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PLATO SATELLITE POINTING PERFORMANCE – PAVING THE WAY FOR CHARACTERISATION OF EARTH-LIKE EXTRASOLAR PLANETS

Abstract

PLAnetary Transits and Oscillations of stars (PLATO) is a medium class ESA mission in the Cosmic Vision program. The goal of the PLATO mission is to detect a large number of terrestrial exoplanets in the habitable zone around solar-like stars. The planets will be characterized to determine their bulk properties as well as their age.

PLATO will be placed in an orbit around the Lagrangian point L2 of the Sun-Earth system. 26 cameras (24 normal cameras and 2 fast cameras) are accommodated on the satellite to perform long (3.85 days), high precision observations of large samples of stars. The detection and characterization of planetary transits that alter the observed light curves reveal the required information about the transiting planets. The characterization of the light curves coming from these long, uninterrupted and highly stable observations is the key to the scientific goal of the PLATO mission. The main scientific measurement concepts are: the transit method (measurement of the dimming of stellar flux by an orbiting planet passing through the line of sight of Earth) and Asteroseismology (measuring intrinsic oscillations of stars). These measurement concepts lead to pointing performance requirements that demand a highly stable long term pointing performance (3.85 days observation time) as well as highly stable short term pointing performances for example during 25 s image acquisition.

The most demanding pointing requirements are formulated in frequency domain and are to be verified by power spectral density estimation. Due to the large frequency range of the pointing requirements (3 Hz to 40 mHz) the satellite disturbance sources that need to be considered range from thermo-elastic effects at low frequencies to attitude control stability at high frequencies. Moreover, demanding requirements during image acquisition lead to the necessity of microvibration analyses. All of these disturbance sources have been analysed and it has been studied in detail how they affect the satellite pointing stability. Extensive long term simulations and analyses taking into account all relevant disturbance sources have been accomplished.

We gained a comprehensive understanding of the mission requirements and the relevant pointing distur-

bance sources and how they affect the PLATO mission performance. The result is a robust satellite design that complies with the defined scientific mission goals.