

Imagerie THz: intérêts pour l'industrie et la recherche

Amalya Minasyan
i2S

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be visionary

About i2S

Specialists in image capture and processing



**40 years of experience
in vision**



**70 people
60% engineers**



**10% of turnover
invested in R&D**



30% export



1. HEALTH & WELLNESS



**2. BOOK SCANNING
SOLUTIONS**



3. INDUSTRY

i2S AND TERAHERTZ ALREADY A LONG STORY

2006

TERA-BOOK project with LOMA and LABRI labs :
Read a closed book

2010

Work with CEA LETI on Terahertz imaging
solutions

2015

Development of a Terahertz camera
with CEA LETI

2016

Starting a common laboratory with
CEA-TECH Aquitaine



2017

Availability of a commercial camera

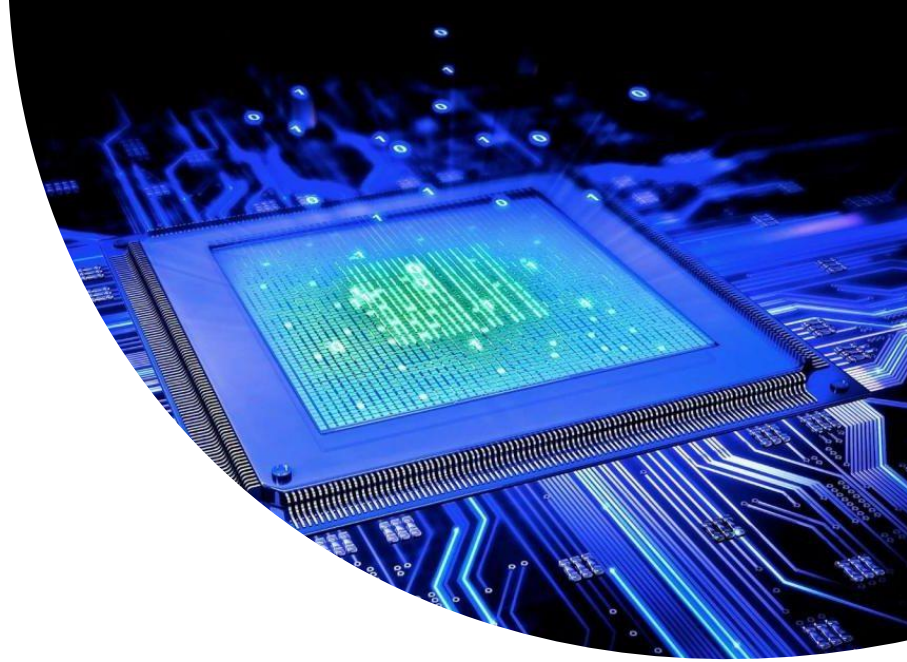




be visionary

TZcam: Terahertz camera

- Unrivalled bolometric sensor sensitivity
- Real time operation
- High resolution large field imaging
- Non hazardous imaging technology



TZcam

Uncooled THz imager



SEE INSIDE THE MATTER SAFELY

Applications

- Non-Destructive Testing
- Life sciences
- Scientific Instruments
- Characterization of THz sources

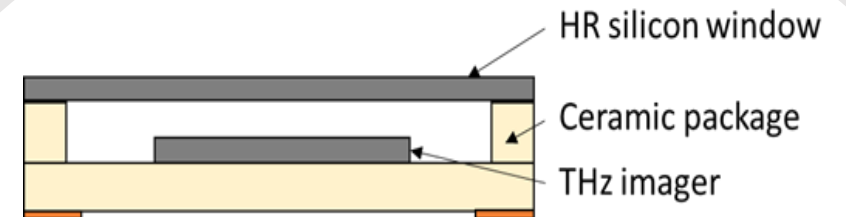
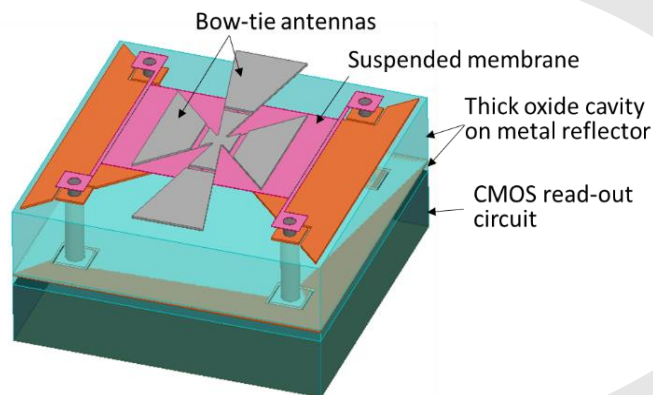
TZcam - Technology

Uncooled THz imager



Antenna-coupled bolometer array

- Dual-polarization antennas with resistive loads
- Suspended membrane with a-Si thermometer
- Fabrication above CMOS read-out IC
- Vacuum packaging with HR silicon window
- Double-side AR coating on window



TZcam - Features

Uncooled THz imager



Broadband operation: $0.3 - 5 \text{ THz}$

Sensor: *320*240 pixels patented pixel architecture designed by CEA LETI*

Real time operation: 25 Hz

Sensor size: 16 mm * 12 mm

With objective lens: 64 mm * 48 mm
Custom optics on demand

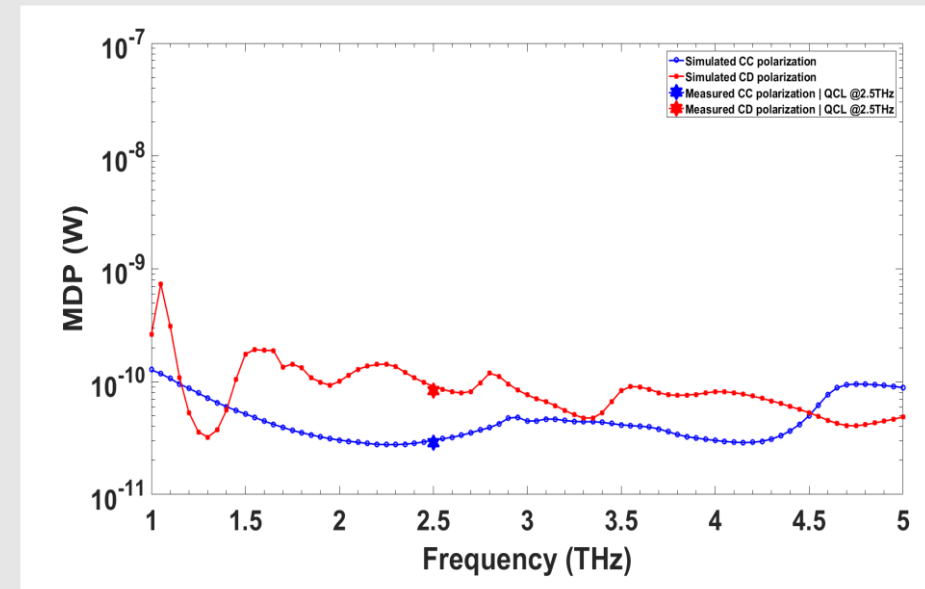
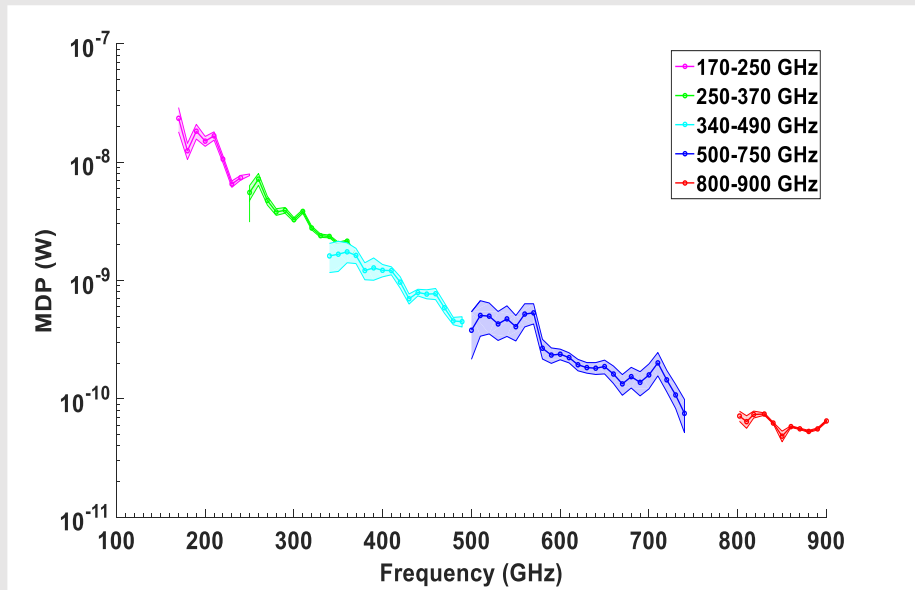
Sensitivity: Starting from 20pW per pixel

TZcam - Technology

Uncooled THz imager

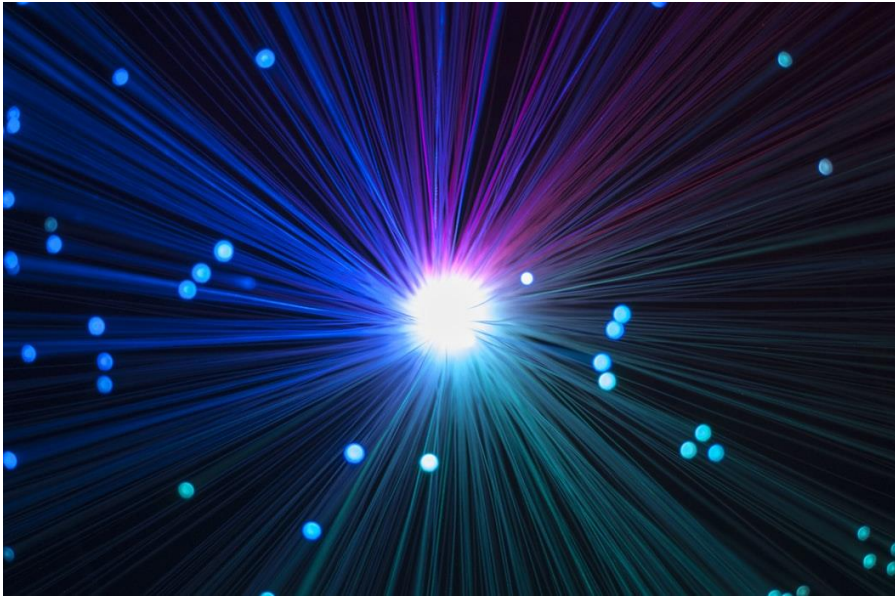


Minimum Detectable Power



Terahertz imaging

What for?



Research



Industry

THz beam profile characterisation

QCL source, CW operation

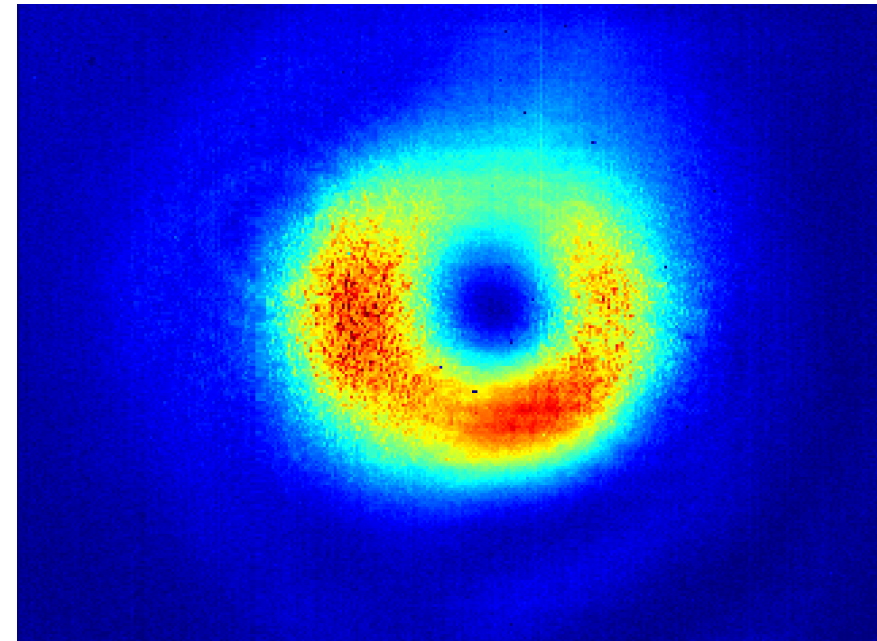


Image of TE_{01} mode of the laser
Frequency: 1 THz
Image size: 16 mm x 12 mm

THz imaging for Research

THz imaging for Research

Real-time THz imaging

Antenne based source, Pulsed operation



Imaging of plastic sample

Frequency: cantered at 1,5 THz

Image size: 64 mm x 48 mm

THz beam alignment

LiNbO₃ based source, Pulsed operation

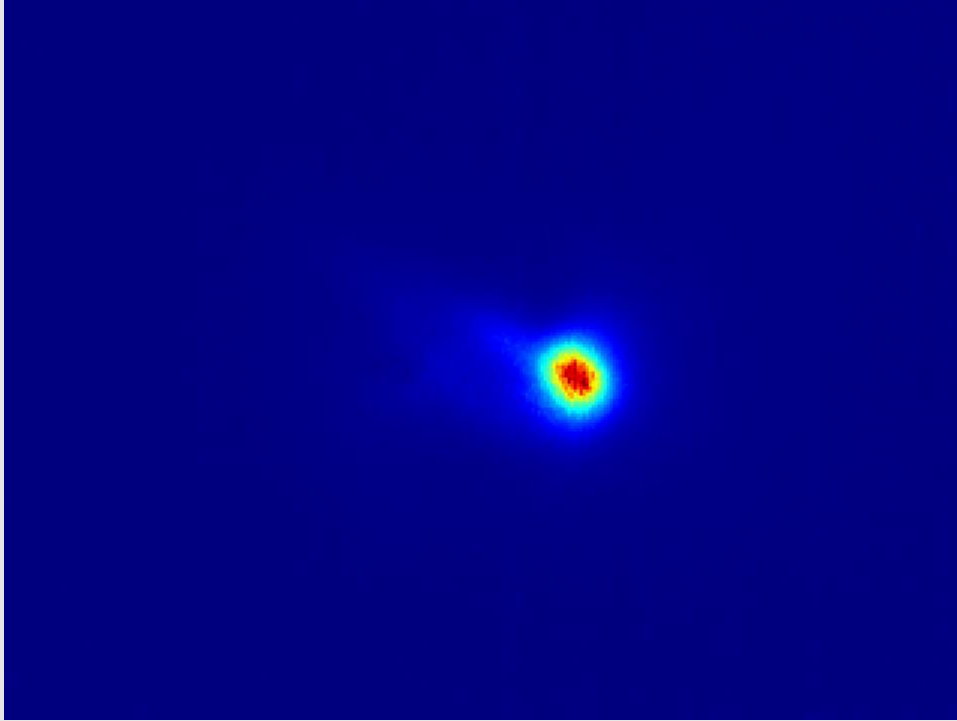


Image of focalised spot of the laser

Frequency: 0,1-5 THz

Image size: 16 mm x 12 mm

Courtesy of James Lloyd-Hughes, Warwick University, UK

THz spectral imaging

THZ FEL source, 50Hz operation

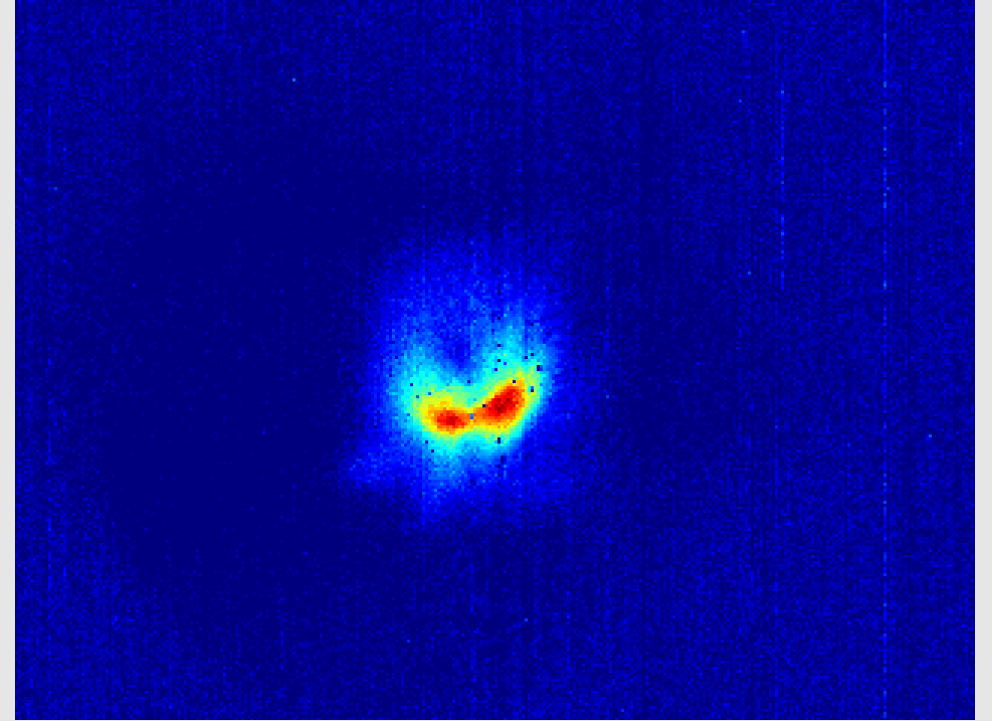


Image of laser beam profile

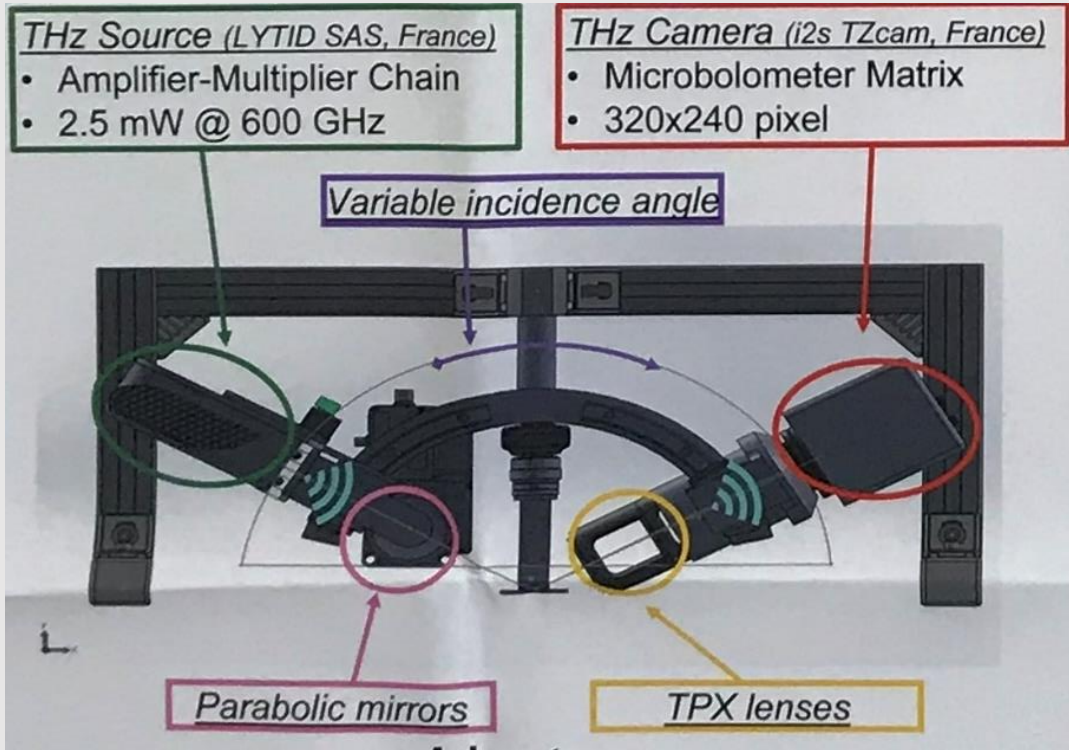
Frequency: 0,5-5 THz

Image size: 16 mm x 12 mm

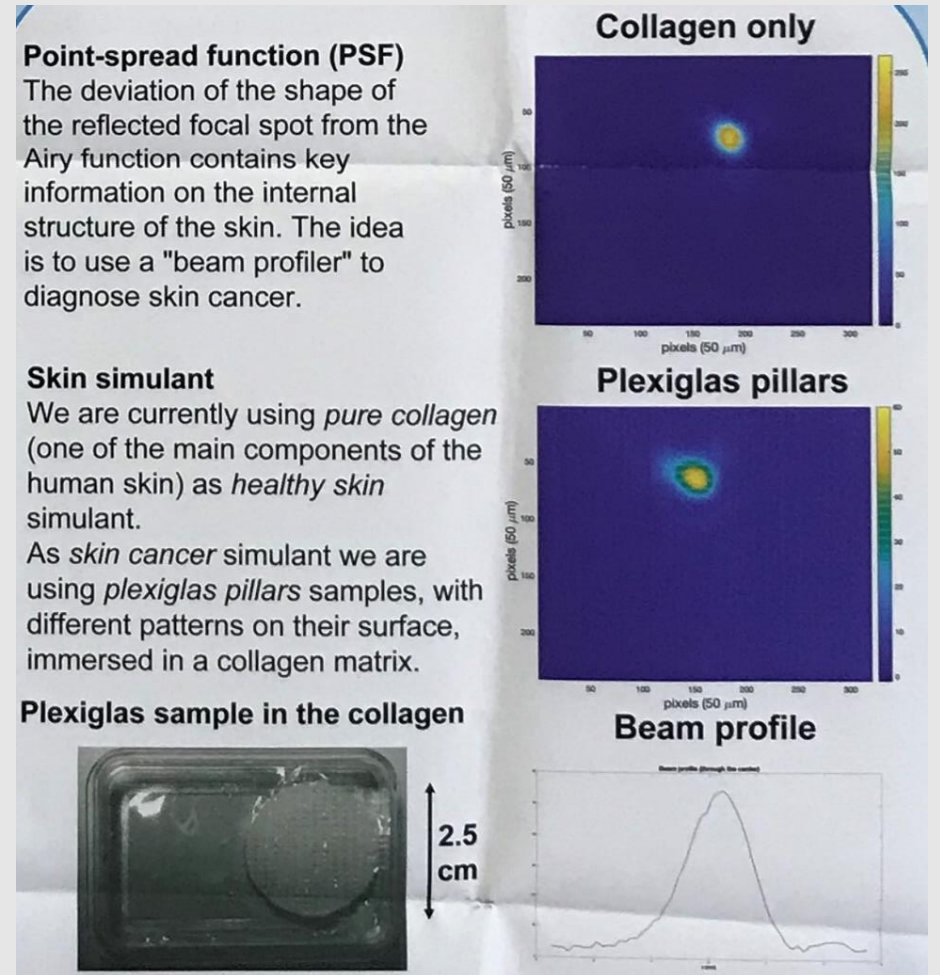
Courtesy of Andrea Perucchi, TeraFermi, Trieste, Italy

THz imaging for Research

THz microscope device development

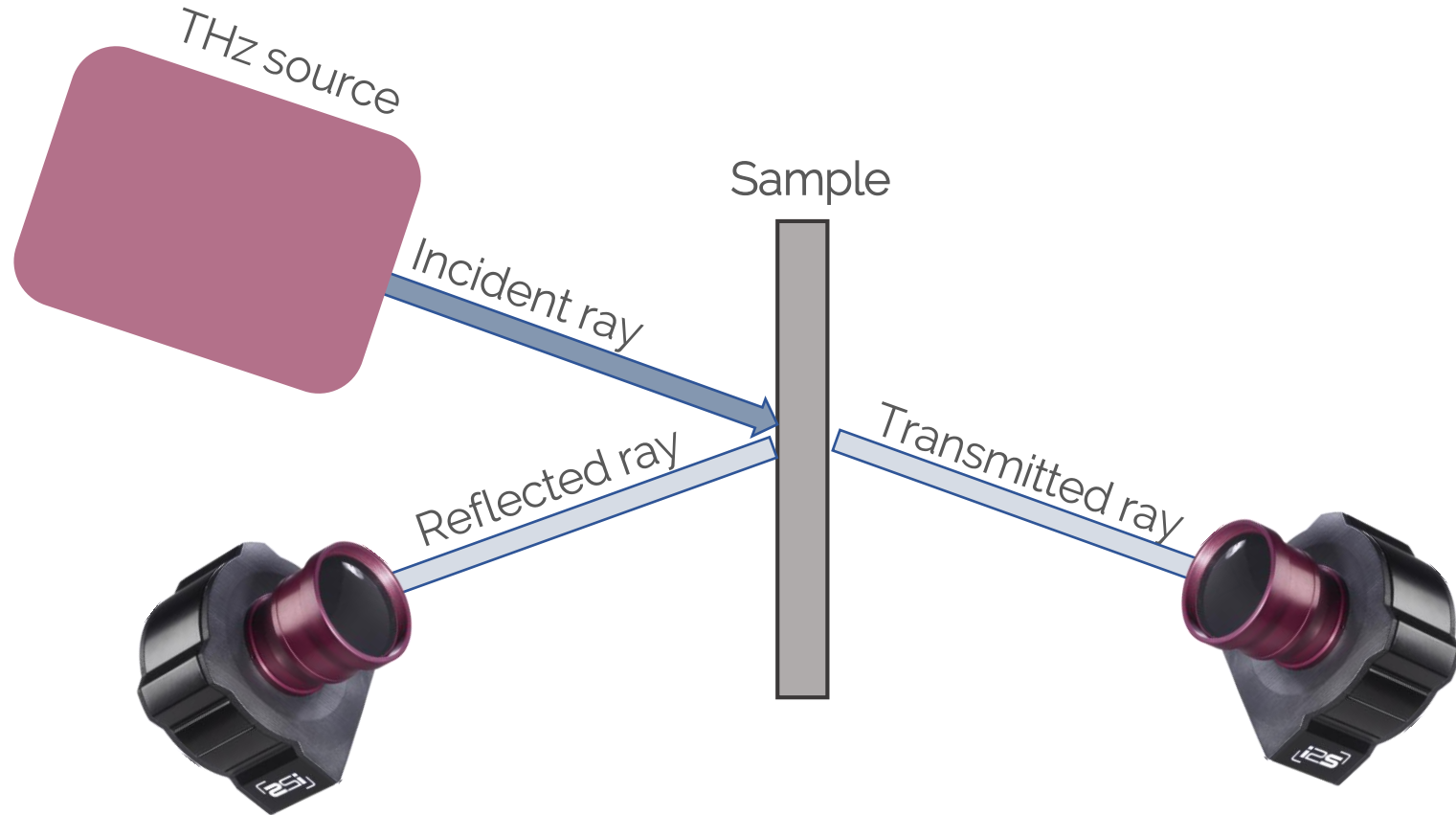


Courtesy of Michele Ortolani, Istituto Italiano di Technologica, Italy



THz imaging for Research

THz imaging for Industry



Terahertz imaging, harmless alternative to X-rays, to see through materials



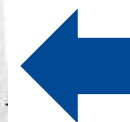
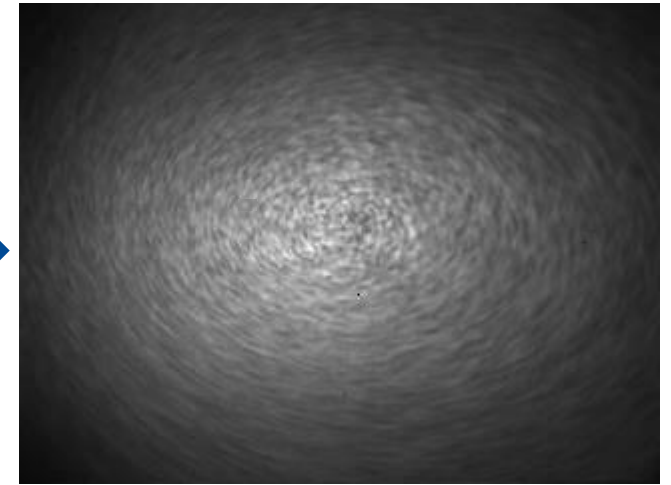
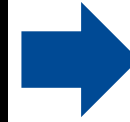
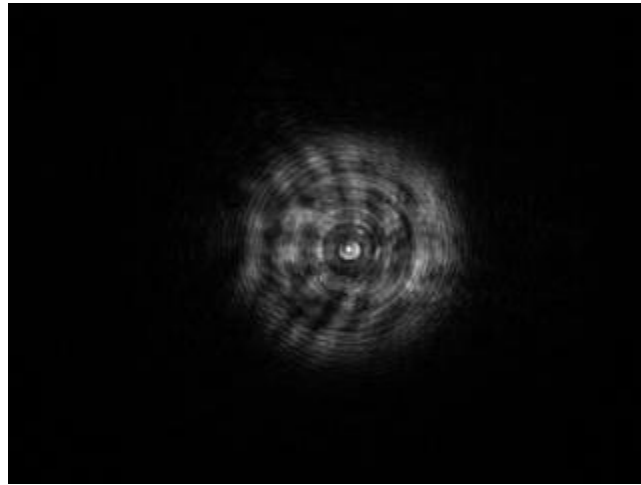
Common testing platform with CEA-TECH



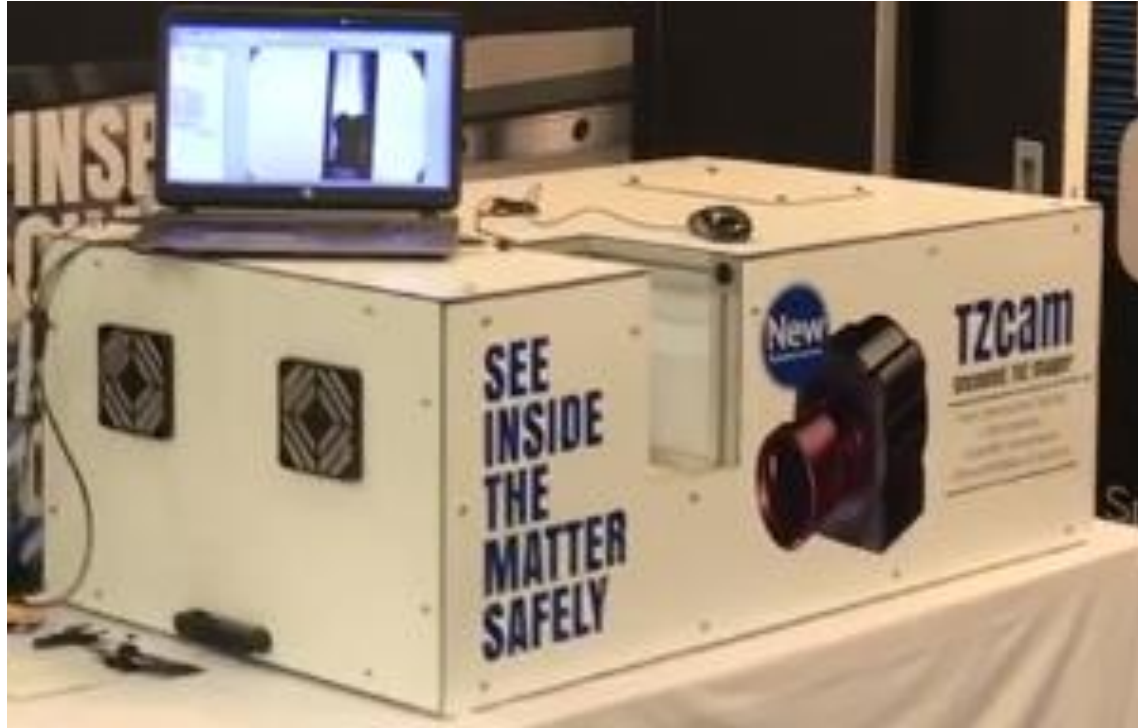
- THz Schottky diodes multipliers :4 frequency bands:
300 GHz, 550GHz, 850 GHz & 1000 GHz
- THz Quantum Cascade Laser (QCL) : 3 frequencies:
2.5 THz, 3.3 THz & 4.7 THz



THz beam correction for high quality imaging



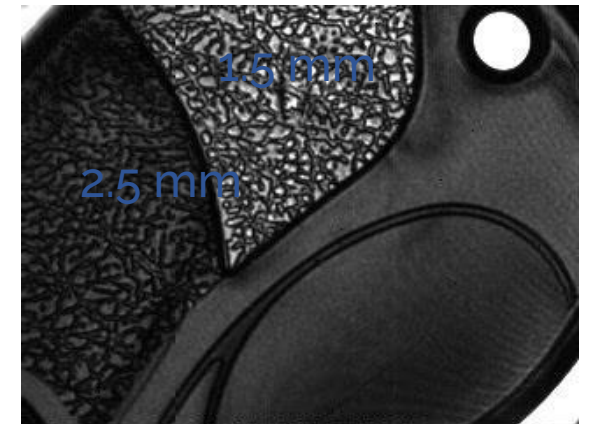
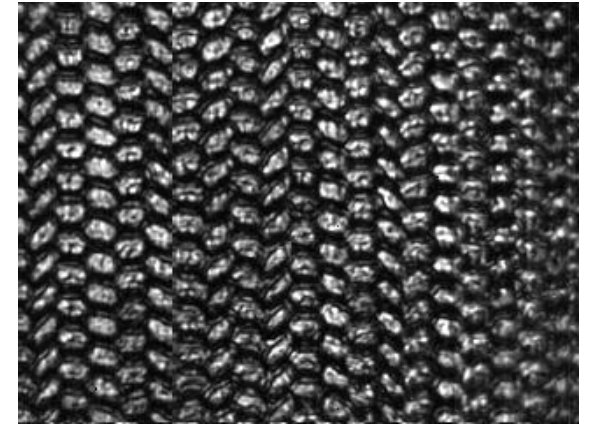
THz imaging NDT device



Visible



THz



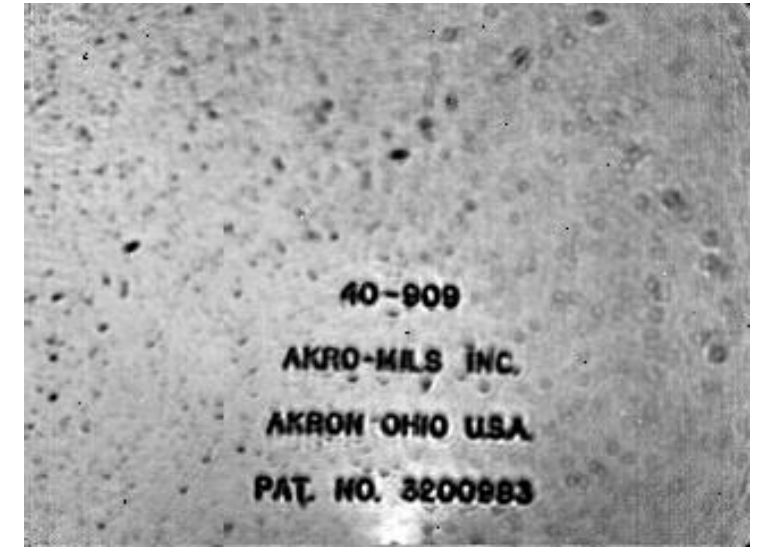
One shot real time THz images without post treatment !

THz imaging for **Industry**

Visible

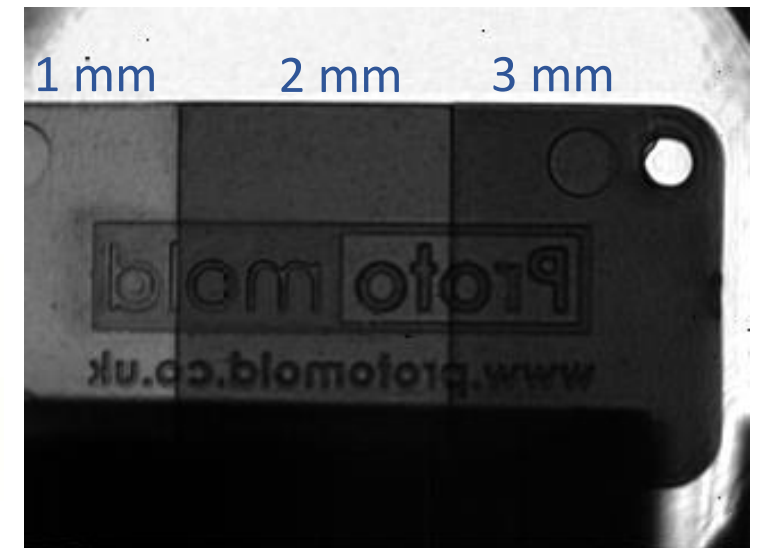


THz



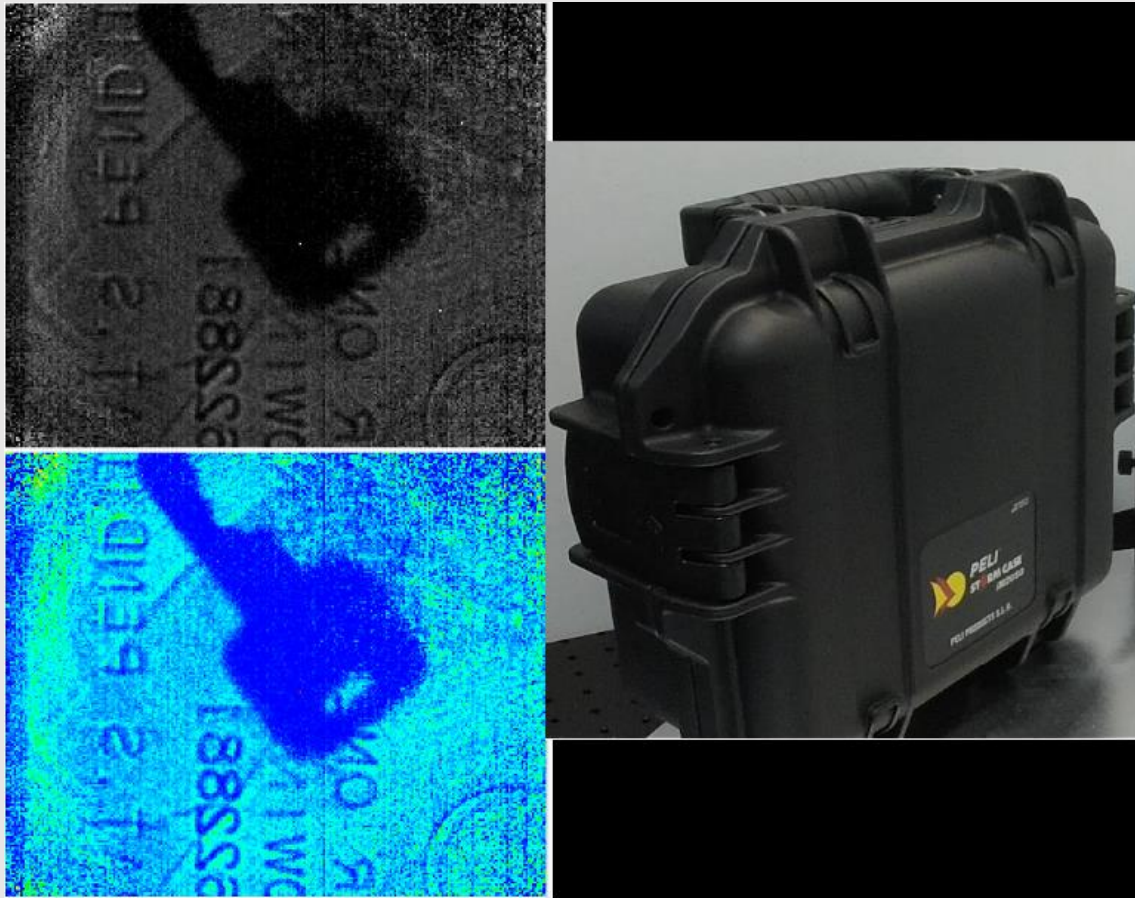
Internal **defect** detection

Thickness and **density** variation detection

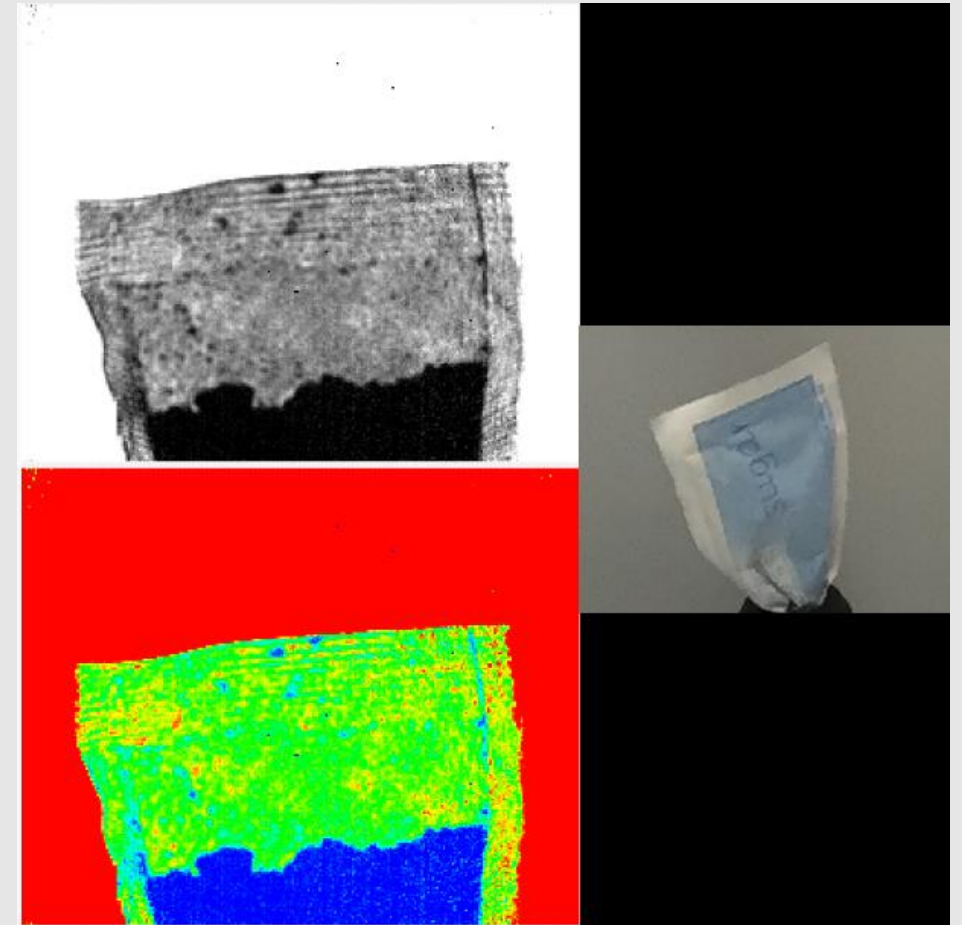


THz imaging for Industry

Hidden object in case



Monitoring powder level in package



THz imaging for Industry

Thank you

be visionary

