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Performance of the ACS NIR channel and O_2 profiles

Anna Fedorova (1), Alexander Trokhimovskiy (1), Oleg Korablev (1), Franck Montmessin (2), Karim Gizatullin (1,3), Daria Betsis (1), Alexander Lomakin (1, 3), Andrey Patrakeev (1), Nikita Kokonkov (1), Alexey Shakun (1), Jean-Loup Bertaux (1,2) and the ACS team
(1) Space Research Institute(IKI), Moscow, Russia, (2) LATMOS-UVSQ, Guyancourt, France; (3) MIPT, Dolgoprudnyi, Russia (fedorova@iki.rssi.ru)

Abstract

The Atmospheric Chemistry Suite (ACS) is a set of three spectrometers (-NIR, -MIR, and -TIRVIM) intended to observe Mars atmosphere onboard the ESA-Roscosmos ExoMars 2016 Trace Gas Orbiter (TGO) mission. [1]. The near infrared channel (NIR) is a compact spectrometer operating in the range of 0.7–1.7 μm with a resolving power of $\lambda/\Delta\lambda \sim 25{,}000$. It is designed to operate in nadir and in solar occultation modes. The spectrometer employs an acousto-optic tunable filter (AOTF) to select diffraction orders in an echelle spectrometer. During one measurement cycle it is possible to register up to ten different diffraction orders, each corresponding to an instantaneous spectral range of 10-20 nm.

The main task of NIR channel in nadir will be measurements of the water vapor in 1.38 μm and the O_2 ($a^1\Delta_g$) emission as a tracer of ozone at 1.27 μm. The solar occultation is mostly aimed to study vertical distribution of water vapor and CO_2 density. Figure 1 illustrates the NIR sequence during a solar occultation, which includes measuring of 10 diffraction orders. Three orders are dedicated to different CO_2 bands, allowing one to profile the atmospheric density over a wide range of altitudes, three orders for H_2O, one mixed order, two orders without significant gaseous absorption for measuring aerosols, and one order aimed for the O_2 at 0.76 μm band.

A vertical profiling of the O_2 density is a unique feature of the ACS NIR science in occultation. No other instrument on a Mars orbiting platform being sensitive to O_2 from 10 to 60 km altitude range.

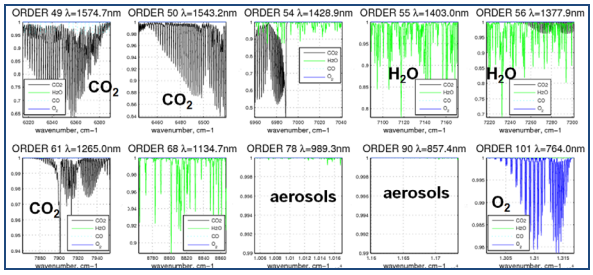

Figure 1: Standard measurement sequence of NIR in solar occultation includes 10 diffraction orders in the range of 0.76-1.58 μm

Here we present the calibration status, performances and first results of the O_2 density retrievals and H_2O vertical profiles from the ACS/NIR solar occultations.

The status, constraints on the signal-to-noise ratio of NIR nadir measurements will be as well presented along with preliminary retrievals of H_2O column abundance and the O_2 airglow intensity.

Acknowledgements

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References

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