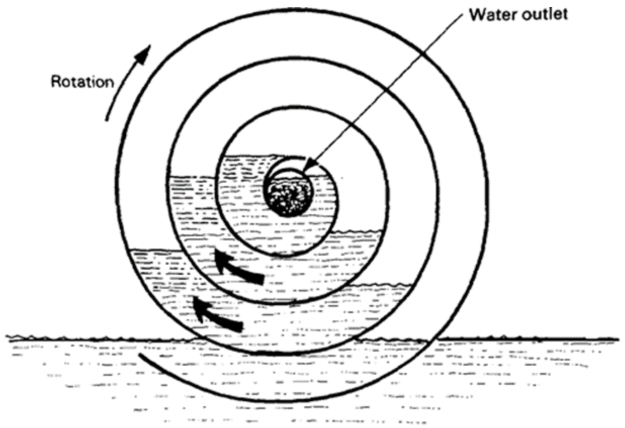
A – lab LFMI

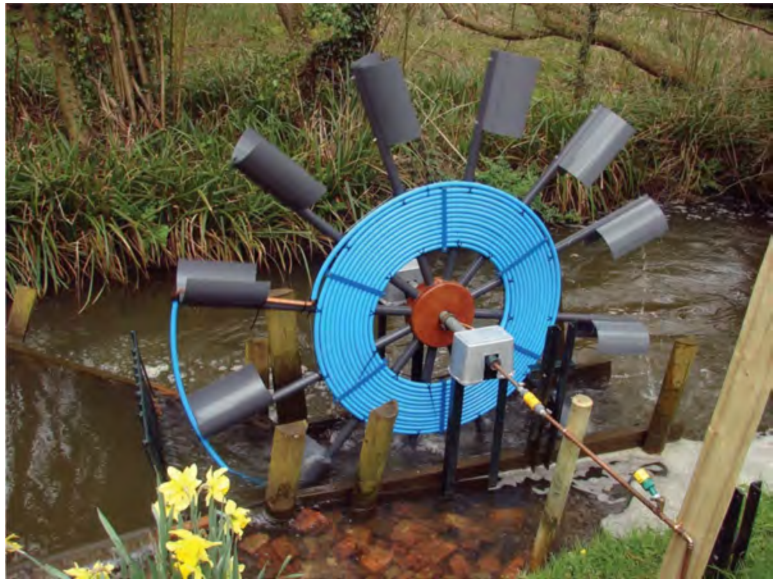
LFMI$_1$ Wirtz pump

- ❖ Hydrostatic spiral pump, able to drive alternating water and air plugs up to great heights (more than 10 metres).
- ❖ Amenable to be fully hydropowered (passive).

Objectives:

- ❖ Construct and characterise a spiral pump, varying the geometrical parameters.
- ❖ Optimise for the output height.
- ❖ Understand the limitations and the sources of failure.





Deane, J. H., & Bevan, J. J. (2018). A hydrostatic model of the Wirtz pump. *Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences*, **474**(2211), 20170533.

$LFMI_2$ Statistics of rain drops

- Project motivated by a proposed mechanism for rillenkarren formation on inclined limestone bedrocks
- The cumulative effect of rain drops running down the path of highest inclination shapes these astonishing patterns
- This requires a proper description of the statistics of rain drops in terms of size and their spatio temporal correlation

Statistics of rain drops

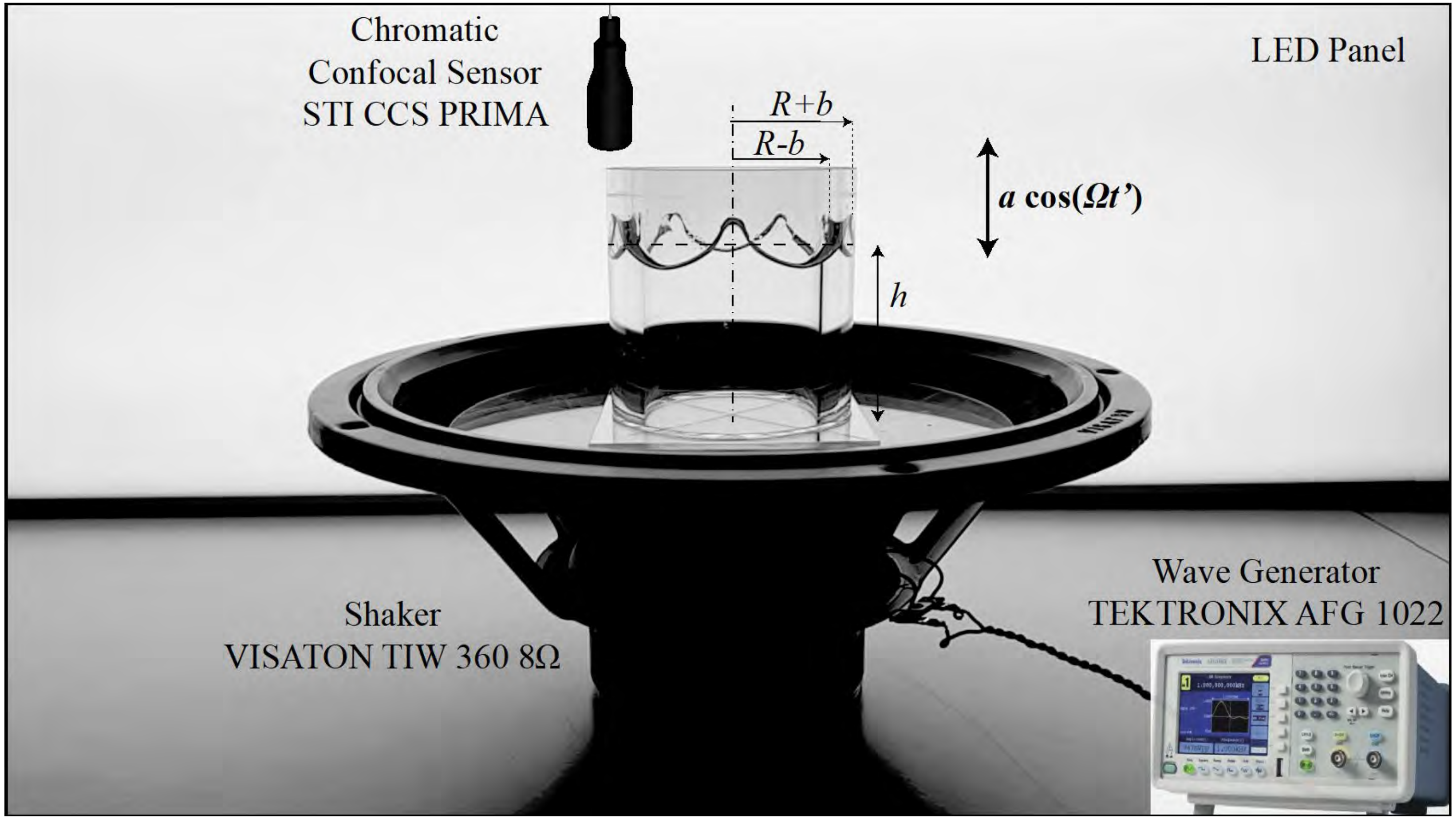
- The objective is to determine the spatio-temporal correlation of the statistics of falling rain drops under different rainfall intensities from the image analysis of rain falling on a inclined plane filmed from below
- The objective is then to be able to reproduce “synthetic rain” to be fed into our numerical simulations.
- Skills on image analysis and interest for statistics are required

$LFMI_3$ Improved Faraday set-up

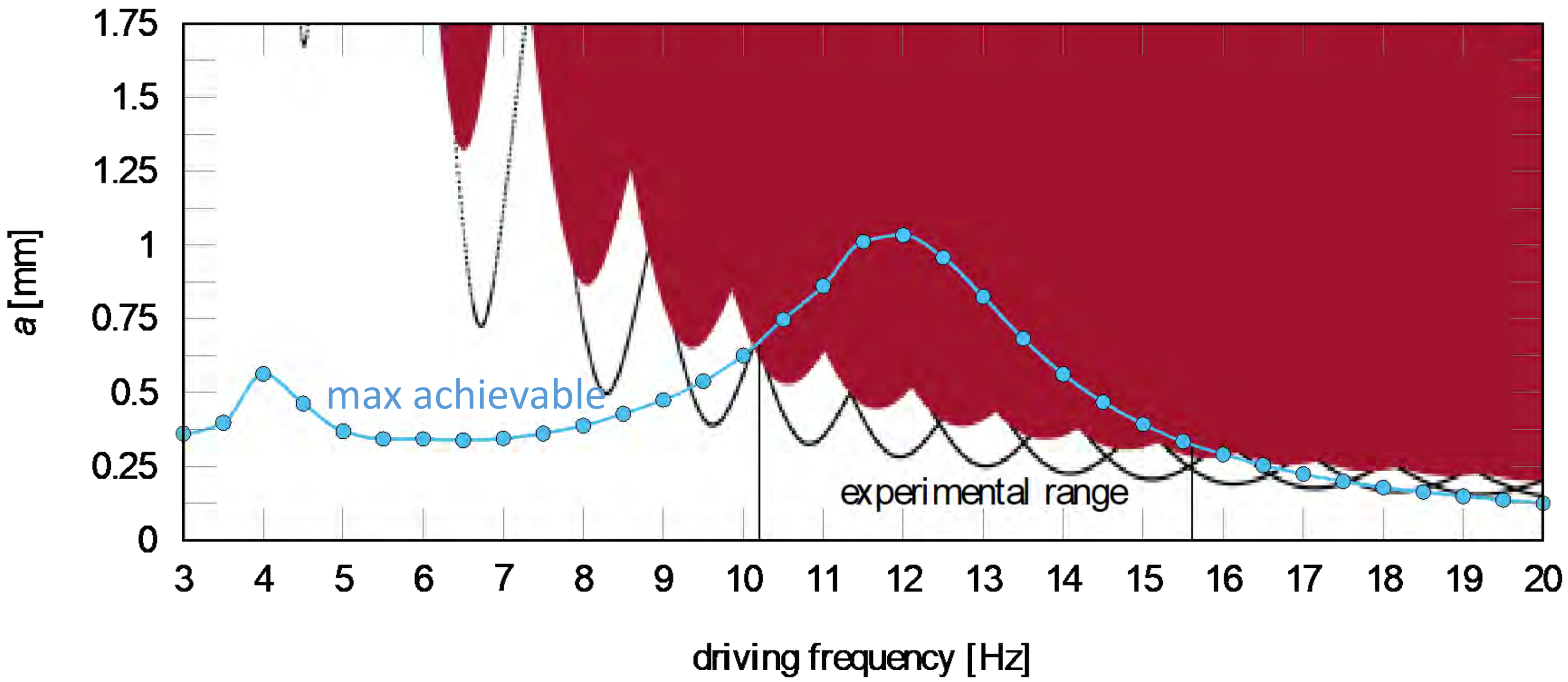
Container	R [mm]	h [mm]	b [mm]
Plexiglas	44	65	7

Liquid	μ [mPa s]	ρ $[\mathrm{kg/m^3}]$	γ [N/m]	M [Pa s]
ethanol 70.0%	2.159	835	0.0234	0.0485

$$\frac{b}{2\pi R} = 0.025 \ll 1$$



Our experimental range is too restricted



- The objective is to build an experimental vertical oscillation set-up suitable to reach higher amplitudes of oscillations (2-5mm) of the container at reasonable cost [<1000CHF]

B – lab LA3

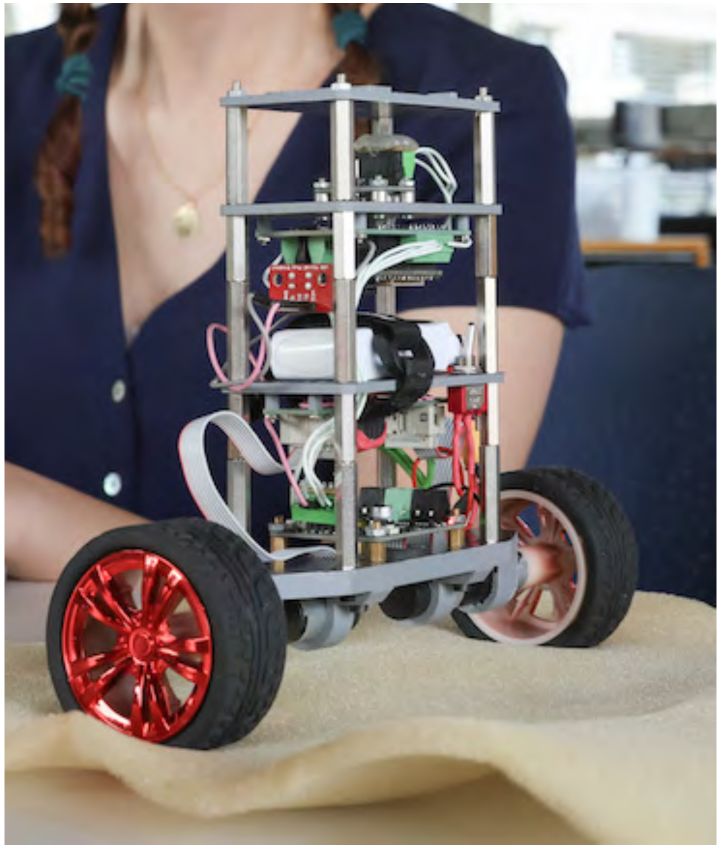
Mini Segway challenge

Multi-years challenge

Year 1 : initial mechanical setup + stand up control

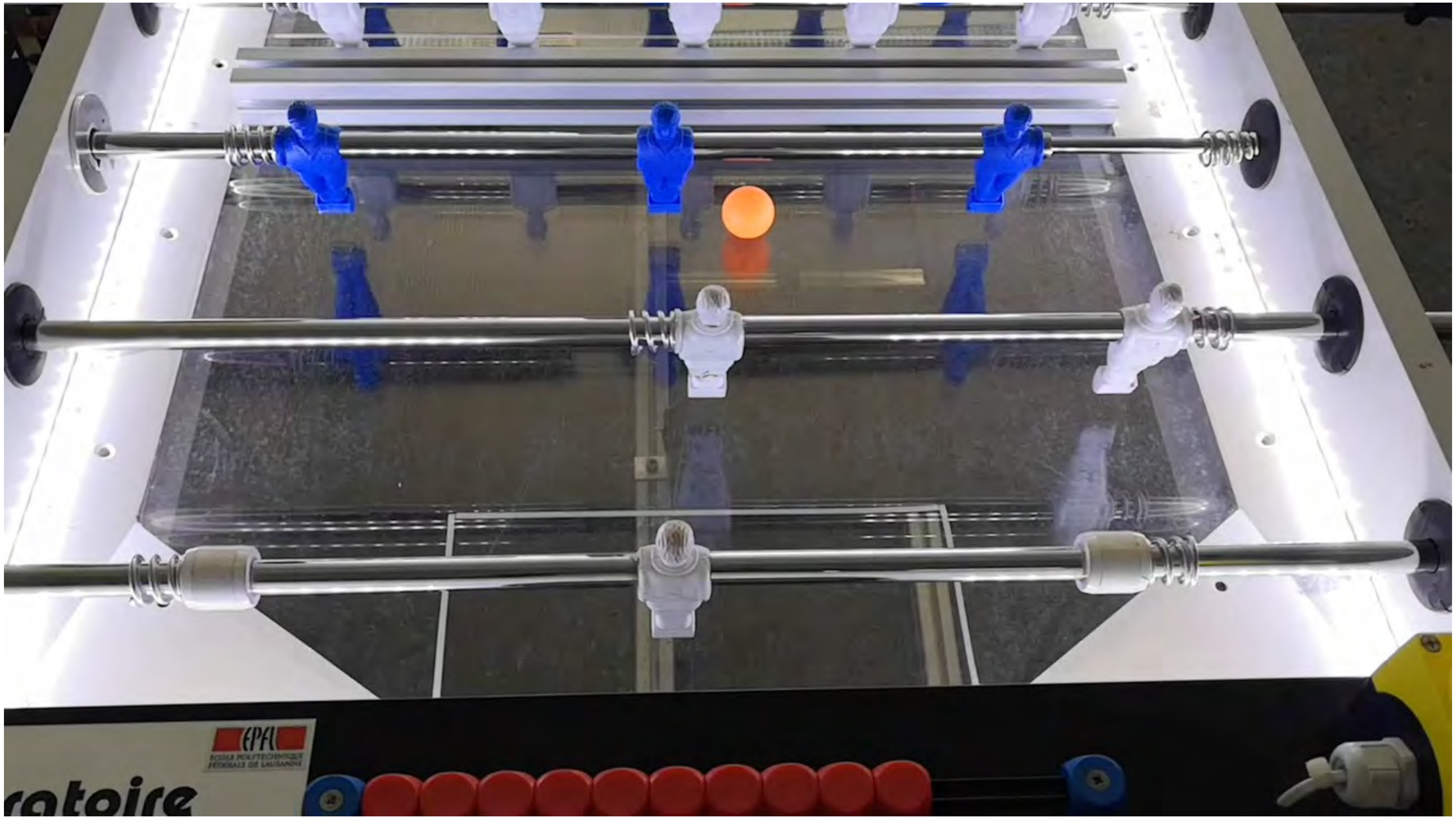
Year 2 : path following/tracking + communication

Year 3 : crowd control via camera tracking



Nbr etudiants: 16, 4 x 4 groupes
Responsables: Christophe Salzmann
Assitants: Vaibhav, Mert

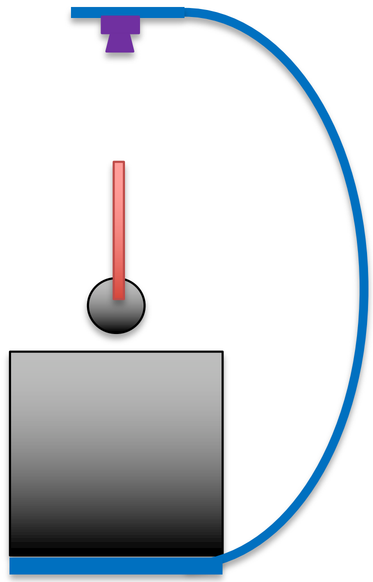
Babyfoot fine control



Improve strategy with moving ball
Programmed in **LabVIEW** !

Nbr etudiants: 2+1
Responsables: Christophe Salzmann

QUBE Extension(s)



- Support for remote experimentation (cameras, usb, power)
- New software modules

Nbr etudiants: 2 x 2
Responsables: Christophe Salzmann

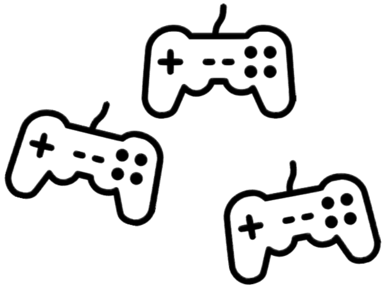
C – lab GFT

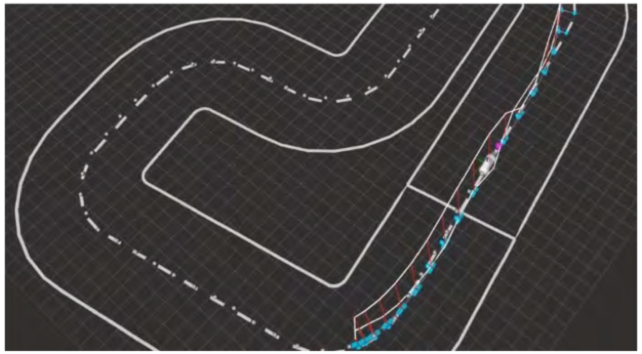
(Un)bumping Cars!

Goal: avoid collision between bumper cars!

Dependable Control and Decision Group

- **Scenario:**
  - Multiple **bumper cars** driven by joystick commands
  - Ensure **no collision** with minimum deviation from joystick commands

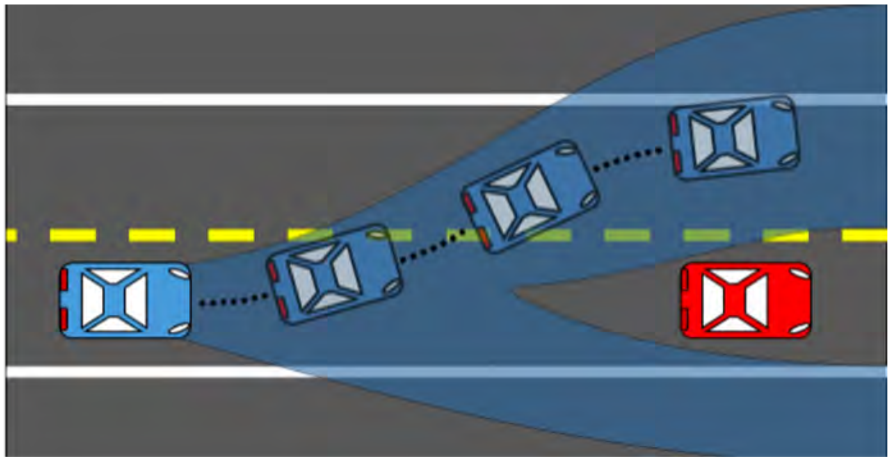




- **First step: simulation and miniature**
  - Racing car platform
  - Simulation software is available

How can cars navigate safely?

- **Methodology**
  - Use Neural Networks (NNs) to plan trajectories for cars
  - Encode avoiding obstacles into the training of Neural Networks
  - Design a real-time safety filter
- **Tasks:**
  - Understand the simulator
  - Implement a NN for avoiding obstacles in Python
  - Link the NN and the simulator to train the NN for completing the goal
  - Experiment with different NN architectures



Supervisor: Prof. Ferrari Trecate
Contact:
mahrokh.ghoddousiboroujeni@epfl.ch
muhammad.zakwan@epfl.ch
riccardo.cescon@epfl.ch

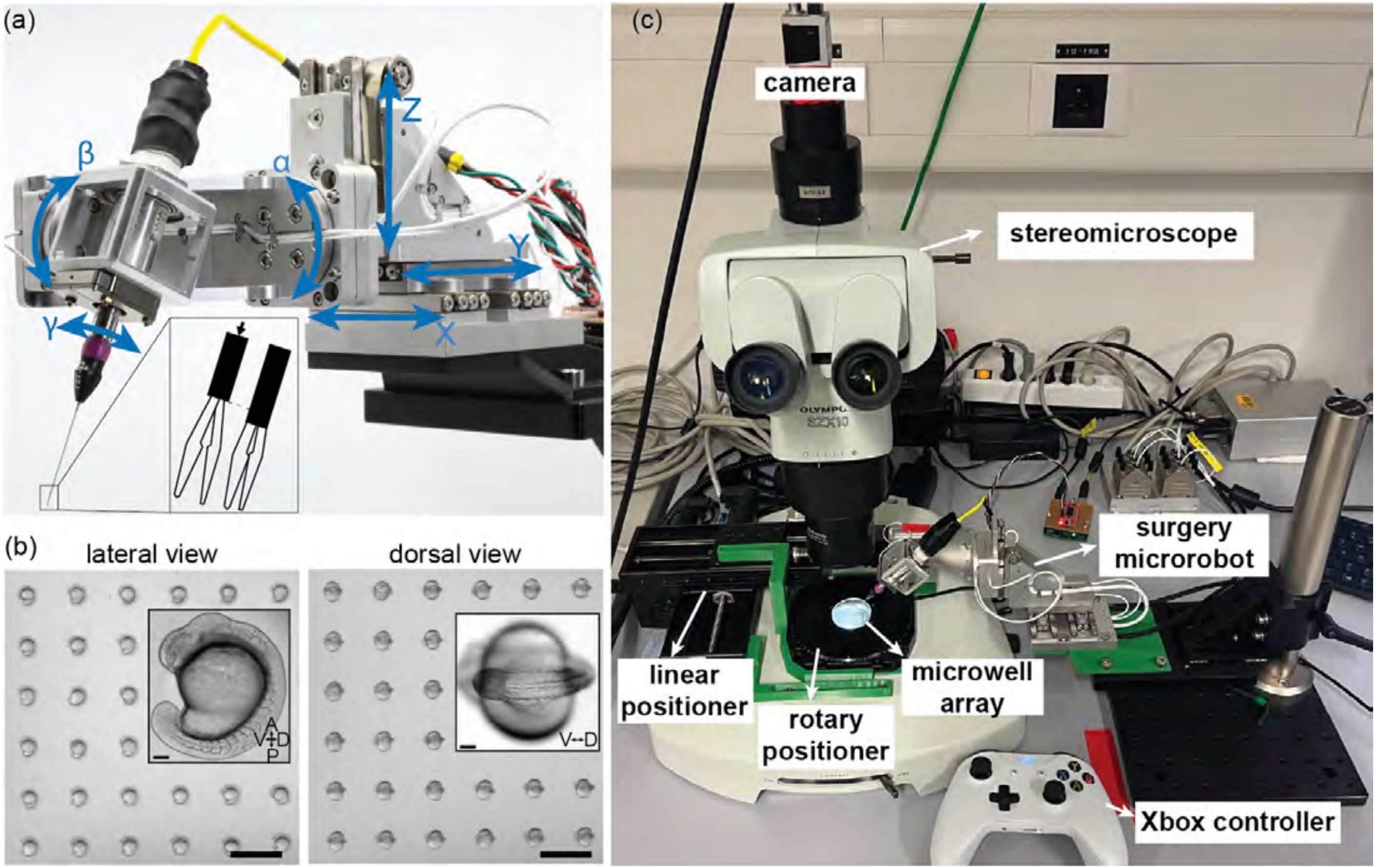
D – Lab MICROBS

Projects at the MICROBS Laboratory

Mahmut Selman Sakar
Institute of Mechanical Engineering

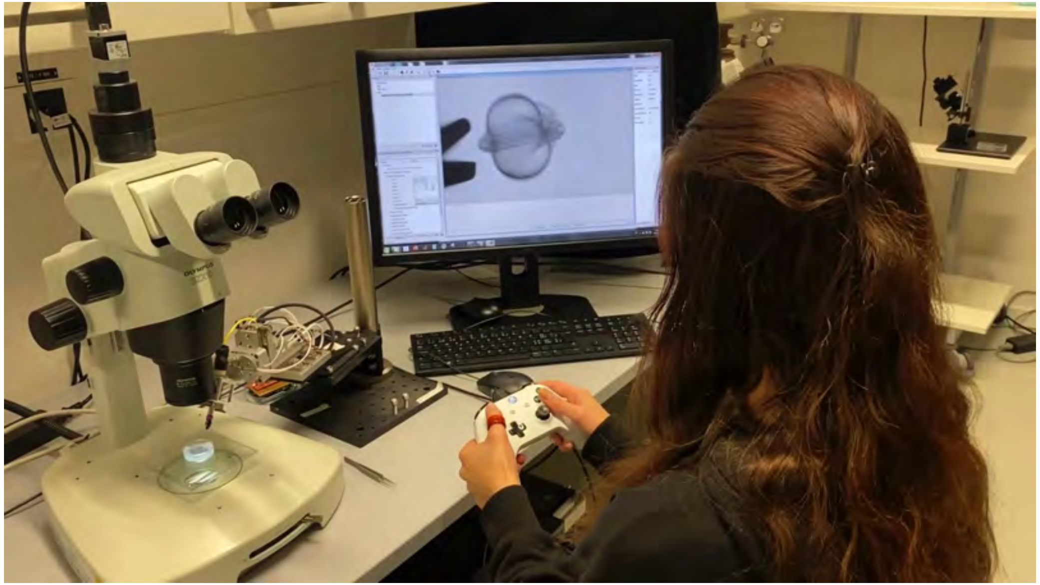
December 7th, 2023

Robotic microsurgery

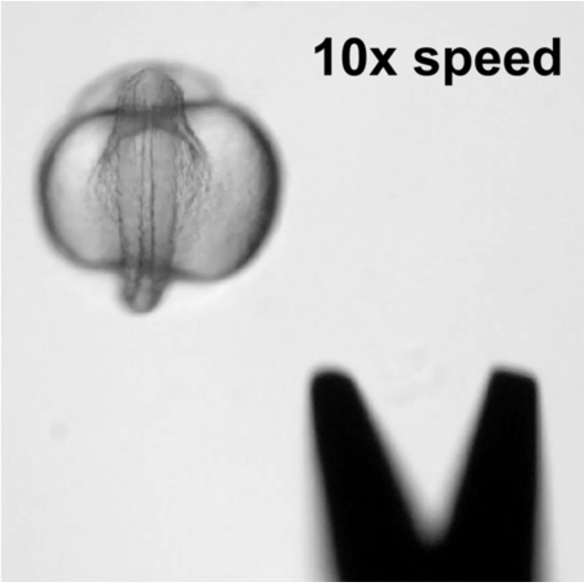


Robotic microsurgery

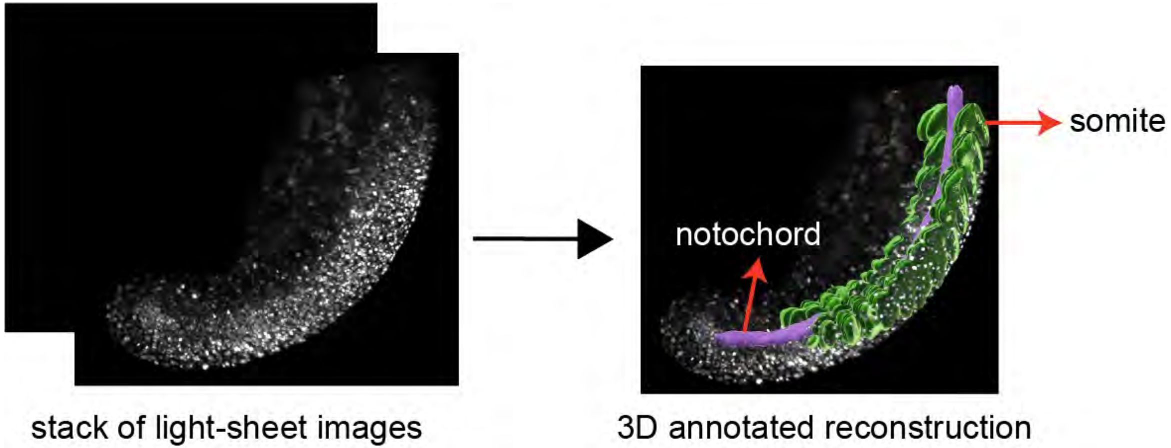
Teleoperation



Visual servoing

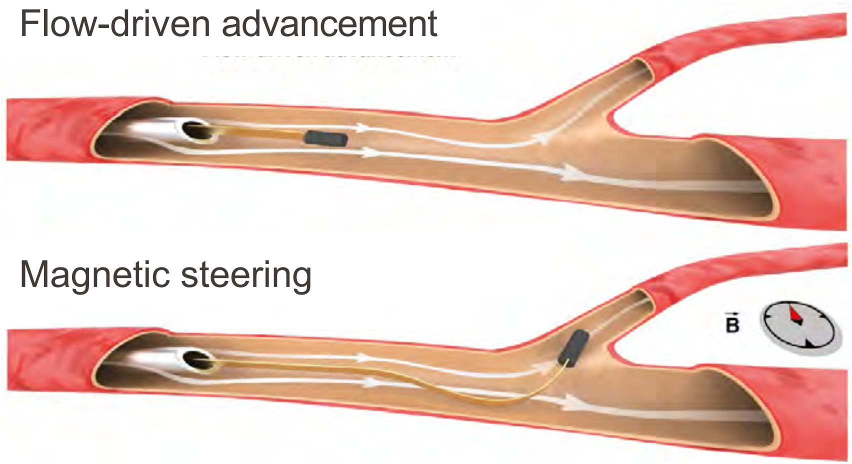


Project I: 3D Automated Microsurgery

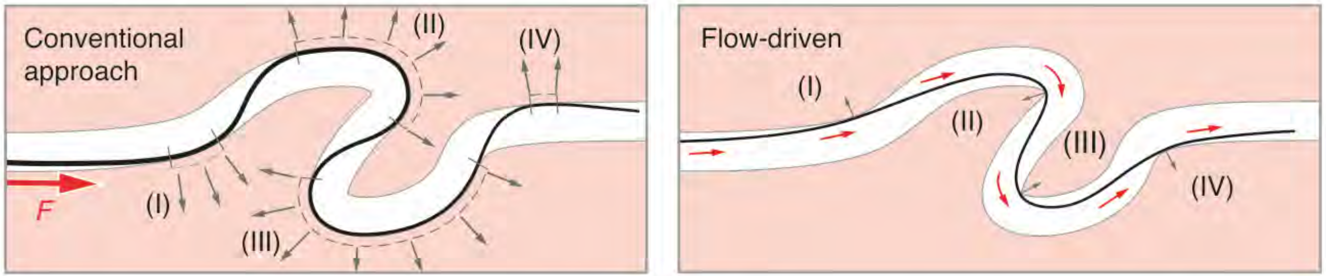


- **Task:** Develop a software to automatically register 2D bright-field microscope image with 3D light-sheet microscope images
- **Application:** System for automated robotic microsurgery
- **Tool:** C++/Python with the use of OpenCV

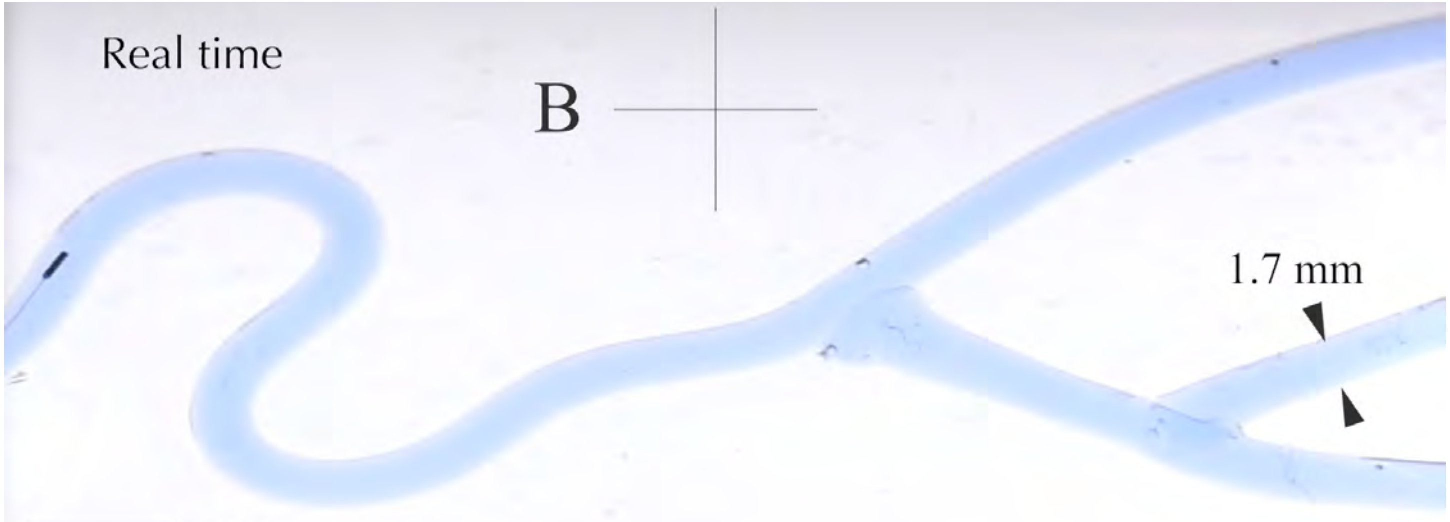
Flow-driven navigation with magnetic steering



- From cylinders to ribbons
- Fluid forces and drag
- Low strength magnetic field

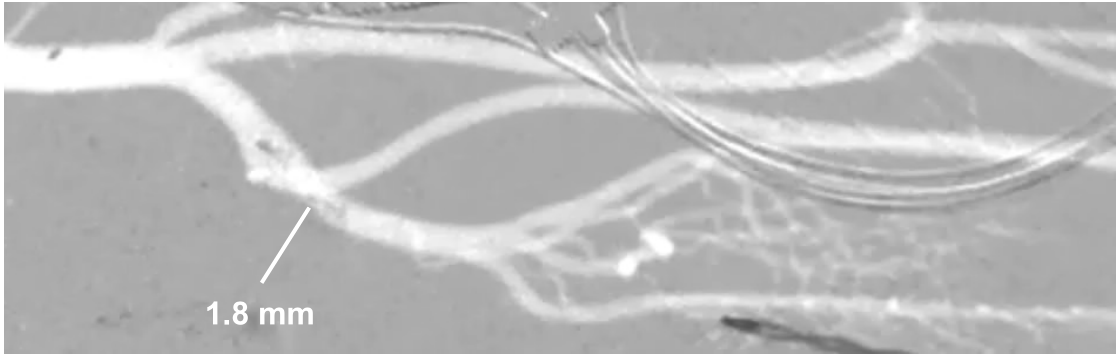


Navigation in biomimetic phantoms



- Navigation at the speed of the flow
- Accessing capillaries
- Extremely low contact forces

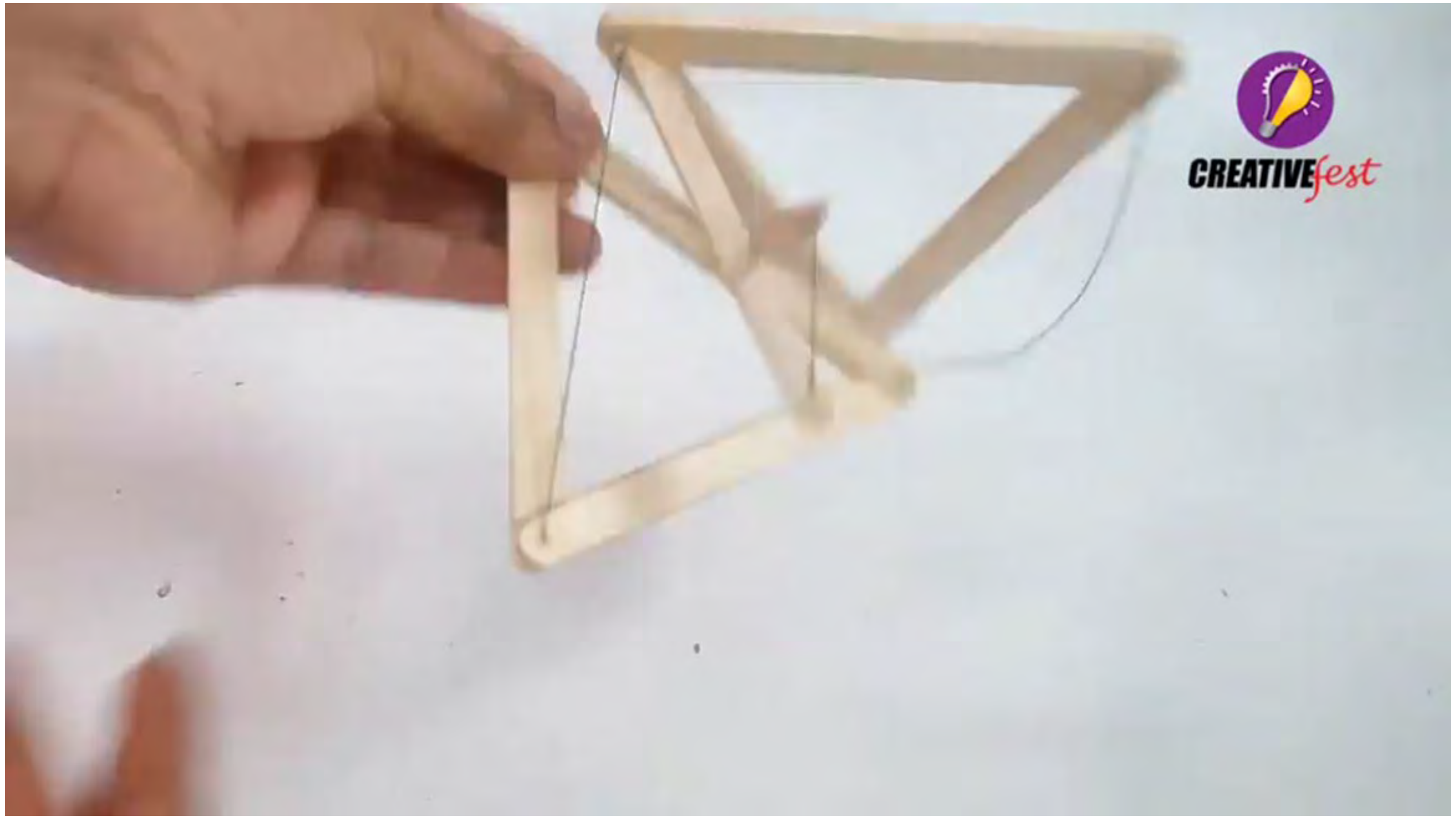
Project II: 3D Automated Navigation



- **Task:** Develop imaging software for accurate tracking of the catheter tip in real-time X-Ray images
- **Application:** System for automated robotic navigation of microcatheters and probing the dynamics of the blood flow
- **Tool:** C++/Python with the use of OpenCV

E – Lab NEMS

NEMS Projet 1 – Mécanisme anti-gravité



- Conception et construction du système
- Analyse de la estructure

Guillermo.Villanueva@epfl.ch

1-5 Groupes – 3-4 personnes par groupe approx.

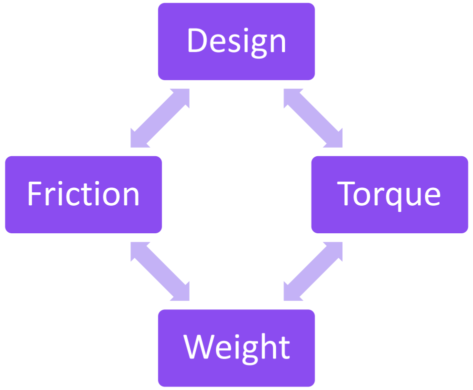
NEMS Projet 2 – Mouvement Perpétuel

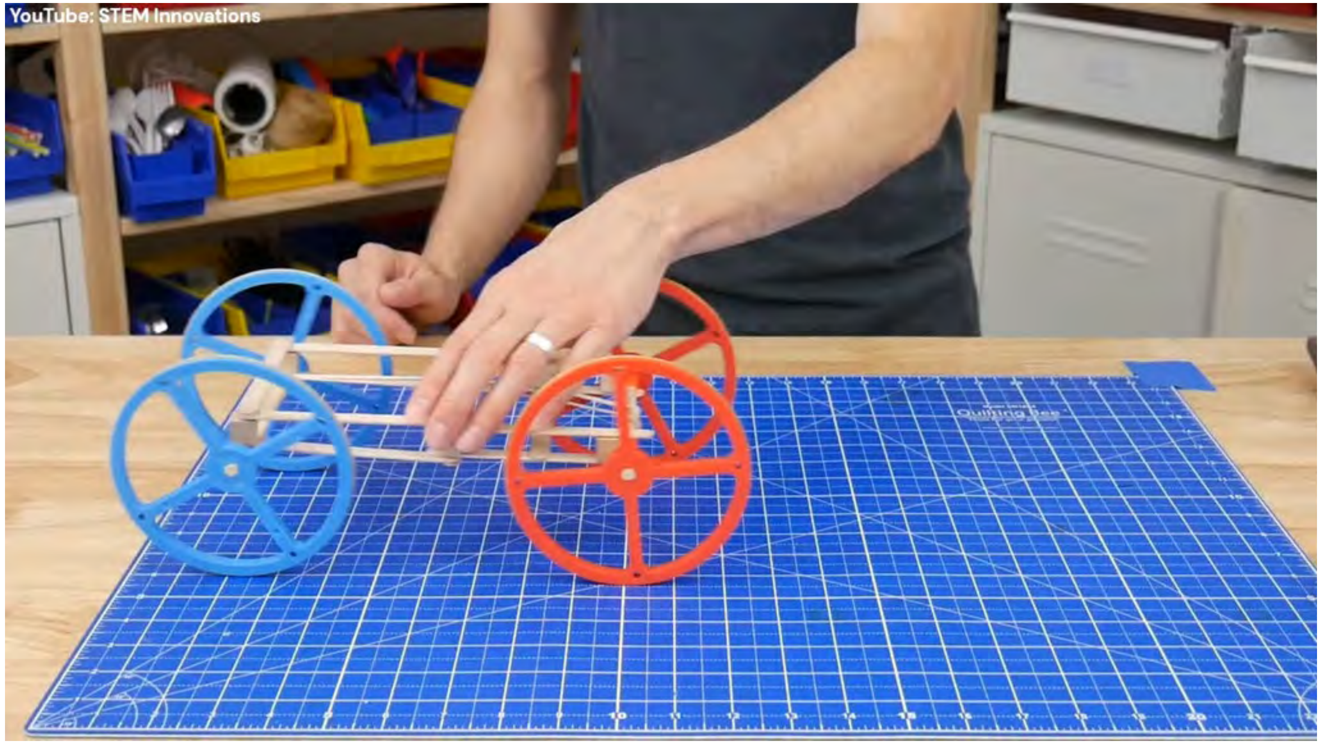
- Mécanique: Conception et construction du système
- Electronique: Construire l'électronique impliquée pour détecter la balle et activer l'électro-aimant au moment précis.

Guillermo.Villanueva@epfl.ch

1-5 Groupes – 3-4 personnes par groupe approx.

NEMS Projet 3 – Rubber car challenge





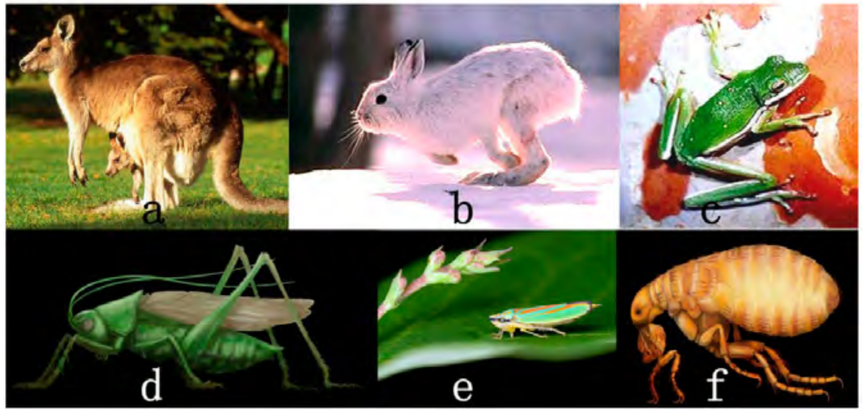
- Propulser une voiture à l'aide d'élastiques
- Objectif : parcourir la plus grande distance possible

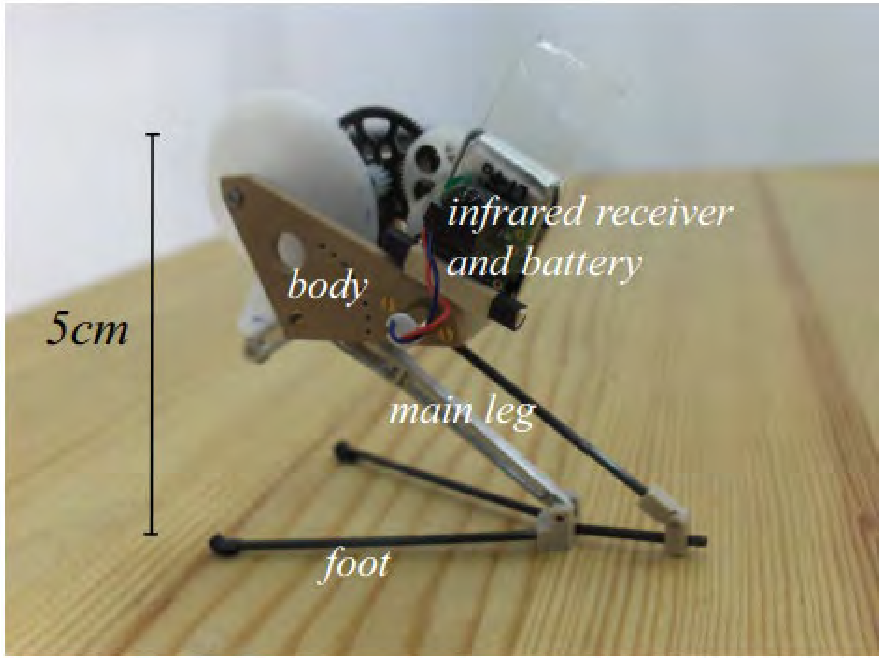
1-5 Groupes – 3-4 personnes par groupe approx.

Guillermo.Villanueva@epfl.ch

F – lab EMSI

EPFL EMSI Projet – Leaping Latches ***challenge***





- Analyse, Matériaux, Fabrication, TEST!!!!
- Objectif : Sauter à la plus grande hauteur possible
- Unleash elastic energy for the highest hop!

John.Kolinski@epfl.ch

1-3+ Groupes – 3-4 personnes par groupe approx.

G – Lab FLEXLAB

Da Vinci-inspired Design Challenge

SGM - Projet d'ingénierie simultanée 2023-2024

Goal: Taking the codices or other art pieces of Leonardo da Vinci as a starting point, you will be ideating, developing, prototyping, analyzing, and studying an innovative technique, process, structure, application, or research/science question.

Up to 4 teams of 5 students. Open-ended project. Lab work will take place at DLL.

Flexible Structures Laboratory – IGM.

Contact: pedro.reis@epfl.ch

https://actu.epfl.ch/news/bringing-leonardo-da-vinci-s-designs-to-life-3/

Bringing Leonardo da Vinci's designs to life

STUDENT PROJECTS - Fourteen mechanical engineering students spent a semester getting inside the head of Leonardo da Vinci. Using his drawings from the 15th and 16th centuries, the teams built ingenious machines – altering the design in some cases – in order to better understand how they worked.

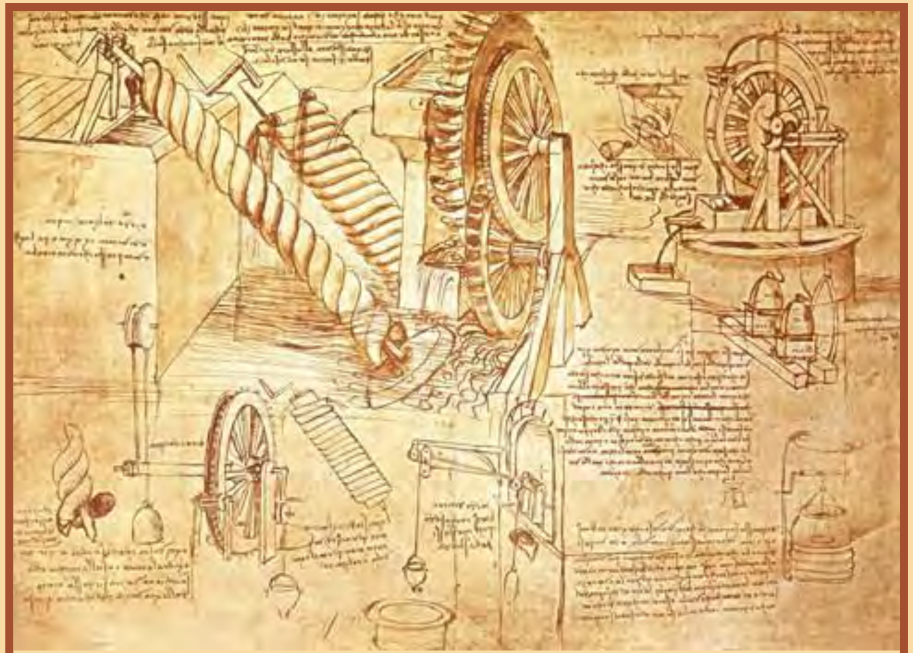
03.07.23

TAGS

CIS | design | electrical engineering | engineering | ERC | mechanics | rehabilitation | students | summer series

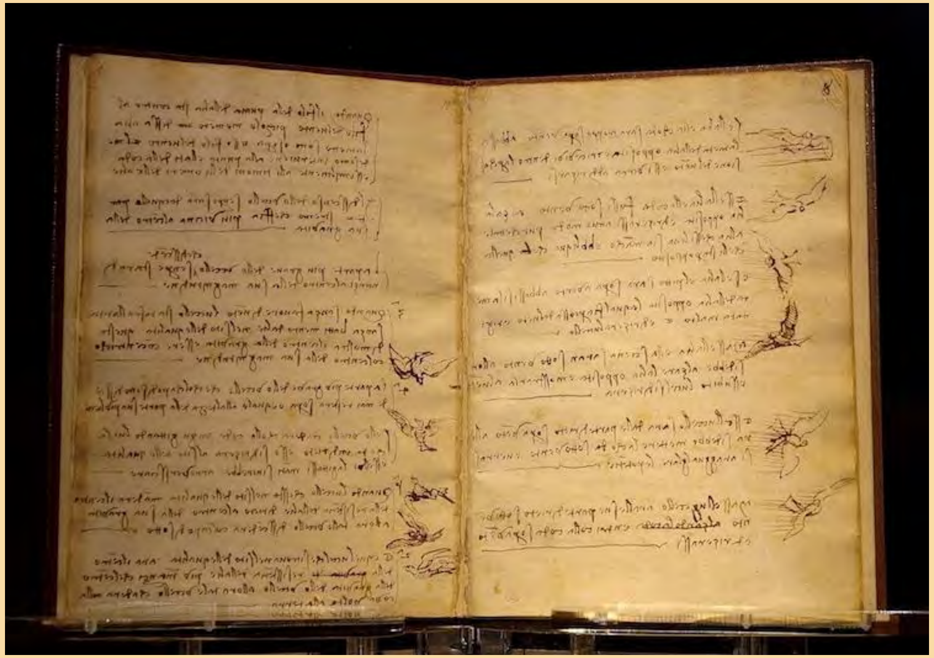
The *Codex Arundel* (CA. 1480S-1518) is a 283-page manuscript by Da Vinci that contains notes on a wide variety of subjects that interested him, including **mechanics and geometry**. The physical copy is held in The British Library.

The *Forster Codex* (1487-1505) is made up of five pocket notebooks that have been bound into three volumes. Inside, Da Vinci explores **geometry, hydraulic engineering, theory of proportions, topology**, and more. The physical copy is held in the Victoria and Albert Museum in London.



The *Codex Atlanticus* (1478-1519) is the largest single collection of drawings and writings by Da Vinci. It includes content about **weaponry, musical instruments, mathematics, botany**, and more across 1,119 leaves of paper. The entire codex spans Da Vinci's career through Florence, Milan, Rome, and Paris. The physical copy is held in the Biblioteca Ambrosiana in Milan, Italy.

The *Codex on the Flight of Birds* (1505) is one of the best-known manuscripts. Relatively short, the codex includes illustrations and notes examining the **flight patterns of birds and several inventions for flying machines**. The physical copy of the manuscript is held in the Royal Library in Turin, Italy.



https://mymodernmet.com/leonardo-da-vinci-notebooks-online/

The *Madrid Codice*…
the most im…
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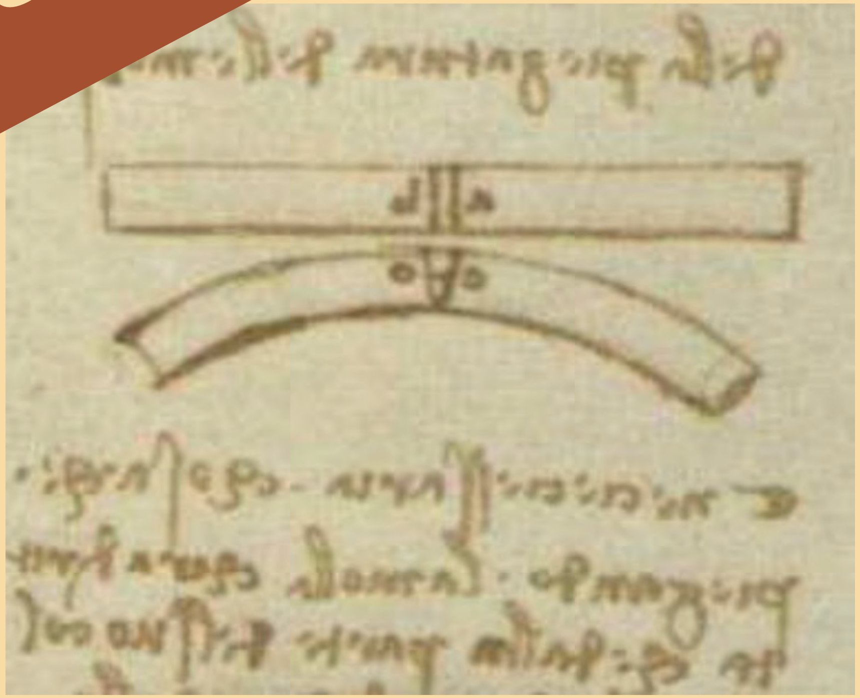


You don’t need to be a genius to join this project!

…rdo-da-vinci-notebooks-online/

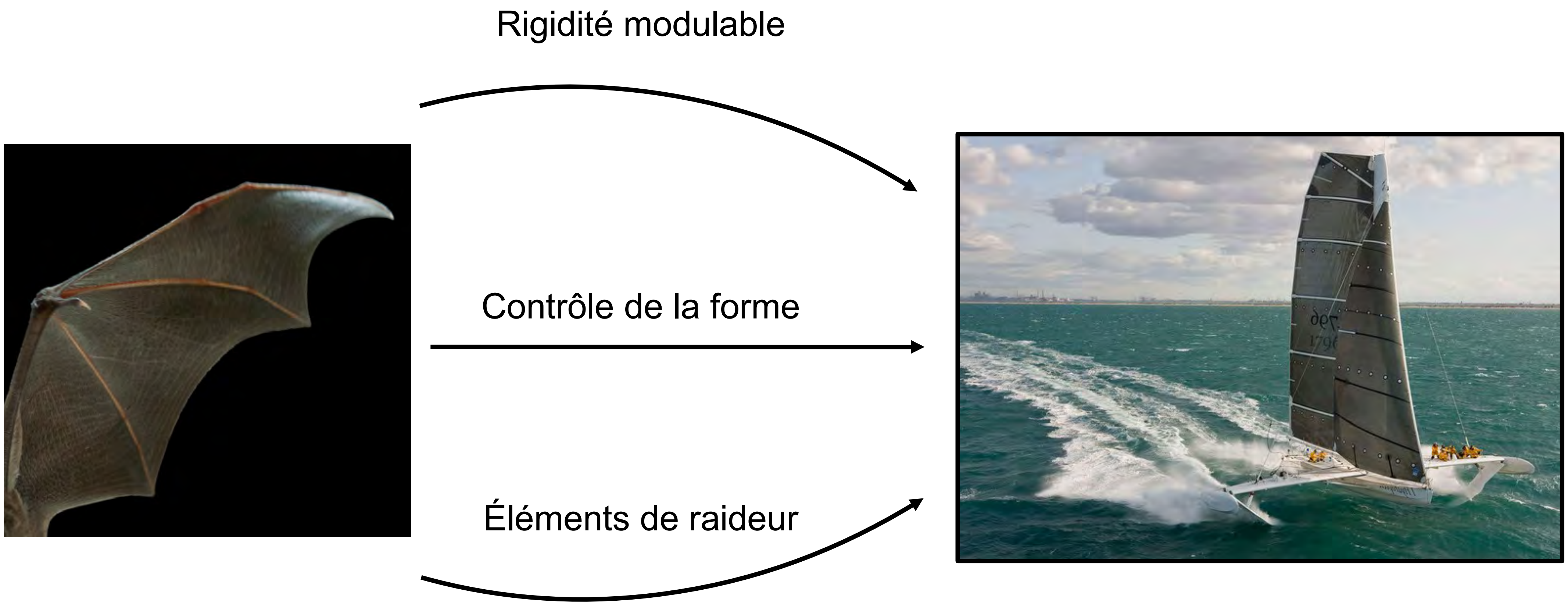
H – lab UNFOLD

Projects at UNFOLD

Rencontre entre voiles et chauve-souris

Projects at UNFOLD

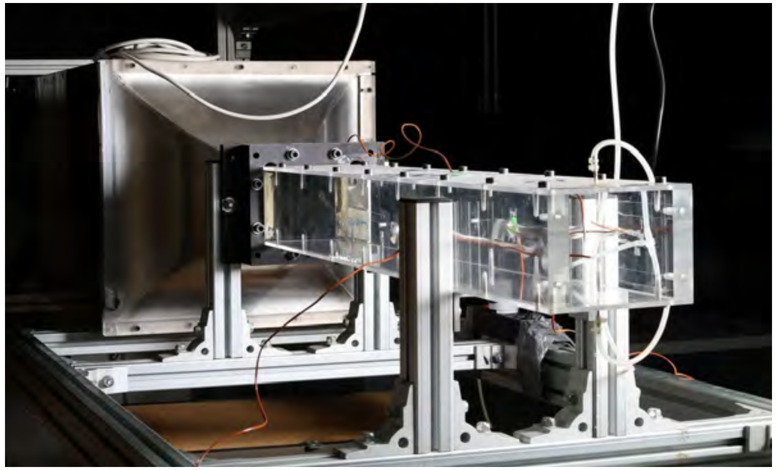
Rencontre entre voiles et chauve-souris



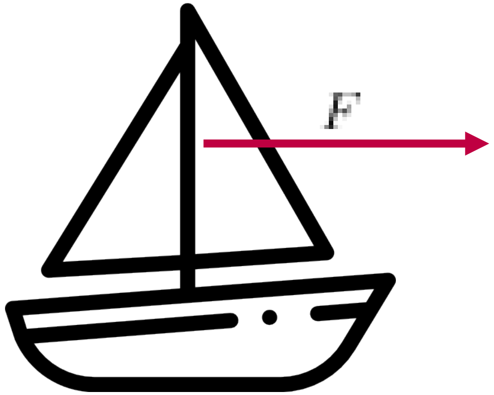
Projects at UNFOLD

Projet: De meilleures voiles grâce à une rigidité contrôlée

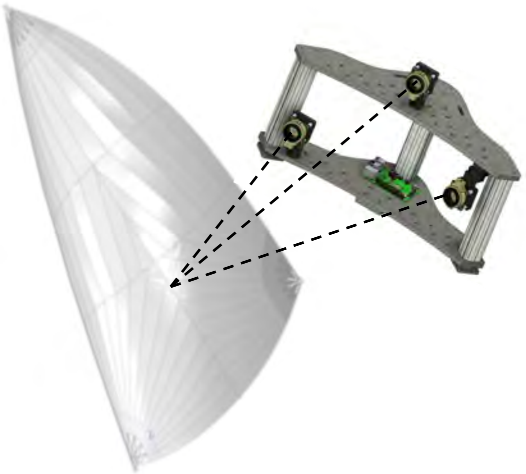
Configurer la soufflerie



Mesurer la performance



Mesurer les déformations



Créer des voiles

I – VPT

EPFL

Projets d’outils agricoles Low Tech

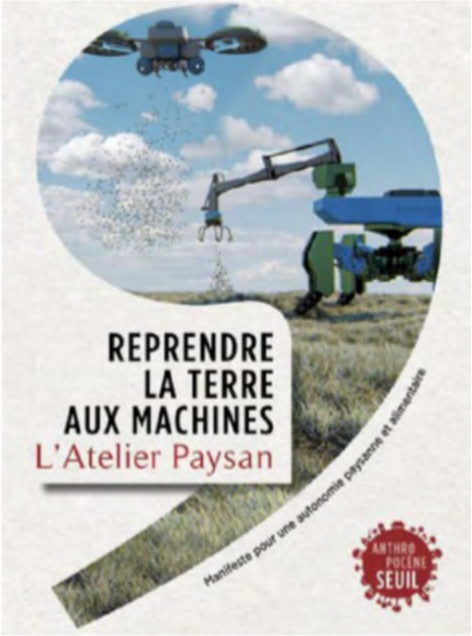
Cours
Projet d’ingénierie simultanée

Siroune Der Sarkissian
07.12.2023

Un peu de contexte

Vous cherchez...

- Un projet qui soit relié à un besoin venant du terrain ?
- Avec une réflexion low-tech ?
- En lien avec un besoin commun de mieux se nourrir ?
- Avec un aboutissement concret ?



3 projets

1 Epandeur manuel

2Disposeur de plants

3- Rouleau vélo

Epandeur manuel

Objectif : Epandre du fumier sur des platebandes de jardins de manière homogène.

Fig 1 : Brouette épandeur

Fig 2: Epandage sur une platebande

Source : *https://mrmondialisation.org/lassociation-twende-en-tanzanie-pour-des-machines-qui-reactivent-lhumanite/*

Manual manure spreader

- **Explanation**: The wheelbarrow (picture 1) is loaded with manure and pushed to the area where it is to be spread (picture 2). Once in the right place, the pull cord is moved to the open position so that the manure is in contact with the helical screw. The screw will scramble the manure and let it pass through the opening onto the bed.

- **Must have:** It would be interesting to be able to adjust the height of the auger so that you can choose how much manure you want to let through. If you can move the auger further away (closer to the ground) it will open up the hole more and let more manure through. It is important to be able to adjust the amount of manure, as different crops require different amounts of manure. Another possibility would be to have the flow of material controlled by the pull tab.

- **Nice to have**: possibility to spread something else than manure, for example, compost, Biorga (fertilizer in granulated form), green manure seeds.

Disposeur de plants

Objectif : Disposer les plants sur les platebandes aux distances optimales de plantation, sur les lignes et entre les lignes

Fig 3 : Plants maraîchers

Fig 2 : Charrette de vélomoteur

Seedling disposer

- **Explanation**: In vegetable production, most crops are established by planting seedlings (4cm x 4cm x4cm plugs; Picture 3). In large-scale vegetable production, tractor-mounted implements allow semi-automatic planting of plugs. In micro-cropping, everything is done by hand. It is important to plant the plants in a regular way in order to be able to make follow-ups of culture and weeding with the help of tools.The machine is pushed by two people. It straddles the bed (80 cm wide) and places the plants at the optimal planting distances. These can be adjusted beforehand. The adjustment can be done at the level of the number of rows (1 row, 2 rows, 3 rows, 4 rows) as well as at the level of the distance between the plants on the same row (5cm, 10cm, 15cm, 20cm, 30cm, 40cm, 50cm).

- **Idea :** Use a moped carriage for support (Picture 4)

- **Must have**: Adjustment between the lines as well as on the lines.

- **Nice to have:** Adjustment of the span of the beds (between 75cm and 120cm).

Rouleau vélo

Objectif : Rouler les platebandes après avoir fait des semis pour tasser le terrain et casser les petites mottes.

Fig 5 : Rouleau plombeur manuel

Fig 6 : Brise-motte

Bike Roller

- **Explanation**: After broadcasting, a pressure roller is recommended (Picture 5). The roller is relatively heavy and difficult to move. The idea would be to replace the rear wheel of the bicycle with a pressure roller so that it can be passed with less effort and more speed.

- **Nice to have:** Possibility to adapt a lump breaker roller (Picture 6)

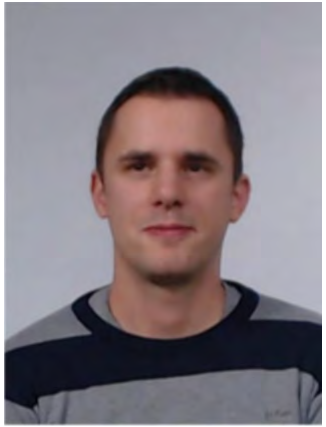
Aide et suivi des projets

EPFL

Support EPFL

SKIL
Student Kreativity & Innovation Laboratory

Samuel Cotture
Develop your prototype



DURABILITÉ EPFL

Siroune Der Sarkissian
Coordination

Projet d'ingénierie simultanée

Alain Prenleloup
Support GM

Support hors EPFL

David Bichsel
Maraîcher, formateur

Initiateur des projets
Pour redéfinir le besoin

Ferme “À la belle courgette" à Bussingy

Pour aller tester vos projets

Atelier Paysan

Pour promouvoir vos résultats

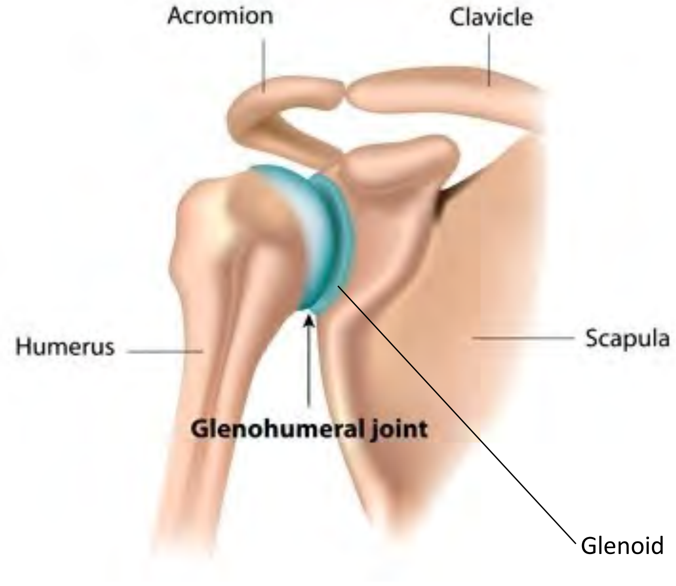
J – lab LBO

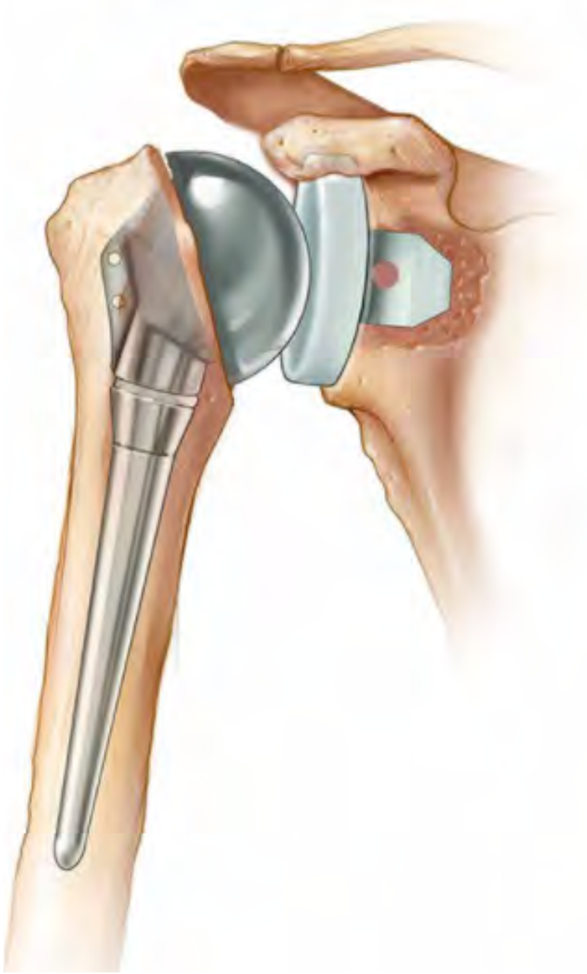
Shoulder Project

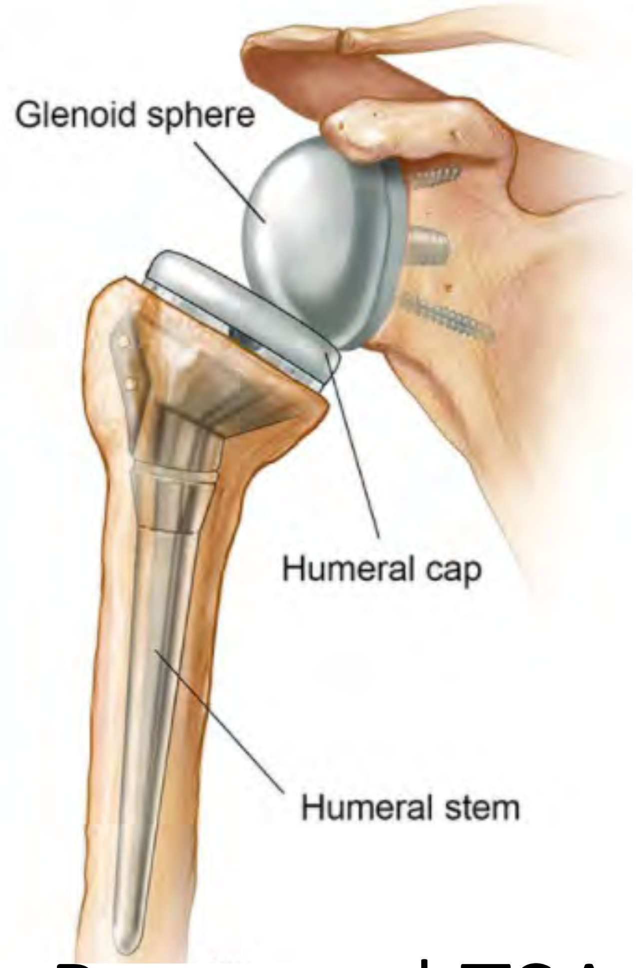
Pezhman Eghbali

Laboratory of Biomechanical Orthopedics (LBO)

Total Shoulder Arthroplasty (TSA)







Anatomical TSA

Reversed TSA

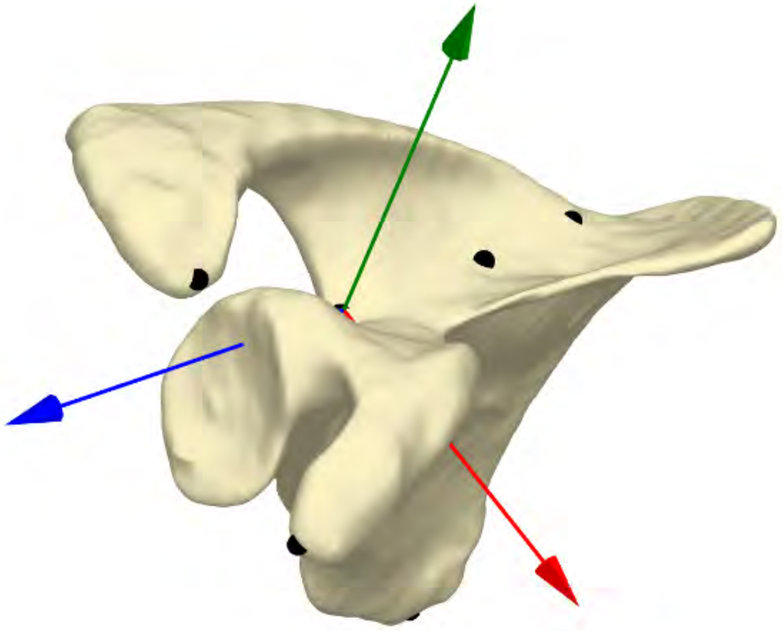
https://www.drgordongroh.com/orthopaedic-injuries-treatment/shoulder/standard-total-shoulder-replacement/

Shoulder Anatomical Measurements Web App

- Objective

  Develop a web app on top a code to perform
  and visulise shoulder anatomical measurements

- Skills
  - Python, Django, HTML

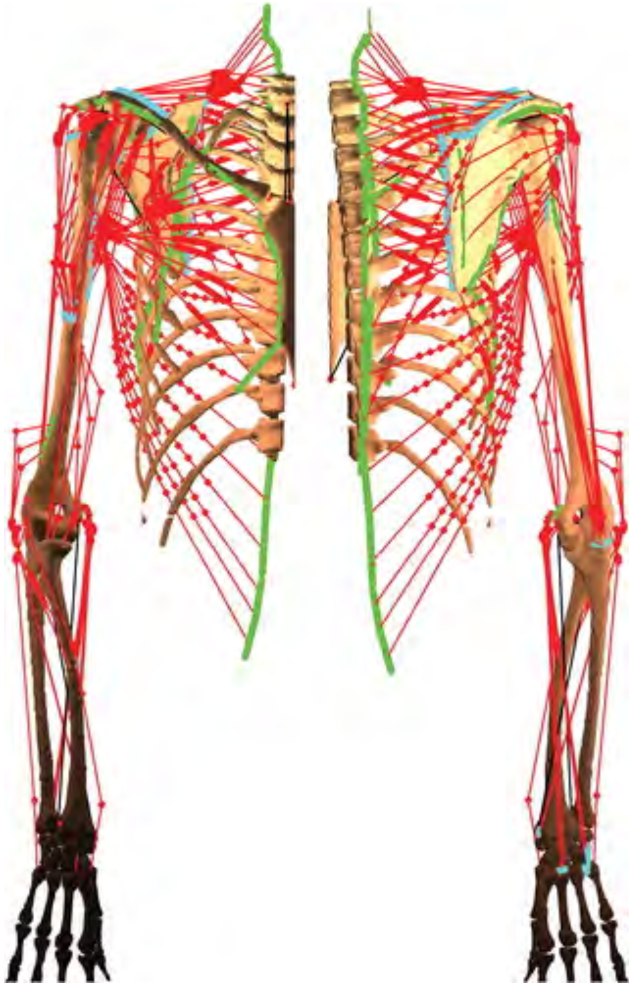


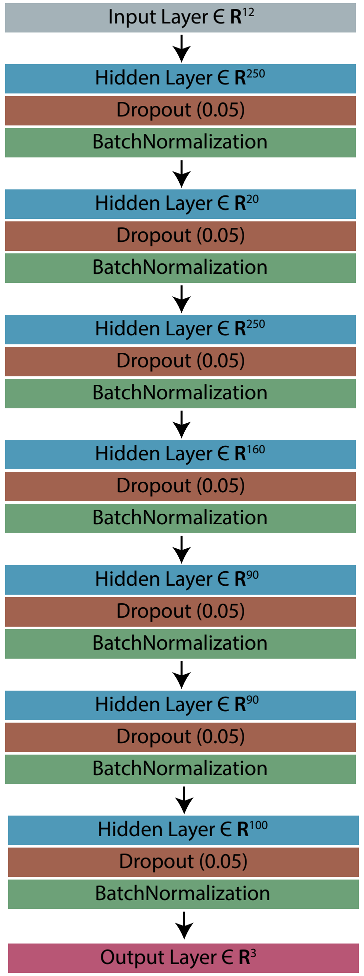
Mapping Joint Angles to Joint Forces

- Objective

  Predict joint force from joint angles

- Skills
  - Python, Deep learning



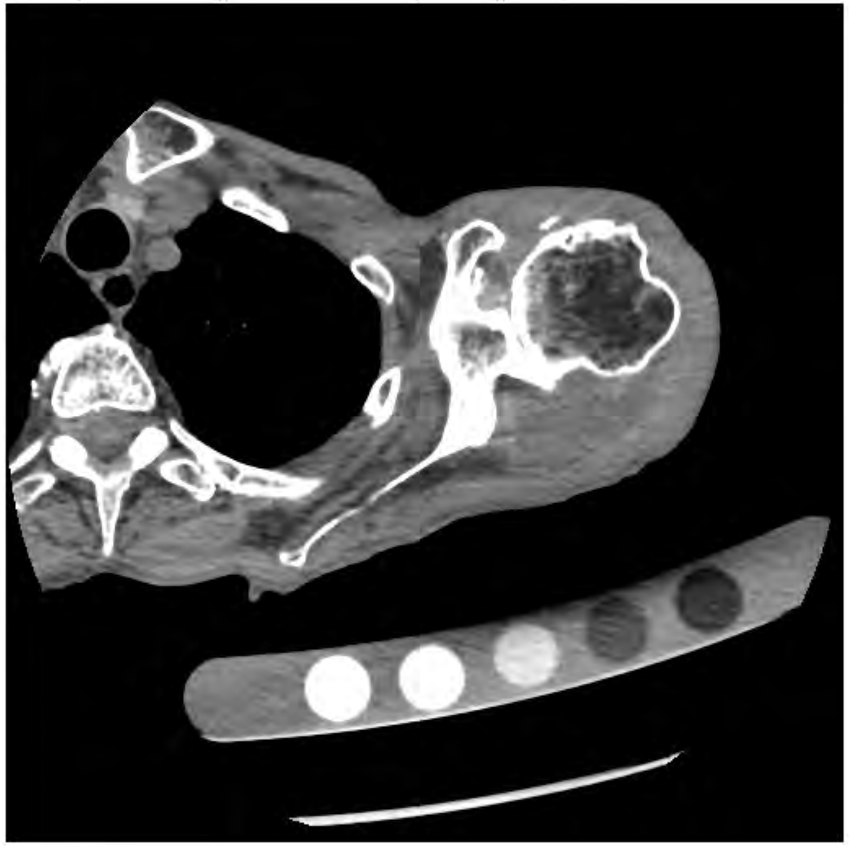


Phantom Detection for Material Assignment of Automatic Finite Element (FE) Modeling of TSA

- Objective

  Detect phantoms in a CT scan image

- Skills
  - Python, Deep learning

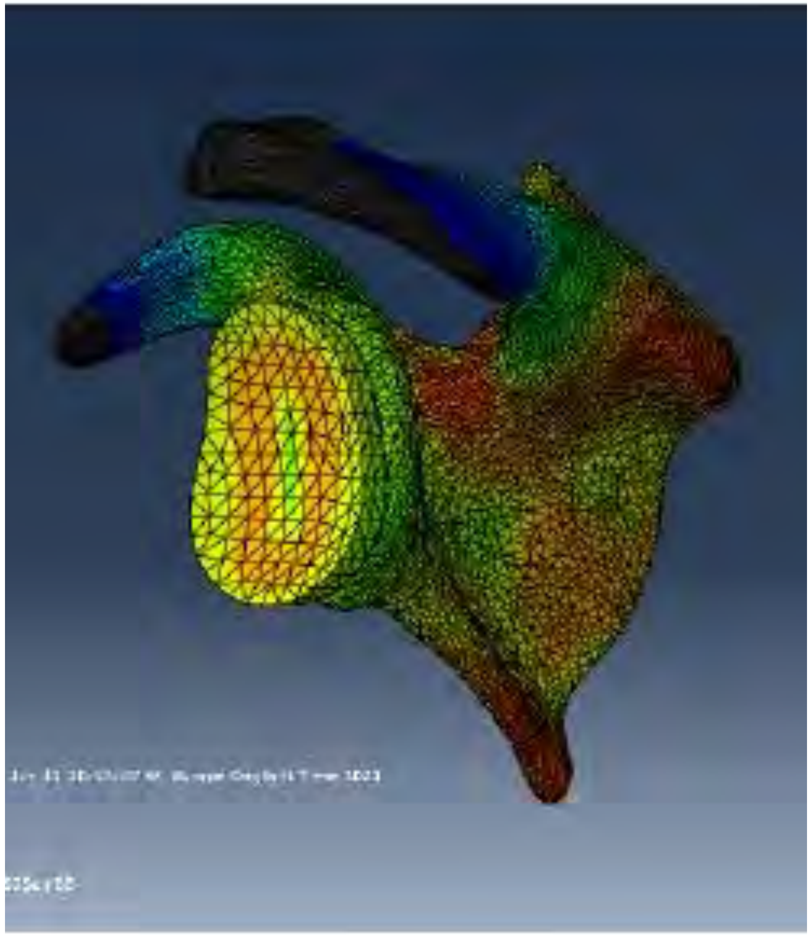


Sensitivity Analysis of TSA Automatic FE Modeling

- Objective

  Implement different mechanical metrics to assess bone, cement, and implant stress/strain

- Skills
  - Abaqus, Python



K – lab Sycamore

Deep reinforcement learning for Pacman

Bachelor student project

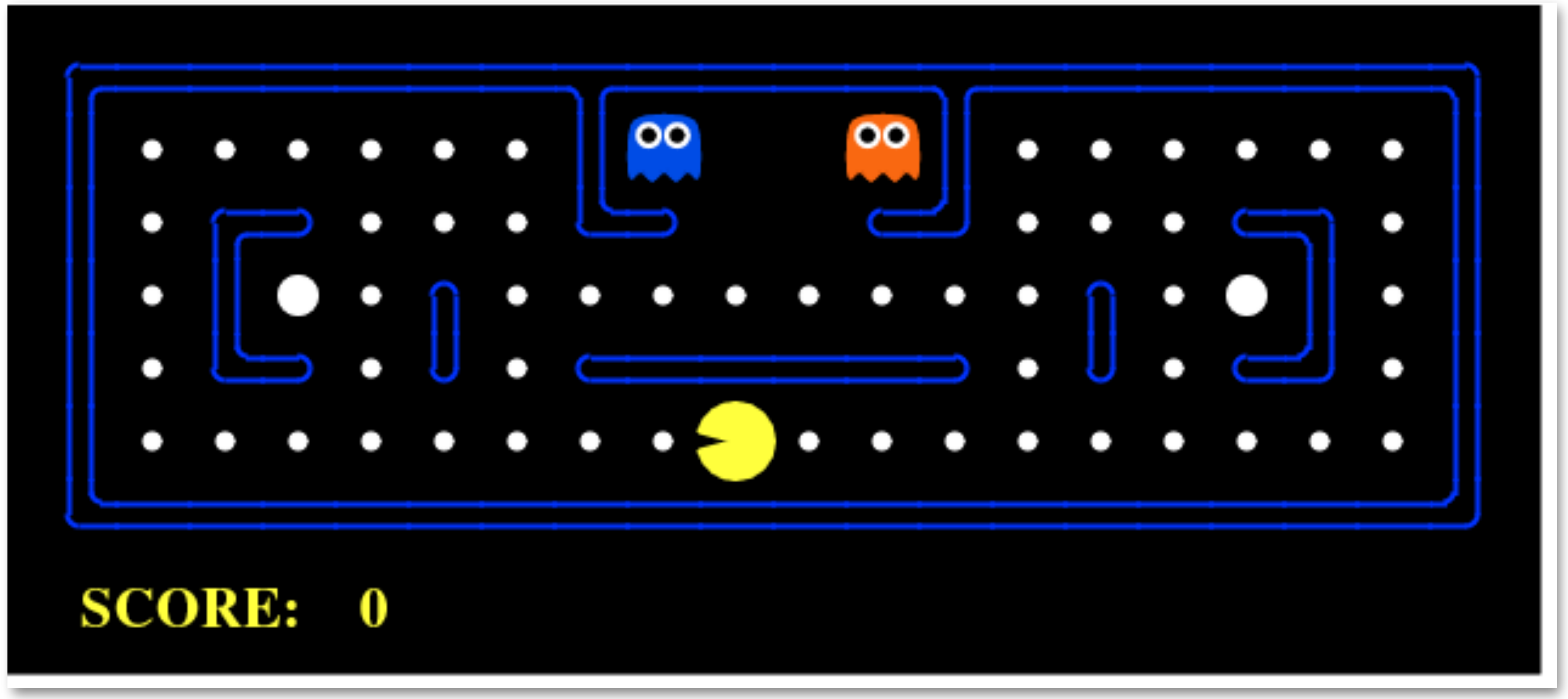
Tingting Ni, Andreas Schlaginhaufen, 07.12.2023

sycamore

Learning to play Pacman

Goal

- Learn to play Pacman by trial and error
- Apply policy gradient methods to learn neural network policy $\pi_\theta : \mathcal{S} \to \Delta_{\mathcal{A}}$



Learning to play Pacman

Timeline

Week 1

- Learn about policy gradient
- Implement environment
- Learn to navigate through the environment
- Learn to play Pacman

Week 14

Requirements

- Strong coding abilities in python (ideally experience with PyTorch)
- Solid math background (analysis and probability theory)
- Teamwork

L – lab CREATE

Can we leverage LLMs to accelerate the design process?

Accelerating the design of gripping solutions

Stella, Francesco, Cosimo Della Santina, and Josie Hughes. "Can Large Language Models design a Robot?." *In Press, Nature Machine Intelligence,* (2023).

How can we use LLMs/Large AI for design?

- ‘Soft simulation’ – prediction of interactions
- Fabrication (online with 3D printing)
- Closed-loop control with CV
- Auto generation of design?
- Design inspiration?
- Education?

- What are the limitations/ethical considerations?

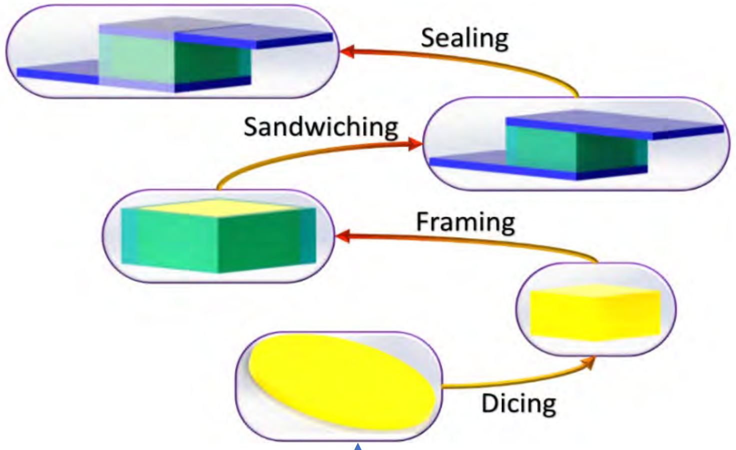
→ 3 Groups → select which area to work on

M – lab LNET

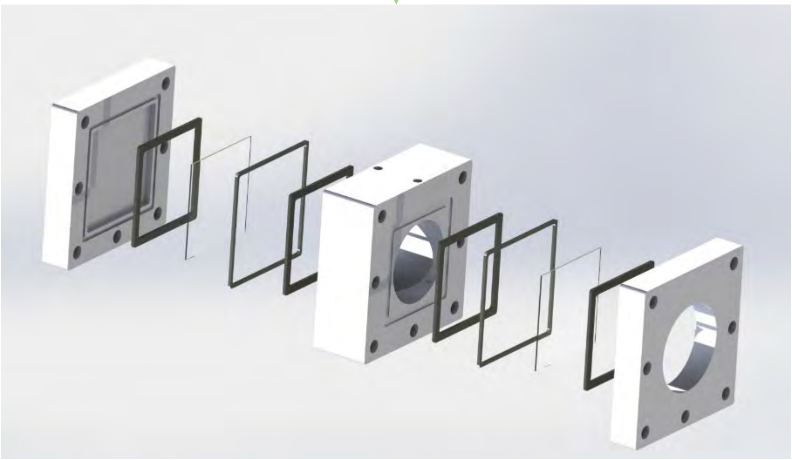
Laboratory of Nanoscience for Energy Technologies

- Head: Prof. Giulia Tagliabue

Photo-ThermoElectroChemical (P)TEC arrays



TEC Hydrogel



Background:

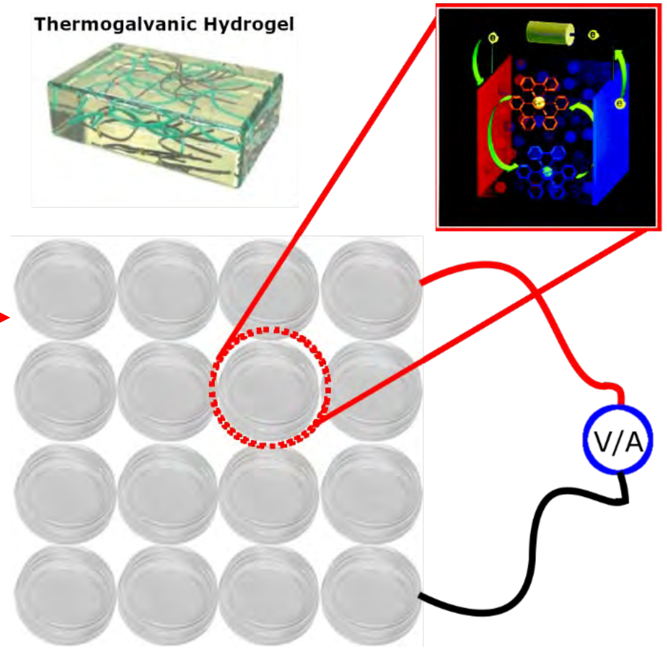
- Goal: harvest low-grade wasted heat ($\approx 150\ °C$) which is abundant and ubiquitous.
- Thermoelectric thermopower in conventional technologies lies: tens of $\mu V/K$;
- Thermo-Electrochemical (TEC) thermopower: tens of mV/K;
- Use of Quasi-solid (Hydrogel) TEC are a promising alternative to liquid:
  - Lower heat transfer;
  - Easier packaging;
  - Tunable mechanical and chemical properties.

Current Status:

- TEC hydrogel available and fully characterized;
- (P)TEC are the next step to exploit also solar radiation;
- (P)TEC prototype available;
- Strategy of enhancement by photocatalytic processes.

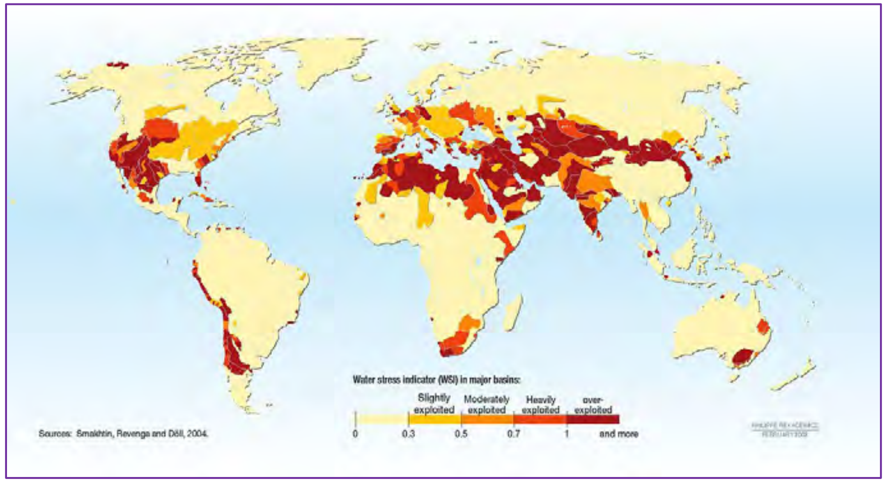
AIM of the project:

- Design and analyze an experimental setup to encapsulates an array of TEC quasi-solid cells.
- Achieve an output voltage of approximately 1V and a current around 1mA.
- Analyse performances using (P)TEC and photocatalitically enhanced TEC;



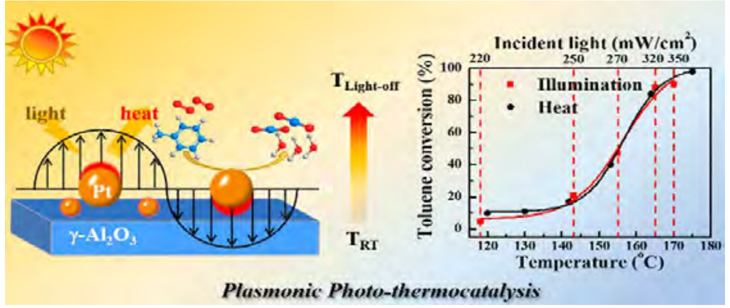
Reference contact: matteo.bevione@epfl.ch Professor: giulia.tagliabue@epfl.ch Laboratory of Nanoscience for Energy Technologies

Plasmonic Hydrogels for Evaporation in Hydrovoltaic Devices



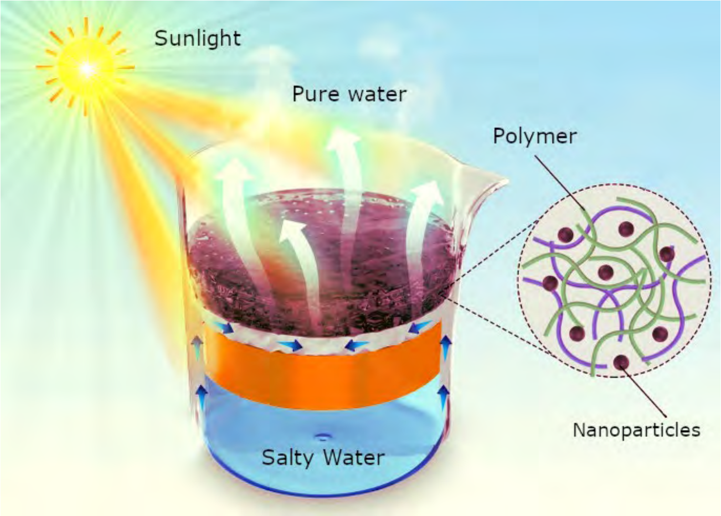
Background:

- ≈ 10% of the global population live in countries with high or medium critical water stress;
- ≈ 2 billion people worldwide lacking access to clean drinking water due to overexploitation and environmental factors.



How to address the issue:

- Plasmonic materials have improved light absorption and photo-thermal capabilities;
- Hydrogels have emerged as a promising tool for achieving efficient water evaporation;
- Hydrogels present an interesting platform for incorporating nanoparticles;



AIM of the project:

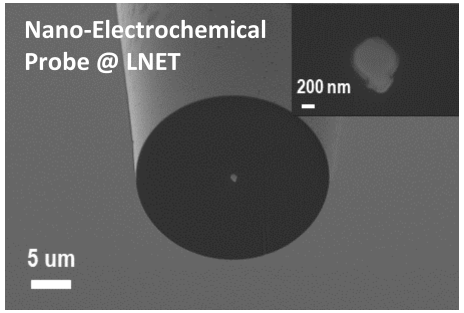
- Design and build an experimental setup to precisely measure photothermal effects on evaporation;
- Evaluate the effectiveness of various hydrogel materials and applicability to hydrovoltaic devices for electricity generation;
- Examine and analyze factors influencing evaporation: e.g hydrogel composition, geometry, environmental conditions and plasmonic materials hybrids;

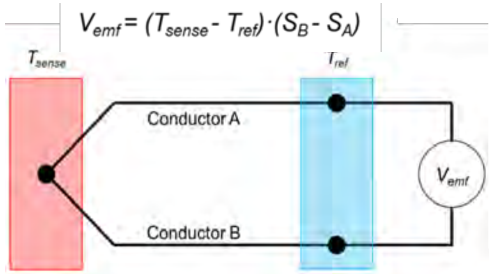
Reference contact: matteo.bevione@epfl.ch, tarique.anwar@epfl.ch - Professor: giulia.tagliabue@epfl.ch - Laboratory of Nanoscience for Energy Technologies

Design and Fabrication of Nanoscale Thermocouples

Supervisors: Milad Sabzehparvar[1], Matteo Bevione[1] - **Professor:** Giulia Tagliabue[1]
[1] Laboratory of Nanoscience for Energy Technologies (LNET), STI, École Polytechnique Fédérale de Lausanne, 1015 Lausanne, Switzerland
Email addresses: milad.sabzehparvar@epfl.ch, matteo.bevione@epfl.ch, giulia.tagliabue@epfl.ch

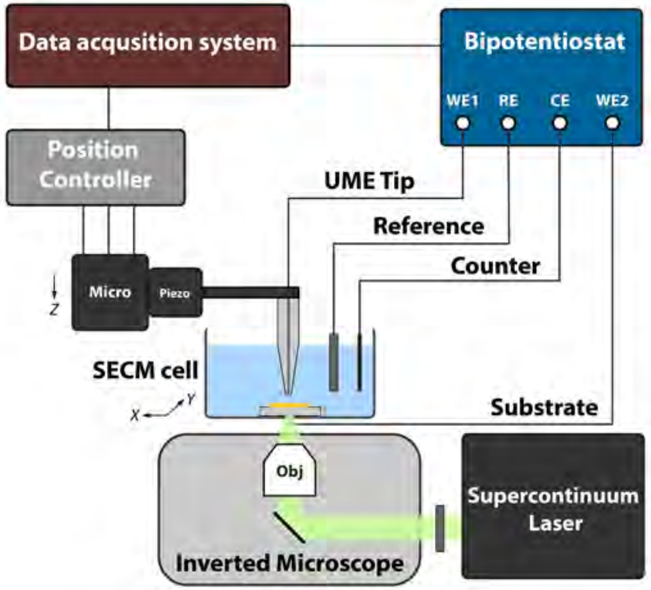
Nanoscale Temperature Measurement and Mapping



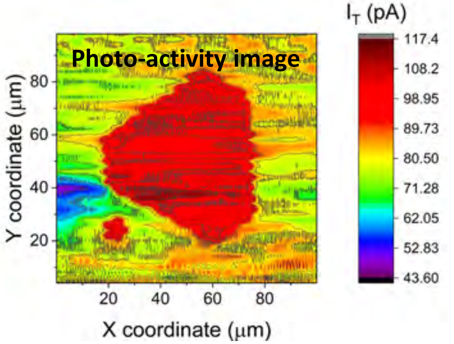


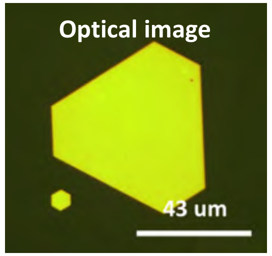
ACS Nano 14.6 (2020): 7358-7369

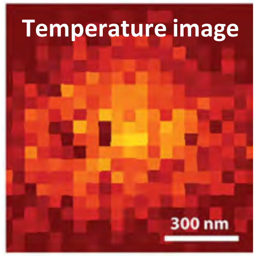
Scanning Photo-Electrochemical Microscopy (Photo-SECM)



Credit to Fatemeh Kiani







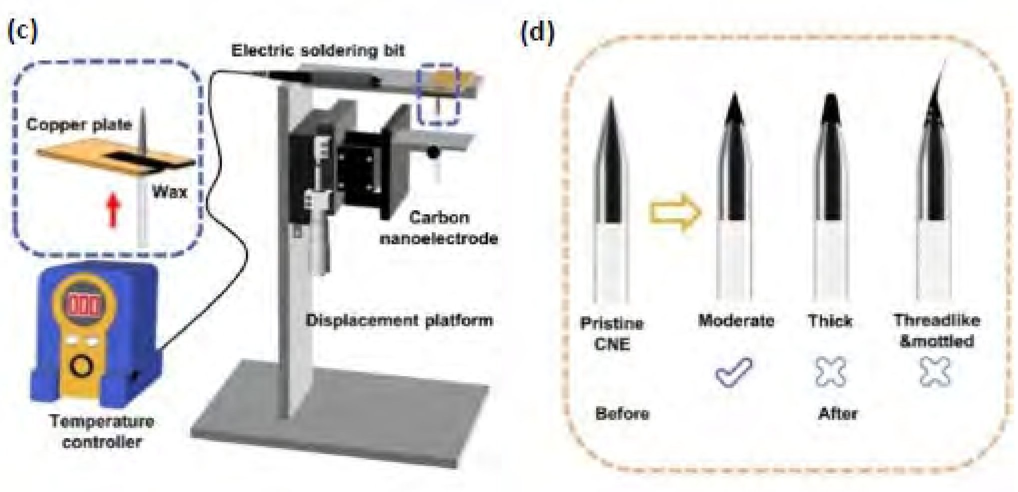
ACS Nano 2020, 14, 6, 7358-7369

- Accurate temperature measurement at the nanoscale level is crucial for various applications, including photo-thermal therapies, sub-cellular biology, micro-fluidics, and artificial photosynthesis.
- At LNET, we have developed nanoscale electrochemical probes tailored for scanning probe microscopies.
- We are seeking a team to contribute to the design, fabrication, testing, and calibration of these nano-probes for thermal measurements. Successful participation in this project could lead to the opportunity for a research paper publication.

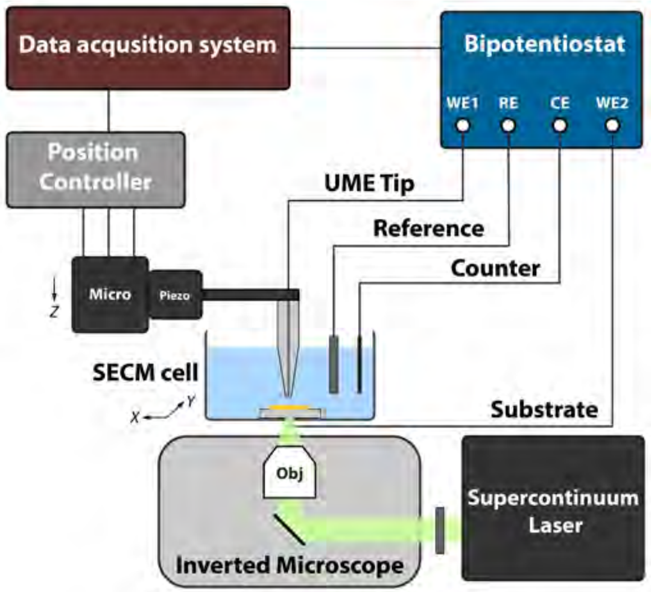
Design and Development of a Coating Platform for Microelectrodes

Supervisors: Milad Sabzehparvar[1], - **Professor:** Giulia Tagliabue[1]
[1] Laboratory of Nanoscience for Energy Technologies (LNET), STI, École Polytechnique Fédérale de Lausanne, 1015 Lausanne, Switzerland
Email addresses: milad.sabzehparvar@epfl.ch,, giulia.tagliabue@epfl.ch

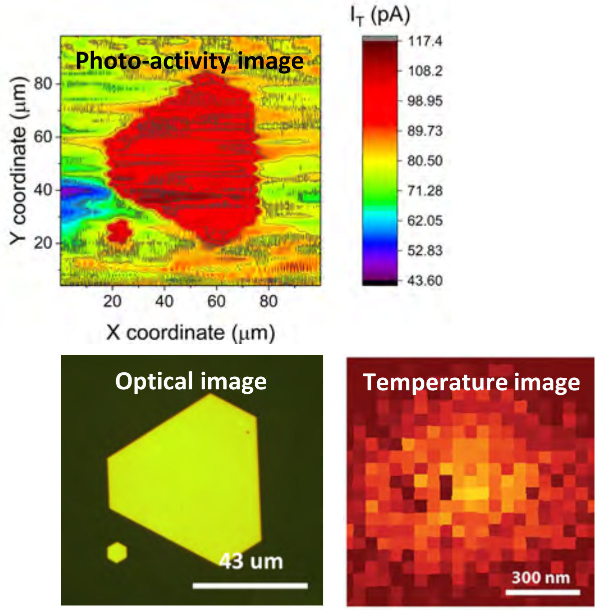
Coating of the Microelectrodes



Scanning Photo-Electrochemical Microscopy (Photo-SECM)



Credit to Fatemeh Kiani

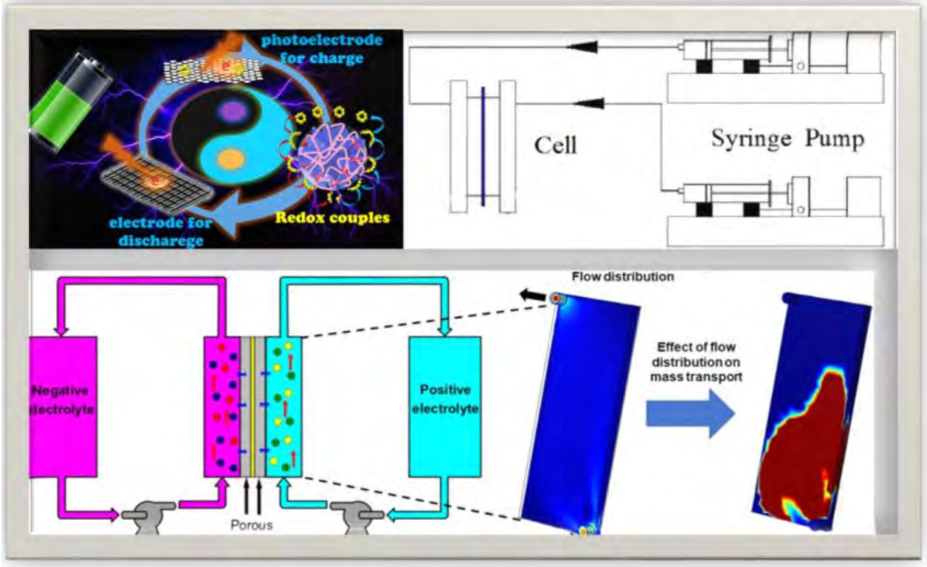


ACS Nano 2020, 14, 6, 7358-7369

- Accurate temperature measurement at the nanoscale level is crucial for various applications, including photo-thermal therapies, sub-cellular biology, micro-fluidics, and artificial photosynthesis.
- At LNET, we have developed nanoscale electrochemical probes tailored for scanning probe microscopies.
- We are looking a team to firstly work on the simple design of a polymer coating set-up, and to secondly do some automatization in terms of temperature control and automatic movement of the electrode during the coating process.

Constructing micro-fluidic chamber for solar redox flow cells

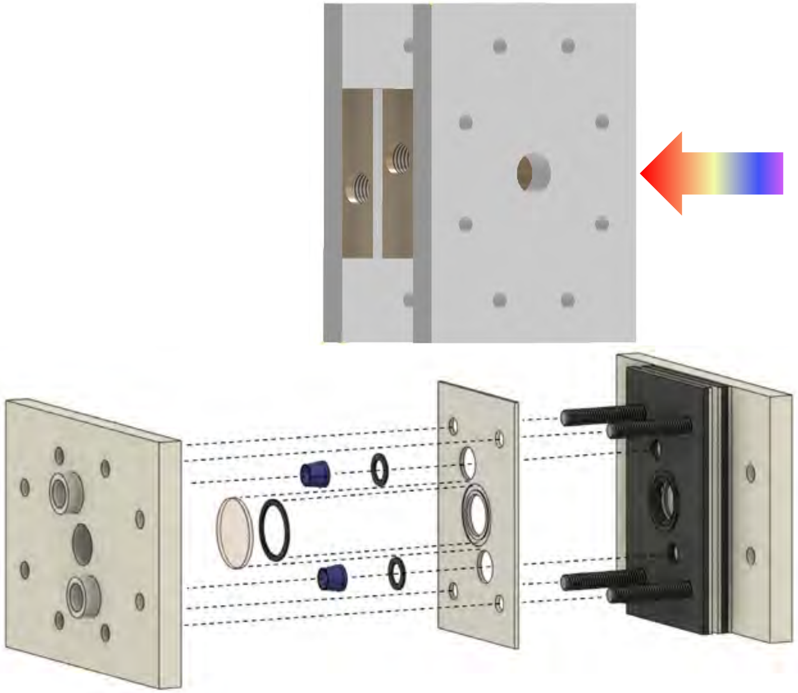
- Solar redox flow battery can realize harvest and storage of solar energy in one device. Its performance is dependent on various factors including cell geometry, dimensions of the flow field channels, flow rate, redox couples concentration, PH value, charge/discharge rate, etc.

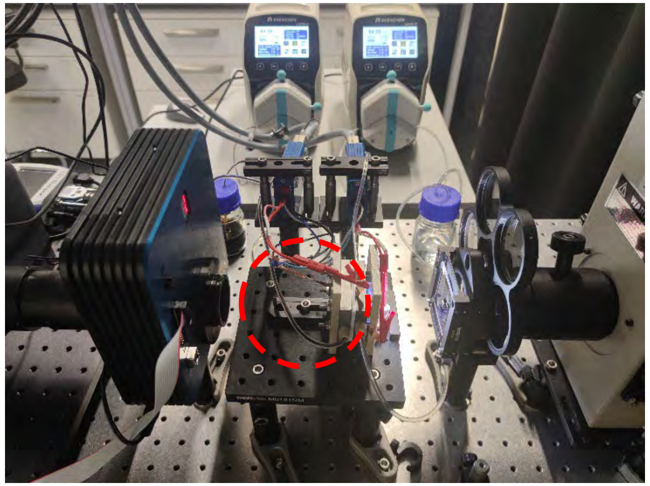


Journal of Applied Electrochemistry (2018) 48:1243–1254
Electrochimica Acta 258 (2017) 842-849

The main task of the project is:

- Construction of a flow mode solar redox cell with microfluidic chamber to further improve mass transport within electrolyte/electrode interface. We already have the solar redox flow cell and micro-chamber prototype, this project is aiming to improve the prototype and perform basic test.





Contact: jiaming.ma@epfl.ch
ziyan.pan@epfl.ch
giulia.tagliabue@epfl.ch

N – SGM-GE

Apprendre avec ses mains (1/2)

- **Etude du fonctionnement de machines anciennes**

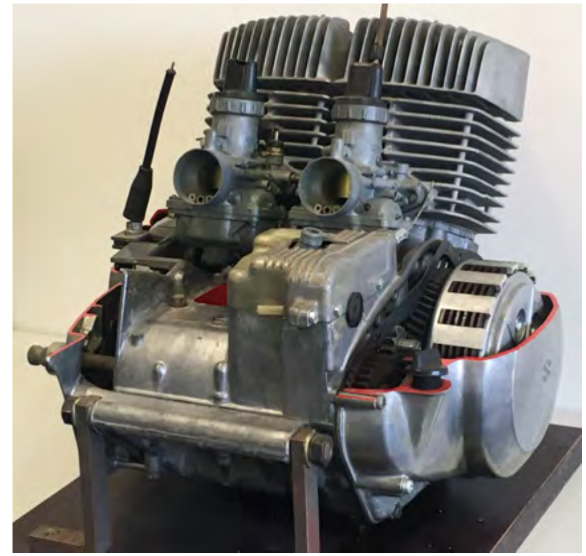


  - **Objectifs** → Analyse des fonctions, en mode « boîte-noire »
    → Brainstorming & concepts de solutions techniques
    → Démontage & analyse des solutions de conception, nettoyage et remontage
    → Modélisation des lois de comportements, etc. (TBD)
  - **Nombre d'étudiants** → 2 par machine

Apprendre avec ses mains (2/2)

- **Etude de moteurs thermiques**





  - **Objectifs** → Analyse du fonctionnement et des spécificités fonctionnelles de chaque moteur étudié
    → Mesure / métrologie + modélisation CATIA du micromoteur (3D + 2D d'assemblage)
    → Analyses théoriques & confrontation à la TDS
  - **Nombre d'étudiants** → 3 (en tout)

Cadre de travail

- **Moyens à disposition pour les 2 projets « AASM »**
  - Machines d'étude
  - Une salle avec outillage (pour monter / démonter)
- **Mode d'encadrement**
  - Séance kickoff en semaine 1
  - 3 revues techniques en cours de semestre (sem. 4-5 + 9-10 + 14)

    + Séances ponctuelles à la demande (vous ou moi !)
- **Mode d'évaluation**
  - Évaluation continue durant le semestre
  - Capacité à maintenir les fonctionnalités des machines après remontage / remise en état de certaines machines
  - Rapport & soutenance (à préciser)

O – Swiss Solar Boat

Swiss Solar Boat

The association

+ 70
Students

12
Sections from EPFL represented

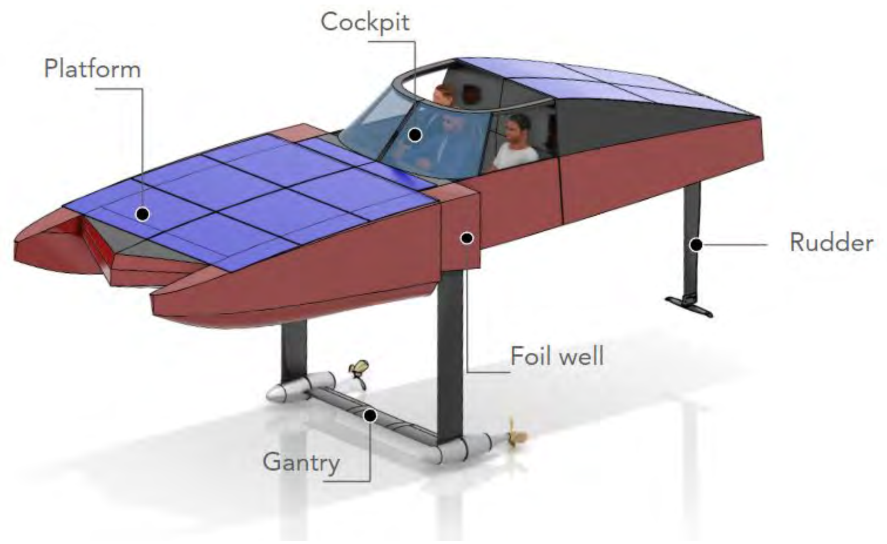
9
Partner laboratories

EPFL Storedge aventron zesst BATEMO UNDERSTANDING BATTERIES csem

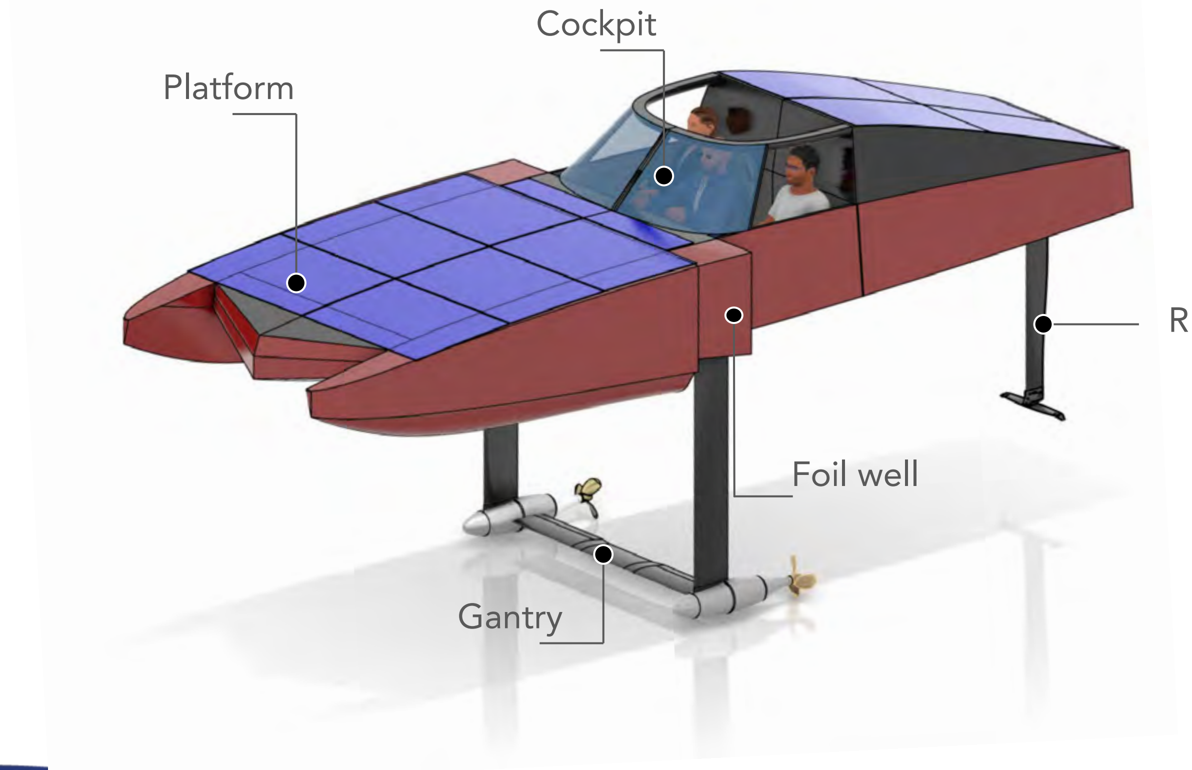
New horizons 2025-2026

The REF:

- Renewable Energy Foiler
- Powered by hydrogen and solar energy
- 3 passengers
- Autonomy: 160 km
- Cruising speed : 25kts
- Top speed : 35kts



Design of the REF (Renewable Energy Foiler)



Design and production of the trailer

Project's description:

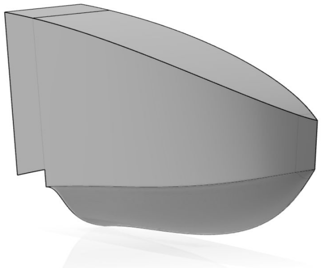
Design and production of a trailer for the REF allowing road transport and put the boat on the water.

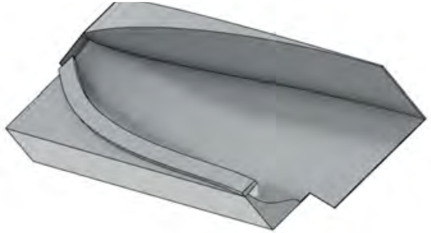
EPFL Storedge aventron zesst BATEMO UNDERSTANDING BATTERIES csem

Preparation of the floats' production

Project's description:

Preparation for float production, assembly method with the main hull, and manufacturing.

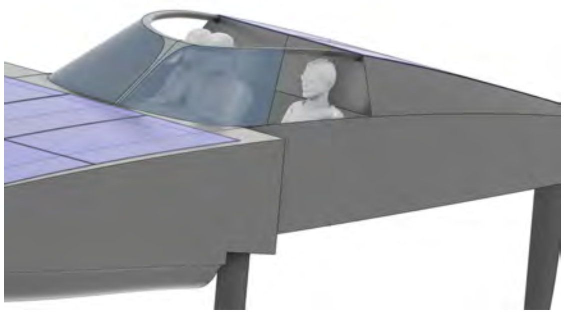




Design and mock-up of the cockpit

Project's description:

Production of a life-sized mock-up of the cockpit, optimization of its components and its ergonomics, and preparation for production (seat, dashboard, windshield).



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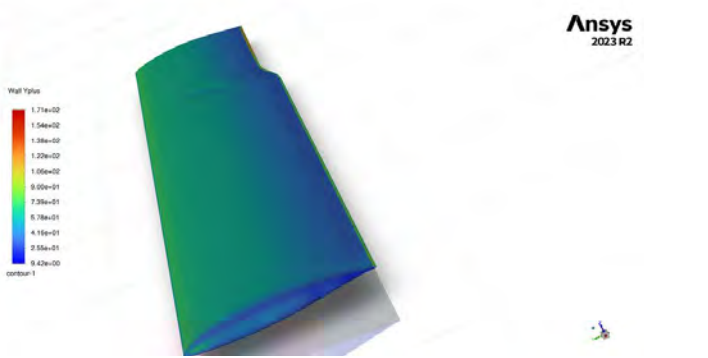
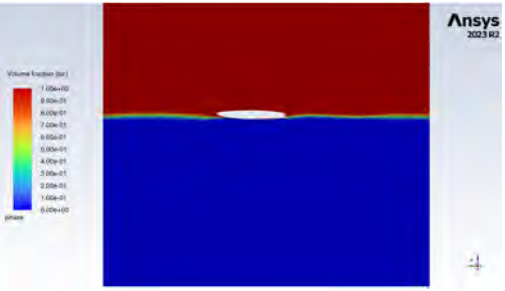
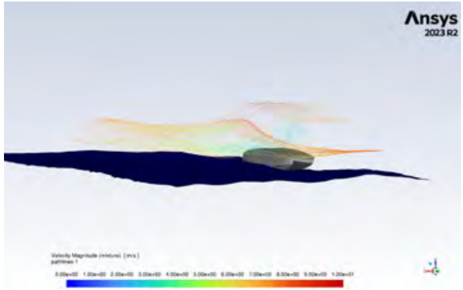
Boat's drag analysis

Project's description:

Fluid simulation analysis of the gantry, rear assembly, and platform for various scenarios and behaviors(slamming, takeoff, steady flight, slalom etc).



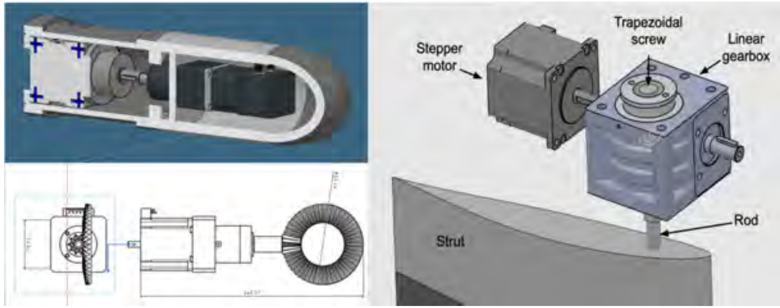




Actuation system design

Project's description:

Designing the actuation systems for the flaps, gantry, and rear assembly, and providing support for the mechanical actuation project.



EPFL Storedge aventron zesst BATEMO UNDERSTANDING BATTERIES csem

Bachelor projects (Spring 2024):

- Design and production of the trailer
- Preparation of the floats' production
- Design and mock-up of the cockpit
- Boat's drag analysis
- Actuation system design

EPFL Storedge aventron zesst BATEMO UNDERSTANDING BATTERIES csem

Thank you!

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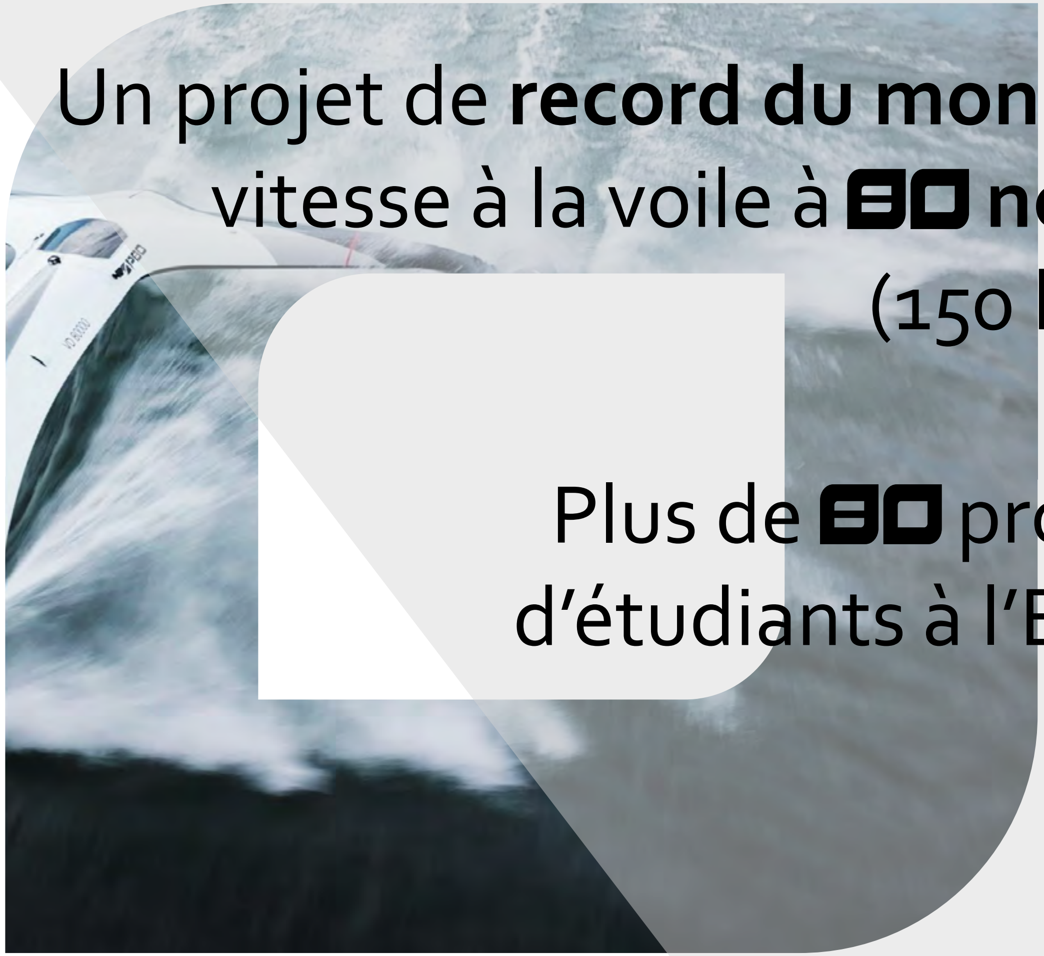
EPFL Storedge aventron zesst BATEMO UNDERSTANDING BATTERIES csem

P – MAKE SP80


SP80
RICHARD MILLE
Présentation Association Automne 2023

SP80 c'est ...



Un projet de **record du monde** de vitesse à la voile à **80 nœuds** (150 km/h)

Plus de 80 projets d'étudiants à l'EPFL

Structure du projet

EPFL

L'association SP80

Gestion des étudiants en lien avec le projet

Projet MAKE

Nouveau projet

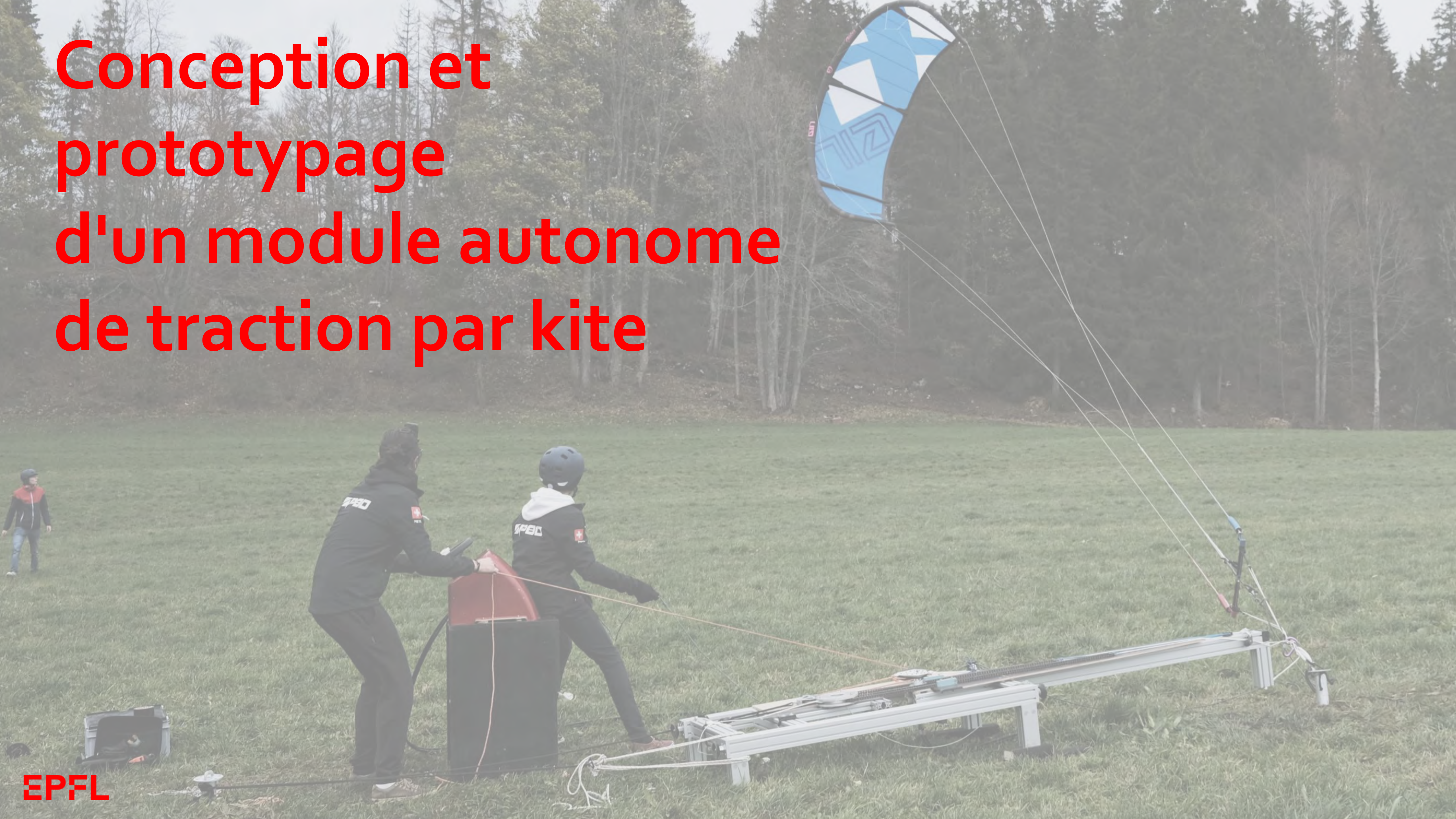
L'entreprise SP80

Gestion de la continuité du projet de record

Relation avec les partenaires

Et maintenant?

Conception et prototypage d'un module autonome de traction par kite

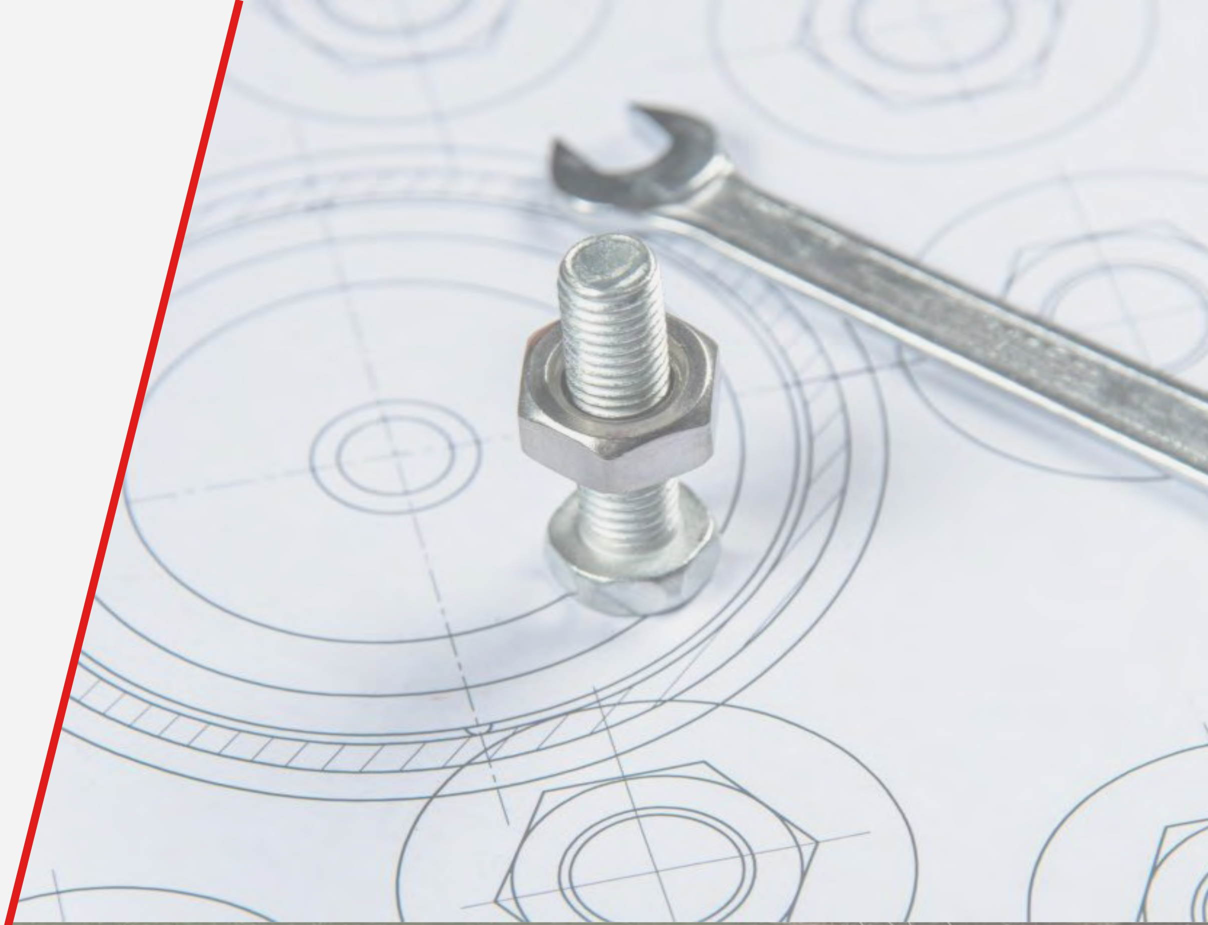


EPFL

Projet 1
Châssis et actuateur

4-6 personnes

- Design du système de contrôle
- Envoi/récupération autonome du kite
- Dimensionnement/choix des composants mécaniques

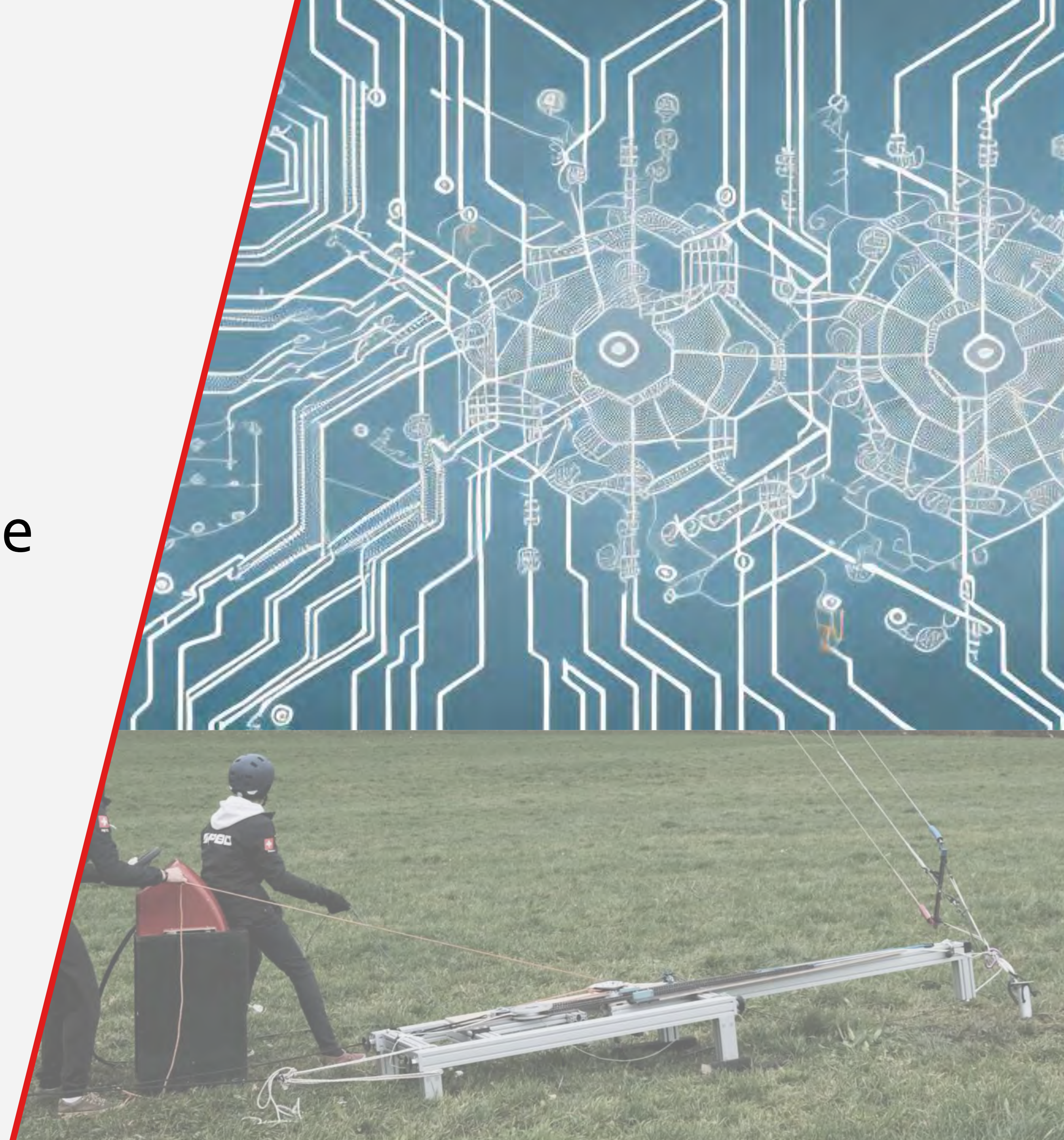


EPFL

Projet 2
Capteurs et contrôle

2-4 personnes

Algorithme de contrôle du kite
Identification des données nécessaires
Implémentation des capteurs adaptés



EPFL

SP80 Association

QUESTIONS

sp80@epfl.ch

Q – Racing Team


127
BATEMO
EPFL
vaudoise aréna
EPFL LAUSANNE
Swissquote
EPFL RACING TEAM

Formula Student

Worldwide engineering competition

120 Teams
3 categories
30 countries

Most innovative motorsport category

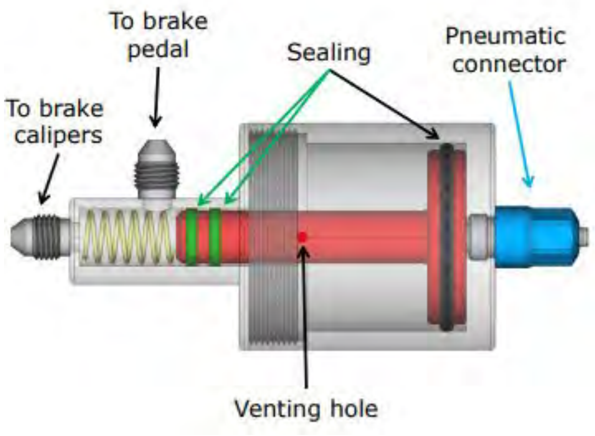
SAISON 2022/23 : ARIANE

EBS: *Emergency Braking System for Autonomous Vehicles*

Nécessaire à la validation des inspections avant le roulage aux compétitions: arrêt à distance avec décélération d’au moins 10m.s^-2

Compétences et acquis de formation:

- *Design Mécanique de Précision*
- *CAD*
- *Etanchéité*
- *Implémentation d’un mécanisme sur une voiture de compétition.*
- *Analyse de manufacturabilité.*
- *Optimisation de masse et fiabilité*



Chassis : *Test bench torsional rigidity of a composite monocoque*

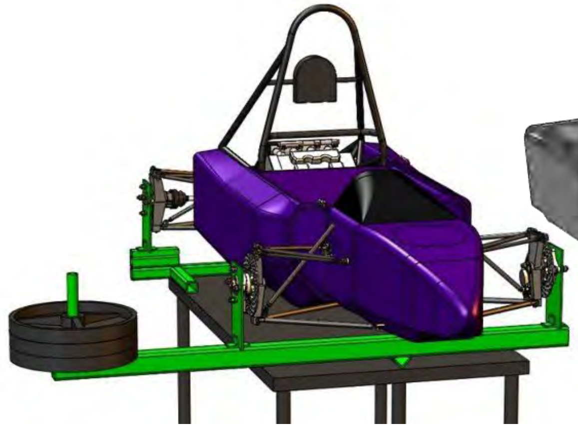
- La **rigidité en torsion** du châssis est importante pour savoir si les suspensions sont immobiles et qu'elles puissent travailler optimalement.
- **Objectif du projet :** Designer, produire et tester la rigidité de LRT5
- **Compétences acquise :**

→ CAD Design et dessin 2D

→ Analyse FEM

→ Production des pièces

→ Composite manufacture

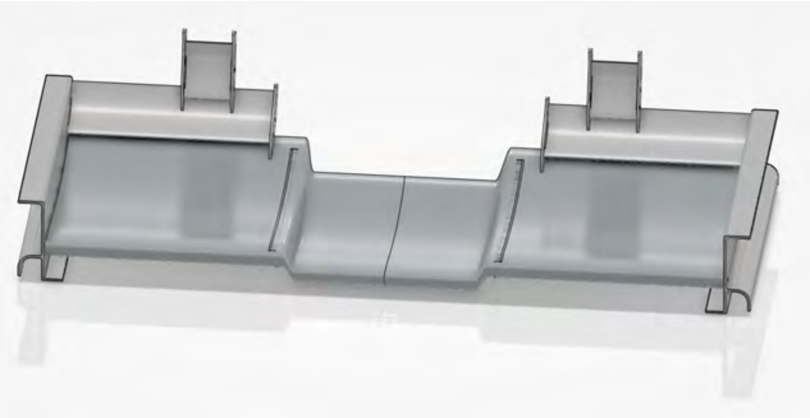

Exemple de test bench

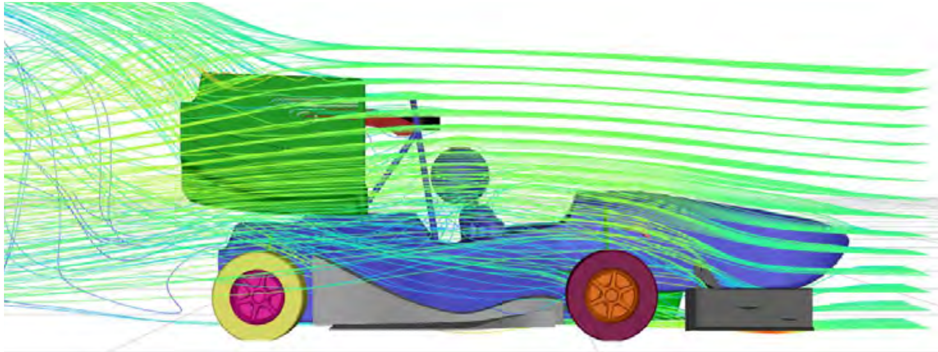

LRT5

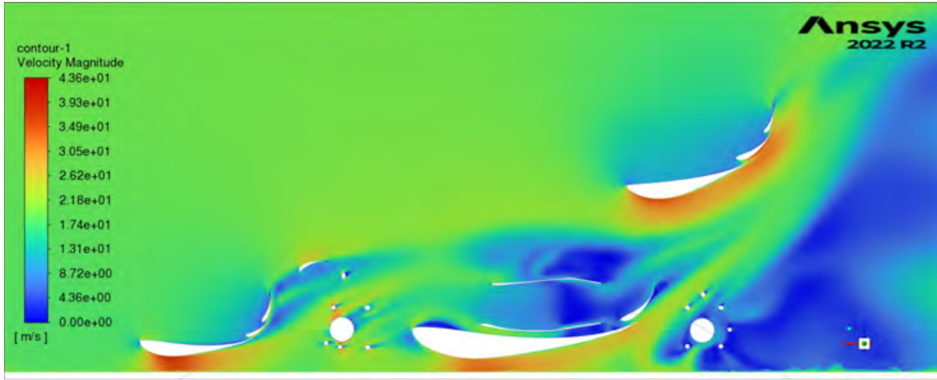
Aerodynamics : *Front wing & Rear wing design (2 projects)*

Compétences et acquis de formation:

- *Design Aérodynamique*
- *CAD*
- *Implémentation et analyse de simulations CFD.*
- *Analyse de manufacturabilité*







Merci pour votre attention

R – Rocket Team

CRYOGENIC TANK FOR SPACESHOT ROCKET

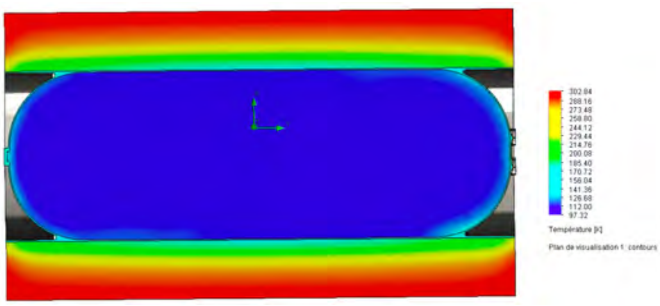
Filename: 2024_SE_ST_SP_CRYOGENIC_TANK.docx
Project: Firehorn project, EPFL Rocket Team
Prepared by: Zina Randriamanantena
Approved by: Michaël Fuser

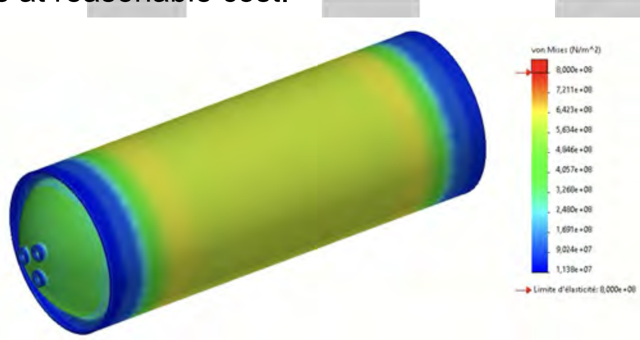
Responsible TL: Zina Randriamanantena, Florent Piton
Responsible SE: Michael Fuser

Role Description

Context: ERT is aiming to build a bi-liquid rocket which goes to space before the end of the decade. In order to prepare for such a feat, the Team will prove its technology through intermediate rockets that fly at lower altitude. These rockets will be fueled using liquid oxygen and ethanol. There is currently a semester-project dedicated to the design of tanks which will contain the propellant of the next class of rockets. This class consists of a first version of rocket that will compete in the 9km bi-liquid category at EuRoc for 2025 and the second version that will fly at 30km for 2026. Once the design is approved, the next step is to manufacture the tanks. This step itself is quite complex, requiring a project on its own. At the end, tests on the produced tanks shall be done.

Project overview : The current design features tanks that fulfills thermal and mechanical requirements, i.e.: keeping the LOx temperature at -183°C for 8min using external thermal isolation and able to sustain a maximum operating pressure of 60 bars (FoS 2). So, the aim of this project is to continue the work that has been done to produce tanks for liquid oxygen and ethanol. The main focus is to adapt, if possible, or re-design the tanks for a viable production, within the limit of the team's means. In other words, the tanks must be capable of being produced using conventional production methods at reasonable cost.





What the student will do :

- Literature review
- Finish the conception of the current end caps
- Conception of the external isolation layer
- Selection of the manufacturing steps (sheet metal rolling, welding, machining)
- Pressure tests (isobaric and cyclic with varying temperature)

Student gain : The student will learn how

- to respect the strict requirements of the aerospace industry
- to produce parts that respect cost and resource constraints
- to plan and follow real parts manufacturing with professional workshops
- to perform certification tests for rocketry

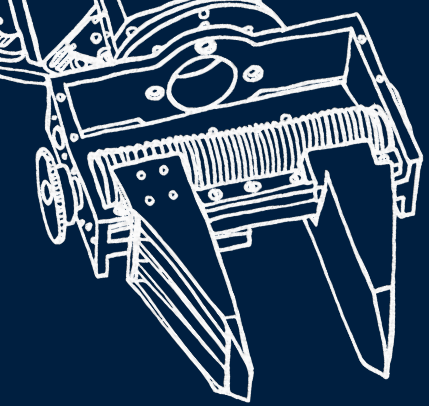
A general idea of the tasks unfolding:

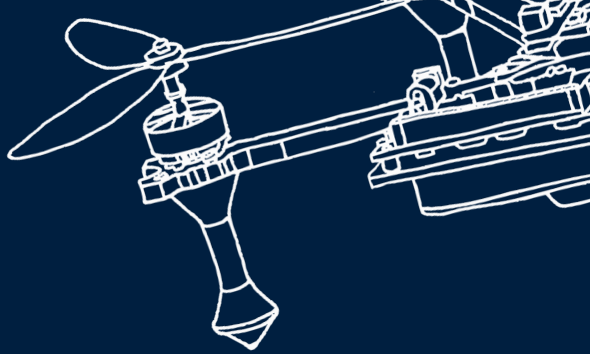
- **[5 weeks]: Conception**
- **[5 weeks]: Manufacturing**
- **[4 weeks]: Test**

Skills involved:

- **General mechanical knowledge**
- **CAD**
- **Material selection**
- **Mechanical simulation**
- **Thermal simulation**

S – Xplore





EPFL Xplore - Pôle de Recherche (XRE)

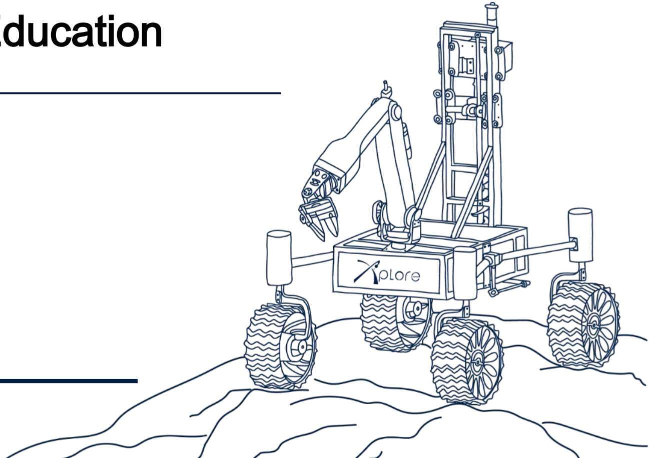
Section Génie Mécanique 07.12.2023

DELINEAU Loïc
loic.delineau@epfl-xplore.ch

Qui suis-je?

Loïc Delineau

Vice-President of Research & Education



loic.delineau@epfl-xplore.ch

Structure de l’association

Management

XRC
(Xplore Rover Challenge)

Pôle d’éducation

33 étudiants BA
8 équipes, 8 rovers

ERC
(European Rover Challenge)

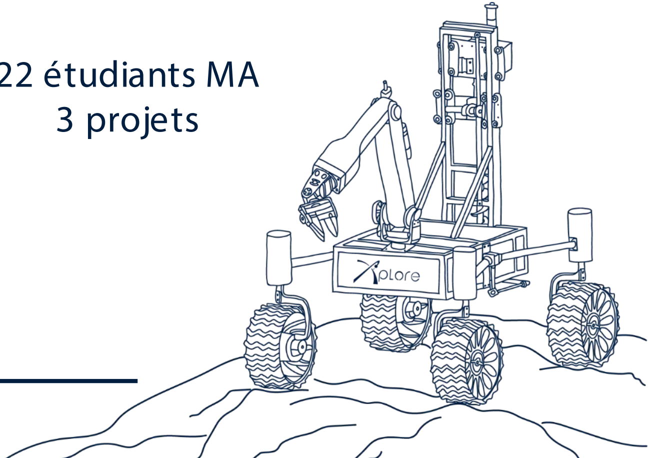
Pôle de compétition

50 étudiants BA & MA
3 années, 3 rovers

XRE
(Xplore Research)

Pôle de R&D

22 étudiants MA
3 projets



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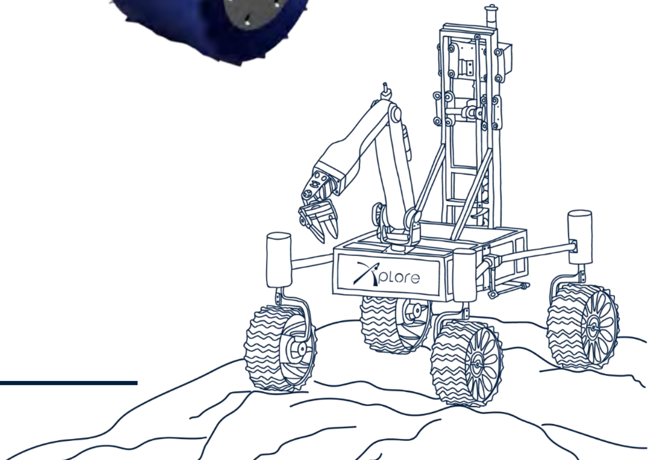
Xplore Rover Challenge (XRC)

XRC
(Xplore Rover Challenge)

Pôle d'éducation

33 étudiants BA
8 équipes, 8 rovers

Microver - 2023



Xplore Rover Challenge (XRC)

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Xplore Rover Challenge (XRC)

8 Teams
8 Rovers
33 Students

loic.delineau@epfl-xplore.ch

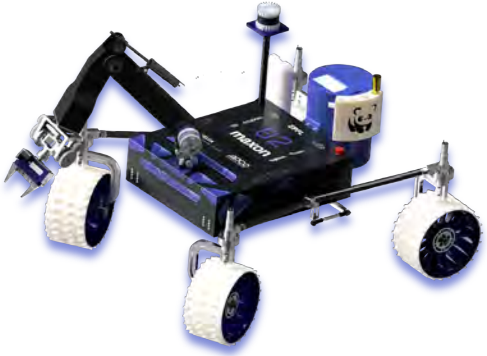
European Rover Challenge (ERC)

ERC
(European Rover Challenge)

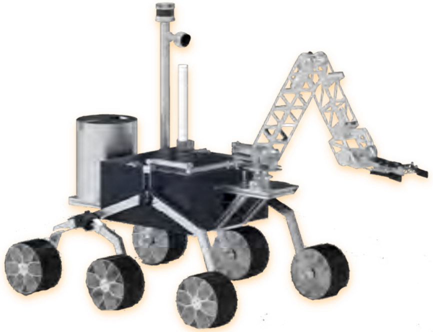
Pôle de compétition

50 étudiants BA & MA
3 années, 3 rovers

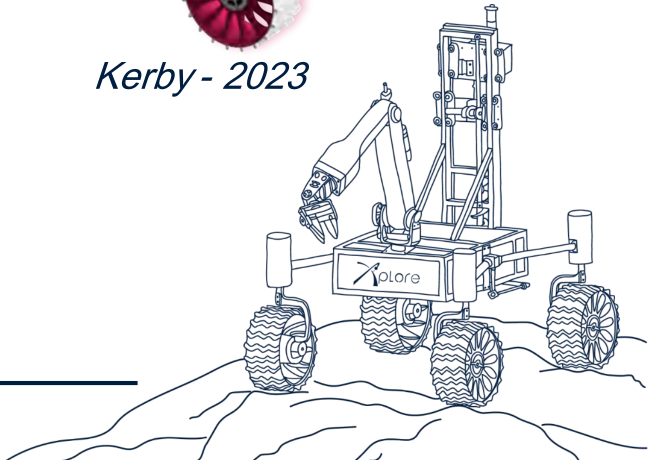
Kerby - 2023



Astra - 2022



Argos - 2021



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European Rover Challenge (ERC)

ERC 2023
3rd Place out of 60 Teams
Best Prize in Manipulation

Xplore Research (XRE)

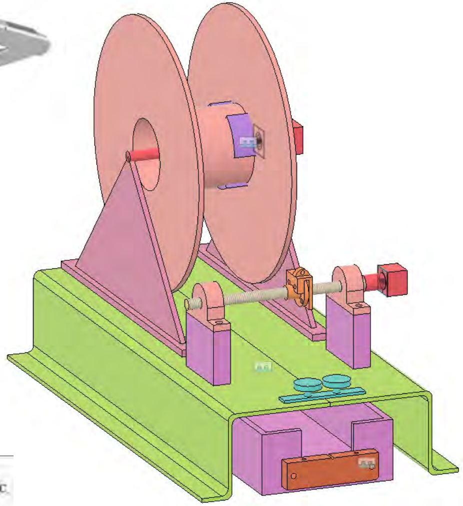
XRE
(Xplore Research)

Pôle de R&D

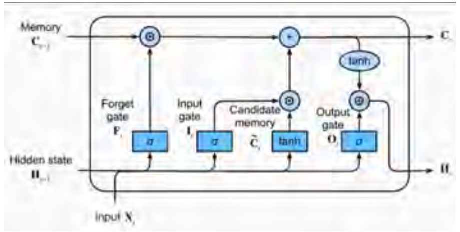
22 étudiants MA
3 projets

Chienpanzé
(Legged Robot)

Wall-E
(Recyclage
Impressions 3D FDM)



Xplore AI
(AI Solutions to
Xplore Problematics)



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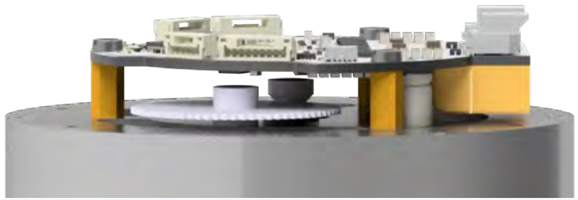
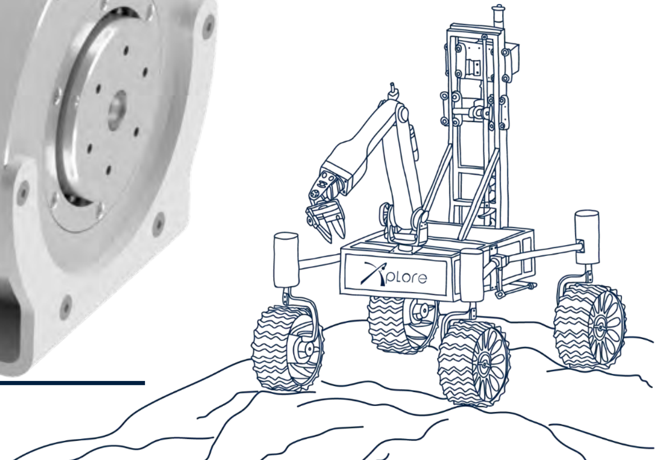
Xplore Research (XRE) - Chienpanzé

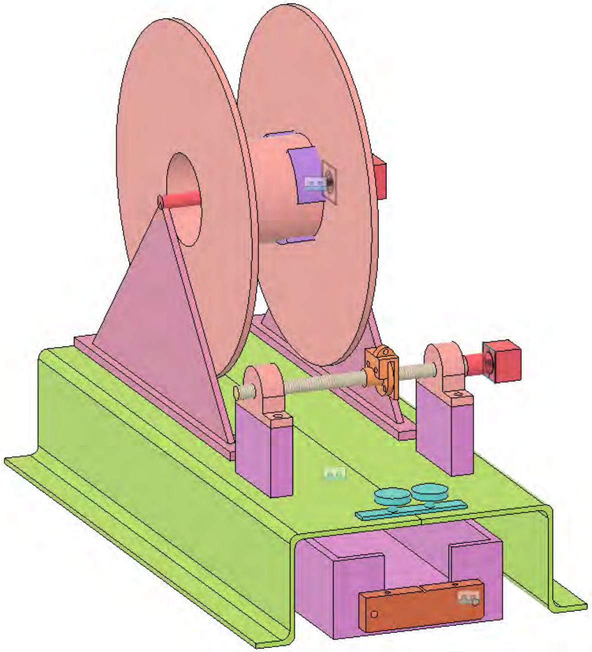


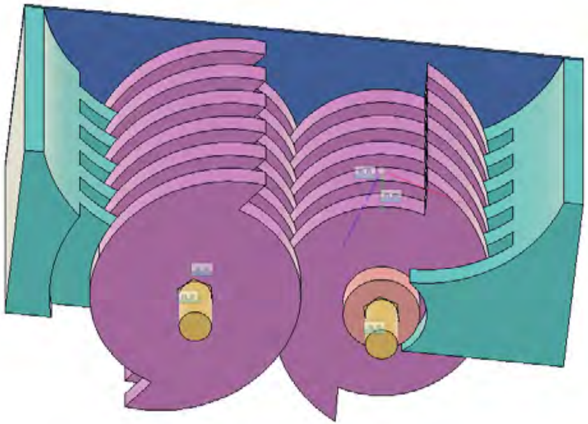


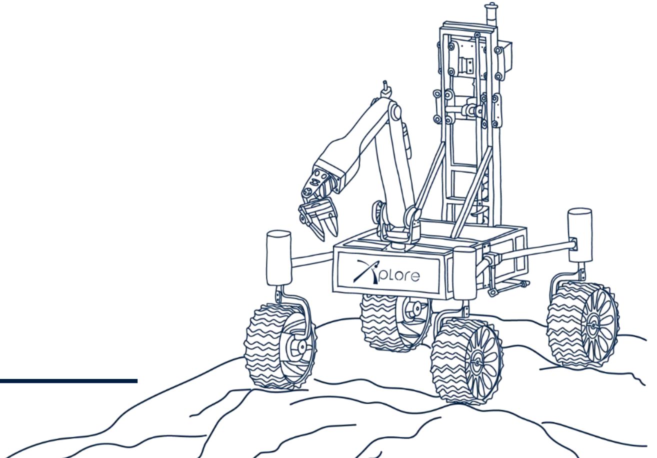
loic.delineau@epfl-xplore.ch

Xplore Research (XRE) - Wall-E

Wall-E
(Recyclage
Impressions 3D FDM)

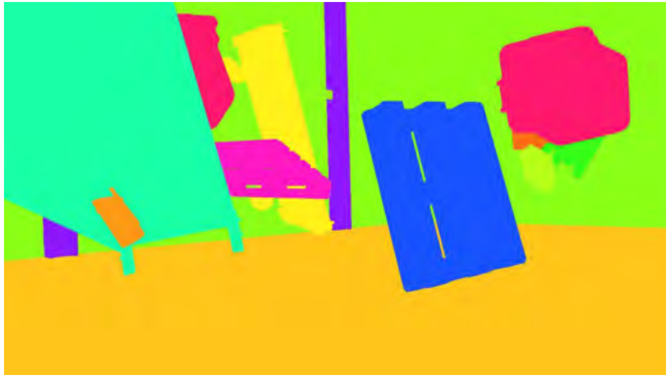


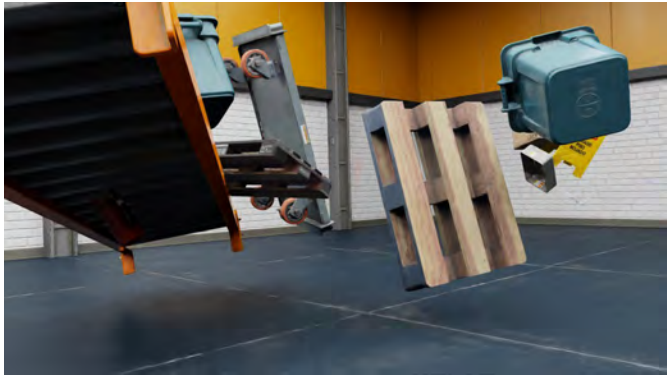




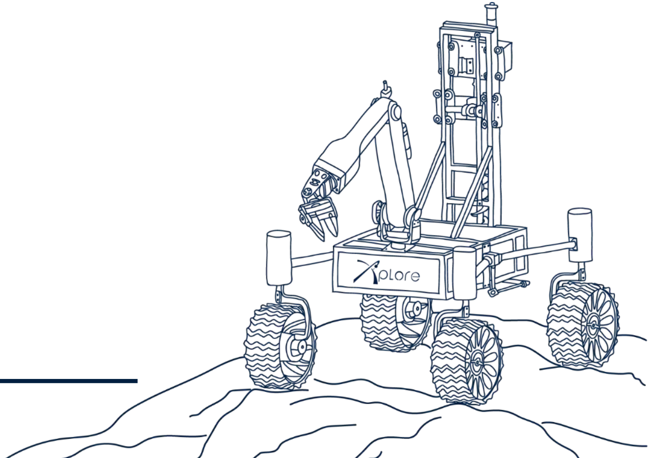
Xplore Research (XRE) - Xplore AI

Xplore AI
(AI Solutions to
Xplore Problematics)

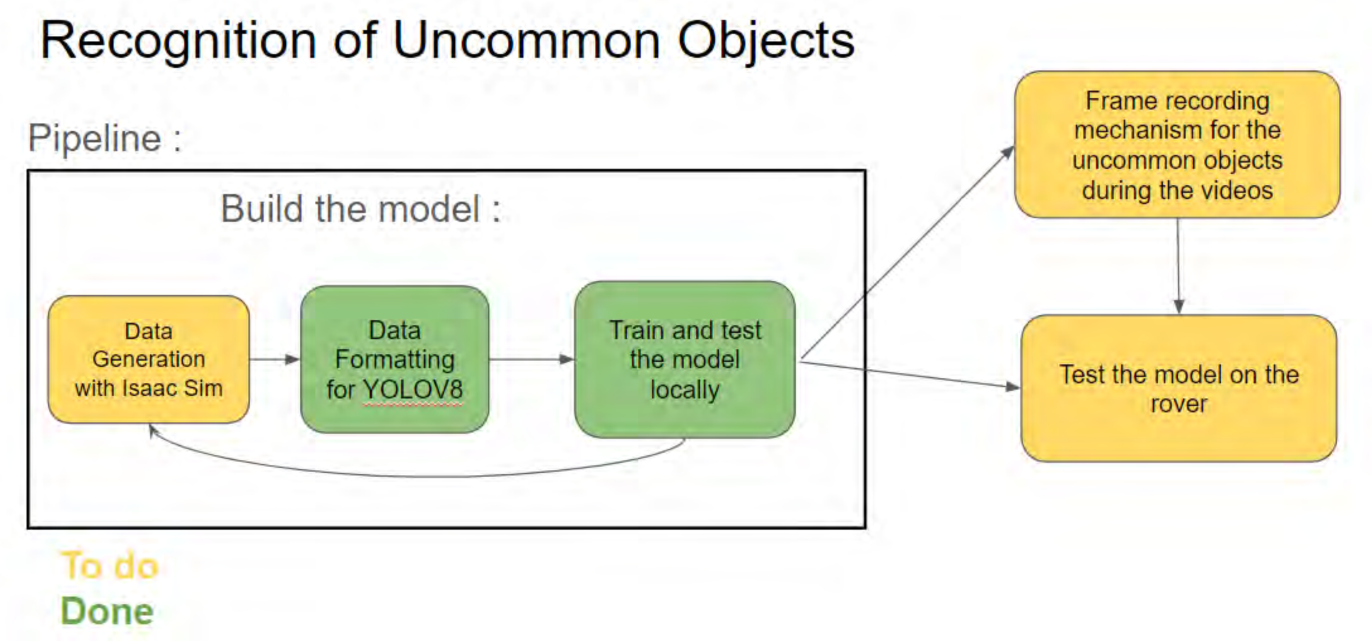




Segmentation



Xplore Research (XRE) - Xplore AI



Semester Projects List

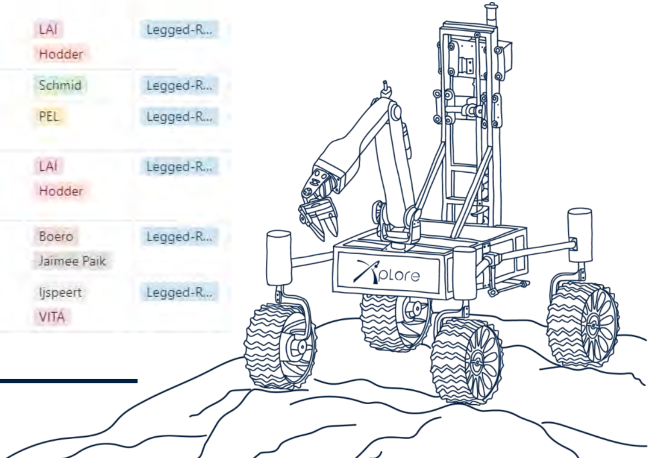
25 Semester Projects
Spring 2024

Xplore Research (XRE)

10 ECTS & 6 ECTS in groups

https://go.epfl.ch/xplore-semester-projects

# Project ID	Aa Name	Domain	Lab / Prof ...	Pole
6	6. Central Pattern Generators Optimization for Enhanced Robotic Locomotion with Integrated Sensors	SOFT	Ijspeert	Legged-R...
7	7. Reinforcement Learning in Robotics using NVIDIA Isaac Sim	SOFT, MECA	Ijspeert	Legged-R...
8	8. MPC	SOFT, MECA	Jones	Legged-R...
9	9. Design and Prototyping of a Cycloidal Gearbox for Robotic Arm Application	MECA	Jaimee Paik, Ijspeert, Henein, Bouri	Legged-R...
10	10. Machine Learning-Based Control Model Development for Real Actuator	MECA, SOFT, ELEC	BioROB, Bouri, Ijspeert	Legged-R...
11	11. Enhancement of Legged Robot Legs through Generative Design and Innovative Manufacturing	MECA	Jaimee Paik	Legged-R...
12	12. Custom Brushless Motor Design for Legged Robot	ELEC, MECA	LAI, Hodder	Legged-R...
13	13. Carrier Board for jetson	ELEC	Schmid	Legged-R...
14	14. Power supply, current monitoring, precharge circuit isolate	ELEC	PEL	Legged-R...
15	15. Custom Code Development for Brushless Motor Control in Legged Robots	ELEC, MECA	LAI, Hodder	Legged-R...
16	16. Foot sensor	ELEC, MECA	Boero, Jaimee Paik	Legged-R...
17	17. Representation learning	SOFT	Ijspeert, VITA	Legged-R...



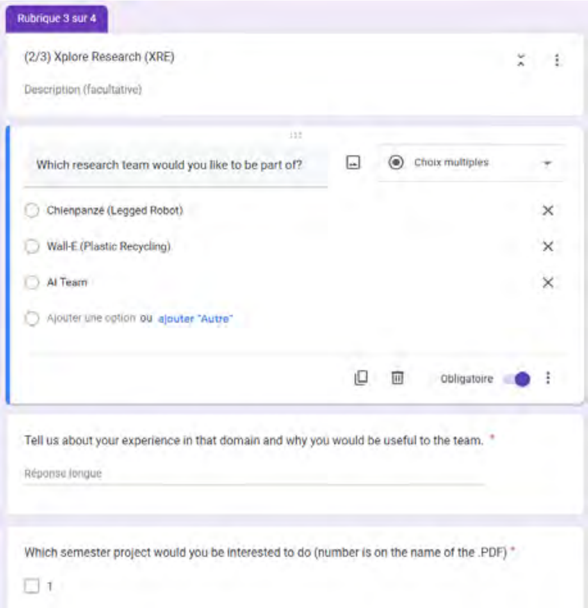
Semester Projects Candidature

25 Semester Projects
Spring 2024

Xplore Research (XRE)

Postulation sur Google Forms

https://go.epfl.ch/xplore-semester-projects-candidature


Rubrique 3 sur 4

(2/3) Xplore Research (XRE)

Description (facultative)

Which research team would you like to be part of?

Choix multiples

- Chienpanzé (Legged Robot)
- Wall-E (Plastic Recycling)
- AI Team
- Ajouter une option ou ajouter "Autre"

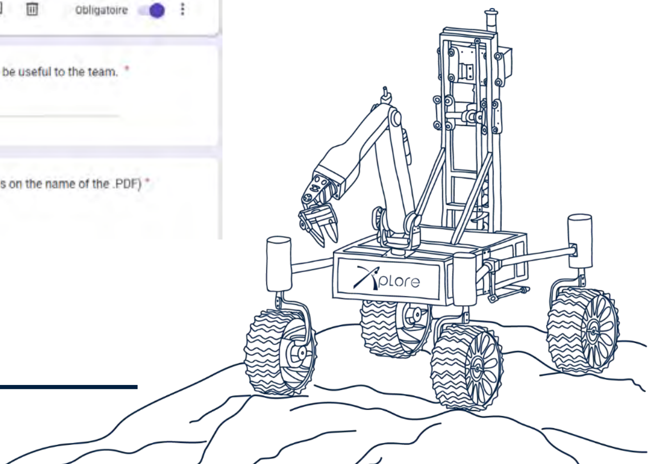
Obligatoire

Tell us about your experience in that domain and why you would be useful to the team. *

Réponse longue

Which semester project would you be interested to do (number is on the name of the .PDF) *

- 1



Xplore Research (XRE) - Xplore AI

Semester Projects List

https://go.epfl.ch/xplore-semester-projects

Semester Projects Candidature Form

https://go.epfl.ch/xplore-semester-projects-candidature

EPFL Xplore

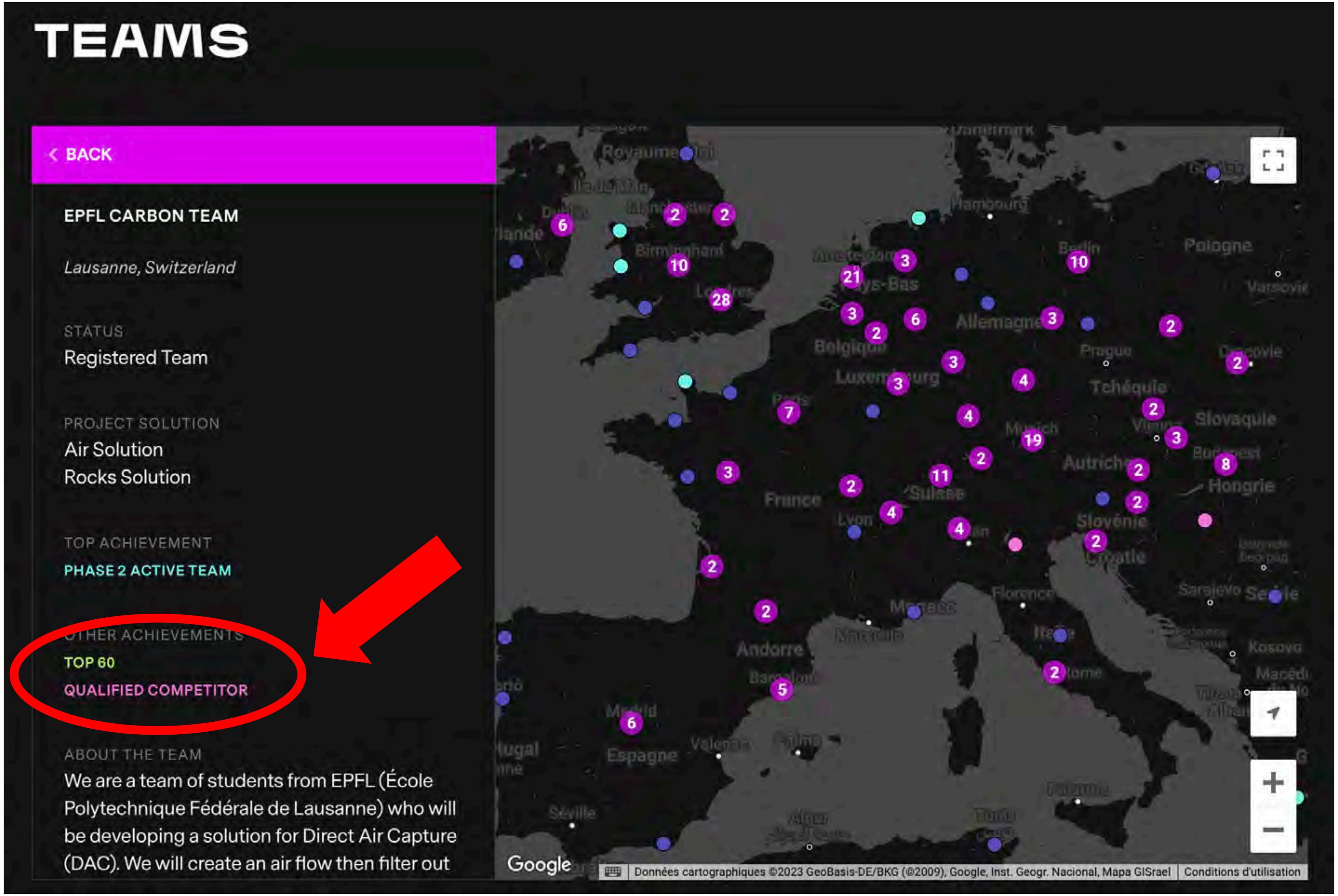
contact@xplore.ch

www.epfl-xplore.ch

epfl_xplore

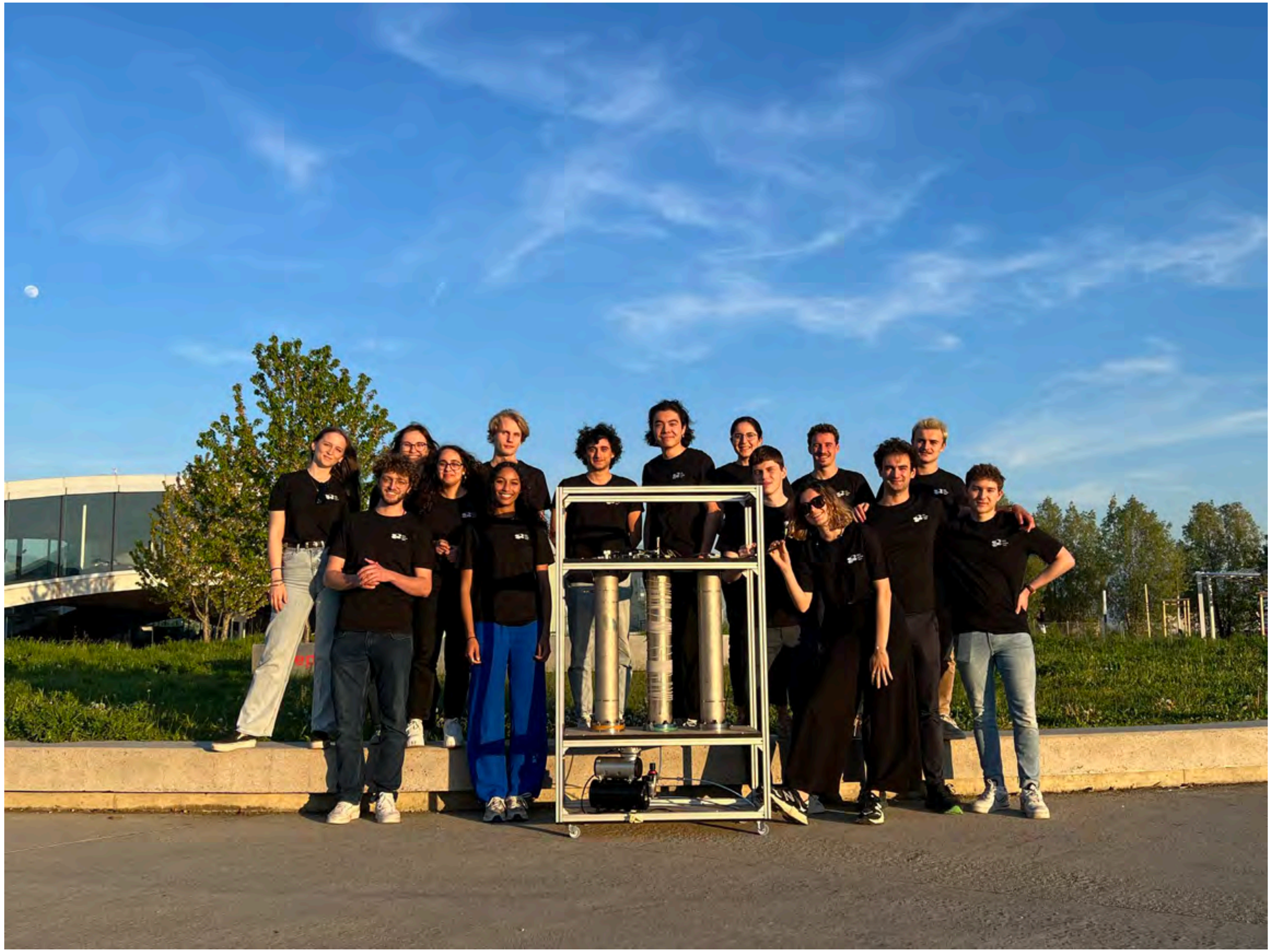
T – Carbon Team

EPFL
Carbon
Team



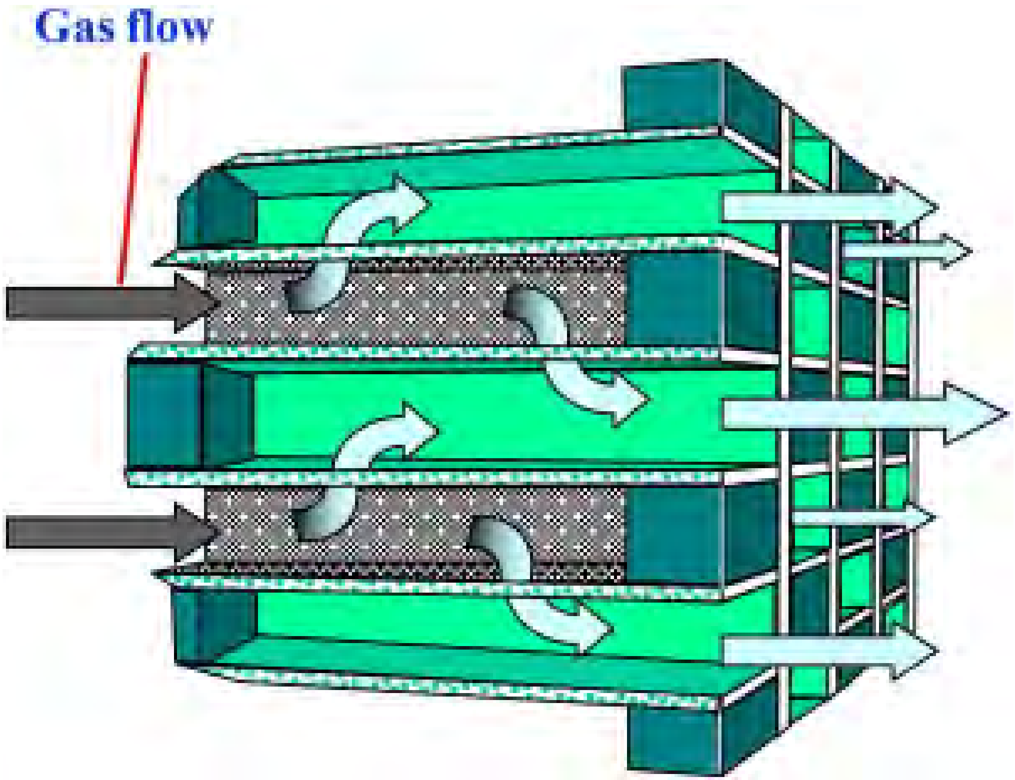
[Link to the competition web site Xprize Carbon Removal]

EPFL Carbon Team



EPFL Carbon Team

Project 1 : Air flow optimization for adsorbent bed (max 5 students)

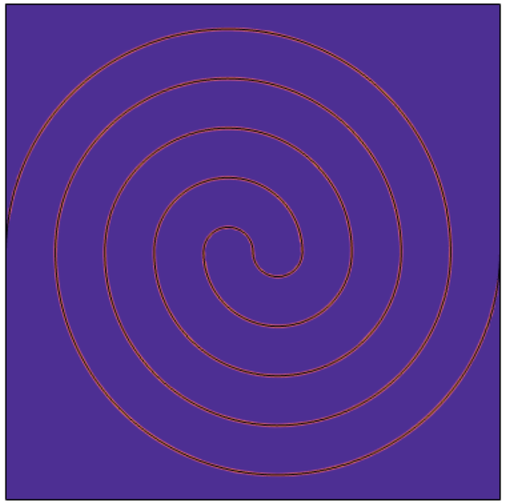


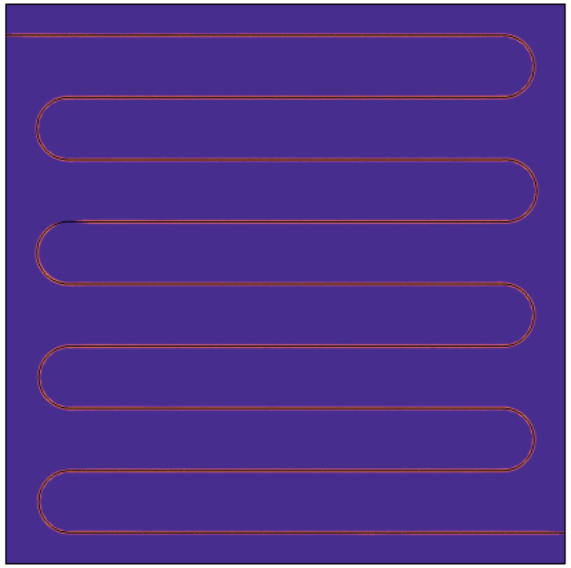
To open the link, you need to be in Diaporama/Presentation mode

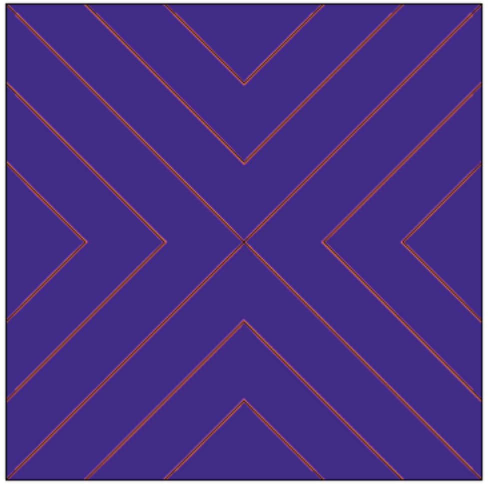
[Link to a more detailed description of the project]

EPFL Carbon Team

Project 2 : Heat transfer optimization for adsorbent bed (max 5 students)



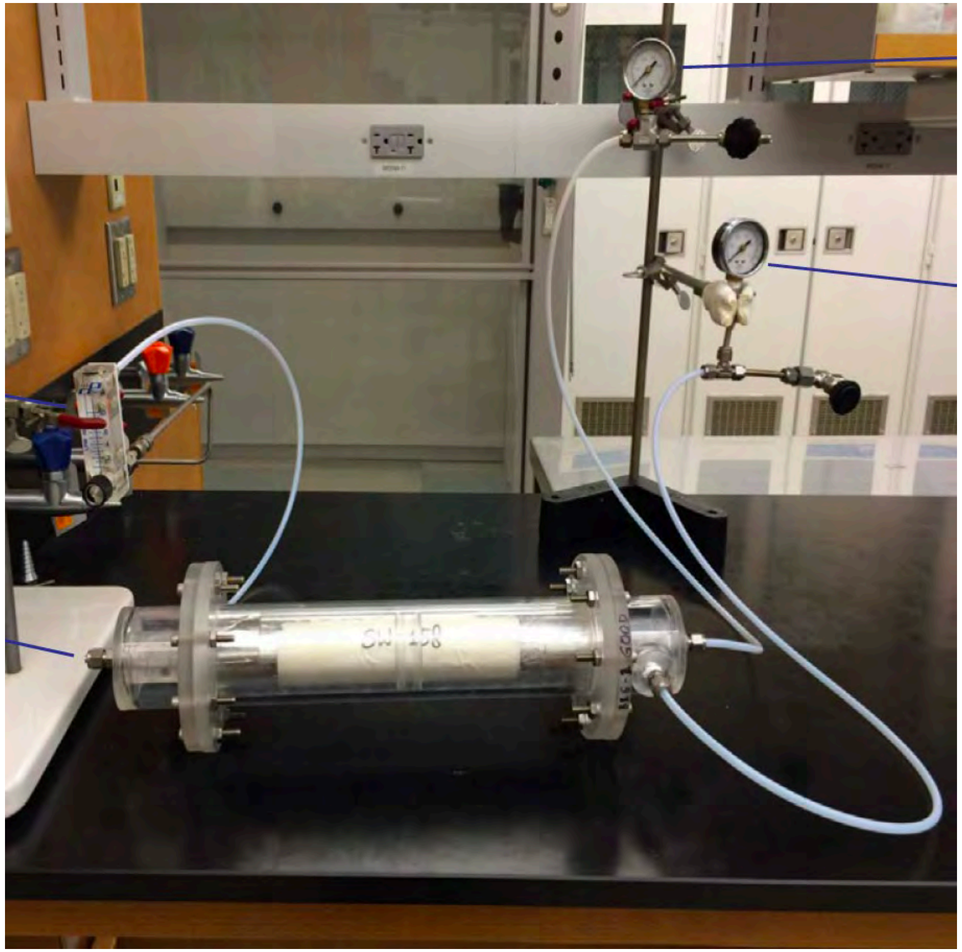


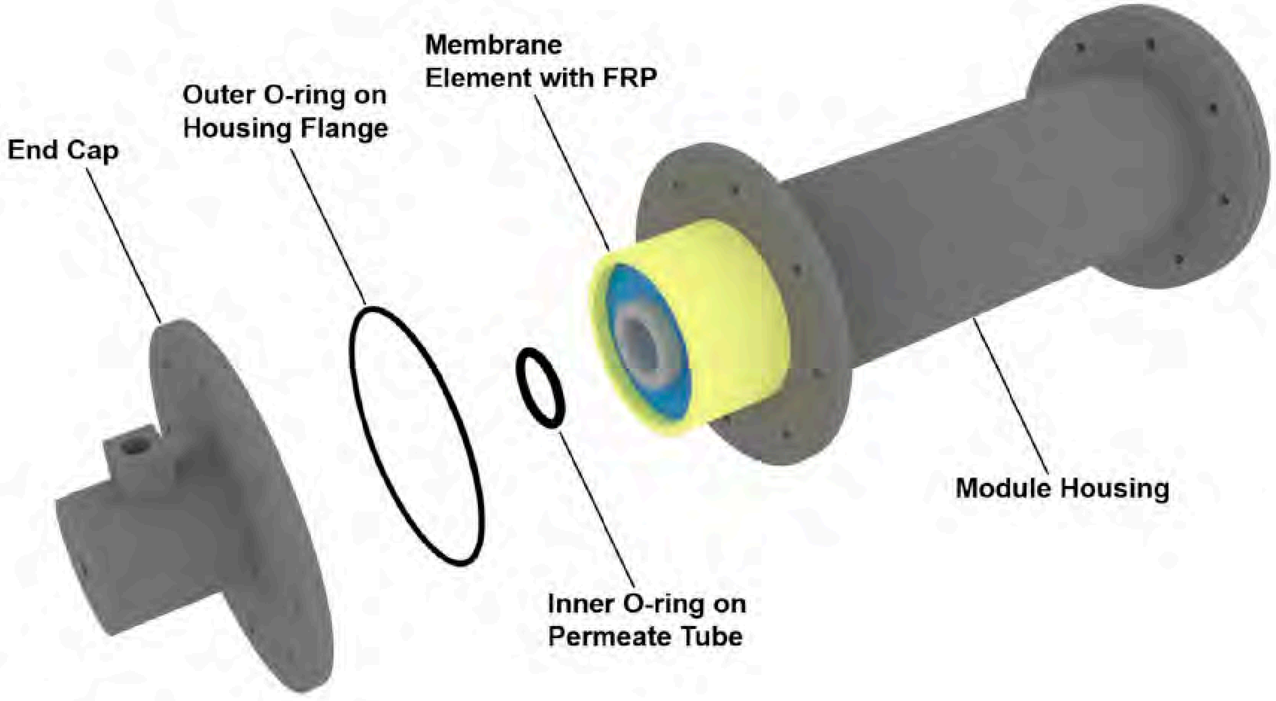


[Link to a more detailed description of the project]

EPFL Carbon Team

Project 3 : Improve the design of a spiral wound graphene membrane module (max 5 students)

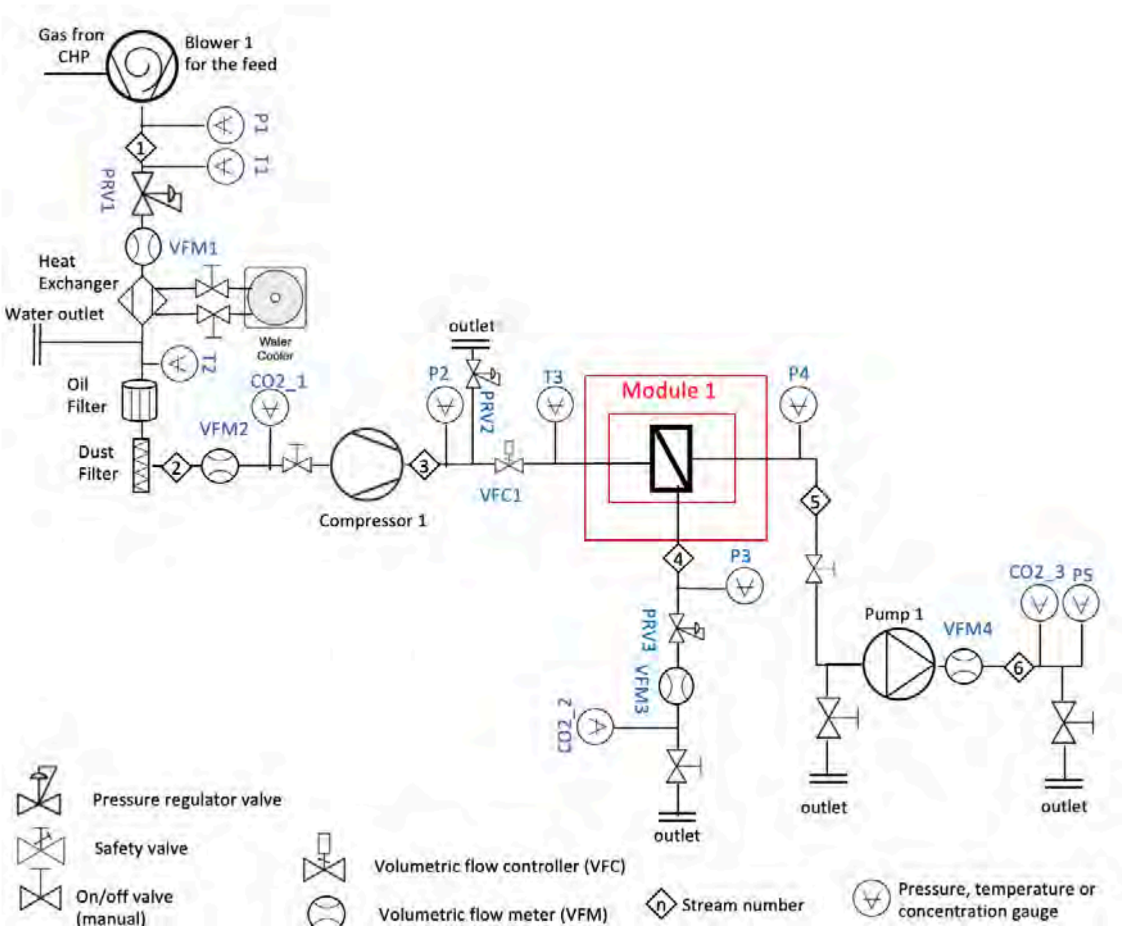




Link to a more detailed description of the project

EPFL Carbon Team

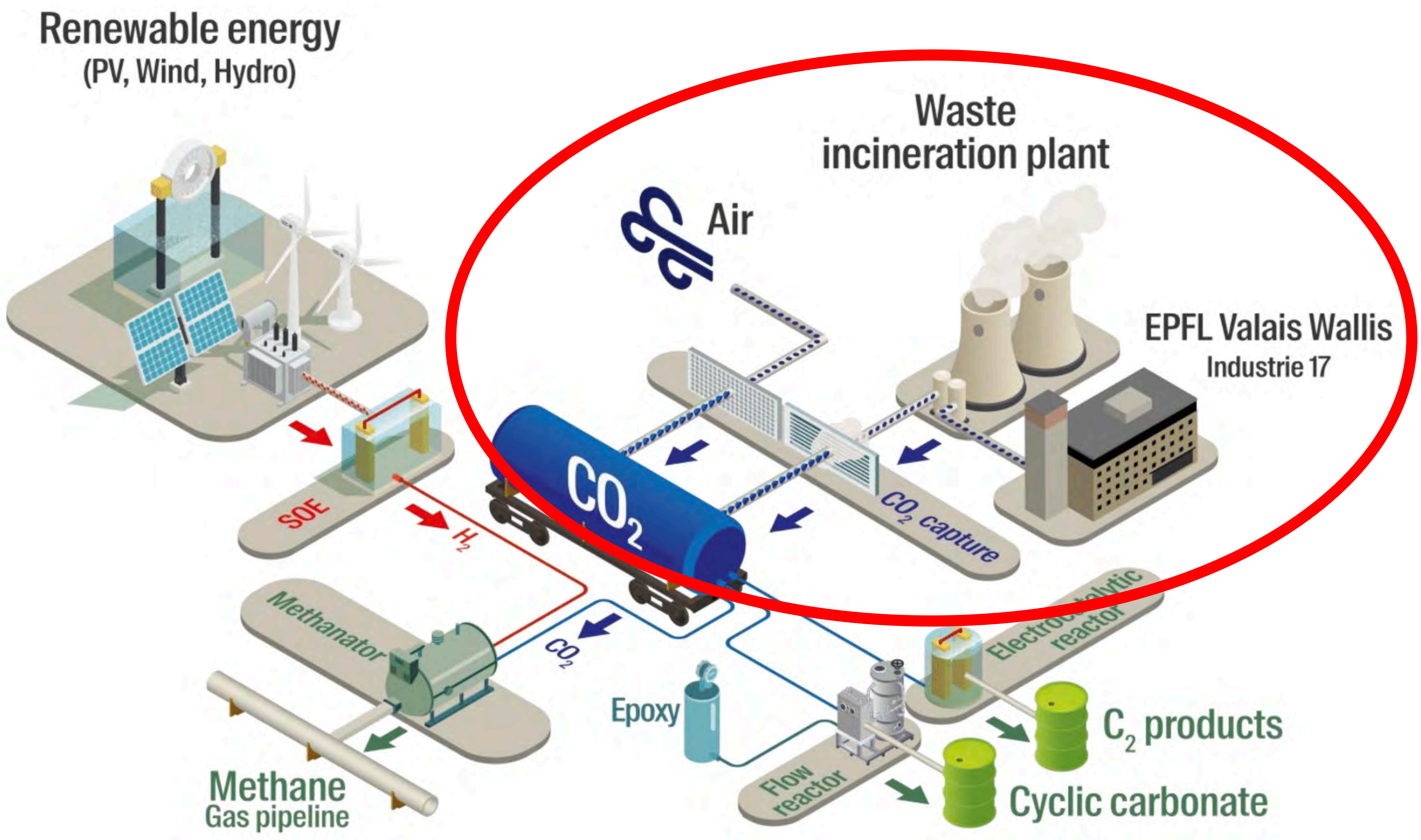
Project 4 : Build a point source carbon capture unit (max 5 students)



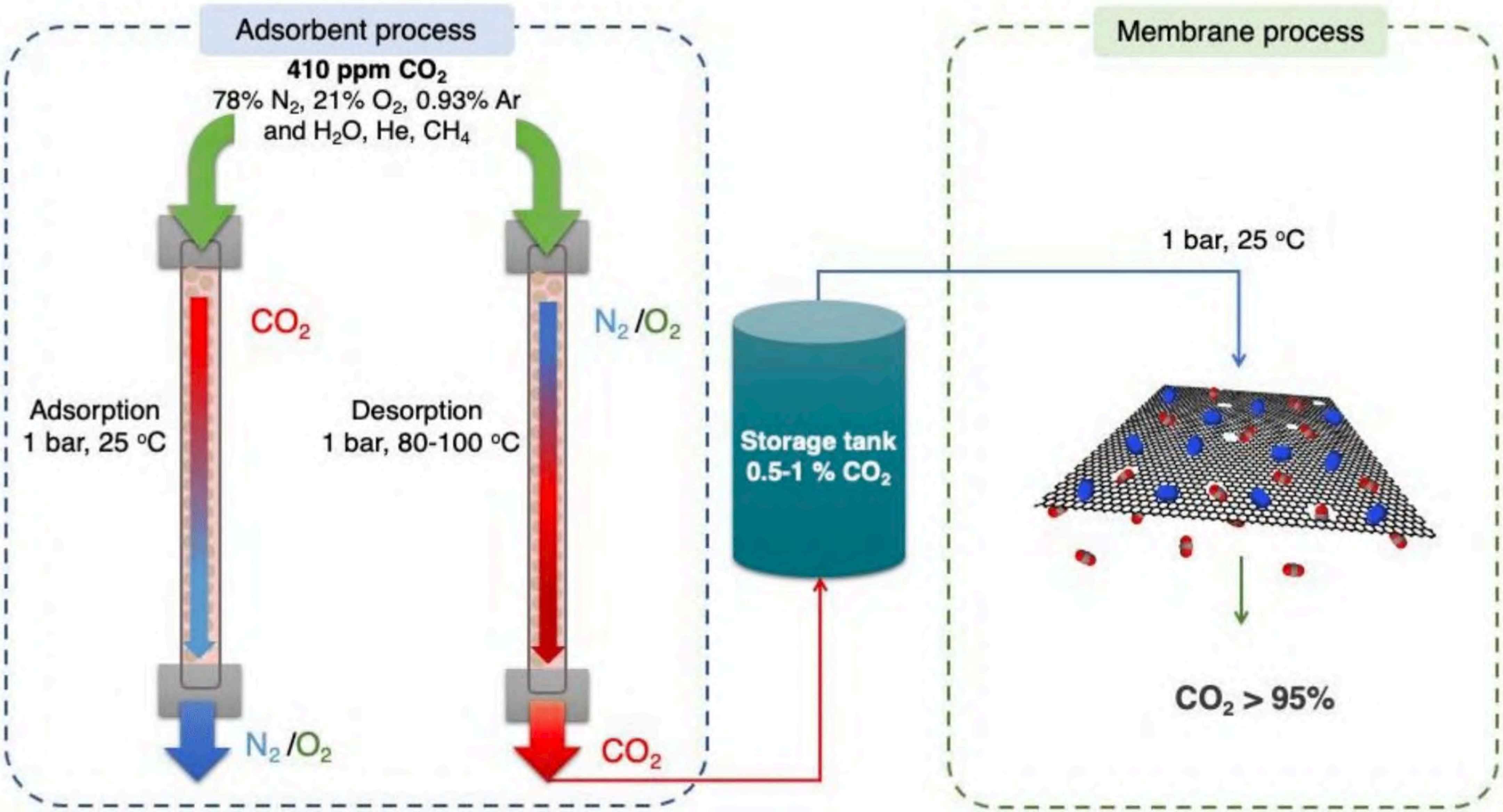
To open the link, you need to be in Diaporama/Presentation mode

[Link to a more detailed description of the project]

EPFL Carbon Team



[Link to the project website Solutions4Sustainability]


Adsorbent process
410 ppm CO_2
78% N_2, 21% O_2, 0.93% Ar
and H_2O, He, CH_4
CO_2
N_2 /O_2
Adsorption
1 bar, 25 °C
Desorption
1 bar, 80-100 °C
N_2 /O_2
CO_2
Storage tank
0.5-1 % CO_2
Membrane process
1 bar, 25 °C
CO_2 > 95%