- Extensive set of ISO quantitative measurements
- Patented Ultracal™ algorithm for highest accuracy measurements in the industry
- Customizable user interface for 'ease of use'
- Auto-setup and Auto-exposure capabilities for fast set-up and optimized accuracy
- Statistical analysis on all calculated results displayed in real time
- New BeamMaker® beam simulator for algorithm self-validation

The performance of today's laser systems can strongly affect the success of demanding, modern laser applications.

The beam's size, shape, uniformity or approximation to the expected power distribution, as well as its divergence and mode content can make or break an application. Accurate knowledge of these parameters is essential to the success of any laser-based endeavor. As laser applications push the boundaries of laser performance it is becoming more critical to understand the operating criteria.

For over thirty years Ophir-Spiricon has developed instruments to accurately measure critical laser parameters. Our LBA and BeamStar software have led the way. Now with the introduction of BeamGage, Ophir-Spiricon offers the first "new from the ground up" beam profile analysis instrument the industry has experienced in over 10 years.


BeamGage includes all of the accuracy and ISO approved quantitative results that made our LBA software so successful. BeamGage also brings the ease-of-use that has made our BeamStar software so popular. Our patented UltraCal algorithm, guarantees the data baseline or "zero-reference point" is accurate to 1/10 of a digital count on a pixel-by-pixel basis. ISO 11146 requires that a baseline correction algorithm be used to improve the accuracy of beam width measurements. UltraCal has been enhanced in BeamGage to assure that accurate spatial measurements are now more quickly available.
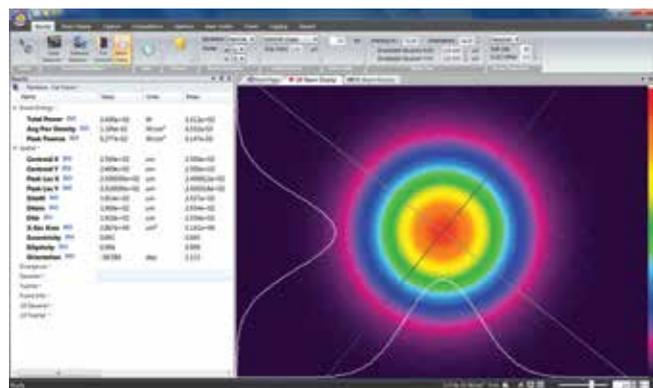
See Your Beam As Never Before:

The Graphical User Interface (GUI) of BeamGage is new. Dockable and floatable windows plus concealable ribbon tool bars empowers the BeamGage user to make the most of a small laptop display or a large, multi-monitor desktop PC.
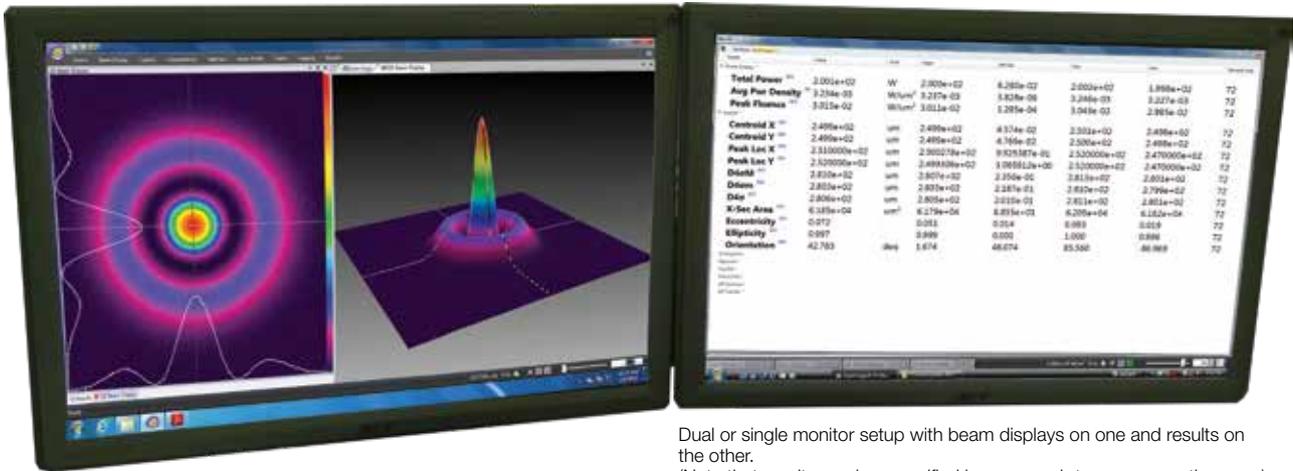
Dual or single monitor setup with beam displays on one and results on the other.
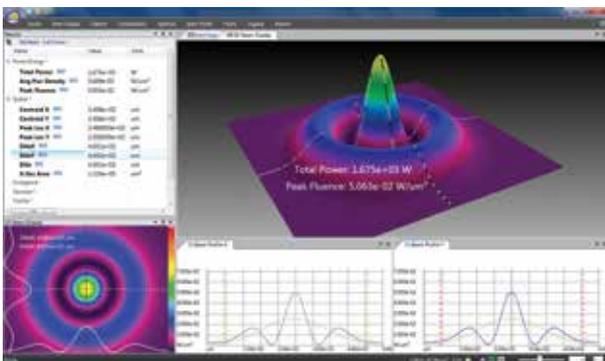(Note that results can be magnified large enough to see across the room).
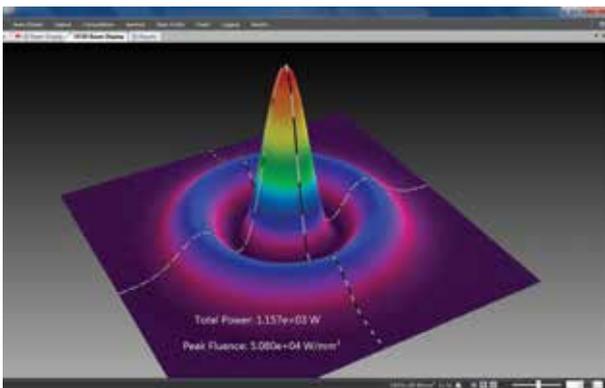
Beam only (Note results overlaid on beam profile).

Beam plus results

• 3D displays Rotate & Tilt. All displays Pan, Zoom, Translate & Z axis Zoom

Multiple beam and results windows.
(Note quantified profile results on 3D display & quantified 2D slices).

Beam Analysis

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Measure Your Beam As Never Before:

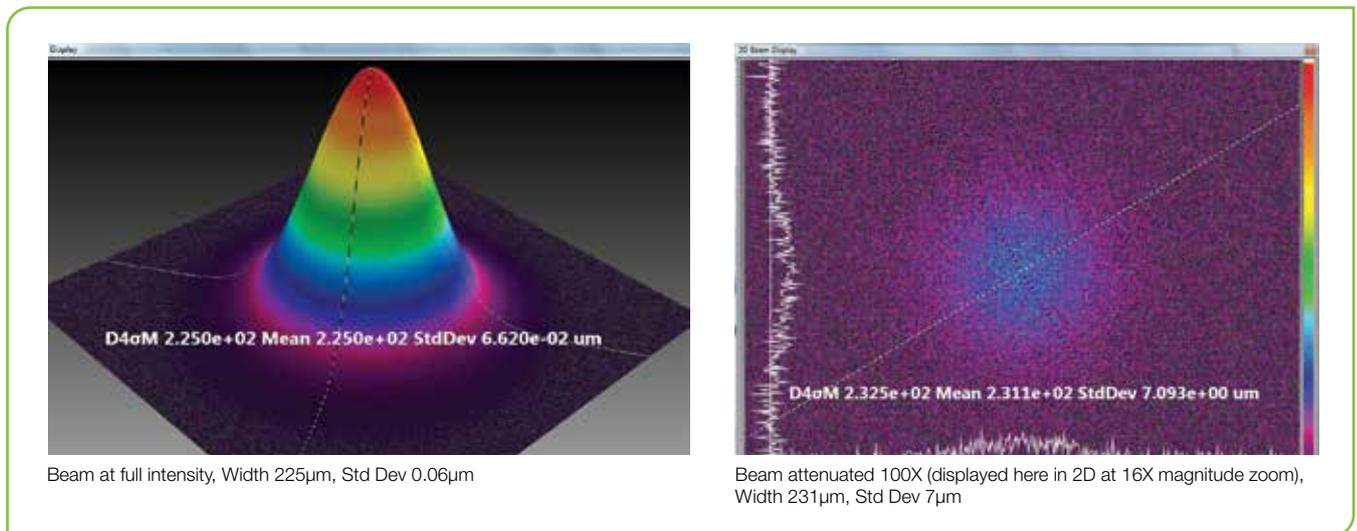### Ultracal: Essential, or no big deal?

If you want accurate beam measurements, you want Ultracal.

What is Ultracal?

Our patented, baseline correction algorithm helped establish the ISO 11146-3 standard for beam measurement accuracy. The problems with cameras used in beam profile measurements are: a) The baseline, or zero, of the cameras will drift with time and temperature changes, and b) include random noise. Ultracal is the only beam profiler algorithm that sets the baseline to "zero", and, in the center of the noise. (Competitive products use other less sophisticated algorithms that perform a baseline subtraction, but truncate the noise below the "zero" of the baseline. This leaves only a "positive" component, which adds a net value to all beam measurements).

Try the following on any other beam profiler product to see the inherent error if you don't use Ultracal.

1. Measure a beam with full intensity on the profiler camera.

2. 0Insert a ND2 filter (100X attenuation) into the beam and measure it again.

3. Compare the results.

4. The Standard Deviation below is about 3%, which is phenomenal compared to the 100% or more of any beam profiler without Ultracal.

Beam at full intensity, Width 225μm, Std Dev 0.06μm

Beam attenuated 100X (displayed here in 2D at 16X magnitude zoom), Width 231μm, Std Dev 7μm

Adding the use of Automatic Aperture improves the accuracy to 1%. (The conditions of this measurement is a camera with a 50dB SNR).

5. You normally don't make measurements at such a low intensity. But occasionally you may have a drop in intensity of your beam and don't want to have to adjust the attenuation. Or, you may occasionally have a very small beam of only a few tens of pixels. In both of these cases, Ultracal becomes essential in obtaining accurate measurements.

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Beam Measurements and Statistics

BeamGage allows you to configure as many measurements as needed to support your work, and comes standard with over 55 separate measurement choices. To distinguish between calculations that are based on ISO standards and those that are not, a graphical ISO logo is displayed next to appropriate measurements. You can also choose to perform statistical calculations on any parameter in the list.

Small sample of possible measurements out of a list of 55

Sample of calculation results with statistics applied

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Beam Analysis

3.3.1

Multiple Charting Options

You can create strip charts for stability observations on practically any of the calculations options available. Charts enable tracking of short or long term stability of your laser.

Strip chart of beam D4sigma width. Note how changing conditions affects the width repeatability.
Beam intensity changed over 10db, making noise a significant factor in measurement stability.

Beam Pointing Stability

Open the Pointing Stability Window to collect centroid and peak data from the core system and display it graphically.
View a chart recorder and statistical functions in one interface:

Peak location scatter plot with histogram color-coding.

A centroid location scatter plot with histogram color-coding.

Set a sample limit, and specify the results items to graph on the strip chart.

The radius is referenced from either an Origin established in BeamGage or from the continuously calculated Average Centroid position.

A pointing stability strip chart presents data over time for the Centroid X and Y, Peak X and Y and centroid radius from an origin or from the mean centroid.

Easy to Use and Powerful

BeamGage is the only beam profiler on the market using modern Windows 7 navigation tools. The menu system of BeamGage is easy to learn and easy to use with most controls only one mouse click away. Some ribbon toolbar examples:

Some of the Beam Display options (Display access options under the Tools tab on the left).
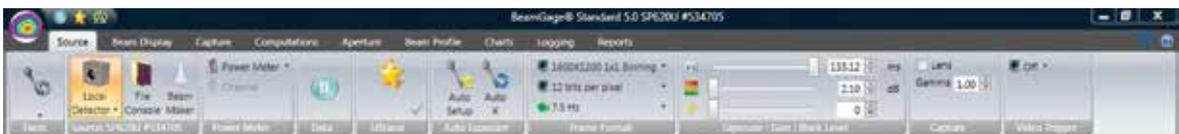
Some of the Beam Capture options.

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BeamGage Main Display Screen

File Save/Load ApplicationButton

Quick Access Toolbar for common tasks

Tabbed Control Access

2D Beam Display

Tool Windows that dock inside or float outside App

User Definable Window Layout

Integrated Help System

Beam Results With Statistics

ISO Compliant Results

1D Profiling Options

Cursors With Power / Energy Readouts

Processing Status Indicators

3D Beam Display

Buffered Video Scrolling Controls

Pass / Fail with Password Protection for Production Testing

BeamGage allows the user to configure the displayed calculations; set-up the screen layout and password protect the configuration from any changes. This permits secure product testing as well as data collection for Statistical Process Control (SPC), all while assuring the validity of the data.

Name		Value	Mean	Std Dev	Max	Min	Units
Power/Energy *							
⊟ Spatial *							
Centroid X	ISO	7.831e+01	7.831e+01	2.849e-03	7.832e+01	7.830e+01	um
Centroid Y	ISO	7.965e+01	7.965e+01	3.047e-03	7.966e+01	7.964e+01	um
Peak Loc X	ISO	7.000000e+01	7.073199e+01	1.340173e+0	7.500000e+01	6.700000e+01	um
Peak Loc Y	ISO	7.100000e+01	7.183659e+01	1.333245e+0	7.500000e+01	6.800000e+01	um
D4σX	ISO	1.238e+02	1.238e+02	8.334e-03	1.239e+02	1.238e+02	um
D4σY	ISO	124.041	124.053	0.008	124.079	124.027	um
D4σ	ISO	1.239e+02	1.239e+02	6.395e-03	1.240e+02	1.239e+02	um

Failures (or successes) can be the impetus for additional actions including a TTL output signal or PC beep and the termination of further data acquisition.

Beam Analysis

3.3.1

Unique Features of BeamGage - Standard

Power/Energy Calibration

Using the USB or GigE output from select Ophir power/energy meters, the BeamGage application will display measured power/energy values from the full range of Ophir thermopile, photodiode and pyroelectric sensors. Pulsed lasers can be synced up to 100Hz, or the frame rate of the triggered camera, whichever is less. This is the first time in the industry a laser power meter has been married to a laser beam profile system.

BeamGage is the only product to integrate profiling and power meter measurements

BeamMaker®; Numerical Beam Profile Generator

BeamGage contains a utility, BeamMaker, that can synthetically generate beam profile data by modeling either Laguerre, Hermite or donut laser beams in various modal configurations. BeamMaker permits the user to model a beam profile by specifying the mode, size, width, height, intensity, angle, and noise content. Once generated the user can then compare the theoretically derived measurements to measurements including experimental inaccuracies produced by the various measurement instruments and environmental test conditions. Users can now analyze expected results and confirm if measurement algorithms will accurately measure the beam even before the experiment is constructed. BeamMaker can help laser engineers, technicians and researchers understand a beam's modal content by calculating results on modeled beams for a better understanding of real laser beam profiles. BeamMaker is to laser beam analysis as a function generator is to an oscilloscope.
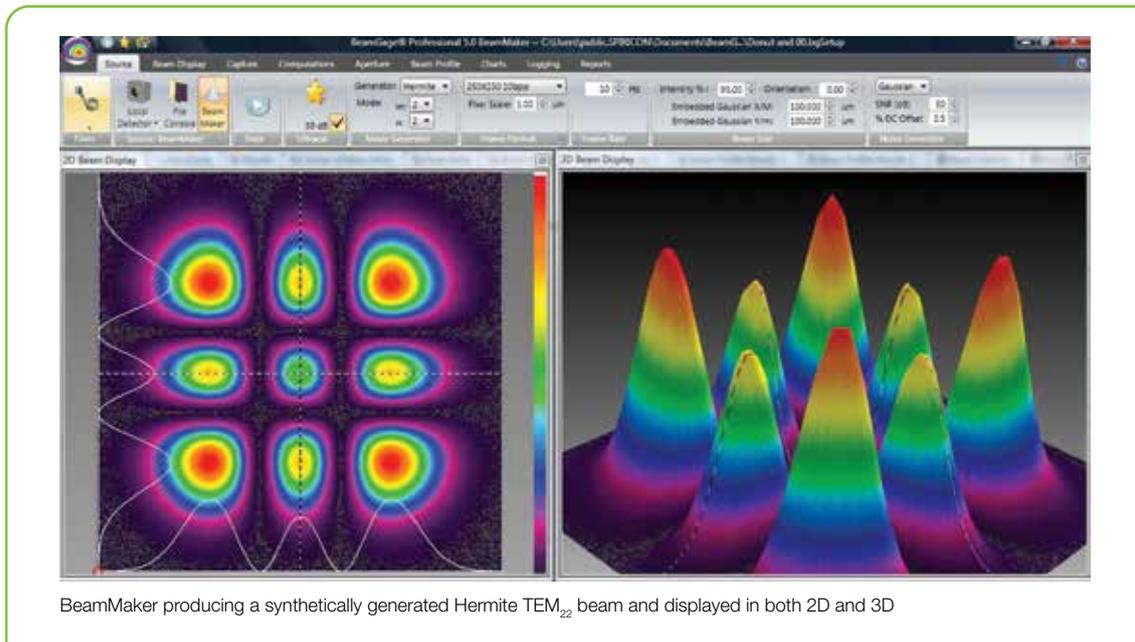
BeamMaker producing a synthetically generated Hermite TEM$_{22}$ beam and displayed in both 2D and 3D

Integrated automatic Help linked into the Users Guide

Touch sensitive Tool tips are available on most all controls, and "What's This" help can provide additional details. Confused about what something is or forgot how it works, just go to the top right corner and touch the "What's This" help icon, then click on the control or menu item that you want more info about and you are taken to the explanation within the BeamGage Users Guide.
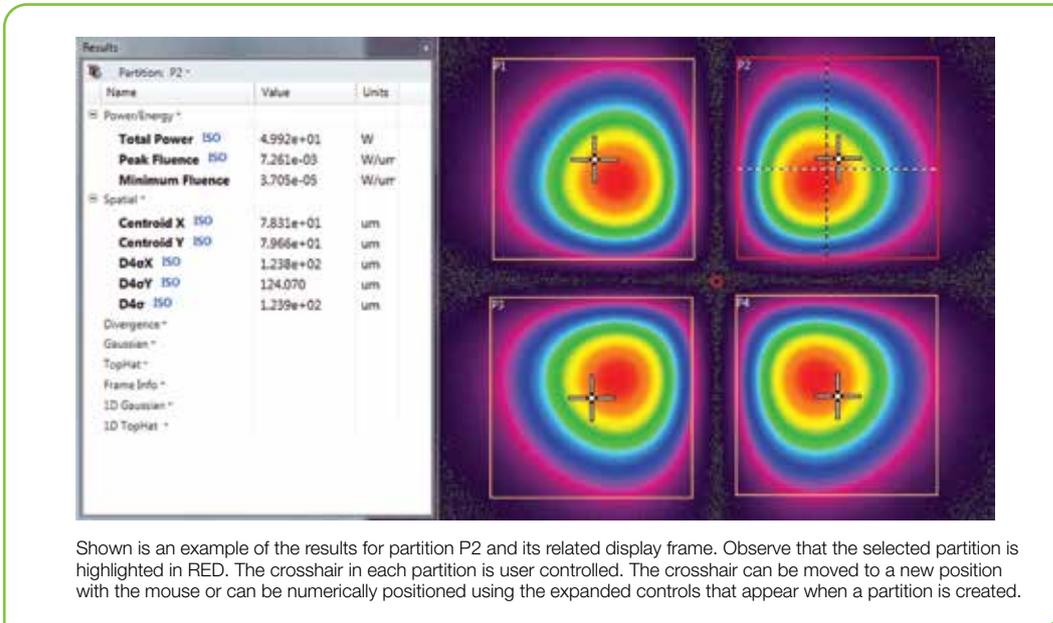
Multilingual

BeamGage comes with both Japanese and Chinese user interface. Country specific manuals can be downloaded from the ophiropt.com/photonics web site.

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Professional is an upgrade version of BeamGage-Standard that has all of the BeamGage-Standard features plus additional functionality.

Image Partitioning

Partitioning allows the user to subdivide the camera image into separate regions, called partitions, and compute separate beam results within each partition. When using partitioning special results items can be displayed that relate to delta values between the computed centroids or peaks of each partition. Partitioning is useful to enable separate analysis of individual beams when multiple beams impinge on the camera simultaneously. This feature is particularly useful when analyzing multiple fibers in a single bundle.

Shown is an example of the results for partition P2 and its related display frame. Observe that the selected partition is highlighted in RED. The crosshair in each partition is user controlled. The crosshair can be moved to a new position with the mouse or can be numerically positioned using the expanded controls that appear when a partition is created.

Automation Interface

BeamGage Professional provides an automation interface via .NET components to allow customers the ability to build custom applications' that incorporate the laser beam analysis and processing power of BeamGage. The BeamGage automation interface allows developers to control BeamGage programmatically via a set of "puppet strings" known as the automation interface. The automation interface was developed to provide the ability to base control decisions for a second application on results and behaviors recognized by BeamGage. With this ability users can quickly and efficiently meet their manufacturing/analysis goals with minimum human interaction.

The automation interface was designed to achieve two main goals. First, to allow the BeamGage user to programmatically do what they could otherwise do via the graphical user interface (GUI). Second, to expose stable interfaces to the user that will not change, causing breaks to their dependent code. Interface examples for LabVIEW, Excel and .NET VB are included.

Custom Calculations

If BeamGage-Standard does not have the measurement you need the Professional version permit the user to program-in their own set of calculations. User defined computations are treated the same as other BeamGage standard calculations.

These custom results are displayed on the monitor, logged with results, and included on hard copy print-outs as if they were part of the original application.

An example of a customer generated custom equation.

$$S = \frac{1}{\pi^2} \left| \int_0^{2\pi} \int_0^1 \exp(2\pi i \Delta W(\rho, \theta)) \, \rho d\rho d\theta \right|^2$$

Beam Analysis

3.3.2

Custom results with statistics

Customer added
custom calculation

Custom results being plotted

Custom results with pass/fail turned on

Beam Analysis

3.3.2

Ophir®

Features	BeamGage® Standard	Upgrade to BeamGage® Professional to include: (all features in Standard plus)
Features Overview	User selectable for either best "accuracy" or "ease of use"	
	Supports our patented Ultracal algorithm plus Auto-setup and Auto-exposure capabilities	
	Extensive set of ISO quantitative measurements	
	Support for USB, GigE and Pyrocam™ IIIHR and Pyrocam™ IV cameras	Supports InGaAs and large format L11059 cameras
	New Beam Maker® beam simulator for algorithm self validation. See below for more detailed description	
	Simultaneous 2D and 3D displays	
	Multi-instance, multi-camera use	
	Results synchronized to select models of Ophir power/energy meters. Supported products include: Vega, Nova II, Pulsar, USBI and Juno, in both 32 and 64bit OS. (Quasar is not supported)	
	Supports Satellite windows on multiple monitors	
	Continuous zoom scaling in both 2D and 3D	
		Window partitioning to allow analysis of multiple beams from a single camera image
	Camera ROI support on USB and GigE cameras	
	Manual and Auto-aperturing to reduce background effects	
	Pass/Fail on all results items, w/multiple alarm options	
	Beam Pointing Stability scatter plot and stripchart results	
	Full featured logging capabilities in a reloadable industry standard data file format	
	Configurable Report Generator that allows cut and paste of results, images and settings	
		NET Automation interface that allows for remote control. Examples in LabView, Excel and .Net VB
	Supports English, German, Japanese and Chinese Windows 7 (64) and Windows 10	
	Multilingual GUI in English, Japanese and Chinese	
	Administrator can lock software options for non-administrators	
Quantitative Calculations; Basic Results	(per ISO 11145, 11146-1/-3, and 13694)	
Power/Energy Results	Total power or energy (Can be calibrated or sync'd to an external Ophir power/energy meter)	
	Peak power/energy density	
	Min. Fluence	
	Average pulse power	
	Peak pulse power	
	Device efficiency	
	% in Aperture	
Spatial Results	Peak and Centroid locations	
	Beam width	
	• Second Moment (D4s)	
	• Knife Edge 90/10	
	• Knife Edge (User selectable level)	
	• Percent of Peak (User selectable)	
	•Percent of Total Energy (User selectable)	
	• Encircled power smallest slit @ 95.4	
	•Moving slit (User selectable)	
	Beam diameter	
	• Average diameter (based on x/y widths)	
	•Second Moment (D4s)	
	• Encircled power smallest aperture 86.5	
	• Encircled power smallest aperture (User selectable level)	
	Elliptical Results	
	• Elliptical orientation	
	• Ellipticity	
	• Eccentricity	
	Distance Measurement	
	• Cursor to Crosshair	
	• Centroid to Crosshair	
	Area Results	
	Beam cross-sectional area	

Beam Analysis

3.3.3

Features	BeamGage® Standard	Upgrade to BeamGage® Professional to include: (all features in Standard plus)
Divergence	Focal Length method	
	Far-field two-point method	
	Far-field Wide Angle method	
Gaussian Fit	2D whole beam fits	
	1D line fits	
	Height	
	Width X/Y	
	Centroid	
	Goodness of fit	
	Roughness of fit	
Tophat Results	2D and 1D	
	Flatness	
	Effective Area	
	Effective Power/Energy	
	Fractional Effective Power/Energy	
	Effective Average Fluence	
	Uniformity	
	Plateau Uniformity	
	Edge Steepness	
	1D or 2D surface inclination	
Other Quantitative Items	Frame Averaging	
	Frame Summing	
	Frame Reference Subtraction	
	Image Convolution	
	Camera signal/noise calculator	
	Row and Column summing with results loggable	
		Scalable Intensity Histogram, exportable
		X or Y axial off axis image correction
Beam Stability Displays and Results	(per ISO 11670)	
	Pointing Stability of Centroid	
	• Scatter Plot display w/histogram	
	• Mean Centroid	
	• Azimuth angle of the scatter	
	• Stability (M'/m'/S)	
	• Max Radius	
	• X/Y centroid/peak Strip chart plots	
	• Sample/Time controlled	
	• Pass/Fail limits	
	• Auto scaling	
	• Beam Width/Diameter Strip Charts with Results	
	• X/Y M/m beam widths plots	
	• Beam Diameter plot	
	• Mean/Std Dev/Min/Max results displayed	
	• Power/Energy Strip Charts	
	• Total Power/Energy plot	
	• Peak fluence plot	
	• Avg Power plot	
	• Elliptical Results Strip Chart	
	• Elliptical orientation plot	
	• Ellipticity plot	
	• Eccentricity plot	
	• Mean/Std Dev/Min/Max results displayed	
Custom Calculations		User can program-in own set of calculations
Beam Profile Display Options	Utilizes advanced hardware accelerated graphics engines.	
	All display windows can be satellited to utilize multiple display monitors.	
	Can open one each simultaneous 2D and 3D beam display windows	
	Common color palette for 2D and 3D displays	
	Can open X and/or Y 1D beam slice profiles overlaid onto the 2D or 3D displays or in separate windows	
	Continuous software zooming in both 1D, 2D and 3D displays	
	Pan to any detector location	
	Continuous Z axis display magnitude scaling	
	Multiple 128 color palettes user selectable	
	Results items can be pasted into 2D, 3D, 1D, Pointing stability or Chart display windows.	
		Able to partition the camera imager into multiple regions with separate results.

Beam Analysis

Ophir®

Features	BeamGage® Standard	Upgrade to BeamGage® Professional to include: (all features in Standard plus)
1D Features	Available overlaid with 2D and 3D or in separate windows	
	X any Y plots on separate or combined displays	
	1D displays with basic results and column row summing option	
	Tophat 1D displays with Tophat results	
	Gaussian 1D displays with Gaussian fit results	
	1D Profile display of the Gauss fit results on 1D, 2D and 3D displays	
2D Features	Continuously zoomable and resizable displays in satellitable window	
	Continuous Z axis display magnitude scaling	
	Zoomable to subpixel resolution for origin and cursor placements	
	Pixel boundaries delineated at higher zoom magnifications	
	Adjustable Cursors that can track peak or centroid	
	Adjustable Crosshairs that can track peak or centroid	
	Adjustable manual apertures	
	Viewable Auto-aperture placement	
	Displayed beam width marker	
	Integrated Mouse actuated pan/zoom controls	
	Separate 2D pan/zoom window to show current view in 2D beam display	
	Manual or fixed origin placement	
		Ability to create partitions using the manual aperture controls
3D Features	3D graphics utilize solid surface construction with lighting and shading effects	
	Integrated Mouse actuated pan/zoom/tilt/rotate controls	
	Selectable Mesh for drawing speed vs resolution control	
	Continuously zoomable and resizable displays in satellitable window	
	Continuous Z axis display magnitude scaling	
	User enabled backplanes with cursor projections	
Partitioning		Users can subdivide the imager into separate beam measurement regions. All enabled results are computed inside of each partition
		The manual aperture is used to define and create rectangular partition
		When partitioning is enabled some new results items will be enabled
		Centroid measurements between beams in each partition can be performed
		Partitioned imagers must have a single origin common to all partitions. All coordinate results are globally referenced to this single origin
Statistical Analysis	Performed on all measurement functions with on-screen display	
	• Choices of intervals	
	• Manual start/stop	
	• Time from 1 second to 1000 hours	
	• Frames from 2 to 99,999 Measurements reported	
	• Current frame data, Mean, Standard Deviation, Minimum, Maximum of each calculation performed	
	Controls integrated with beam stability results, scatter and strip chart plots	
File types	Industry Standard HDF5 data and setup file format which are compatible in third party applications such as MatLab and Mathmatica	
	Math program and Excel compatible ASCII-csv results files	
	Graphics in jpg file format	
	Legacy file Compatibility with LBA formats	
	A user defined single file output that can contain settings, beam displays, beam profiles, charts, results, etc. in either .pdf or .xps file formats	
Printing	Images, reports, results, graphs, charts, statistics and setup information	
	Option to print many frames in a single operation	
	WYSIWYG images	
Pass/Fail	Set Maximum/Minimum limits on all calculations and statistics	
	Red/Green font color indication on result items	
	Multiple choices for indication of failed parameters, including TTL pulse for external alarm	
	Master pass/fail which triggers alarm on any failure	
	USB/GigE signal, beep, stop, and log alarm options	

Features	BeamGage® Standard	Upgrade to BeamGage® Professional to include: (all features in Standard plus)
Logging	Video Data Logging Formats: HDF5, ASCII-csv	
	Results in ASCII-csv	
	Pictures 2D and 3D in jpg, gif, tiff, bmp, png file formats	
	Charts in ASCII-csv	
	Cursor Data in ASCII-csv	
	Row/Column summed in ASCII-csv	
	Continuous Logging	
	Time Interval Logging	
	Frame Count Logging	
	Periodic Sampling	
	Pass/Fail Sampling	
	Burst Sampling, after a user specified time interval, sample a user specified number of frames	
Exporting	Convert frame buffer data to third party format	
	Export a user specified number of frames from the buffer	
	Export Image Data: ASCII-cvs	
	Export Results: ASCII-csv	
	Export Picture: jpg, gif, tiff, bmp, png file formats supported	
	Export Cursor Data: ASCII-cvs	
	Export Row/Column summed: ASCII-cvs	
	Export Image Data in Aperture	
Automation Interface (.NET)		Automation Interface with examples in LabVIEW, Excel and Net VB
		Automate launch and termination of the application
		Automate start, stop, Ultracal, Auto-X and Auto Setup
		Automate the loading of application setups
		Automate control of most camera settings
		Automate a subset of the application features and controls
		Automate the capture of Binary Video Data
		Automate the acquisition of application results
		Automate the acquisition of application Images
Integrated Help	PDF Operators Manual	
	Context Sensitive (Whats this?) Help	
	Context Sensitive Hints	
Signal Conditioning for Enhanced Accuracy	Spiricon's patented Ultracal enables more accurate beam measurement and display. Ultracal takes a multi- frame average of the baseline offset of each individual pixel to obtain a baseline accurate to approximately 1/8 of a digital count. This baseline offset is subtracted from each frame, pixel by pixel, to obtain a baseline correction accurate to 1/8 digital count. Spiricon's Ultracal method retains numbers less than zero that result from noise when the baseline is subtracted. Retaining fractional and negative numbers in the processed signal can increase the beam width measurement accuracy by up to 10X over conventional baseline subtraction and clip level methods. Spiricon's Ultracal conforms to the best method described in ISO 11146-3:2004	
Frame Averaging	Up to 256 frames can be averaged for a signal-to-noise ratio, S/N, improvement of up to 16X (Noise is averaged up to 1/256th [8 fractional bits]). Data is processed and stored in a 32bit format	
Frame Summing	Up to 256 frames can be summed to pull very weak signals out of the noise	
	Due to the precise nature of Ultracal baseline setting, (i.e., a retention of both positive and negative noise components) summing of frames can be performed without generating a large offset in the baseline	
Convolution (Adjacent Pixel Averaging)	Choice of 5 convolution algorithms for spatial filtering for both display and calculations. Spatial filtering improves the visual S/N	
Beam Maker®	Beam Maker is a new feature that allows the user to model both Laguerre-Gaussian and Hermite-Gaussian laser beams in various modal configurations. With these models you have verification and validation tools that allows not only OSI but also the end user to verify BeamGage's basic beam width measurement algorithms. It can also be used to model laser beams with special input conditions such as signal-to-noise, background offset, and bits per pixel resolution. This allows the user to better understand the accuracy of measurements made under both optimum and adverse conditions. This tool provides the user with a method to validate algorithms against current ISO standards and methods. It can also be used to validate third party algorithms by making the output data available for use in third party applications	

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Features	BeamGage® Standard	Upgrade to BeamGage® Professional to include: (all features in Standard plus)
Camera Features	Camera features are governed by the capabilities of the various cameras that will interface with these software products, and second by which of these camera features are implemented in the software. This section will describe typical camera features supported in the application	
	Black Level Control (used by Ultracal and Auto-X and Auto-setup)	
	Gain Control (used by Auto-X and Auto-setup)	
	Exposure Control (used by Auto-X and Auto-setup)	
	User Programmable ROI	
	Pixel Binning	
	Pixel Sampling	
	Bits per pixel setting	
	External Trigger Input	
	Trigger Delay	
	Strobe Output	
	Strobe Delay	
	External Trigger Probe	
	Internal Trigger Probe	
Camera related features in the applications	These are features related to but not generally dependent upon the camera design	
	Gamma Correction	
	Gain Correction	
	Bad Pixel Correction	
	Lens Applied Option	
	Pixel scale settings	
	Magnification settings	
	Frame buffer settings	
	Ultracal	
	Enable Auto-X (auto exposure control)	
	Perform an Auto-Setup	
	8/10/12/14/16 bits per pixel	
	Select Format or ROI	
	Measure S/N ratio	
Trigger, Capture and Synchronization Methods	Capture methods are features related to the application while Synchronization methods relate more to the abilities of the specific camera. NOTE: Frame capture rates are determined by many factors and are not guaranteed for any specific operating configuration	
	Trigger modes	
	• CW - captures continuously, see Capture Options below	
	• Trigger-In from laser: Trigger pulses supplied to the camera	
	• Strobe-Out to laser: Strobe pulses output from the camera	
	• Video Trigger: Frame captured and displayed only when the camera sees a signal greater than a user set level	
	Capture options	
	• Capture options are redefined and are approached in a different manner than older products. The items listed below will allow for all of the previous methods but with more flexibility than ever before	
	• Results Priority: Results priority will slow the capture rate to be in sync with the computational results and display updates	
	• Frame Priority: Frame priority will slow results and display updating to insure that frames are collected and stored in the frame buffer as fast as possible (replaces block mode)	
	• Stop After: Will collect a set number of frames and then stop (replaces Single-Shot mode)	
	• Periodic: Will collect frame at a programmed periodic rate	
	• Periodic Burst: Will collect frames in a Burst at programmed periodic rates	
	• Post processing is still available but is done via a different mechanism and is limited to only data file sources	
Video Playback	Video playback, post processing and post analysis	
	User customizable playback rates	
	Video file quick pan/search controls	
	Whole video file playback looping with sub-selection looping	
	Playback Video produced by logging	
	Almost all measurements can be performed on video files	
System Requirements	PC computer running Windows 7 (64) and Windows 10 Laptop or Desktop	
	Not all cameras run in all Microsoft OS versions, see camera section for specifics	
	GHz Pentium style processor, dual core recommended	
	Minimum 2GB RAM (4GB required for L11059 camera)	Minimum 3-4GB RAM
	Accelerated Graphics Processor	
	Hard drive space suitable to hold the amount of video data you expect to store (50-100 GB recommended)	

Beam Analysis

3.3.3