

RAMAN LASER SPECTROMETER FOR 2020 EXOMARS MISSION

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Introduction: The Raman Laser Spectrometer (RLS) is one of the Pasteur Payload instruments, within the ESA's Aurora Exploration Programme, ExoMars mission.

Two missions are part of ExoMars: one consisting of an Orbiter plus an Entry, Descent and Landing Demonstrator (launched in March 14th 2016) and the other including a Rover as part of ESA-Roscosmos collaboration (to be launched in 2020). ExoMars Rover would carry a drill and a suite of instruments dedicated to exobiology and geochemistry research and its main Scientific objective is "Searching for evidence of past and present life on Mars".

Raman Spectroscopy is used to analyze 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 a unique fingerprint by which the substances can be identified and structurally analyzed.

The RLS is being developed by an European Consortium composed by Spanish, UK, French and German partners. It will perform Raman spectroscopy on crushed powdered samples, obtained from 2 meters depth under Mars surface, inside the Rover's Analytical Laboratory Drawer.

The Raman Laser Spectrometer Instrument: The RLS Instrument is composed by the following units:

- SPU (Spectrometer Unit)
- iOH: (Internal Optical Head)
- ICEU (Instrument Control and Excitation Unit)

Other instrument units are EH (Electrical Harness), OH (Optical Harness) and RLS Application SW On-Board.

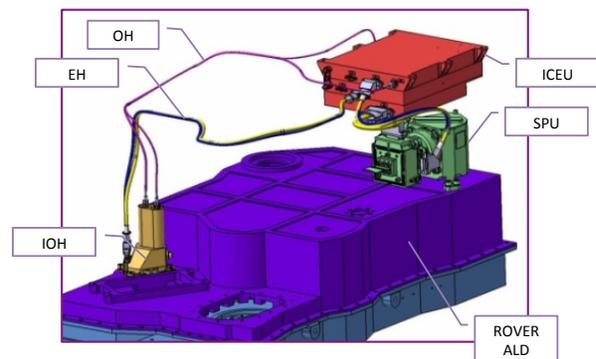


Figure 1: RLS layout over Rover ALD (Analytical Laboratory Drawer)

Results: RLS expected main characteristics are as follows:

- Laser excitation wavelength: 532 nm
- Irradiance on sample: 0.6 - 1.2 kW/cm²
- Spectral range: 150-3800cm⁻¹
- Spectral resolution: between 6 cm⁻¹ and 8 cm⁻¹
- Spectral accuracy: < 1 cm⁻¹
- Spot size: 50 microns

TRL8: After a wide campaign for evaluating Instrument performances by means of simulation tools and development of an instrument prototype, Instrument Structural and Thermal Model was successfully delivered on February 2015.

Since then, the RLS Engineering and Qualification Model has been manufactured and is expected to be delivered by November 2016, after a full qualification testing campaign developed during Q3 & Q4 of 2016.

A summary of main Instrument functionalities obtained during the last months, achieving high levels of scientific performances will be described.