

Evaluation and correction of distortion for real-time terahertz camera

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Terahertz active imaging in transmission is an elegant solution to see through object made of non-polar materials optically opaque [1]. One of the main challenges of applied terahertz imaging is to achieve fast acquisition with high quality images. In particular, one has to take into account the geometrical aberrations of the optical set-up that generate image distortions. Distortions can be an important issue for advanced applications such as tomography [2].

In this study, we characterize the distortion of a real-time terahertz imaging set-up with the help of a hole array acting as a diffraction mask. The idea is to quantify experimentally the distortion and numerically correct images.

The THz source is the Teracascade QCL emitting 1mW at 2.5 THz [3]. The detector is the commercial TZcam camera from I2S society [4] that integrates the micro-bolometer array from CEA LETI (Fig. 1 (a)). The mask (Fig. 1 (b)) is 3D printed 3mm thick plate made in absorbing material. The array is composed of 2 mm and 3 mm diameter holes with a pitch of 4 mm. The external square is corresponding to the object field of view.

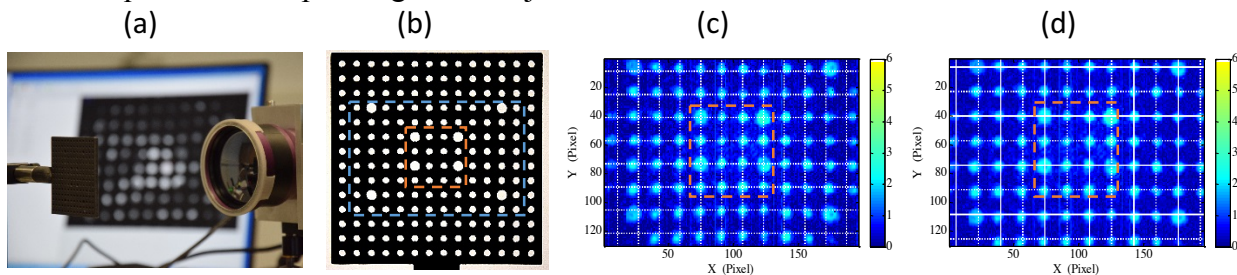


Fig. 1. (a) Terahertz imaging setup at 2.5 THz, (b) Optical picture of the mask holes, (c) Superposition of distorted mask image with the reference grid (d) Superposition of distortion corrected image with a new reference grid which matches all the points.

Terahertz normalized images in transmission of the mask is presented in **Fig. 1** (c). The superposition of this image with a reference grid highlights the distortion due to geometrical aberrations of the complete optical set-up. The reference grid is created so that it matches the group of 4*4 holes at the center of the image. The paraxial magnification is equal 0.20 and the relative distortion calculated at edges positions is equal to 0.07.

To correct this pincushion distortion, a numerical algorithm is performed on the image with the calculated factor. The distortion corrected image is shown in **Fig. 1** (d) where a new grid with a new paraxial magnification of 0.21 matches all the point of the mask.

References:

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