

# Specifications for an Optical Parametric Oscillator System with a Nd:YAG pump laser

## 1.0 Requirement

The Contractor shall provide one solid-state nanosecond laser system that meets or exceeds the specifications defined herein. The full laser system must include a high-peak-power, appropriately seeded, amplified Nd:YAG primary laser source and an independently tunable, computer controlled, optical parametric oscillator. The Contractor shall install the system at The Naval Research Laboratory, Washington DC, and then demonstrate the system capabilities to meet or exceed the government's requirements.

## 2.0 Specifications

### 2.1 Specifications for the complete OPO system:

- a) Pulse repetition rate: Continuously adjustable between 0.1 and 50 Hz.
- b) Output energy at a 50 Hz pulse rate:

Wavelength Range	Energy/pulse
200 nm-450 nm	>1 mJ
450 nm-900 nm.	> 20 mJ
900 nm–2300nm	> 3 mJ
- c) Temporal profile: Smooth with a FWHM between 3 and 10 nsec.
- d) Line width:  $<5 \text{ cm}^{-1}$  (FWHM) between 450 and 650 nm and between 750 and 1800 nm
- e) Spatial quality: Gaussian profile with  $M_x^2 = M_y^2 < 1.5$ , beam ellipticity  $< 0.02$
- f) Beam divergence:  $< 2 \text{ mrad}$
- g) Beam pointing stability: The total beam motion must not exceed 100 microrad per hour after a two-hour warm-up.
- h) Beam pointing errors: The resultant (X and Y) beam motion must not exceed 50 microradians as the OPO is tuned over the range from 450 to 1800 nm.
- i) Energy stability: 99% of the pulses must be within 5% of the average over a period of 5 minutes.
- j) Signal/Idler wavelength separation optics: The ratio of the desired beam (signal or idler) intensity to the rejected beam (idler or signal) intensity must be greater than  $10^4$ .

## 2.2 Specifications on the Nd/YAG pump laser component.

a) Pulse repetition rate: Continuously adjustable between 0.1 and 50 Hz.

b) Output Energy at a 50 Hz pulse rate:

Wavelength	Energy/pulse
1064 nm	> 1200 mJ
532 nm	> 600 mJ
355 nm	> 3500 mJ

c) Temporal profile: Must be smooth with a FWHM between 3 and 10 nsec.

d) Line width: Must be less than  $0.1 \text{ cm}^{-1}$

e) Spatial quality: Gaussian profile with  $M_x^2 = M_y^2 < 1.2$

f) Beam divergence:  $< 0.5 \text{ mrad}$  @355nm, 532 nm and 1064 nm.

g) Beam pointing stability: The total beam motion must not exceed 50 microradians per hour after a two-hour warm-up.

i) Energy stability: 99.9% of the pulses must be within 2% of the average over a period of 5 minutes. There must be no pulses with more than 105% of the average energy.

j) Injection seeding: The laser must have an injection seeder to provide a single longitudinal mode.

k) Harmonic generation crystals: The laser must have temperature stabilized second and third harmonic generators.

l) Wavelength separator optics: The system must have wavelength separator optics to separate the fundamental, second and third harmonic frequencies. At each output wavelength, the total energy outside the line width of the laser must be  $< 0.1\%$  of the output energy.

j) Power requirements: The power supply must be a part of the package. It must require less than 20 amps/phase of 208 V three phase power.

## 3.0 Deliverables:

Operation and Maintenance manuals.