EPSC Abstracts
Vol. 17, EPSC2024-1190, 2024, updated on 12 May 2025
https://doi.org/10.5194/epsc2024-1190
Europlanet Science Congress 2024

Guiding and Target Acquisition for the Ariel Space Mission: Algorithms and Performance

Gerald Mösenlechner, Roland Ottensamer, and Franz Kerschbaum
Department of Astrophysics, University of Vienna, Vienna, Austria (gerald.moesenlechner@univie.ac.at)

Nothing in space is ever truly stable. For space telescopes such as Ariel, this leads to a noise source in photometric and spectroscopic measurements caused by the movement of the target star or spectra (also refereed to as jitter) across the detectors inconsistent pixels. In order to minimise this source, continuously guiding the telescope becomes a necessity.

Ariel will perform both photometric and spectroscopic observations of transiting exoplanets across multiple phases of their orbit in order to study the chemical composition of their atmosphere. Given the long duration of these observations, an unstable pointing of the telescope would add significant noise to the time series of the measurements. Therefore, Ariel is equipped with a dedicated instrument: the Fine Guidance Sensor (FGS). While the FGS is a scientific instrument that provides both low-resolution spectra and photometry in bands specific to atmospheric molecular features, it also doubles as an input for the closed loop guiding of the telescope. For this task, the FGS uses two of its three photometric channels to measure the position of the target star at a rate of 10 Hz. This positional information is then sent to the spacecrafts Attitude and Orbit Control System (AOCS), which applies the necessary corrections using the platforms actuators. In order to obtain the necessary measurements, the FGS will be equipped with dedicated guiding algorithms as part of its Instrument Application Software (IASW), which is developed by the University of Vienna.

In this paper we present the current state of the design of these methods. The algorithms are split into Target Acquisition and Tracking, where the former is used to correctly identify the star on a large field of view. On the other hand, Tracking is used during the scientific observations of the target in order to keep the instruments line of sight as stable as possible. In addition to the design and implementation of these algorithms, we also discuss their performance and our tools for their evaluation and testing. The images we use for performance testing are generated using our own simulators. These simulators are able to properly represent the noise sources we expect in the real instrument such as detector noise, line of sight jitter and smearing. Additionally, the simulators are designed to be as fast as possible to allow their reuse in closed loop testing, both in simulation environments and using real hardware.