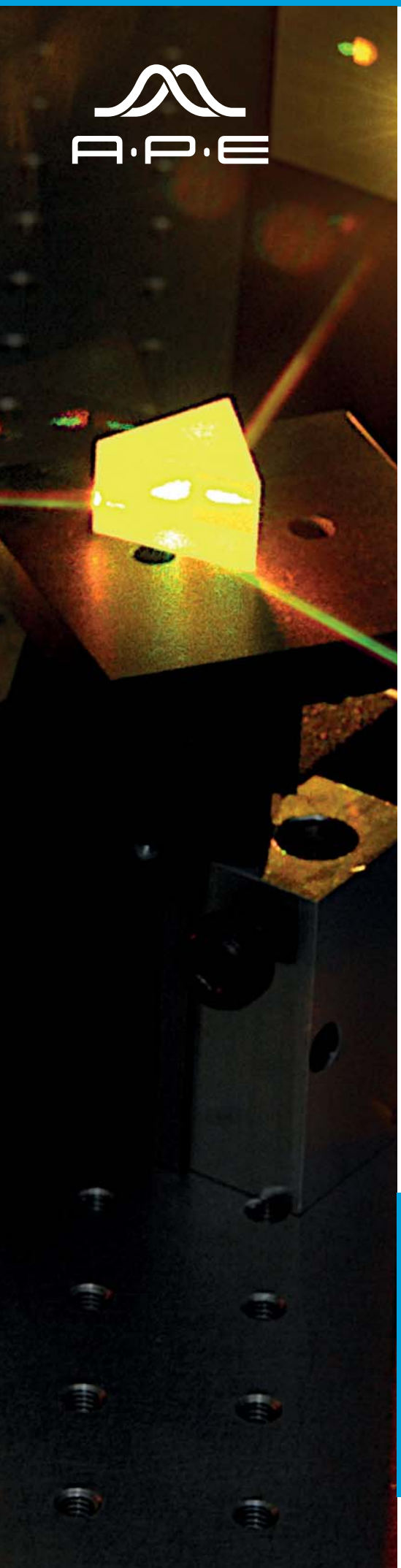


PRELIMINARY!

*pico*Emerald™ S

The *pico***Emerald**™ platform has been the first fully automated tunable picosecond light source in the near infrared with few picosecond pulse width.

The version *pico***Emerald™ S** is equipped with a new pump source offering shorter pulses of just **2 ps with 10 cm^{-1} spectral width**, compared to the original *pico***Emerald** version offering 6 ps.

The instrument is based on A·P·E's long standing experience in building OPOs (optical parametric oscillators) combined with its expertise in electronic control and automation making the *pico***Emerald™ S** an everyday easy to use instrument in a biological, medical, or physics lab.

The *pico***Emerald™ S** enables the shortest pulses possible for highest signal level while maintaining best spectral resolution in ps Coherent Raman measurements. At the same time, combination with SHG and multiphoton fluorescence measurements as multimodal imaging approach is enhanced by using shorter pulses.

The *pico***Emerald™ S** combines a picosecond OPO and its pump laser incorporated in a single housing with an integrated software control run from a Panel PC with a graphical user interface (GUI). It can be completely remote controlled by a user software or a microscope through a simple RS-232 interface. The optics´ modules are optimized by finite element analysis and mechanical stability algorithms (misalignment sensitivity optimization) to obtain maximum passive stability of the sealed OPO compartment made in a monolithic design. The RS-232 allows the integration of the *pico***Emerald™ S** into larger software run and controlled experiments. For fast remote diagnostics, the *pico***Emerald™ S** has service capability via the internet using a LAN interface.

- Fully remote controlled and hands-free
- Entire coverage of Raman fingerprint region 720 … 9000 cm^{-1}
- 2 ps with 10 cm^{-1} spectral width, ideal for ps-Coherent Raman
- Modulation of 1031 nm beam up to 20 MHz optional for video rate SRS imaging
- Extremely low noise comparable to solid state laser pumped OPOs

automated hands-free green pumped ps OPO

The OPO generates narrowband picosecond pulses from 700 ... 960 nm and 1120 ... 1960 nm with pulse widths of about just 2 ps. A part of the undepleted fundamental pump laser beam at 1031 nm is available as well.

The wavelength of the OPO Signal is selected through the GUI and the actual wavelength is measured with a built-in real time high resolution spectrometer.

The system is actively and passively stabilized, ideally suited for long time experiments. To accommodate latest experimental needs, not limited to the above applications, a wavelength sweep function for spectra acquisition has been added allowing to tune from a set start wavelength to a set end wavelength automatically in short time. Either with a predefined hold at each spectral step, or with advance for each step on a software trigger.

The three beams (OPO Signal, OPO Idler, and 1031 nm pump laser fundamental) are available individually or at the same time in various combinations overlapped in space from a single beam output. They are also temporally overlapped via an internal delay line. The delay line is variable and computer controlled to allow few tens of picoseconds delay variation to accommodate possible dispersion which the beams of different wavelengths may be exposed to when propagating through optical elements, e.g. in a microscope.

The above features make the *pico***Emerald**™ **S** well suited for CARS (Coherent Antistokes Raman Scattering) Microscopy, and the availability to modulate the 1031 nm beam (optional) enable novel variants of Raman Microscopy like SRS (Stimulated Raman Scattering) as well.

More applications are waiting to take advantage of the above features.

Optionally are SHG and THG of OPO Signal and Idler available as well as FHG of OPO Signal supplied in an additional housing (**HarmoniXX** series of frequency converters).

Wavelength sweep function

- For rapid spectra acquisition from short to long wavelengths
- User defined hold time on each wavelength position
- Or external software trigger (RS-232) for advance from step to step
- Real time measurement of spectra by internal high resolution laser spectrometer

- Integration into remotely controlled experiments
- Three output wavelengths perfectly overlapped in space and time monitored by sensors
- Jitter-free pulse generation
- Constant power control loop
- Ideally suited for CARS and SRS microscopy (optional modulation of the 1031 nm beam available)

Concentrate on your experiment, not the light source.

automated hands-free green pumped ps OPO

PRELIMINARY!

Specifications

Tuning ranges:	
OPO Signal[1)]	700 ... 960 nm
Idler	1120 ... 1960 nm
Δν Signal - Idler	1440 ... 9000 cm^{-1}
Δν Signal - 1031 nm	720 ... 4500 cm^{-1}
Wavelength sweep	typ. 5 s per wavelength step[2)]
Output power:	
Signal (@ 720 ... 960 nm)	> 500 mW
Idler (@ 1150 ... 1350 nm)	> 400 mW
Laser fundamental @ 1031 nm	> 700 mW
Repetition rate	80 MHz
Pulse width:	
Laser fundamental @ 1031 nm	typ. 2 ps
OPO Signal	typ. 2 ps
Spectral bandwidth (Signal, 1031 beam)	< 1 nm (10 cm^{-1})
Time bandwidth product (Signal, Idler)	typ. 0.6
Beam waist diameter at OPO exit @ 817 nm	1.2 (± 0.2) mm
Beam divergency[3)] @ 817 + 1031 nm	1.0 (± 0.2) mrad
M^2 (OPO Signal, Idler)	< 1.2
M^2 (1031 nm)	typ. 1.2
Ellipticity	< 10 %
Pointing stability OPO Signal	< 100 µrad / 100 nm
Polarization	linear / horizontal > 100:1
Common output beam is selectable for OPO Signal and 1031 nm or OPO Signal and Idler with overlap in space and time.	
Computer interface	USB / RS-232
Beam height at exit	121 mm from base

1) The Signal range is limited to 780 ... 990 nm when using “Signal only” or “Signal + 1031 nm” (limitation by the output filter).

2) Wavelength sweep is performed from selectable start to end wavelength setpoint with a user defined step size (max. 2 nm).

3) Beam waist position approx. ~ 500 mm within housing.

Options

- Amplitude modulator for 1031 nm beam[1)]: a) AOM up to 1.5 MHz user adjustable
  b) EOM fixed to 10 or 20 MHz
  (please ask for details)
- Harmonic generation: SHG and THG of OPO Signal and Idler,
  FHG of OPO Signal

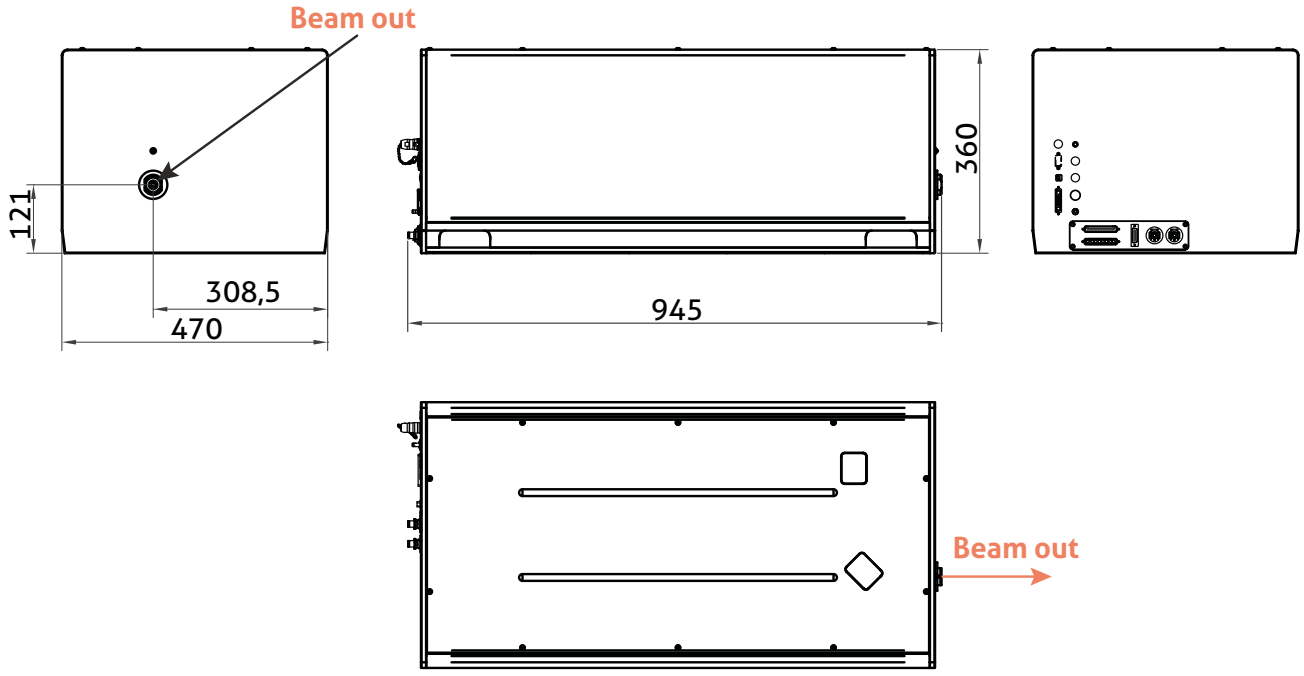
1) synchronized to the pulse train of the 1031 nm beam, with the possibility of a phase-lock

Power Consumption and Environmental Requirements

	Operational voltage	Max. power consumption
User interface (Panel PC)		
Power supply	100 … 240 V AC, 50 … 60 Hz	100 W
OPO optics unit		
Power supply	100 … 240 V AC, 50 … 60 Hz	100 W
Laser control unit		
Power supply	100 … 230 V AC, 50 … 60 Hz	400 W
Chiller	100 … 240 V AC, 50 … 60 Hz	400 W
Total heat dissipation		max. 1200 W
Ambient temperature during operation		+ 19 … 25 °C
Relative humidity during operation		< 60 %

Dimensions

OPO Optical unit (see drawing below)	945 x 360 x 470 (W x H x D in mm)
User interface (Panel PC)	234 x 41 x 128 (W x H x D in mm) (not depicted)
Laser control unit	19" | 4 U (not depicted)
Chiller	197 x 330 x 279 (W x H x D in mm) (not depicted)



Weight (in kg)

OPO optical unit	98
User interface (Panel PC)	2
Laser control unit and chiller	11 plus 10

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