

Uncooled Terahertz real-time imaging sensors developed at LETI: present status and perspectives

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The commercial spread of terahertz (THz) cameras has to fulfil simultaneously the criteria of high sensitivity and low cost and SWAP (size, weight and power). Monolithic silicon-based 2D sensors integrated in uncooled THz real-time cameras are good candidates to meet these requirements. Over the past decade, LETI has been studying and developing such arrays with two complimentary technological approaches, i.e. antenna-coupled silicon bolometers and CMOS Field Effect Transistors (FET), both being compatible to standard silicon microelectronics processes.

LETI has built upon its know-how in thermal infrared bolometer sensors a proprietary architecture for THz sensing. High technological maturity has been achieved as illustrated by the demonstration of fast scanning of large field of view and the recent birth of a commercial camera in collaboration with the French SME I2S.

Two FET-based approaches are developed at LETI: direct detection and heterodyne detection. The former technic has reached the most advanced demonstration with 31x31 arrays and real-time 2D imaging, while the latter has been demonstrated with single-point heterodyne detector and raster scanning and showed very promising sensitivity.

The authors describe the present status of these developments and perspectives of performance evolutions are discussed.

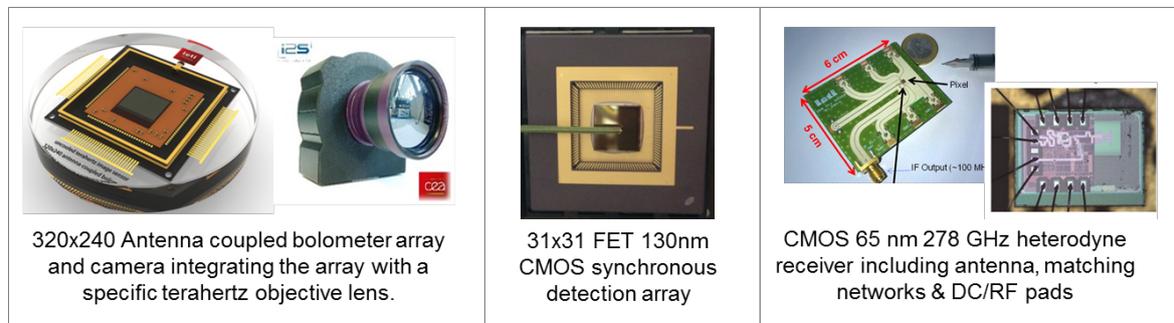


Fig.1. Three technologies of uncooled Terahertz real-time imaging sensors developed at LETI

References

- [1] Simoens F., Meilhan J., “Terahertz real-time imaging uncooled array based on antenna- and cavity-coupled bolometers,” *Philosophical Transactions of the Royal Society of London A: Mathematical, Physical and Engineering Sciences* 372(2012), 20130111 (2014).
- [2] A. Boukhayma, J-P. Rostaing, A. Mollard, F. Guellec, M. Benetti, G. Ducournau, J-F. Lampin, A. Dupret, C. Enz, M. Tchagaspanian, J-A. Nicolas, “A 533pW NEP 31×31 pixel THz image sensor based on in-pixel demodulation,” *IEEE European Solid State Circuits Conference (ESSCIRC)*, 303-306 (2014)
- [3] A. Siligaris, Y. Andee, E. Mercier, J. Moron Guerra, J.-F. Lampin, G. Ducournau, Y. Quere, “A 278 GHz heterodyne receiver with on-chip antenna for THz imaging in 65 nm CMOS process,” *IEEE European Solid State Circuits Conference (ESSCIRC)*, 307-310 (2015).