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Performance of the MOMA Gas Chromatograph-Mass Spectrometer onboard the 2018 ExoMars Mission

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The Mars Organic Molecule Analyzer (MOMA) is a dual ion source linear ion trap mass spectrometer that was designed for the 2018 joint ESA-Roscosmos mission to Mars. The main scientific aim of the mission is to search for signs of extant or extinct life in the near subsurface of Mars by acquir-ing samples from as deep as 2 m below the surface. MOMA will be a key analytical tool in providing chemical (molecular) information from the solid samples, with particular focus on the characterization of organic content. The MOMA instrument, itself, is a joint venture for NASA and ESA to develop a mass spectrometer capable of analyzing samples from pyrolysis gas chromatograph (GC) as well as ambient pressure laser desorption ionization (LDI). The combination of the two analytical techniques allows for the chemical characterization of a broad range of compounds, including volatile and non-volatile species. Generally, MOMA can provide in-formation on elemental and molecular makeup, po-larity, chirality and isotopic patterns of analyte spe-cies. Here we report on the current performance of the MOMA prototype instruments, specifically the demonstration of the gas chromatography-mass spec-trometry (GC-MS) mode of operation.
Both instruments have been tested separately first and have been coupled in order to test the efficiency of the future MOMA GC-MS instrument. The main objective of the second step has been to test the quantitative response of both instruments while they are coupled and to characterize the combined instrument detection limit for several compounds. A final experiment has been done in order to test the feasibility of the separation and detection of a mixture contained in a soil sample introduced in the MOMA oven.