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Towards ultra-small pixel pitch cooled MW and LW IR-modules

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In recent years a diversity of new IR-detector formats, mainly in MWIR but as well in LWIR spectral range, has been introduced by leading detector manufacturer. These arise from enormous progress in pitch size reduction, while keeping array size manageable. As a consequence, opportunities on system level for modernization and performance enhancement are manifold. Portable systems will benefit from ultra-compact, low power MWIR solutions, while rotorcraft pilotage or surveillance applications will rely on LWIR detector arrays with highest possible resolution.
IR-modules providing HD-format (1280x720) in 12µm pixel pitch were already introduced at AIM in 2016 for both MWIR and more challenging LWIR spectral range. Detector arrays with an even smaller pixel pitch of 10µm with XGA format (1024x768) have so far only been realized in MWIR for usage as system upgrade of 640x512, 15µm pitch IR-modules and for an ultra-compact IR-engine in a low power, high operating temperature (HOT) version. The electro-optical characterization of this, recently presented, HOT IR-engine has been continued and performance and design have now further been optimized. Moreover, next steps in pitch size reduction towards wavelength scale are under development at AIM by introducing an XGA format, 10µm pitch LWIR version using an optimized ROIC design and by preparing required technology and processes for an ultra-small pitch of 7.5µm and beyond.
In this paper latest performance results of MWIR and LWIR detector arrays with small pixel pitch will be presented, together with design considerations and optimization of associated cooled IR-modules.

Keywords: MCT, IR-module, small pixel pitch, MWIR, LWIR, ultra-compact, XGA 1024x768, HD-format

Short version:

Recent progress in large format detector arrays with small pixel pitch allows for optimized tailoring of IR-systems according to their specific needs such as usage of ultra-compact, low power MWIR solutions for portable systems or LWIR detector arrays with highest resolution for rotorcraft pilotage.
IR-modules providing HD-format (1280x720) in 12µm and XGA-format (1024x768) in 10µm pixel pitch have already been realized at AIM. Recently, the first prototype of an ultra-compact HOT MWIR engine was presented and has now been optimized. Moreover, next steps in pitch size reduction are under development using optimized ROIC designs and technology processes.
In this paper latest performance results of MWIR and LWIR detector arrays with small pixel pitch will be presented, together with design considerations and optimization of associated cooled IR-modules.