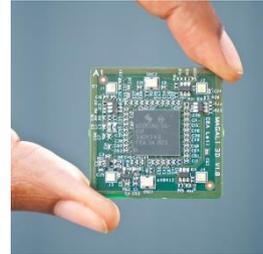


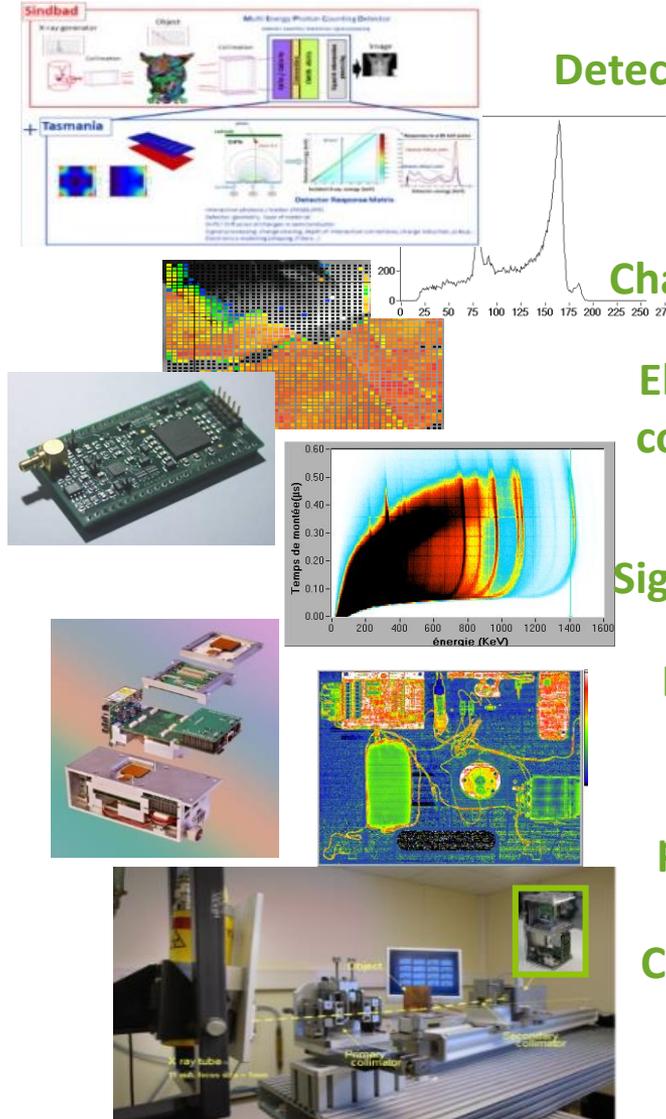
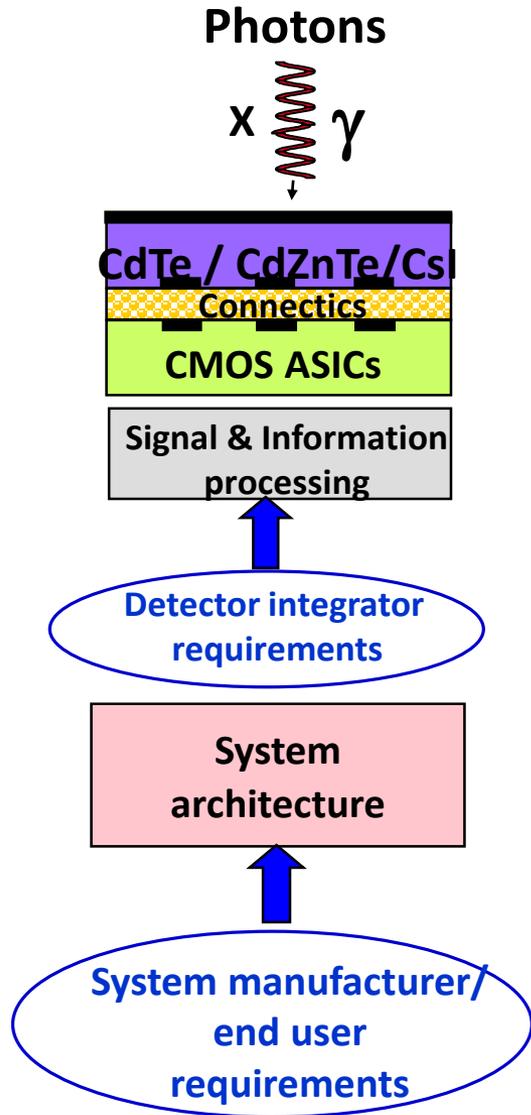
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HIGH PERFORMING SPECTROMETRIC DETECTOR AND TOMOGRAPHY APPLICATIONS

Journée Tomographie | Nicoleta Galatanu | 26 May 2016

...and...their integration into the systems



Detector / system modeling

Physics & Characterization

Electronics conception

Signal processing

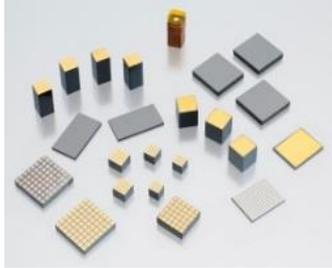
Integration

Image processing

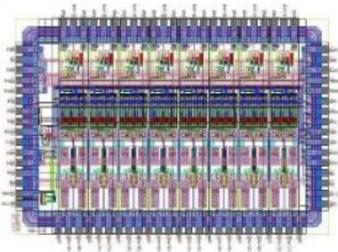
Configurable test benches

ADVANCED X-RAY SPECTROMETRIC DETECTOR

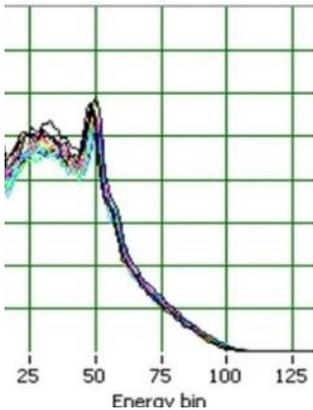
Technology used



Semi-conductor X-ray detector
(CdTe / CZT)



Dedicated ASIC: optimized
dimension, high speed low
noise, front end electronics



1 full spectrum/pixel

In real time

Real time signal processing:
new spectrometric material
discrimination processing
algorithms

Compact detection module
Operating at room temperature
Energy of each incident photon at high count
rate is measured in real time



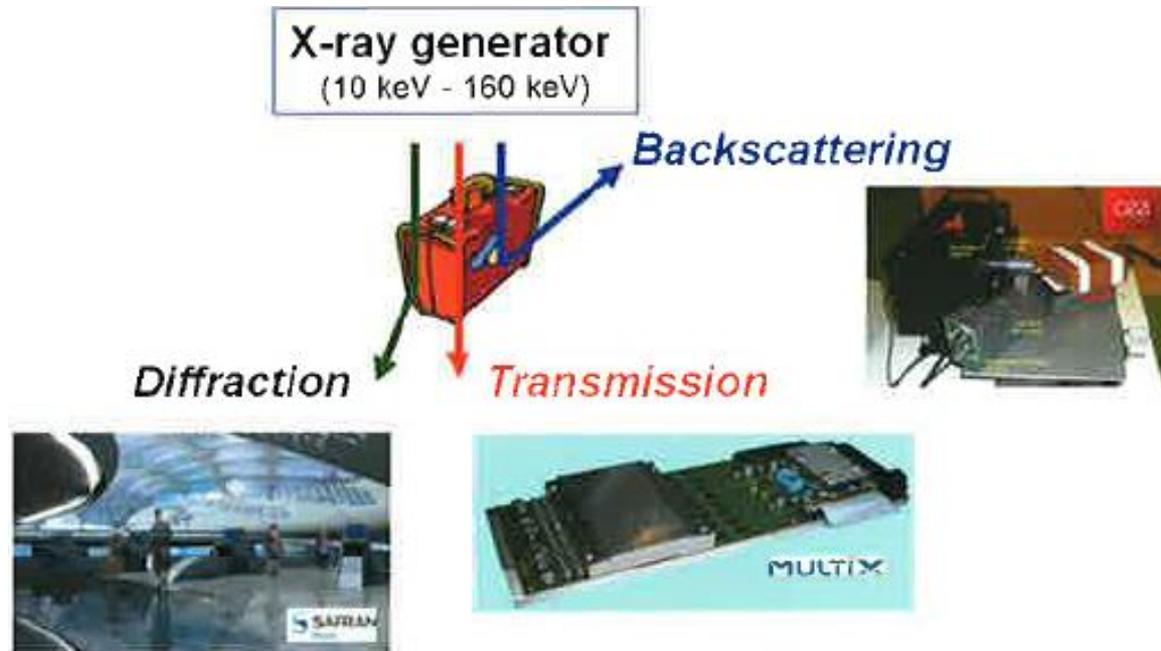
ME100 module

128 pixels, 0.8 mm pitch, 3 mm thick
64 channels
 $3 \cdot 10^6$ photons/mm².s in real time

- **The spectral information:**
 - Improves the accuracy of material identification
 - Reduces the false alarm rate
 - Increases the speed controls of X-ray systems
- **The spectral information opens the way for new approaches in the multi energy information processing by analyzing the spectral signature of each pixel to improve the identification of materials including various components of complex mixtures.**
- **Towards color imaging**

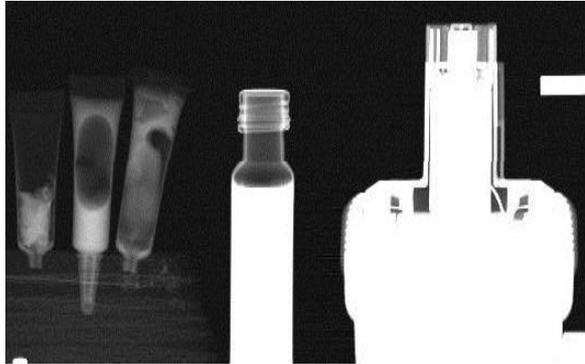
THREE TECHNIQUES: DIFFRACTION, BACKSCATTERING AND TRANSMISSION

- **Transmission:** comprehensive measure of the attenuation curve for high accuracy materials discrimination (luggage control in airports)
- **Backscattering:** accurate measurement of material density and atomic number of materials. (isolate luggage control)
- **Diffraction:** access to high-speed imaging signature associated with the atomic or molecular structure of materials, liquids included (luggage control in airports)

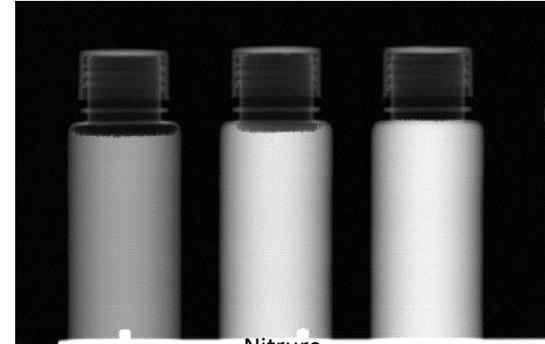


Domains	Application fields
Security	Material identification
NDT	Aircraft blade and welding control
	Drug counterfeiting by X-ray tag
	Composite inspection
Environment	Sorting of waste
Medical imaging	Medical scanner

MULTISPECTRAL IMAGING



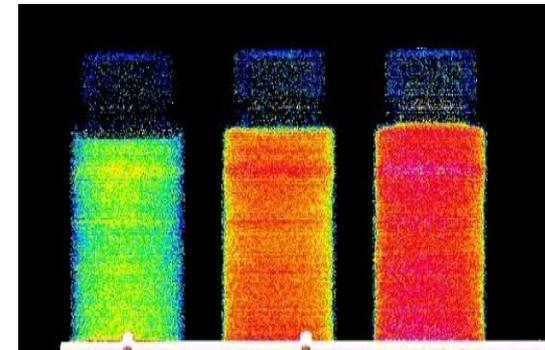
Density image



eau Nitreure
méthane acétone



Multi-spectral
Image



Original proposed solution: X-ray marker

Issue: on line authentication of completeness of large volumes

- Incorporation of X-ray marker in the packaging
- Exclusive X-ray spectral identifiable
- Invisible both to the naked eye and by traditional X-ray means



→ Specific method developed by LETI



IDEMAX

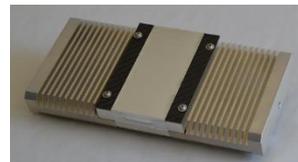


Papermaker, ink

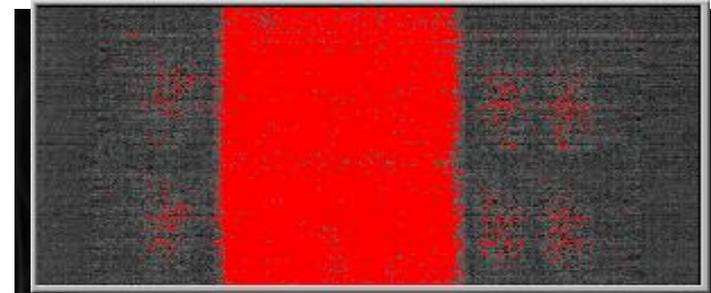


LGP²
agefpi

Detector

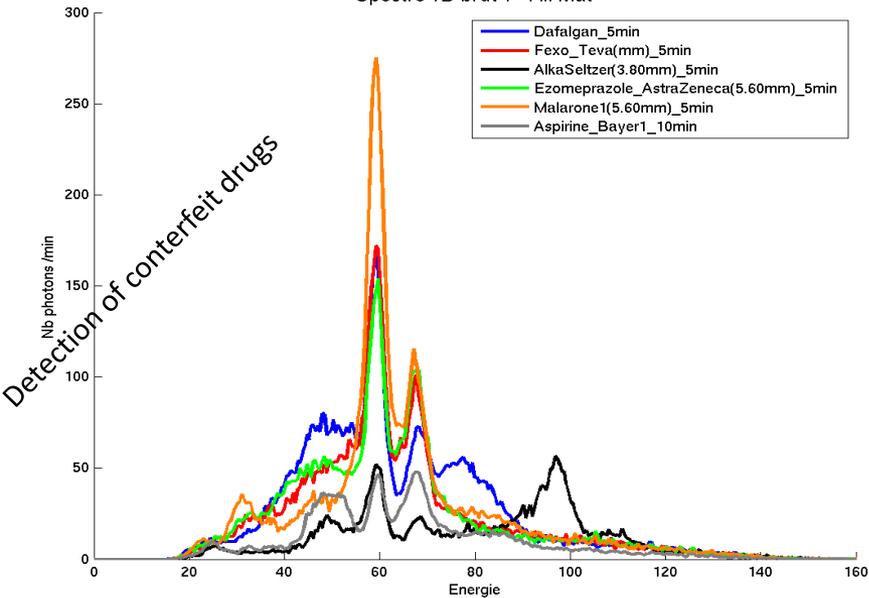


MULTIX[®]
Xray Spectrometric Imaging

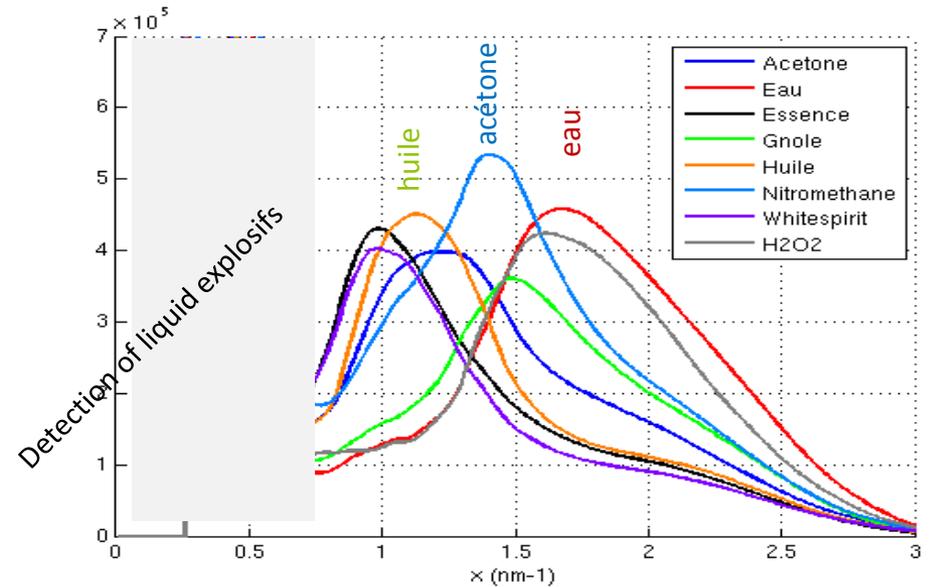




Spectre 1D brut 1 - All Mat

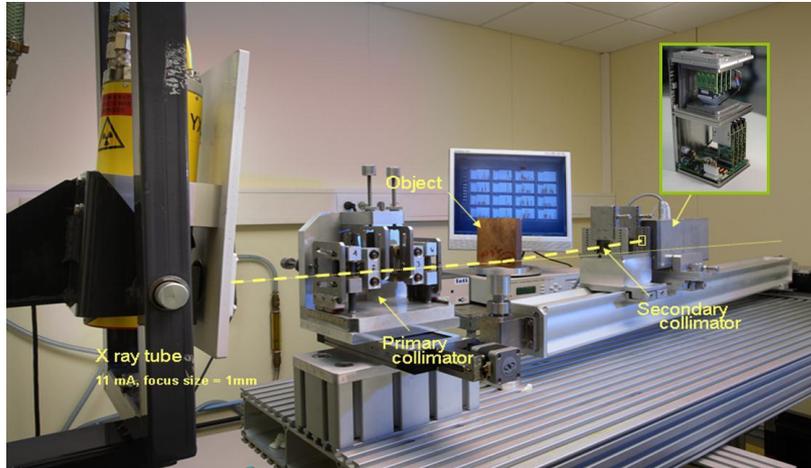


Liquids



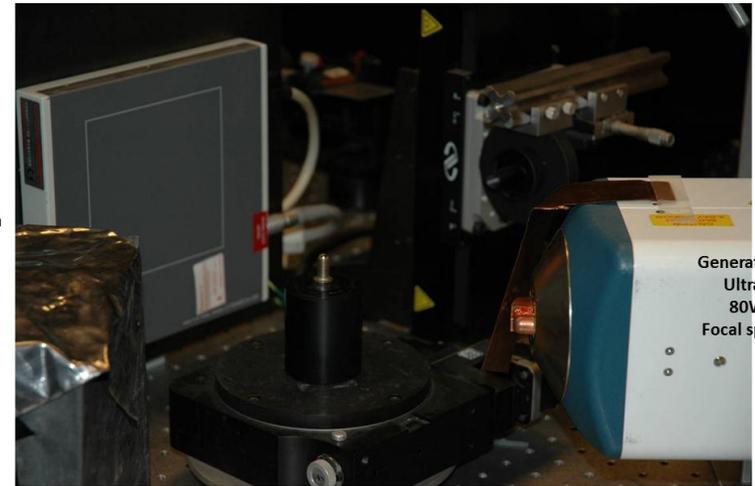
X-RAY TEST BENCHES

X-ray diffraction



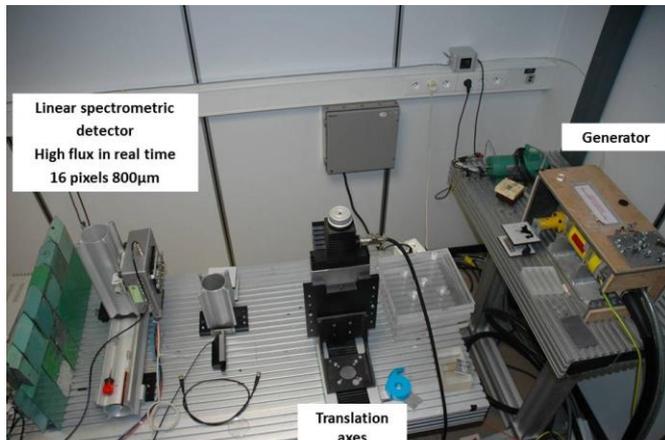
Detector
Hamamatsu
c7942ca-02:
Flat panel
Pixel 50 μm
12x12cm area

X-ray micro tomography

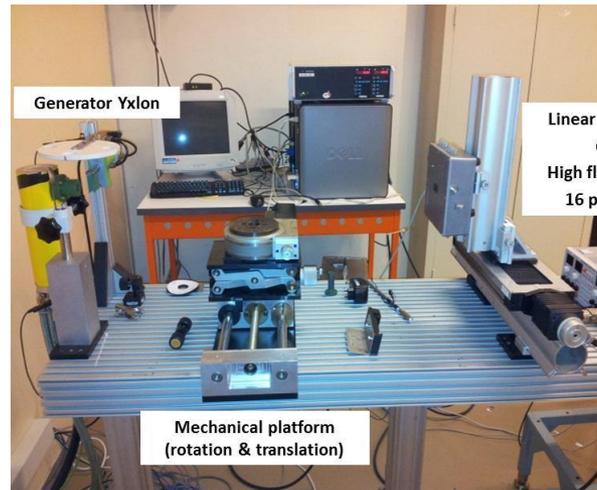


Mechanical platform (rotation)

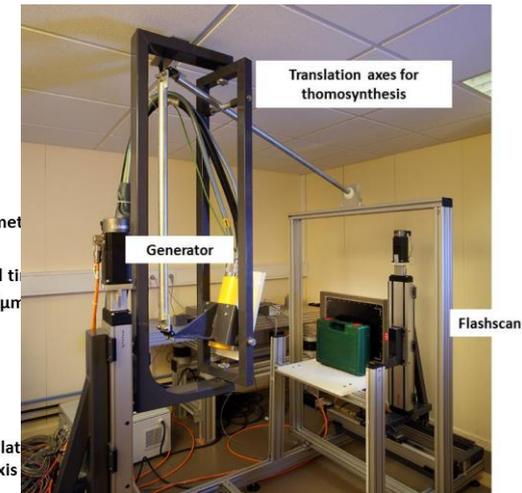
X-ray radiography



X-ray computed tomography



X-ray tomosynthesis



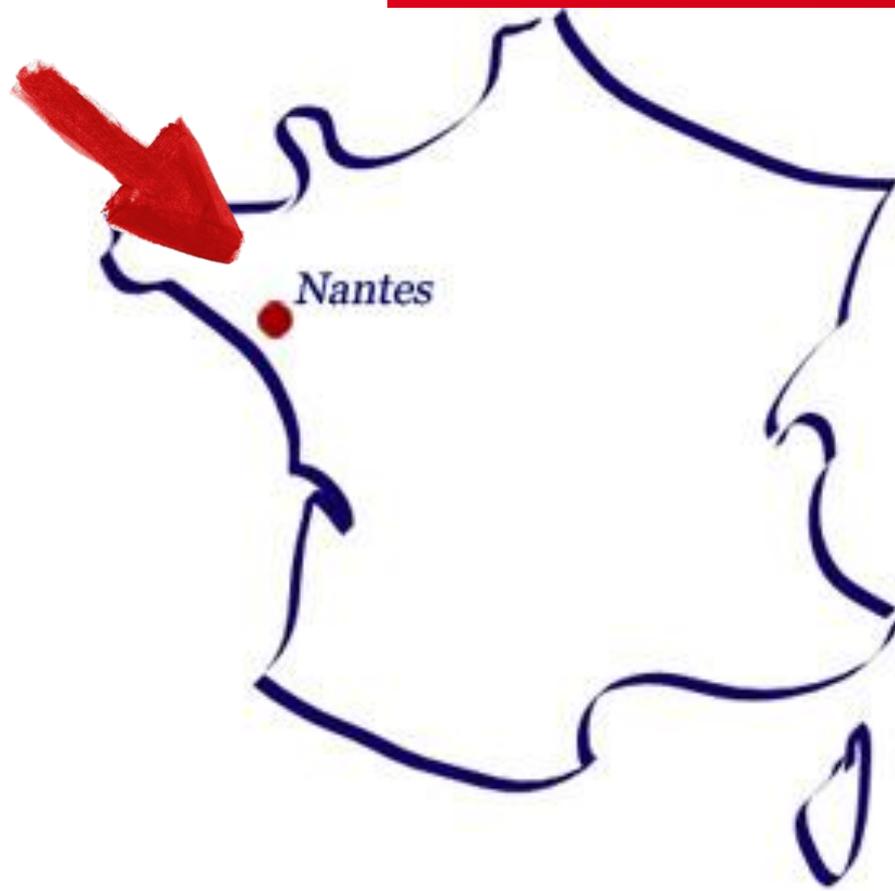
FROM RESEARCH TO INDUSTRY

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PLATEFORME DE CND PAR IMAGERIE RX ROBOTISÉE

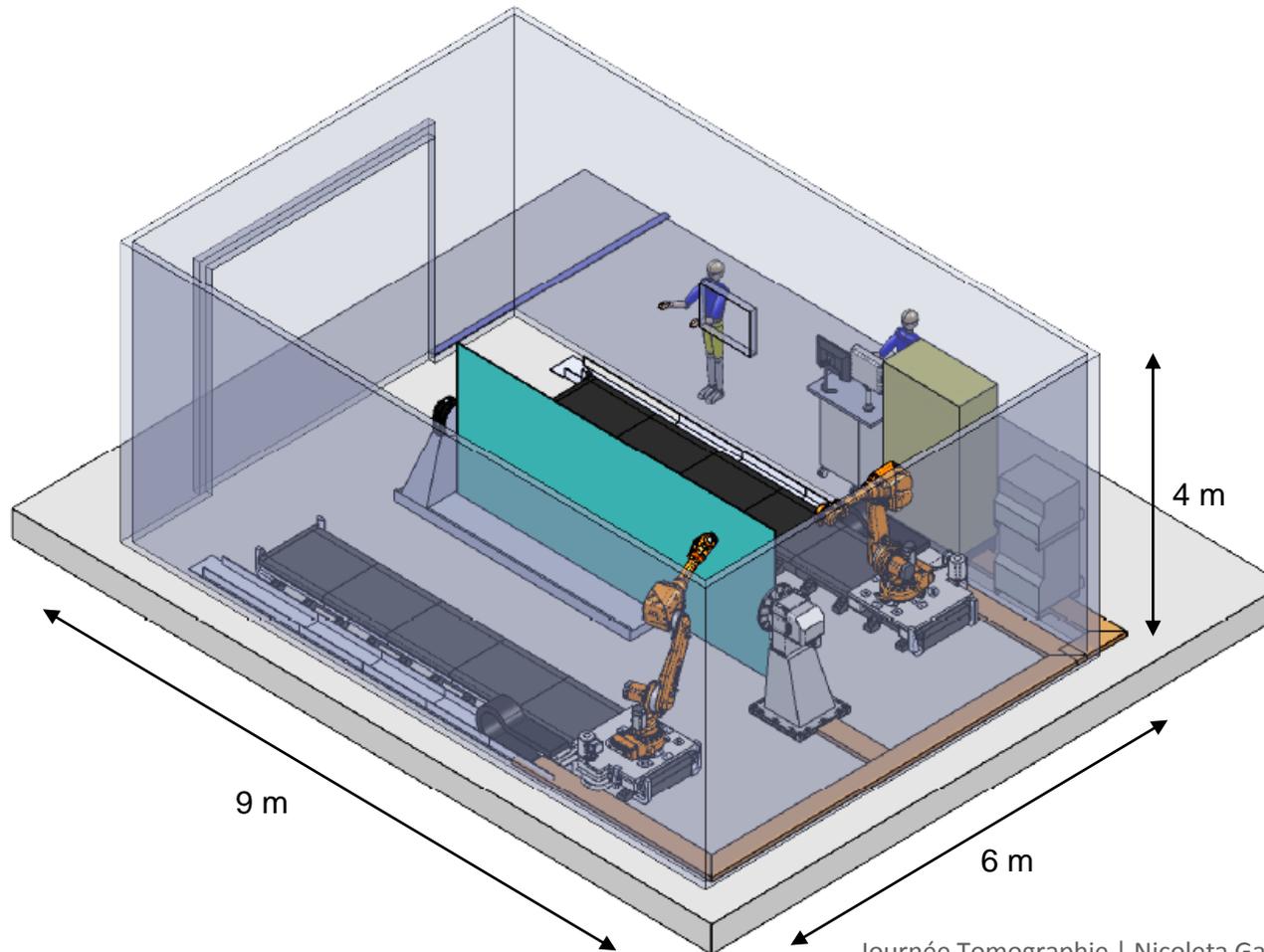
Journée Tomographie | Nicoleta Galatanu | 26 May 2016

UNE PLATEFORME DE CND PAR IMAGERIE RX ROBOTISEE



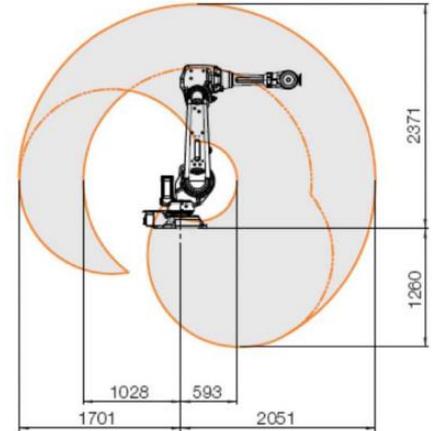
Un équipement couplant robotique et instrumentation RX

- ▣ Une cellule de radioprotection de grandes dimensions (70 T Pb)



Un équipement couplant robotique et instrumentation RX

- ▣ Deux **robots 6 axes** montés sur des glissières de 5 m
- ▣ Un positionneur à têtes rotatives (distance adaptative)
- ▣ Un générateur RX **µfoyer** 225 kV
- ▣ Un détecteur de grande taille 400 x 400 mm (pixels de 200 µm)
- ▣ Un détecteur résolu 128 x 128 mm (pixels de 50 µm)



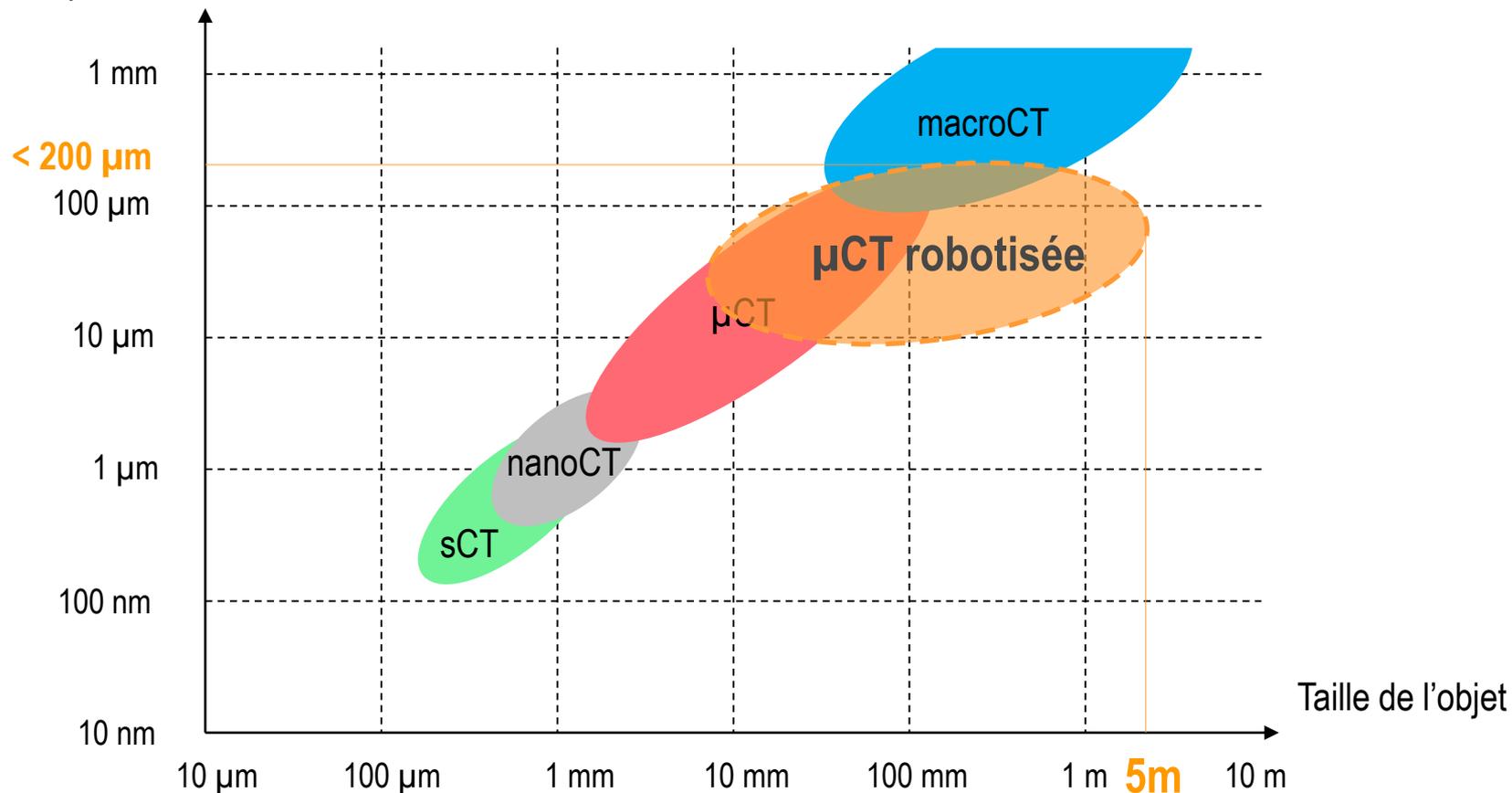
Des outils logiciels et de mesure de précision

- ▣ Un laser de poursuite pour la **précision de positionnement**
- ▣ Un **logiciel de simulation** pour l'optimisation des contrôles
- ▣ Un logiciel d'**optimisation de trajectoires** et de **gestion des collisions**
- ▣ Des algorithmes de **reconstruction 3D** et des outils de **traitement d'image** (détection de défauts, POD, caractérisation 3D)



PLATEFORME DE TOMOGRAPHIE RX ROBOTISÉE

Résolution spatiale





Une plateforme technologique au service de l'innovation industrielle

- ▣ Soutien à la compétitivité en termes de prototypage, réduction des cycles, amélioration de la fiabilité et de la sécurité
- ▣ **Support au développement** de technologies à fort potentiel et de procédés de fabrication émergents
- ▣ Nouveau moyen d'imagerie pour **le contrôle et le suivi de pièces complexes et/ou de grandes dimensions**
- ▣ Vers un **contrôle adapté** à l'objet étudié (réduction des temps d'inspection, imagerie locale, imagerie multi-résolution)



Fanny BUYENS

RESPONSABLE PLATEFORME CND
PAR IMAGERIE RX ROBOTISÉE

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02 28 44 35 98

Prochaine journée PRECEND, le 13
octobre 2016, Nantes - visite de la
plate-forme

Plate-forme opérationnelle courant
2017

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Come and join us for **LETI** **Innovation Days** on **23 June**, Lyon Congress Center



Nicoleta GALATANU
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Xray and gamma imaging - NDT and security

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