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Prototype of the gas chromatograph – mass spectrometer to investigate volatile species in the lunar soil for the Luna-Resurs mission.

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The Russian spacecraft Luna-Resurs will be landing on the lunar south pole in 2019. One of the scientific instruments on board the spacecraft is the gas chromatographic mass spectrometric complex (GC-MS), dedicated to analyse the volatiles in the lunar soil.
For this instrument we combined our compact time-of-flight mass spectrometer (TOF-MS) with a chemical preseparation of the species by gas chromatography (GC). Coupled measurements with both instruments were successfully performed with the prototype of the mass spectrometer and a flight-like gas chromatograph. The system was tested with two test gas mixtures, a mixture of hydrocarbons and a mixture of noble gases. Due to its capability to record mass spectra over the full mass range at once with high sensitivity and a dynamic range of up to 10^6 within 1 s, the TOF-MS system is a valuable extension of the GC analytical system. The prototype of the combined GC-MS complex is able to detect concentrations of volatile species in the soil sample of about $2 \cdot 10^{-10}$ by mass for hydrocarbons and $2 \cdot 10^{-9}$ by mass for noble gases.