

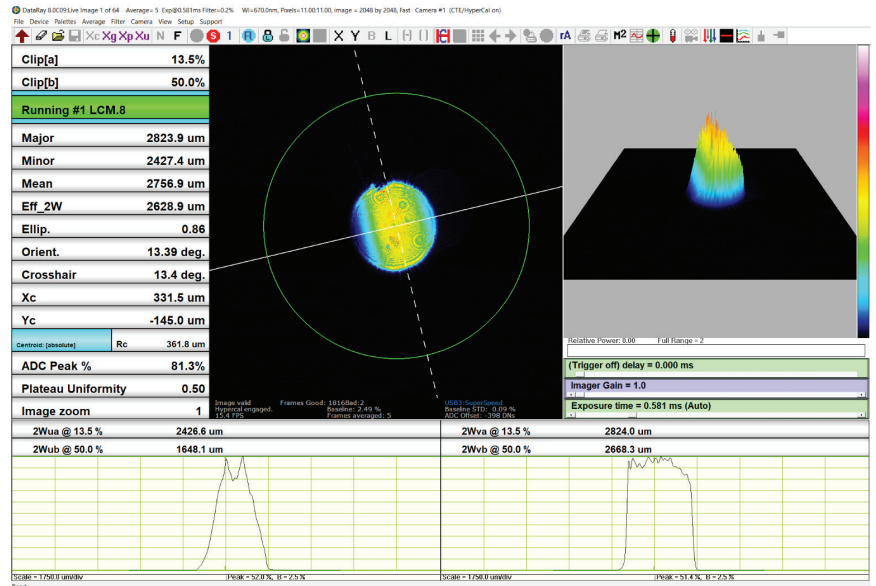


DataRay Software

DataRay's full-featured, easy to use software is specifically designed to enable quick and accurate laser beam profiling. The software, which supports the WinCamD, BladeCam, and TaperCam series of cameras, does not require any licenses. All features are freely available. This software controls DataRay's Line Laser Profiling System, Large Beam Profiling Systems, and M² measuring systems allowing for a large variety of beams with specific analysis needs.

The software offers a comprehensive set of beam profiling measurements including: diameter, centroid, orientation, ellipticity, relative fluence, and more. The software contains measurements defined in ISO standards 11146, 11145, and 13694. DataRay's proprietary HyperCal algorithm allows for continuous, simple to use noise reduction.

The software utilizes OpenGL for displaying 2D and 3D images of your beam. With OpenGL, the software is able to support very high frame rates. The software also displays 1D line profiles. The user can select arbitrary slices of the beam or auto-orient to the measured source. Both Gaussian and Top Hat fits can be performed with quantitative metrics.

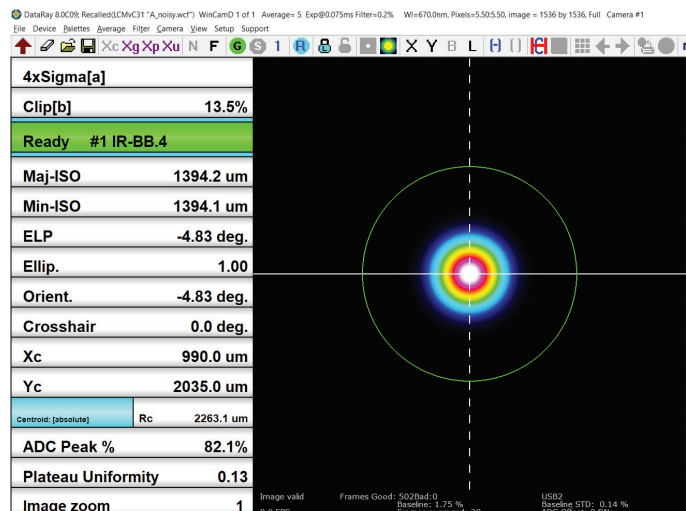


Data can be exported in many formats (CSV, TIFF, BMP). DataRay unique file formats allow for all settings to be restored when recalling data. Logging on a per frame or specified time interval allows for simple analysis of long term testing. PDF reports can be automatically generated.

Feature Highlights

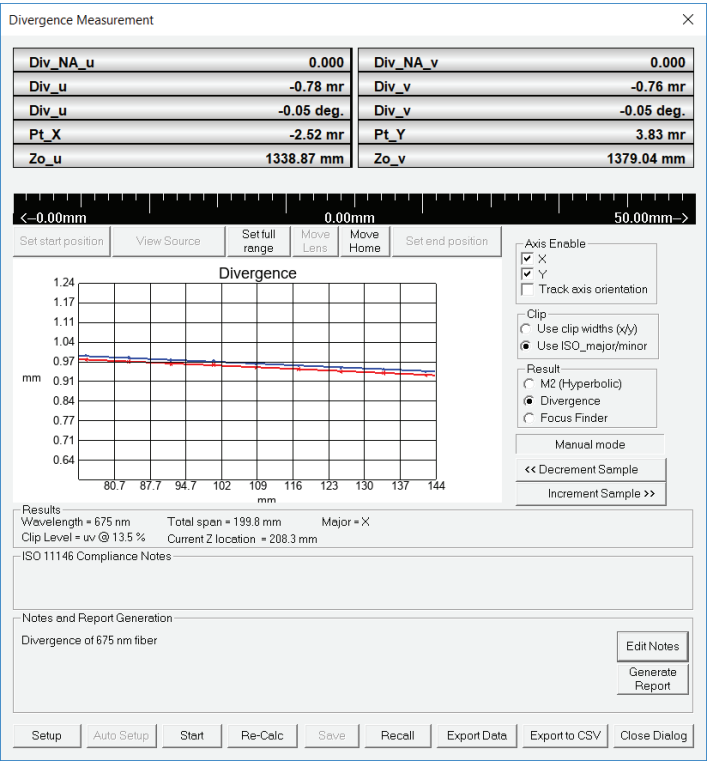
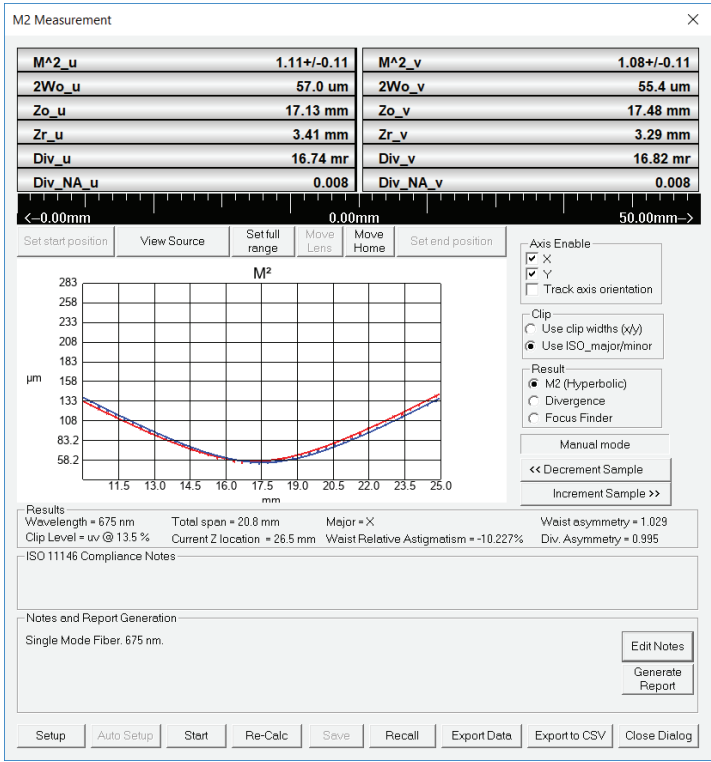
Software Aperture/ISO measurements

- Auto Aperture size or user set
- ISO 11146 compliant measurements
- Optional 99% inclusion region
- Scale factor option for improving ISO1116 accuracy
 - See [SPIE Optical Engineering paper](#)



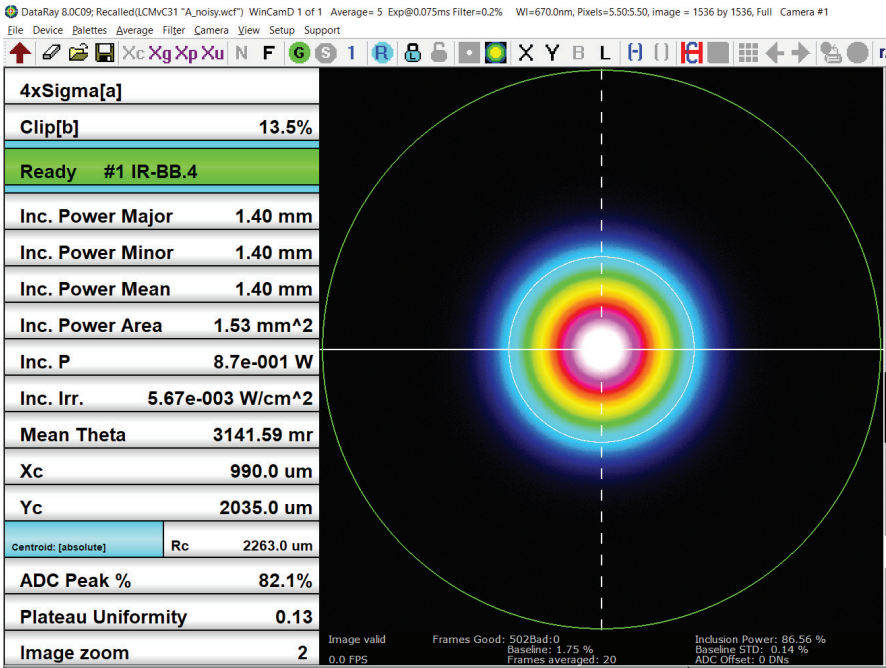
M² and Divergence Measurements

- Fully automated M² and divergence measurements with M2DU stage accessory
- Option to use 3rd party stage for manual measurements
- ISO11146 compliant measurements
- Report generation/data export
- OpenGL based plots with intuitive pan/zoom control



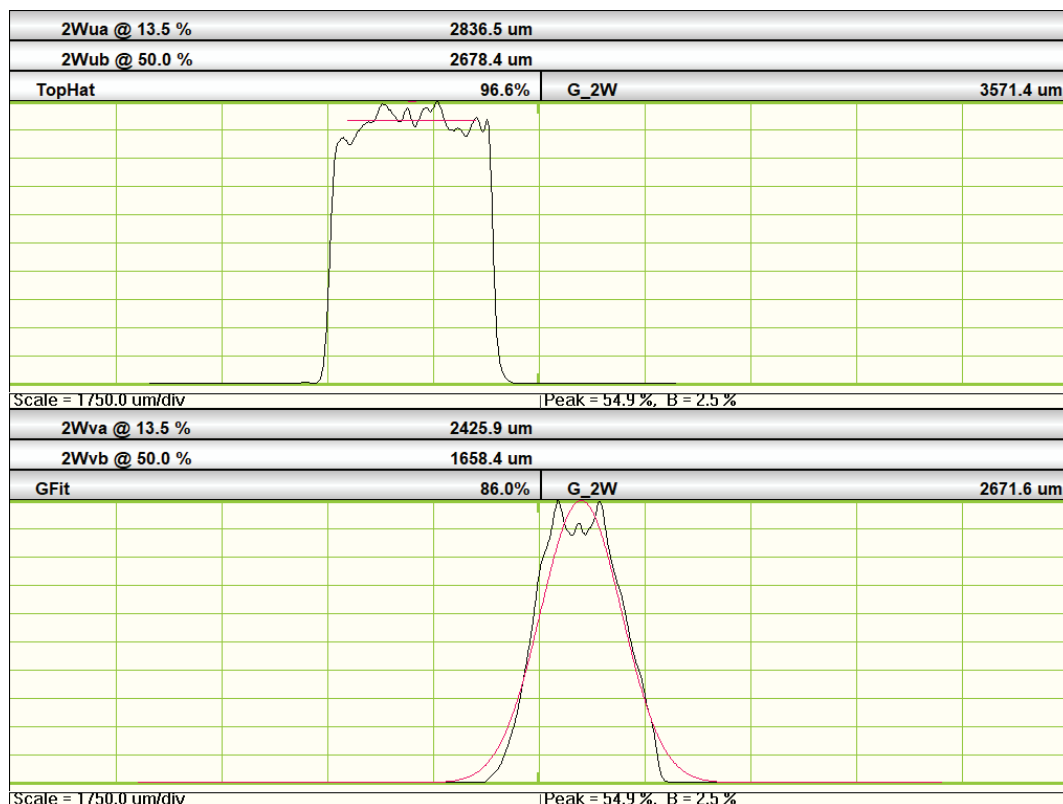
Included Power Mode

- Encircled power
 - Default 86.5%
 - User selectable power level
- Irradiance (with relative power user input)
- Mean diameter of enclosed area



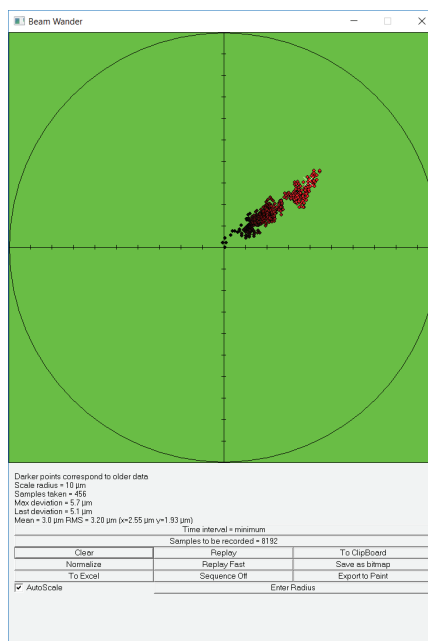
Profile Fits

- Top Hat Fit
 - Goodness of fit
 - Standard deviation
 - Point of Max Deviation
 - Non-uniformity
- Gaussian
 - Fitted diameter
 - Goodness of fit
 - Standard Deviation
 - Point of max deviation



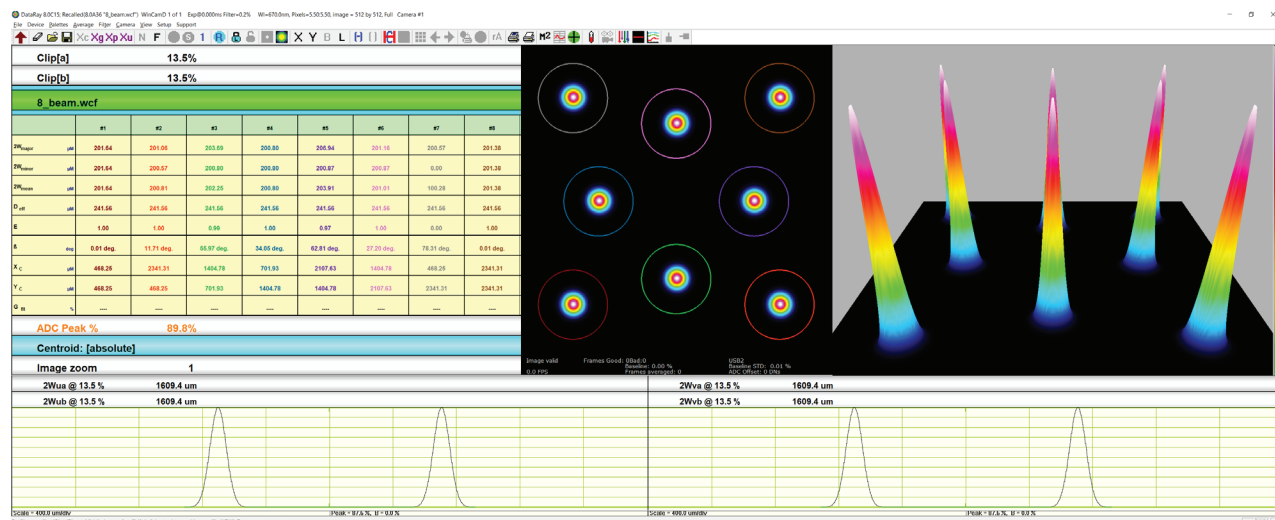
Beam Wander

- Tracks X and Y centroid wander
- Replay recorded data
- Max, Last, Mean deviation
- Samples every frame or per user entered time interval
- Auto-scale or user set scale



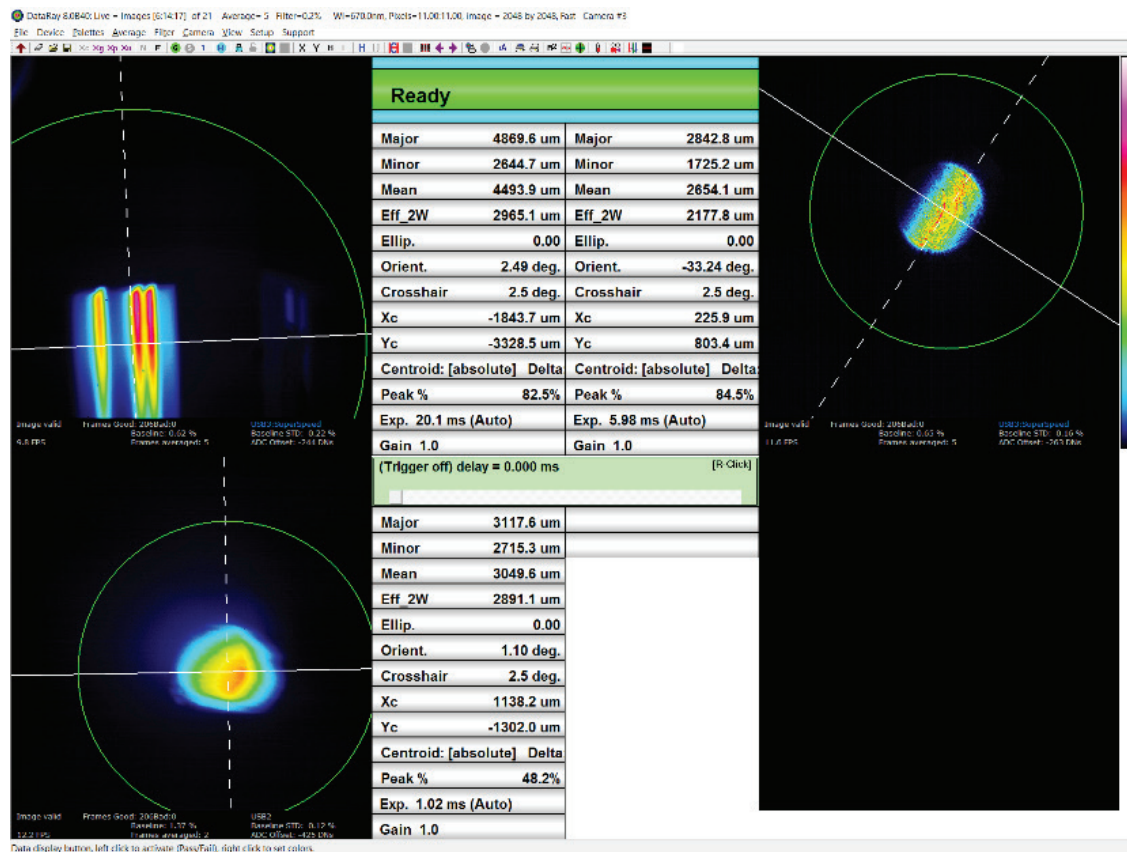
Multibeam

- Supports independent tracking of up to 8 lasers
- User-selected partitions
- Heuristic algorithm for auto-partitions
 - Accepts user inputs to tweak algorithm



Multicamera

- Supports up to 4 cameras running in parallel
- Supports up to 8 cameras connected to one PC. Easy to switch between cameras

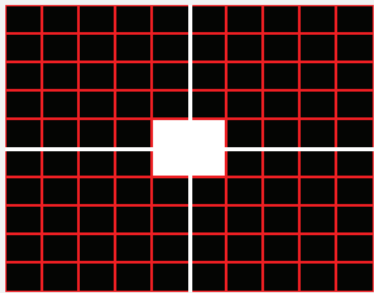


Fluence

- Display peak fluence over user defined peak pixel area
- Fluence over user defined square or circle
- Display Peak/Average, Peak/Defined, and Average/Defined ratios
- Pass/Fail limits enabled

Fluence Setup Dialog

Peak Fluence Aperture



Peak Fluence Aperture Pixels

Peak Area = 1.210e-6 cm²

Restore Clean Save

OK Cancel

Fluence Test Limits

Average: Min — Max — Enable
 ☐ On

Defined: Min — Max — Enable
 ☐ On

Peak: Min — Max — Enable
 ☐ On

Peak/Average: Min — Max — Enable
 ☐ On

Peak/Defined: Min — Max — Enable
 ☐ On

Defined Fluence Area

☒ Show Fluence Area

Shape = ☒ Round ☐ Square

Area units = ☒ cm² ☐ mm²

Fluence Diameter =

Logging

- Create CSV files with any or all calculated values
 - Use only user-selected values for more concise reports
- Log over arbitrary time periods
- Log with arbitrary sample periods

2	DataRay Log File version 4.0								
3	Started Friday August 11 2017 at 09:51								
4	Type = WinCamD								
5									
6	Sample #	Time In Seconds	2Wua	2Wub	2Wva	2Wvb	Xc	Yc	Ellip.
7	1	3.532	852.499	452.654	945.297	493.748	-222.999	316.393	0.856
8	2	7.063	853.658	504.663	926.158	435.215	-222.035	315.169	0.853
9	3	10.596	846.127	505.566	848.766	440.910	-220.363	314.156	0.851
10	4	14.131	881.229	551.340	859.357	430.487	-219.807	314.841	0.835
11	5	17.632	824.160	486.188	945.297	494.445	-218.739	314.577	0.828
12	6	21.163	887.207	553.928	871.835	427.847	-217.532	313.422	0.841
13	7	24.666	866.786	505.332	916.487	430.959	-217.085	313.782	0.852
14	8	28.196	883.936	482.120	915.623	515.045	-215.788	317.236	0.855
15	9	31.730	870.274	469.673	926.555	526.289	-225.066	327.348	0.878
16	10	35.233	882.587	527.629	903.411	534.813	-222.936	328.645	0.887
17	11	38.762	865.965	449.085	903.900	489.525	-219.109	324.129	0.894
18	12	42.264	875.028	514.971	939.509	494.496	-217.451	322.094	0.897
19	13	45.796	870.004	540.515	849.211	432.830	-215.629	321.398	0.891
20	14	49.330	886.092	525.003	859.292	440.182	-214.290	320.804	0.882
21	15	52.865	919.435	489.894	873.983	434.188	-212.907	320.306	0.867
22	16	56.398	906.439	499.878	889.468	422.011	-210.662	318.863	0.866

PDF Report

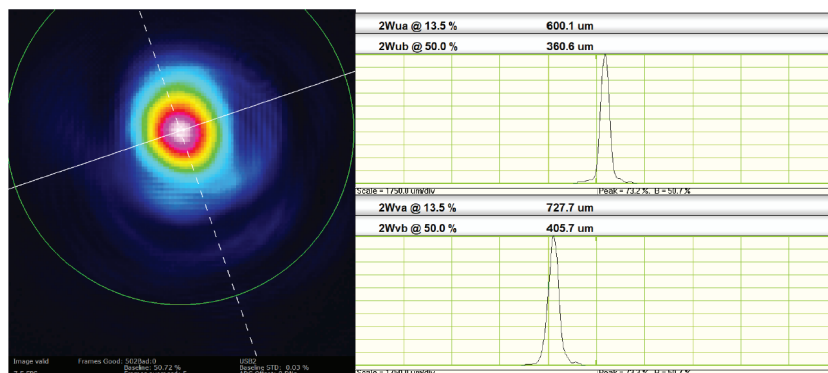
- PDF report generated with user entered notes
- Standard reports for current screen display
- Reports available for
 - M²
 - Divergence
 - Line Laser Profile System

DataRay Report

08/11/2017 11:42

DataRay 8.0C09 Exposure:35.056 ms Gain:1.0 Filter:0.2% Wavelength:635.0 nm Pixels:17.00x17.00 um Resolution:840x480

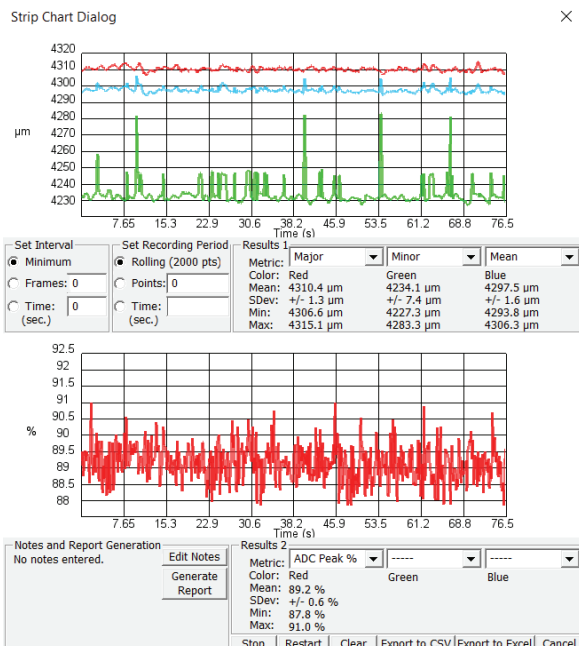
Notes: IR-BB Sample Report. MWIR Laser.



2Wua: 600.1 um
2Wub: 360.6 um
2Wva: 727.7 um
2Wvb: 405.7 um
Eff_2W: 644.3 um
Xc: 260.7 um
Yc: 155.2 um

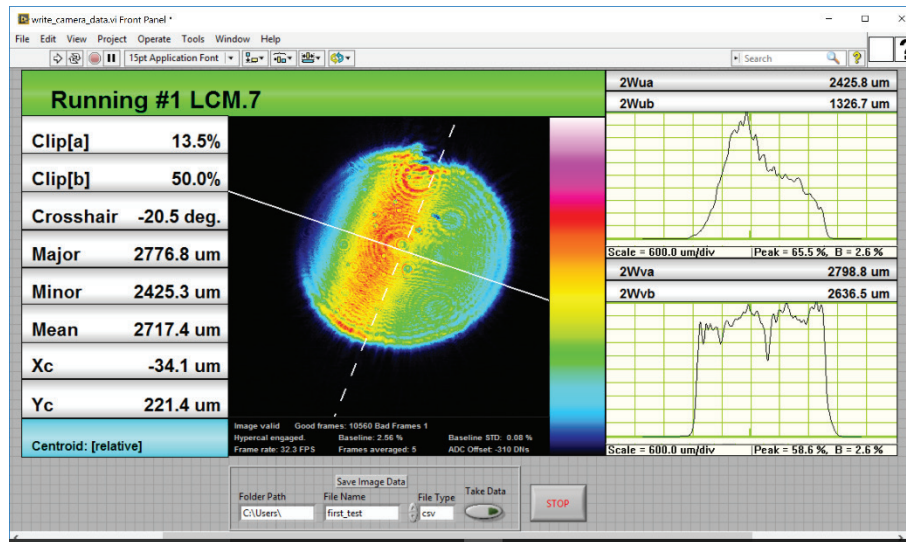
Strip Chart

- Generate up to 2 strip charts
 - Each with up to 3 parameters
- Sample over arbitrary time or frame counts
- Calculate mean, min, max, and standard deviation—calculated and updated during live measurement
- Export to CSV or Excel
- Strip Chart PDF Report Generation



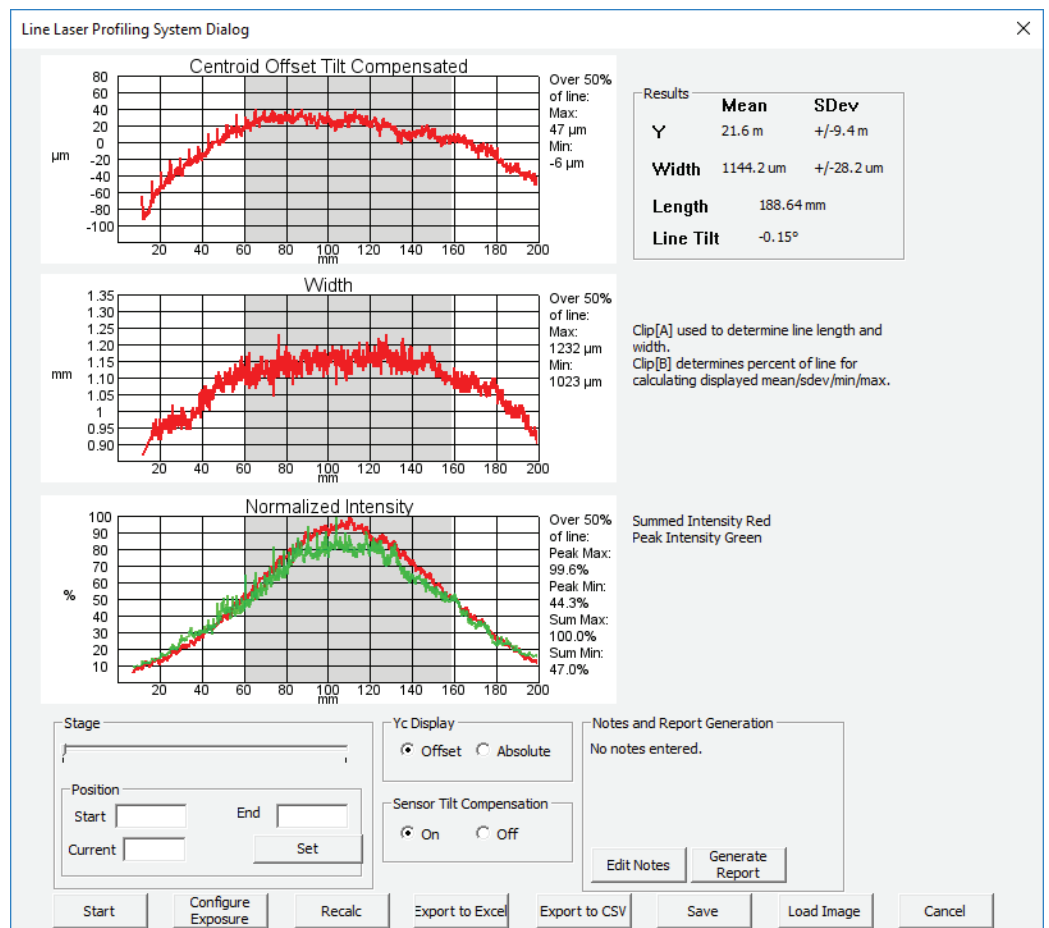
Interfacing

- Easy to use ActiveX OCX object
- Examples in Visual Basic, Visual C++, LabVIEW, MATLAB, Python
- Drag and drop GUI elements



Line Laser Profiling System

- Measure line lasers
- Intuitive plots
 - Line tilt
 - Line thickness
 - Intensity
- Sensor residual tilt correction



Software Feature Summary Table	
Features Overview	<i>Intuitive Easy to use software with no license requirements</i>
	HyperCal algorithm to minimize noise
	Extensive set of ISO quantitative measurements
	Supports WinCamD-UCD, WinCamD-HR, WinCamD-XHR, BladeCam seires, WinCamD-LCM, WinCamD-FIR-8-14HR, WinCamD-IR-BB
	Simultaneous 2D and 3D displays using OpenGL
	Supports up to 4 cameras in parallel
	Supports up to 8 cameras connected to one host
	Multibeam mode supports up to 8 beams on one sensor
	<i>Camera ROI (capture block) support</i>
	Automated or user-set software aperture
	Beam wander logging and plotting
	Strip charts with statistics for any calculated parameter
	Pass/Fail on all results items
	Full featured logging capabilities into CSV files
	Full featured logging capabilities that are reloadable
	PDF report generator
	Supports Line Laser Profiling System (LLPS), Large Beam Profiling System (LBPS), and M2DU translating stage for M ² measurments
	ActiveX interface that allows for full remote control
	Examples in LabView, VB, Visual C++, Python, and Matlab
	Automated M ² measurement featuring scaling factor correction for more accurate ISO11146 measurements
	Supports user entered pixel multiplication factors for correcting for external optics
	Option to lock settings with password
Power/Energy Results	Total power or energy (must be calibrated by user)
	Average Fluence
	Peak Fluence
	Fluence over defined area
Area calculations	Peak and Centroid locations
	Arithmetic centroid and geometric centroids with user adjustable clip level
	Beam diameter -user-selectable clip level, second moment (4 sigma), ISO11146 compliant
	Average diameter (based on x/y widths)
	Encircled power smallest aperture 86.5
	Encircled power smallest aperture (User selectable level)
	Elliptical orientation
	Ellipticity
	Plateau Uniformity
	Peak to average
	Effective Slit option
Profile calculations	1D line fits
	Height
	Width X/Y
	Centroid

	<i>Goodness of fit</i>
	Roughness of fit
	Gaussian fit
	Uniformity calculations
	Top Hat fit
	Displayed beam width marker
	Displayed clip level
Other Quantitative Items	Frame Averaging
	<i>Background subtraction offered</i>
	Effective Slit Option
	Noise qualifier (standard deviation of baseline area)
Beam Stability Result	Pointing Stability of Centroid
	Mean Centroid
	Max Radius
	X/Y centroid/peak Strip chart plots
	Sample/Time controlled
	Pass/Fail limits
	Auto scaling
	Beam Width/Diameter Strip Charts with Results
	Beam Diameter plot
	Mean/Std Dev/Min/Max results displayed
	Ellipticity
Beam Profile Display Options	Utilizes advanced hardware accelerated graphics engines
	Simultaneous 2D and 3D beam display windows
	Common color palette for 2D and 3D displays
	Pan to any detector location
	Multiple palettes selectable
	Adjustable Crosshairs that can track peak or centroid
	Adjustable manual apertures
	User set grid/targets
3D Features	Integrated Mouse actuated zoom/tilt/rotate controls
	Integrated Mouse actuated pan/zoom/tilt/rotate controls
Multibeam mode	Users can subdivide the imager into separate beam measurement regions. All enabled results are computed inside of each partition
	Can be done manually
	Can set parameters to heuristic algorithm for easy and quick multibeam measurements
Statistical Analysis	Any measured parameter can be selected for Strip Chart which allows
	Choice of intervals
	Manual start/stop
	Time from 1 second to 1000 hours
	Frames from 2 to 2048
	Measurements reported
	Current frame data, Mean, Standard Deviation, Minimum, Maximum of each calculation performed
File types	Unique DataRay file-types which store all settings
	Math program and Excel compatible csv results files

	<i>Graphics in tiff or bmp file format</i>
	Export multiple frames to same file
Pass/Fail and Report generation	PDF Report options
	Set Maximum/Minimum limits on all calculations and statistics
	Red/Green font color indication on result items
	Continuous Logging
	Time Interval Logging
	Periodic Sampling
Automation Interface (ActiveX OCX)	<i>Active X object for simple, straightforward interfacing</i>
Integrated Help	Context Sensitive Help
Signal Conditioning for Enhanced Accuracy	HyperCal algorithm takes a rolling average of a many background frames to reduce the thermal, electrical, and fixed pattern noise.
	Auto baseline subtraction
	Up to 20 frames can be averaged for a signal-to-noise ratio
	Continuous averaging can further increase signal-to-noise on stable beams
	Area filtering from 3x3 to 9x9 pixels
	Adjustable profile filtering
Other	Gain Control
	Exposure Control
	User Programmable ROI
	Pixel Binning/Sampling (camera dependent)
	External Trigger Input (TTL or optical(LCM only)) - camera dependent
	Gamma correction (for TEL series and THz measurements)
	Bad Pixel Correction (FIR and IR-BB)
	Pixel scale settings
	Magnification settings
	Autoexposure control
System Requirements	PC computer running 64-bit Windows 7, Windows 8/8.1, or Windows 10
	GHz Pentium style processor, dual core recommended
	Minimum 3-4GB RAM
	Accelerated Graphics Processor (must support OpenGL 3.3 or later)
	Hard drive space suitable to hold the amount of video data you expect to store. (50-100 GB recommended)