EPSC Abstracts
Vol. 12, EPSC2018-62-2, 2018
European Planetary Science Congress 2018

SpectroLab: a planetary test bench for spectroscopic analysis in a CubeSat

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1. Introduction

Spectroscopic analysis of soil samples provides precious information about the nature and composition of the rocks.

2. SpectroLab

The idea of SpectroLab is to build an easy-to-move test bench, which could be used in different environments: on a Lunar lander, with a robotic arm to bring the samples to analyse, or in extra-terrestrial facilities etc.
To do so, the format of SpectroLab is inspired by a 2U CubeSat. The spectrometer is located in the top unit, with a lamp and a camera to monitor the state of the system. In the lower unit, the sample holder is shaped as a drawer which can be pulled out to place the sample, and then in to analyse it. When the drawer is open, a calibration target faces the aperture of the spectrometer to allow the best precision of measures.

Figure 1 - SpectroLab 1.0

3. Different test configurations

There are two configurations: the "Lab mode" and the "Lander mode".

In the "Lab mode", we consider that the user is close to the SpectroLab. SpectroLab is plugged to a laptop, on which the user runs the spectro analysis. The operator activates the opening of the sample holder, place the sample and closes it.
In the "Lander mode", SpectroLab is embedded on the ExoGeoLab lander (EuroMoonMars robotic test bench). Using the equipment on board the lander, the user can control SpectroLab remotely: open the sample holder, store the flat field, close the drawer and acquire the spectrum of the sample. The user will also have access to a live view of the sample holder, to allow him to check the functioning of it all, the illumination of the sample, etc.

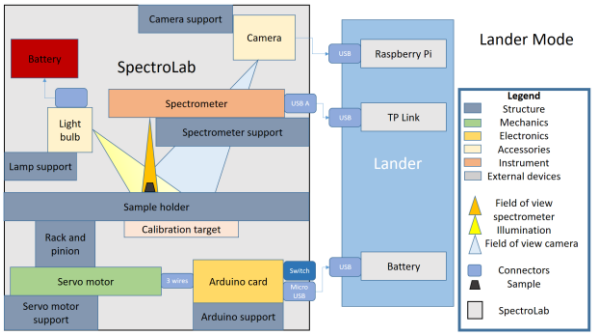

Figure 2 - SpectroLab architecture in Lander Mode

4. Development of SpectroLab

The development of SpectroLab is still ongoing. Figure 1 shows the first version of the test bench; it still lacks the servomotor and control system of the drawer as well as the camera and the illumination system. It is the simplest configuration allowing to run spectro tests.
We 3D printed the structure at ESTEC, in the EuroMoonMars ExoHabitat.

5. Future uses

This SpectroLab is a prototype for a future planetary spectroscopic test bench. To make the design adapted to extra-terrestrial use, it would of course need to be

either made of a more resistant material, or 3D printed once arrived on location.

6. Scientific aspect

The work on SpectroLab also has a more scientific part, dedicated to the data analysis. We are developing a detailed method allowing to get spectra with as little noise as possible in the 700nm – 880nm range for characterisation of Moon and Mars minerals, as well as a database of spectra of Moon/Mars analogue minerals.

Acknowledgements:

We would like to thank the International Lunar Exploration Working Group (ILEWG) and acknowledge the help Alexander Zaklinsky provided by lending us his 3D printer.

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