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## Performance of the ACS NIR channel and O<sub>2</sub> profiles

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### 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  $\mu\text{m}$  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  $\mu\text{m}$  and the O<sub>2</sub> ( $a^1\Delta_g$ ) emission as a tracer of ozone at 1.27  $\mu\text{m}$ . The solar occultation is mostly aimed to study vertical distribution of water vapor and CO<sub>2</sub> 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<sub>2</sub> bands, allowing one to profile the atmospheric density over a wide range of altitudes, three orders for H<sub>2</sub>O, one mixed order, two orders without significant gaseous absorption for measuring aerosols, and one order aimed for the O<sub>2</sub> at 0.76  $\mu\text{m}$  band.

A vertical profiling of the O<sub>2</sub> density is a unique feature of the ACS NIR science in occultation. No other instrument on a Mars orbiting platform being sensitive to O<sub>2</sub> from 10 to 60 km altitude range.

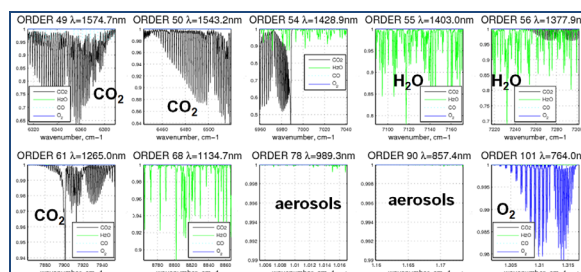


Figure 1: Standard measurement sequence of NIR in solar occultation includes 10 diffraction orders in the range of 0.76–1.58  $\mu\text{m}$

Here we present the calibration status, performances and first results of the O<sub>2</sub> density retrievals and H<sub>2</sub>O 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<sub>2</sub>O column abundance and the O<sub>2</sub> airglow intensity.

### Acknowledgements

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### 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.