Contribution ID: **84**                                   Type: **not specified**

# ARRAKIHS FGS task and simulator

*Wednesday 11 March 2026 14:00 (1 hour)*

The European Space Agency's (ESA) F-class mission Arrakihs aims to study the nature of galaxy formation, and the role of baryonic physics and dark matter by observing the faint structures within the halos of nearby MW-like galaxies at unprecedented depth. The required surface brightness is achieved by stacking multiple observations. The high image quality needed is obtained by the inclusion of a Fine Guidance System (FGS) within the control loop of the satellite's Attitude and Orbit Control System (AOCS) during the science exposures. Four modified Maksutov-Cassegrain telescopes of 15 cm effective aperture simultaneously observe different wavelength bands. Two channels operate in the Near Infrared (NIR) using H2RG detectors, whereas the other two operate in the Visual (VIS) using CIS-300 detectors. The NIR channels are simultaneously used for the FGS, thus serving a dual purpose. The Arrakihs FGS will track the movement of multiple guide stars, which can be distributed over the entire detector area. The input data for the FGS is cut out of the full frames (FF) produced by the continuous periodic non-destructive readouts every ~1.5 seconds. Depending on the guide star's location on the detector, it probes a different span in time and gets uniquely moved by rotation. The different quality of each guide star needs to be considered in the preparation of the data for the AOCS. The derived algorithms for acquisition and guiding are validated by simulation. The simulator used was based on the one developed for the ARIEL FGS [Mösenlechner et. al., SPIE 2024], with expanded functionality capturing the specific time and position dependent errors. This poster describes the design of the ARRAKIHS FGS task and the simulator used for development and testing, including the trajectory-based approach to star signal calculation.

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**Session Classification:**  Poster Session