

## ANICAN IMAGE: A NEW IN VIVO IMAGING PLATFORM FOR SMALL ANIMALS

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### Development of non-invasive in vivo imaging dedicated to small animal

### New applications fields:

2) Improves pathological monitoring 1) Diagnostic imaging

4) Development of new therapeutic drugs 3) Biomedical research

Treatment effectiveness and translational biomedical research

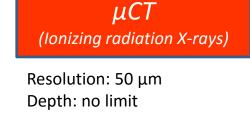
Better results predictability, accelerate the transition to new clinical therapies

Allows longitudinal analysis and avoids euthanasia of large animal numbers (Reduction of the 3R rule)

**Functional** 



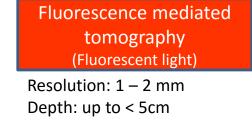








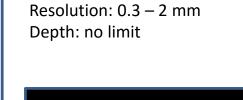
**Photoacoustic** 

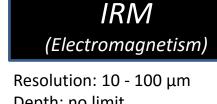






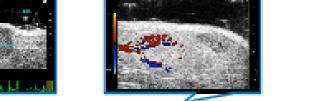
Depth: up to < 5cm

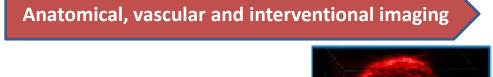




Depth: no limit



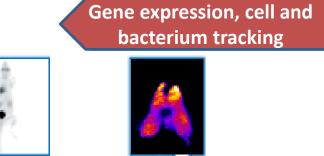






Oxygen saturation, hypoxia and sentinel lymph node detection Quantitative imaging of fluorescent reporters

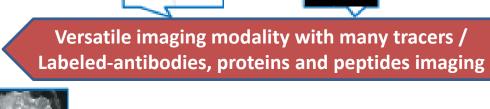
**Modalities for small-animal** imaging in vivo



Molecular

maging modalities

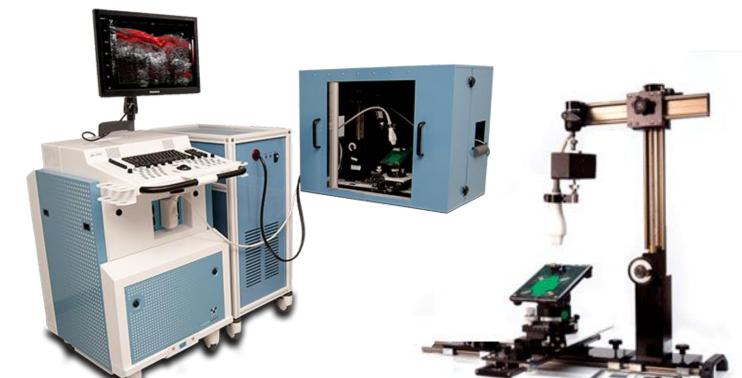
in AniCan Image





Versatile imaging modality with high soft-tissue contrast

# VevoLAZR® (Visual Sonics) - Ultrasound and Photoacoustic imaging



### **Transducer features:**

- Ultrasound transducer
- Frequency: 21 and 30 MHz - Axial resolution: 30 and 75 μm
- Lateral resolution: 75 and 165 μm
- Laser pulsed:
- Frequency: 20 Hz
- Wavelength: 680-970 nm Increment of wavelength: 1nm

### **Vevo Imaging Station:**

- Adjustable X, Y, and Z positioning system
- Mouse Handling Table
- Motor 3D (Scan)
- Advanced Physiological Monitoring Unit to monitor animal temperature, ECG, heart rate and blood pressure

### **Ultrasound imaging applications**

- Organ and tumor imaging (3D)
- Biology happens in real time
- Growing tumors
- Nephrology, Hepatology, Rheumatology
- Vascular flow (Doppler)
- Cardiac function
- Ultrasound guided injection
- Interventional procedures
- Translational research

**Photoacoustic imaging** 

hemoglobin count

the tumor real mapping)

sentinel lymph nodes

**Evaluation stages of tumors** 

Melanoma and other skin cancers

### **Contrast imaging functionality**

- Perfusion analysis using destruction and reperfusion quantification
- Biomarker quantification tools when using µbubble targeted

Quantification of oxygen saturation and

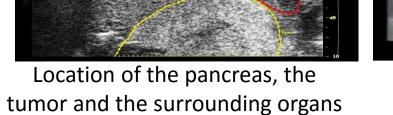
Oxygen distribution measurements in

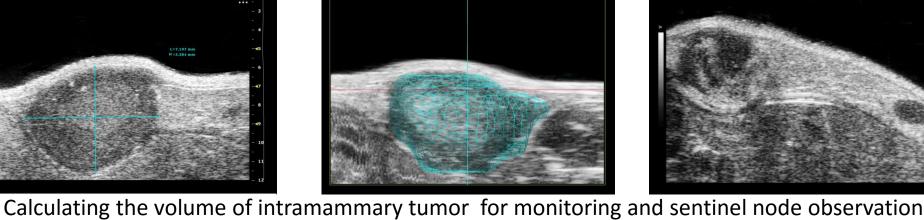
Identification of lymphatic vessels and

Nanoparticles, contrast agent imaging

Microdistribution of biomarkers

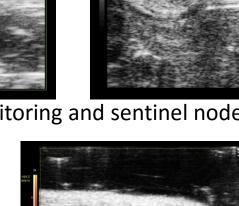
Generating absorption spectra

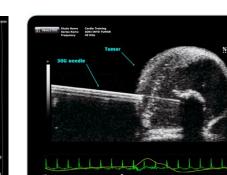




3D Doppler with

pancreatic tumor





injection

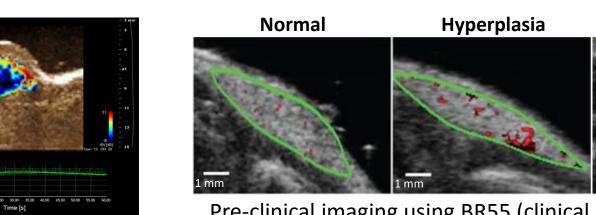
Invasive

Équipement d'excellence (2ème appel à projet)

PROJET PhenoCan

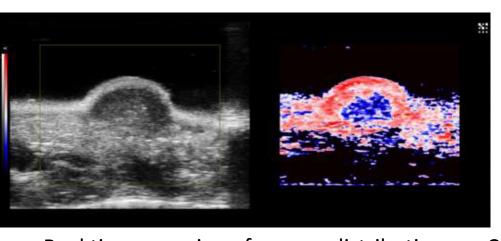
Ultrasound guided Kidney vascularization

Carcinoma in situ

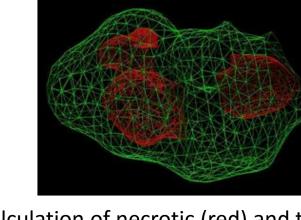


Blood perfusion studies in vivo

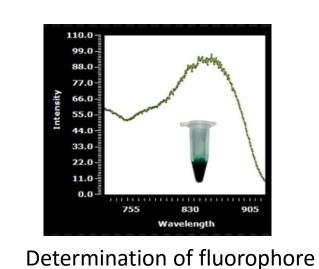
Pre-clinical imaging using BR55 (clinical grade anti-VEGFR2) MB in a transgenic mouse model of breast cancer development. (Bachawal 2013 AACR)



Real time mapping of oxygen distribution in the intramammary tumor



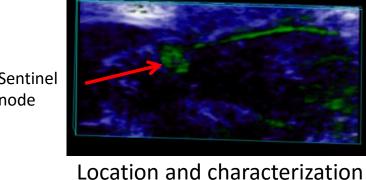
Calculation of necrotic (red) and tumor (green) volumes on pancreatic tumor



absorption profiles



B-Mode and photoacoustic images of a subcutaneous tumor before and 2 minutes after a 200 µl bolus of GNR. Photoacoustic contrast in enhanced by GNRs in the vasculature.



of sentinel lymph node after methylene blue injection

# Quantum FX<sup>®</sup> (Perkin Elmer) - Preclinical μCT



- X-ray-based high resolution imaging modality
- Revolving arm (360°): acquire full 3D data
- Detector: convert absorbed X-rays into visible light photons Anatomical imaging: tissues, organs and whole organisms
- Characterization of disease progression



Kidneys

3D image to obtain

greater structural and anatomical informations.

# FMT4000® (Perkin Elmer) - Fluorescence Molecular Tomography



Excitation (nm) Excitation (nm)

600 → 635

635 → 675

735 → 750

 $780 \to 788$ 

FMT4000 Excitation and Emission wavelengths

in infrared to provide auto fluorescence

Injection IV of PLA DIR 0,5%

and biodistribution in the liver

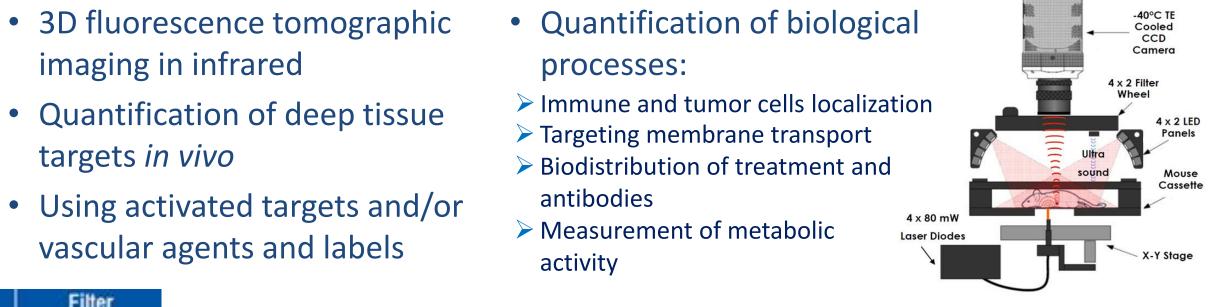
 Quantification of deep tissue targets in vivo

imaging in infrared

- Using activated targets and/or vascular agents and labels
- > Biodistribution of treatment and antibodies ➤ Measurement of metabolic

processes:





Positioning of the mouse

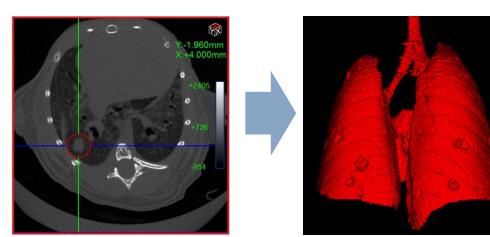
1- Reflectance Fluorescence: Reference Image acquired using led Transillumination FMT Raster Scan using 80mW lasers

Tomographic data collected using a CCD

Lung tumoral imaging

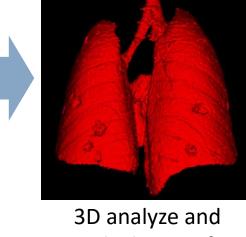
Positioning of

the mouse



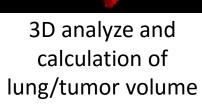
longitudinal follow-up of lung tumor growth

Bone tumor imaging



Observation and

Observation of femur and trabecular bone



Fluoroscopy mode:

Real-time imaging enables

precise animal positioning

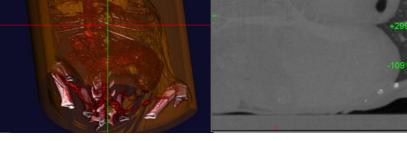


Contrast agents for blood vessel and tumor imaging

Tomographic images or slices of specific areas

of the body are obtained from a large series of

2D X-ray images taken in different directions.

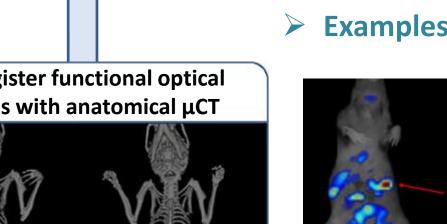


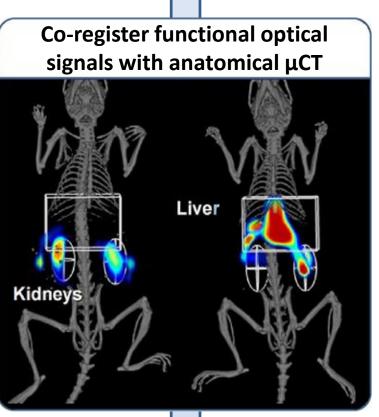


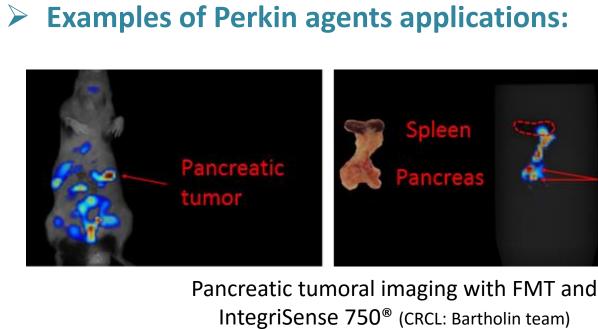
elimination



Kidney and tumor vascularization







Emission (nm)

 $648 \to 668$ 

690 → 740

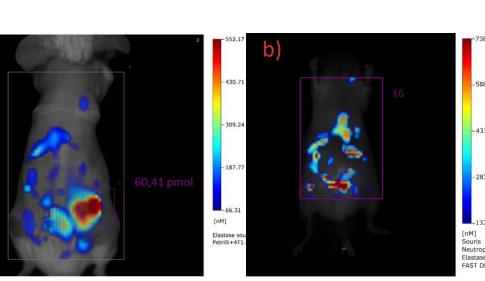
770 -> 80

≥ 805

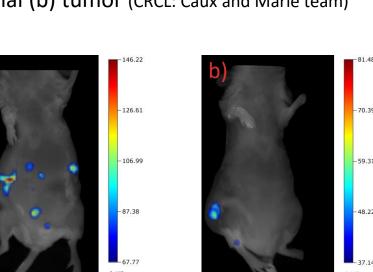
IntegriSense 750<sup>®</sup> (CRCL: Bartholin team) Testing and imaging its own fluorescent agents:

Intratracheal administration of PLA DIR 0,5% and bio-

distribution monitoring in the lungs (LBTI: Verrier team)

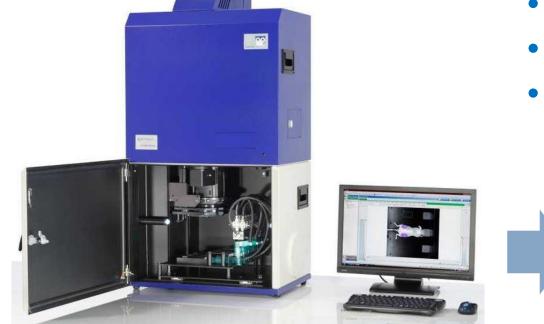


Inflammation imaging with FMT and Neutrophil Elastase 680 FAST® on mammary (a) and intestinal (b) tumor (CRCL: Caux and Marie team)



Test of new florescent agents of CIPA (Orléans) to detect mammary tumor (a) with RGD 750 and inflammation (b) with Macro750

# Night OWL - Bioluminescent imaging



Powerful approach using animals/cells with genetic modifications

- Luciferase reporter systems
- Tumor cells or bacteria location

