

Body Scanning for Security: Impact of Cryogenic Detectors at the Example of a Sub-mm Video Camera

T. May, E. Heinz, S. Anders, D. Born, G. Thorwirth, V. Zakosarenko, T. Krause, A. Krüger, K. Peiselt, M. Schulz, G. Zieger, and H.-G. Meyer

Institute of Photonic Technology (IPHT),
Albert-Einstein-Str. 9, D07745 Jena, Germany

Abstract - As reported in the years before (see ESNF paper ST3), “THz-Videocam” is a German project to build a passive security camera which visualizes sub-mm wavelengths using superconducting bolometer arrays. In the intended market it has to compete with established near-field millimeter-wave scanners, which use active microwave techniques. Comparing both concepts, a cryogenic sub-mm video camera constitutes a complementary solution to a conventional near-field scan, because of its unique feature to perform a stand-off scan with a useful spatial resolution – an ability which is almost out of reach for the millimeter-wave technology. Therefore, a sub-mm wave camera could be used in a variety of application scenarios beyond the obvious airport screening, ranging from the protection of buildings (*e.g.*, embassies) to safeguarding public events.

Against the background of existing solutions, our camera is analyzed in terms of achieved performance and practical use. The presented current generation was designed to demonstrate the stand-off capability whilst achieving a background-limited performance. It is able to record videos with 10 Hz frame rate by using a small array of superconducting bolometers in combination with an opto-mechanical scanner. The necessary cooling of the detector array is provided by a commercial pulse tube cooler with a second, self-contained cooling stage. The cooling cycle is completely automated; after about 15 hours of initial cooling from room temperature, the system can operate continuously. For imaging, a 50 cm class optics is used, which is able to resolve approximately 1.7 cm objects from 8 m distance. For a flexible installation, the object distance can be tuned manually between 7 and 10 m. All image data are displayed in various graphic renditions by unified system software to assist a security official.

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