

Design and qualification of a recessed satellite cornercube retroreflector for ground-based attitude verification via satellite laser ranging

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The design and qualification of a retroreflector specifically designed for a CubeSat (CubeL) is described.[1] The CubeSat will be launched to space end of 2019 and demonstrate the latest generation of the optical space infrared downlink system developed by the German Aerospace Center together with the industrial partner Tesat-Spacecom. The retroreflector is optimized to allow for a coarse verification of the satellites attitude control system. Attitude information is obtained from the analysis of the returned photon count, when the satellite is operated in station pointing mode during satellite laser ranging (SLR). To achieve this goal, the entrance face of the retroreflector is recessed by a circular tube-shaped aperture. Due to this recession, the signal reflected from the retroreflector falls off rapidly when the retroreflector is tilted away from the SLR station. From measurements of the retroreflectors far-field diffraction pattern and calculations, we expect to be able to determine the orientation accuracy of the satellite to within $\pm 2^\circ$. The proposed method is an effective and cheap way for coarse attitude verification, e.g., for satellites of mega-constellations with any existing satellite laser ranging ground station. In addition to this particular project, plans for the development of novel retroreflector arrays (including a pyramid for LEO satellites) at the Institute of Technical Physics (DLR Stuttgart) are outlined.

[1] N. Bartels *et al.*, "Design and qualification of a recessed satellite cornercube retroreflector for ground-based attitude verification via satellite laser ranging", CEAS Space Journal (2019). <https://doi.org/10.1007/s12567-019-00255-x>