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REVIEW ARTICLE

Characterization and performances of the primary mirror of the PILOT balloon-borne experiment

C. Engel · I. Ristorcelli · J.-Ph. Bernard · Y. Longval · C. Marty · B. Mot · G. Otrio · G. Roudil

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Abstract PILOT is a balloon-borne experiment designed to perform large-scale surveys of the polarized interstellar emission in the submillimeter. It is based on the use of an off-axis Gregorian type telescope, with a 1 m diameter primary mirror, and a large focal plane equipped with detectors arrays providing a $\sim 1^\circ \times 1^\circ$ field of view. All optical elements except the primary mirror are located inside a large liquid He cryostat, cooled down to 3 K. Strong constraints are then imposed on the alignment between the primary mirror and the cold optics. The characterization and optimization of the optical system performances are critical to the success of the mission. In this paper, we present the modelling and measurements performed on the primary mirror for this purpose. The optical and mechanical parameters of the as-built primary mirror have been determined using a method based on 3D measurements of the mirror surface. The deformations expected under flight conditions due to temperature variations and flexion under gravity have been estimated. We have also performed measurements using a submillimeter test bench in order to control the image quality and derive the main optical parameters. The parameters derived from the modeling using 3D measurements are in agreement with the requirements except for the conic constant. The best positioning of the mirror has been optimized consequently. The modeling has also allowed us to determine the pre-flight alignment parameters of

C. Engel (✉) · I. Ristorcelli · J.-Ph. Bernard · C. Marty · B. Mot · G. Roudil
Université de Toulouse, UPS-OMP, IRAP
CNRS, IRAP,
9, avenue du Colonel Roche BP 44346, 31028 Toulouse Cedex 4, France
e-mail: celine.engel@irap.omp.eu

Y. Longval
Institut d'Astrophysique Spatiale, CNRS & Université Paris Sud-11, Bat. 121, 91405 Orsay Cedex, France

G. Otrio
CNES Centre spatial de Toulouse, 18 avenue Edouard Belin, 31 401 Toulouse Cedex 9, France