

RAMOS CARS 3D scanning laser spectrometer



Common specifications

Spatial XYZ resolution of CARS signals (Objective lens: 60x, NA=1.2, watter immersion):	< 0.7 μm
Spatial resolution of Raman signals (excitation wavelength 633 nm; objective lens: 60x, NA=1.2, watter immersion):	XY: < 300 nm Z: < 700 nm
Spectral detectable range:	CARS signals: 985 – 5000 cm^{-1} Raman signals: 75 – 6000 cm^{-1}
Spectral resolution:	CARS signals: 7-8 cm^{-1} Raman signals: 0.25 cm^{-1} (grating 75 l/mm Echelle); 0.6 cm^{-1} (grating 1800 g/mm)
Scanning range (fast scanning mode, 60x lens)	XY: 225 x 225 μm Z: 80 μm
Control and automation:	Fully motorized

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Optical microscope

Type:	inverted
Model:	Nikon Ti-U
Stage:	motorized
- travel range:	114 x 75 mm
- accuracy (for 1 mm traveling):	0.06 μ m
- XY repeatability:	\pm 1 μ m
- minimal step:	0.02 μ m
Micro- objective lens:	60 x NA-1.2 water immersion 20 x NA-0.45
Z-scanner:	
- type:	piezo scanner
- lens movement range:	80 μ m
- minimal step:	50 nm
- Reapetability:	< 6 nm
Illuminator for reflection mode:	Halogen lamp 100 W
Illuminator for transmission mode:	LED
Laser input port:	motorized triple turret
High resolution digital video camera:	
- type:	digital color CCD camera
- sensor:	1/2", 2048 x 1536 pixels
- ADC:	10 bit, 12 frames per min

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CARS excitation laser system

Single module optical parametric laser system consisting of:	
Picosecond solid state Nd:YVO4 laser	
Output wavelength:	1064 nm
Pulse duration:	6.5 ps
Output power:	6 W
Pulse repetition rate:	85 MHz
Mode composition:	TEM00
Beam quality (M2):	< 1.5
Beam diameter:	2 mm
Tunable SOPO (Synchronously pumped Optical Parametrical Oscillator)	
Wavelength tuning range:	690 - 990 nm
Output power:	> 400 mW (at 800 nm)
Pulse duration:	5 - 6 ps
Pulse repetition rate:	85 MHz
Polarization:	horizontal
Mode composition:	TEM00
Beam quality (M2):	< 1.2
Beam diameter:	2 mm
Built-in delay tuning optical line	

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Laser for Raman spectroscopy

Laser type:	CW HeNe
Wavelength:	632.8 nm
Average output power:	> 10 mW
Polarization:	linear
Beam diameter:	0.65 mm
Beam divergence:	< 1.24 mrad

Main optical unit

Optimized optics for spectral range:	400 - 1100 nm
Polarization analyzer:	Glan-Taylor prism
Laser beam attenuator:	variable neutral density filter 0 - 3D
Pinhole lens positioner:	three-axis (X, Y, Z)
CARS, Raman, fluorescence filters positioner:	five- position
Posotioner of dihoic mirrors:	six- position

Imaging monochromator / spectrograph MS5004i

Focal length:	520 mm
F number (input):	9.8
Horizontal magnification:	1.0
Vertical magnification:	1.0
Vertical spatial resolution:	< 20 μ m

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Flat field size:	28 x 5 mm
Stray light (20 nm from 633 nm laser line)	1 x 10 ⁻⁵
Diffracton gratings unit:	4-position motorized grating turret
Spectral resolution (wavelength 633 nm, CCD pixel size: 12x12 μm)	0.01 nm (Echelle grating 75 l/mm) 0.025 nm (grating 1800 l/mm)
Entrance spectral slit	motorized confocal pinhole, continuously adjustable from 0 to 1.5 mm
Output spectral slit:	motorized, width from 0 to 2 mm (continuously adjustable)
Ports:	1 input, 2 output
Detector (Raman, E-CARS, fast measurements)	Hamamatsu Photosensor module H7844 (with TE cooling)

Monochromator for fluorescence measurements (integrated with MS5004i)

Focal length:	100 mm
Input spectral slit:	motorized confocal pinhole
Output spectral slit:	fixed, width 4.2 mm
Diffracton grating:	600 l/mm
Spectral range:	400 - 920 nm
Linear reciprocal dispersion:	13 nm/mm
Detector	Hamamatsu Photosensor module H7844 (with TE cooling)

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Spectral CCD camera (Raman, E-CARS)

Type:	digital CCD camera
Photosensor:	back-thinned CCD sensor 2048 x 122 pixels
Pixel size:	12 x 12 μm
Photosensitive area:	24.576 x 1.464 mm (length x heigh)
Spectral sensitivity range:	from 200 to 1100 nm
Cooling with temperature stabilization:	two-stage Peltier (TE) cooling down to $-45\text{ }^{\circ}\text{C}$
ADC digitization:	16 bit
Sensitivity:	1 photon for 1 ADC count (at 650 nm)
Dinamic range:	at least 10 000

Fast scanning unit (X, Y)

Scanners:	Galvano-mirror scanners (X, Y)
Scanning model:	raster high speed and start-stop mode
Positioning accuracy:	$< 30\text{ }\mu\text{m}$
Scanning area:	$225\text{ }\mu\text{m} \times 225\text{ }\mu\text{m}$ (objective lens 60X)
Full frame scanning speed:	4 s/frame: 1000 x 1000 points

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Laser confocal microscope unit (Reflected)

Prepinhole lens positioner:	three -axis (X, Y, Z)
Confocal pinhole:	motorized confocal pinhole, continuously adjustable from 0 to 1.5 mm
Detector:	Hamamatsu Photosensor module H6780-01

F-CARS and transmitted signal registration system

Polarization analyzer:	Glan-Taylor prism
F-CARS filters positioner:	4-position, motorized
F-CARS signal registration detector:	Hamamatsu Photosensor module H7844 (with TE cooling)
Transmitted signal registration detector:	Hamamatsu Photosensor module H6780-01

Registration and processing control unit

Number of registration channels:	5
Number of simultaneously registered channels:	up to 5
PC connection interface:	Ethernet 100 Base-T (TCP/IP protocol)

Optical table

All components of the system based on the optical plate with the pneumatic vibrated insulating legs.

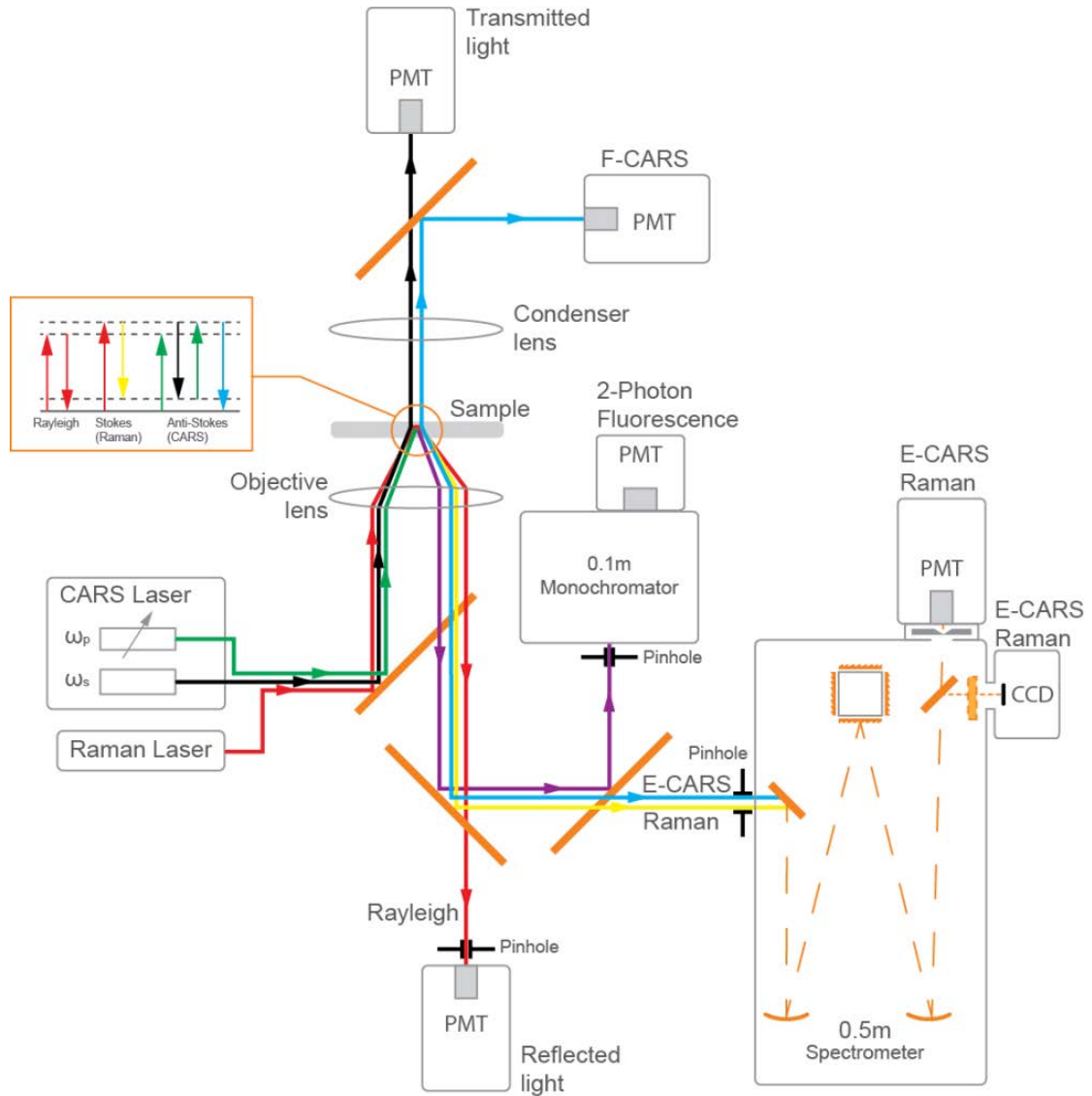
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