INSTRUMENT DATA ANALYSIS TOOL (IDAT) FOR THE ANALYSIS OF RLS DATA

Jesús Saiz Cano[1], Guillermo Lopez-Reyes[1], Álvaro Guzmán[1], David Moreno-Dominguez[1], Fernando Rull[1], Andoni Moral[2], Carlos Pérez[2], Laura Seoane[2], Jose Antonio Manrique[1], Aurelio Sanz[1], Marco Veneranda[1]
(1) Unidad Asociada Universidad de Valladolid-CSIC-CAB, C/ Francisco Valles 8. Parque Tecnológico de Boecillo. 47151. Valladolid (SPAIN). jsaiz@cab.inta-csic.es
(2) INTA, Crtra. Ajalvir km 4, 28850 Torrejón de Ardoz, Madrid (SPAIN)

Abstract

The Instrument Data Analysis Tool (IDAT) for the Raman Laser Spectrometer (RLS) instrument is a software tool that can be used for the reception, decodification, calibration and verification of the telemetries (science and housekeeping) generated by the RLS instrument. This allows the verification of the instrument status and the reception and interpretation of science data in a very user friendly and fast way. IDAT also incorporates SpectPro, a comprehensive spectra analysis tool for the interpretation and analysis of the science data with tools and operations for both images and binned spectra. In this work, attention is focused on the spectral treatment functionalities of the software.

The RLS IDAT and SpectPro software tools have been key for the acquisition and interpretation of the data from the instrument during the FM calibration and characterization campaign, and will continue to be used during the operations phase of the mission.

1. Introduction

The ExoMars 2020 rover mission will carry a drill able to obtain samples up to 2 meters depth under the Martian surface. It also features a suite of instruments (Pasteur Payload) inside the Rover's Analytical Laboratory Drawer (ALD) dedicated to exobiology and geochemistry research at the mineral grain scale after these samples have been crushed and powdered. The RLS Raman spectrometer is one of these key instruments [1]. The main ExoMars 2020 mission scientific objective is "Searching for evidence of past and present life on Mars". The RLS will contribute to this scientific goal through the precise identification of the mineral phases and the capability to detect organics on the powdered samples.

The on-ground characterization of the RLS FM is of utmost importance to guarantee the accuracy of the data received from the operation on Mars. During the RLS FM performance characterization campaign, several representative samples were analyzed, both in ambient and representative operational temperatures, including NIST standards, calibration lamps, the RLS Calibration Target and mineral powdered samples. These samples have allowed the performance characterization of the instrument, including spectral response characteristics to allow for intensity and wavelength characterization. In addition, the analysis of representative samples has allowed the proper parameterization of the instrument acquisition algorithms [2] for its automated onboard operation.

The use of IDAT/SpectPro software during the RLS instrument test campaign has proven its usefulness, allowing the 'live' interpretation of data and proper monitoring of the instrument state during the tests. Furthermore, the analytical tools for the acquired spectra (SpectPro) have facilitated a very fast analysis of the science data. Now, IDAT and SpectPro need to be adapted to work with data received through the Rover Operations Communications Center (ROCC) of the mission.

2. IDAT and SpectPro

The Instrument Data Analysis Tool (IDAT) for the RLS instrument is a software tool that is used for the reception, decodification, calibration and verification of the telemetries generated by the RLS instrument, including both science and housekeeping (HK) data, as shown in Figs. 1&2. This allows the verification of the instrument status and the reception and interpretation of science data in a very user-friendly and fast way. The use of this tool is necessary during the system development phase of the instrument to provide a fast means for the decompression and interpretation of data in a fast and friendly way, saving a lot of data treatment time during the always-tight schedule on this development phase.

IDAT also incorporates SpectPro, a comprehensive spectra analysis tool for the interpretation and analysis of the science data with tools and operations for both images and binned spectra. This tool includes all types of spectra analysis tools to operate both images (Fig. 3) and linear spectra (Fig. 4), and to perform all kind of operations such as binning, SNR calculation, baseline removal, cosmic ray removal, filtering, cutting, band adjustment to gaussian/lorentzian curves, and it even features a spectra calculator (Fig. 5) to allow operations with spectra in a very simple and reliable way.

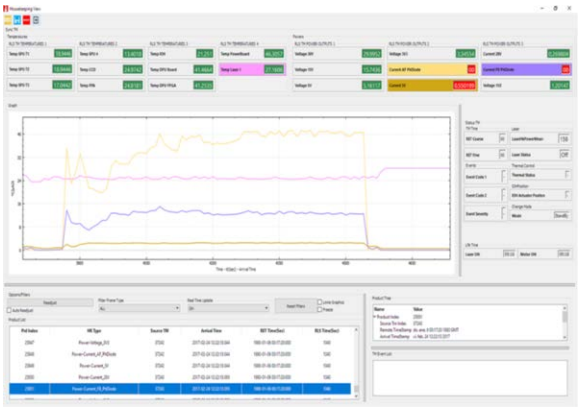

Figure 1. *IDAT housekeeping view. This window allows monitoring the HK telemetry from the instrument in real time*

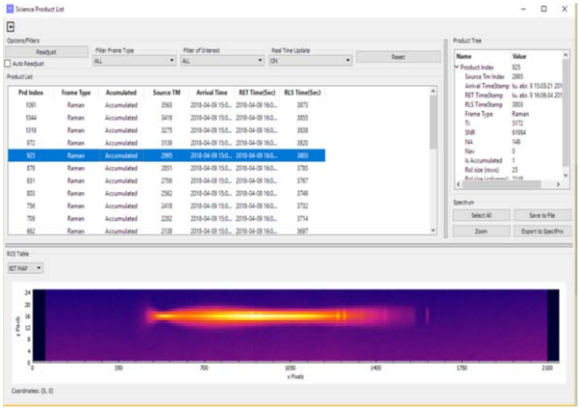

Figure 2. *IDAT science product view. This window receives and shows all science products received from the instrument in real time*

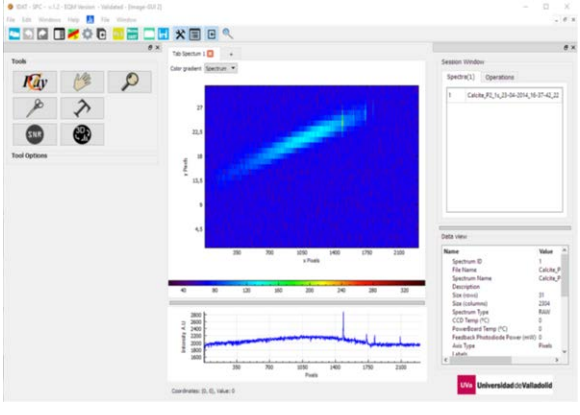

Figure 3. *SpectPro image spectra view. This window allows operation on image spectra.*

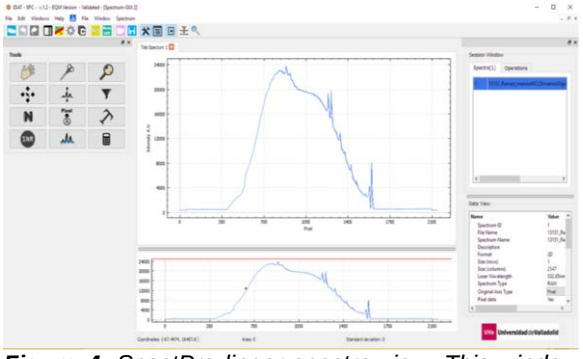

Figure 4. *SpectPro linear spectra view. This window allows operation on linear spectra using the available tool palette on the left.*

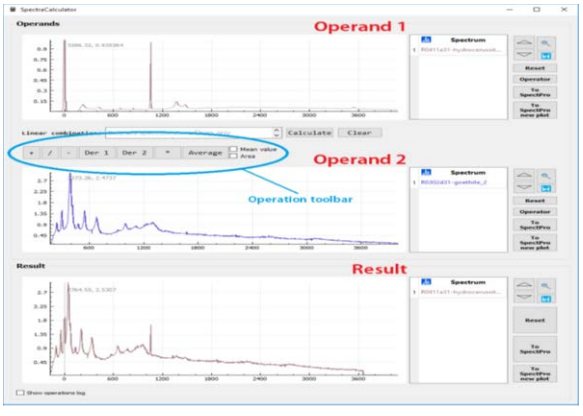

Figure 5. *SpectPro spectrum calculator tool. This tool allows executing diverse operations with spectra for correction or detailed analysis.*

3. References

[1] Rull et al., Astrobiology, 2017, 17, 627-654.

[2] Lopez-Reyes, G. and F. Rull Pérez (2017). "A method for the automated Raman spectra acquisition." Journal of Raman Spectroscopy 48(11): 1654-1664.

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