



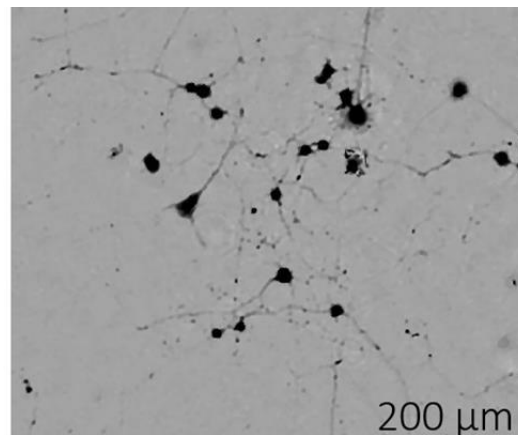
February 5, 2020

Leti Photonics Workshop

W-Hotel, San Francisco

SPIE. PHOTONICS
WEST

Disruptive photonic concepts for new applications & markets



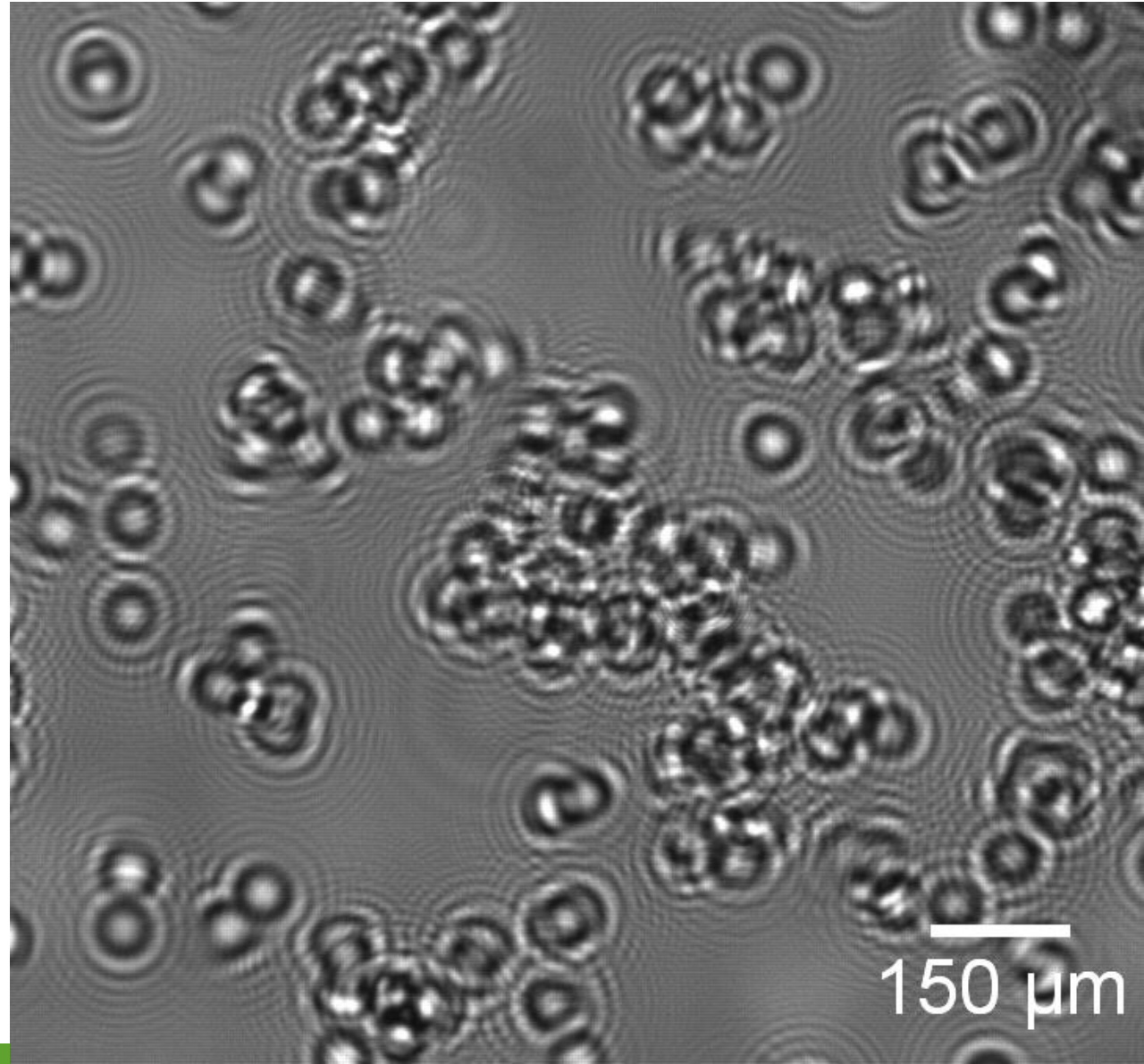
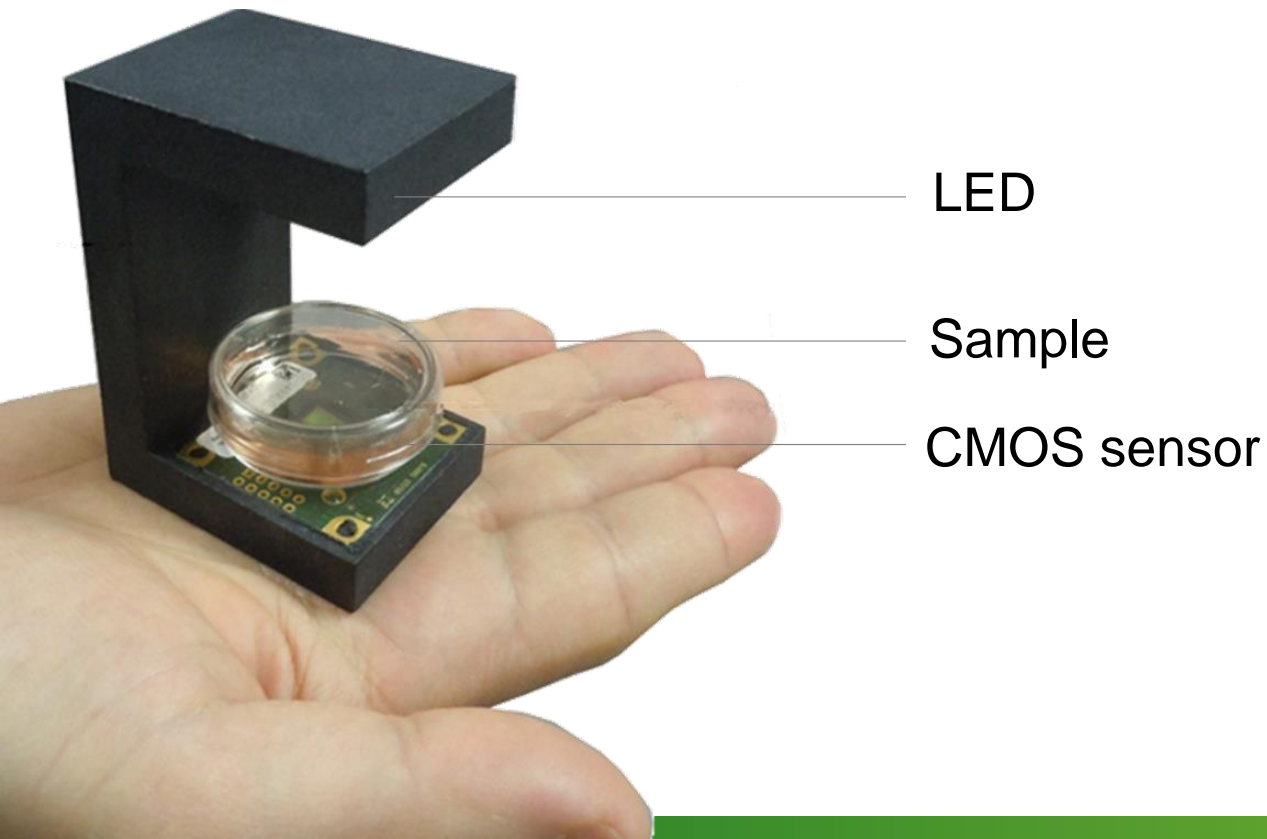
COMPUTATIONAL IMAGING IN MICROSCOPY

5th Leti Workshop San Francisco | Cédric Allier | 2/5/2020

Computational imaging in microscopy

Consists in replacing optical components or mechanics by algorithms.

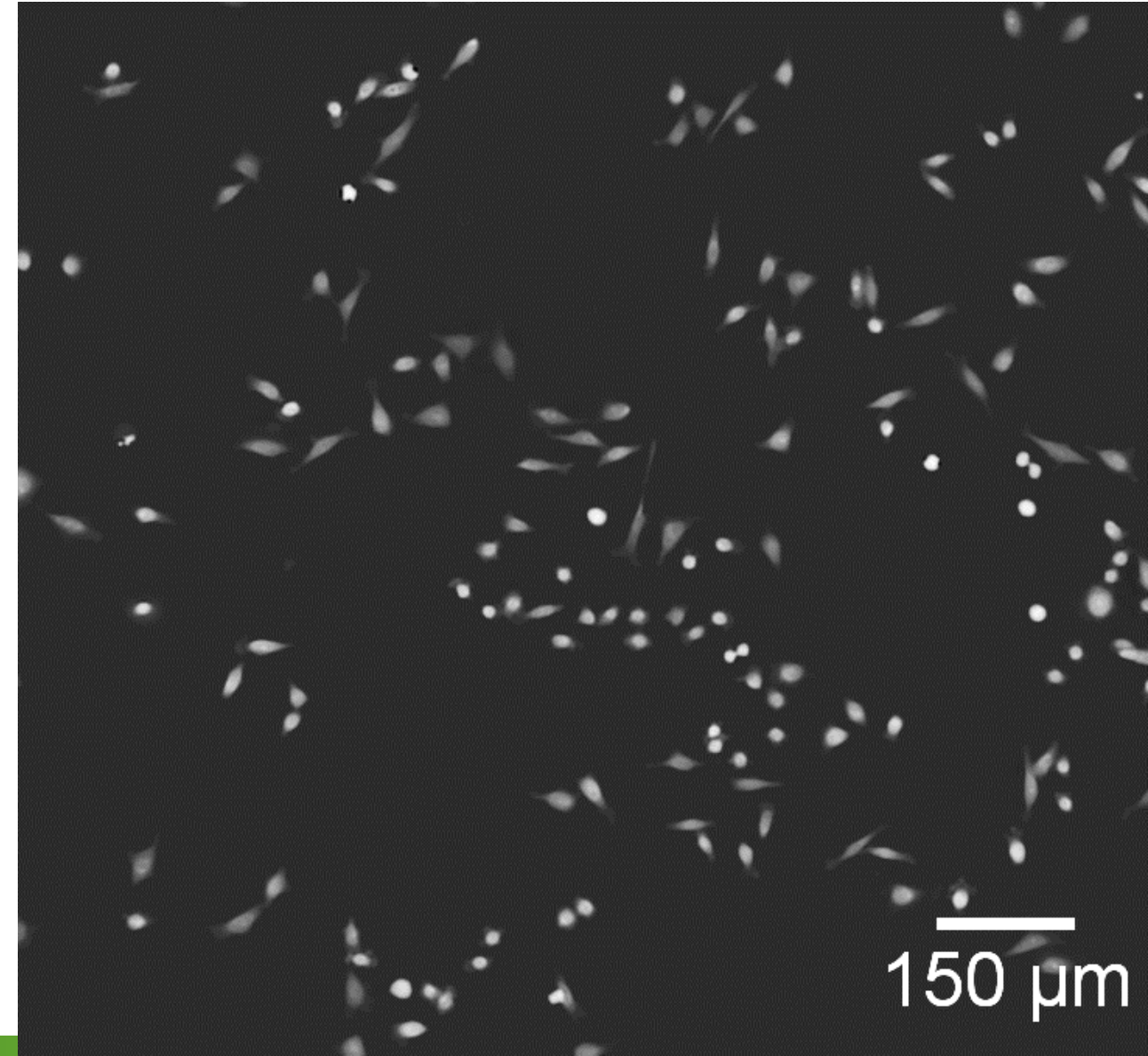
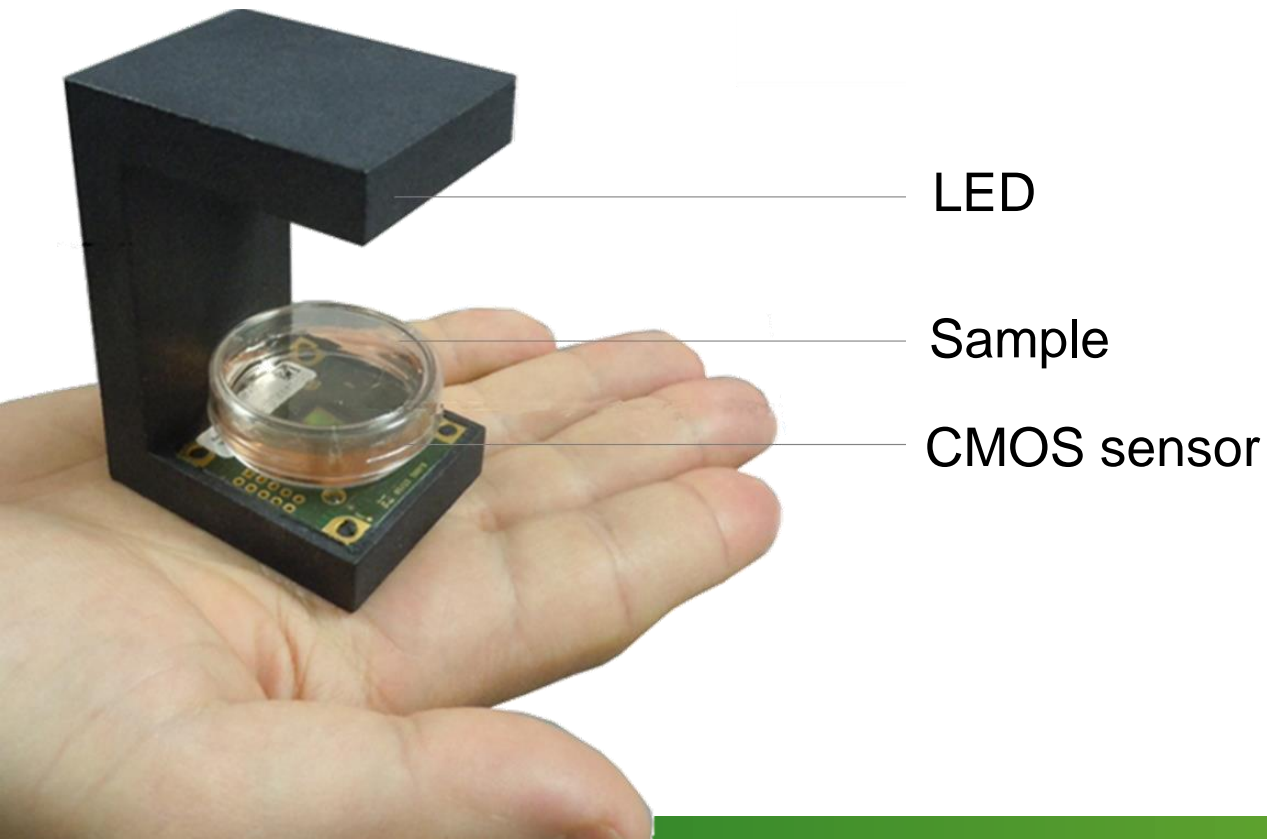
For instance at Leti, we developed lens-free microscopy where the lens and the Z-translation stage are replaced by algorithms.

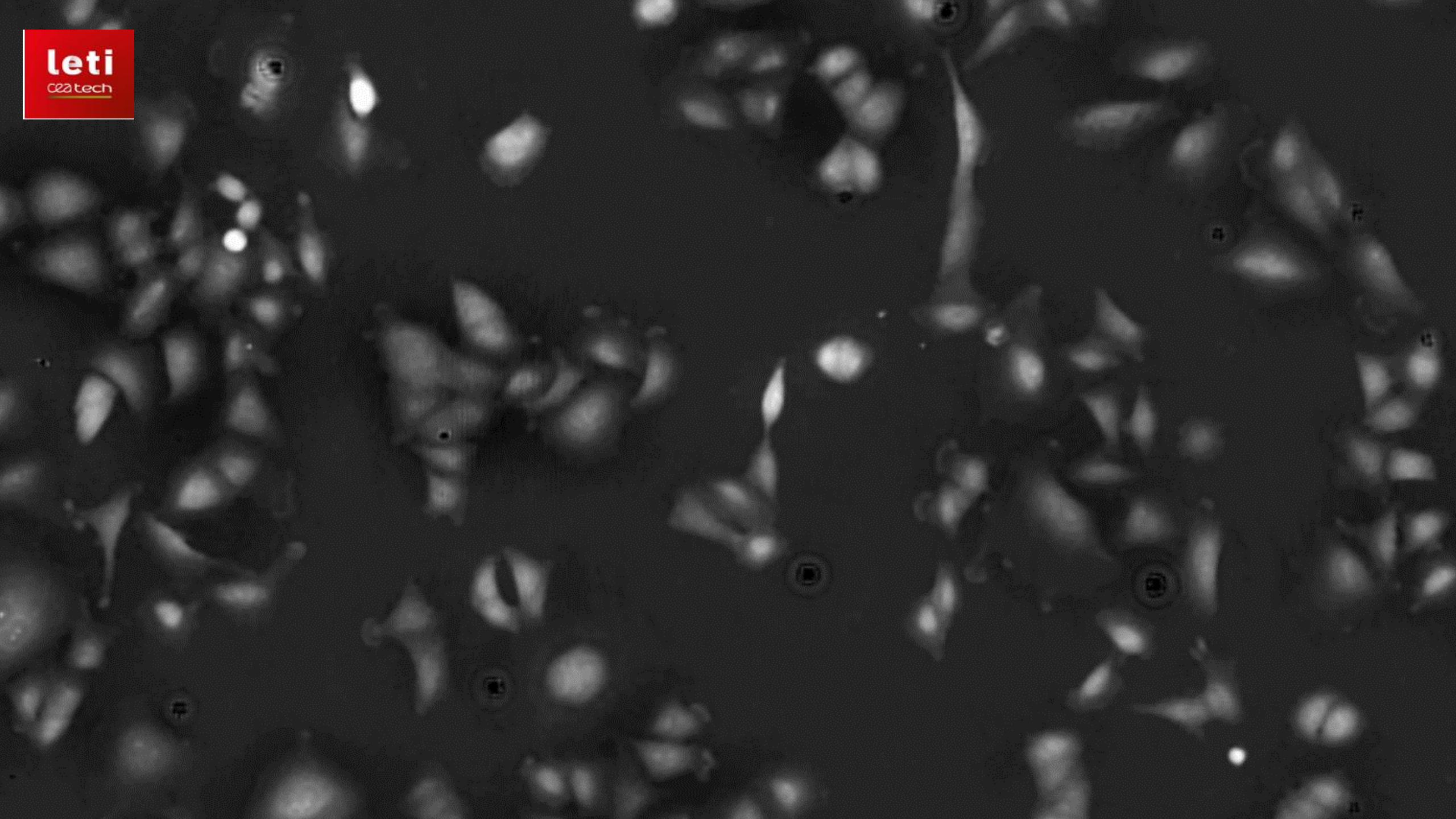


Computational imaging in microscopy

Consists in replacing optical components or mechanics by algorithms.

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Computational imaging in microscopy

Now if we want to go further.
It must be faster, better and smarter

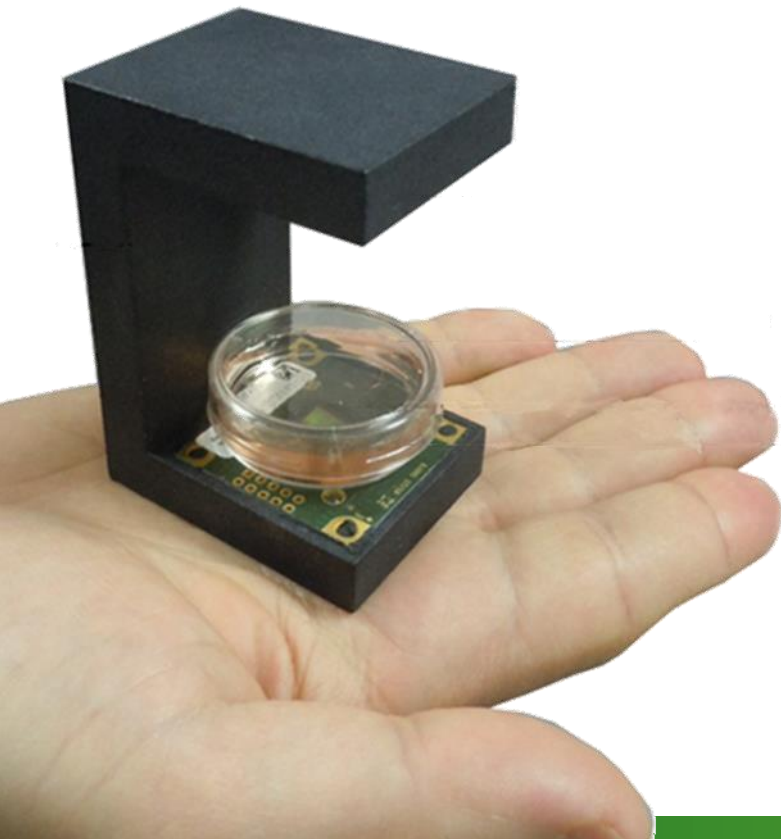
Faster image
reconstruction

Better image
reconstruction

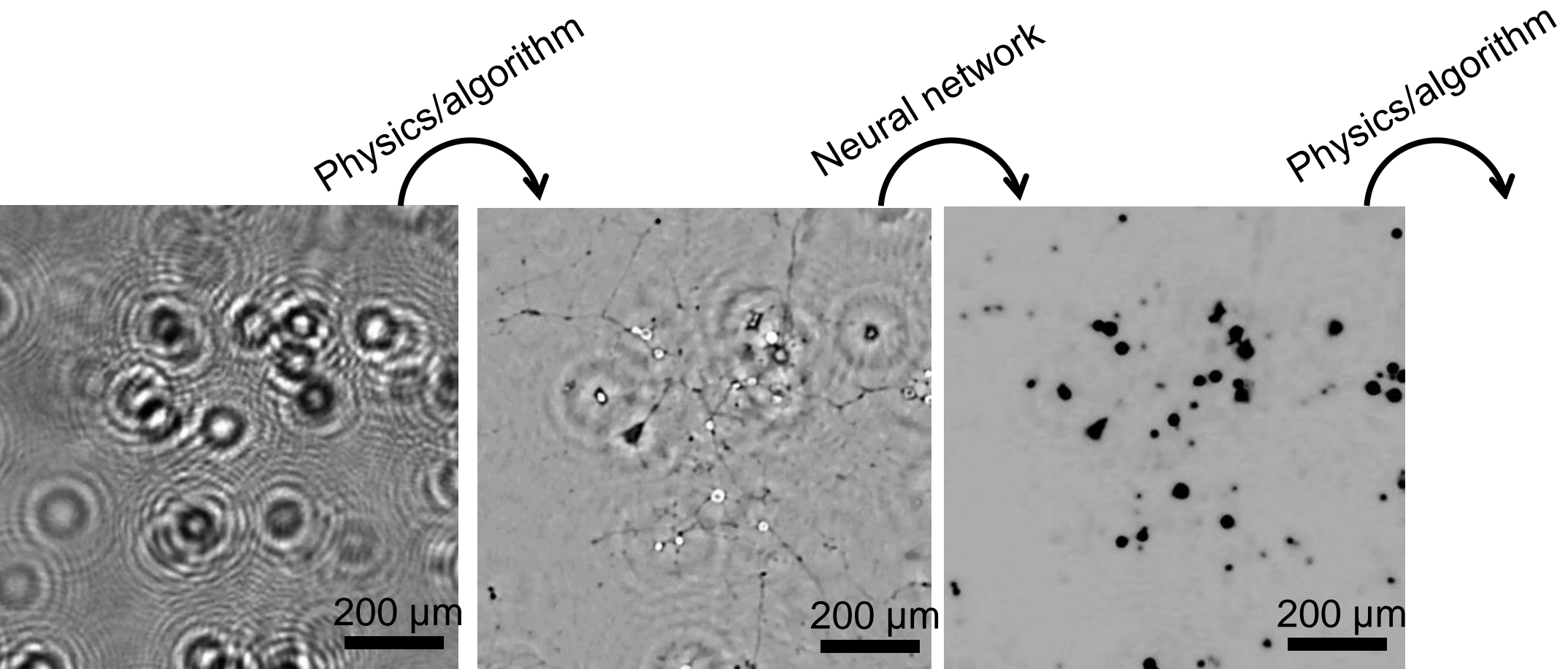
Smarter
cell analysis

It is now possible thanks to IA (deep neural networks)

**Today computational imaging is
becoming neural imaging**



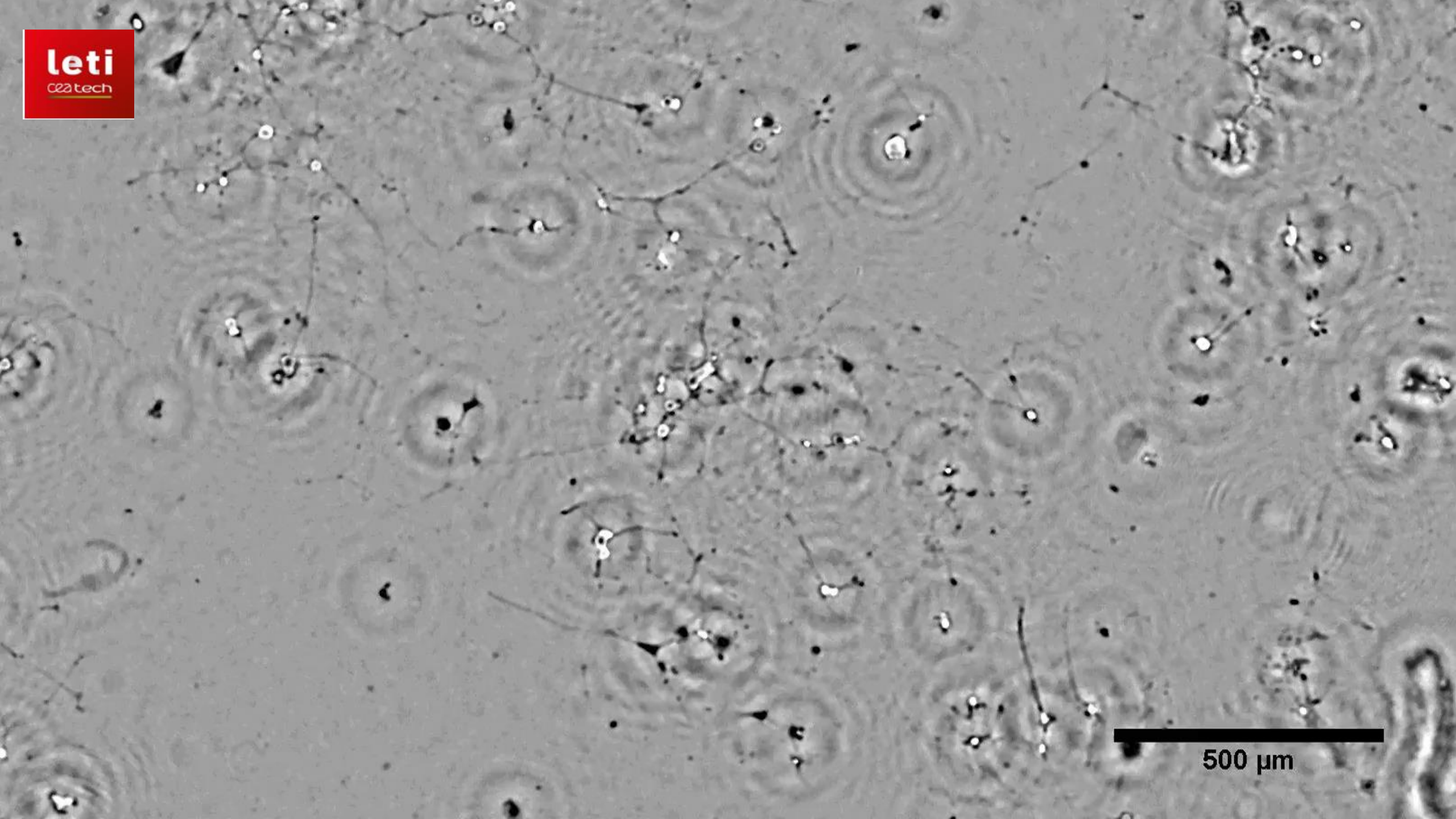
Neural imaging in microscopy



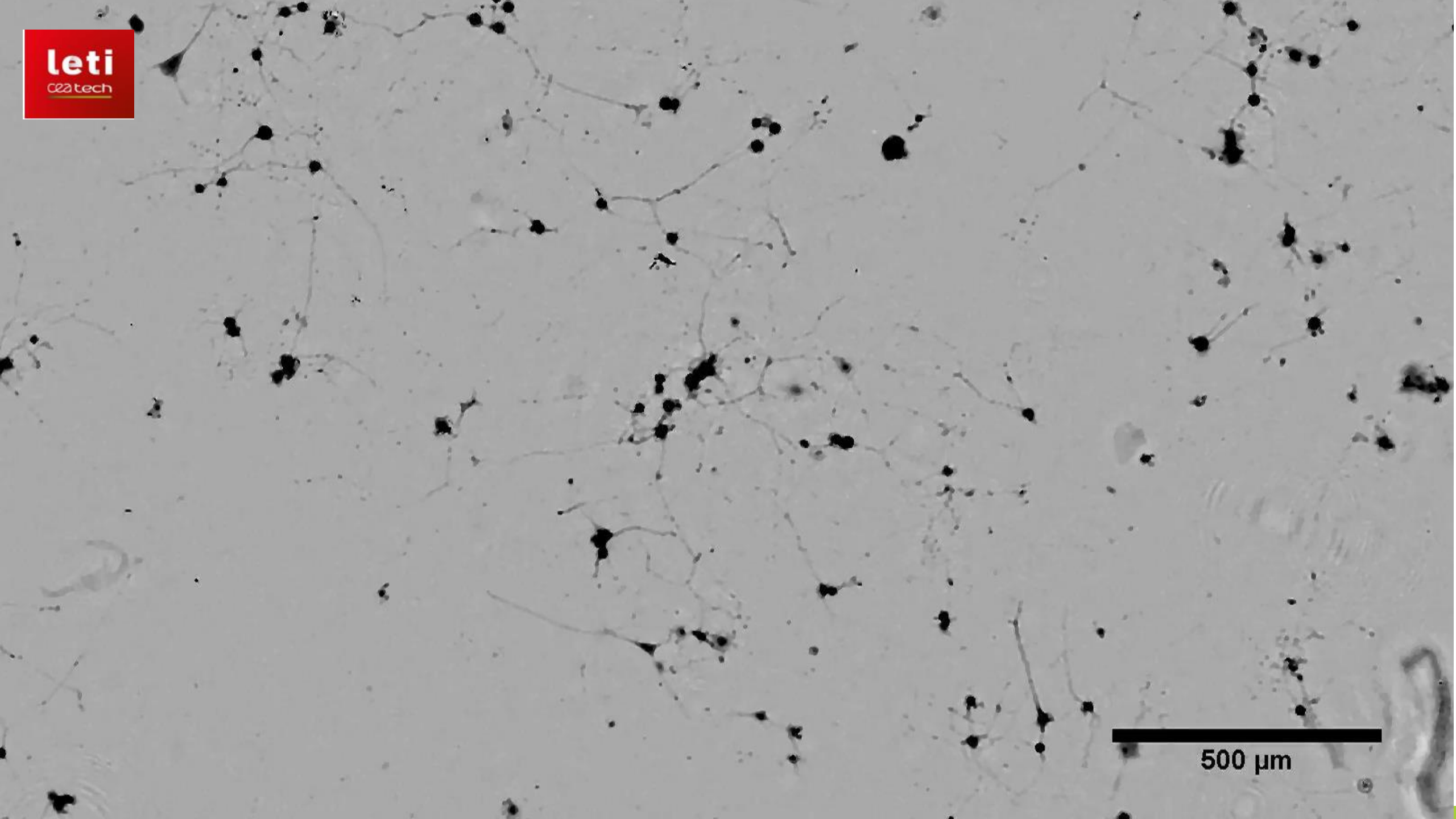
Alternation of image reconstruction and neural network
Hybrid solution



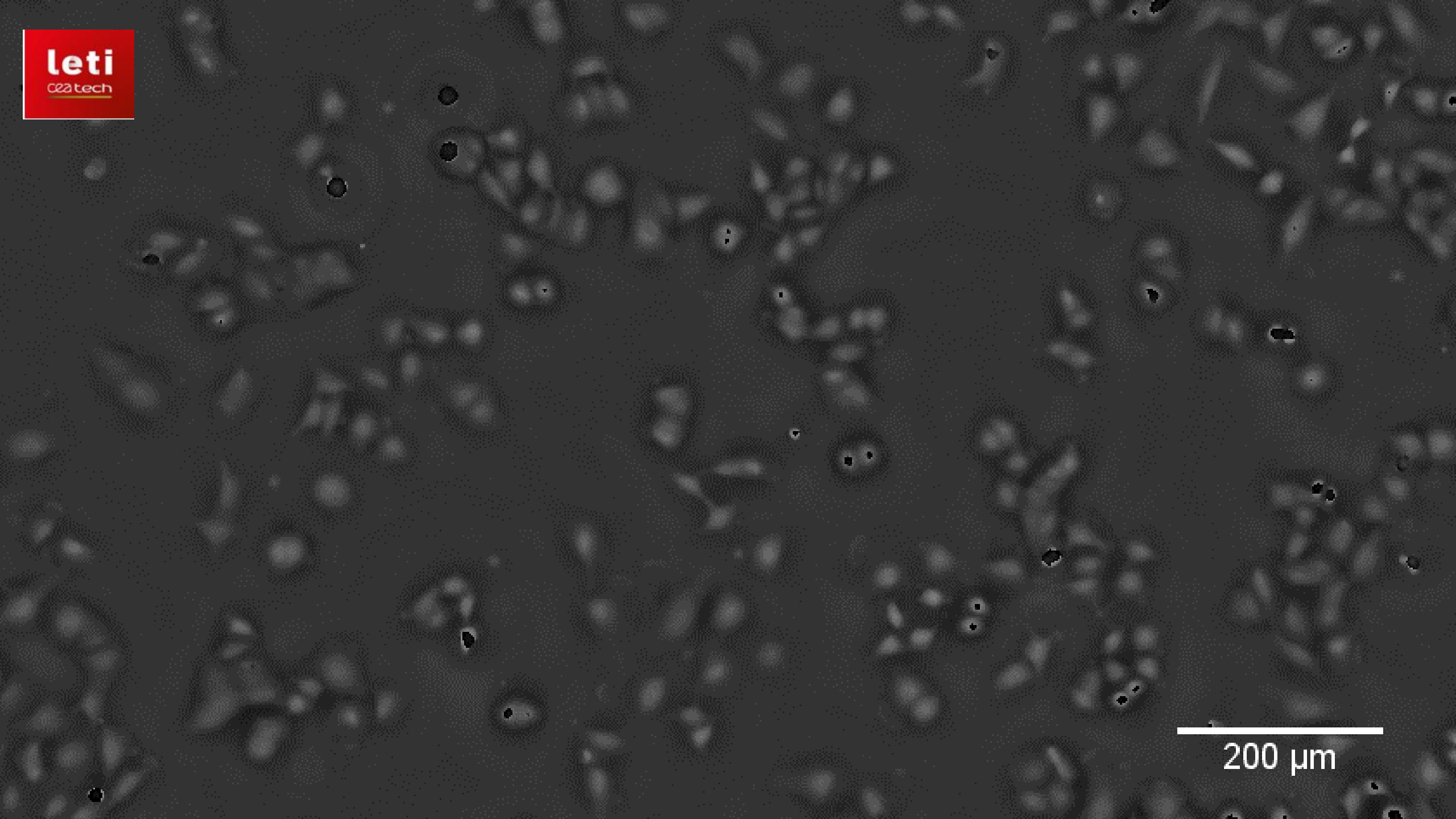
500 μm



500 μm



500 μm

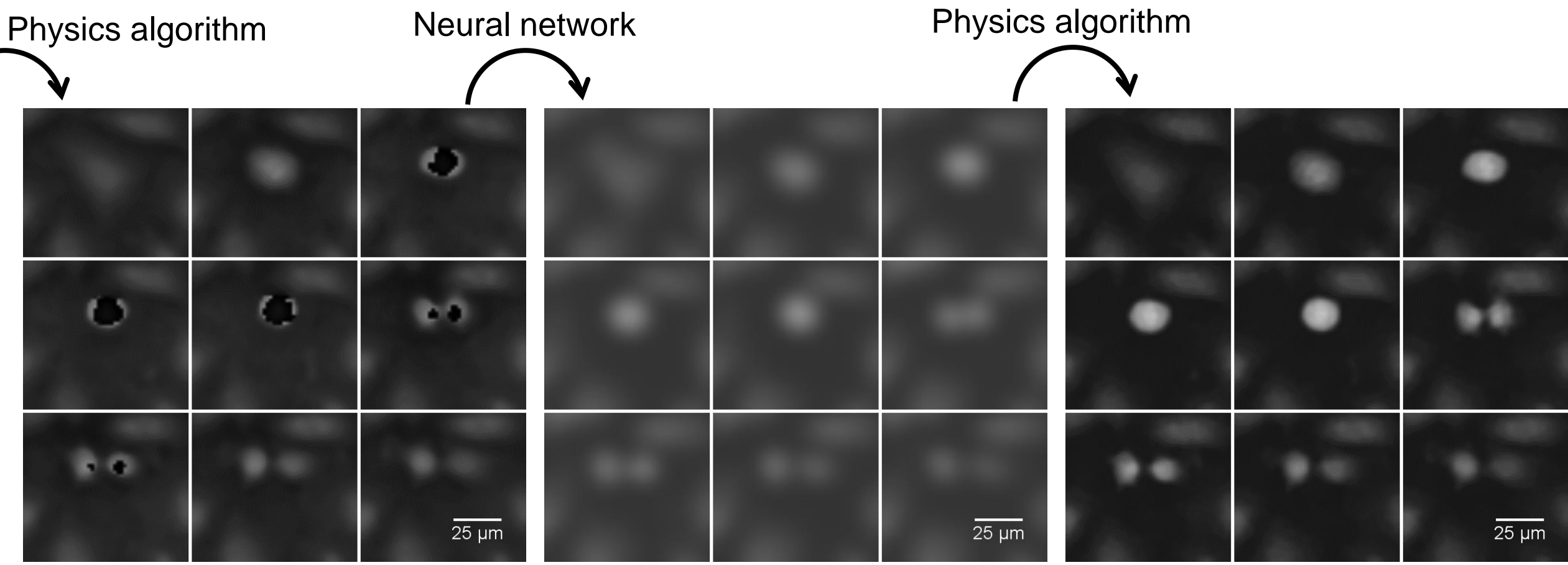


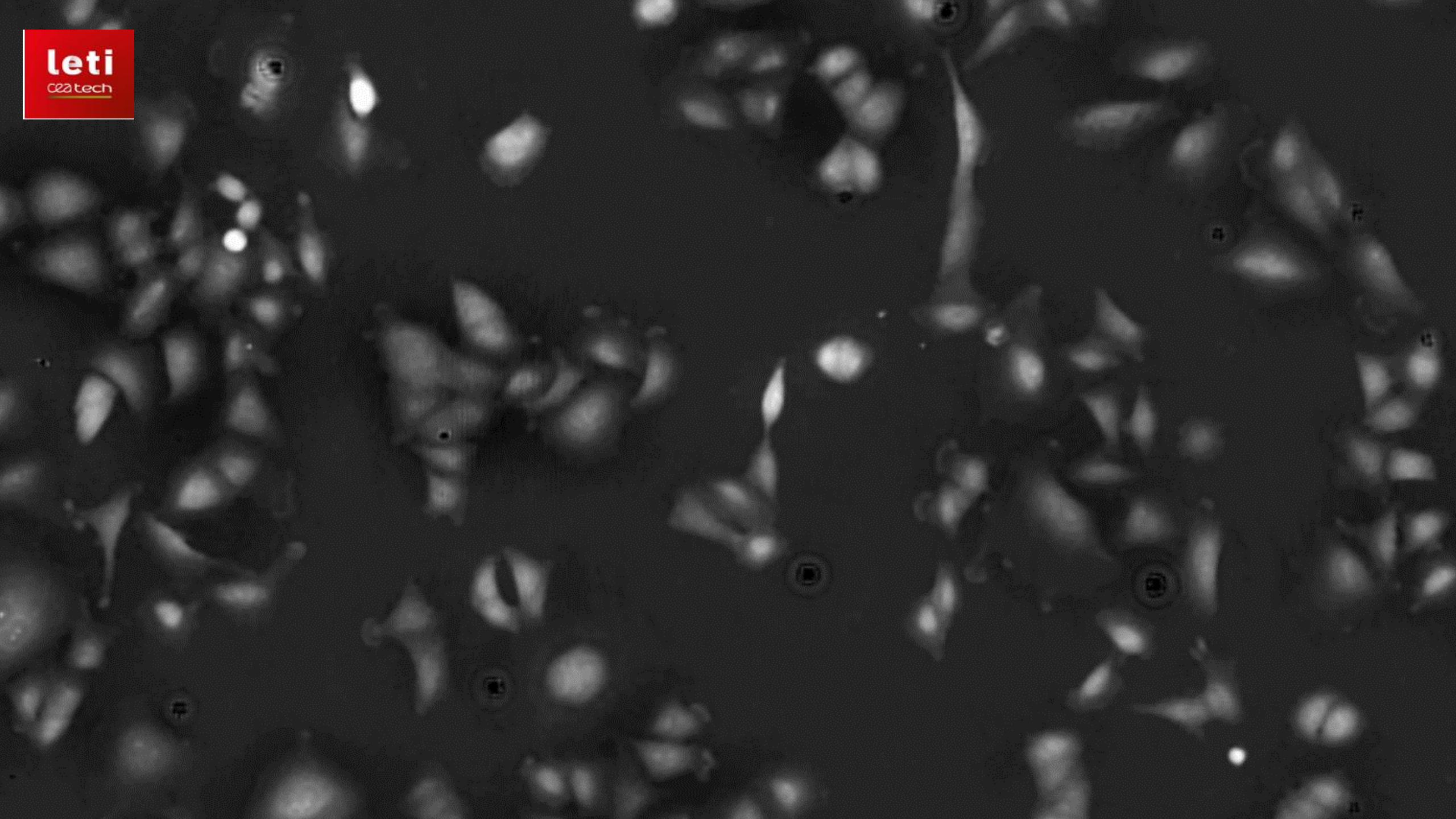
200 μm



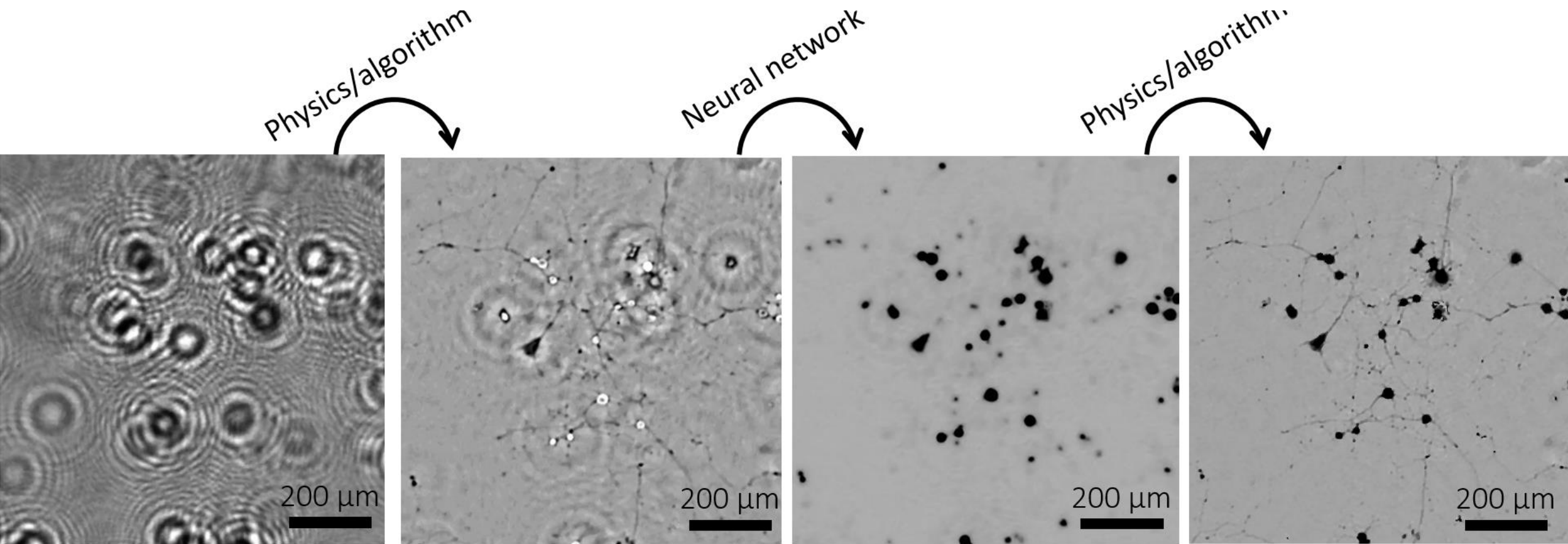
200 μm

Neural imaging ... in microscopy





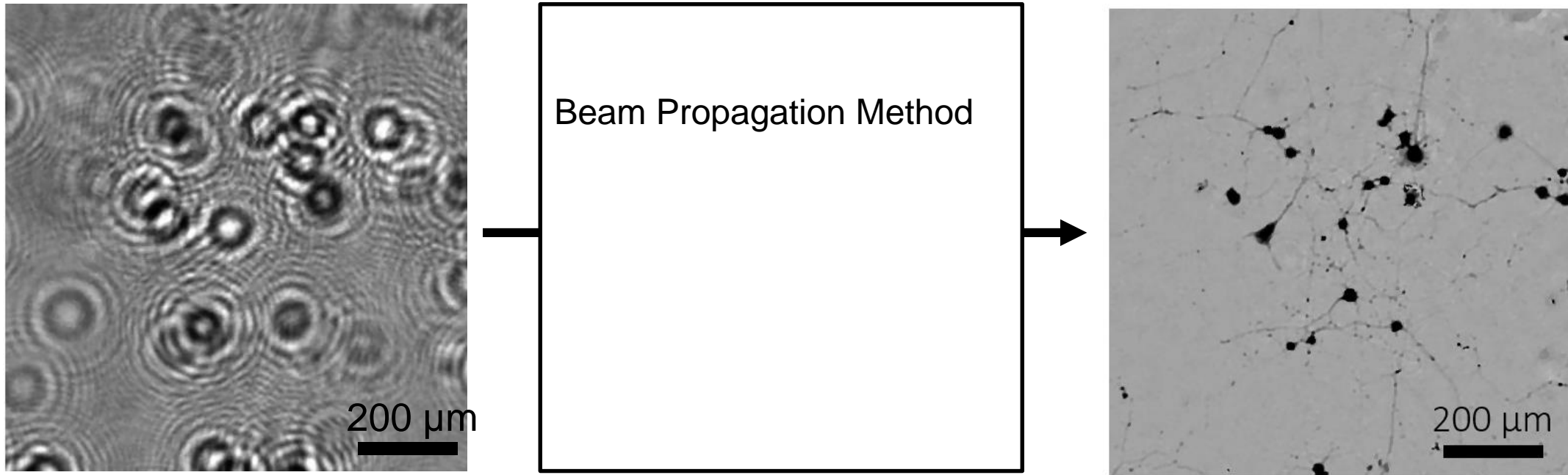
Neural imaging in microscopy



Alternation of image reconstruction and neural network
Hybrid solution

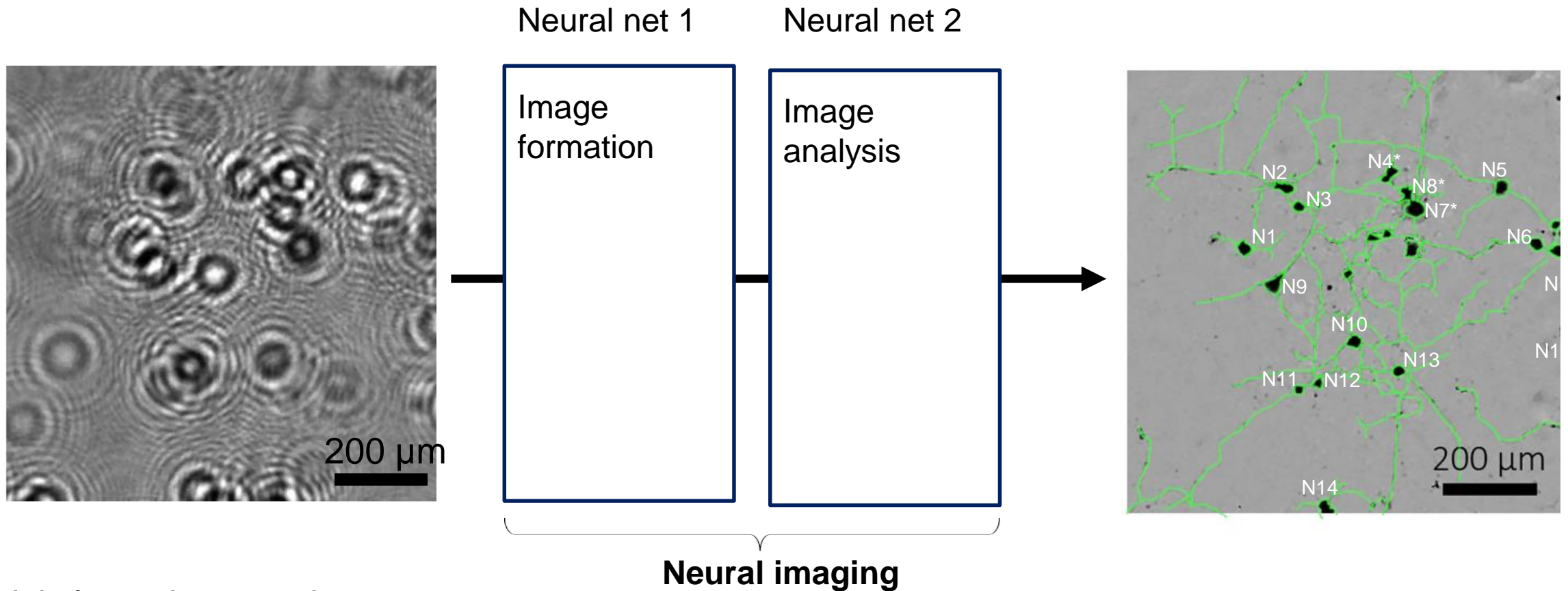
Neural imaging in microscopy

Physics within a neural network



Here we have replaced lens by a deep learning framework
It's faster and better

Neural imaging ... in microscopy



It is faster, better and smarter.
 It is close to visual cortex brain.
 It is compatible with future brain-inspired computing

Neural imaging in microscopy



First prototype of

Real-time lens-free imaging + cell analysis

- Breakthrough to adress the healthcare
- For instance pre-diagnosis of meningitis

booth 857A
France Pavilion (South Hall)



Take away messages

Microscopy became computational imaging
(thanks to GPU)

It is becoming neural imaging
(thanks to deep learning)

Next is a thinking imaging:

- able to automate a microscope
- able to make prediction
- towards discoveries

***Thank you
for your
attention***

***See Leti's demonstrators at booth 857A
France Pavilion (South Hall)***

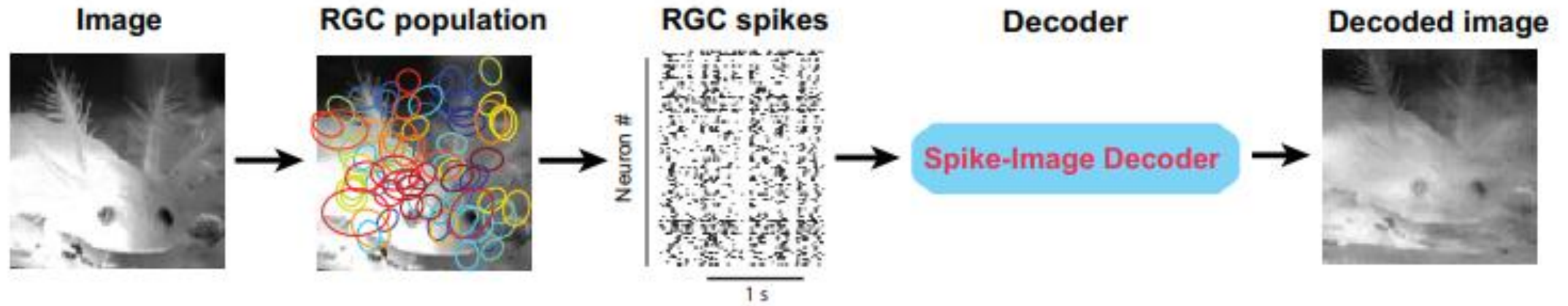
***And welcome in
Grenoble in June >>***



Leti, technology research institute
Commissariat à l'énergie atomique et aux énergies alternatives
Minatec Campus | 17 avenue des Martyrs | 38054 Grenoble Cedex | France
www.leti-cea.com



Neural imaging ... in microscopy ... is close to visual cortex



National Engineering Laboratory for Video Technology, School of Electronics Engineering and Computer Science, Peking University, Beijing, and Peng Cheng Laboratory, Shenzhen, China