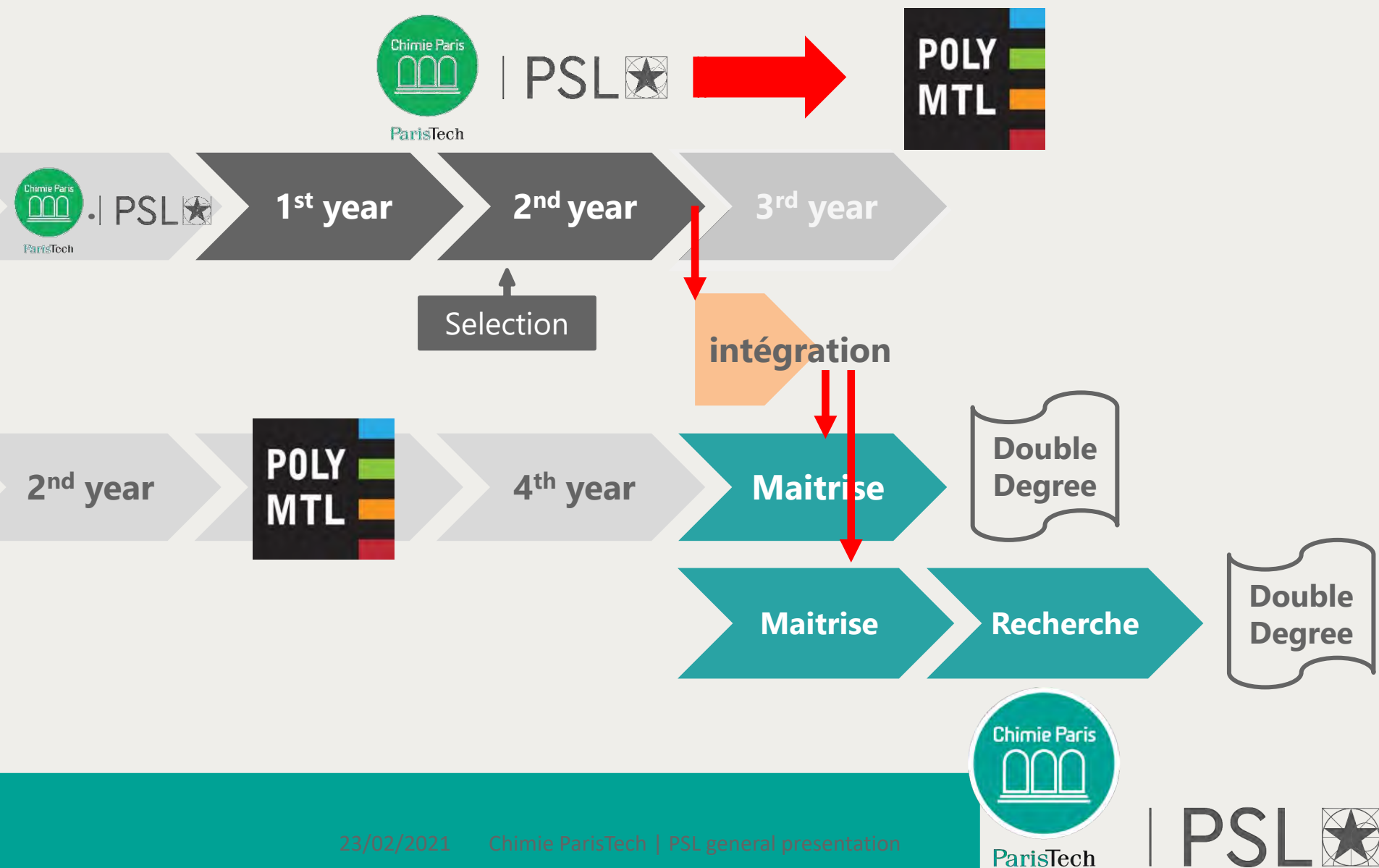
PSL 



Double degree with Polytechnique Montreal



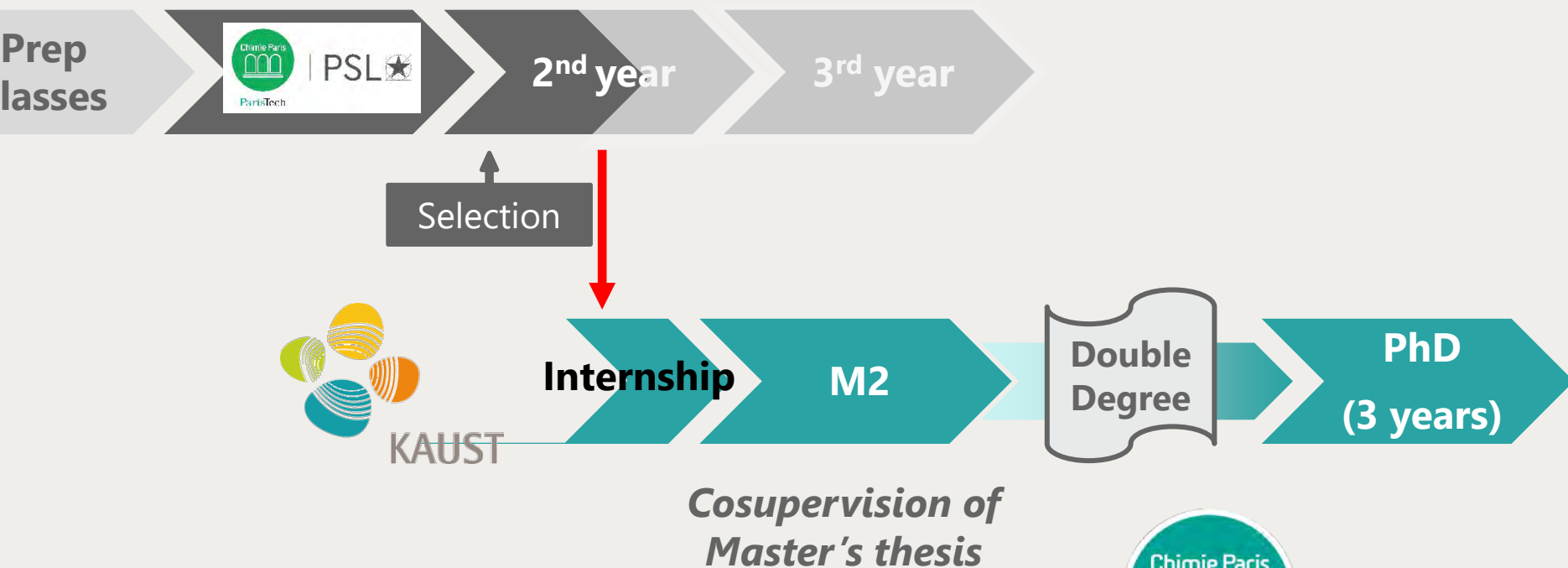
Double degree with Polytechnique Montreal



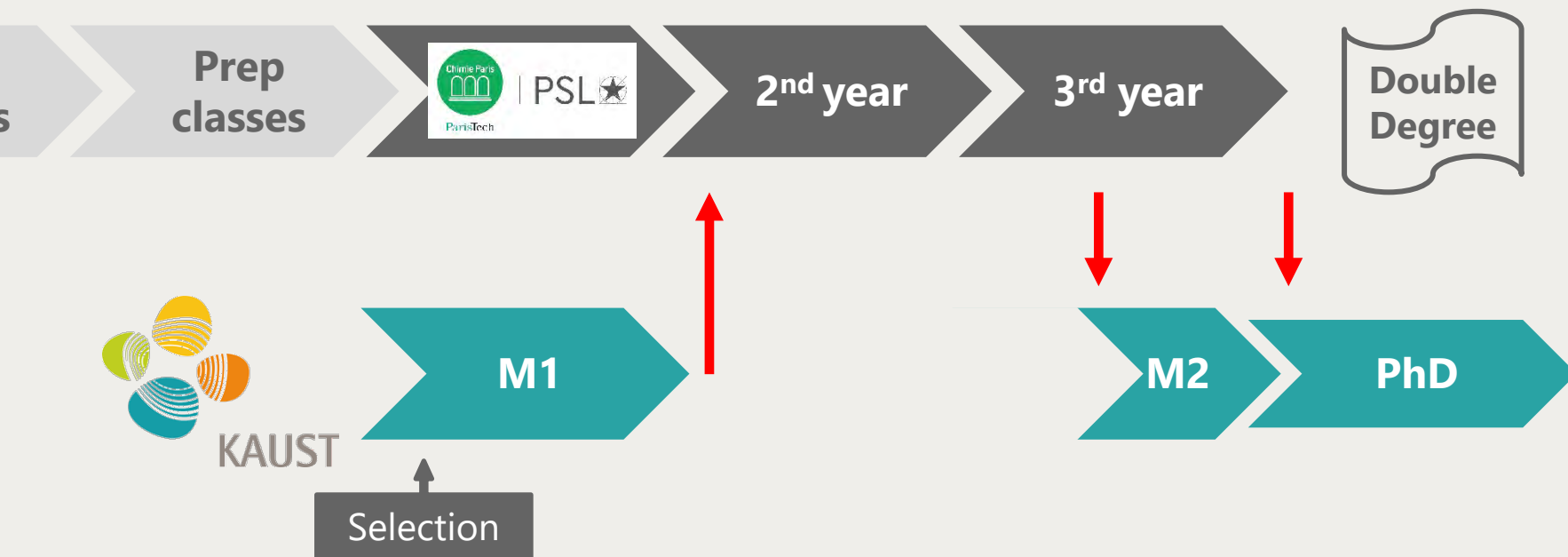
Double degree with KAUST



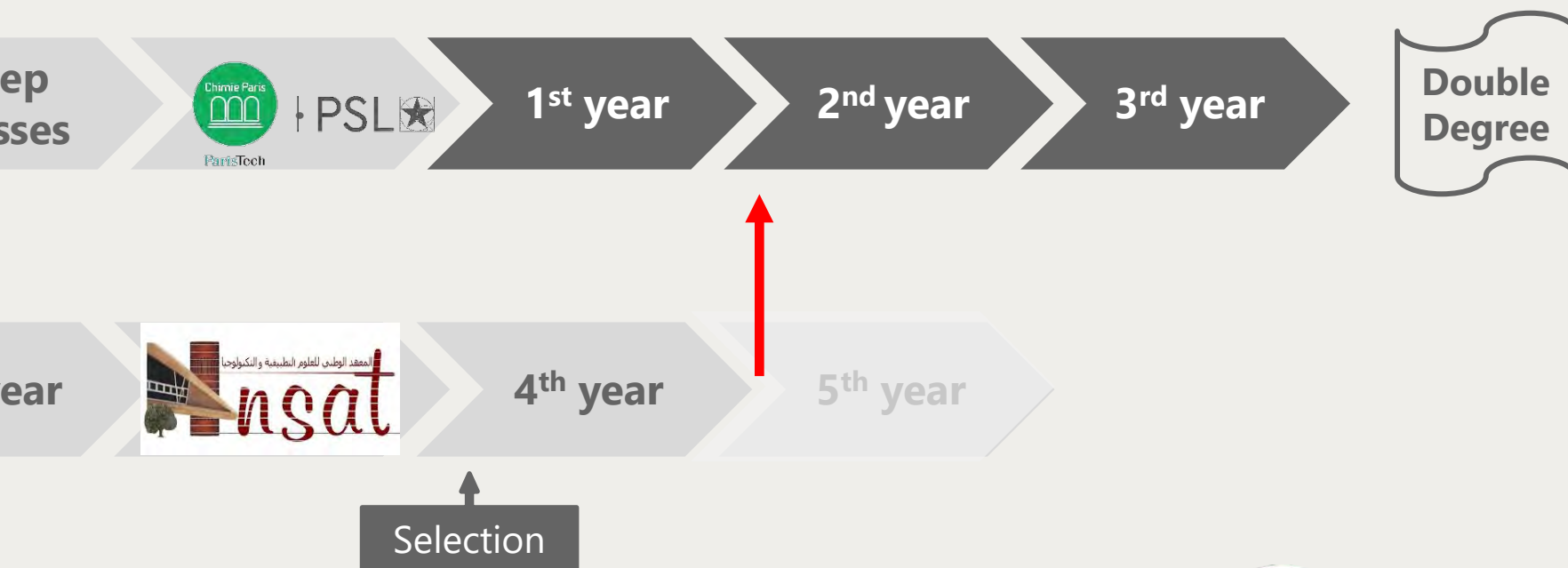
PSL



Double degree with KAUST



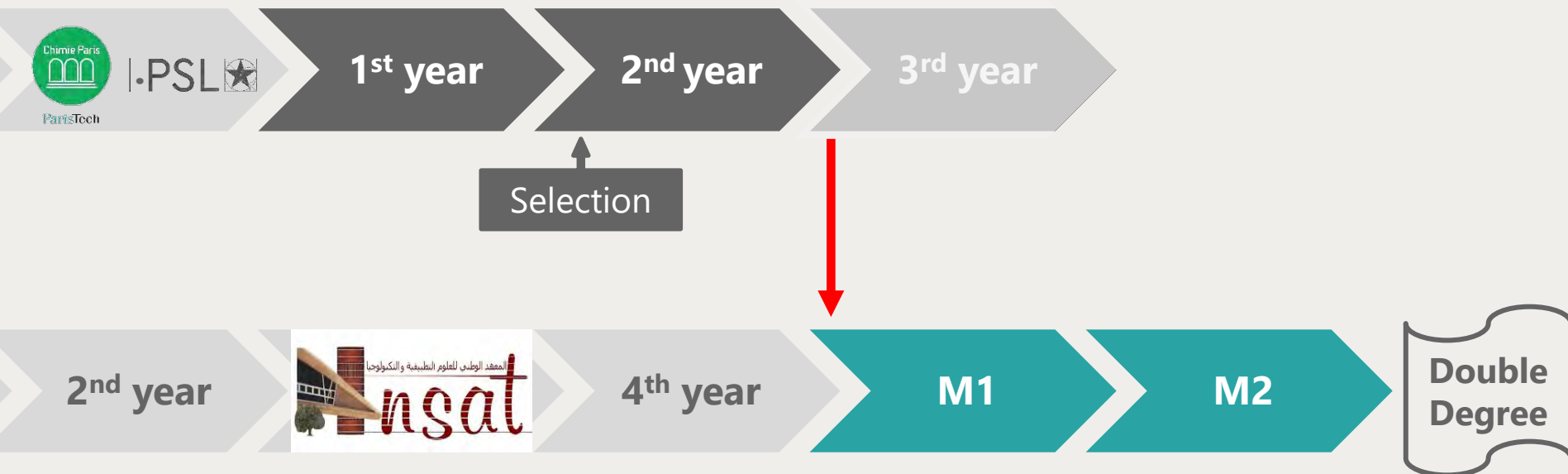
Double degree with INSAT



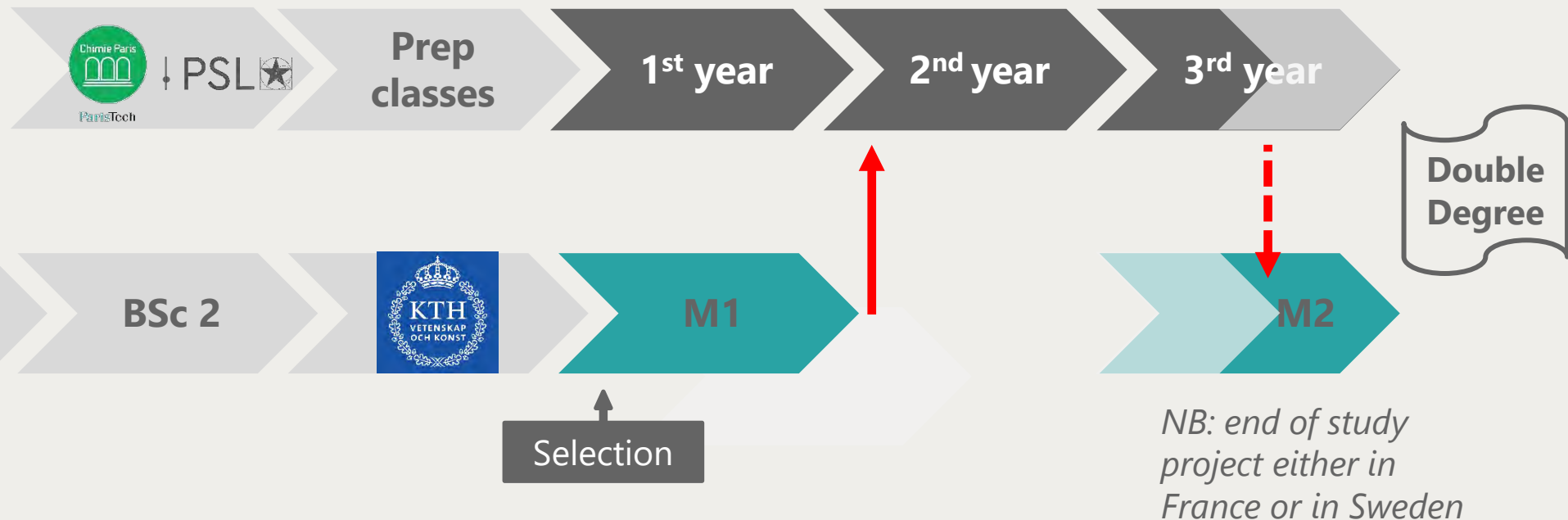
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PSL



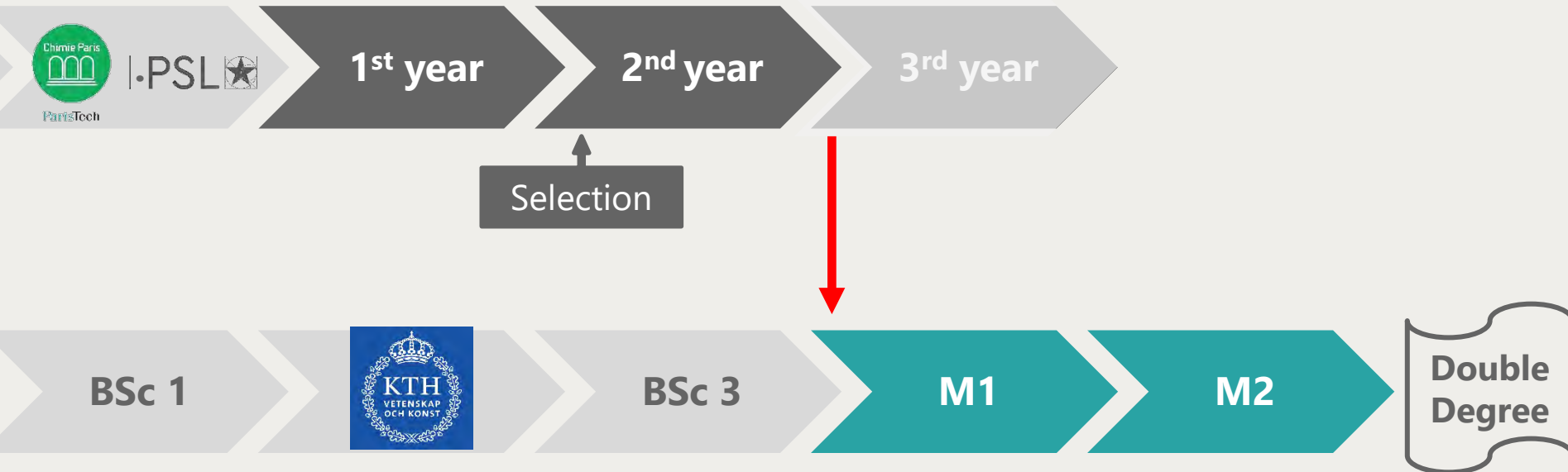
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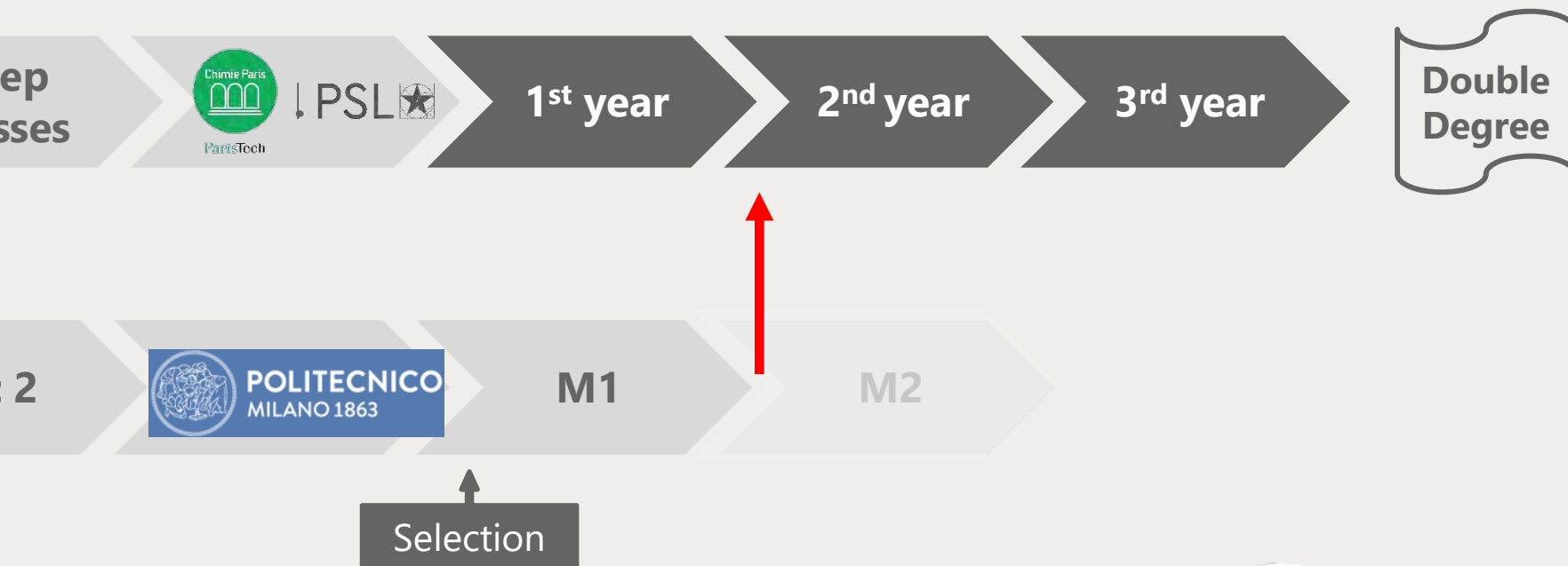
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PSL 



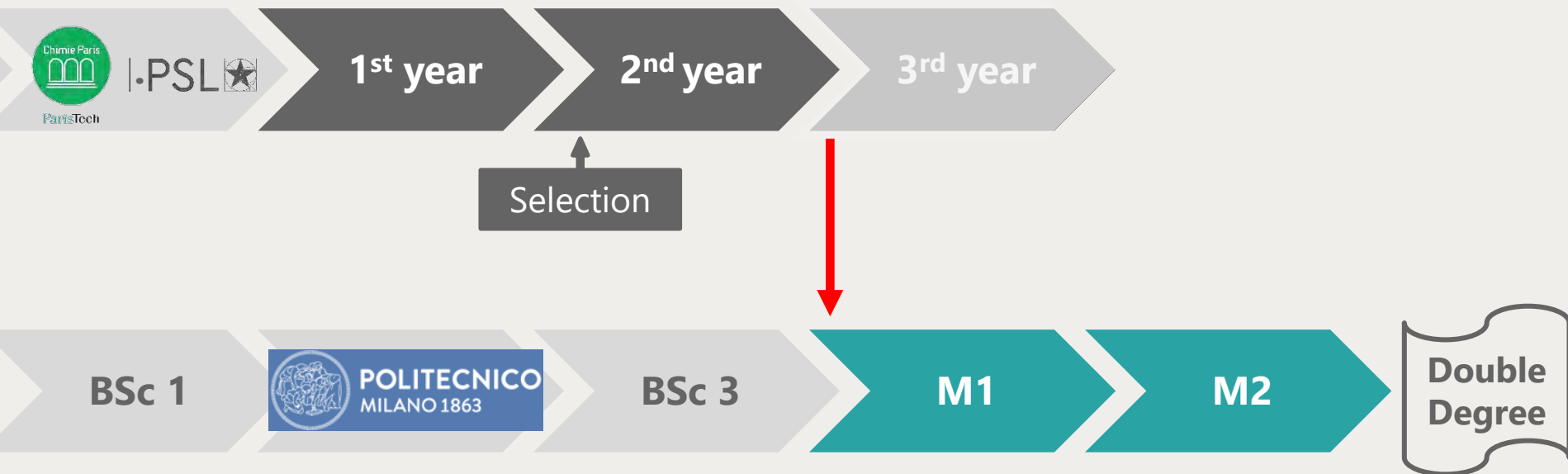
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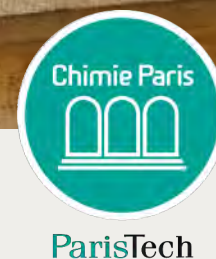
Double degree with Politecnico di Milano



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