µBeam USB 2017

The Analyzer for Microscopic beams

User Manual

December 2017
Revision 5.0
Software Version 4.0

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1.0 System Description

***µBeam* is a versatile measurement system, offering both analytical and graphical capabilities for sub micron beam measurement and analysis applications. This is a custom design measurement station composed of a CCD type beam profiler, supplemented with high magnification optics and the computing technology. This is a powerful beam diagnostics measurement system for real-time measurement and display of small CW or pulsed lasers in the sub-micron range, fiber optic and laser diode beam profiles.**

This is a software driver device that interfaces to any host PC computer, running under Windows XP, Win7, Win8 and Win10, via the USB port, to meet a wide range of automated laser analysis requirements in the laboratory, field or factory.

µBeam has applications in CD pickup, laser diodes, adjustment of pickup lenses and optics components, evaluation and testing of various light beam parameters, and any application where the quality and shape of the beam affects system performance and there is a need to analyze very small beams.
The main parameters measured are: Intensity profiles, beam width, beam position and beam shape.

The new *µBeam* system has an improved resolution and improved optical zooming, allowing a wide range of microscopic beams to be measured. The built-in motorized optical zooming greatly improves the beam finding capabilities, as well as the user convenience. The 470,000 pixels CCD allows improved measuring resolution.

1.1 Copyright and Manual Notice

This manual describes the operation of the *µBeam* System.

2.0 Precautions

2.1 Handling of the Measurement Head & magnification optics

- The CCD detector head should never be attached to the control unit unless it is turned off.
- The magnification optics is very delicate, handle with precaution

2.2 Laser safety precautions

This instrument is most commonly used with laser sources. The operator should observe all laser safety procedures and precautions when operating this device. In particular it should be noted that a small portion of the laser beam incident on the detector head will be reflected. This can be hazardous and the operator should beware of both specular and diffuse reflections. The operator should exercise special care when working with invisible laser radiation.

3.0 Theory of Operation

In the modern laser world, focused beams are smaller and smaller and there is a developing need to measure and characterize those beams. Although theory predicts the behavior of a beam quite accurately, manufacturing constrains such as tolerances in lenses and mirrors have a strong influence on the actual beam size.

Consequently, it is crucial for laser manufacturers, especially on those applications requiring sub-micron accuracy to be able to accurately measure the laser beam width at the focal point.

Defining Beam Width

The commonly used definition of beam width is the width at which the beam irradiance has fallen to some percentage value when compared to the peak (100% value). In order to allow maximum flexibility this parameter can be set by software means in most of the valuable beam profilers.

CCD Camera based Beam Profilers

A CCD camera consists of a two-dimensional array of pixels. The impinging laser beam on a CCD based profiler leaves an “electronic footprint” which is linearly dependent on its intensity distribution.
The intensity distribution is then recorded pixel by pixel, analyzed and displayed as two, or three dimensional contour plot.

Unfortunately, this measurement technique works as long as the examined beam is significantly bigger than the CCD’s pixel size (about 5 µm).
This fact limits the use of such a system to measurement of beams, which are bigger than 50 µm.

In order to overcome this limitation, a special beam profiler was developed, operating in a similarity to a microscope.
A high quality lens is used to magnify the sub-micron beam by a factor of X100 onto the surface of a high quality CCD camera. In order to facilitate initial beam acquisition into the field of view, the system is equipped with a built-in zooming optics.

The analyzing software processes the data and displays results with a nanometric resolution.

Dynamic Range

One of the main obstacles encountered when working with a CCD is its limited dynamic range. The powerful software and electronics overcome the dynamic range limitation of the camera by software control of gain and electronic shutter.
Due to its pixel-like construction and low noise feature, the *µBeam* is still useful in extremely low light conditions as well.

Optical Zooming

When equipped with an objective of x100 and at its minimum field of view, the µBeam USB system will see an object of 55x44µm max (using Video resolution of 720x576). The pixel size at the objective plane is 0.076µm.
The relatively small field of view at maximum magnification posses significant difficulties in the initial beam finding.
In order to over come this limitation and to increase the field of view the system is equipped with a zooming optical magnification from x25 to x1. The maximum field of view at minimum zoom is about 150x130µm.

Main software features:

1. Graphical presentation of a laser beam in 2D.
2. Three ROI's (Region of Interest) user-selectable.
3. Centroid and beam width profile calculation to sub micron accuracy.
4. User adjustable dynamic range by controlling the built-in electronic shutter speed and gain.
5. Performs Test analysis (Absolute distance between user defined Points)
6. Customer set pass/fail test criteria
6. Measures CW or pulsed beams.
7. UV option.
8. Real time beam measurements:
   - Beam size at 3 clip levels with Gaussian fit
   - Total intensity (sum profile) along XY axes
   - XY profiles selectable by anchor point & rotation
9. Real time position measurements
   - XY centroid position
10. Data logging with detailed statistics
11. Video with playback
12. Save / View images
13. Digital Zooming
14. On line instructions and help
15. Calibration - Pre factory calibration for accurate measurements
16. Motorized optical zooming
17. Coma aberration calculation and display (for testing optical disk systems)

4.0 Specifications

Item	Specification
Camera and Magnification	
Camera type	CCD 1/4" format, with 470,000 pixels
Spectral Response	350 - 1100nm, (190-1100nm optional)
Infinite conjugate objectives: X100, x50, x20, x10, x5	Infinite conjugate objectives: X100, x50, x20, x10, x5
For fast beam finding the system is equipped with a zooming lens for observing large areas	For fast beam finding the system is equipped with a zooming lens for observing large areas
Built in removable NG10 filter	Built in removable NG10 filter
Configuration	Tube type zooming microscope equipped with M6 mounting thread adaptor
Dimensions:	163.5 mm (L) X 83mm Diameter (without objective and base)
Weights:	1.1 Kg without base
Lens Working Distance (W.D.):	6.0mm (for X100), 13mm (for X50), 33.5mm (for X10), 20mm (for X20)
System Performance with Software: Minimum measurable beam size 0.5 µm for X100 objective	
Maximum frame rate 25Hz (CW lasers) Max refreshment speed 10Hz (CW lasers)	

***** Repeater USB (5m long) is provided as optional item for cases where longer distance from MicroBeam head to host computer is required**.**

4.1 Mechanical drawing

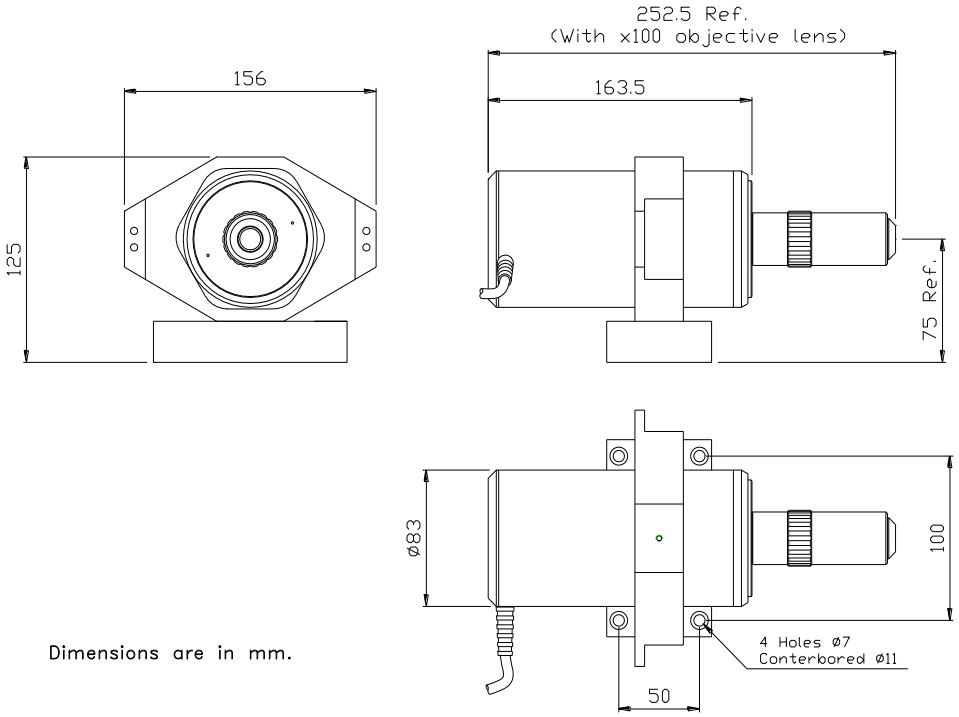


Figure 1: Mechanical drawing

5.0 Getting Started

Setting Up for a measurement
This chapter provides a basic instruction for setting up the measurement cycle.
Before you can accurately perform a measurement you need to bring the laser beam into the measurement area, by doing the following the herein described procedure. This operation is a very delicate one, since the total measuring area of the CCD (after the magnification) is about 40 µm.

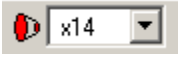
For users that need various beam measurements it is strongly suggested to mount an X-Y Table beneath the pickup lens basis, for an easier alignment.

1. Install the laser in front of the system's objective lens (See Figure I).

2. Use the system's zooming function for course adjustment.
(See µBeam Main Functions, chapter 6.0).

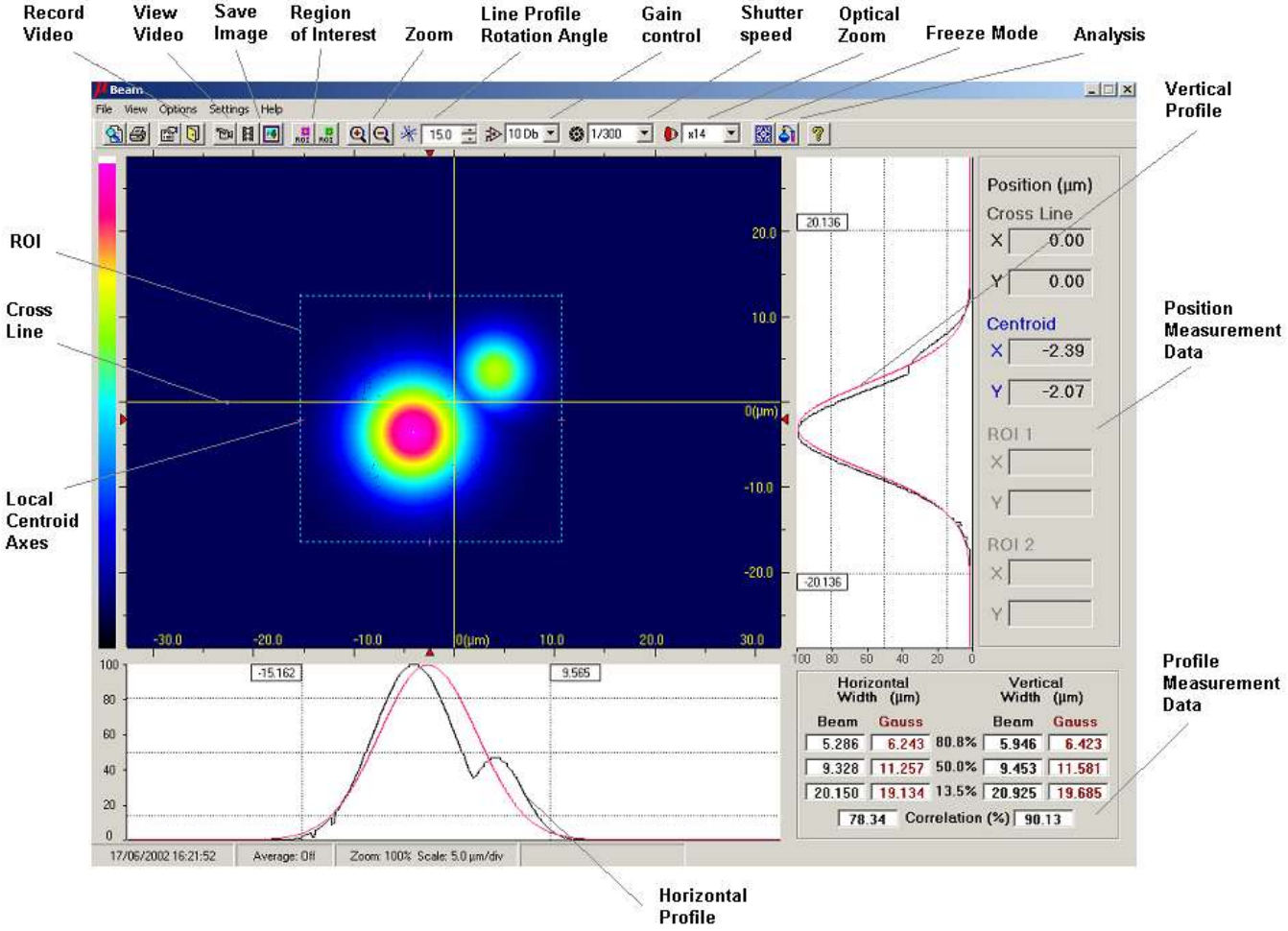
Find the beam at the minimum magnification. Focus the beam by using some adjusting means (manipulators).

3. Slowly change the magnification by moving the zooming lens to its maximum position,
By using software function called Optical Zoom, activated through the ToolBar icon.
In order to get the right magnification (X100) perform a measurement while refocusing for best results.
The measurements are calibrated at the following zoom ratios: X25, X1.7D, X2D.
In this magnification region, the optical zoom icon will turn from Red color to Green color, see as follows:



Optical zoom

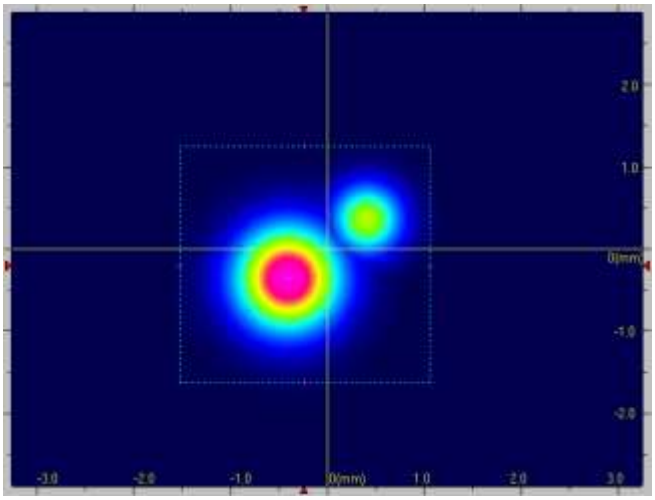
6.0 *µBeam* Main Functions



Menu Bar
The Menu Bar lists menus available for the *µBeam*. The menus listed in the Menu Bar contain commands that allow specific actions to be performed, other sub-menus or dialog boxes to be displayed which provide various controls of such functions as graphics, analysis, configuration setup, etc.

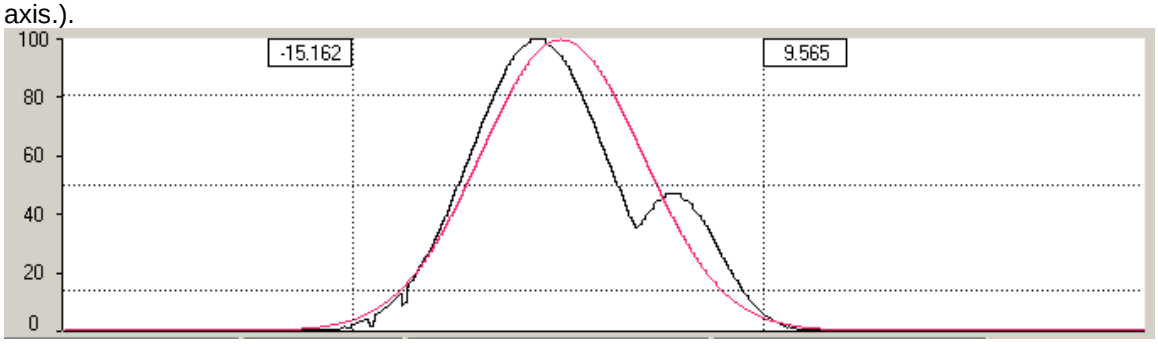
Tool Bar
The Tool Bar consists of various icon buttons, which are small symbols that provide quick access alternatives to using menus or keyboard equivalent keys to perform various functions. To use a smart icon button, move the mouse cursor over the icon and click on the button with the left mouse button. To view the function of any icon button, place the cursor on the icon and wait momentarily, a brief function description will appear near the icon.

View Area
The View Area is used to view and monitor the captured beam image. The View Area will graphically display intensity contour maps (2D), beam centroid coordinates, one or two ROI's, zoom and graphics scroll bars, beam line profiles at any selected view angle. The View Area is marked in engineering units (mm) for the entire CCD detecting area. There is a cross hair target, which represents the center of the CCD detection area.
The examined beam Center of Gravity coordinates are also displayed at the main ROI as solid cross in blue color, while the ROI limits are marked as dashed lines.
The size and location of the default ROI can be changed by the user, by graphical means using the mouse.
The beam profiles are being calculated and displayed *over the entire area of the CCD*, by default. There are 4 red colored arrow heads, which mark the beam centroid location. This feature is very useful when performing a Zoom operation: in some cases, after a relatively big zoom operation, the beam is not viewed on the main view area, and the location and direction of the arrow heads will guide the user in locating the beam.



The digitized pixel intensities of the image can be plotted as a 2D contour map in one of two different color scales shown at the color scale bar (color or B/W). When graphics Zoom is enabled scroll bars will appear on the sides of the View Area.

Profile Area
Just below and to the right hand side of the View Area there is a display of the vertical and horizontal beam profiles. There are two types of profiles: sum profiles (which are two orthogonal profiles, one along the vertical axis and one along the horizontal axis), or line profiles (which are contours of the beam along a line parallel to the vertical axis and a line parallel to the horizontal axis.).



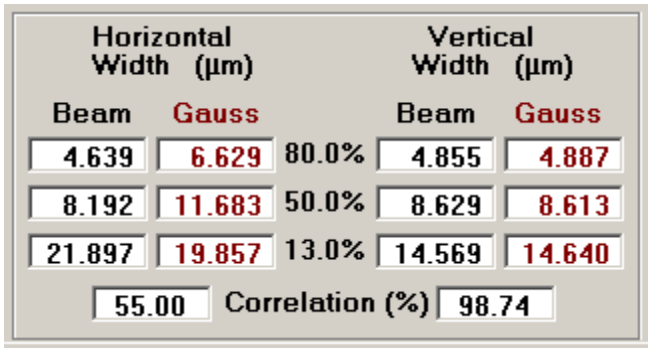
The profiles are calculated and displayed in conjunction with the main ROI, while other two ROI's can be used for presentation of position measurements only! If Gausian function is On there is a presentation of the Gausian beam superimposed over the profile in real-time.

User Area

The User Area displays four numerical results. There are two types of presentations, according to the system setup setting: **Beam centroid** (X, Y), which is the beam centroid location calculated over the entire CCD area. **Cross Line** coordinates (X, Y) displaying either the CCD center of origin (CCD Center option), or the cross line coordinates at any point over the CCD View Area (Free option), or the beam centroid coordinates or any offset value with respect to the centroid (Centroid option)
ROI 1: the beam centroid (X, Y) in the defined Region of Interest1 .
ROI 2: the beam centroid (X, Y) in the defined Region of Interest 2.

In each one of the above listed presentations (Centroid, ROI1 and ROI2) a third line can appear, marked as "R" and stands for the Radius calculation (squared-root of X^2+Y^2). This calculation and presentation appear when the Radius parameter is set on in the System Setup – Position tab.

Profiles Measurement Area
This area displays the beam width measurement results at the 3-selected clip levels, for both V Profile and H Profile.
Also, when the Gaussian function is On, there is a presentation of the ideal Gaussian profile width at the same three clip levels selected, and also the correlation factor between the measured beam and the ideal Gaussian is displayed.



Status Bar

The status bar is located at the bottom of the *µBeam* window. It indicates the current status of some operational parameters, such as presentation of date and time, Average level and zooming level.

6.1 Quick Start

This chapter provides brief instructions for operating the *µBeam* system. Full explanations of these various operations can be found throughout this manual.

To begin using the µBeam system:

1. Connect the *µBeam* USB device to Hi-Speed USB 2.0 input of the computer.
2. Connect the 9 Pin RS232 connector cable to the 9-Pin COM Port labeled as COM port of the computer (in case you are going to use RS232 Communication in this session).
3. Follow the instructions in section 5.0 Getting Started for alignment of the system.

To set up a continuous laser beam (default):

1. Open the Settings menu and select **Hardware Setup**.
2. Click the **Laser** tab and select the **CW** radio button in the *Type* field.
3. Select a shutter speed or gain control that enables an acceptable saturation level.
4. If the image is still saturated at the fastest shutter speed or lowest gain, contact factory in order to replace the built-in ND filter inside the system (the *µBeam* contains one NG10 filter that can be installed or removed from the camera).

To set up a pulsed laser beam:

1. Open the Settings menu and select **Hardware Setup**.
2. Click the **Laser** tab and select the **Pulsed** radio button in the *Type* field.
3. Select the slowest shutter speed (1/3s).
4. Set the Trigger Control level to the Left (zero) via **Hardware Setup**.

5. If the image is still saturated at the fastest shutter speed or lowest gain, contact factory in order to replace the built-in ND filter inside the system (the *µBeam* contains one NG10 filter that can be installed or removed from the camera.

To freeze the screen graphics:

1. Click  on the **Control** Toolbar.
2. To return to real-time measurement mode, click  on the **Control** Toolbar.

To print various screens:

1. To print the entire screen, open the File menu and select **Print Screen.**
2. To print the view area only, open the File menu and select **Print Frame**.

To save screen graphics:

1. Open the Options menu and select **Save BMP File**. A sub-menu displays.
2. Select the screen section to be saved: **Frame** or **Full Screen**. The *Save BMP File* window displays.
3. Enter a filename for the saved screen graphic and click **OK**.

To view a file:

1. Click  on the **Control** Toolbar. The *View File* window displays.
2. In the *Files of Type* field, select the file type for the file you want to view.
3. Select the file and click **OK**.

To print a text or bitmap file:

1. Click  on the **Control** Toolbar.
2. Select the file type for the file you want to print **Text** or **BMP**. If you select **Text**, the *Print Text File* window displays. If you select **BMP**, the *Print BMP File* window displays.
3. Select the file you want to print and click **OK**.

To test a laser beam:

1. Click  on the **Control** Toolbar. The *Analysis Toolbar* displays.
2. Select the parameters to include in the test and set the minimum and maximum values for these parameters.
3. Enter your test related information.
4. To run the test, click the *Test* button. The Test window displays the test results.
5. To save the current test result in a bitmap or test file, click **Save** in the Test window.

To measure the distance between two points on the beam image:

1. From the **Control** Toolbar, click  to freeze the screen.
2. From the **Control** Toolbar, click  . The *Analysis Toolbar* displays.
3. From the **Analysis** Toolbar, click  .
4. Select the first point by placing the cursor on the beam image and click the left mouse button. Drag the mouse to the second point on the beam image and click the left mouse button. A straight line is drawn between these two points and the line distance calculation is displayed below the Analysis toolbar.

To measure two beam's centroids simultaneously:

1. From the **Control** Toolbar, click  to select the first Region of Interest.
2. Move the small rectangle marking  to the first beam presentation on the screen, magnify or shrink it to the proper size by graphical means (using the mouse).
3. From the **Control** Toolbar, click  to select the second Region of Interest.
4. Move the small rectangle marking  to the second beam presentation on the screen, magnify or shrink it to the proper size by graphical means (using the mouse).

To create a data log or Excel file:

1. From the **Control** Toolbar, click  to setup the data log. The *Log Setup* window displays.
2. Enter the information in the Log Setup window. Select between Log and Excel file options and click **OK**.
3. From the **Control** Toolbar, click  to start the data log function.
4. To view the data log file, open the File menu and select **View File**. Select the data log file you want to view and click **Open**.

To create a Snapshot File:

The snapshot image is captured as soon as you select the Save Snapshot option. You then save the snapshot image as an .SNP file. The snapshot file is saved in binary format and can only be processed by this application.
To create a snapshot file:

1. Open the Options menu and select **Save Snapshot**. The *Save Snapshot File* window displays.
2. Enter a filename for the snapshot file.
3. Click **OK**.

To save a Snapshot in TEXT file:

The snapshot image is captured as soon as you select the Save Snapshot option. You then save the snapshot image as a .TXT file. The snapshot file is saved in ASCII

format and can only be processed by various programs later on (EXCEL, MATLAB, etc.). The file contains 640 columns and 480 rows respectively, with 8-bits intensity data for each pixel saved.
To save a snapshot as text file:

1. Open the Options menu and select **Save Snapshot in Text file**. The *Save Snapshot in Text File* window displays.
2. Enter a filename for the snapshot file.
3. Click **OK**.

To view a Snapshot File:

To view a snapshot file:

1. Open the **View menu** and select **Snapshot**. The *Load Snapshot File* window displays.
2. Select a snapshot file.
3. Click **Open**. The snapshot file displays.

To close a Snapshot File:

To close a Snapshot file, open the View menu and select **Snapshot**. The system restores real-time measurement displays.

Alternatively, press the X sign at the right top corner of the Windows screen application.

To create a video:

1. Open the Settings menu and select **Video Properties…**. The *Video Properties* window displays.
2. Enter your information and click **OK**.
3. Click  on the **Control** Toolbar.

To play a video file:

1. Click  on the **Control** Toolbar. The **Playback Toolbar** displays.
2. Click  on the Playback Toolbar. The *Open Video File* dialog displays.
3. From the Open Video File dialog, select the video file you want to view and click **Open**. The video file displays.
4. Use the **Playback** Toolbar buttons to play the video.
5. Click  to close the video file.

To work with still images:

1. To capture a still image, click  on the **Control** Toolbar.
2. To view a single still image, position the cursor on the still image icon on the **Status Bar** and click the left mouse button.
3. To close an opened still image click the close button in the upper right corner of the image window. If you want to save the still image, click **Yes** in the Still Image window.

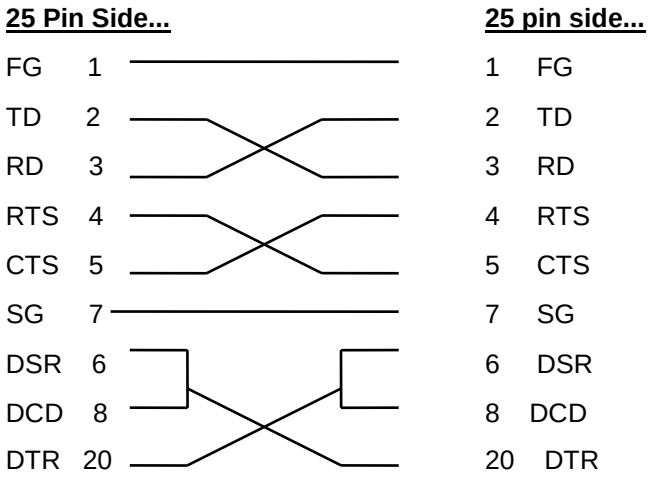
To transmit serial data over an RS-232 link:

1. Open the File menu and select **Link Setup**. The *Link Setup* window displays.
2. Click the **General** tab and enter your information.
3. Select the **Port Settings** tab, enter your information and click **OK**.
4. Connect the *µBeam* stand alone unit to another computer using a null-modem cable.
5. Enable the receiving program to receive the file/data.
6. Open the File menu and select **Start Link**. If you are transmitting data, the *µBeam* automatically starts sending the data. A link-in-progress message displays in the menu bar.
7. If you are transmitting a file, the *Link File* window displays. Select the file you want to send and click **OK**. A link-in-progress message displays in the menu bar.

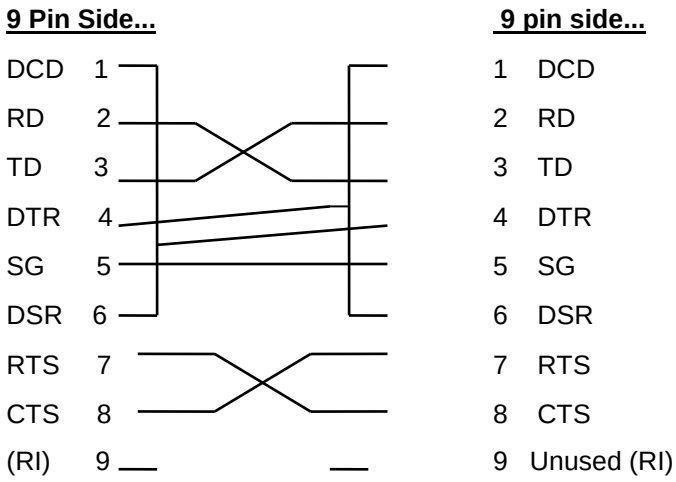
6.2. RS232 Cable Pin connections

A null modem cable can be made from a standard RS-232 cable by connecting the pins on one end of the cable to the pins on the other end as shown below.

Null-modem with 25 pins on both sides



Null-modem with 9 pins on both sides



6.3 Using Attenuating Filters

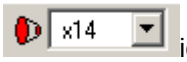
The *µBeam* system is supplied with one calibrated optical filter (type NG10) that can be installed inside it to attenuate powerful beams. By doing so, the amount of energy, which the camera is sensing is significantly smaller. The use of filters is especially significant when operating a pulsed laser beam.
The NG10 attenuation level is about 240:1 @ 633nm. You can order more filters if desired from factory. To attenuate powerful continuous laser beams, select a combination of shorter shutter speeds and higher gain levels until the saturation level is acceptable.

The filter is directly mounted on top of the objective and it is screwed in.

6.4 Configuring software

To configure the software, open the Settings menu and select **System Setup**. The *System Setup* window displays **Settings Tab**.

From the Settings tab, you can configure the following information:

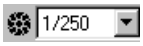
- Average value of consecutive measurements.
- Zoom level (change the optical zooming by using the 

icon. Values from X1 to X25, X1.7D and X2D. The digital zoom is applied to the X25 optical zoom.
- Color or mono display
- Number of still image bitmap files taken during the Still Image function (for pulsed lasers only).

6.4.1 Configuring a Continuous Laser Beam

When using a continuous laser beam, attenuate powerful laser beams by selecting a combination of shorter shutter speeds and or higher gain levels, until the saturation level is acceptable. Refer to **Gain** issues for more information.

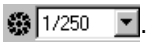
To configure a continuous laser beam:

1. Open the Settings menu and select **Hardware Setup**.
2. Click the **Laser** tab and select the **CW** radio button in the *Type* field.
3. From the **Control** Toolbar, select a shutter speed using the drop down list in the shutter field 

that enables an acceptable saturation level.
4. If the image is still saturated at the fastest **shutter** speed, try setting the **gain** level for a higher level. If still observing saturation – contact factory in order to get additional ND filters for the *µBeam* system to obtain an acceptable saturation level.

6.4.2 Configuring a Pulsed Laser Beam

To configure a pulsed laser beam:

1. Open the Settings menu and select **Hardware Setup**.
2. Click the **Laser** tab and select the **Pulsed** radio button in the *Type* field.
3. From the **Control** Toolbar, select the slowest shutter speed (1/3s) using the drop down list in the shutter field 

.
4. From the Control Toolbar, select the gain level using the drop down list in the gain field.
5. From the Hardware Setup, Laser tab, set the **Trigger control** level at the minimum value (to the left side of the scale). Increase the trigger level manually by sliding the bar graphically. The trigger control is also displayed at the Control Toolbar area.
6. If still observing saturation – contact factory to order other/additional ND filters to the *µBeam* camera to obtain an acceptable saturation level.

7.0 Installation

This chapter provides instructions for installing the hardware and software for the µBeam USB 2.0 system.

7.1 Hardware Requirements

To run the µBeam USB 2.0 version, the computer system must meet the following minimum requirements:

Item	Minimum Requirements	Recommended Requirements
CPU	Pentium 4, 1 GHz	Pentium 4, 1.7 GHz
System RAM	128MB RAM	
Hard disk	100MB HD free	
CD ROM drive	Any type	
Operating system	Windows XP/7/8/10	
Mouse	Microsoft mouse or equivalent	
VGA display	1024 x 768 resolution	
VGA card	16MB 16 bit color	64MB 16 bit color
USB Port	One free High Speed USB 2.0	

7.2 Software Installation - µBeam USB Device

Important Note: ***Please install the USB device driver before connecting the USB Device to your computer!***

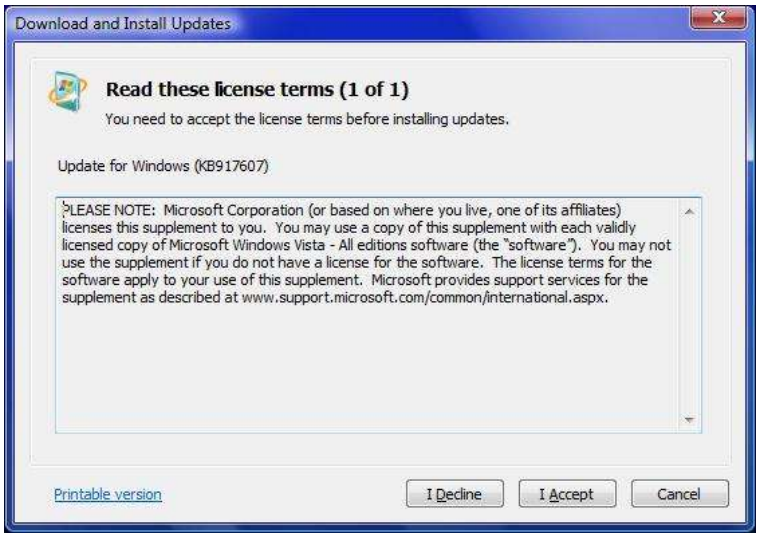
1. Perform **Software Installation**. Only after you click “Finish” to complete the software installation procedure, continue with the **Hardware Installation** as follows:
2. Connect the power supply cable to the µBeam USB device via the 12V jack and plug the power supply into the surge-protector outlet.
3. Plug the µBeam USB Device into a Hi-Speed USB 2.0 -compliant port.
4. The USB will be detected and the New Hardware Wizard will launch.

Important Note: ***Please do not connect / disconnect µBeam USB device, while application program is running!***

1. A Welcome screen appears when beginning the software installation routine. Click *Next*.
2. Insert your User Name, Company Name and System S/N (appearing on the system CD).
3. The following screen is a Registration Confirmation. Click *Yes* in order to confirm. If you click No, the software will return back to a previous prompt (stage 6 above).
   Now provide the full path for installation of the µBeam USB 2013 system software:
   More information about the exact folder for the software and branching in existing folder for µBeam USB 2013 system software can be done in the Select Program Folder prompt.
   Click the *Next* button to proceed.

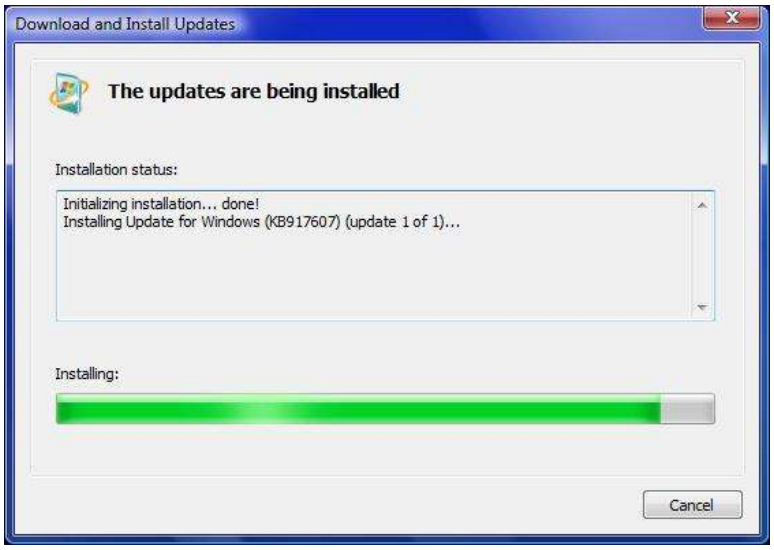
4. Copying files routine. Click Next button. At this stage the system copies all files from the CD-ROM to the selected directory in your computer. There is a graphical presentation showing the amount of data copied to the system disk. If the Cancel button is pressed the installation is aborted.
5. For Windows 7:

Windows Update

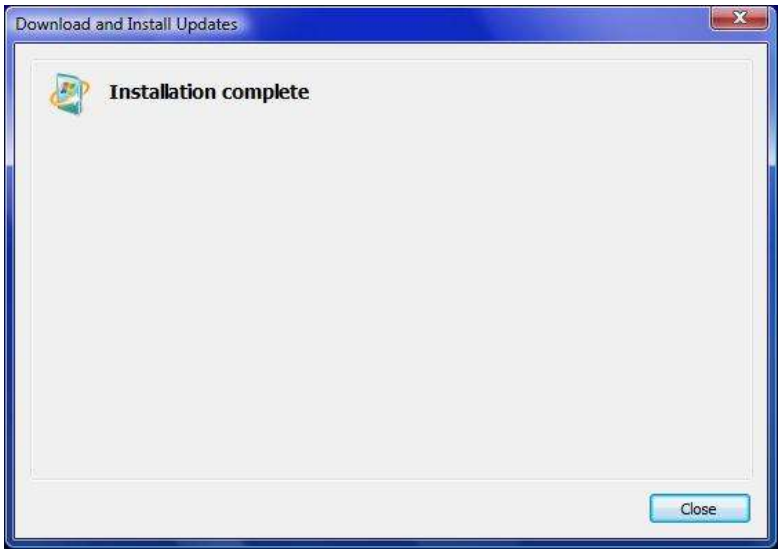


Download and Install Updates

Press “I Accept” button for install update.



Update installation status



Installation complete

6. Setup complete. At this stage, the user is requested to Restart the computer (Reset). Select *Yes* to Restart. The reason for the Restart operation is: during the installation process, there were a few drivers added to the Windows Registry, these drivers are required for the system proper operation. The drivers are activated only after the computer is rebooted.
   If you select *No* at this point, you will have to perform the Restart operation manually later on.
   Should you face any problem with the video device installation in your computer – please refer to the section: **Troubleshooting** for more information.

7.3 Hardware Installation – µBeam USB Device

Plug the µBeam USB device into a Hi-Speed USB 2.0 port.

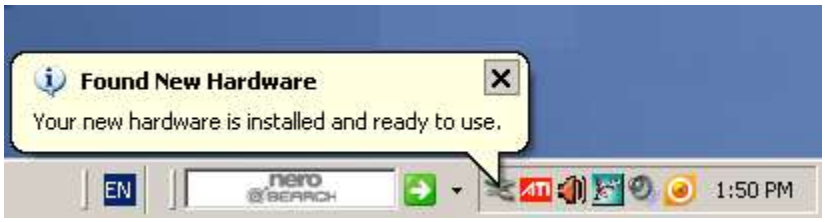
The USB device will be detected and the New Hardware Wizard will launch.

7.3.1 Windows XP

7.3.1.1. Installation Video Capture

1. The following message is displayed

Found new hardware message

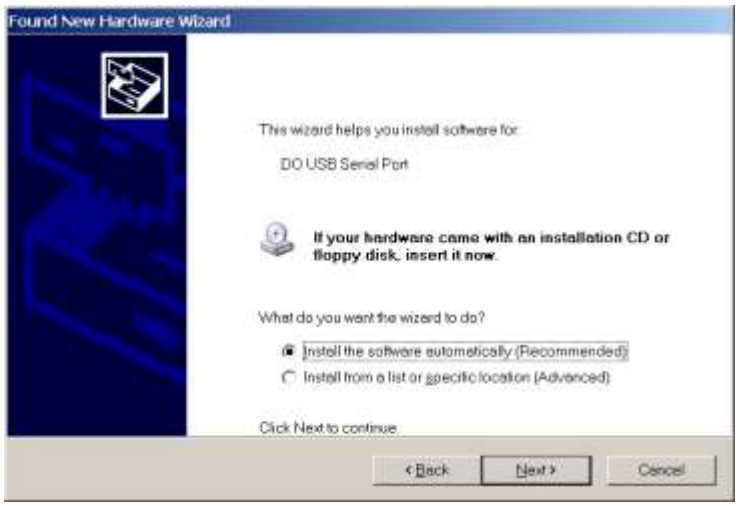


New Hardware ready to use

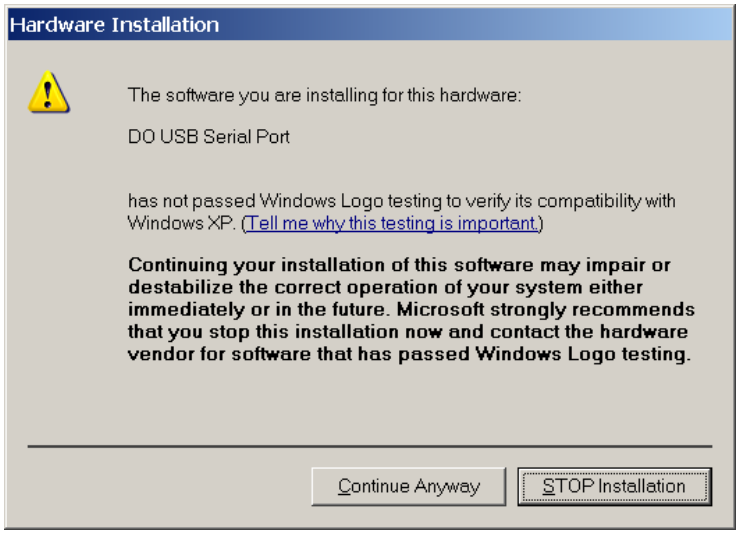
7.3.1.2. Installation USB Serial Port

Found new hardware message

Welcome Screen. Press "*Next"* to continue.



New Hardware Wizard. Press "*Next"* to continue.



Digital Signature Message. Press "Continue Anyway".

Installing…

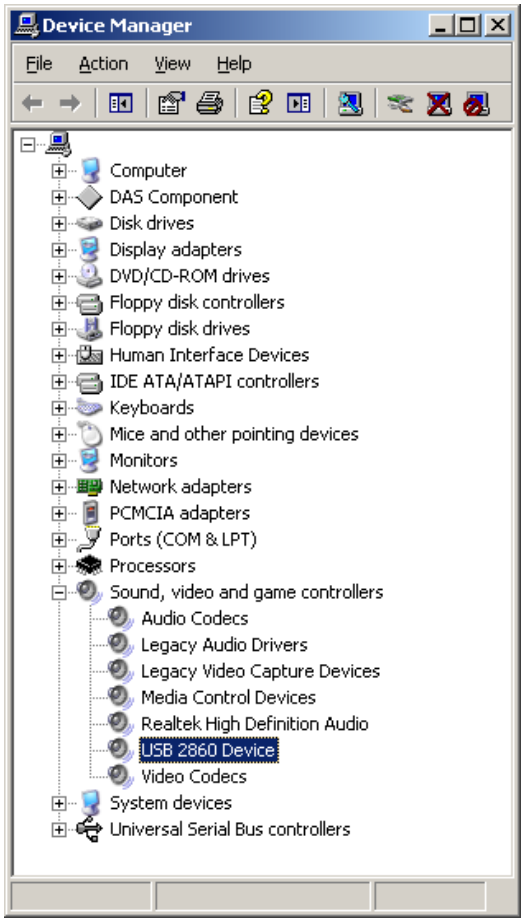
Complete installations Video Capture

Press *Finish* now and continue with the video capture installation.

New Hardware ready to use

After completion of USB device installation, when the device is configured successfully, the blue led on the front panel of the MicroBeam Head should be blinked.

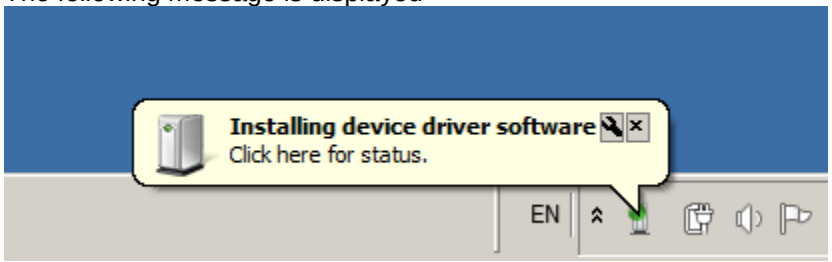
Additionally one can check the installation status under System Properties, Device Manager Tab and verify that **"USB 2860 Device"** line is listed under the Sound, video and game controllers devices, and **"DO USB Serial Port"** line is listed under the Ports devices.



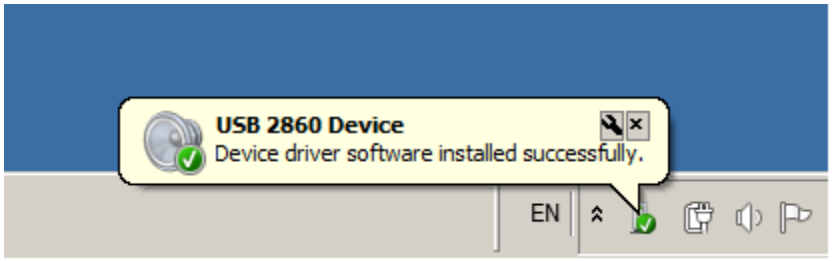
Drivers installed list

7.3.2 Windows 7/8/10

The following message is displayed



Installing device driver software



Devices are ready to use

After completion of USB device installation, when the device is configured successfully, the blue led on the front panel of the MicroBeam Head should be blinked.

Additionally one can check the installation status under System Properties, Device Manager Tab and verify that **"USB 2860 Device"** line is listed under the Sound, video and game controllers devices, and **"DO USB Serial Port"** line is listed under the Ports devices.

Drivers installed list

7.4 Running the Software

Make sure hardware is installed properly. (See **Hardware Installation – µBeam USB 2.0 Device**). Boot the computer.

From the **Start** Menu, select **Programs**, then choose **MicroBeam USB 2017** folder, and then click on the **MicroBeam USB 2017** program. Alternatively, you can activate the software by placing the mouse cursor at the **MicroBeam USB 2017 Icon**  and click the mouse button twice.

To end a program session, open the **File** menu and select **Exit.**

The MicroBeam USB saves all current setup parameters when you exit a session.

Possible Errors that indicate an interface board conflict:

There are a few common symptoms, which point to an interface board conflict:

* System Lock-up during software startup.
* There is no picture displayed on the screen
* Displayed measurements are sporadic and erroneous.

> If your symptoms match one of those presented above, or if the µBeam System was working at one time and has now stopped working, check for conflicts with other plug in cards in the same computer.

If it has no affect and no new software of any kind has been installed since the µBeam System last worked and the computer has not been moved, contact Duma Optronics Inc. for immediate support.

More information about Installation problems in the **Troubleshooting** section.

8.0 System Overview

This section provides a general overview of the system Main Menu items of the *μBeam System*. The following command menus are available on the Main Menu:

To display menu commands and close selected menus, use one of the following methods:

Display Menu Commands
Move the cursor to the desired menu item on the Menu Bar with the mouse or arrow keys and click the left-hand button of the mouse or press the Enter key.
OR Hold down the ALT key and press the underlined letter (hot key) in the menu name.

Close Menu
Click the left-hand button of the mouse on the menu name again or on another menu item OR Press the ESC key.

File Menu

The File menu allows the user to perform many file operations such as: save, view, print, delete or transmit data files. It can be used to also save data in real time into Excel software for further analysis at a later stage.

View Menu

The View menu enables the user to view additional ROI's (Regions of Interest), select type of profile, as well as activate/deactivate the control toolbar and the status bar.

Options Menu

The Options menu enables saving and recording operations:
- Save video, save a still image, save a BMP file, save snapshot.
- Insert user data.

Settings Menu

The Settings menu enables the user to perform System setup parameter settings, including: system settings, hardware settings, video properties, and offset.

Help Menu

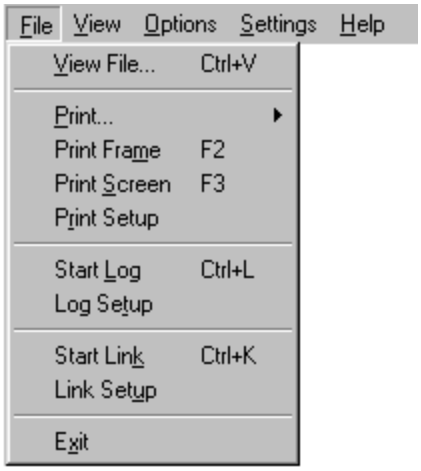
The Help menu provides on-line help on all system functions and buttons. The help screens are intended to provide short explanations about the current function and guidelines for operation. One can select the part of Help, which is required, either the Contents Window, the Search Window, or information on the current Active Window.

9.0 Operating Instructions

This section provides complete and detailed overview of the system software. It describes the layout of each operating screen as well as its setup screen.

9.1 File Menu

The File menu allows the user to perform many file operations.
File operations include: View, Delete, Print, Save and Transmit data files.
Upon activation of File function, the following list of options appears:



◆Note that the list of keys or key combinations on the right side of the menu indicate the keyboard shortcut for that feature. These shortcuts may be activated from the Main Window by pressing the keyboard combination.
◆If a menu item is gray it means that item is unavailable until something else is done. For example, to start Log there is a need to go through Log Setup first.
For more information on each option - place mouse cursor at the option name and click its LEFT button.

◆**View File...**
◆**Print...**
◆**Print Frame**
◆**Print Screen**
◆**Print Setup**
◆**Start/Stop Log**
◆**Log Setup**
◆**Start/Stop Link**
◆**Link Setup**
◆**Exit**

9.1.1 View File... *Ctrl+V*

View File provides the user the ability to view any stored file, including data log, configuration file, Test file, bitmap and video files.

View File can be selected from the **File menu**, the keyboard shortcut Ctrl+V, or via the **Control ToolBar**.

To view a file:

1. Select **View File** from the **File** menu.
2. Select the "File Type" for the file to be viewed.

-Log files have the extension:	*.LOG
-Config files have the extension:	*.INI
-Test files have the extension:	*.TST
-Image files have the extension:	*.BMP or *.JPG
-Video files have extension:	*.AVI
-Excel files have extension:	*.XLS

3. There should be no need to change the directory because most files should be stored in the system directory (the default)

4. Click on a file from the file list on the left.

5. Click **OK**. The file can now be displayed in the notepad application.

9.1.2 Print...

Print allows the user to print an entire saved data file.

Print can be selected from the **File menu**, or via the **Control ToolBar**.
The data is printed in the same format as it is shown on-screen, via View Data File.
Once **Print** is activated, a sub-menu is opened, as follows:

- Text file (or the keyboard shortcut Ctrl+T).

- Image file (or the keyboard shortcut Ctrl+I).

Print a Text file:
1. Select **Text file** via option **Print** in **File** menu.
2. Select the **File Type** for the file to be printed:
   - Log files (*.LOG)
   - Config files (*.INI)
   - Test files (*.TST)
   - Excel files (*.XLS)
3. There should be no need to change the directory because most files should be stored in the system directory (the default).
4. Click on a file from the file list on the left.
5. Click **OK**.

Print an Image file:
1. Select **Image file** via option **Print** in **File** menu.
2. Select **BMP** files or **JPG** files.
3. A list of all saved BMP/JPG files (having extension of ***.**BMP or *.JPG accordingly) is displayed.
4. There should be no need to change the directory because most files should be stored in the system directory (the default).
5. Click on a file from the file list on the left.
6. Click **OK**.

A message box "Printing..." is displayed as long as the program sends the file to the printer via the Windows Print Manager.

To select and setup a specific printer for printing select **Print Setup** from the **File** menu prior to selecting Print - use **Print Setup**.

9.1.3 Print Frame *F2*

Print Frame enables an immediate printing of the image screen as seen at the View Area.

Print Frame can be selected from the **File menu**, or the keyboard shortcut F2.
A message box "Printing..." is displayed as long as the window graphics is being transferred from the program to the printer via the Windows Print Manager.

To select and setup a specific printer for printing select **Print Setup** from the **File** menu prior to selecting Print Frame. Activate **Print Setup**.

9.1.4 Print Screen *F3*

Print Screen enables an immediate printing of the full screen display.

Print Screen can be selected from the **File menu**, or the keyboard shortcut F3.
A message box "Printing..." is displayed as long as the screen graphics is being transferred from the program to the printer via the Windows Print Manager.

To select and setup a specific printer for printing select **Print Setup** from the **File menu** prior to selecting Print Window. Activate **Print Setup**.

9.1.5 Print Setup

Print Setup enables the user to load the appropriate printer driver, set the orientation and paper size, via the standard Windows Pop-Up Setup Screen.

Print Setup is selected from **File menu**.

Make sure the appropriate printer driver is selected prior to activating **Print...**, **Print Frame** or **Print Screen** functions.

9.1.6 Start/Stop Log

 **Start Log**.
Start/Stop Log is selected from the **File menu**, or from the keyboard shortcut Ctrl+L, or from the **Control ToolBar**. Activate this option in order to initiate a data logging operation, or to terminate current data logging session. The duration of the experiment, the rate of data logging along with the filename should be set prior to activating this option through the **Setup Log** option.

While log is in progress, a banner is displayed at the top right corner of the Control Toolbar.

☞ *Start Log button is disabled until the following parameters are configured in the Setup Log option:*

- The duration of the experiment,
- The rate of data logging,
- The Log filename,
- Log file type: Excel or Log.

☞ *During Log, the **Start Log** menu item and Control ToolBar icon will change to **Stop Log**.*

Once saved, the data can be viewed on screen through **View File..**, printed for reference through **Print...**, or transmitted via an RS232 interface through **Link**.
If Excel file type was selected, data will be saved in real-time to a file type XLS via Excel.

Once saving data via Excel is activated, the banner **Excel in progress** appears at the right area of the Control Toolbar.

After the saving to Excel operation is terminated various presentations and analysis functions can be performed.

Stop Log

Stop Log is selected from **File menu**, or the **Control Toolbar**. The Log will save data according to the parameters set through the Log Setup.
The Log operation will automatically terminate after the user-preset time period in duration. However, activating option Stop Log in order to stop the saving operation at any prior stage can also terminate the session.

Note: When LOG file type was selected, all data collected will be saved in a file name ***.LOG**, which is a text file and can be imported into other programs.
When Excel file type was selected, all data collected will be saved in a file name ***.XLS**.

LOG file is stored in a text ASCII format so they can be easily printed, viewed, and analyzed by other programs.

- System name and software version
- User data (if inserted by the user)
- Date and Time
- Serial number
- Screen size
- Average level in use
- Zoom level in use
- 3 Clip levels in use for both V and H profiles
- Line Profile angle with respect to the origin
- Gain level
- Shutter level

Additionally, for each measurement taken, the following data is saved: Time, Centroid displacement value in µm: X value, Y value (centroid position of main Region of Interest area ROI(1)), and a set of Horizontal (H) and Vertical (V) profiles widths at 3 different clip levels which were preset by the user.

At the end of each Log file, there is a statistics summary, including: Minimum value, Maximum value, Mean value and Standard deviation value for each parameter saved.

Following please find the Log file example:

*** MicroBeam USB 2.0 Measurement system, Version 2.0 ***

UserData:

Date: 01 October 2017
Time: 08:54:24

Serial number: 001

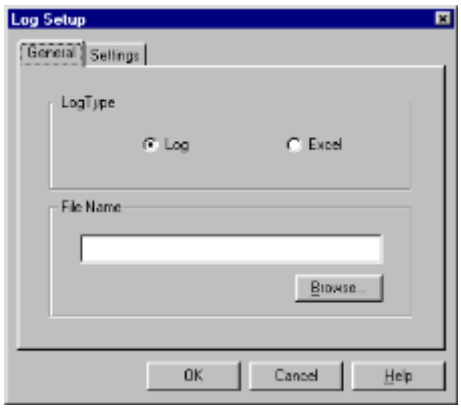
Size: 720x576
Average: Off
ClipLevel I : 13.5%
ClipLevel II : 50.0%
ClipLevel III: 80.0%
ProfAngle: -15°

Zoom: Off
Gain: 17 Db
Shutter: 1/2000 sec

Time (sec)	CentroidX (µm)	CentroidY (µm)	H_WidthI (µm)	H_WidthII (µm)	H_WidthIII (µm)	V_WidthI (µm)	V_Width II (µm)	V_WidthIII (µm)
0.00	-4.070	-3.576	9.795	5.731	3.324	11.391	6.601	3.859
0.35	-4.070	-3.594	9.867	5.834	3.324	11.478	6.720	3.859
0.70	-4.070	-3.576	9.795	5.731	3.324	11.391	6.601	3.859
1.06	-4.070	-3.594	9.867	5.834	3.324	11.478	6.720	3.859
1.45	-4.070	-3.576	9.795	5.731	3.324	11.391	6.601	3.859
1.80	-4.070	-3.594	9.867	5.834	3.324	11.478	6.720	3.859
2.14	-4.070	-3.576	9.795	5.731	3.324	11.391	6.601	3.859
2.49	-4.070	-3.594	9.867	5.834	3.324	11.478	6.720	3.859
2.84	-4.070	-3.576	9.795	5.731	3.324	11.391	6.601	3.859
3.18	-4.070	-3.594	9.867	5.834	3.324	11.478	6.720	3.859
**********	Statistics	**********						
Min	-4.070	-3.594	9.795	5.731	3.324	11.391	6.601	3.859
Max	-4.070	-3.576	9.867	5.834	3.324	11.478	6.720	3.859
Aver	-4.070	-3.585	9.831	5.782	3.324	11.435	6.661	3.859
STD	0.002	0.009	0.038	0.054	0.000	0.046	0.063	0.002

9.1.7 Log Setup

This setup screen allows the user to customize the Log operation to suit a particular need: the duration of an experiment, the rate of data saving into file, and the Log filename can be input by this setup screen. Also, data can be saved either to a Log file or to Excel file for further analysis at a later stage.



Log Setup is selected from **File menu**, or from the **Control ToolBar.**

Upon selecting this function and pressing **OK** button, one can initiate the log file operation via **Start Log** option, in **File** function. Press **Cancel** button to abandon Log Setup parameters.

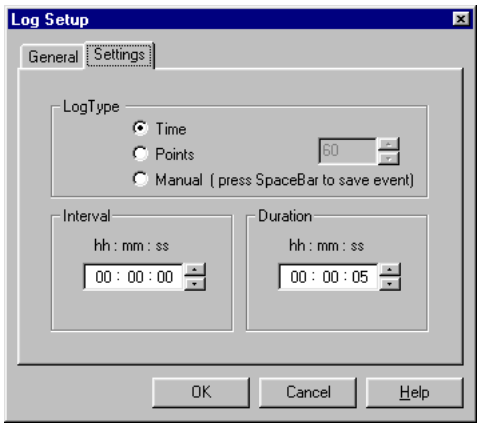
General tab settings include:

- **Logtype:** LOG file or Excel file
- **File Name** - Providing the system with a filename where Log data will be saved to. **Activate Button Browse...** in order to provide the system with a filename via the standard Windows File Input interface box.

Note: When LOG file type was selected, all data collected will be saved in a file name ***.LOG**, which is a text file and can be imported into other programs.
When Excel file type was selected, all data collected will be saved in a file name ***.XLS**.

At the end of each Log file there is a statistics summary, including: Minimum value, Maximum value, Mean value and Standard deviation value for each parameter saved.

Settings tab parameters include:



- **Interval** Insert the time interval between consecutive measurements. The interval can be set in: hours (h button), minutes (m button), or seconds (s button). After selecting h, m, or s parameters, enter the required value for each parameter using the data entry box.
- **Duration** Insert the length of time during which the system is to acquire data. The Log operation ends automatically at the end of the period. The logging data operation can be stopped prematurely using the Stop Log function. The duration for the measurement can be set in: hours (h button), minutes (m button), or seconds (s button). After selecting h, m, or s, enter the required value in the data entry box.

- **Logtype** - Provide the system with a method to control the data logging operation:

  Time: Save measurements for a pre-defined duration, the interval between the saved measurements is also defined prior to saving.

  Points: Save a certain amount of measurements taken at the system's data capturing rate, the exact figure is entered at the points field to the right of this option.

  Manual: Save a certain measurement to the file by pressing the SpaceBar. This method is called "Event oriented", meaning once the user observes a certain

measurement on the screen he can control the system to save this exact measurement data to the file, rather than other methods of stream data saving.

Activate Button Help to get help on this window.
Press **OK** button to confirm, or **Cancel** button to abandon.

9.1.8 Start/Stop Link

Start/Stop Link provides the capability to operate an RS232 Communication channel for serial data transmission.

Start/Stop Link is selected from the File menu, or the keyboard shortcut Ctrl+K. Any displayed data or pre-saved Log file can be transmitted via Link. Typically, this feature is used to transfer real time data from the system to another computer over a serial cable. The other computer can receive the data using a program that can communicate over a COM Port like Windows Hyper Terminal program.

While link is in progress, a banner is displayed on the top right corner of the Control Toolbar.

To Transmit data/file over RS232:

1. Connect the system to another computer using a null-modem cable.

2. Before using Start Link, the Link parameters in Link Setup must be configured to match the communications protocol of the computer that will receive the file/data.

3. Enable the receiving program to receive the file/data.

4. Select Start Link from the File menu.

In case you are transmitting data, after Start Link is pressed the program immediately starts sending measured data via RS232.

The data transmitted includes the following information:
Time of measurement: Time, Beam Centroid (X), Beam Centorid (Y), ROI1 (X), ROI1(Y), ROI2(X), ROI2(Y), CLIP_LEVEL1, CLIP_LEVEL2, CLIP_LEVEL3, H_WidthI, H_WidthII, H_WidthIII, V_WidthI, V_Width II, V_WidthIII.

In case you are transmitting a file, a standard Windows File box is displayed.

- Select the File Type for the file to be sent:
- Log files (*.LOG)
- Config files (*.INI)
- Test files (*.TST)
- Excel file (*.XLS)

6. Click on a file from the list on the left.

7. Click **OK**.

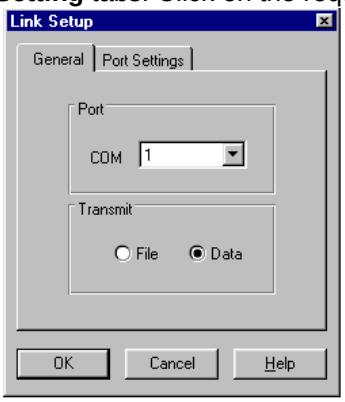
The file (or measured data) is transmitted in the background while the system continues to capture data. A link status window will be displayed at the upper left-hand corner of the Window area. When finished the Linking status message will disappear.

To stop a Link in progress, when Link is transmitting on-line data select **Stop Link** from the **File** menu.
Link is terminated automatically upon completion of the transmission of a file, or can be stopped by selecting **Stop Link** from **File** menu.

9.1.9 Link Setup

Link Setup allows the user to configure the system to suit a particular set of parameters needed for the RS232 transmission.
Link Setup is selected from **File menu**.

The parameters relating to the RS232 serial link are grouped in two tabs: **General** and **Port Setting** tabs. Click on the required tab.



General

This option can be activated from **Link Setup** window and includes the following two parameters setting:

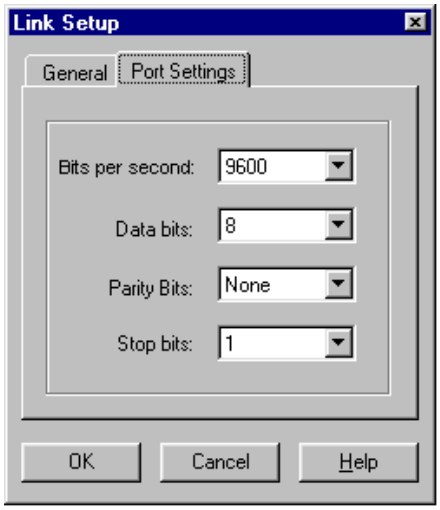
◆**Port:** Selects the computer communication port, through which data is to be transmitted over the RS232 link. Ensure that the selected port does not coincide with the port being used for the mouse. Many PC's have the mouse installed on COM1.
The possible values for **Port** are 1 through 4, for COM1 through COM4 respectively, and can be entered in the data entry box.

◆**Transmit:** Transmits a **File** (a pre-saved text file), or **Data** (real-time measurements). Selection is made using the **Option Buttons** (**File** or **Data**). If **File** is selected, the system opens a File Selection Dialog box in order to provide the text file name & path information.
If **Data** is selected, the system will transmit on-line live data. The system will send the data in the sequence and format of the saved data in the LOG file.

Activate **Help** button to get help on this window.
Press **OK** button to confirm, or **Cancel** button to abandon.

Port Settings

This option can be activated from **Link Setup** window.



Port Settings Tab includes the following four parameters related to the RS232 transmission:

◆**Bits per second:** Selects the right transmission rate for the RS232 link. The possible values, are: 110, 300, 600, 1200, 2400, 4800, 9600, 19200, 38400, 57600, 115200. This setting must match the same setting on the receiving computer, and can be entered by clicking on the down arrow and selecting the value from the list.

◆**Parity Bit**: Determines whether or not a parity bit is to be transmitted. The possible values are: None, Odd, Even, Space, Mark. This setting must match the same setting on the receiving computer, and can be entered by clicking on the down arrow and selecting the value from the list.

◆**Data Bit:** Determines the number of bits in use for the RS232 transmission. The possible values are: 4, 5, 6, 7, and 8. This setting must match the same setting on the receiving computer, and can be entered by clicking on the down arrow and selecting the value from the list.
◆**Stop Bit:** Determines the number of stop bits to be transmitted. The possible values are: 1 or 2. This setting must match the same setting on the receiving computer, and can be entered by clicking on the down arrow and selecting the value from the list.

Activate Button **Help** to get help on this window. Press **OK** button to confirm, or **Cancel** button to abandon.

9.1.10 Exit

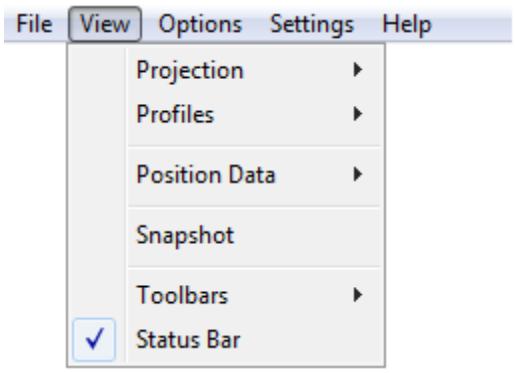
Use Exit to terminate the current session (close the application program and exit Windows).

Exit is selected from the **File menu**.
All current setup parameters will be saved automatically when program is exited in the uBeam.INI file and will be reloaded when the program is started.

9.2 View menu

View enables the user to control the screen presentation as follows:
Add/Remove ROI's, select the Profiles type, activate/deactivate the presentation bars (Toolbars, Status Bar).

The following commands and menu items are available:

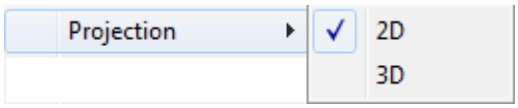


Available functional windows, are:

- **Projection**
- **Profiles**
- **Position Data**
- **Snapshot**
- **Toolbars**
- **Status Bar**

9.2.1 Projection

Select any one of the following options for the Projection presentation at the major ROI:

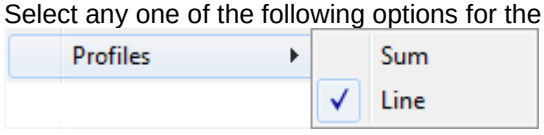


To select the graphical presentation*:*

From the **Control Toolbar**, click  for a 2D display or  for a 3D display. Or,
Open the View menu and select Projection ▶ **2D** or **3D**.

9.2.2 Profiles

Select any one of the following options for the Profiles presentation at the major ROI:



Sum Profiles: Displays the two orthogonal profiles, one along the vertical axis and one along the horizontal axis. Each profile is composed of a summation of rows and columns at a beam cross section.

Line Profile: Displays the contour of the beam along a line parallel to the vertical axis and a line parallel to the horizontal axis. The two lines, along which these contours are displayed, are

designated as a cross hair cursor. The cross hair cursor can be moved across the CCD entire area, so the displayed profile is the cross section line profile located by the cursor.

Note: The line Profile can be defined according to the Cross Line options (see 9.2.3).

9.2.3 Cross Line

Cross Line function toggles between two possible settings for the X-Y scale coordinates presentation, as follows:

- **Free:** Displays a cross hair target at a user' selected coordinates. Define any point over the CCD View Area to be the cross line coordinates, by moving the mouse to the selected point and clicking the mouse right-hand button once. Yellow lines mark the cross line coordinates, and the coordinates values are displayed at the cross line field in the User Area.

- **Centroid:** Displays a cross hair target which represents the system' main ROI centroid coordinates. Blue lines mark the centroid coordinates, and the centroid values are displayed at the User Area section.

  Note: *When Centroid is selected, one can define a relative point over the View Area which is referred to the centroid by a certain "offset".*
  In order to set the centroid offset move the mouse to the selected point and click the mouse right-hand button once. The centroid offset coordinates will be displayed at the User Area.
  Return to centroid display (no offset) by double clicking on the mouse LEFT-hand button.
  This operation also sets the main ROI to its default setting (in case it has been changed in size and location)

9.2.4 Position Data

Position Data enables toggling between Absolute position reading (the default) and the relative position reading.
When Relative is selected then all the position centroid data will be calculated versus the Cross Line center, and a small message which reads "Relative" will be displayed at the top left corner of the View Area.

The Relative point coordinates can be set by graphical means, by dragging the Cross Line center to any requested location over the View Area.

The software calculates the centroid of the beam which resides inside the ROI area only, disregarding the energy outside of this region. Thus, the result of the beam centroid calculation will be displayed in the appropriate ROI area at the User Area.

Note:

- The Profiles presentation are displayed over the entire area of the CCD. If additional ROI's are selected and opened (ROI1 / ROI2) these will obtain beam position centroid information only, not Beam Profile information.

The user can change the default size and location of the ROI by graphical means:

- **Change the ROI location:** by placing the mouse cursor inside the ROI frame and dragging the ROI frame to any required location while pressing the mouse left button.
- **Change the ROI size:** by placing the mouse cursor at one of the ROI frame edges and dragging it slowly to the required size while pressing the mouse left button.
- **Restore ROI size and location (default):** by pressing first the mouse left button and then pressing the mouse right button. The ROI is brought back to its original size and location over the CCD area.

9.2.5 Snapshot

Snapshot enables viewing a saved snapshot file, or closing a snapshot file and returning to a real time measurement mode.
To view a Snapshot File:

- Select **Snapshot** option. The *Load Snapshot File* window displays.

- Select a snapshot file.

- Click **Open**. The snapshot file displays.

To close a Snapshot File:
- Select **Snapshot** option. The system restores real-time measurement displays.
  Alternatively, press the X sign at the right top corner of the Windows screen application.

9.2.6 Toolbars

Toolbars can be selected from the **View menu**,

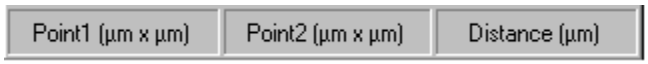
- **Analysis Toolbar**
- **Control Toolbar**
- **Playback Toolbar**

9.2.6.1 Analysis

Analysis is selected from the **Control Toolbar** or from **Toolbars** option in **View menu**.

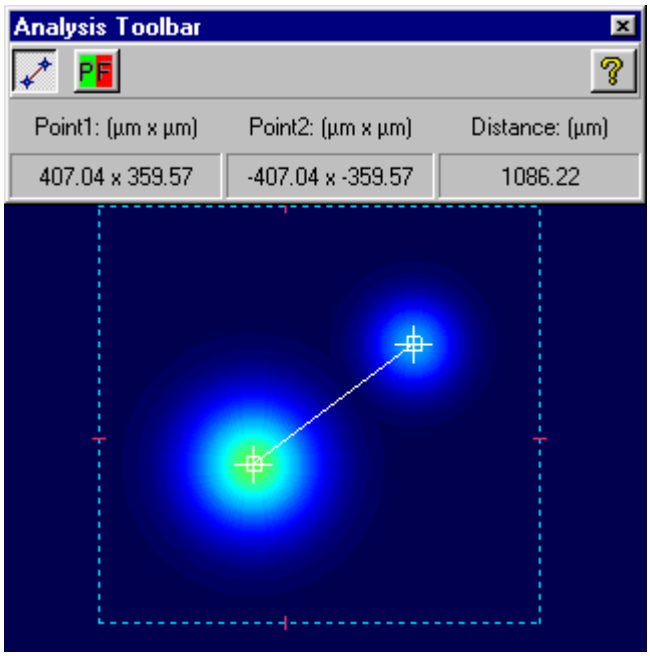
Ellipse - Defining a laser beam frequently requires a definition of beam elliptical foot-print and beam orientation with respect to the camera axis. A special function which calculates the best fit ellipsoid to the examined beam is provided by the Ellipse function.

Line - Performs accurate distance measurements between any two points on the beam topographic map. The two points are selected using the mouse and the calculation result (distance between these points) is displayed at the Analysis Toolbar window just below the tool buttons of the Analysis Toolbar.



The *µBeam* can accurately measure distances between any two points on the beam image. You select the end points and the *µBeam* calculates and displays the results.
To measure the distance between two points on the beam image:

1. Open the Options menu and select **Freeze Mode**, or from the **Control** Toolbar, click  .
2. Open the View menu and select Toolbars at **Analysis,** or from the **Control** Toolbar, click  . The *Analysis Toolbar* displays.
3. From the **Analysis** Toolbar, click  .
4. Select the first point by placing the cursor on the beam image and click the left mouse button.



5. Drag the mouse to the second point on the beam image and click the left mouse button. A straight line is drawn between these two points and the line distance calculation is displayed below the Analysis toolbar (see attached figure).

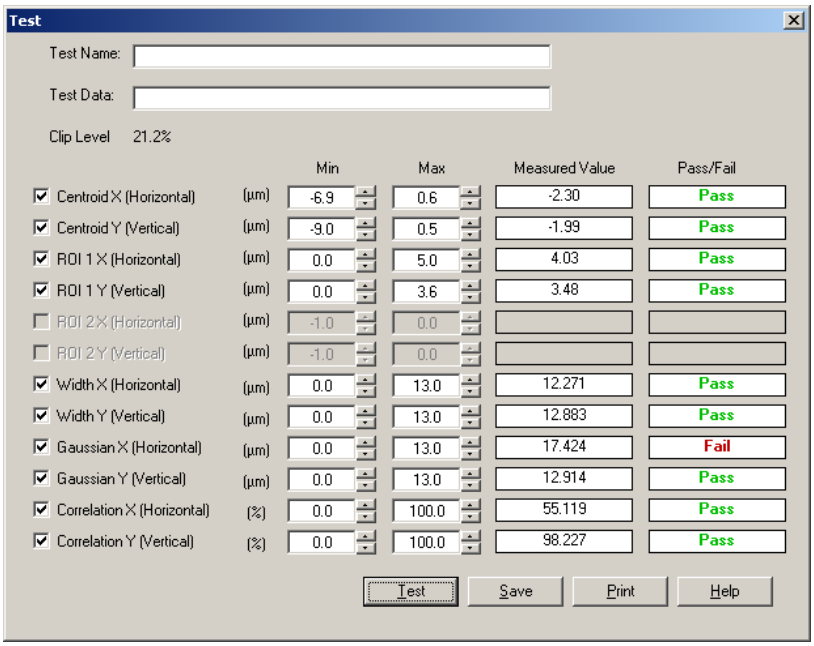
Test – Activates a test routine, which allows the user to test the laser beam, based on the user pre-defined pass/fail criteria. The test results are calculated while being in Freeze Mode for any

one of the following user-selected parameters:

- Centroid X Horizontal (µm)
- Centroid Y Vertical (µm)
- ROI1 Centroid X Horizontal (µm)
- ROI1 Centroid Y Vertical (µm)
- ROI2 Centroid X Horizontal (µm)
- ROI2 Centroid Y Vertical (µm)
- Width X Horizontal (µm)
- Width Y Vertical (µm)
- Gausian X Horizontal
- Gausian Y Vertical
- Correlation X
- Correlation Y

Parameters that are not activated in the test setup are marked as “Skipped” in the Test window. To test a laser beam:

1. Open the View menu and select Toolbars then **Analysis,** or from the **Control Toolbar**, click  . The *Analysis Toolbar* displays. To run the test, click  on the **Analysis** Toolbar. The *Test* window displays.
2. Select the parameters to include in the test and set the minimum and maximum values for these parameters.



3. Enter your test related information (Test Name and/or Test Data).

4. Press the Test button to perform a Test operation.
   The test window displays the beam’s test results based on the parameters entered in the Setup parameters.

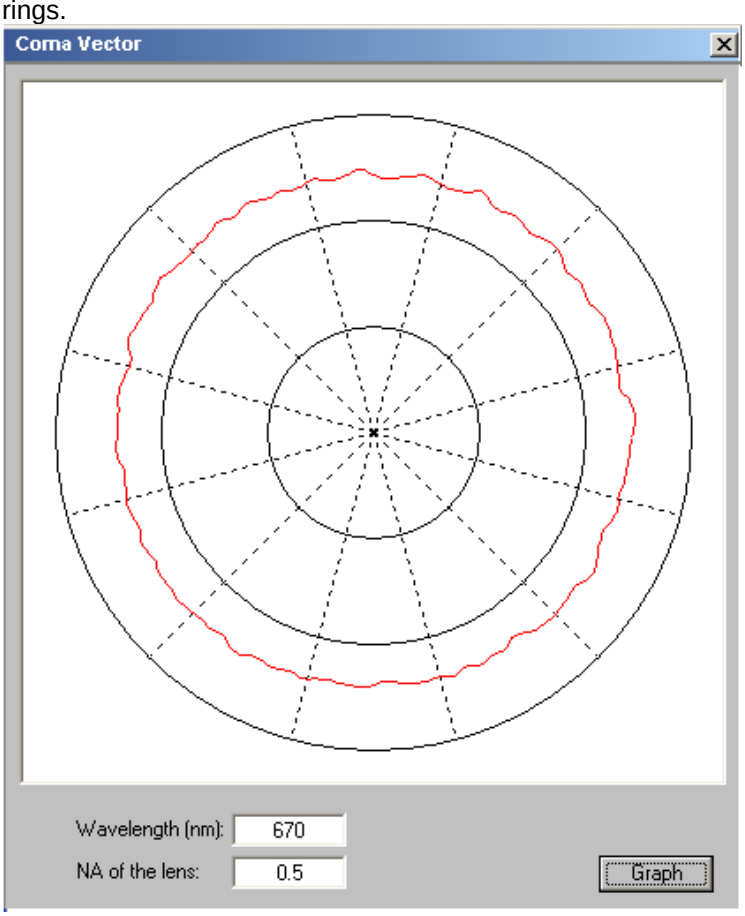
To save the current test results in a bitmap or test file, click **Save**. To print the current test results, click **Print**.

To stop the test and close the test window, close the Test window or click PF on the **Analysis** Toolbar.

Coma - The coma function provides a novel measuring technique of the optical performance of objective lenses for optical disk systems.
The coma aberration has a magnitude and direction. The magnitude and the direction of lens decentering correspond to the magnitude and direction of the coma. The radii of the first dark ring R1 and the second dark ring R2 are given by the following:

$$R1 = 0.61 \lambda / NA$$
$$R2 = 1.12 \lambda / NA$$

Under the assumption that there is no aberration and that the intensity distribution of the incident light is uniform. Thus λ is the wavelength, and NA is the numerical aperture of the lens. The feature of coma aberration is characterized well by the profile between the first and second dark rings.



The graph presentation shows the intensity distribution between the first dark ring and the second dark ring and their coma vectors.

9.2.7 Control Toolbar

Select Control ToolBar from the View menu, in order to show/hide the ToolBar respectively.

Control ToolBar is a collection of shortcut buttons to menu items that are used frequently. Each shortcut is represented by a special icon (picture) and is called a Tool Button.

To activate a tool button, place the mouse over the button and click the LEFT mouse button. The button will change both color and shadow to designate the fact that this function is activated.

This is an example of ToolBar (for CW lasers):

This is an example of ToolBar (for Pulsed lasers):

To view the function of each icon button, place the mouse cursor on the icon and wait momentarily, a brief function description will appear near the icon.

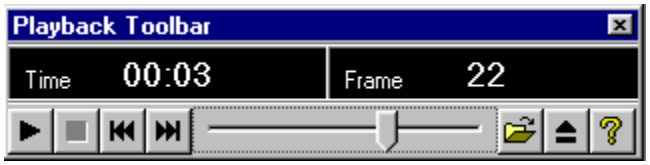
9.2.8 Playback Toolbar

Select Playback ToolBar from the Toolbars in View menu, in order to show/hide the ToolBar respectively.

During a video playback routine, the *µBeam* displays a digital presentation of the time elapsed since the video began, as well as the number of the frame being displayed.
To play a video, open the video file you want to see and use the following buttons on the Playback Toolbar to play your video:

Play	Plays the recorded video file.
Stop	Stops the playback of the video file once it is started.
Rewind	Rewinds the current video one frame backwards.
Forward	Fast forwards the current video one frame.
Open	Opens a video file.
Close	Closes an open video file.

There is a slide bar in the middle of the Playback Toolbar, which moves in accordance with the video's progress. It is also possible to use this slide bar to rewind the video to its starting point, or to bring it to the end of the video.



To play a video file:

1. Open the View menu and select Toolbars then **Playback**.

   OR

   Click  from the **Control** Toolbar.

   The *Playback Toolbar* displays.

2. Click  on the **Playback** Toolbar. The *Open Video File* dialog displays.
3. From the Open Video File dialog, select the video file you want to view.
4. Click **Open**. The video file displays.
5. Use the **Playback** Toolbar buttons as defined above to play the video.
6. Click  to close the video file.

9.2.9 Status Bar

Select Status Bar from the View menu, in order to show/hide Status Bar respectively.

The Status Bar provides the status of various settings and operational conditions.
If the system is not operating as intended, the Status Bar provides a quick summary of why it is not functioning properly. The Status Bar is a valuable aid in diagnosing unexpected results, and can quickly help you get back to the desired operation.
Example of Status Bar:

☞ *The Status Bar also provides quick access to System or Hardware setup parameters. One click at the panel opens the System/Hardware setup window.*

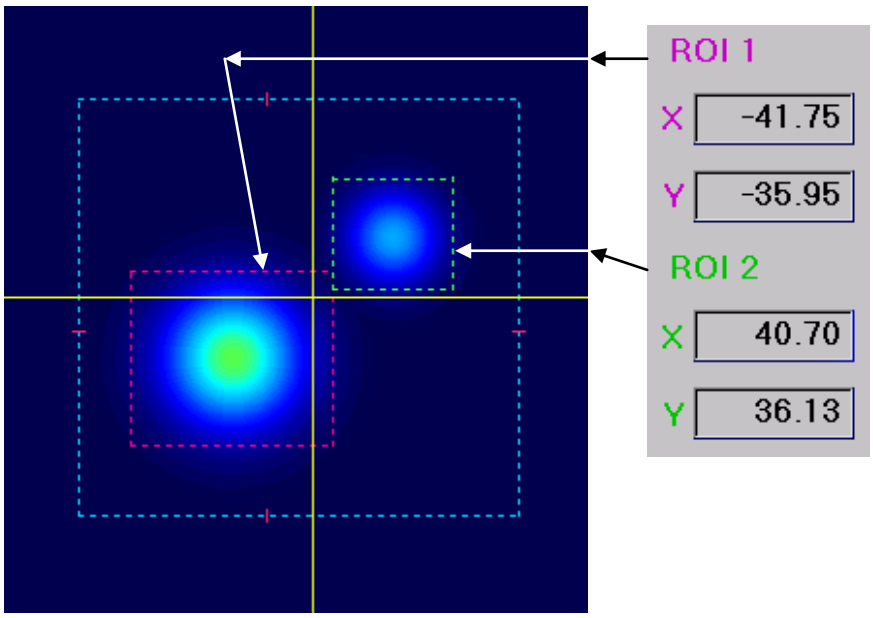
Status Bar Panels:

- Date and Time
- **Average** - number of data samples that are being averaged before calculations and display of the data is performed.
- **Scale –** The zooming level used in microns/division
- **Profiles type –** Indication of profile type
- **Still Image**

Region of Interest

The ROI function selects a region of interest within the total CCD detector area.

To activate the ROI press the appropriate ROI button on the **ToolBar**. The ROI region is defined by a square, the color of which is identical to the numerical presentation at the **User Area,** as well as to the ROI tool button color. The user can control the size of the ROI and its location by graphical means using the mouse.



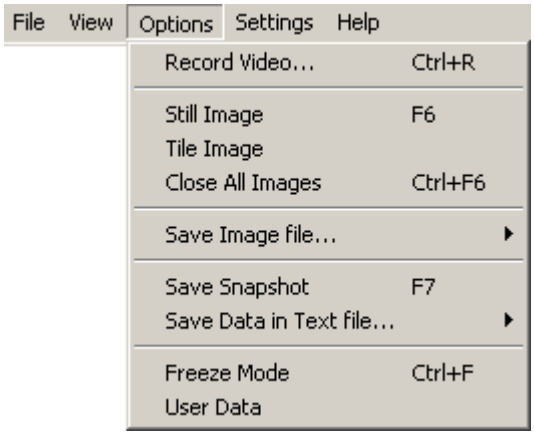
The software calculates the centroid of the beam, which resides inside the ROI area only, disregarding the energy outside of this region. Thus, the result of the beam centroid calculation will be displayed in the appropriate ROI area at the User Area. In case the Radius parameter is set On at the Position Setup – Position tab, then there is an additional calculation and display of the R value, which is the radius of beam centroid with regards to the cross line.

Note: The default ROI is the total centroid of the energy impending on the entire CCD area.

The user can change this default by graphical means, by dragging the ROI frame to the location and size at the screen, which is of interest.
The default setting of the system when it boots up is the entire CCD area is being considered the area main region of interest and the beam centroid calculation is performed over the entire CCD area. This default can also be changed by graphical means, the same way both other ROI's borders and location can be set.
In order to resume the default setting, double click on the mouse Left button.

9.3 Options Menu

Options menu enables the user to record Video/Still Image files, save a BMP file and input User Data. It also enables freezing a screen display and selection of the zooming criteria (axes / centorid stabilize).
The following commands and menu items are available from this menu:



Available options for Options menu are:
- **Record Video...**
- **Still Image**
- **Tile Image**
- **Close All Images**
- **Save Image file ...**
- **Save Snapshot**
- **Save data in Text file ...**
- **Freeze Mode**
- **User Data**

A check mark in front of a menu item means that the function is enabled.

9.3.1 Record Video...

Record Video enables recording and saving movies (or a continous set of images). The movies will have the file extension .AVI.

To initialize the video parameters:
Open the **Settings** menu and select **Video Properties…**.window.

To record a Video:
When you record a video, the video is saved in the file you specified in the **Video Properties** window. If you don't want to overwrite this file, you need to change the file name before recording a new video.
During video recording, a moving bar on the Status Bar (just to the right of Zoom field) graphically displays the progress of the recording operation.

Open the Options menu and select **Record Video**. A checkmark is placed beside this option. Or

Click from the **Control** Toolbar.

When the *µBeam* is recording a video, a message displays on the top left side of the screen, which reads:

Stopping the Video Recording:
The video recording automatically terminates after the user-preset time is reached. However, you can stop recording at any time. When recording terminates, it is automatically saved in the file you specified during video setup.
To stop the video recording:

Open the Options menu and select **Record Video**. The checkmark is removed from this option, or Click  from the **Control** Toolbar.

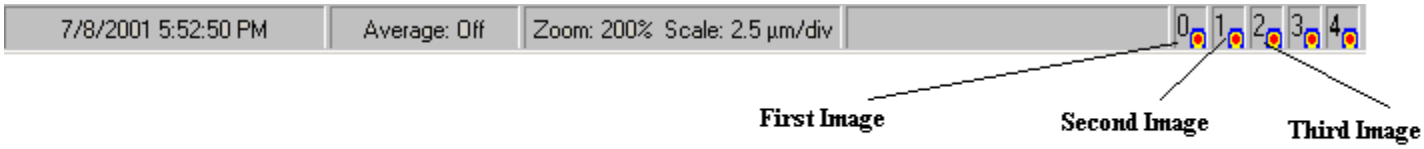
9.3.2  Still Image

This section describes how to capture high quality digital images with your *µBeam* system. A still image is captured by digitizing a single video frame. The still images can be saved as bitmaps. The captured image is displayed as an icon on the Status Bar with a number assigned to it. If you are using a pulsed laser, you can set the number of bitmap files that the system captures when performing a still image operation via Set Images function. The *µBeam* can capture up to 12 still images during one session.

Capturing a Still Image

To capture a still image:

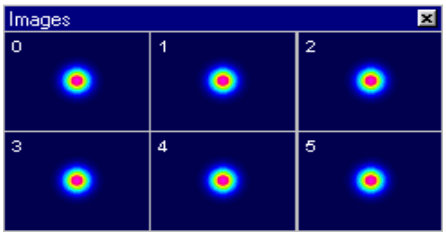
1. Open the Options menu and select **Still Images**, or click  on the **Control** Toolbar.



The image is captured and an icon is placed on the Status Bar.

9.3.3 Tile images

You can view a single still image or all your still images in a matrix (refer to the following figure). When viewing the still images in a matrix, you can select a single still image to magnify for details.



To view a single still image, click the still image icon on the Status Bar.
To view the still images in a matrix, open the Options menu and select **Tile Images**.
To magnify a still image in a matrix, click one of the tile images. To close the magnified still image, click in the upper right corner of the image window. The still image remains in the matrix.

9.3.4 Close All Images

When you close a still image you must either save it or discard it. If you close a still image matrix and choose to save it, each of the images in the matrix are saved as separate bitmap files. The bitmap filenames are created by the *µBeam* system and consist of the image number, day, hour, minutes and seconds (n_ddhhmmss.bmp).

To close an opened still image or still image matrix:

1.Click in the upper right corner of the image window. The *Still Image* window displays.

2.If you want to save the still image, click **Yes** in the Still Image window.

Close All Images option is selected from **Options menu**, or by the keyboard shortcut **Ctrl+F6**. When this option is selected a message box is displayed:

To save all open images press "Yes" and the related BMP file will be saved immediately.

9.3.5 Save Image file

Save Image File enables the user to save a screen graphics into either a BMP file or a JPG file, in order to edit/print it at a later stage.

Save Image File can be selected from **Options menu**.
Once this function is selected, the software opens a sub-menu including:

Save Frame: saving only the displayed image screen at the View Area.
Save Full Screen: saving the full screen presentation.

9.3.6 Save Snapshot

Snapshot enables viewing a saved snapshot file, or closing a snapshot file and returning to a real time measurement mode.

To view a Snapshot File:

- Select **Snapshot** option. The *Load Snapshot File* window displays.
- Select a snapshot file.
- Click **Open**. The snapshot file displays.

To close a Snapshot File:

- Select **Snapshot** option. The system restores real-time measurement displays.
  Alternatively, press the X sign at the right top corner of the Windows screen application.

9.3.7 Save Data in Text file…

The system allows you to save the numerical values of the Horizontal and Vertical profiles for later analysis.

To save the numerical data of the profiles:

- From the **Options** pull-down menu select the **Save Profiles as Text file** option.
- Input a file name via the open dialog Save/Print Text file. The data will be saved as a text file with the relative Horizontal and Vertical intensity vs. pixel number. The setup data will be saved at the same time. The data file is stored with an extension of "TXT".
- To view the data, press **File** menu, **View File** option, select the text file and double click on the desired TXT file. If you want to print this file when open, press Print. An example of a saved profile text file as follows:

  *** MicroBeam USB Measurement system, Version2.0 ***

UserName:
UserData:
Date: 01 Oct 2011
Time: 17:25:56
Serial number: 0013
Size: 720x576
Average: 20
Gain: 6 Db
Shutter: 1/500 sec
Optical Factor: 10
Horizontal Scale: 0.5101473 (micron/pixel)
Vertical Scale: 0.5615108 (micron/pixel)

No#	Horizontal (%)	Vertical (%)
1	0.00	2.07
2	0.00	2.07
3	0.00	2.07
4	0.00	2.07
5	0.00	2.07
6	0.00	2.49
7	0.00	2.49

9.3.8 Freeze Mode

Freeze Mode can be selected from **Options menu**, or by the keyboard shortcut **Ctrl+F**, or via the **Control ToolBar**. This function freezes on the screen the last image and its measured data. It is possible to perform further analysis on the last measurement using Analysis function, such as: measure distance between any two points using line function, or performing a Pass/Fail test for various beam parameters. It also enables the user to explore the last measurements in detail.

When the *µBeam* is in freeze mode, a message displays on the top left-hand side of the screen, which reads: *Freeze Mode*.

To freeze the screen graphics:

1. Open the Options menu and select **Freeze Mode,** or Click on the **Control** Toolbar. A Freeze Mode message appears on the menu bar.

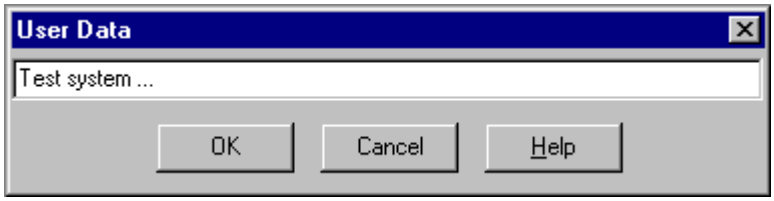
To return to real-time measurement mode:

1. Open the Options menu and select **Freeze Mode,** or Click on the **Control** Toolbar. The Freeze Mode message disappears from the menu bar.

9.3.9 User Data

User Data enables the user to insert any information required during the measurement session, which does not exceed 60 characters.

User Data can be selected from **Options menu**.



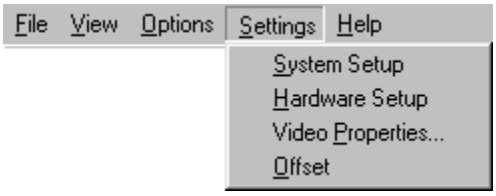
After inserting the user data information and pressing **OK** button - the information inserted will automatically be displayed at the Title Bar, just right to the system name.

New! It is possible to scan a bar-code using a barcode reader connected to the system, and after performing the scan the barcode will be displayed at the User Data field and later on at the Title Bar.

9.4 Settings Menu

Settings menu allows the user to activate the various settings operations.

The following commands and menu items are available:



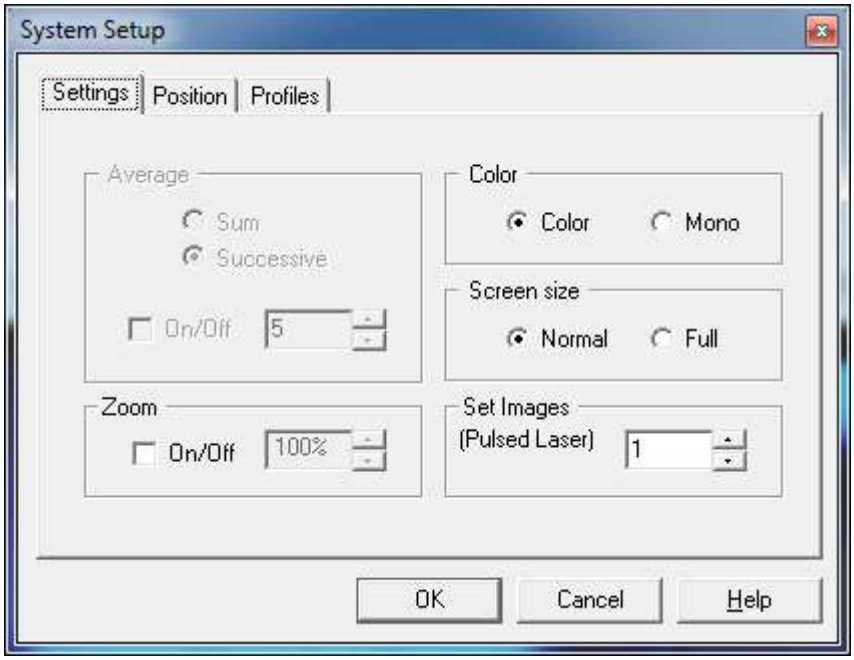
- **System Setup**
- **Hardware Setup**
- **Video Properties**
- **Offset**

9.4.1 System Setup

System Setup allows the user to configure the *µBeam* measurements to suit a particular set of needs.

System Setup is selected from the **Settings menu** and includes the **Settings options** and **Profiles options**.

Settings Options Tab



- **Average**
- **Zoom (beam/axes stabilize)**
- **Color**
- **Set Images (Pulsed laser)**

Average

Average function is used to smooth the data display of quickly varying sources.

Average can be set via **System Setup**.

When using a beam with significant amount of jitters, it is sometimes convenient to set Average On.
When Average in On, a few successive measurements are averaged and displayed. The amount of successive measurements averaged can be controlled via this option (possible values are 1-20), where 1 means "no averaging" and each measured value is displayed.

When, for example, a value of 10 is chosen, ten consecutive measurements are averaged and the result is displayed. When an eleventh measurement is taken, the first measurement value is dropped and the second through the eleventh are averaged, etc.

Because a successive averaging technique is employed, the window display update rate is only slightly affected, if at all.

Upon activation, a few consecutive measurements are averaged and displayed. The amount of consecutive measurements averaged can be controlled by this option.

Follow the steps for setting Average:

- **Check Box Average** button to activate/deactivate the Average On/Off setting.

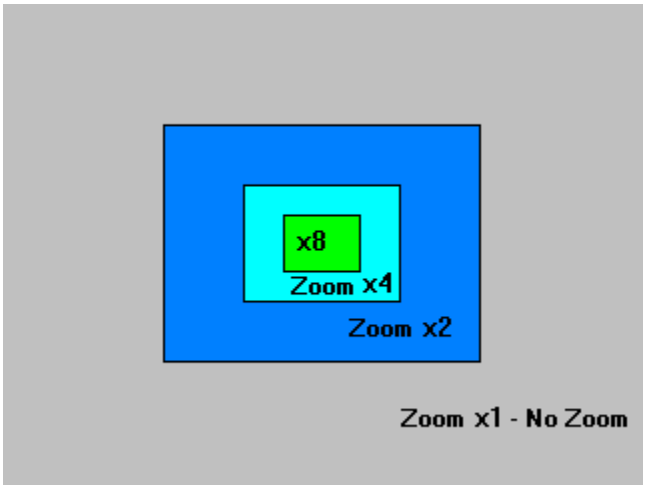
◆Input value for **Average** using the data entry box, set the required Average level by

Value Setting.

The Average setting is displayed at the Status Bar. If one rests the mouse cursor at the status bar and double clicks on the mouse left button – the system setup screen will open-up to enable a faster method to update this parameter.

Zoom

The Zoom command provides a graphics zoom of the image data displayed in the **View Area**. The beam image can be zoomed by **100% (no zoom), 200%, 400%, 800%, 1600% and 3200%.** When zooming in and out, the plot will center as closely as possible over the current cross hair cursor position.
Zoom is controlled by a set of 3 tool buttons at the Toolbar: Zoom In, Zoom Out and Axes/Beam stabilize.



At zoom levels above 100%, scroll bars will be displayed on the right and bottom sides of the contour and 3D plots. The slide bars allow positioning of the zoom area.
To choose the Zoom command, select **ToolBar**.
The small red arrow-head marks will show the beam centroid location at both X and Y axes. When using a big magnification factor these arrow head marks are very useful for finding the beam location over the entire displayed image.

The Zoom function can also be selected by choosing the Zoom icon button from **Control Toolbar**.


Choosing this Zoom icon button causes the Zoom function to Zoom In.


Choosing this Zoom icon button causes the Zoom function to Zoom out.

Color

Color can be set via **System Setup**.

Activate this option in order to toggle between full color presentation or B/W presentation (mono) of the graphical presentation's background color.

NOTE: White color means "local saturation." The red color stands for the beam highest intensity.

Set Images

Sets the number of still image bitmap files that the system takes during pulsed laser operations.

If, for example, you input 4 and select the still image function, the system captures and saves the next 4 still images.

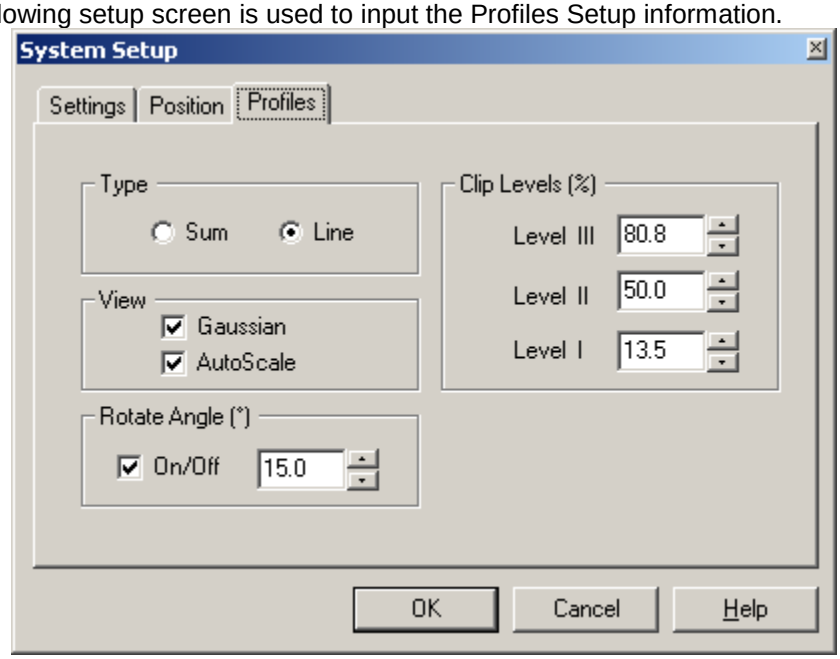
The set images function is disabled for continuous lasers.

> *To set the number of still image bitmap files, enter a set image value. Possible values are 1 - 12.*

Upon selecting the required parameter value, press OK to confirm the selection, press Cancel to abort.

Profiles tab

The following setup screen is used to input the Profiles Setup information.

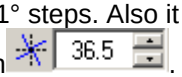


Type: Toggle between *Sum Profile* and *Line Profile*. This setting can also be made via the ToolBar. See detailed description in section 8.2.1. Each image is a digital representation of the spatial power distribution across the beam. The numerical value of the profiles width can be viewed in the Profile Measurement Area.

Clip Levels: Set any one of the 3 displayed and calculated clip levels for the beam profile presentation. Clip level defines the percentage of the peak of the intensity profile at which the width of the beam is measured. For instance, a clip level of 50% indicates that the beam width is to be measured at its full width at half maximum (FWHM). A clip level of 13.5% would measure the beam width at a point, which is 13.5% of the peak of the profile and corresponds to the $1/e^2$ point of a Gaussian profile.

The three clip levels appear in the V Profile and H Profile displays and are represented by horizontal dashed lines that are superimposed on the profile. The user may choose to change any one of the three to a new clip level leaving the other two unchanged.

Set the value for the clip level either via the Profiles Setup screen, or graphically by placing the mouse cursor at the clip level line: once this is done a double-headed arrow cursor appears on the profiles display, drag the clip level line up or down until the desired level is reached.

Rotate Angle: Set the view angle (angle of rotation) at which the X Y cross section profiles are cut. The rotation angle can be set in 0.1° steps. Also it is possible to set the rotation angle via the ToolBar, using the tool button 

. Here one can input the rotation angle in +/- 0.5° steps. Press the Up or Down arrows while watching the rotation Operation on the screen.

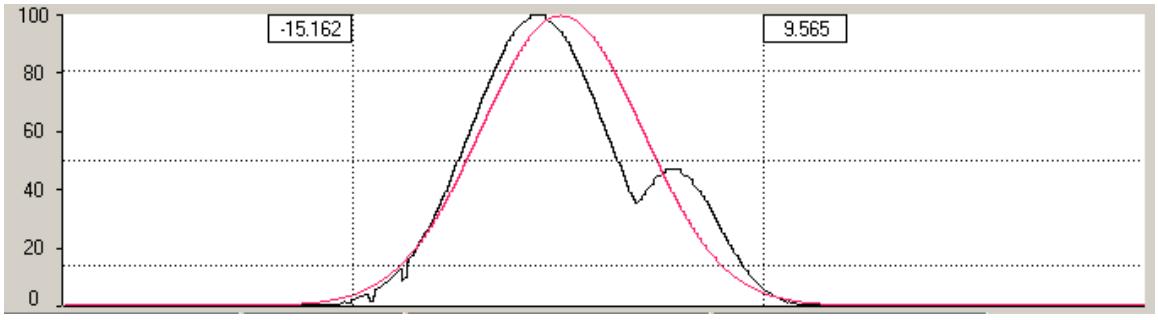
View: Set Gaussian presentation On or Off, also set the Autoscale value On and Off.
Autoscale On : Displays the profiles using the full height of the profile window.
Autoscale Off: The beam peak can be observed as it changes. This feature is important for a focusing process. The peak intensity changes may be observed as a function of the focus, showing the variations in beam peak with respect to the changes in beam size.

Gausian On The Gausian fit profile shows how closely the measured beam profile matches a Gaussian profile. The Gaussian fit profile is displayed on top of both the vertical and horizontal profiles in red.
The Gaussian Fit is a least-squares fit of a Gaussian equation to the cross section beam profiles. The correlation coefficient is the normalized sum of the fit residuals. The following equation is used for the Gaussian Fit calculation:

$$I = Ve \wedge \{-(x-c)/\sigma\}^2$$

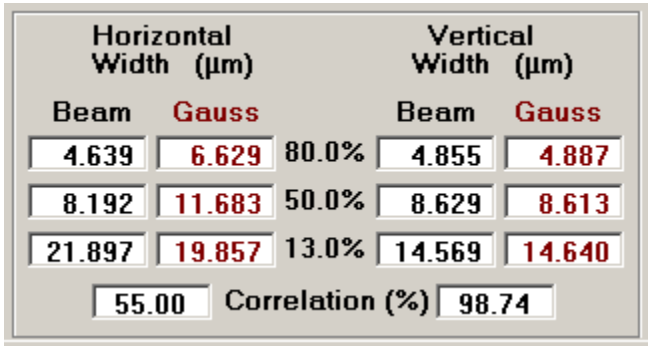
Where

I = the intensity of a pixel at location x
V = the maximum intensity of the fitted Gaussian curve
C = the center of the Gaussian fit peak (centroid)
σ = the radius of the Gaussian fit curve at the $1/e^2$ intensity level (diameter)

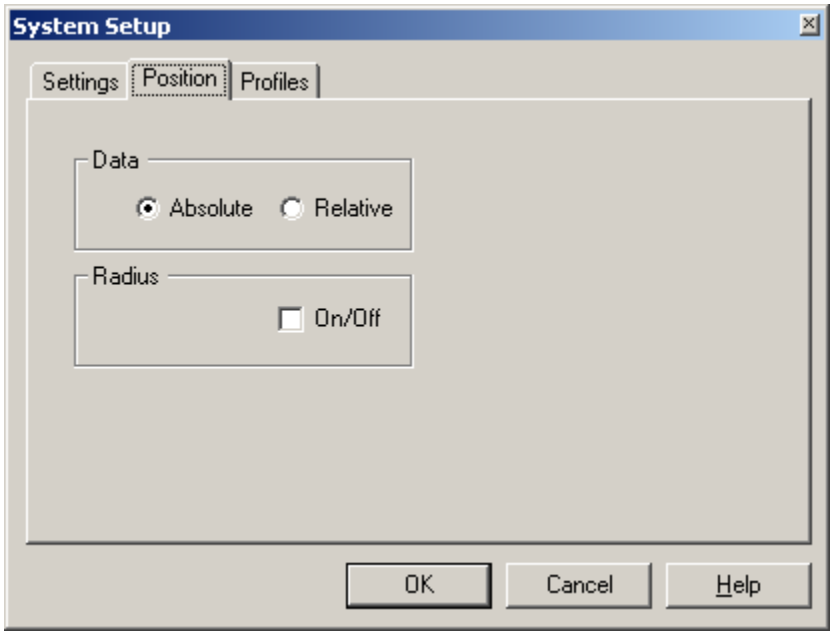


The Gaussian function determines how closely the measured beam profile matches a Gaussian profile. When Gaussian is activated, a Gaussian profile is overlaid on to the actual measured profile in real time. The theoretical Gaussian profile is displayed in red color over the actual measured profile, displayed in white color.
There are two vertical measures, which can be moved manually by the user. This is a useful feature for checking beam size at various points of interest.

The percent correlation factor with the Gaussian profile, as well as width comparisons at the three-selected clip levels is displayed.



Position Tab

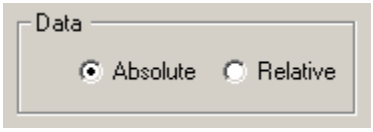


The following options are available:

- Data (Absolute or Relative)
- Radius On/Off

Date

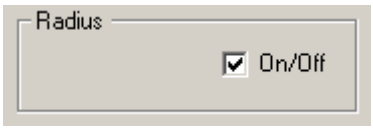
The Data field enables toggling between Absolute and Relative settings. The absolute setting is the default and in this case all the position measurements are done with respect to the origin (0,0).
When Relative is set then all the position centroid measurements are made relative to any other pre-defined point over the View Area, this point is user-selectable.
The relative point is set by graphically moving the Cross Line coordinates, the location of the Cross Line determines the relative center point.



Radius

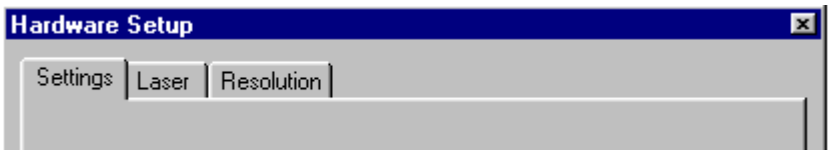
The Radius field enables toggling between Radius calculation On and Off (calculation is with respect to the Cross Line center).

In case Radius is On then for each one of the active regions of interest, a third parameter line appears marked as “R” and it stands for the Radius calculation (squared-root of X^2+Y^2).



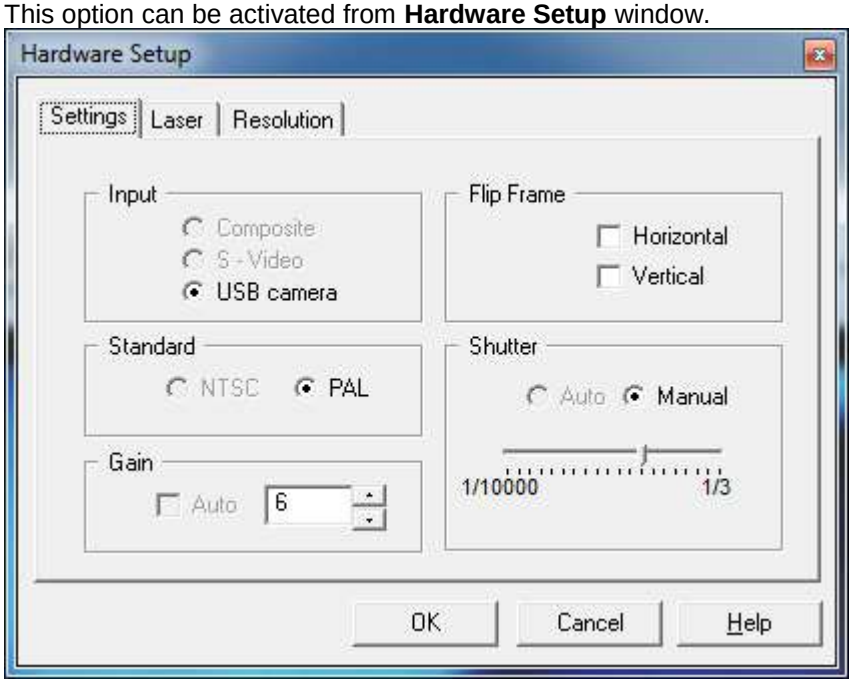
9.4.2 Hardware Setup

This option can be activated from **Settings menu.** It contains all hardware related parameters settings of the system.



Hardware Settings

This option can be activated from **Hardware Setup** window.



- **Standard:**
  NTSC Use this setting with NTSC (US compatible) video equipment.
  PAL Use this setting with PAL (European standard) video equipment.
- **Input:**
  Composite Use this setting for the RCA-style video connector.
  S-Video Use this setting for the S-Video input connector.
  MXC Use this setting for the 8-pin connector of the *µBeam* measuring head.
- **Gain** Controls the *µBeam's* analog gain at 14 levels from 0 Db to 28 Db.

Using the gain function the user can adjust the image quality to prevent beam saturation or a weak signal.

Select a gain value from the Gain Control list menu via the **ToolBar** button  , or via Hardware Setup function, Settings Tab.
This technology is superior to the Auto Gain technology, since it allows the experienced user to define the best gain level, which is appropriate.

- **Flip Frame:**

Horizontal setting is useful for capturing mirrored images. Flips the image presentation by 180 degrees. *To flip the image presentation, select Horizontal or Vertical*

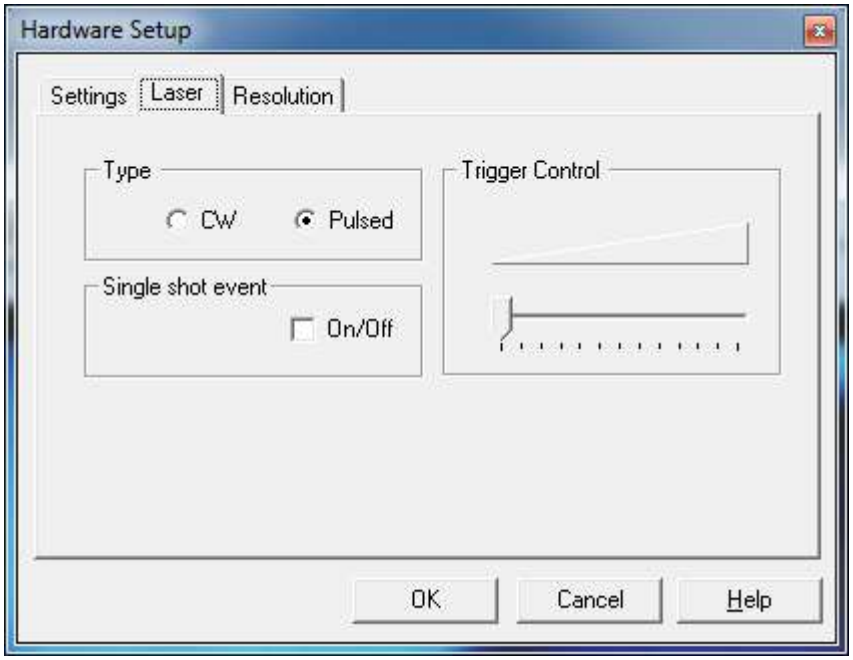
- **Shutter:** The built in electronic shutter controls the integration time of each frame. By activating the shutter one can control the amount of collected light in a similar way a mechanical shutter controls the exposure time in a regular photographic camera. The list box in the Control Toolbar allows the user to select the required shutter to prevent saturation and distortion of the measured beam.

This option is significant for continuos laser beams only. Possible shutter speeds range from 1/3 to 1/10000 sec
Select the shutter value from the shutter slider display at the Hardware Settings menu, or via the ToolBar button  **.**

Upon selecting the required parameter value, press OK to confirm the selection, press Cancel to abort.

Laser Setup

This option can be activated from **Hardware Setup** window. Laser setup allows you to specify the type of laser used and define the trigger control.



◆ **Type** - select one of the laser types: CW or Pulsed.

◆ **Trigger Control –** This option is enabled only for pulsed laser beams only!
This is an interactive function which allows setting the level of the Auto Pulse detection.
Since it is an interactive function, if you get erratic pulses or unstable pulsed captures then lower or raise the level accordingly until you are satisfied with the displayed results.

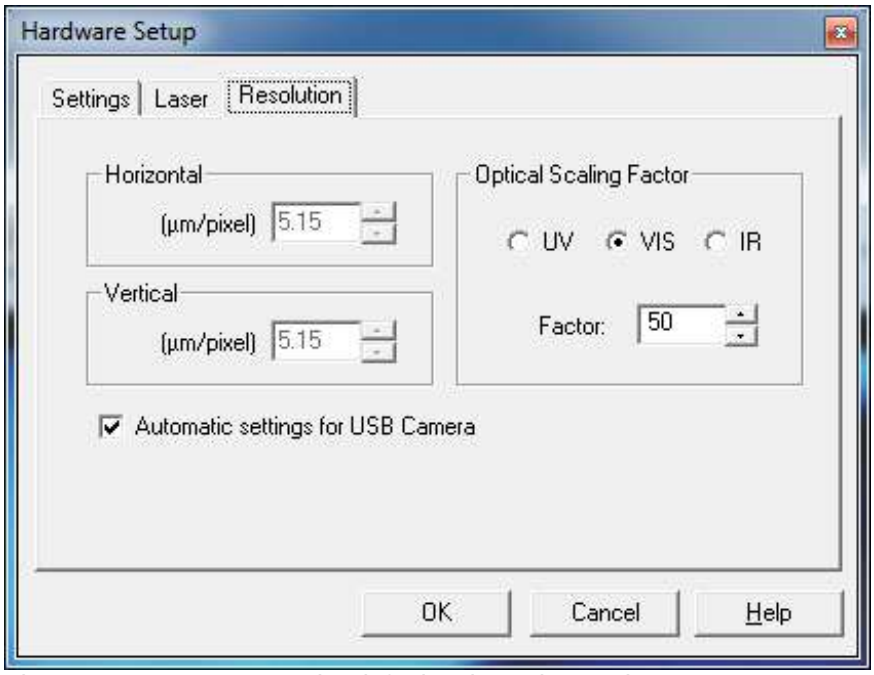
Select the trigger value via the **Hardware Setup** function, **Laser Setup** Tab (by moving the slider to the right hand side for increasing values).
Alternatively, one can activate trigger via the **ToolBar,** when the "Pulsed Laser" is activated, and select the trigger level using the slider.

Upon selecting the required parameter value, press OK to confirm the selection, press Cancel to abort.

Resolution Setup

This option can be activated from **Hardware Setup** window.
This function enables setting the resolution for the digitized beam images captured by the system.

This configuration is only necessary if you are not using the *µBeam* custom camera. These values are the resolution parameters (in microns per pixel) of your non-*µBeam* camera.



The *µBeam* camera uses the default values shown above.

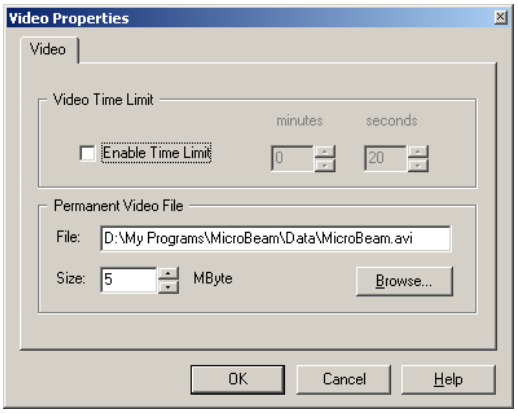
When setting On the **Automatic Settings for MXC Camera** option, the system resumes its default parameters for the MXC camera used for the *µBeam* system measuring head.

- **Resolution** - Typically is determined by the quantity of pixels displayed per line or for a given area. Here the user can define the Resolution parameters of his CCD camera. Both the Vertical and the Horizontal resolution values should be input, the values are given in microns per pixel.
- **Optical Scaling Factor -** This function enables optical magnification or reduction of laser beams by a factor of 1 to 10.

Upon selecting the required parameter value, press OK to confirm the selection, press Cancel to abort.

9.4.3 Video Properties

This option can be activated from **Settings menu**



Video Time Limit - Use these settings to cause the recording to cease after a specified number of the minutes and seconds.

Permanent Video File - This setting allows you to specify the file that is used to record video clips into. For best results, if you have multiple hard drives this file should be located on the fastest hard disk drive or the disk drive with the most space.

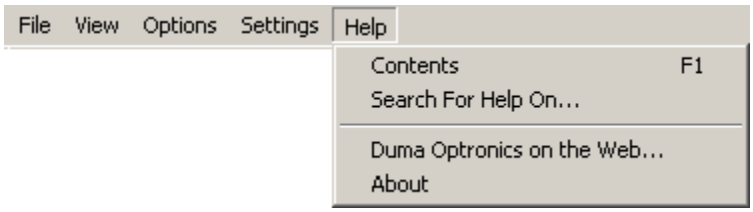
9.4.4 Offset

This function is operative when one selects the Line Profile presentation along with the Centroid option. The Offset enables defining a relative point to which the line profile is related to.

This means that you can have a line profile crossing through a center of gravity or being offset from center of gravity by a certain amount (defined by Offset).
The meaning of this feature is that even in an environment where the beam moves the line profile will always stay in the same area with respect to the beam centroid.
Set the amount of Horizontal and Vertical offset enabled by 0.1 degrees via this screen.

9.5 Help Menu

The following commands and menu items are available from Help menu:



- **Contents:** For help on using help press **F1**. To access the on-line system Help routine, select Contents from the **Help** menu. The contents topic is organized into topics (Alphabetic order). To find specific information fast use the **Search for Help On** menu item under the **Help**.

- **Search For Help On:** To find help quickly select Search for Help On from the Help menu. This will bring up a list of all the topics in the help system. Type the first few letters of the topic of interest. The search engine will automatically select any topic that matches the entry. If no entries match your topic scroll through the list to see a find a related topic.

- **Duma Optronics on the Web…:** The Website item in the Help menu will start the default browser and connect to the http://www.duma.co.il.

- **About:** The About box is selected from the **Help** menu. This is your typical Windows about box showing copyright and contact information.

10.0 Customer Support

Please have your serial number and software version number available before you call, and include it on your faxes! This will greatly assist our technical service personnel in helping you solve your difficulty!

By Phone
Please call the Duma Optronics Ltd. at 972-4-8200577 and ask for " Customer Service on the MicroBeam USB 2013 ". Our Support Hours are from 9 AM to 5 PM.

By Fax
If you wish to fax your question, our fax number is available 24 hours a day at 972-4-8204190. Please put "ATTENTION: MicroBeam USB Customer Service", on the cover sheet of the Fax.

By Internet
Email: sales@duma.co.il
Web: http://www.dumaoptronics.com