

Longitudinal imaging

2P large FOV
multispectral
galvo / resonant
microscope



2P & 3P
galvo / resonant
microscope



Freely moving

2P & 3P
scanning
endoscope

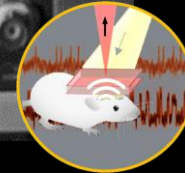
2P ultra-thin
lensless
endoscope



Deep imaging

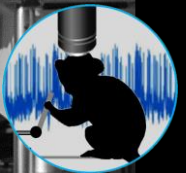
Photoacoustic
imaging setup

All-optical
photoacoustic
system for high
resolved Ca²⁺
imaging

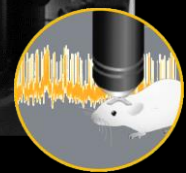


Voltage imaging

2P large FOV
low noise
ultrafast AOD
microscope



2P low noise
ultrafast
AOD
microscope

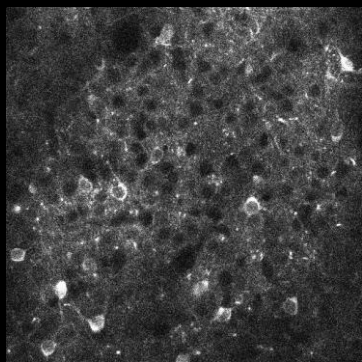


Contexte?

La photonique pour « éclairer » le fonctionnement des réseaux neuronaux



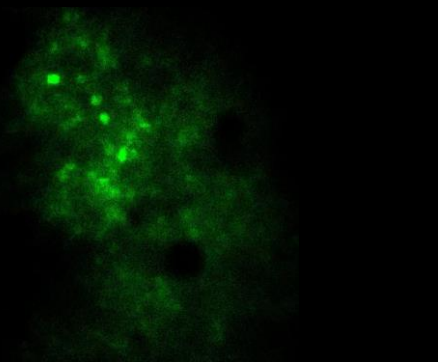
Imagerie et photostimulation
du cortex de souris



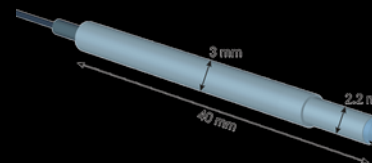
Cossart et al. Nature 2003, Bonifazi et al. Science 2009, Malvache et al. Science 2016, Modol et al. Nature Neuro. 2021 in revision



Imagerie du cortex
visuel de marmoset

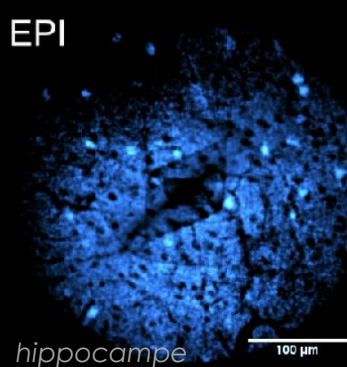


Muller et al. Nat. Com. 2014, Deneux et al. Neurophotonics 2017, Chemla et al. J. Neuro 2019,

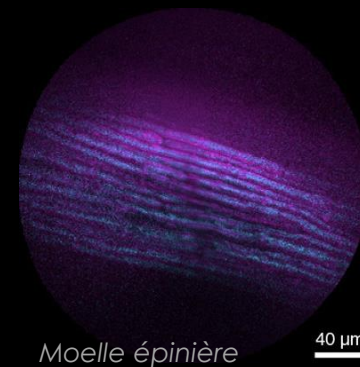


Imagerie par fibre optique

EPI



hippocampe



Moelle épinière

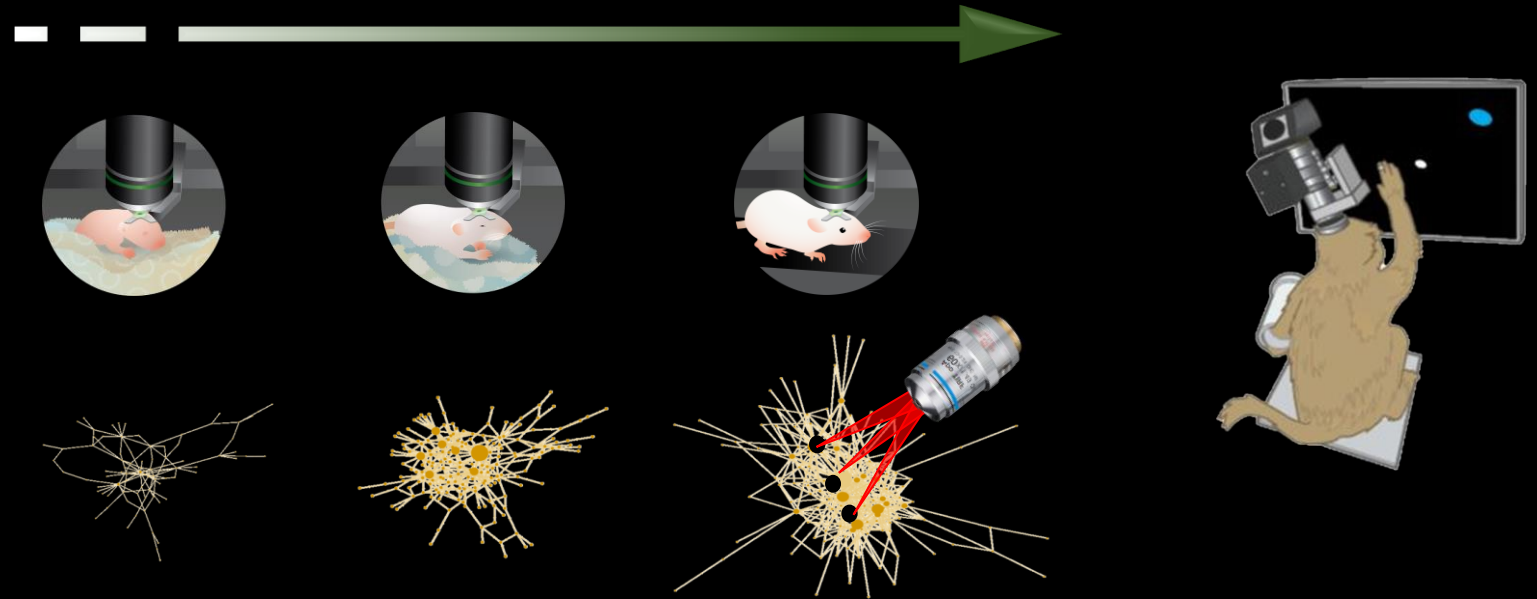
Lombardini et al. Light: Science & Applications 2018, Kudlinski et al. Opt. Exp. 2020

Objectifs?

Besoins scientifiques et structuration locale

Exploration fonctionnelle des circuits neuronaux *in vivo*:

- Profondeur
- Champ-large
- Mini-invasif
- Rapidité



- Porter l'expertise technologique à l'état de l'art au service de la communauté
- Structurer l'expertise des neurosciences marseillaises en photonique et augmenter leur visibilité et leadership

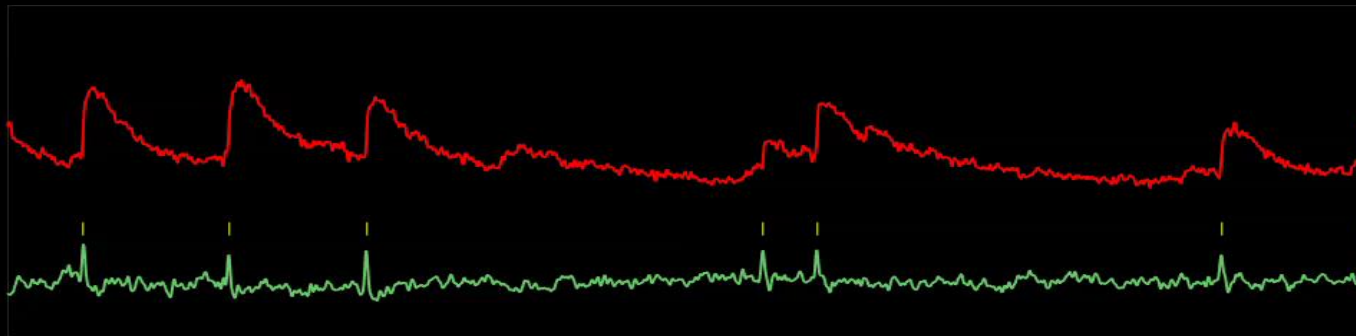
Stratégie?

Un centre d'imagerie photonique des circuits neuronaux rongeurs et primates

Deux niveaux de solutions technologiques:

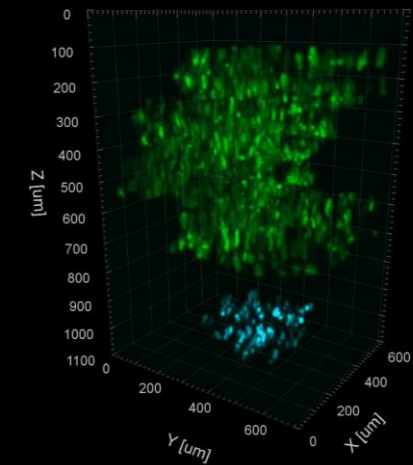
1. Instruments photoniques commerciaux à l'état de l'art:
façonnés « sur mesure » avec nos partenaires industriels

Imagerie AOD du potentiel



Dual scanning lines allow concurrent calcium and voltage recordings on dendrites

Imagerie 3-photons



Weinsenburger et al. Cell 2019



Stratégie?

Un centre d'imagerie photonique des circuits neuronaux rongeurs et primates

Deux niveaux de solutions technologiques:

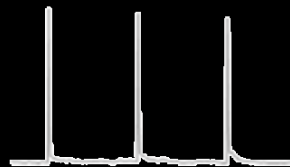
2. Co-développement d'instruments photoniques de rupture :

accélérer le transfert de solutions technologiques innovantes en développement depuis les laboratoires d'optique vers la plateforme



No fluorescence signal at large depths (>1mm)

Membrane potential



Fluorescence \propto [Ca²⁺]

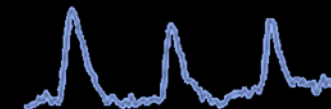


Photoacoustic imaging can probe optical absorption contrast at several millimeters in depth

Optical absorption



Ultrasounds \propto [Ca²⁺]



Organisation de la plateforme

Project Manager - Dr Rosa COSSART

Functional exploration of
primate

INT, MARSEILLE TIMONE

Dr Guillaume MASSON

Administrative officer
Jean-Louis Chassaing

**Scientific & technical
manager**
Ivo Vanzetta

inphim
in vivo & in vitro
neuronal
photonic imaging platform

**Project
coordinator**

Sophie
Brustlein

Aix*Marseille
université
Initiative d'excellence

Inserm
La science pour la santé
From science to health



Functional exploration of
rodent

INMED, MARSEILLE LUMINY

Dr Rosa COSSART

Administrative officer
Fanny PRA

**Scientific & technical
manager**
François Michel

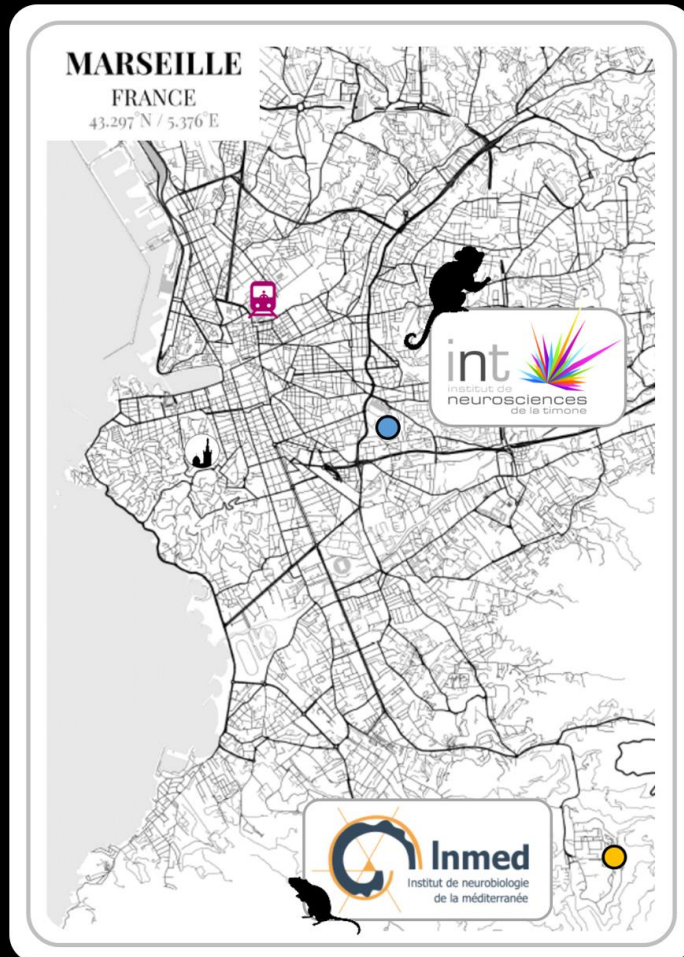


Boards and councils

Projects Committee
Scientific Advisory Board



Accès aux équipements



Fast voltage imaging



Adaptation of 2P ultrafast low-noise AOD scanning microscope (3D)
+ 2P ultrafast low-noise AOD scanning microscope (2D)



Structural & functional imaging



2P multicolor large FOV resonant scanning microscope



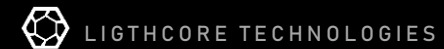
Longitudinal deep brain imaging



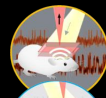
2P/3P large FOV resonant microscope with holographic stimulation module



Freely moving imaging



2P/3P scanning endoscope + 2P ultrathin lensless endoscope



Imaging at large depth



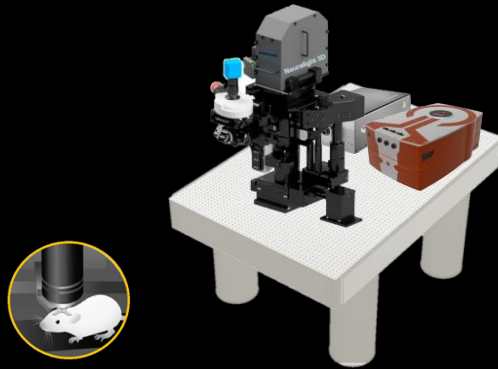
All-optical photoacoustic system for deeper Calcium imaging

Accès aux équipements



Rodent

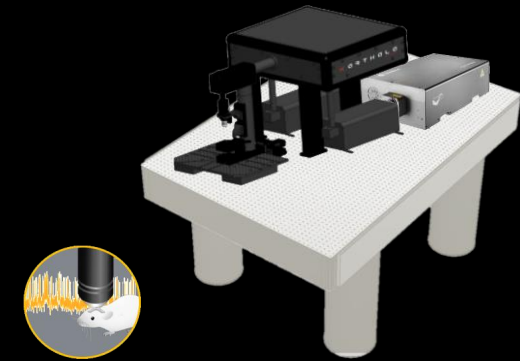
2P & 3P + photo-stimulation



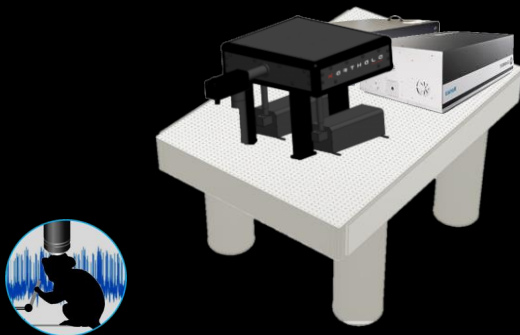
2P & 3P endoscope



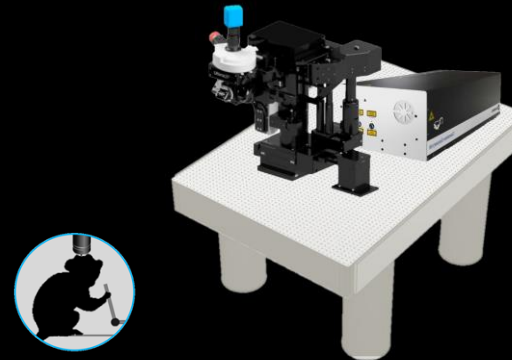
2P AOD scanning (2D)



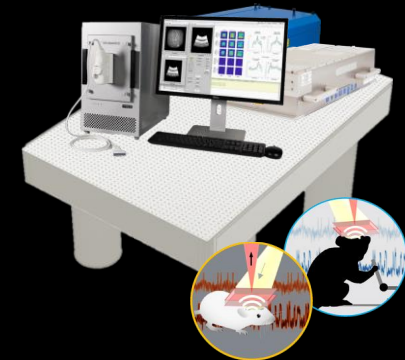
2P AOD scanning (3D)



2P multicolor



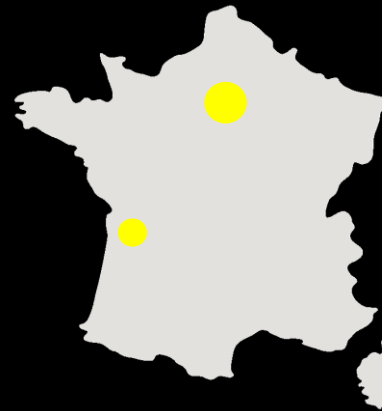
Photoacoustic



Primate

Utilisateurs internes / externes

LOCAL



NATIONAL

IBENS (Paris)
Institut de la Vision (Paris)
Institut du fer à Moulin (Paris)
Neuro-PSI (Gif-sur-Yvette)
IINS (Bordeaux) ...

INTERNATIONAL

King's College London,
University of Oxford (UK)
Bernstein Center Freiburg, Aachen
University (Germany)
Instituto de Neurociencias (Spain)
Netherlands Institute of Neuroscience
(Netherlands)
University of Helsinki (Finland)



⇒ Système de réservation international: **Open IRIS**

Tarification

