

## NT230 SERIES NANOSECOND OPO.

### Applications

- Laser-induced fluorescence
- Flash photolysis
- Photobiology
- Remote sensing
- Metrology
- Non-linear spectroscopy
- Photo acoustic imaging

### Features

- Integrates DPSS pump laser and OPO into a single housing
- Hands-free no-gap wavelength tuning from 192 to 2600 nm
- High, up to 15 mJ pulse energy from OPO
- up to 100 Hz pulse repetition rate
- More than 2 mJ output pulse energy in UV
- Less than 5 cm<sup>-1</sup> linewidth
- 3 – 5 ns pulse duration
- Remote control pad
- PC control via USB/RS232 port and LabVIEW™ drivers

### Specifications <sup>1)</sup>

Model	NT230-50	NT230-100
OPO		
Wavelength range <sup>2)</sup>		
Signal	405–710 nm	
Idler	710–2600 nm	
SH generator (optional)	210–405 nm	
SF generator (optional)	300–405 nm	
SH/SF generator (optional)	210–405 nm	
DUV generator (optional)	192–210 nm	
Output pulse energy		
OPO <sup>3)</sup>	15 mJ	9 mJ
SH generator (optional) <sup>4)</sup>	2mJ	1.5 mJ
SF generator (optional) <sup>5)</sup>	2mJ	1.3 mJ
SH/SF generator (optional) <sup>5)</sup>	2mJ	1.5 mJ
DUV generator (optional) <sup>6)</sup>	0.3 mJ	0.2 mJ
Linewidth	<5 cm <sup>-1</sup> <sup>7)</sup>	
Tuning resolution <sup>8)</sup>		
Signal (405–710 nm)	1 cm <sup>-1</sup>	
Idler (710–2600 nm)	1 cm <sup>-1</sup>	
SH/SF/DUV beam (192–405 nm)	2 cm <sup>-1</sup>	

Pulse duration <sup>9)</sup>	2–5 ns	
Typical beam diameter <sup>10)</sup>	4 mm	
Typical beam divergence <sup>11)</sup>	<2 mrad	
Beam pointing stability <sup>12)</sup>	≤ 50 μrad rms	
Polarization		
Signal beam	horizontal	
Idler beam	vertical	
SH/SF/DUV beam	horizontal	
Pump laser <sup>13)</sup>		
Pump wavelength	355 nm	
Typical pump pulse energy	50 mJ	35 mJ
Pulse duration	2-5 (4–6) ns	
Beam quality	Hat-top in near field, without hot spots	
Beam divergence	<0.8 mrad	
Pulse energy stability (StdDev)	<3.5 %	
Pulse repetition rate	50 Hz	100 Hz
Nominal lifetime for pump diodes	5×10 <sup>9</sup> shots	
Typical warm-up time <sup>14)</sup>	5 min	
Physical characteristics		
Unit size (W × L × H) <sup>15)</sup>	451 × 640 × 152 mm	
Power supply size (w × L × H)	365 × 395 × 290 mm	
Umbilical length	2.5 m	
Maximal weight		
Laser head (without options)	55 kg ±10%	
Power supply	35 kg ±10%	
Operating requirements		
Water consumption (max 20 °c) <sup>16)</sup>	Built-in chiller	External chiller
Room temperature	15–30 °C	
Relative humidity	20–80 % (non-condensing)	
Power requirements	208 or 240 V AC, single phase 50/60 Hz	
Power consumption	<1.0 kVA	
Cleanness of the room	Not worse than ISO Class 9	

1) Due to continuous improvement, all specifications are subject to change ~~without notice~~. Parameters marked typical are illustrative; they are indications of typical performance and will vary with each unit we manufacture. Any order will be carried out according to our general terms and conditions of sale you will find on <http://www.ekspla.com/wp-content/uploads/GSC.pdf>. We do not accept customer's general terms and conditions of purchasing and supply deviating therefrom. Unless stated otherwise, all specifications are measured at 450 nm.

2) Hands-free tuning range is from 192 nm to 2600 nm.

3) Measured at 450 nm. See tuning curves for typical outputs at other wavelengths.

4) Measured at 260 nm. See tuning curves for typical outputs at other wavelengths.

5) Measured at 340 nm. SF generator is optimized for maximum output in 300–405 nm range. See tuning curves for typical outputs at other wavelengths.

6) Measured at the peak of tuning curve. See tuning curves for typical outputs at other wavelengths below.

- 7) Linewidth is  $<8 \text{ cm}^{-1}$  for 210–405 nm range.
- 8) For manual input from PC.
- 9) FWHM measured with photodiode featuring 1 ns rise time and 300 MHz bandwidth oscilloscope.
- 10) Beam diameter is measured at 450 nm at the  $1/e^2$  level and can vary depending on the pump pulse energy.
- 11) Full angle measured at the FWHM level at 450 nm.
- 12) Beam pointing stability is evaluated as movement of the beam centroid in the focal plane of a focusing element.
- 13) Separate output port for the 355 nm beam is standard. Outputs for 1064 nm and 532 nm beams are optional. Laser output will be optimized for OPO operation and specifications may vary with each unit we manufacture.
- 14) Starting from 22°C.
- 15) Please refer to dimensions table bellow.
- 16) Air cooled. Water cooled under request.

### Typical beam profile

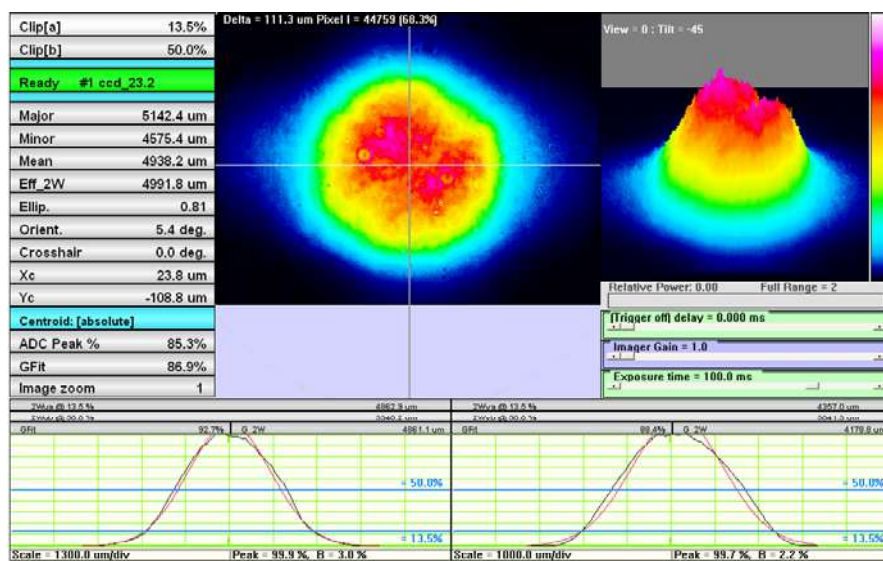


Fig1. NT230 series laser beam profile at 450 nm in near field

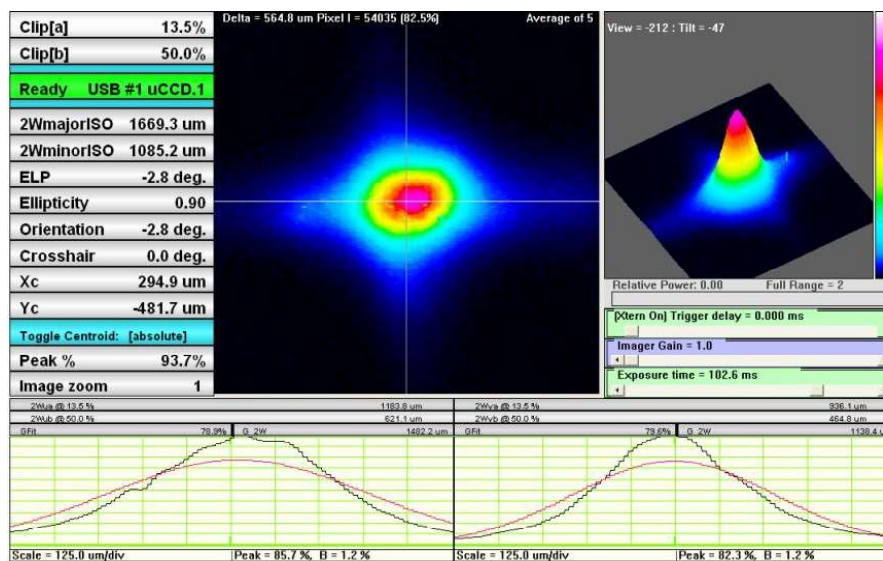
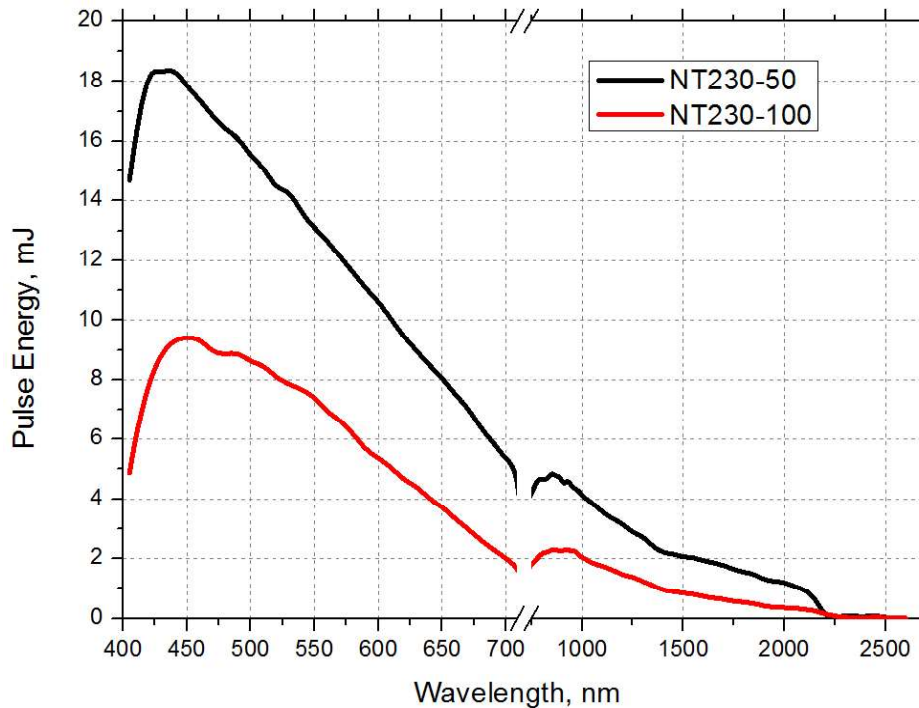


Fig2. NT230 series laser beam profile at 450 nm in far field

### Output energy



**Fig. 3.** Typical (**smoothed**) NT230-xx laser tuning curves in signal (405 – 710 nm) and idler (710 – 2600 nm) ranges.

### Features

#### *a) Laser head*

- Precision machined monolithic aged aluminum alloy chassis.
- Diode pumped pump laser with short unstable resonator and variable reflectivity output coupler.

#### *b) Power supply/Cooling cabinet*

- Includes control, communication, power units.
- Compact case. The front panel includes:
  - o Mains key-lock;
- Microprocessor control unit for laser operation control via remote control pad or PC interface.
- Power supply for harmonic generators' crystal heaters.
- Closed loop of deionized water for diodes and rods.
- Water to air heat exchanger, water-water option.

*\*Communication module allows control from Windows and non-Windows OS machines: Windows, Windows CE, Linux, LabVIEW RT and etc.*

#### *c) Remote Control functions*

- Internal operation mode:

- Laser operation control (ON/OFF);
- Internal or external triggering mode setting;
- Pump diode and Q-switch timing control;
- Q-switch burst mode (from 1 to 9999 pulses in the burst);
- Q-switch off mode (no laser output beam, diodes operating);
- Single shot mode;
- External operation mode using two external sync pulses
- Pump diode and Q-switch triggering with rise fronts of sync pulses;
- Control of delay between pump diode and Q-switch triggering by adjusting of the time delay between sync pulses

#### ***d) Software***

- Installable control, diagnostic and servicing Windows executable utility.

Remote control implemented through DLL calls. To support customer development, LabVIEW and C++ applications together with source codes are provided:

- LabVIEW drivers,
- Control panel application, Windows executable control application together with C++ sources.
- Some Delphi and Visual Basic examples that are not product specific and intended for demonstration of concept.
- PC interface module with USB/RS232 interface, remote control through Windows DLL function calls.
- Communication module\* adds the following interfaces:
  - USB - virtual serial port, ASCII commands
  - RS232 - ASCII commands
  - LAN - REST API
  - WLAN - REST API

#### **Safety**

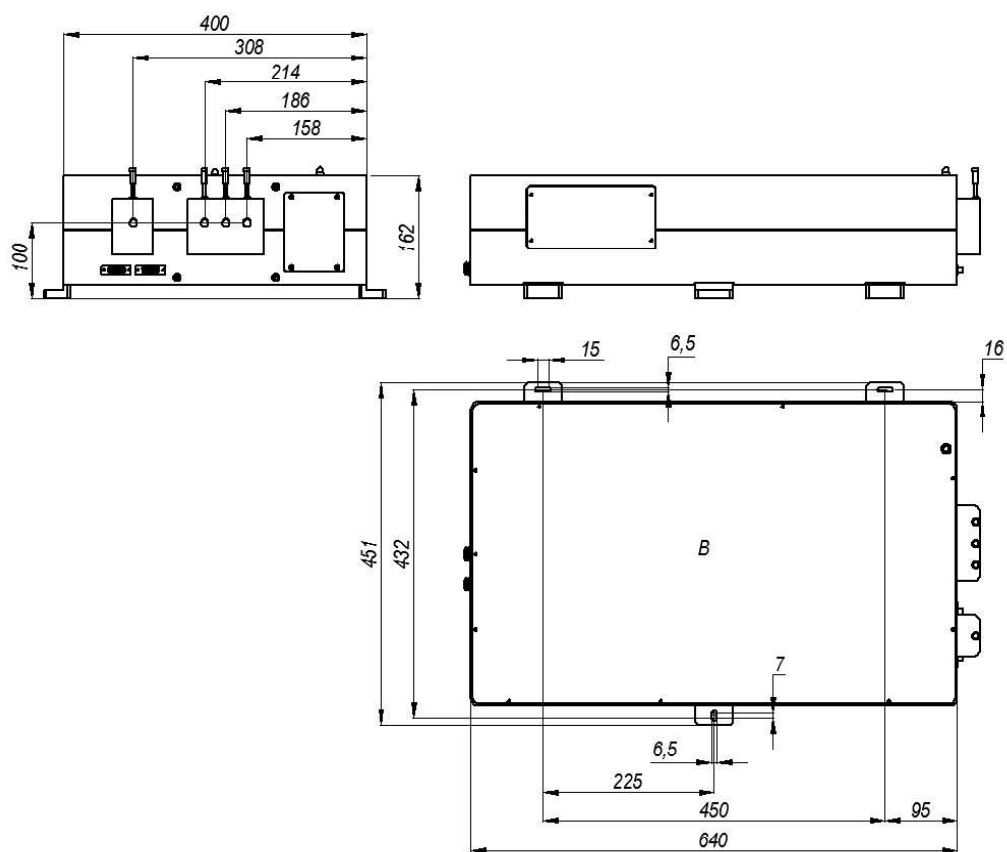
- Laser complies to IEC60825 and IEC61010 safety standards;
- Laser is class IV product according to IEC60825-1.

## Pictures

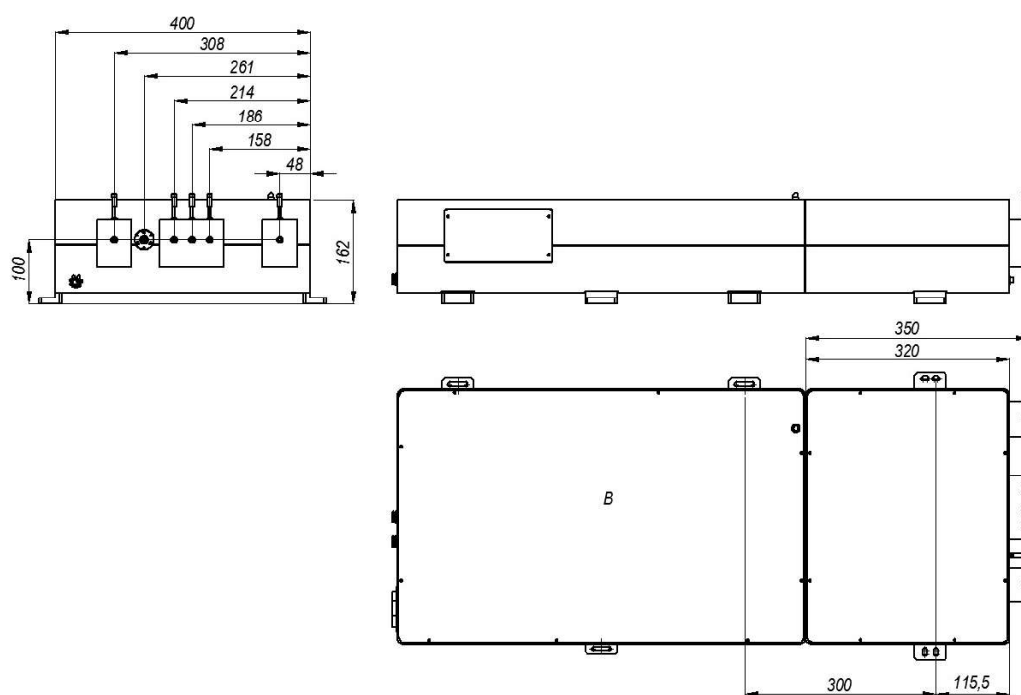


**Fig.4.** Outside view of the NT230-xx series laser.

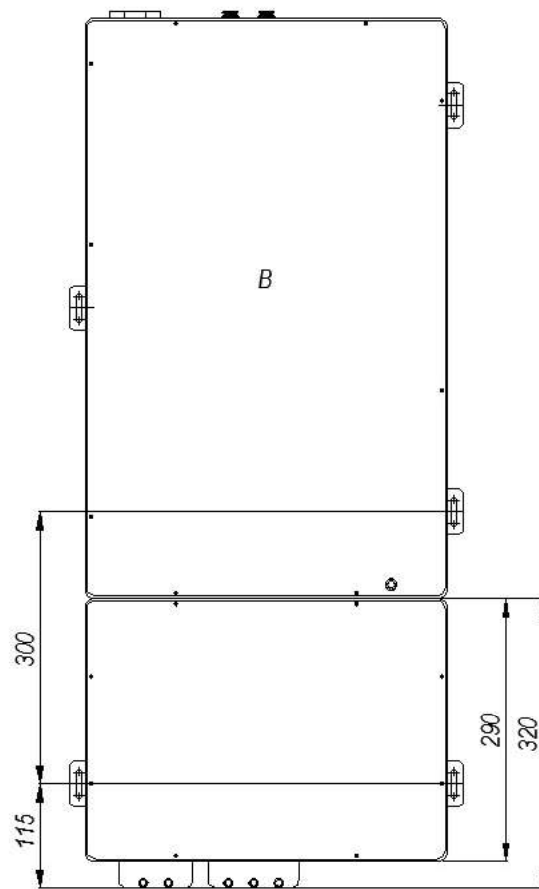
## Dimensions of laser



**Fig.5.** External dimensions of base NT230-xx series laser



**Fig.6.** External dimensions of NT230- ATTN/FC series laser



**Fig.7.** External dimensions of NT230- SCU/DUV series laser



Dimensions table:

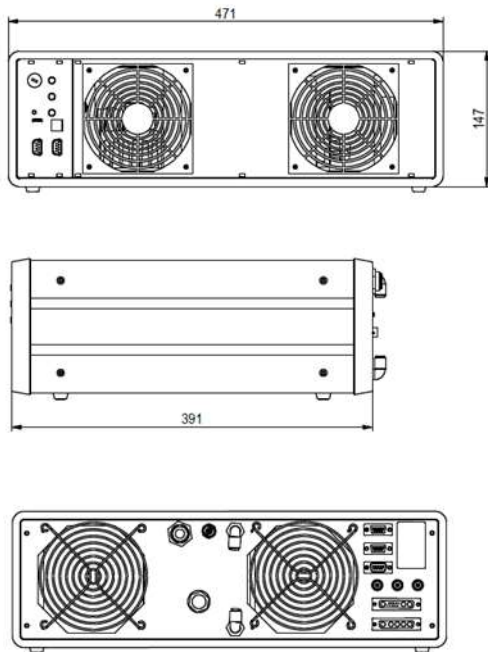
Model	Length L, mm
NT230 NT230-1H(-2H), NT230-SH(-SF)-1H(2H), NT230-SH/SF-1H(2H)	<i>670 mm</i>
NT230-SCU NT230-SH (-SF)-SCU NT230-SH(-SH/SF)-DUV	<i>960,5 mm</i>
NT230-SH (-SH/SF)-FC NT230-SH (-SH/SF)-ATTN/FC	<i>1011 mm</i>

Port position table:

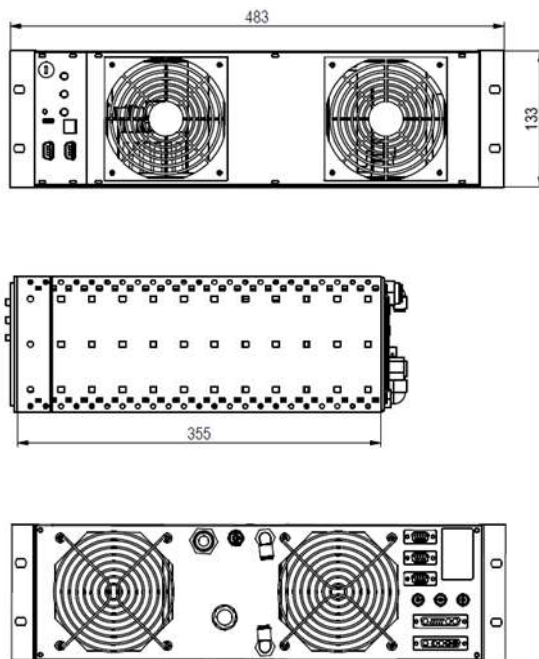
Model	Port #1	Port #2	Port #3	Port #4	Port #5	Port #6
NT230 (picture no.5)	<i>308 mm</i> (405-2600 nm)	<i>214 mm</i> (532/1064 nm)	186 mm (355nm)	158 mm (SCU 210-2600nm)	-	-
NT230-DUV(-SCU) (picture no.6)	<i>336 mm</i> (210-2600 nm SCU)	<i>308 mm</i> (405-2600 nm Direct)	242mm (192-209nm)	<i>214 mm</i> (532/1064 nm)	186mm (355 nm)	
NT230-ATTN/FC (picture no.7)	<i>308 mm</i> (405-2600 mm)	<i>261 mm</i> Fiber output 350– 2000 nm	<i>214 mm</i> (532/1064 nm)	<i>186 mm</i> (355nm)	<i>158 mm</i> (210-2600 nm)	<i>48 mm</i> (Attn 350-2000 nm)

Note: Outputs at Ports are not simultaneous.

### Dimensions of power supply



**Fig.8.** Dimensions of NT230-xx laser power supply/cooling rack. Desktop case (with water-air heat exchanger).



**Fig.9.** Dimensions of NT230-xx laser power supply/cooling rack. 19" module (with water-air heat exchanger).

## OPTIONS.

### -SH/SF GENERATOR

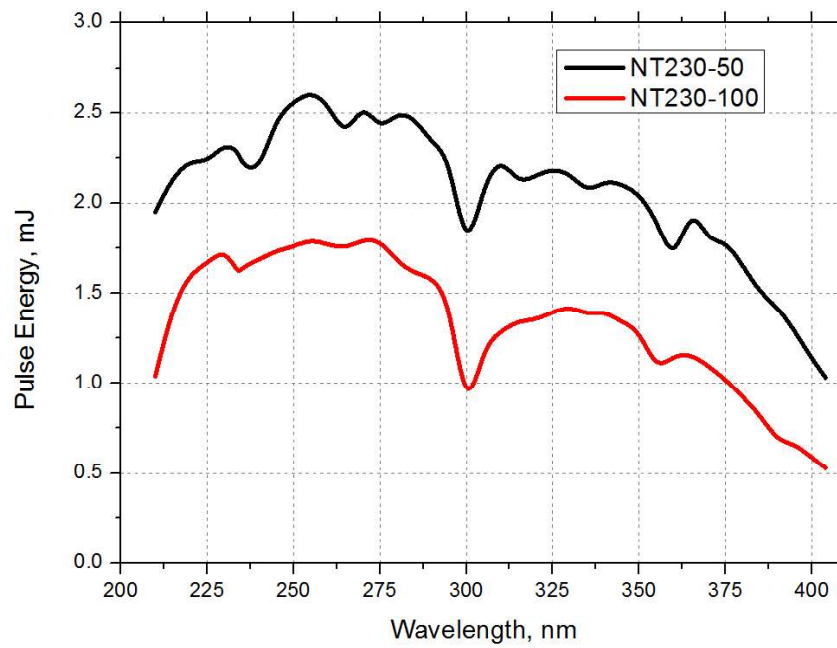


Fig. 10. Typical (smoothed) NT230-xx laser output with –SH/SF option.

### -SH GENERATOR

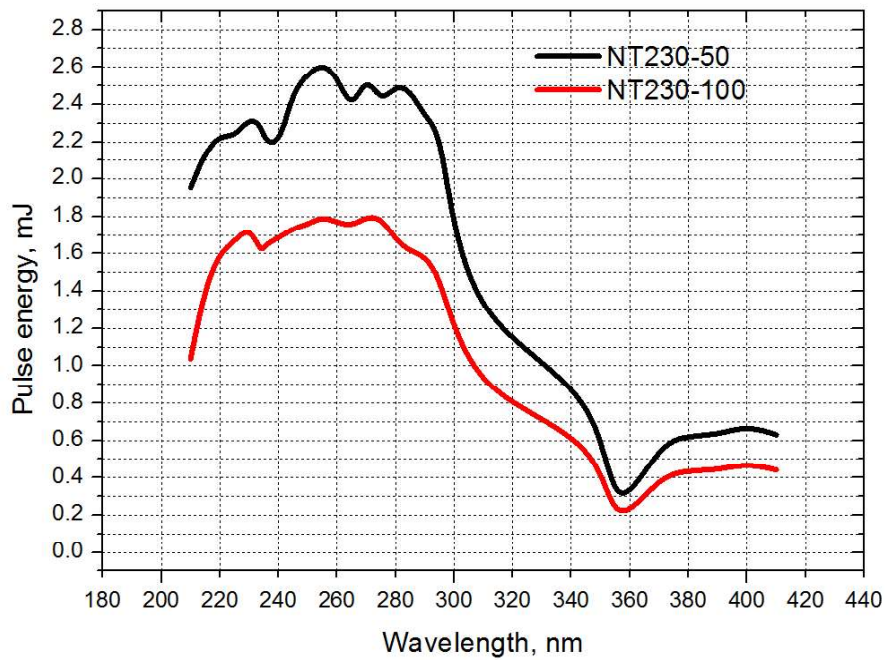


Fig. 11. Typical (estimated) NT230-xx laser output with –SH option.

### -SF GENERATOR

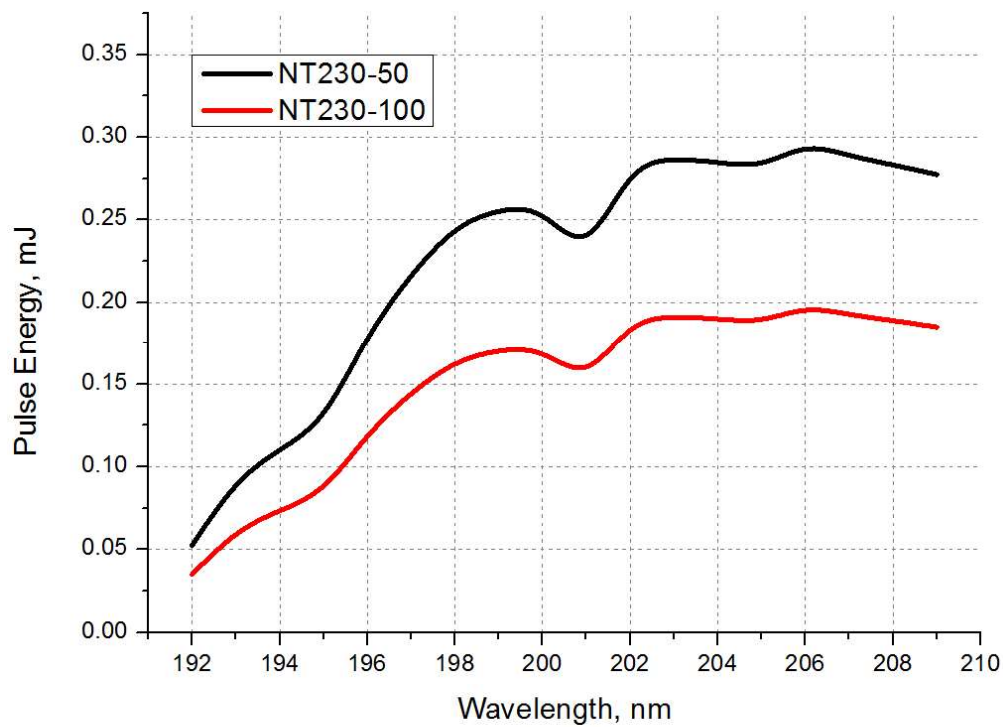
Please refer to –SH/SF option.

## -DUV GENERATOR

### Features:

- Provides tuning in 192-210 nm spectral range.
- DUV option can be implemented in NT230x-SH, NT230x-SH/SF models only.
- Requires larger laser housing to house all components.

### Pictures



**Fig. 12.** Typical NT230-xx laser output with –DUV option.

## - H/2H OPTION

- Provides fundamental and/or second harmonic output from pump laser\*.
- Shared output port (one wavelength at the time 1064/532 nm).
- Motorized reconfiguration of output wavelength
- Harmonics output is NOT simultaneous with OPO output.

*\* Inquire for pulse energy specifications.*

## -FC OPTION

### Features:

Non-solarizing silica fiber (1000  $\mu\text{m}$  core, 5 meters long) with SMA connectors is supplied.  
Motorized switching between fiber/free space outputs.

### Specifications

Spectral range:	300-2000 nm.
Fiber coupling and transmission efficiency:	
300-405nm	> 35%
405-1500 nm:	>50 %.
1500-2000 nm:	>40%.
Minimum fiber bending radius:	
Short-term:	200 mm
Long-term:	300 mm.

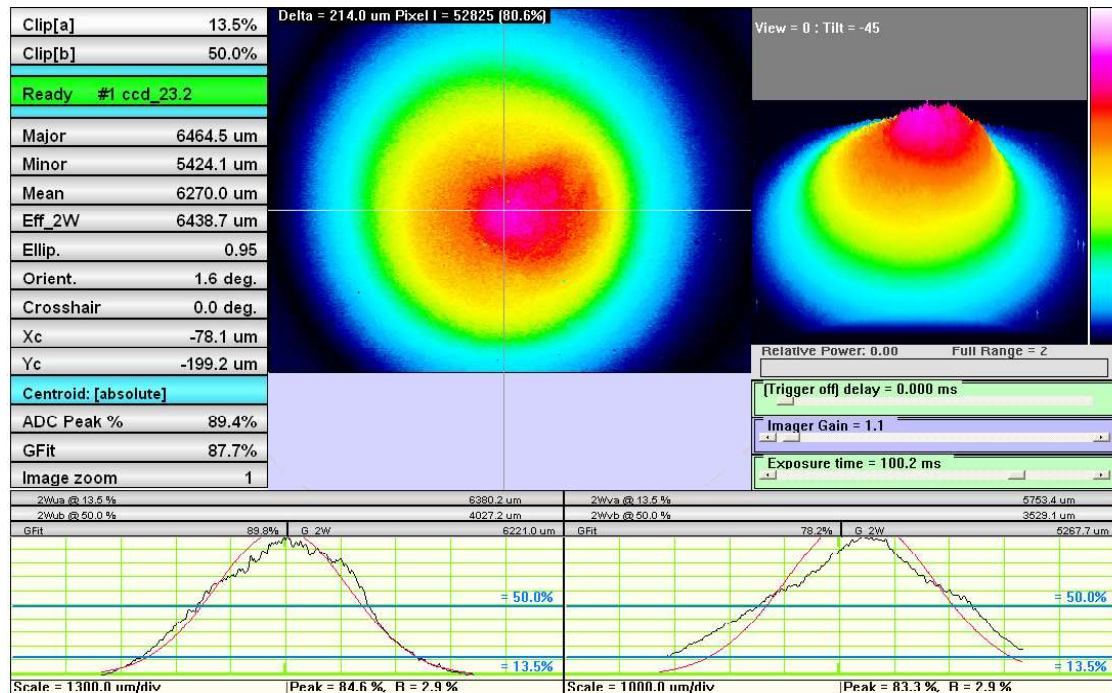


Fig. 13. Typical beam profile at fiber output (measured at 450 nm).

### -ATTN/FC option

Typical >50% total transmission (attenuator + fiber) in 405-1500 nm range. (1500 – 2000 nm >40%)  
Attachable to NT230x laser housing.  
Motorized switching between free space and fiber coupled outputs.

### Attenuator:

Motorized attenuation of laser output in 300-2600 nm spectral range.

Beam deviation <800  $\mu$ rad.

Labview based software for setting of transmission.

Max Transmission:

300-1200 nm: >65%.

1200-2000 nm: >45%.

2000-2600 nm: AS IS

Min Transmission:

300-2600 nm: <0.5%.

### **Fiber coupler:**

Non-solarizing silica fiber (1000  $\mu$ m core, 5 meters long) with SMA connectors is supplied.

Spectral range: 300-2000 nm.

Fiber coupling and transmission efficiency:

300-405nm > 35%

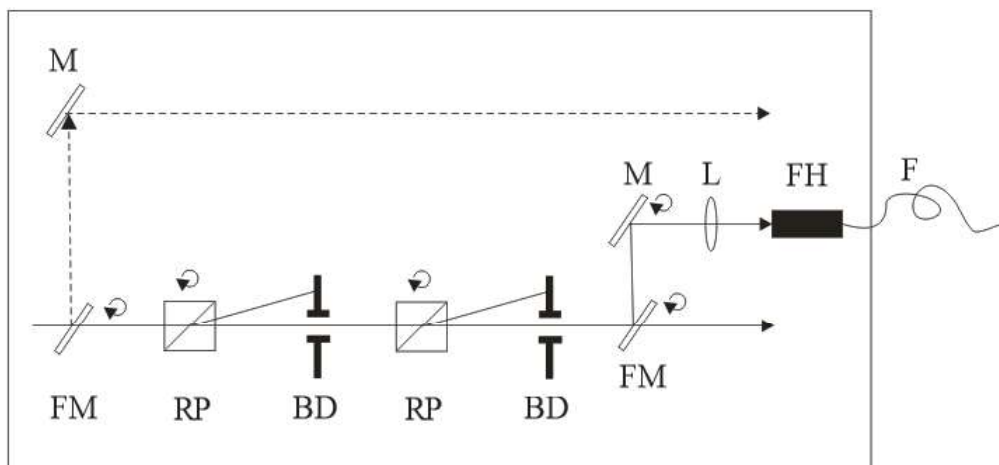
405-1500 nm: >50 %.

1500-2000 nm: >40%.

Minimum fiber bending radius:

Short-term: 200 mm

Long-term: 300 mm.



**Fig. 14.** Attenuator ATTN3/FC optical layout.

### **Service requirements**

Electrical supply: 90-240 VAC

Power consumption: < 100 W

Operating ambient temperature: 15 – 30  $^{\circ}$ C

System housing size (W  $\times$  H  $\times$  L): 450  $\times$  265  $\times$  400 mm (preliminary)

Power supply/driver unit (W  $\times$  H  $\times$  L): 110  $\times$  65  $\times$  180 mm.

**Note:** For operation of Attenuator-Fiber unit one has to connect it to NT230-xx unit with supplied cable.

## **-SCU OPTION**

Enhanced Spectral cleaning of beams in wide spectral range.

<b>Spectral range</b>	<b>Spectral purity (estimated)</b>	<b>Transmission</b>
210-405 nm (SH range)	$>10^{-6}$	$> 65\%$
300-405 nm (SF range)	$>10^{-6}$	$> 65\%$
405-640 nm (signal range)	$>10^{-6}$	$> 70\%$
640-710 nm	In $10^{-2} - 10^{-6}$ range	$> 70\%$
710-2600 nm (idler range)	$>10^{-6}$	$> 70\%$