A low-cost Raman microscope for detecting microplastics in the ocean

Maxence Dominjon, Armelle Bouhali
Supervisor : Alan Bowman

Sommaire

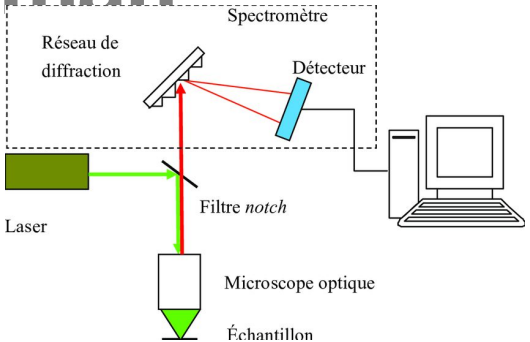
1. Introduction
2. Revue de littérature
3. Choix du design
4. Avancement actuel
5. Etapes à venir

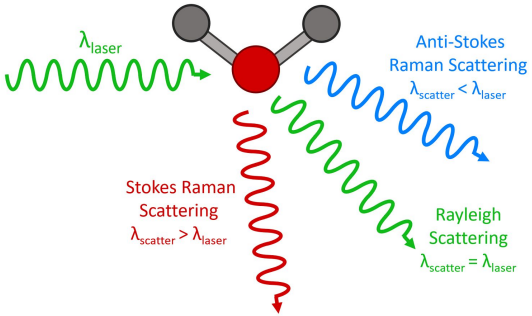
1. Introduction

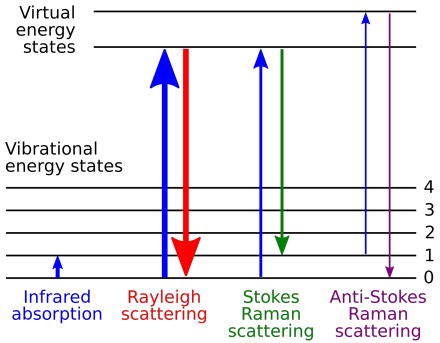
Motivation du projet

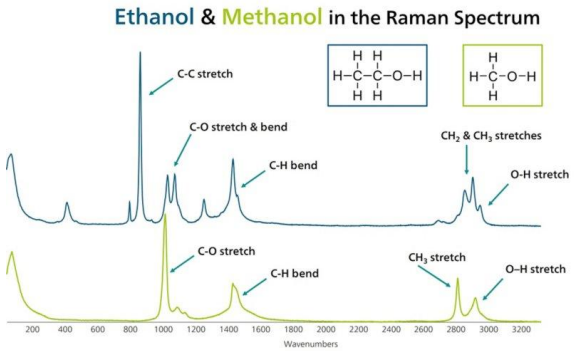
1. Introduction

La spectroscopie de Raman

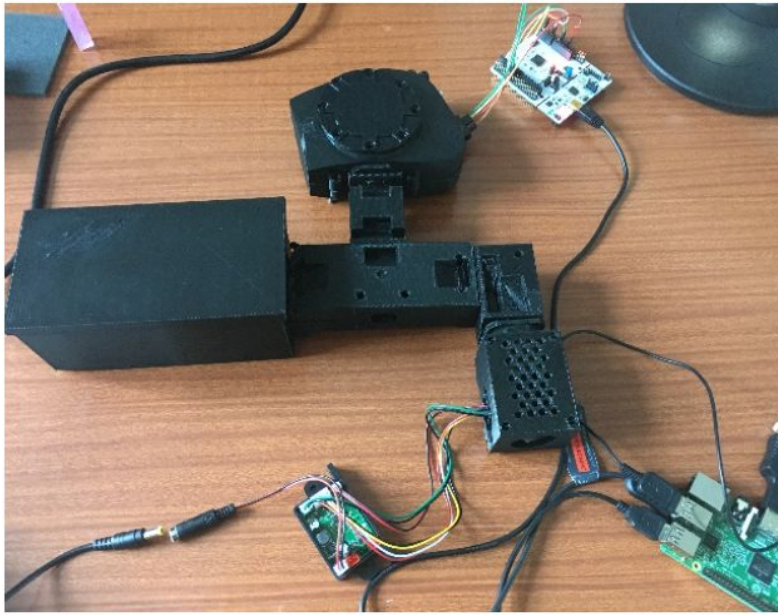


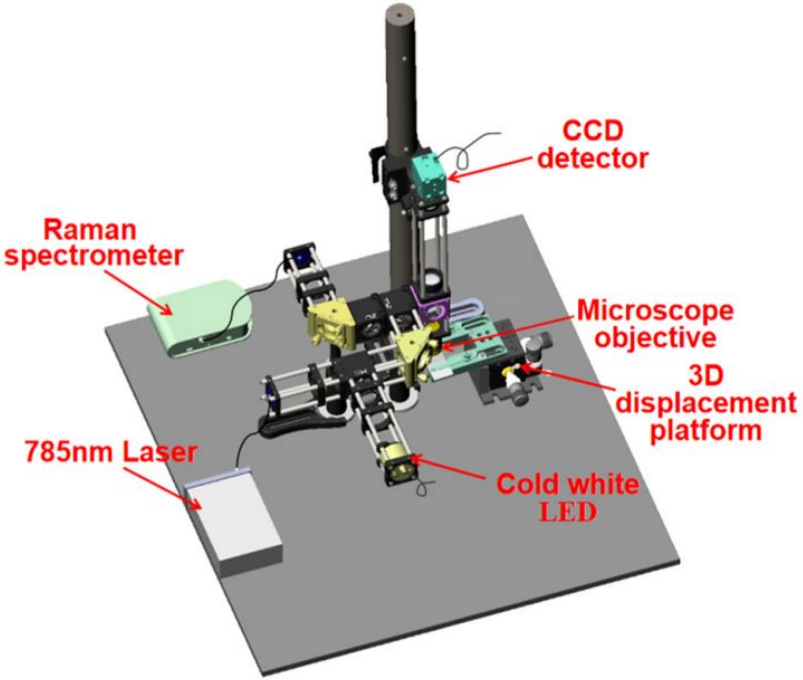






2. Revue de littérature

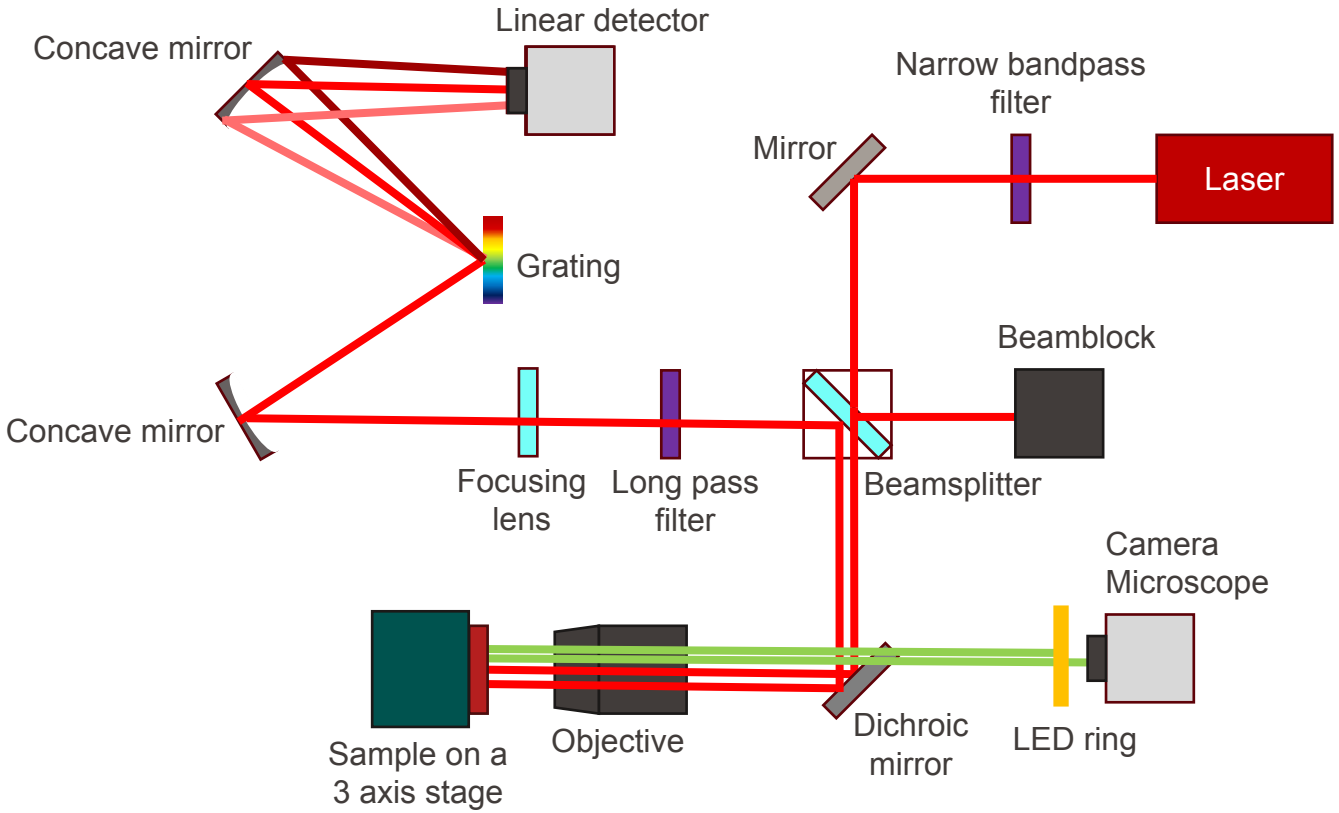




Aydogan, O., & Tasal, E. (2018). Designing and building a 3D printed low cost modular Raman spectrometer. CERN IdeaSquare Journal of Experimental Innovation, 2(2), 3–14. https://doi.org/10.23726/cij.2017.799

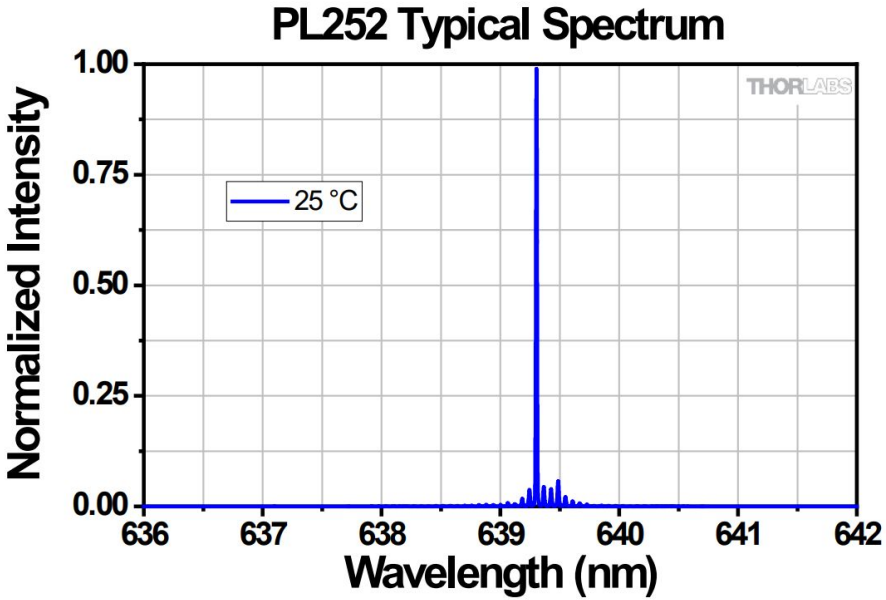
Jitao Lu, Qingsheng Xue, Haoxuan Bai, and Nan Wang, "Design of a confocal micro-Raman spectroscopy system and research on microplastics detection," Appl. Opt. 60, 8375-8383 (2021)

3. Choix du design



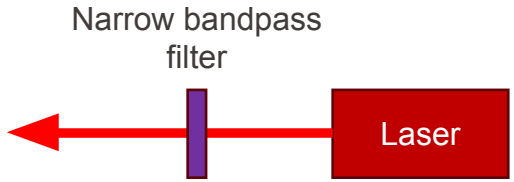
3. Choix du design

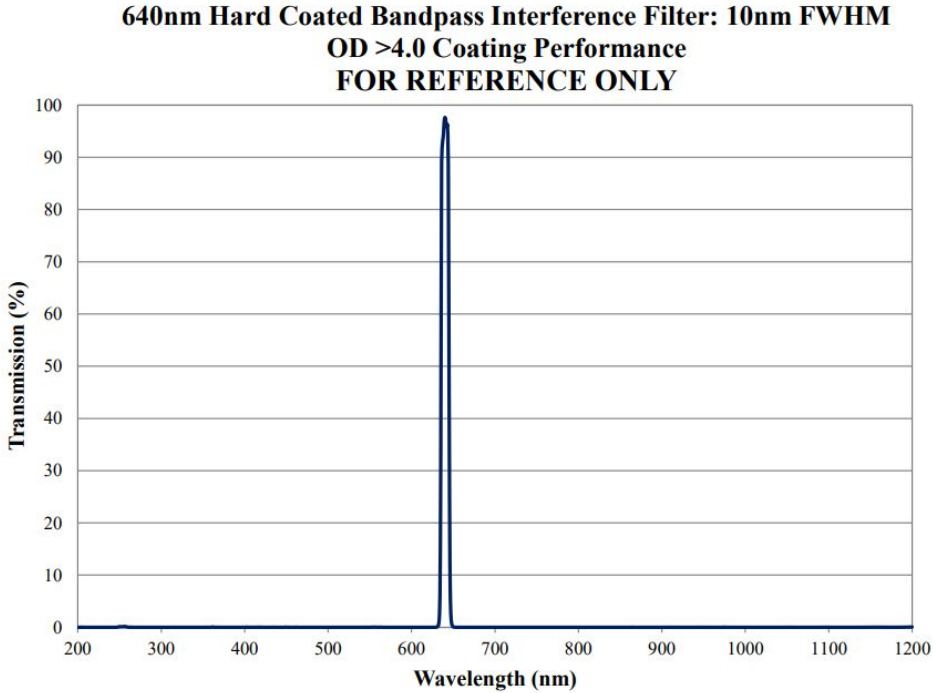
Laser



Thorlabs (PL252): 639 nm – 4,5mW

3. Choix du design

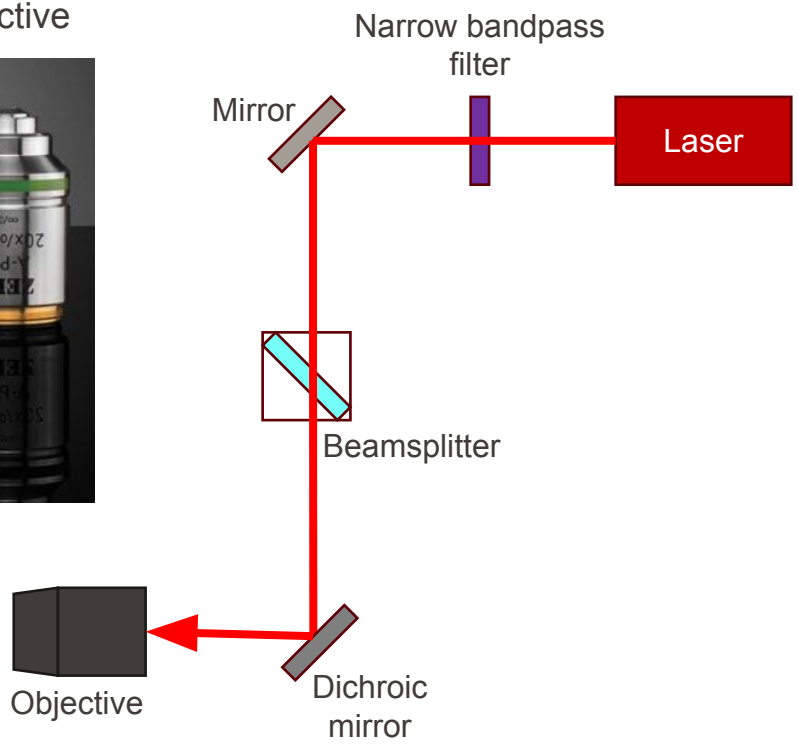




Edmund optics: CWL 640nm - 10nm FWHM

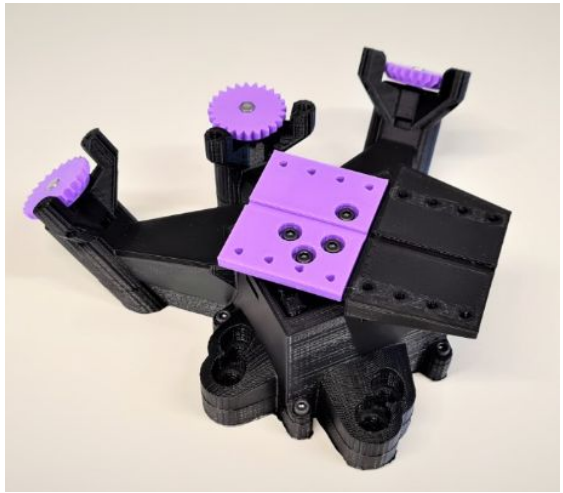
3. Choix du design

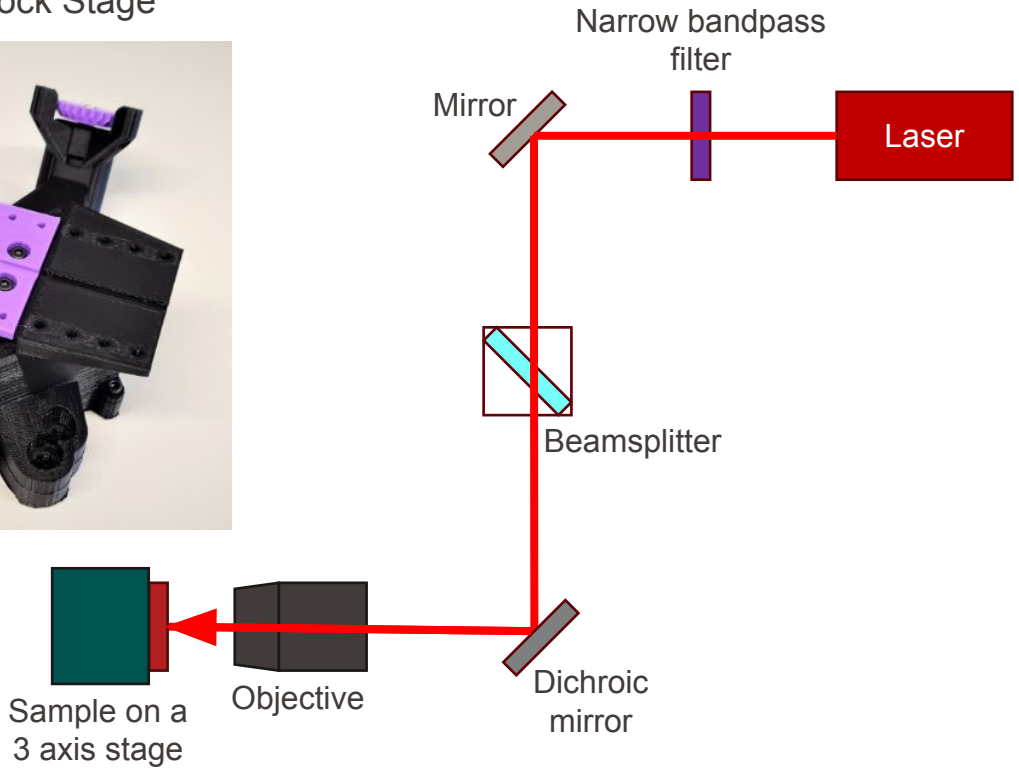
Edmund optics (Zeiss): 40X A-plan objective



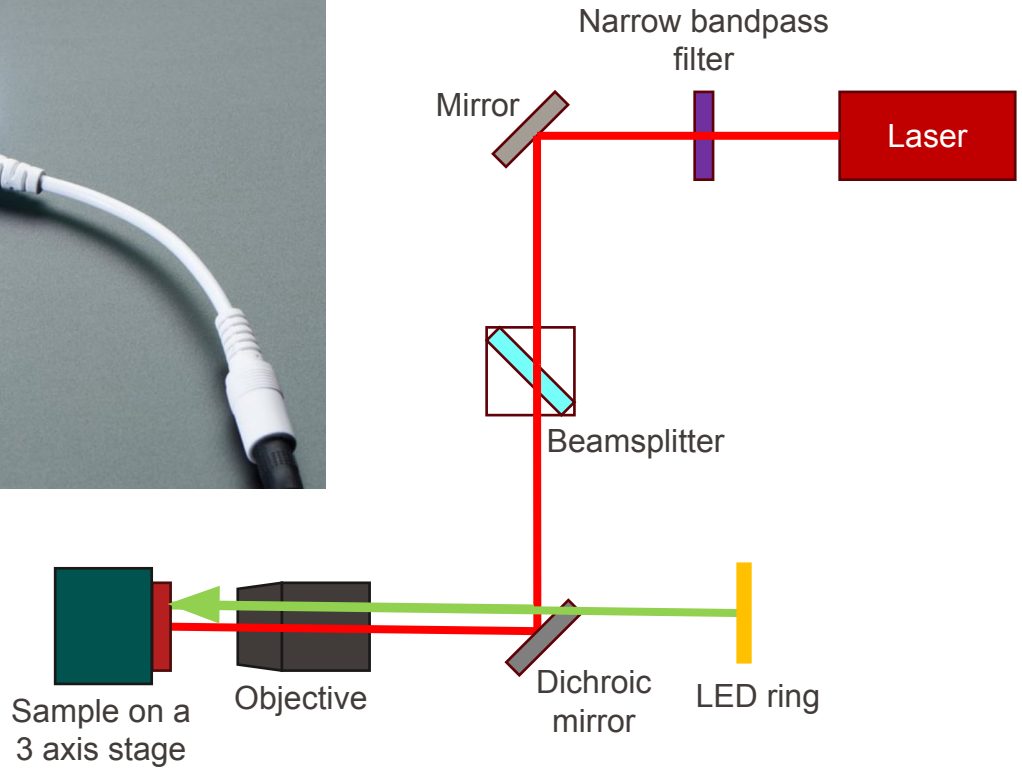
3. Choix du design

OpenFlexure Block Stage



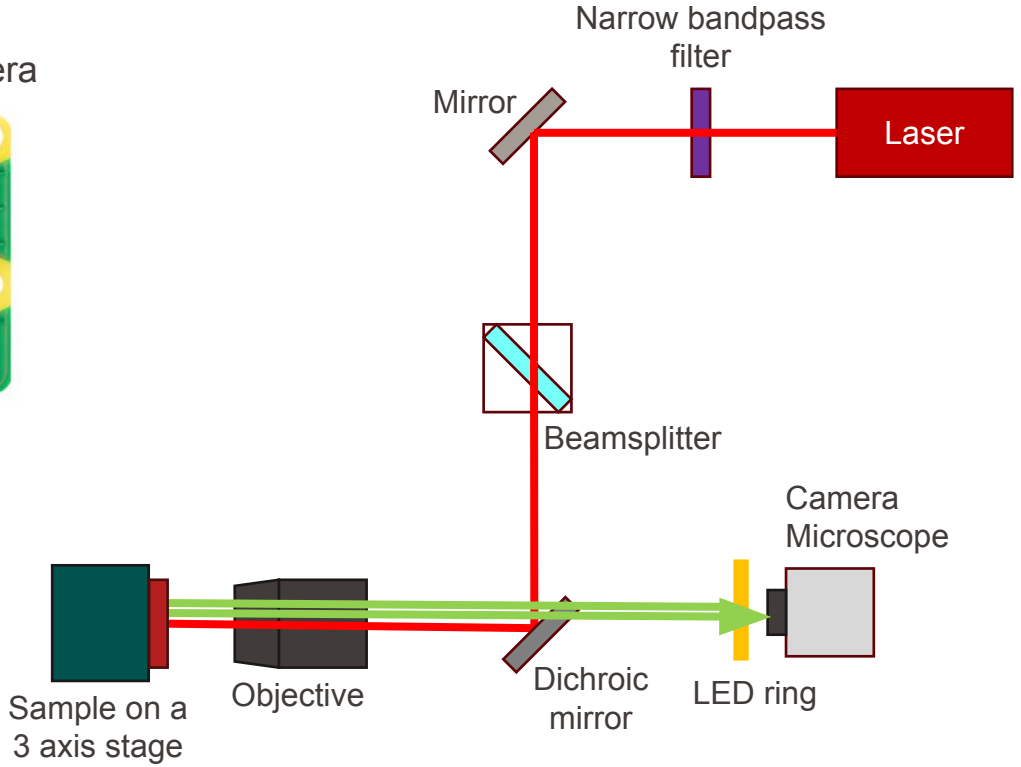


3. Choix du design



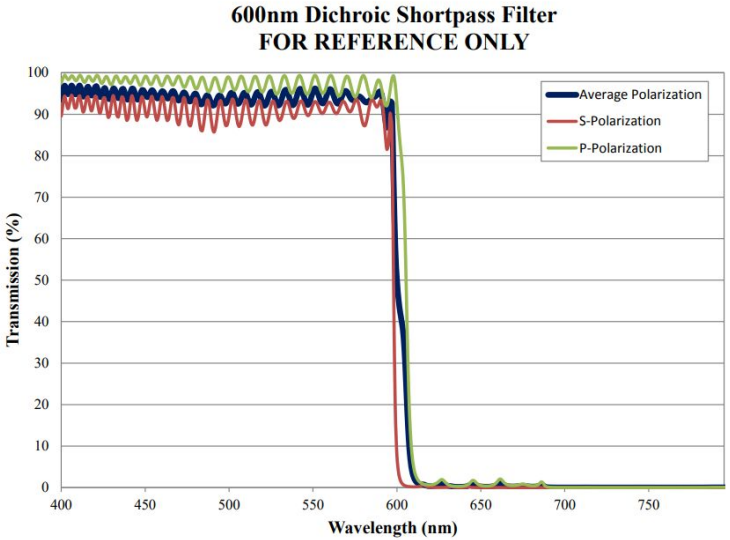
3. Choix du design

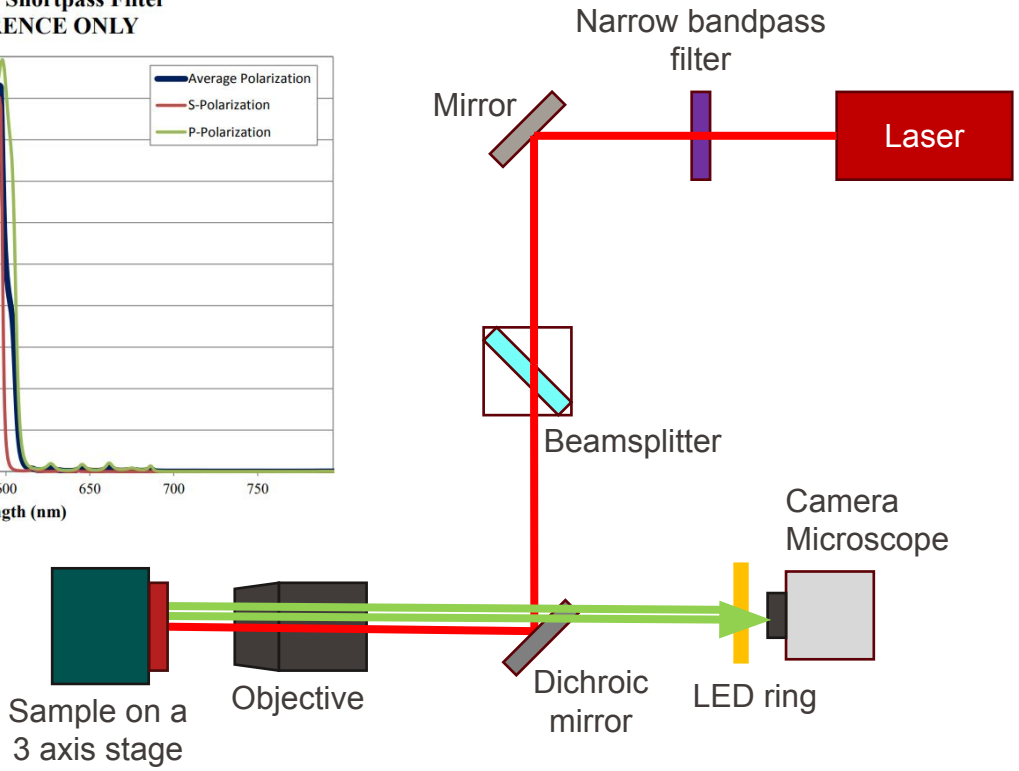
Raspberry Pi Camera



3. Choix du design

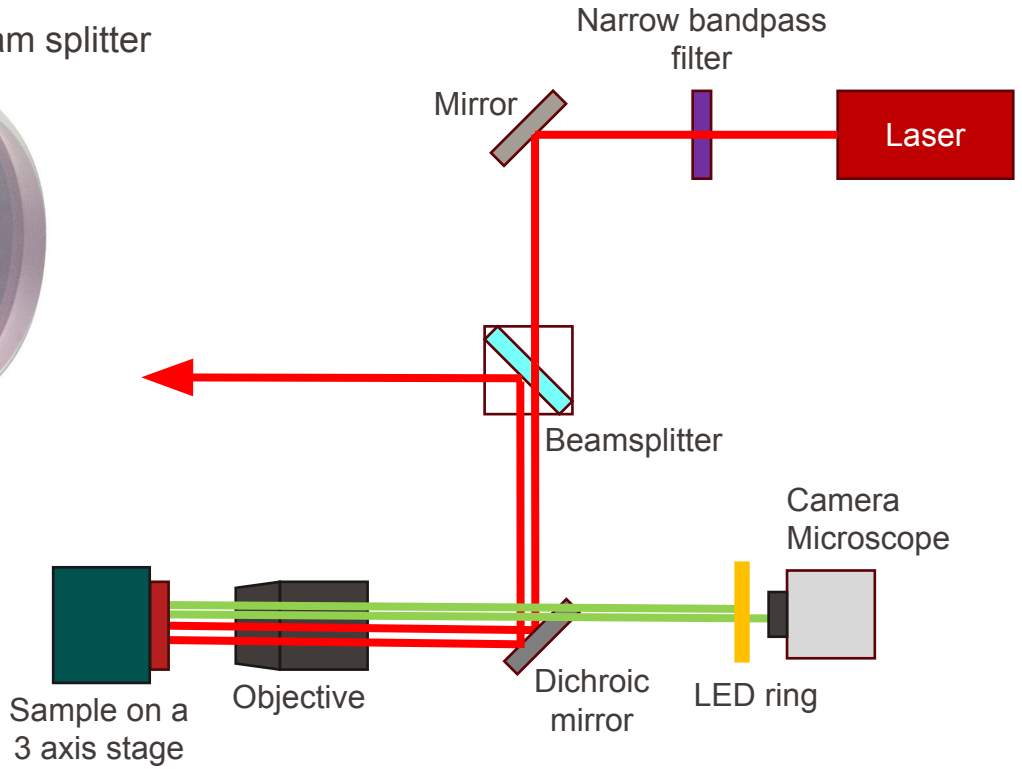
Edmund optics: Dichroic miror 600nm





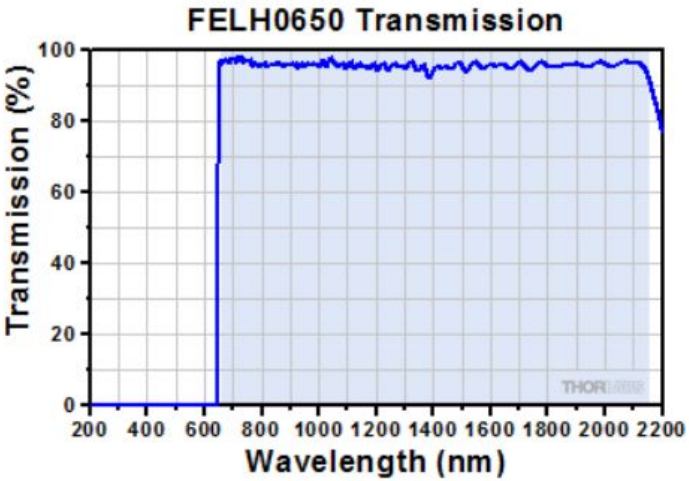
3. Choix du design

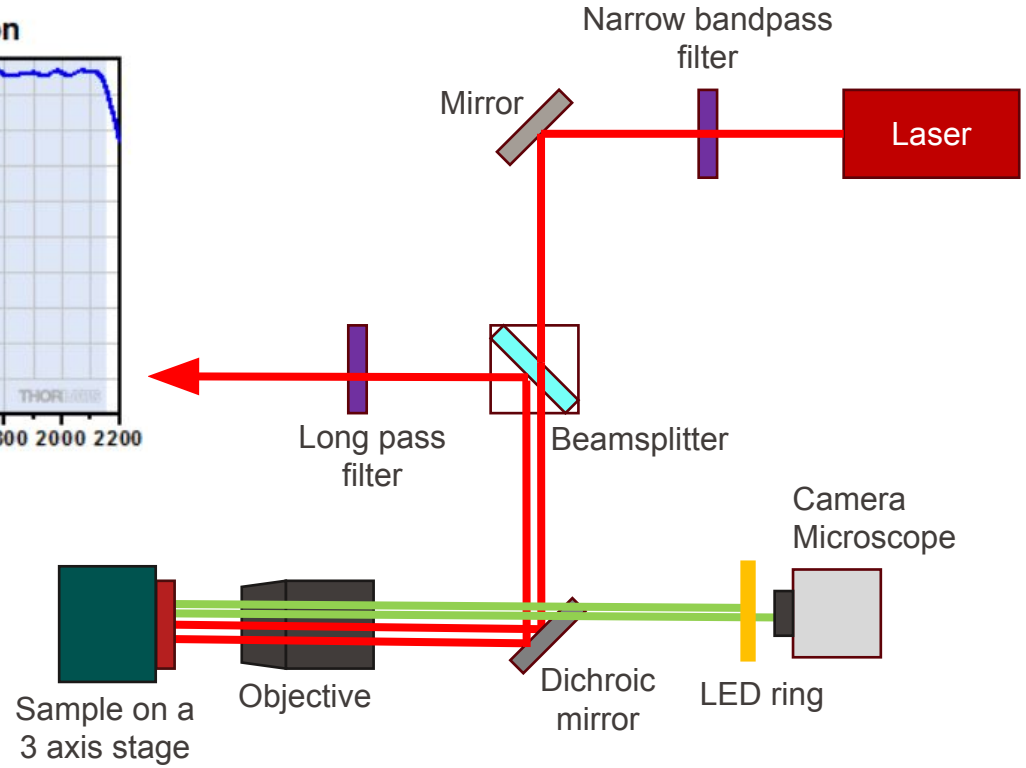
Thorlabs: 50/50 beam splitter



3. Choix du design

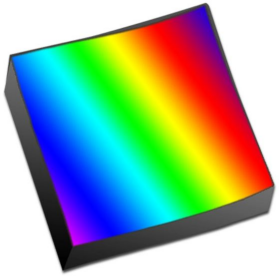
Thorlabs (FELH0650): 650nm longpass filter

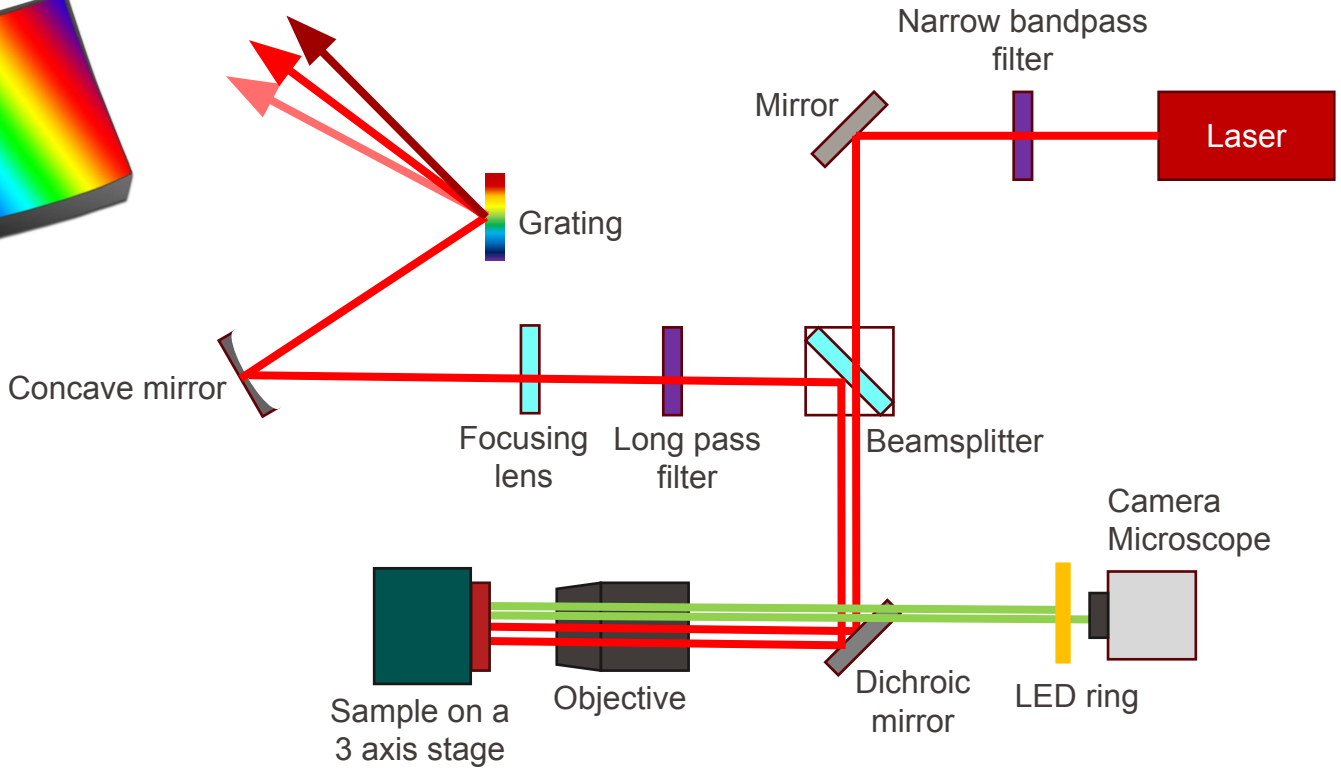




3. Choix du design

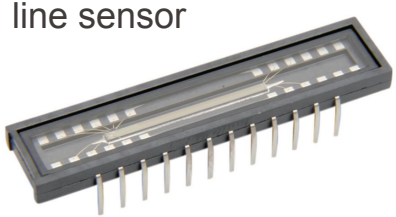
Edmund optics: 1200 Traits

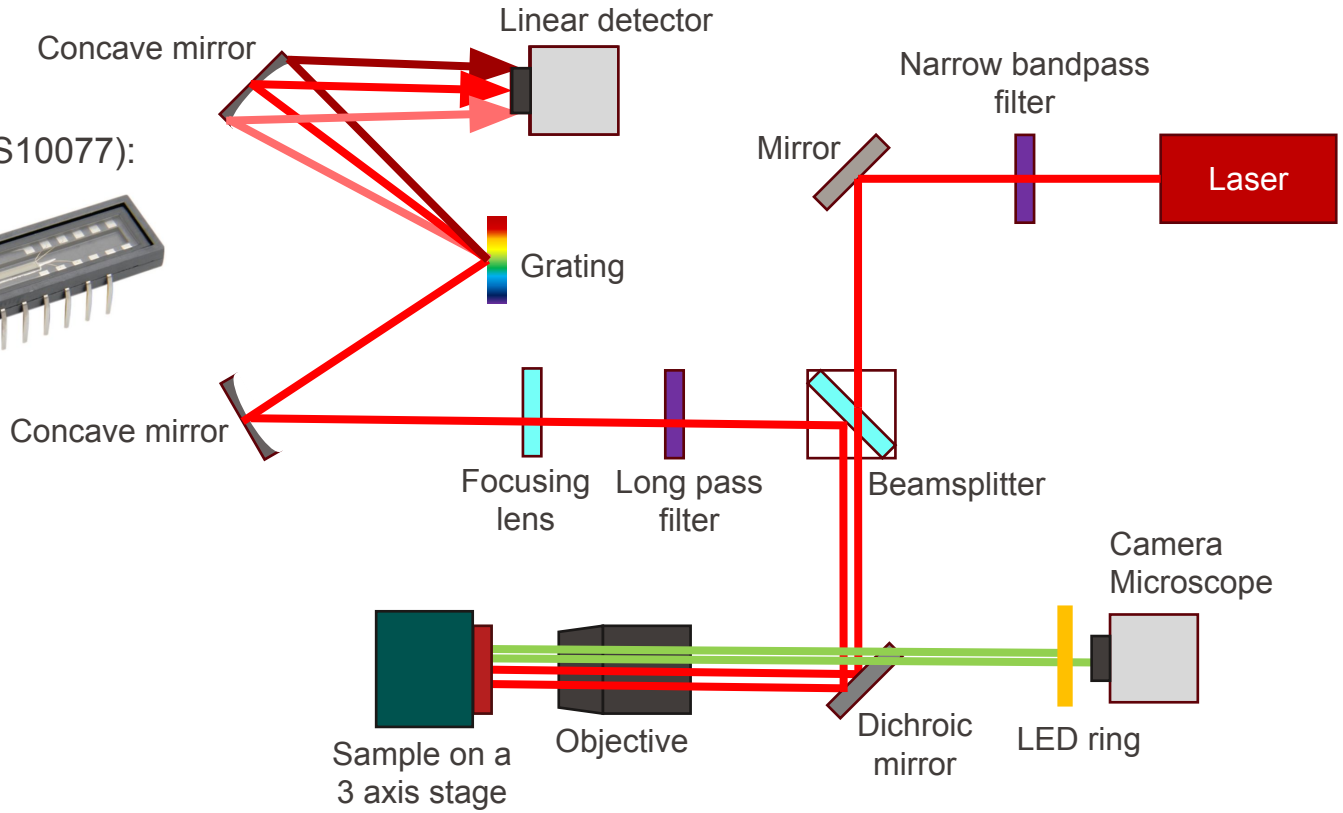




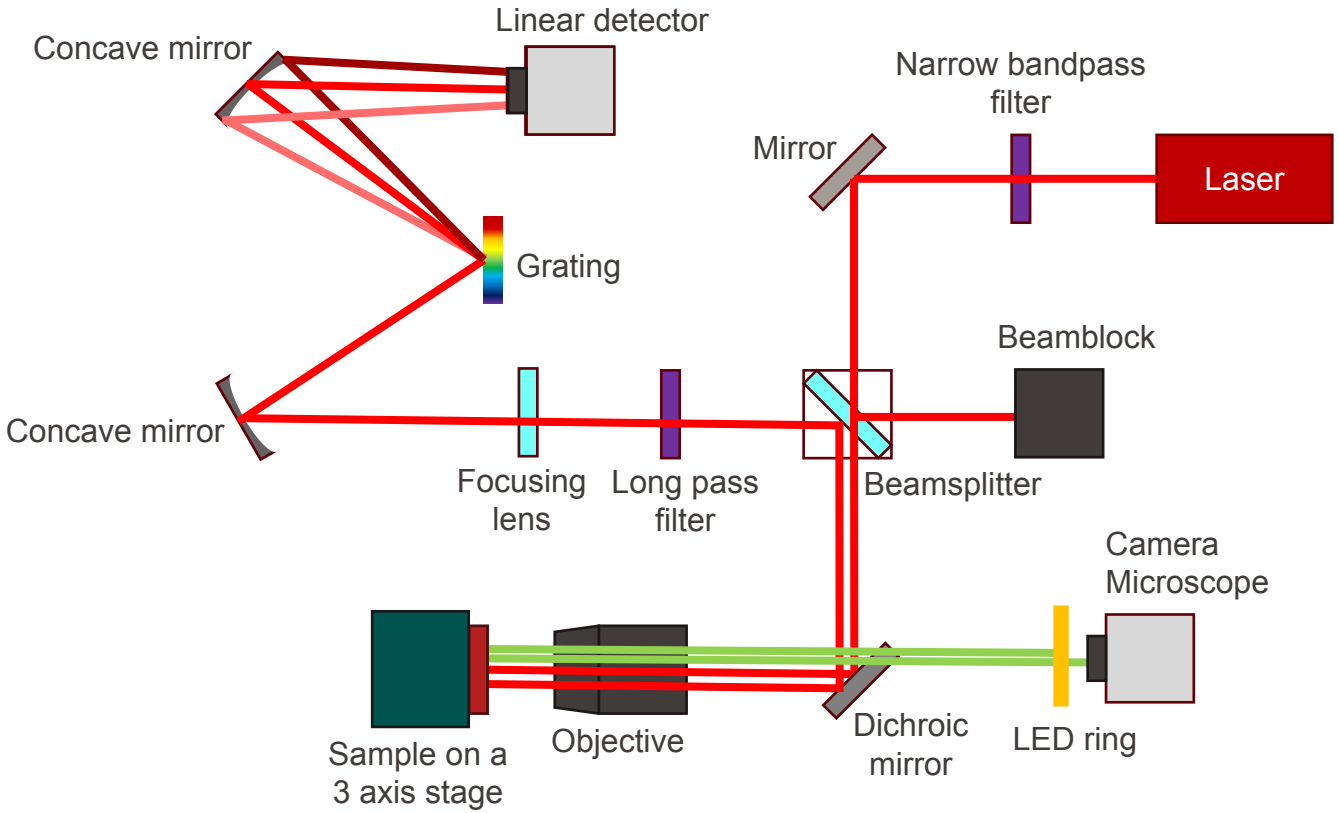
3. Choix du design

Hamamatsu(S10077):
line sensor

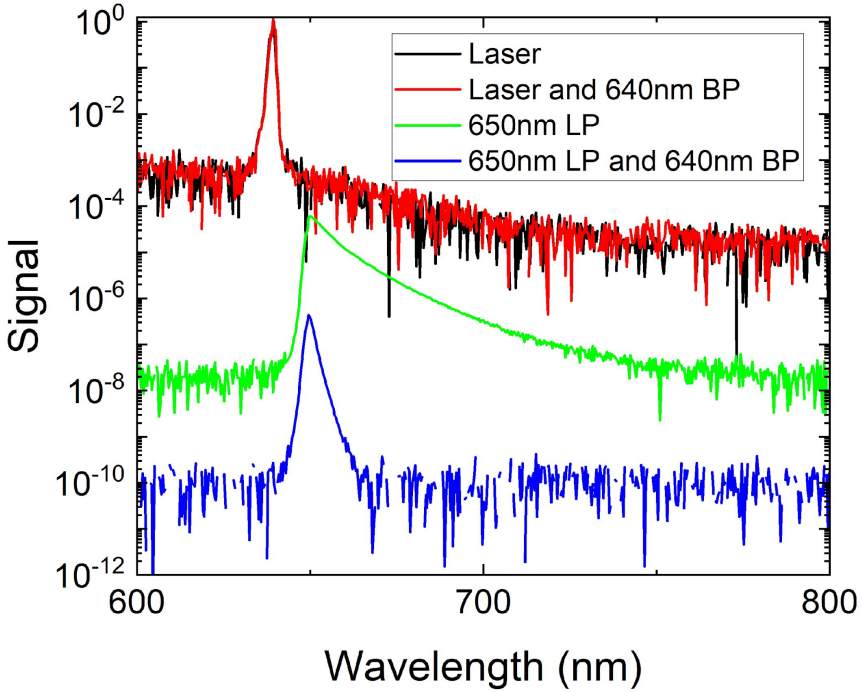




3. Choix du design

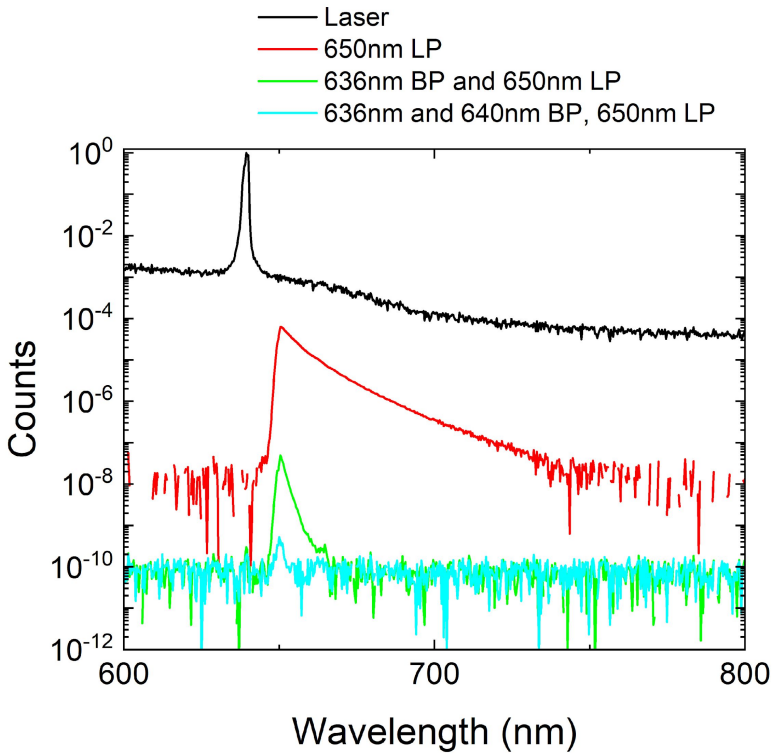


4. Avancement actuel
Premiers résultats



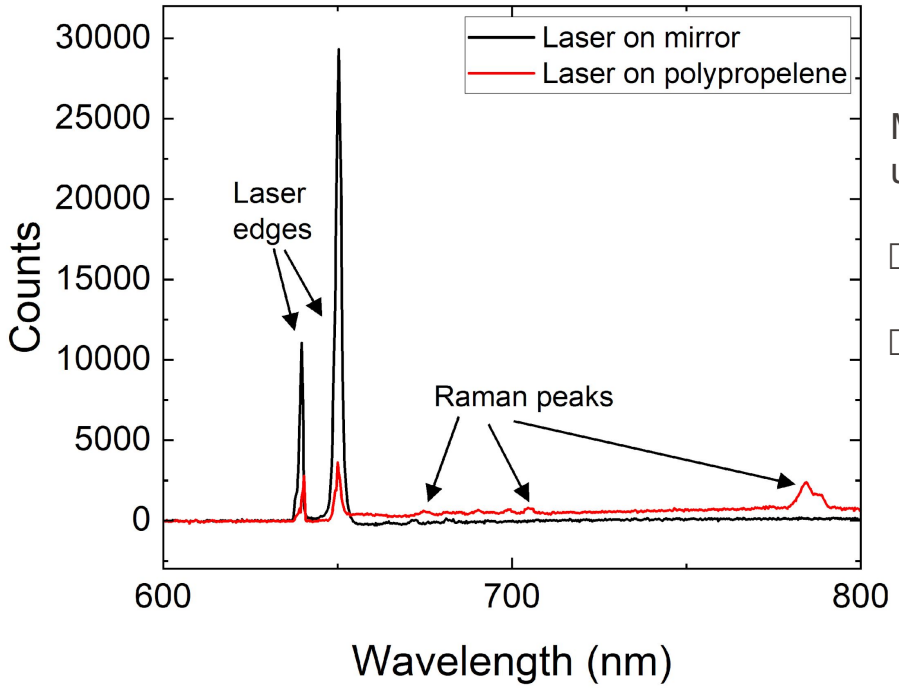
- Le signal “propre” n’est pas assez réduit

4. Avancement actuel
Premiers résultats



- Ajout d'un 636nm bandpass filter utilisé en plus du 640nm bandpass filter
- Avec ces 2 filtres, on obtient une reduction de la force du signal d'environ 10^{-10}

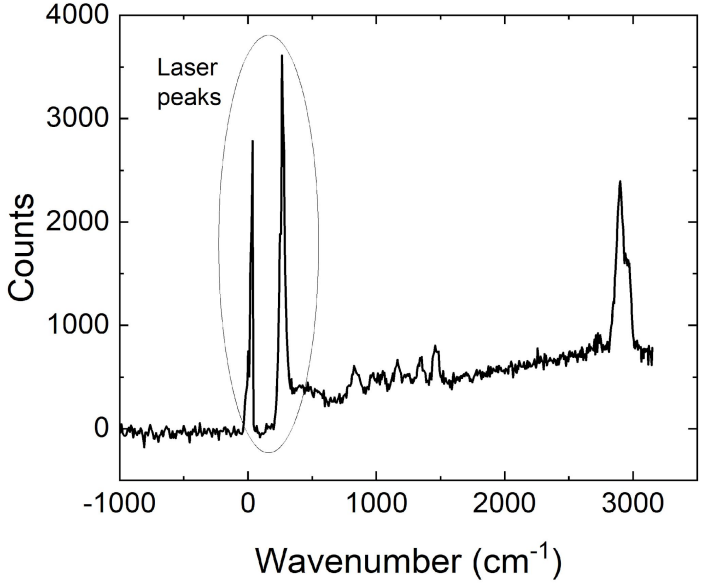
4. Avancement actuel
Premiers résultats

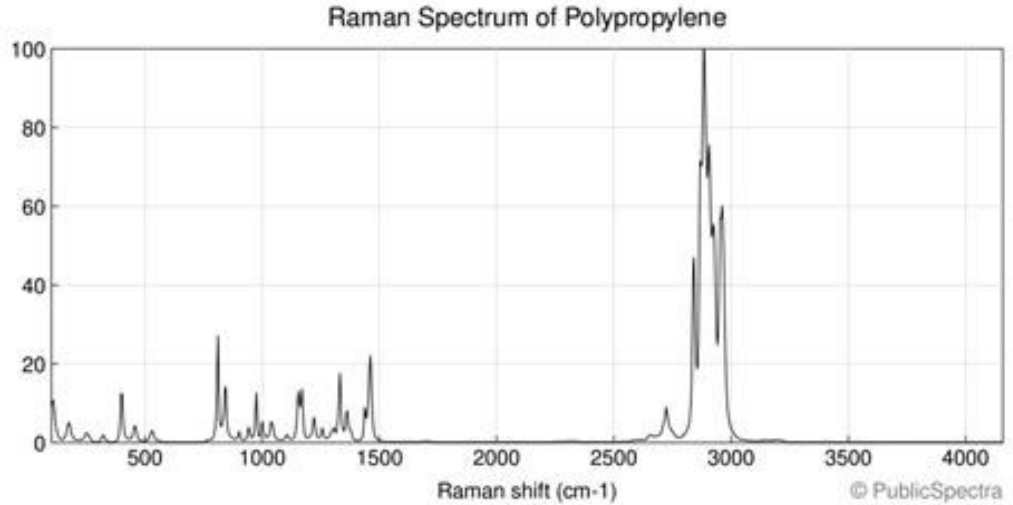


Mesure du signal de Raman pendant 30s sur un miroir en argent et sur du polypropylene

- Il y a toujours un peu de signal résiduel dû au laser
- Mais on est quand même capable de voir les pics pour le polypropylene

4. Avancement actuel
Premiers résultats





Après conversion de la longueur d'onde en nombre d'onde □ le signal mesuré est en accord avec la littérature

5. Etapes à venir

- Finir la programmation du Rasberry Pi
- Impression 3D des supports optiques
- Impression 3D de la « block stage »
- Construire le microscope de Raman!