

Improvements in ALMA band 10 optics: Influence of IR filters and solutions

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Abstract—ALMA band 10 (787 – 950 GHz) tertiary optics is located in the 4K stage of the ALMA cryostat and the RF signal has to go through two infrared filters and one quartz window in the optical path between optics and secondary. It has been found that when the standard optics design is used at cryogenic temperatures in the real receiver, performance is degraded with respect to measurements at room-temperature without filters and window. This degradation consists of strange beam side lobes or unexpected interference patterns which degrade efficiency. The origin of this degradation has been found to be multiple reflections in filters and in the plane of the corrugated horn aperture. An improved design using chamfered-rim corrugated horns and absorbent paint around the horns has been adopted and tested. Results show improvements and achieved performance is similar to performance before inserting filters and window in the optical path. Cross-polarization measurements have also been performed to guarantee there is no degradation with the new optics design. This paper proposes a very simple solution for a problem which can be potentially encountered in practical mm/sub-mm cryogenically-cooled receivers.