BEAMAGE

CMOS Beam Profiling Cameras

laserlines
01295 672500
photonics@laserlines.co.uk
www.laserlines.co.uk

KEY FEATURES

1. **USB 3.0 FOR THE FASTEST TRANSFER RATES**
   Up to 10X faster than regular USB 2.0 connections (also USB 2.0 compatible)
2. **HIGH RESOLUTION**
   2.2 and 4.2 MPixels resolutions give accurate profile measurements of very small beams
3. **LARGE APERTURES**
   - 11.3 x 6.0 mm for the Beamage-3.0
   - 11.3 x 11.3 mm for the Beamage-4M
   - 20.5 x 20.5 mm for the Beamage-4M-FOCUS
4. **AVAILABLE WITH IR COATING**
   Beamage-IR cameras have a special Phosphor coating for IR wavelengths (1495-1595 nm)
5. **ISO COMPLIANT**
   D4σ Definition of Diameter, Centroid, Ellipticity and Orientation are ISO 11146:2004 and 11146:2005 compliant
6. **INTUITIVE SOFTWARE INTERFACE**
   Easy to navigate interface, with many displays and control features:
   - 2D, 3D and XY Displays
   - Background Subtraction Function
   - Unique “Animate” Function
   - Gaussian Fit
   - Semi-Log Graph
7. **EXTERNAL TRIGGER**
   To synchronize the camera with a pulsed laser

AVAILABLE MODELS

Beamage-3.0 and Beamage-3.0-IR
(2.2 MPixels with 5.5 µm Pixels
6.0 x 11.3 mm Sensor)

Beamage-4M and Beamage-4M-IR
(4.2 MPixels with 5.5 µm Pixels
11.3 x 11.3 mm Sensor)

Beamage-4M-FOCUS
(4.2 MPixels with 10 µm Effective Pixels
20.5 x 20.5 mm Effective Aperture)

ACCESSORIES

Stand with Delrin Post
(Model Number: 200428)

BA Series
Optical Attenuators

Stackable ND Filters
(0.5, 1.0, 2.0, 3.0, 4.0 & 5.0)

UV and IR Filters

UV Converters &
IR Adaptors

Pelican Carrying Case

SEE ALSO

ACCESSORIES FOR BEAM DIAGNOSTICS **190**
LIST OF REGULAR ACCESSORIES **206**

APPLICATION NOTE
HOW TO CHOOSE A UV CONVERTER 202182
PROFILING AN IR LASER 202190

Watch the Introduction video available on our website at www.gentec-eo.com

BEAMAGE

SPECIFICATIONS

	BEAMAGE-3.0	BEAMAGE-3.0-IR	BEAMAGE-4M	BEAMAGE-4M-IR	BEAMAGE-4M-FOCUS
SENSOR TECHNOLOGY	CMOS	CMOS (with Phosphor Coating)	CMOS	CMOS (with Phosphor Coating)	CMOS (with Fiber Optic Taper)
EFFECTIVE APERTURE	11.3 x 6.0 mm	11.3 x 6.0 mm	11.3 x11.3 mm	11.3 x 11.3 mm	20.5 X 20.5 mm [b]
MEASUREMENT CAPABILITY					
Wavelength Range					
Camera Only	350 - 1150 nm	1495 - 1595 nm	350 - 1150 nm	1495 - 1595 nm	350 - 1150 nm
With UG11-UV Filter	250 - 370 nm	---	250 - 370 nm	---	---
With B3-IR-FILTER	1250 - 1350 nm	---	1250 - 1350 nm	---	---
Pixel Count	2.2 MPixels	2.2 MPixels	4.2 MPixels	4.2 MPixels	4.2 MPixels
H x V	2048 x 1088	2048 x 1088	2048 x 2048	2048 x 2048	2048 x 2048
Minimum Measurable Beam	55 µm	70 µm	55 µm	70 µm	120 µm
Frame Rate	---		6.2 fps at 4.2 MPixels (Full Frame)		
	11 fps at 2.1 MPixels (Full Frame)		11.4 fps at 2.1 MPixels (2048 x 2048)		
	20 fps at 1.1 MPixels (2048 x 544)		18.6 fps at 1.1 MPixels (2048 x 544)		
	32 fps at 0.066 MPixels (256 x 256)		32 fps at 0.066 MPixels (256 x 256)		
RMS Noise	1000:1 (60 dB)		1000:1 (60 dB)		
ADC Level (User Settable)	12 bit (default) / 10 bit (option)		12 bit (default) / 10 bit (option)		
DAMAGE THRESHOLDS [a]					
Maximum Average Power	1 W with ND filter				
Maximum Density (1064 nm)	CW: 10 W/cm^2 ; Pulsed: 300 µJ/cm^2				
SOFTWARE					
Displays	2D, 3D, XY and Beam Tracking				
Display Features	2D: Print Screen, Reset View, Show/Hide Beam Diameter 3D: Print Screen, Reset View, Top View XY: Save Data, Zoom, Gaussian Fit, Semi-Log, Show/Hide Cursor, Show/Hide FWHM, Show/Hide 1/e^2 Beam Tracking: Save Data, Print Screen, Reset View, Zoom				
Beam Diameter Definitions	D4σ (ISO compliant) 1/e^2 along crosshairs (13.5%) FWHM along crosshairs (50%) Custom (%)				
Buffer Controls	Open File, Save Current Data, Save All Data, Previous/Next Image, Clear Buffer, Animate				
Printing and Reports	Full Report in Print Ready Format (2D, 3D, XY, Measures, Parameters) Print Screen in BMP format (2D and 3D)				
PHYSICAL CHARACTERISTICS					
Sensor Size	11.3 x 6.0 mm	11.3 x 6.0 mm	11.3 x 11.3 mm	11.3 x 11.3 mm	11.3 x 11.3 mm
Sensor Area	0.67 cm^2	0.67 cm^2	1.28 cm^2	1.28 cm^2	1.28 cm^2
Effective Aperture	Same as sensor	Same as sensor	Same as sensor	Same as sensor	20.5 x 20.5 mm [b]
Dimensions (not including filter)	61H x 81.1W x 19.7D mm	61H x 81.1W x 19.7D mm	61H x 81.1W x 19.7D mm	61H x 81.1W x 19.7D mm	61H x 81.1W x 46.5D mm
Weight (head only)	138 g	138 g	138 g	138 g	235 g
ORDERING INFORMATION					
Product Name	BEAMAGE-3.0	BEAMAGE-3.0-IR	BEAMAGE-4M	BEAMAGE-4M-IR	BEAMAGE-4M-FOCUS
Product Number (without stand)	201939	202360	202880	202955	203191

Specifications are subject to change without notice // Compatible stand: P/N 200428

a. With ND4 filter
b. With a typical pixel multiplication factor (PMF) of 1.8.

BEAMAGE

INTUITIVE SOFTWARE INTERFACE

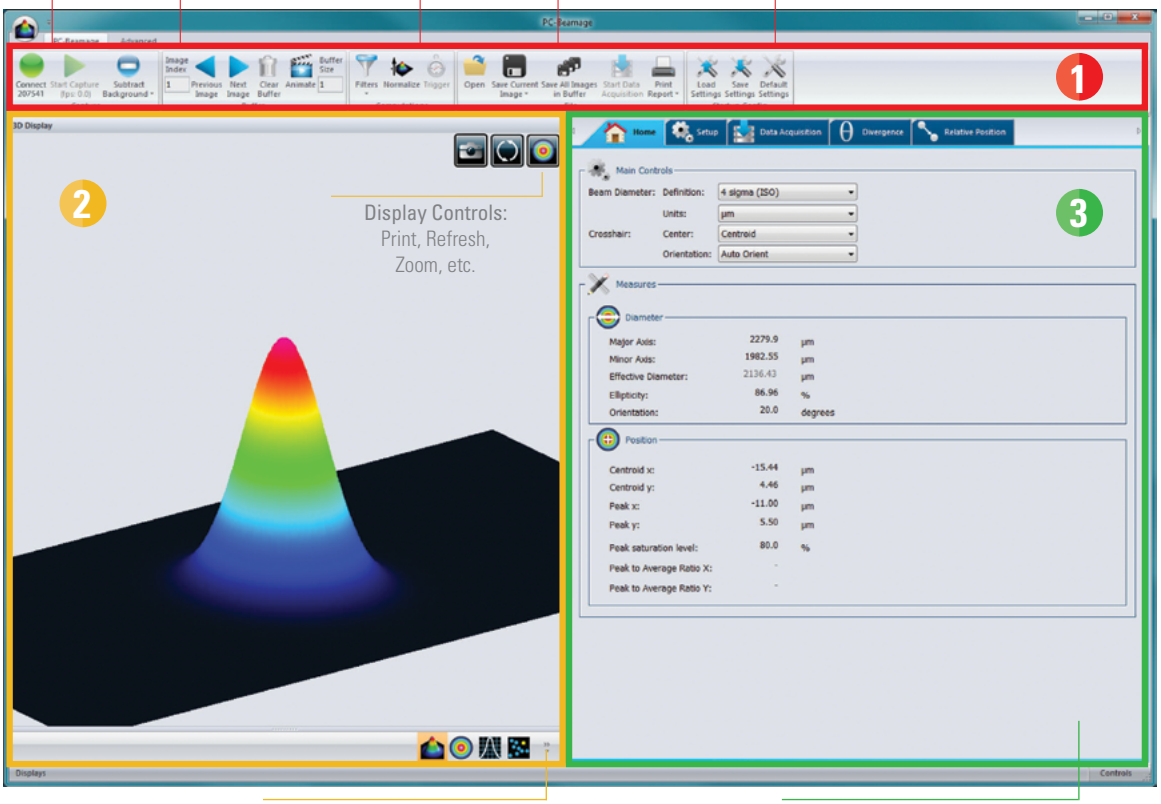
Capture Controls:
Start/Stop,
Subtract Background

Buffer Controls:
View Data Offline

Data
Computation

File Controls:
Save and Open Data

Startup Configuration:
Save and Load Settings



1 MAIN CONTROLS

The upper part of the software includes all the main controls in a ribbon format. These controls are grouped by family:
Capture Controls, File Controls, Buffer Controls, M2 Controls and Data Computations. The last includes very useful filters and a normalizing function.

2 DISPLAYS

The left-hand side of the software is the display panel. Four displays are available: 3D, 2D, XY (cross-sectional graphs along the crosshairs) and Beam Tracking. The desired display is selected by clicking on the corresponding icon at the bottom of the panel. Print screen controls are available for the 3D, 2D and Beam Tracking displays. They allow the user to save an image of the current view in BMP format.

3 HOME AND SETUP TABS

The right-hand side of the software contains the Home, Setup and Data Acquisition tabs. The Home tab allows the user to select the main controls for his measurements (Beam Diameter Definition, Crosshair Center and Orientation) and displays the resulting measurements below. The Setup tab allows the user to set the measurement parameters (Exposure Time, Image Orientation and Averaging, Active Area, etc.) and the Data Acquisition tab allows the user to save measurements or measurements and full images, to enter the Sampling Rates and a Total Duration for the Acquisition. More tabs with advanced controls are available when clicking on the Show/Hide Options button in the Computations panel.

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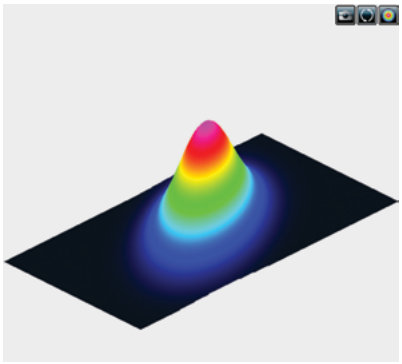
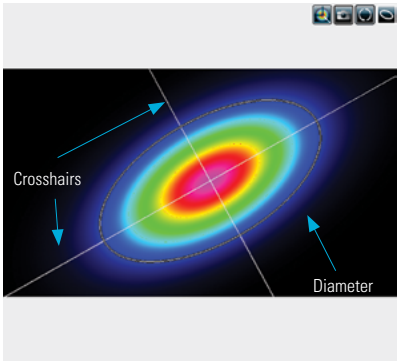
3D, 2D AND XY DISPLAYS



3D DISPLAY

The 3D display shows the actual shape of the beam. It is possible to easily zoom, pan and rotate the image. The very useful Reset button allows to put the data back in its original configuration. This display also features a Print Screen button to save the latest image in BMP format.

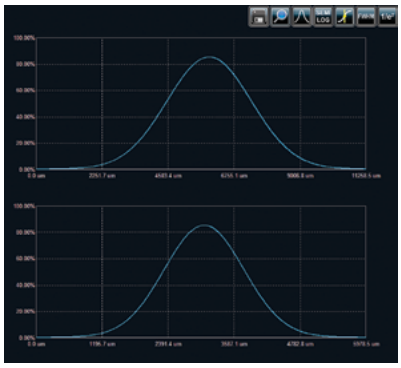
Print Screen | Reset View | Top View



2D DISPLAY

The 2D display features the crosshairs (set to the major and minor axis or along specified angles) and the measured diameters of the beam. These diameters vary with the chosen definition (4-sigma, FWHM, $1/e^2$, etc.) and the display can be turned ON or OFF. The Print Screen button allows to save a picture of the current screen in BMP format.

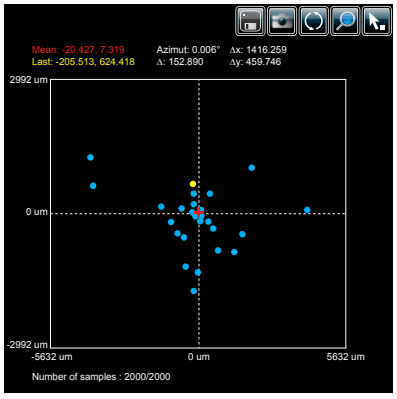
Select Active Area | Print Screen | Reset View | Show/Hide Diameter



XY DISPLAY

The XY display plots cross-sectional graphs of the beam along the crosshairs. This display features many useful tools like zoom, cursor, and FWHM and $1/e^2$ level bars. It is also possible to display the graphs in semi-log format to enhance the details in the low intensity parts of the beam.

Save Data | Zoom | Gaussian Fit | Semi-Log Graph | Show/Hide Cursor | Show/Hide FWHM | Show/Hide $1/e^2$



BEAM TRACKING DISPLAY

The Beam Tracking Display allows the user to visualize the variation of the beam's centroid position on the sensor. This display shows the latest calculated position as well as the previous ones, until the user resets the view. The display also shows the mean position of all computed values and gives information regarding position stability for both X and Y axes. This tool is great to monitor the beam pointing stability over time.

Save Data | Print Screen | Reset View | Zoom | Pick Origin Point

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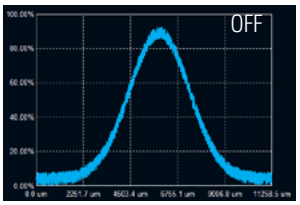
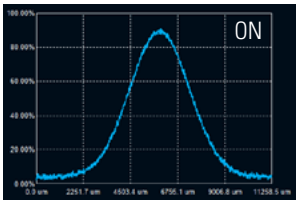
MAIN FUNCTIONS

FILTERS

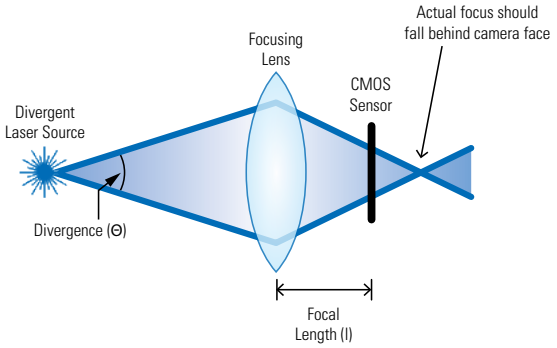
Filter out the noise in your beam profile by using one of the filter functions. The Beamage has both smoothing and despeckle filters. The Smoothing filter is a soft noise reduction method whereas the Despeckle filter is a much more aggressive spatial filter that is designed to remove speckles and noisy signals from very poor quality beam profiles. Instead of performing a 3x3 pixel smoothing filter with a relative weight of 20% for the central pixel and 10% for the others, the software performs a 9x9 pixels simple averaging, with all pixels having the same relative weight (1/81). The filter can be found in the Filters menu of the main controls.





DIVERGENCE

The Divergence of a beam is defined as the increase in beam radius with propagation from the optical aperture. For most applications, a lower-divergence beam is preferable. Using the Divergence tab in the PC-Beamage application, this parameter can now be computed for both mains axes (X, Y) according to the ISO 11146-1:2005 and 11146-2:2005 standards. A focal lens with a known focal length is required for the measurement of the divergence.



ACQUISITION

In the Acquisition tab, the user can define a total duration for the acquisition and can specify a name and a path for his saved files. The user can either choose to save measurements only or both measurements and full images. It is possible to save the data shown in the measure tab in a *TXT file, which includes a header that displays the custom acquisition settings above the data. Each line corresponds to a single frame. This file can be opened in a spreadsheet software such as Microsoft Excel. It is also possible to save the images associated with the measurements from the *.TXT logging file. Each image will be individually saved in a native *.BMG file. For measurements, it is possible to choose a sampling rate for the saved data. Similarly, for the full images, one can manually set a temporal interval at which the software will save the data. With these tools, the user will be able to store only the information that is useful to his work.

RELATIVE POSITION

In the “Relative Position” tab, the “Setup” section allows the user to select the parameter that will be considered as the origin position (0,0). “Centroid” (center of energy) and “Peak” (highest measured value) are the options. The “User Define” option allows the user to manually enter origin position values for both axes. It is also possible to position the origin by simply clicking with the mouse in the display. Once the origin position is determined by the user, the software calculates the difference between the coordinates of this new position and the latest computed one. The results are displayed in the “Measures” section. It is possible to save the data in the acquisition file if desired.

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MAIN FUNCTIONS

SUBTRACT BACKGROUND

The background subtraction function is a necessary tool to have an accurate measurement and to abide by the ISO 11146-3:2004 standards. By taking 10 images and averaging them pixel by pixel to compute the average background map, contamination of all images can be avoided with the help of environment noise subtraction.

ANIMATE

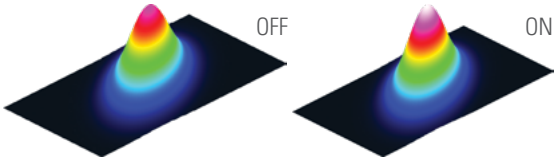
Give life to your measures with the animate function. With as much as 32 images temporarily saved in the buffer, simply pressing the animation button will create a movie with any display (2D, 3D and XY). This allows to visualize the beam while working offline and to have a recalculation process if the beam diameter definition or crosshair parameters are changed.

MULTIPLE CAMERAS

It is possible to use multiple Beamage cameras on one computer simultaneously. By running multiple PC-Beamage instances and selecting the desired camera for each one, the user will be able to stream multiple cameras simultaneously, thus effectively monitoring all the beams and easily switching from one to another.

NORMALIZE

The normalize function spreads the intensity over the full range (0% to 100%). This is especially useful with low level signals or to enhance the variations in the beam.



TRIGGER

For the case of pulsed laser sources, the trigger function will be useful to synchronize the system's capture rate with the source's repetition rate, especially when this one is so low that only a few pulses are captured during the exposure time. To be achieved, a TTL (0-5 V) or other (1.1-24 V) trigger signal can be connected to the Beamage camera via a BNC or SMA plug.

IMAGE AVERAGING

The image averaging function uses a temporal filter that captures 2, 5 or as much as 10 images of the beam to create a single time-averaged image with them. This process will smooth the beam fluctuations that can occur over time when working with unstable laser sources.

ACTIVE AREA (ROI)

Increase the data transfer rate by reducing the area of the sensor that is scanned. This tool is perfect for small beams that don't need the full sensor area.

PIXEL ADDRESSING

Increase the data tranfer rate by using larger pixels or by reducing the number of pixels. This is great for large beams that don't need the full resolution.