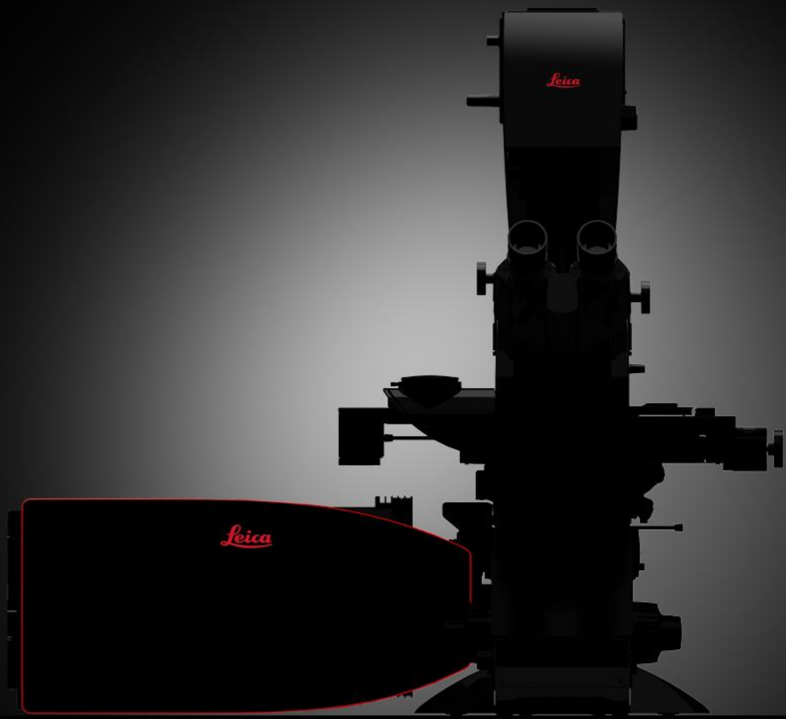


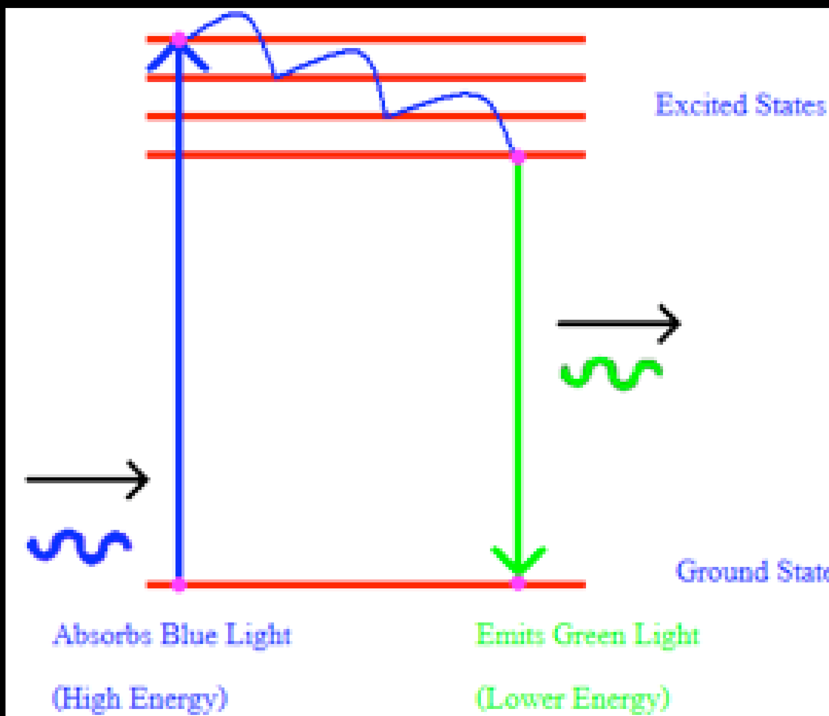
STELLARIS

Leica New Confocal Platform

劉思嫺
美嘉儀器股份有限公司
www.major.com.tw

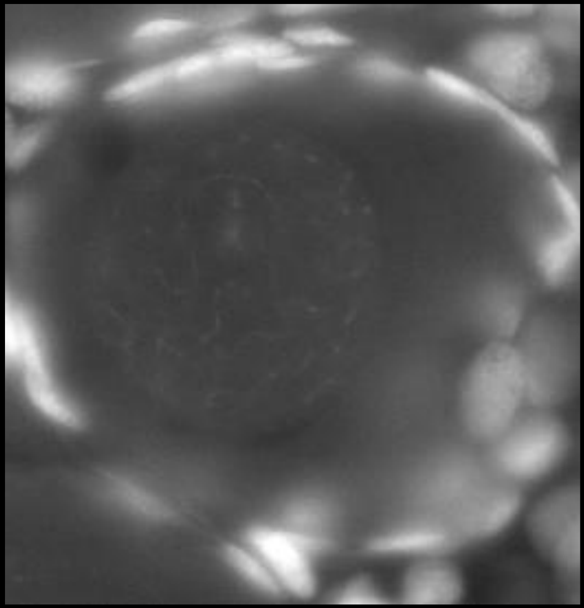
Confocal Image

Fluorescence



Neonatal cardiac myocyte (muscle cell)
yellow (DAPI) indicates DNA,
green (Cy3) myomesin,
red (Texas Red) Cadherin,
blue (Alexa 633) actin

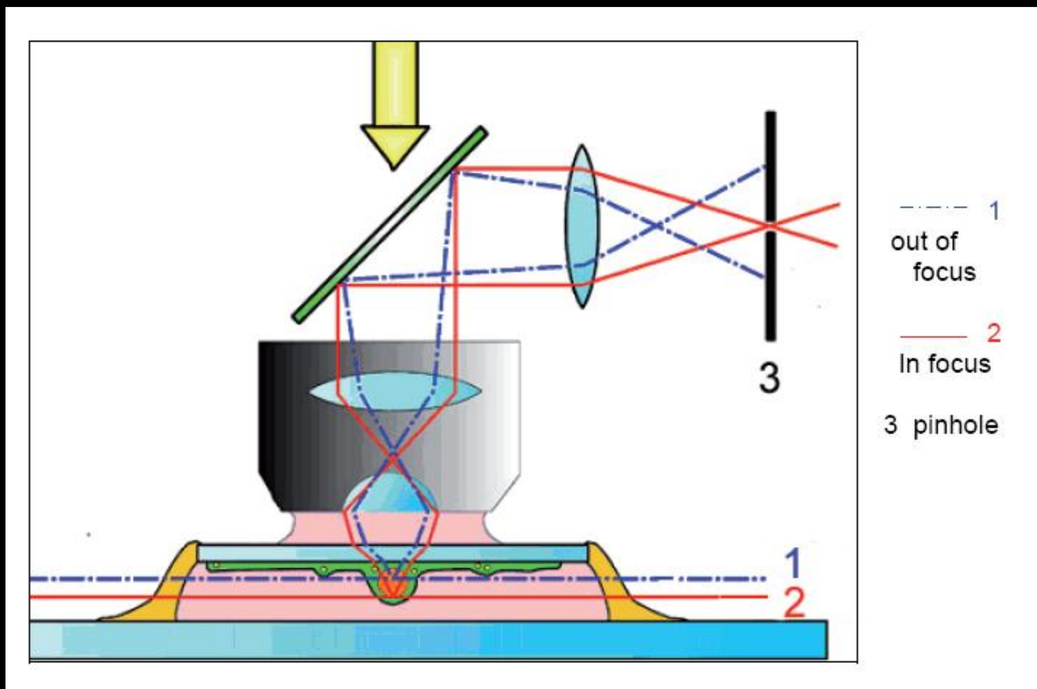
Fluorescence Microscope → Confocal System

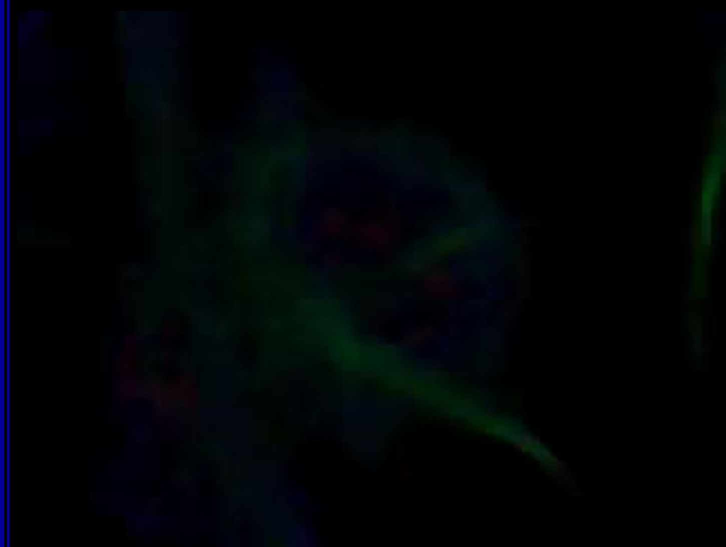


Confocal Microscopes can optically remove all information that is from outside the depth of focus.

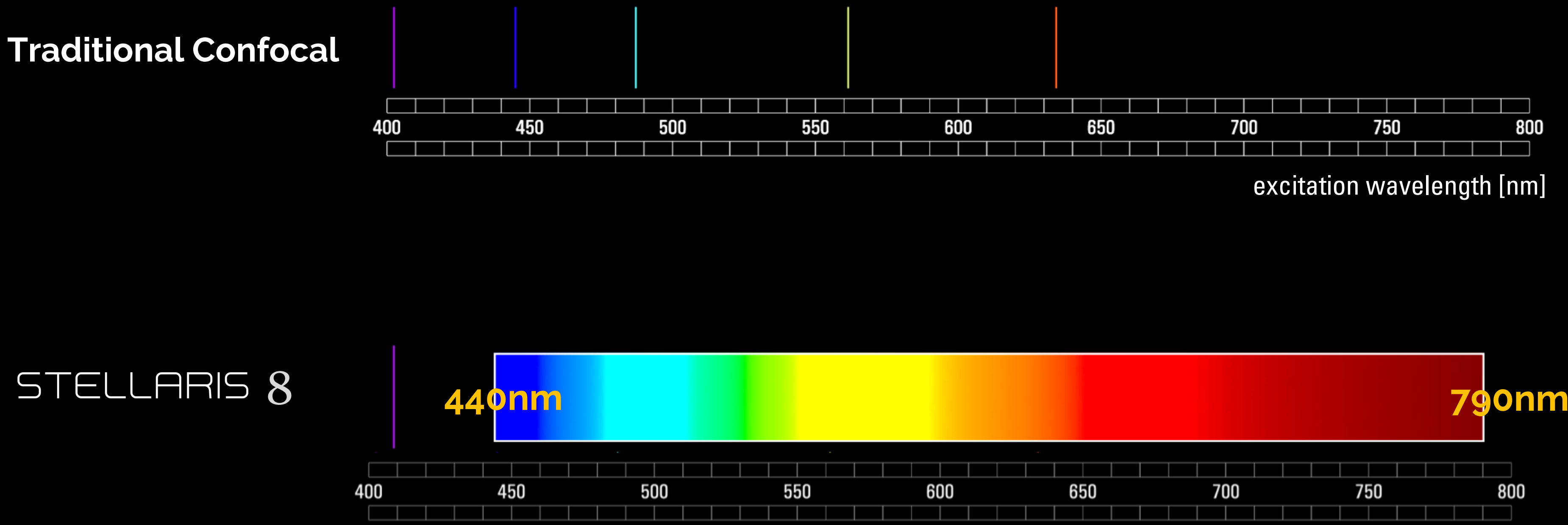
The consequence is a sharp optical section.

Conventional Microscope → Confocal ?





The Second Key Innovation: The next-generation White Light Lasers



- A single laser to do the work of many.
  Up to 8 single excitation lines
  from 440 nm to 790 nm can be used simultaneously
- New optics design: detection range from 410nm to 850nm

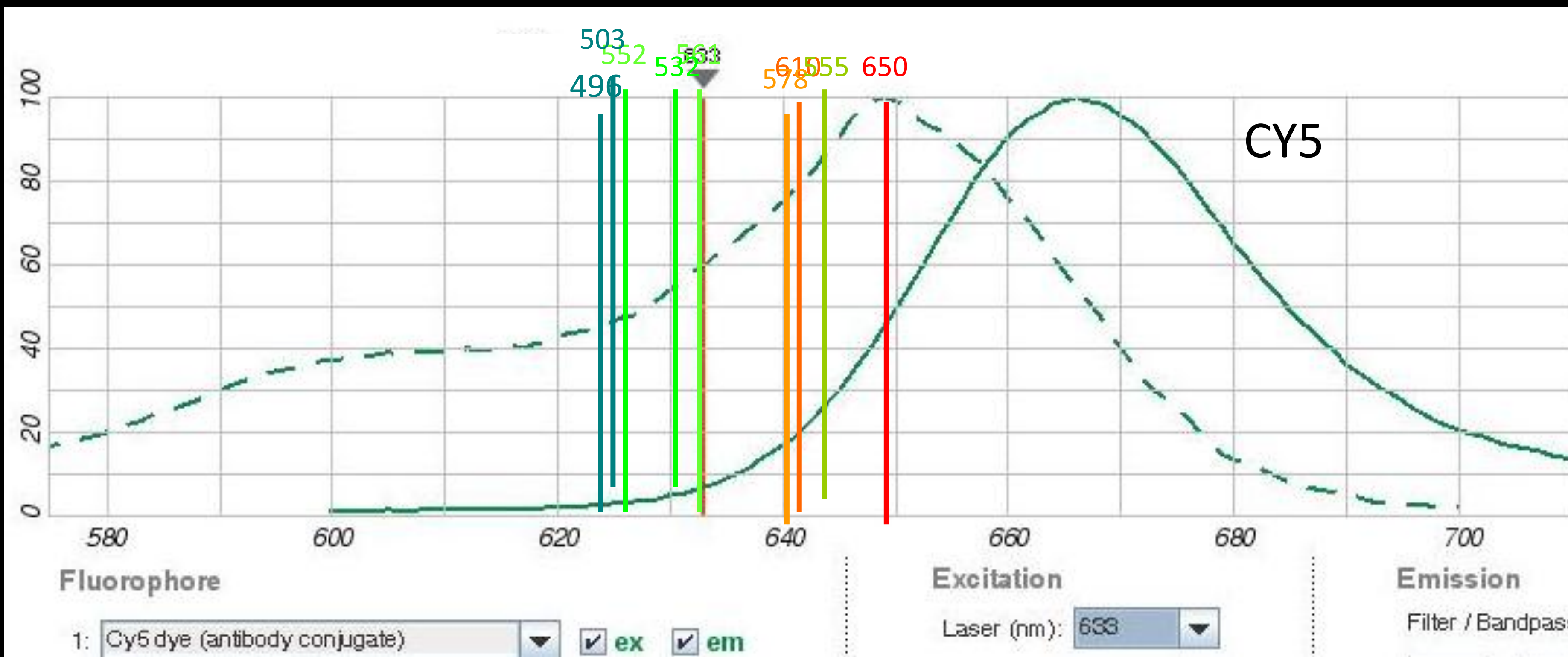
Traditional Excitation wavelength

458nm, 476nm, 488nm, 496nm, 514nm, 543nm, 561nm, *594nm*, 633nm

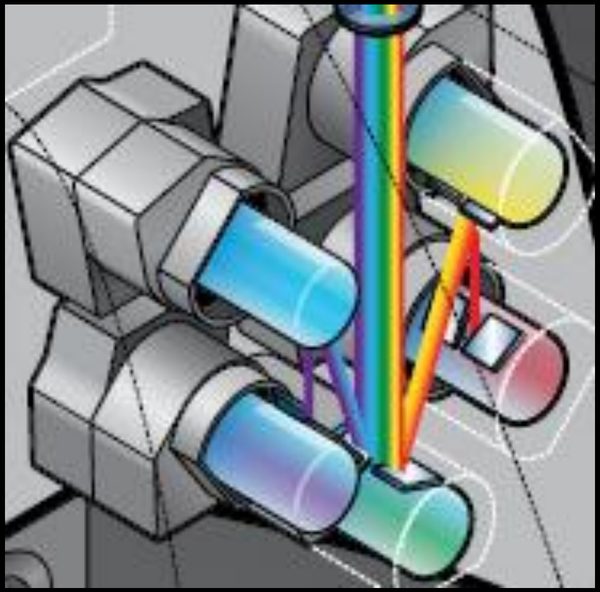
LEICA STELLARIS Confocal Microscope

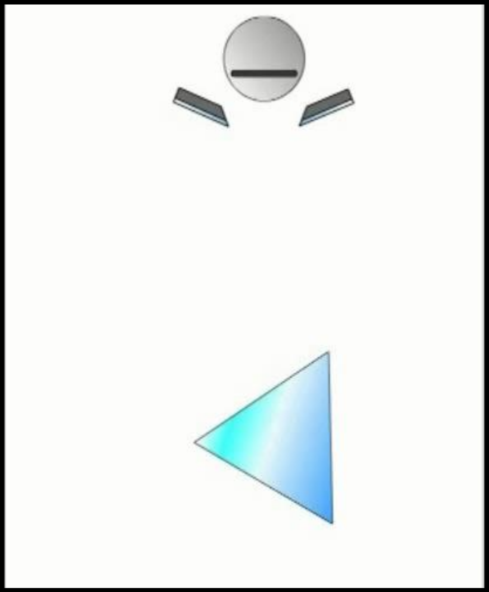
Excitation wavelength

440nm - 790nm, 351 ex. Lines, no limitation



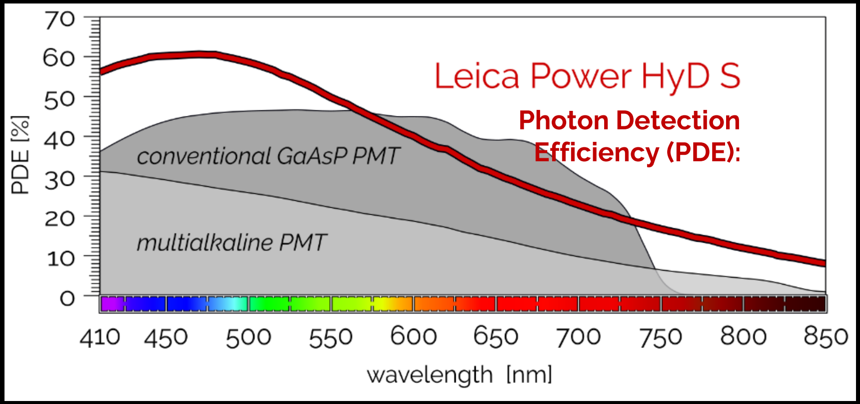
Spectral Imaging Detector -- Fit For Purpose

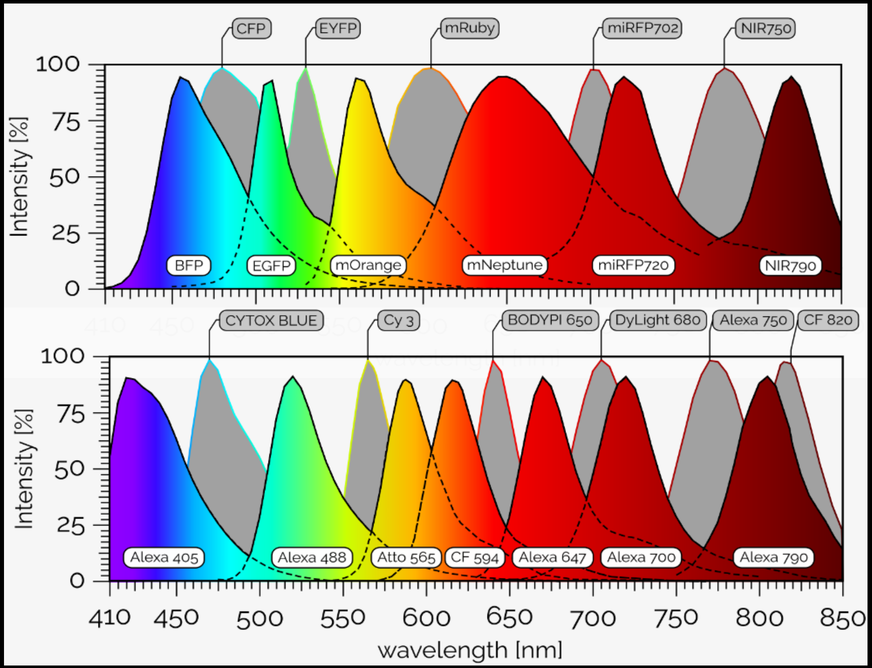




Enhanced Spectral Freedom: STELLARIS

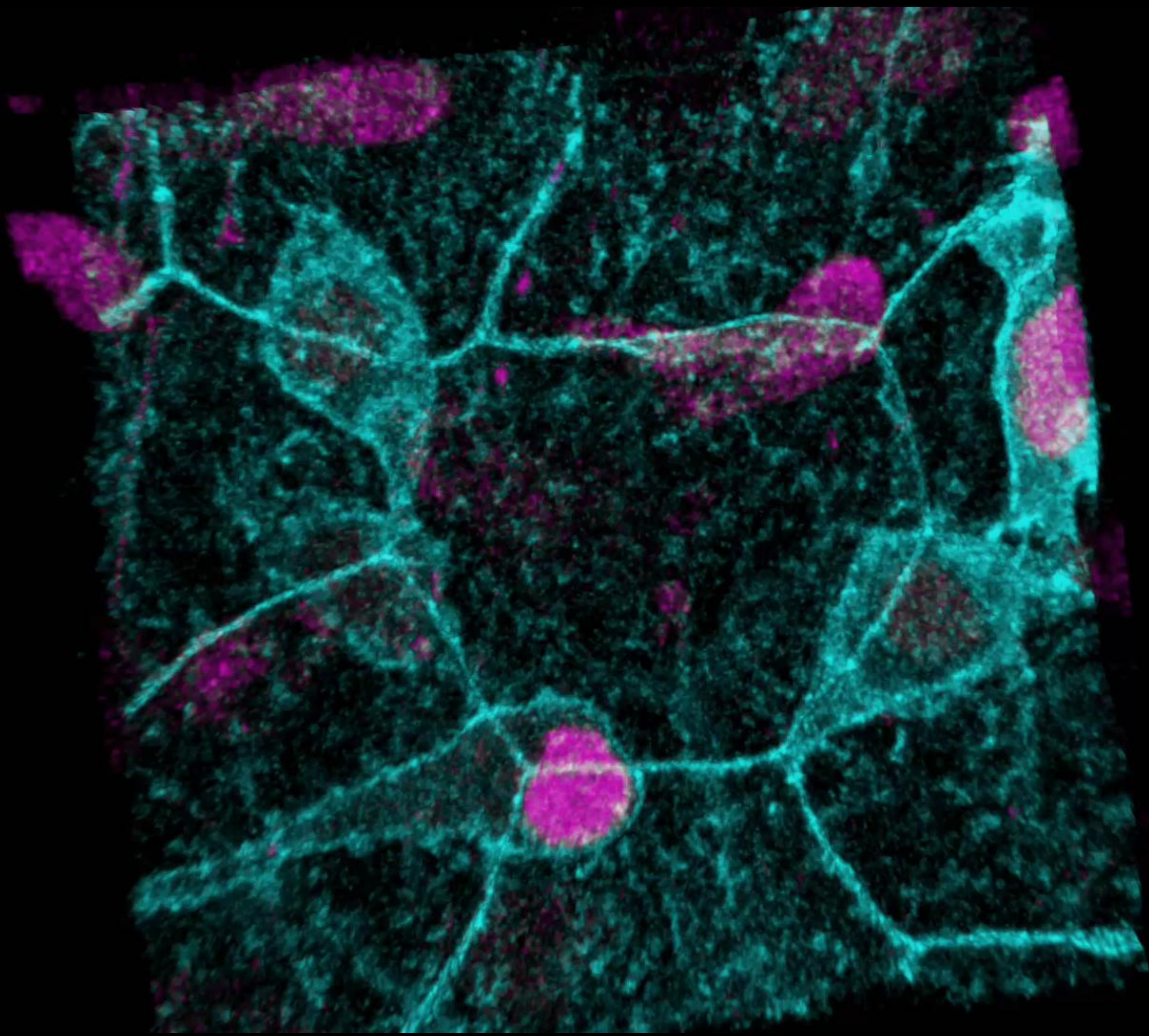
The Power HyD S Is The New All-rounder Detector For Confocal Applications





- No more PMT or GaAsP detectors
- Detection range: 410nm-------850nm
  (normal confocal: 400nm-750nm)

Gentle Live-Cell Imaging



- Perform imaging for longer periods, since both excitation as well as detection are optimally tuned
- Preserve sample integrity with efficient signal acquisition, at the lowest needed power

Zebrafish posterior lateral line primordium migration.
Cyan: Membranes, GFP, Magenta: Nuclei, tdTomato
Sample Courtesy: Jonas Hartmann, Gilmour Group, EMBL Heidelberg.

The Red Extended Benefits Of Our Next Generation WLLs

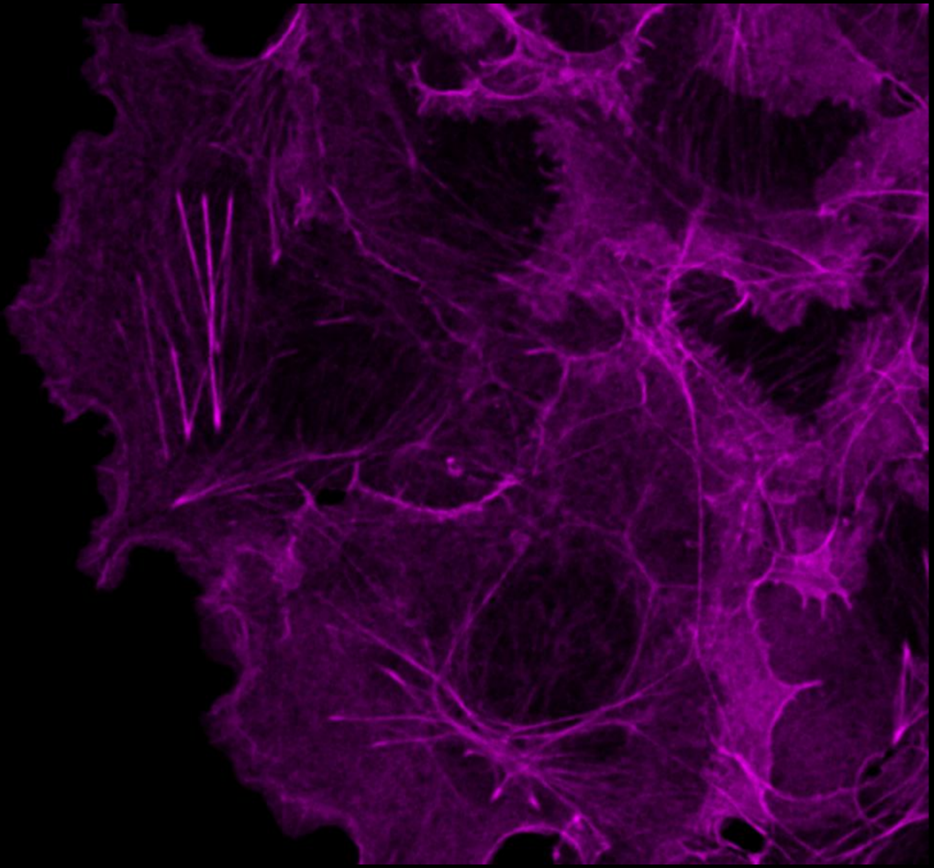
- Enhance multiplexing capabilities by adding up to 3 more fluorophores in the NIR range

Some >685 nm excitable dyes:

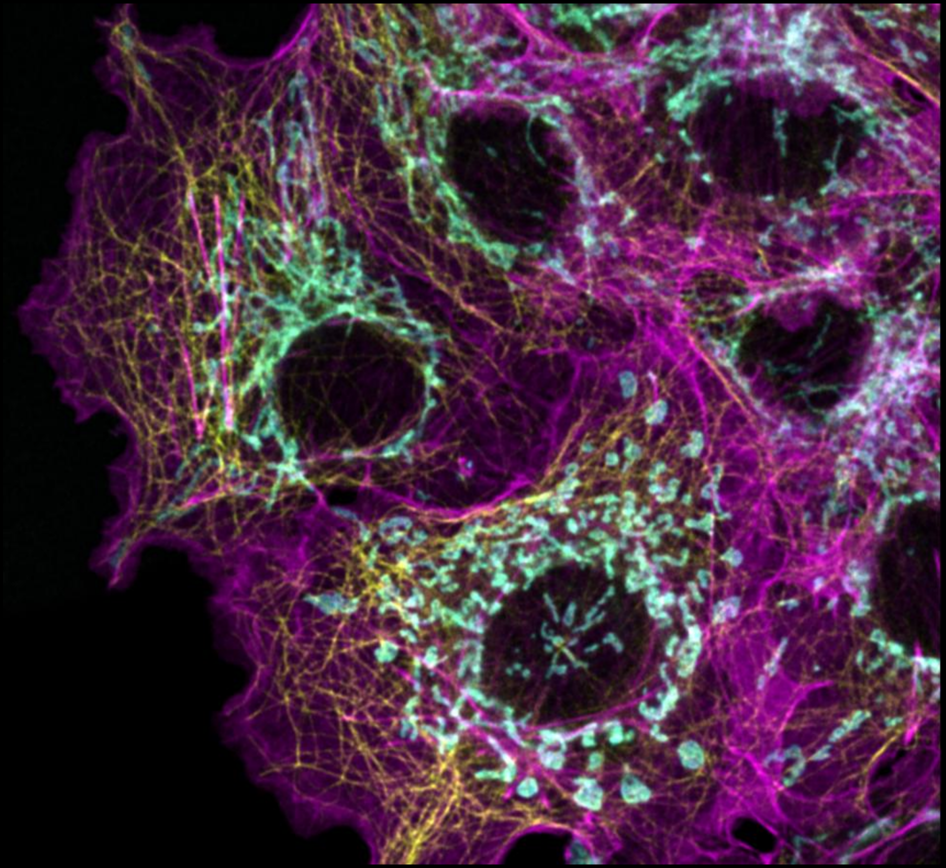
ATTO 740	ATTO 700
CF680	CellBrite NIR750
CellBrite NIR680	Alexa 750
CF750	CF700
BioTracker NIR750	MitoView720
Alexa 700	CellBrite NIR770
CellBrite NIR700	Alexa 680
	ATTO 680
	ATTO 725

STELLARIS Delivers Expanded Multicolor Flexibility

Traditional Confocal



STELLARIS



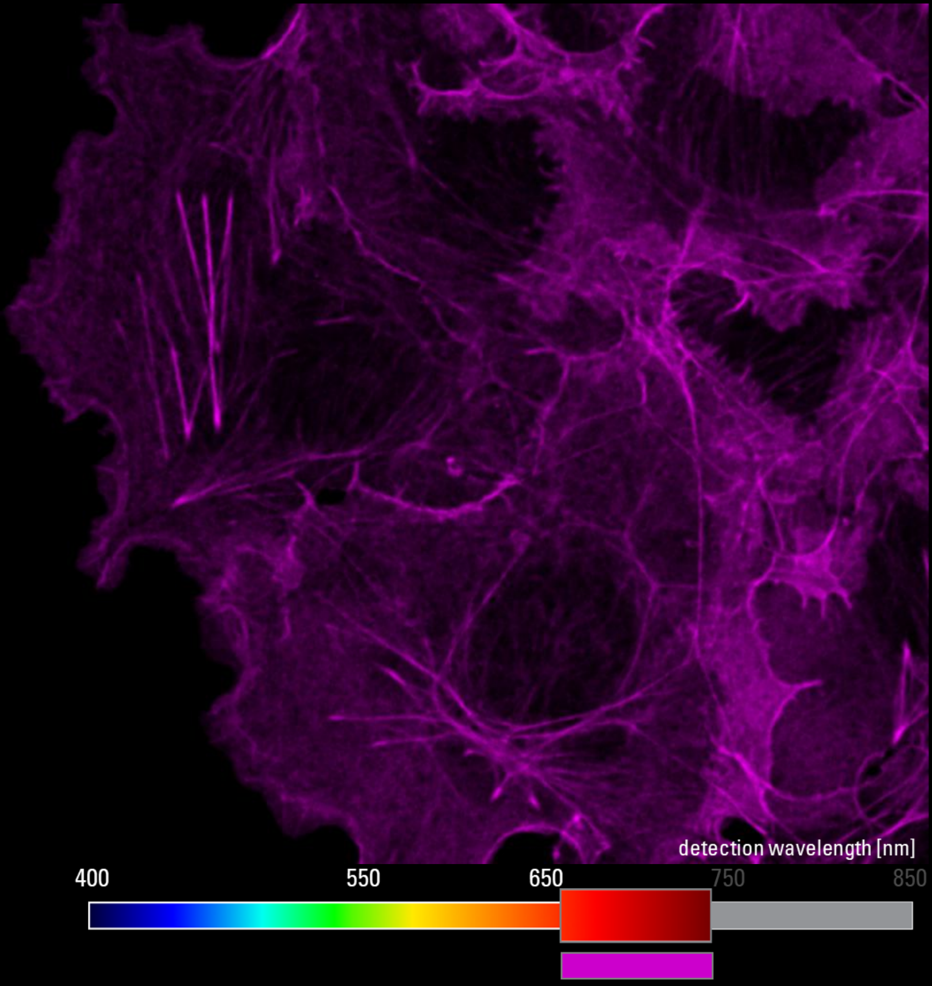
COS7 cells. Actin (magenta, SiR-Actin 657-740 nm), Mitochondria (cyan, AF750 760-790 nm), Microtubules (yellow, AF790 810-850 nm)
Sample Courtesy: Jana Döhner, Urs Ziegler, University of Zurich

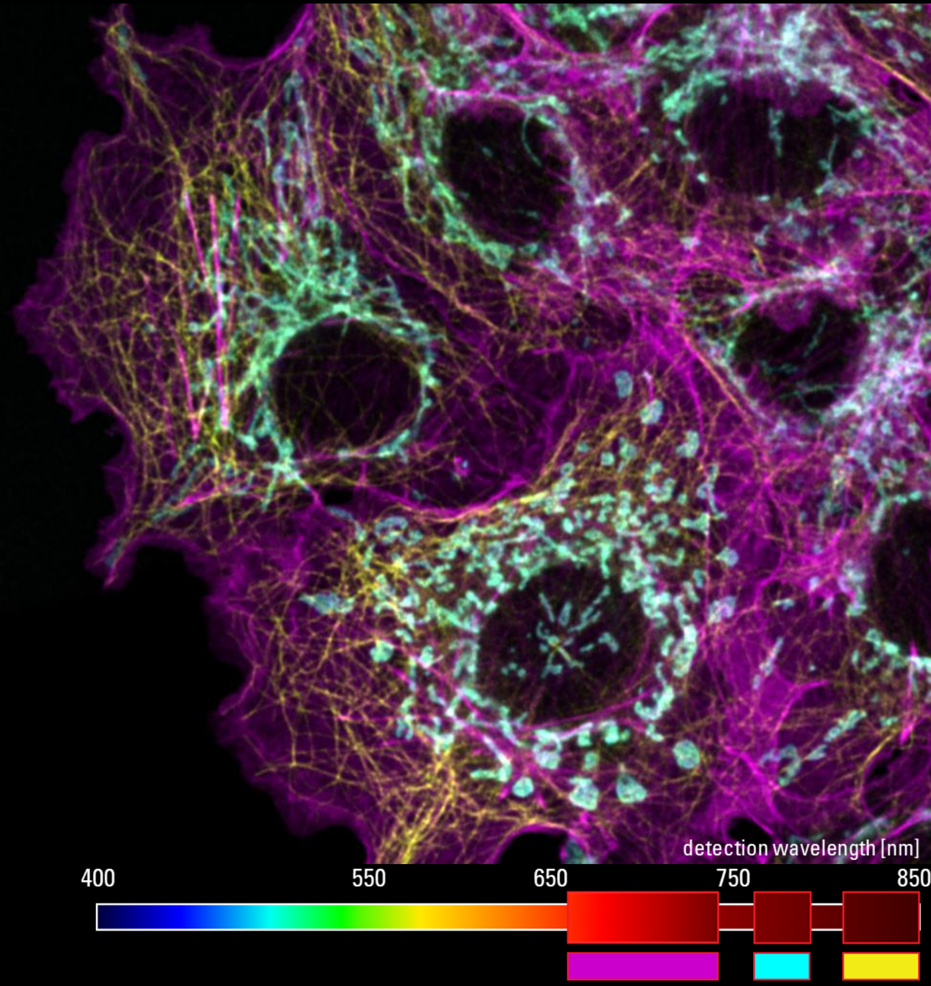
Leica

STELLARIS Delivers Expanded Multicolor Flexibility

Traditional Confocal

STELLARIS





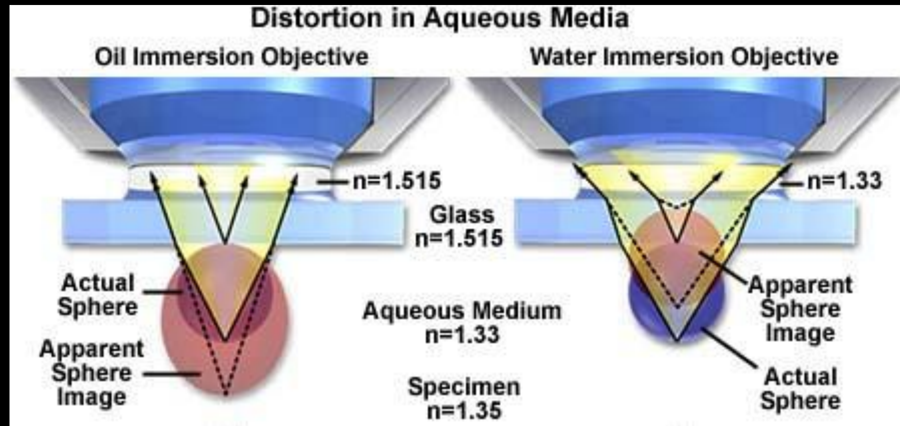
COS7 cells. Actin (magenta, SiR-Actin 657-740 nm), Mitochondria (cyan, AF750 760-790 nm), Microtubules (yellow, AF790 810-850 nm)
Sample Courtesy: Jana Döhner, Urs Ziegler, University of Zurich

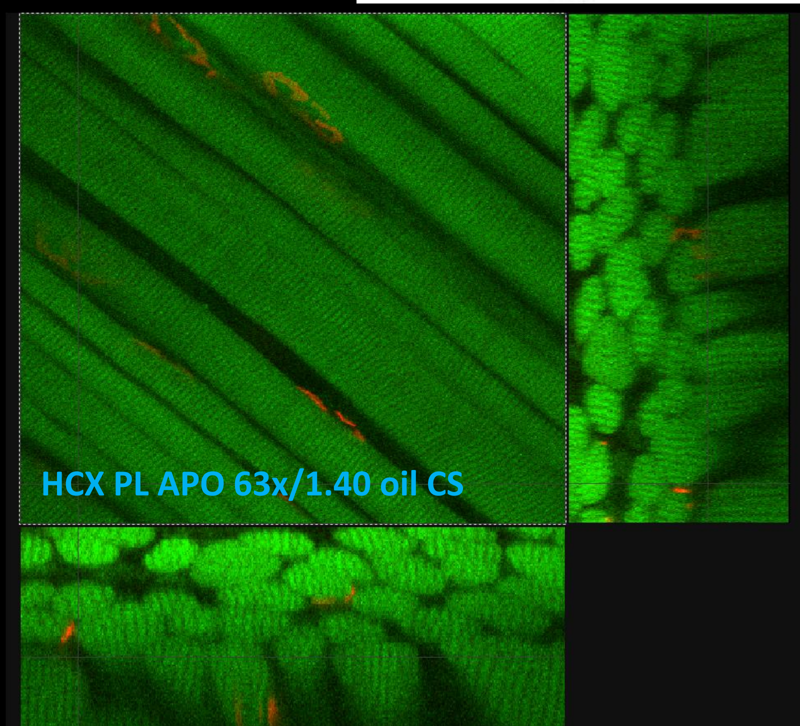
New Objectives

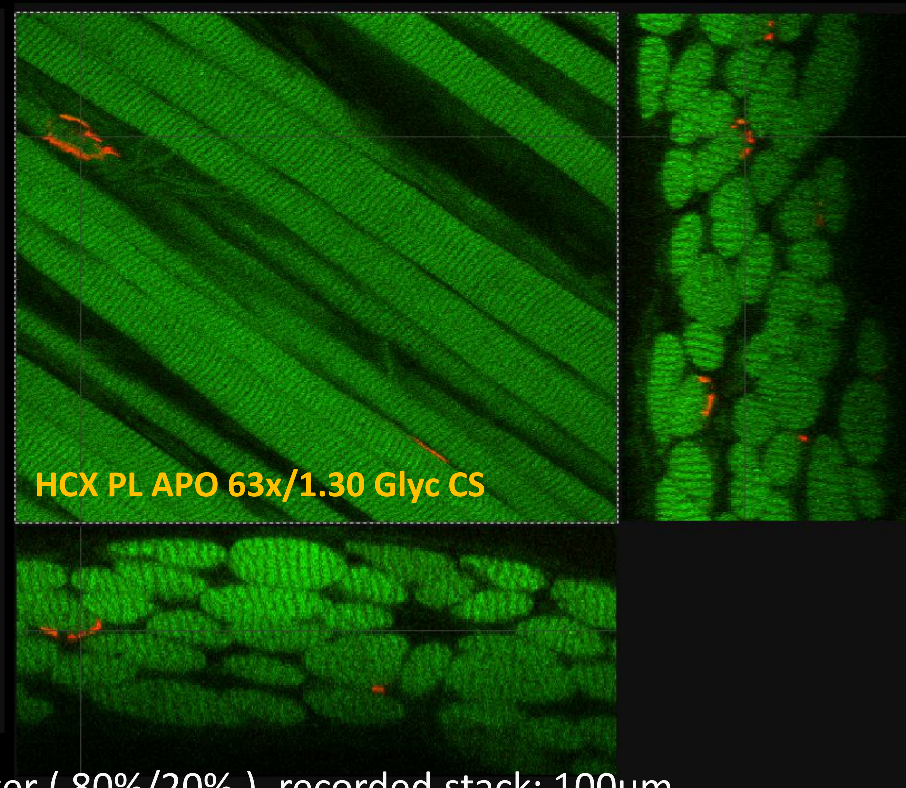
20X/0.75 IMM
Water, Glyc,Oil

40X/1.25 Glyc

- Reflective Index Match -

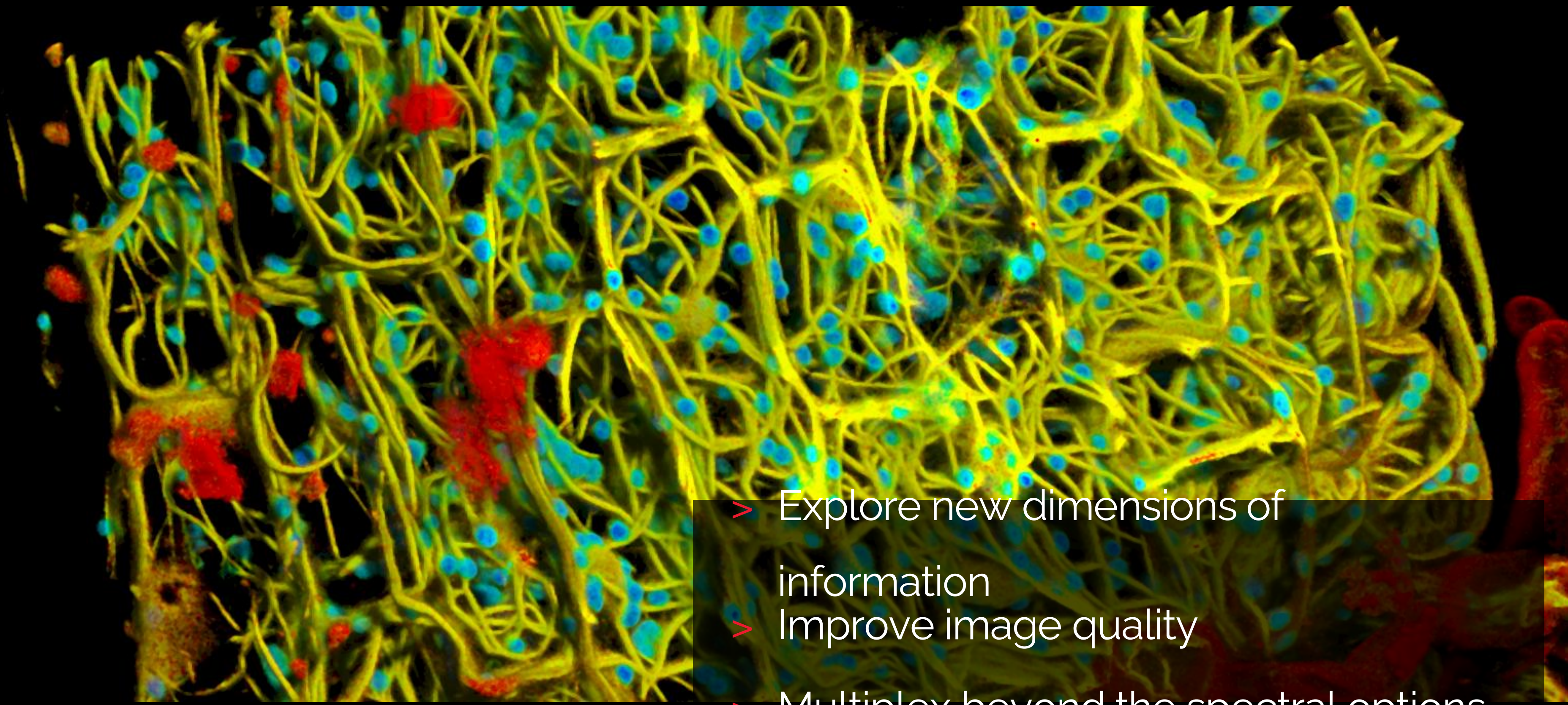






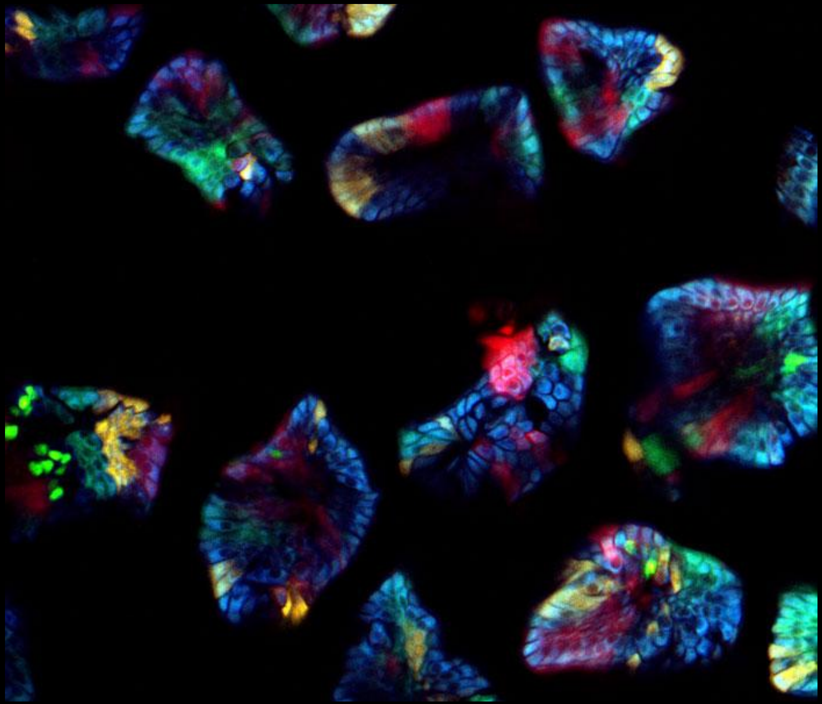
Moscle tissue embedded in glycerol/water (80%/20%), recorded stack: 100um

POTENTIAL
DISCOVER MORE



- Explore new dimensions of information
- Improve image quality
- Multiplex beyond the spectral options

Fluorescence imaging focus on spectral contrast....



Confetti Mouse Small Intestine. CFP, GFP, YFP and RFP. Acquired with SP8 DIVE
Sample courtesy of Jacco van Rheenen, University of Utrecht, the Netherlands

… fluorescence contains much more information

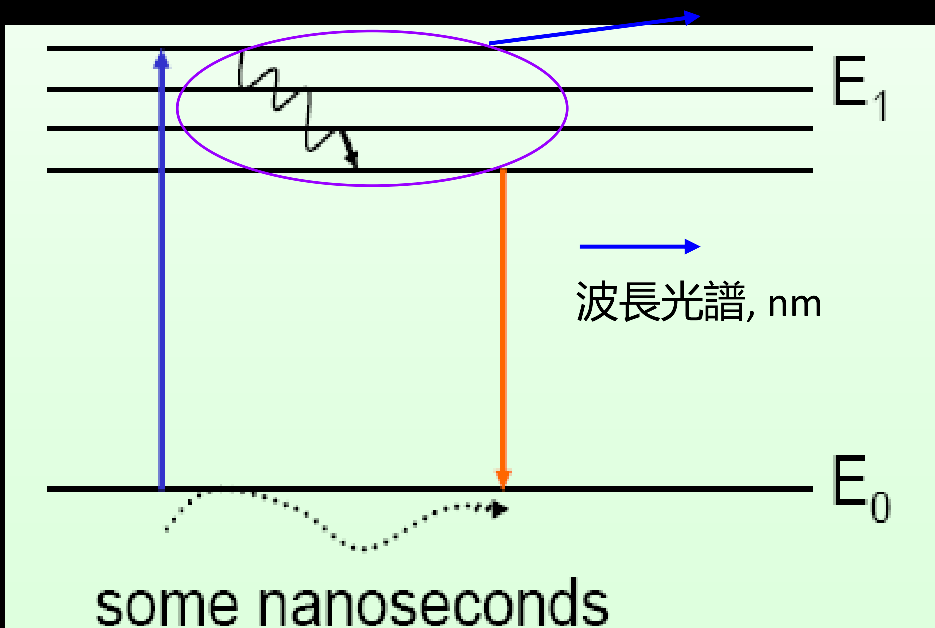
時脈頻譜(TauSense)技術的應用概念來自螢光生命週期影像技術

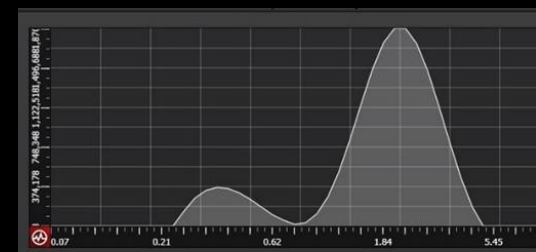
Fluorescence Lifetime Imaging Microscopy (FLIM)

Fluorescence lifetime

Average time that molecules stay in their excited state

生命週期（時脈頻譜, ns)





Fluorophore	Ex. Max.	(X) Em. Max.
AF 488	494nm	519nm
GFP	498nm	516nm

Fluorophore	Ex. Max.	Em. Max.
Fluo3 w. Ca2+	490nm	520nm
Fluo3 w/o Ca2+	490nm	520nm

The Technology Behind STELLARIS Potential

TauSense™

> Set of tools based on fluorescence lifetime

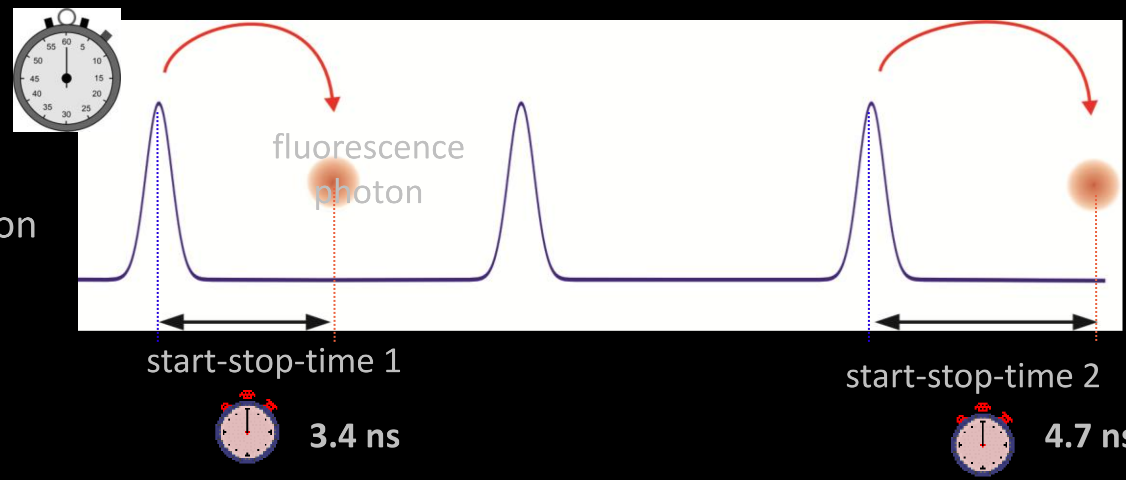
Leica STELLARIS首度將時脈頻譜技術 TauSense technology 整合於共軛焦顯微平台上

How to Measure the Time?

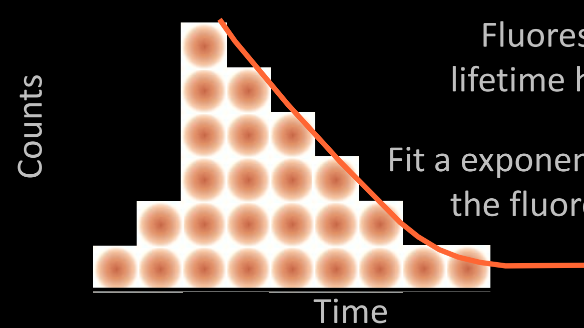
In principle with a stop watch:

1. Start the clock with a laser pulse.
2. Stop the clock with the first photon that arrives at the detector.
3. Reset the clock and wait for next start signal.

It is a statistical process!



- Repeat this time measurement very often and count “how many photons have arrived after what time”
- Sort the photons within a histogram into time bins according to their arrival times

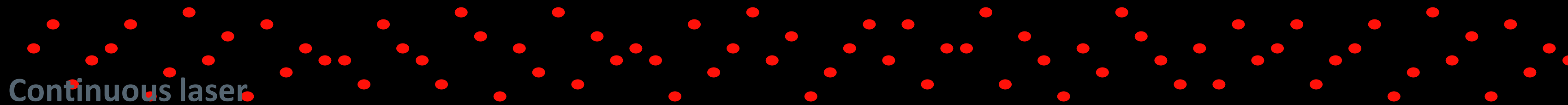


Fluorescence lifetime histogram:

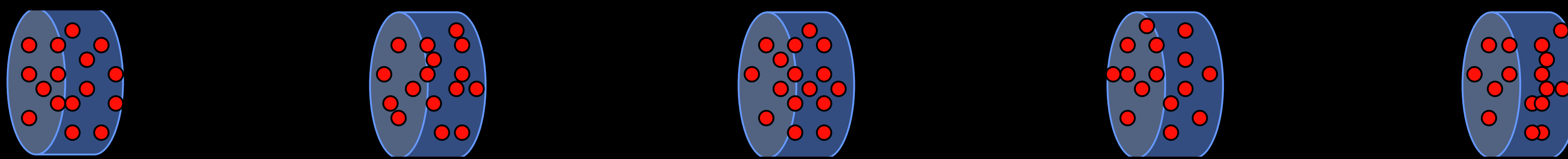
Fit a exponential decay to get the fluorescence lifetime

What we need for TauSense or FLIM?

- **A pulsed laser**



Leica STELLARIS white light laser is pulsed laser 440nm-790nm



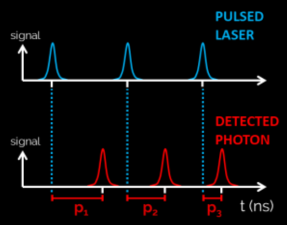
Pulsed laser

- **Photon counting detector**

-- Leica STELLARIS power HyD detectors are all photon counting detectors
Normal PMT or GaAsP is not suitable for photon counting

The Technology Behind TauSense

- Fluorescence Intensity ($N_{photons}$)
- Photon Arrival Time (ns)

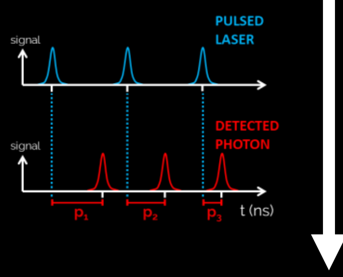


1) FPGA
2) Pixel-by-pixel
3) On the fly

- Fluorescence Intensity ($N_{photons}$)
- **Average** Photon Arrival Times (AAT, ns)

The Technology Behind TauSense

- Fluorescence Intensity ($N_{photons}$)
- Photon Arrival Time (ns)



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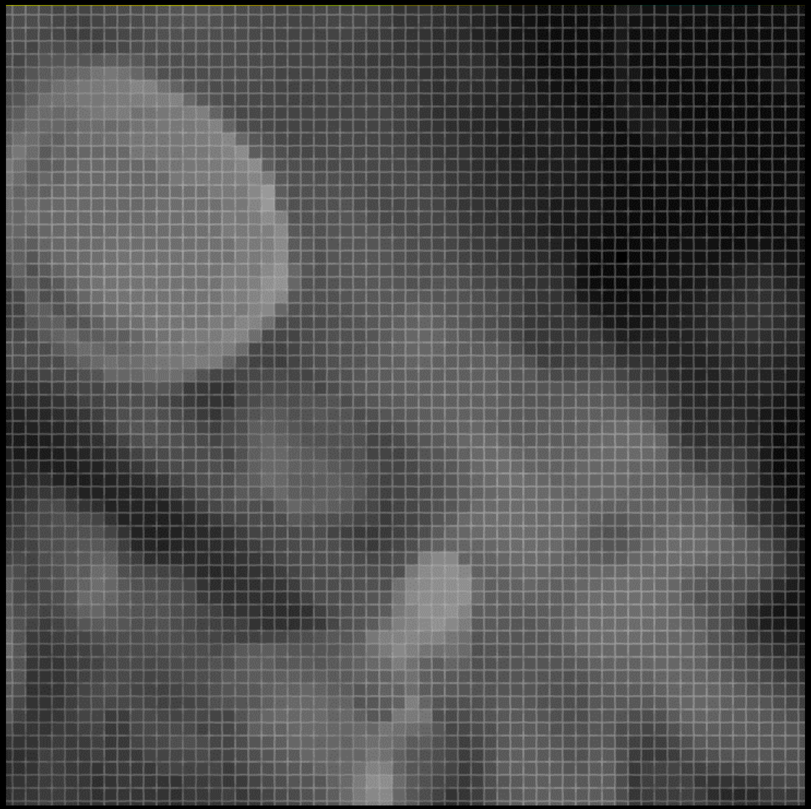
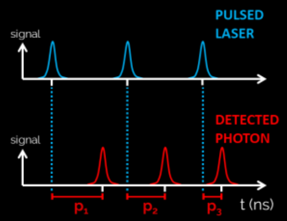


The Technology Behind TauSense

> Fluorescence Intensity ($N_{photons}$)

> Photon Arrival Time (ns)



1) FPGA
2) Pixel-by-pixel
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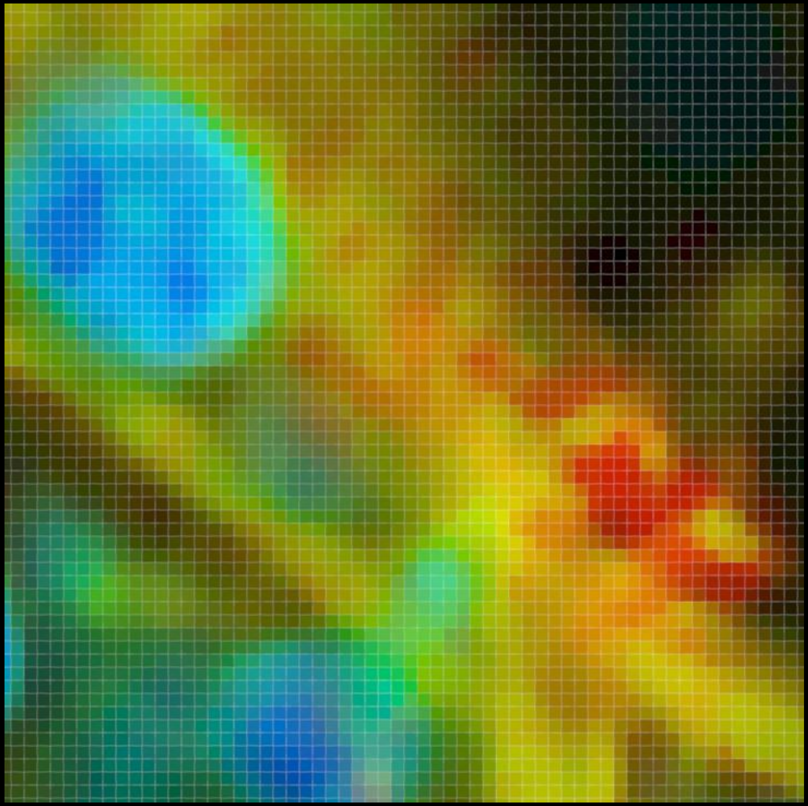
> Fluorescence Intensity ($N_{photons}$)

> **Average** Photon Arrival Times (AAT, ns)



Alexa Dyes

Alexa Fluor Dye *	Ex (nm)	Em (nm)	τ (ns) ‡
Alexa Fluor 488	496	519	4.1 §
Alexa Fluor 532	532	553	2.5
Alexa Fluor 546	556	573	4.1
Alexa Fluor 555	555	565	0.3
Alexa Fluor 568	578	603	3.6 §
Alexa Fluor 594	590	617	3.9 §
Alexa Fluor 647	650	665	1.0
Alexa Fluor 660	663	690	1.2 **
Alexa Fluor 680	679	702	1.2
Alexa Fluor 700	702	723	1.0
Alexa Fluor 750	749	775	0.7

Measurements were made on free succinimidyl ester derivatives in aqueous solutions. † For Alexa Fluor 488, Alexa Fluor 532, Alexa Fluor 546, Alexa Fluor 555, Alexa Fluor 568, Alexa Fluor 594 and Alexa Fluor 647 dyes, QY measurements were made in PBS (50 mM potassium phosphate, 150 mM NaCl, pH 7.2) at 22°C relative to fluorescein in 0.01 M NaOH (QY = 0.92). For Alexa Fluor 660, Alexa Fluor 680, Alexa Fluor 700 and Alexa Fluor 750 dyes, QY measurements were made in PBS (50 mM potassium phosphate, 150 mM NaCl, pH 7.2) at 22°C relative to Alexa Fluor 647 succinimidyl ester in PBS (QY = 0.33). ‡ Except for the footnoted values, lifetime measurements were made in water at 22°C, data provided by ISS Inc. (Champaign, IL). § Lifetime measurements were provided by the SPEX Fluorescence Group, Horiba Jobin Yvon Inc. ** Lifetime measurement was made in pH 7.5 buffer at 20°C by Pierre-Alain Muller, Max Planck Institute for Biophysical Chemistry, Göttingen.

Atto Dyes

Dyes	Ex (nm)	Em (nm)	τ (ns)
Atto 465	453	508	2.2
Atto 488	501	523	3.2
Atto 495	495	527	2.4
Atto 514	511	533	3.0
Atto 520	516	538	3.8
Atto 532	532	553	3.8
Atto Rho6G	535	560	4.1
Atto 550	554	576	3.2
Atto 565	563	592	3.4
Atto Rho3B	565	592	1.5
Atto Rho11	571	595	4.0
Atto Rho12	576	601	4.0
Atto Thio12	579	609	2.0
Atto Rho101	586	610	4.2

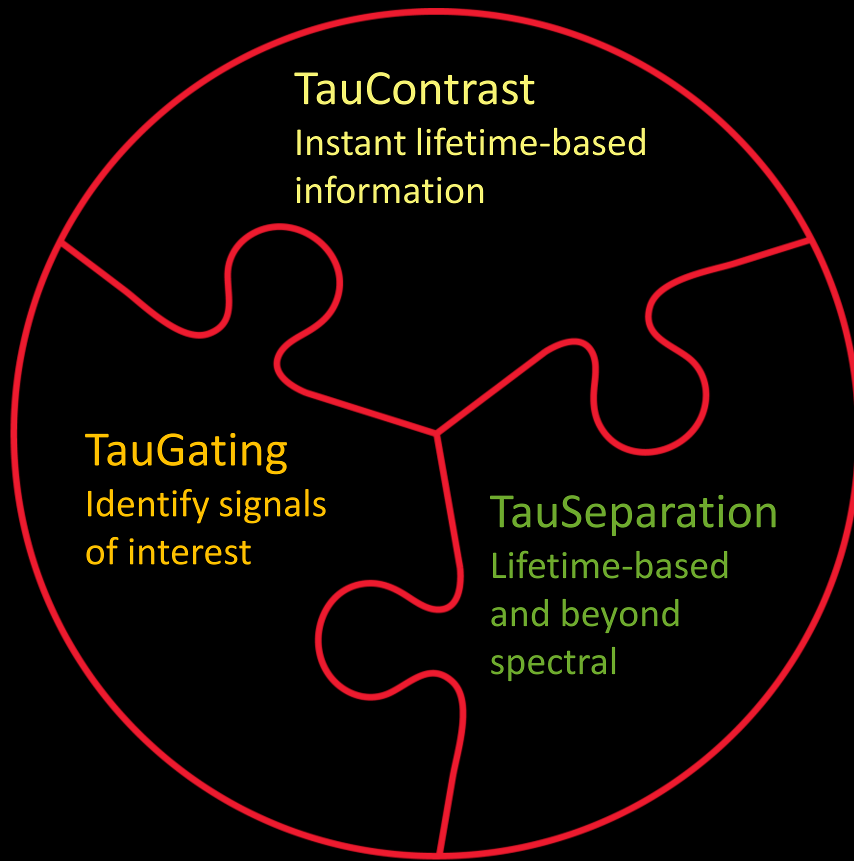
Dyes	Ex(nm)	Em(nm)	τ (ns)
Atto 590	594	624	3.7
Atto 594	601	627	3.5
Atto Rho13	600	625	3.9
Atto 610	615	634	3.3
Atto 620	619	643	2.9
Atto Rho14	625	646	3.7
Atto 633	629	657	3.2
Atto 647	645	669	2.3
Atto 647N	644	669	3.4
Atto 655	663	684	1.9
Atto Oxa12	663	684	1.8
Atto 665	663	684	2.9
Atto 680	680	700	1.8
Atto 700	700	719	1.5
Atto 725	729	752	0.5
Atto 740	740	764	0.6

Dye	Ex (nm)	Em (nm)	τ (ns)
Cy3	548	562	0.3
Cy3.5	581	507	2.6
Cy5	646	664	1.0
Cy5.5	675	695	1.0
FITC	494	518	4.1
Oregon Green 488	493	520	4.1
Oregon Green 500	402	522	2.18
Rhodamine 6G	525	555	4.08
Rhodamin B	562	583	1.68
Texas Red	589	615	4.2
TOTO-1	514	533	2.2

Fluorescent Protein

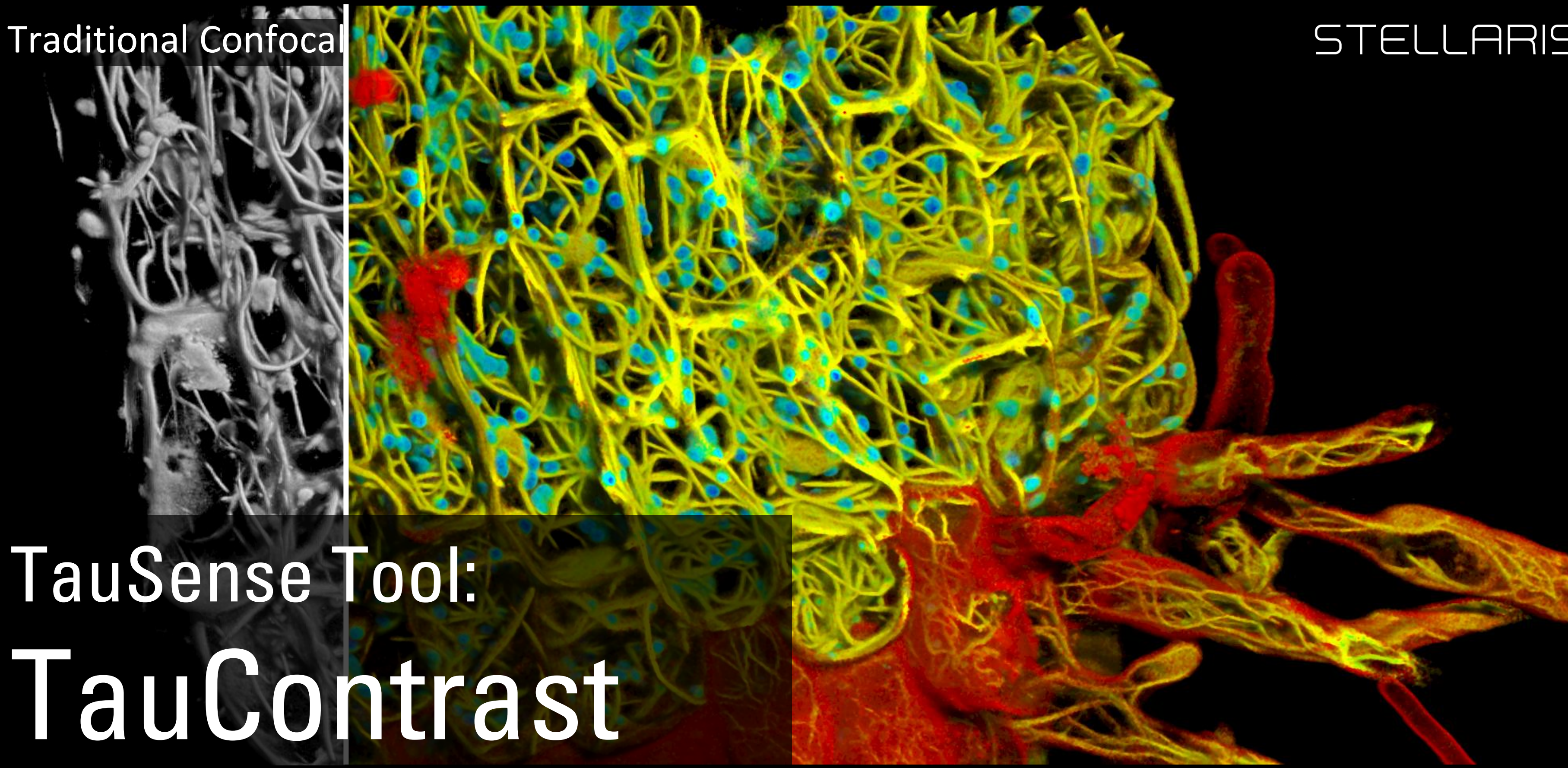
Fluorescent Protein	Ex (nm)	Em (nm)	τ (ns)
ECFP	434	477	3.0
EGFP	488	507	2.6
EYFP	513	527	3.1
mRuby	558	605	2.6
mScarlet	569	594	3.9
mCherry	587	610	1.4
mKate2	588	633	2.5

STELLARIS: Ready to Discover with TauSense（時脈頻譜技術）



ALL Leica STELLARIS series confocal with WLL offer TauSense technology (lifetime-based information) to discover more

Explore A New Dimension Of Information



Leica

Explore New Dimensions Of Information

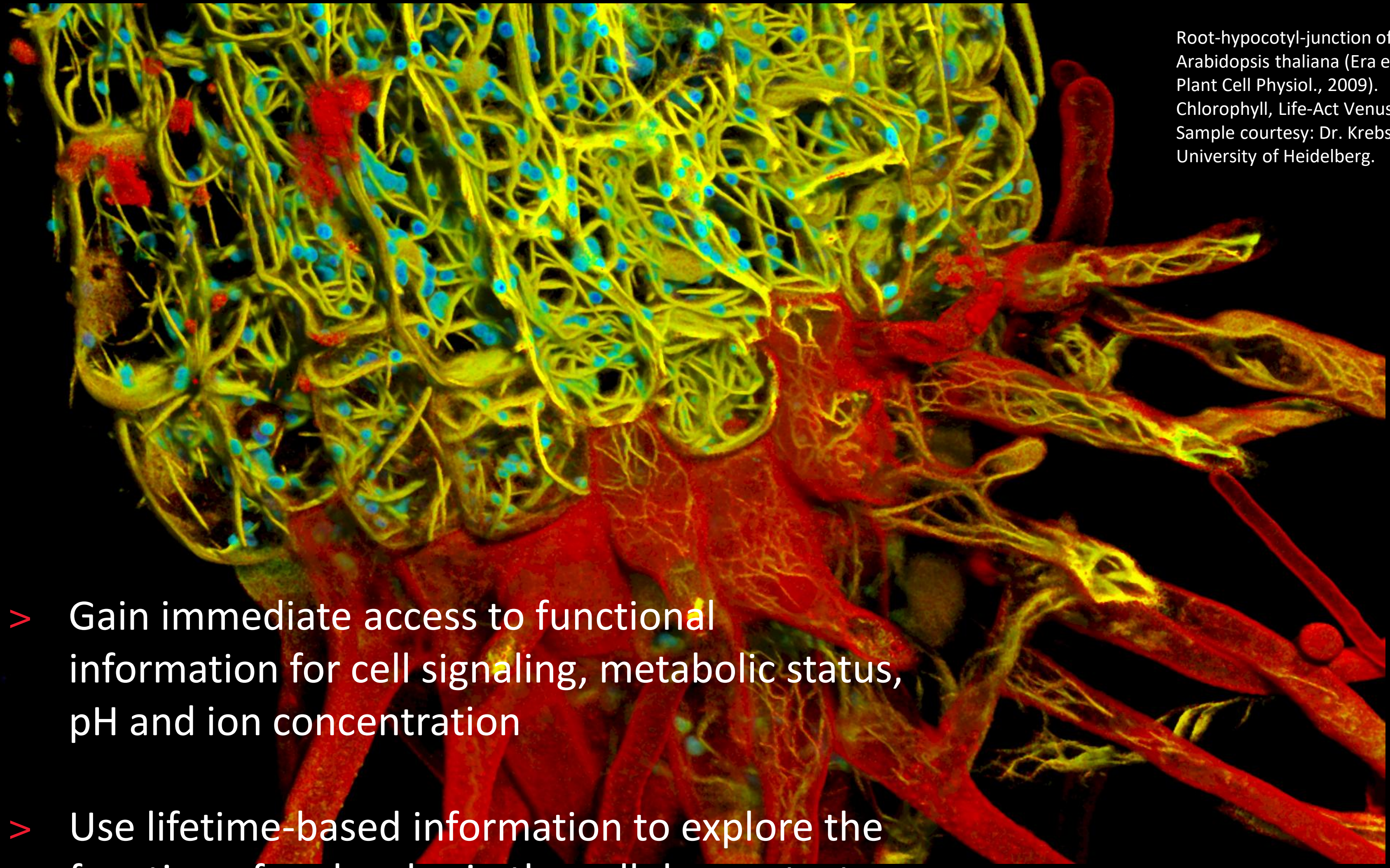
Root-hypocotyl-junction of Arabidopsis thaliana (Era et al. Plant Cell Physiol., 2009). Chlorophyll, Life-Act Venus, IProp. Sample courtesy: Dr. Krebs, COS, University of Heidelberg.

… go beyond today's limits

… see the unseen

… acquire more accurate and reliable data to prove your hypothesis

Explore New Dimensions Of Information - TauContrast

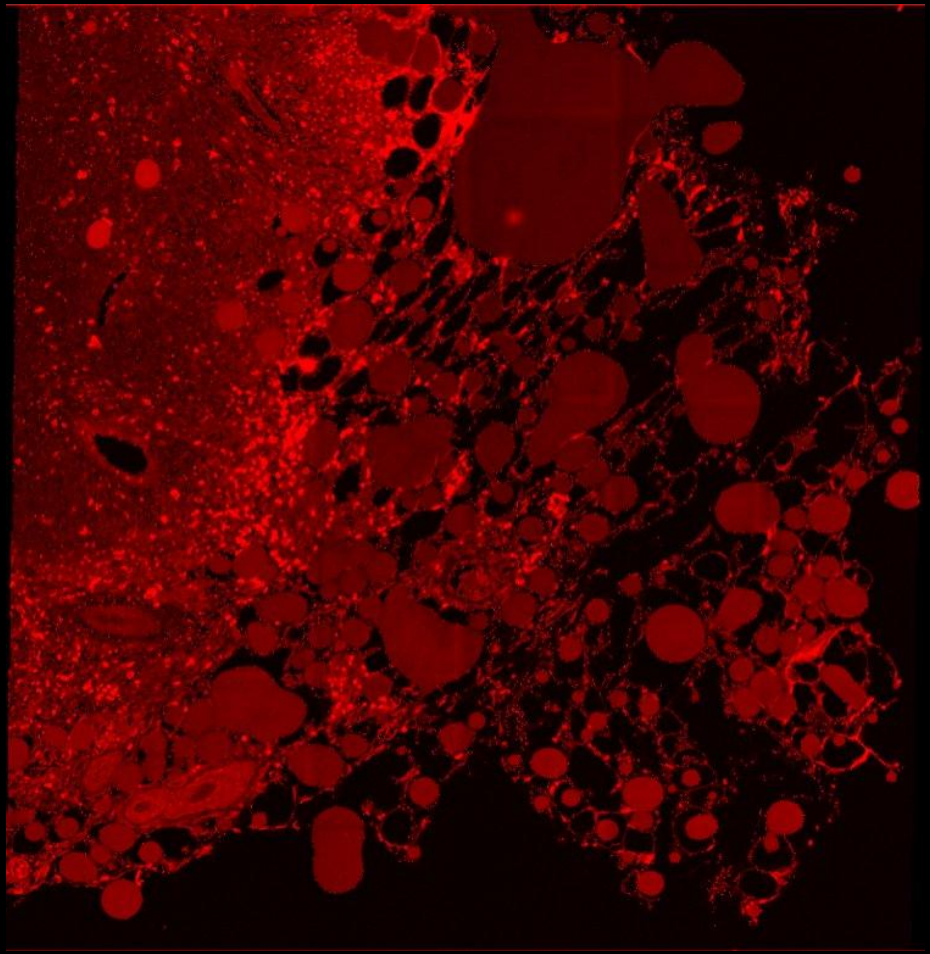


Root-hypocotyl-junction of Arabidopsis thaliana (Era et al. Plant Cell Physiol., 2009). Chlorophyll, Life-Act Venus, IProp. Sample courtesy: Dr. Krebs, COS, University of Heidelberg.

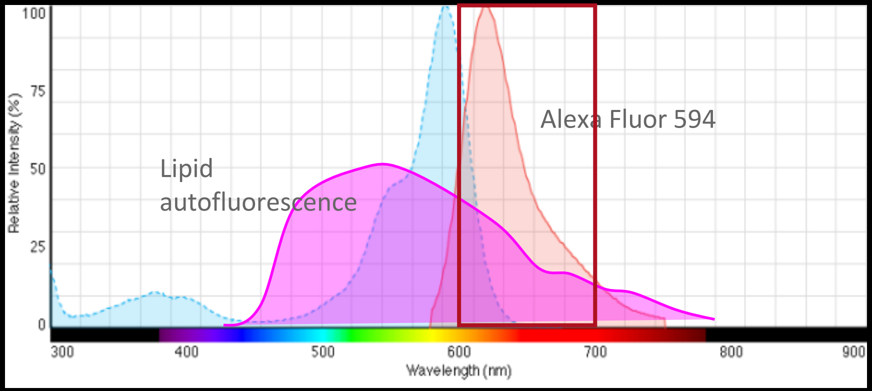
- Gain immediate access to functional information for cell signaling, metabolic status, pH and ion concentration
- Use lifetime-based information to explore the function of molecules in the cellular context

TO GET CLOSER TO THE TRUTH

TauContrast – autofluorescence- T cell



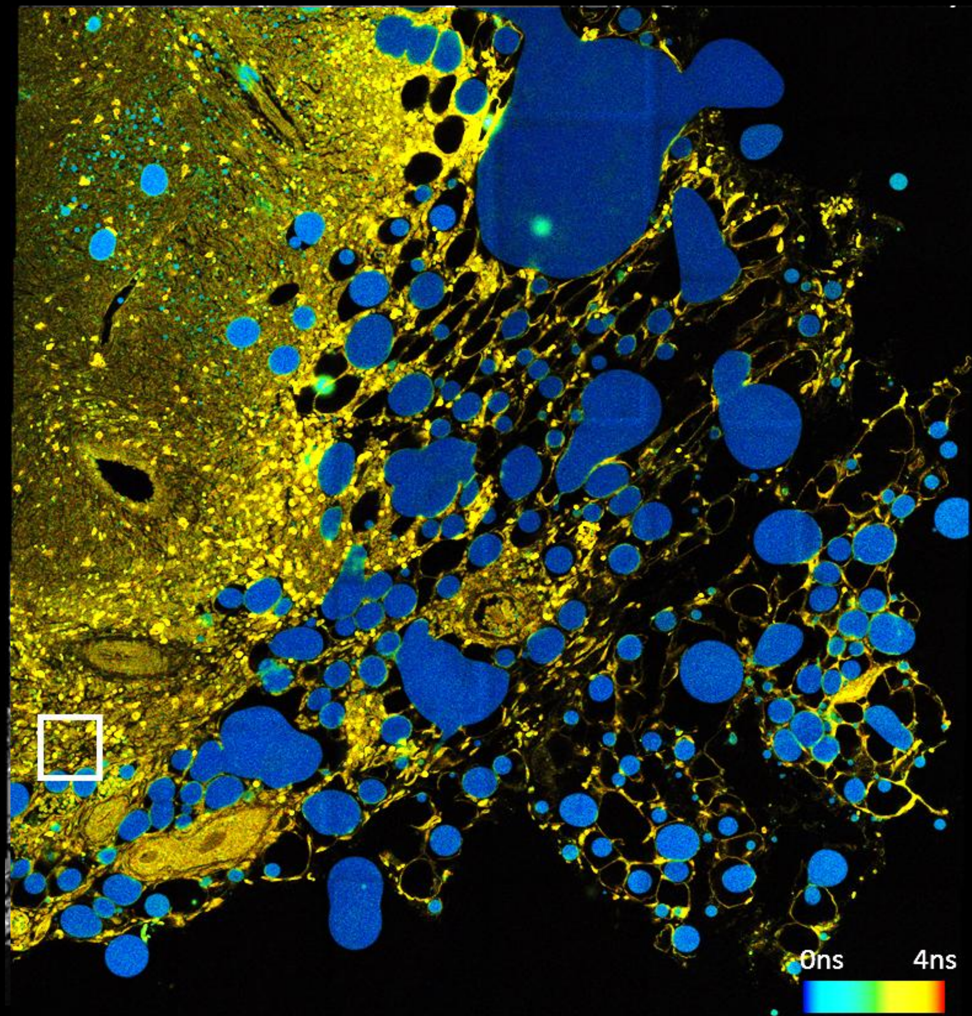
Excitation : 588nm, detection : 615-705nm



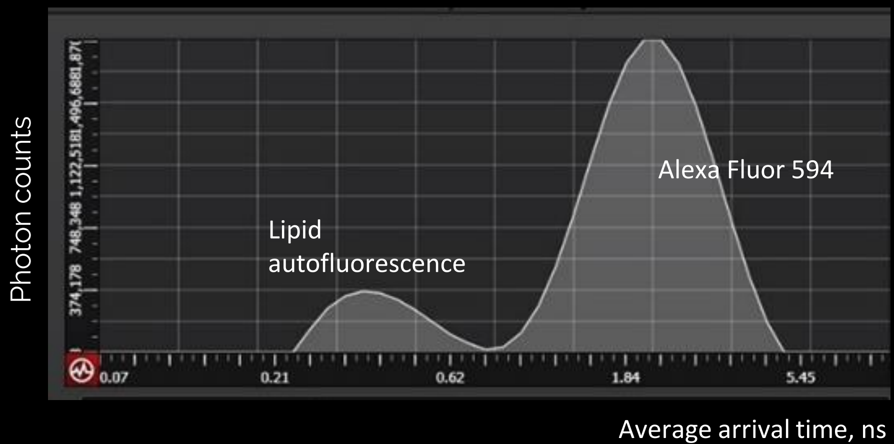
Subcutaneous BRAF600E mouse melanoma with surrounding fat tissue. Cytotoxic T cells stained with anti-CD8a Alexa Fluor 594. Tissue shows high autofluorescence which interferes with Alexa Fluor 594 signal. Fluorescence lifetime information (fast FLIM) enables to distinguish CD8a+ T cells (longer lifetime, yellow) from the autofluroescence of the lipid droplets (short lifetime in blue) and of other cells (green in Fast FLIM images)

Courtesy of Dr. Jan Boettcher, Institute of Molecular Immunology, TU Munich

TauContrast – autofluorescence- T cell



Excitation : 588nm, detection : 615-705nm



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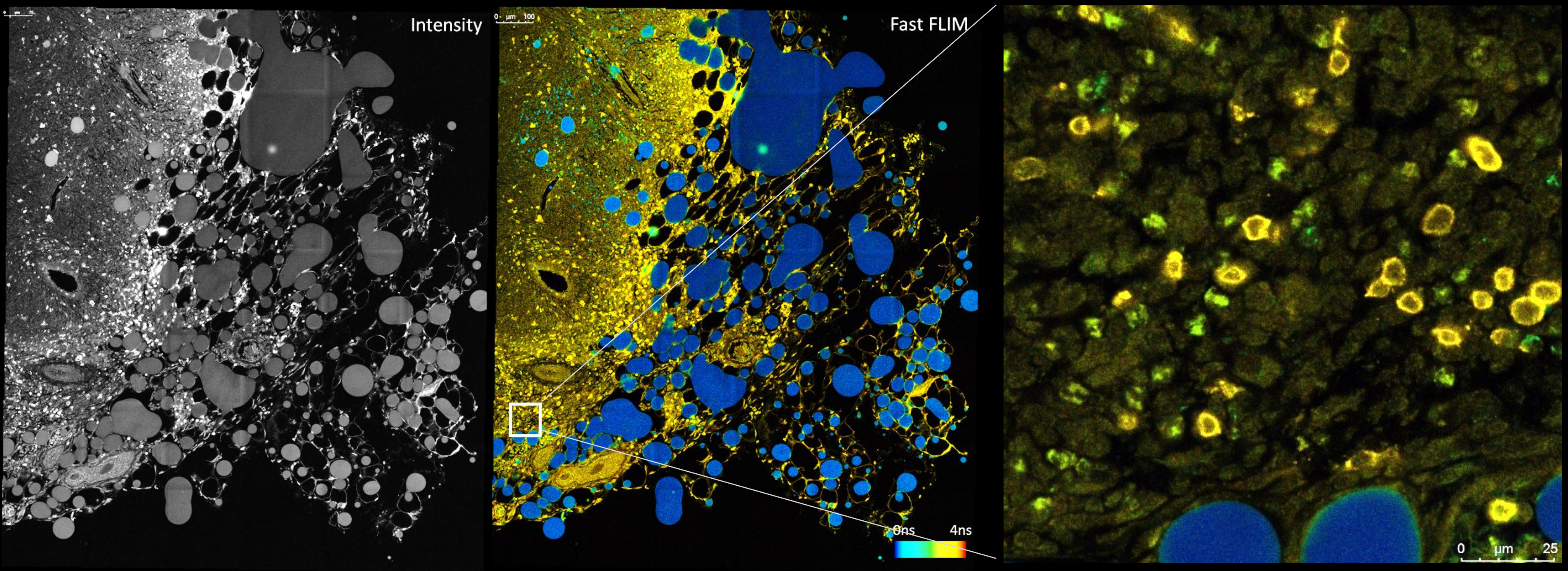
TauContrast – autofluorescence- T cell



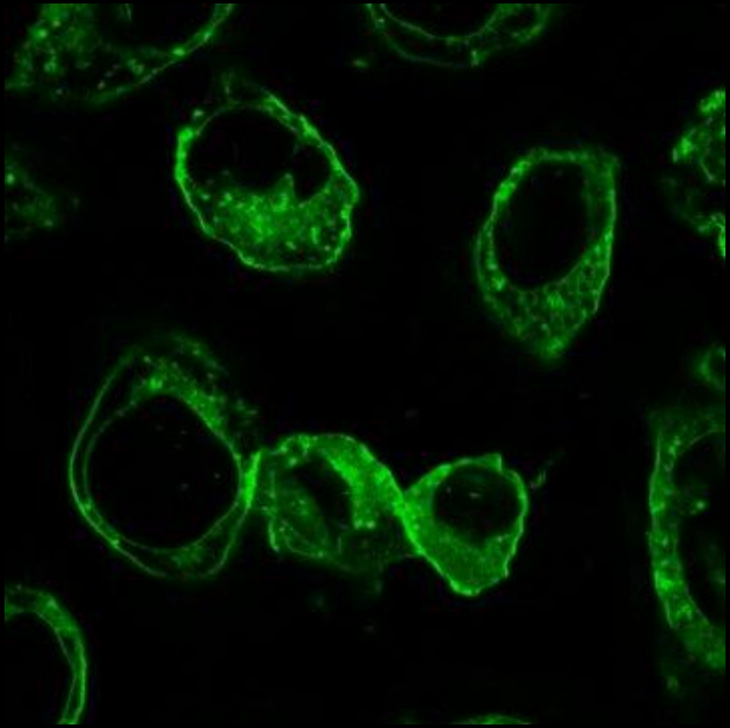
Subcutaneous BRAF600E mouse melanoma with surrounding fat tissue. Cytotoxic T cells stained with anti-CD8a Alexa Fluor 594. Tissue shows high autofluorescence which interferes with Alexa Fluor 594 signal. Fluorescence lifetime information (fast FLIM) enables to distinguish CD8a+ T cells (longer lifetime, yellow) from the autofluroescence of the lipid droplets (short lifetime in blue) and of other cells (green in Fast FLIM images)

Courtesy of Dr. Jan Boettcher, Institute of Molecular Immunology, TU Munich

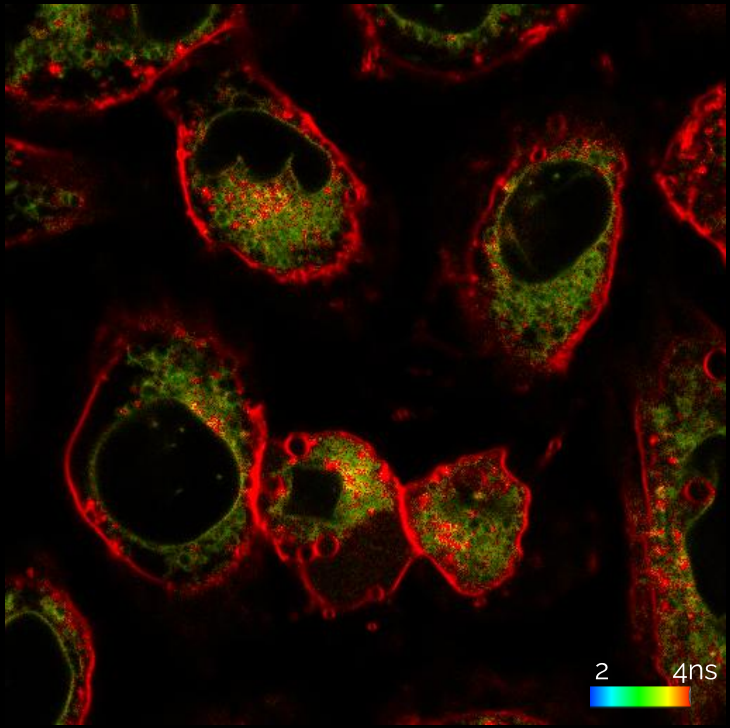
Membrane tension visualization with FlipperTR®

Excitation : 488nm, detection : 575-625nm

Intensity



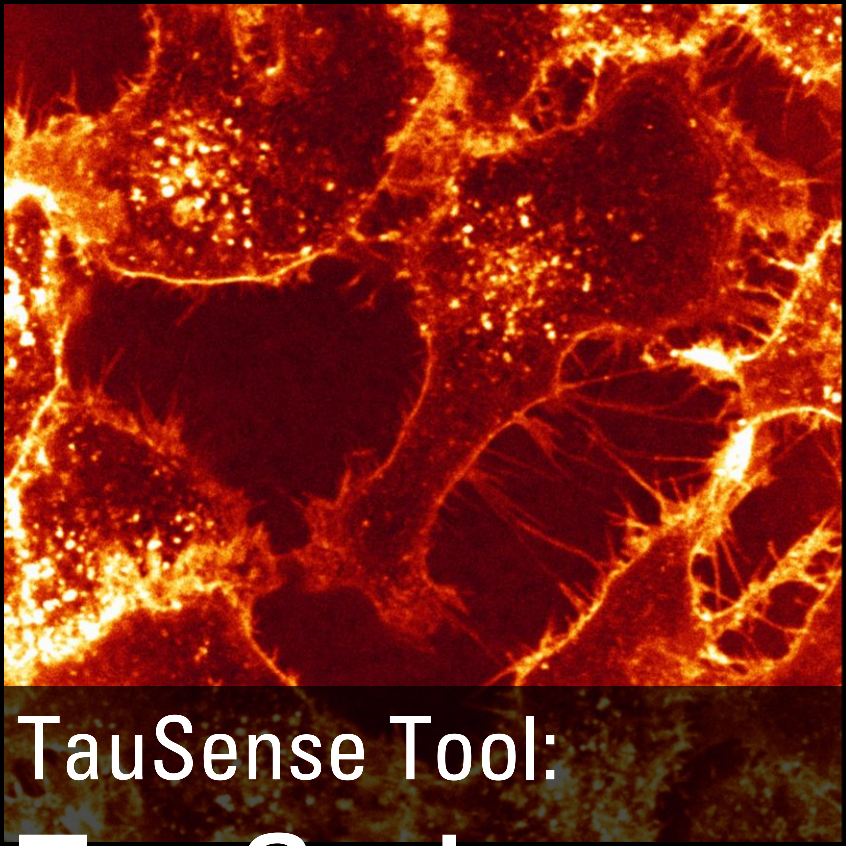
Tau Contrast



U2OS cells labeled with Flipper TR,

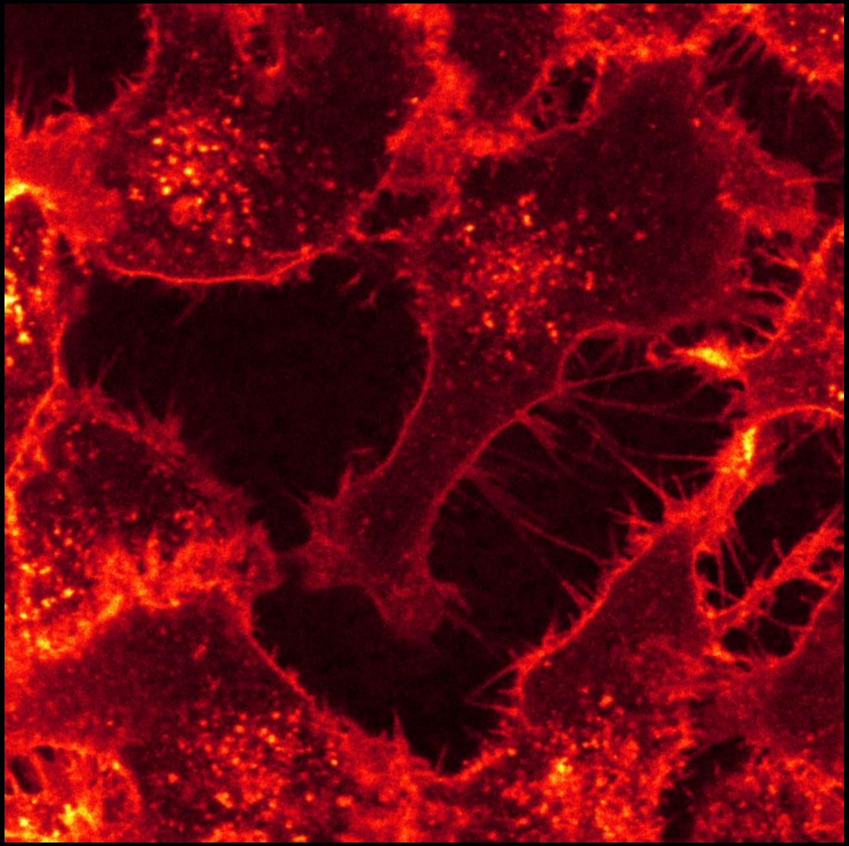
Improve Image Quality

Traditional Confocal



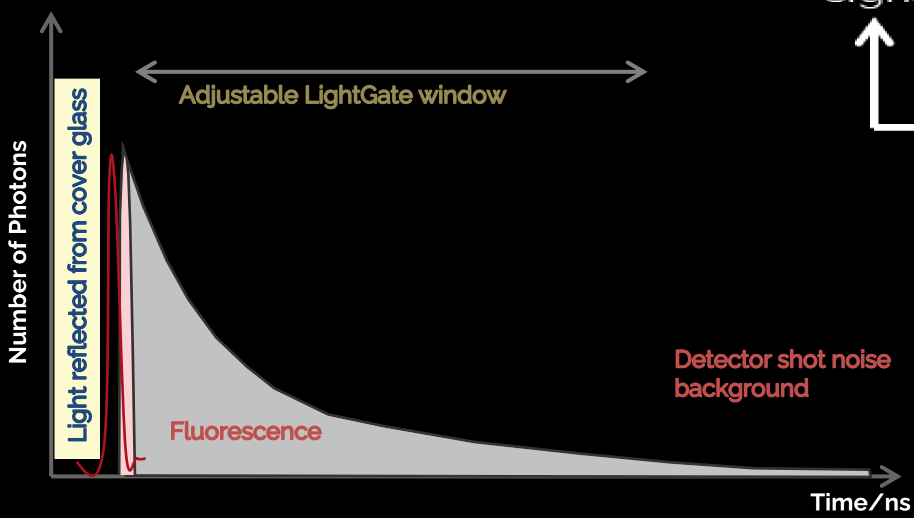
TauGating

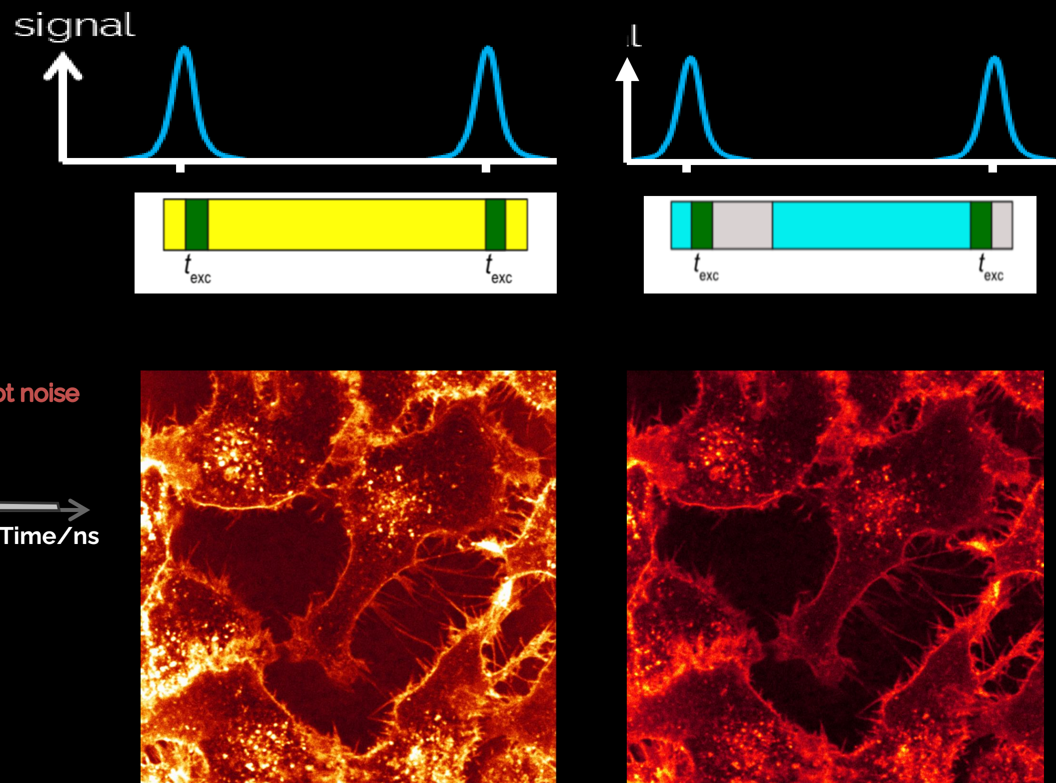
STELLARIS



Leica

The Technology Behind TauGating



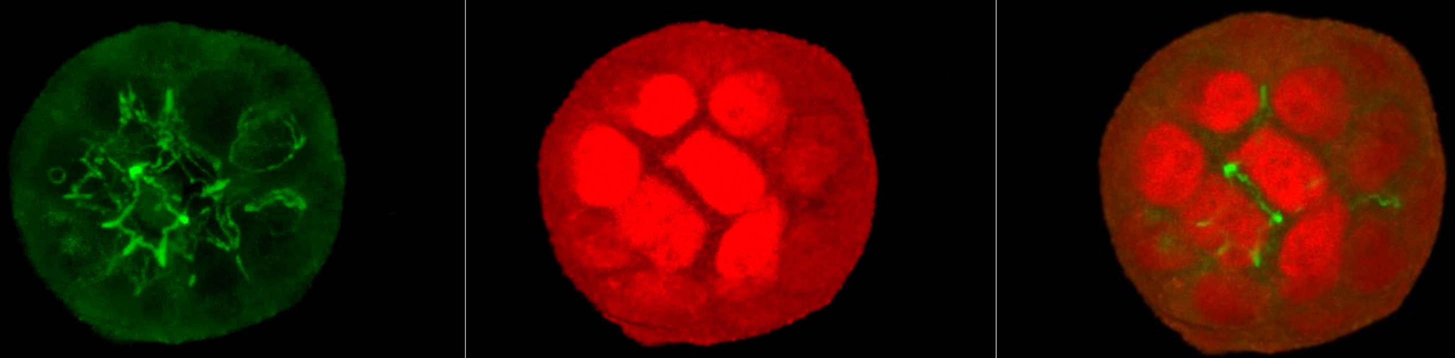


> Digital Gate Channels (Intensity, $N_{photons}$)

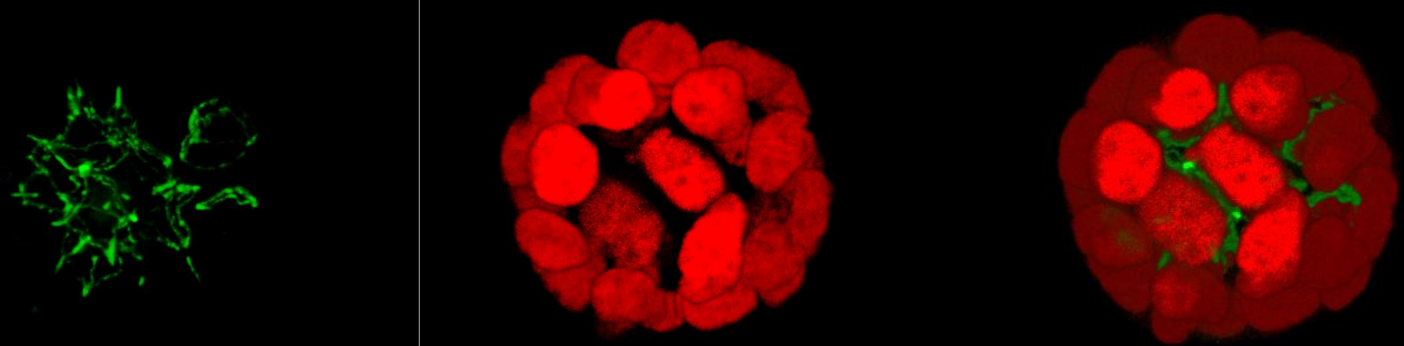
TauGating - Improve Image Quality

Traditional Confocal

3D cell culture

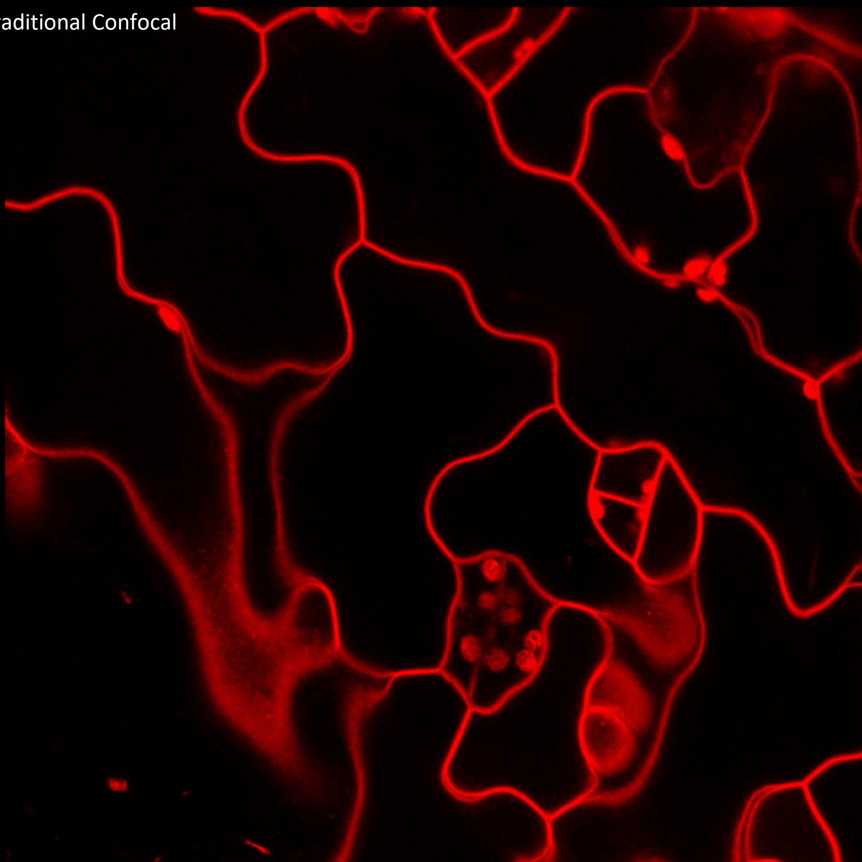


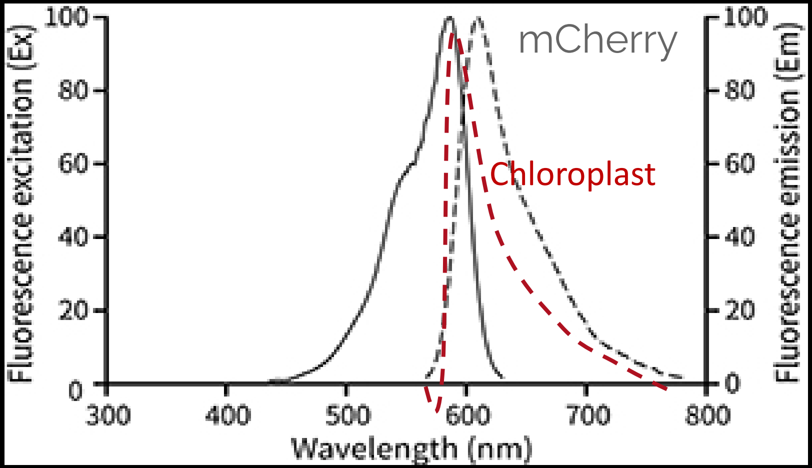
STELLARIS TauGating



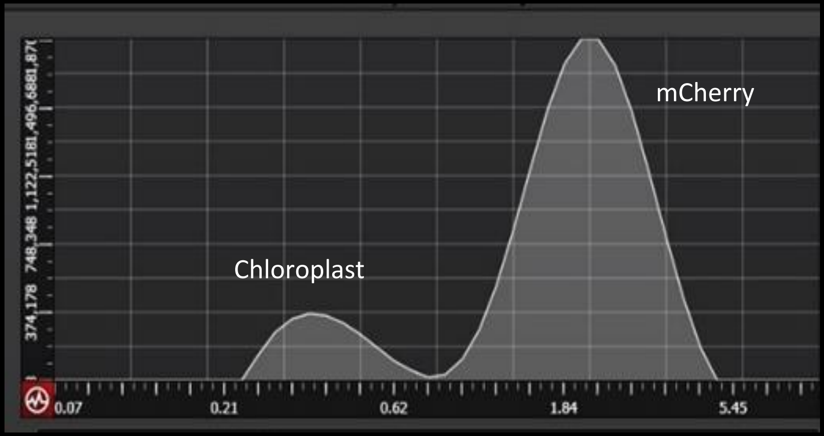
mCherry + Chloroplast

Traditional Confocal





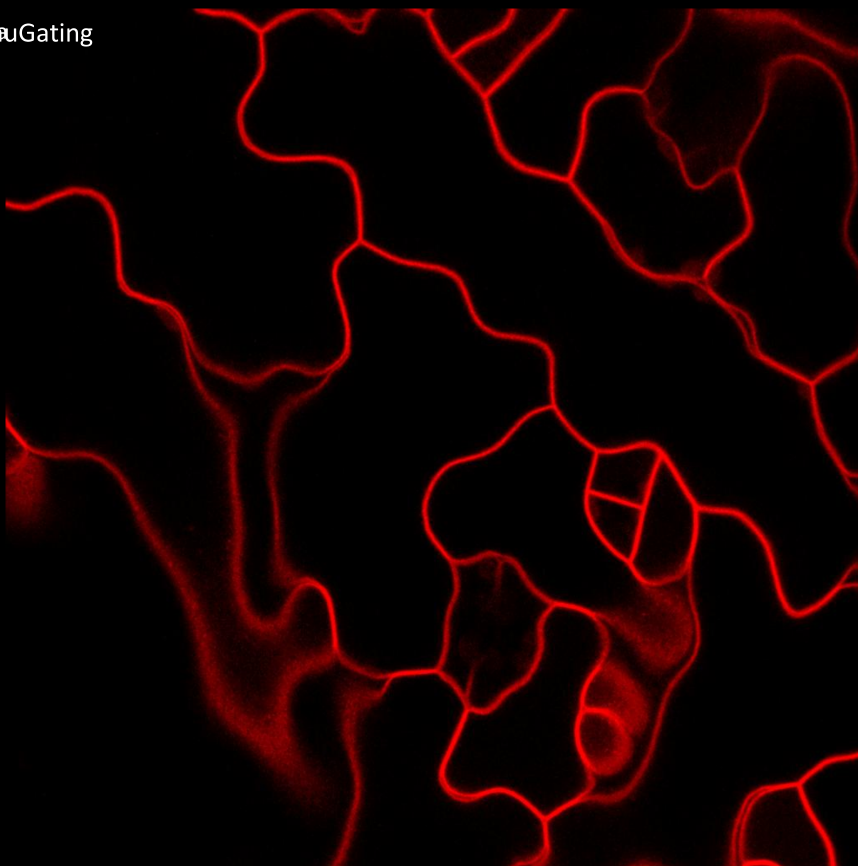
Photon counts

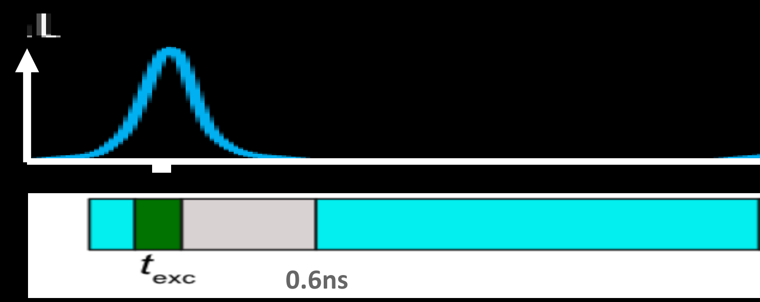


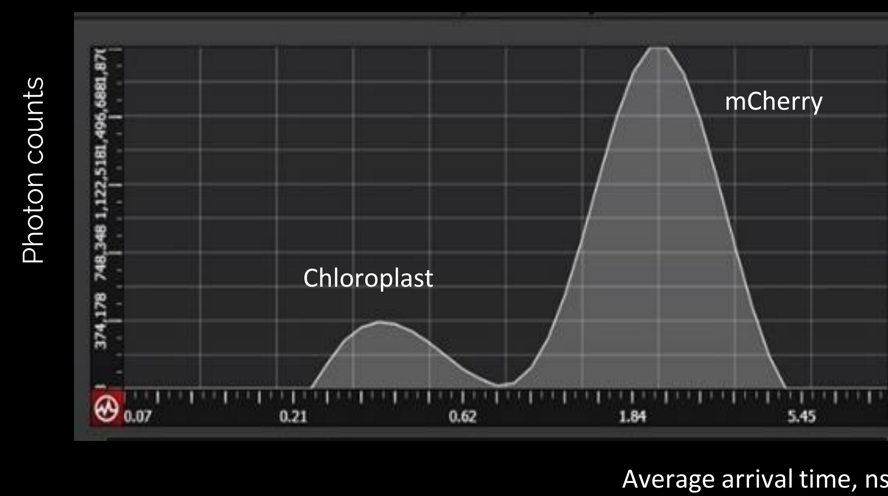
Average arrival time, ns

mCherry + Chloroplast

TauGating



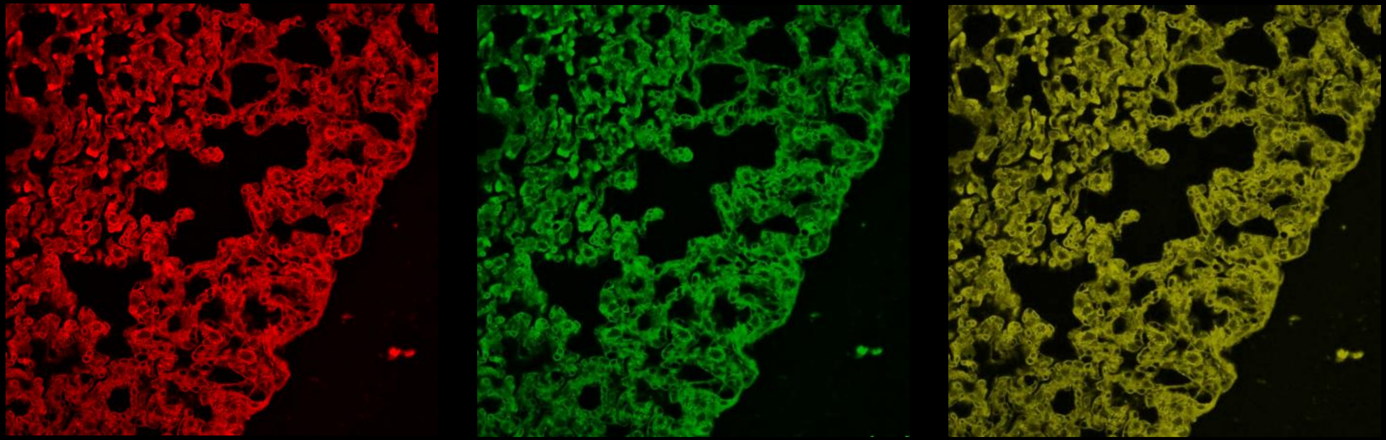




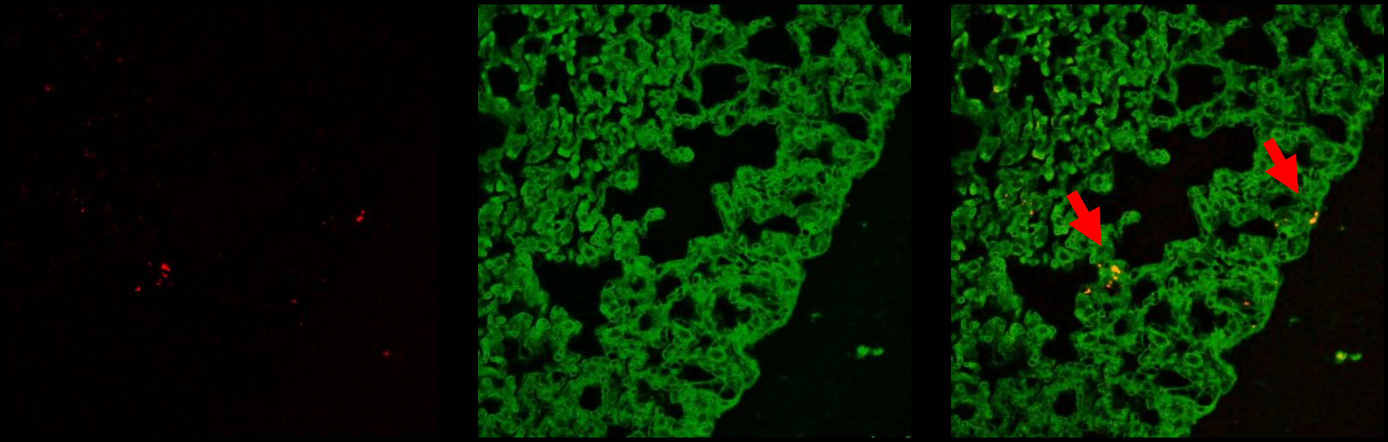
TauGating - Improve Image Quality

Tissue & nano diamond

Traditional Confocal

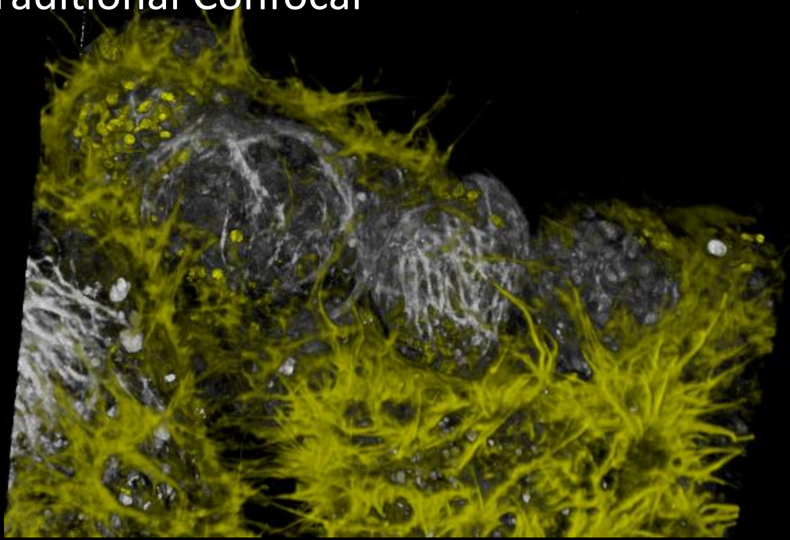


Tau gating

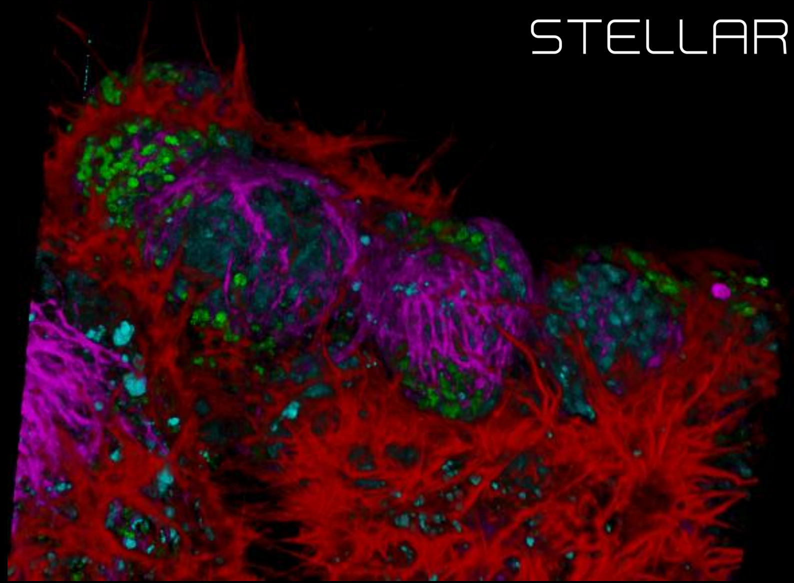


Multiplex Beyond The Spectral Options

Traditional Confocal



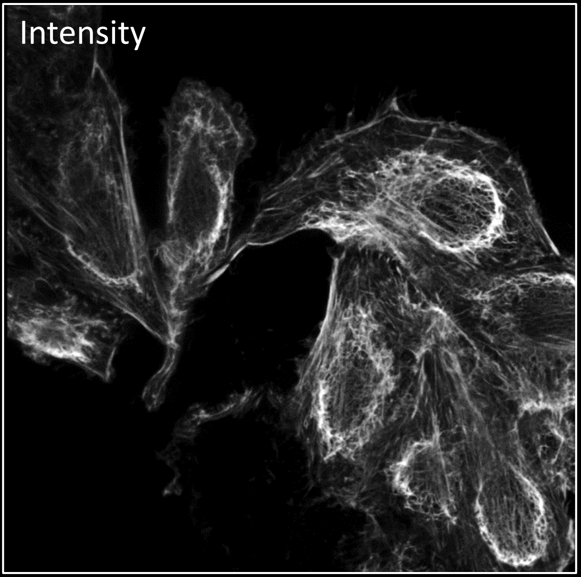
STELLARIS



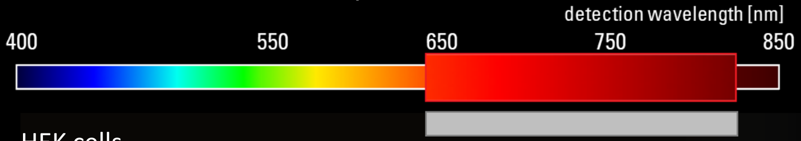
TauSense Tool:

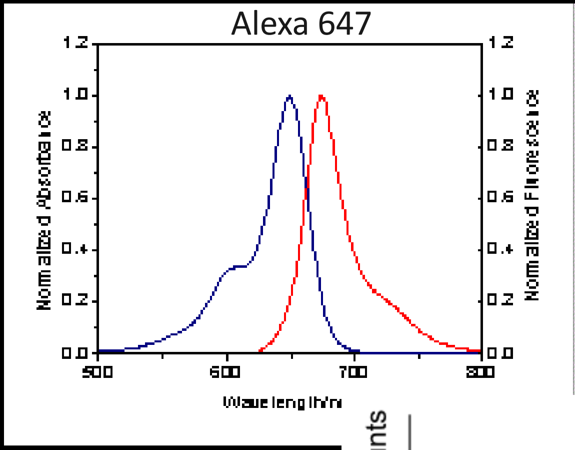
TauSeparation

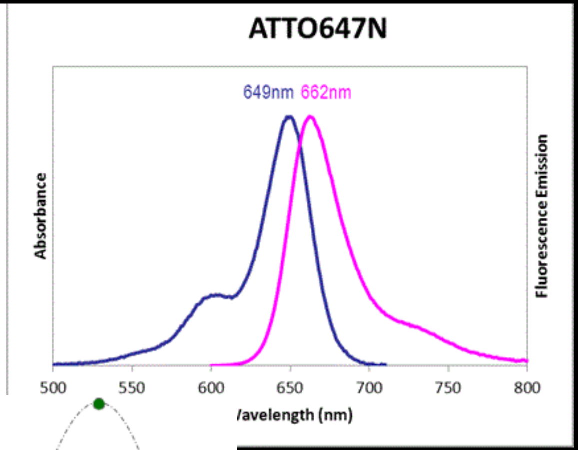
Species Separation using TauSense

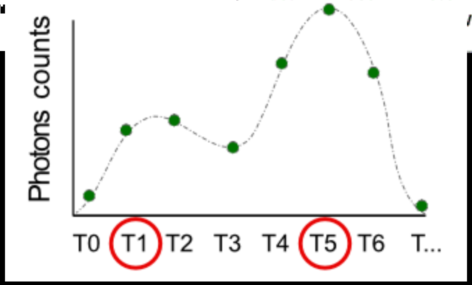


1 detector, 1 intensity channel







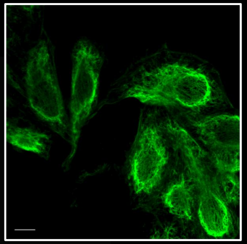


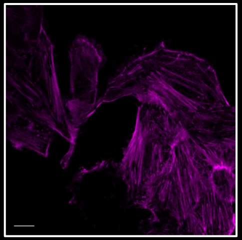
HEK cells.

Vimentin (Alexa 647 IF), actin (ATTO647N-phalloidin)

Sample Courtesy: Sebastian Hänsch,

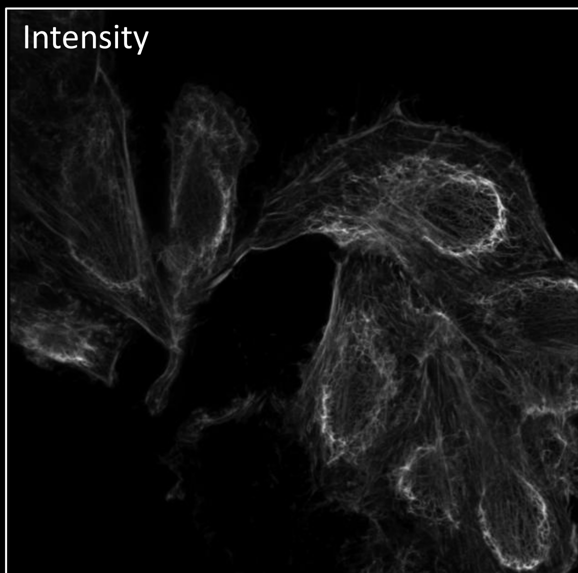
Stephanie Weidtkamp-Peters, CAI, Düsseldorf.

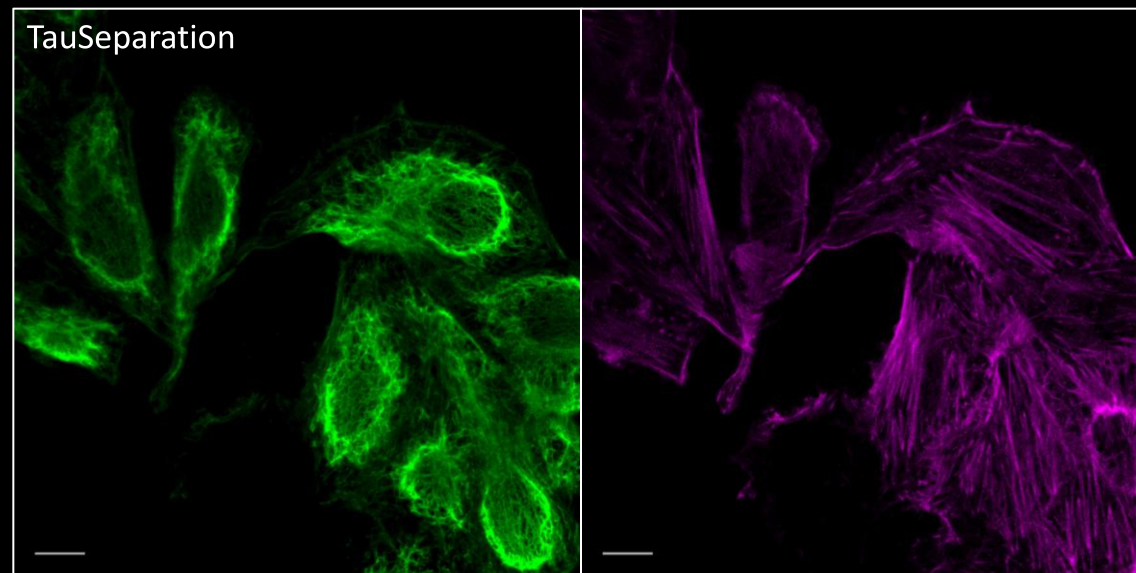




Application Example

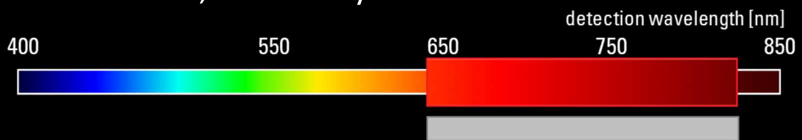
Species Separation using TauSense

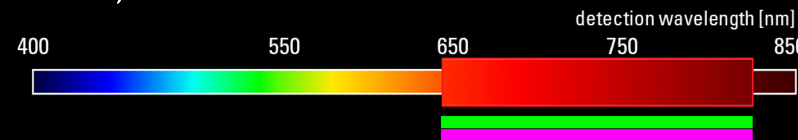




1 detector, 1 intensity channel

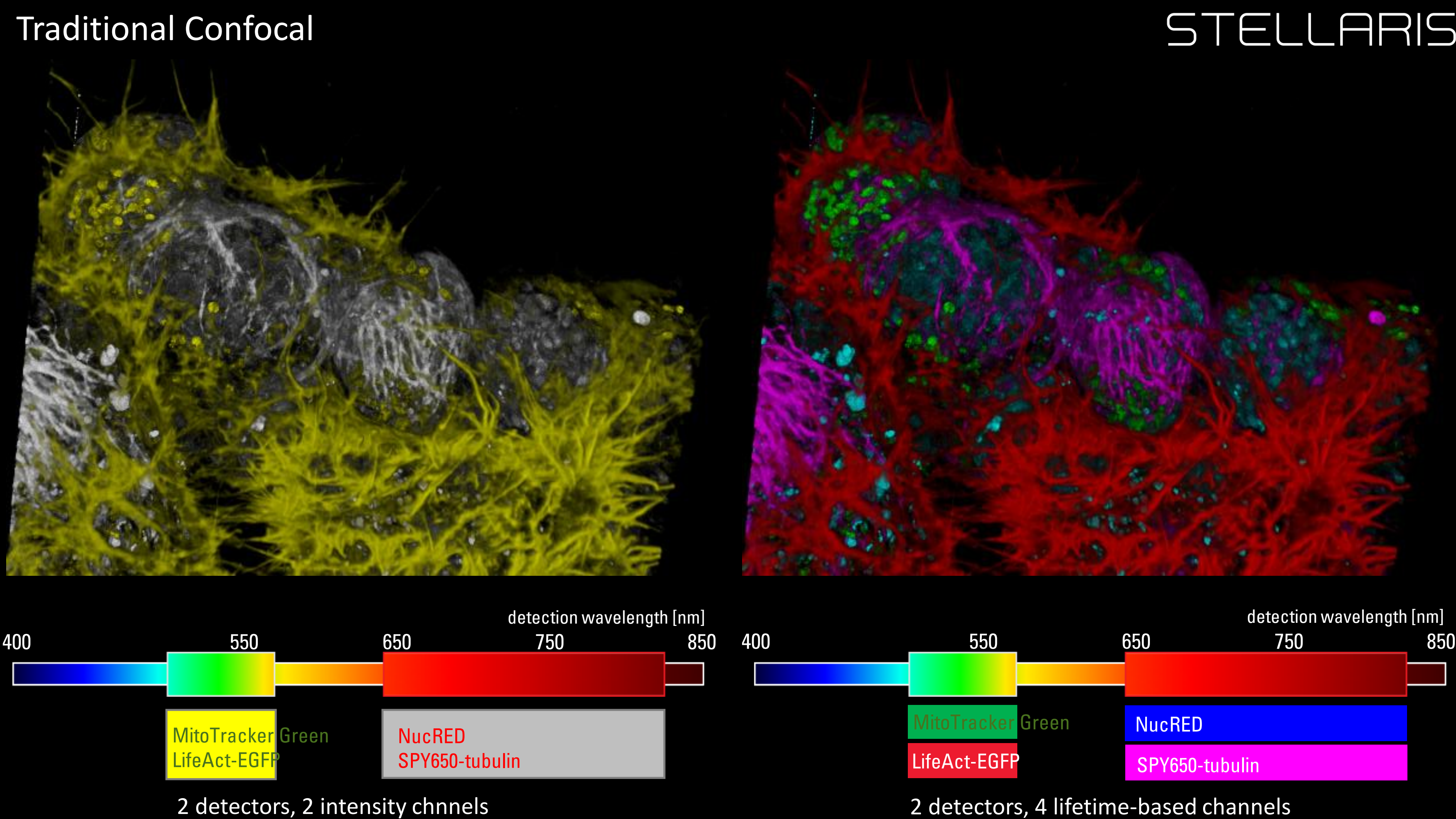
1 detector, 2 lifetime-based channels





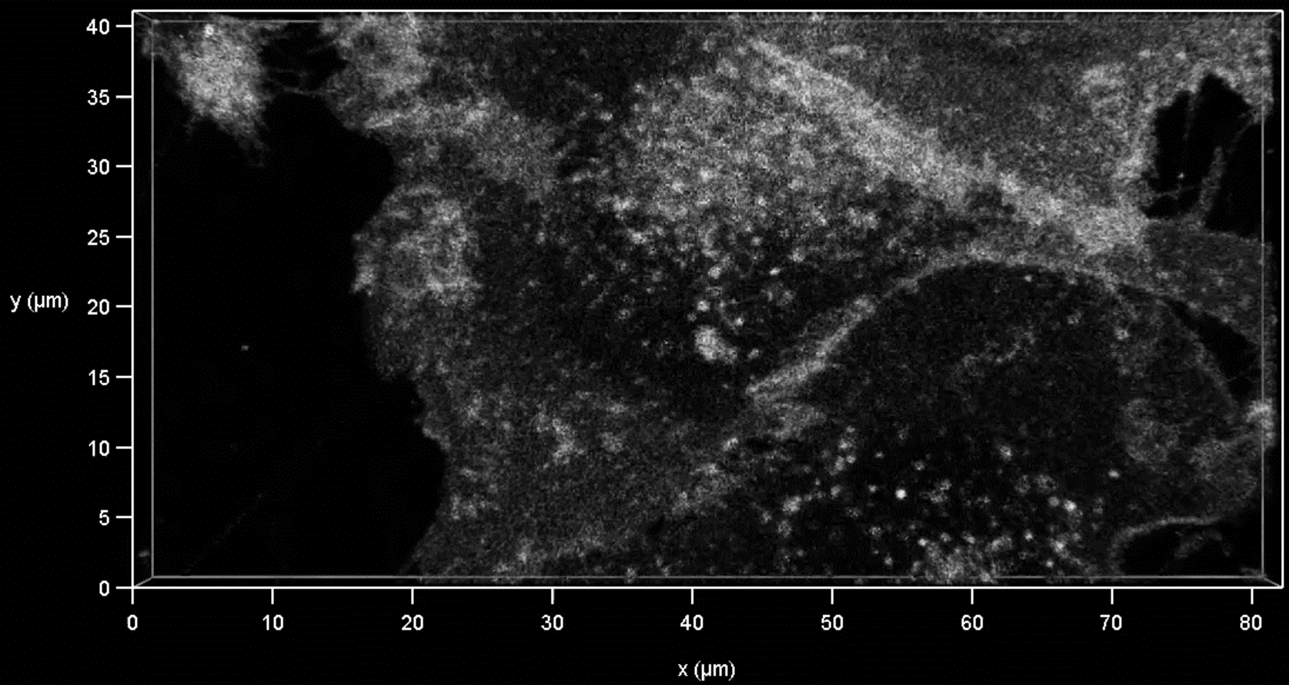
HEK cells. Vimentin (left: gray, Alexa 647 IF), actin (left: gray, ATTO647N-phalloidin). TauSeparation separates the signals coming to the detector according to the lifetime components distribution generated online at the FPGA level (right: green, Vimentin; right: magenta, Actin). Scale bar 10 µm.
Sample Courtesy: Sebastian Hänsch, Stephanie Weidtkamp-Peters, CAI, Düsseldorf.

Separate Species Beyond The Spectral Options



NE-115 cells. LifeAct-mNeonGreen (left: yellow, right: red), MitoTracker Green (left: yellow, right: green), NUC Red (left: gray, right: blue), and SiR-tubulin (left: gray, right: magenta).
Courtesy: Max Heydasch, University of Bern and Spirochrome

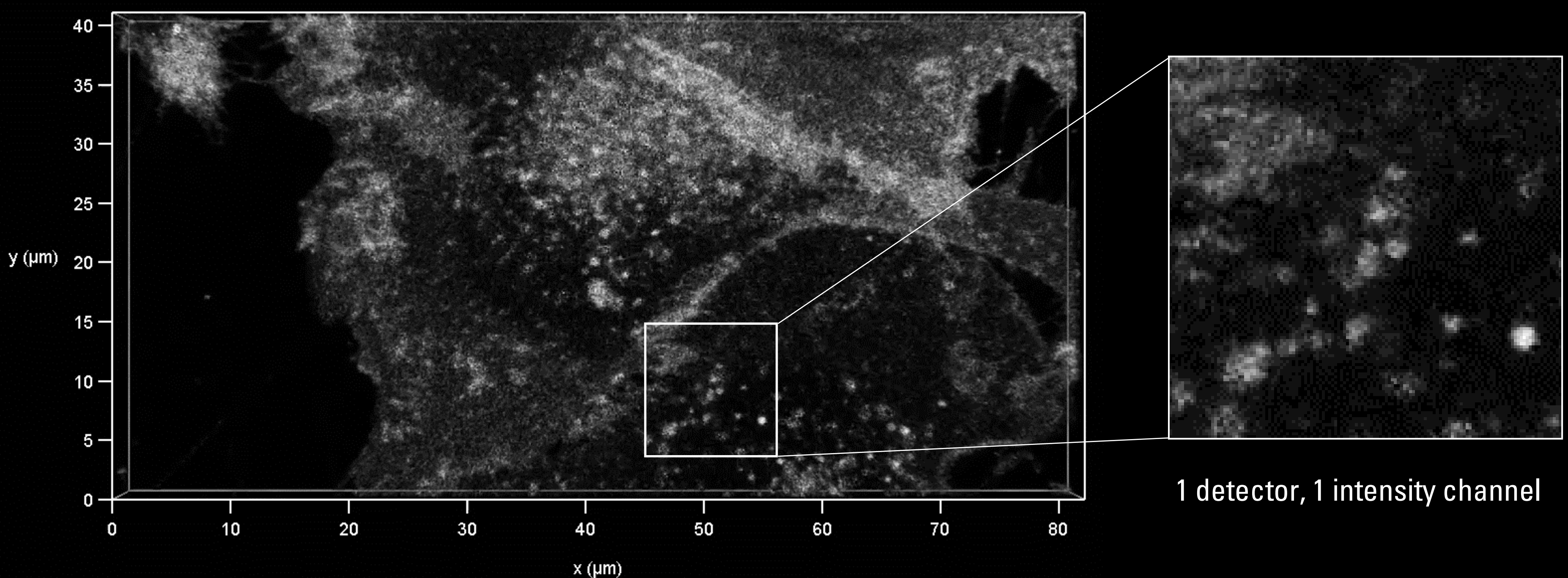
Visualize vesicle transport in living cells



Endosome maturation
pH changes (7 --> 4)
early to late endosomes and lysosomes

Vesicle transport in mammalian cells labeled with a NIR membrane stain, imaged @1 volume every 1,82s.

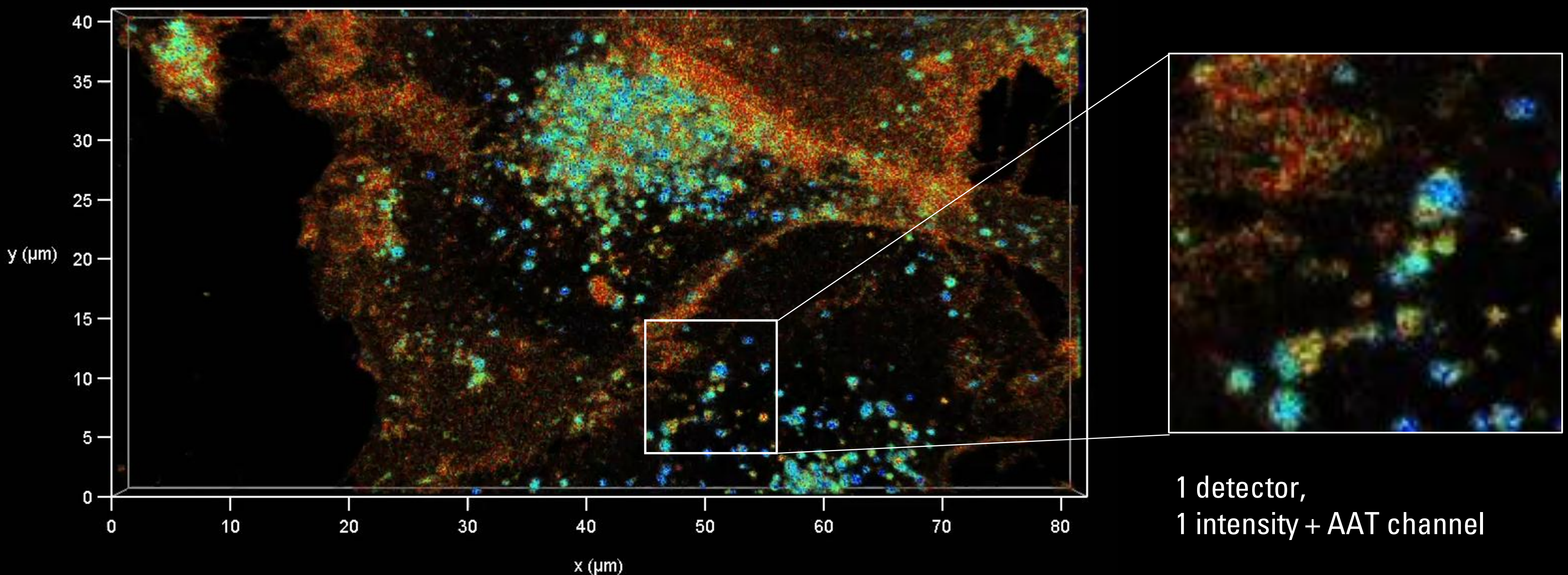
Visualize vesicle transport in living cells



1 detector, 1 intensity channel

Vesicle transport in mammalian cells labeled with a NIR membrane stain, imaged @1 volume every 1,82s.

TauContrast: Average Arrival Times show effect of pH

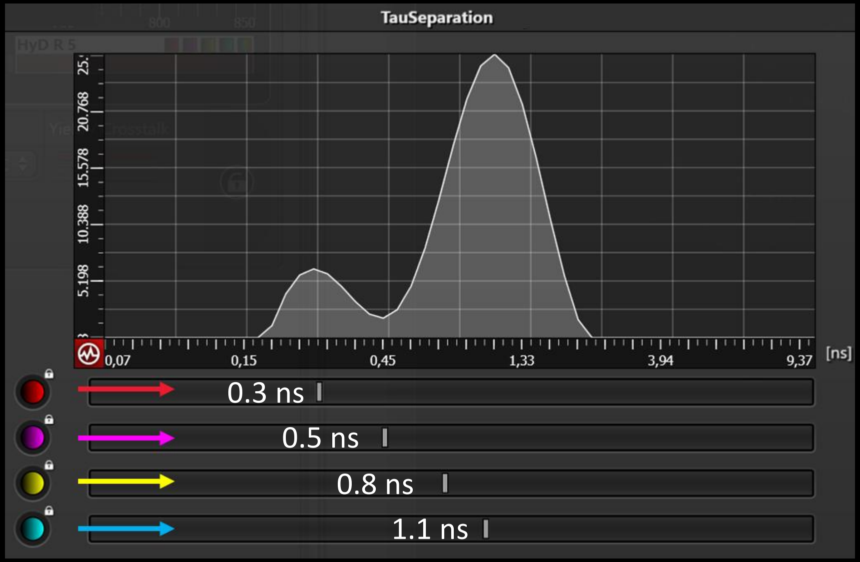


1 detector,
1 intensity + AAT channel

Vesicle transport in mammalian cells labeled with a NIR membrane stain, imaged @1 volume every 1,82s.

Visualize pH-related changes with TauSeparation

TauSeparation: lifetime components divided into 4 distinct channels



Fluorescence lifetime for NIR stain shortens @lower pH.
Early endosomes: cyan / yellow.
Late endosomes and lysosomes: magenta / red.

Application Example

Species Separation using TauSense

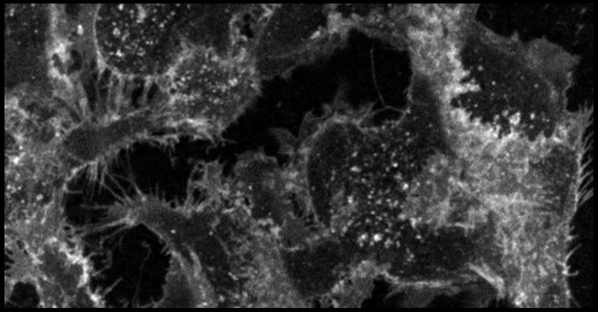
U2OS cells. nuclear counterstain (cyan, Sytox green), tubulin (magenta, AF 555).

#CONFOCALREIMAGINED

What is TauSense Good For?

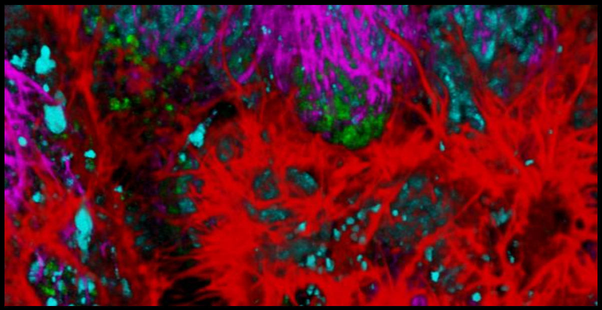
TauContrast

- Qualitative / Semi-quantitative information
- Is there a change in microenvironment? Is FRET happening?
- Changes over time (x-fold ↑↓ compared to baseline)



TauGating

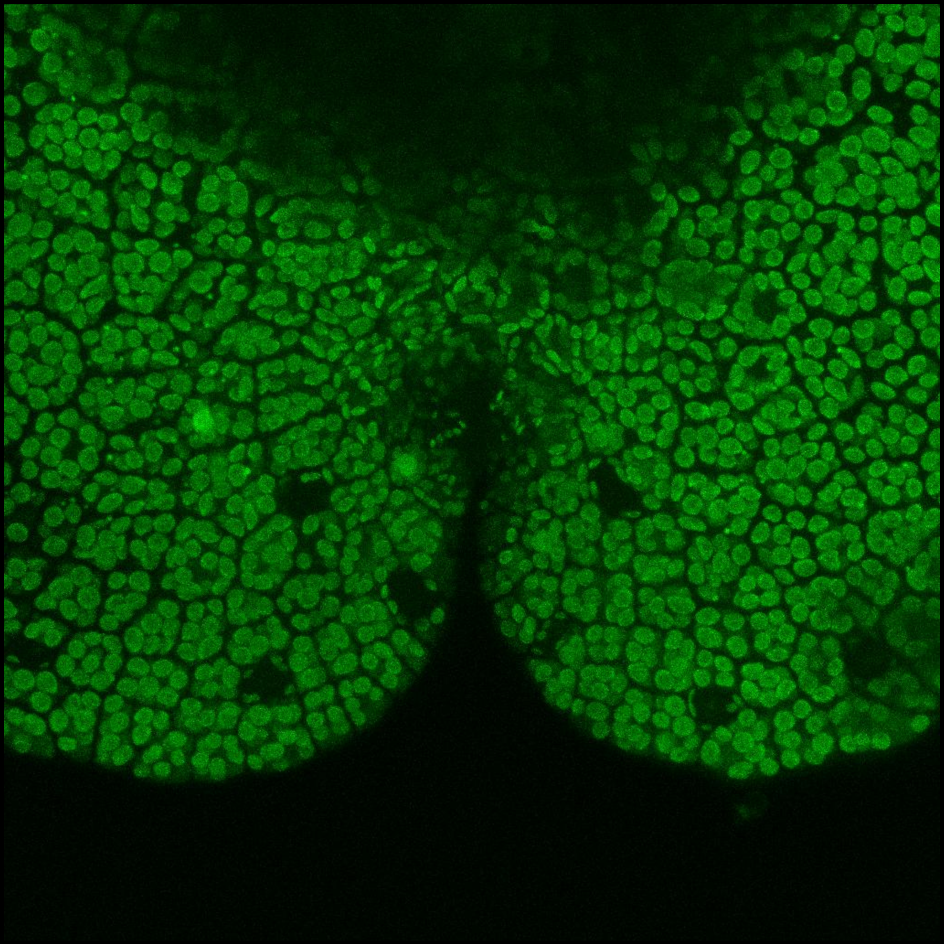
- Explore sample with gates
- Remove reflections
- Remove unwanted fluorescence contributions



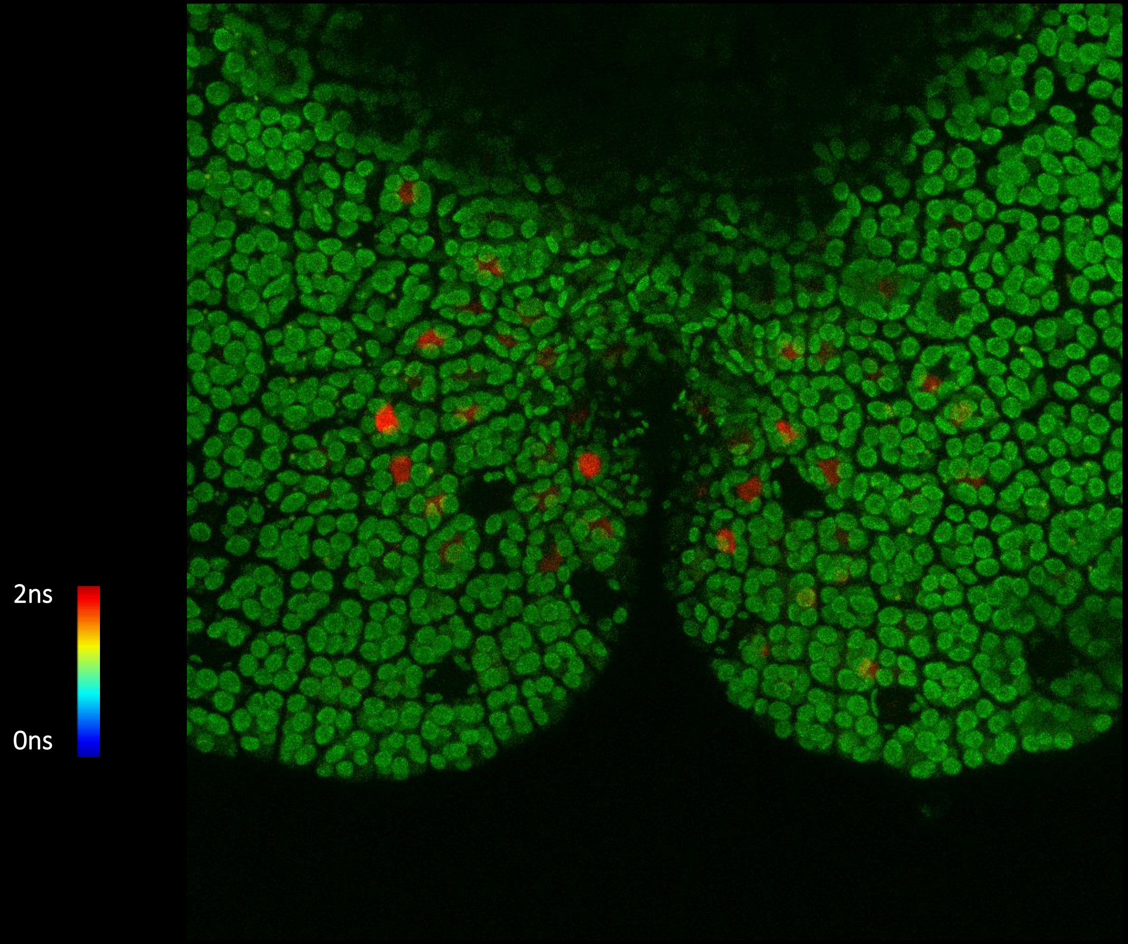
TauSeparation

- Separate species with different lifetimes

Traditional Confocal - intensity

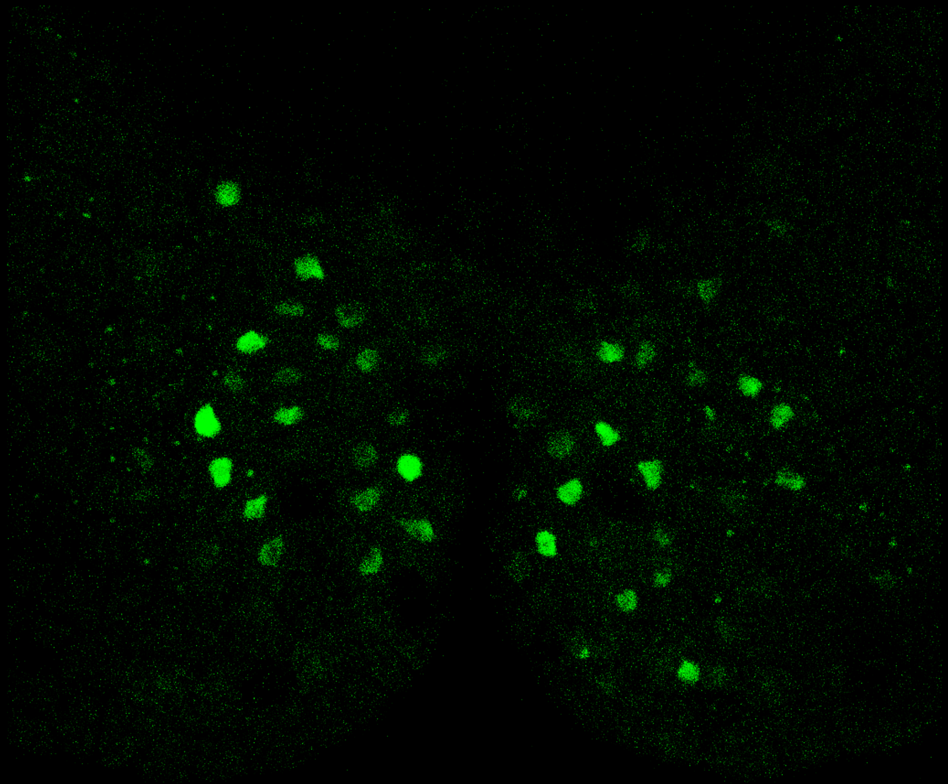


Tau Contrast

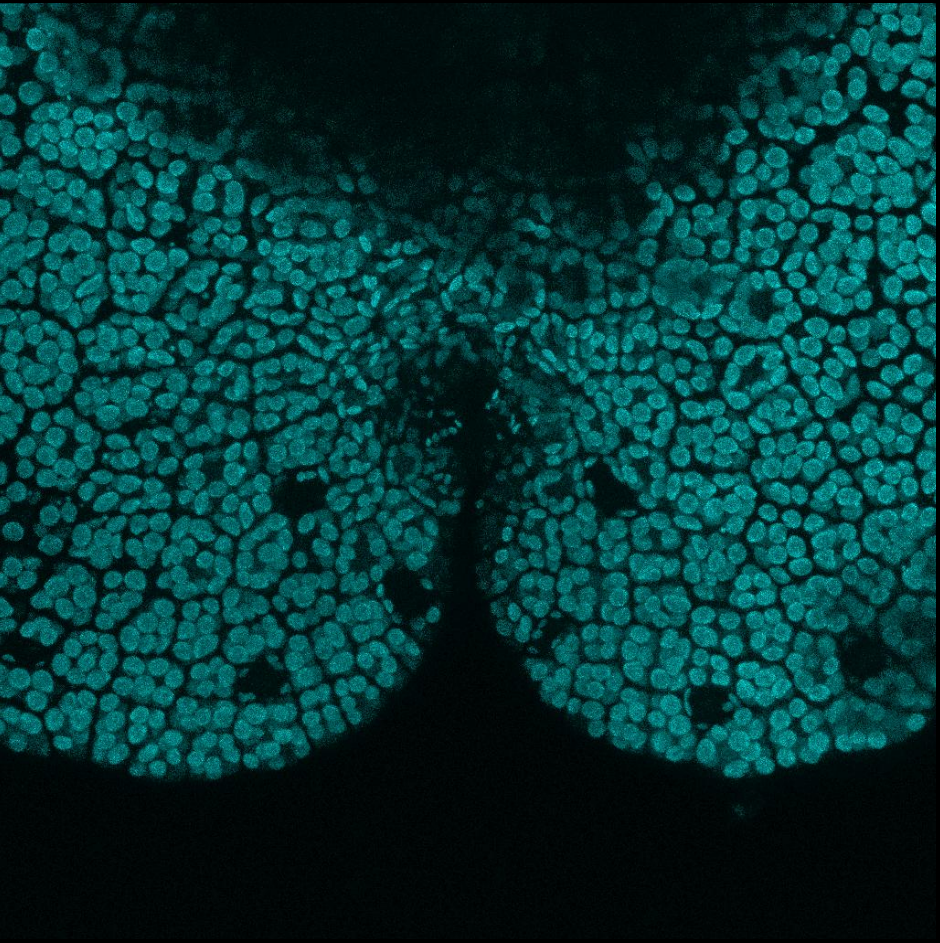


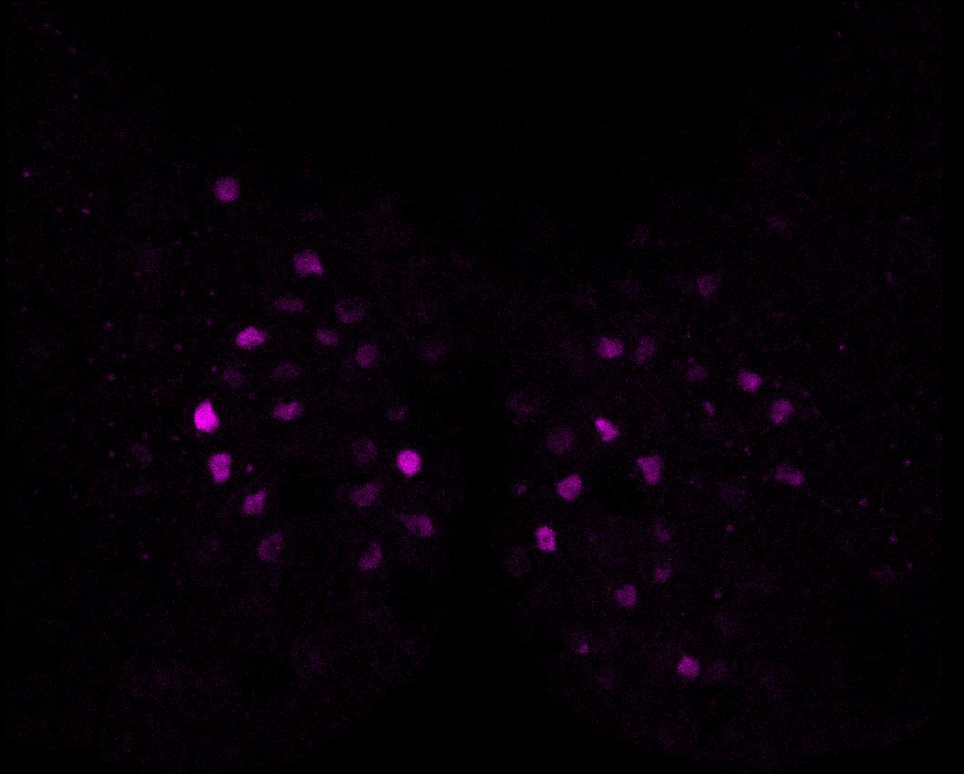
Tau Gating

Gating : 0.5-6 ns



Tau Seperation





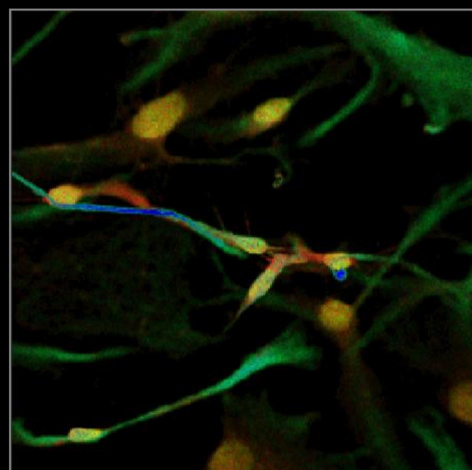
FALCON: Synergies and integrated workflows

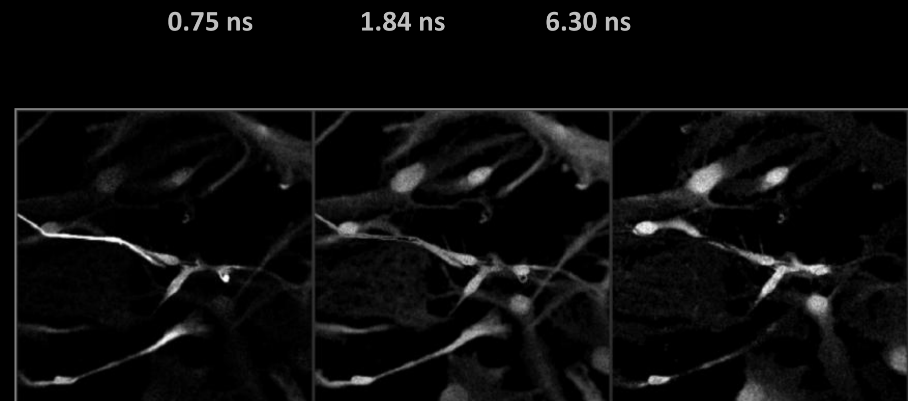
- Component Separation

Parameters to fit

Parameter	Fit
Decay Time 1	
Decay Time 2	
Decay Time 3	
Amplitude 1	✓
Amplitude 2	✓
Amplitude 3	✓
Tail Offset	✓
IRF Background	
IRF Shift	

FLIM Image Fit
3 Components



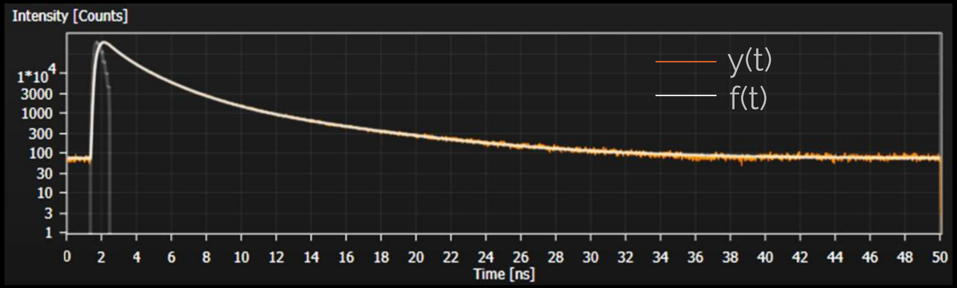


FALCON: FAst Lifetime CONtrast

Fit Model

$$f(t) = \int_0^t IRF(x)\cdot\left\{\sum_{i=0}^{n-1} A(n)\cdot e^{-\frac{x}{\tau(n)}} + B\right\} dx$$

$y(t)$ - Experimental data
$f(t)$ - Theoretical curve
$IRF(t)$ - Instrument Response Function
$A(n)$ - Amplitude of n-th component
$\tau(n)$ - Decay time of n-th component
B - Background



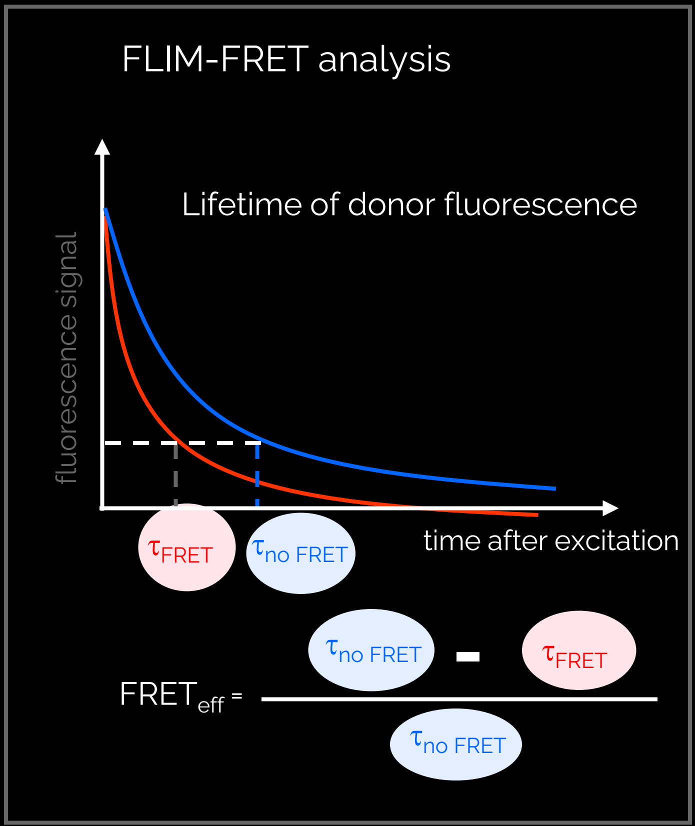
Maximum-Likelihood Estimator (Poissonian distribution)

Minimizes: $$\chi^2_{mle} = 2\cdot\sum_{i=1}^{N} f(i) - y(i) - 2\cdot\sum_{i=1}^{N} y(i)\cdot ln(f(i)/y(i))$$

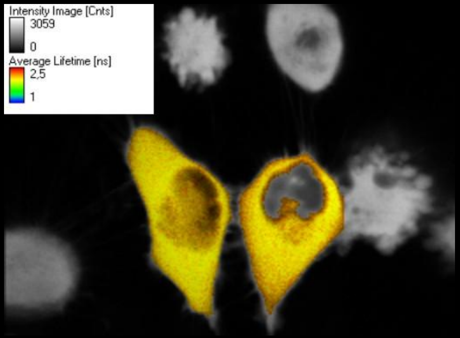
FLIM-FRET?

- **Donor lifetime shortens**

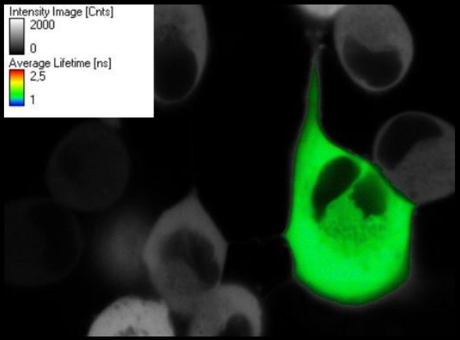
  FRET efficiency is calculated from the difference between arising fast component in donor lifetime in the presence of the acceptor and original lifetime in the absence of the acceptor



FLIM-FRET (CFP-YFP) in live cells



Donor only (CFP)



FRET pair (CFP-YFP tandem)

Donor lifetime images of FRET and control cells:

Sample: RBKB78 cells transfected with a CFP donor only or CFP-YFP fusion.

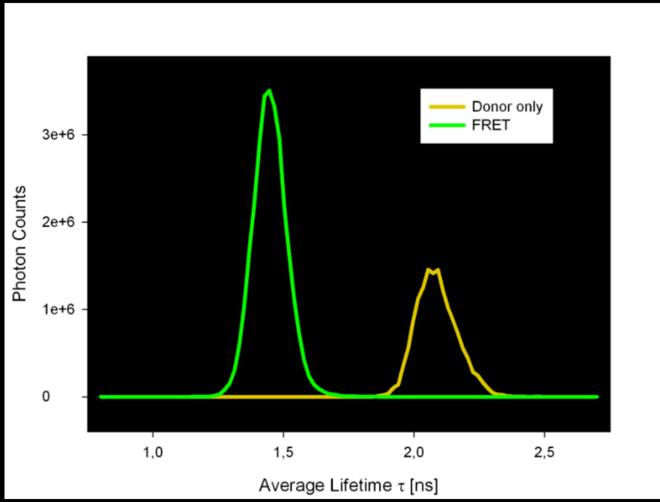
Data Acquisition: The detection band was set between 445-495 nm. Excitation @ 405 nm

Data Analysis: The coloured region has been used for analysis. Colours represent intensity modulated fluorescence lifetimes.

Result: In the presence of acceptor the donor lifetime is decreased.

Courtesy: G. Hams, University of Würzburg

FLIM-FRET (CFP-YFP) in live cells: Quantitative data analysis



Fluorescence lifetime distribution histogram of **donor only (yellow)** and **FRET (green)** samples using average lifetimes.
There is a clear shift of 0.7 ns towards shorter lifetimes in the FRET sample.

From lifetime distribution histograms one obtains:

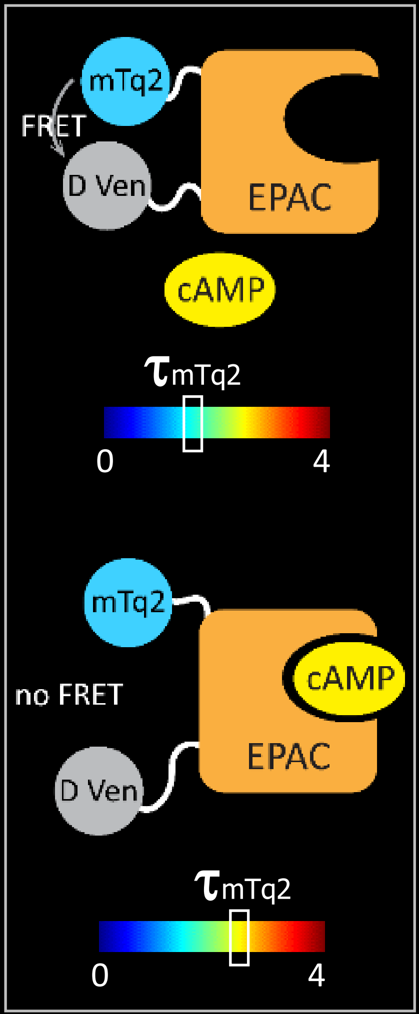
- average lifetime of the donor is: 2.1 ns.
- donor lifetime of the FRET construct is: 1.4 ns.
- FRET efficiency is: E = 30%.

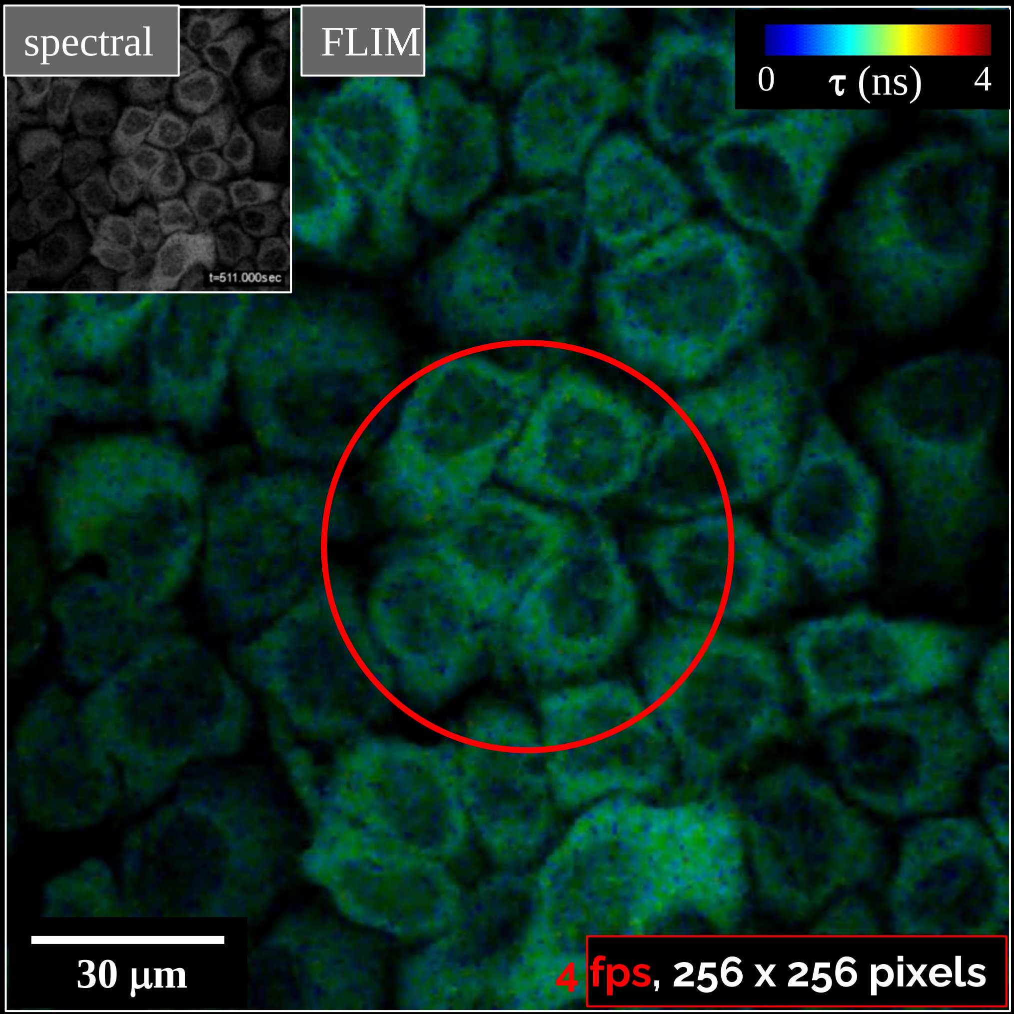
Computation of FRET Efficiency:

$$E = 1 - \frac{\tau_{quench}}{\tau}$$

Key application: Molecular interaction

cAMP signalling on-the-fly with a FLIM-FRET sensor

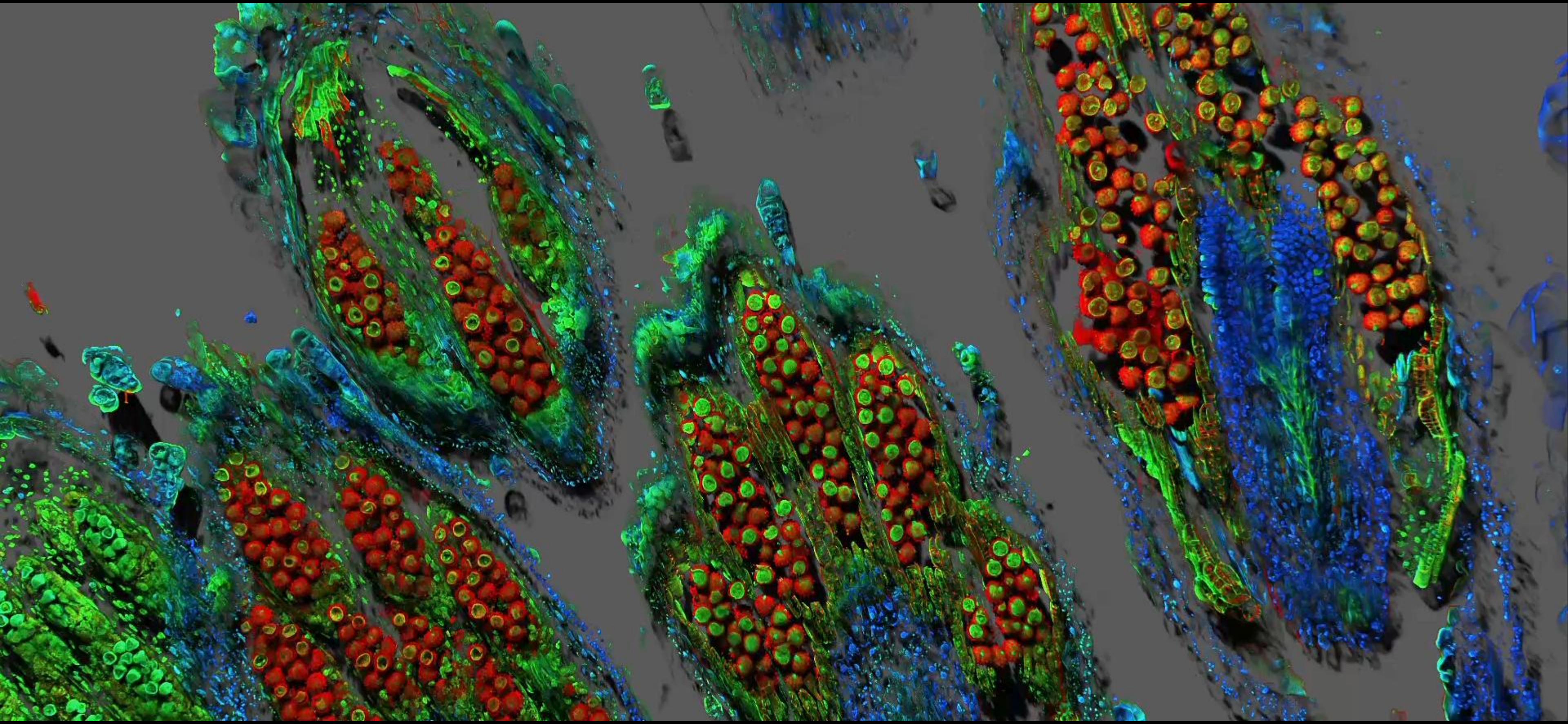




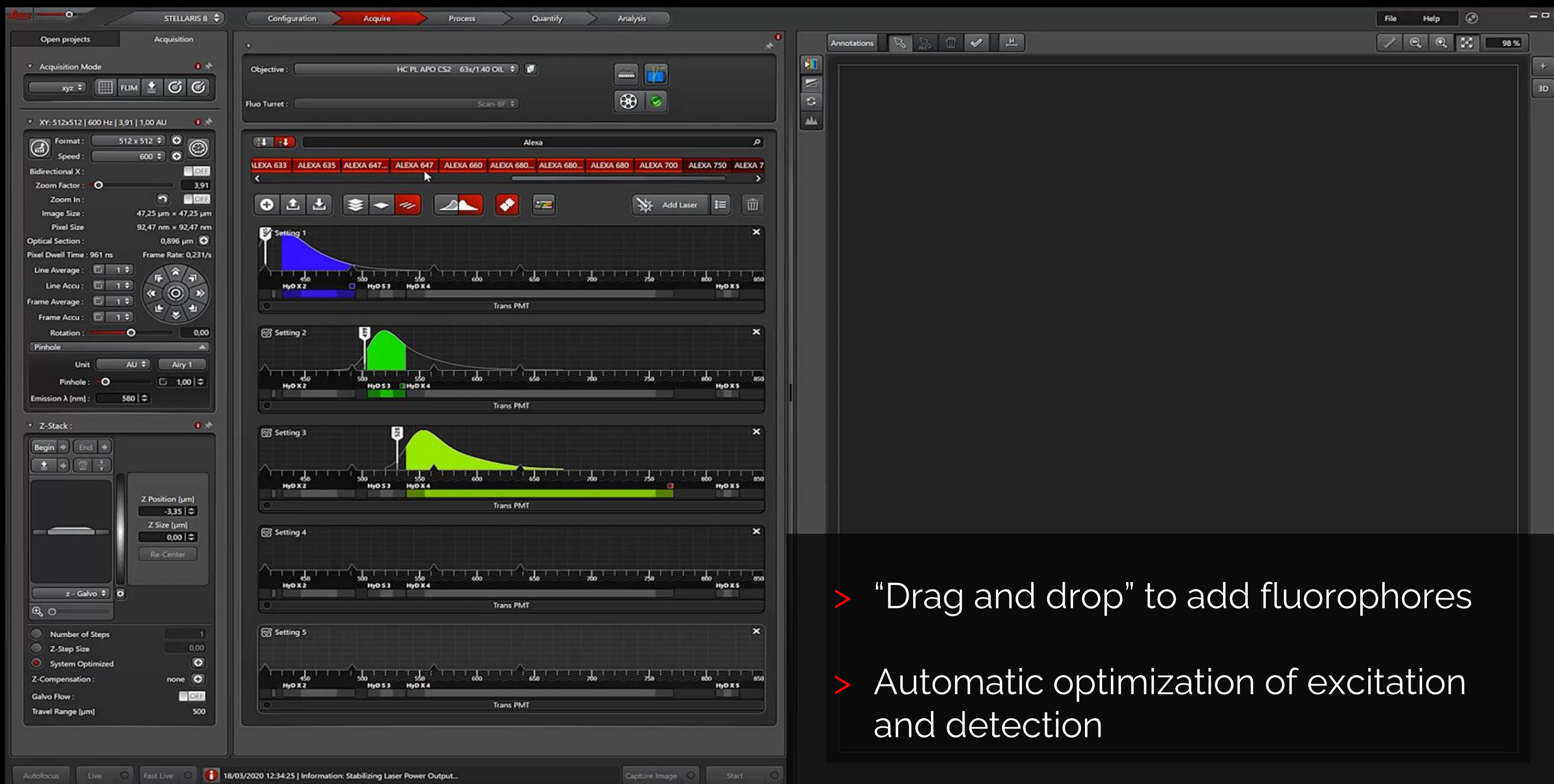
Caged cAMP in HeLa cells expressing EPAC mT2-dVenus FRET sensor.
EPAC response to UV-mediated cAMP uncaging.
Courtesy Kees Jalink, Bram van den Broek, NKI Amsterdam.

PRODUCTIVITY

DO MORE



Simple, Even For Complex Experiments

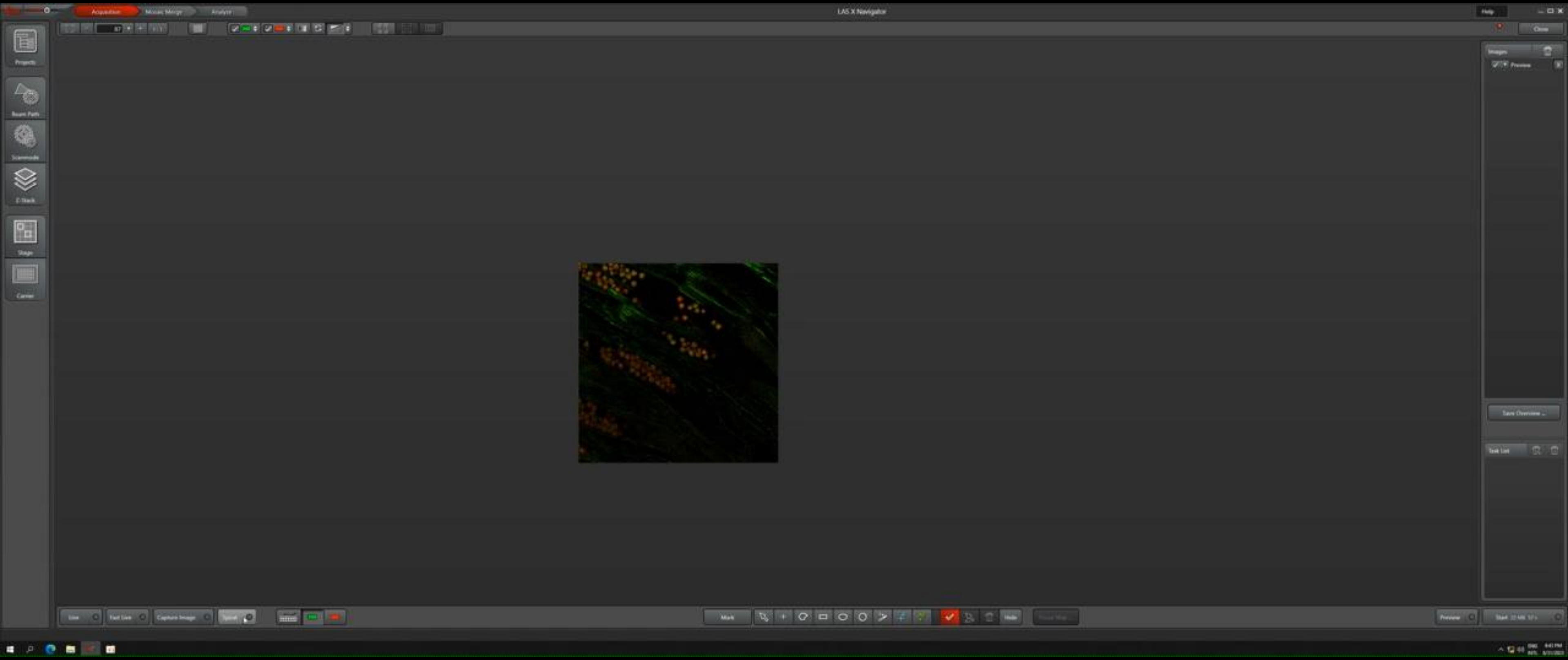


- “Drag and drop” to add fluorophores
- Automatic optimization of excitation and detection

Simple, Even For Complex Experiments – Image Compass

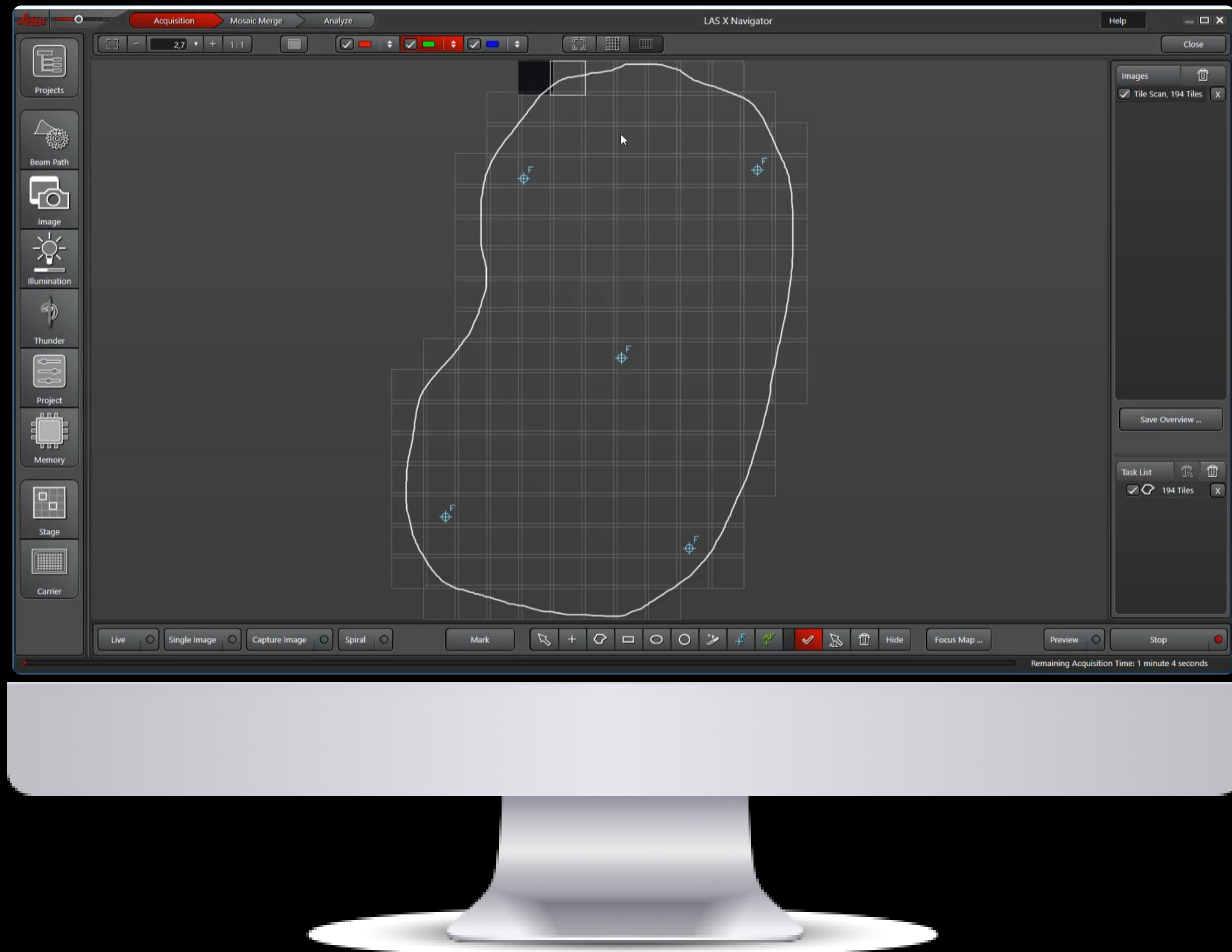
Leica Navigator

Spiral scan – preview – High magnification

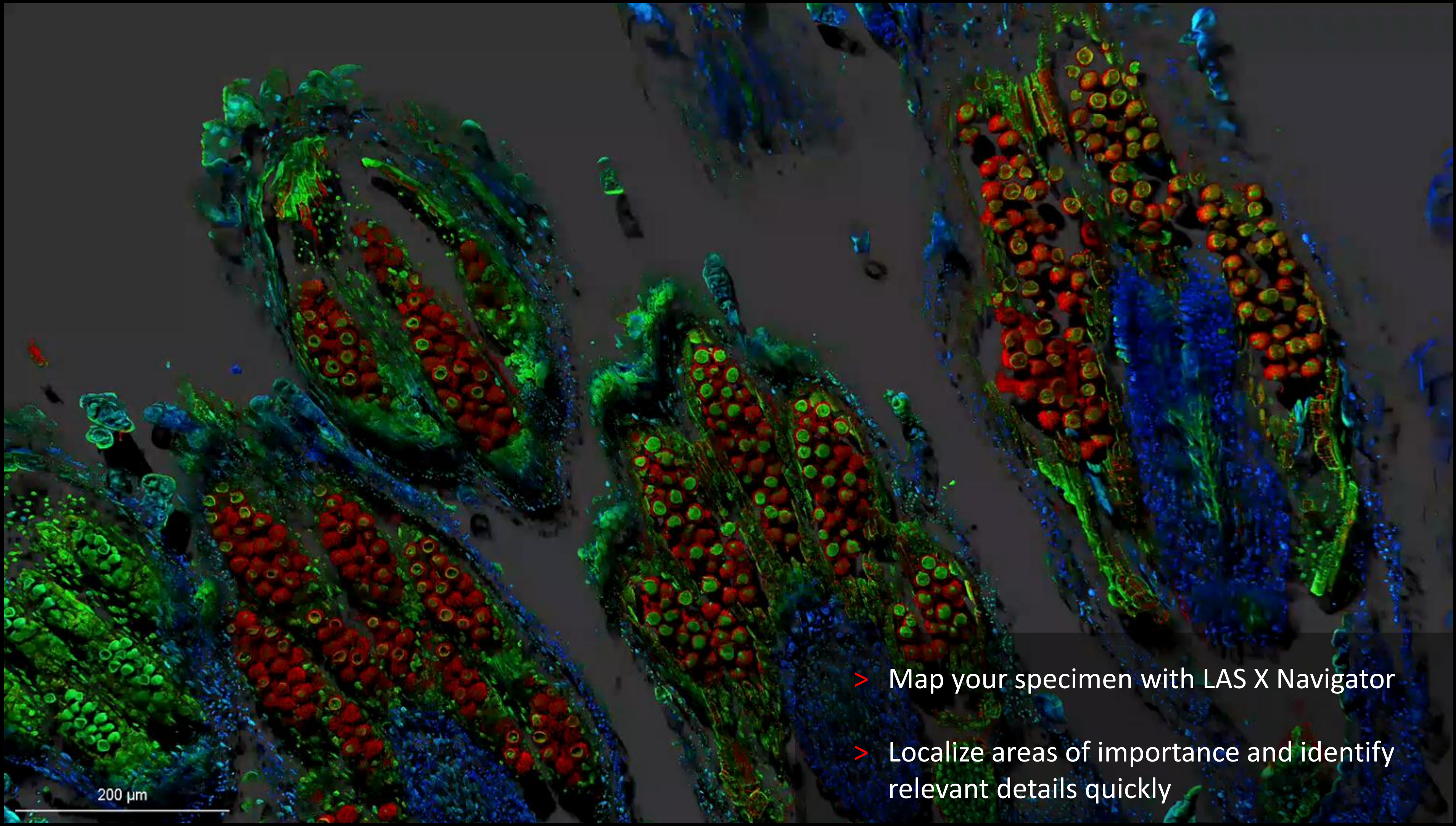


LAS X software - Navigator

Flexible setting for tile scan and multiposition

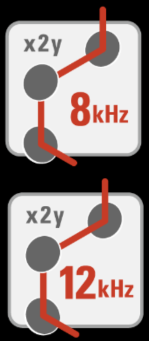


Relevant Details Instantly Identified



Daisy pollen. Image acquired with TauContrast and LAS X Navigator.

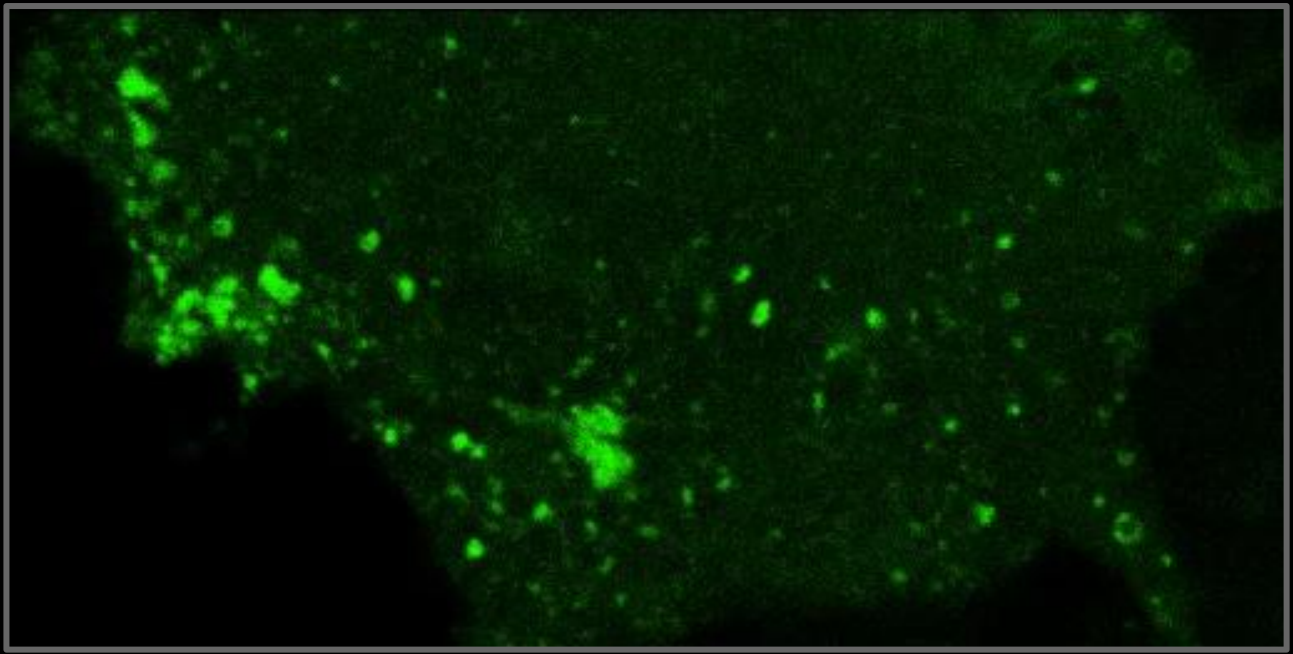
Tandem Scanner



- Tandem Scanner with 8 kHz
- Fits in well with
  - SuperZ
  - Galvoflow
  - Power HyD

Scan format	8 kHz [fps]
512 x 512	28
512 x 32	145
512 x 16	286

50 fps, Resonant Scanner

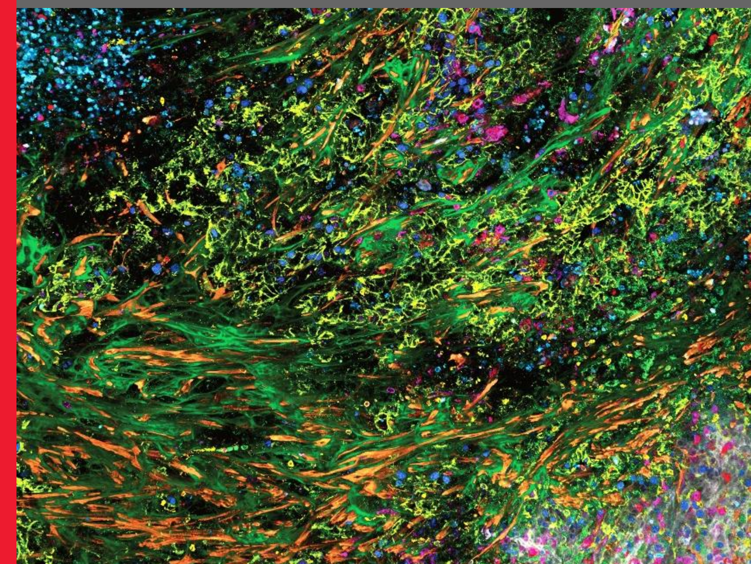


Hrab5a_GFP, vesicle dynamics in live cell imaging, Sample Courtesy of Dr. Sandra Ritz, Microscopy & Histology Core Facility, Institute of Molecular Biology gGmbH (IMB), Mainz, Germany. Transfection of EGFP by Marino Zerial

STELLARIS SpectraPlex:

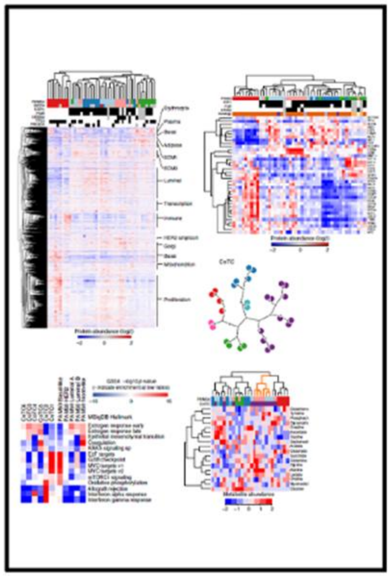
Discover the power of

3D high-plex imaging across scales



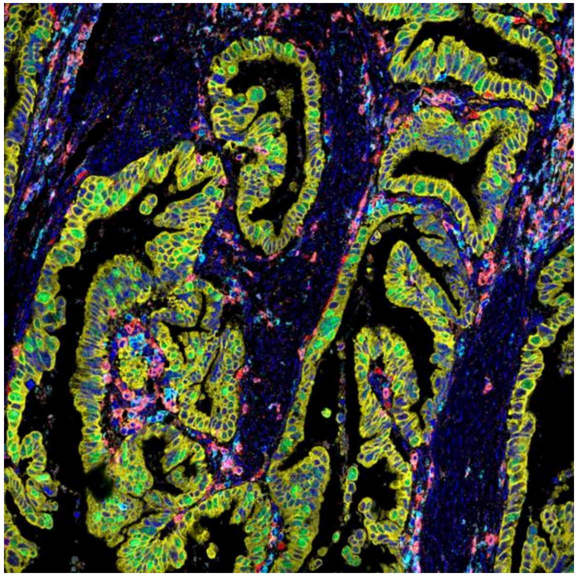
From Eye to Insight

Spatial Biology



Multi-Omics

2000s



Cervix cancer tissue showing 9 biomarkers with STELLARIS.

Spatial Biology

Cancer Research
Immunology
Neuroscience

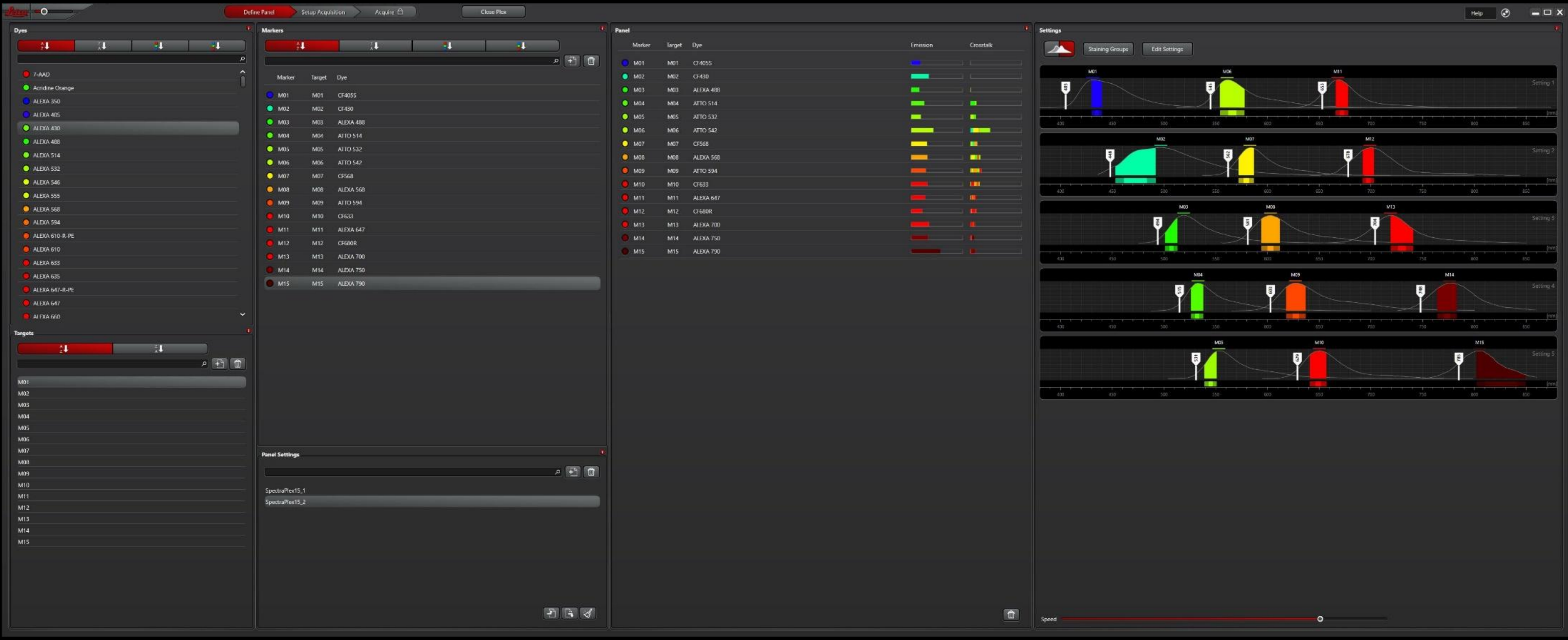
Discover new cell types

Identify cell types and states

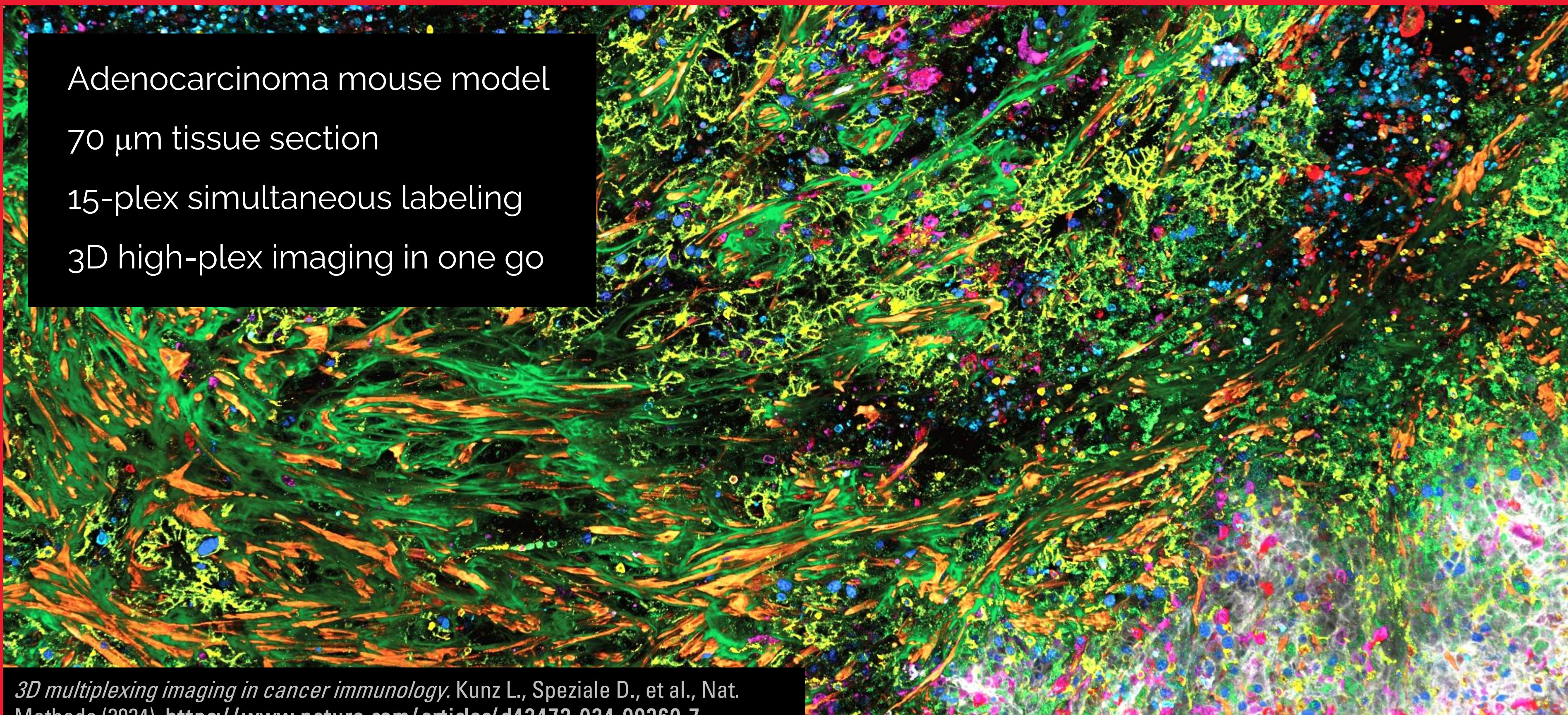
Map functional relationships

Spatial Phenotyping

How Is SpectraPlex Integrated in STELLARIS?



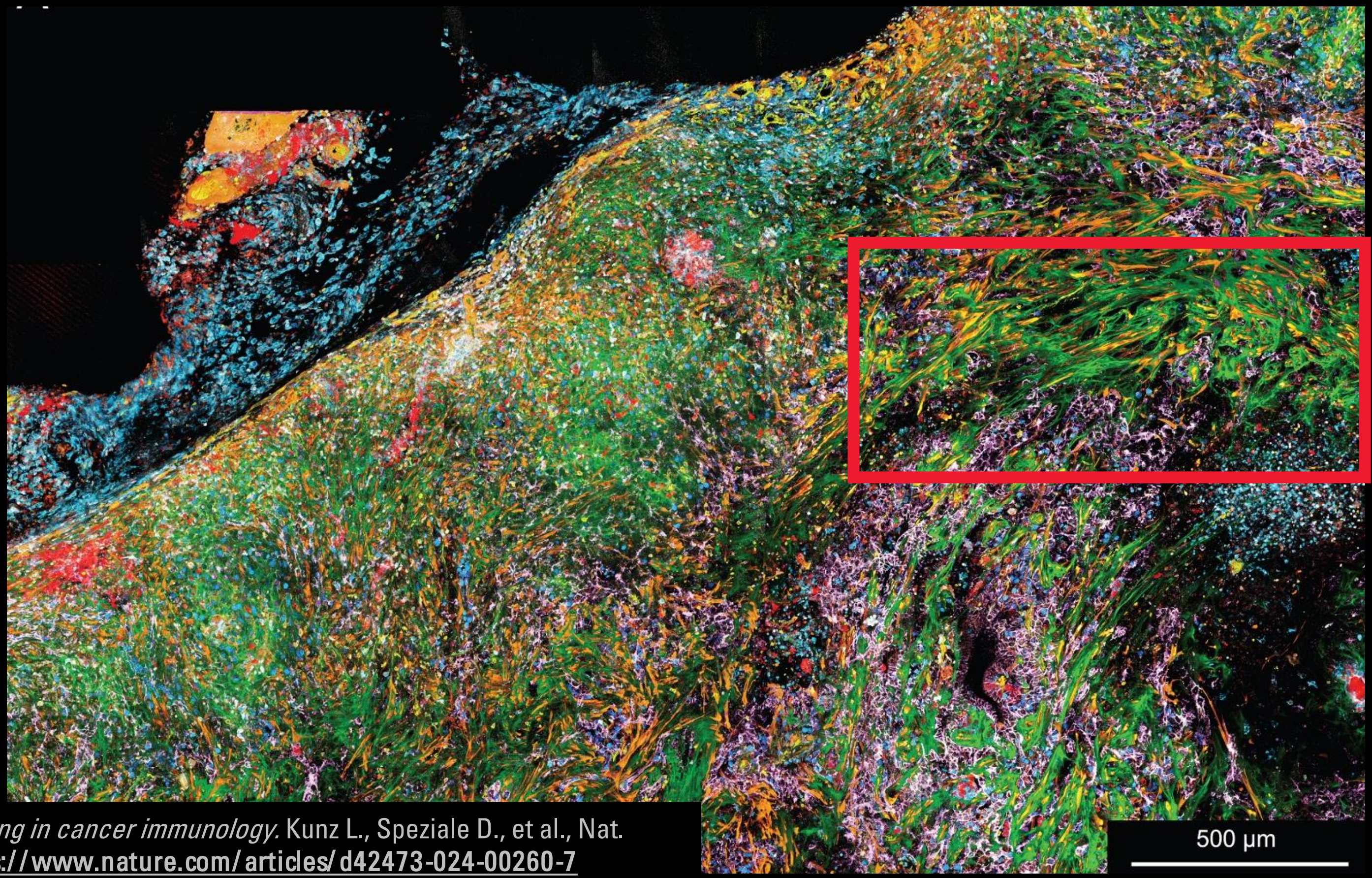
Your Journey to Spatial Discoveries Begins Here



- Adenocarcinoma mouse model
- 70 µm tissue section
- 15-plex simultaneous labeling
- 3D high-plex imaging in one go

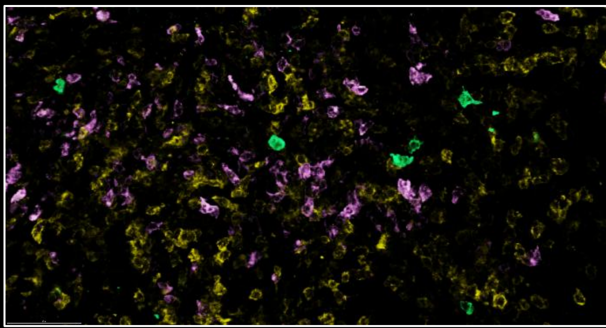
3D multiplexing imaging in cancer immunology. Kunz L., Speziale D., et al., Nat. Methods (2024). https://www.nature.com/articles/d42473-024-00260-7

Your Journey to Spatial Discoveries Begins Here

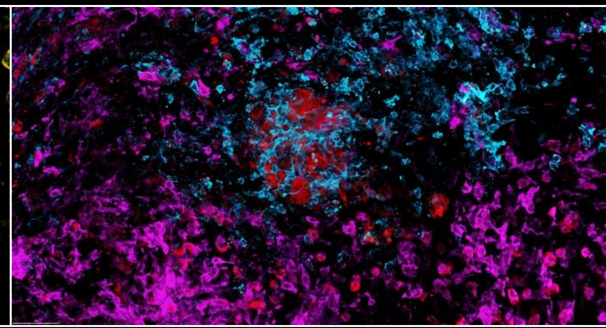


3D multiplexing imaging in cancer immunology. Kunz L., Speziale D., et al., Nat. Methods (2024). https://www.nature.com/articles/d42473-024-00260-7

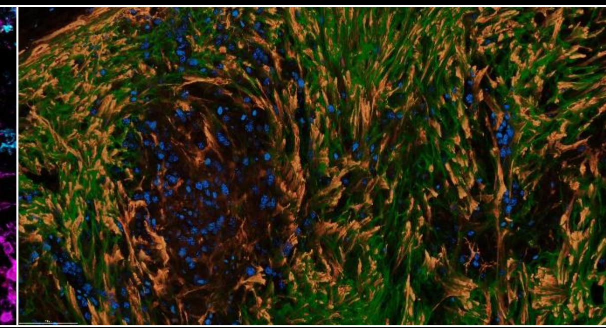
Your Journey to Spatial Discoveries Begins Here



Lymphoid cells (B and T cells)

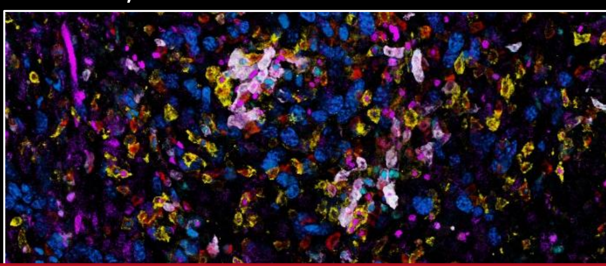


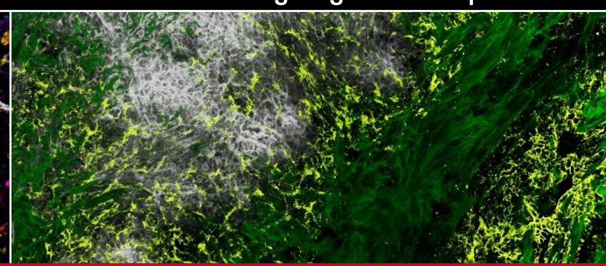
Lymphoid cells fighting tumor growth (TCF1 and PD1 expression)

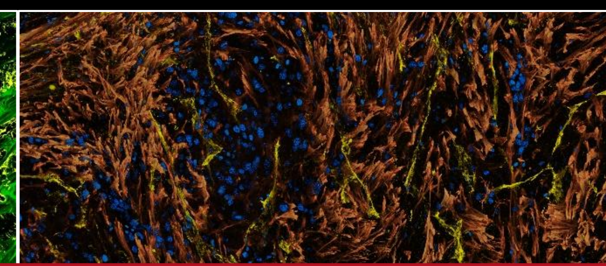


Myeloid cells

Cancer, stromal and extracellular matrix markers decorating regions of epithelial and endothelial cells

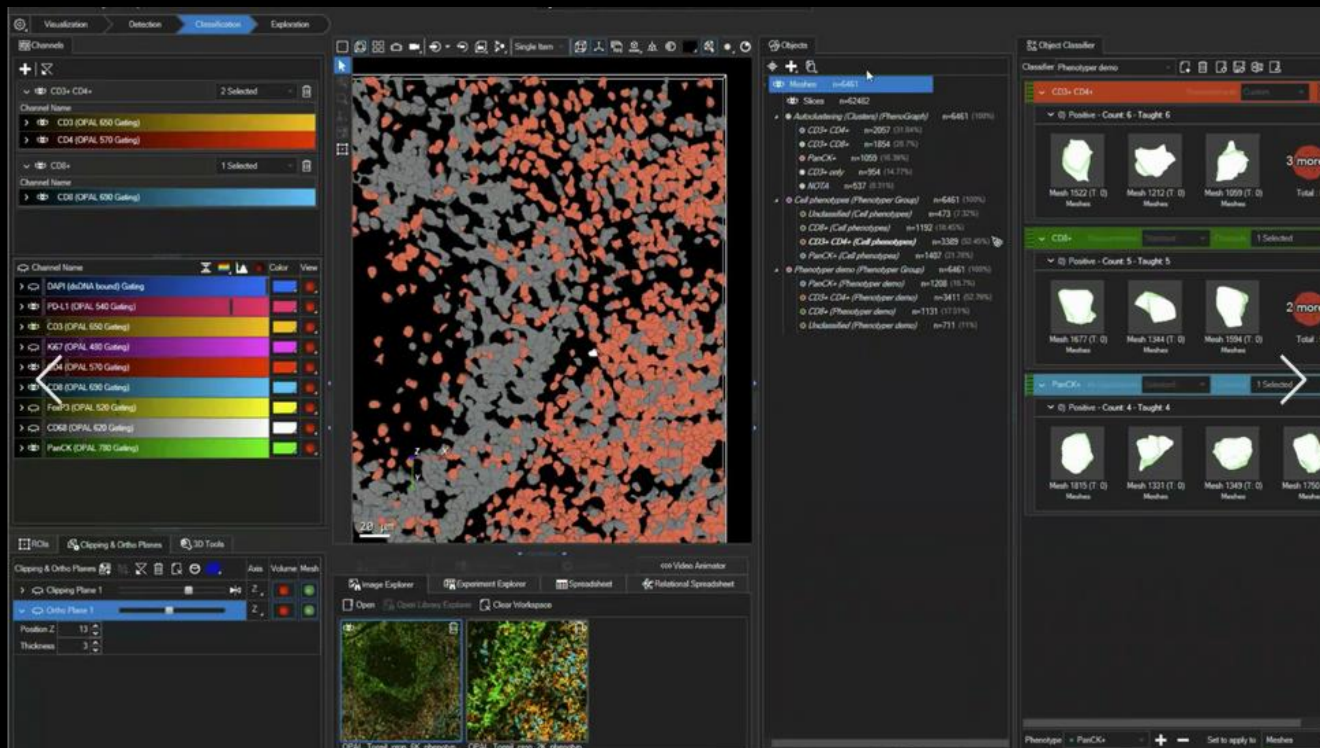






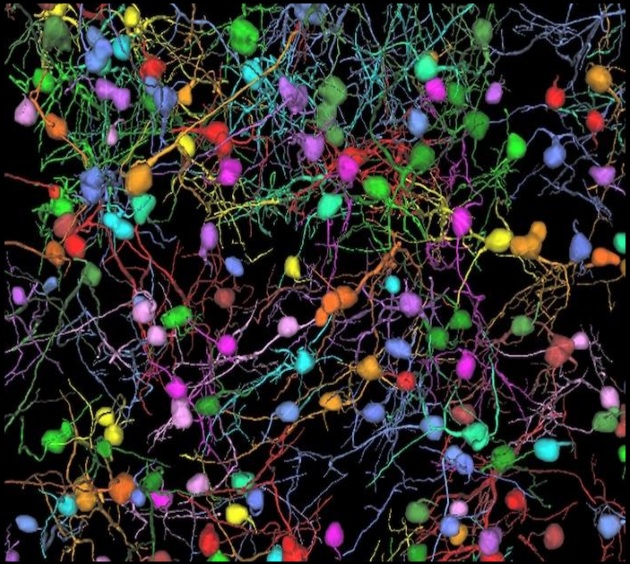
SpectraPlex enables a functional description of the tissue

Benefit From a Workflow from Imaging to Analysis with Aivia



- Transfer your results from STELLARIS to Aivia and benefit from the expert- and data-driven approach for cell clustering and phenotyping.

AIVIA –
AI based Imaging analysis software



From Eye to Insight

Traditional vs AI based image analysis (Provide examples)

Human created Rules
(intensity, size.....)
Data

Traditional
Human created
program

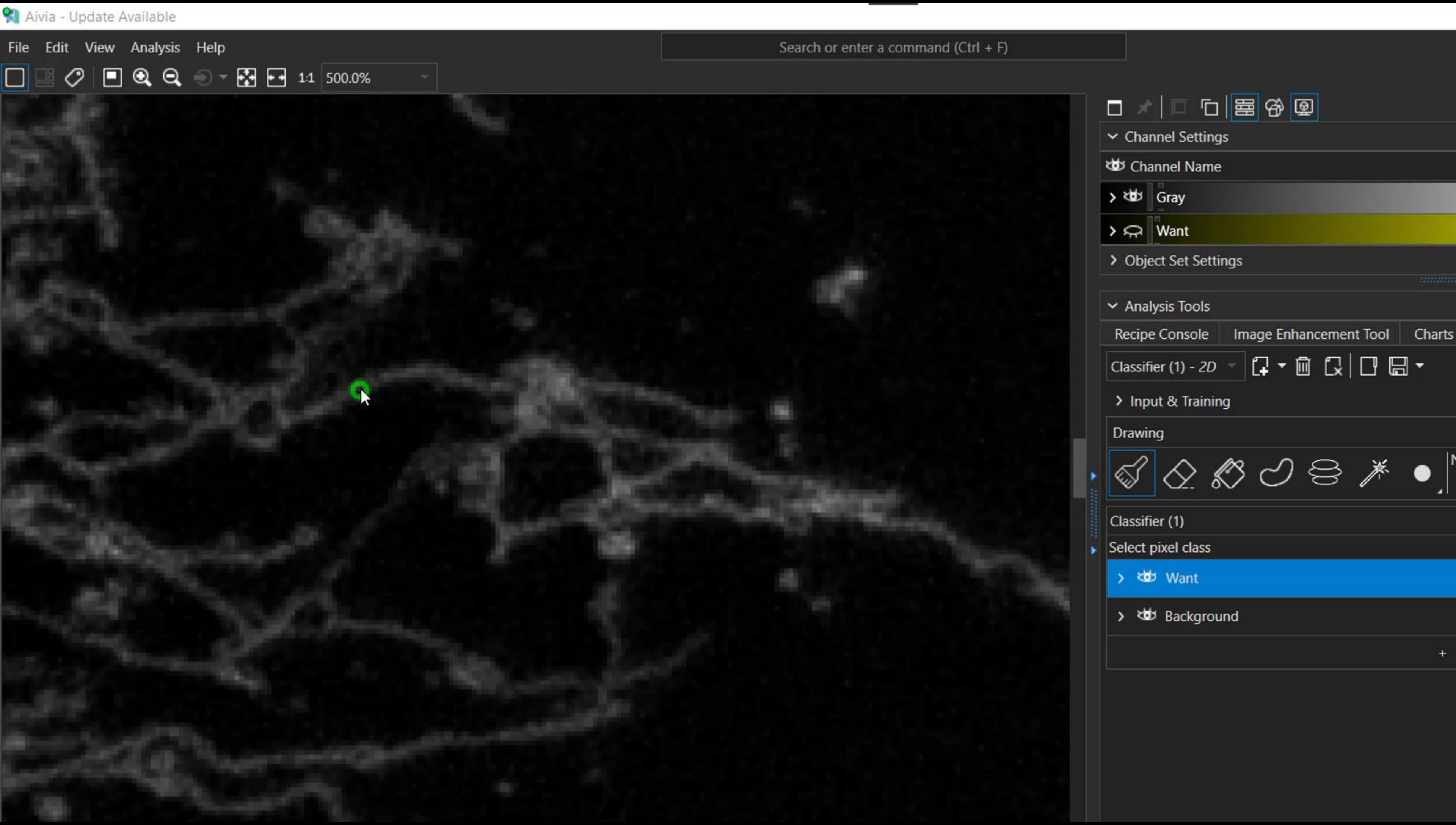
Answers

Answers
Data

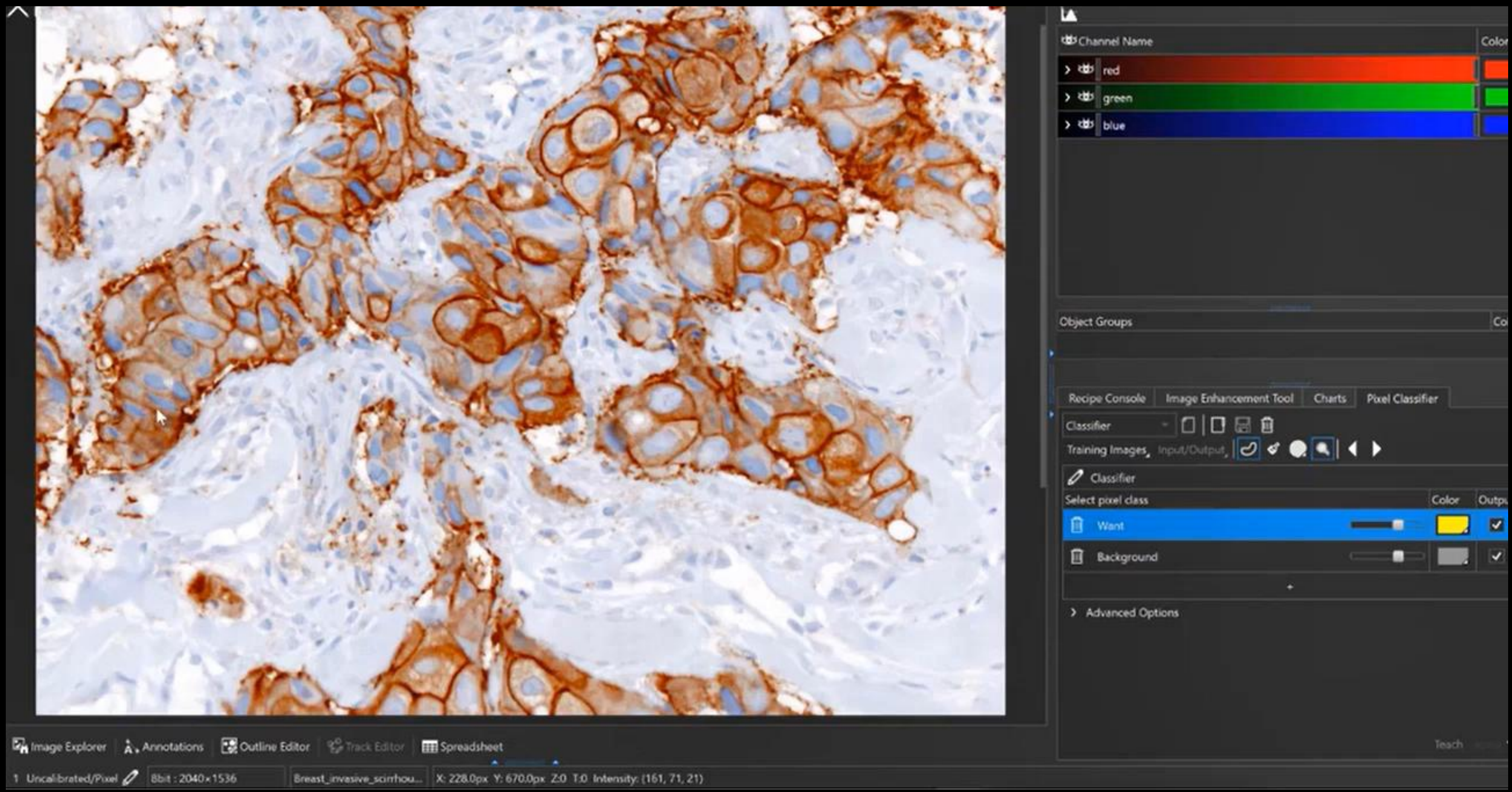
AI Machine Learning

Rules

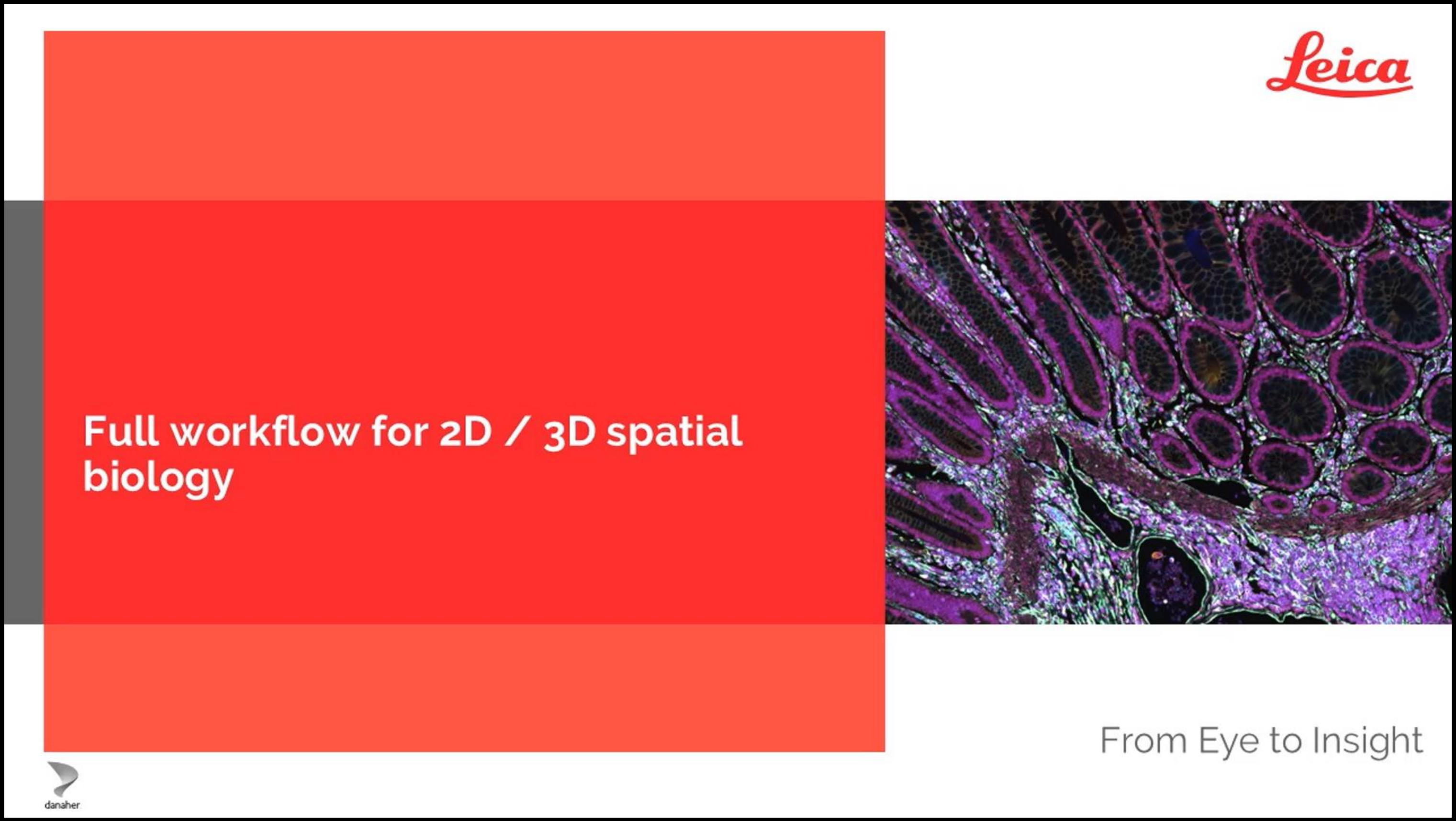
Pixel classification_AI Mitochondria analysis



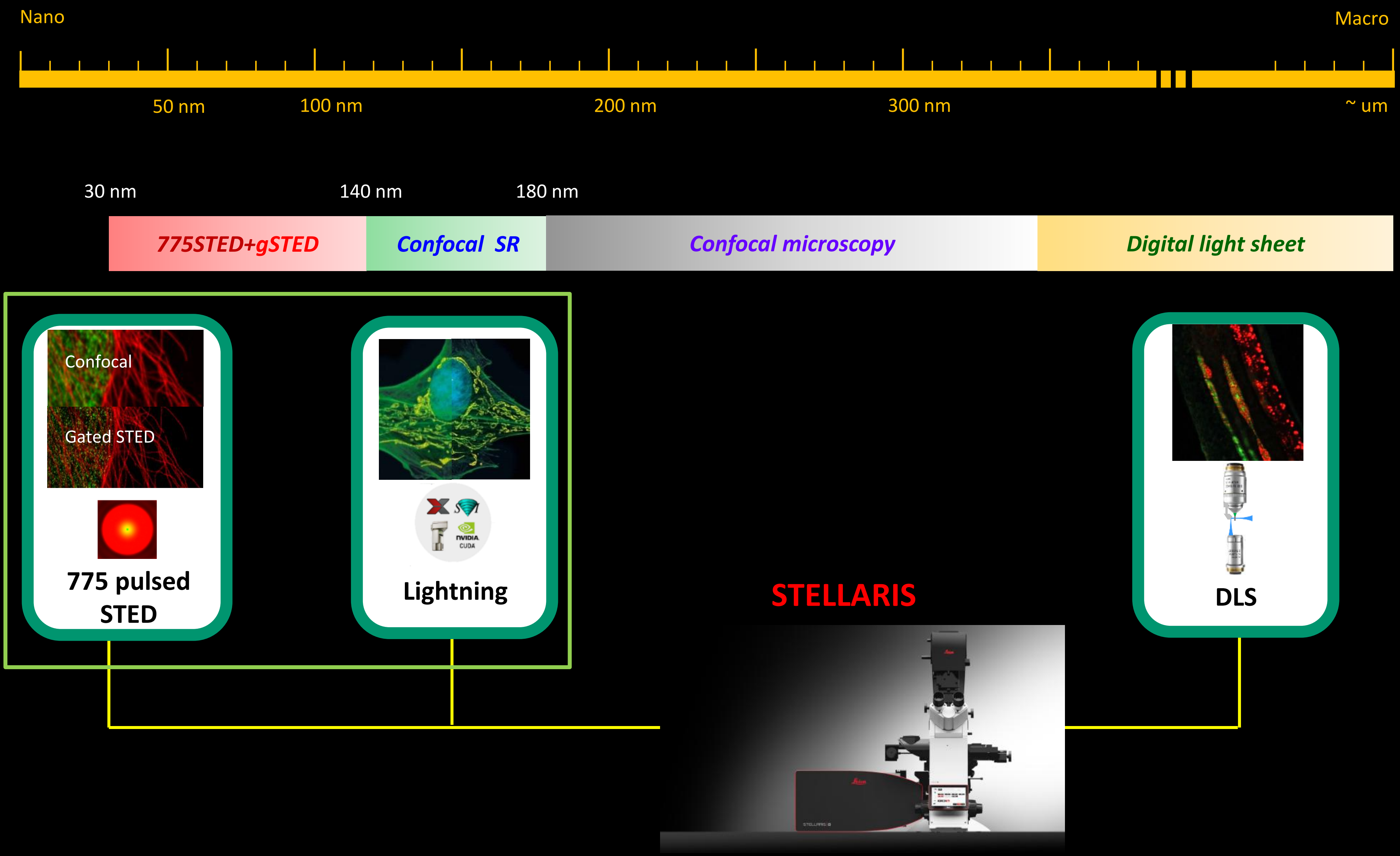
Machine Learning in Microscopy (AIVIA AI image analysis software)



Highlight video: Complete Spatial Biology Workflow



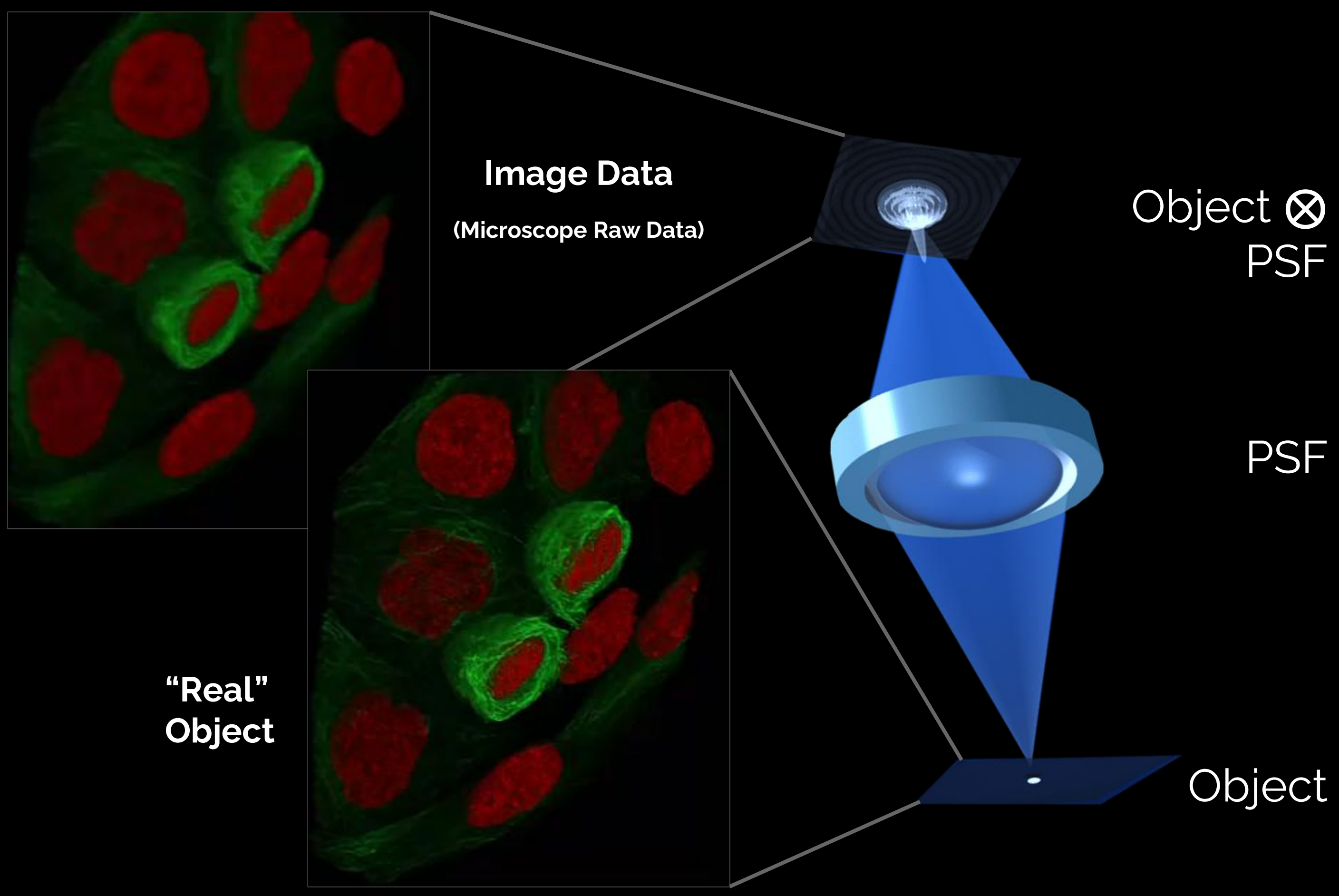
LEICA STELLARIS



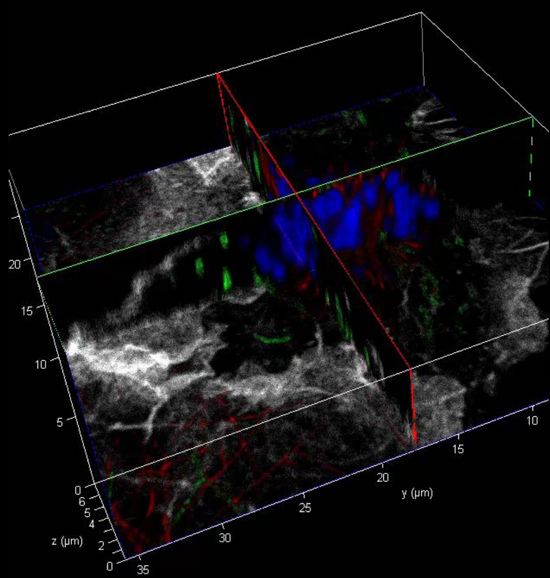
LIGHTNING

Image Information Extraction

Microscopy Image Formation

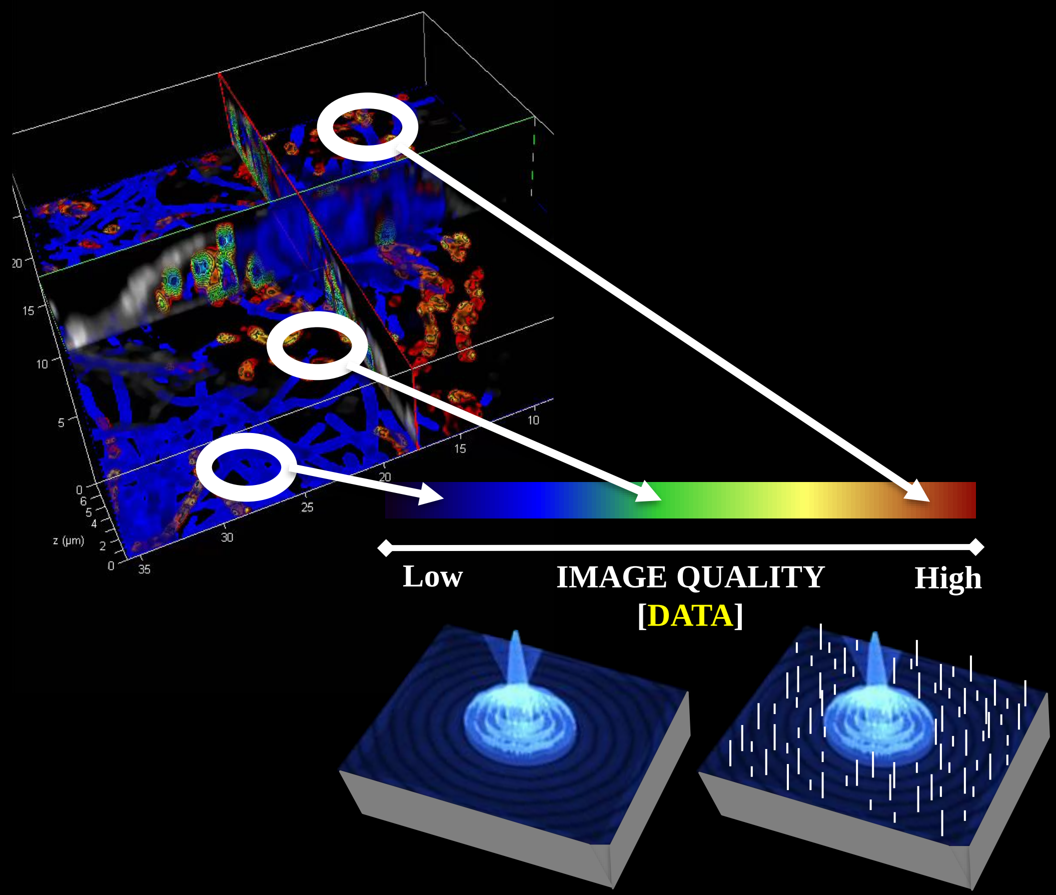


Raw data



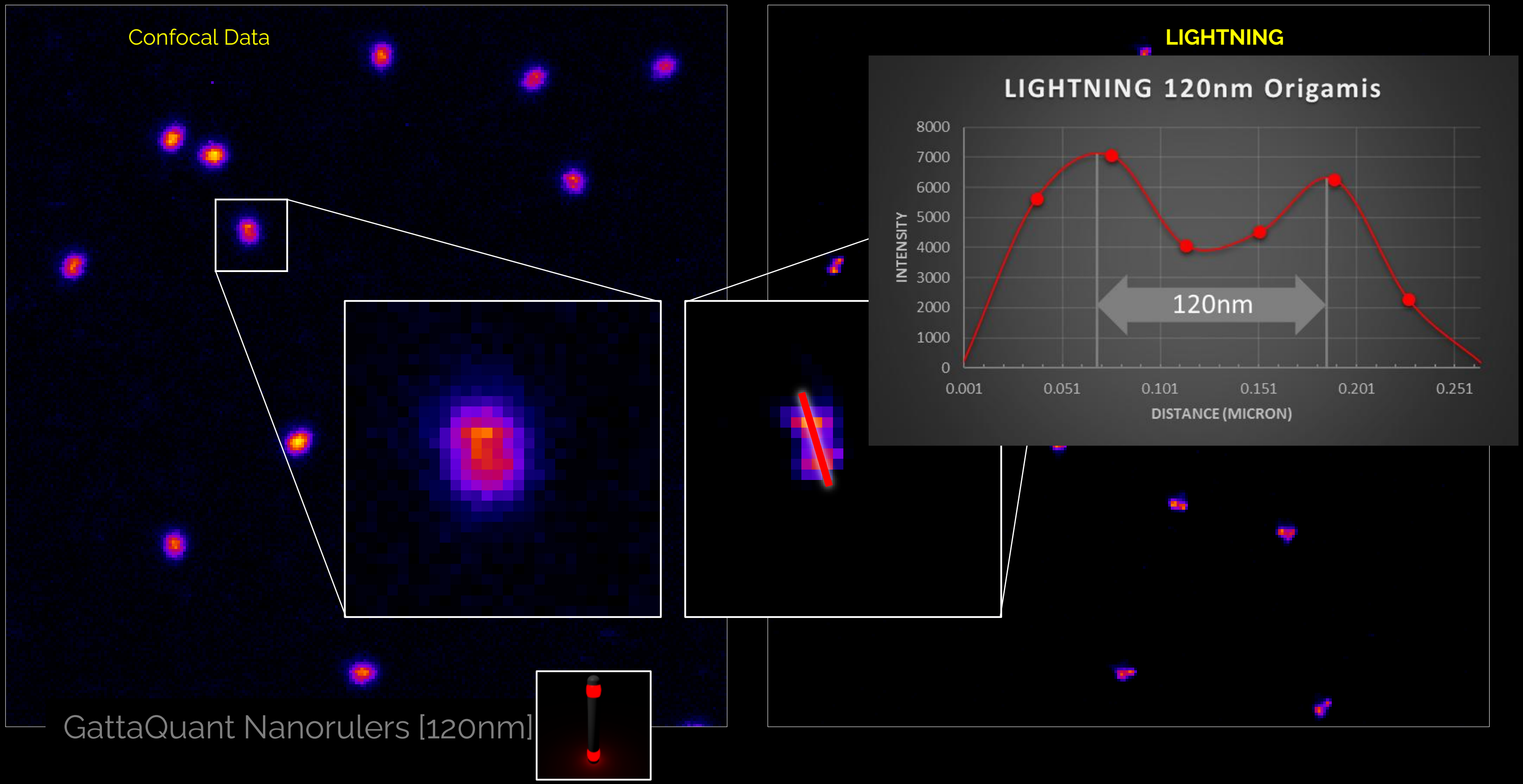
Decision Mask

Position dependant image quality

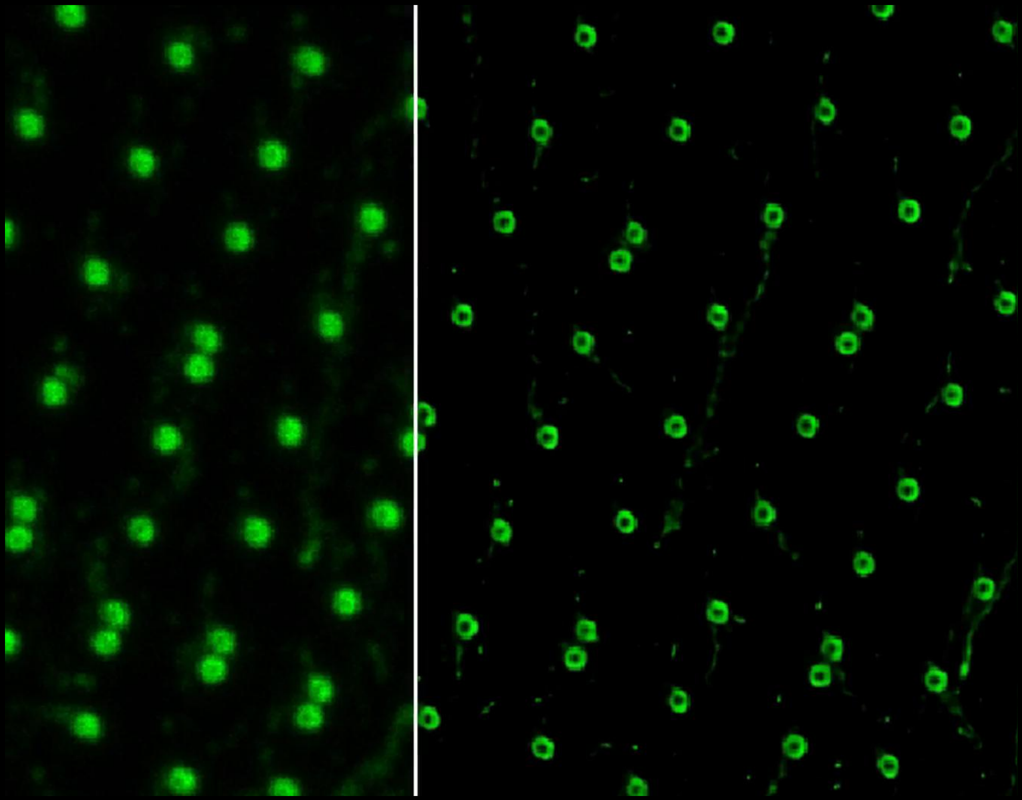


GATTA cells

Accessing Super-Resolution



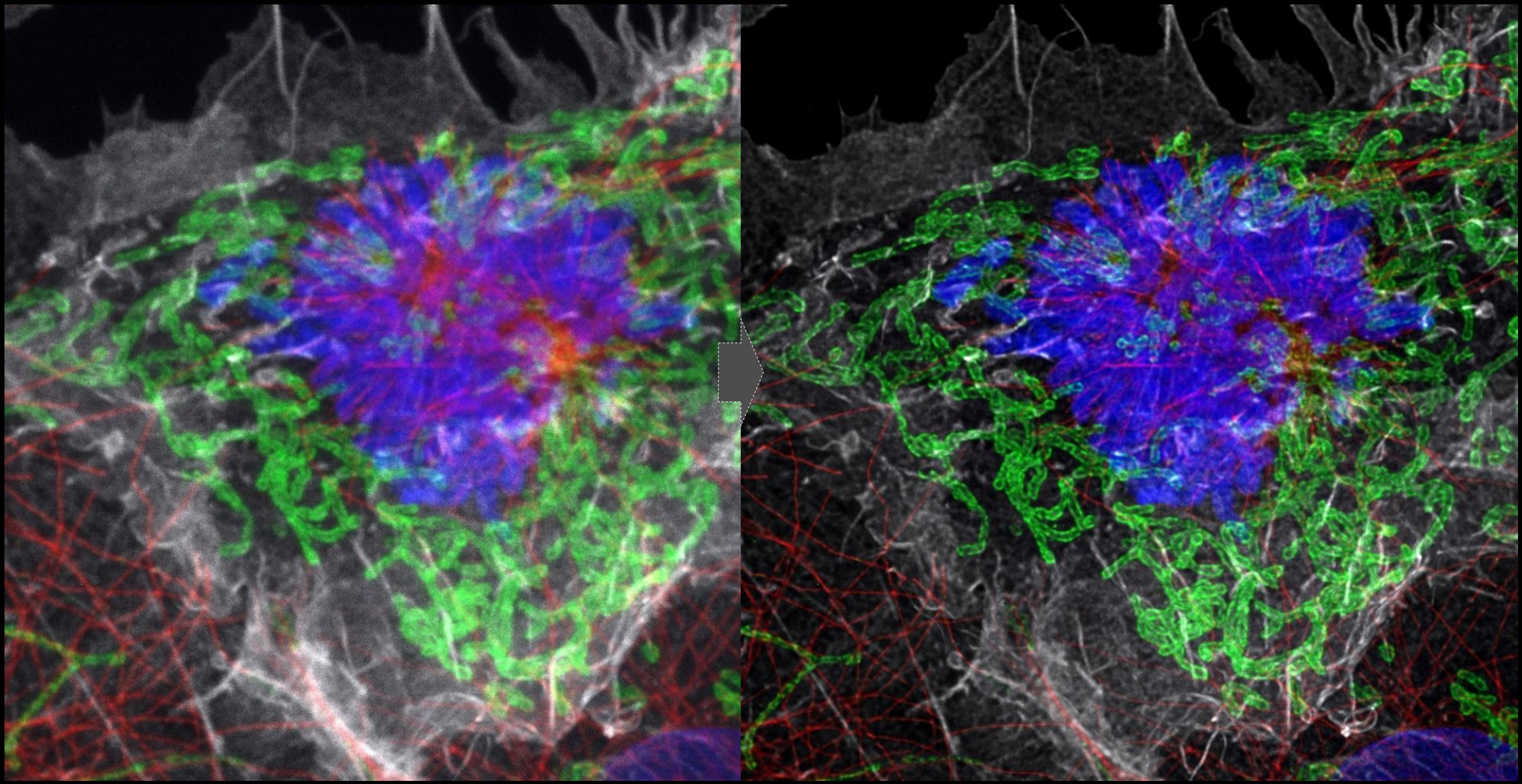
LIGHTNING: Accessing The True Nature Of Image Data



Confocal | MP | gated STED

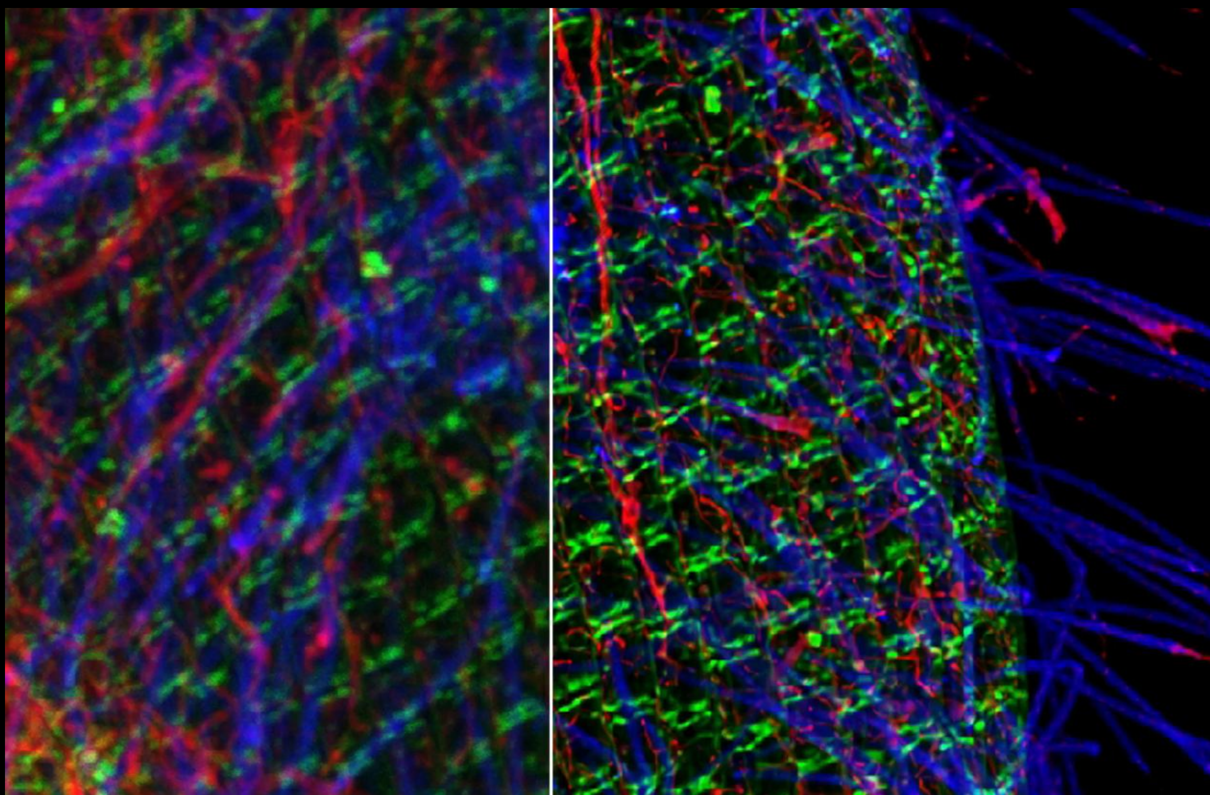
Including every imaging modality

Adaptive Deconvolution



Gatta cells

LIGHTNING: Adaptive Multicolor Super-Resolution



Confocal | MP | gated STED

Including every imaging modality

STELLARIS

Leica