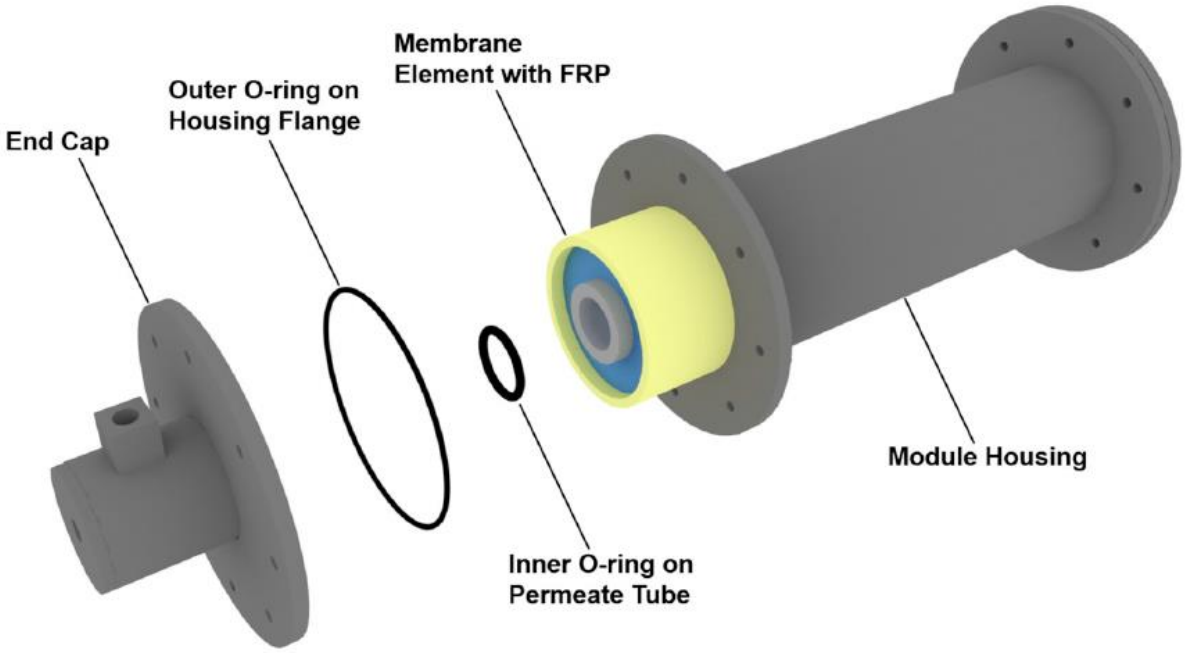
# Title of the project: Improve graphene membrane module design




## Context

When a graphene membrane is synthesized, it cannot be directly utilized for $CO_2$ capture. Instead, it must be incorporated into a module, as depicted in the image below. It's essential to note that a membrane resembles a sheet, similar to a piece of paper, and can either be flat or rolled. Regardless of their geometry, each membrane module features one inlet for the gas stream containing the $CO_2$ to be captured, and two outlets—one for the captured $CO_2$ stream and the other for the $CO_2$-depleted gas stream. The design of a module must facilitate the insertion of the maximum membrane surface while minimizing the overall volume. Have you considered one of the most optimal geometry ? It turns out to be a spiral ! In addition, a good module is perfectly sealed and avoid concentration polarization.

## Description

To fabricate a single operational membrane leaf, students will employ advanced 3D printing technology. Initially, they will apply this technique to create their own module. The design can be tested initially with homemade polymeric membranes and subsequently with graphene membranes. Within the laboratory, the Laboratory of

Advanced Separations (LAS) provides various setups for testing the module, including assessments for leaks and straightforward $CO_2/N_2$ separation. When we refer to sealing, it entails the application of a sealant, such as epoxy, by the students. This sealant is crucial to ensure that the feed gas and permeate gas remain separate and do not intermingle. For a more detailed reference, a report previously authored by a student is available below.

## Requirements

- Knowledge regarding how to use a CAD software.
- Knowledge in prototyping.

Bonus: experience in a lab or with other projects.

## Tasks

- Design a module in a CAD software.
- Build the module with the help of mechanical workshops and test its ability to separate $CO_2$.

## Contact

Supervising lab: LAS, Prof. Kumar Agrawal
Student supervisor: Louis Saix (louis.saix@epfl.ch)

## Remarks

Project location: Lausanne and Sion.
The project can accommodate a maximum of 5 students.