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Optical characteristics and performances of the PILOT ballon-borne experiment

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Engel C. and the PILOT collaboration

Optical Characteristics and Performances of the PILOT balloon-borne experiment

PILOT is a balloon-borne astronomy experiment, designed to study the polarization of interstellar dust emission in our Galaxy. The PILOT instrument will allow simultaneous observations in two photometric channels at wavelengths 240 μm (1.2 THz) and 550 μm (545 GHz). The angular resolution is better than 3.5 arc minutes over an instantaneous field of view of 0.8°x1°, with diffraction limited image quality.

The concept is based on a Mizuguchi Dragone type telescope, coupled with a re imager system and a polarimeter. The polarization will be measured using a combination of a rotating half-wave plate near the Lyot stop and a fixed analyzer grid positioned in front of the detectors housing. The optical configuration is optimized in order to provide good optical performances, to minimize stray light and instrumental polarisation. All the optical elements are cooled down at 3K except the primary mirror.

We have characterized each optical component at 20°C. For secondary mirror, a measurement of the foci positions was done using a visible test bench. For the lenses and the primary mirror, 3D measurements were performed on the optical surfaces. In addition, the image quality of the primary mirror was measured using a submm test bench.

On the basis of the results obtained using the characterizations done at 20°C, we have modelled the behaviour of the optical components for different environmental conditions (thermo-elastic and gravity effects). These results have been used to optimize the optical modelling of the system and to evaluate the best mechanical position for each optical component in the instrument.

The optical performances of the system have been assessed and are in agreement with the requirements in term of image quality and tolerancing. The instrumental polarization is currently studied in details. All the optical performances will be measured during ground tests, on the integrated payload system.

We will present the results obtained on the characterization of each components, the estimated optical performances and the planned tests.