IceFyre®

Versatile UV and IR Picosecond Lasers: The New Standard for Picosecond Micromachining

mks | Spectra-Physics®

IceFyre redefines picosecond micromachining lasers with a patent-pending design to achieve exceptional performance and unprecedented versatility at industry leading cost-performance. Based on Spectra-Physics' *It's in the Box*™ design, IceFyre integrates laser and controller into the industry's smallest package.

Exceptional Performance and Unprecedented Versatility

The new IceFyre 355-50 is the highest performing UV ps laser on the market, providing >50 W of UV output power at 1.25 MHz (>40 µJ) with 100's µJ pulse energies in burst mode, and pulsewidths of 10 ps. The IceFyre 355-50 sets new standards in power and repetition rates from single shot to 10 MHz. The IceFyre 355-30 offers >30W of typical UV output power with pulse energy >60 µJ (greater pulse energies in burst mode) and delivers exceptional performance from single shot to 3 MHz. The IceFyre 1064-50 provides >50 W of IR output power at 400 kHz single pulse and delivers exceptional performance from single shot to 10 MHz.

IceFyre's unique design exploits fiber laser flexibility and Spectra-Physics' exclusive power amplifier capability to enable TimeShift™ ps programmable burst-mode technology for the highest versatility and widest range in the industry. A standard set of waveforms is provided with each laser; an optional TimeShift ps GUI is available for creating custom waveforms. The laser design enables true pulse-on-demand (POD) and position synchronized output (PSO) triggering with the lowest timing jitter in its class for high quality processing at high scan speeds, e.g. when using a polygon scanner.

The IceFyre Advantage

- Highest power at high repetition rates UV and IR models
- Industry leading cost-performance
- Unprecedented pulse control
  - TimeShift ps technology
    - Adjustable number of pulses in burst
    - Programmable burst shape (envelope of burst)
    - Adjustable burst mode pulse separation
    - Full power available with burst mode adjustments
  - Widest adjustable repetition rate range
  - Best pulse-on-demand (POD) and position synchronized output (PSO) triggering
  - Lowest timing jitter variability in pulse timing
- Most compact, *It's in the Box* laser
- 24/7 industrial reliability

Applications

- OLED processing
- 5G flexible printed circuits (FPC & MPI) cutting/drilling
- ITO drilling/scribing
- Semiconductor scribing and dicing
- PCB processing
- Ceramic cutting, drilling and scribing
- Solar cell scribing and drilling
- LED scribing, dicing and patterning
- Metal cutting, drilling and marking

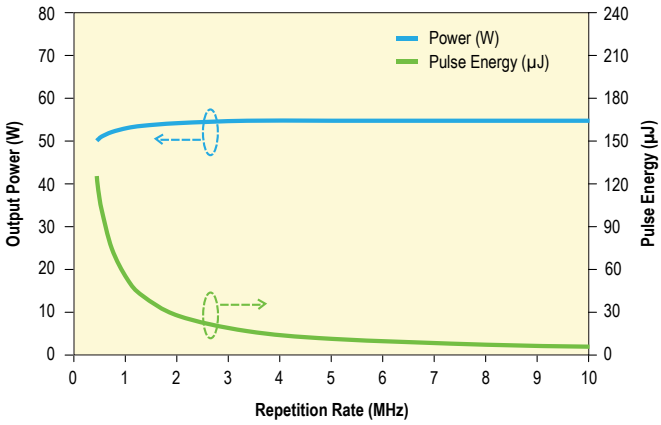
It's in the Box™

IceFyre

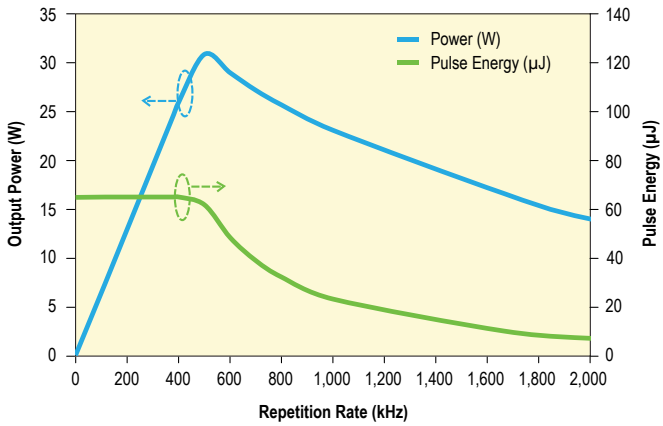
24/7 Industrial Reliability

IceFyre is designed, built, and tested to stringent quality standards for reliable continuous operation in demanding 24/7 manufacturing environments, resulting in high initial quality and low cost of ownership. IceFyre lasers' automatic data logging software monitors all key laser performance parameters over the life of the laser, providing a powerful service and preventative maintenance diagnostics feature and product reliability tool.

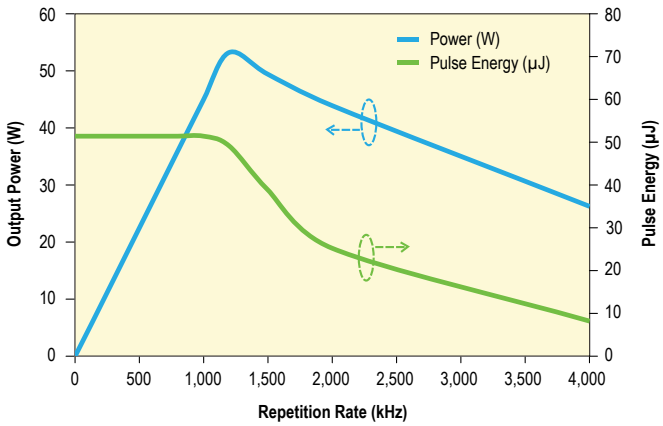
IceFyre 1064-50 Typical Power and Pulse Energy[1]



IceFyre 355-30 Typical Power and Pulse Energy[1]



IceFyre 355-50 Typical Power and Pulse Energy[1]



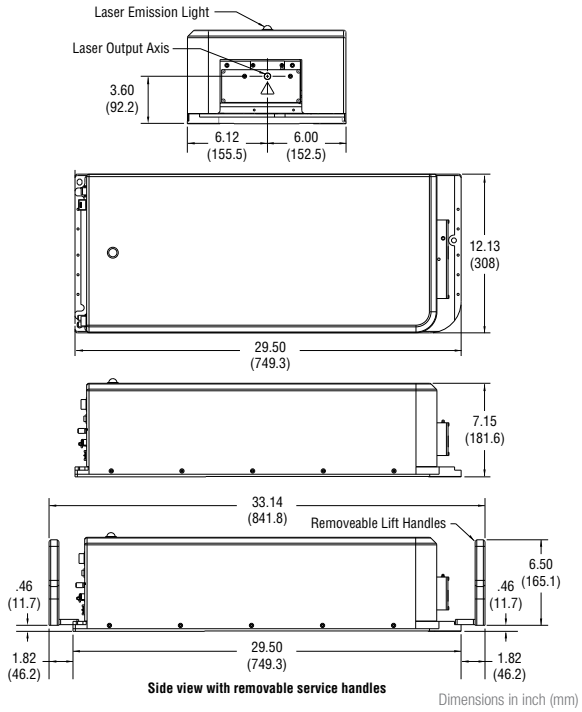
1. Typically measured performance, not a guaranteed or warranted specification.

IceFyre Specifications[1, 2, 10]

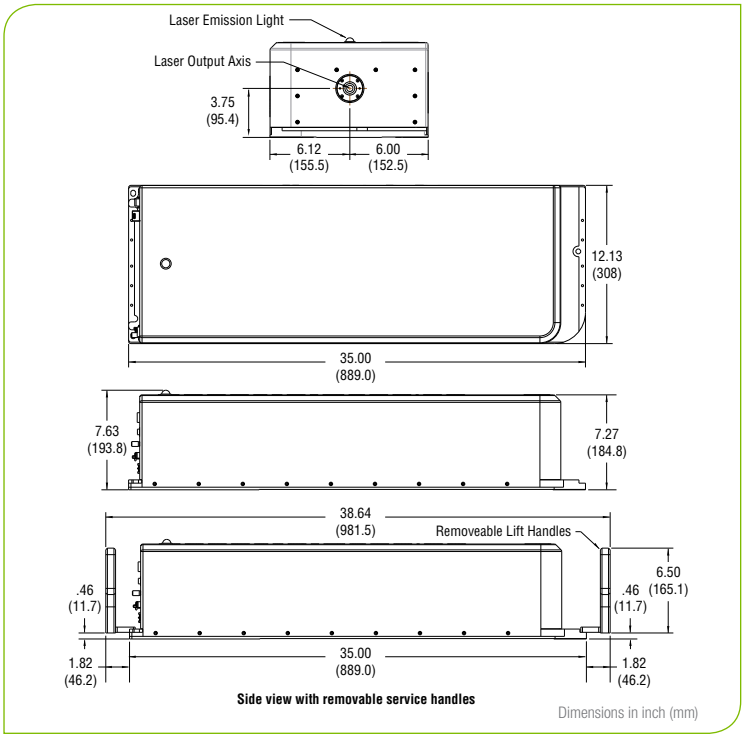
	IceFyre 1064-50	IceFyre 355-30	IceFyre 355-50
Output Characteristics			
Wavelength	1064 nm	355 nm	
Power[2, 3]	>50 W @ 400 kHz	>30 W typical @ 500 kHz >25 W @ 800 kHz >20 W typical @ 1 MHz	>50 W @ 1250 kHz
Maximum Pulse Energy, typical (greater pulse energy per burst possible with TimeShift ps)	>200 µJ @ 200 kHz	>60 µJ typical @ 500 kHz >31 µJ @ 800 kHz >20 µJ typical @ 1 MHz	>40 µJ @ 1250 kHz
Repetition Rate Range[6]	Single shot to 10 MHz	Single shot to 3 MHz	Single shot to 10 MHz
Pulse Width, FWHM[2]	<20 ps (15 ps typical)		<12 ps (10 ps typical)
TimeShift ps	yes		
Pulse-to-Pulse Energy Stability[2]	<1.5%, 1 σ	<2.0%, 1 σ	
Power Stability (after warm-up)[2]	<1%, 1 σ, over 8 hours		
Beam Characteristics			
Spatial Mode[2]	TEM_{00} (M^2 <1.3)		
Polarization	>100:1, vertical		
Beam Diameter (D4σ)[2]	3.0 ±0.3 mm	3.5 ±0.35 mm	5.0 ±0.5 mm
Beam Divergence, full angle[2]	<0.75 mrad	<0.20 mrad	
Beam Asymmetry[2]	≤1.10 (≥90% circularity)		
Boresight Tolerance[2]	±0.5 mm, ±5 mrad		
Beam Pointing Stability[2]	<±25 µrad/°C		
Operating Conditions[8]			
Warm-up Time, typical	<15 min from warm start mode, <40 min from cold start[7]	<45 min from warm start mode, <60 min from cold start[7]	
Temperature Range	15–30°C		
Altitude	0–2000 m		
Humidity[7]	0–90% non-condensing, dew point <19°C		
Storage Conditions[8]			
Temperature Range	0–50°C		
Altitude	0–10,000 m		
Humidity[7]	0–90% non-condensing, dew point <22°C		
Electrical and Chiller Requirements[7]			
Water Temperature (laser inlet)	20 ±1°C, stable to ±0.5°C		
Water Flow Rate (at laser head)	1.8 GPM (6.8 LPM)		
AC Input	100–240 VAC, 1000 W Max, 50/60 Hz, single phase		200 VAC (180–260), 2000 W Max, 50/60 Hz, single phase
Heat Load (at laser head)	<800 W (600 W typical)		<1600 W
Heat Load (at power supply)	<200 W		300 W
Total Power Consumption	<1000 W		<2000 W
Physical Characteristics[5]			
Dimensions (Laser) (L x W x H)[4]	29.50 x 12.13 x 7.50 in (749.5 x 308.0 x 190.6 mm)	35.00 x 12.13 x 7.63 in (889.0 x 308.0 x 193.8 mm)	42.14 x 19.88 x 7.63 in (1070.4 x 504.8 x 193.08 mm)
Weight (Laser)	95 lbs (43 kg)	108 lbs (49 kg)	215 lbs (97.5 kg)
Dimensions (Utility Module) (L x W x H)	21.16 x 18.02 x 1.58 in (537.5 x 457.7 x 40.1 mm)		
Weight (Utility Module)	15.00 lbs. (6.80 kg)	22.80 lbs. (10.34 kg)	24.70 lbs. (11.20 kg)
Features			
EU RoHS 2 Compliant, China RoHS 2, CE Compliant	Product compliant with restriction of hazardous substances		
Internal Power Monitor	May be calibrated against an external power meter		
Alignment Beam Mode	Lower power beam for installation and alignment in a tool (IR requires optional AOM)		
Replaceable Output Window	Customer replaceable to maintain power in harsh environments		
Data Log (includes customer version as well)[9]	Long and short term recording for diagnostics and equipment maintenance		
Optional Safety Shutter	Externally mounted for easy field service and customer replaceable		
Optional Output AOM	Provides power attenuation at constant power, used with trigger, gate and pulse on demand, use as a process shutter	NA (Power attenuation by software control. Consult Spectra-Physics)	
Optional Timeshift ps GUI	Enables waveform customization		

1. Due to our continuous product improvement program, specifications may change without notice.
2. IR specifications are at 400 kHz single pulse with the diode current set to achieve 51 W, unless otherwise noted. IceFyre 355-30 specifications are at 800 kHz single pulse with the diode current set to achieve 25.5 W, unless otherwise noted. IceFyre 355-50 specifications are at 1250 kHz single pulse with the diode current set to achieve >50 W, unless otherwise noted
3. IR power shown is without optional AOM.
4. Dimensions noted do not include the removable lift handles.
5. AC to DC converter module included with standard system.
6. Please consult factory for IR operation below 400 kHz without output AOM option.
7. Warm start: AC, chiller and GUI on, all diodes off.
8. High temperature, high humidity operation limited to dew point <19°C; high temperature, high humidity storage limited to dew point <22°C.
9. Customer version: future release.
10. IceFyre is a Class IV – High-Power Laser, whose beam is, by definition, a safety and fire hazard. Take precautions to prevent exposure to direct and reflected beams. Diffuse as well as specular reflections can cause severe skin or eye damage.

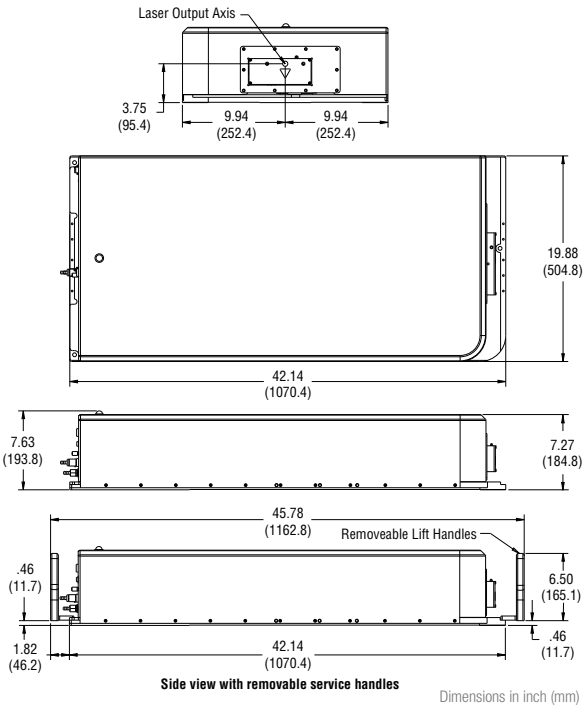
IceFyre



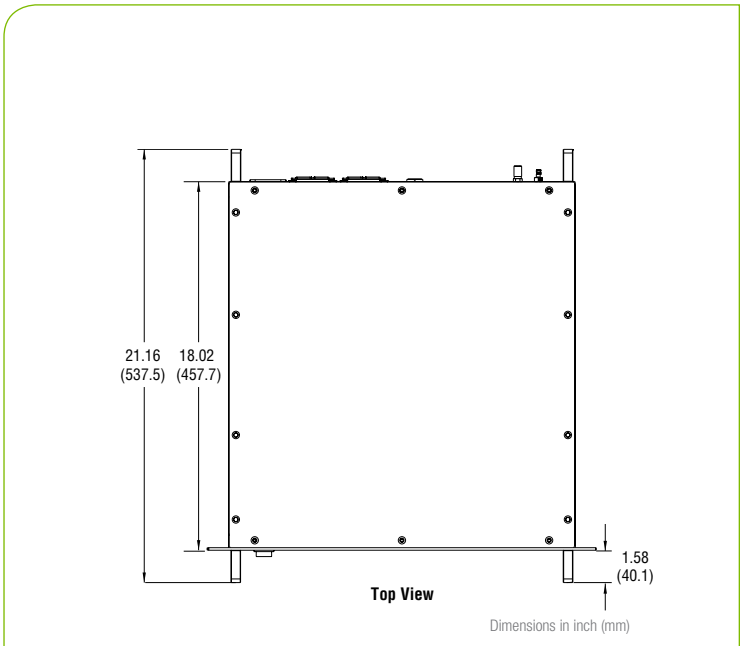
IceFyre 1064-50 Laser Dimensions



IceFyre 355-30 Laser Dimensions



IceFyre 355-50 Laser Dimensions



Utility Module Dimensions

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