End-To-End Performance of the Gas Chromatography-Mass Spectrometry Experiment for the 2018 ExoMars Rover

V. Pinnick[1], A. Buch[2], C. Szopa[3,8], N. Grand[4], R. Danell[5], A. Grubisic[1], F. van Amerom[6], D. Glavin[1], C. Freissinet[1], P. Coll[4], F. Stalport[4], B. Lustrement[3], R. Arevalo[1], W. B. Brinckerhoff[1], H. Steininger[7], F. Goesmann[7], F. Raulin[4], P. Mahaffy[1] and the MOMA Science Team.

[1]NASA Goddard Space Flight Center, 8800 Greenbelt Rd, Greenbelt, MD 20771, USA,, [2]Ecole Centrale Paris, LGPM, Grande voie des vignes, 92295 Châtenay-Malabry, France, [3]LATMOS, Univ. Pierre et Marie Curie, Univ. Versailles Saint-Quentin & CNRS, 75005 Paris, France,[4]LISA, Univ. Paris-Est Créteil, Univ. Denis Diderot & CNRS, 94000 Créteil, France , [5]Danell Consulting, Inc., Winterville, NC 28590, [6] MiniMass Consulting, Hyattsville MD, [7]Max Planck Institut für Sonnensystemforschung (MPS), Göttingen, Germany, [8]Institut Universitaire de France, Paris, France.

With the success of the Sample Analysis at Mars experiment aboard the Curiosity rover, the Mars Organic Molecule Analyzer (MOMA) experiment aboard the 2018 European Space Agency's ExoMars mission will be the continua-tion of the search for organic matter on the Mars surface. To increase the probability of detecting intact organic molecules, the ExoMars rover will extract drilled samples from as deep as 2 meters below the Martian surface to minimize effects of radiation and oxidation on organic materials. MOMA is equipped with a dual ion source ion trap mass spectrometer utilizing UV laser desorption / ionization (LDI) and pyrolysis gas chromatography (pyr-GC) which allows for the analysis of a wide range of organic compositions (volatile and non-volatile compounds) from the Martian soil. In order to analyze refractory organic compounds and chiral molecules during GC-ITMS analysis, samples may undergo a one-step volatilization/ derivatization process, which reacts sample target molecules with specific reactants for enhancing volatility (MTBSTFA, DMF-DMA, or TMAH).

This work focuses on the performance verification and optimization of the GC-MS experiment using the Engineering Test Unit (ETU) models of the GC provided by the French team (LISA, LATMOS, CentraleSupelec) and the MS provided by the US team (NASA-GSFC) including a flight-like pyrolysis oven and tapping station providing by the German team (MPS). The results obtained demonstrate the current status of the end-to-end performance of the gas chromatography-mass spectrometry mode of operation.