TECHNOLOGY OFFER

REVOLUTIONARY CONICAL LIGHT-SHAPING DEVICE FOR HIGH-PRECISION 3D-MICROSCOPY

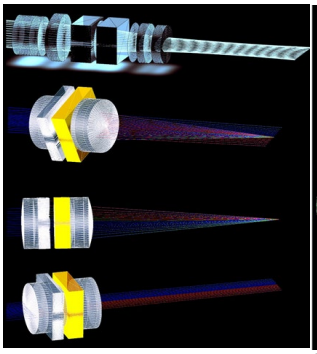
Precision light shaping has become a core technology for high-tech devices. Conical Light Shaping Technology (CLST) uses an innovative beam-shaping unit to yield a focused carpet of light with outstanding uniformity and precision. These super-thin light sheets have unique optical properties, which open new avenues for a great number of applications in 3D-microscopy and material processing far beyond our presented proof-of-concept.

BACKGROUND

Precise shaping of light using modern and classical optics technology still remains a technical challenge that is comparatively complex and expensive. Despite various methods for generating a plane of uniform light, there are challenging knots in achieving isotropic volumetric results. In light sheet-based 3D-microscopy, there is an urgent need for a sheet of light with minimum width, minimum divergence, and uniform intensity distribution along all axes, as they affect the quality of the results directly. In most commercial techniques using refractive optics for generating a thin plane of light, many undesired optical effects such as the existence of noticeable side lobes (side-shoulders) around the focal plane exist. They degrade the quality of the image and undermine the resolution substantially. Replacing refractive lenses with diffractive optical elements (DOE) is an alternative approach, however, the optical diffraction efficiency, parasitic diffraction orders, and high costs are among the disadvantages of solely using DOEs.

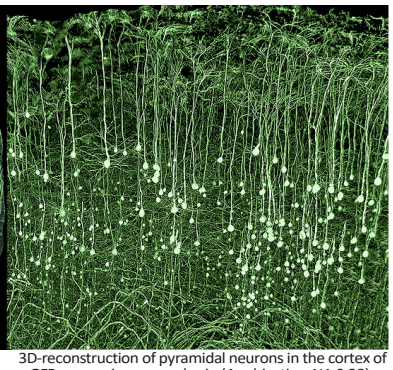
TECHNOLOGY

CLST, our revolutionary beam-shaping technology, is used in the development of an optical device that reshapes a symmetrical laser beam into a super-thin, parfocal light sheet with minimum beam width, extended Rayleigh Range, and minimum divergence. It is utilized for high-resolution 3D microscopy that yields 3D images with outstanding, almost isotropic resolution along all axes, superior to any standard light-sheet imaging systems currently on the market. In summary, our CLST-based light sheet microscope is a fast and highly precise, but yet affordable, system for imaging large biological samples (cm-size) on a cellular level of resolution.



Optical design of the meso-aspherical light-sheet generator

3D-reconstruction of an entire, chemically cleared GFP-expressing mouse brain (2x objective, NA 0.14)



3D-reconstruction of pyramidal neurons in the cortex of a GFP-expressing mouse brain (4x objective, NA 0.28)

ADVANTAGES

- Easy to handle
- High-resolution Non-invasive 3D-monitoring of biological samples
- Motion Computer Control System (MCCS)
- Diffraction-limit light sheet
- Equipped with the optically corrected objective for signal detection in various medium

WISSENS/ TRANSFER/ OST/

REFERENCE:
M014/2020

DEVELOPMENT STATUS:
Labscale proof-of-concept done; Prototype in development
TRL = 3

APPLICATIONS:
3D-Microscopy, Disinfecting surfaces using scanning sheet of high-energy light, Art restoration

KEYWORDS:
Light-sheet Microscopy,3D-imaging, nerve fiber, brain, Breast Cancer, Spinal cords

IPR:
WO 2022/129596
EP und US filed

OPTIONS:
R&D cooperation, Development partnership, License agreement

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