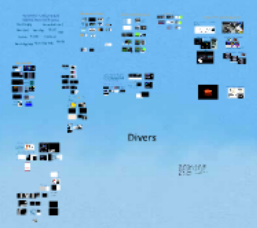
Pascal Dardelin - SuperSonic Imagine - Aix en Provence - France

SUPERSONIC imagine

Ultrasound goes Ultrafast



Pascal Dardelin - SuperSonic Imagine - Aix en Provence - France

SUPERSONIC imagine

Ultrasound goes Ultrafast

Ultrasound goes Ultrafast

SuperSonic Imagine "The New Kid on The Block"

Several new concepts & completely novel imaging modes:

1) Ultrafast Imaging
2) Mechanical properties of tissues
3) Shear Wave Elastography (SWE)
4) Ultrafast Doppler
5) And more to come ...

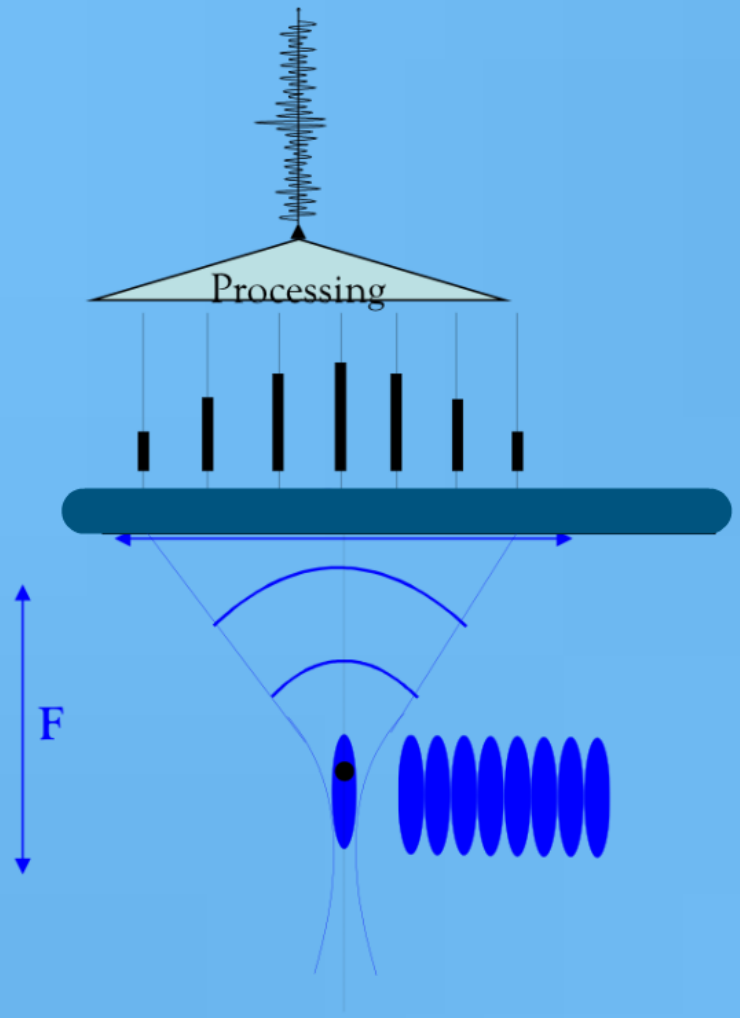
From a research platform to a clinical product

The largest acoustic lab worldwide

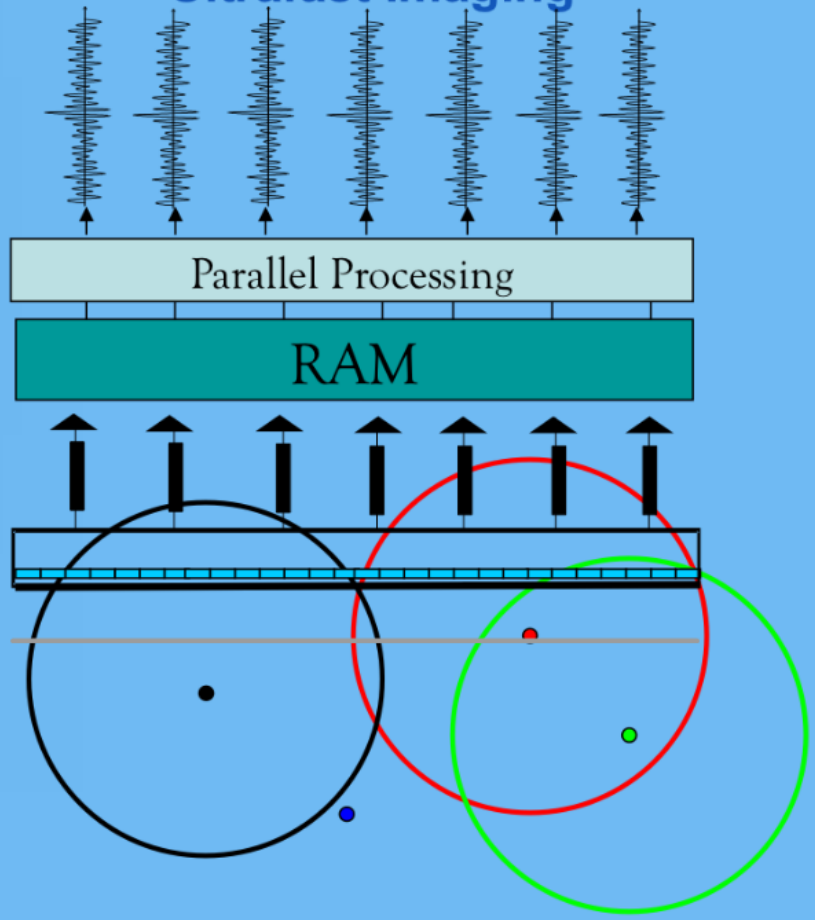
Institut **Langevin**
ONDES ET IMAGES

The key concept of Ultrafast Imaging is plane wave transmission

Conventional Imaging



Ultrafast Imaging



Why ? ...for tracking invisible vibrations ...

Going Beyond the Traditional Applications of Ultrasound ...

The first Ultrafast UltraSound Scanner

built in 1998 (128 independent Channels)
Analog Log/linear Amplifiers
9 Bits A/D converters
256 MBytes Embedded memory
up to 10000 frames/s
100 ms Ultrafast sequences
40 minutes of processing
(Data transfer + beamforming process)

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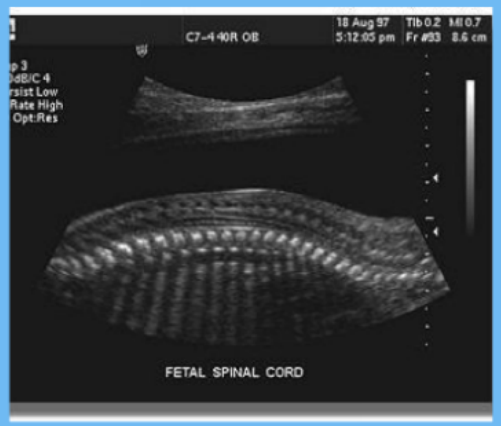
ONDES ET IMAGES

A new paradigm for Ultrasound Imaging

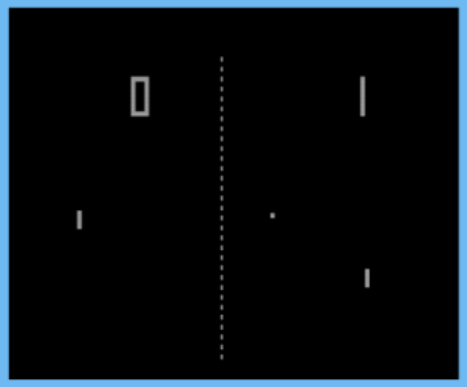
1980

1990

1995



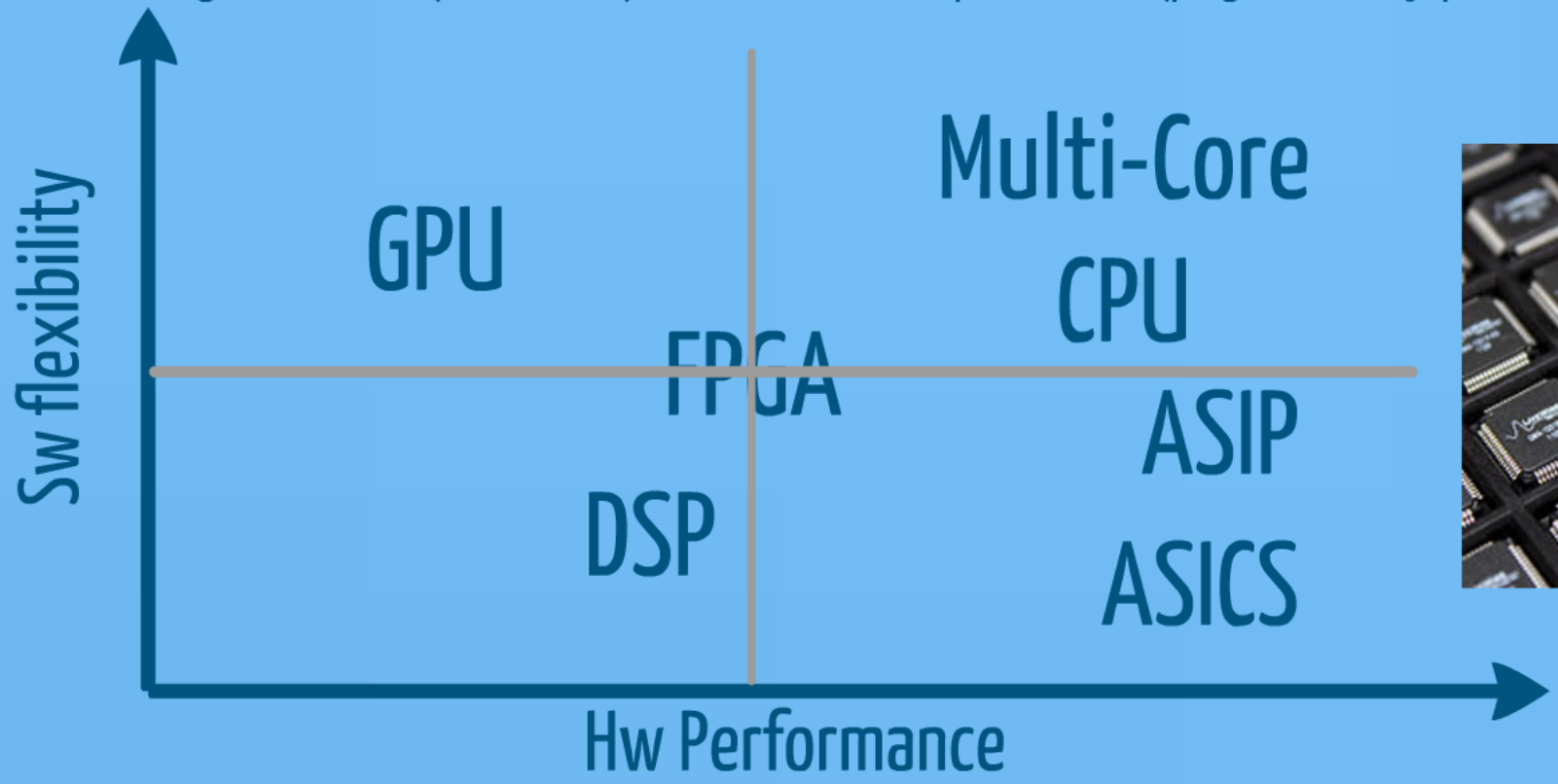
2010



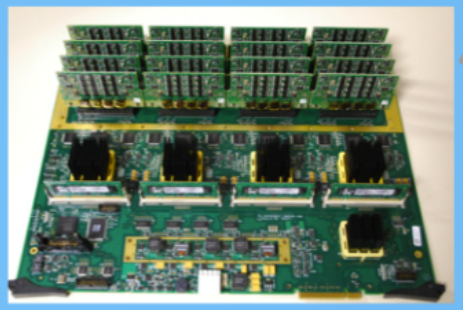
... the e-game industry ...

Multiprocessors architecture and Software goes beyond existing technologies

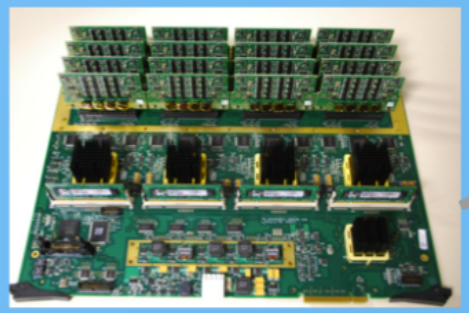
Development cost of dedicated ICs (ASICs, ASIPs) becomes unaffordable for most applications
Development time of dedicated ICs (ASICs, ASIPs) to reaches market visibility
Programmable ICs (FPGAs, DSPs) reach their limits of performance (programmability, power consumption, cost)



Aixplorer, a all software-based ultrasound



ADC + FPGA



20Gb/s

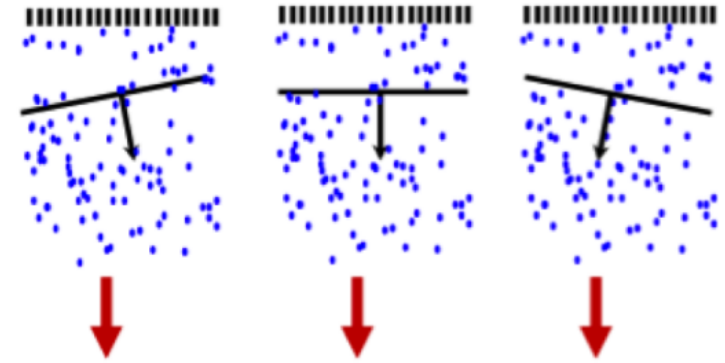
PCI Express
AGP

debian

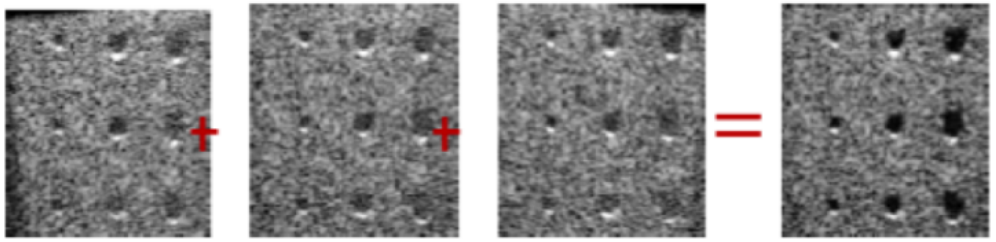
GPU + CPU

Image quality with Ultrafast Imaging Coherent Plane Wave Compounding

Illumination with a set of
Plane Waves
with DIFFERENT ANGLES



Each plane wave gets
a LOW QUALITY IMAGE

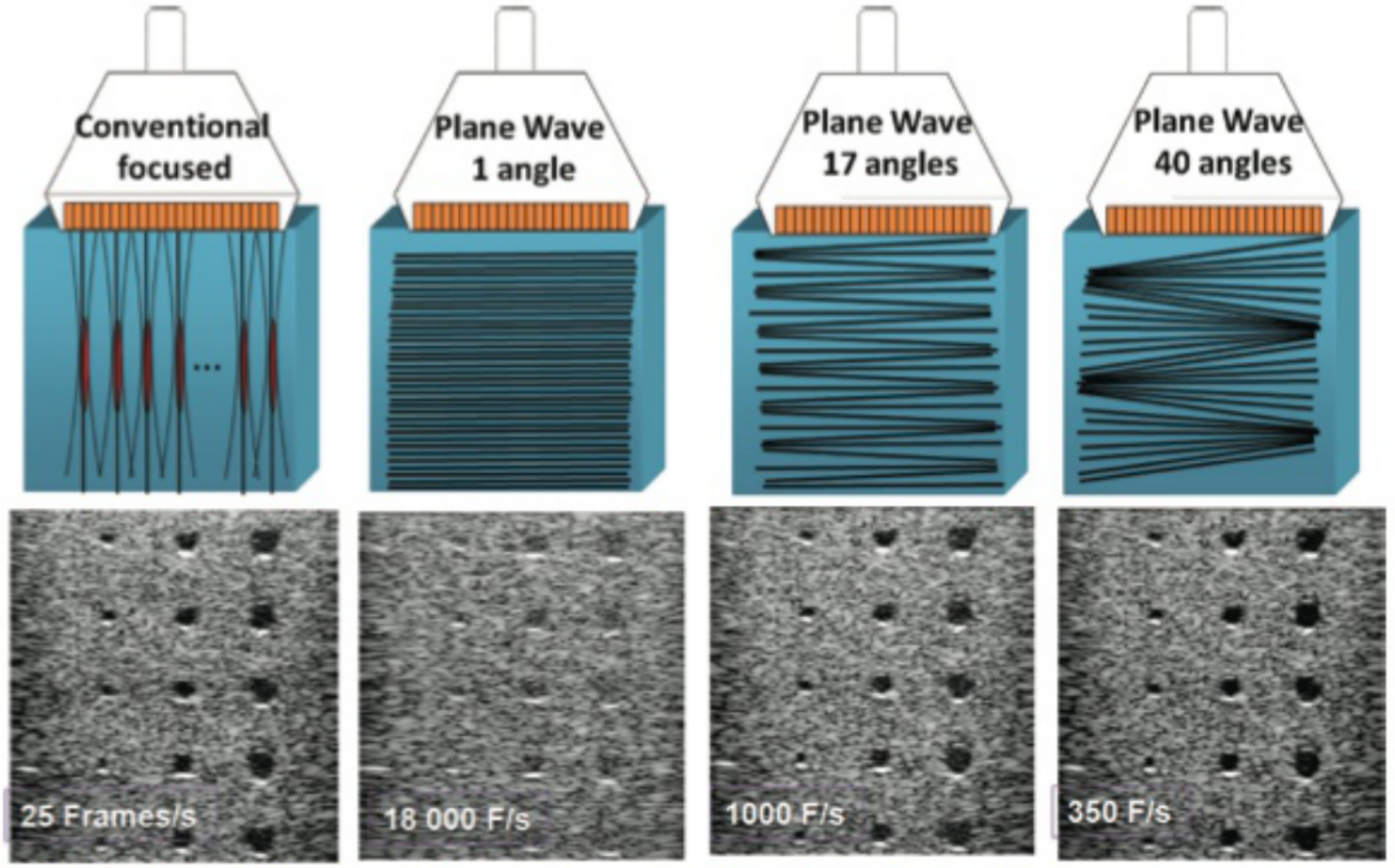


The coherent addition generates a
HIGER QUALITY IMAGE

Coherent plane-wave compounding for very high frame rate ultrasonography and transient elastography.

G. Montaldo, M. Tanter, J. Bercoff, N. Benech, M. Fink, IEEE Trans.UFFC, March 2009

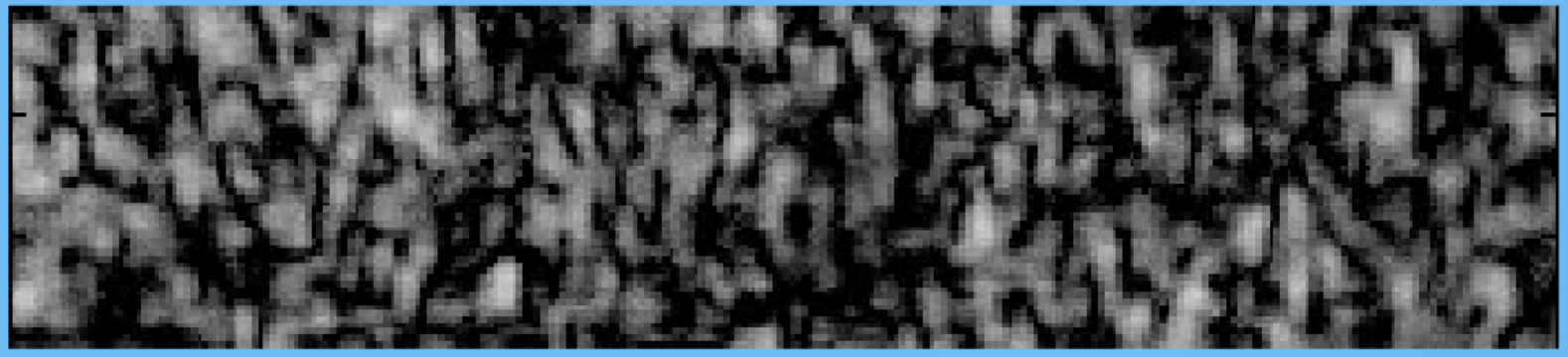
Coherent Plane Wave Compounding / Trade-off between speed quality



From a reSearch platform to a clinical product

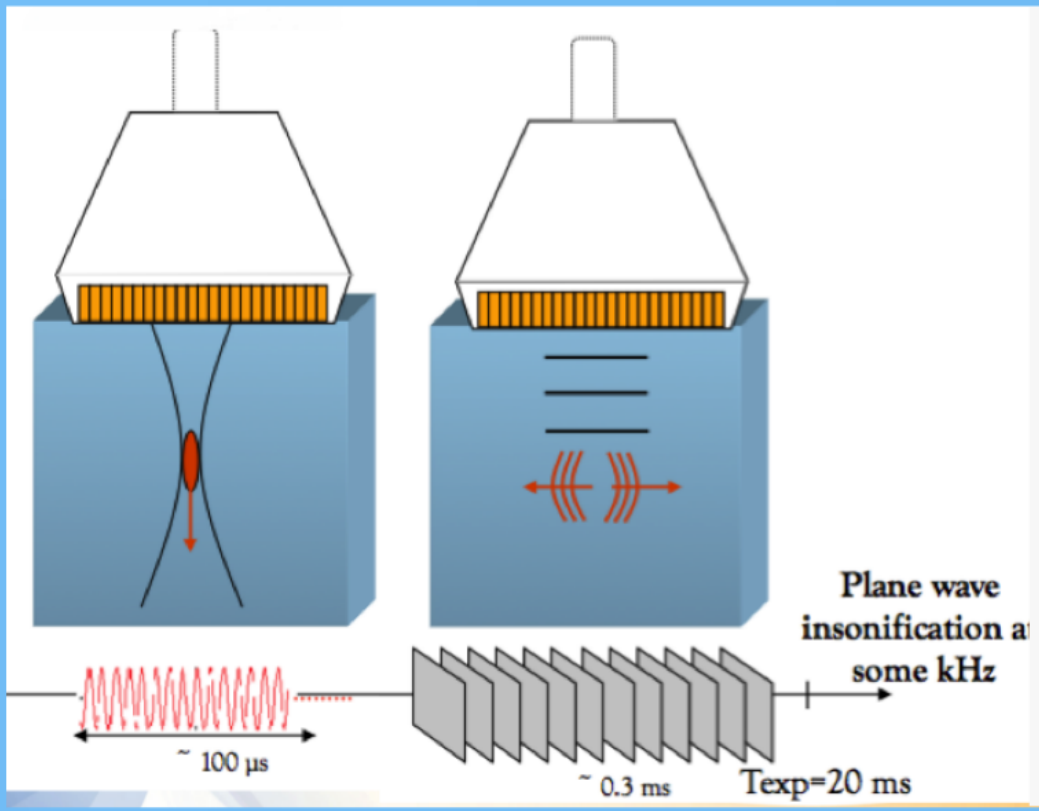
2005 created
2008 1st RSNA & JFR
+120 col.
› 800 units ww
›150 France
12 APHP
› 80% exp

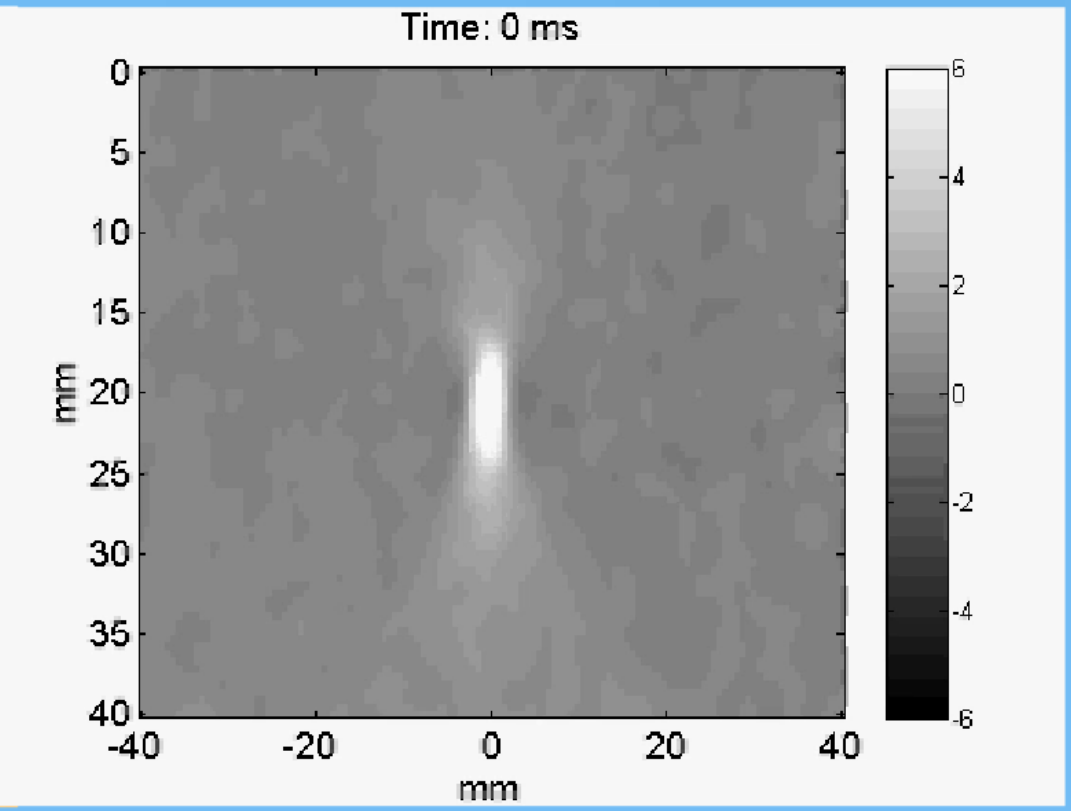
Ultrafast imaging of the Shear wave propagation



10000 frames/second in a US Phantom

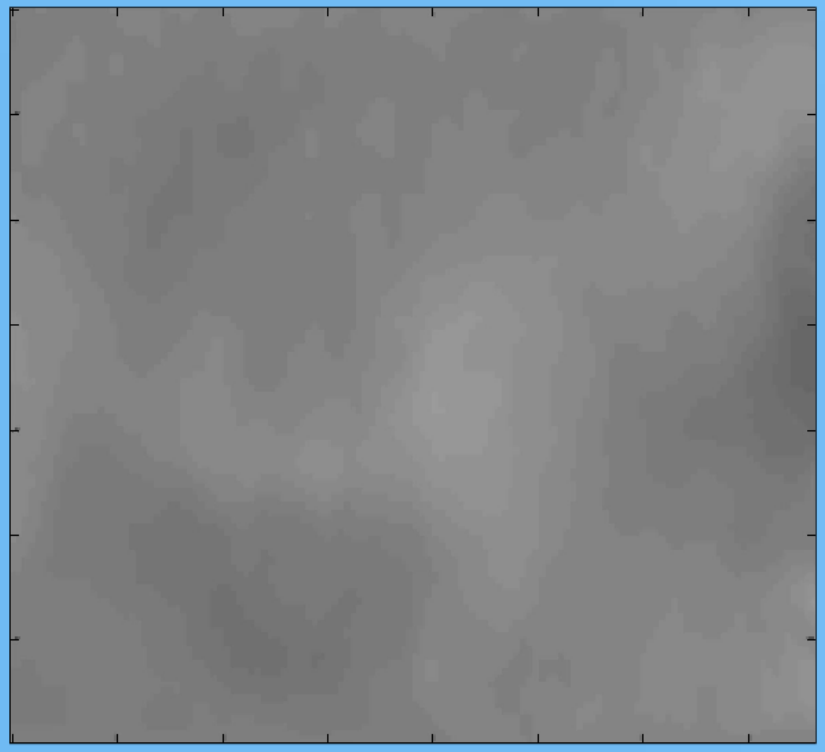
The first Application : A kind of Human Body SiSmology

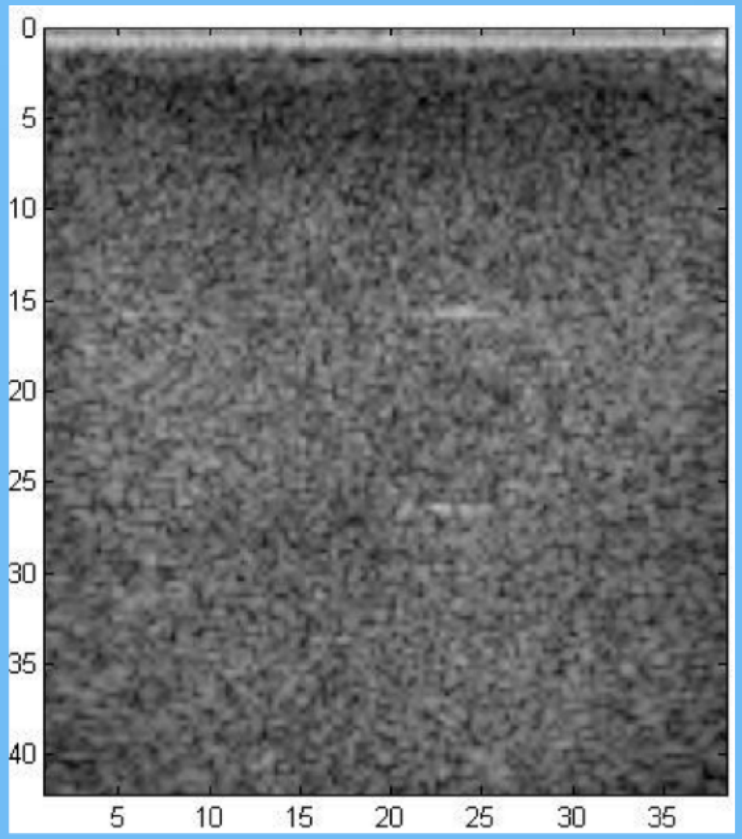




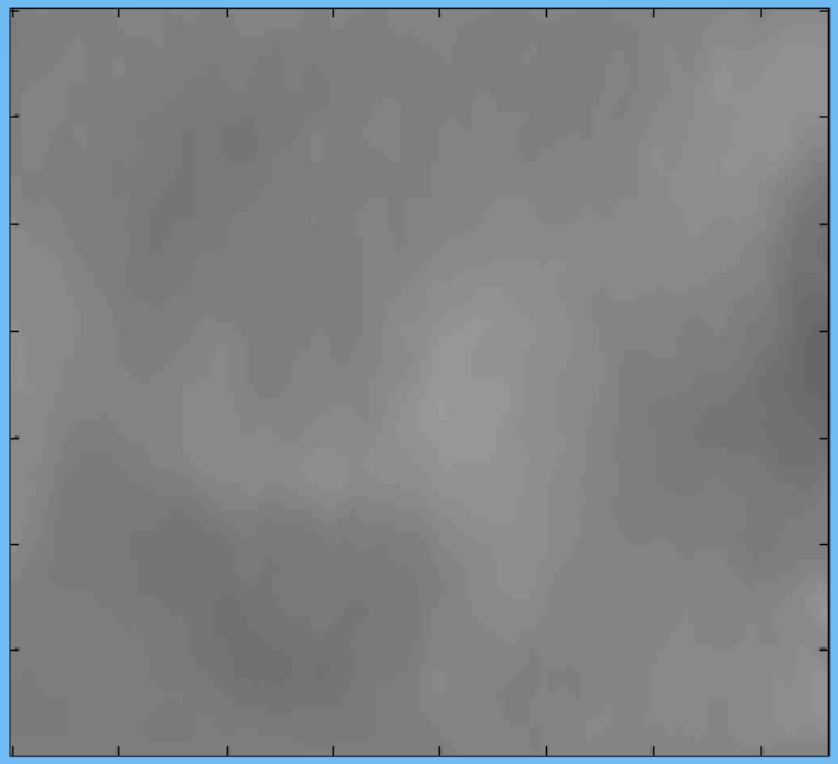
Combining Ultrafast Imaging and Acoustic Radiation Force palpation

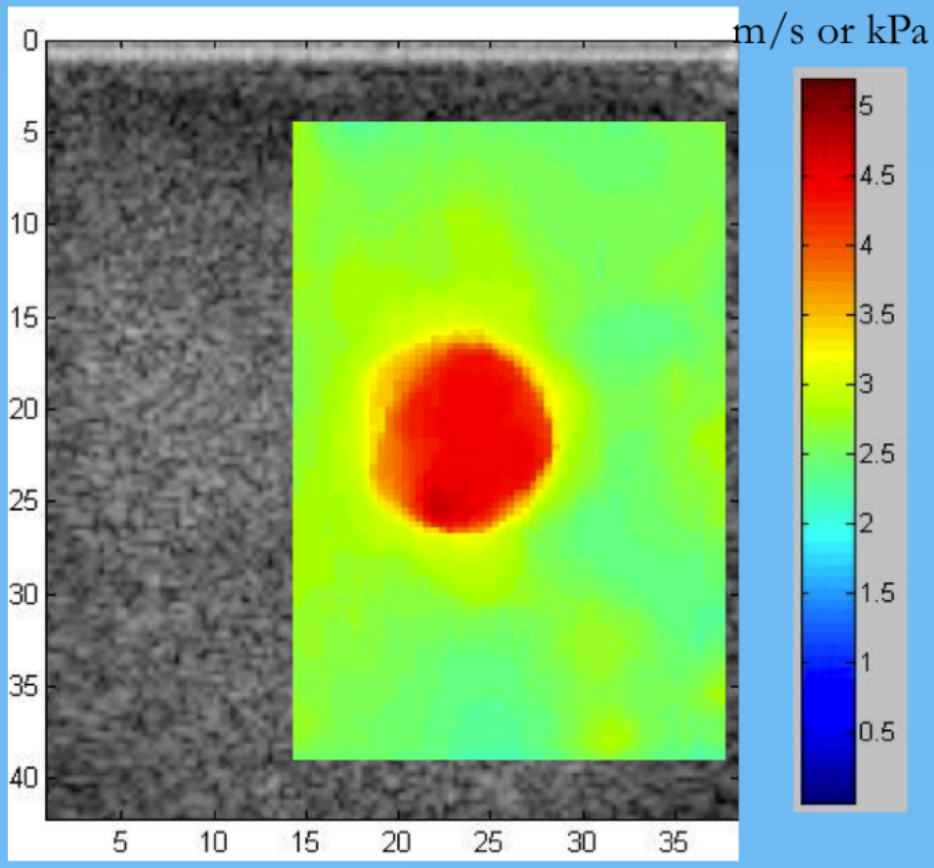
The local Shear wave Speeed gives access to local mechanical properties



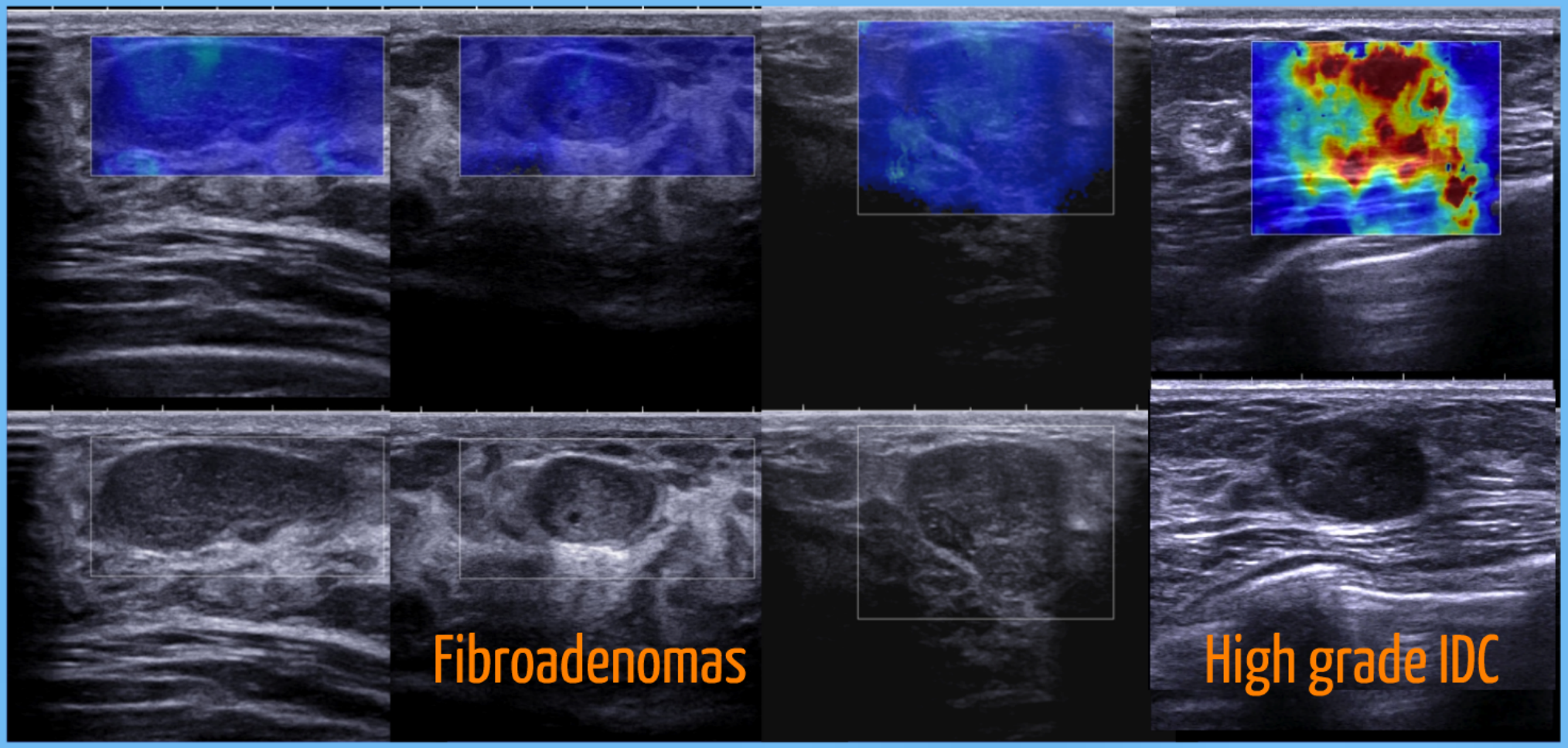


The local Shear Wave Speed gives access to mechanical properties





Dr. Tourasse, Lyon France



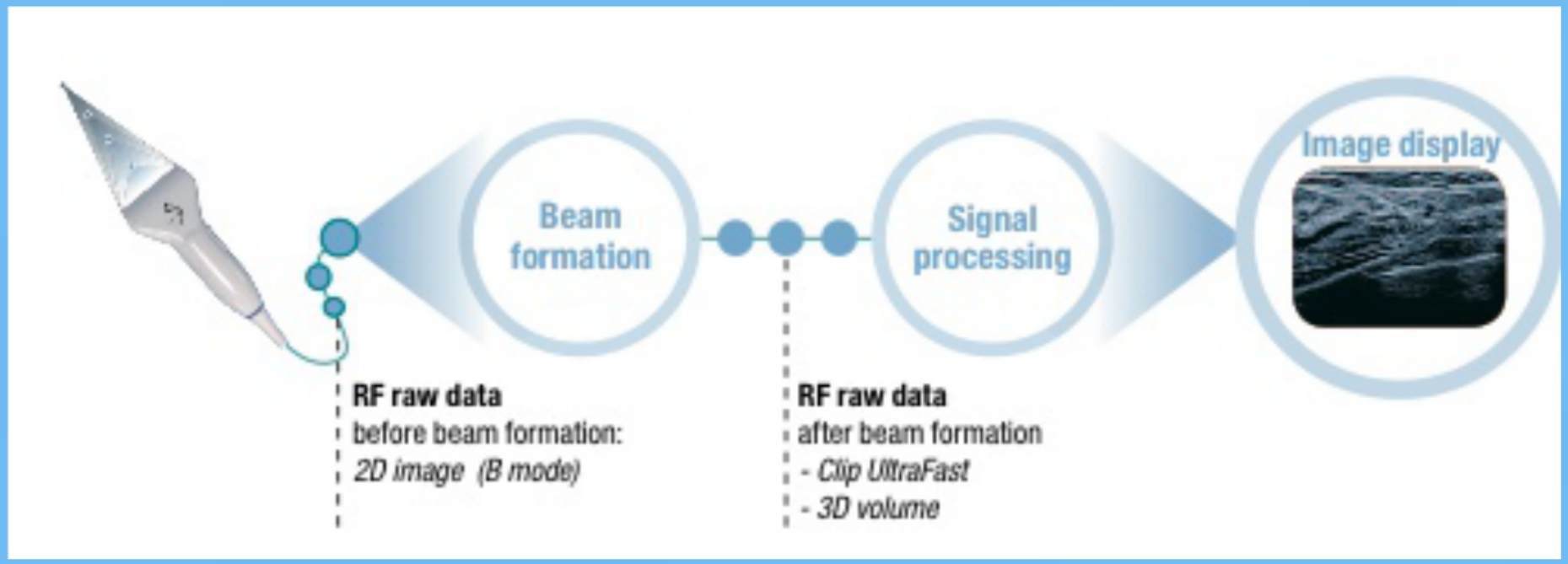
Dr. Tourasse, Lyon / Dr Chamming's HEGP

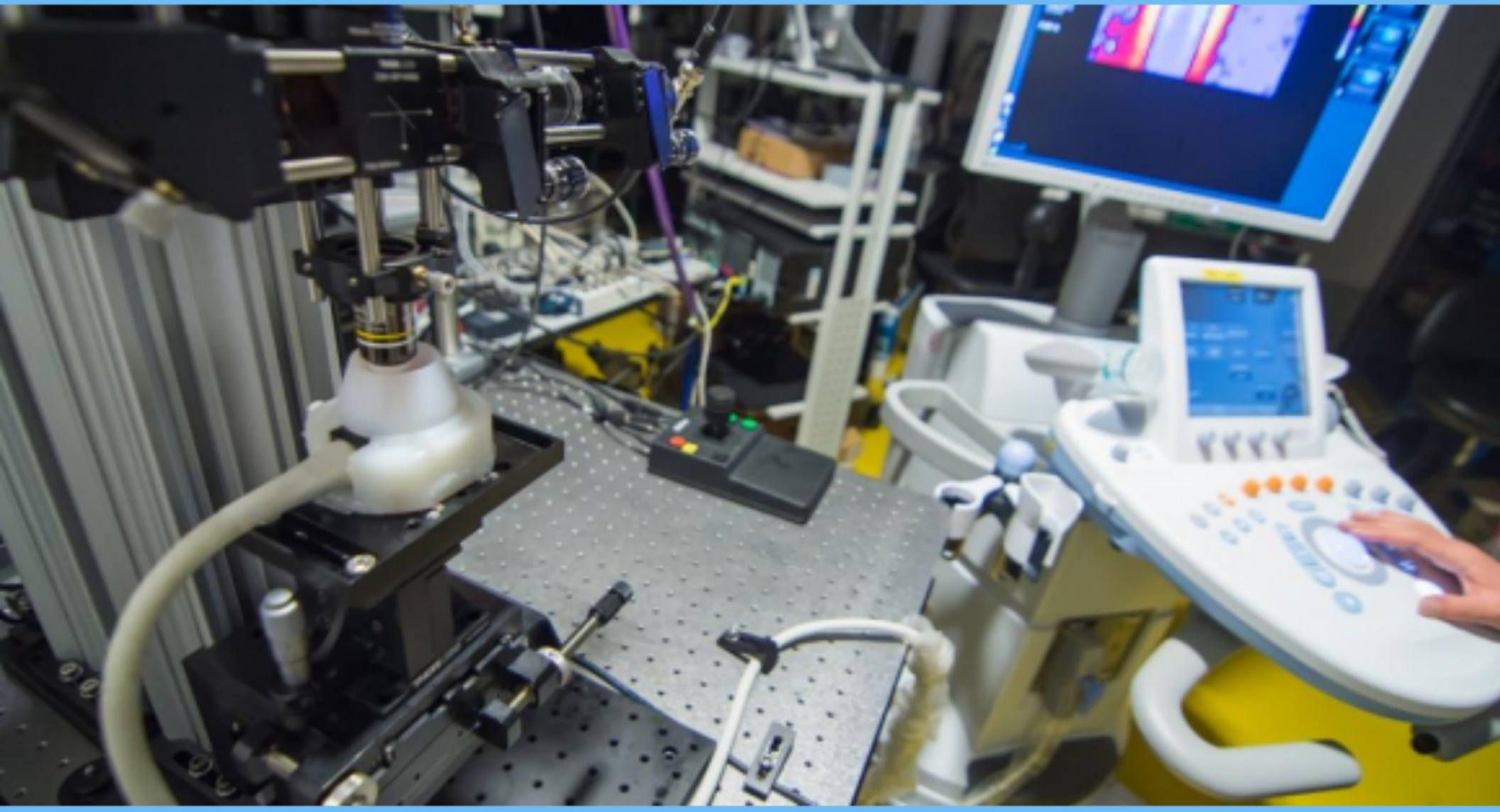
Pre-Clinical

Possible Uses

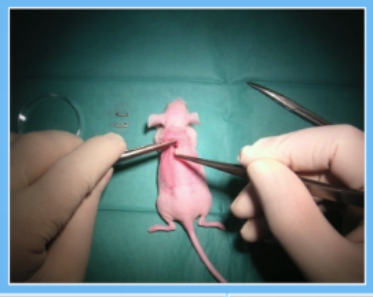
The raw RF data, easily acquired by the SonicResearch option, can be useful in many research fields such as:

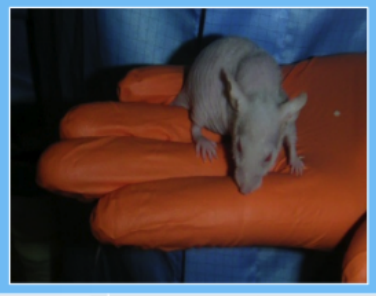
- UltraFast Hemodynamics
- Impact Biomechanics
- Physiology of Muscle Contraction
- Elastography

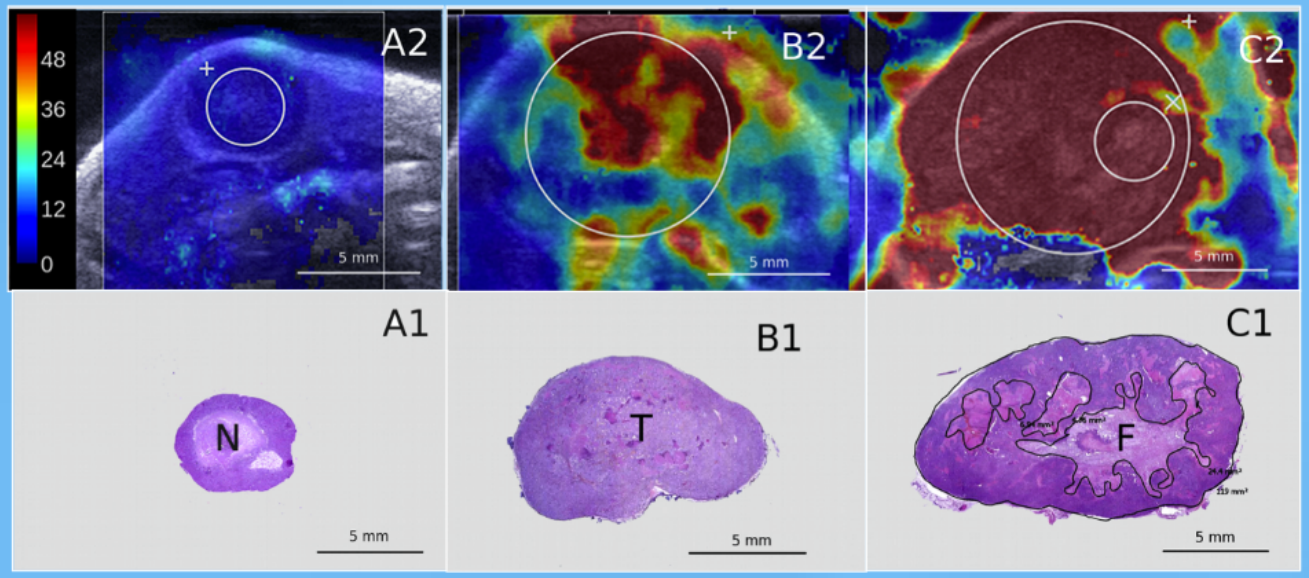




Pre-Clinical reSearch and Mice Imaging



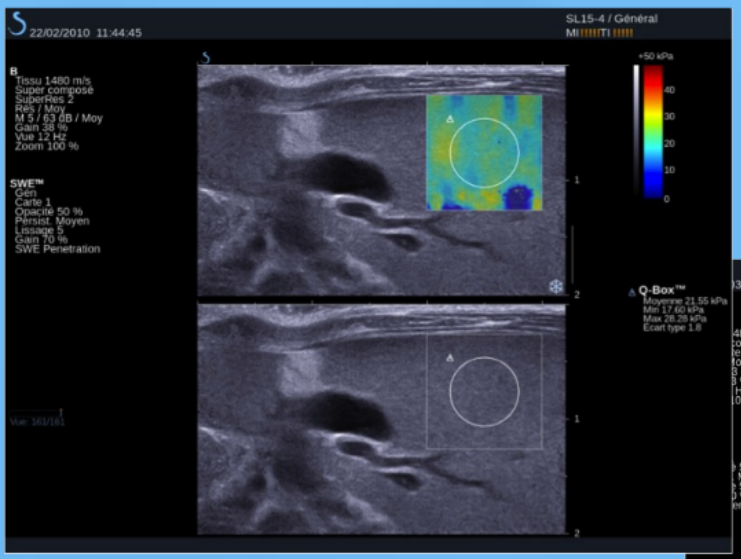




Dr Chamming's HEGP

Eur Radiol. 2013 Aug;23(8):2079-86. doi: 10.1007/s00330-013-2828-8. Epub 2013 Apr 4.
Shear wave elastography of tumour growth in a human breast cancer model with pathological correlation.

Pre-Clinical reSearch and Mice Imaging



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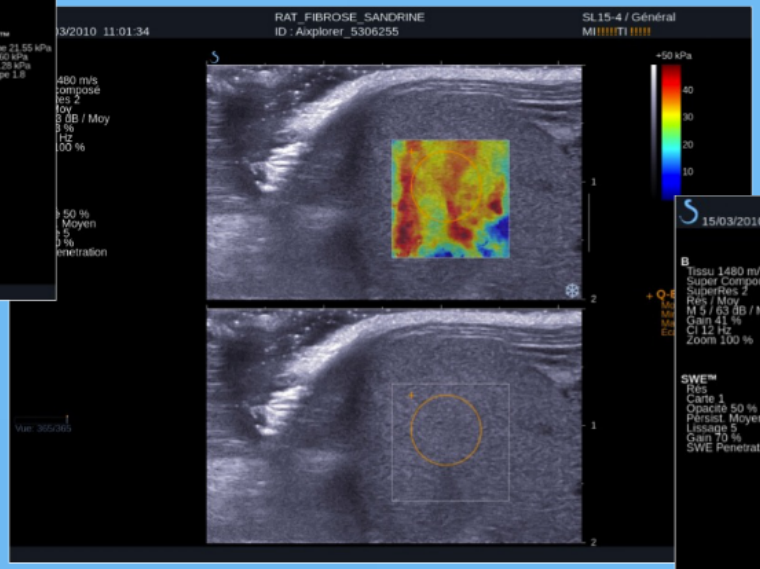
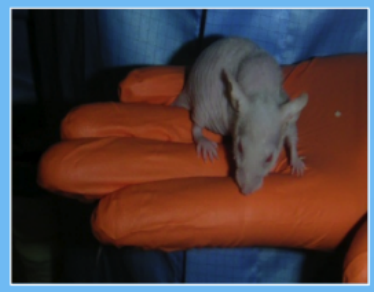
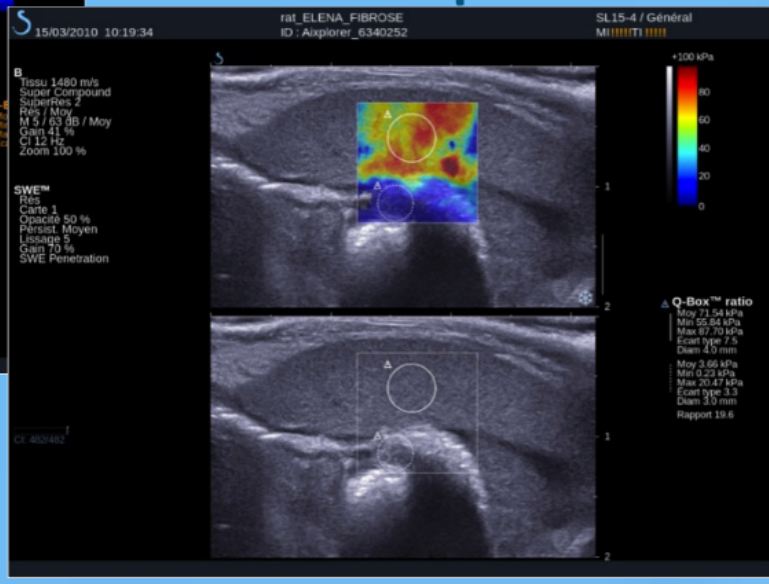


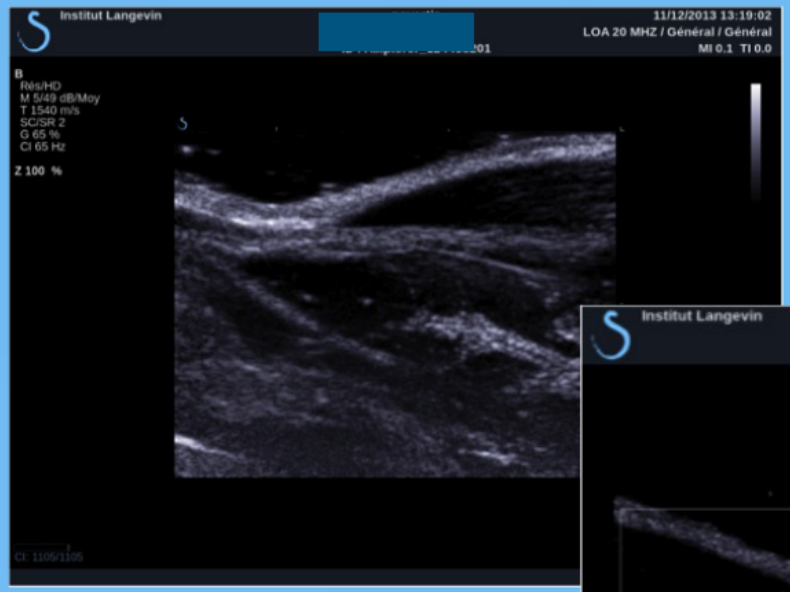
35 kpa

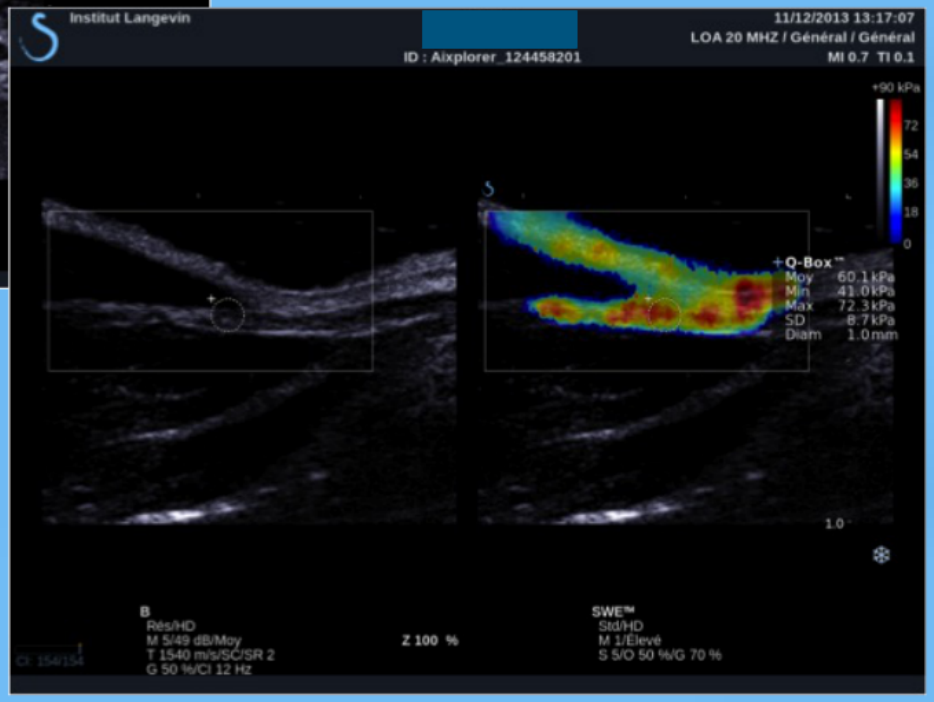


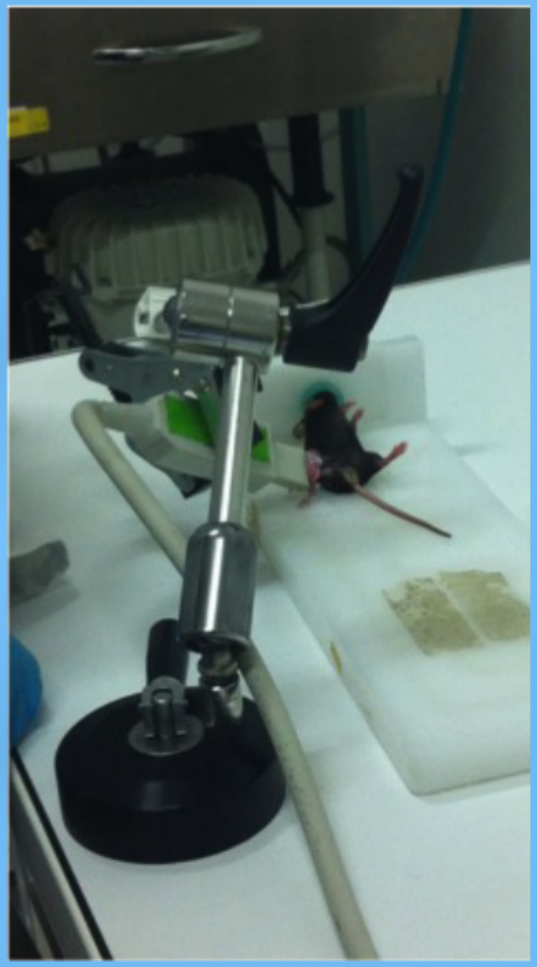
70 kpa

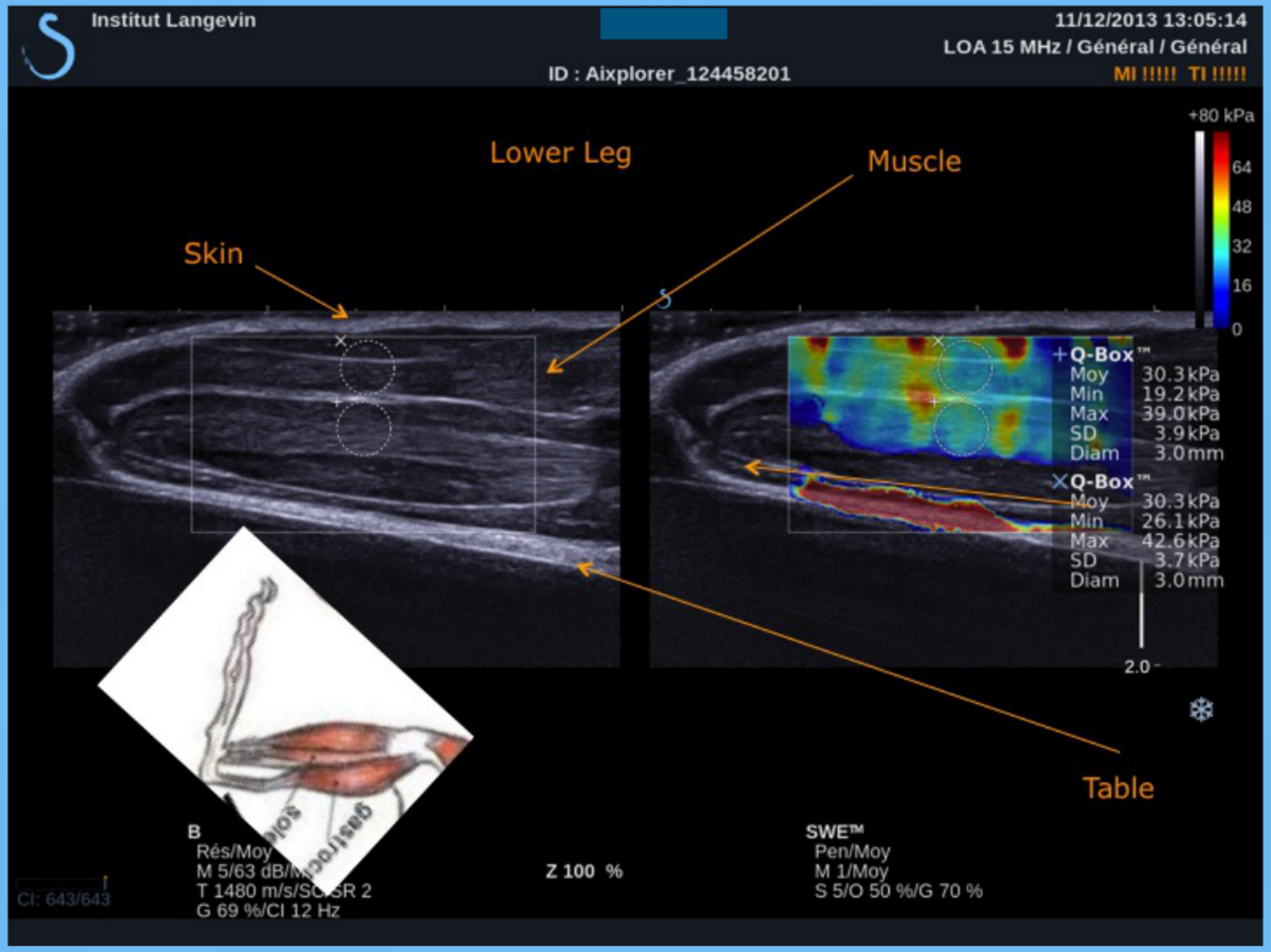


Pre-Clinical reSearch and Mice Imaging








Institut Langevin
11/12/2013 13:05:14
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48
32
16
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Muscle
Skin
Q-Box™
Moy 30.3 kPa
Min 19.2 kPa
Max 39.0 kPa
SD 3.9 kPa
Diam 3.0 mm
Q-Box™
Moy 30.3 kPa
Min 26.1 kPa
Max 42.6 kPa
SD 3.7 kPa
Diam 3.0 mm
2.0
Table
B
Rés/Moy
M 5/63 dB/M
T 1480 m/s/SC/SR 2
G 69 %/CI 12 Hz
Z 100 %
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Pen/Moy
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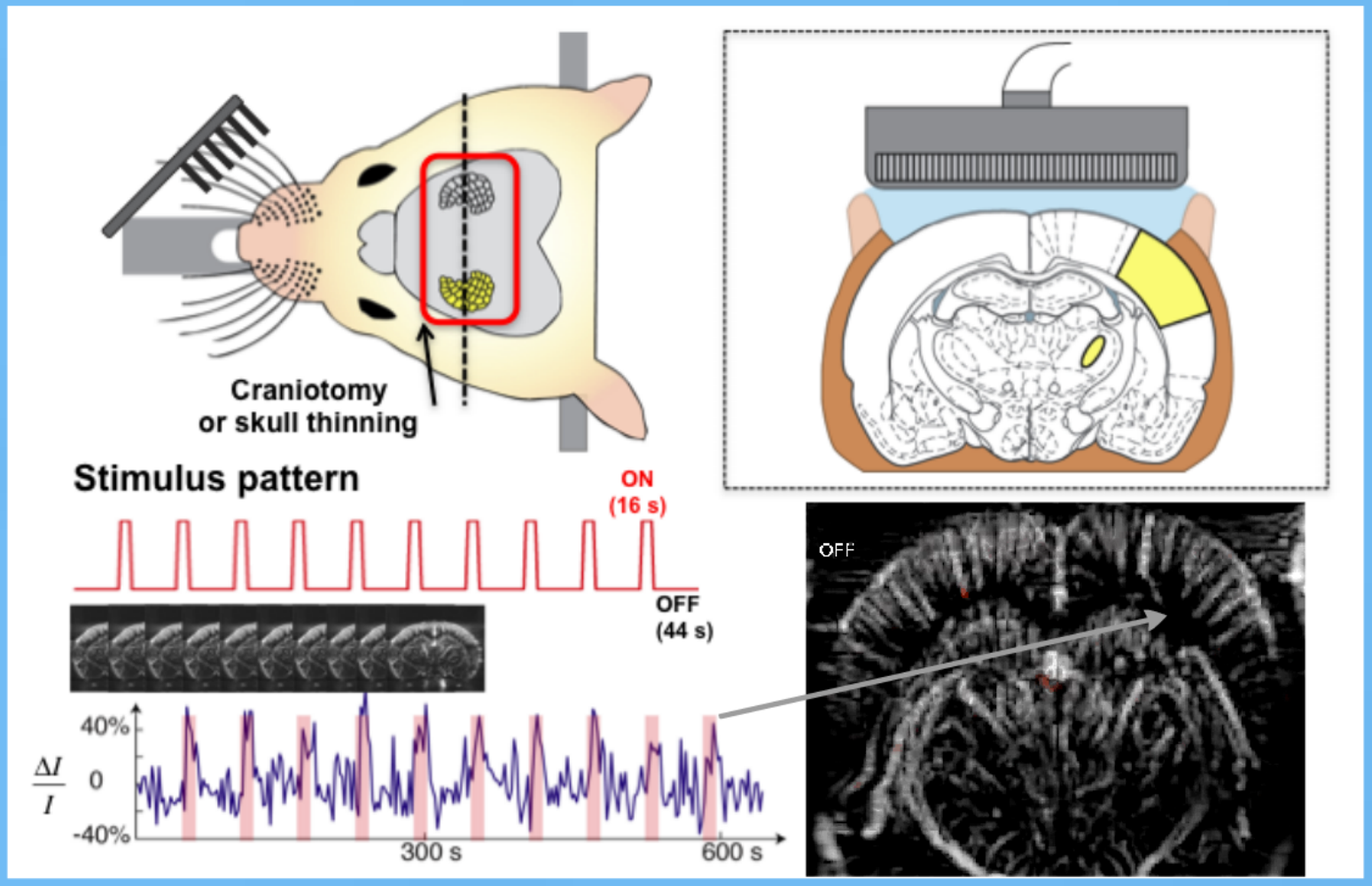
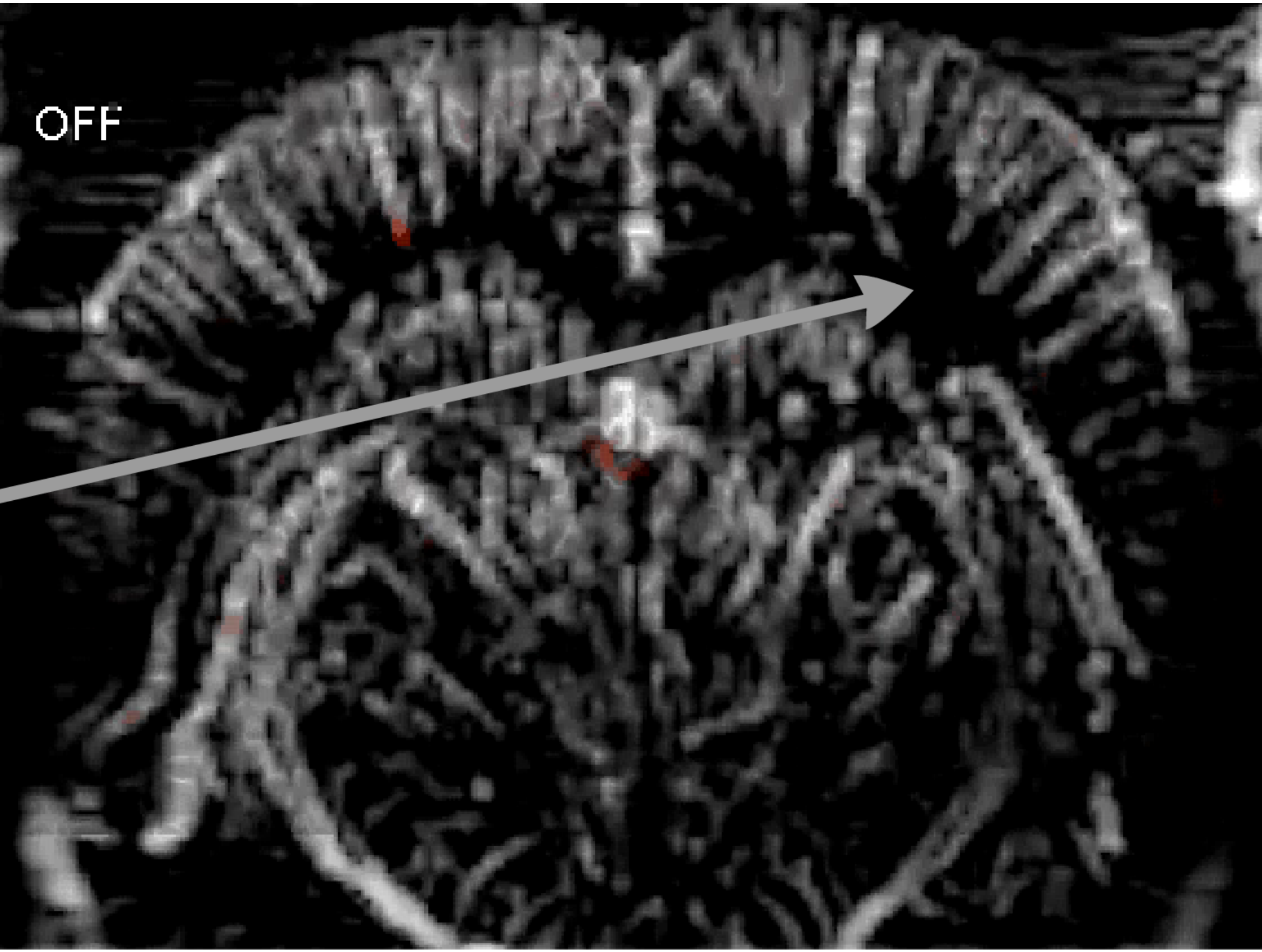
S 5/O 50 %/G 70 %
CI: 643/643

A bright future for Ultrafast Ultrasound ?

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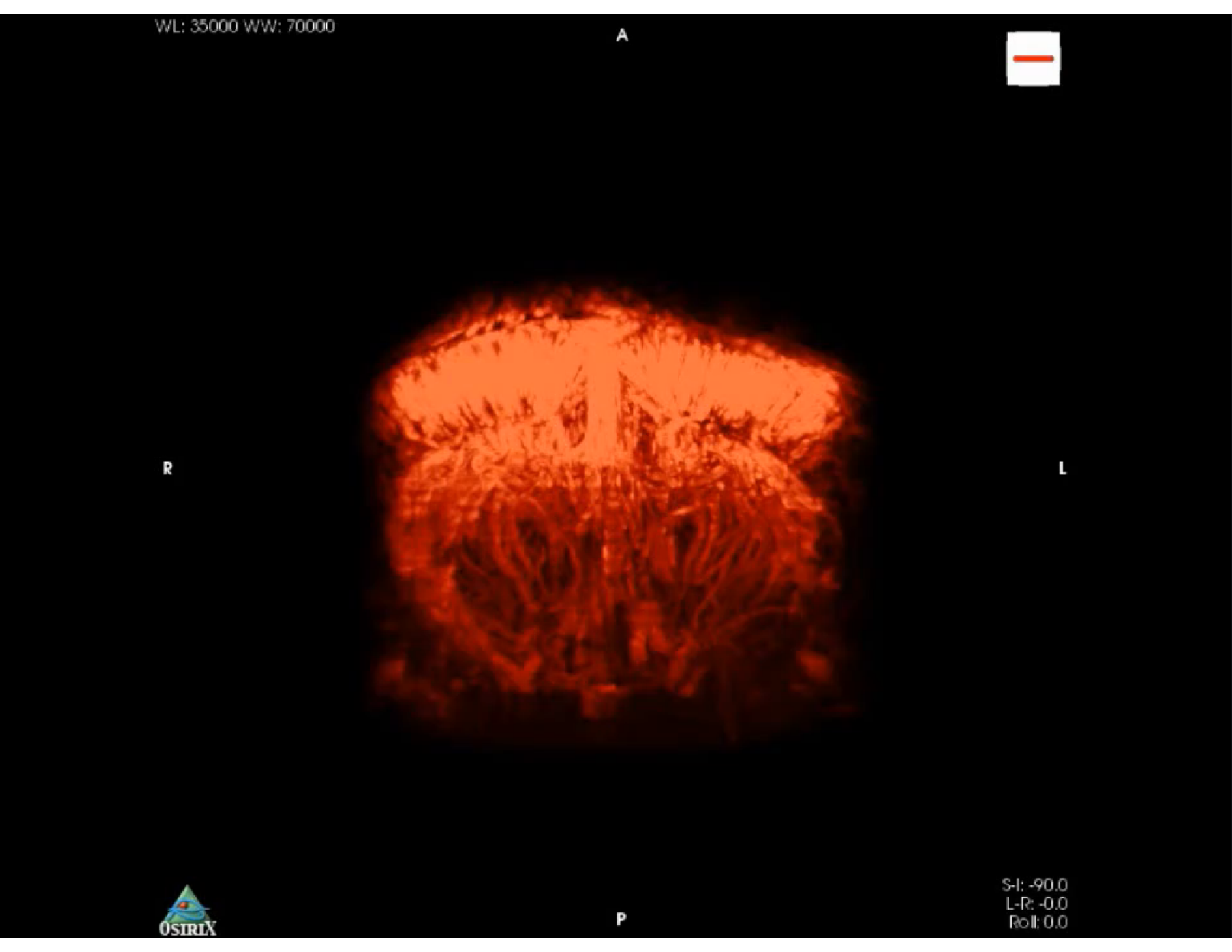
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A
R
L
P
S-I: -90.0
L-R: -0.0
Roll: 0.0
OSIRIX


SUPERSONIC
imagine