DEVELOPMENT OF THE CALIBRATION TARGET FOR EXOMARS' RAMAN INSTRUMENT (RLS).

A. Sansano[1], R. Navarro[1], G. López-Reyes[1], and F. Rull[1], [1]Unidad Asociada UVA-CSIC a traves del Centro de Astrobiologia (SPAIN) (sansanoca@cab.inta-csic.es)

Introduction: ExoMars 2018 main Scientific objective is "Searching for evidence of past and present life on Mars" and the Raman Laser Spectrometer (RLS) is one of the Pasteur Payload instruments of ExoMars mission.[1]. This instrument will analyze samples drilled from until 2 meters deep and crushed as powder.

Raman Spectroscopy is used to analyse the vibrational modes of a substance either in the solid, liquid or gas state. It relies on the inelastic scattering (Raman Scattering) of monochromatic light produced by atoms and molecules. The radiation-matter interaction results in the energy of the exciting photons to be shifted up or down. The shift in energy appears as a spectral distribution and therefore provides an unique fingerprint by which the substances can be identified and structurally analyzed.

Calibration Targets for spectroscopy devices are very important on the develop of space instruments [2],[3]. We need to calibrate two subjects on board. One is the laser wavelength and the other one is the relationship between CCD pixel and wavelegth. For both we need a target that has enough separated signals to perform a accurate calibration. With this signasl we can elaborate a calibration equation to assign the correct value to each pixel.

Due to the complexity and precision of the instrument, calibrations will be conduct on board the rover. This is necessary to make comparable the results with the obtained spectra databases, and also to evaluate the health of the instrument.

Description: The calibration target consists in one cylindrical container of 5-6 mm diameter and 2-3 mm high located in the SPDS in a position as one of the MOMA's ovens. This calibration target container will be filled by a mixture of powdered standard compounds with a spectral Raman response covering the entire spectral range and with enough number of bands able to perform a precise calibration.

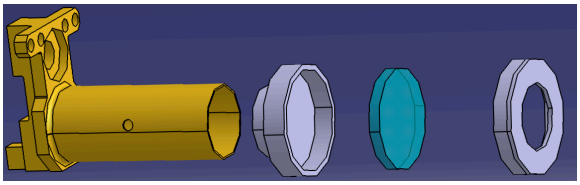

Figure 1: CT Holder Elements

Calibration target composition. For calibration sample have been searched a combination of organic and inorganic compounds that have spread throughout the range signals while meeting a number of other conditions, which are: Stable, wide range of signal in function of their composition, easy to manipulate and conformate, light.

This mixture, finely pulverized and homogeneously mixed, will be introduced in a sealed envelope with a window on top that allows the measurement. The actual compounds used for the mixture are Calcite, KSCN, 2-naphtol and DMG, but this list is still open until the final test would be done.

Hardware. The container, suitably sealed to meet the requirements of Planetary Protection, will be located on a level equivalent to an oven in the SPDS MOMA support. Thus when this turns, will position the calibration sample under the Raman probehead that will acquire Raman spectra of the mixture inside.

The RLS instrument will be accommodated and operate inside the Rover's ALD (Analytical Laboratory Drawer) with the unit directly in contact with samples, the internal optical head, placed at the UCZ (Ultra Clean Zone), which complies with COSPAR Planetary Protection requirements.

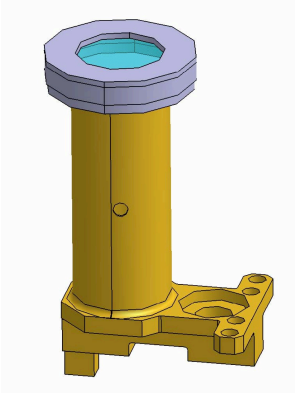

Figure 2: CT Holder Overview

Calibration procedure overview

The compounds will give us different Raman signals that are convertible to wavelength from the wavelength of the laser and hence an exact relationship between the position and the corresponding pixel of the CCD were taken out. Normally this can fit a curve of the second or third grade and this will be precisely the

calibration function of the instrument. The CCD detector will be a Non Inverted Mode, 2048 X 512 pixels detector. CCD pixel size is 15 microns. The CCD requires a specific cold condition to provide the required performance for that it will be thermally controlled by means a TEC for be kept within a -40ºC to -10ºC temperature range.

First tests

This is an example spectrum for the mixture made in the laboratory calibration.

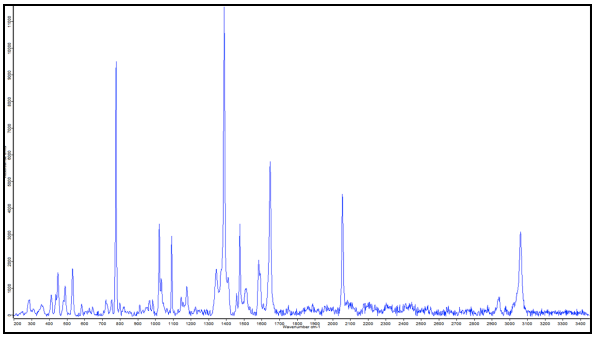

Figure 3: CT Spectrum on standard conditions

In figure 3, we can notice that we get more tha 20 sharpe and clear signals, enough to perform a good calibration.

Also, we are testing in the temperature conditions that will occur during the mission to assess the influence on the position of the signals

Acknowledgements

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References: Use the brief numbered style common in many abstracts, e.g., [1], [2], etc. References should then appear in numerical order in the reference list, and should use the following abbreviated style:

[1] Rull, F., Martinez-Frias, J. (2006). *Spectroscopy Europe 18*: pp. 18–21. [2] Vaniman D.T. et al. (2009) LPSC XL, Abstract #2296. [3] Vaniman D.T. et al. (2012) *Space Sci Rev* 170:229–255.