Wideband sensitive THz core for application integration

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***Abstract*— A compact camera core designed for application integration is introduce. The camera core shows high sensitivity over a wide spectral range.**

I. INTRODUCTION

IN recent years there has been an increase in interest and in development of terahertz (THz) waveband technologies for various applications[1,2]. Terahertz wavelengths are longer than their infrared counterpart. These long wavelengths combined with a lower material absorption, result in long penetration depth into various materials and are therfore perfect candidates for see-through imaging. The selection of the wavelength used to perform an inspection depends on the material to be analyzed and the atmospheric transmission. Typically longer wavelength are required to see through denser materials. Consequently a wavelength that is good for a given material inspection may not be suitable for another kind of material. When facing a new application an existing detector may not have an optimal response for a given wavelength. Therefore a detector with a wideband response is needed to address the development of new applications. Moreover as the THz technology moves from the laboratory environment to the market place there is an emerging need for a compact camera core that can be easily integrated into prototype and products.

INO has a long history in the development of very low noise camera cores for device integration and of uncooled microbolometers[3] focal plane array sensitive to the THz waveband. Combining this expertise INO has developed a new camera core that shows a broad sensitive response up to the millimeter waveband.

II. RESULTS

INO has thus developed a compact electronic core making use of INO 384x288 THz FPA. The FPA specifically designed for the THz waveband is packaged in a sealed metallic package. The electronics is based on a micro-platform and exhitbit an extremely low noise level. The full performances of the FPA can thus be reached since the system capabilities are not limited by the electronics.

The electronics can incorporate basic image processing functionalities such as gain and offset corrections, bad pixel replacement and reverse video. A thermo-electric cooler controller is also added to accommodate various potential integration scenarios. Furthermore the camera is equipped with a gigabit Ethernet link enabling seamless integration with standard computers. The cross-section of the electronic core is 57 mm x 57 mm in size.

The rectangular form factors is designed to optimize compactness and functionalities, nevertheless the layout of the electronics core can be modified to accommodate other form factor.

The THz FPA shows high sensitivity from 40 µm to more than 1 mm. The package is a commercial adaptation of a previous packaging technology developed at INO[4]. The custom metallic package can accommodate imaging objective with F-number as low as F/0.7. The fast collection optics[5] combined with high FPA sensitivity and low-noise electronics opens the way to imaging with low power sources over a very broad range of wavelengths. Furthermore, the use of fast optics improves the modulation transfer function (MTF) of the system. A system with a better MTF will provides higher transmission of the high spatial frequency content[6,7]. It results a better contrast of the resulting image and the resolution is thus improved. In this paper a review of the compact electronics, the FPA, the optics and the performances of the core will be presented, along with imaging examples.

III. SUMMARY

A new compact THz camera core is introduced. The high sensitivity broadband FPA is combined to a very low noise level electronics. With its high acceptance angle the FPA can be used with new fast optical elements making it an ideal tool for prototyping applications.

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