

# WAVELENGTH MANAGEMENT

## UV CONVERTERS

UV Converters take advantage of a phenomenon called fluorescence to extend the performance range of the Beamage beam profiling camera to ultraviolet wavelengths. A fluorescent crystal located at the entrance of the converter absorbs UV wavelengths and reemits longer wavelengths (in the visible spectrum), which are less energetic and detected by the CMOS sensor.

### MAIN CHARACTERISTIC

- Transforms wavelengths contained between X-Rays and 400 nm to visible and near-IR wavelengths.
- Images larger beams due to the magnification properties of the optics.
- Built with an iris at the output port for a control of the exposure on the CMOS sensor.
- Removable extension tube that is easily fixed onto the entrance port of the Beamage camera.
- Ready to use within minutes



### SPECIFICATIONS

MODEL	BSF12C12N	BSF12C23N	BSF12P12N	BSF12P23N	BSF12R12N	BSF12R23N	BSF12G12N	BSF12G23N
Input Aperture Ø	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm	12 mm
Closest Standard Optical Camera Format	1/2"	2/3"	1/2"	2/3"	1/2"	2/3"	1/2"	2/3"
Main Tube Length (L)	60 mm	60 mm	60 mm	60 mm	60 mm	60 mm	60 mm	60 mm
Extension Tube Length (D)	24.3 mm	29.2 mm	24.3 mm	29.2 mm	24.3 mm	29.2 mm	24.3 mm	29.2 mm
Overall Length (OAL)	102.8 mm	109.7 mm	102.8 mm	109.7 mm	102.8 mm	109.7 mm	102.8 mm	109.7 mm
Max Input Beam Size	7.2 x 9.6 mm	7.2 x 9.6 mm	7.2 x 9.6 mm	7.2 x 9.6 mm	7.2 x 9.6 mm	7.2 x 9.6 mm	7.2 x 9.6 mm	7.2 x 9.6 mm
Max Beam Size on CMOS	4.2 x 5.6 mm	6.0 x 8.0 mm	4.2 x 5.6 mm	6.0 x 8.0 mm	4.2 x 5.6 mm	6.0 x 8.0 mm	4.2 x 5.6 mm	6.0 x 8.0 mm
Magnification	1.7	1.2	1.7	1.2	1.7	1.2	1.7	1.2
Crystal Type	C	C	P	P	R	R	G	G
Wavelength Range	110 - 225nm	110 - 225 nm	110 - 350 nm	110 - 350 nm	110 - 535 nm	110 - 535 nm	X-ray - 400 nm	X-ray - 400 nm
Relative Response	193 nm: 22 248 nm: 0.17 308 nm: 0.03	22 0.17 0.03	48 15 1	48 15 1	100 8 0.18	100 8 0.18	480 480 112	480 480 112
Saturation Level	193 nm: 400 mJ/cm <sup>2</sup> 248 nm: N/A 308 nm: N/A	400 mJ/cm <sup>2</sup> N/A N/A	30 mJ/cm <sup>2</sup> 30 mJ/cm <sup>2</sup> 50 mJ/cm <sup>2</sup>	30 mJ/cm <sup>2</sup> 30 mJ/cm <sup>2</sup> 50 mJ/cm <sup>2</sup>	50 mJ/cm <sup>2</sup> 400 mJ/cm <sup>2</sup> 400 mJ/cm <sup>2</sup>	50 mJ/cm <sup>2</sup> 400 mJ/cm <sup>2</sup> 400 mJ/cm <sup>2</sup>	10 mJ/cm <sup>2</sup> 10 mJ/cm <sup>2</sup> 50 mJ/cm <sup>2</sup>	10 mJ/cm <sup>2</sup> 10 mJ/cm <sup>2</sup> 50 mJ/cm <sup>2</sup>
Decay Time	3 - 5 µs	3 - 5 µs	5 µs	5 µs	3000 µs	3000 µs	0.5 µs	0.5 µs
Max Repetition Rate	30 - 20 kHz	30 - 20 kHz	20 kHz	20 kHz	30 Hz	30 Hz	200 kHz	200 kHz
Product Number	202314	202315	202318	202319	202320	202323	202316	202317

MODEL	BSF23C12N	BSF23C23N	BSF23P12N	BSF23P23N	BSF23R12N	BSF23R23N	BSF23G12N	BSF23G23N
Input Aperture Ø	23 mm	23 mm	23 mm	23 mm	23 mm	23 mm	23 mm	23 mm
Closest Standard Optical Camera Format	1/2"	2/3"	1/2"	2/3"	1/2"	2/3"	1/2"	2/3"
Main Tube Length (L)	76.3 mm	76.3 mm	76.3 mm	76.3 mm	76.3 mm	76.3 mm	76.3 mm	76.3 mm
Extension Tube Length (D)	27.4 mm	30 mm	27.4 mm	30 mm	27.4 mm	30 mm	27.4 mm	30 mm
Overall Length (OAL)	118.2 mm	124.8 mm	118.2 mm	124.8 mm	118.2 mm	124.8 mm	118.2 mm	124.8 mm
Max Input Beam Size	13.8 x 18.4 mm	12.5 x 18.4 mm	13.8 x 18.4 mm	12.5 x 18.4 mm	13.8 x 18.4 mm	12.5 x 18.4 mm	13.8 x 18.4 mm	12.5 x 18.4 mm
Max Beam Size on CMOS	4.6 x 6.1 mm	6.0 x 8.8 mm	4.6 x 6.1 mm	6.0 x 8.8 mm	4.6 x 6.1 mm	6.0 x 8.8 mm	4.6 x 6.1 mm	6.0 x 8.8 mm
Magnification	3	2.1	3	2.1	3	2.1	3	2.1
Crystal Type	C	C	P	P	R	R	G	G
Wavelength Range	110 - 225 nm	110 - 225 nm	110 - 350 nm	110 - 350 nm	110 - 535 nm	110 - 535 nm	X-ray - 400 nm	X-ray - 400 nm
Relative Response	193 nm: 22 248 nm: 0.17 308 nm: 0.03	22 0.17 0.03	48 15 1	48 15 1	100 8 0.18	100 8 0.18	480 480 112	480 480 112
Saturation Level	193 nm: 400 mJ/cm <sup>2</sup> 248 nm: N/A 308 nm: N/A	400 mJ/cm <sup>2</sup> N/A N/A	30 mJ/cm <sup>2</sup> 30 mJ/cm <sup>2</sup> 50 mJ/cm <sup>2</sup>	30 mJ/cm <sup>2</sup> 30 mJ/cm <sup>2</sup> 50 mJ/cm <sup>2</sup>	50 mJ/cm <sup>2</sup> 400 mJ/cm <sup>2</sup> 400 mJ/cm <sup>2</sup>	50 mJ/cm <sup>2</sup> 400 mJ/cm <sup>2</sup> 400 mJ/cm <sup>2</sup>	10 mJ/cm <sup>2</sup> 10 mJ/cm <sup>2</sup> 50 mJ/cm <sup>2</sup>	10 mJ/cm <sup>2</sup> 10 mJ/cm <sup>2</sup> 50 mJ/cm <sup>2</sup>
Decay Time	3 - 5 µs	3 - 5 µs	5 µs	5 µs	3000 µs	3000 µs	0.5 µs	0.5 µs
Max Repetition Rate	30 - 20 kHz	30 - 20 kHz	20 kHz	20 kHz	30 Hz	30 Hz	200 kHz	200 kHz
Product Number	202324	202325	202328	202329	202330	202331	202326	202327

A complete procedure on how to choose the appropriate UV Converter (UV Converter Application Note) is available on our website at [www.gentec-eo.com](http://www.gentec-eo.com).

# WAVELENGTH MANAGEMENT

## IR ADAPTOR

Typically, a CMOS silicon sensor is operating at its full potential when imaging lasers with wavelengths between 350 nm and 1150 nm\*. If you want to extend the performance range of your Beamage beam profiling camera to the near-IR telecom wavelengths band, you can use the IR Adaptor. This ideal solution takes advantage of a multi-photon absorption process to extend the sensitivity range of the camera sensor to a portion of the near-IR spectrum (1495 nm – 1595 nm).

### MAIN CHARACTERISTICS

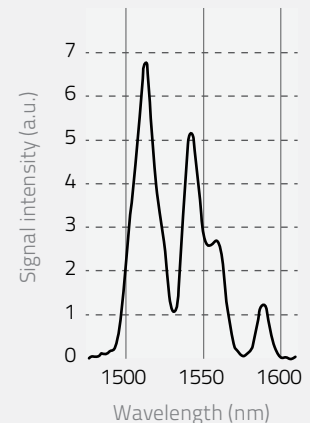
- Converts wavelengths between 1495 nm and 1595 nm to shorter wavelengths between 950 nm and 1075 nm.
- Images larger beams due to the convergent properties of the optics (3.29X).
- Built with a high quality coated anti-reflection input window that allows wavelength conversion with low distortion and maximum image resolution.
- Removable and easily C-mounted onto the entrance port of the camera.
- Ready to use within minutes.



### SPECIFICATIONS

MODEL	IR ADAPTOR
Active Area	27.5 mm Ø
IR Spectral Range	1495 nm – 1595 nm
Peak IR Sensitivity	1510 nm and 1540 nm
Converted Wavelengths	950 nm – 1075 nm
Pixel Multiplication Factor	3.29
Minimum Beam Size	230 µm
Maximum Beam Size	19 mm
Maximum Resolution	12 lp/mm over active area 40 lp/mm at sensor focal plane
Distortion	-1.0% barrel distortion (inverted image)
Linearity	Non-Linear, IR converted output $\propto$ IR input intensity $^{1.41}$
Spectral Transmission	360 nm – 2000 nm @ F30.8
Damage Threshold	1 W/cm <sup>2</sup>
Dimensions	46 mm Ø x 97 mm L
Operating Temperature	-10°C to +40°C
Weight	210 g
Product Number	201061

### EXCITATION SPECTRUM



\* The Beamage-3.0 is also offered with an optional phosphor coated CMOS sensor (Beamage-3.0-IR), which is sensitive to wavelengths between 1495 nm and 1595 nm. See page 179 for more details.

# WAVELENGTH MANAGEMENT

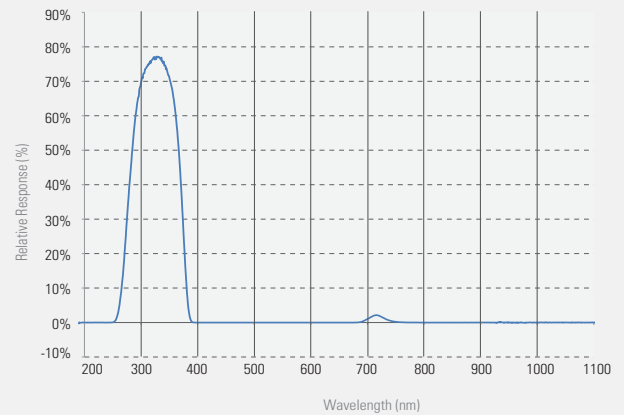
## UV BANDPASS FILTER

We also offer a color glass filter specially designed for the UV spectrum. Depending on the wavelength, the UG11-UV filter transmits 20% to 70% of the input beam power. It is particularly useful for applications with wavelengths contained between 250 nm and 370 nm. Other wavelengths are blocked by the filter. The UG11-UV is SM1 threaded and comes with a SM1 to C-mount adaptor.

MODEL	UG11-UV
Spectral Range	250 nm – 370 nm
Diameter	25 mm Ø
Clear Aperture	80% of area
Dimensional Tolerance	+0.0/-0.2 mm
Thickness	3 mm
Thickness Tolerance	+0.0/-0.2 mm
Parallelism	< 3 arcmin
Surface Flatness	< $\lambda/4$
Maximum Power	1 W
Surface Quality	40-20 Scratch-Dig
Damage Threshold	30 W/cm <sup>2</sup> (typical)
Product Number	202602

\* Data specified at 633 nm

### SPECTRAL TRANSMISSION

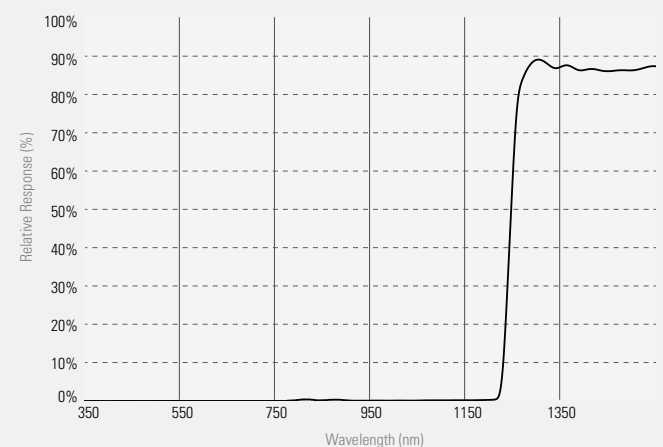


## IR FILTER

The B3-IR-FILTER is a color glass filter specifically designed for IR applications. Acting as a longpass filter, the B3-IR-FILTER cuts all the wavelengths below 1250 nm and only lets the IR wavelengths pass. It transmits approximately 70% of the incident light. The B3-IR-FILTER is SM1 threaded and comes with a SM1 to C-mount adaptor so you can mount it on the Beamage camera.

MODEL	B3-IR-FILTER
Spectral Range	1250 – 1350 nm
Diameter	25 mm Ø
Clear Aperture	80% of area
Dimensional Tolerance	+0.0/-0.2 mm
Thickness	6.3 mm max
Parallelism	< 3 arcmin
Surface Flatness	< $\lambda/4$
Maximum Power	1 W
Surface Quality	80-50 Scratch-Dig
Damage Threshold	30 W/cm <sup>2</sup> (Typical)
Product Number	202855

### SPECTRAL TRANSMISSION



MONITORS

ENERGY DETECTORS

POWER DETECTORS

HIGH POWER SOLUTIONS

PHOTO DETECTORS

THZ DETECTORS

OEM DETECTORS

SPECIAL PRODUCTS

BEAM DIAGNOSTICS

# BEAM SIZE MANAGEMENT

## CAMERA LENSES

Camera lenses work by indirectly imaging on the sensor the reflection or the transmission of a beam that previously went through a diffusing material such as glass (see diagrams below).

It is necessary to use a Camera Lens to image beams that are larger than the CMOS sensor (11.3 mm X 6.0 mm) of the Beamage beam profiling camera.

A Camera Lens can be directly C-mounted onto the aperture of the Beamage camera.

## SPECIFICATIONS

MODEL	CL-25	CL-50
Focal Length	25 mm	50 mm
Maximum Beam Size	2000 mm X 2000 mm (not a limiting factor)	2000 mm X 2000 mm (not a limiting factor)
Maximum Measurable Intensity / Energy	Very high because of indirect mechanism	Very high because of indirect mechanism
Inverted Image	Yes	Yes
Beam Distortion	Setup, lens aberration and speckles from diffusing glass	Setup, lens aberration and speckles from diffusing glass
Diffusing Material Needed	Yes	Yes
Magnification Calibration Needed	Yes	Yes
Possibility of Wavelength Conversion	Yes	Yes
Optical Filter Needed	Rarely to never	Rarely to never
Removable	Yes	Yes
Product Number	202343	202344

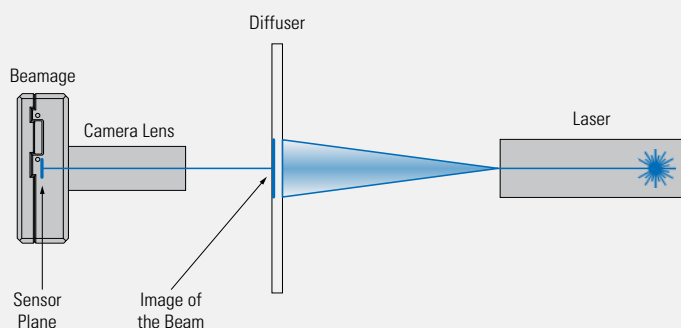


To determine which lens better fits your requirements, refer to the table below.

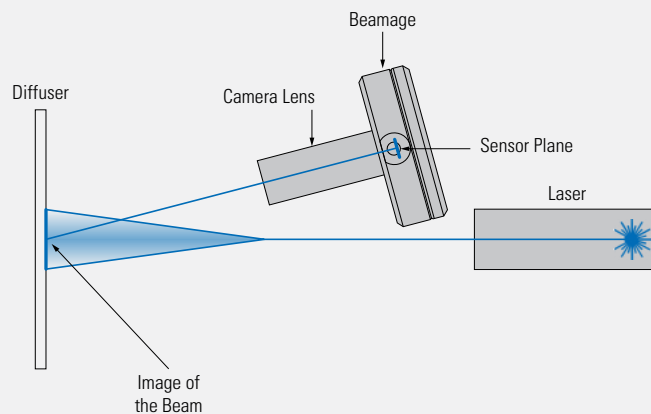
PRODUCT	PRODUCT NUMBER	FOCAL LENGTH	HORIZONTAL FOV	FOV AT 1 m	MINIMUM WORKING DISTANCE
CL-25	202343	25 mm	14°	245 mm	0.5 m
CL-50	202344	50 mm	7°	120 mm	1 m

To calculate linear FOV (Field of View) at distances other than 1 m, simply multiply the value found in the table by the distance in meters.

## IMAGING A TRANSMITTED BEAM



## IMAGING A REFLECTED BEAM



# POWER MANAGEMENT

## NEUTRAL DENSITY (ND) FILTERS - UP TO 1 W

We offer various SM1 threaded absorptive ND (Neutral Density) filters that can be fixed directly on the aperture of the Beamage camera via a SM1 to C-mount adaptor. Subsequent filters can be stacked directly on each other. These filters reduce the intensity of all wavelengths without affecting the wavefront of the beam or distorting the image. Sets of 3 filters or 6 filters as well as individual filters are available. An empty SM1 threaded filter holder is also available for those who would like to use their own ND filters with their camera. It holds 25 mm wide filters.

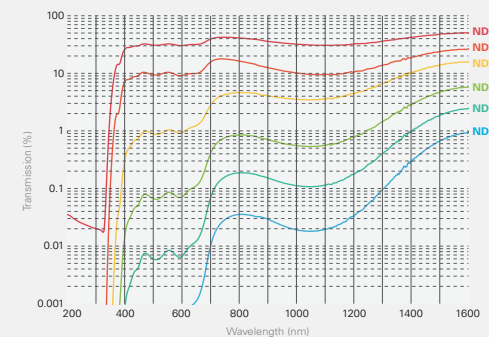
Each filter and each holder comes with a SM1 to C-mount adaptor.

### MAIN SPECIFICATIONS

MODEL	ND0.5 TO ND5.0
Spectral Range	400 nm <sup>a</sup> - 1595 nm
Filter Diameter	25 mm Ø
Clear Aperture	22.5 mm Ø (90% of diameter)
Dimensional Tolerance	+0.0/-0.25 mm
Optical Density Tolerance	±5%
Parallelism	< 10 arcsec
Transmitted Wavefront Error	< λ/10 at 633 nm
Surface Flatness	< λ/4
Surface Quality	40-20 Scratch-Dig
Maximum Power	1 W
Damage Thresholds	100 W/cm <sup>2</sup> or 3 J/cm <sup>2</sup>

\* Data specified at 633 nm  
 a. For ND4.0 filter, lower limit with other models.

### SPECTRAL TRANSMISSION OF ALL FILTERS



### OVERVIEW OF THE MODELS

MODEL	P/N	EQUIVALENT ATTENUATION	TRANSMITTANCE @ 633 nm	SUBSTRATE	MODEL	P/N	EQUIVALENT ATTENUATION	TRANSMITTANCE @ 633 nm	SUBSTRATE
ND0.5	201094	(1/3,16)	~32%	NG4	NDSET-6 (Set of all 6 filters)	202605	See left	See above	See left
ND1.0	201045	(1/10)	~10%	NG4	NDSET-3 (Set of 3 filters (ND1, ND2, ND3))	202606	See left	See above	See left
ND2.0	201046	(1/100)	~1%	NG9	ND-H (ND filter holder)	Call	---	---	---
ND3.0	201047	(1/1000)	~0.1%	NG9					
ND4.0	202600	(1/10 000)	~0.01%	NG9					
ND5.0	202601	(1/100 000)	~0.001%	NG9					

## VARIABLE ATTENUATOR - UP TO 1 W

The BDA-A-VAR is an easy to use variable attenuator equipped with 4 wheels, each one containing 3 filters and 1 empty space at fixed positions. The filters have transmission factors ranging from 100% to 0.003%. With 256 possible configurations, this variable attenuator offers almost continuous attenuation from 0 db to 93 dB. The BDA-A-VAR has M6 holes on 3 sides for mounting versatility and has C-mount threads on both ends for connection with the Beamage via a male to male C-Mount connecting tube (sold separately).

### SPECIFICATIONS

MODEL	BDA-A-VAR
Maximum Attenuation	93 dB (0.00000005%)
Minimum Attenuation	0 dB (0%)
Maximum Power Density	1 W/cm <sup>2</sup>
Maximum Energy Density	100 mJ/cm <sup>2</sup>
Wavelength Range	350 nm – 2200 nm
Clear Aperture	18 mm Ø
Angle Between Filters	4° (Suppresses unwanted interference fringes)
Mounting Capabilities	M6 holes on 3 sides, C-mount threads on both ends
Product Number	201116



MONITORS

ENERGY DETECTORS

POWER DETECTORS

HIGH POWER SOLUTIONS

PHOTO DETECTORS

THZ DETECTORS

OEM DETECTORS

SPECIAL PRODUCTS

BEAM DIAGNOSTICS

# POWER MANAGEMENT

## BEAM SAMPLER - UP TO 200 W

The BDA-S-1000-40W-VIS/IR and BDA-S-1000-200W-VIS/IR beam samplers use Fresnel reflection on two orthogonal wedges to pick off a small fraction of the input beam. Within the 400 nm – 2500 nm range, they provide a fixed  $10^3$  (30 dB) attenuation that weakly depends on the wavelength. The incoming beam polarization state and irradiance are preserved. The wavefront distortion is negligible and the laser output power stability is not affected. These beam samplers have 3 or 4 ports: “Input”, “Sampled Beam”, “Residual Beam” and “Port 4”. They can be connected to the Beamage via a male to male C-mount adaptor (sold with the Beam Sampler) and can be easily combined with the BDA-A-VAR variable attenuator via a male to male C-mount connecting tube (sold separately).

### SPECIFICATIONS

MODEL	BDA-S-1000-40W-VIS/IR	BDA-S-1000-200W-VIS/IR
Spectral Range	400 nm – 2500 nm	400 nm – 2500 nm
Average Attenuation	$10^3$ (30 dB)	$10^3$ (30 dB)
Maximum Power Range	40 W	200 W
Aperture Diameter	17.5 mm	17.5 mm
Max Beam Diameter	15 mm	15 mm
Optical Wedges Material	UV Fused Silica	UV Fused Silica
Refractive Index ( $\lambda = 532$ nm)	1.4607	1.4607
Refractive Index ( $\lambda = 1064$ nm)	1.4496	1.4496
Sampled Beam Lateral Shift	15 mm	15 mm
Sampled Beam Deviation	90°	90°
Residual Beam Deviation	5°	5°
Power Supply	N/A	YES
Product Number	202345	202345



## BEAM SPLITTER CUBE - UP TO 40 W

- The BDA-S-10-UV/IR beam splitter cube provides attenuation and beam sampling for high power laser diagnostics. It uses the front surface of an uncoated mirror and reflects 3% to 10% of the input laser beam.
- There is no back reflection, no unwanted interference fringes, and the image of the beam is virtually undistorted.
- It can take power densities up to 2 GW/cm<sup>2</sup>.
- It is C-mount threaded. It can be connected directly to the Beamage or the BDA-A-VAR variable attenuator with compatible connecting tubes and can be mounted onto a post via its M6 holes.

### SPECIFICATIONS

MODEL	BDA-S-10-UV/IR
Reflection	3% to 10% (polarization dependent)
Spectral Range	190 nm – 2200 nm
Clear Aperture	19 mm
Damage Threshold (Power)	2 GW/cm <sup>2</sup>
Damage Threshold (Energy)	50 J/cm <sup>2</sup>
Wedge	30 arcmin
Surface Flatness	$\lambda/10$
Surface Quality	10-5 Scratch-Dig
Product Number	202604

