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THE QUEST FOR EARTH-LIKE PLANETS: PLATO MISSION PERFORMANCE STATUS AT COMPLETION OF THE PRELIMINARY DESIGN PHASE

Abstract

The European Space Agency's upcoming planet-hunter mission, PLATO, aims to survey tens of thousands of stars simultaneously with unprecedented precision, enabling the discovery through transit photometry of hundreds (if not thousands) of as yet unknown extra-solar planets and boosting our ability to study the formation and evolution of planetary systems. Long periods of uninterrupted observation, over timescales of the order of years, have the capacity to unveil planets at orbital distances hitherto largely unexplored, enabling key questions in the flourishing field of exoplanet science to be addressed. PLATO promises to supply a wealth of new targets for further study by both ground and space-based observatories, in turn helping to maximise their scientific yield.

The demanding science goals of the PLATO mission translate into ambitious engineering requirements, ranging from a large field of view (over 47deg x 47deg) coupled with arcsecond pointing stability, ultra-low noise and high reliability and availability. The need to manufacture, test and integrate 26 individual telescopes in time for a launch in 2026 adds a further dimension of complexity to the mission development. These factors have motivated early validation of key performance capabilities.

With the spacecraft system and the payload having now successfully completed their Preliminary Design Reviews, alongside the results of tests on both breadboard and flight hardware becoming available, the expected performance at mission level has recently been consolidated. In this paper, we present the results of this consolidation in the form of the expected end-to-end technical performance of the PLATO mission, pulling together information on the up to date design along with the latest analyses and test results for the spacecraft and payload. The methodology for budgeting and breakdown of top-level mission performance parameters to lower levels, the elucidation of key performance drivers and the key aspects of corresponding design features are also described.

In addition to the predicted performance of PLATO being relevant for the scientific community, the mission design and development experience in pursuit of the desired performance is of potential benefit for developers of other ambitious astronomy missions of the future.