

Project proposal

Title: SC_RAMAN_IMPROVEMENT_2021
 Supervisor: Christophe Galland
 Timeframe: Autumn 2021

EPFL Xplore is an interdisciplinary project whose aim is to design and develop a Rover to participate in two international competitions: The University Rover Challenge and the European Rover Challenge.

Every year, the Rover must complete a different science task. In anticipation of future tasks, we would like to develop a suite of instruments which could be integrated into the rover's science bay, depending on the nature of the science task. The main such instrument would be the Raman spectrometer Artsakh, which would be used to analyze the composition of the soil samples recovered by the rover, as well as potentially detect the presence of water or even life in a sample.

Project description

Problematic

Over the past two semesters, some preliminary work has been done on this topic - a first design was proposed, modified, corrected, and built, and a first draft of the basic software to run the spectrometer was written. However, this prototype design is little more than a proof-of-concept and has many issues which make it impossible/useless to integrate into a rover as it is: a next iteration of design improvements is necessary.

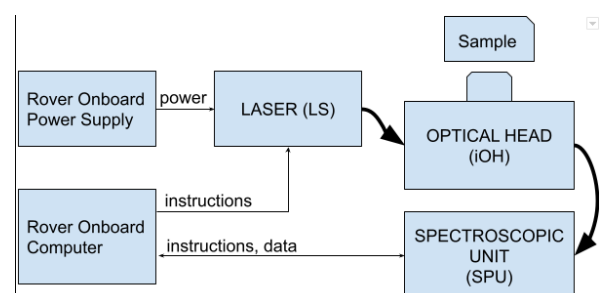


Figure 1: schematic of the Artsakh spectrometer

Therefore, we want YOU to work on (some of) the following issues:

- detector sensitivity: the spectrometer currently requires an extremely sensitive (and expensive!) detector in order to see anything other than noise - we would like to improve the SNR of the design in order to use a more "reasonably priced" detector (e.g. by using active cooling on a standard detector).

- electronically focusable optics: the spectrometer is not always focused on the sample. A design must be proposed, which will include hardware allowing for an "autofocus".

- user feedback: currently, the spectrometer probes blindly. Some feedback to the user about what is being probed is necessary - hence the need for the hardware allowing brightfield imaging, as well as a visible-light camera.

- fine control: the spectrometer currently lacks fine control of the probed location. A fine XYZ-linear translation stage would be a useful addition to its capabilities.

Once you have a design and if time allows, you should:

- implement a prototype of your design (at least on an optical breadboard)

- test and validate your design under field conditions with the Team Scientists

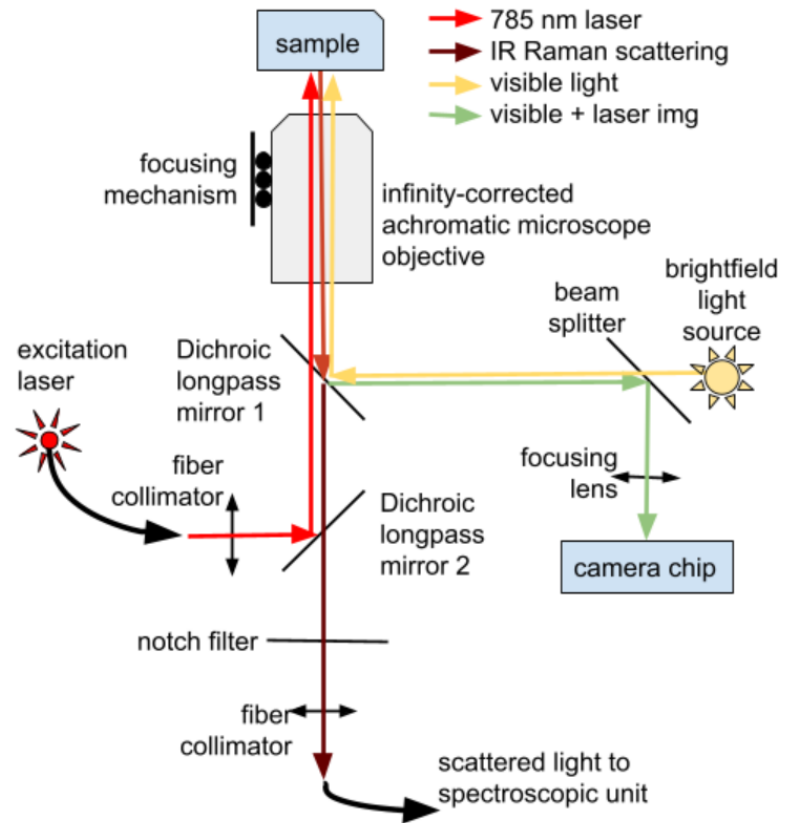


Figure 2: schematic of the possible improved system

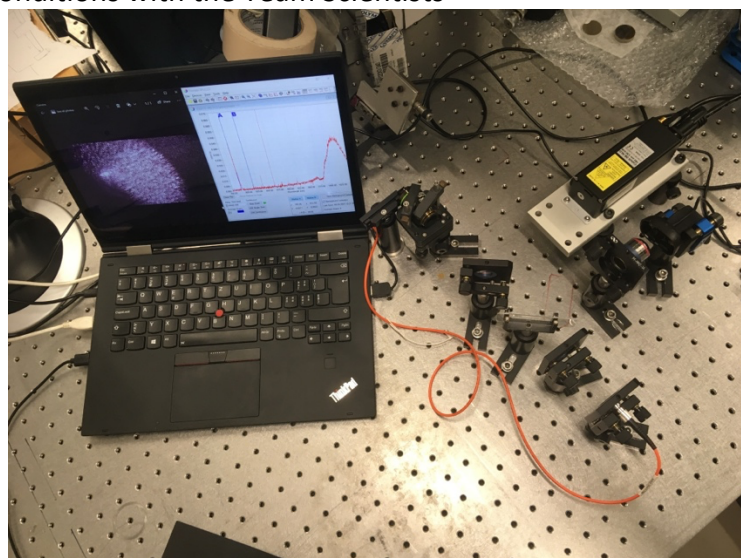


Figure 3: the current prototype design on a breadboard

Target Sections

OPTICS / MICTROTECHNOLOGY / MECHANICS

Resources

A design concept has already been sketched out; however you are free to improve it however you see fit.

EPFL Xplore already has some of the hardware from the previous designs.

Contact

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