Passive submillimetre-wave video imaging: implementation of a practical instrument

Erik Heinz, Torsten May, Detlef Born, Gabriel Zieger, Solveig Anders, Vyatcheslav Zakosarenko, Marco Schubert, Torsten Krause, Andre Krueger, Hans-Georg Meyer

Against a background of newly emerged security threats the well-established idea of utilizing submillimeter-wave radiation for personal security screening applications has recently evolved into a promising technology. Possible application scenarios demand sensitive, fast, flexible and high-quality imaging techniques. At present, best results are obtained by passive imaging using cryogenic microbolometers as radiation detectors.

Building upon the concept of a passive submillimeter-wave stand-off video camera introduced previously, we present the evolution of this concept in a practical application-ready imaging device. This has been achieved using a variety of measures such as optimizing the detector parameters, improving the scanning mechanism, increasing the sampling speed, and enhancing the camera software. The image generation algorithm has been improved and an automatic sensor calibration technique has been implemented taking advantage of redundancy in the sensor data.

The concept is based on a Cassegrain-type mirror optics, an opto-mechanical scanner providing spiraliform scanning traces, and an array of 20 superconducting transition-edge sensors (TES) operated at a temperature of 450 mK. The TES are cooled by a closed-cycle cooling system and read out by superconducting quantum interference devices (SQUIDs). The frequency band of operation centers around 350 GHz. The camera can operate at an object distance of 7 to 10 m. At 8 m distance it covers a field of view of 110 cm diameter and achieves a spatial resolution of 1.7 cm and a system NETD of 150 mK at 1 Hz frame rate. The maximum frame rate is 10 frames per second

%end abstract

--
Torsten May
Institute of Photonic Technology
tel.: +49 3641 206123
fax.: +49 3641 206199