

## 3.5.2 Beam Splitter + Neutral Density Filters Combo

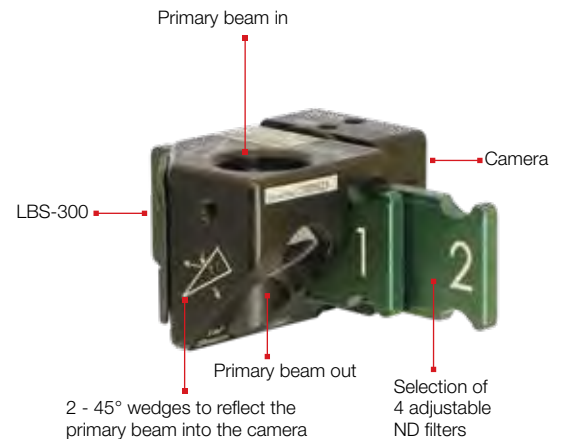
The attenuators described before can provide a high degree of attenuation however, these neutral density attenuators cannot dissipate more than 5W or so. Therefore we often place beam splitters in front of the attenuators to reduce the intensity before the ND filters. These beam splitters are made of UV grade fused silica for use from 190 to 2500nm. Since they do not absorb light, they have a much higher power handling capacity than the ND attenuator/filters.



Model	LBS-300s	LBS-300HP-NIR	LBS-400	LBS-100
Wavelengths	multiple versions from 190-2500nm	980-1100nm	UV or 10.6µm	multiple versions; 400-700nm, 1064nm, 10.6µm
Reflection	0.01% of incident beam For reflectance Spectra see LBS-300 User Note	<0.0001%	0.01%	4% @ 400-900nm, 1% @1064nm, 0.5% or 5% @10.6µm
Nominal ND value	See spec sheet	0.4, 0.8, 1, 2, 3, 4	0.5, 1.0 in both filters	0.3, 0.7, 1, 2, 3, 4 for 300-700nm & 1064nm 30% & 60% for 10.6µm
Clear Aperture	Ø17.5mm	Ø15mm	Ø31.75mm	Ø19mm
Damage threshold	See spec sheet	See spec sheet	See spec sheet	See spec sheet
Mounting	C-Mount	C-Mount	Custom thread	C-Mount and Lab post mounted

### LBS-300s Beam Splitters

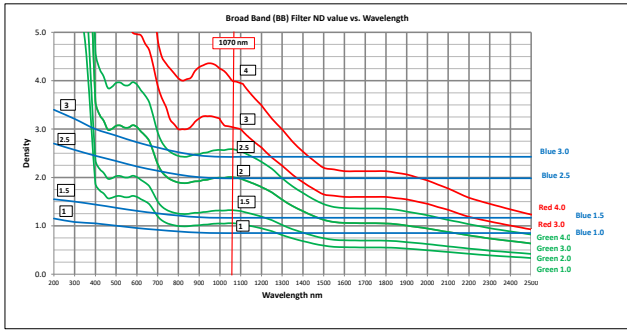
The LBS-300s beam splitter attachment for C-mount, CS-mount, or Ophir mount cameras allow you to measure laser beams with diameters up to 15mm and powers ranging from 10mW to ~400W<sup>(1)</sup>. The beam sampler is designed so that the preferential polarization selection effect of a single wedge is cancelled out and the resulting beam image is polarization corrected to restore the polarization components of the original beam. The beam sampler operates by reflecting the incoming beam from the front surfaces of a pair of wedges through 90 degrees into the camera. Approximately 99% of the beam is transmitted through the beam sampler with 0.01% passed on to the camera. A set of adjustable ND filters are provided to make final intensity adjustments to the beam before it reaches the camera imager. If additional attenuation is needed, an external wedge may be mounted at the input port, however this 3rd wedge will cause polarization selectivity when the beam is significantly polarized different in the S and P planes. A 1.035-40 thread is provided behind each wedge along the axis of the output beam that can be used to directly mount accessories with 1" lens tubes such as beam dumps or even power and energy sensors to the LBS-300s.



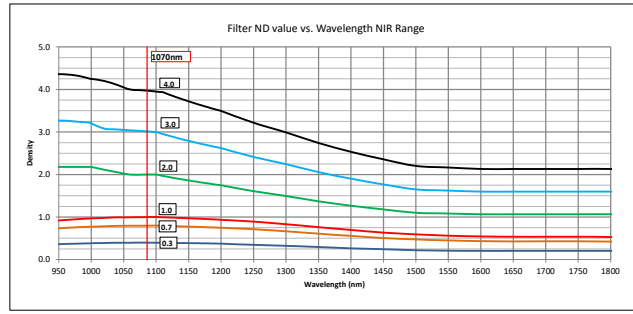
(1) For Gaussian beam diameter <1/2 the clear aperture and depending on ND filter and camera saturation limits the maximum power may be as high as 1000W.

### Specifications

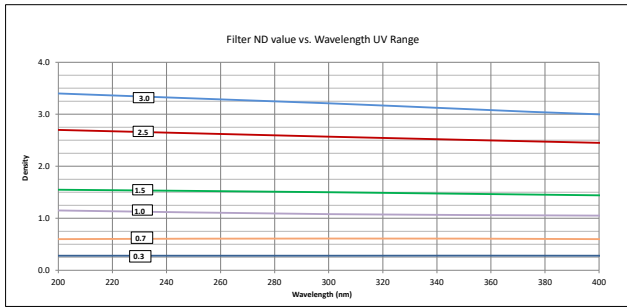
Model	LBS-300s-UV	LBS-300s-VIS	LBS-300s-NIR	LBS-300s-BB
Wavelengths	266-355nm	400-950nm	950-1800nm	190-2500nm
Wedge Material	UVFS	UVFS	UVFS	UVFS
Wedge Coating	A/R ≤1%	AR ≤1%	AR ≤1%	No coating, 4% reflection
Clear aperture	17.5mm	17.5mm	17.5mm	17.5mm
Reflection <sup>(1)</sup>	0.01%	0.01%	0.01% <sup>(2)</sup>	0.16%
Wedge ND value, each	ND ≥2	ND ≥2	ND ≥2	ND ~1.3
Maximum allowable input to wedge	10MW/cm <sup>2</sup> 5 J/cm <sup>2</sup>	10MW/cm <sup>2</sup> 5 J/cm <sup>2</sup>	10MW/cm <sup>2</sup> 5 J/cm <sup>2</sup>	10MW/cm <sup>2</sup> 20 J/cm <sup>2</sup>
ND Filters	Inconel	Bulk ND	Bulk ND	Combination of Inconel and Bulk ND
ND Values, nominal	0.3, 0.7, 1.0, 1.5, 2.0, 3.0 (Blu holders)	0.3, 0.7, 1.0, 2.0, 3.0, 4.0 (Grn holders)	0.4, 0.8, 1.0, 2.0, 3.0, 4.0 (Red holders)	See Broad Band (BB) chart below
Filter Slides	3	3	3	5
Maximum allowable input to filter <sup>(2)</sup>	100 W/cm <sup>2</sup> CW 20mJ/cm <sup>2</sup> , 10ns pulse	50 W/cm <sup>2</sup> 1J/cm <sup>2</sup> , 10ns pulse	50 W/cm <sup>2</sup> 1J/cm <sup>2</sup> , 10ns pulse	See UV, VIS and NIR specifications
Part number	SP90464	SP90465	SP90466	SP90467
<b>Accessories</b>				
Large C-mount Wedge Splitter	For additional attenuation add this to the front end of the LBS-300. Good for 350-2000nm			SP90273
Beam Deflector Assembly	for 350-1200 nm only			SP90263
Beam Deflector Assembly	For 266 nm, high damage threshold			SP90287
Beam Deflector Assembly	For 355 nm, high damage threshold			SP90286
Beam Deflector Assembly	For 532 nm, high damage threshold			SP90285
Beam Deflector Assembly	For 1064 nm, high damage threshold			SP90284
2" LT- Mount Extension Tube	2" Extension tube between LBS-300s and camera, Reduces noise on the camera, reduces intensity on ND, other uses			SP90575
3" LT- Mount Extension Tube	3" Extension tube between LBS-300s and camera, Reduces noise on the camera, reduces intensity on ND, other uses			SP90574
LT To External C-Mount Adapter	Adapter to fit tube to LBS-300s - required with 2" and 3" extension tubes			SP90576
LT To Internal C-Mount Adapter	Adapter to fit tube to camera mount - required with 2" and 3" extension tubes			SP90577
Notes:	(1) For reflectance Spectra see LBS-300 User Note. (2) For 100nm reflectance is ~0.04% and for 950nm reflectance is ~0.16%. (3) This is the damage threshold of the filter glass of the filters. Distortion of the beam may occur with average power densities of 5W/cm <sup>2</sup> for beam size 5mm, 10W/cm <sup>2</sup> for 2mm beam and >30W/cm <sup>2</sup> for 1mm beam			



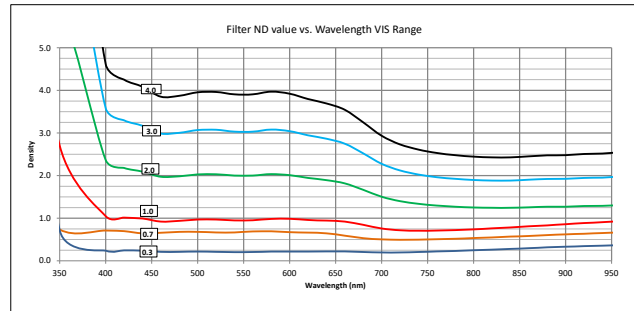
VIS and NIR ND glass filter set (Green and Red Holders) & UV metallic coating filter set (Blue) - SP90467



NIR filter set (Red Holders) – SP90466



UV filter set (Blue Holders) – SP90464



VIS filter set (Green Holder) – SP90465

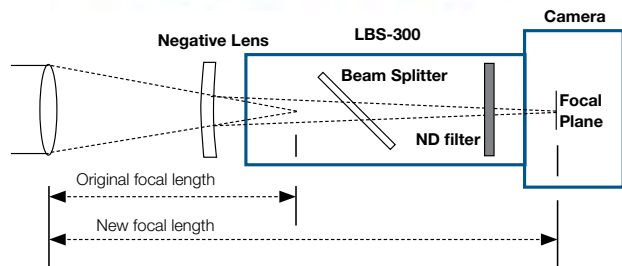


### Beam Extending Negative Lenses for LBS-300s

Sometimes we want to measure the focal spot of converging beam but the focal length of the system is not enough for the beam to go through the LBS and reach the camera focal plane.

Also, sometimes the focal spot is too small for the pixel spacing of the camera. The above problem can be solved by simply screwing a negative lens on top of the LBS and thus extending the focal spot as shown in the diagram.

Model	FSA-50Y	FSA-100Y	FSA-150Y
Negative lens focal length	~50mm	~100mm	~150mm
Use with original focal length	35-99mm	100-149mm	150-mm
Approx. image magnification	2.8	1.9	1.5
Part number	SP90187	SP90188	SP90190



# LBS-300HP-NIR Beam Splitters

## Beam Splitter for High Power Lasers NIR

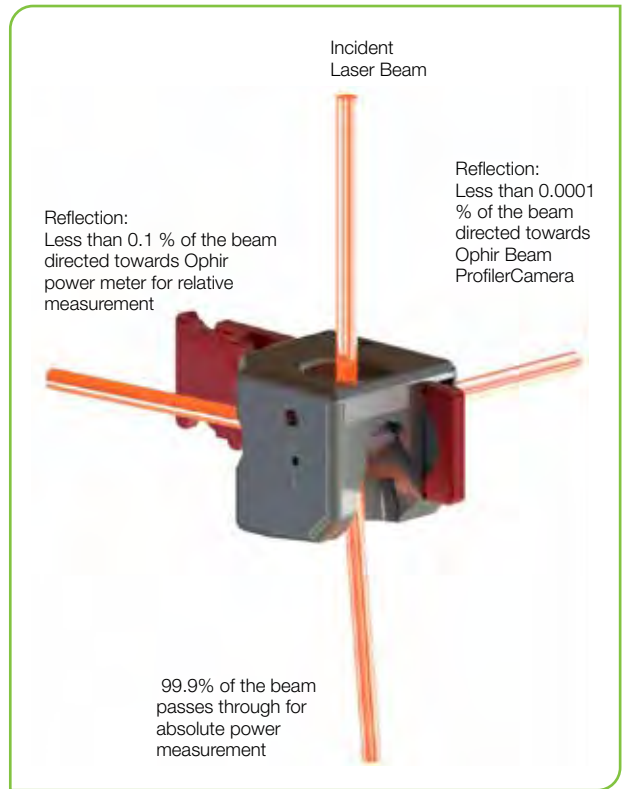
The LBS-300HP-NIR is a patent pending technology beam splitter for High Power lasers that allows measuring NIR (~1064nm) focused or collimated laser beam profiles up to **5kW** or **15MW/cm<sup>2</sup>**.

The LBS-300HP-NIR operates by reflecting a fraction of the incoming beam through the front surface of each of a pair of orthogonally oriented wedges. Less than 0.0001% (1/10<sup>6</sup>) of the beam is reflected towards the Ophir Beam Profiler Camera. This enables beam shape, focal spot, beam waist, M<sup>2</sup> of a high-power laser; up to **5kW** or **15MW/cm<sup>2</sup>**.

Relative power can be measured by placing an Ophir power sensor after the first wedge, thereby measuring the laser beam after being reduced to 0.1% (1/10<sup>3</sup>).

99.9% of the laser beam passes through, ideal for absolute power measurement .

Each optical path through the LBS-300HP-NIR provides uniform attenuation of any beam shape (Gaussian, flat-top, doughnut, etc.) while preserving the polarization and overall profile of the incoming laser beam thus providing accurate sample of incident beam. A 1.035-40 thread is provided behind each wedge along the axis of the output beam. These can be used to directly mount accessories with 1" lens tubes such as beam dumps or power/energy sensors.



### Specifications

Model	LBS-300HP-NIR
Wavelengths <sup>(1)</sup>	1000-1100nm
Wedge Material	UVFS
Wedge Reflection (each)	<0.1%
Surface Quality	λ/6
Clear Aperture	15mm
LBS-300HP-NIR Reflection	0.000025% - 0.0001% (1/10 <sup>6</sup> )
Wedge ND value	≥3
Maximum Laser Power Exposure	5 kW for up to 10 minutes
Minimum Detectable Laser Power	100 mW
Maximum Power Density <sup>(2)</sup> , Energy Density	15MW/cm <sup>2</sup> , 10J/cm <sup>2</sup> at beam splitter
3 x Bulk Filters ND <sup>(3)</sup> values, nominal	0.4, 0.8, 1.0, 2.0, 3.0, 4.0 (Red Holders)
<b>Part number</b>	<b>SP90540</b>

### Suggested Add-Ons

Item	Description	P/N
SP932U	Beam Profiler CMOS-based cameras	<b>SP90606</b>
SP920s	Beam Profiler CCD-based cameras	<b>SP90549</b>
Ge/9/5µm	Slit Based Beam Profilers, NanoScan 2s	<b>PH00460</b>
BD10K-W-V1 Beam Dump	Beam Dumps Up to 11kW Max Power, Water Cooled	<b>7Z17205</b>
Power Sensors	Compatible with most Ophir sensors	See catalog pages 67-74, 81

Note: (1) Although the LBS-300HP-NIR is designated for 1000nm - 1100nm, the real spectral range is significantly wider and covers 500nm-1500nm range. However, the spec above refers only to designated wavelength and can't be guaranteed for out of the range wavelength. Red alignment laser can also be used with LBS-300HP-NIR for alignment and targeting.  
 (2) 15 MW/cm<sup>2</sup> was maximal power density that was tested. Actual Maximum Power Density may be higher.  
 (3) ND bulk absorbing filters damage threshold is 5W/cm<sup>2</sup> for beam size 5mm, 10W/cm<sup>2</sup> for 2mm beam and >30W/cm<sup>2</sup> for 1mm beam.

### LBS-300HP-NIR

