

# Accessories for Beam Profiling

## Introduction

Spiricon has the most extensive array of accessories for beam profiling existing. There are components for attenuating, filtering, beam splitting, magnifying, reducing and wavelength conversion. There are components for wavelengths from the deep UV to CO<sub>2</sub> wavelengths. Most of the components are modular so they can be mixed and matched with each other to solve almost any beam profiling requirement needed.

## Detachable Neutral Density Attenuators/Filters

For almost all applications, the laser beam intensity is too high for the operating range of the CCD. Therefore ND glass attenuator filters are available to reduce the intensity to the proper level at the CCD. In general, either the LBF-50 attenuating filter set or a set of individual screw on filters is recommended. These filters are carefully designed not to affect beam quality or cause interference effects. One stackable ND1 filter and 2 ND2 filters are supplied standard with each camera.

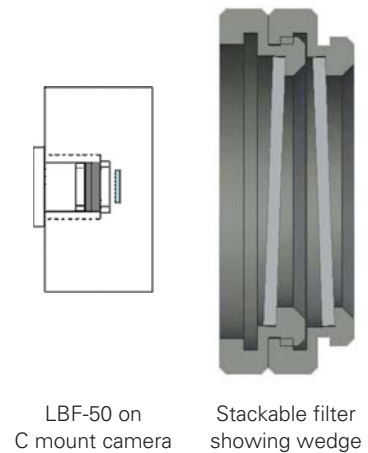
**LBF-50:** The LBF-50 comes with a set of filters that are inserted into the flange shown, mounted on top of each other and secured. A set of 6 filters is provided that can achieve attenuation anywhere from OD 0.3 to OD 8. The LBF-50 is especially useful for CS or C mount cameras with the CCD recessed way below the surface. The filters are recessed into the camera thus saving thickness as shown in the illustration to the right.

**Stackable ND filters:** The individual filters come in three versions, the ND1 filter in the red housing with ~10% transmission in the visible, the ND2 filter in the black housing with ~1% transmission and the ND3 filter in the green housing with ~0.1% transmission. The individual filters can be screwed on top of each other and thus stacked. They are set at a small wedge angle in the housing so as not to cause interference effects.

**Specialized Filters:** There are also specialized filters available to eliminate extraneous wavelengths when measuring very short or very long wavelengths where the CCD cameras are not sensitive and the desired signal can get swamped by extraneous light of other wavelengths. These filters are as follows:

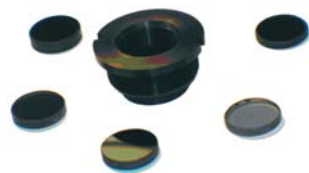
1. The 355nm filter for monitoring the 3<sup>rd</sup> harmonic of YAG. This filter transmits 355nm but blocks 532nm and 1064nm.
2. The 1300nm filter transmits 1300nm but blocks wavelengths shorter than 1100nm.

These filters are also on the same standard thread so can be mixed with all the other components. See ordering information pages for more details.



LBF-50 on C mount camera

Stackable filter showing wedge



LBF - 50 filter assembly



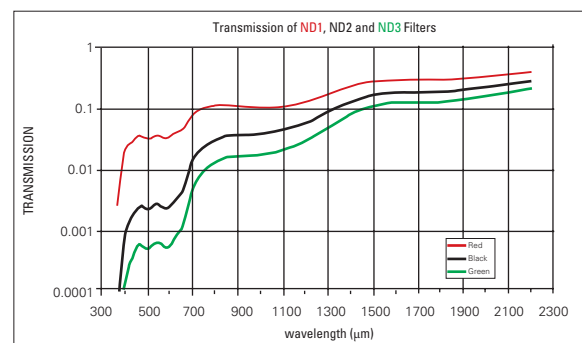
ND1, ND2 and ND3 stackable filters

## Specifications

Item	LBF-50	ND1 / ND2 / ND3
Nominal OD (vis)	0.3, 0.7, 1, 2, 3, 4	1, 2, 3
Clear Aperture	Ø14mm	Ø19mm
Damage threshold	50W/cm <sup>2</sup> , 1J/cm <sup>2</sup> for ns pulses	

## Transmission vs. Wavelength

These "neutral density" or ND filters do not have a flat response in attenuation vs. wavelength. See the graph for typical transmission vs. wavelength characteristics.





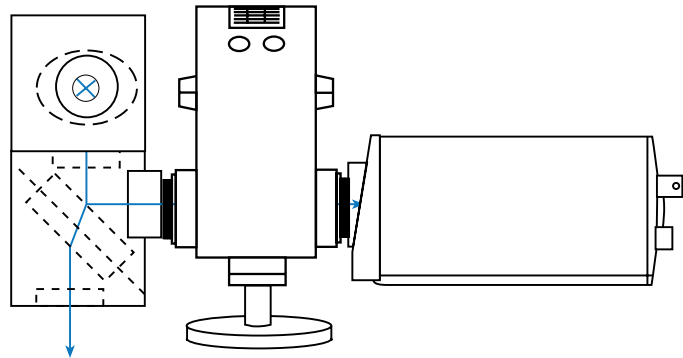
## Wavelength Response

Because materials used to produce ND filters are not wavelength independent, two units are available to provide relatively calibrated steps over the primary range of use. The BA-VIS with filters calibrated at 632nm provide relative uniform attenuation from 400nm to 700nm. The BA-NIR filters are calibrated at 1064nm and provide relatively uniform attenuation from 700nm to 1250nm. Both filter sets provide attenuation from 400nm to 1800nm. The filters in each wheel are tilted at 2° to the normal, in opposite directions, so that the surfaces between adjacent filters are tilted at 4° with respect to each other to eliminate interference effects.

## Sealed Filter Assembly and Components

Except for the input and output apertures, the BA series attenuators are sealed to minimize the possibility of dust, finger prints, or other foreign matter collecting on the filter surfaces. This also eliminates ambient stray light from entering, except at the input and output ports. The input and output ports accept a number of adapters to enable direct connection to other optical components such as a Beam Tap II on the input, and a CCD camera on the output. This then provides a complete optically sealed unit.

Item	Description	Attenuation
BA-NIR	Beam Attenuator calibrated at 1064nm	700-1250nm
BA-VIS	Beam Attenuator calibrated at 632nm	400-700nm



BeamTap II

BA

Any C Mount  
Camera

Typical application of a BA with a Beam Tap II and a CCD camera.

<b>Beam Splitters and Attenuators</b>		
<b>Stackable beam splitters and filters/attenuators</b>		
Beam splitter for mounting on cameras	45 degree angle wedge beam splitter which mounts onto camera. Reduces beam intensity by ~20 times. For spectral range 190 – 2500nm. Fits all cameras	SPZ17015
Additional beam splitters for mounting to previous beam splitter	Additional wedge beam splitter as above which mounts at right angles to previous beam splitter. As many as 3 beam splitters can be mounted in this fashion in series, each one reducing intensity by ~20 times.	SPZ17026
Large beam splitter	45 degree angle wedge beam splitter with large 30mm aperture. When stacked on top of smaller beam splitters especially useful for monitoring a converging beam.	SPZ17025
Stand alone large wedge beam splitter	Large size Wedge beam splitter which mounts to standard ¼" thread ½" laboratory rod. Reduces beam intensity by ~20 times. For spectral range 190 – 2500nm. Especially for 4X beam reducer.	SPZ17018
ND1 stackable filter (red housing)	4mm spacing screw on filter for camera with transmission of between 20% and 5% depending on spectral range Can be stacked and combined with other filters and beam splitters.. One filter is included with Spiricon cameras	SPZ08234
ND2 stackable filter (black housing)	4mm spacing screw on filter for camera with transmission of between 7% and 0.5% depending on spectral range. Can be stacked and combined with other filters and beam splitters. Two filters are included with Spiricon cameras	SPZ08235
ND3 stackable filter (green housing)	4mm spacing screw on filter for camera with transmission of between 2% and 0.05% depending on spectral range. Can be stacked and combined with other filters and beam splitters.	SPZ08253
4mm spacer	Blank stackable spacer / filter holder where 4mm spacing is needed but no attenuation is needed	SPG01698
5mm spacer	Spacer ring for adapting 12.5mm recess CS cameras to 17.5mm recess C mount lenses	SPG02106
8mm spacer	Spacer ring for adapting 4.5mm recess cameras to work with 12.5mm recess CS mount lenses	SPG02067
Filter holder and 50x50 filter set	Filter holder with set of 4 standard Schott 50X50mm neutral density filters. Useful to reduce intensity before inputting into 4X beam reducer. Mounts to standard ¼" thread, ½" diameter laboratory rod.	SPZ08240
LBF-50 filter set	Compact screw in filter holder with set of ND filters. Attenuations from low to 10 <sup>6</sup>	SP90081
Variable attenuator	Continuously variable attenuator for complete control over beam intensity. Especially useful for pulsed lasers. Varies the intensity over more than 4 orders of magnitude between wavelengths 350nm and 1100nm. Can be stacked and combined with other filters and beam splitters	SPZ17012
Filter for 355nm-V2	Silicon cameras can see the 355nm 3rd harmonic radiation of YAG. The YAG however usually emits some light at 532nm and 1064nm as well. This filter filters out the other 2 wavelengths to give an undistorted image of the 355nm light.	SPZ08246
Filter for 1300nm	For all cameras that can operate at 1300nm but are quite insensitive there. This filter filters out all light below 1200nm to allow viewing 1300nm radiation without background interference	SPZ08242
<b>LBS System Beam Splitters and attenuators</b>		
BA-NIR	Beam Attenuator calibrated at 1064nm	SP90159
BA-VIS	Beam Attenuator calibrated for the Visible region.	SP90158
BT-II	Beam Tap II (250nm-2000nm), UVFS, 0.16% R <sub>avg</sub>	SP90133
BT-II VIS	Beam Tap II-VIS (400nm-700nm)	SP90172
BT-I	Beam Tap I (250nm-700nm), Beam Tap-1 - YAG (1064nm)	SP90173
BT-I VIS	Beam Tap I-VIS (400nm-700nm)	SP90136
LBS-100-C	19mm clear aperture, recommended for 400nm to 900nm. Kit contains one uncoated fused silica beam splitter wedge and 6 ND filters	SP90061
LBS-100-YAG	As above but for YAG with beam splitter wedge AR coated to give a reflection of 1% for both S and P polarizations.	SP90057
LBS-100-IR-0.5	As above but for CO <sub>2</sub> . Contains 1 ZnSe wedge with 0.5% reflection and set of 4 CaF <sub>2</sub> flats.	SP90058
LBS-100-IR-5.0	As above but with 5% reflecting wedges	SP90059
LBS-100-UV	19mm clear aperture, recommended for 266nm to 355nm. Kit contains one uncoated fused silica beam splitter wedge and 6 ND filters	SP90171
LBS-100 to 4X beam reducer adapter	This adapter enables mounting of the LBS-100 beam splitter / attenuator assembly in front of the 4X beam reducer. The combined assembly can image large high power beams in one unit. See illustration on page 149.	SPZ17029