



## Cleared Tiling LightSheet

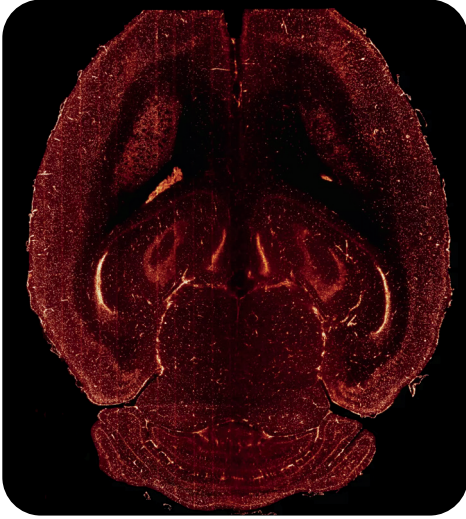


## High Speed High Resolution Imaging of Cleared Whole Organs

Cleared Tiling LightSheet (CTLS) is a large field microscope designed to image whole organs at high speed. CTLS creates a focused sheet with a narrow waist for better optical sectioning, then uses a spatial light modulator (SLM) to rapidly shift the waist of the sheet along the axis of propagation. A dual excitation setup allows imaging from right and left sides of the

specimen for optimal lightsheet projection throughout. Piezoelectric stages move the specimen in x, y and z with sub-micron resolution. The result is clear: a 1 cm<sup>3</sup> volume can be imaged at 1µm x 1µm x 5µm (XYZ) resolution in 9 hours and a cleared mouse brain can be imaged in as little as 3 hours.

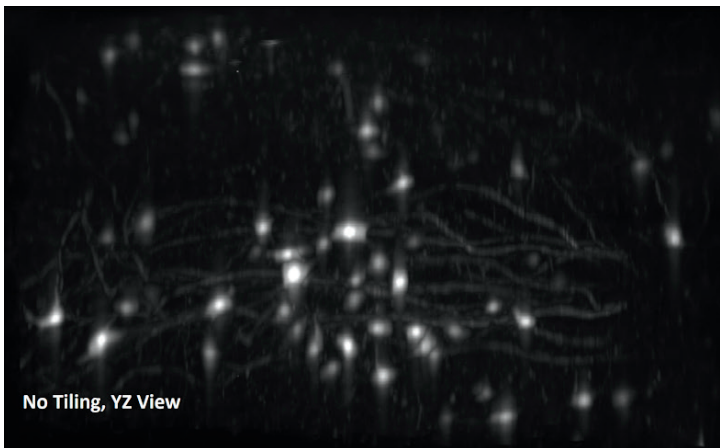
# How it works



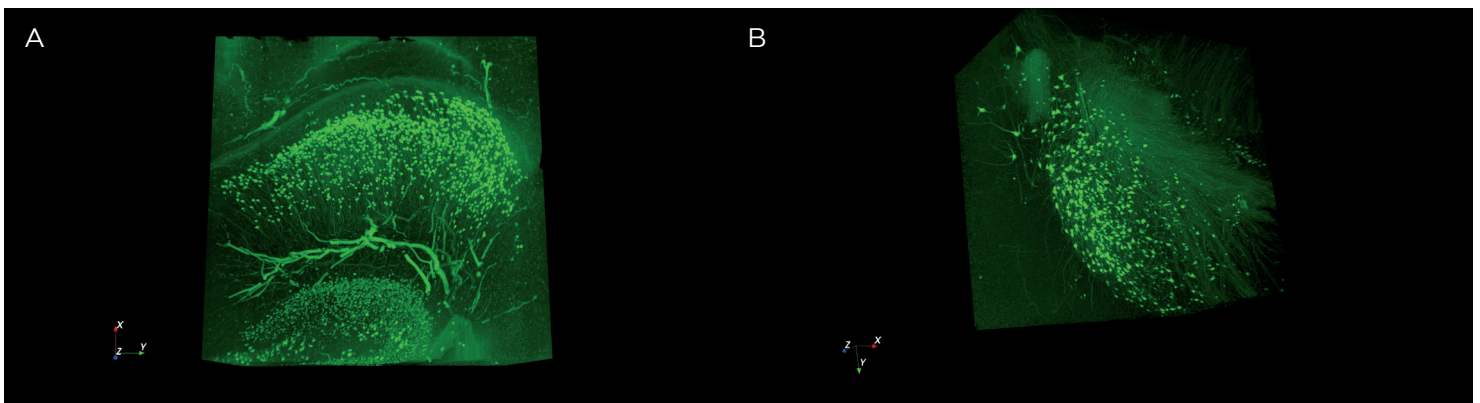
Blood vessels in a whole mouse brain shown in a XY fly-through. Specimen cleared with PEGASOS and imaged by CTLS.

Lightsheet microscopy can be a powerful technique for imaging large specimens by taking full advantage of emerging tissue clearing methods. The chemistry behind these techniques has advanced to where we can easily penetrate 1, 5 even 10mm into a specimen with a focused sheet of light. In combination with a macro zoom microscope using high NA large field of view lenses, Cleared Tiling LightSheet can image large field sizes with high resolution in short periods of time.

The Cleared Tiling LightSheet takes macro lightsheet microscopy to a new level by applying tiling technology. We start with a high NA beam to make a necessarily short but thin lightsheet, then step the beam waist across the field of view using a spatial light modulator. The sweet spot of the sheet is digitally shifted across the field of view and the best section or "tile" of each image is retained. The resulting data has excellent x/y resolution from the macro objectives, excellent axial resolution from the thin waist of the lightsheet, low photobleaching due to the use of lightsheet vs. confocal, and is captured quickly due to a large format macro objective and large format sCMOS camera.



CTLS offers multiple tiling modes to give users flexibility to balance their specimen biology with concerns of speed, file size and axial resolution. A single tile can be used for fast whole organ imaging in an hour or less. A six tile pattern reduces the sheet thickness from  $\sim 25\mu\text{m}$  to  $\sim 10\mu\text{m}$  giving significant improvement in signal to noise and axial resolution. A twenty tile pattern further reduces the sheet thickness to below Nyquist for the objective and gives the ultimate S/N and axial resolution.



(A) Hippocampus, and (B) substantia nigra of thy1-GFP adult mouse cleared with PEGASOS and imaged by CTLS

# Key Features

## **DUAL LEFT AND RIGHT ILLUMINATION**

Allows for optimal sheet penetration across wide specimens and avoidance of opaque structures that may be present on one side but not the other

## **HIGH NA / LARGE FIELD OF VIEW / LONG WORKING DISTANCE OBJECTIVES**

Apochromatic macro lenses at 1x/0.25NA and 1.5x/0.37NA can image through any cleared organ with excellent resolution

## **PIEZO STAGES DRIVING MULTIPLE SAMPLE CHAMBERS**

Sub-micron resolution stages allow precise positioning of the specimen in sample chambers sized to fit the biology

## **LASERSTACK LASER COMBINER**

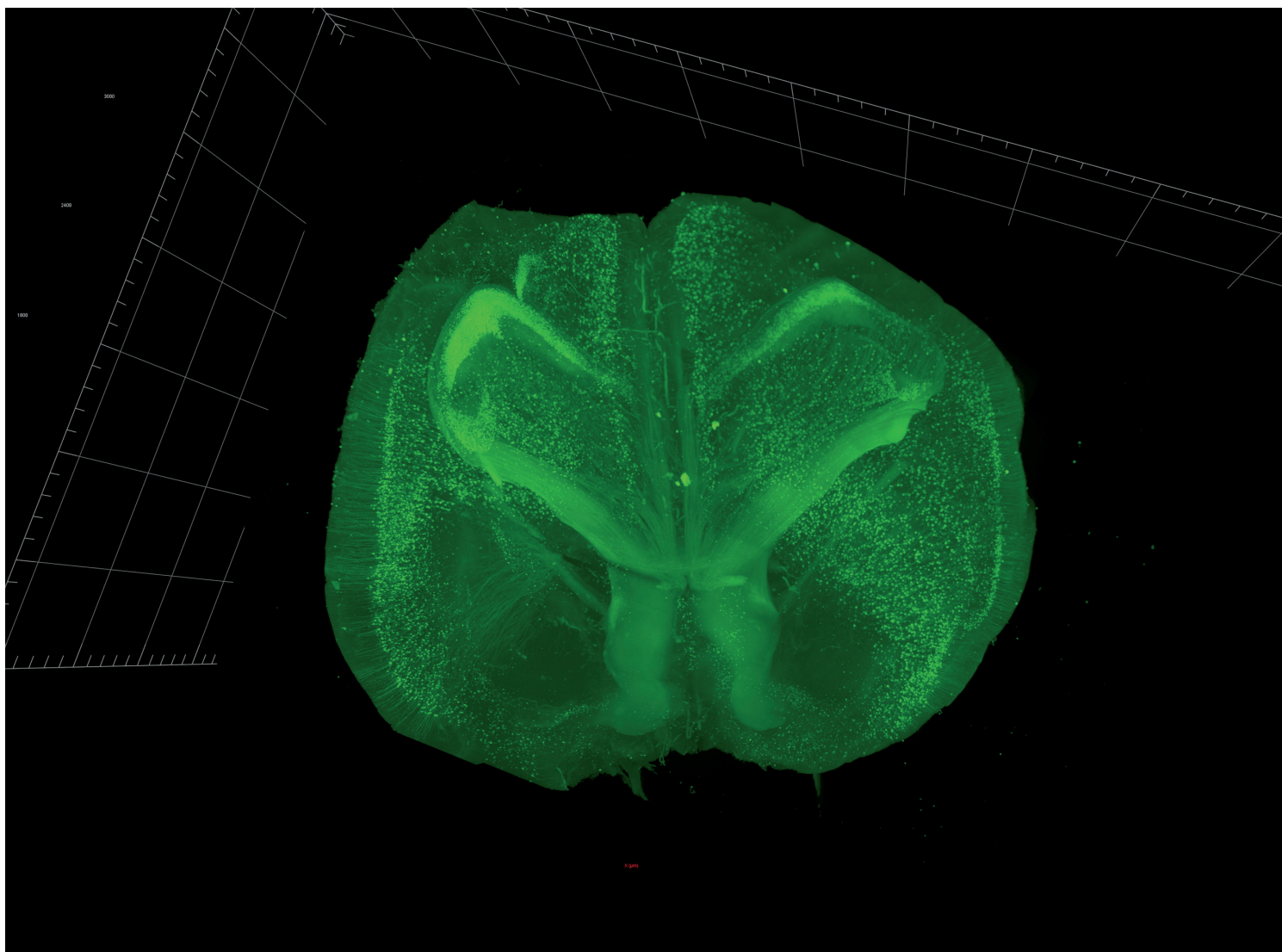
Fiber coupled laser combiner allows up to six lasers covering the entire visible spectrum at multiple power levels

## **GPU-OPTIMIZED SLIDEBOOK SOFTWARE**

SlideBook directs all hardware synchronization and data capture, creating 3D datasets at over 1TB ready for analysis and rendering

## **LARGE DATA SOLUTIONS**

Available DDN® unified storage systems allow direct acquisition and analysis without time-consuming file transfers for 200TB to over 1PB

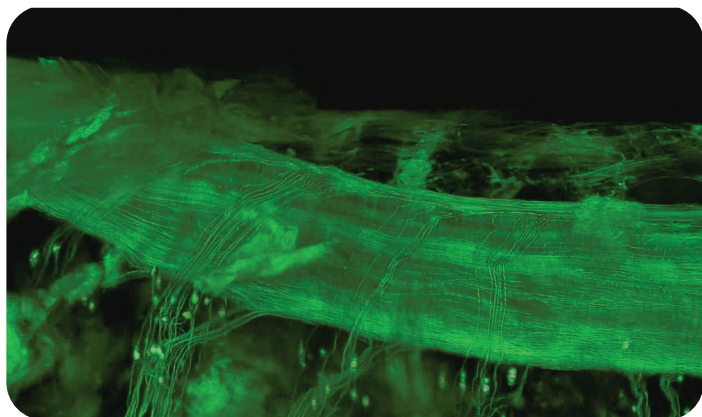


Whole brain of thyl-GFP adult mouse cleared with PEGASOS and imaged by CTLS

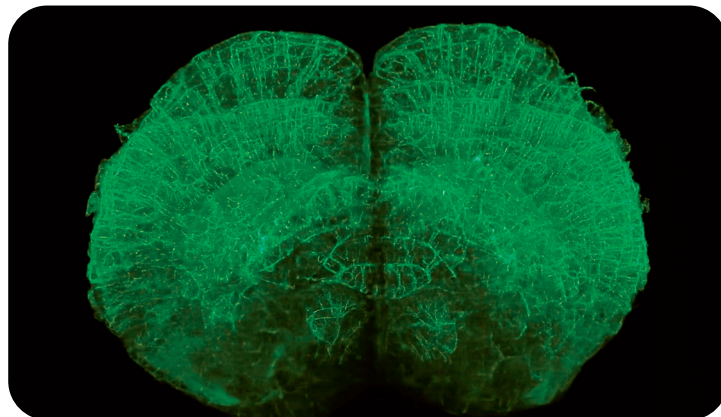


# Specifications

<b>RESOLUTION</b>	1 $\mu\text{m}$ x 1 $\mu\text{m}$ x 5 $\mu\text{m}$
<b>DETECTION NA</b>	0.25 - 0.37
<b>IMAGING SPEED</b>	< 1 min/mm <sup>3</sup>
<b>SPECIMEN SIZE</b>	1 mm up to 10 mm, larger holders available upon request
<b>SPECIMEN CHAMBER</b>	Thermally regulated chamber
<b>COMPATIBLE CLEARING METHODS</b>	Organic or aqueous clearing solutions
<b>CAMERA</b>	2048x2048 16-bit sCMOS
<b>LASER LINES</b>	LaserStack compact modular laser launch with up to 6 lasers from 405nm to 640nm
<b>XYZ TRANSLATION STAGE</b>	Piezoelectric with sub-micron resolution in X, Y and Z
<b>SOFTWARE</b>	SlideBook™ software for acquisition and GPU-accelerated analysis



Mouse spine. Specimen cleared with PEGASOS and imaged by CTLs.



Blood vessels in a whole mouse brain. Specimen cleared with PEGASOS and imaged by CTLs.



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