FireWire® Laser Beam Profilers, Model LBA-FW

Spiricon, Inc. now offers you the ease of FireWire with our world-renowned Laser Beam Diagnostics; all from the company you’ve come to rely on for accurate, reliable laser beam profiling. Spiricon LBA-PC systems have set standards in beam profiling for many years with their unique and patented features. Now these systems are available with the simplicity and portability of FireWire cameras. Just plug them in and you’re ready to acquire data! You can even use your laptop without a framegrabber interface!

With FireWire, all you need is your laptop and a camera!

All the features of LBA-PC now in LBA-FW

Of course, you still get all the features that make Spiricon the most accurate beam profiler in the world. Our patented Ultracal™ baseline correction retains negative signals essential for making correct beam width measurements and for extracting weak signals out of noise - two features that set the Spiricon LBA apart from all the others.

Install multiple cameras and view the experiment at different points in the optical train.

Connect multiple cameras easily

With FireWire, connecting multiple cameras is a breeze. And, they can be synchronized, so that single events can be observed simultaneously from many locations. Cameras can be triggered by the event itself or externally triggered.

Using the ability to choose a smaller Region of Interest (ROI), the experimenter can conserve bandwidth without degrading the quality of the measurement.

All data is stored in computer memory, providing almost limitless real-time data storage.

Same beam under various baseline conditions. A- Baseline set too high, & algorithm interprets baseline as wings in the laser beam. Beam width calculation is too large. B- Baseline set too low & laser wings are clipped off in the A/D converter. Beam width calculation is too small. C- Ultracal™ sets baseline precisely. Beam width calculation is the most accurate possible.
Versatile beam displays show you what you want to see.

Powerful calculations make analysis easy.

“Measuring the width of a laser beam is like trying to measure the size of a cotton ball with a caliper.”

Tom Johnston

Spiricon LBA-FW has all the algorithms and calculations necessary for you to achieve the results you need for successful measurements. Add to that an Active-X® interface so you can extract data into other applications, 2D and 3D viewing, reference subtraction, user-customizable apertures and color palettes, Z-axis scaling, and we think you’ll agree that this system will serve both your current and future needs. Here are just a few of the features accessible at the click of your pointing device.

Zoom capability

For those experiments where the beam width is small, zoom magnification reveals the detail otherwise lost. Magnify up to 32 times the original image size.

User-selectable Z-axis scaling displays weak signals and energy in the wings

Sometimes the signal is too small to adequately display on the screen. Z-axis scaling recovers the detail that can’t be seen. The added benefit is to examine energy in the wings of a beam even if the peak signal was large enough for normal display. Since the data is stored in raw form, any user can do this, whether they are recording the beam live or if they are analyzing data by post-processing.

Even weak signals can be analyzed, just by increasing the z-axis sensitivity. Without Ultracal™, the DC baseline offset would make this almost impossible.
Reference-Subtract easily compares images

Is that beam from the last experiment the same as the current one? No need to guess, just use ‘reference-subtract’ to see the differences- both positive and negative- instantly.

Are the beams really different? Eliminate the guesswork. The difference between beams (1) and (2) is displayed at 4x z-scaling.

Apertures restrict calculations to a specific area

Can’t get an accurate beam width measurement? Maybe the noise or diffraction structure outside your region of interest is the cause. Eliminate the problem by placing an aperture around the relevant data, and perform the specific calculation.

Placing an automatic aperture around the beam increases the accuracy of the calculation. Or, place a manual aperture around a region of interest to focus on specific data.

Statistics, Pointing Stability, Graphing - it’s all In there

Using the unique features of Active-X allows you to write your own applications, from Statistical Process Control to pointing stability. It’s only limited by your own needs.

Pointing stability allows ‘chart recorder’ and statistical functionality, all in one interface.

Customer First Focus at Spiricon, Inc.

Whether you have a problem to be solved, need demo equipment, require training or a demonstration on your laser, Spiricon’s customer-first policy is there to serve you. This philosophy has sustained our reputation for 27 years. Ask anyone in the industry, and discover who gives unmatched customer service, both before and after the sale.
Specifications of LBA-FW

LBA-FW Features Overview
- Patented Ultracal™ baseline setting
  - Baseline calculated to accuracies better than 1/8 of 1 digital count, pixel by pixel.
  - Maintains positive and negative going noise components in the signal relative to the average background level.
- Zoom to Region of Interest (ROI)
- Software zoom
  - 1X to 32X by powers of 2
- Displays in 2D and 3D at up to the camera frame rate
- Quantitative Measurements
- Pass/Fail testing with external alarm capability
- Beam stability strip chart and scatter chart display
- Active X control with results and data access
- LabVIEW® virtual instruments
- Simultaneous multiple camera input option
- Automatic exposure, for signal attenuation
- Statistical analysis on all calculated results displayed in real time
- Windows® 2000 Pro and XP Pro compatible
- 2 Year Warranty

Beam Profile Display Options
Both 2D and 3D features
- Resolution choices, user programmable by Region of Interest (ROI)
- Software Zoom Magnification
  - 1X, 2X, 4X, 8X, 16X, 32X
- Pan to any detector location
- Display Magnitude Scaling (Display Gain): 1X, 2X, 4X, 8X, 16X
- Automatic Color and Display Options:
  - 128 color, 16 color, shades of gray, 16 contour lines, single colors crosshatched in 3D
- Personalized color palette design and selection
  - Four standard palettes plus a set of customizable palettes.
  - Users can design their own or modify a customizable palette.

2D Features
- Cross section beam profiles
  - Along X-Y axis
  - Along Major and Minor axis
  - Positions: Manually controlled, track centroid, track peak
- Secondary display of reference beam or Gaussian fit
- Crosshairs for precise point-to-point distance measurements
- Apertures
  - Overlay aperture shows graphical representation of beam width calculation
  - Overlay grid for coarse measurements

3D Features
- Hidden line 3D display
- 3D wire frame display with either unidirectional or cross hatch wires
- Selectable wire frame density
- Contour line overlay in 16 levels
- Rotate and tilt through 360° and 90° respectfully in 1° increments

- Multiple display options:
  - Current frame
  - Current frame and reference frame overlay
  - Current frame minus reference frame (Reference frame can be another beam profile or a Gaussian fit.)
  - Other addition/subtraction modes

Quantitative Calculations
Basic Results (per ISO 11145 and 11146)
- Total power or energy (Can be calibrated to a known reference power meter.)
- Peak power or energy density
- Peak and centroid locations
- Beam width - user selectable methods
  - Second Moment (D4σ)
  - 90/10 Knife Edge
  - Knife Edge (User selectable level)
  - Percent of Peak (User selectable)
  - Percent of Total Energy (User selectable)

Other Quantitative Measurement Choices
- Top Hat measurement of Mean, Standard Deviation, (Choice of calculation method) (Per ISO 13694)
- Maximum and Minimum within user defined spatial limits
- Gaussian Fit calculations (Per ISO 13694)
- Intensity distribution histogram
  - Shows graph of signal levels of all pixels.
- Divergence angle
  - Separate X, Y or Major/Minor angles
  - Near field and far field method (Use of lens, or 2 separated width measurements)
- Row and Column summing (Log Data only)

Elliptical
- Analysis of major/minor axis beam widths
  - Orientation angle
  - Roundness factor

Apertures
- Drawn aperture with user defined size and shape
  - Circle, ellipse, square, rectangle
  - Selectable rotation angle on ellipse and rectangle
- Automatic aperture of 2X beam width
  - Both Drawn Aperture and Automatic Aperture Limit calculation area to reduce noise and increase calculation accuracy.
  - Displayed aperture shows beam width calculation.

Statistical Analysis
- Performed on all measurement functions
- 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
Pass/Fail Calculations
- Set Maximum/Minimum limits on most calculations
- Multiple choices for indication of failed parameters, including TTL pulse for external alarm.

Beam Stability Display Charts (Per ISO 11670)
- Strip charts of:
  - X & Y centroid positional stability
  - X & Y peak positional stability
  - Beam radius
- Scatter charts of:
  - Centroid location
  - Peak location

Signal Conditioning & Enhancement
Ultracal
- Spiricon’s patented Ultracal enables more accurate beam measurement and display. Ultracal takes a 64 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 methods.

Multiple 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 sub bits] and the 32 bit processing memory is used to retain large sums before division.)

Multiple Frame Summing
- Up to 256 frames can be summed to pull very weak signals out of the noise.
- Because of 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 and Adjacent Pixel Averaging
- Choice of 5 convolution algorithms for spatial filtering for both display and calculations.
- Adjacent pixels can be averaged in the display to produce an improved visual S/N.

Camera Options
- Gamma Correction
  - Corrects for tube cameras and fluorescent phosphor cameras with nonlinear response
- Lens Applied Option
  - Inverts image to correspond to a through the lens view
  - Pixel scale adjustment compensates for optical system
- Reference Subtraction
- Camera Gain Correction
- Video Gain and Black Level Control
- Manual gain and black level control for individual unique applications when automatic features must be overridden.

Synchronization and Capture Modes
- Multiple options for camera triggering and synchronization
  - CW - captures continuously at the camera frame rate
  - Trigger-In from laser
  - Trigger-Out to laser
  - Video Trigger. Display and calculations are updated only when the camera captures a signal greater than a user set level
  - Capture options
    - Continuous
    - Single shot
    - Live video (Displays at camera rate without calculations or storage of frames.)
    - Block Mode (Captures frames at camera rate without display.)
    - Post processing (Processes a block of frames previously captured.)
  - Frame buffer to store frames limited only by computer memory

Interface Options
- ActiveX (MAT LAB and LabView compatible) Control of start, stop, Ultracal, load configuration, exporting of computational results, raw beam data, and beam image
- Automatic exposure, for signal attenuation, with cameras that have externally controlled electronic shutter
- Selection of modes for printing displays, graphics, and results
- Multiple modes for saving or logging data or calculating results
- On-line help

System Requirements
- PC computer (Pentium® III/IV or faster processor)
- IEEE 1394 FireWire® input
- Windows® 2000 Pro or XP Pro operating system
- Plug & Play compatible
- CE certified