LBS-300

Beam Sampler for C-mount Cameras

P/N SP90183, SP90184, SP90185 and SP90186

YAG Focal Spot Analysis Adapter

P/N SP90187, SP90188, SP90189, SP90190, SP90191

User Notes

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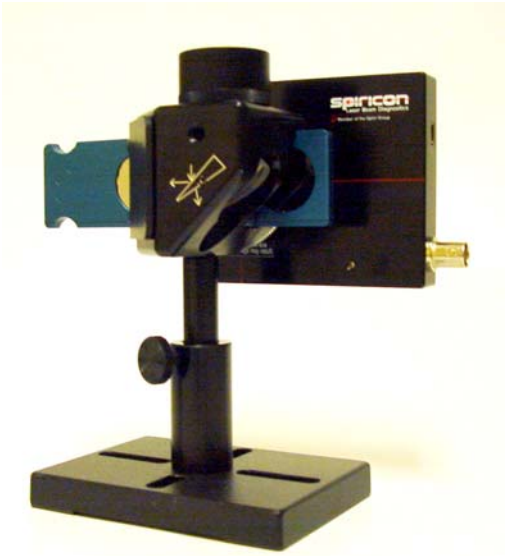


LBS-300 with FSA adapter and camera

The LBS-300 beam sampler 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 10 mWatts to ~400 Watts[1]. 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 oncoming 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 .01% passed on to the camera[2]. 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 (P/N SPZ17015) 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. Alternatively, two LBS-300s can be coupled in series providing up to a 10^{-8} attenuation.[3]

> Note: If operating with pulsed lasers you should trigger the camera externally and set the exposure time long enough to collect one laser pulse.
>
> If operating with CW YAG lasers at 1064nm, you must use the SP620, Gras20 or Scor20 cameras set to 7.5 Hz fps and maximum exposure timing. You cannot use the exposure control to reduce beam amplitude without causing image blooming.

[1] 0.5 mW to ~400 W for SP90186
[2] The SP90186 passes 0.25% to the camera.
[3] $6x10^{-6}$ attenuation for the SP90186

LBS-300 components

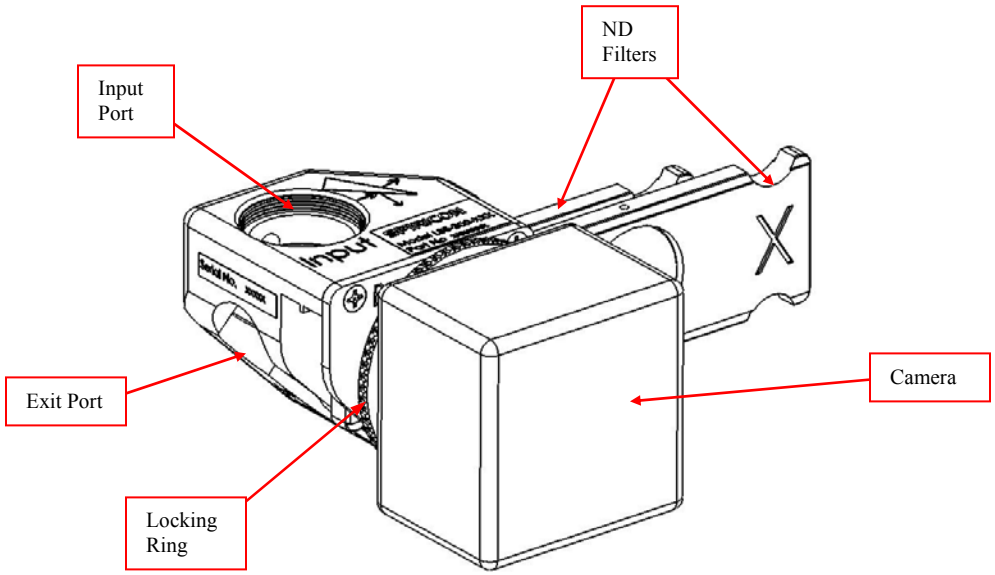


Figure 1

Installation and Setup:

1. The LBS-300 is attached to the camera as shown in Figure 1. An adjustable locking ring is provided so that the beam sampler can be oriented with the input port to the right, left, up or down as required.

WARNING: You must provide a beam stop for the laser beam that passes through the beam sampler. The beam stop must be able to withstand the continuous power/energy of the input beam.

Position the LBS-300 so that the laser beam will enter the center of the input port. The beam will exit the LBS-300 turned approximately 5 degrees in the direction shown in Figure 2. Provision must be made to safely contain the transmitted beam. An optional beam dump is available to contain the beam if required.

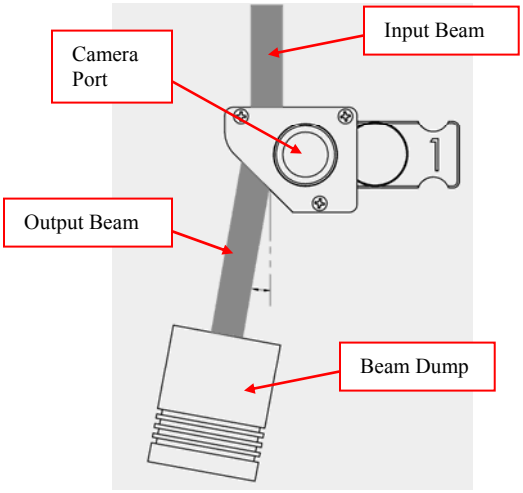


Figure 2

2. Adjust the position of the LBS-300 so that the beam will exit the center of the camera port. An alignment fixture consisting of a ground glass plate is provided to assist in aligning visible beams to the camera imager. This plate allows you to directly view a visible or UV beam (UV by secondary emissions). In the NIR you would need to use an NIR viewer or a visible alignment beam. To use the alignment fixture, screw the fixture onto the camera port and center the image of the beam in the plate. See Figure 3. When the LBS-300 is aligned remove the alignment fixture and attach the camera.

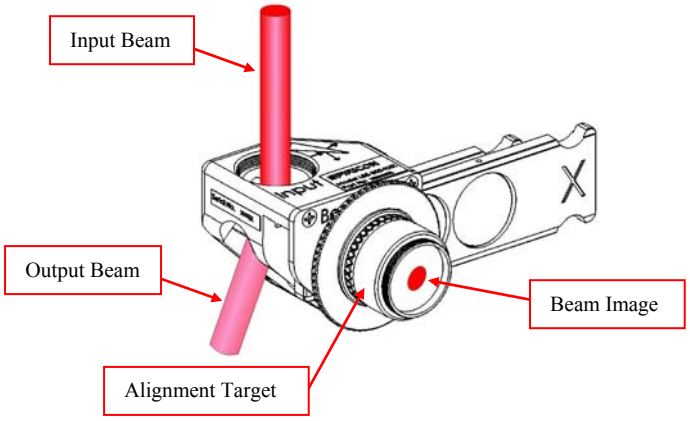


Figure 3

Operation

1. Start the beam profiler software and adjust the ND filter holders for optimum image. See appendix A for ND filter details. If there are interference effects seen, slight angling of the camera-sampler setup to the beam path may eliminate this.
2. If no picture is seen, check again that the beam is aligned into sampler. If the image is saturated when the maximum ND filters are in place, lower the camera signal below saturation by reducing the camera exposure setting[4] or removing the camera, adding one or more of the c-mount ND filters provided with the camera and remounting the camera.

CAUTION: The damage threshold for the ND filters is 50 Watts/cm². Make sure that the power density in the beam as it hits the ND filters does not exceed this amount. If the beam is converging (focusing) rather than collimated be sure to take this effect into consideration as well.

At power levels >5 watts/cm^2 the ND filters may start to thermal lens and deform the observed beam profile.

[4] Do not use this method with pulsed lasers or 1064nm CW lasers.

YAG Focal Spot Analysis Adapter

P/N SP90187, SP90188, SP90189, SP90190, SP90191

The FSA series of accessory lenses allow the measurement of the focal spot for relatively high power YAG laser beams. The LBA-300 has the ability to attenuate the beam to safe levels, however the focal length of many laser systems is too short to reach the camera detector through the LBS-300. The FSA consists of a negative lens that lengthens the path of the focusing beam allowing the focal spot to reach the camera detector. The negative lens also has the added benefit of magnifying the beam to make measurements easier.

An Excel spreadsheet is available that will help select the appropriate lens for your laser configuration and calculate the position . Contact Ophir-Spiricon or see the Ophir-Spiricon web site.

Assembly:

The FSA adapter simply screws into the input port of the LBS-300.

Operation:

1. Make sure that there is a beam stop capable of handling the full power of the laser installed in the path of the deflected beam from the LBS-300.
2. Using spreadsheet, calculate the required distance from the LBS-300 to the laser source.
   Alternatively use the formula D = L + 1 / (1/F-1/i), where L is the distance from the source to the focal spot, F is the focal length of the negative lens and i is the distance from the negative lens to the CCD to calculate the distance D from the negative lens to the laser. (See appendix B.)
3. Start the beam profiling software and adjust the LBS-300 until the beam image is centered and not saturated. Adjust the distance from the LBS-300 to the laser source until the displayed spot size is minimized. For additional information on using beam profiling software, consult the beam profiler user manual.
4. To obtain the correct spatial results from the beam profiling software, the pixel scaling factor will need to be set to the magnification factor. The approximate magnification factor is provided by the spreadsheet or from the calculations in Appendix B.
   To find the exact scaling factor, move the camera and beam sampler a known distance in a lateral direction while measuring the movement indicated by the software. The final scaling factor is:
   (movement indicated by software) / (actual movement).
   Use this factor to modify the scaling in the beam profiling software.

Ordering Information:

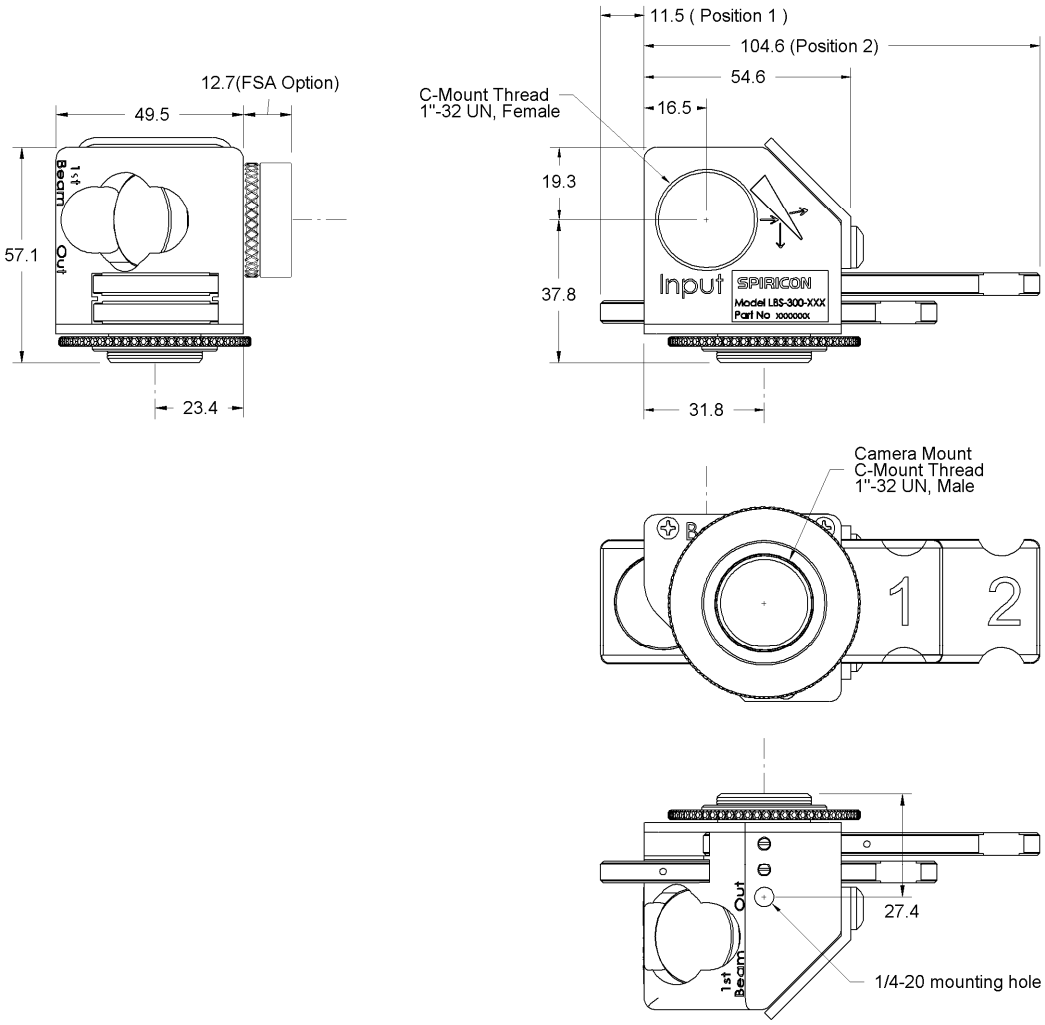
Compact Laser Beam Sampling Systems for C-mount Cameras				
Model	**LBS-300-UV**	**LBS-300-VIS**	**LBS-300-NIR**	**LBS-300-BB**
Part No.	**SP90183**	**SP90184**	**SP90185**	**SP90186**
Wavelength	266-355nm	400-700nm	1064nm	190-1550nm
Wedge Material	UVFS	BK7	BK7	UVFS
Wedge Coating	A/R ≤1%	AR ≤1%	AR ≤1%	None
Clear aperture	17.5mm	17.5mm	17.5mm	17.5mm
Wedge ND value, each	ND ≥2	ND ≥2	ND ≥2	ND ~1.3
ND Filters	Inconel	Bulk ND	Bulk ND	One each of the UV, VIS & NIR sets
ND Values, nominal	.3, .7, 1.0, 2.0, 3.0, 4.0 (Blue holders)	.3, .7, 1.0, 2.0, 3.0, 4.0 (Green holders)	.3, .7, 1.0, 2.0, 3.0, 4.0 (Red holders)	See UV, VIS and NIR descriptions
Filter Slides	3	3	3	9
Filter Damage(1)	100 W/cm² CW 20mJ/cm², 10ns pulse	50 W/cm² 1J/cm², 10ns pulse	50 W/cm² 1J/cm², 10ns pulse	See UV, VIS and NIR specifications
Accessories				
Wedge Variable ND Filter kit		**WVF-300 SP90195**	**WVF-300 SP90195**	**WVF-300 SP90195**
Negative Lens To add FSA capability	*	*	**FSA-50Y SP90187** -50mm YAG	*
	*	*	**FSA-100Y SP90188** -100mm YAG	*
	*	*	**FSA-125Y SP90189** -125mm YAG	*
	*	*	**FSA-150Y SP90190** -150mm YAG	*
	*	*	**FSA-200Y SP90191** -200mm YAG	*
Beam Dumps	**BD-040-A, SP90192** 40 Watts Max Power, Air Cooled			
	BD-500-W, SP90193 500 Watts Max Power, Water Cooled			

* available as special order, consult your OSI rep.

(1) ND bulk absorbing filters damage threshold is 50W/cm² but should be used at <5W/cm² to avoid thermal lensing effects.

Features:

C-mount stackable design compatible with most other C-mountable accessories
Wedges removable for replacement and cleaning
Multiple mounting points
Marked for easy use
Lenses can be added for FSA operation
Sliding wedge filters will fit in the filter slots.
Power/Energy meter at 1st exit port can measure ~99% (~95%-BB) of input beam
Optional Wedged Variable replace the fixed ND filters and must be used as a set.

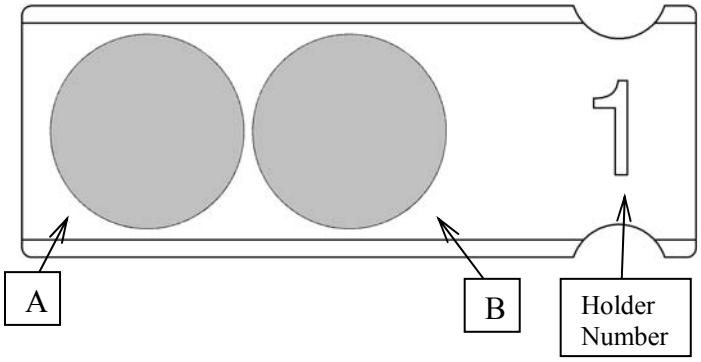


LBS-300 Dimensions

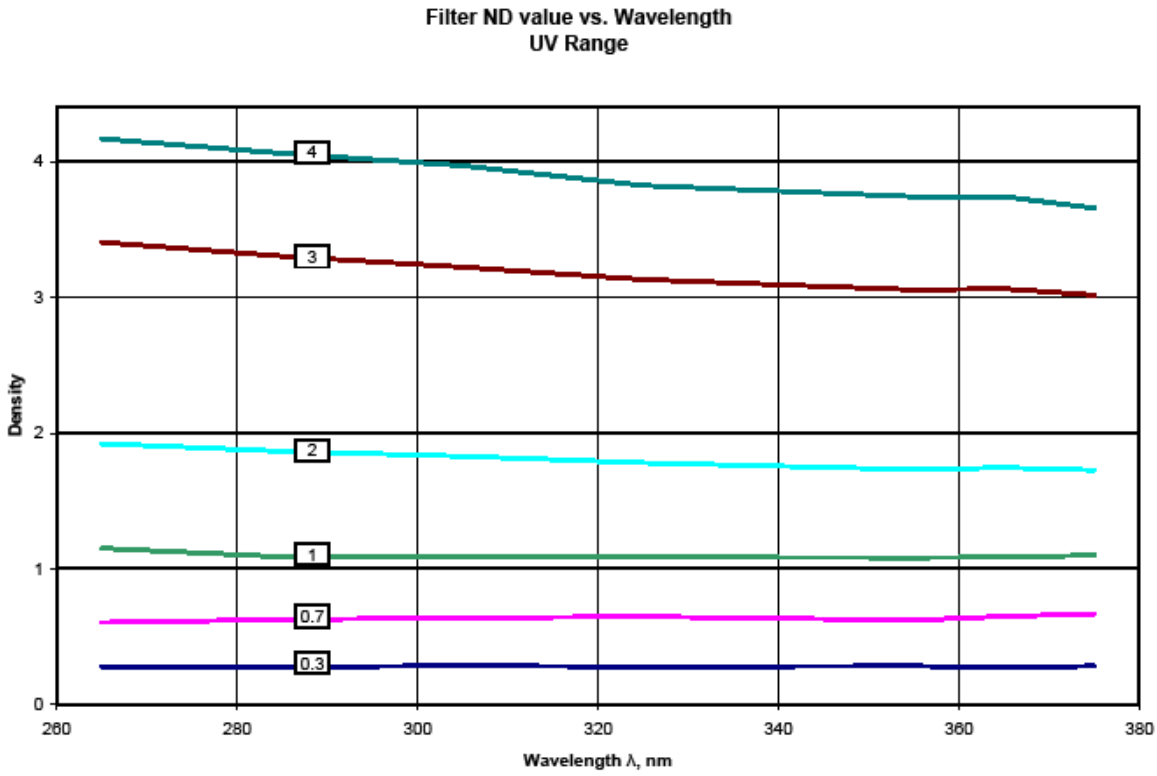
Appendix A ND Filters

ND filter holders are provided with each LBA-300 to allow for final attenuation of the laser beam. Each filter in the holder provides for a different value of attenuation. To use, slide the desired holder into the slot in the LBS-300. A click is felt when the filter is properly aligned with the beam. The holders provided will allow for attenuation of up to ND 6.

Holder Number	Filter A	Filter B
1	0.3	0.7
2	1	2
3	3	4

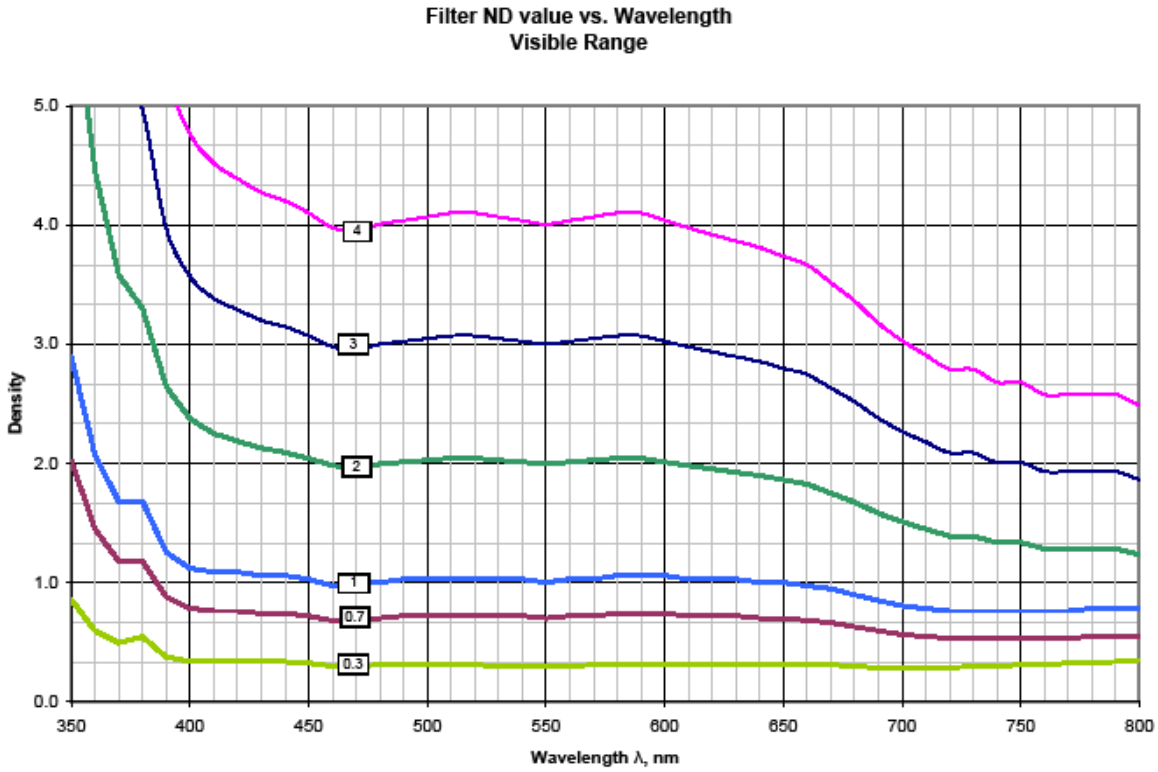


The attenuation at specified wavelengths are available in the charts below.

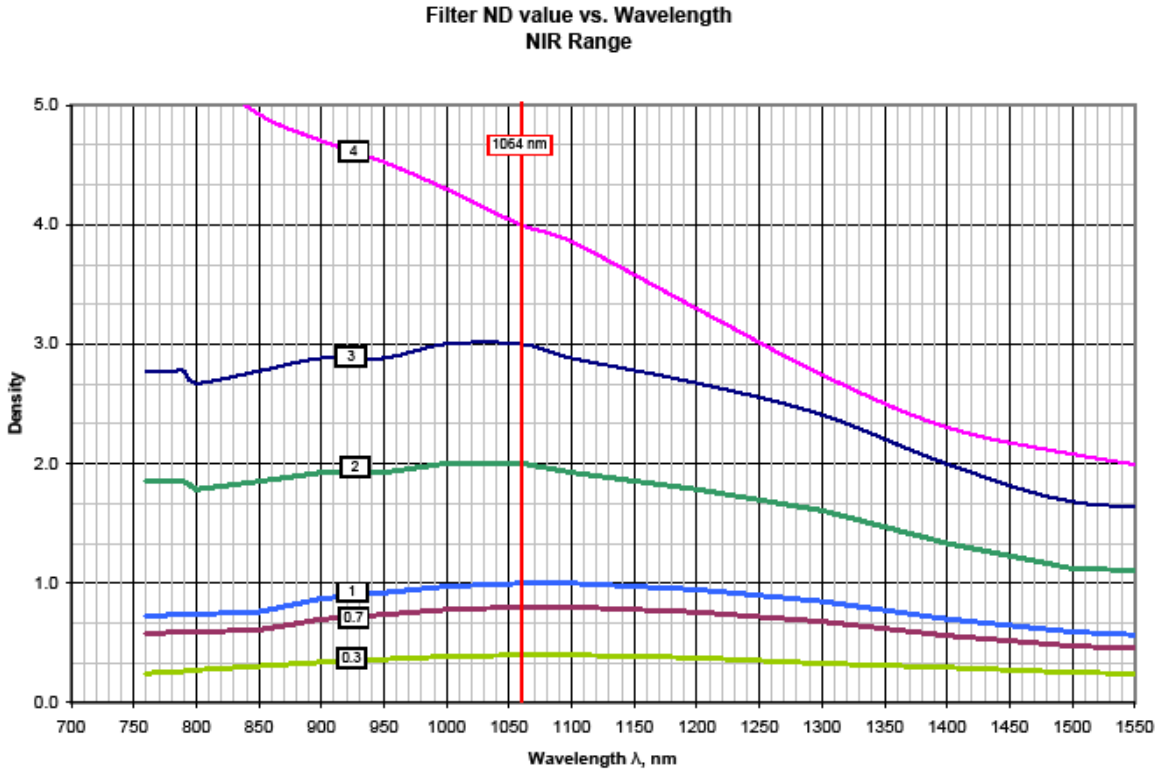


UV filter set (Blue Holders)

Appendix A ND Filters



Visible filter set (Green Holders)



NIR filter set (Red Holders)

Appendix B Calculation of distances for Focal Spot Analyzer

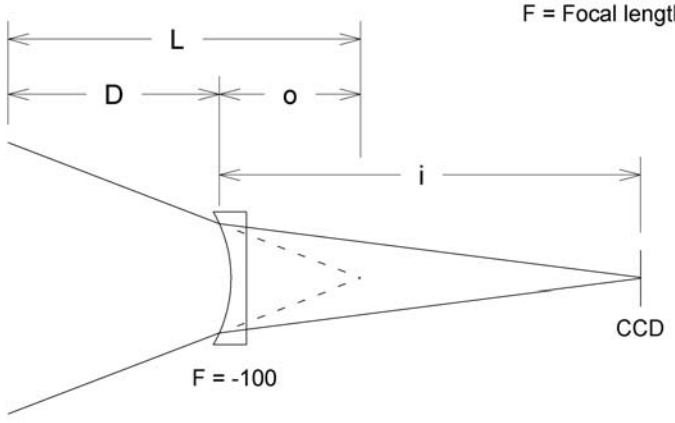
The correct placing of the FSA assembly depends on the distance from the source to the focal spot and on the configuration of the FSA – beam sampler system. In order to calculate this, you must determine the distance from the negative lens to the CCD as well as the distance from the source (or closest spot you can approach to the focusing lens) to the focal spot.

Calculate the placement as follows:

1. The distance i from the negative lens to the CCD of a ophir mount camera is 79.8mm with no c-mount attenuators. Add 4mm for each c-mount attenuator added. Add 8 mm for a CS mount camera. Add 13mm for a C-mount camera.
2. The focal length of the negative lens F is as chosen by the user and may be -50, -100, -125, -150 or -200mm.
3. The distance L from the source to the focal spot will be the focal length of the system lens less the distance from the lens to the nearest approach point in the system to the lens.
4. When the above is known, calculate the distance D to place the negative lens from the source from the formula D = L + 1/(1/F-1/i) See the example below. The FSA adapter extends 6.3mm above the negative lens, so when measuring the placement of the beam sampling system, use D-6.3mm for the distance from the end of the FSA adapter to the source.

EXAMPLE

for: L = Source to Focus = 70mm
i = Internal path length from lens to CCD = 79.8mm
F = Focal length of negative lens = -100mm



formulas:
1/o + 1/i = 1/F
1/o = 1/F - 1/i
o = 1/ (1/F - 1/i)

D = L + o
D = L + 1/ (1/F - 1/i)

M = -i / o

o = Negative lens to original focus = 1/ (1/100mm - 1/79.8mm) = -44.4mm
D = Source to Negative lens = 70mm + 1/ (1/-100mm - 1/ 79.8mm) = 25.6mm
M = Magnification factor = -79.8mm / -44.4mm = 1.80