



HAL
open science

Performance of the ACS NIR channel and O 2 profiles

Anna A. Fedorova, Alexander V. Trokhimovskiy, Oleg I. Korablev, Franck Montmessin, Karim Gizatullin, Daria Betsis, Alexander Lomakin, Andrey Patrakeev, Nikita Kokonkov, Alexey Shakun, et al.

► To cite this version:

Anna A. Fedorova, Alexander V. Trokhimovskiy, Oleg I. Korablev, Franck Montmessin, Karim Gizatullin, et al.. Performance of the ACS NIR channel and O 2 profiles. European Planetary Science Congress 2018, Sep 2018, Berlin, Germany. pp.EPSC2018-490. insu-04438874

HAL Id: insu-04438874

<https://insu.hal.science/insu-04438874v1>

Submitted on 5 Feb 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Performance of the ACS NIR channel and O₂ 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 O₂ ($a^1\Delta_g$) emission as a tracer of ozone at 1.27 μm . The solar occultation is mostly aimed to study vertical distribution of water vapor and CO₂ density. Figure 1 illustrates the NIR sequence during a solar occultation, which includes measuring of 10 diffraction orders. Three orders are dedicated to different CO₂ bands, allowing one to profile the atmospheric density over a wide range of altitudes, three orders for H₂O, one mixed order, two orders without significant gaseous absorption for measuring aerosols, and one order aimed for the O₂ at 0.76 μm band.

A vertical profiling of the O₂ density is a unique feature of the ACS NIR science in occultation. No other instrument on a Mars orbiting platform being sensitive to O₂ from 10 to 60 km altitude range.

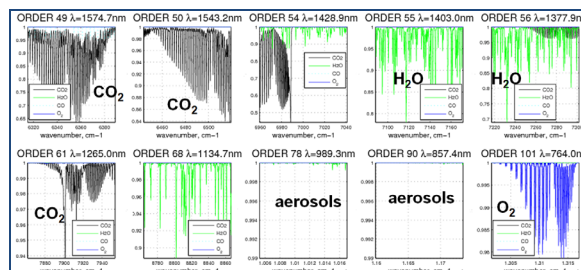


Figure 1: Standard measurement sequence of NIR in solar occultation includes 10 diffraction orders in the range of 0.76–1.58 μm

Here we present the calibration status, performances and first results of the O₂ density retrievals and H₂O 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 H₂O column abundance and the O₂ airglow intensity.

Acknowledgements

ExoMars is the space mission of ESA and Roscosmos. The ACS experiment is led by IKI Space Research Institute in Moscow. The project acknowledges funding by Roscosmos and CNES. Science operations of ACS are funded by Roscosmos and ESA.

References

- [1] Korablev, O., Montmessin, F., and ACS Team: The Atmospheric Chemistry Suite (ACS) of three spectrometers for the ExoMars 2016 Trace Gas Orbiter, Space Sci. Rev., 214:7, 2018.