Leica TCS STED CW

The Fast Track to Super-Resolution

Technical Documentation

Living up to Life

Leica
MICROSYSTEMS

1. Inverted research microscope Leica DMI6000 CS
2. Scan head
3. Laser and power supply
4. Computer table
5. Air damped optical table
6. Control panel
7. Supply control
8. STED module
9. Housing for 592 nm STED depletion laser
10. APD detection unit (optional, recommended)
11. Microscope control

STED Module		
Mechanics		ultra stable and compact device, firmly fixed to scanner
STED Laser:	excitation:	internal Argon gas lasers (continuous wave), variable excitation wavelength
	depletion:	592 nm visible fiber laser (continuous wave)
Optomechanics		used imaging port UV-port (no UV available)
		modulation of depletion PSF, automated beam adjustment for perfect alignment
		of excitation and depletion laser, average duration: < 1 min., alignment inside the
		scanhead, no illumination by lasers of the sample during alignment

Specifications*

Microscope	inverted	Leica DMI6000 CS Trino/Bino
Z-drive	SuperZ galvanometer stage	1500 µm travel range/3 nm stepsize
	motorfocus (stand)	travel range depending on mechanics
		of microscope/15 nm step size
Lasers	VIS	diode 18 mW 442 nm
		Ar 100 mW 458, 476, 488, 496, 514 nm
		HeNe 1 mW 543 nm
		HeNe 2 mW 594 nm
		HeNe 10 mW 633 nm
		DPSS 10 mW 561 nm
STED depletion		VFL depletion 1.5 W
Optics	number of laser ports for imaging	3 (STED, VIS, IR)
	number of lasers for imaging	up to 8
	excitation – emission splitting	Acousto Optical Beam Splitter (AOBS®)
		or dichroic mirrors
	detection range	400...800 nm
	pinhole	alignment stable single pinhole
	pinhole diameter control	motorized by software, automatic mode available
Scanner	scanning concept	optically correct scanning at low inertia
	switch conventional – resonant scanner	conventional and resonant scanner
		in one system (optional)
	vibration insulation	active
Conventional (C)	max line frequency	2800 Hz
	min line frequency	1 Hz
	scan speed granulation	1400
	max frame rate 512 x 512	5 Hz
	max frame rate 512 x 16	50 Hz
	beam park	yes [no]
	max frame resolution	8192 x 8192 pixel
	scan zoom	1.0 ... 64x [2.0 ... 64x]
	pannning	yes
	field rotation	200° optical [no]
	field diameter	22 mm [min. zoom 2 for optimal STED performance]
Resonant (R)	max line frequency	16000 Hz
	min line frequency	8000 Hz
	scan speed granulation	1
	max frame rate 512 x 512	25 Hz
	max frame rate 512 x 16	250 Hz
		no
		1024 x 1024 pixel
		1.7 ... 64x [2.0 ... 64x]
		yes
		200° optical [no]
		15 mm [75 µm]

* Text in brackets: deviant specifications when system is used in STED mode

Specifications*

Scan modes	t	yes (conventional scanner)
	xt	yes
	xλ	yes
	xyt	yes
	xyλ	yes
	xz	yes
	xzλ	yes
	xyz	yes
	xyzλ	yes
	xyt	yes
	xzt	yes
	xyzt	yes
	xytz	yes
Detection	emission separation	highly sensitive prism spectral detector
	max spectral confocal channels	5
	tunability of emission bands	yes
	tuning steps of emission bands	1 nm
	sensors	high sensitivity low noise PMT: R 9624
		ultra sensitive Avalanche Photo Diodes (APD): 2 [1] (optional)
		high speed CCD Camera: Leica DFC360 FX, fully integrated (optional)
	digitization	12 or 8 bit per channel
	max grey resolution	16 bit imaging
	read out frequency	40 MHz
	transmitted light detector	optional, allowing BF, DIC, Ph etc
	non descanned transmitted light channels	1 – 2 (optional)
	non descanned reflected light channels	1 – 2 (optional)
Electronics	scanner control	digitally at high performance (FPGA, field programmable gate arrays)
	trigger out functions	yes
	computer	high performance PC workstation
		programmable control panel with LCD function & value display
Software	general	intuitive and guiding user interface
		context sensitive online help system
		multi-dimensional data acquisition
		region of interest (ROI) scan
		excitation line/frame sequential scan
		emission spectrum recording
		quantification tools
		multi-color restoration, spectral unmixing
		general time lapse experiment control tile scanning (mosaic scan)
		fully integrated STED control
Software options	Live Data Mode	Interactive data recording also allowing job-sequencing and
		online evaluation
	Advanced Mark & Find	combines Mark & Find with sophisticated 3D recordings,
		Live Data Mode etc.
	3D visualisation	maximum and other projections, simulated fluorescence process,
		rotation animations, stereo pairs, red-green anaglyphes,
		height color coded extended depth of focus images etc.
	Colocalization	histogram based colocalization and area measurements
	Deconvolution	deconvolution option for widefield images, confocal images
	MicroLab	FRAP wizard, FRAPxt wizard, FLIP wizard, FRET SE wizard,
		FRET AB wizard etc.

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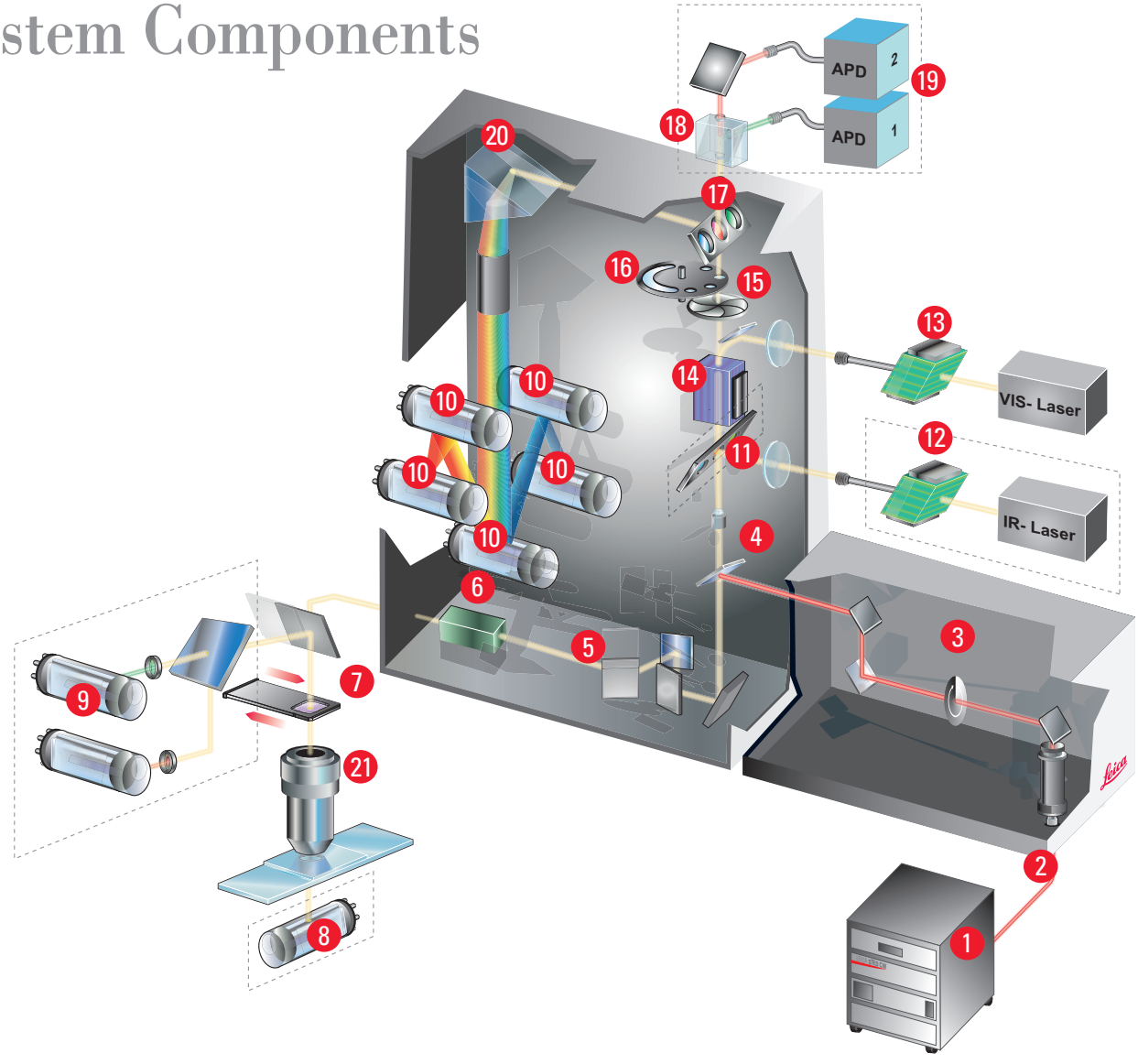
System Components



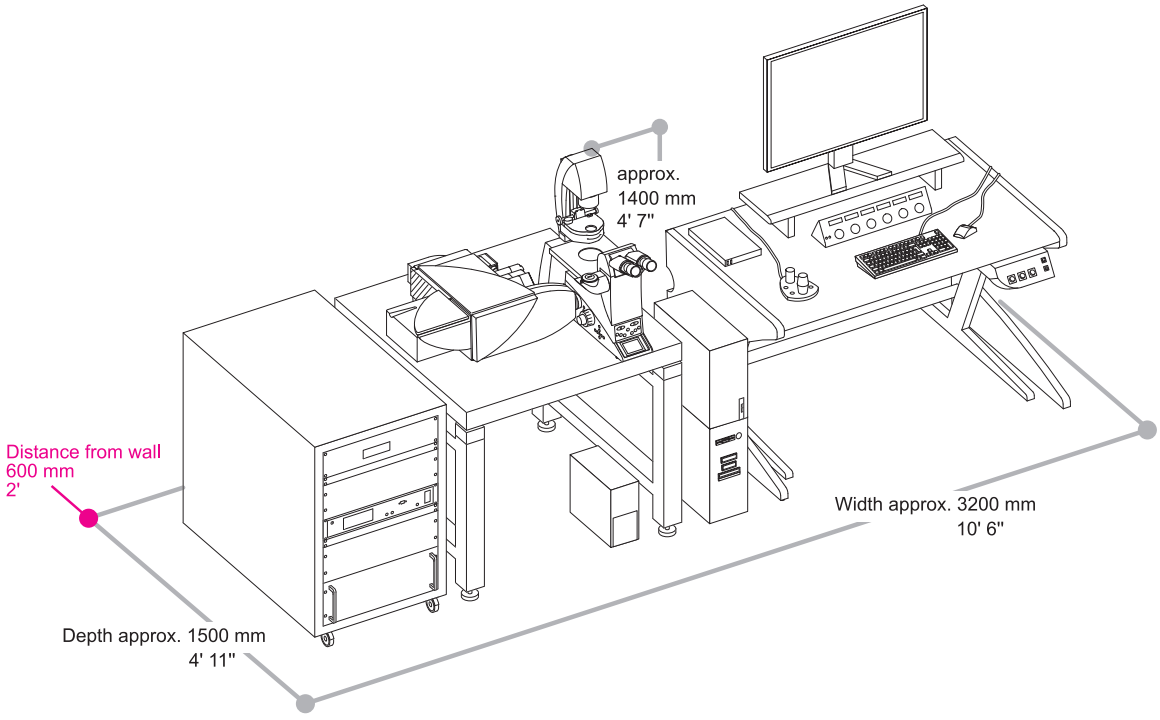
1. Housing for 592 nm depletion laser, AOTF, electronics
2. Fiber
3. Helical vortex phase filter
4. Incoupling STED dichroic
5. Tandem Scanner
6. Field rotation optics
7. Quarter wave plate
8. Transmitted light detector
9. Reflected light detectors
10. Photomultipliers
11. Multi-function port
12. IR EOM
13. Visible range AOTF
14. AOBS
15. Confocal detection pinhole
16. Filter- and polarizer wheel incl. notch filters
17. X1 emission port
18. APD filter cubes
19. Avalanche photodetectors
20. Spectrophotometer prism
21. STED objective lens

visible and ultraviolet radiation:

infrared radiation:

Installation Requirements

Including optical bench & IR laser system	500 kg
Heat load max	3.5 W
Electric supply	Minimum three separate phases:
	VIS lasers: 100…240 V AC ± 10%
	2 x 1600 VA, 50/60 Hz (Power Input 1 + 2)
	592 nm depletion laser: 100...240*-10, 2...1A
Environment	Temperature: 23°C ± 1°C
	Humidity: approx. 40 – 50% 1013 hPa
	Max floor vibration amplitudes:
	– frequency range 5...12.5 Hz: 30 µm/sec rms
	– frequency range > 30 Hz: 12.5 µm/sec rms
	Internet access for advanced remote diagnostics
	Room must comply with country-specific regulations
	for laser class IV
	Room darkening recommended
	Protect from dust
	(fiber length: 3 m) to minimize vibrations, noise and heat



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