

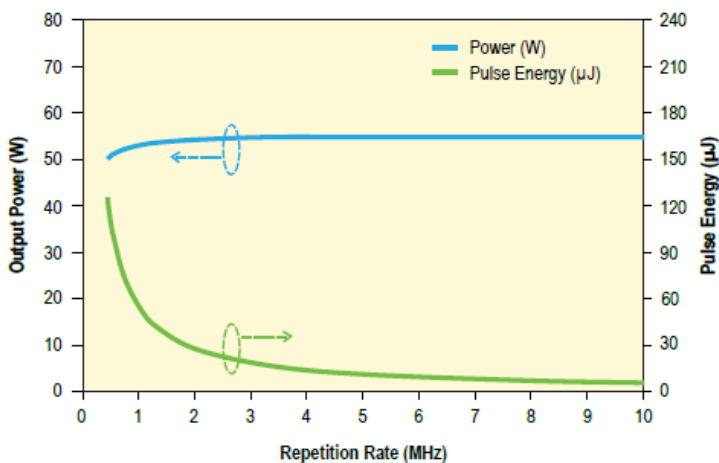
Spectra-Physics Micromachining Laser Lineup



IceFyre UV and IR Picosecond Lasers

355nm
50W

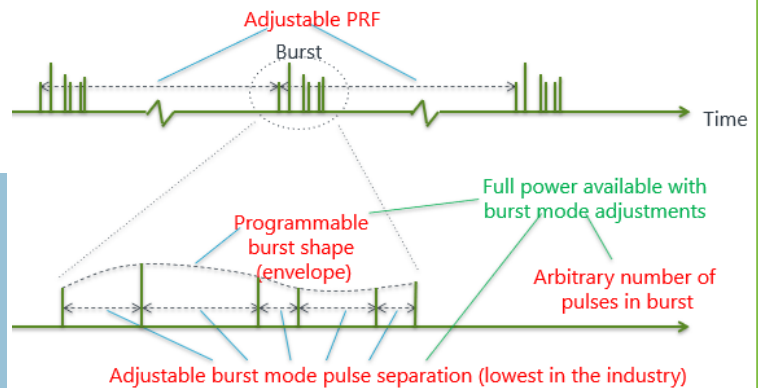
IceFyre 1064-50 Typical Power and Pulse Energy¹



- Highest power at high repetition rates UV and IR models
- Industry leading cost-performance
- Unprecedented pulse control
- Most compact It's in the Box laser
- 24/7 industrial reliability

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

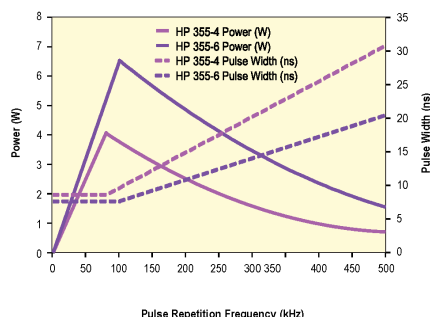


	Wavelength	Average Power	Max Pulse Energy	Repetition Rate	Pulse Width
IceFyre 355-50	355nm	>50W@1250kHz	>40μJ@1250kHz	0-10MHz	<12ps
IceFyre 355-30	355nm	>30W@500kHz	>60μJ@500kHz	0-10MHz	<20ps
IceFyre 1064-50	1064nm	>50W@400kHz	>200μJ@200kHz	0-10MHz	<20ps

Explorer One HP Compact UV and Green Lasers



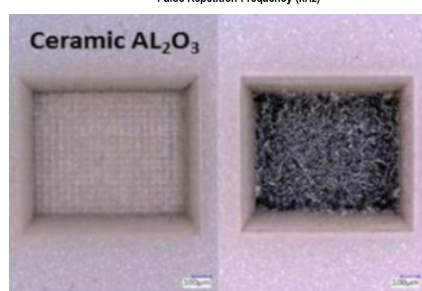
Explorer One HP 355 - Power and Pulse Width¹



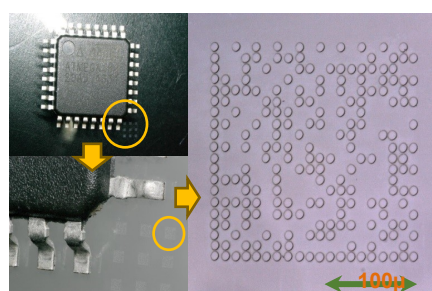
- High Power – Up to >6 W at 355 nm
- Lightweight – only 1.5 and 4.1 kg, air cooled design
- Unique “It’s in the Box” design – smaller than any competitive product
- Feature rich software for ease-of-use and simplified integration
- E-Track™ – active pulse energy and power control on selected models



355nm
6W



Ceramic ablation rate improvement, 2x factor (Left : 1x1x0.5mm with 2W, Right : milled through completely with 4W)



2D data matrix code marking for Soda Lime glass (20 × 20 dots, 220µm × 220µm size)



High contrast marking for polished ceramic (1cm x 1cm size)

	Wavelength	Average Power	Max Pulse Energy	Repetition Rate	Pulse Width
Explorer One HP HE 355-200	355nm	>4W@20kHz	>200µJ@20kHz	Single shot-200kHz	<15ns@20kHz,4W
Explorer One HP 355-6	355nm	>6W@100kHz	>60µJ@100kHz	Single shot-500kHz	<12ns@100kHz,6W
Explorer One HP 355-4	355nm	>4W@80kHz	>50µJ@80kHz	Single shot-500kHz	<15ns@80kHz,4W

SPFL 532-40

Pulsed Green Fiber Lasers



- >40 W average output power, >180 µJ pulse energy
- TimeShift programmable burst mode operation
- Single shot to 2 MHz adjustable repetition rate
- High beam quality ($M^2 < 1.2$)

532nm
40W

		Wavelength	Average	Max Pulse Energy	Repetition Rate	Pulse	
SPFL 532-40 HF	High Frequency	532nm	40W	100μJ	75% of max PRF, each Wave Form	3-6ns	
SPFL 532-40 AF	All Frequency				Single shot		
SPFL 532-40 FG	Fast Gating						
SPFL 532-40 HE	High Energy			180μJ	9-50ns		

Spirit1030-140/100/70/515-50

High Power Femtosecond Lasers

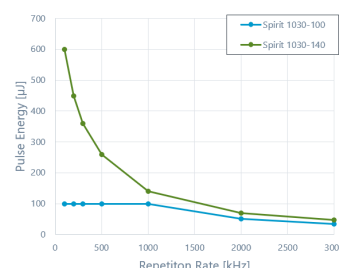


1030nm
140W
600μJ

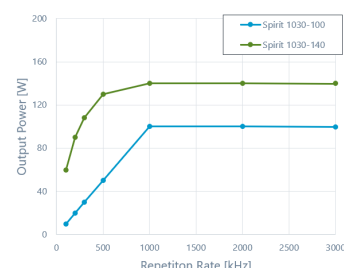
- High average power up to >140W
And pulse energy up to >600μJ
- Adjustable repetition rate from single shot
up to 30MHz for processing at highest throughput
- User-configurable burst mode for processing with
highest ablation efficiency

Spirit1030-140&100 – Performance Comparison

Pulse Energy

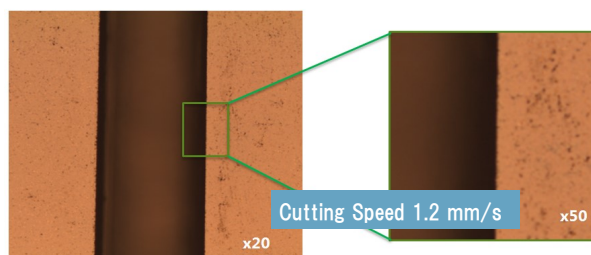


Average Output Power

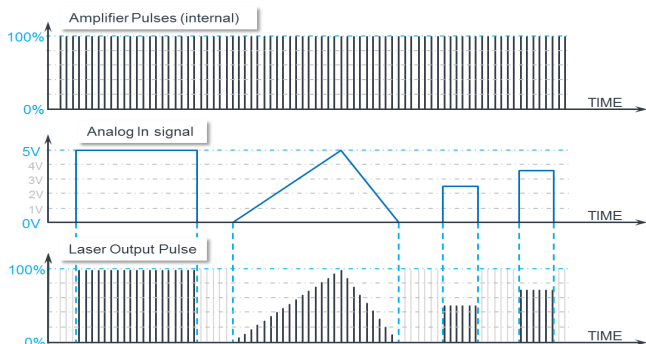


Cutting of 0.5 mm thick PCD: Quality

Top View of Cutting Edge after fs Laser Machining



Spirit – Integrated Pulse Picker for Fast Power Modulation



Machining of Polyester using 100W fs Spirit

Application: Cutting

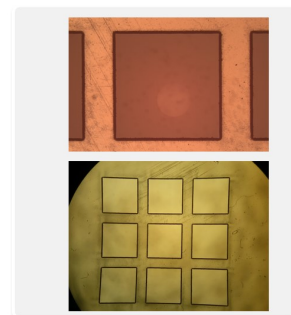
Material: Polyester (PET)

- Thickness: 75 μm
- Transparent for 1030 nm

Laser: Spirit® 1030-100

Process Details:

- 1030 nm; 400 fs
- Cutting speed: >1200 mm/s
- Minimal HAZ

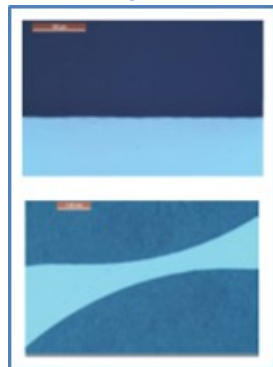


	Wavelength	Wavelength (SHG)	Average Power (1030nm)	Average Power (515nm)	Max Pulse Energy (1030nm)	Max Pulse Energy (515nm)	Repetition Rate	Pulse Width
Spirit 1030-140	1030±5nm	N/A	>140W @1MHz	N/A	600μJ	N/A	Single shot to 30MHz	<400fs
Spirit 1030-100			>100W @1MHz		100μJ			
Spirit 1030-70			>70W @1MHz		70μJ			
Spirit 515-50		515±3nm	N/A	>50W @1MHz	N/A	50μJ		

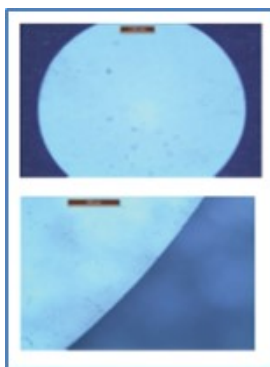
Spirit ClearShape Processing example



Strengthened glass cutting

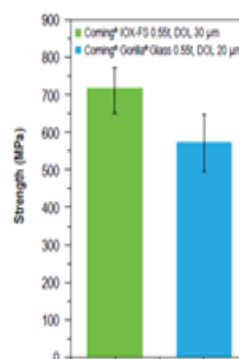


Non-strengthened glass cutting



Sapphire wafer cutting

High Quality (four point bending test)



Results of four point bending tests. The tests show very high bending strength as-cut (up to 700 MPa).

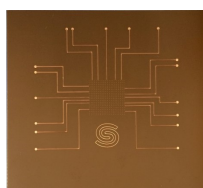
Talon & Talon HE

Diode-Pumped Solid State Q-Switched Lasers

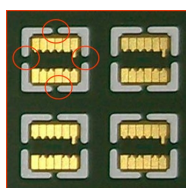


- Superior combination of performance reliability and cost
- 11 interchangeable models with common optical electrical and command interfaces for wide breadth of process coverage
- Rugged industrial platform

	Talon (High Power/High repetition type)								Talon HE (High Energy type)		
Model	355-45	355-30	355-20	355-15	355-12	355-6	532-40	532-20	355-500	355-275	532-1000
Wavelength	355nm						532nm		355 nm		532 nm
Max Average Power	45W	30W	20W	15W	12W	6W	40W	20W			
	@150kHz	@100kHz	@100kHz	@50kHz	@50kHz	@50kHz	@100kHz	@50kHz			
Pulse Energy									>500 μ J	>275 μ J	>1000 μ J
									@20 kHz	@40 kHz	@15 kHz
Repetition Rate	0 – 500kHz								0 – 150kHz		
Pulse Width	<40nsec	<25nsec @100kHz							25-40 nsec	40-60 nsec	25-40 nsec
	@150kHz								@20 kHz	@40 kHz	@ 20 kHz



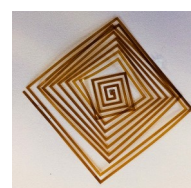
PCB micro structuring



μ SD singulation

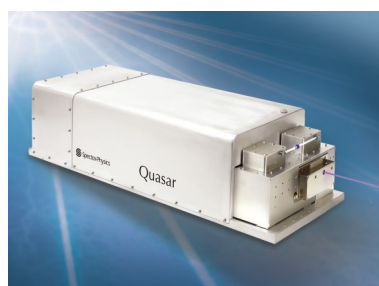


Glass Inner marking



Polyimide cutting

Quasar High Power Hybrid Fiber Lasers



- >80 W UV(400 μ J) or >60 W UV(300 μ J)
- >95 W Green (475 μ J) or >75 W Green (375 μ J)
- TimeShift Technology
- High repetition rates from 0–3.5 MHz for fast processing



Actual Pulse Traces of Constant Pulse Widths vs PRF



10 nsec at 200 kHz

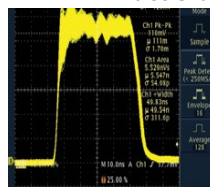


10 nsec at 300 kHz

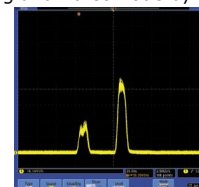


10 nsec at 500 kHz

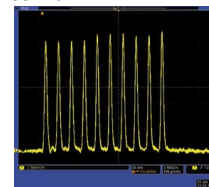
Pulse Shaping and Burst Mode by TimeShift



50 ns at 200 kHz



10 ns with 1:2 height ratio



10x5 ns sub-pulses (Burst Mode)

	Wavelength	Average Power	Max Pulse Energy	Spatial Mode
Quasar UV80	355nm	>80W@200kHz	>400 μ J	TEM ₀₀ (M ² <1.3)
Quasar UV60		>60W@300kHz	>300 μ J	
Quasar UV60-Turbo		>38W@3MHz	>12 μ J	
Quasar UV45		>45W@250kHz	>225 μ J	
Quasar GR95	532nm	>95W@200kHz	>475 μ J	
Quasar GR75		>75W@200kHz	>375 μ J	