



# 11 Beamage-3

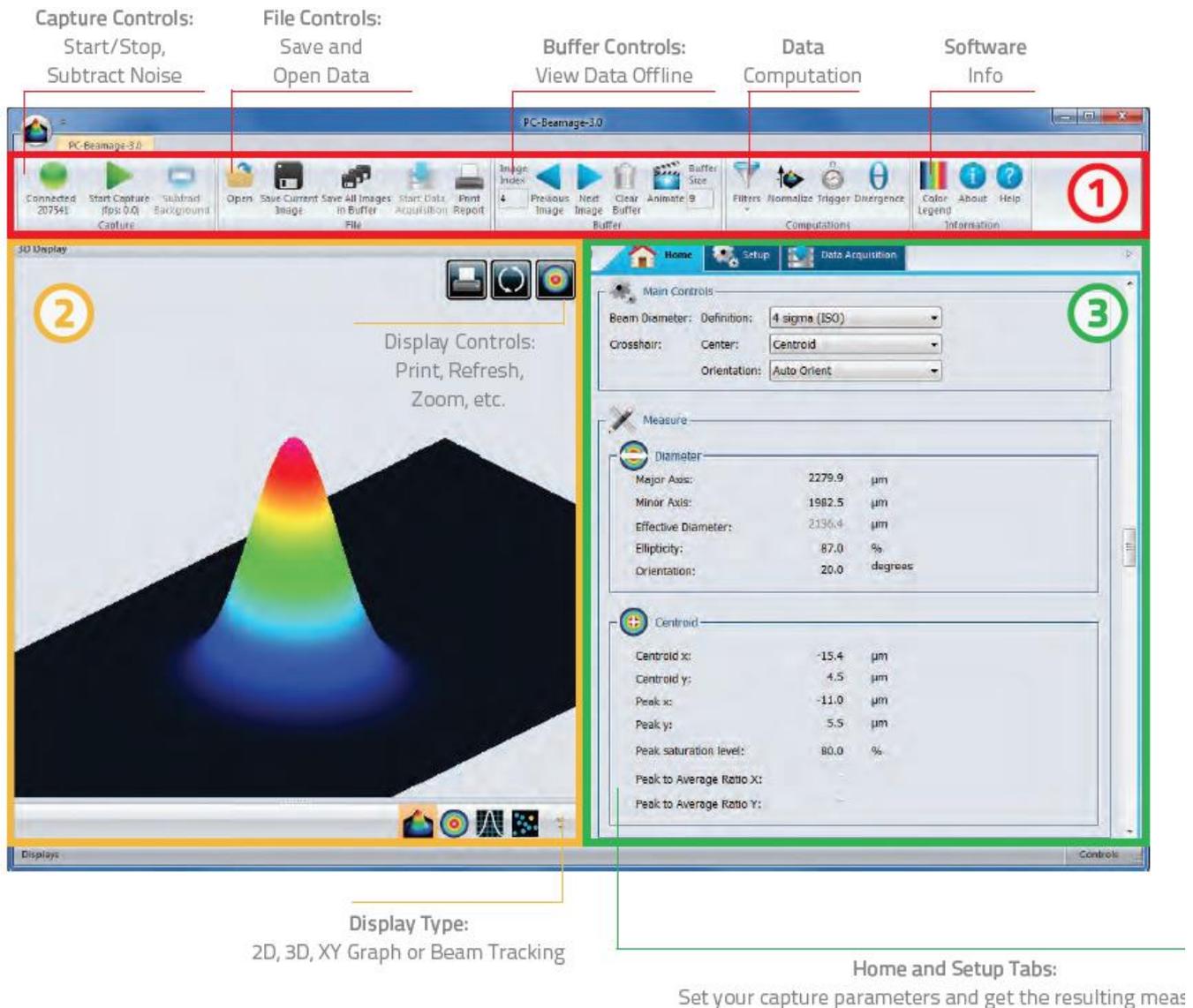
CMOS Beam Profiling Cameras



## Key Features

- **USB 3.0 FOR THE FASTEST TRANSFER RATES**  
Up to 10X faster than regular USB 2.0 connections (also USB 2.0 compatible)
- **HIGH RESOLUTION**  
2.2 MPixels resolution gives accurate profile measurements on very small beams
- **LARGE AREA SENSOR**  
The 11.3 x 6.0 mm sensor allows to measure very large beams
- **AVAILABLE WITH IR COATING**  
Beamage-3.0-IR has a special Phosphor coating for IR wavelengths (1495-1595 nm)
- **ISO COMPLIANT**  
D4 $\sigma$  Definition of Diameter, Centroid, Ellipticity and Orientation are ISO 11146:2004 and 11146:2005 compliant
- **INTUITIVE SOFTWARE INTERFACE**  
Easy to navigate interface, with many display and control features:
  - 2D, 3D and XY Displays
  - Background Subtraction Function
  - Unique "Animate" Function
  - Gaussian Fit
  - Semi-Log Graph
- **EXTERNAL TRIGGER**  
To synchronize the camera with a pulsed laser

# INTUITIVE SOFTWARE INTERFACE



1

## MAIN CONTROLS

The top portion of the software is in a ribbon format and includes all the main controls. These are grouped by family, including capture controls, file controls, buffer controls and data computations such as a very useful spatial filter and a normalizing function.

2

## DISPLAYS

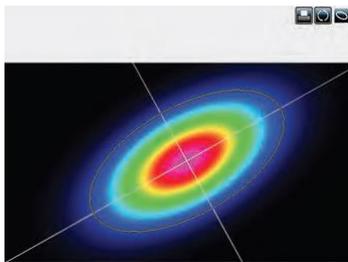
The left-hand side of the software is the display panel. 4 displays are available: 3D, 2D, XY (cross-sectional graphs along the crosshairs) and beam tracking. The various displays are chosen using the corresponding icons at the bottom of the panel. Convenient Print Screen controls are located the 2D, 3D and beam tracking displays and allow the user to save an image of the current view in BMP format.

3

## HOME AND SETUP TABS

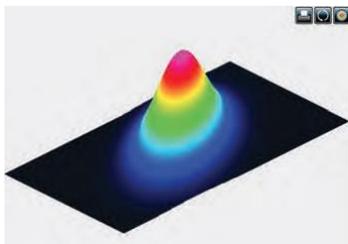
The right-hand side of the software contains the Home and Setup tabs. The Home tab allows the user to select the type of measurements performed (like 4-sigma and FWHM). It also shows the resulting measures of the beam. The Setup tab contains all the measurement parameters, like Exposure Time, Image Orientation, Averaging, Active Area definition (ROI) and more.

# 2D , 3D AND XY DISPLAYS



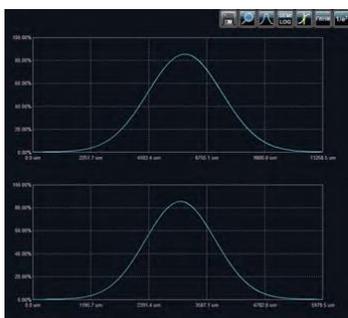
## 2D DISPLAY

The 2D display features the crosshairs (set to the major and minor axis or along specified angles) and the measured diameter of the beam. This diameter varies with the chosen definition (4-sigma, FWHM,  $1/e_2$ , etc.) and its display can be turned ON or OFF. The Print Screen button allows to save a picture of the current screen in BMP format.



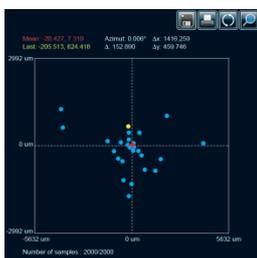
## 3D DISPLAY

The 3D display shows the actual shape of the beam. It is possible to easily zoom, pan and rotate the data. 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.



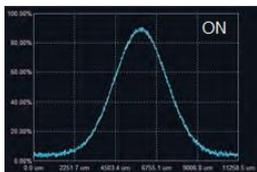
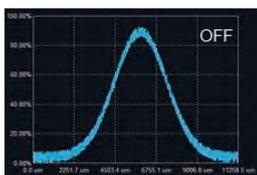
## XY DISPLAY

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.



## 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.

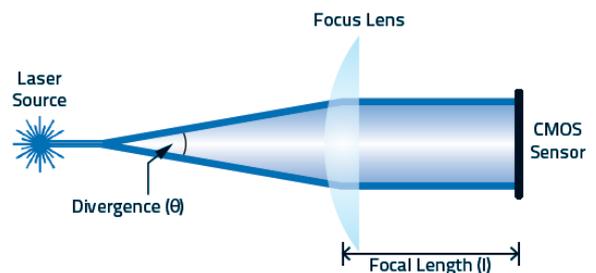


## FILTERS

Filter out the noise in your beam profile by using one of the filter functions. The 11Beamage-3 has both smoothing and despeckle filters. The Smoothing filter is a soft noise reduction method whereas the Despeckle filter is a new and 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). This new 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 new Divergence tab in the PC-Beamage-3.0 application, this parameter can now be computed for both main axes (X, Y) according to the ISO 11146-1:2005 and 11146-2:2005 standards.



## ACQUISITION

In the Acquisition setup, 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 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.

## 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 frame 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 have a recalculation process if the beam diameter definition or crosshair parameters are changed.

## MULTIPLE CAMERAS

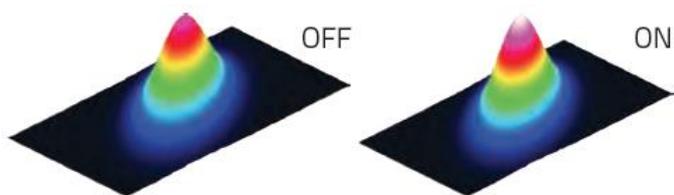
It is possible to use multiple Beamage-3.0 cameras on one computer simultaneously. By running multiple PC-Beamage-3.0 instances and selecting the desired camera for each one, the user will be able to stream multiple cameras simultaneously, thus effectively monitoring all the beams and easily switching from one to another.

## 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 low (<16 Hz). To be achieved, a TTL (0-5 V) or other (1.1-24 V) trigger signal can be connected to the Beamage-3.0 camera via a BNC or SMA plug.

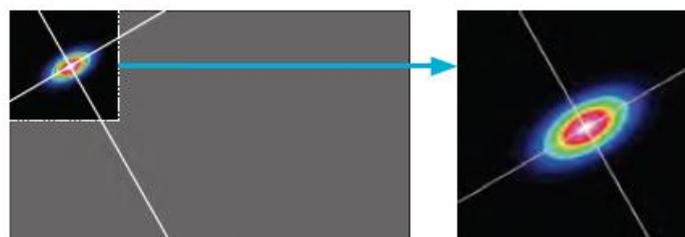
## IMAGE AVERAGING

The image averaging function uses a temporal filter to provide the possibility to take 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.



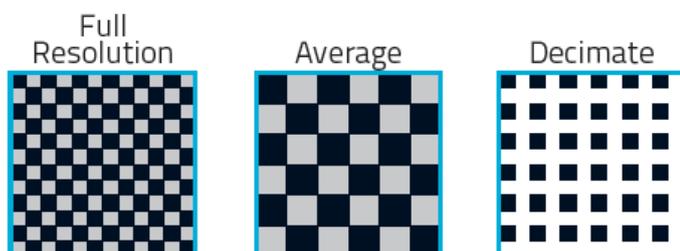
## NORMALIZE

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.



## 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 transfer 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.

## Specifications

11BEAMAGE-3		
SENSOR TECHNOLOGY	CMOS	
EFFECTIVE APERTURE	11.3 x 6.0 mm	
11BEAMAGE-3		11BEAMAGE-3-IR
<b>MEASUREMENT CAPABILITY</b>		
Wavelength Range	350 - 1150 nm	1495 - 1595 nm
Pixel Count	2.2 MPixels	
H x V	2048 x 1088	
Pixel Dimension	5.5 x 5.5 $\mu$ m	
Minimum Measurable Beam	55 $\mu$ m	70 $\mu$ m <sup>b</sup>
Shutter Type	Global	
Frame Rate	9 fps @ 2.2 MPixels (Full Frame) 12 fps @ 1.1 MPixels (2048 x 544) 16 fps @ 0.016 MPixels (128 x 128)	
RMS Noise	1000:1 (60 dB)	
ADC Level (User Setable)	12 bit (default) / 10 bit (option)	
M2 Measurement	In Real-Time, no moving parts, with the Beamage-M2 Module (see page 178)	
<b>DAMAGE THRESHOLDS <sup>a</sup></b>		
Maximum Average Power	1 W	
Saturation Level (1064 nm)	CW: 10 W/cm <sup>2</sup> ; Pulsed: 300 $\mu$ J/cm <sup>2</sup>	
<b>SOFTWARE</b>		
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 <sup>2</sup> Beam Tracking: Save Data, Print Screen, Reset View, Zoom	
Beam Diameter Definitions	D4 $\sigma$ (ISO compliant) 1/e <sup>2</sup> along crosshairs (13.5%) FWHM along crosshairs (50%) 86% effective diameter (D86)	
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)	
<b>PHYSICAL CHARACTERISTICS</b>		
Sensor Size	11.3 x 6.0 mm	
Sensor Area	0.67 cm <sup>2</sup>	
Dimensions (not including filter)	61H x 81.1W x 19.7D mm	
Weight (head only)	139 g	
ORDERING INFORMATION		
Product Name	11Beamage-3	11Beamage-3-IR

a. With ND4 filter

b. With despeckle filter

**Specifications are subject to change without notice**