

SPACE EXPLORATION SYMPOSIUM (A3)
Mars Exploration – Part 3 (3C)

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SOLID (SIGNS OF LIFE DETECTOR) AN INSTRUMENT FOR DETECTING ORGANICS IN
PLANETARY EXPLORATION

Abstract

Habitability is the main goal of Mars Science Laboratory. ExoMars is trying to go beyond with a payload capable to detect some organic molecules from extinct life. Mars 2020 call opens the door to extinct biomarkers identification, new opportunities to explore Mars could be found in the NASA's

Discovery call, and perhaps in the next ESA class M call. Each one is closer to search for extinct and extant biomarkers in the red planet.

SOLID (Signs of Life Detector) instrument was designed to detect organic molecules based on antibody microarrays, a well-known technology in biomedicine field and with a large potential in other areas. SOLID has put together, in a single instrument, all the tools required to identify organic molecules in a few grams of soil. It has two main functional units: Sample Preparation Unit (SPU) and Sample Analysis Unit (SAU). The SPU process a soil sample (0.5 to 2g) and extract the organics into a liquid solution by ultrasonication. The solution is pumped to the SAU where there are several flow chambers with a collection of antibodies. The antigen (target molecule)-antibody reactions are identified by fluorochromes, revealed by a laser and recorded by a CCD. In the end, a matrix of bright dots shows the positions where antibodies are detecting their targets.

SOLID instrument has evolved from the proof of concept (SOLID1.0) to a TRL6 level prototype (SOLID3.1) tested in different field campaigns (Atacama, Río Tinto, Arctic, and Antarctica). Some critical components and subsystems have been tested under Mars relevant conditions. Similarly, some representative antibodies have been tested to verify its degradations level against representative space radiation levels and temperature cycles. The results indicated that antibodies are robust molecules when treated and stored accordingly and are suitable for planetary exploration.

A critical part of the instrument is the selection of the antibody targets and their elaboration. Until now, the SOLID team has a repertory of more than 400 different Ab's, some of them commercial, some specially elaborated from terrestrial extreme environment, some of them elaborated from universal biomarkers on Earth microorganisms. This archive of Ab's allows selecting a proper combination of them as a function of the Mars zone to be explored.