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Performance of the ACS NIR channel in nadir

Alexander Lomakin (1,2), Anna Fedorova (1), Alexander Trokhimovskiy (1), Andrey Patrakeev (1), Nikita Kokonkov (1), Karim Gizatullin (1,2), Gaetan Lacombe (3), Franck Montmessin (3), Oleg Korablev (1)
(1) Institute of Space Research, Moscow, Russia, (2) Moscow Institute of Physics and Technology, Dolgoprudnyi, (3) LATMOS/IPSL, UPMC Univ. Paris 06 Sorbonne Universités, UVSQ, CNRS, Paris, France
(aleksander.lomakin96@gmail.com)

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 $\lambda/\Delta\lambda$ around 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 in nadir is measurements of water vapor in 1.38 μm and the O_2 ($\text{a}^1\Delta_g$) emission as a tracer of ozone at 1.27 μm . But, first results showed that the signal-to-noise ratio (SNR) of NIR does not exceed 30, while the planned value was more than 100.

ACS/NIR in terms of nadir capabilities can be compared to SPICAM IR: both spectrometers work in almost similar spectral range but they have different resolving power: ~ 2000 for SPICAM and ~ 25000 for NIR. Here we will present a comparison of the water retrieval for close observations of two instruments, NIR calibration status, signal-to-noise estimations and first results from ACS/NIR nadir mode.

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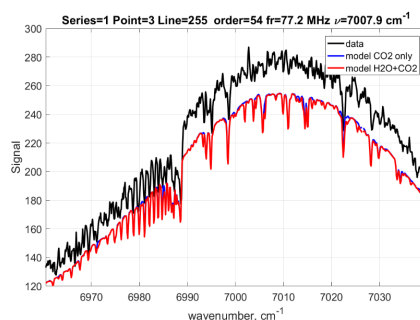


Figure 1: Example of the ACS-NIR spectrum in nadir in order 54 corresponding to CO_2 1.43 μm band

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.