

# THz imaging

Array detectors in the THz waveband based on antenna-coupled microbolometers (320 × 240 pixels)

#### What is CEA-Leti's THz device?

Building on its thermal infrared bolometric technology, CEA-Leti developed smart detectors that enable THz real-time imaging in the most effective way, similar to visible-light digital cameras. CEA-Leti's THz imaging technology is unique. It relies on a patented bolometer architecture in which optical collection is provided by crossed bow-tie antennas combined with a quarter-wavelength dielectric cavity.

THz waves collected by these antennas are then converted into heat and detected by a thermo-resistive layer derived from CEA-Leti and Lynred's mature bolometer technology.

## **Applications**

THz radiation can translate into various commercial applications:

- Non-destructive testing for various industrial fields: food/agriculture, pharmaceutical products, semiconductors, automotive, etc.
- Defense and security: people screening, luggage control, etc.
- Remote spectral analysis in waste sorting or cultural-heritage diagnosis.
- **Biology and medicine**—dermatology, biochips, etc.

# Key advantages

- Room temperature operation, compactness and video output
- Full compatibility with silicon technology manufacturing process
- Low-cost and high production yield
- Broadband spectral absorption
- Millimetric or submillimetric resolution
- May be customized with innovative pixel and array architecture: frequency range, polarization, etc.

## **Key figures**

- Large format: 320 × 240 pixels
- Pixel pitch: 50 μm
- Spectral range: 0.3 THz-4THz (optimized for 1-3 THz)
- NEP @2.5 THz: 20 pW
- Frame rate: 25 Hz

# THz radiation

Terahertz (THz) band loosely denotes the spectral region 0.3-10 THz (1 mm - 30 µm). Electromagnetic waves in this band uniquely combine very interesting properties:

- Sees through matter: penetration through non-polar materials such as fabric, ceramic, plastic, leather and cardboard.
- Monitors water content: high sensitivity to polar molecules.
- Identifies materials like chemicals, explosives, etc.: specific spectral signatures of many gases, liquids and solids.
- **Safer than X-ray**: low-energy, non-ionizing radiation.

# How do we work together?

# **Proof of feasibility** Optical characterization of samples Theoretical signal-to-noise assessment

#### Design of a system prototype

Dedicated to your application

**Performance assessments** & lab validation

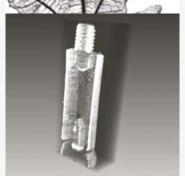
Tests of samples in lab set-up

**Prototype fabrication** & tests

Tests of samples in lab set-up







▲ THz tomography of a screw inside a piece of teflon

# **Interested** in this technology?

Contact:

Nicolas Lio Soon Shun nicolas.liosoonshun@cea.fr +33 679 295 297

#### CEA-Leti, technology research institute

17 avenue des Martyrs, 38054 Grenoble Cedex 9, France cea-leti.com









