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ANTONI VAN LEEUWENHOEK



EPIC MEETING ON PHOTONICS FOR CANCER DIAGNOSTICS AND TREATMENT AT NKI

Optics and photonics | nicolas.liosoonshun@cea.fr

-  Since **1967**
-  France, USA, Japan
-  **2,000** People
-  **> 2,760** Patents in Portfolio
-  **350** Industrial Partners
-  **> 65** Startups Created
-  **10,000 m²** Cleanroom
200-300mm
-  **315 M€** Budget
(85% from R&D contracts)



8" & 12" Microsystems



Nano-characterization



12" Nanoelectronics

- More than 30 years of knowledge in applied photonic technologies development, IP protection and transfer to industry
- Sharp focus on developing smaller, cheaper and smarter photonic products with our industrial partners
- Capability to use III-V, II-VI materials as well as Si and Ge and combine 3D, MEMS, CMOS and photonics technologies
- Up-to-date industrial-like fabrication facilities from 4" to 12" substrates
- The Optics and Photonics Department develops:
 - Imaging technologies development from Gamma, X ray to THz spectral range
 - Led lighting
 - Displays based on OLED technologies
 - Optical environment sensors
 - Photonics on silicon



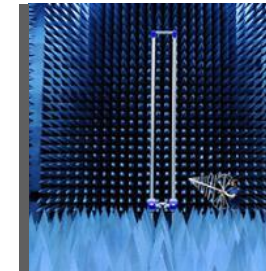
Optics and photonics



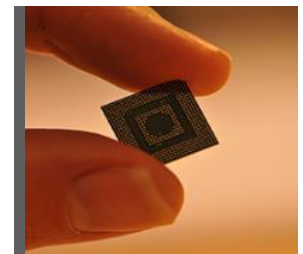
Nano-biotechnology: biology and healthcare



Clinathec: medical equipments



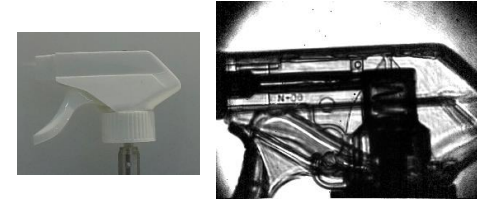
Sensors Network & Communicating Objects



Integrated Circuits Design

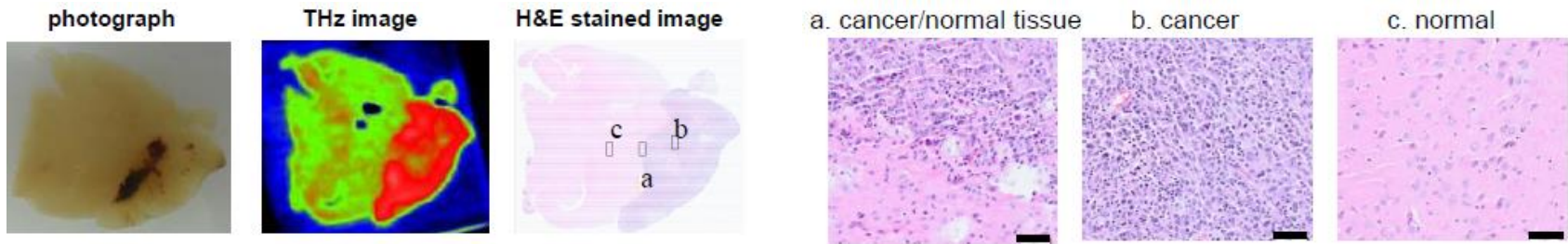
TeraHertz technology

Harmless radiations, see through certain material, sensitive to water content, reflected by metal, interaction with molecules



THz imaging of mouse brain tumor

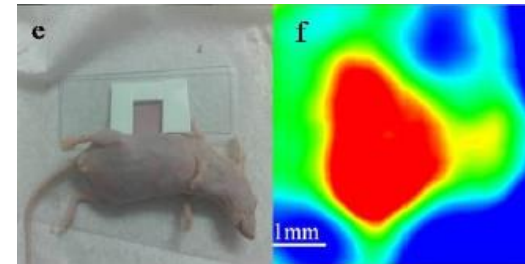
THz contrast between normal and cancer tissues in brain is caused not only by water content but also by the density of cells



Cheon et al. Toward Clinical Cancer Imaging Using Terahertz Spectroscopy

In vivo THz imaging of human breast cancer in xenograft mouse model

(e) Stretched mouse dorsal skin, (f) in vivo THz imaging of a visible cancer in mouse dorsal skin



Cheng et al. High-sensitivity in vivo THz transmission imaging of early human breast cancer in a subcutaneous xenograft mouse model



Courtesy of I2S

Camera available THz sensor integrated in a camera by company I2S



Infrared technologies

Infrared multispectral active imaging: cancer and infectious diseases diagnosis

- Biochemical information fingerprint without labels : FTIR spectroscopy
- Absorption of light by vibration of molecular links : fundamental energy of vibration → high responsivity

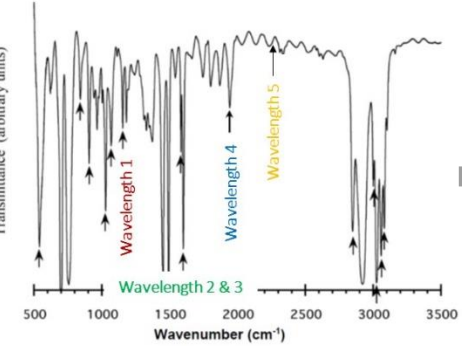
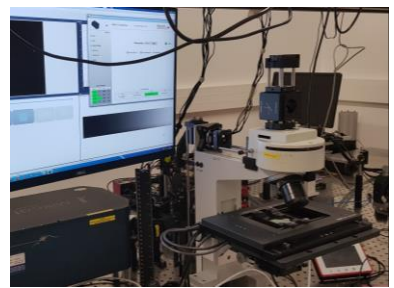


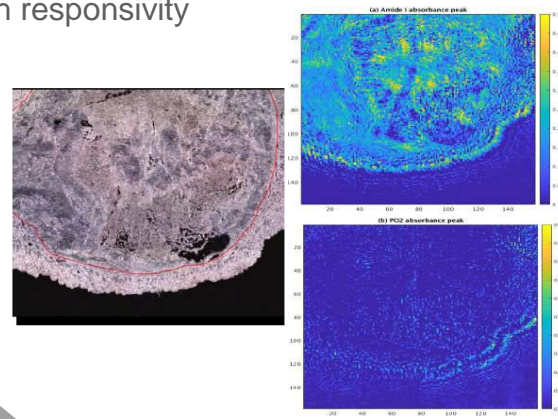
Figure 1. Spectrum of polystyrene film showing locations of certified absorption bands.



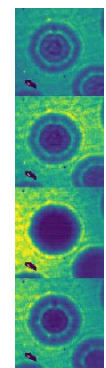
Set of QCLs matching with wavelengths selection



Imaging setup



Cancer diagnosis



Confusion matrix

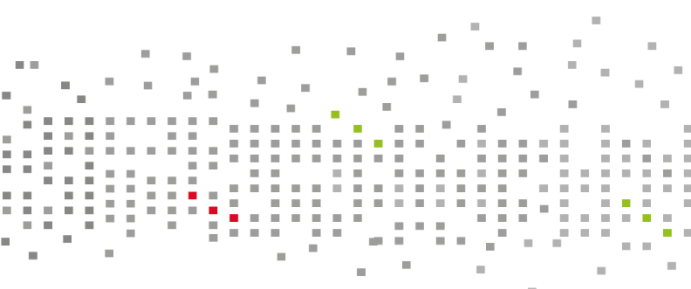
	CA36	EC08	EC10	SE26
Original CA36	0.9	0.0	0.0	0.1
Original EC08	0.0	0.86	0.14	0.0
Original EC10	0.0	0.14	0.86	0.0
Original SE26	0.07	0.0	0.02	0.91
Predicted				

Infectious diseases diagnosis

Fast thermal imaging: able to see shorter/quicker thermal events



Courtesy of LYNRED



Leti, technology research institute

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