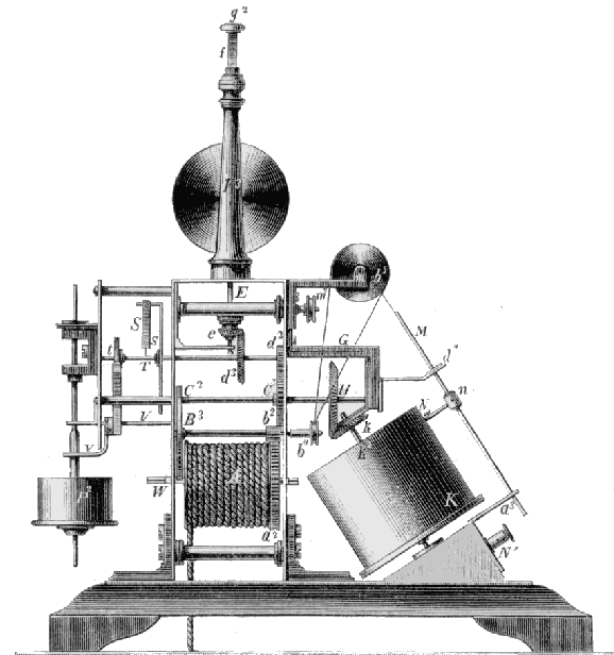


Alexander Bain

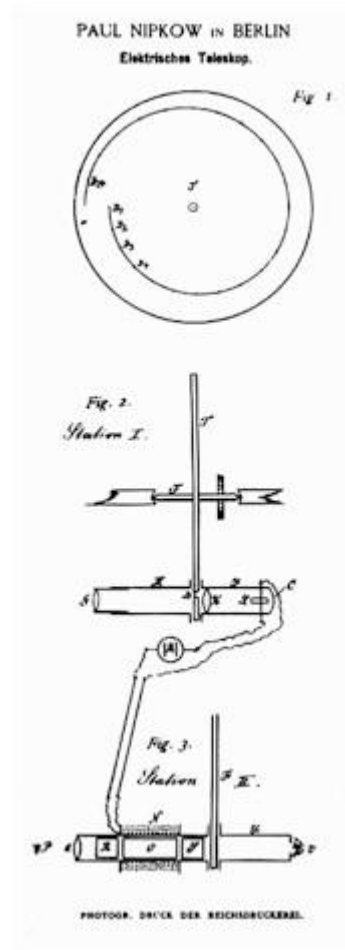


Alexander Bain, from the Mech. Mag. p. 104, 1850; Dinglers Journal 117, p. 40, 1850; Zetsche, p. 411-413.

Facsimile machine used a clock to synchronise the movement of two pendulums for line-by-line scanning of a message.

In **1843**.

Paul Gottlieb Nipkow patented his spiral-perforated disk (Nipkow disk) in **1884**, January 6



patent: "electric telescope" for the "**electric reproduction of illuminating objects**", in the category "electric apparatuses"

"electric telescope" using the Nipkow disk to divide a picture into a linear sequence of points. It improved the encoding process.

Mechanical television:

John Logie Baird in 1925 built some of the first prototype video systems



The principle of confocal imaging was patented in 1957 by **Marvin Minsky**

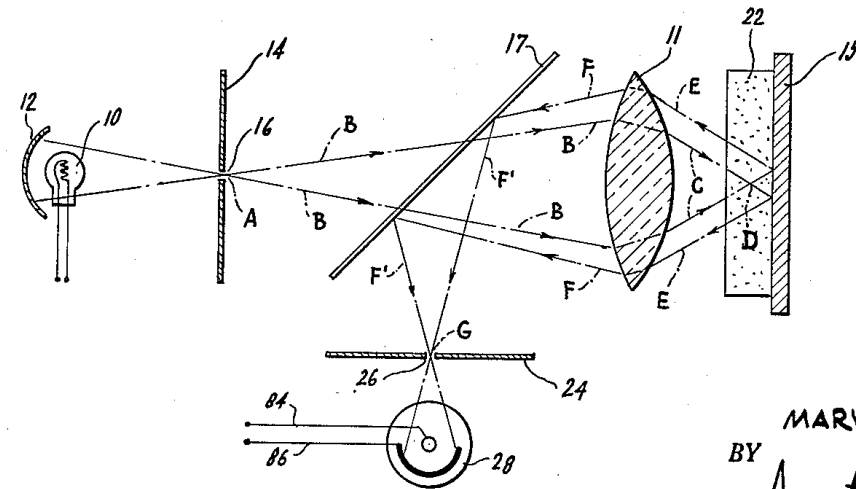
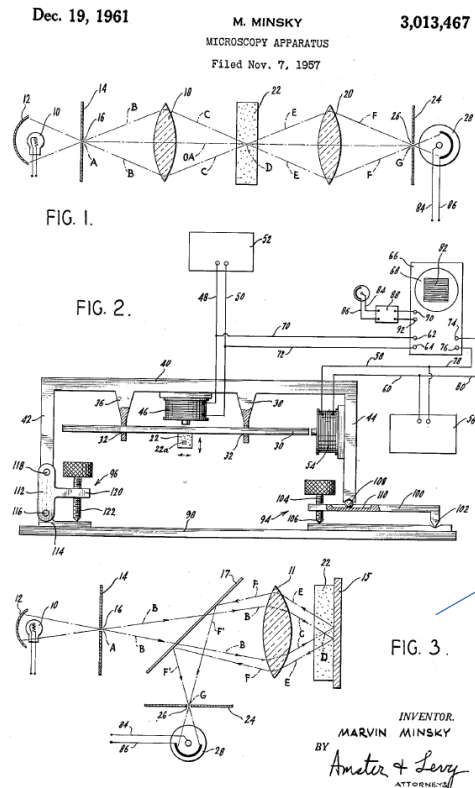
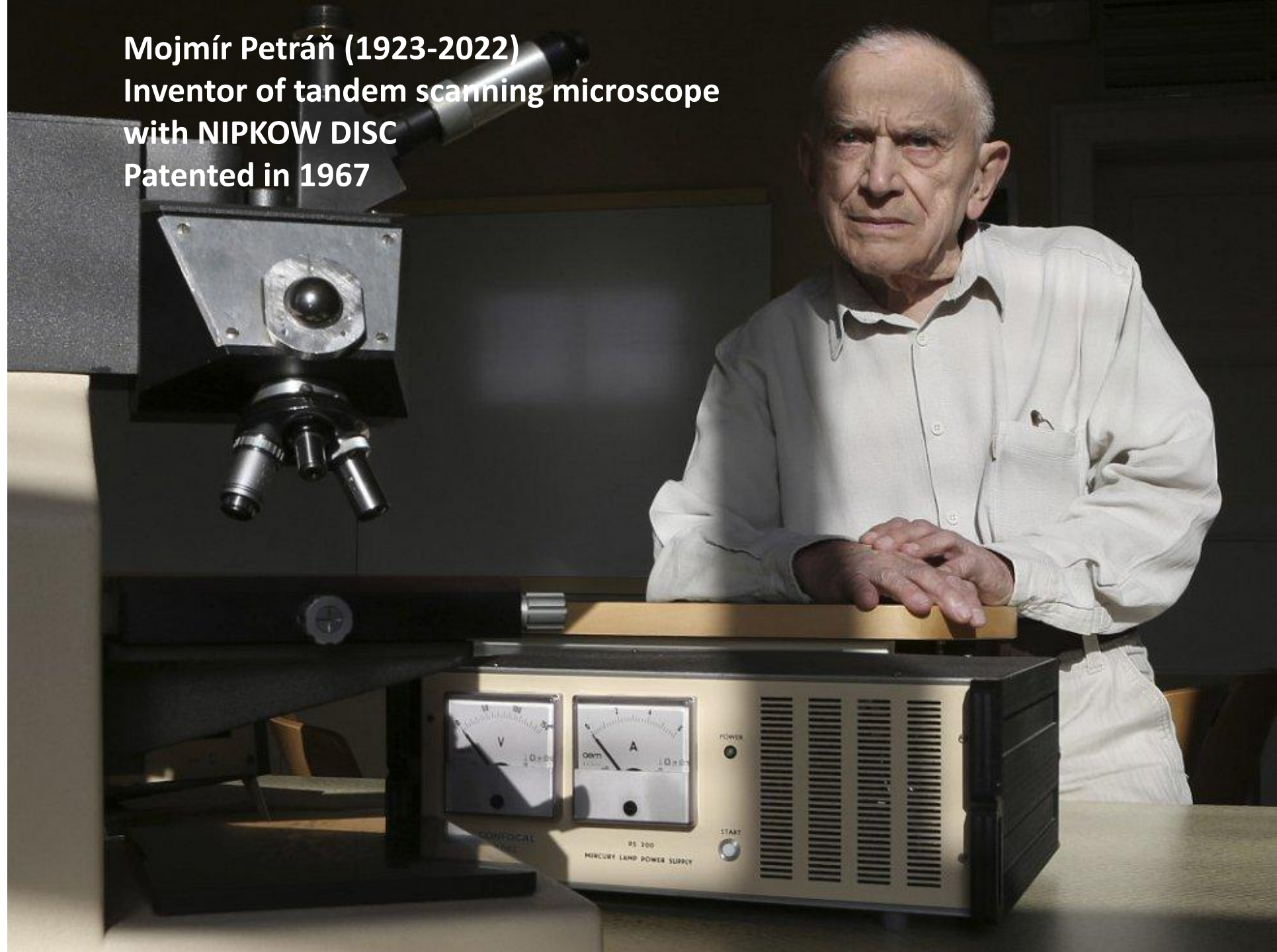


FIG. 3.

INVENTOR.
MARVIN MINSKY
BY
Ameter & Levy
ATTORNEYS

Mojmír Petrů (1923-2022)
Inventor of tandem scanning microscope
with NIPKOW DISC
Patented in 1967



June 30, 1970

M. PETRÁŇ ET AL
METHOD AND ARRANGEMENT FOR IMPROVING THE RESOLVING
POWER AND CONTRAST

Filed Dec. 4, 1967

3,517,980

5 Sheets-Sheet 1

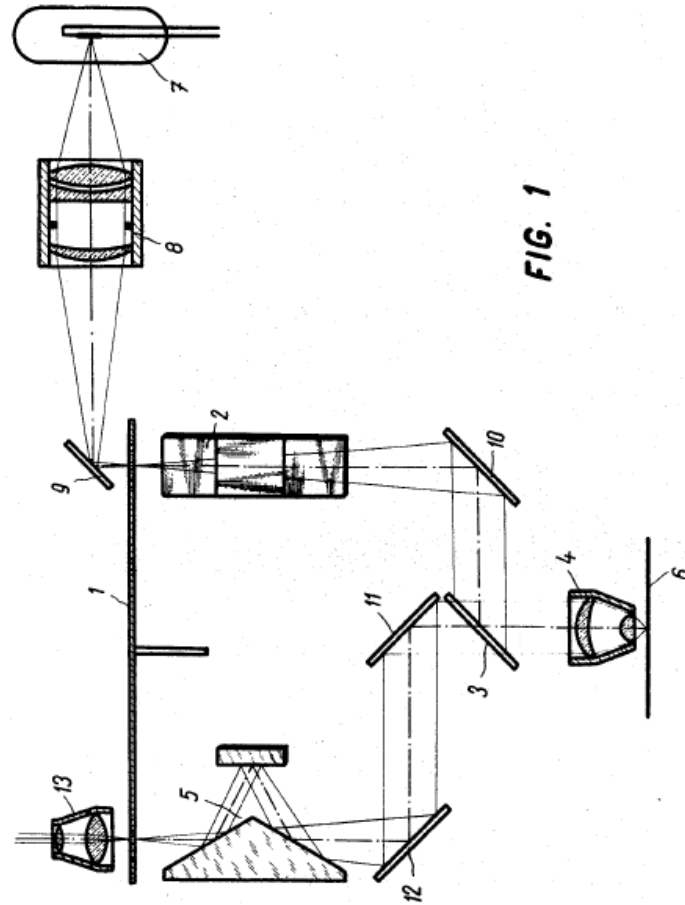


FIG. 1

INVENTORS
Mojmír Petráň, Milan
BY Hadravský
Richard Lind
Agent

June 30, 1970

M. PETRÁŇ ET AL
METHOD AND ARRANGEMENT FOR IMPROVING THE RESOLVING
POWER AND CONTRAST

Filed Dec. 4, 1967

3,517,980

5 Sheets-Sheet 2

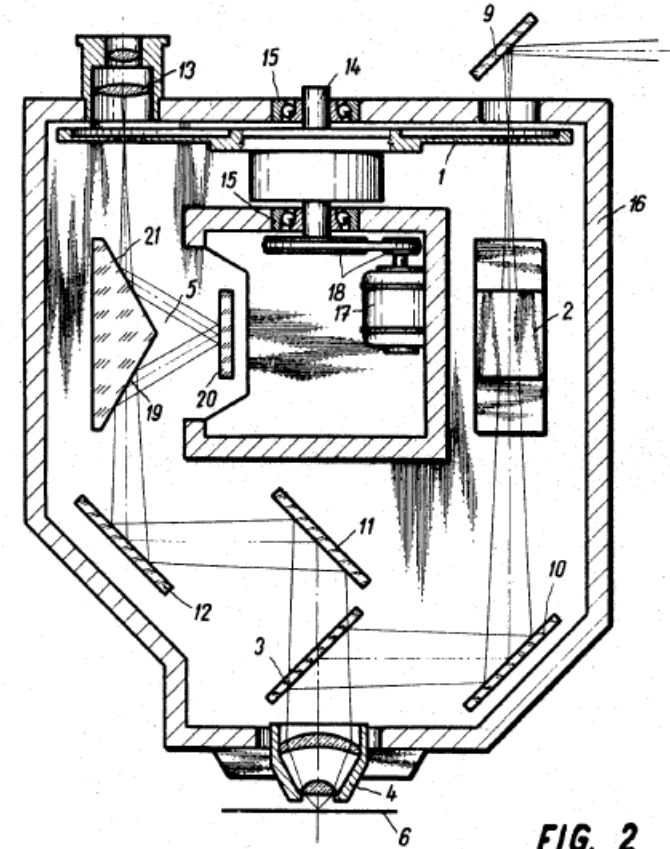


FIG. 2

INVENTORS
Mojmír Petráň, Milan
BY Hadravský
Richard Lind
Agent

MMIB 2025

LIGHT MICROSCOPY

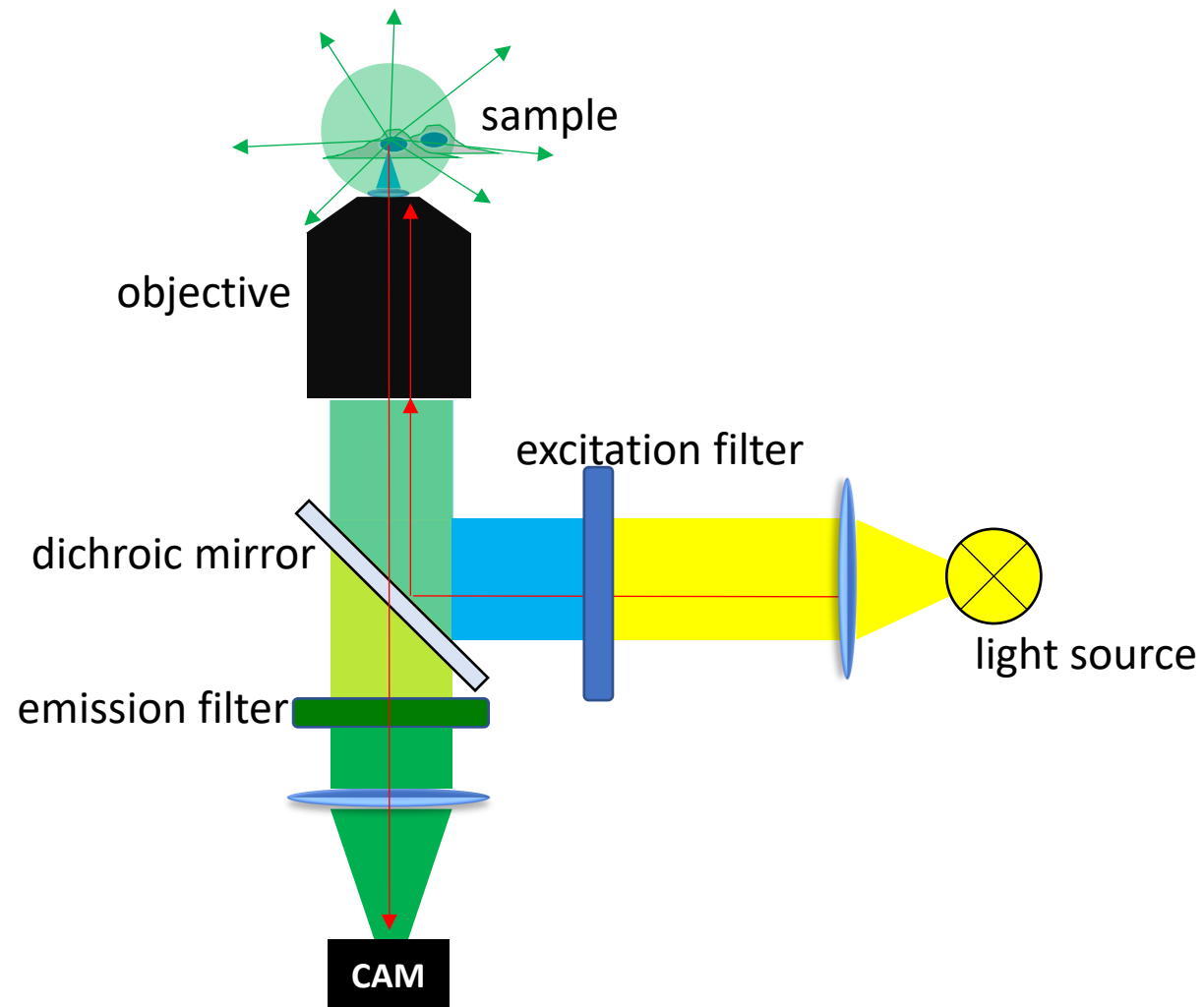
SCANNING CONFOCAL MICROSCOPE

construction and principle

function of the emission pinhole; confocal section

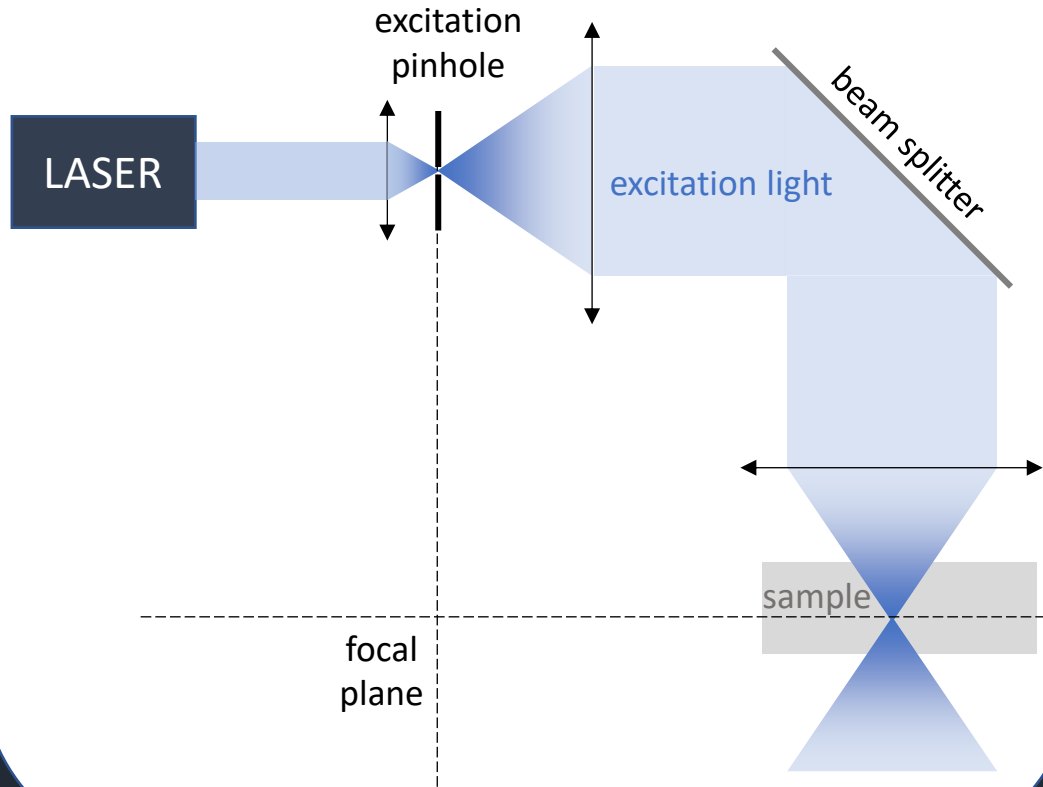
optical sectioning

The **widefield** fluorescence microscope

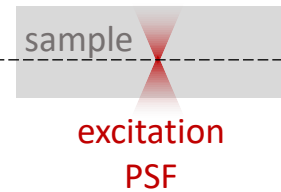


The **confocal** fluorescence microscope

ILLUMINATION

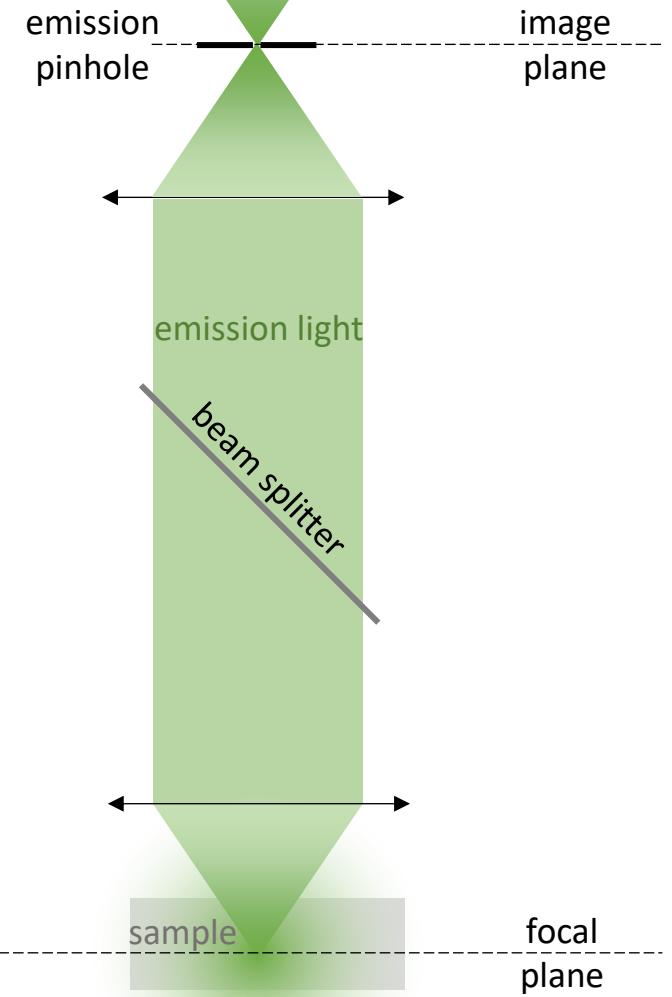


EXCITATION

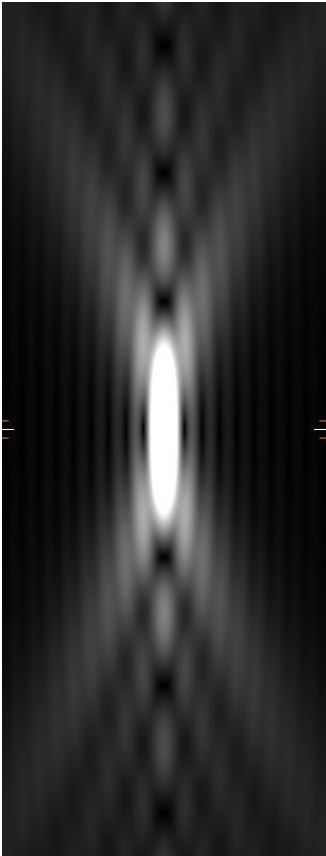
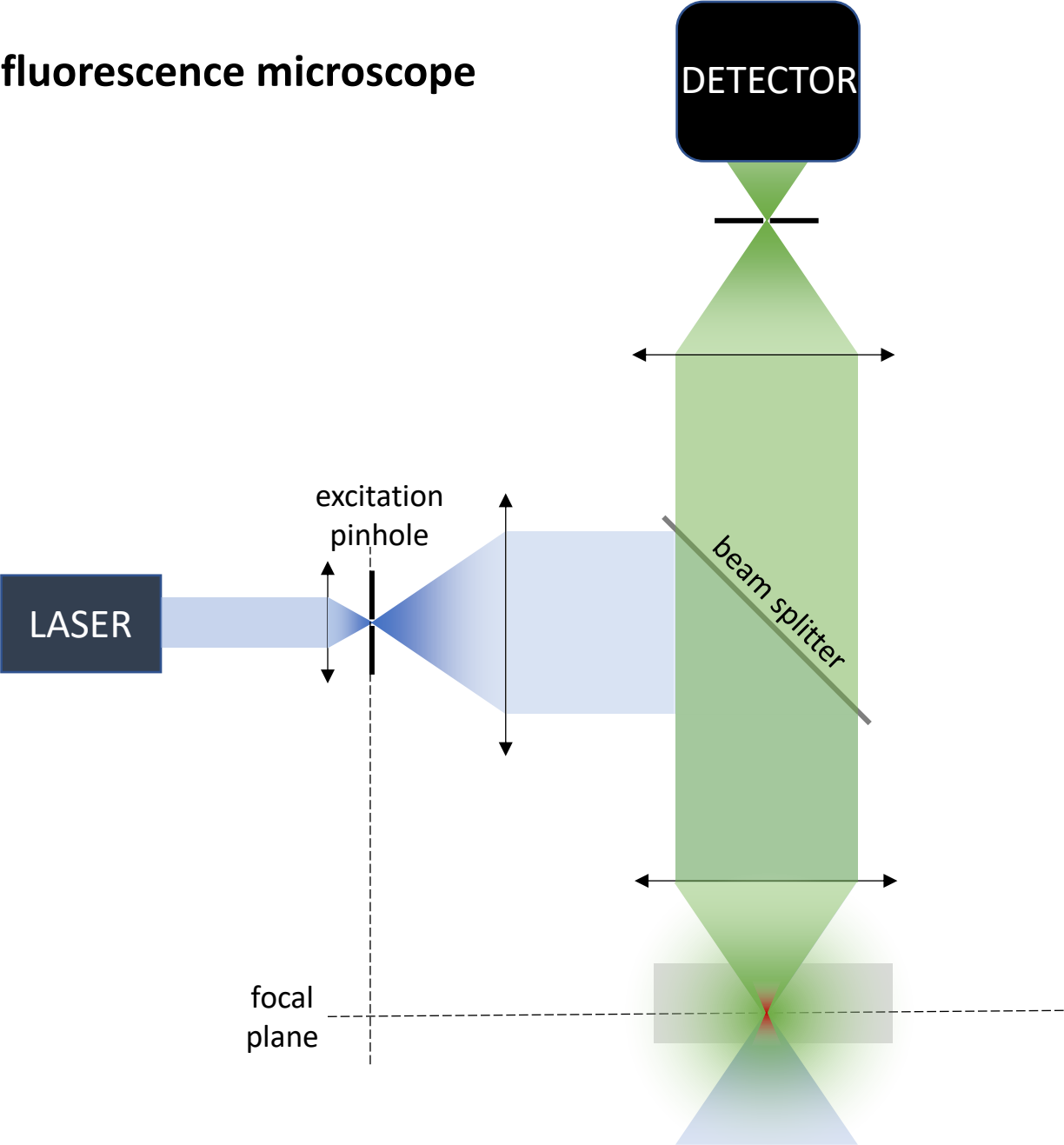


DETECTOR

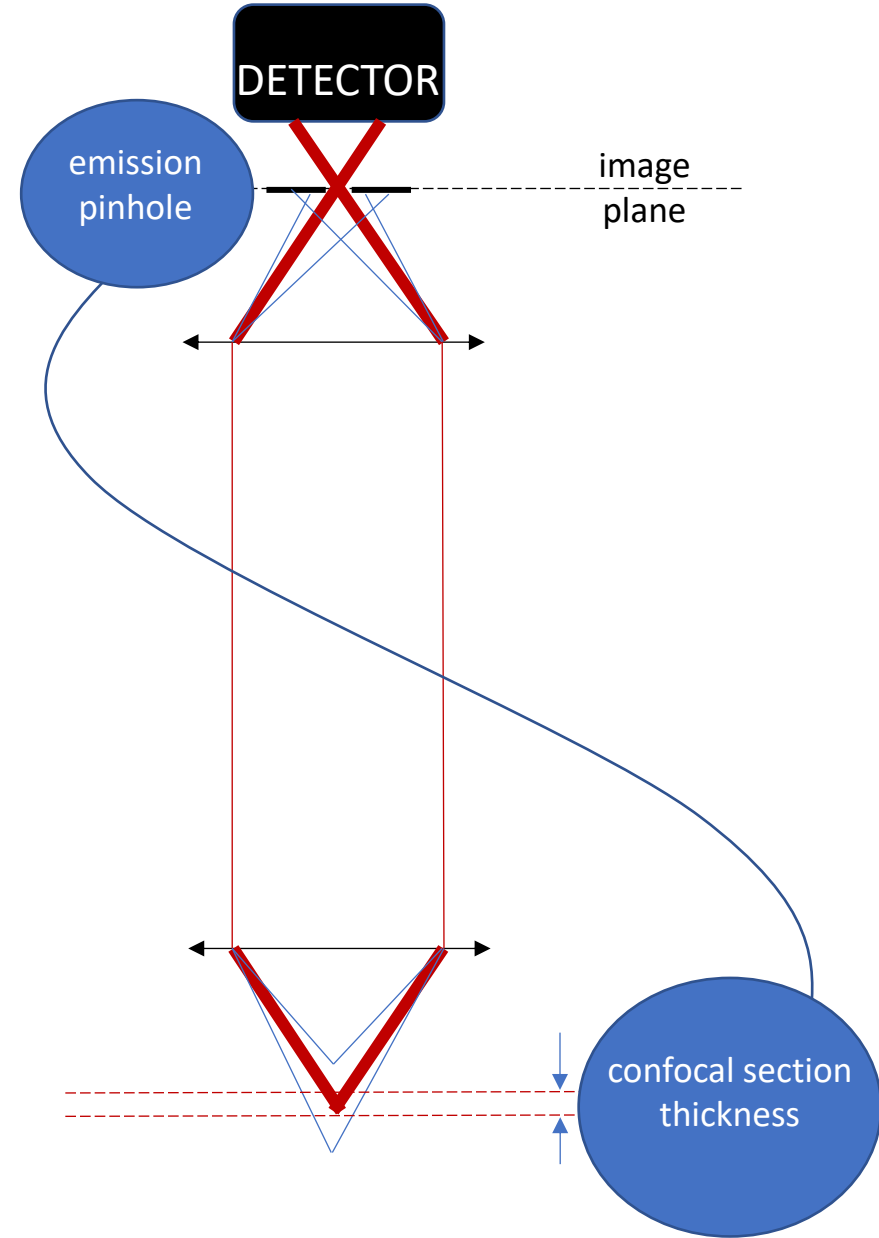
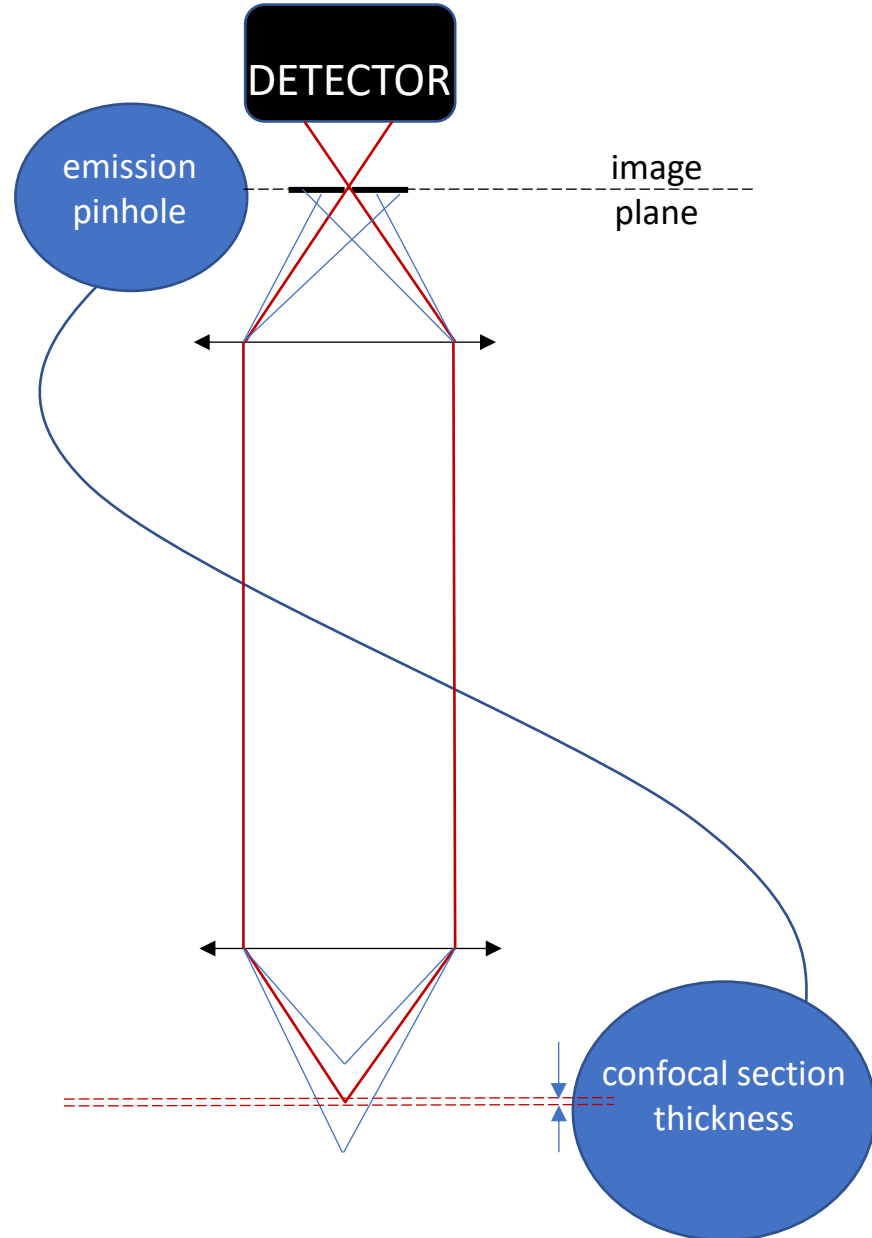
EMISSION

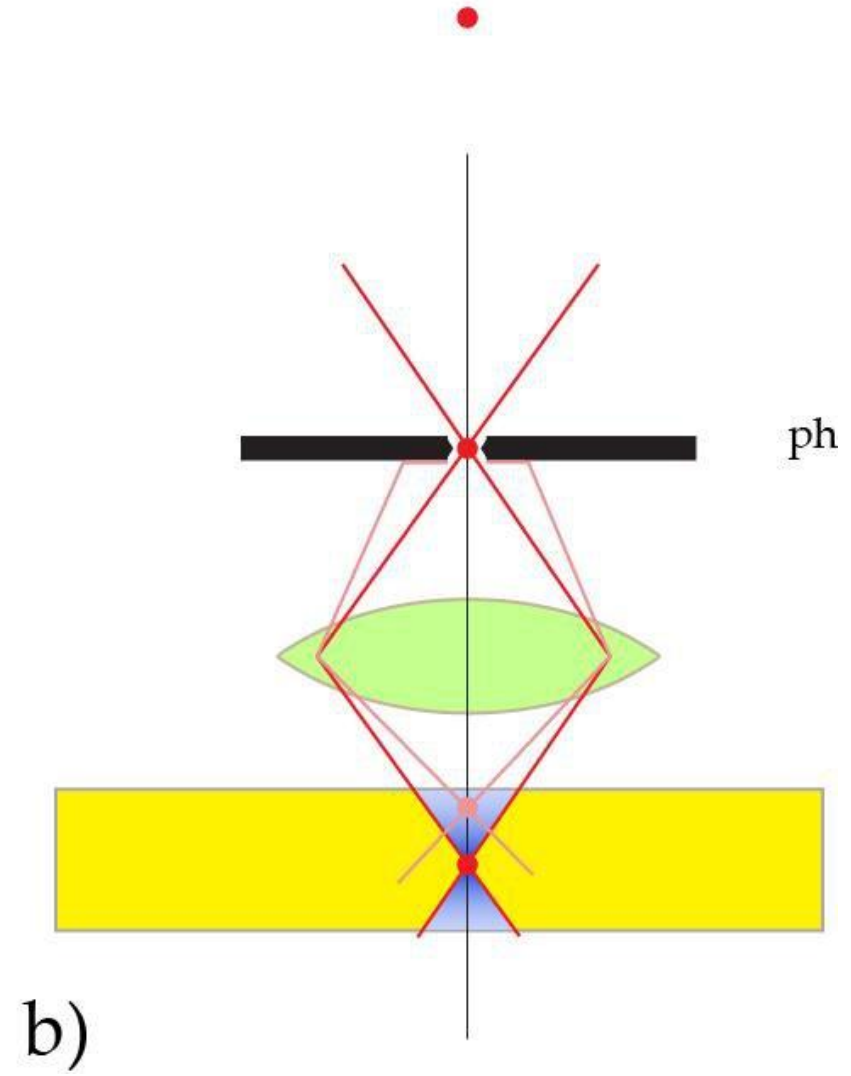
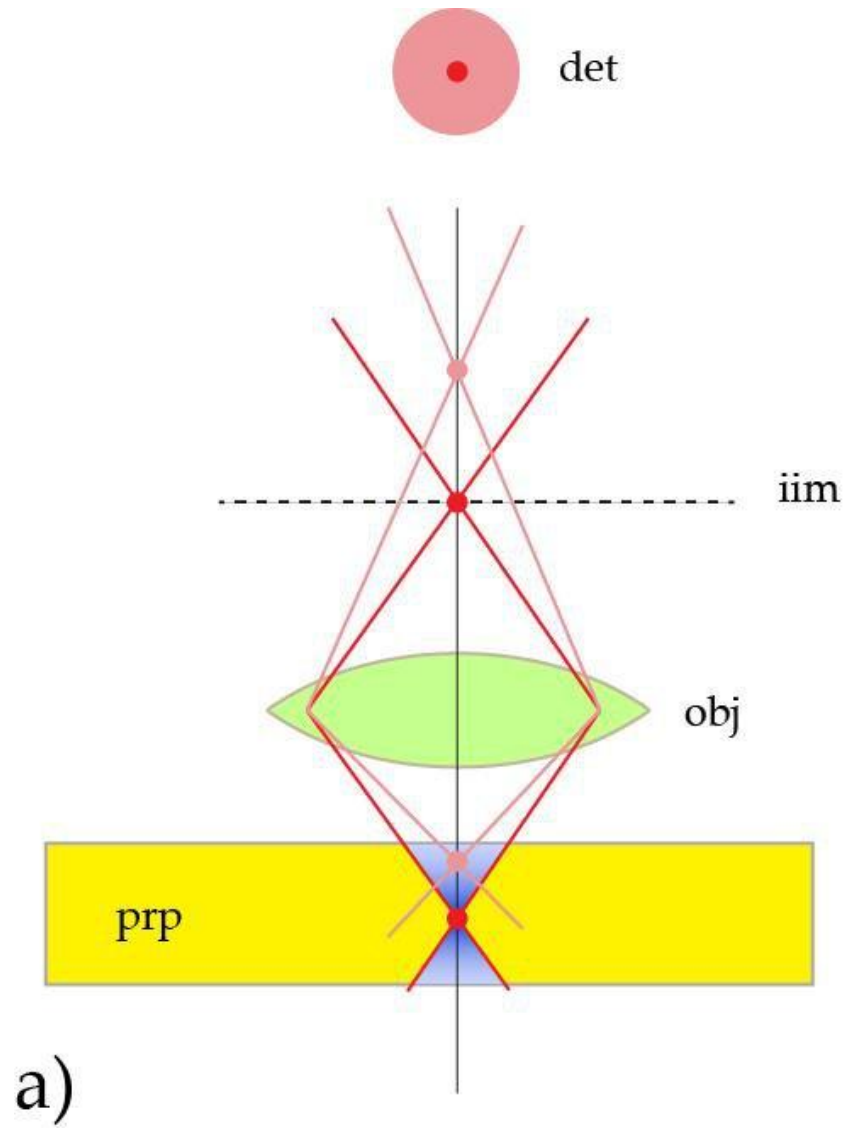


The **confocal** fluorescence microscope

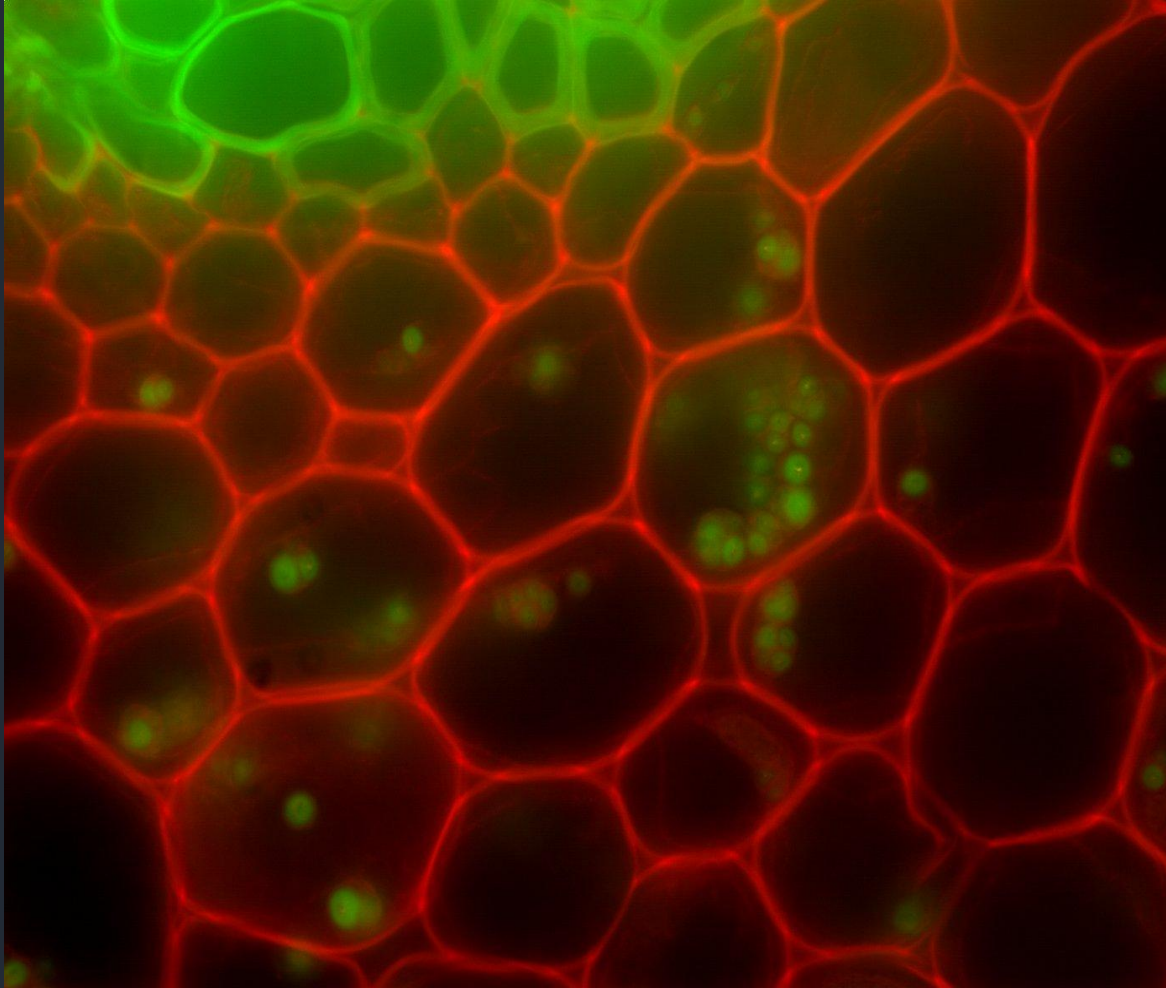


The **pinhole** defines the **confocal section** thickness

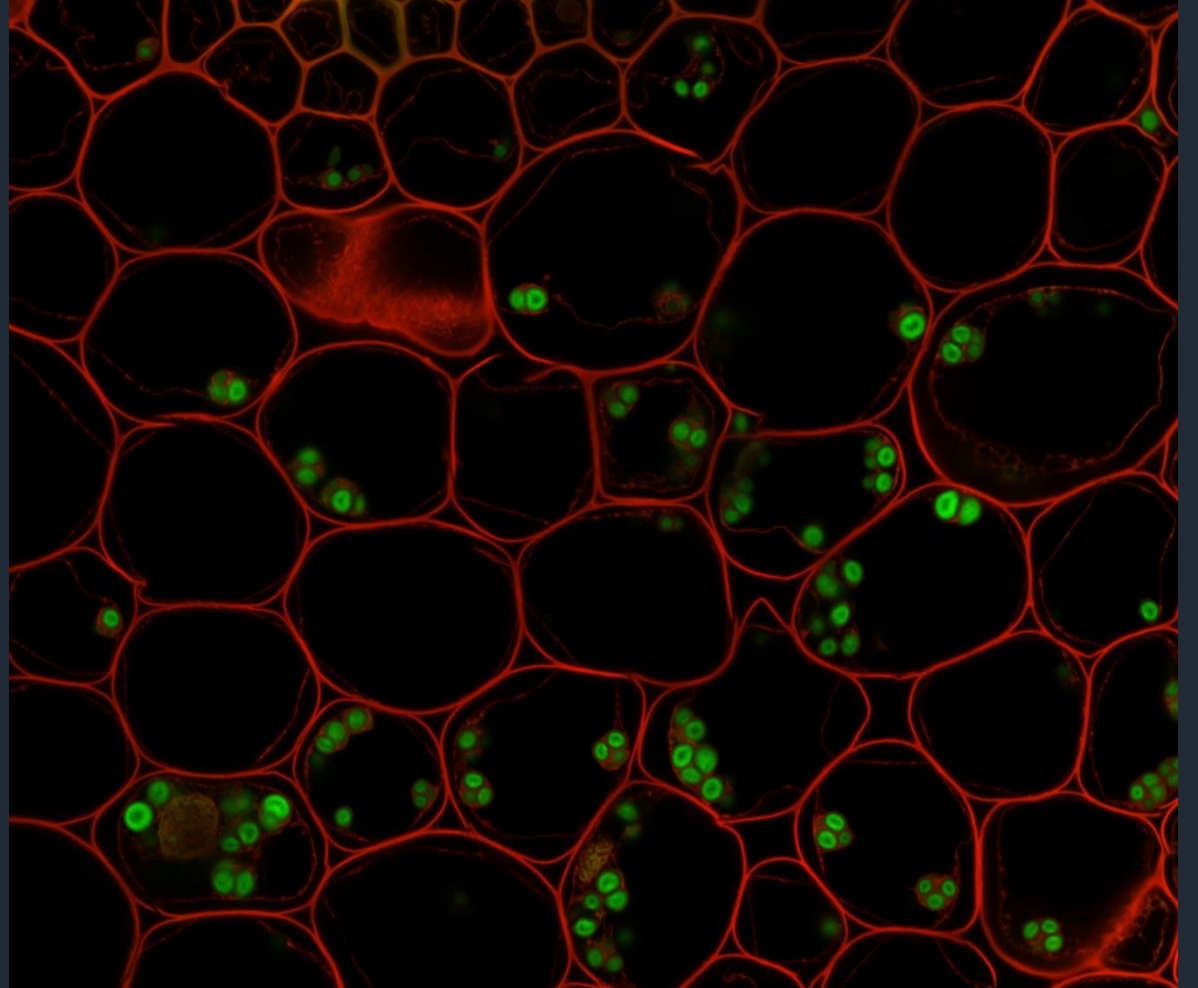




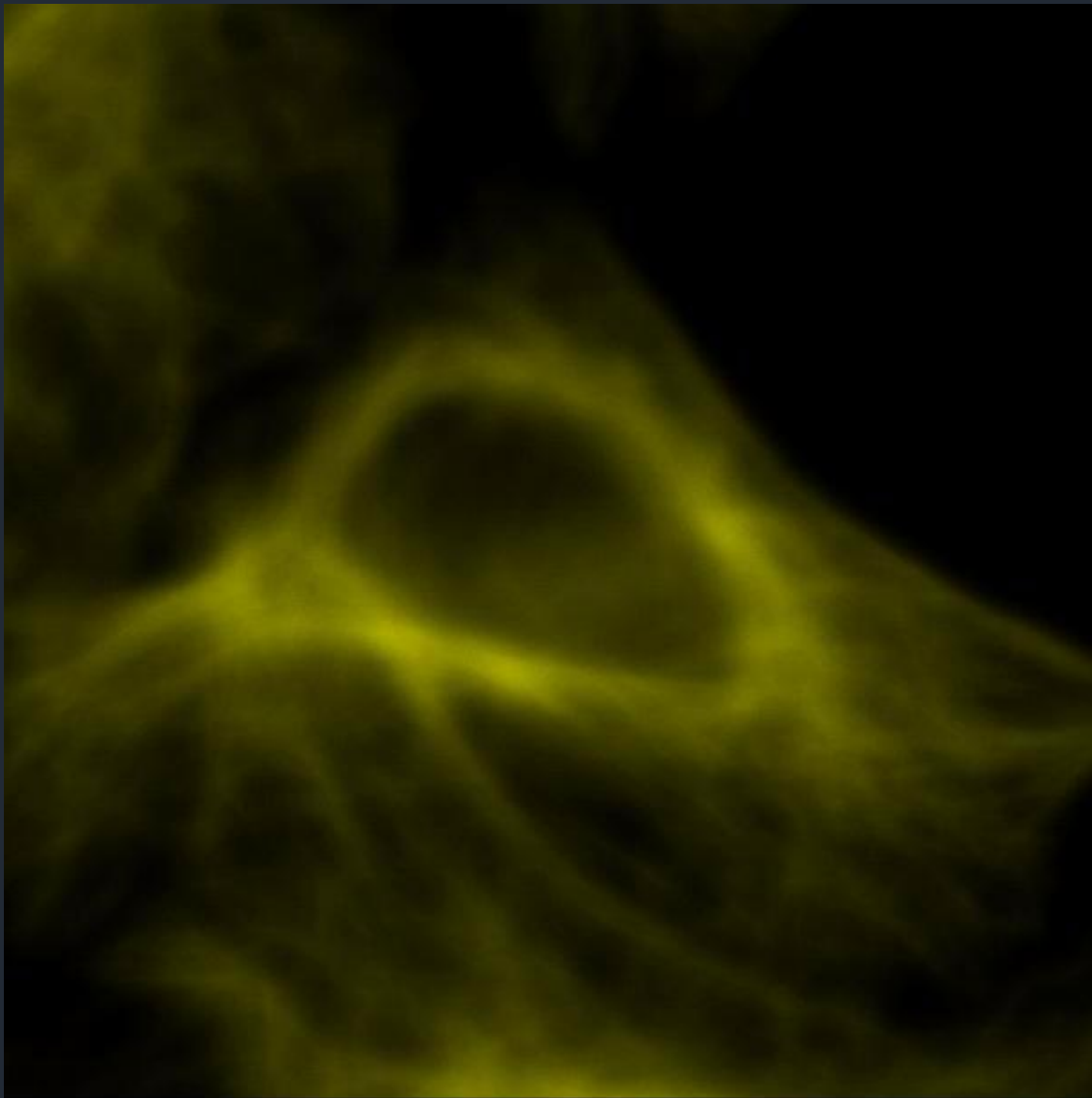
Wide Field Fluorescent microscope



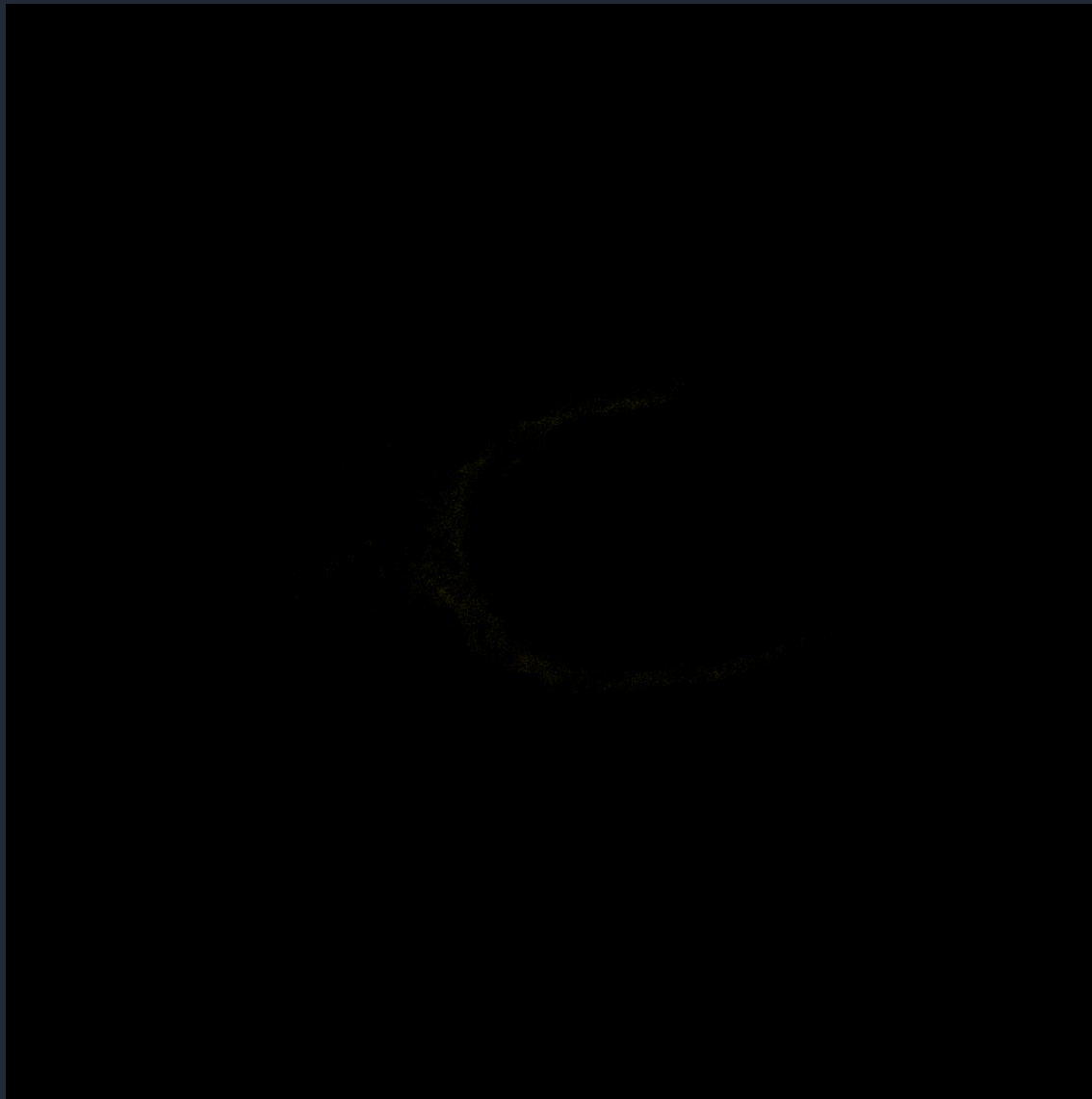
Confocal scanning microscope



Wide Field Fluorescent microscope

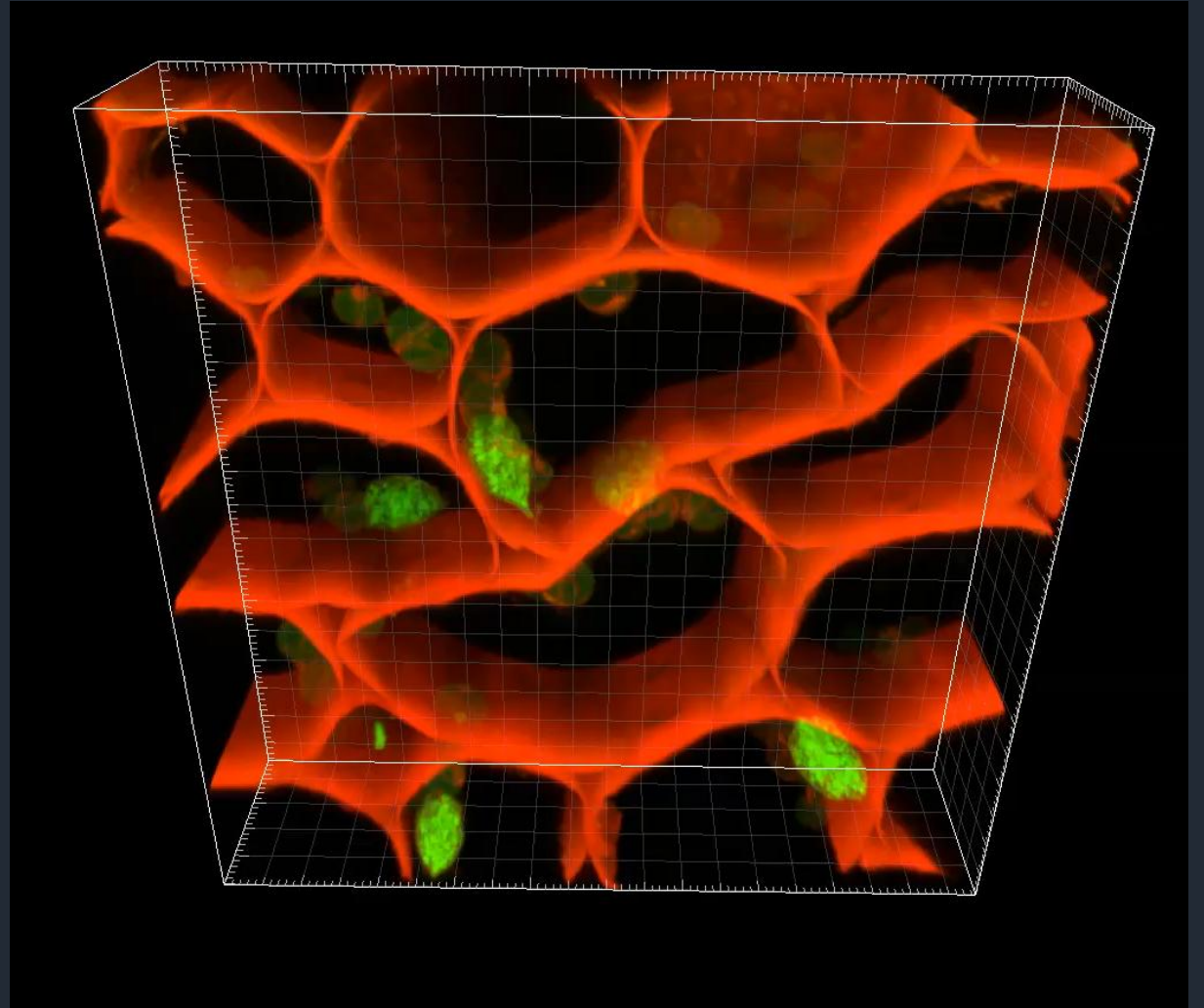
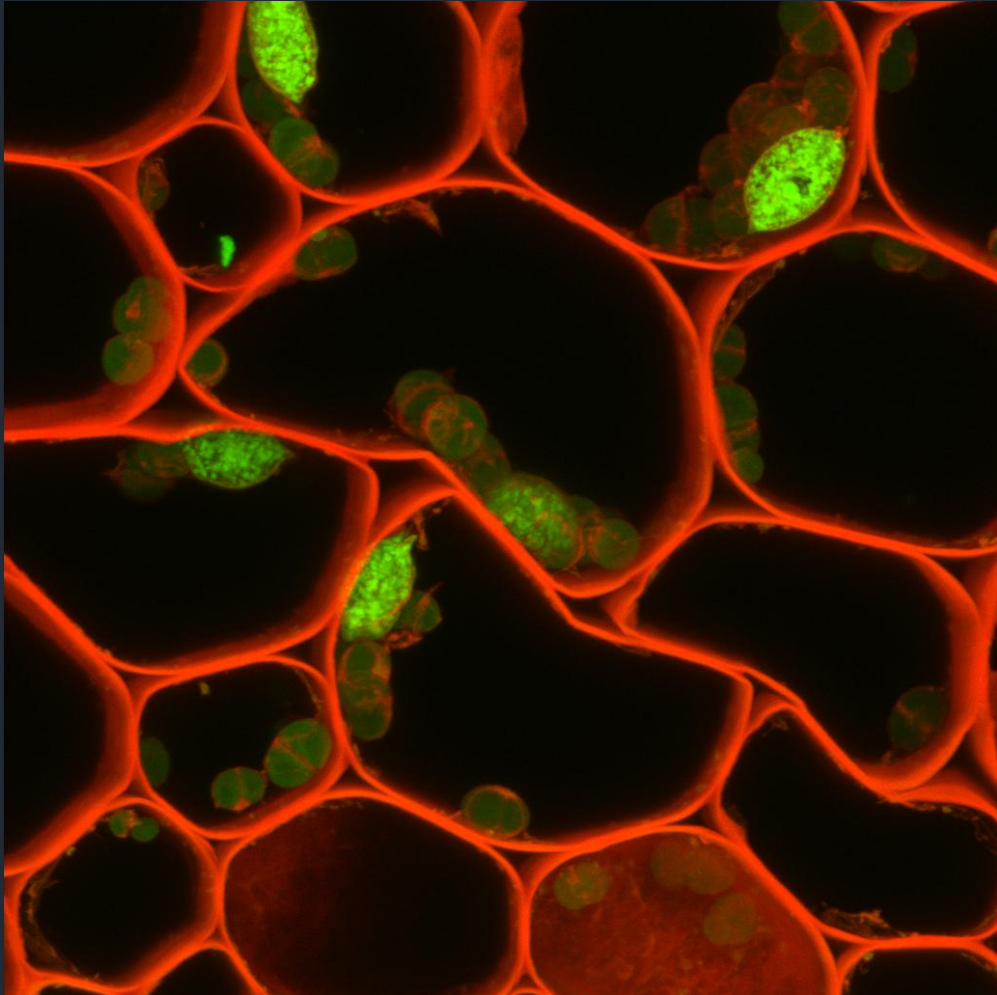


Confocal scanning microscope

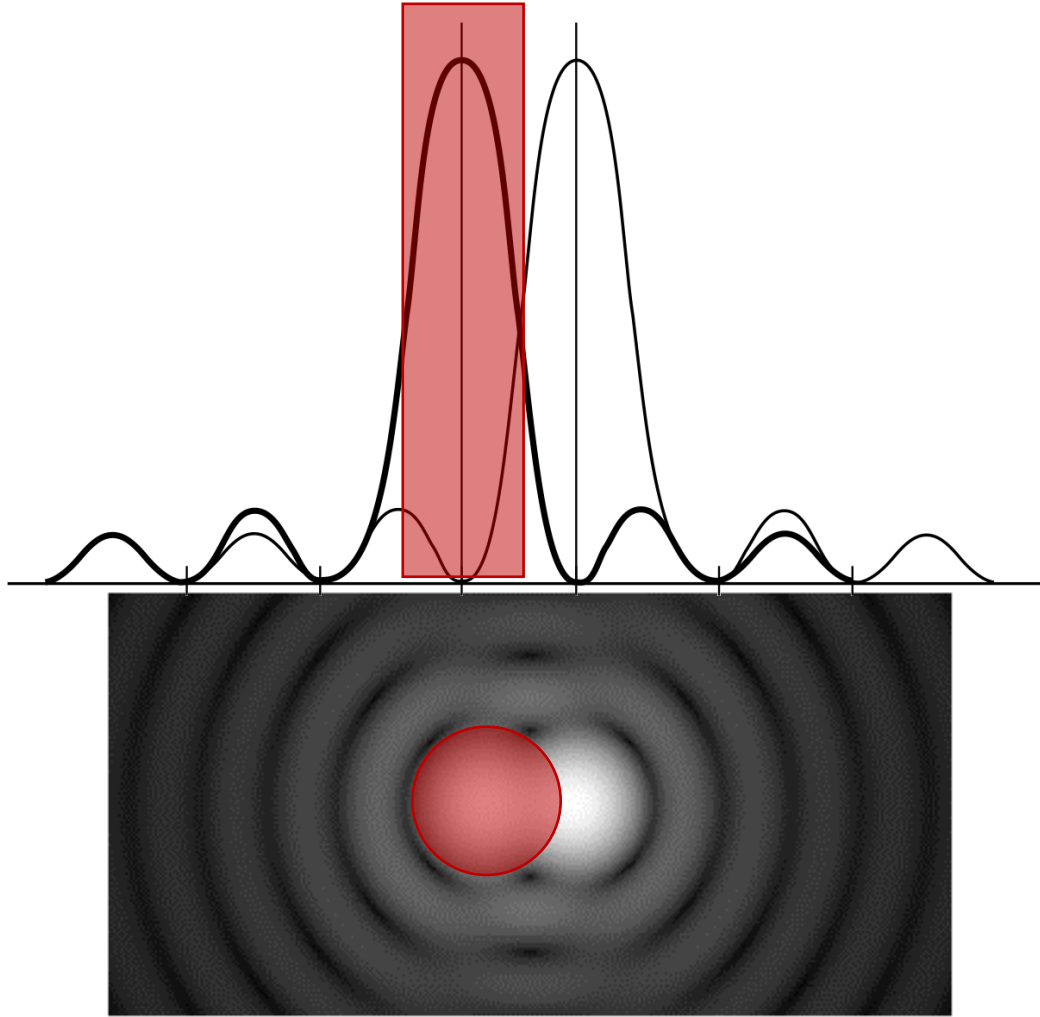


Optical sectioning in fluorescence microscopy

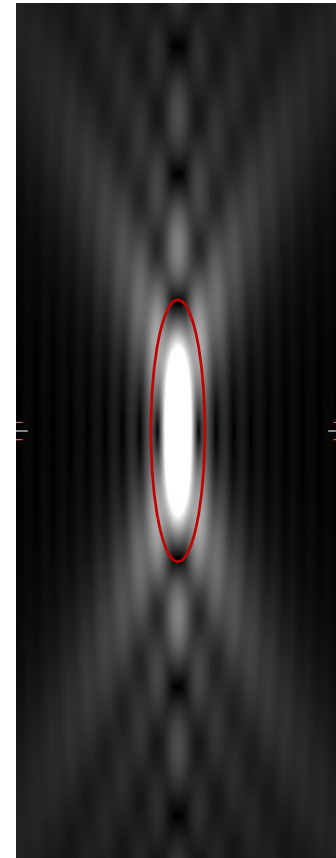
Confocal SCANNING Fluorescent microscope



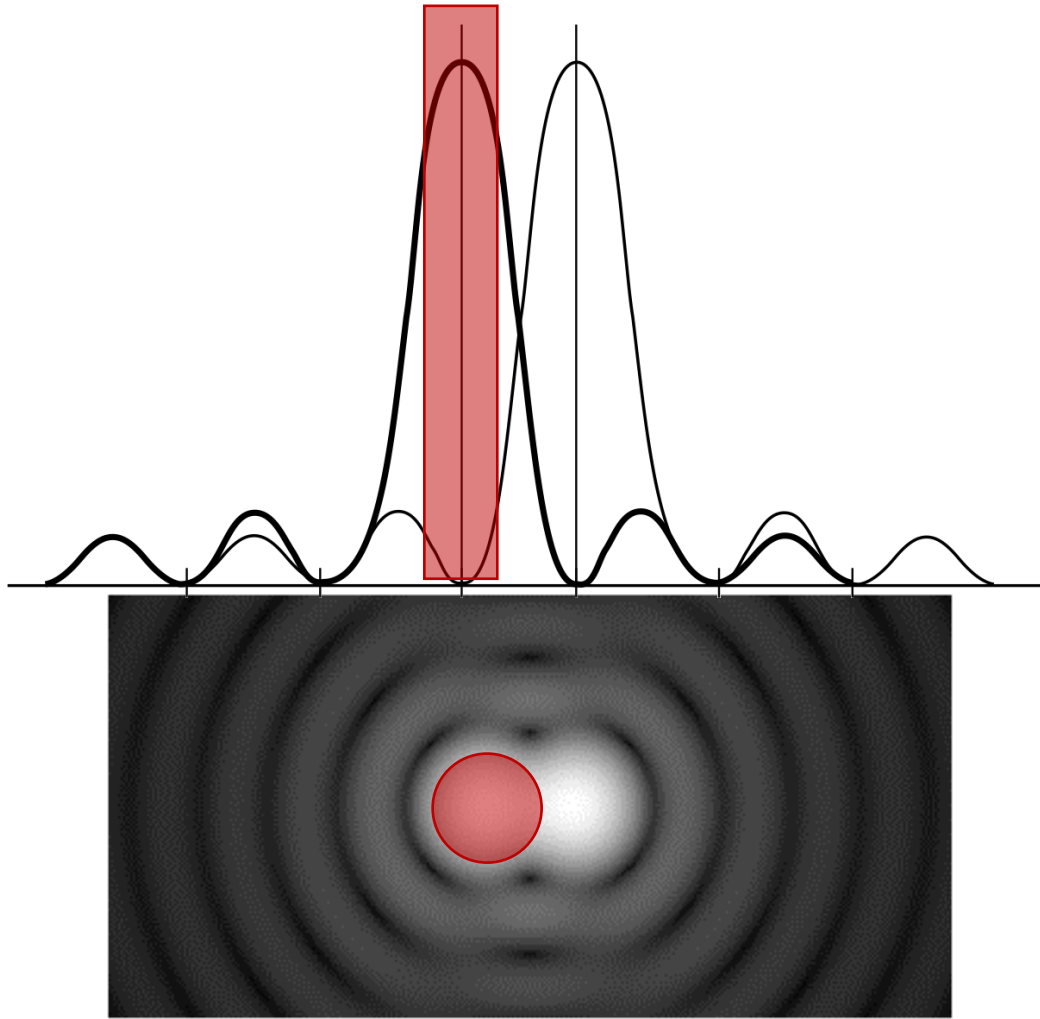
The **pinhole** contributes to the confocal system **resolution**



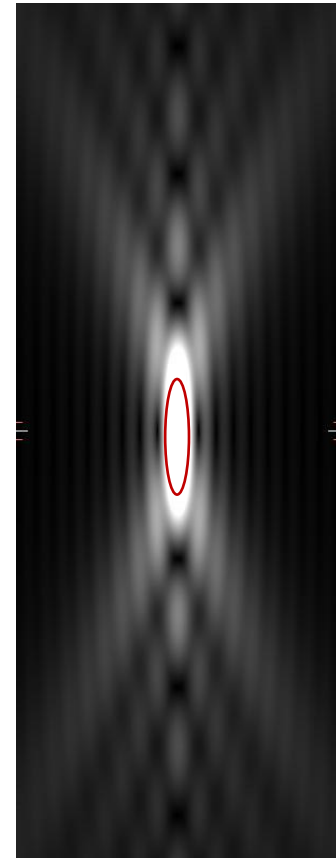
1.0 AU



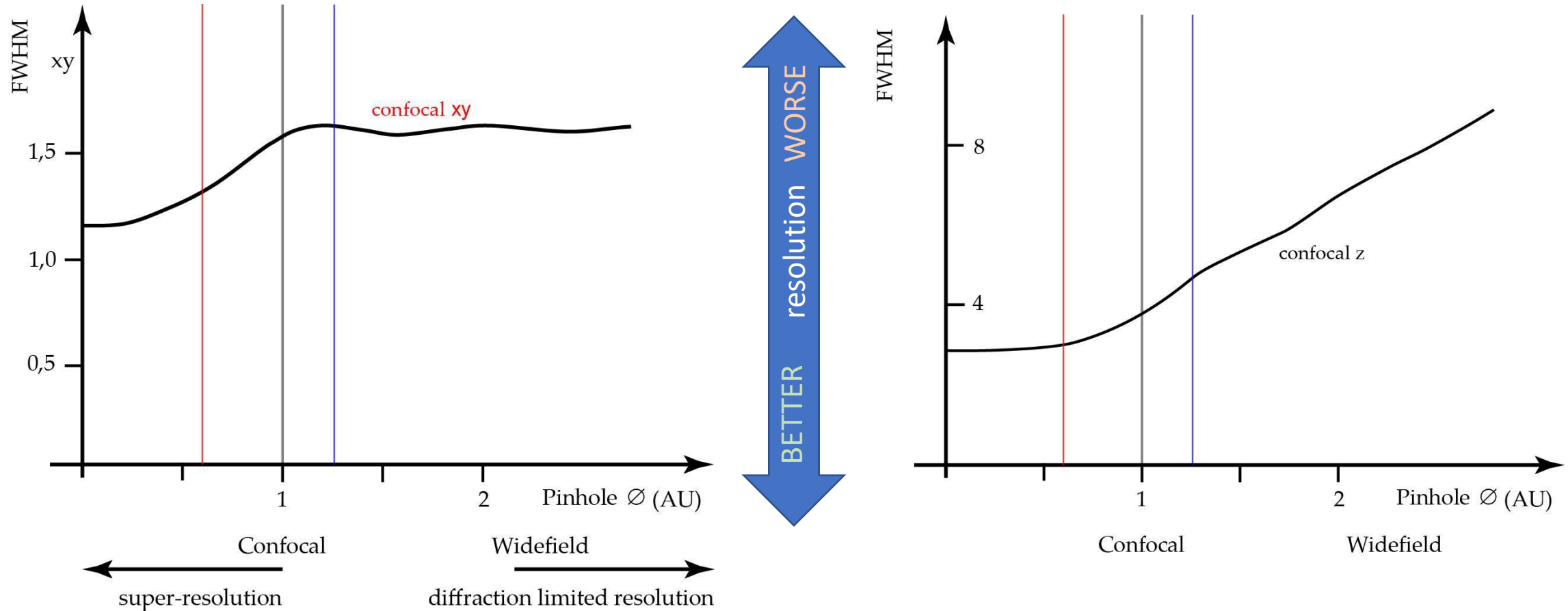
The **pinhole** contributes to the confocal system **resolution**



~ 0.6 AU

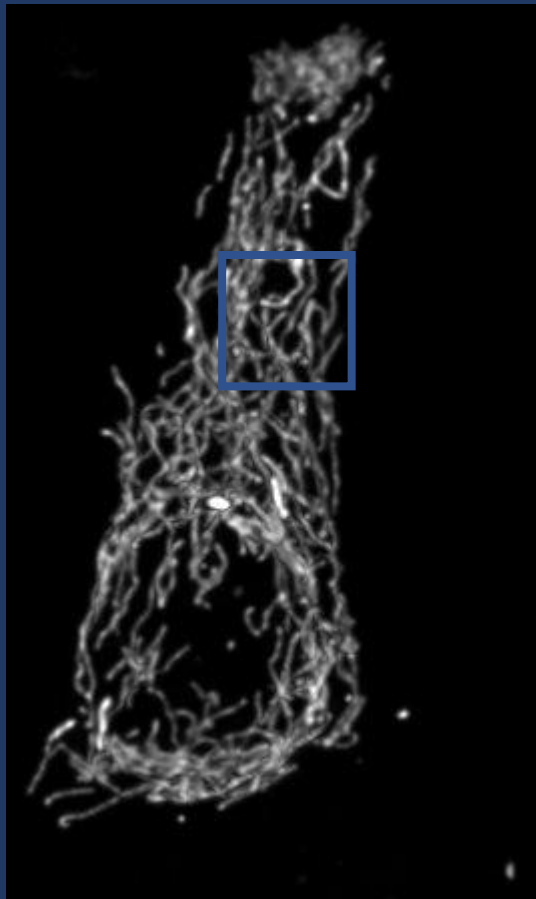


The **pinhole** contributes to the confocal system **resolution**

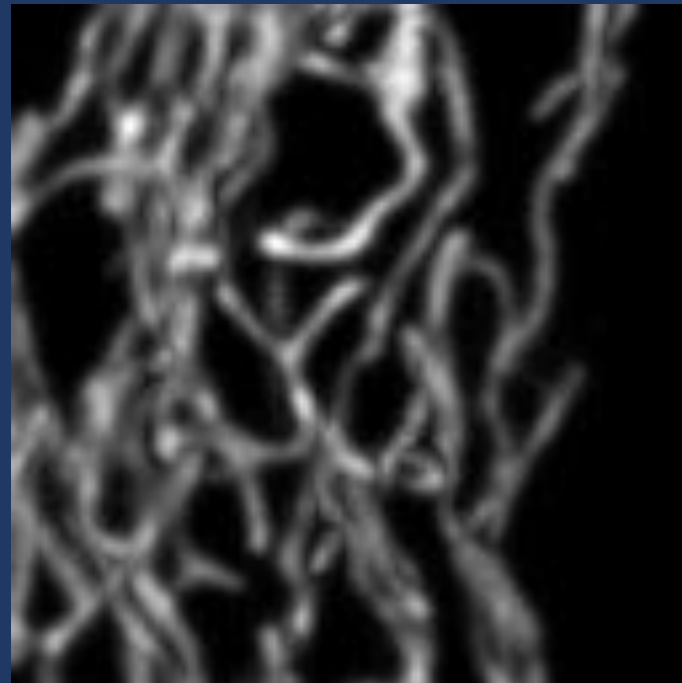


Confocal SCANNING Fluorescent microscope

- Variable pinhole – could increase the resolution



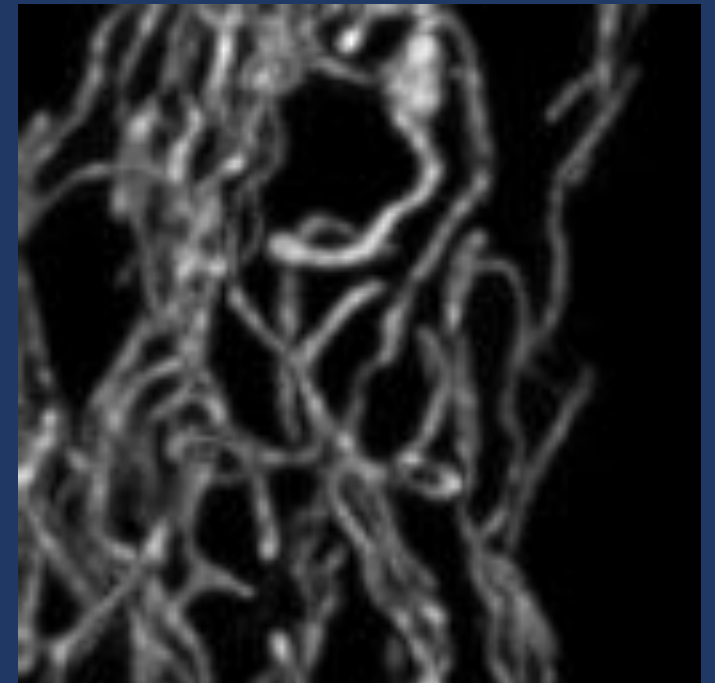
1 AU



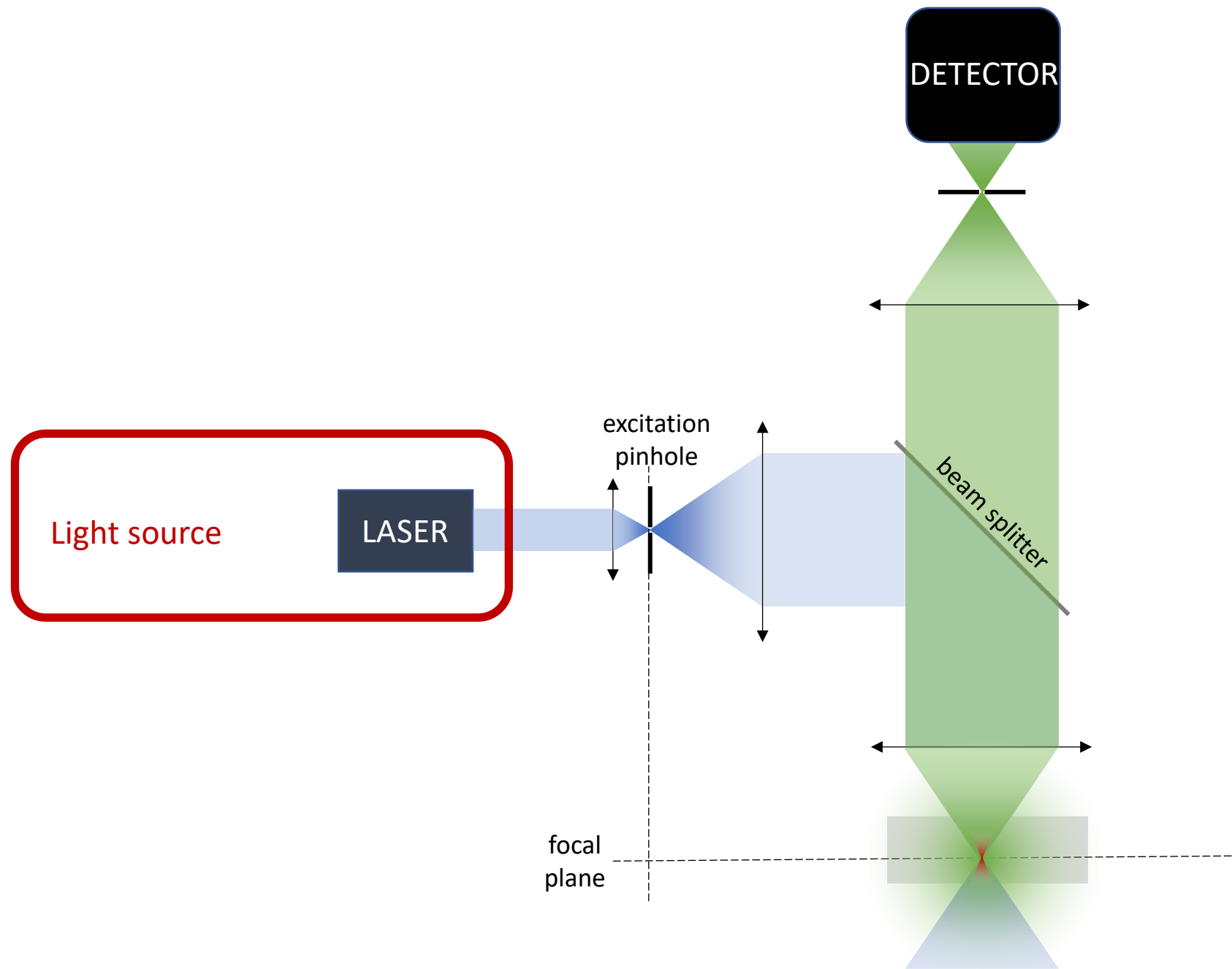
Leica TCS SP5



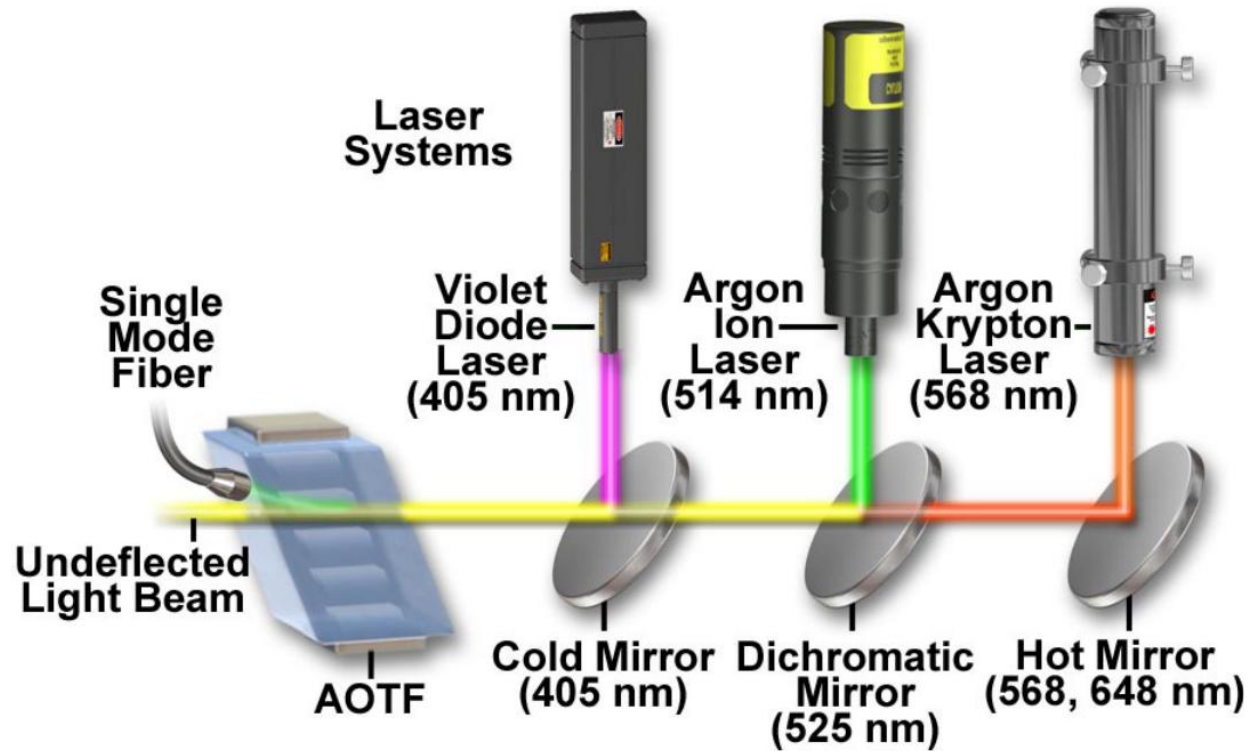
0.5 AU



Leica TCS SP5







e.g. Argon laser:

351.1 nm, 363.8 nm, 454.6 nm, 457.9 nm, 465.8 nm, 476.5 nm,
 488.0 nm, 496.5 nm, 501.7 nm, 514.5 nm, 528.7 nm, and
 1092.3 nm

He-Ne laser:

633 nm; Stimulated emissions are known from over 100 μm in the far infrared to 540 nm in the visible.

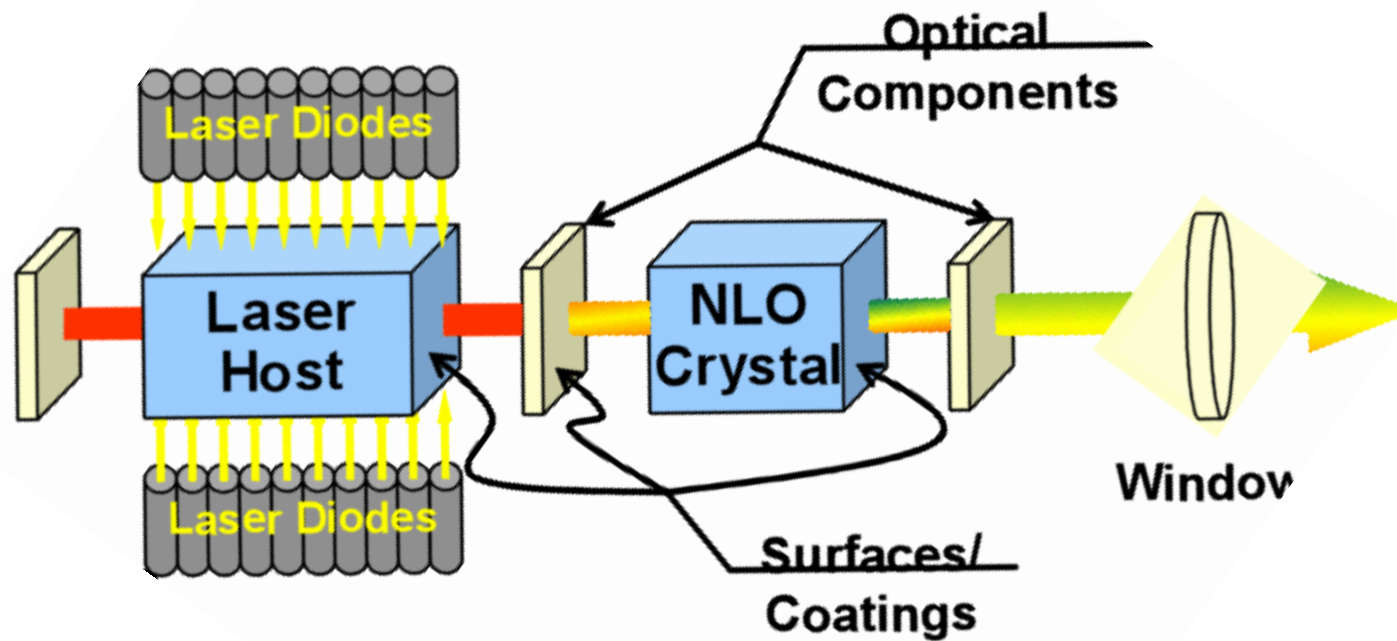
laser diode (LD, also injection laser diode or ILD, or diode laser)

405 nm

is a semiconductor device similar to a light-emitting diode in which a diode pumped directly with electrical current can create lasing conditions at the diode's junction.



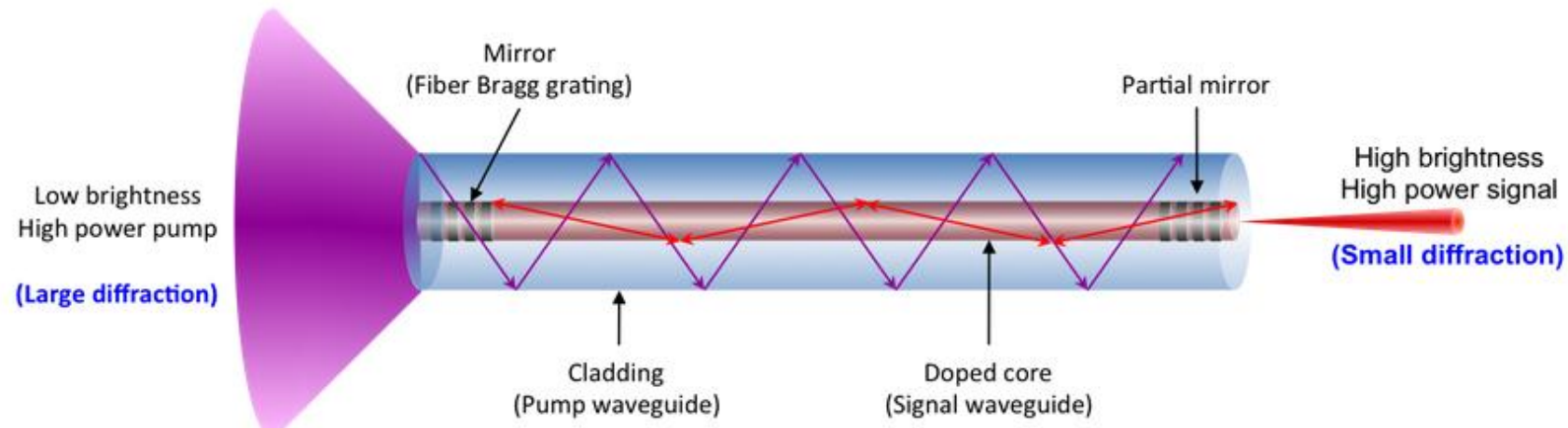
A diode-pumped solid-state laser (**DPSSL**) is a solid-state lasers



Hopkins, F. & Fernelius, Nils & Goldstein, Jonathan & Zelmon, David & Leininger, Christopher. (2005). Advances in nonlinear optical crystals. Proceedings of SPIE - The International Society for Optical Engineering. 5912. 10.1117/12.617016.

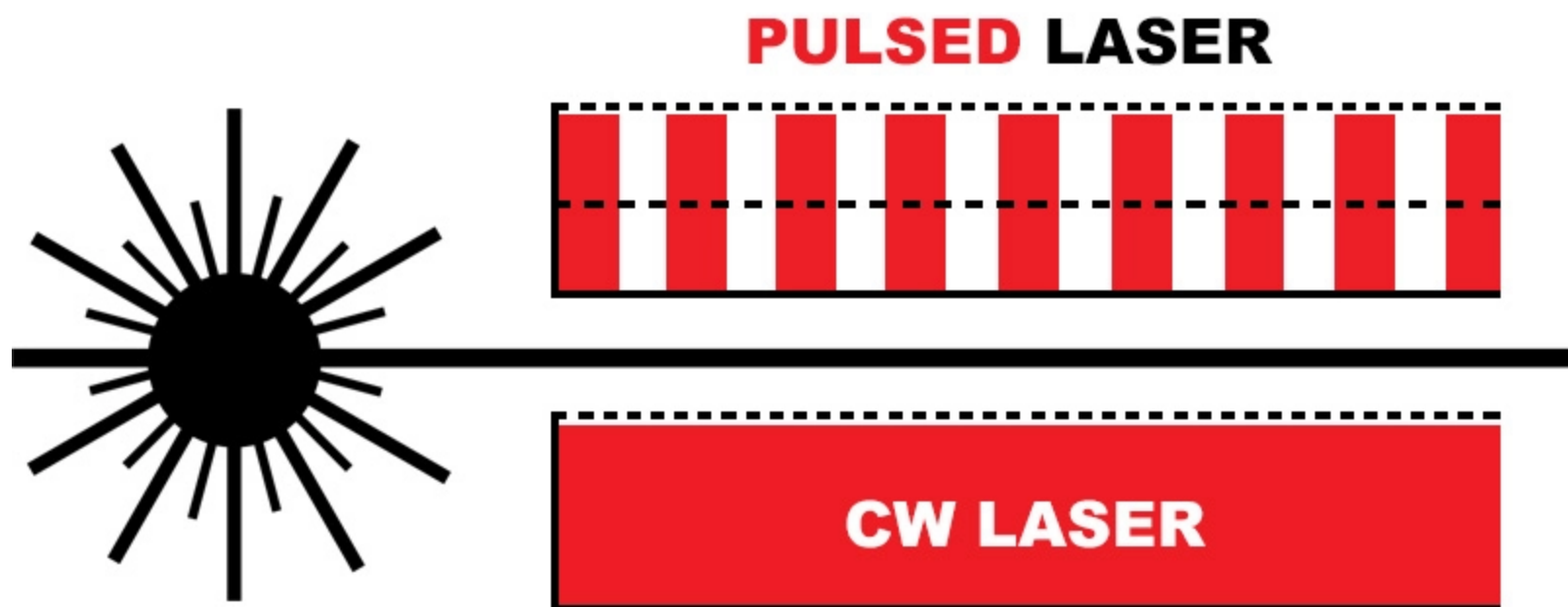
Fiber lasers

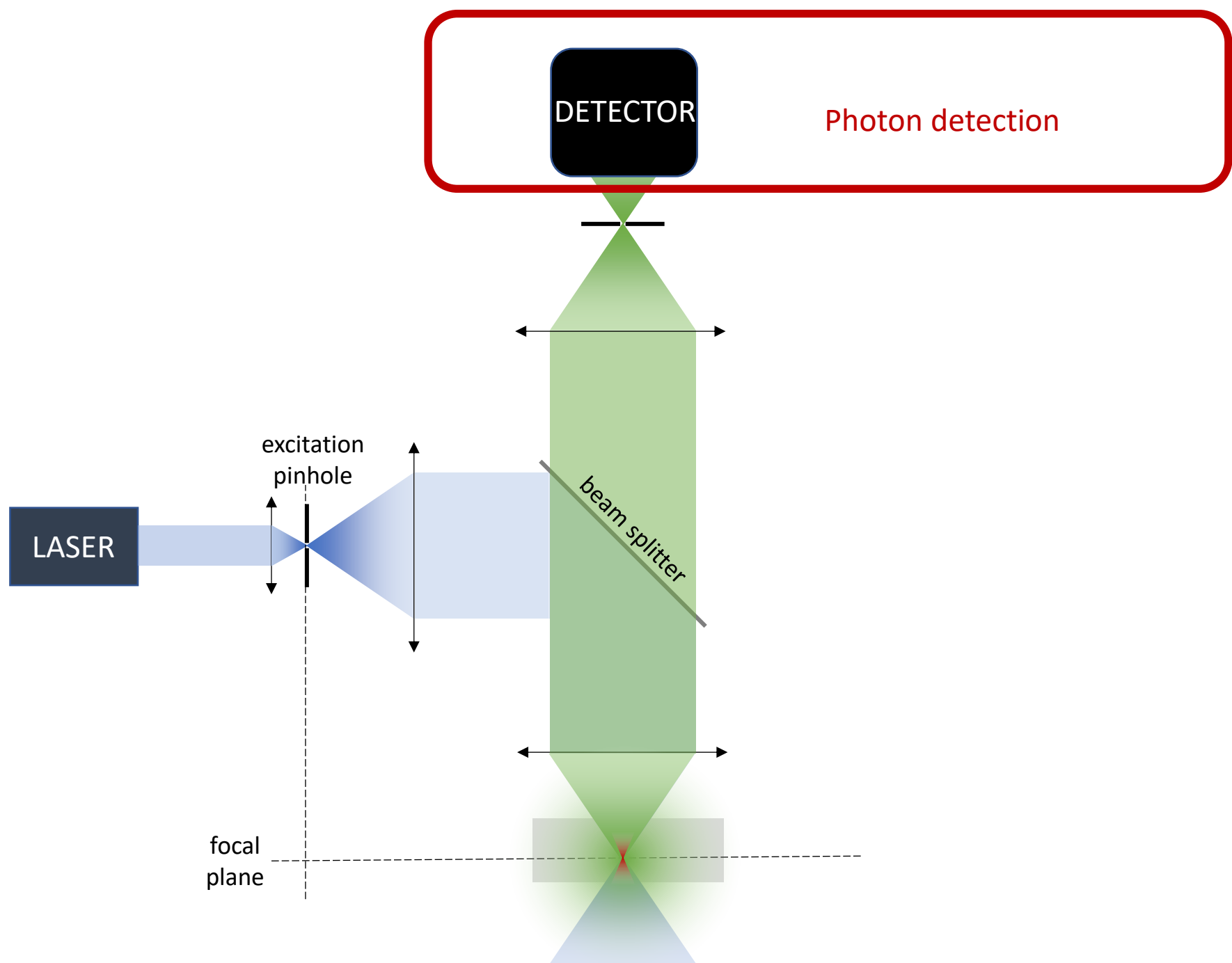
A fiber laser is a laser in which the **active gain medium is an optical fiber** doped with rare-earth elements such as erbium, ytterbium, neodymium, dysprosium, praseodymium, thulium and holmium.





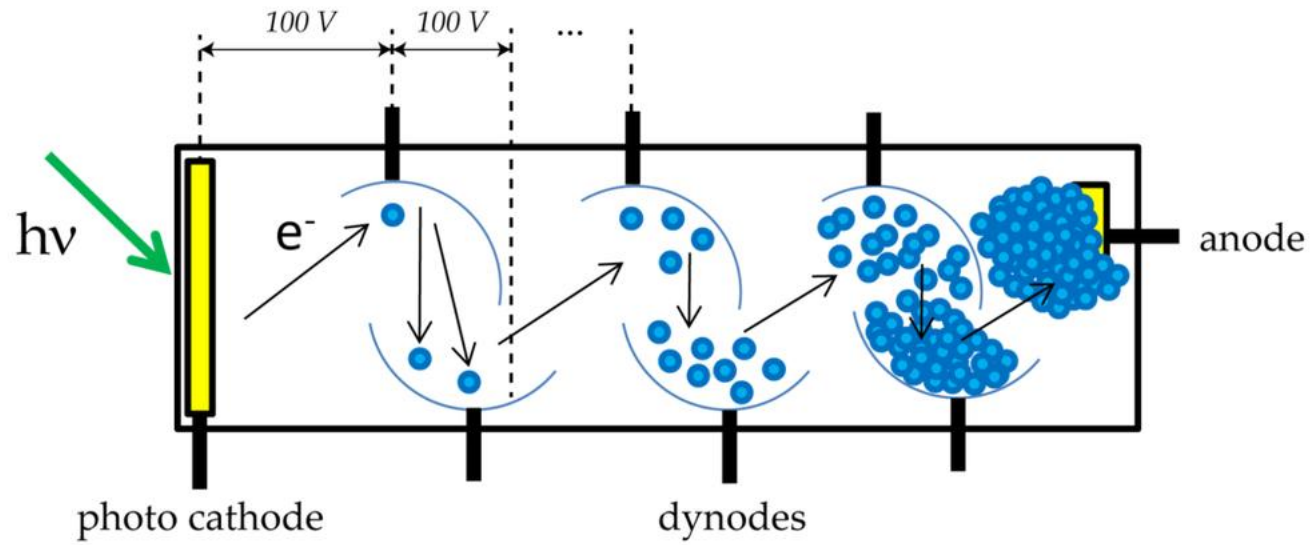
SC-450
Supercontinuum Fibre Laser System





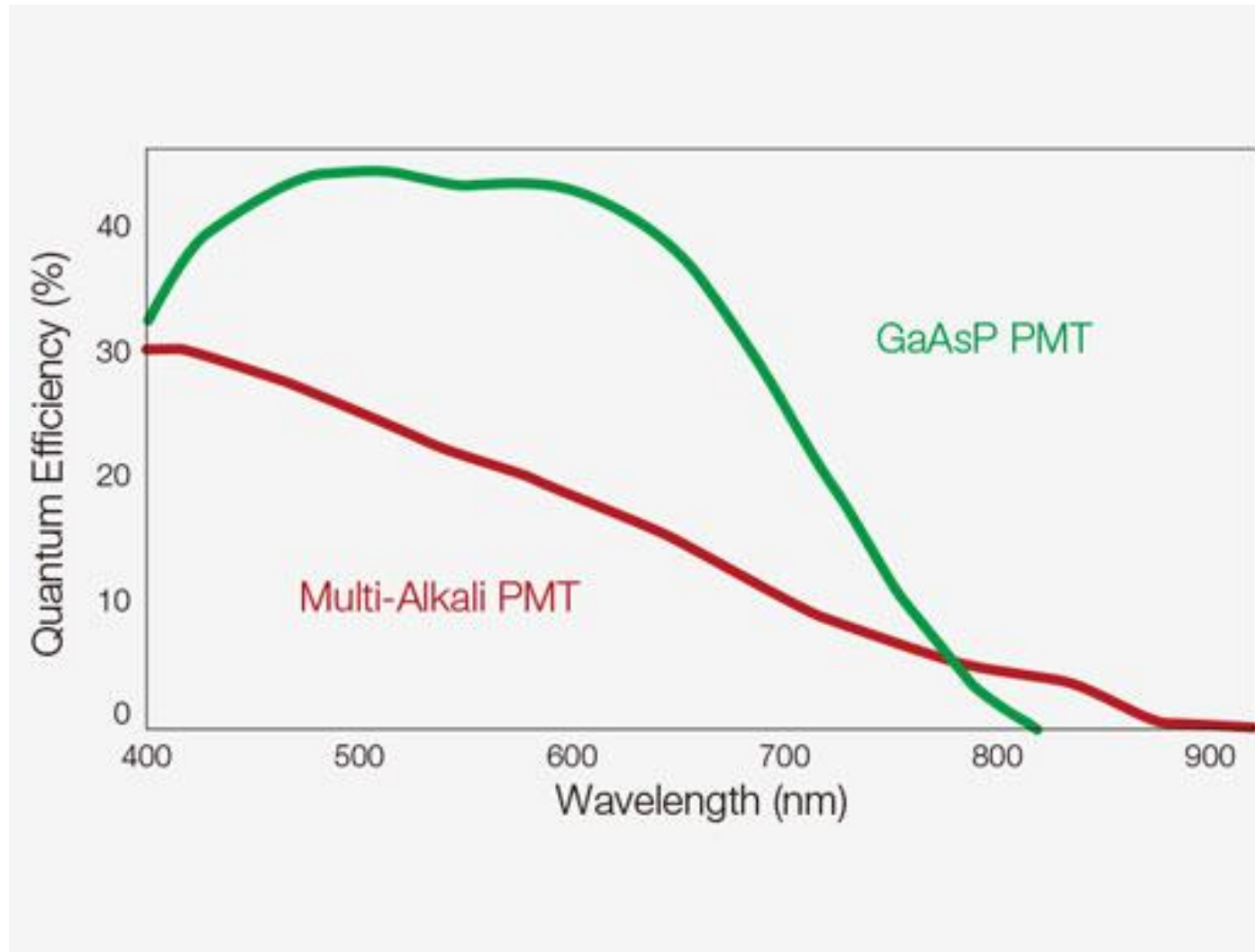
PMT detector

Photomultiplier tube



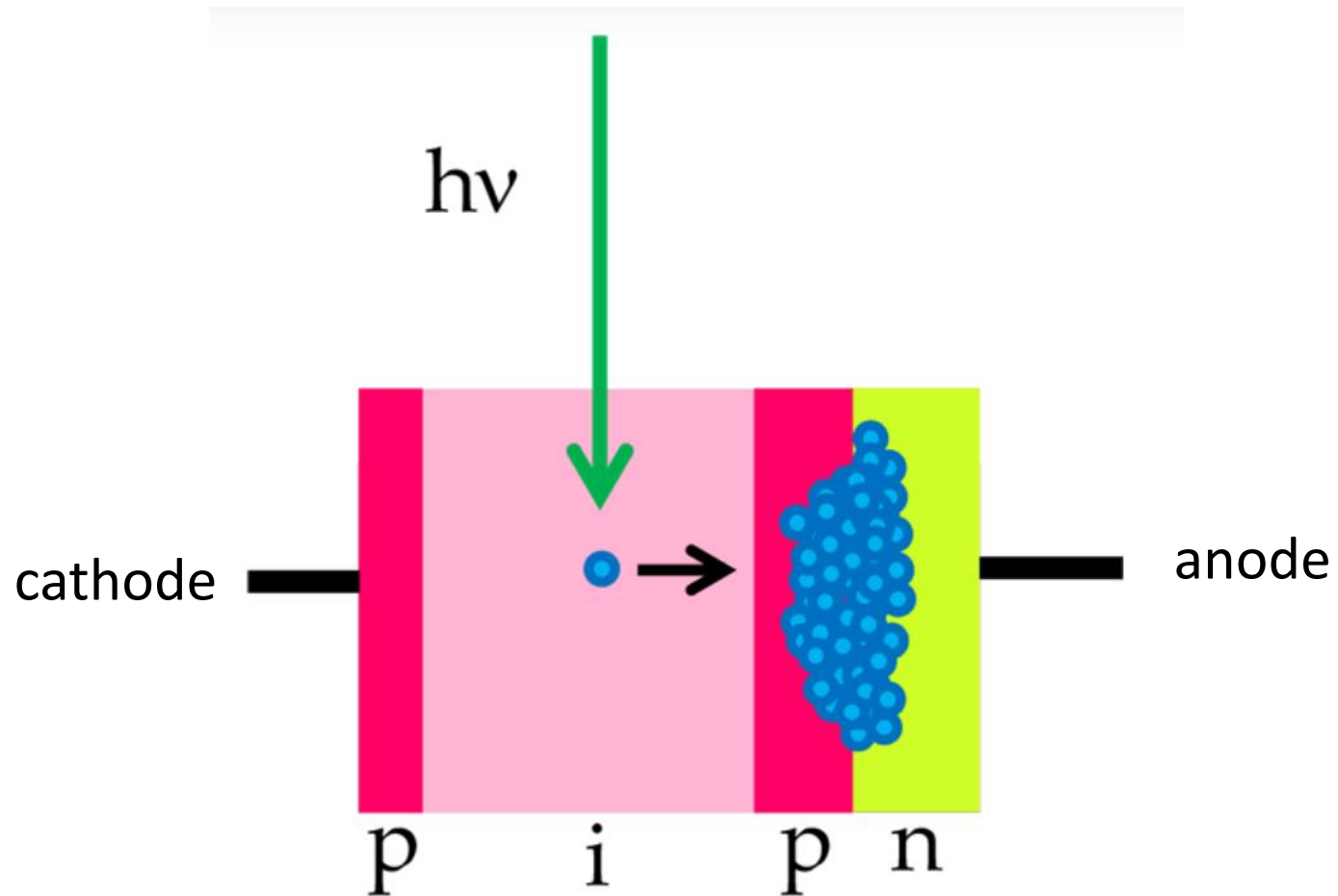
25 ns
17 MCP

“classic” PMT detector vs. **GaAsP PMT** detector spectrum sensitivity



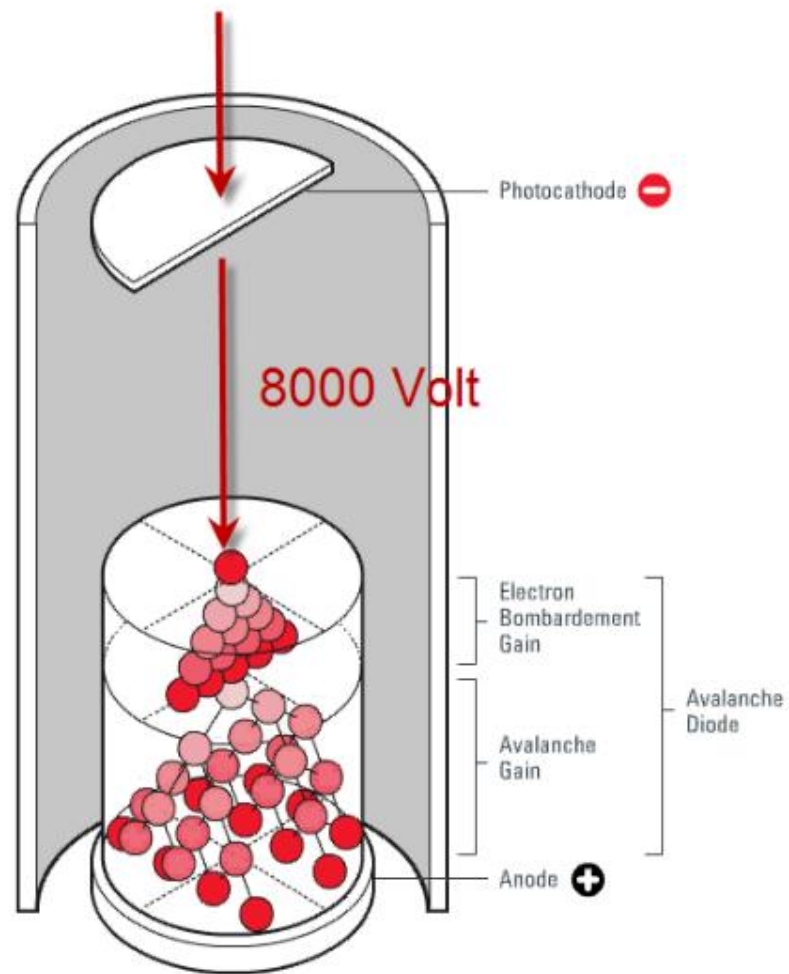
APD detector

Avalanche photo-diode



HyD

Hybrid Detector



HYBRID DETECTOR TECHNOLOGY



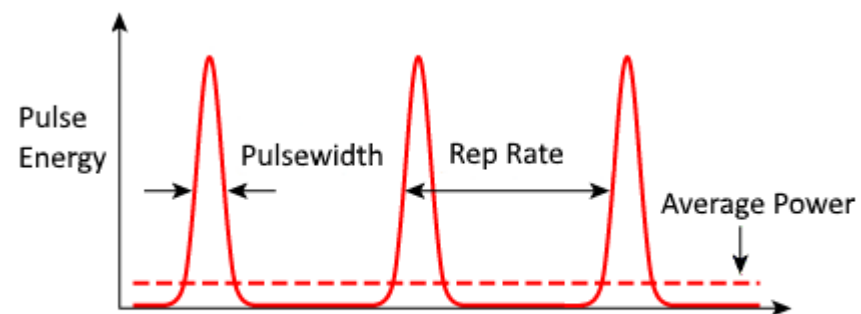
1.6 ns
60 MCP

HyD Information Overview

Standard and Photon Counting mode secret's reveals

Information collected from Marco Meijering (Leica Microsystems)

Pulsed laser



Laser Pulses

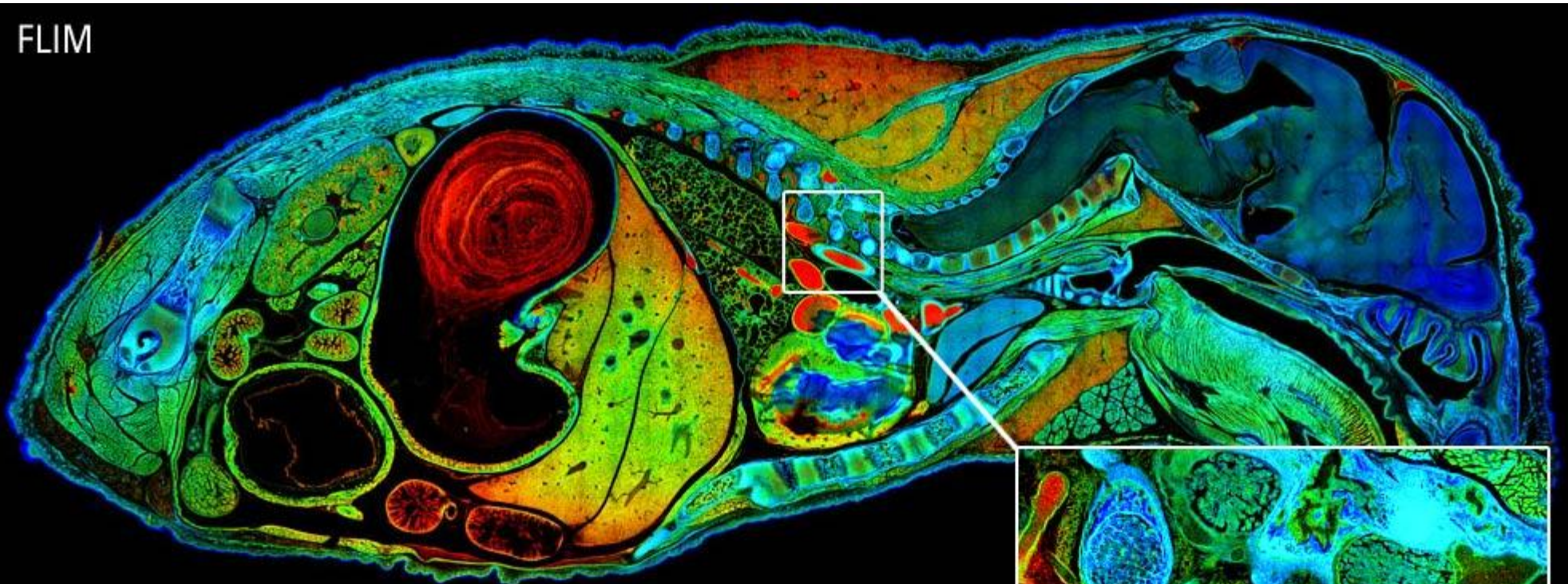
+

Single photon counting detectors with time resolve detection

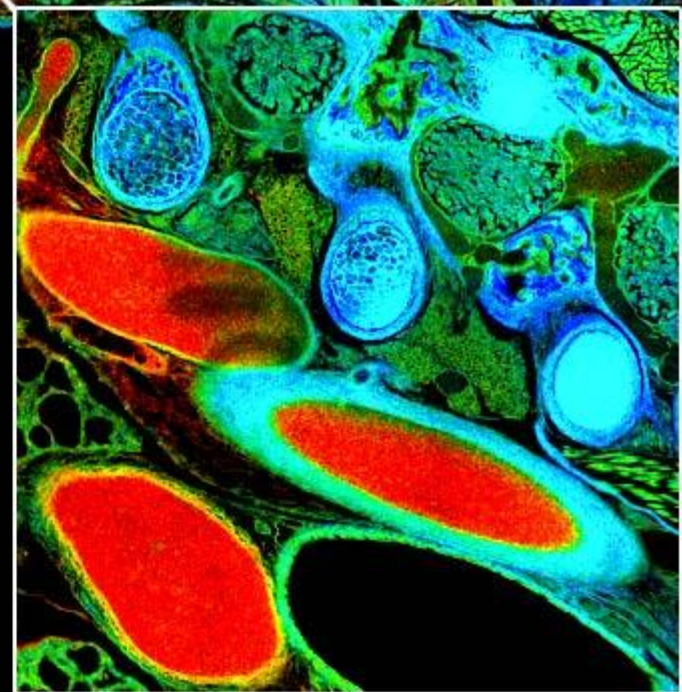
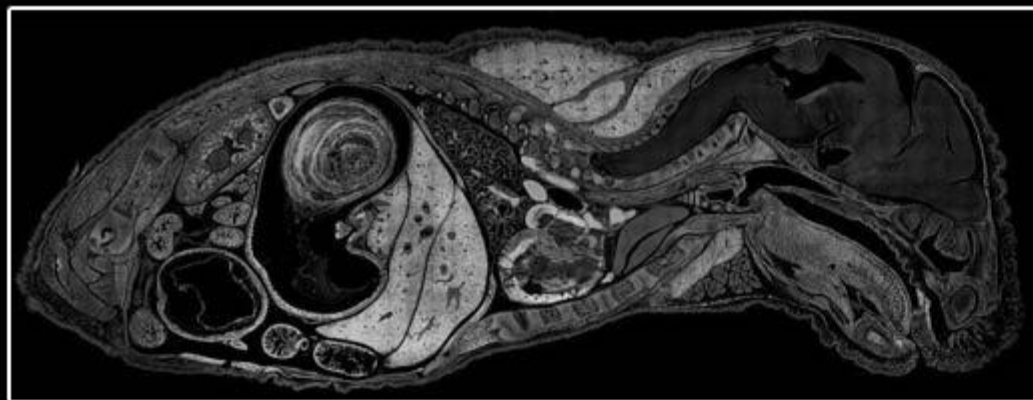
FLIM



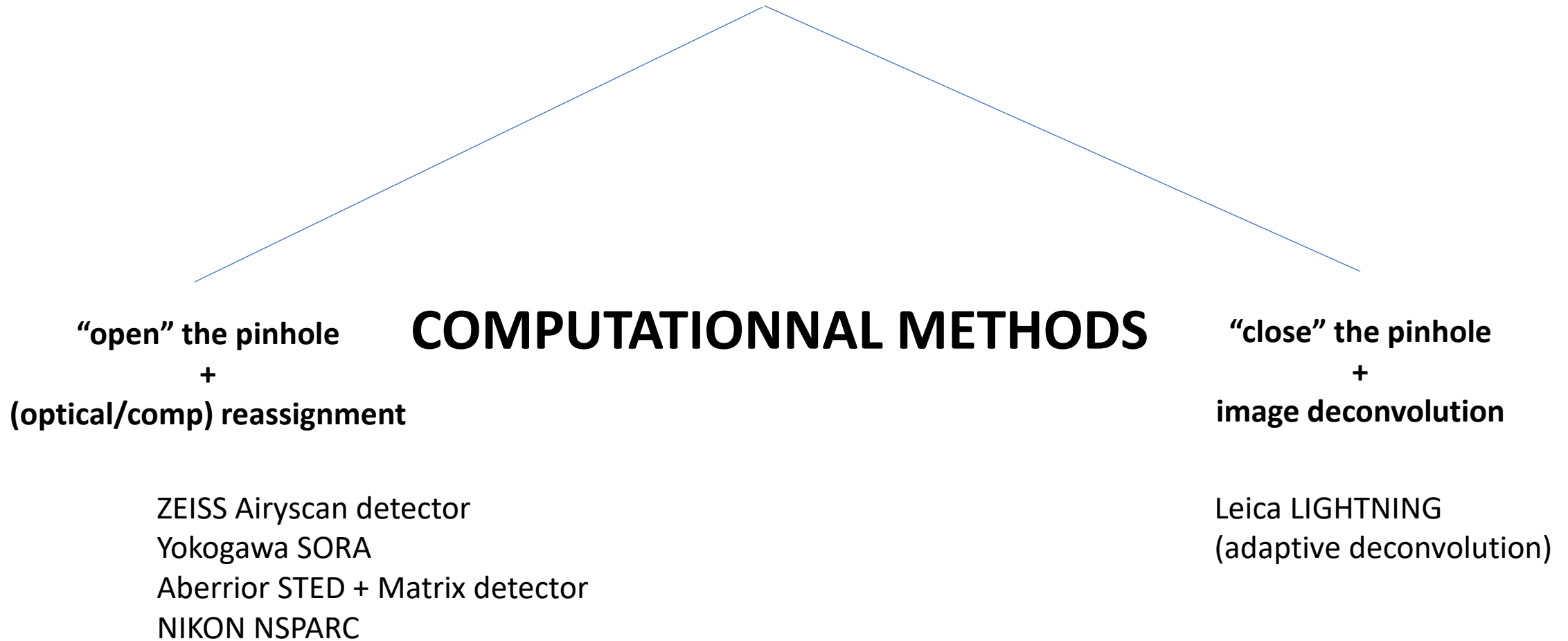
FLIM



INTENSITY



“SUPER-RESOLUTION” with the confocal microscope



THANK YOU FOR YOUR ATTENTION



[Hasbro Nerf roblox arsenal pulse laser](#)