Optical design of the submillimeter limb sounder TELIS

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TELIS (Terahertz and submm Limb Sounder) is cooperation between European institutes, DLR, RAL and SRON, to build a three-channel balloon-borne heterodyne spectrometer for atmospheric research. The optical front-end of the instrument consists of a dual-offset Cassegrain pointing telescope, calibration blackbody and relay optics, common for the three channels. Beam separation between the channels is performed quasioptically by a dichroic filter and a polarizer. After the splitting, the three beams enter liquid helium cooled cryostat, where each receiver has dedicated cold optics and mixer elements.

In this paper we present optical design and experimental results of the quasioptical 500 - 650 GHz channel for TELIS. It is based on a phase-locked Superconducting Integrated Receiver (SIR). The SIR chip is placed on the flat back surface of the elliptical silicon lens. Further shaping and relaying of the beam is done by means of reflective optics.

Design and validation of the optics, as well as estimation of optical components tolerances, have been performed using commercial software packages ZEMAX and GRASP.

In this paper we present experimental results of the amplitude-phase beam pattern measurements of the SIR cold optics performed at 620 GHz. We have also measured amplitude beam pattern of the complete instrument, including the telescope, using the compact range. Results of these tests will be presented at the conference.